



Traditional Statistical Measures Comparing Weather Research and Forecast Model Output to Observations Centered Over Utah

by John Raby, Jeff Passner, Robert Brown, Yasmina Raby

ARL-TR-5422

January 2011

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Computational and Information Sciences Directorate, ARL**

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
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1. REPORT DATE (DD-MM-YYYY) January 2011		2. REPORT TYPE Final		3. DATES COVERED (From - To) October 2009–September 2010	
4. TITLE AND SUBTITLE Traditional Statistical Measures Comparing Weather Research and Forecast Model Output to Observations Centered Over Utah			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) John Raby, Jeff Passner, Robert Brown, and Yasmina Raby			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Battlefield Environment Division Computational and Information Sciences Directorate, ARL (RDRL-CIE-M) White Sands Missile Range, NM 88002-5501			8. PERFORMING ORGANIZATION REPORT NUMBER ARL-TR-5422		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The Model Assessment Project automated legacy scripts produce model validation statistics using the National Center for Atmospheric Research (NCAR) Model Evaluation Tools (MET) software. The project also accessed the Meteorological Assimilation Data Ingest System (MADIS) mesonet observation data to augment the legacy National Centers for Environmental Prediction (NCEP) PrepBUFR METAR observational data to provide a twentyfold increase in the number of observations to compare with model forecasts. MET Point-Stat was used to generate statistics based on the point differences between the model forecast and the observations. The statistics were then aggregated to produce a summary of results for twenty case study days for nine surface meteorological variables. The model forecasts were generated by the Nowcast Modeling Project in support of a request from Air Force Weather Agency (AFWA) to compare the performance of the Advanced Research Version of the Weather Research Forecasting model (WRF-Advanced Research WRF [ARW]) using seven different model parameter settings. These model runs were executed over the Dugway, Utah area and evaluation of the statistical output is discussed with some graphical examples.					
15. SUBJECT TERMS Weather, forecast verification, model evaluation tools, WRF model					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 336	19a. NAME OF RESPONSIBLE PERSON John Raby
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (Include area code) (575) 678-2004

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Acknowledgements

The error statistics included in this data report were generated using the Model Evaluation Tools (MET), developed at the National Center for Atmospheric Research (NCAR) through a grant from the United States Air Force Weather Agency (AFWA) (National Center for Atmospheric Research, 2009).

In addition, AFWA provided funding and guidance to the U.S. Army Research Laboratory (ARL) to provide Numerical Weather Prediction (NWP) model research.

Special appreciation is extended to Mr. Robert Craig and his colleagues in the Model Assessment group at AFWA for reviewing the draft statistical results and providing useful suggestions on better ways to present the results.

Special appreciation is extended to Mr. Robert Dumais of ARL, BED who provided his interpretation and insights from a numerical modeler's perspective.

Special appreciation is extended to Mr. Robert Flanigan of ARL, BED who provided system administration expertise, which enabled to automation of the model evaluation processes necessary to accomplish the calculation of error statistics using the MET software.

Special appreciation is extended to Mr. R.W. Hornbaker of Serco, Inc, under contract with ARL for his assistance in information assurance, network administration and script writing, which enabled to automation of the model evaluation processes necessary to accomplish the calculation of error statistics using the MET software.

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Executive Summary

Problem

Weather has a significant impact on Army personnel, weapons, tactics, and operations, so accurate weather forecasts can be a deciding factor in any conflict, large or small. The weather forecasting task has shifted from a human forecaster located in-theater to computerized Numerical Weather Prediction (NWP) with the human forecaster located far from the area of interest.

Weather forecast validation has always been of interest to the weather forecasting community, civilian and military, and this interest has recently shifted from the accuracy of human forecasters to the accuracy of the NWP models. The validation of the models, especially high resolution models produced by the NWP, has proven to be especially difficult when addressing small time and space scales.

Results

The U.S. Army Research Laboratory's (ARL)'s Battlefield Environment Division (BED) has performed case studies investigating the performance of various NWP to develop appropriate weather forecast applications for predominantly military use. Previous studies have included some traditional statistical measures including bias Mean Error (ME), Mean Absolute Error (MAE), and Root Mean Square Error (RMSE) values, but resource constraints dictated a fairly small number of data points used for the calculations. A cornerstone study that incorporated the use of the Model Evaluation Tools (MET) for the first time at ARL enabled more comprehensive statistical evaluations of current DoD options for using the Weather Research Forecasting (WRF) model (Sauter et al., 2009).

The authors used those previously developed methods as the core for a more robust implementation of MET with the inclusion of a twentyfold increase in Meteorological Assimilation Data Ingest System (MADIS) observational data. The MET process was also automated to generate ME, MAE, and RMSE statistics based on 140 WRF runs for 20 case study days during the period from the end of March 2009 through July 2010. A longer-term goal is to use the spatial verification capability in MET, although this study made significant headway toward the ability to generate statistically significant numbers of comparisons of forecast model output to point observation data.

Conclusions

The statistical results presented here are from 20 case studies conducted over complex, mountainous terrain in Utah and thus any conclusions drawn from the results are limited to domains of similar characteristics. The case studies do not characterize the day-to-day variations

of WRF model performance as would continuous evaluations of performance. The cases present snapshots at various times of the year and during certain types of weather conditions of error statistics produced by comparing point weather observations with WRF forecasts values interpolated to the location of the observation. The WRF parameter settings and resolution were varied so that error statistics for each perturbation could be compared.

The comparison of error statistics for the seven WRF variations for the 20 case study days suggests that no particular variation gives significantly lower overall errors. There is an exception in the case of one of the boundary layer parameter settings, which appears to yield greater errors compared to the control run boundary layer setting. It is not yet clear as to the conclusive reasons for this and further investigation is necessary.

The comparison of error statistics for the two WRF model spatial resolutions shows no significant difference between the two models. This conclusion holds true regardless of the WRF parameter setting used.

Recommendations

The MET tool has proven to be a powerful means to assess the accuracy of the WRF model. The automation effort of the three components of MET (Point-Stat, Grid-Stat, Method for Object-based Diagnostic Evaluation (MODE) (Davis et al., 2009), and the use of Ensemble/Probabilistic forecasting must be continued.

1. Introduction

1.1 Subject

The atmosphere is a non-linear system with intertwined feedback loops, thus accurate weather forecasting has proven to be a daunting task, even for state-of-the-art Numerical Weather Prediction (NWP) models. The models are typically segregated or “nested” according to space and time resolutions into synoptic, mesoscale, and microscale. The synoptic scale resolves weather systems approximately the size of the Continental U.S. with a temporal period of 24–72 hours. According to Orlanski (1975), mesoscale generally spans weather systems of spatial scales from 2–2000 km and temporal periods of 6–24 hours. Microscale resolves weather systems covering areas of a few city square blocks to approximately 2 km and temporal periods of seconds to a few hours. The Army is very interested in weather phenomenon scales from the meso-gamma (2–20 km) to the microscale. Additionally, the Army focuses its attention on the weather conditions in the boundary layer, a highly variable layer near the surface of the earth that changes frequently and diurnally based on the time of day and synoptic atmospheric conditions. Forecasting in the boundary layer is extremely difficult due to the interaction of the atmosphere with terrain, vegetation, buildings, and bodies of water.

The assessment of model accuracy relies on the ability, or lack thereof, to generate verification statistics that compare the model output to actual observations. This is especially difficult for high-resolution model verification that requires time, as well as spatial forecast verification. A model, for example, may predict rain in a certain area at a specified time. Did the forecast “hit” if it did rain at the specified time but missed the intended area, or what if it rained at the intended area but missed the predicted time by several hours?

The validation efforts are further complicated by the necessity of measuring the validity of newer numerical model forecast systems, such as probabilistic and ensemble forecasts. These methods must also address the propriety and equitability of the verification measures, as well as the verification of extreme or rare events.

1.2 Purpose

The target audience of the U.S. Army Research Laboratory (ARL) Model Assessment Project is twofold: (1) research meteorologists and modelers interested in the forecast accuracy of the Weather Research Forecasting (WRF) model, and (2) Army research meteorologists, stakeholders and managers interested in the “value added” of such weather research to the Army. In short, are the research efforts to improve the forecast accuracy at the finer scales worth the time, energy, and resource investment?

The WRF model is a mesoscale numerical weather prediction system intended for use for operational forecasting and atmospheric research needs. The model was developed and improved by a collaborative partnership of the National Center for Atmospheric Research (NCAR), the National Oceanic and Atmospheric Administration (NOAA), the National Centers for Environmental Prediction (NCEP), the NOAA Global Systems Division, the Air Force Weather Agency (AFWA), the Naval Research Laboratory (NRL), the University of Oklahoma, and the Federal Aviation Administration (FAA). The Army, through the United States Air Force (USAF), intends to apply WRF to meet Army operational and research requirements.

NWP development requires consistent methods to evaluate the models and then modify, improve, and increase their capabilities based on these assessments. The validation and assessment of the WRF forecast model is a high priority for the NWP community, as well as ARL's Nowcast Modeling Project. ARL intends to work closely with the NOAA Developmental Testbed Center (DTC), the developers of MET, and AFWA, a major sponsor of the MET program and ARL's research program.

The ARL has ongoing efforts to adapt, enhance, validate, and operate the WRF. The goal is to produce a Weather Running Estimate-Nowcast (WRE-N) tool for transition to the tactical Army to provide 0–3 hour hourly updated Nowcast grids for Army systems, such as Distributed Common Ground System-Army (DCGS-A), as well as fine resolution initialization input for boundary layer/urban meteorological models and gridded meteorological fields for advanced acoustic and/or electro-optical wave propagation algorithms.

The WRF model is used operationally at both the AFWA and the NCEP. The ARL WRF-Advanced Research WRF (ARW) model research is to develop better understanding and treatment of the model's fine-scale meteorological processes for use in Air Force and Army applications, and increase ARL collaboration and visibility with both the DTC and the larger university atmospheric modeling community.

2. Methods, Assumptions, and Procedures

2.1 MET Tools

The MET is a set of verification tools developed by the WRF DTC for use by the numerical weather prediction community, especially users and developers of the WRF model, to help them assess and evaluate the performance of the models (National Center for Atmospheric Research, 2009).

The ARL Model Assessment Project will over time utilize all three components of the MET. The initial phase started in FY 2009 and continued through 2010, focusing on the use of the

MET Point-Stat tool and a domain centered on the Dugway Proving Ground, Utah (figures 1 and 2).

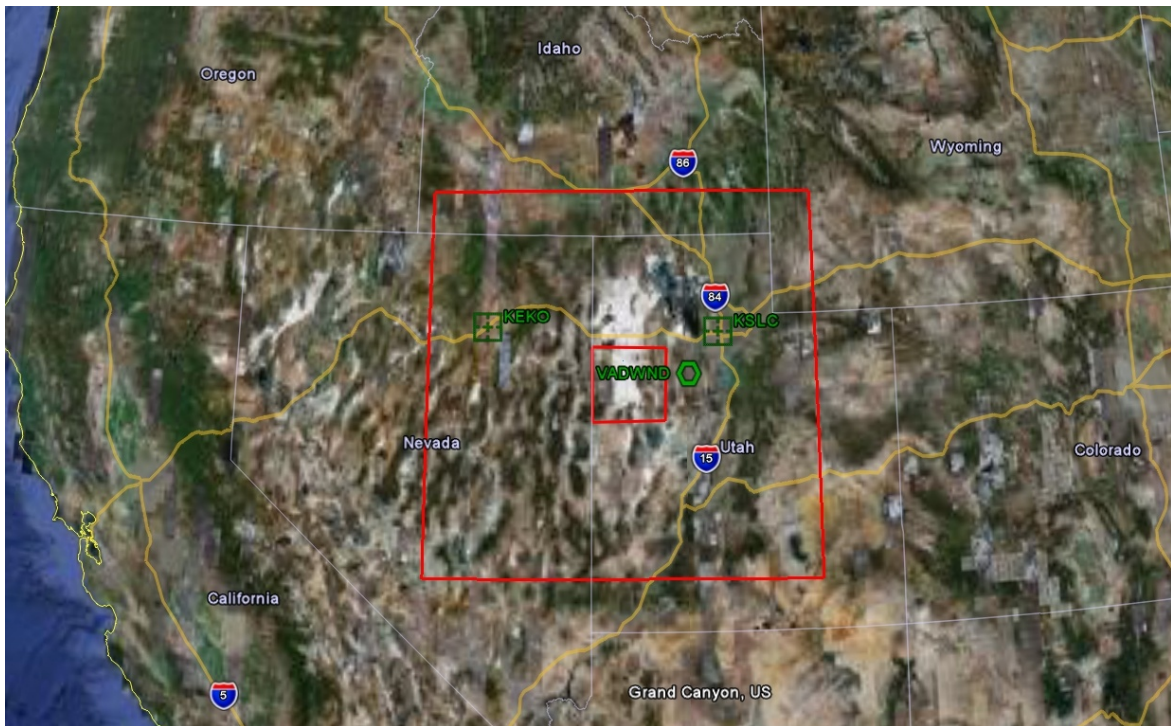


Figure 1. Domains 1 and 2.

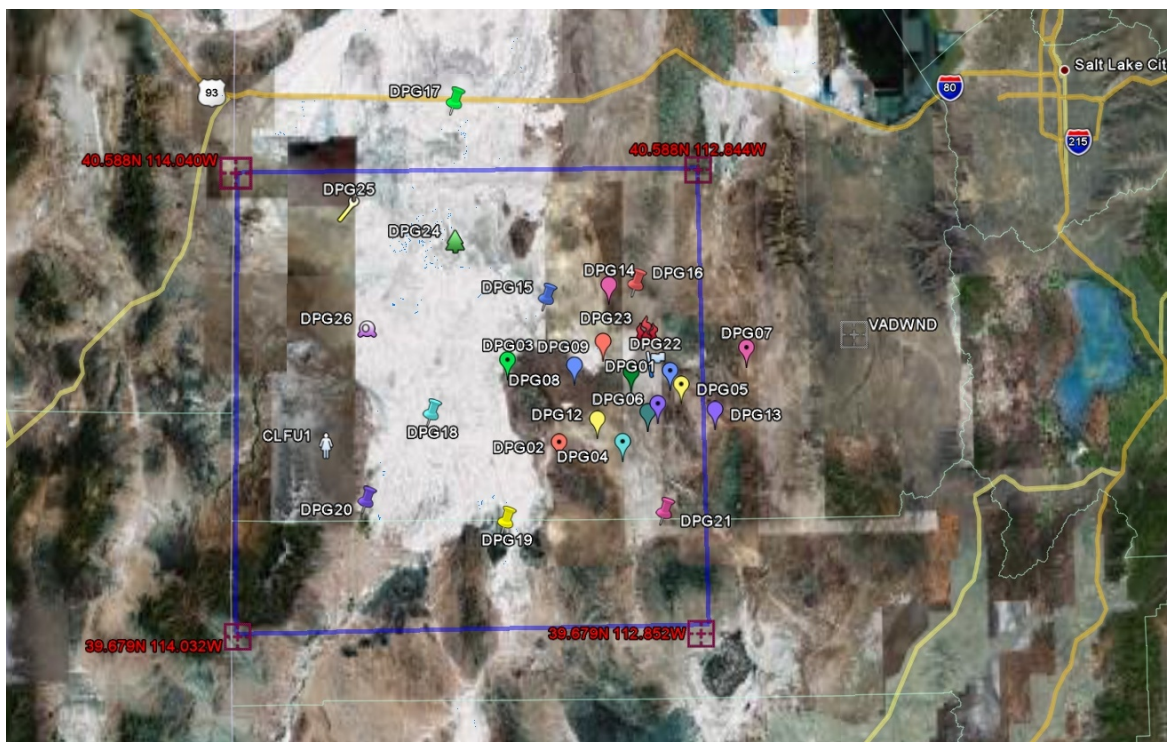


Figure 2. Expanded view of Domain 2.

We will soon (FY 2011) start using the Grid-Stat tool eventually migrating to the MODE tool. In the future, these studies will also take advantage of a data rich area over central Florida, and use special observations provided by the Kennedy Space Center mesonet.

The three main statistical analysis components of the current version of MET are named Point-Stat, Grid-Stat, and MODE.

The Point-Stat tool is used for grid-to-point verification, or verification of a gridded forecast field against a point-based observation (i.e., surface observing stations, rawinsondes, and other point observations). The MET Point-Stat tool provides forecast verification scores for both continuous (e.g. temperature) and categorical (e.g. rain) variables, and confidence intervals are also produced. Confidence intervals take into account the uncertainty associated with verification statistics due to sampling variability and sample size limitations.

The Grid-Stat tool produces verification statistics when a gridded field is used as the observational dataset. Like the Point-Stat tool, the Grid-Stat tool also produces confidence intervals. By using either the MET Grid-Stat or the MODE modules, severe limitations exist due to the lack of suitable independent gridded observation data. Other than for precipitation data derived from NEXRAD; there was no source for gridded observational data in our Utah study. The recent development of a Real-Time Mesoscale Analysis (RTMA) product by NWS seems to have an answer to this dilemma for surface-based analyses only. The RTMA product is at a 2.5 km spatial resolution, which is at the lower end of the resolution requirements of future Grid-Stat and MODE applications (Caldwell, 2010). For higher resolution WRF forecasts, a higher resolution analysis product will be needed.

The MODE tool also uses gridded fields as observational datasets, defining objects in both the forecast and observation fields. The objects in the forecast and observation fields are then matched and compared to one another.

2.2 Model Assessment Process Automation

The sequential process of post-processing the WRF output data, acquiring the required observation data, performing data format conversions, and running Point-Stat and the Stat-Analysis routines on several different computers required the coordination of over 100 Unix scripts. The complexity of the process, plus the acquisition of a large number of observations and the need to produce case study results for a statistically significant number of cases, necessitated the automation of the model evaluation process.

2.3 Case Studies

The WRF model was run with an outer nest over Utah and portions of several surrounding states, and a single inner nest centered over Dugway Proving Ground. These domains are shown by the red rectangles on the first map (figure 1). The outer nest (Domain 1) was run with a grid spacing of 3 km, and the inner nest (Domain 2) was run with grid spacing of 3 km and 1 km. In the case

of the 3-km WRF run over Domain 2, the results were interpolated onto the 1-km inner nest grid space. In the case of the 1-km WRF run over Domain 2, the results populated the 1-km inner nest grid space.

WRF version 3.0.1.1 was used in this study. WRF runs were initialized at 0600 Coordinated Universal Time (UTC) with output generated every hour from 0–24-hour forecast hours for the following dates:

- March 26, 2009
- April 21, 2009
- May 19, 2009
- June 26, 2009
- November 3, 14, and 16, 2009
- December 22, 2009
- February 4, 5, and 7, 2010
- March 4, 7, and 9, 2010
- April 13, 2010
- June 17, 21, 27, and 30 2010
- July 4, 2010

Most of the dates were selected based on expected weather conditions on those days. There was an effort to find an equal number of clear and cloudy days with a variety of temperature and precipitation types. The days selected to run the model were chosen to provide a “challenge” for the WRF and to provide a wide spectrum of conditions for the statistical verification. As an example, March 26, 2009 was selected because it was a situation with localized upslope snow over the high terrain. The days of June 26, 2009 and June 17, 2010 were more traditional Utah “monsoon” conditions with moist southerly flow in the summer. Also chosen were benign weather days to assess WRF ability to reproduce normal diurnal weather conditions under weak synoptic forcing (i.e., ridging) conditions. These days were: April 21, 2009, November 3, 2009, November 16, 2009, June 27, 2010, June 30, 2010, and July 4, 2010. Two days were included because they were interesting cases of mid-level moisture advection—May 19, 2009 and February 5, 2010. There were several days selected for their moisture in the form of clouds, rain, or snow. Included in the cloudy days were November 14, 2009, December 22, 2009, February 4, 2010, February 7, 2010, March 4, 2010, March 7, 2009, March 9, 2010, and April 13, 2010. The June 21, 2010 case was a warm and dry day with southwest flow in the upper atmosphere.

Appendix C contains synoptic scale meteorological charts that characterize each case study day (U.S. Department of Commerce, 2010).

One of the strengths and advantages of the WRF-ARW is the ability of the user to edit or modify the model controls through an input namelist file. In other words, the user can determine the location and horizontal resolution of model domains, the number of vertical levels in the model run, the internal time step, the model physical parameterizations, model dynamics, data assimilation options and boundary controls. Thus, the WRF results can be altered based upon the user input of all these namelist parameters. Often, these operations are done in a “research” mode where the user is studying the result of the model based on certain inputs, or the user has determined that these options are the best combination of parameters for the environment that model is being run in. For this ARL study, the parameters were tested as a research effort to find the best combination for the Utah complex terrain, desert environment. The model was set with a “control” set of parameters, the parameters and configuration most likely to be used by AFWA for the WRF-ARW, and then six other cases were run with either different boundary layer, microphysics, vertical resolution or time step namelist input values.

Three different microphysics schemes were used in the model simulations for this project. They are:

1. Lin's, sometimes called "Purdue" scheme (microphysics=2) which is a 6-class scheme that includes graupel, ice sedimentation, and time split fall terms (Lin et al., 1983).
2. WSM (WRF single-moment microphysics scheme) 5-class scheme (microphysics=4). This includes ice, supercooled water, snow melt, ice sedimentation, and time-split fall terms (Hong et al., 2004).
3. Thompson's scheme (microphysics=8). This includes a 6-classes including graupel and time-split terms. The routine also includes ice-number concentration, which makes it a double-moment scheme for ice (Thompson et al., 2006).

The parameterization of the planetary boundary layer (PBL) is vital to the forecasts of surface and boundary-layer weather. Both the Mellor-Yamada-Janic (MYJ) scheme and Yonsei State University (YSU) schemes were tested in this study. The MYJ is a local mixing scheme that implements the Mellor-Yamada Level 2.5 turbulence closure model through the full range of atmospheric turbulent regimes. Turbulent Kinetic Energy production is nonsingular in the case of growing turbulence (Chiao, 2006). The YSU scheme is a modification of the older MRF scheme to reduce nonlocal mixing and to include explicit entrainment fluxes of heat, moisture, and momentum, counter-gradient transport of momentum, and different specification of the PBL height (Hong and Pan, 1996).

Additional tests were done by changing the number of vertical levels, varying them from 60 levels in the control run to cases of 40 and 80 levels (using all the other control run options). Another model test was conducted by testing one case using a 3-second time advective step in the model against the control value of 9 seconds. This was done in order to see if model numerical stability changed the results of the model temperature, moisture, and wind fields.

WRF runs were done using a "control" parameter setting and six other parameter setting "variations" as shown in table 1.

Table 1. WRF Parameter settings.

Parameter Setting Name	Size of Internal Time Step (secs)	Number of Vertical Levels	Microphysics Choice	Boundary Layer Choice
Control (CO)	9	60	4	YSU
Physics2 (P2)	9	60	2	YSU
Physics8 (P8)	9	60	8	YSU
3Second (T3)	3	60	4	YSU
40Levels (L4)	9	40	4	YSU
80Levels (L8)	9	80	4	YSU
MYJ BL (B2)	9	60	4	MYJ

WRF output, interpolated from model sigma terrain-following coordinates onto pressure-level surfaces was generated with the WRF Post Processor version 3 (WPPV3), and those values were compared to point observations including surface, upper air, and aircraft data. All the observations were within 21 minutes before or after the model valid time on the hour. The METAR observations, considered acceptable for operational use, were obtained from the NCEP PrepBUFR files for Domain 1. Approximately 20–25 PrepBUFR surface station observations were available each hour for Domain 1, with only a sporadic single surface observation within Domain 2. The PrepBUFR observations also include two upper air soundings at Salt Lake City, UT (KSLC) and Elko, NV (KEKO) and sporadic aircraft observations. Based on the potential for increasing the numbers of surface observations used in the Domain 1 evaluations, the MADIS mesonet data was added to the PrepBUFR METAR observations increasing the typical number of observations from 20–25 to approximately 500. These also included up to 25 surface station observations within Domain 2, as shown in the second map (figure 2). These Domain 2 mesonet surface data are predominantly provided by Dugway Proving Ground, and their quality control is considered to be acceptable. No upper air soundings were available within Domain 2 for this study.

This report documents the Mean Error (ME), Mean Absolute Error (MAE), and Root Mean Square Error (RMSE) error statistics and uses them to analyze WRF performance. As a matter of convenience, results are noted to two decimal places even though the data are not significant to that degree of accuracy. MET also provides many more statistical, correlation, and confidence measures that are not included in this report. Since variations between different model runs were generally very small, it was not considered worthwhile to note the confidence limits. Wind direction errors were omitted for any observed wind speed less than 1 m/s. MET calculates wind direction MEs in two different ways:

1. For the “ROW_MEAN_WDIR” line, the mean forecast wind direction, mean observation wind direction, and the associated error are computed for each forecast-observation vector difference. Then the means are computed across each of these forecast wind directions, observation wind directions, and their errors.
2. For the “AGGR_WDIR” line, all the forecast vectors are summed. Then the observation vectors are summed. The vector difference between these two summed (aggregated) vectors provides an aggregated difference from which, the mean forecast wind direction, observation wind direction, and the associated error are computed and written out.

Both wind direction errors are included in this report. Bias values near 180 degrees are misleading since they are actually very close to a 0 degree bias.

3. Results and Discussion

3.1 Extraction and Depiction of Case Study Results

The depiction of statistical results for the independent case studies was achieved by extracting the statistics from the Stat-Analysis files. Stat-Analysis can aggregate the Point-Stat results by observation type, by hour, by case study day and over numbers of case study days. For this report, the results for surface meteorological variables by case study day were calculated. The results were differentiated by model parameter setting and by model horizontal resolution.

The extract files are database files (.dat) that were imported directly into MS Excel worksheets that were used to produce the tabular results. The line and column charts were created using the MS Excel chart tools. The line chart option worked well for the plots, comparing all three statistics for the two model resolutions, but it was noted by AFWA reviewers that the plots comparing results by WRF parameter variations were misleading. The impression given by connecting the independent case study data points with lines was that the results appeared to form a time series of error statistic behavior. The jumpiness of the plots led to the mistaken conclusion that model performance varied greatly over time. The reality of this is that the model performance varied from case study to case study as a result of meteorological conditions and season, thus making connection of the individual case study data points inappropriate for discontinuous data. The decision was made to plot the results for WRF parameter variations using clustered column charts that break up the case studies into discreet groups of data points.

The vertical scale of the plots had to be adjusted so as to exploit the full range of the error statistic values, thereby revealing more detail about the error behavior from case study to case study and thus varying the y-axis from one plot to the next.

Appendices A and B contain the complete set of tabular and graphical results.

3.2 Comparison Of Case Study Surface Results By Model Parameter Setting

Figures 3–6 are example plots that show the salient features of interest for analysis and discussion.

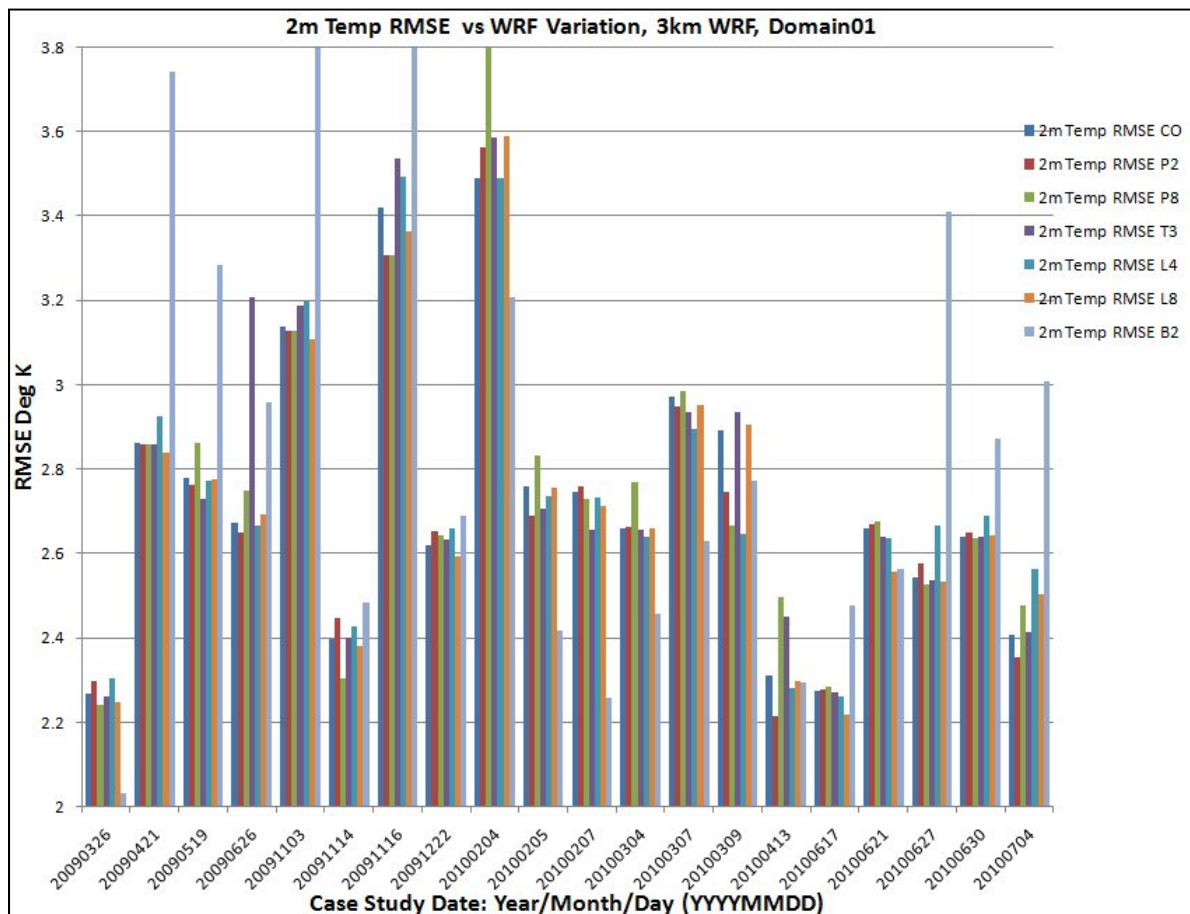


Figure 3. Comparison of the 2-m air temperature RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

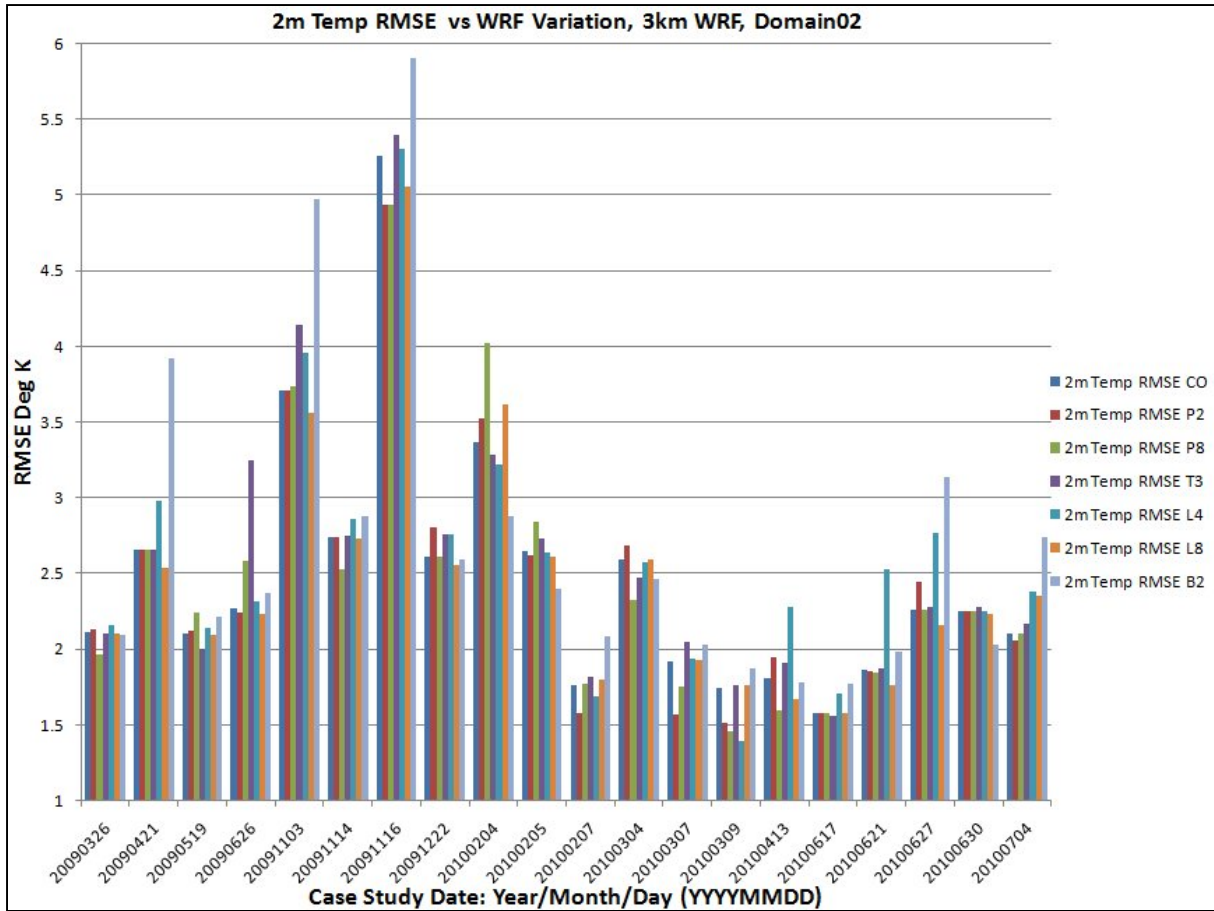


Figure 4. Comparison of the 2-m air temperature RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

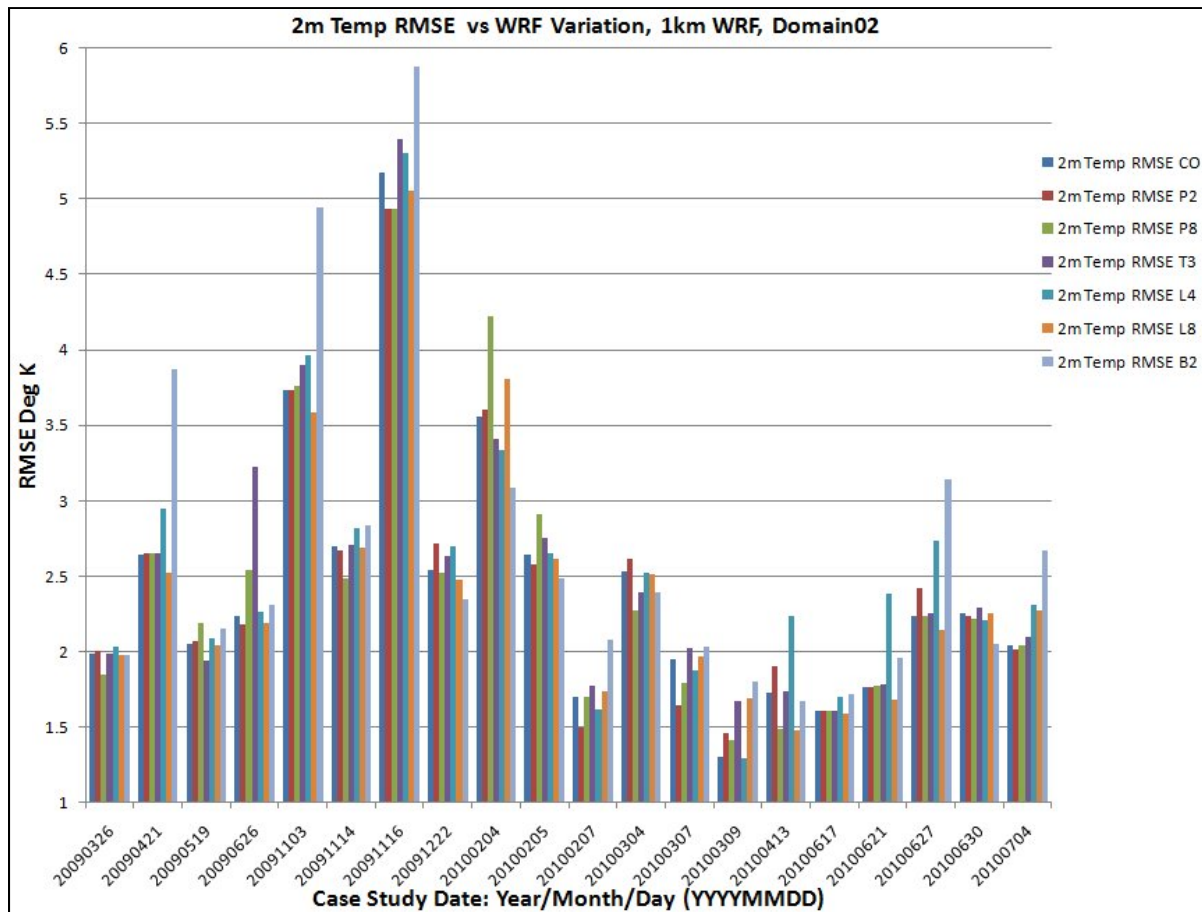


Figure 5. Comparison of the 2-m air temperature RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

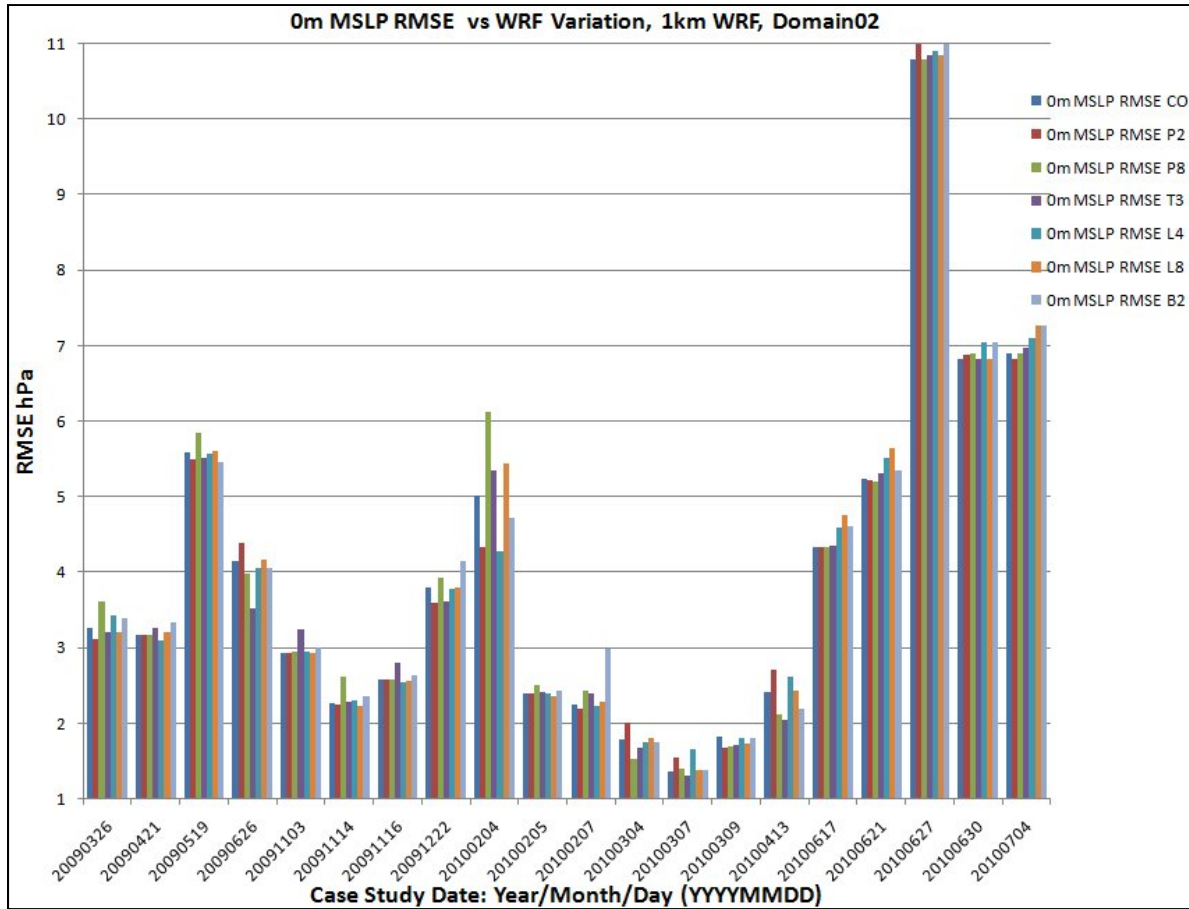


Figure 6. Comparison of the mean sea level pressure RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

In general, these results show that the RMSE error for surface temperature varies from case study day to case study day and that the particular WRF variation does not have a significant influence on the size of the RMSE error with the exception of the MYJ setting.

There is an obvious large RMSE error for mean sea level pressure on June 27, 2010, which is the result of an error introduced by an incorrect pressure in one of the observations.

3.2 Overall Surface Results Aggregated Over All Case Study Days By WRF Variation

These results will be produced in a future phase of the project, which is expected to be completed in 2011.

3.3 Comparison Of Case Study Surface Results By Model Resolution

The 1-km resolution WRF was run only over Domain 2 so the only comparisons between the 3-km WRF and the 1-km WRF are over Domain 2. Figures 7–10 are noteworthy examples of the results obtained in this comparison.

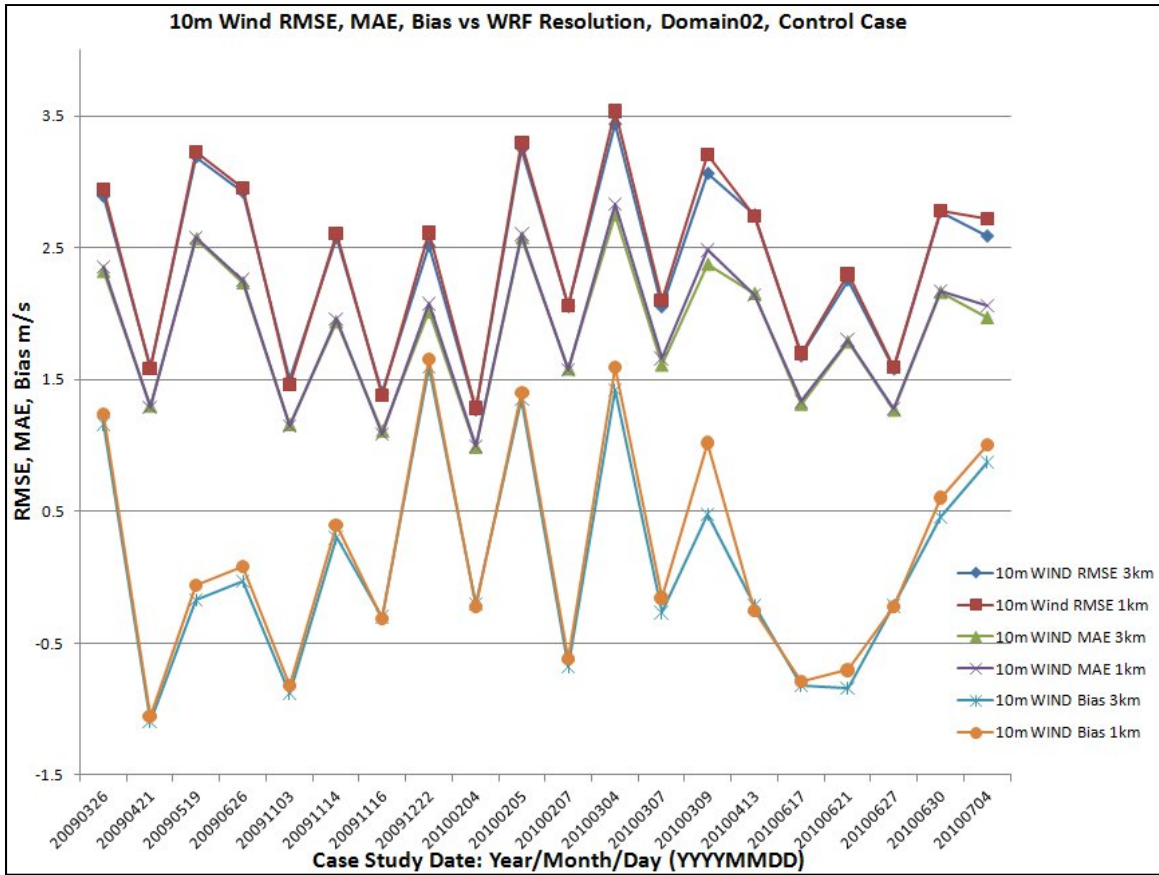


Figure 7. Comparison of the wind speed RMSE, MAE and Bias statistics for the 3-km and 1-km WRF, Domain 2, for Control parameter setting.

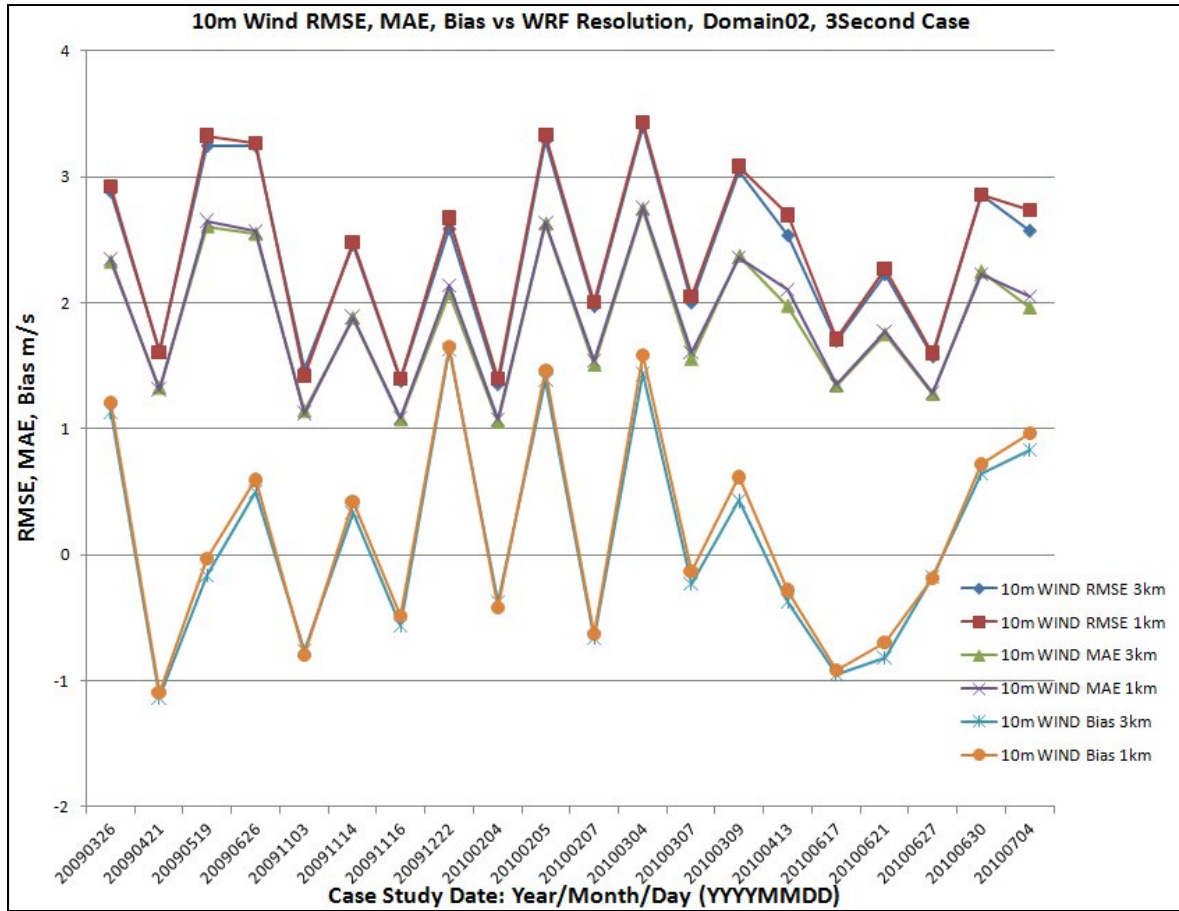


Figure 8. Comparison of the wind speed RMSE, MAE and Bias statistics for the 3-km and 1-km WRF, Domain 2, for the 3Second parameter setting.

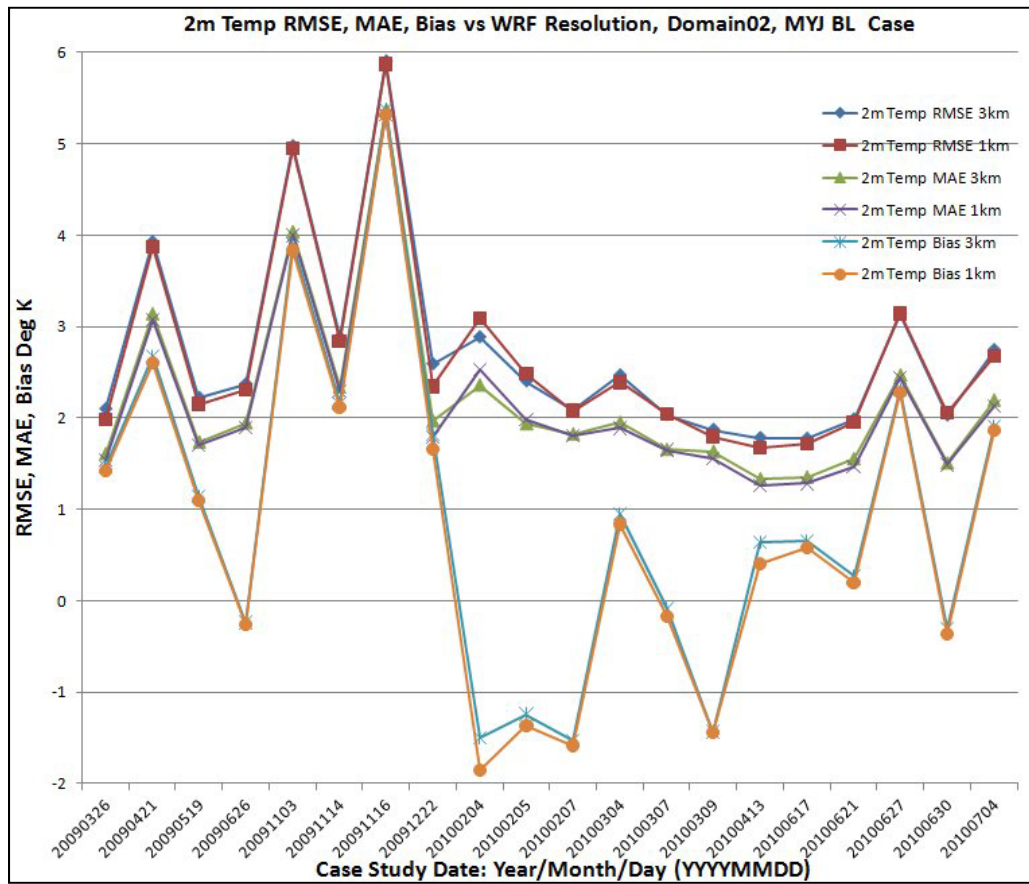


Figure 9. Comparison of the temperature RMSE, MAE and Bias statistics for the 3-km and 1-km WRF, Domain 2, for the MYJ BL parameter setting.

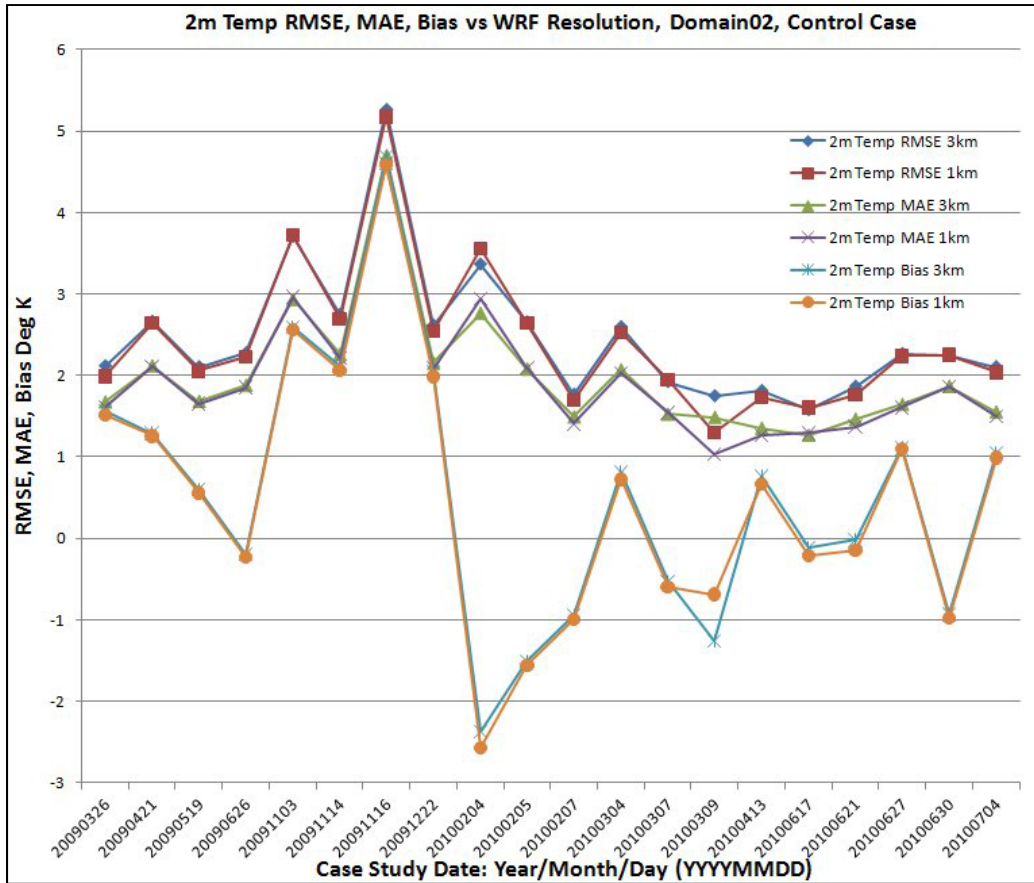


Figure 10. Comparison of the temperature RMSE, MAE and Bias statistics for the 3-km and 1-km WRF, Domain 2, for the Control parameter setting.

In general, these results show that the surface temperature errors for the two WRF resolutions are very similar in size. The size of the temperature error for the 20091116 is significant and is attributable to the WRF forecast data. The errors in the wind speed forecasts vary from case study to case study with no obvious pattern and with no significant difference attributable to the WRF resolution. The above observations are the same regardless of which WRF parameter setting was used.

3.4 Overall Surface Results By Hour

These results will be produced in a future phase of the project, which is expected to be completed in 2011.

3.5 Overall Upper Air Results

These results will be produced in a future phase of the project, which is expected to be completed in 2011.

4. Conclusions

The following list contains the conclusions evident to the authors based on their analysis of the results:

- Analysis of all statistical results shows that running the WRF at 3-km and 1-km spatial resolution over Domains 1 and 2 in Utah produced similar error statistics regardless of what parameter setting was used. The only notable difference is a higher error when using the MYJ planetary boundary layer scheme for reasons not clear at this time.
- There were no significant differences in error statistics arising from the use of the different WRF parameter settings that were studied.
- The results for temperature on November 16, 2009 show a higher error, believed to be a result of the model over forecasting the early morning surface temperatures.
- WRF model surface temperature forecasts appear better in the warm season than in the cold season. The days with the largest errors related to days when upper ridging occurred, mainly under clear skies.
- WRF model surface dew point forecasts appear better in the warm season than in the cold season. There appears to be an obvious trend for better forecasts when there are observed clouds and precipitation.
- WRF surface wind speed and direction forecasts have errors that vary from day-to-day, with no obvious trend and no clear relationship to the synoptic situation.
- All surface parameters we examined (temperature, dew point, winds) appear to have no substantial biases.

5. References

- Caldwell, D. Product and Service Description Document–Real-Time Mesoscale Analysis. *Proceedings of the 25th Army Science Conference*, Orlando, FL, November 27–30, 2006.
- Chiao, S. Performance of Planetary Boundary Layer Schemes in the WRF Model. Presented at the 25th Army Science Conference, Orlando, FL, 2006.
- Davis et al. The Method for Object-Based Diagnostic Evaluation Applied to Numerical Forecasts from the 2005 NSSL/SPC Spring Program. *Weather and Forecasting* **2009**, 24, 1252–1267.
- Hong, S. Y.; Dudhia, J.; Chen, S. H. A Revised Approach to Ice Microphysical Processes for the Bulk Parameterization of Clouds and Precipitation. *Mon. Wea. Rev.* **2004**, 132, (1), 103–120.
- Hong, S. Y.; Pan, H. L. Nonlocal Boundary Layer Vertical Diffusion in a Medium Range-Forecast Model. *Mon. Wea. Rev.* **1996**, 124, (10), 2322–2339.
- Lin, Y.-L.; Farley, R.; Orville, H. Bulk Parameterization of the Snow Field in a Cloud Model. *J. Climate Appl. Meteor.* **1983**, 22, 1065–1092.
- National Center for Atmospheric Research. *Model Evaluation Tools Version 2.0 User's Guide*, Developmental Testbed Center: Boulder, CO, 2009.
- Orlanski, I. Rational Subdivision of Scales for Atmospheric Processes. *Bull. Amer. Meteor. Soc.*, **1975**, 56, 527–530.
- Sauter et al. *Traditional Statistical Measures Comparing Weather Research and Forecast Model Output to Observations Centered Over Utah*; ARL internal report; U.S. Army Research Laboratory: White Sands Missile Range, NM, 2009.
- Thompson, G.; Hall, B.; Field, P.; Rasmussen, R. *A New Bulk Microphysical Parameterization in WRF*. 7th WRF Users' Workshop, Boulder, CO, 2006.
- U.S. Department of Commerce. Daily Weather Maps.
http://www.hpc.ncep.noaa.gov/dailywxmap/index_20100823.html (accessed September 2010).

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Appendix A. Tabular and Graphical Error Statistics for Surface Meteorological Variables for the Three Combinations of WRF Spatial Resolution and Domain for each of the Seven WRF Parameter settings

Appendix A contains tables and graphs of the error statistics of Bias or ME, MAE, RMSE and the total number of matched forecast-observation pairs (TOTAL) used in calculating the statistics for the following surface meteorological variables:

- Air temperature (degrees Kelvin, 2-m level)
- Dew point temperature (degrees Kelvin, 2-m level)
- Relative humidity (percent, 2-m level)
- Mean sea level pressure (HectoPascals, 0-m level)
- U-component wind speed (meters/second, 10-m level)
- V-component wind speed (meters/second, 10-m level)
- Wind speed (meters/second, 10-m level)
- Row mean wind direction (degrees, 10-m level)
- Aggregate wind direction (degrees, 10-m level)

Note: MET does not calculate RMSE for wind direction. MET does not calculate MAE for aggregate wind direction.

The figures (A-1 through A-72) with their associated tables (A-2 through A-22) are presented in the following order shown in table A-1.

Table A-1. Figures and tables of appendix A in the order they appear organized by WRF parameter setting.

Parameter Setting	Associated Figures and Tables
All WRF parameter settings	3-km WRF, Domain 1 (m1o1)—figures A-1–A-24 3-km WRF, Domain 2 (m1o2)—figures A-25–A-48 1-km WRF, Domain 2 (m2o2)—figures A-49–A-72
Control (CO)	3-km WRF, Domain 1 (m1o1)—table A-2 3-km WRF, Domain 2 (m1o2)—table A-3 1-km WRF, Domain 2 (m2o2)—table A-4
Physics2 (P2)	3-km WRF, Domain 1 (m1o1)—table A-5 3-km WRF, Domain 2 (m1o2)—table A-6 1-km WRF, Domain 2 (m2o2)—table A-7
Physics8 (P8)	3-km WRF, Domain 1 (m1o1)—table A-8 3-km WRF, Domain 2 (m1o2)—table A-9 1-km WRF, Domain 2 (m2o2)—table A-10
3Second (T3)	3-km WRF, Domain 1 (m1o1)—table A-11 3-km WRF, Domain 2 (m1o2)—table A-12 1-km WRF, Domain 2 (m2o2)—table A-13
40Levels (L4)	3-km WRF, Domain 1 (m1o1)—table A-14 3-km WRF, Domain 2 (m1o2)—table A-15 1-km WRF, Domain 2 (m2o2)—table A-16
80Levels (L8)	3-km WRF, Domain 1 (m1o1)—table A-17 3-km WRF, Domain 2 (m1o2)—table A-18 1-km WRF, Domain 2 (m2o2)—table A-19
MYJ BL (B2)	3-km WRF, Domain 1 (m1o1)—table A-20 3-km WRF, Domain 2 (m1o2)—table A-21 1-km WRF, Domain 2 (m2o2)—table A-22

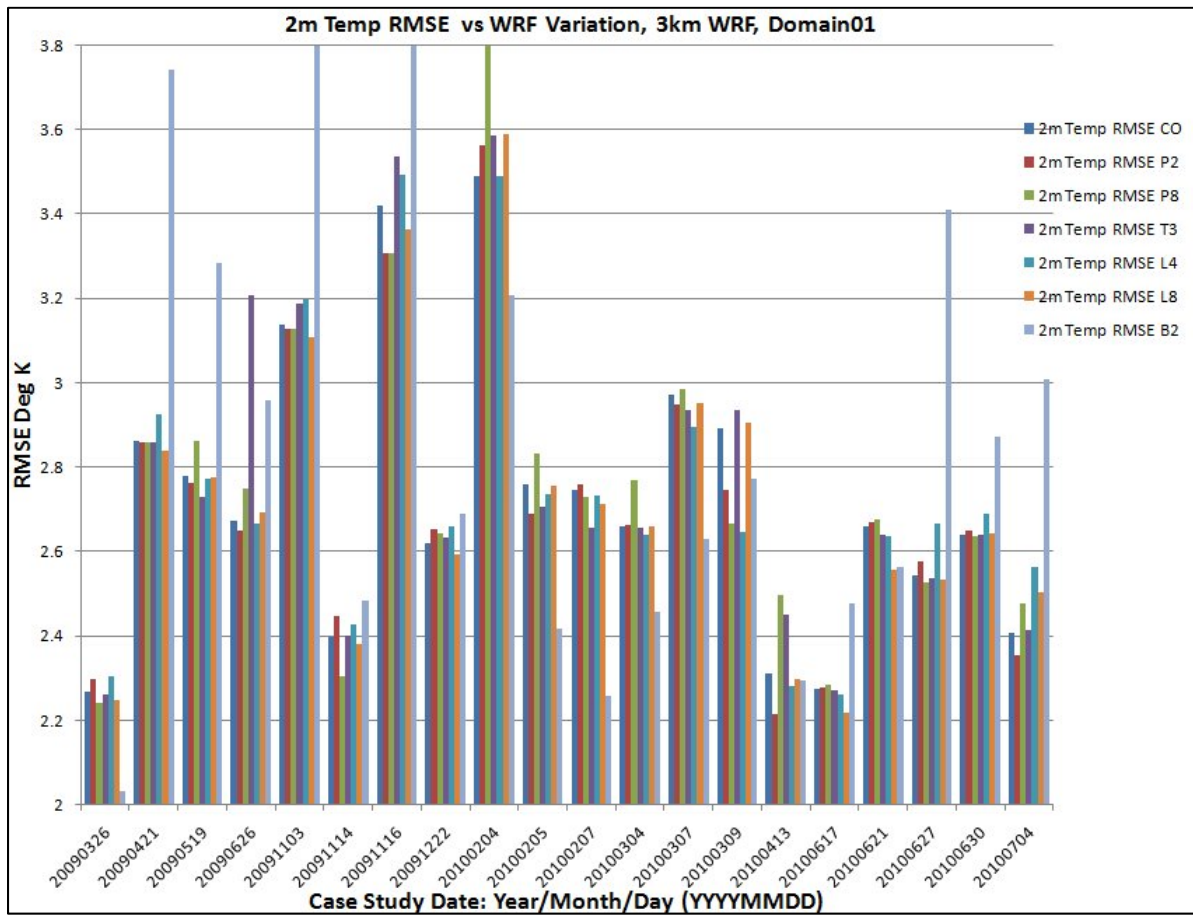


Figure A-1. Comparison of the 2-m air temperature RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

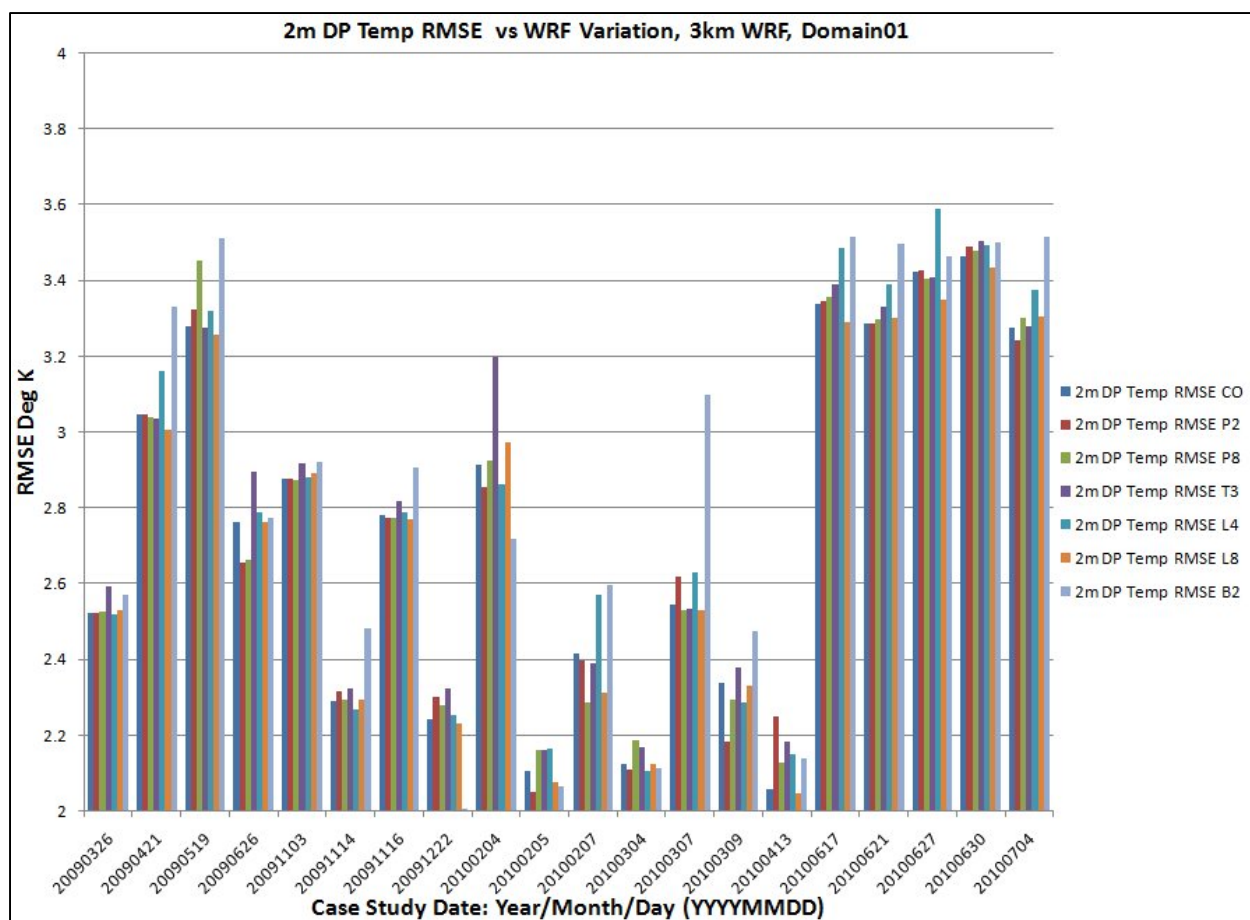


Figure A-2. Comparison of the 2-m dew point temperature RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

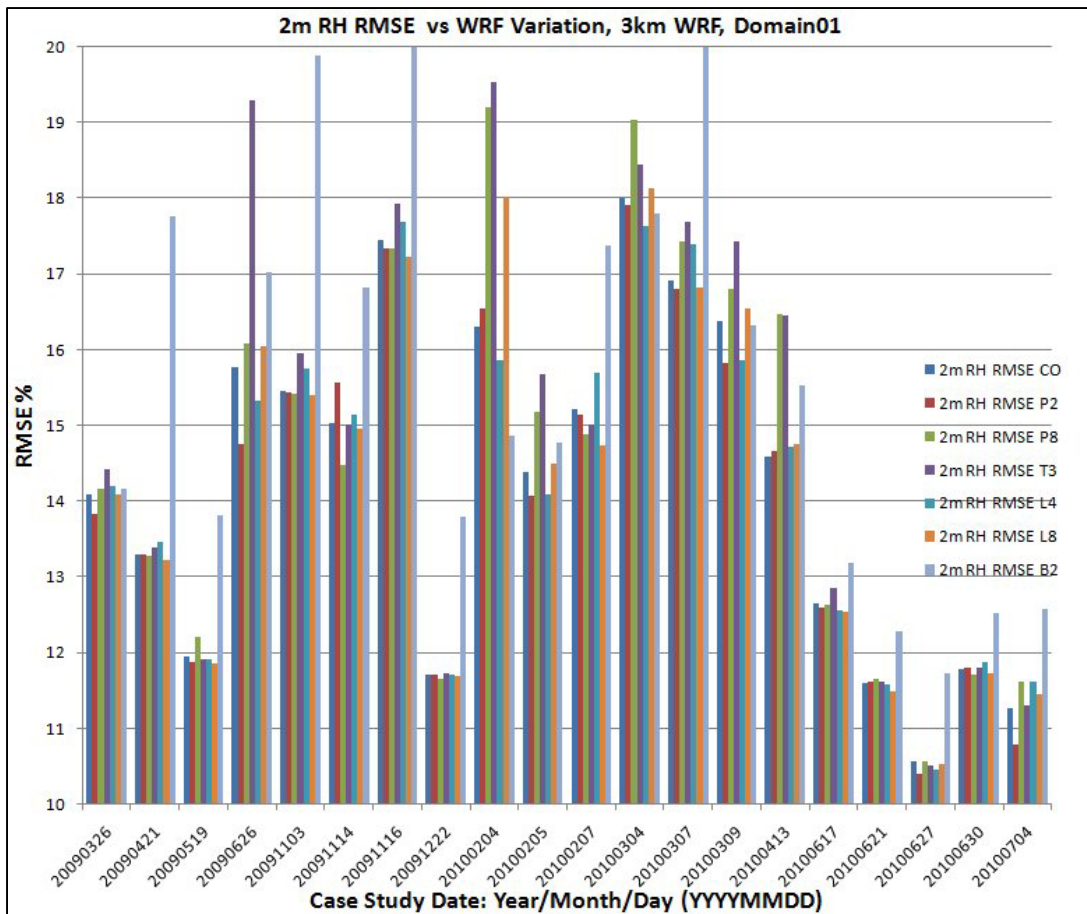


Figure A-3. Comparison of the 2-m relative humidity RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

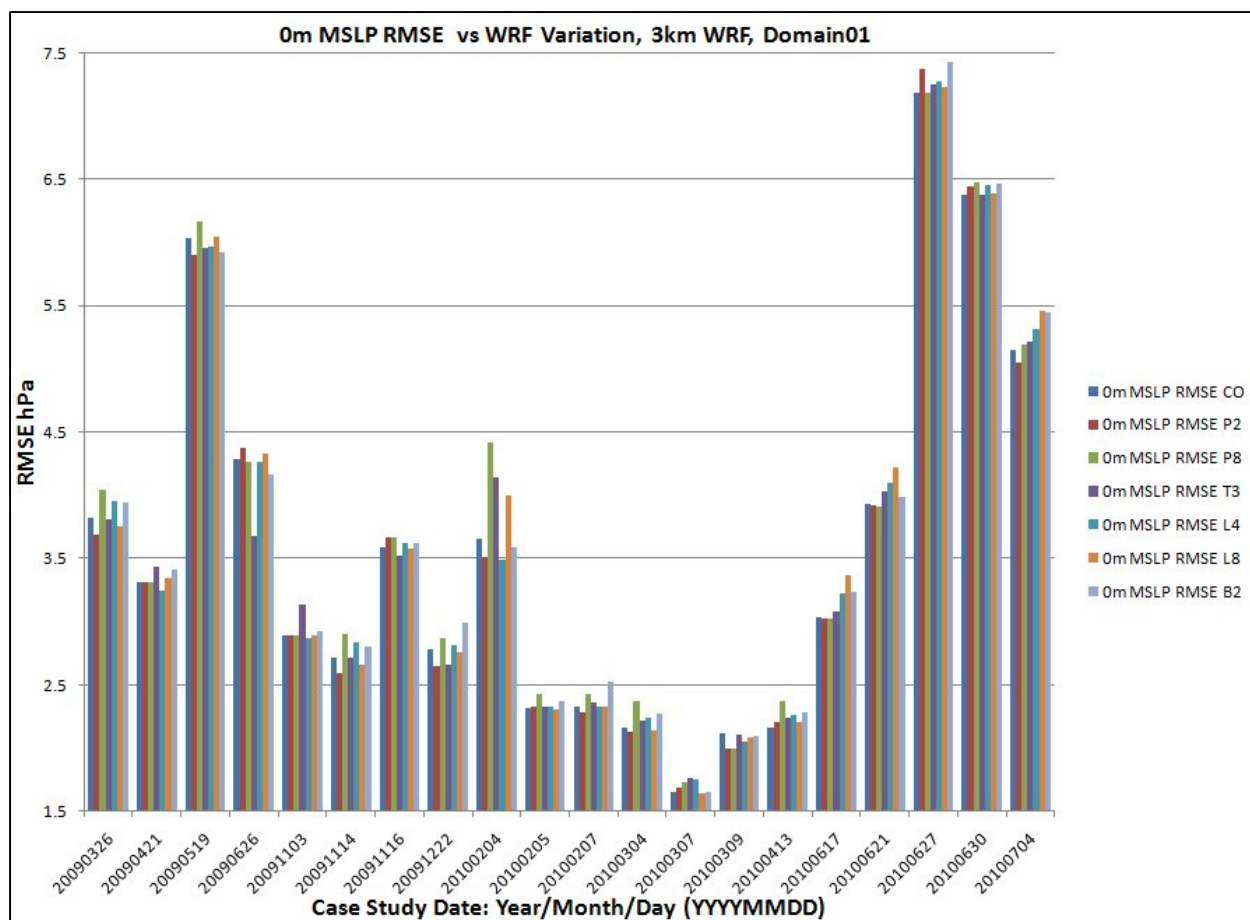


Figure A-4. Comparison of the mean sea level pressure RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

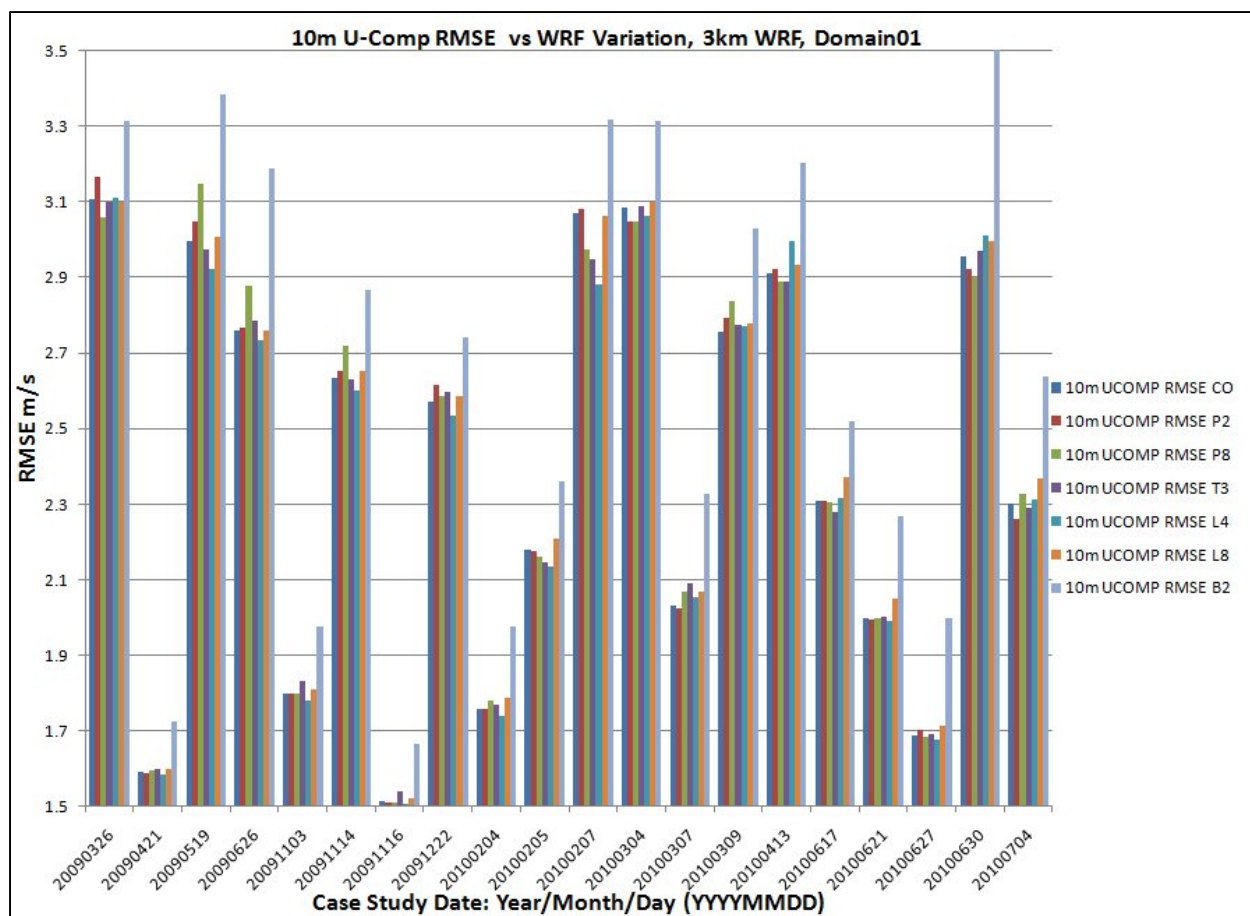


Figure A-5. Comparison of the 10-m U-component wind speed RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

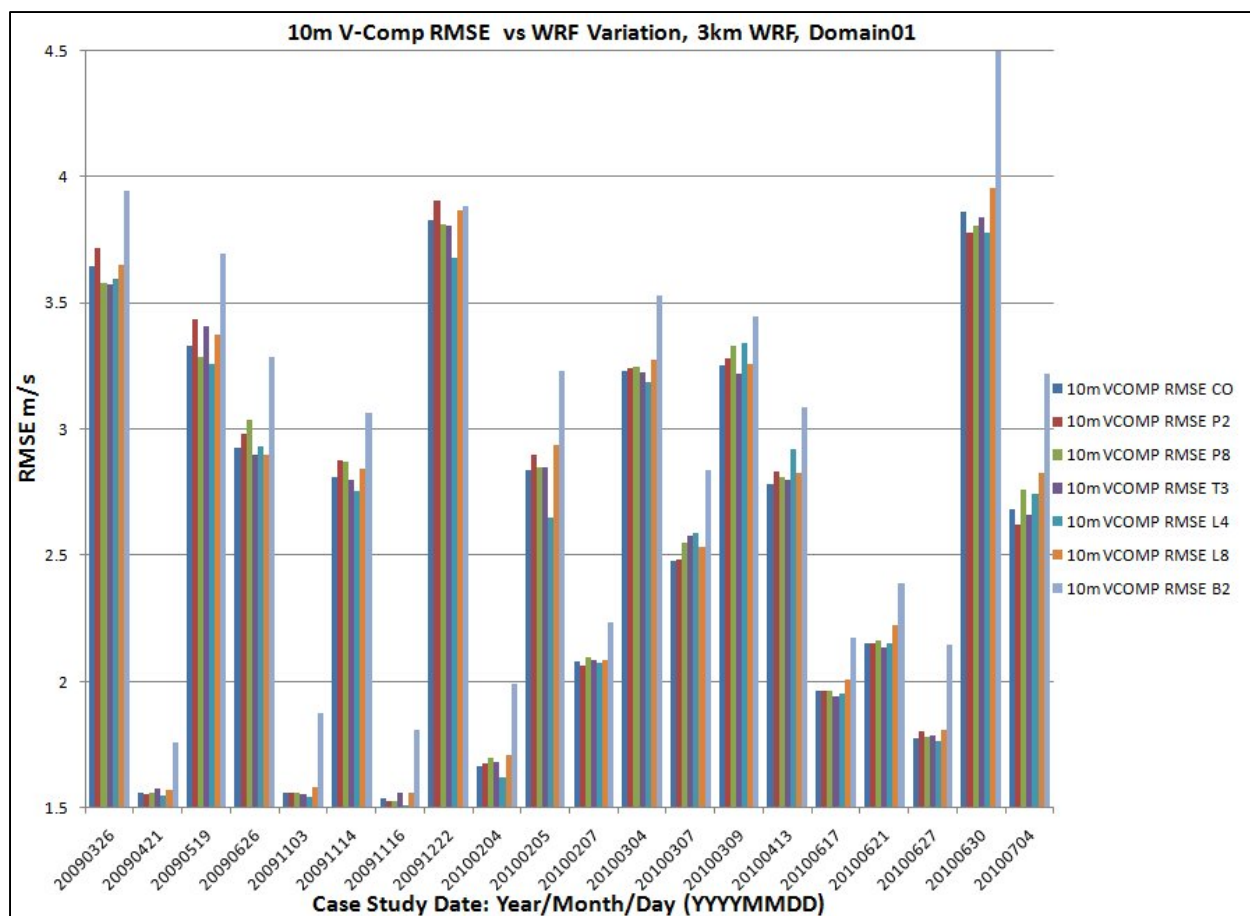


Figure A-6. Comparison of the 10-m V-component wind speed RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

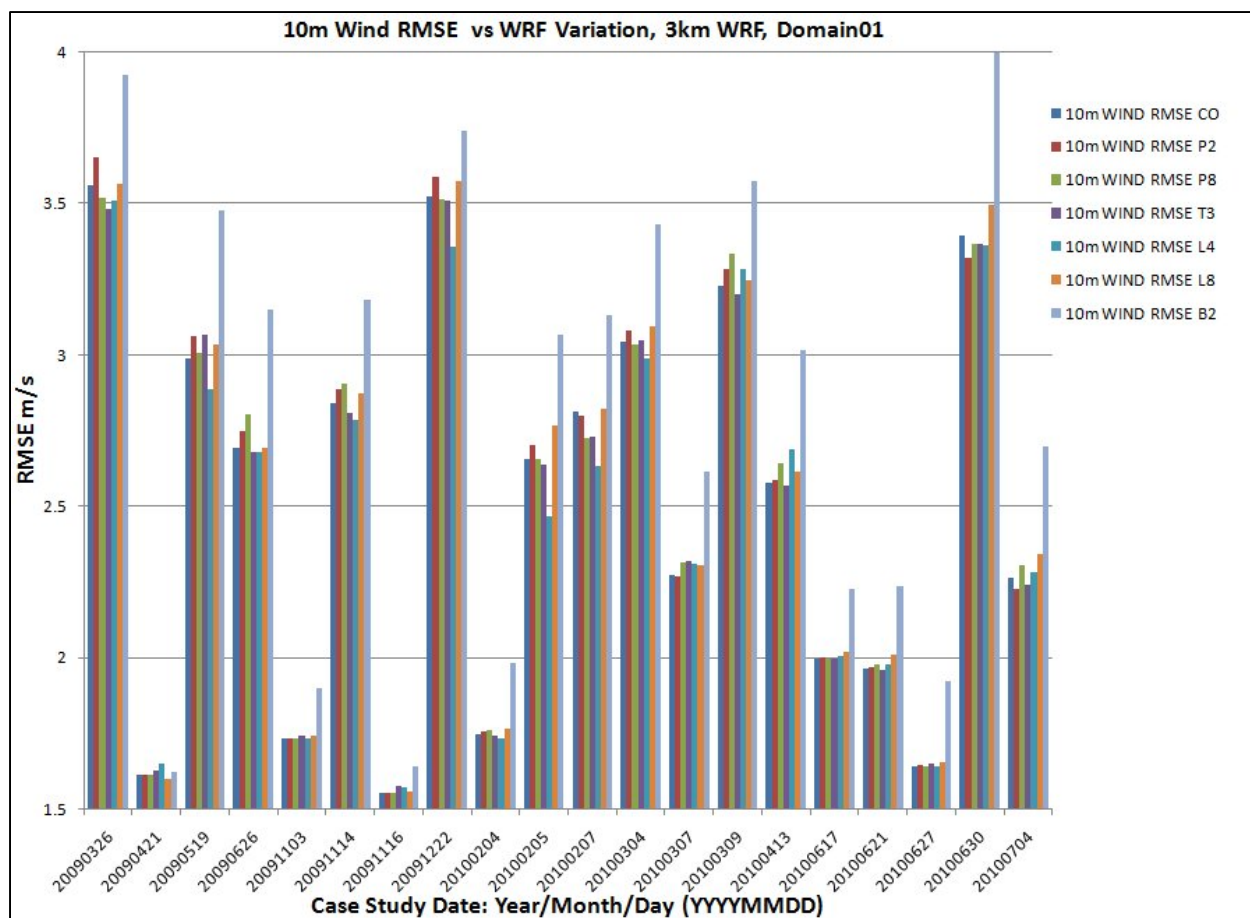


Figure A-7. Comparison of the 10-m wind speed RMSE statistic for 3-km WRF, Domain 1, for all parameter settings.

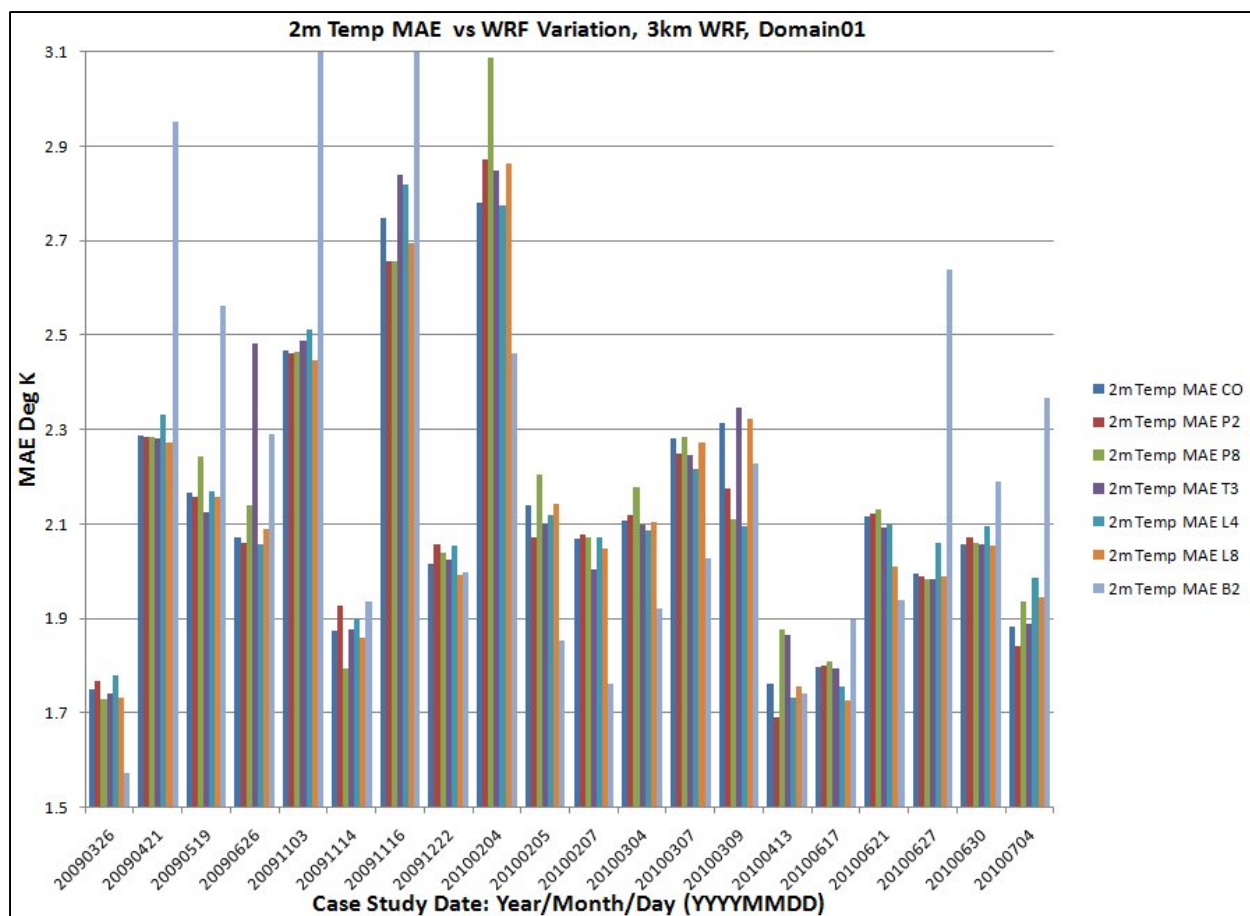


Figure A-8. Comparison of the 2-m air temperature MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

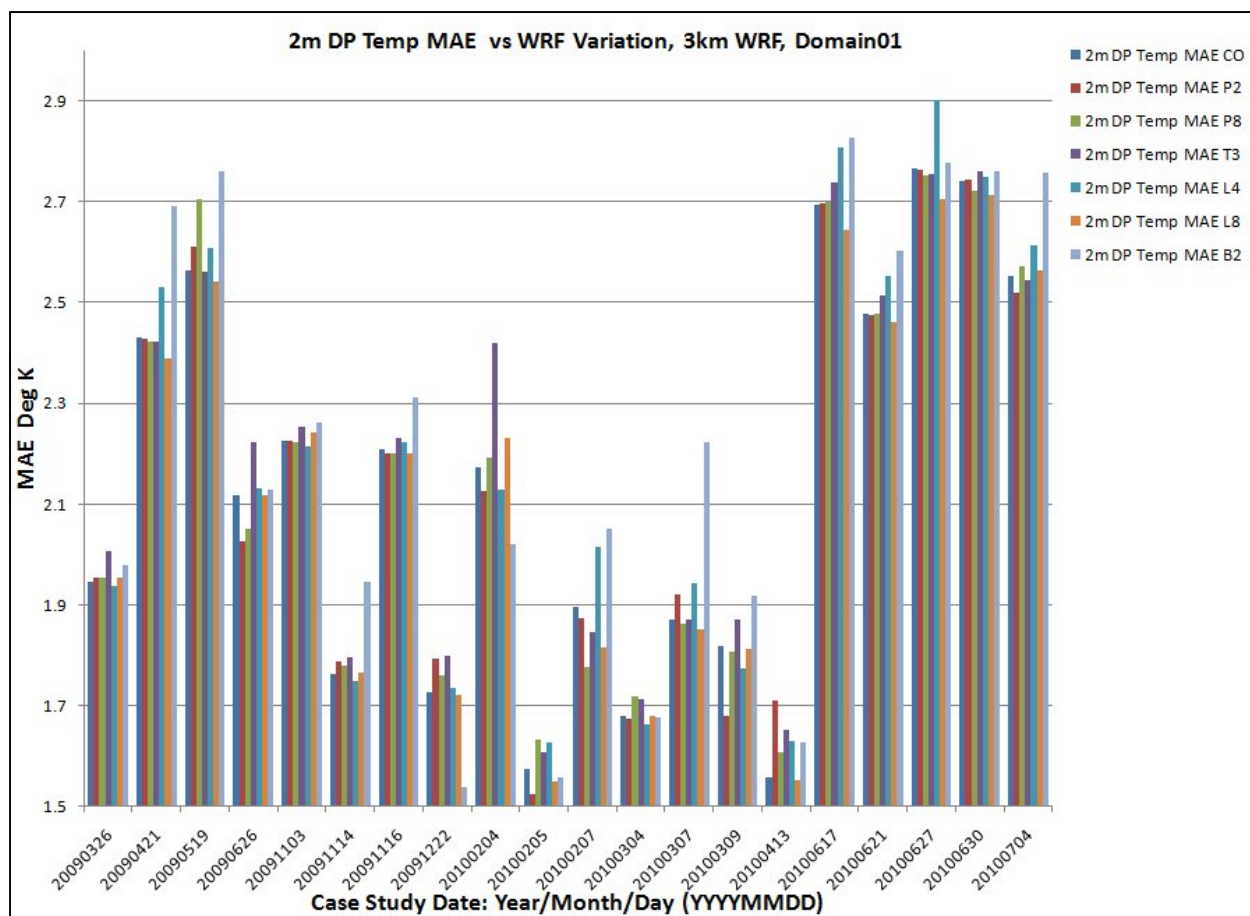


Figure A-9. Comparison of the 2-m dew point temperature MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

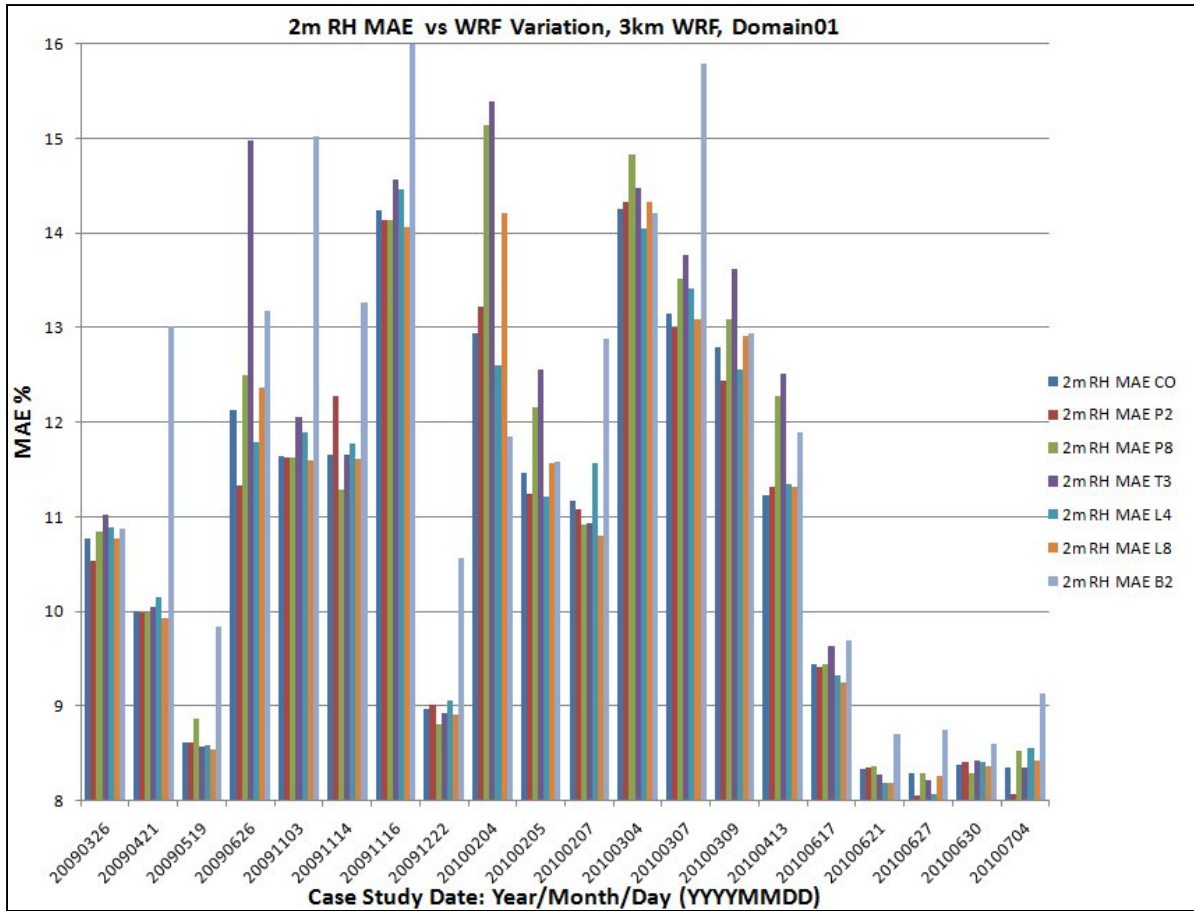


Figure A-10. Comparison of the 2-m relative humidity MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

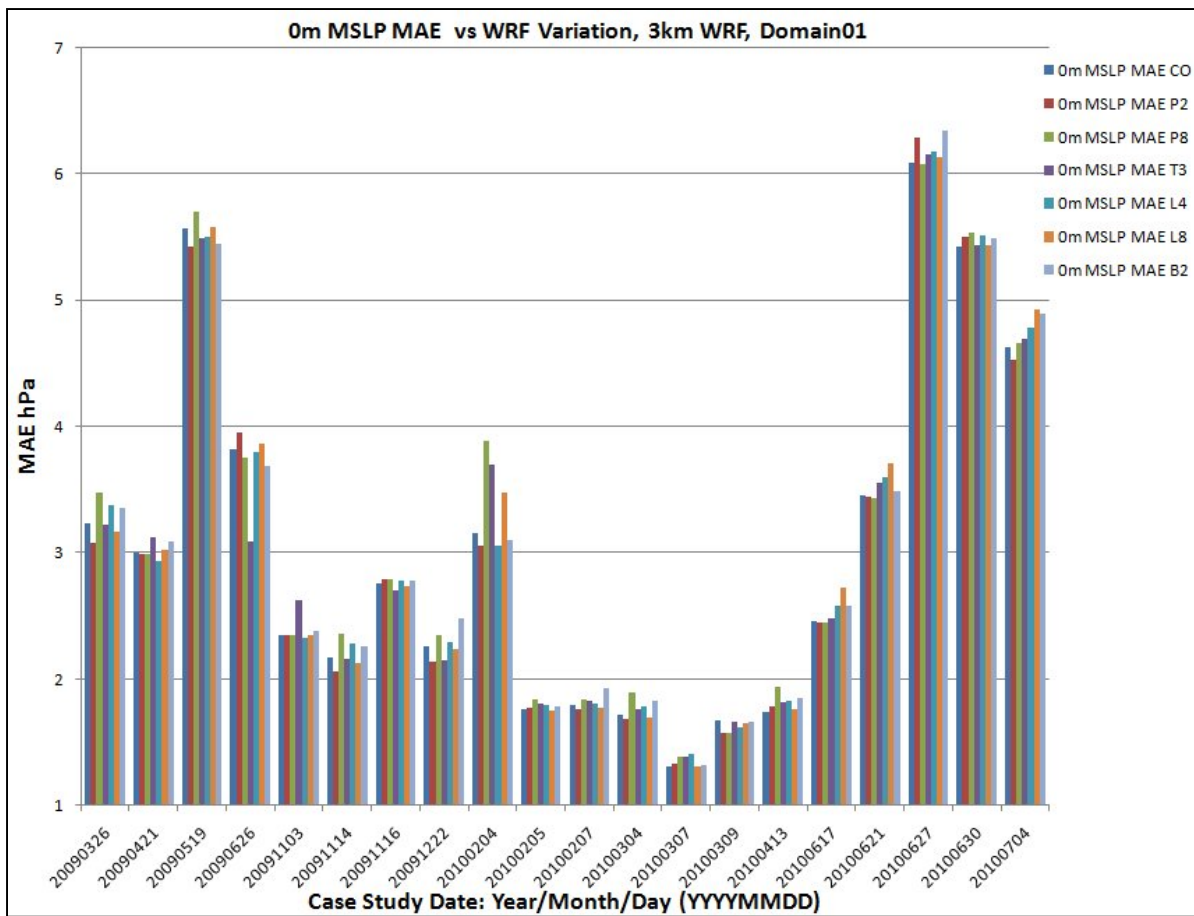


Figure A-11. Comparison of the mean sea level pressure MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

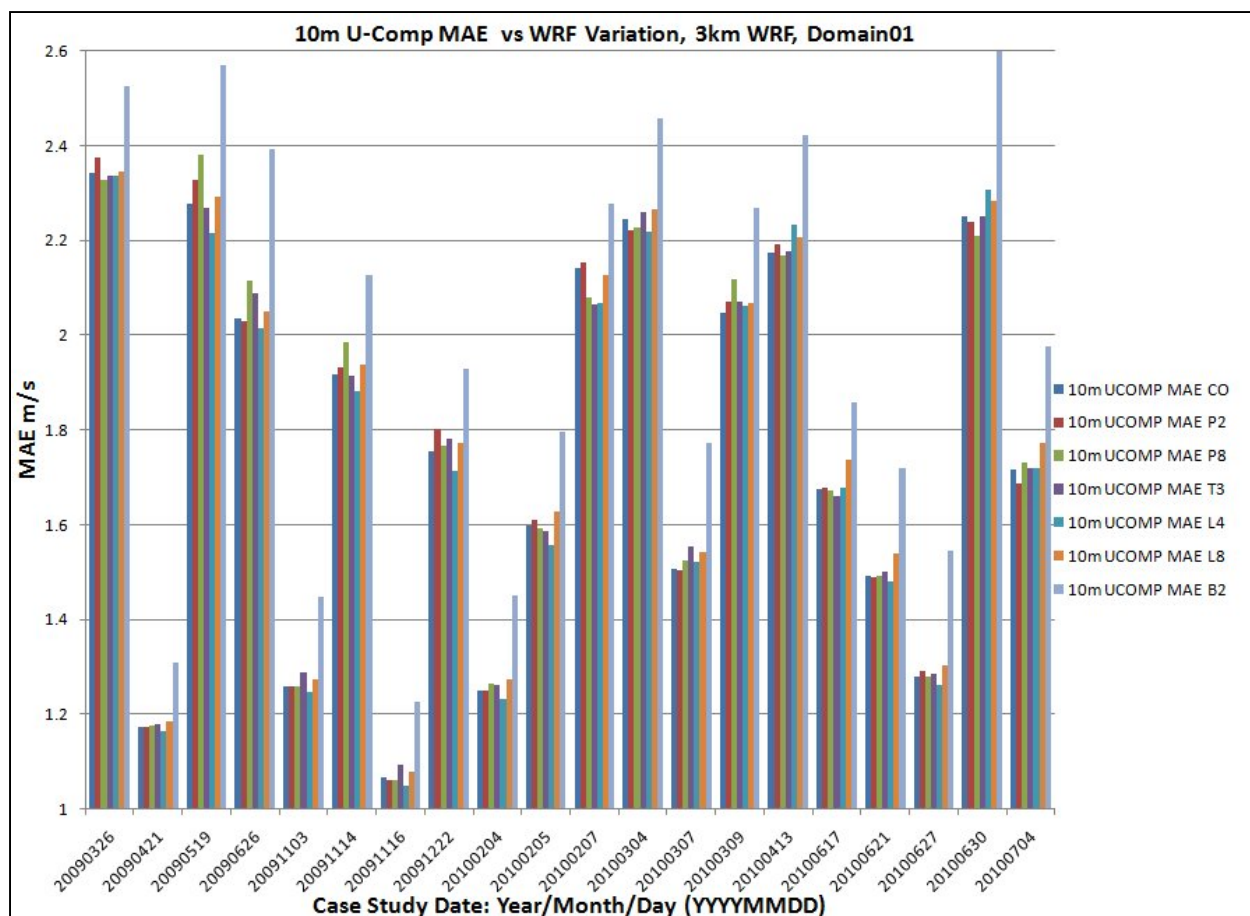


Figure A-12. Comparison of the 10-m U-component wind speed MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

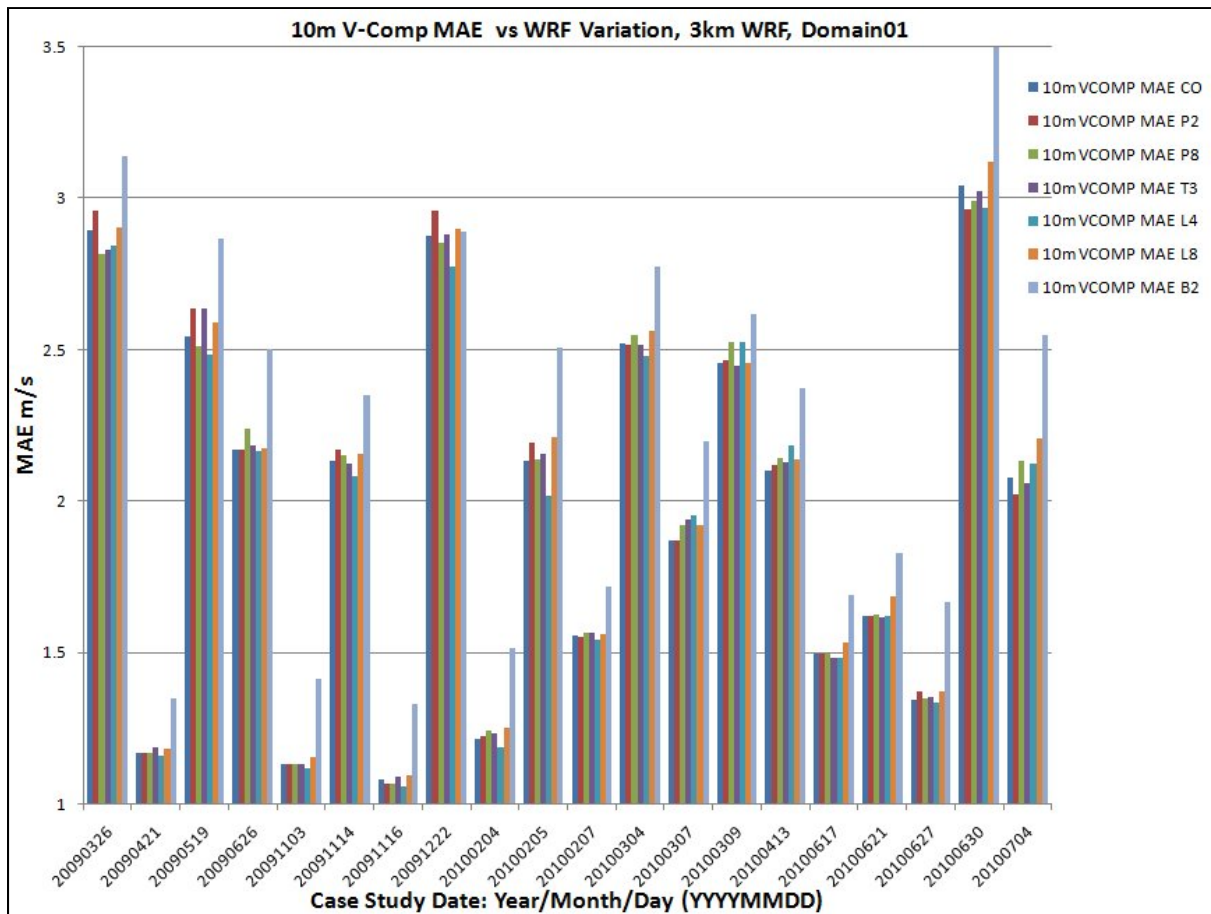


Figure A-13. Comparison of the 10-m V-component wind speed MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

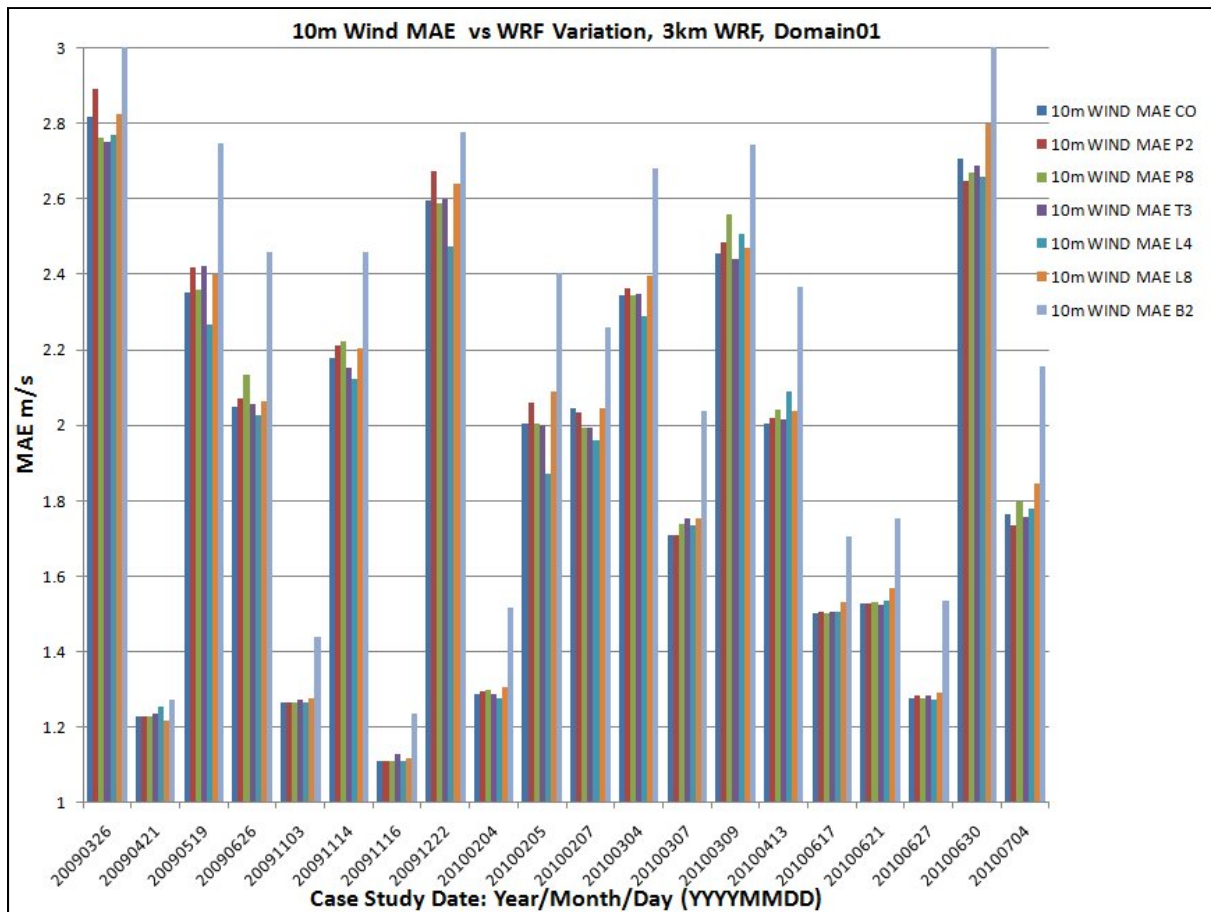


Figure A-14. Comparison of the 10-m wind speed MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

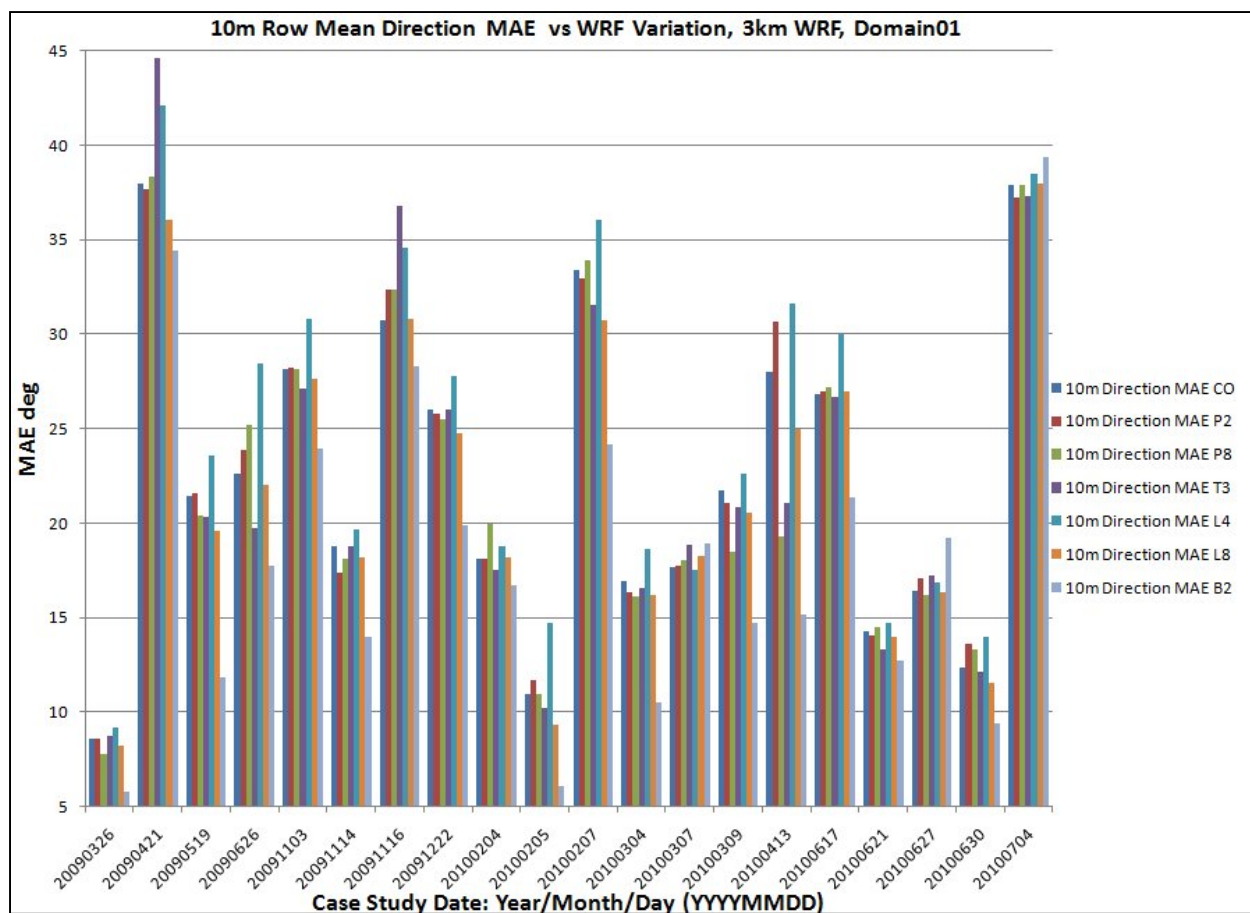


Figure A-15. Comparison of the 10-m row mean wind direction MAE statistic for 3-km WRF, Domain 1, for all parameter settings.

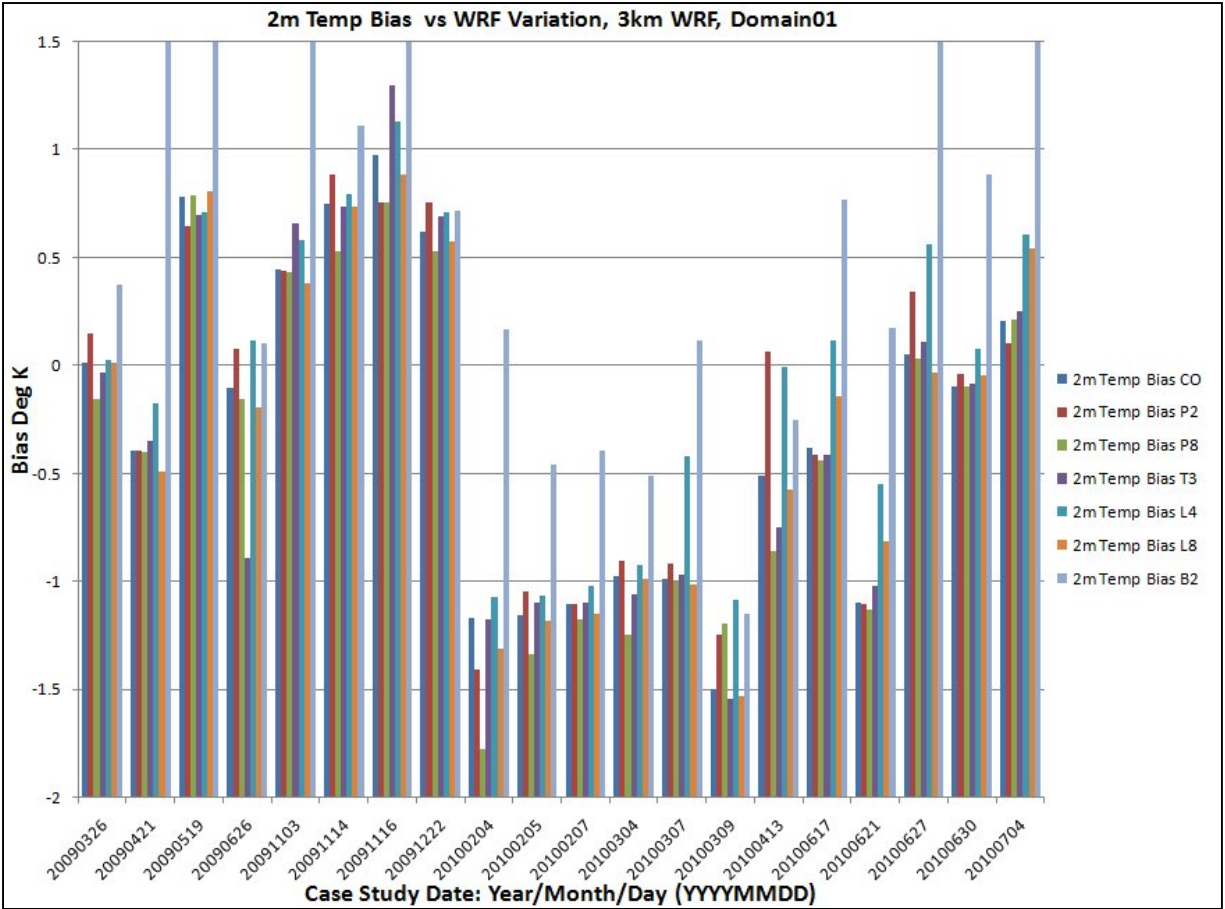


Figure A-16. Comparison of the 2-m air temperature Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

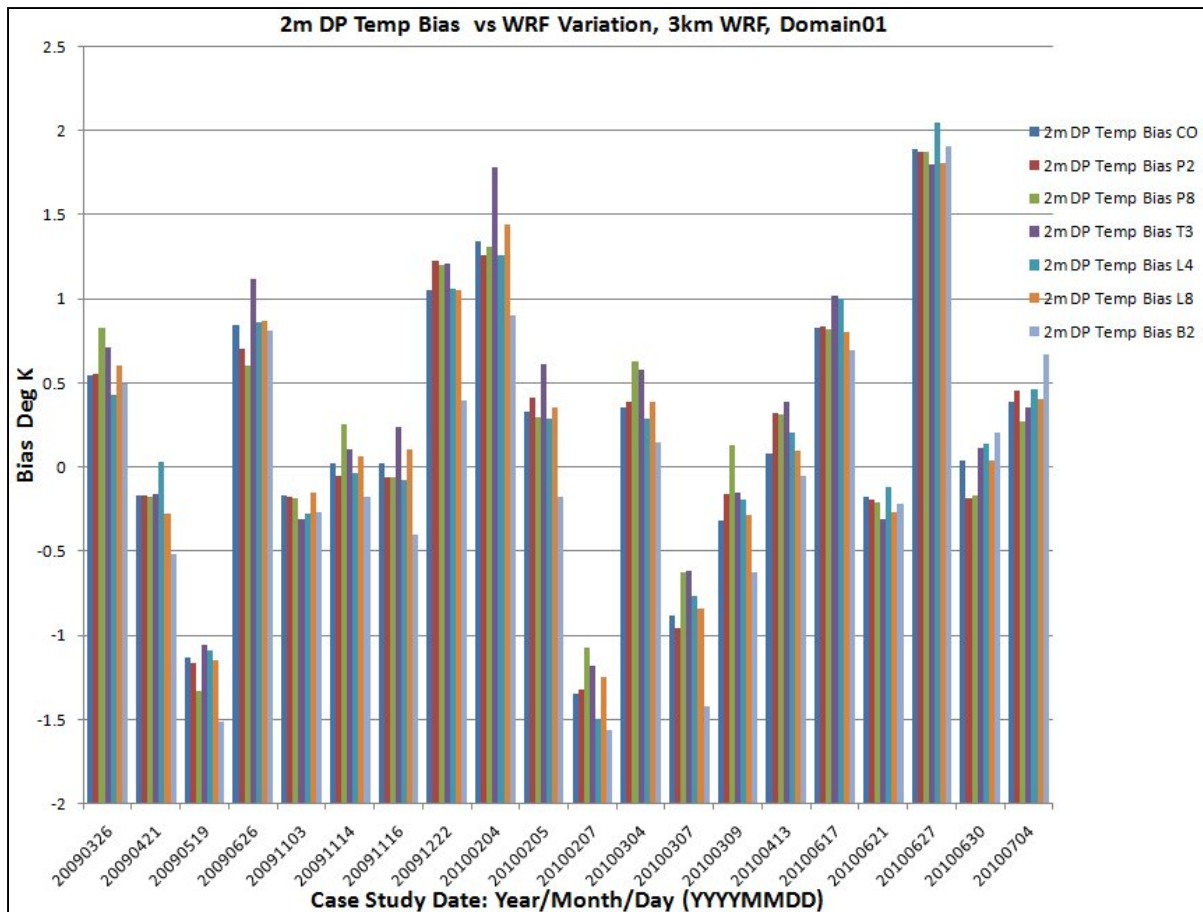


Figure A-17. Comparison of the 2-m dew point temperature Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

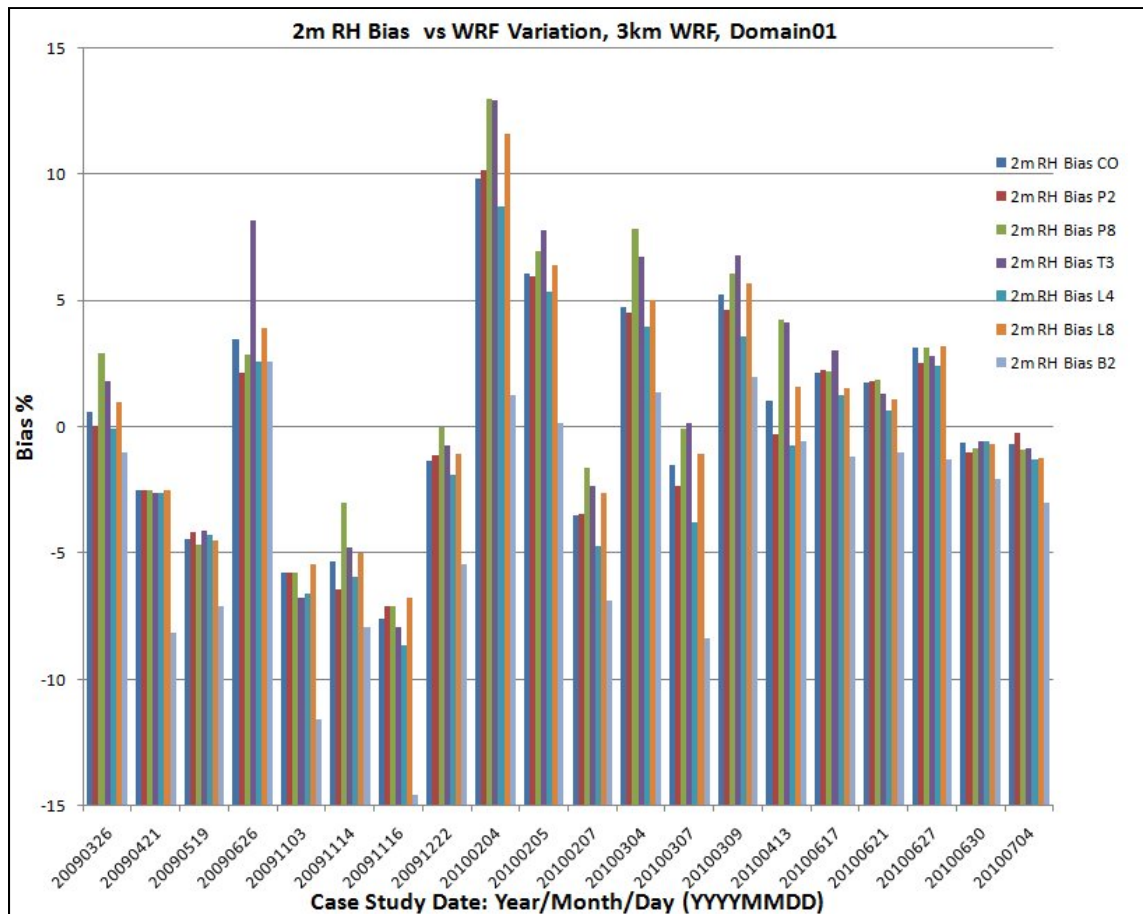


Figure A-18. Comparison of the 2-m relative humidity Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

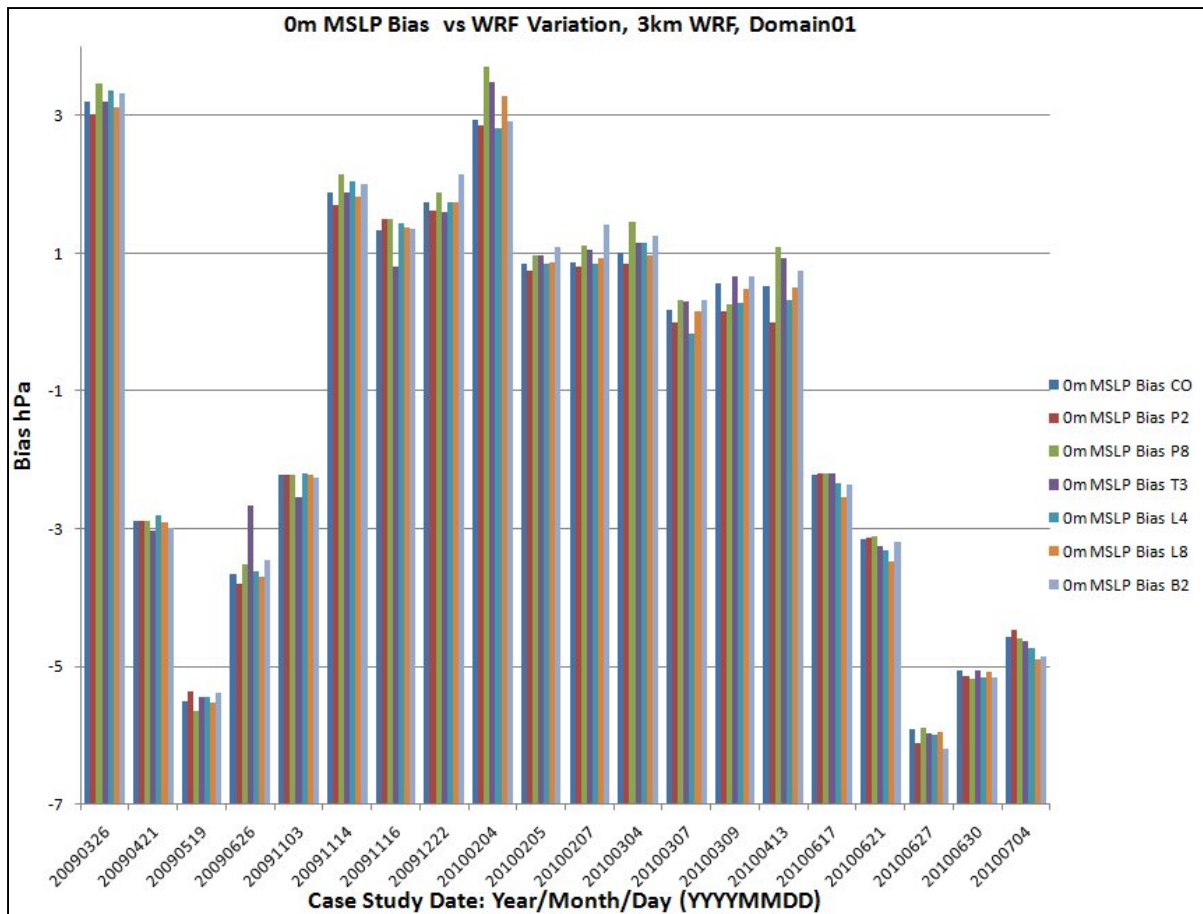


Figure A-19. Comparison of the mean sea level pressure Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

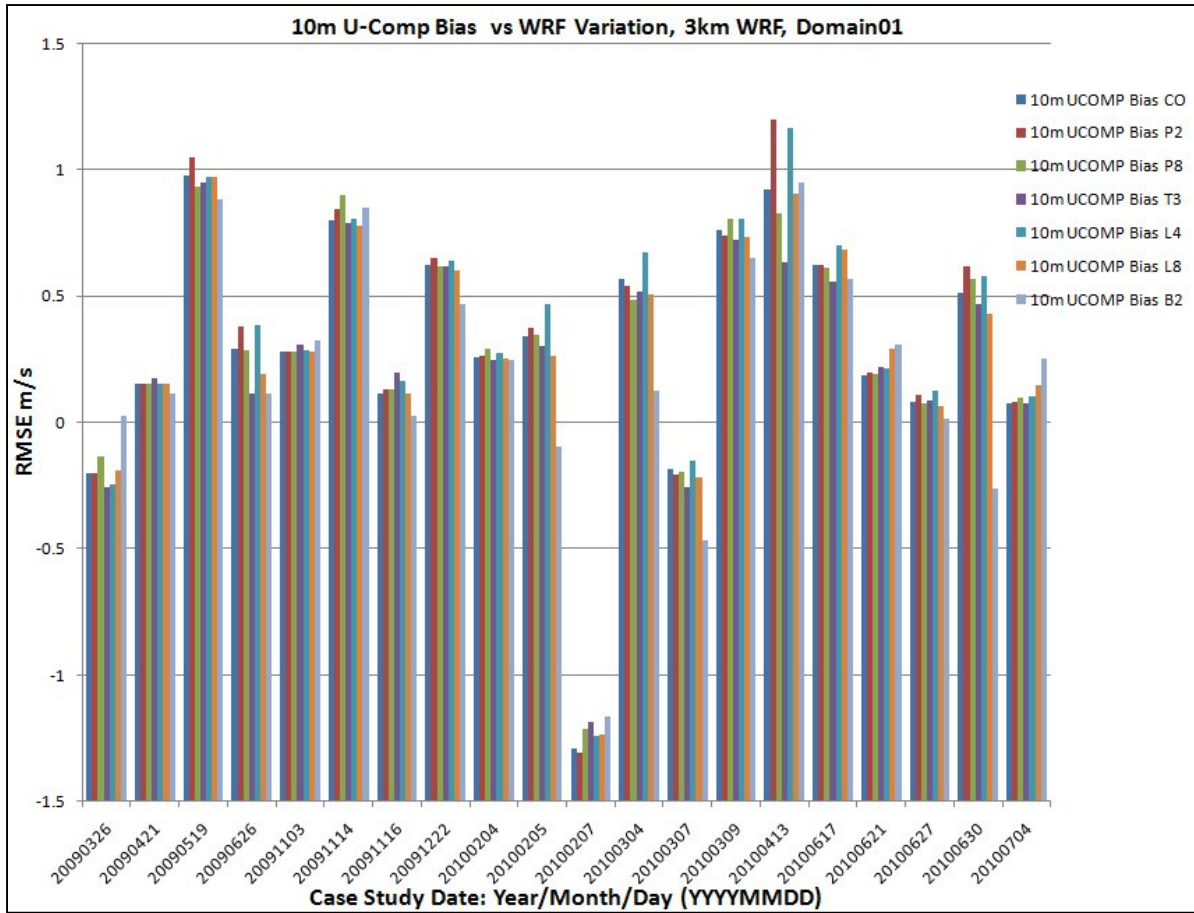


Figure A-20. Comparison of the 10-m U-component wind speed Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

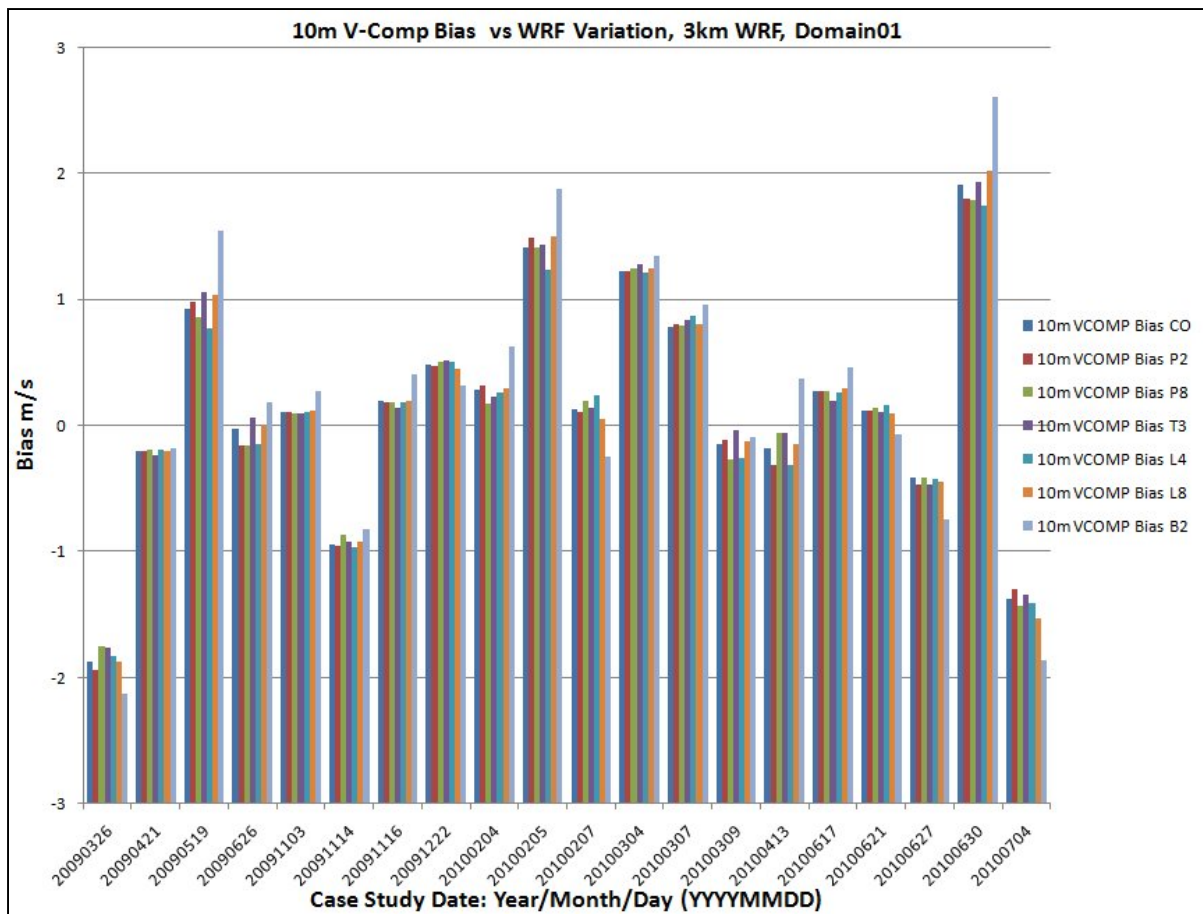


Figure A-21. Comparison of the 10-m V-component wind speed Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

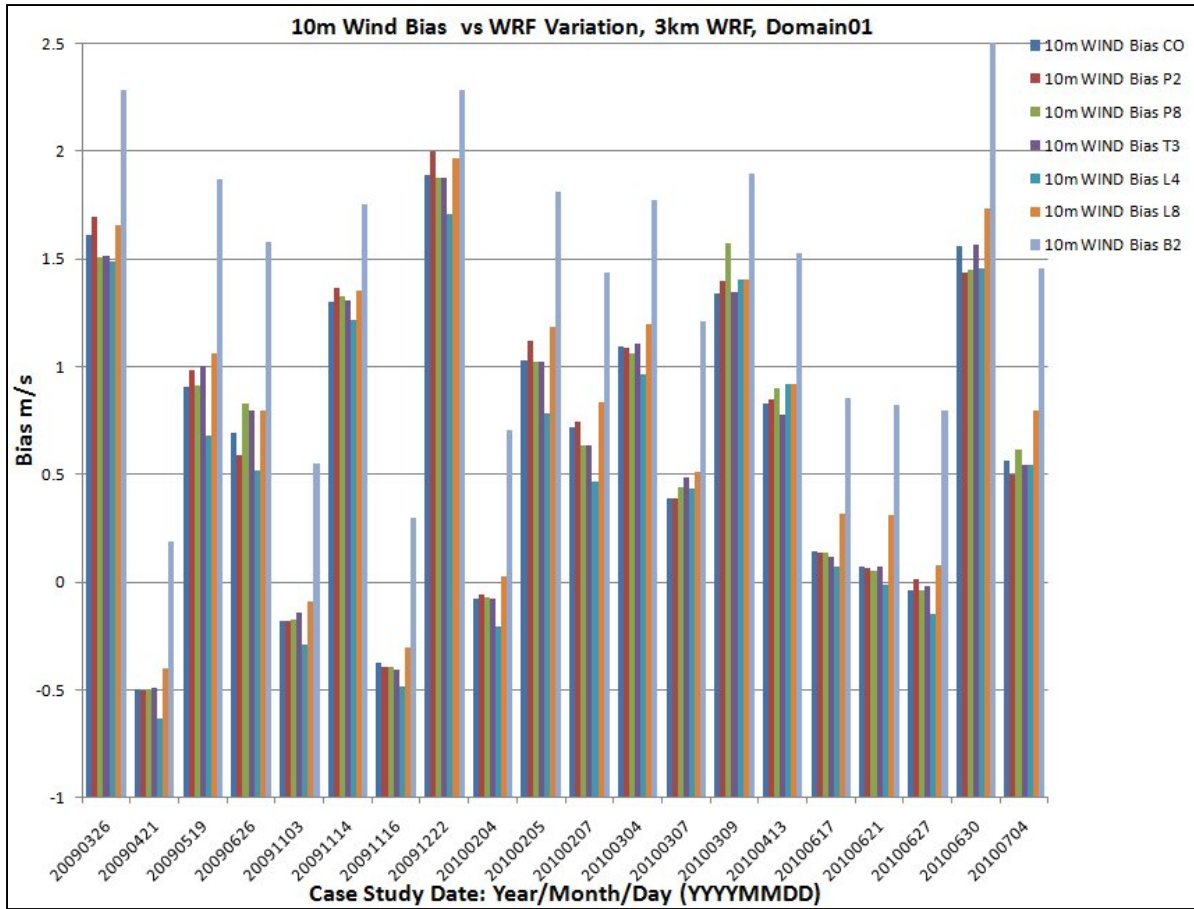


Figure A-22. Comparison of the 10-m wind speed Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

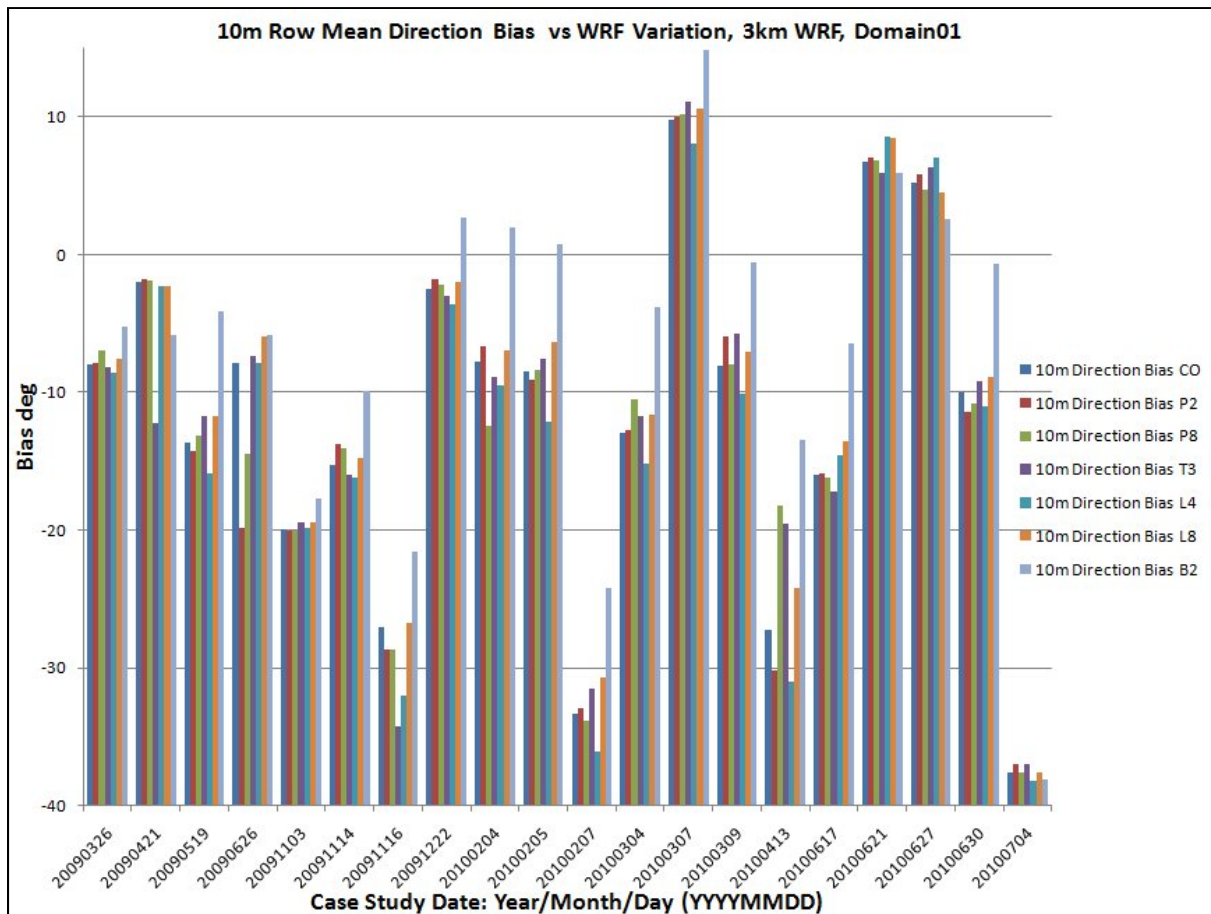


Figure A-23. Comparison of the 10-m row mean wind direction Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

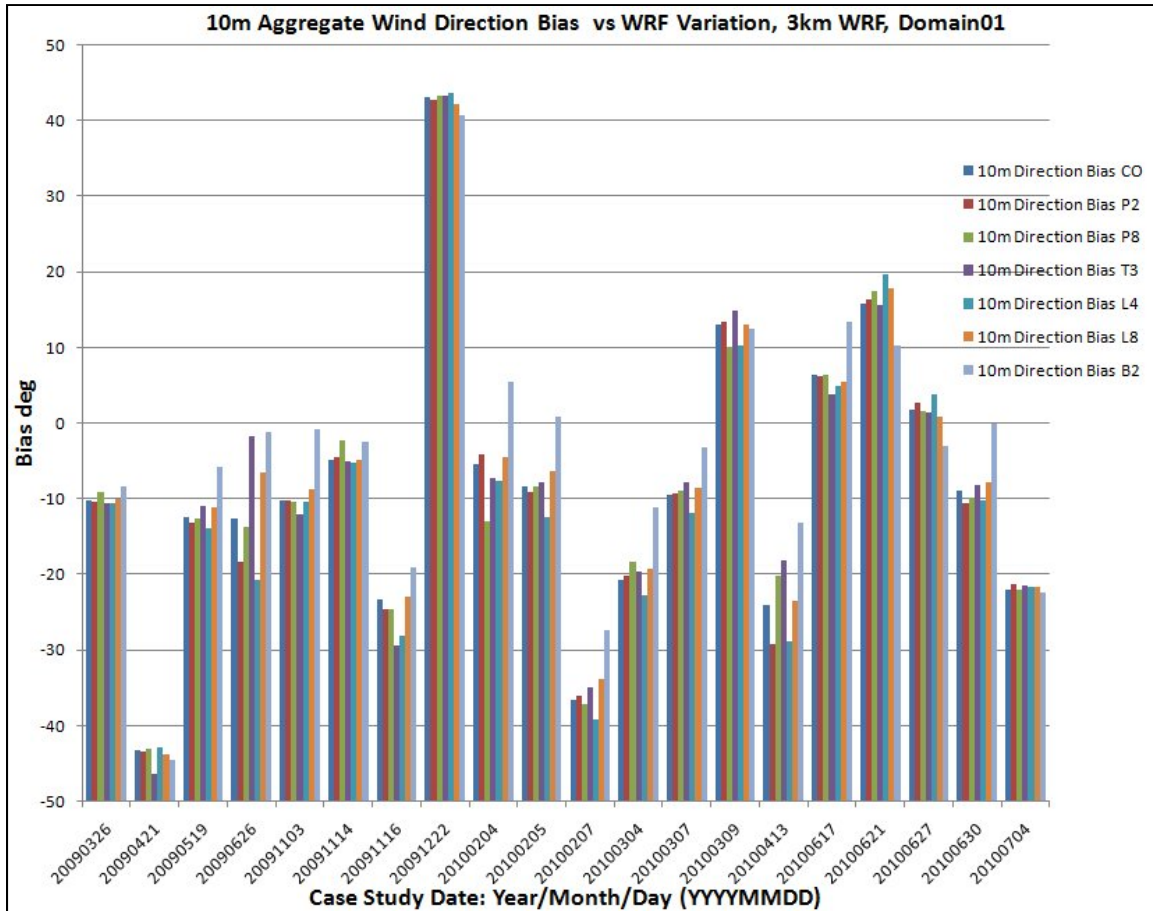


Figure A-24. Comparison of the 10-m aggregate wind direction Bias statistic for 3-km WRF, Domain 1, for all parameter settings.

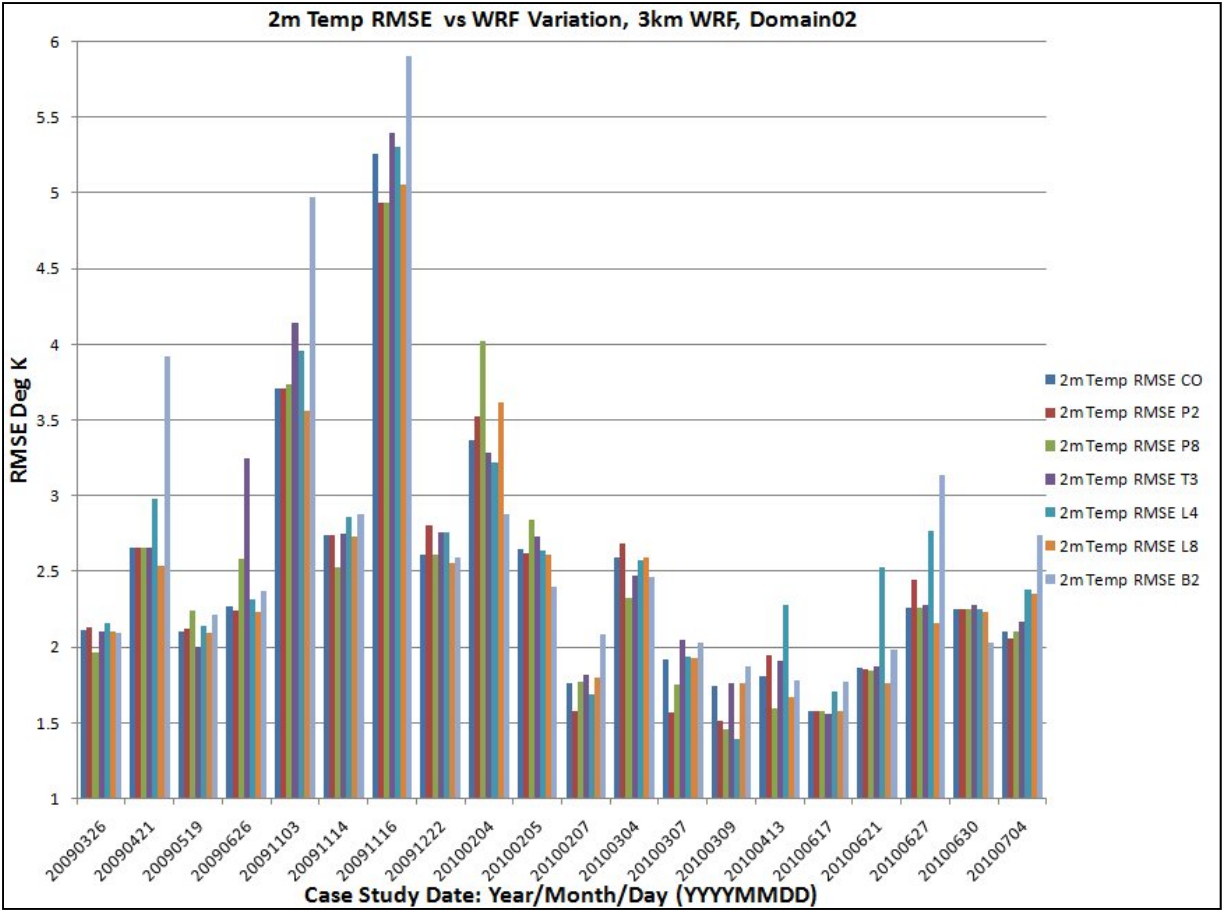


Figure A-25. Comparison of the 2-m air temperature RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

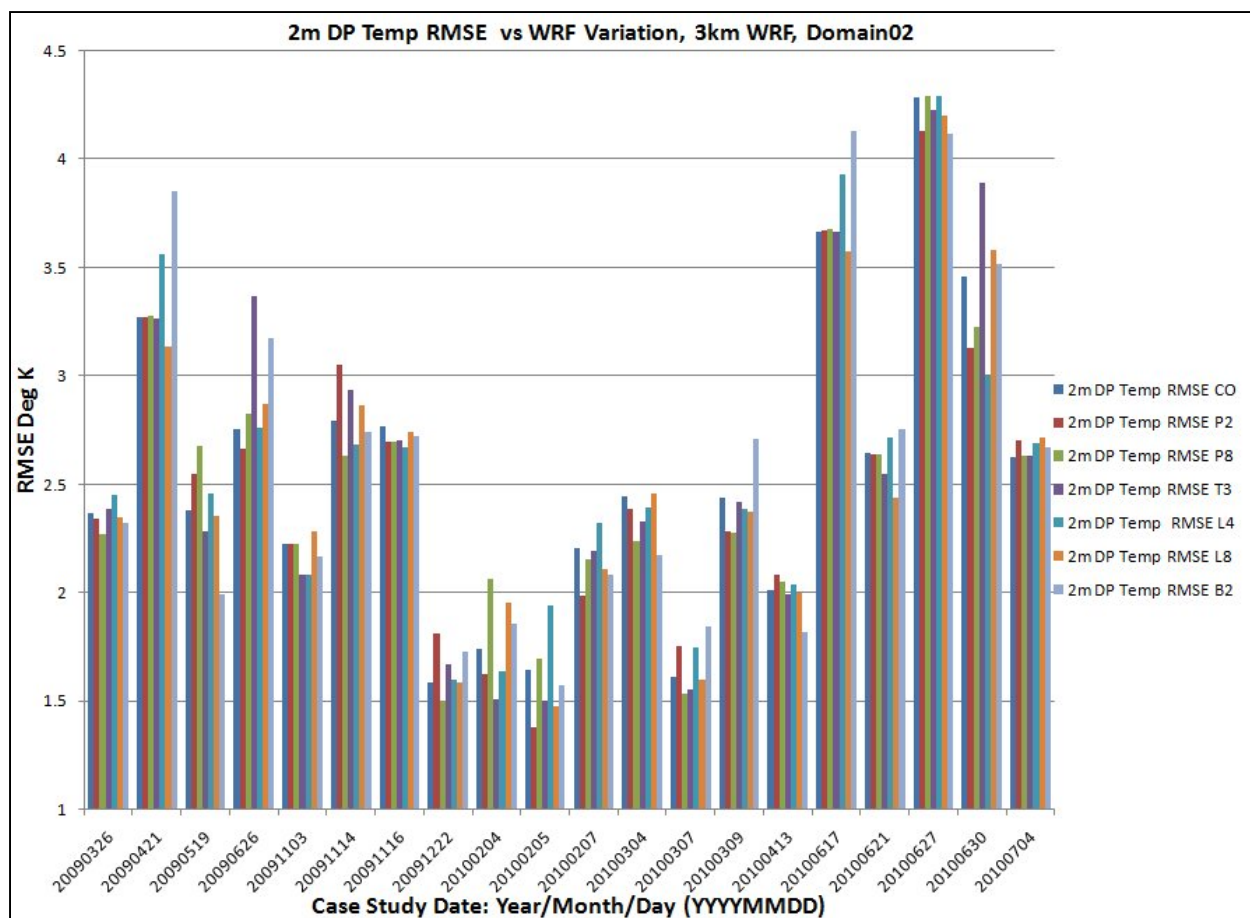


Figure A-26. Comparison of the 2-m dew point temperature RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

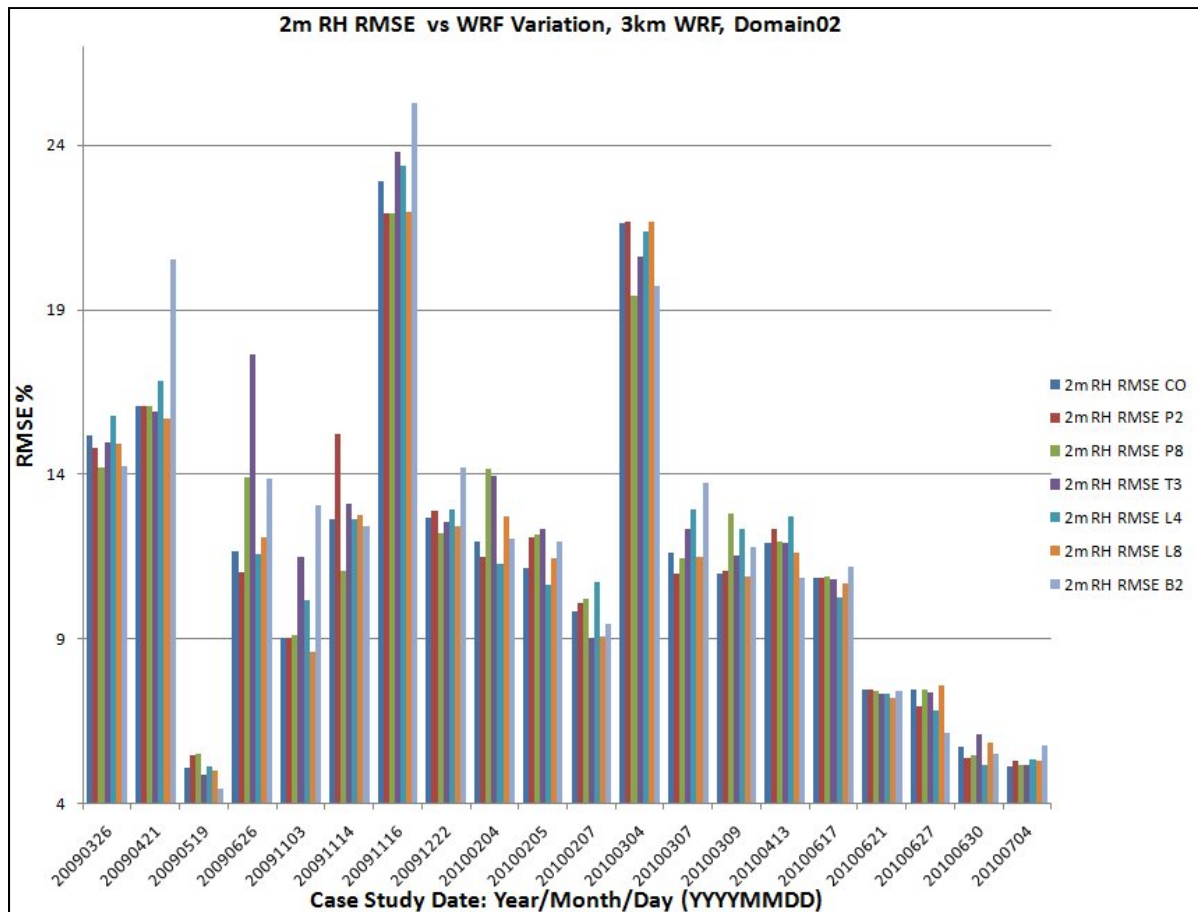


Figure A-27. Comparison of the 2-m relative humidity RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

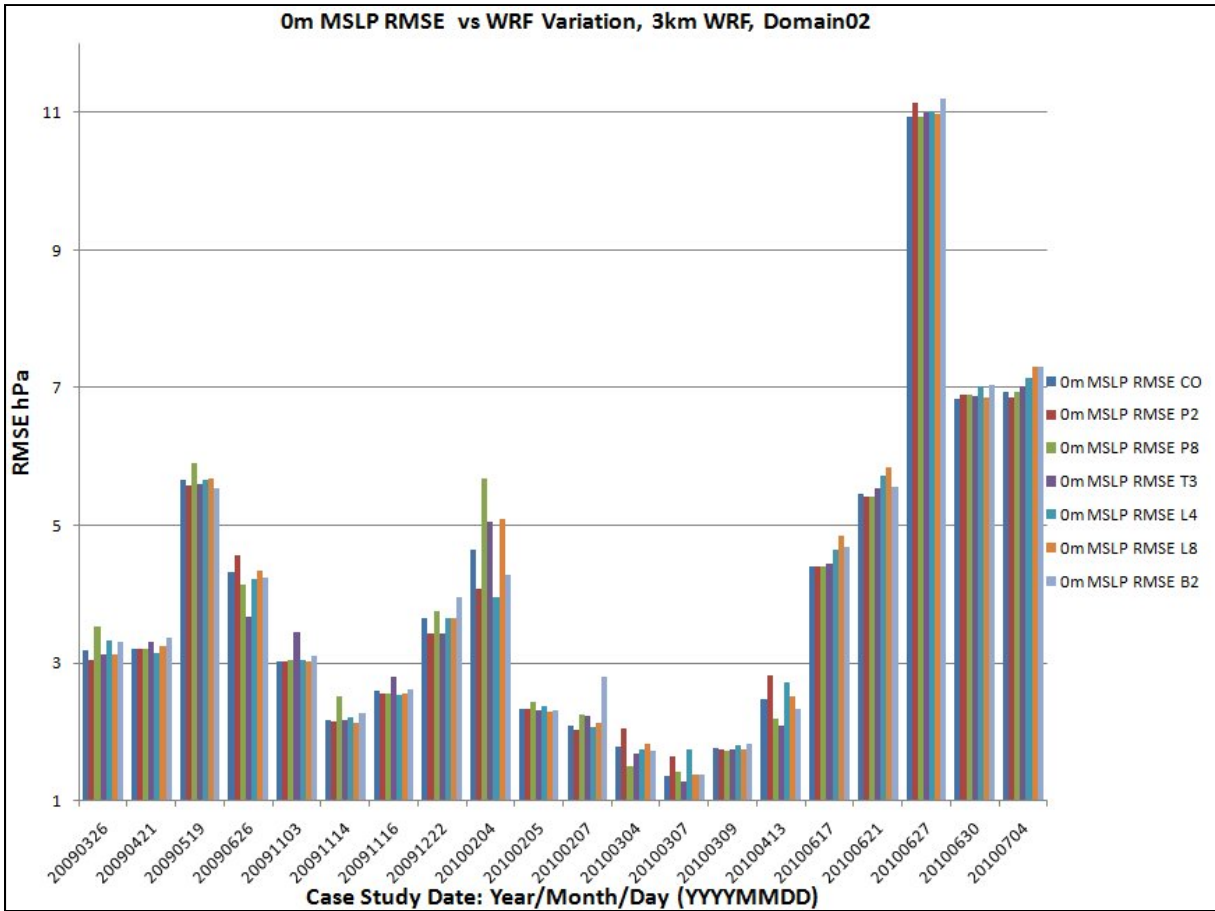


Figure A-28. Comparison of the mean sea level pressure RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

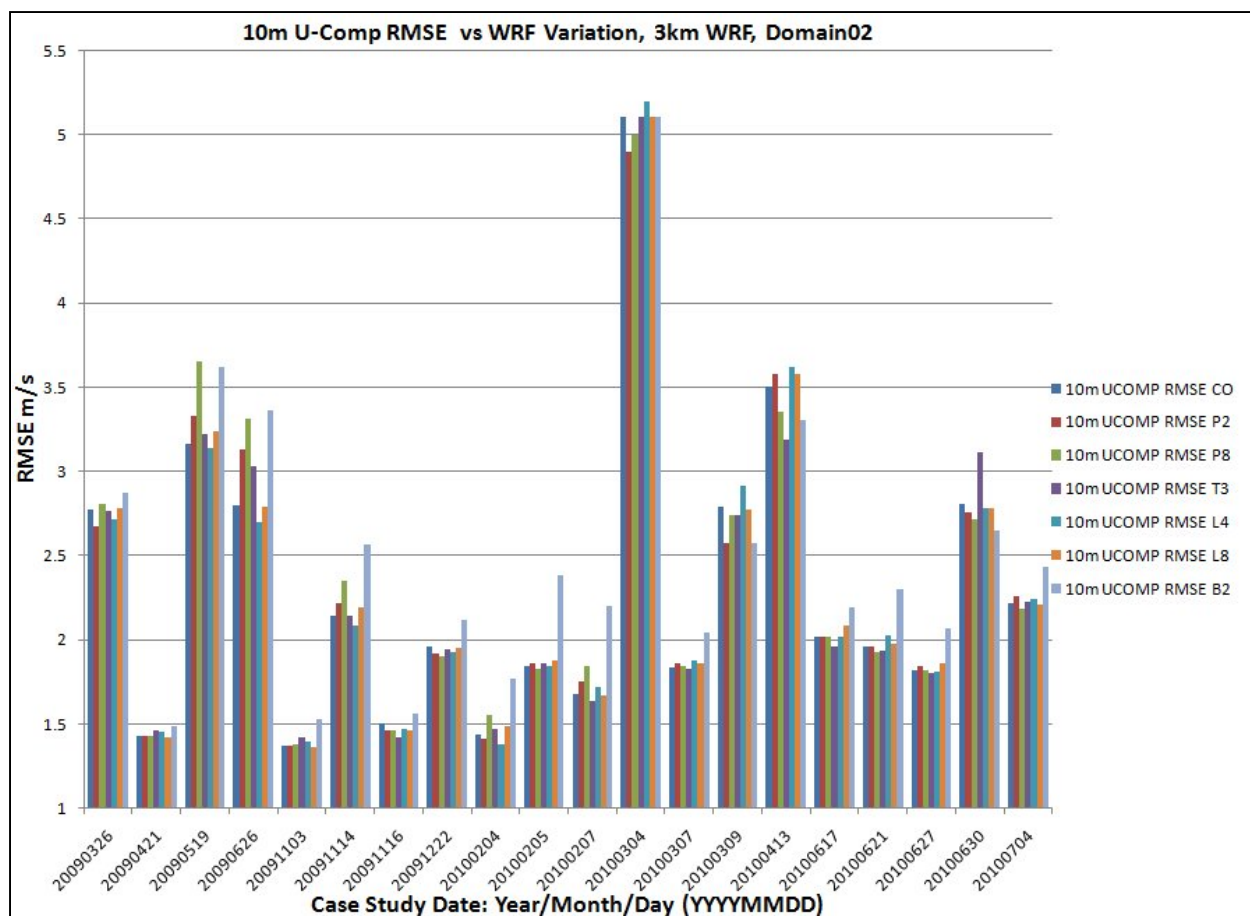


Figure A-29. Comparison of the 10-m U-component wind speed RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

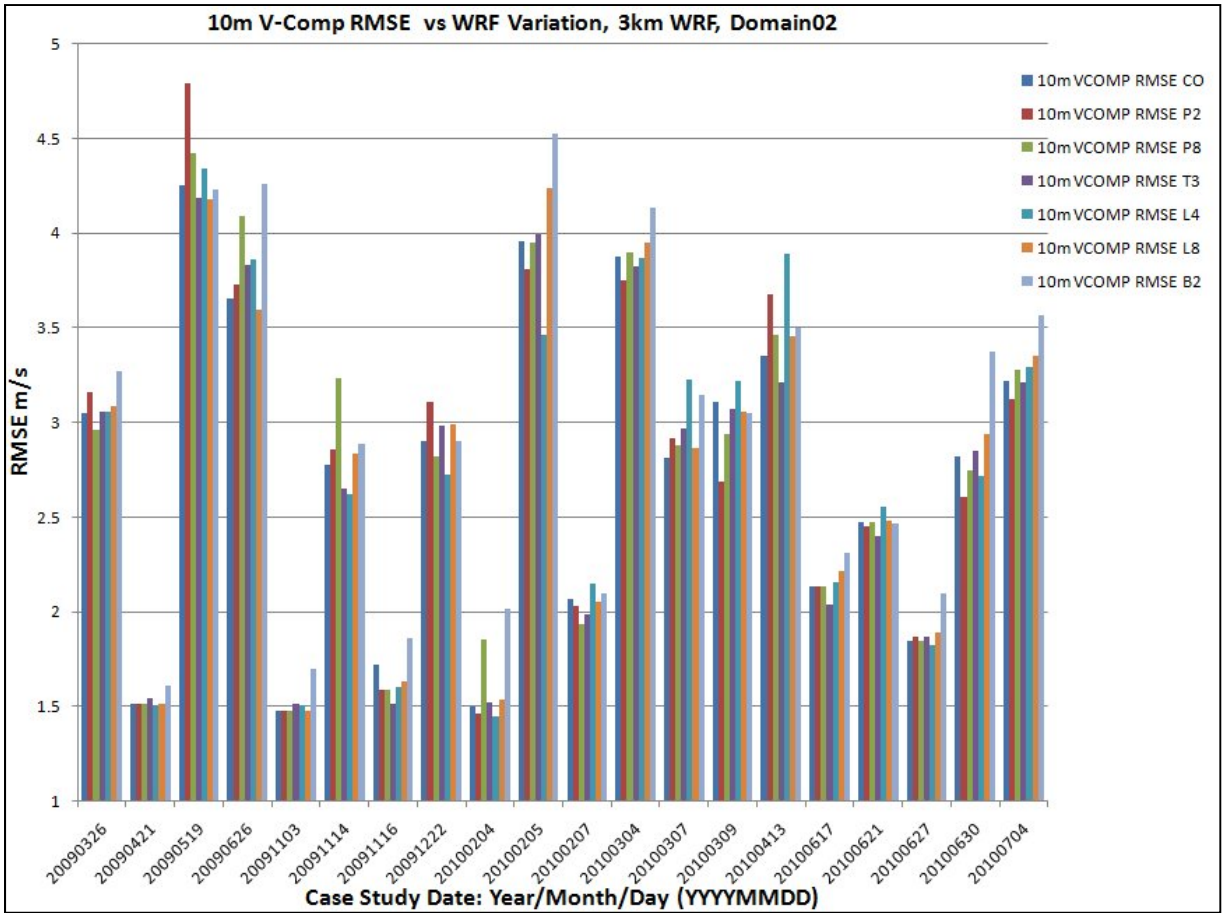


Figure A-30. Comparison of the 10-m V-component wind speed RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

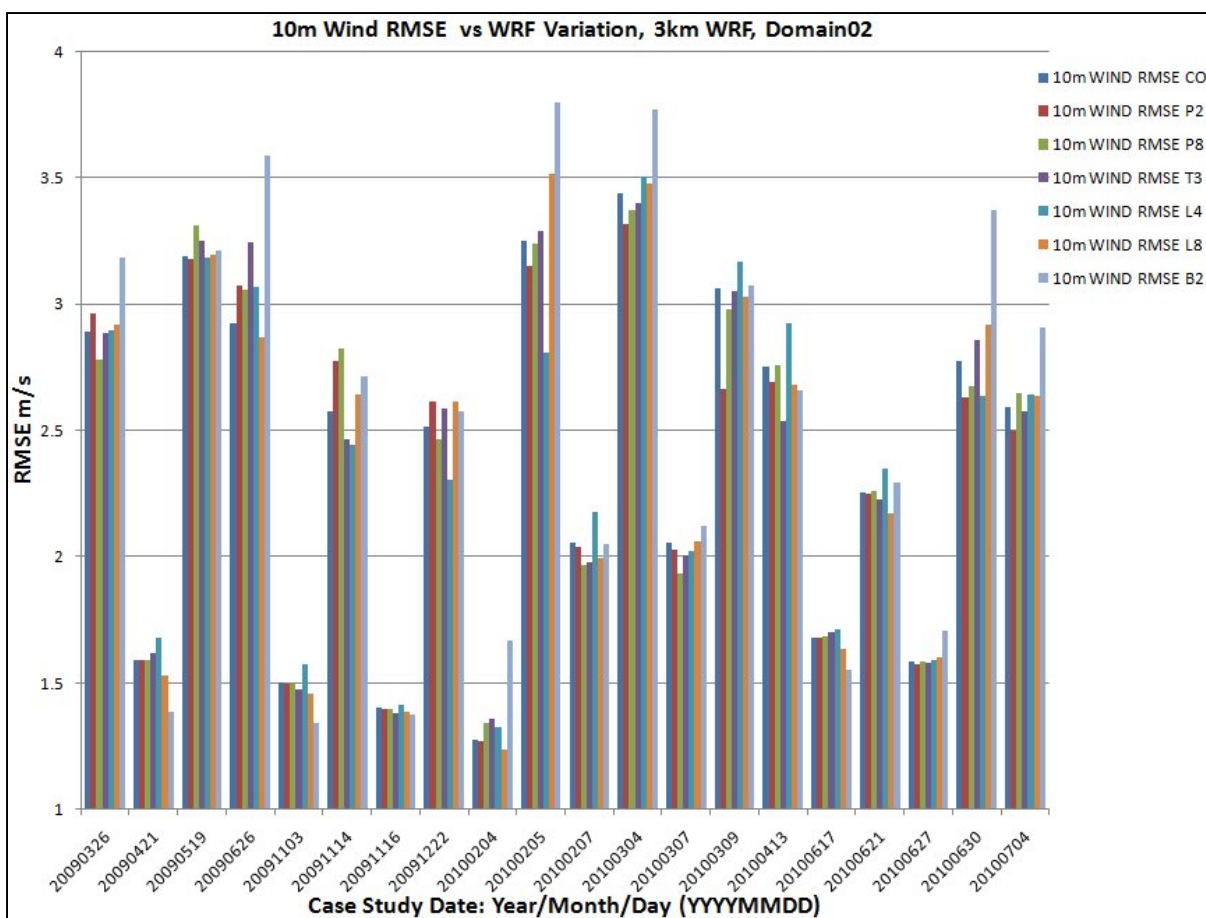


Figure A-31. Comparison of the 10-m wind speed RMSE statistic for 3-km WRF, Domain 2, for all parameter settings.

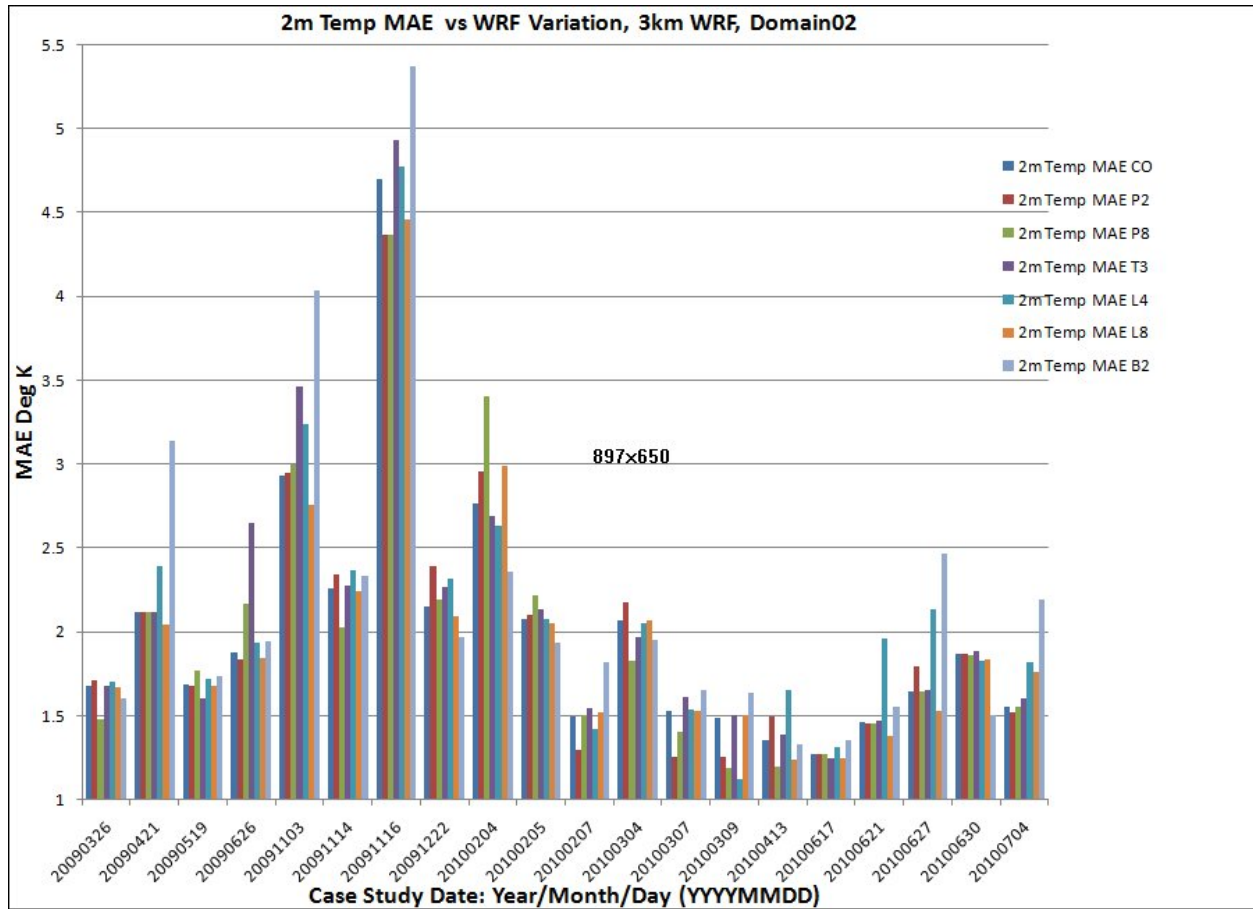


Figure A-32. Comparison of the 2-m air temperature MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

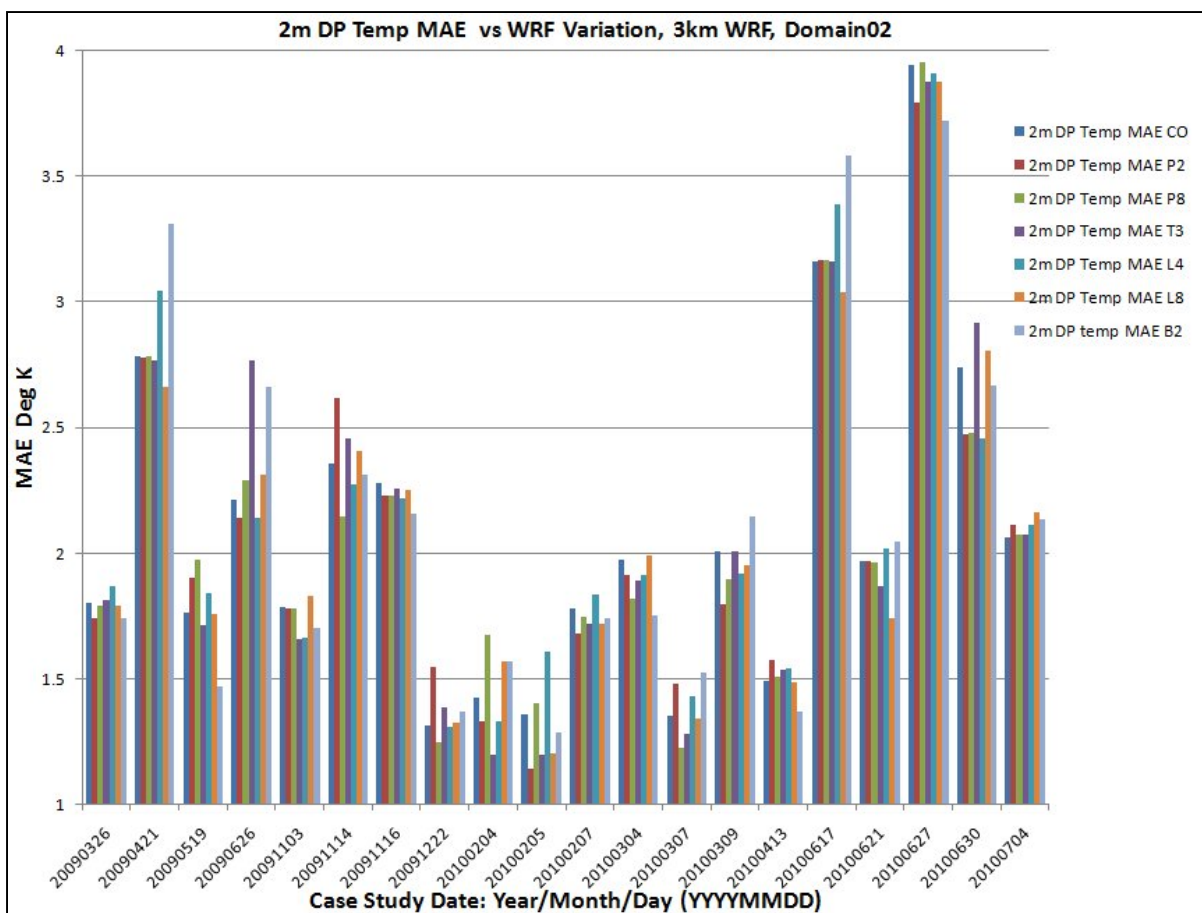


Figure A-33. Comparison of the 2-m dew point temperature MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

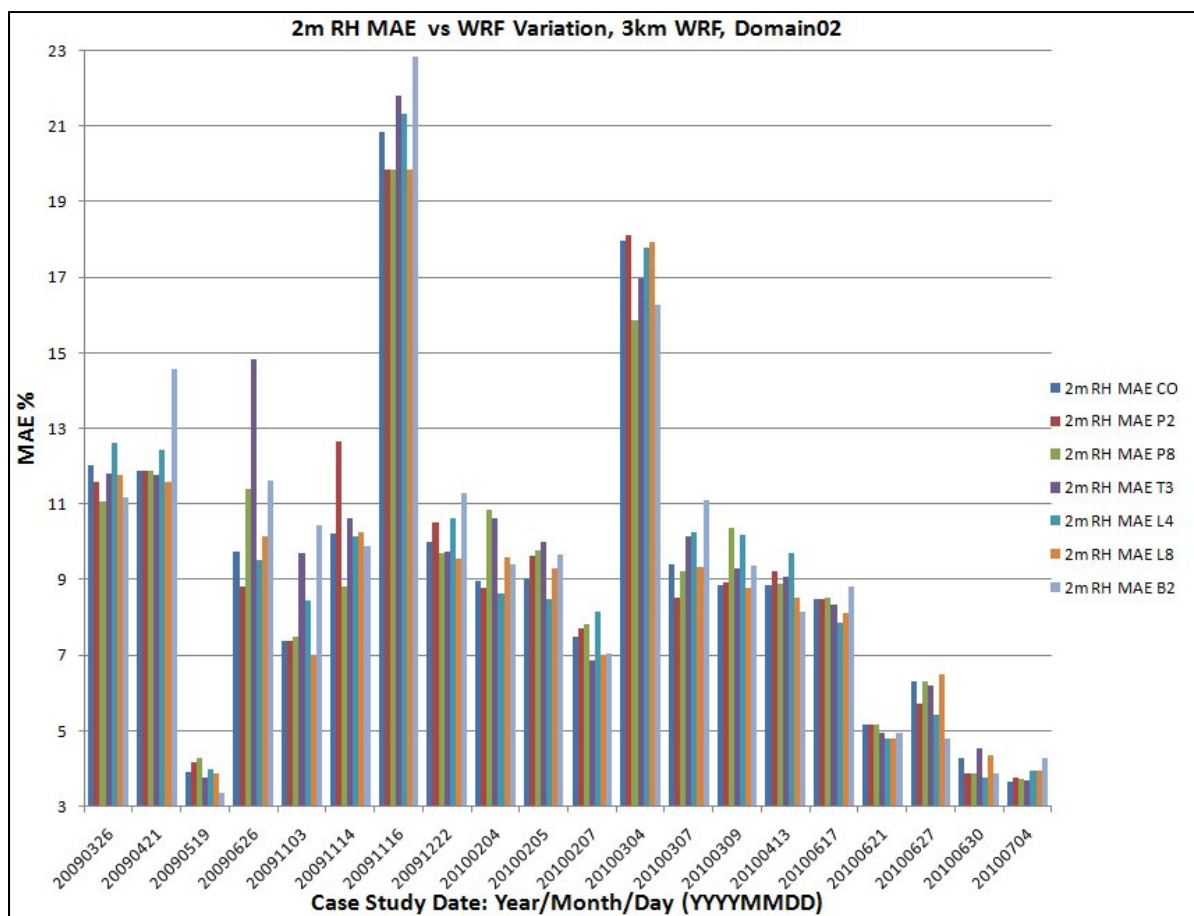


Figure A-34. Comparison of the 2-m relative humidity MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

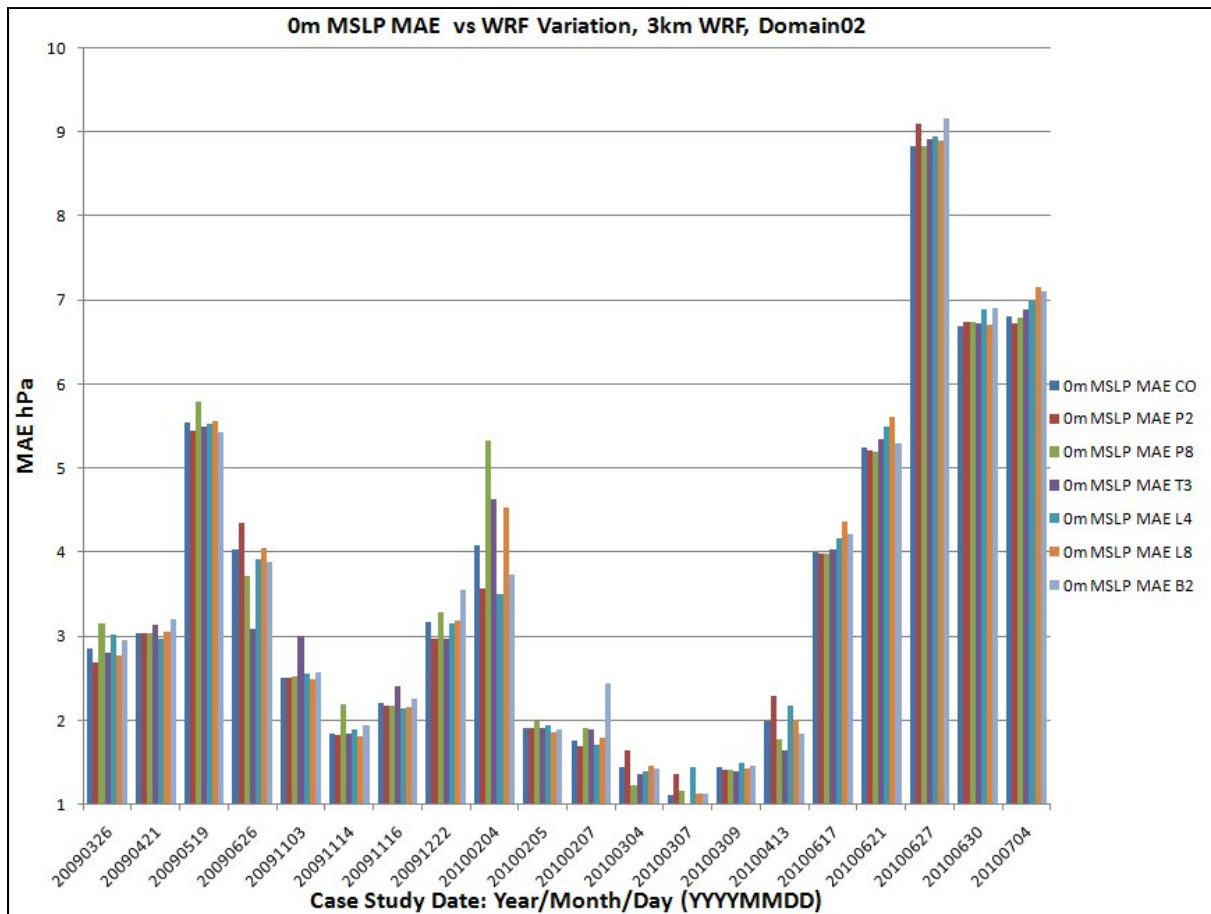


Figure A-35. Comparison of the mean sea level pressure MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

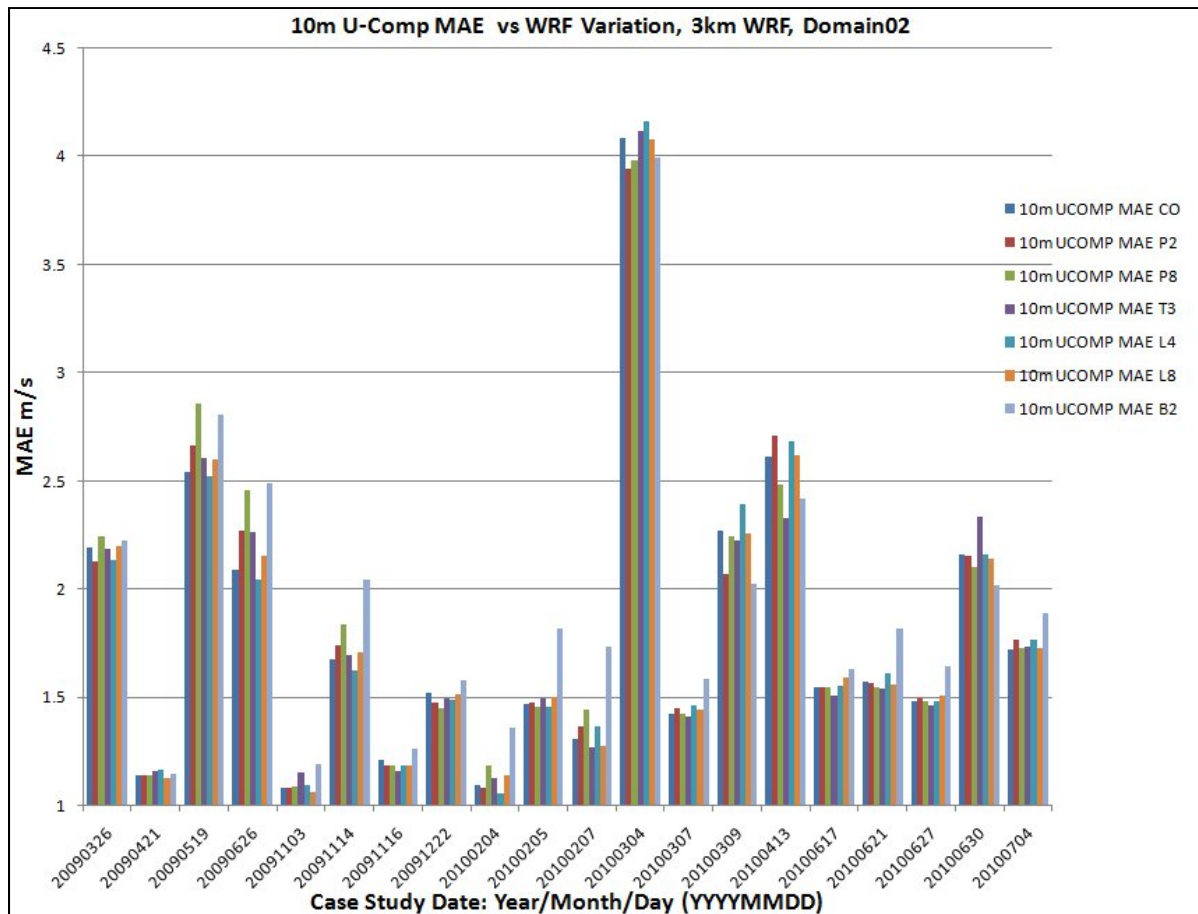


Figure A-36. Comparison of the 10-m U-component wind speed MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

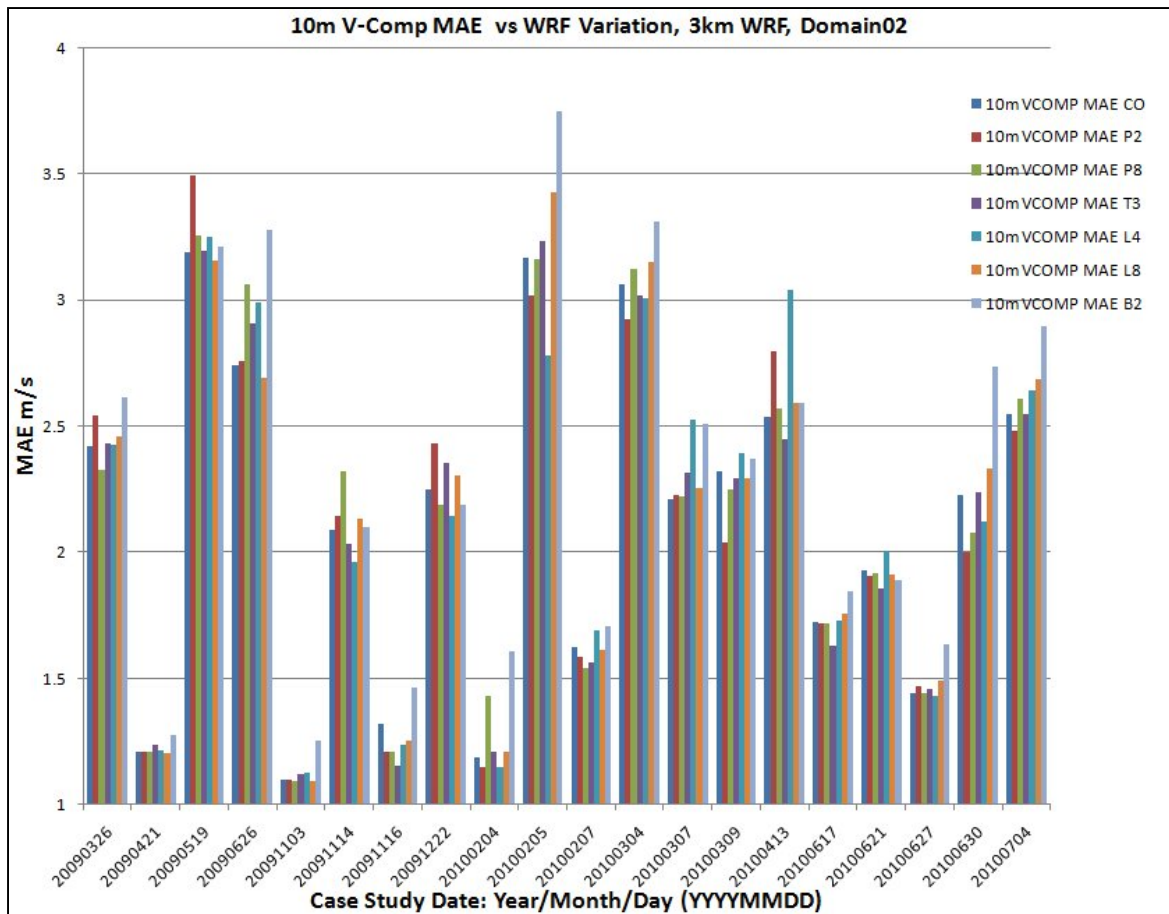


Figure A-37. Comparison of the 10-m V-component wind speed MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

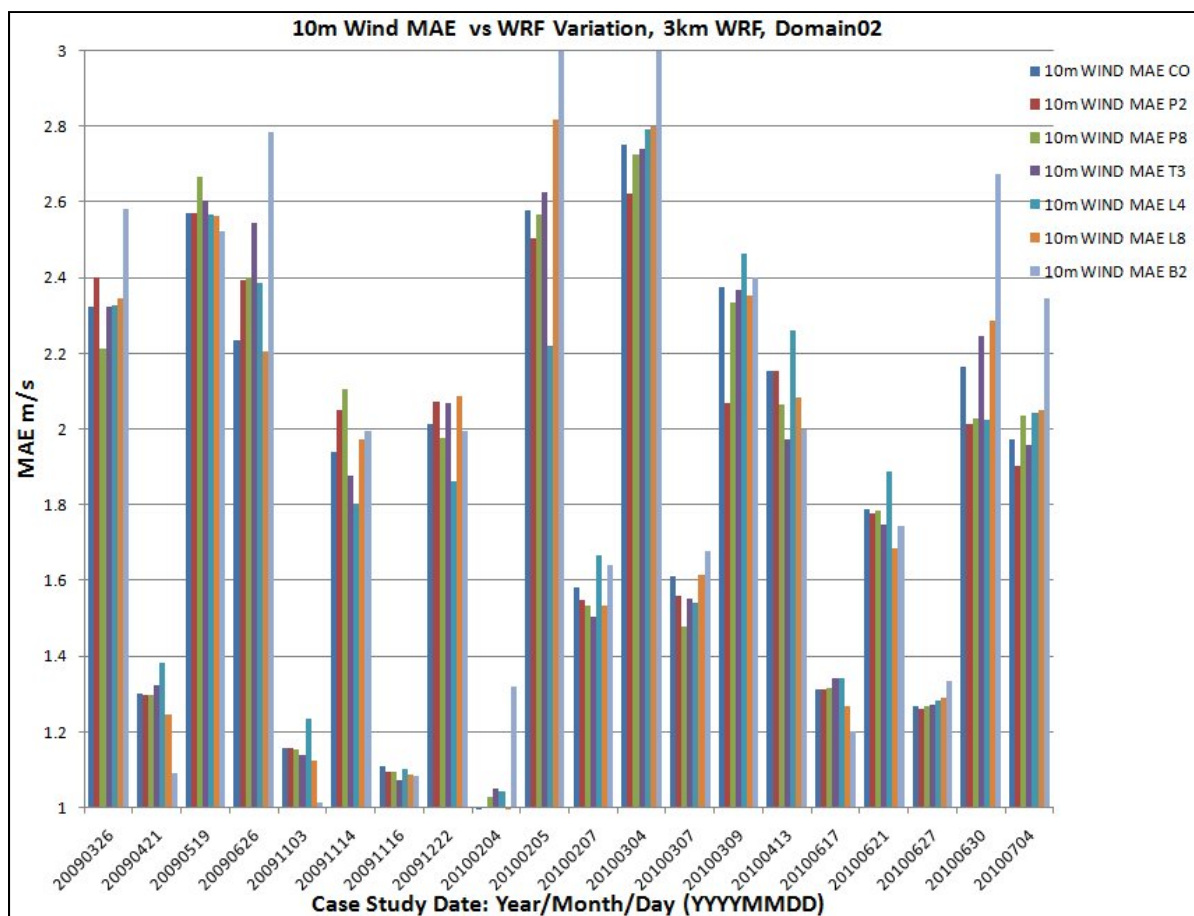


Figure A-38. Comparison of the 10-m wind speed MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

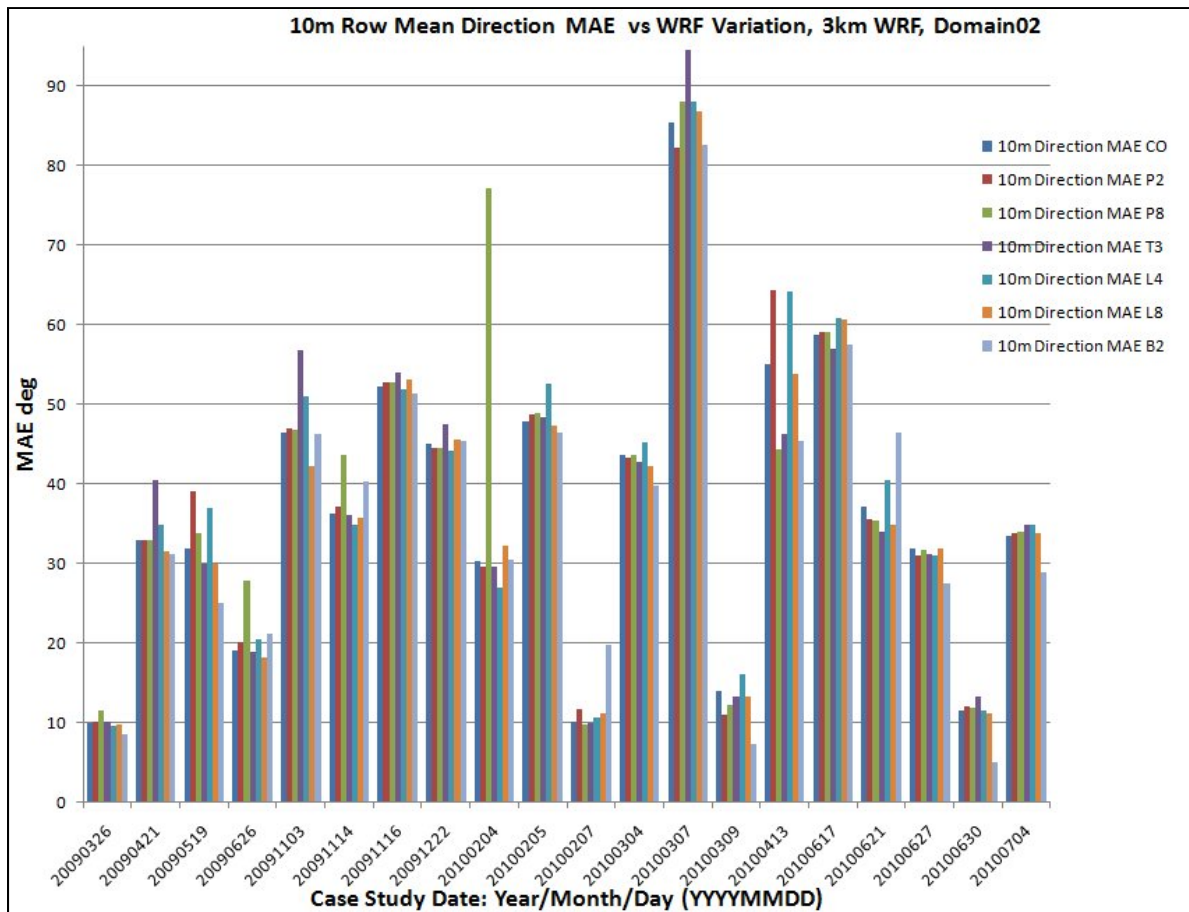


Figure A-39. Comparison of the 10-m row mean wind direction MAE statistic for 3-km WRF, Domain 2, for all parameter settings.

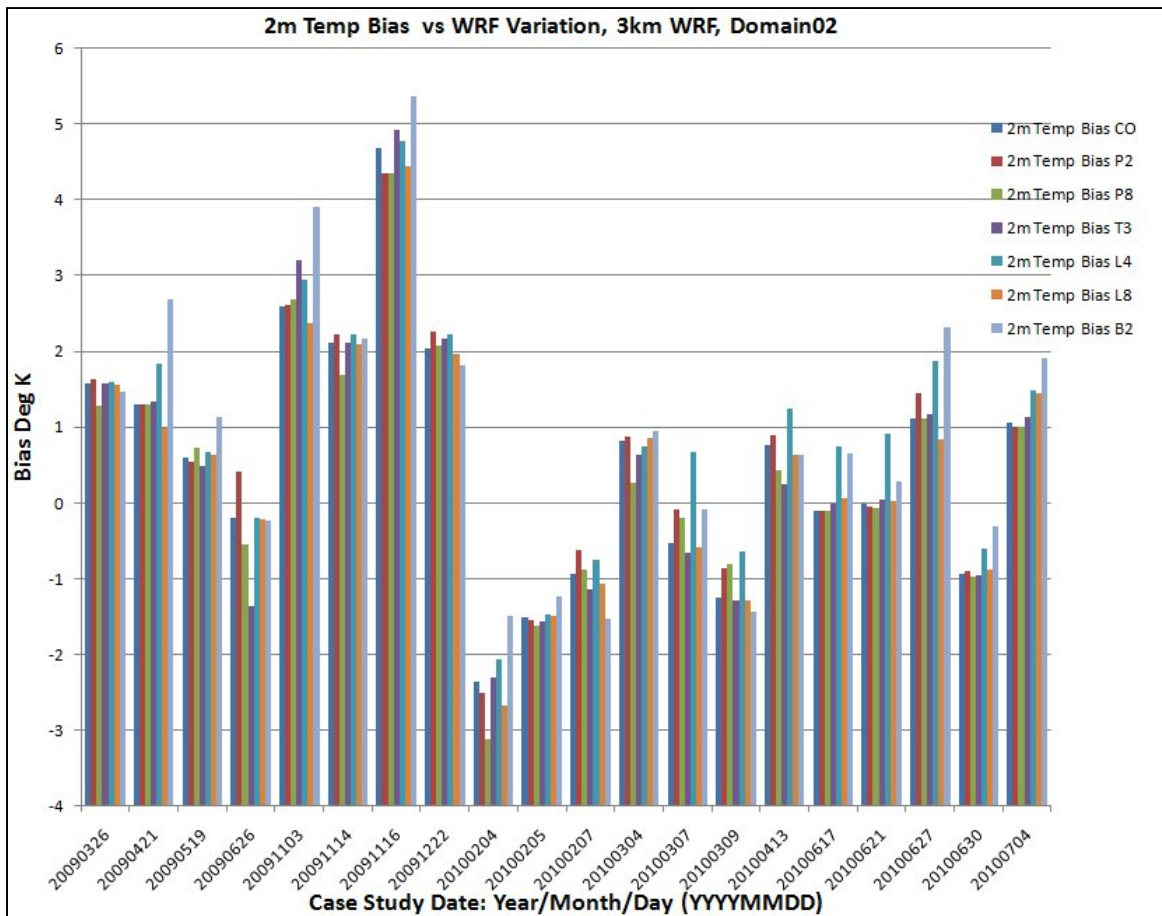


Figure A-40. Comparison of the 2-m air temperature Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

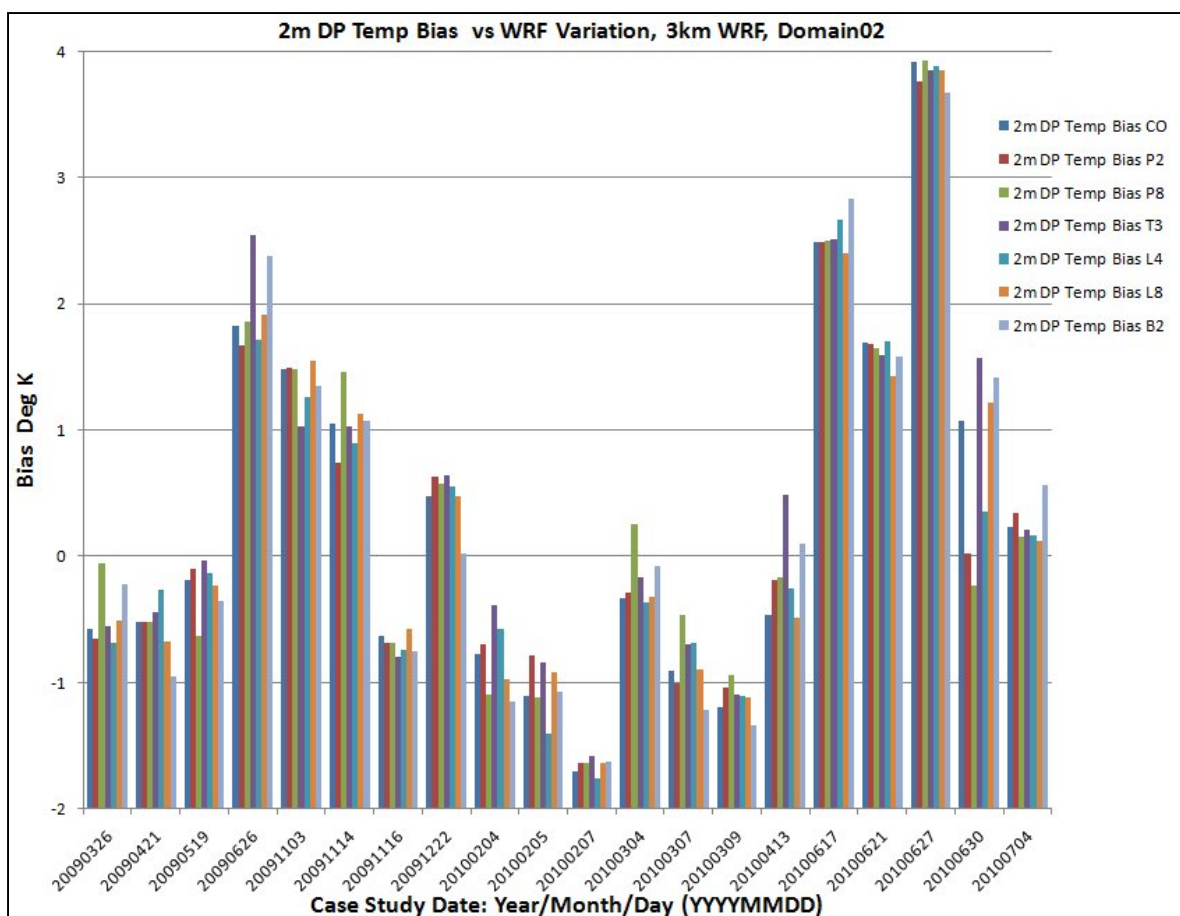


Figure A-41. Comparison of the 2-m dew point temperature Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

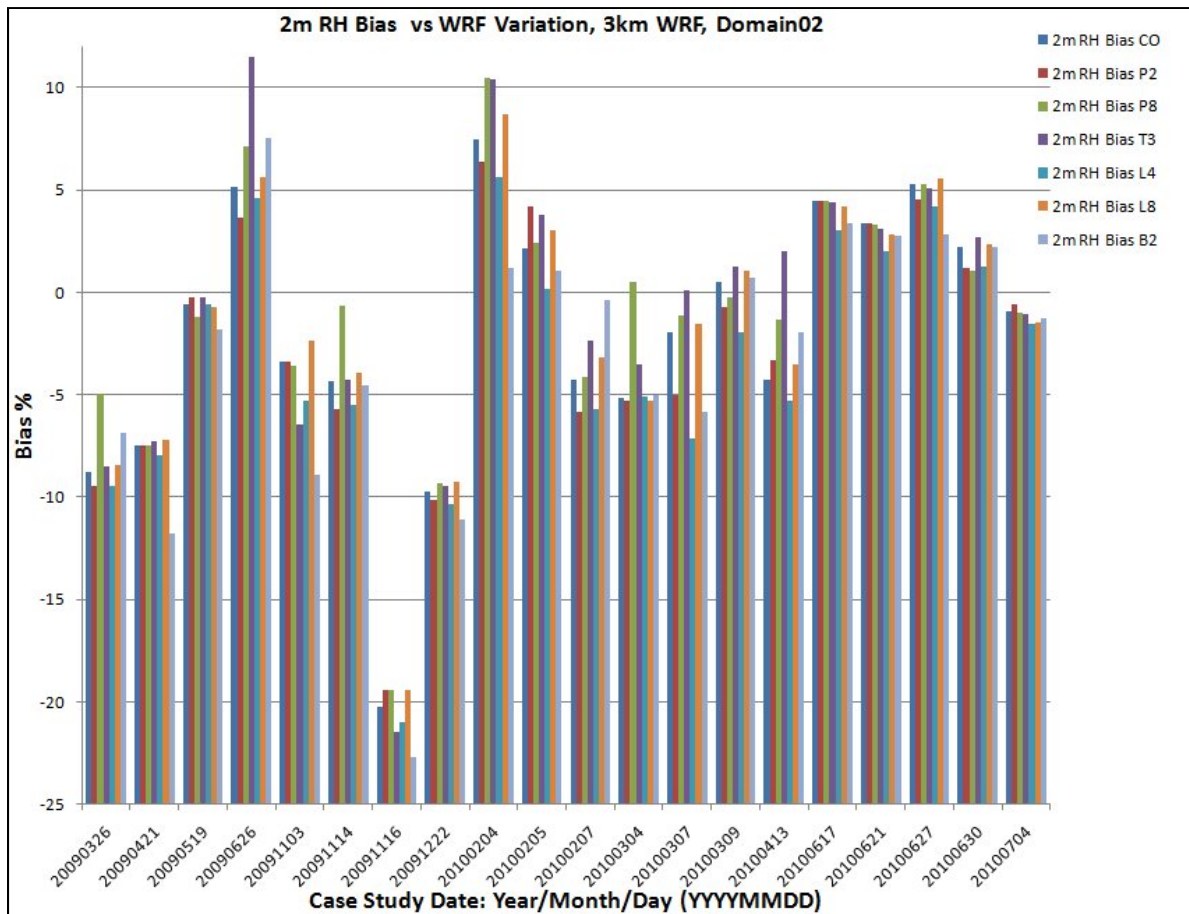


Figure A-42. Comparison of the 2-m relative humidity Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

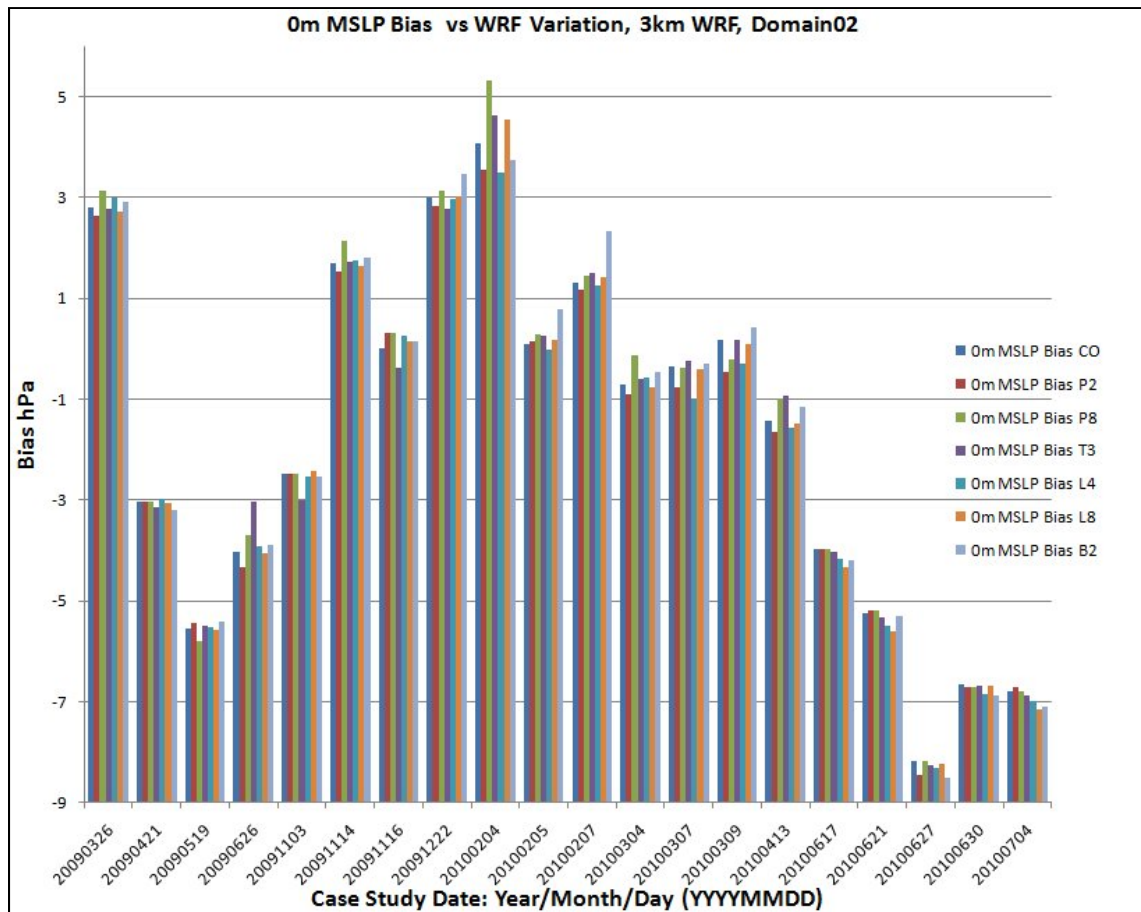


Figure A-43. Comparison of the mean sea level pressure Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

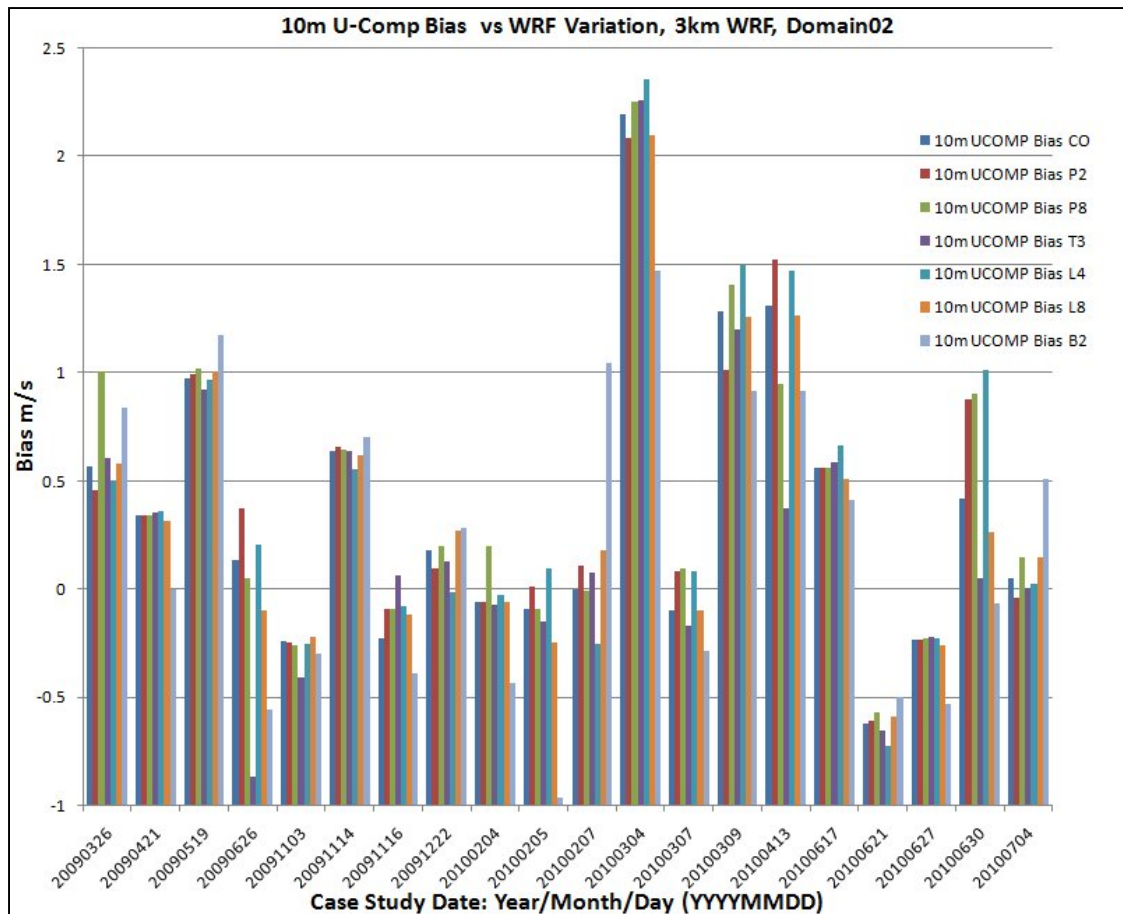


Figure A-44. Comparison of the 10-m U-component wind speed Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

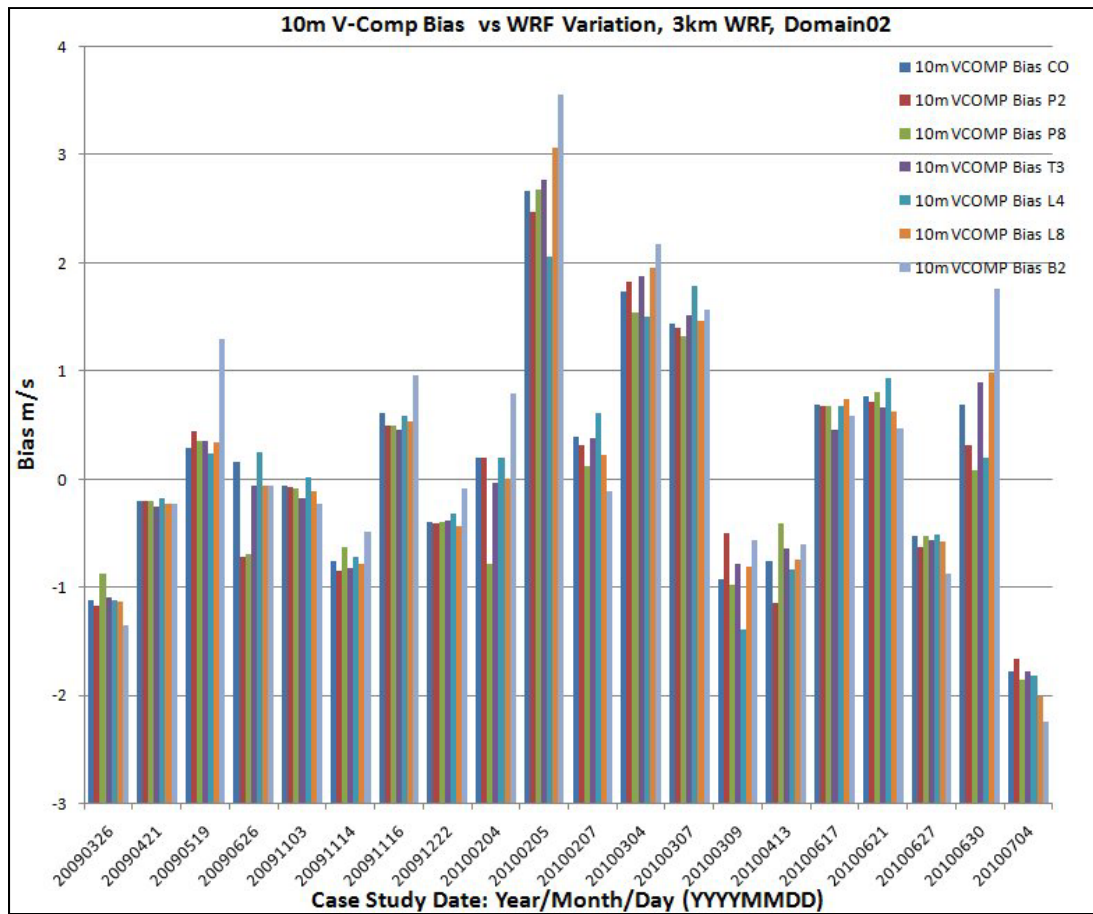


Figure A-45. Comparison of the 10-m V-component wind speed Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

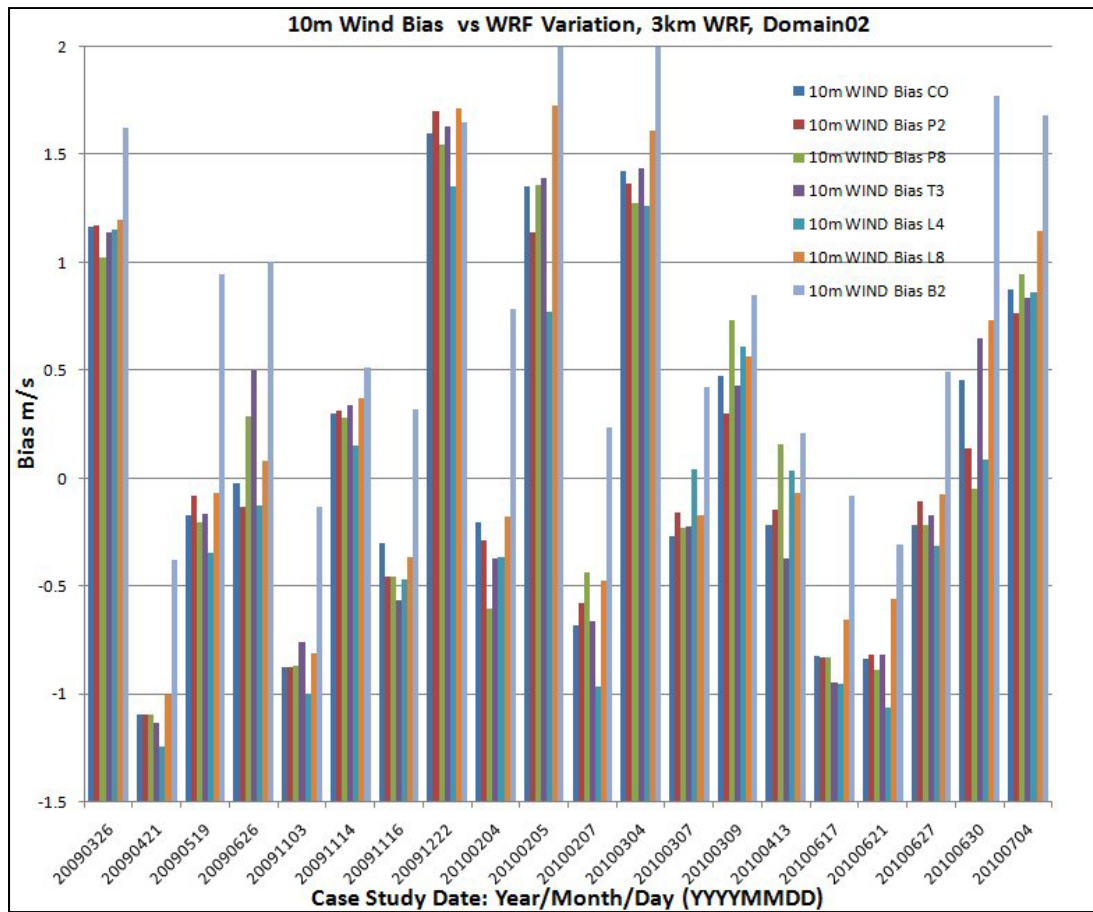


Figure A-46. Comparison of the 10-m wind speed Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

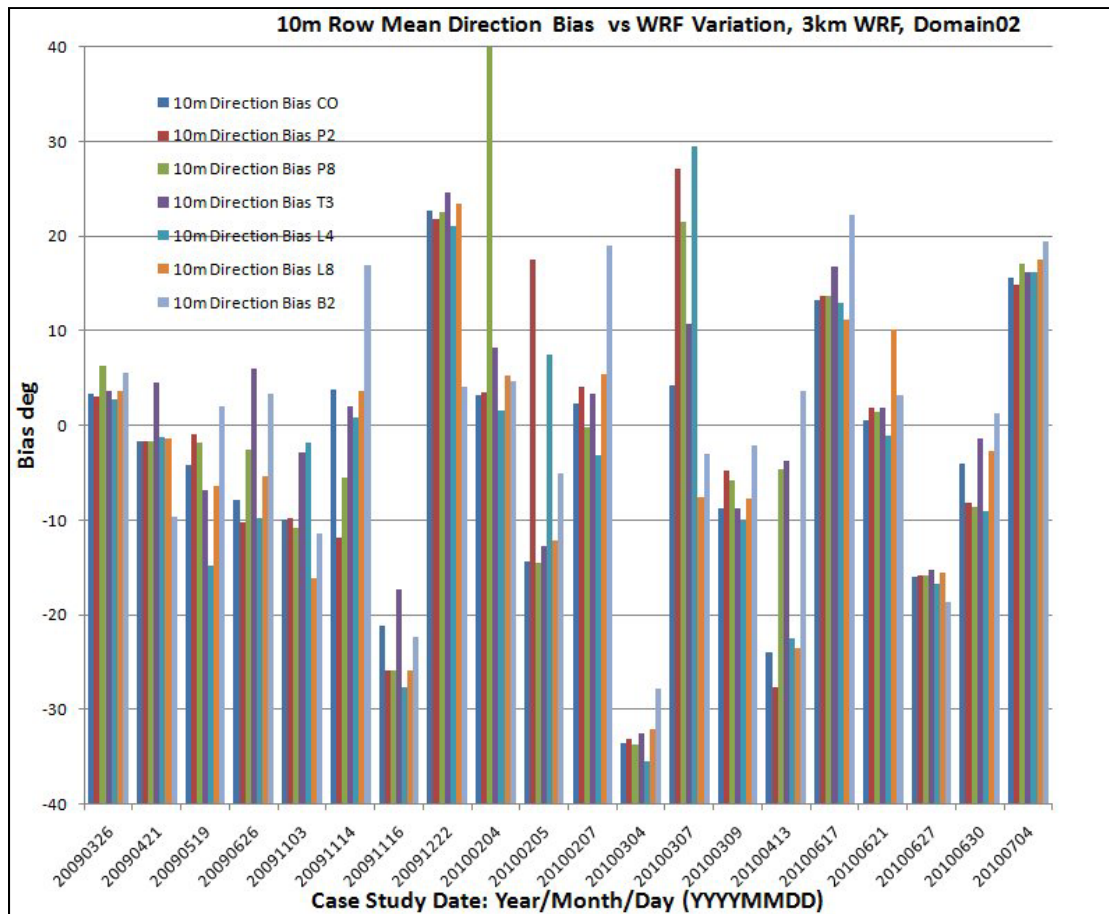


Figure A-47. Comparison of the 10-m row mean wind direction Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

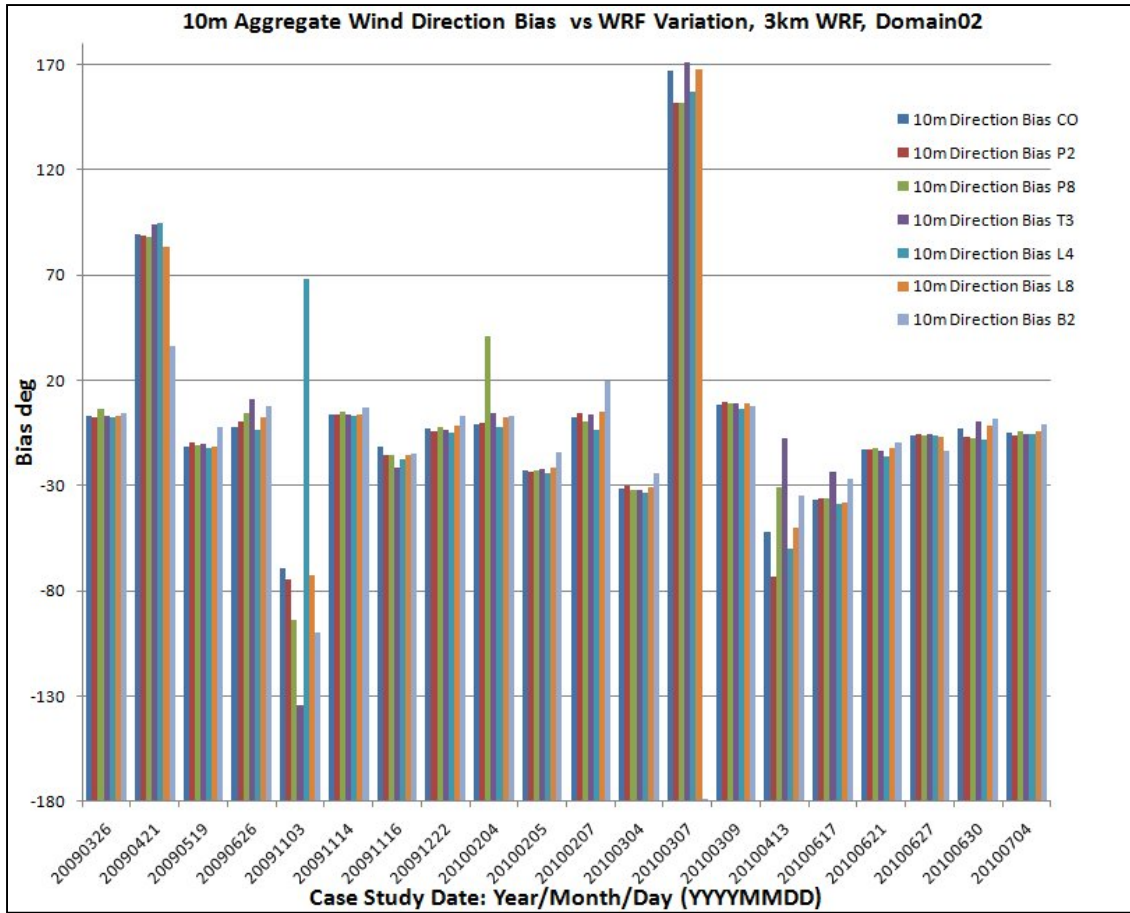


Figure A-48. Comparison of the 10-m aggregate wind direction Bias statistic for 3-km WRF, Domain 2, for all parameter settings.

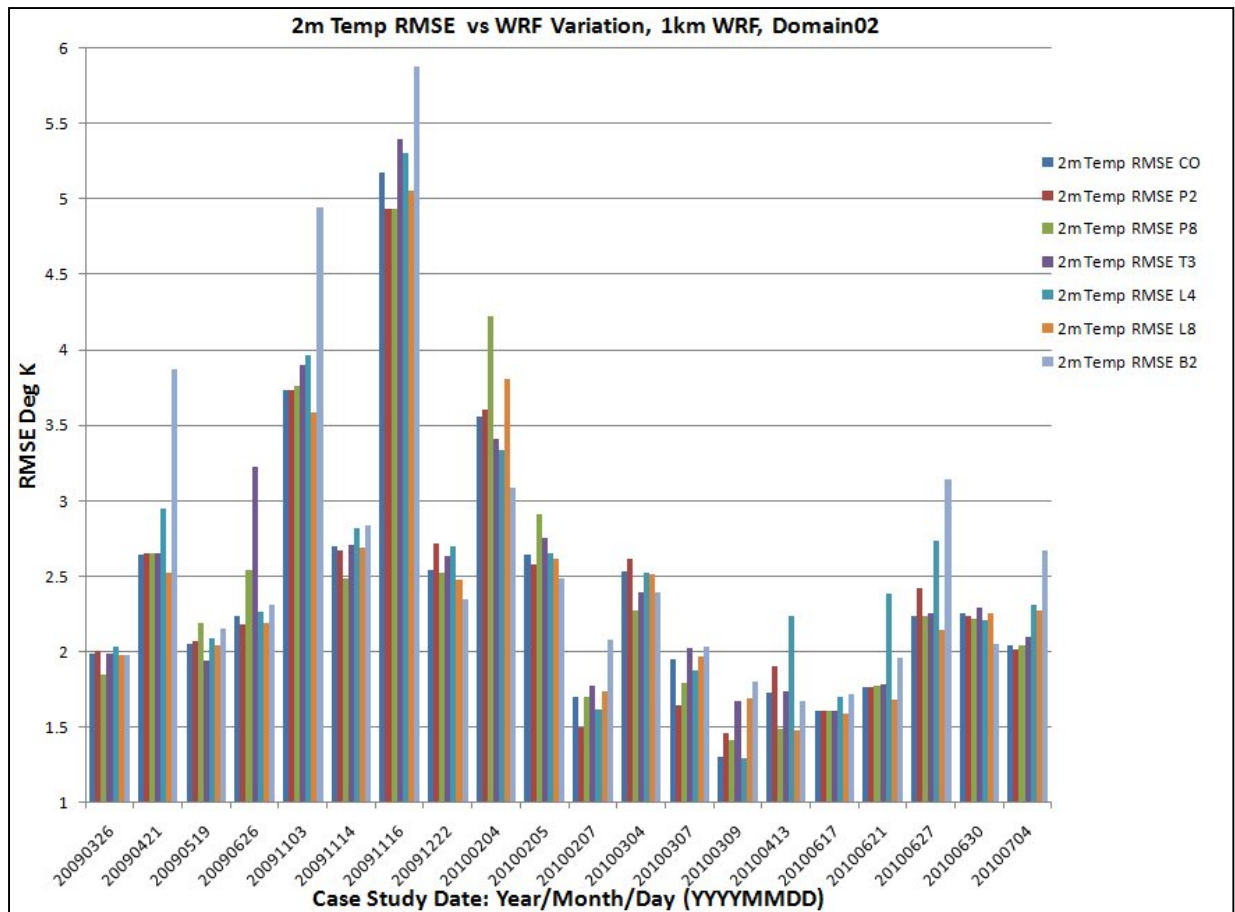


Figure A-49. Comparison of the 2-m air temperature RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

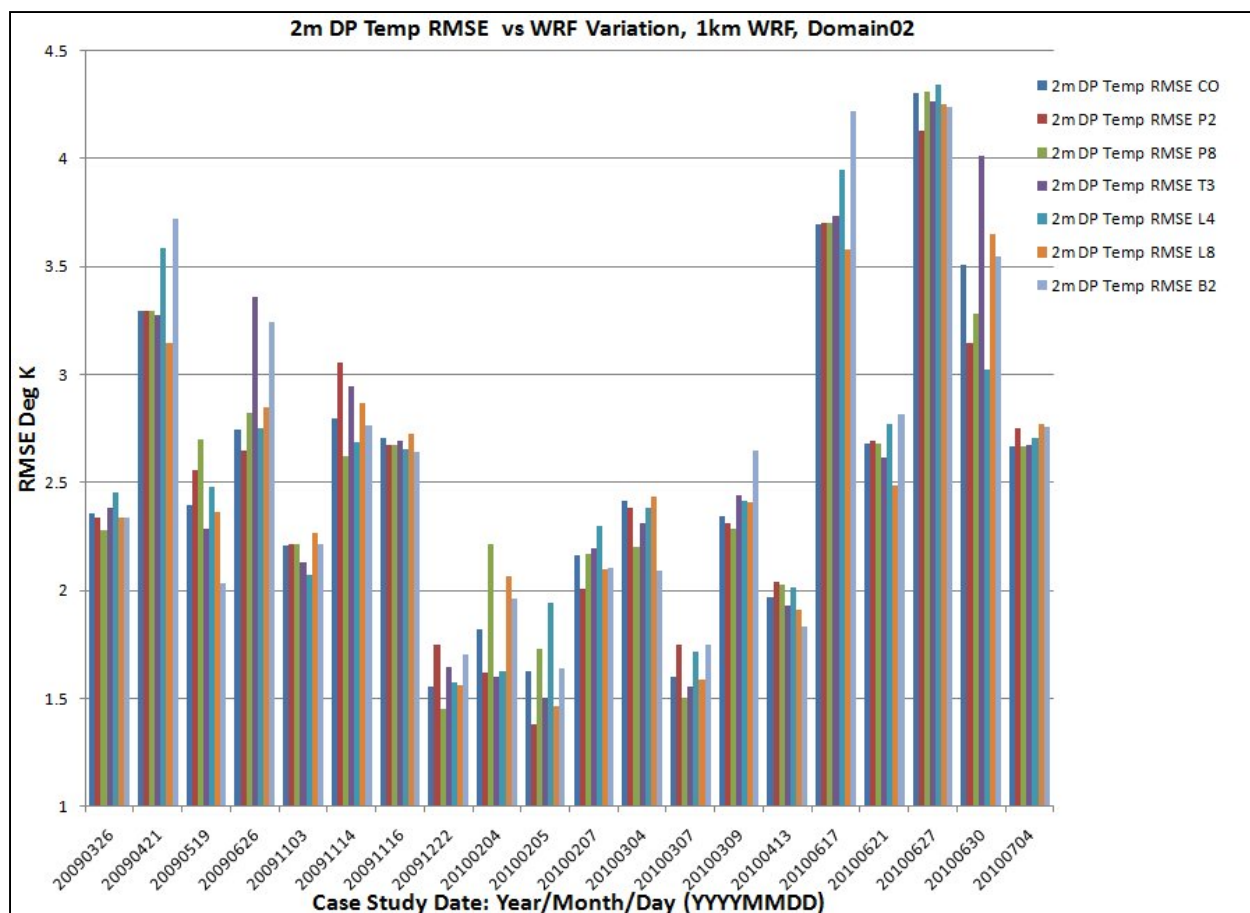


Figure A-50. Comparison of the 2-m dew point temperature RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

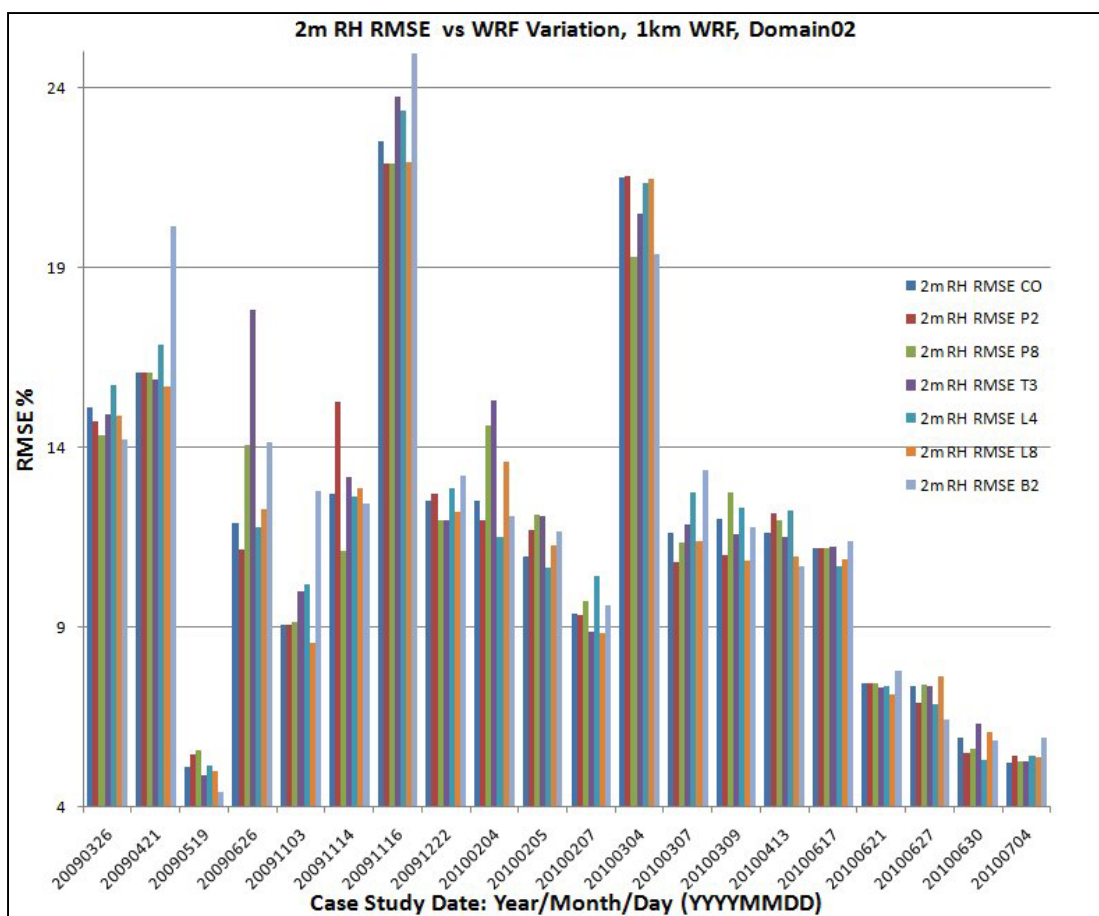


Figure A-51. Comparison of the 2-m relative humidity RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

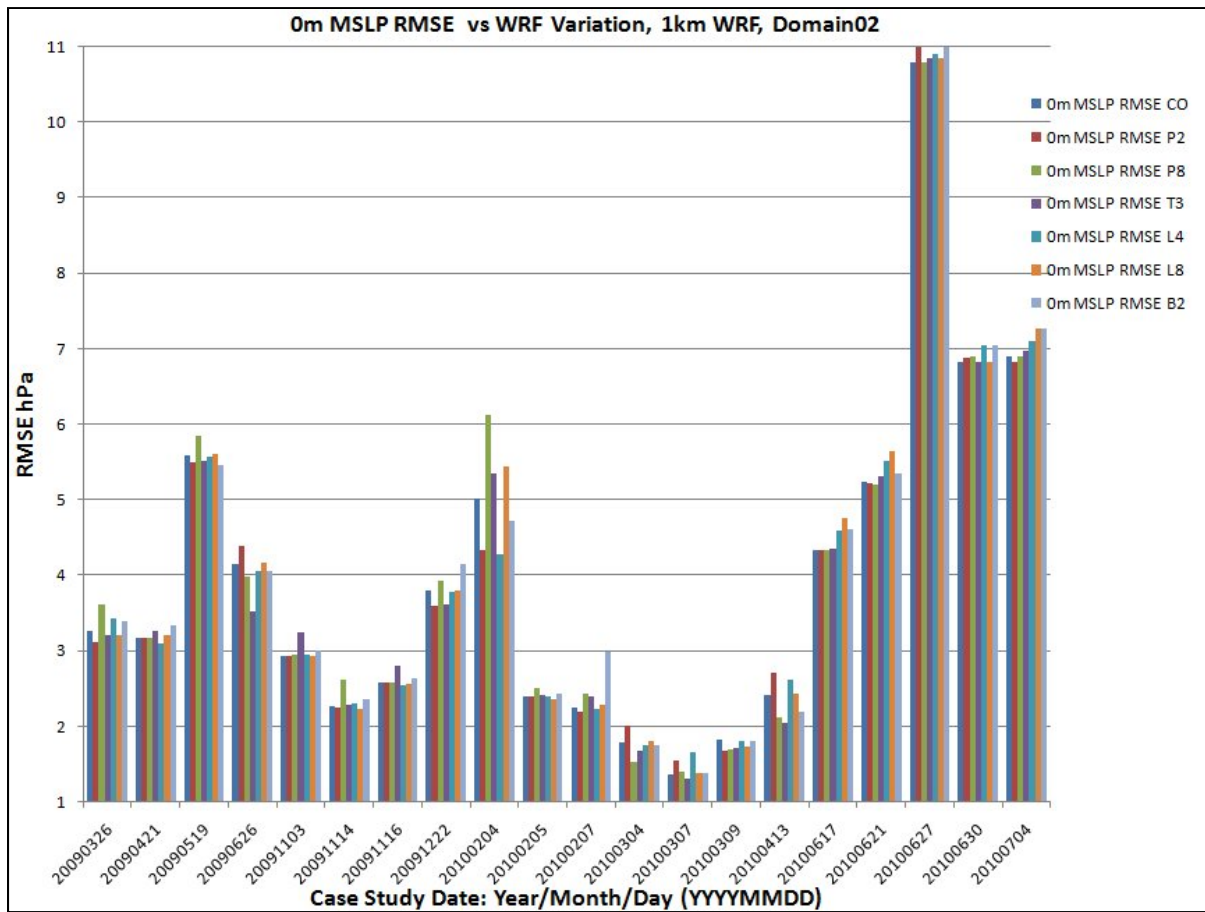


Figure A-52. Comparison of the mean sea level pressure RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

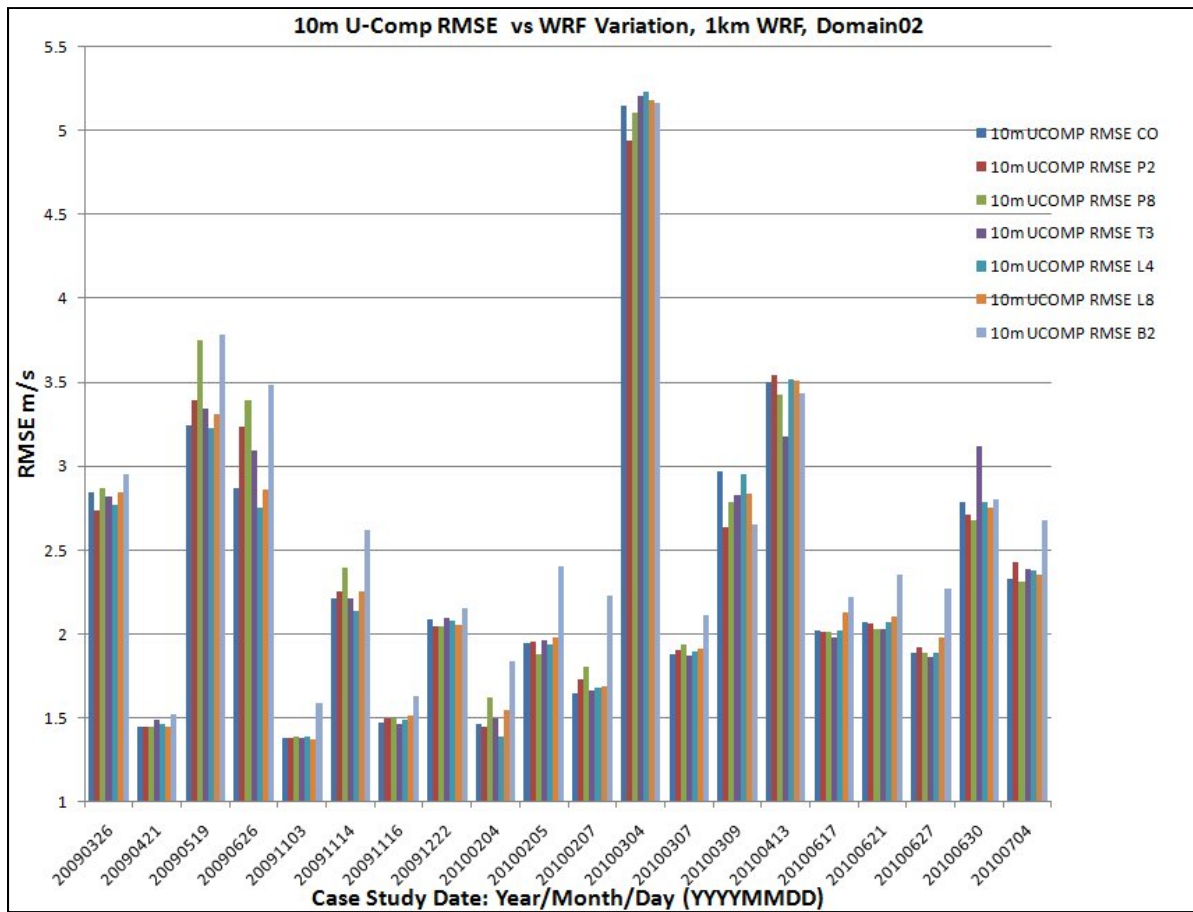


Figure A-53. Comparison of the 10-m U-component wind speed RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

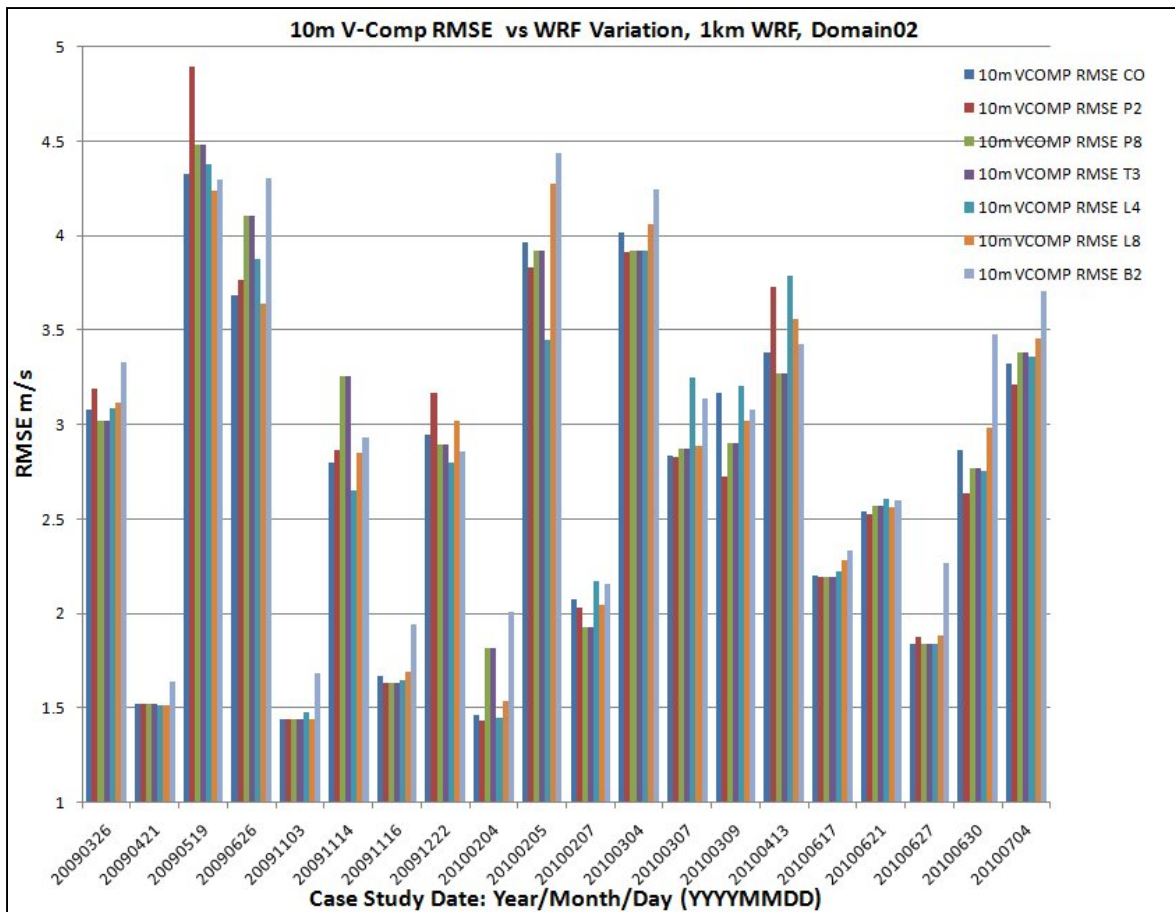


Figure A-54. Comparison of the 10-m V-component wind speed RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

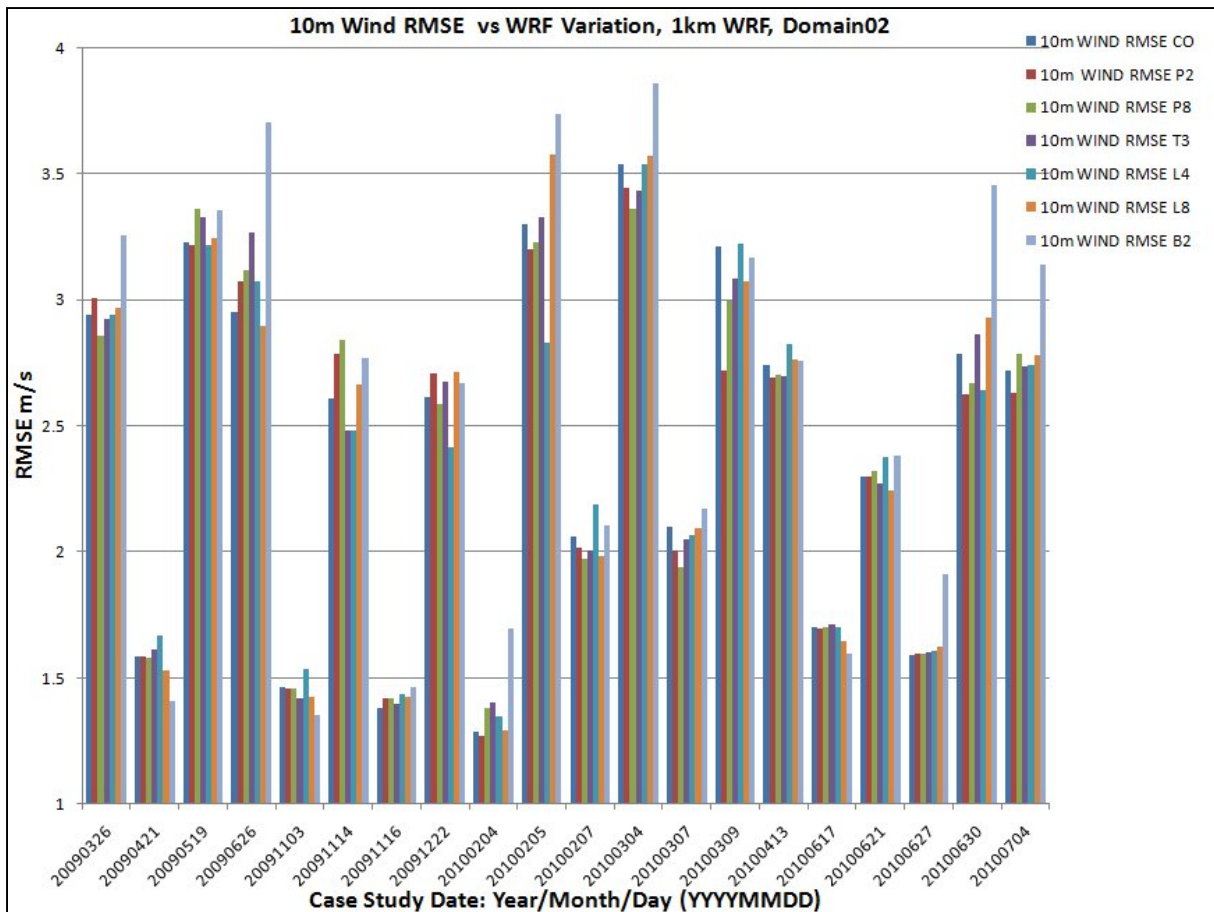


Figure A-55. Comparison of the 10-m wind speed RMSE statistic for 1-km WRF, Domain 2, for all parameter settings.

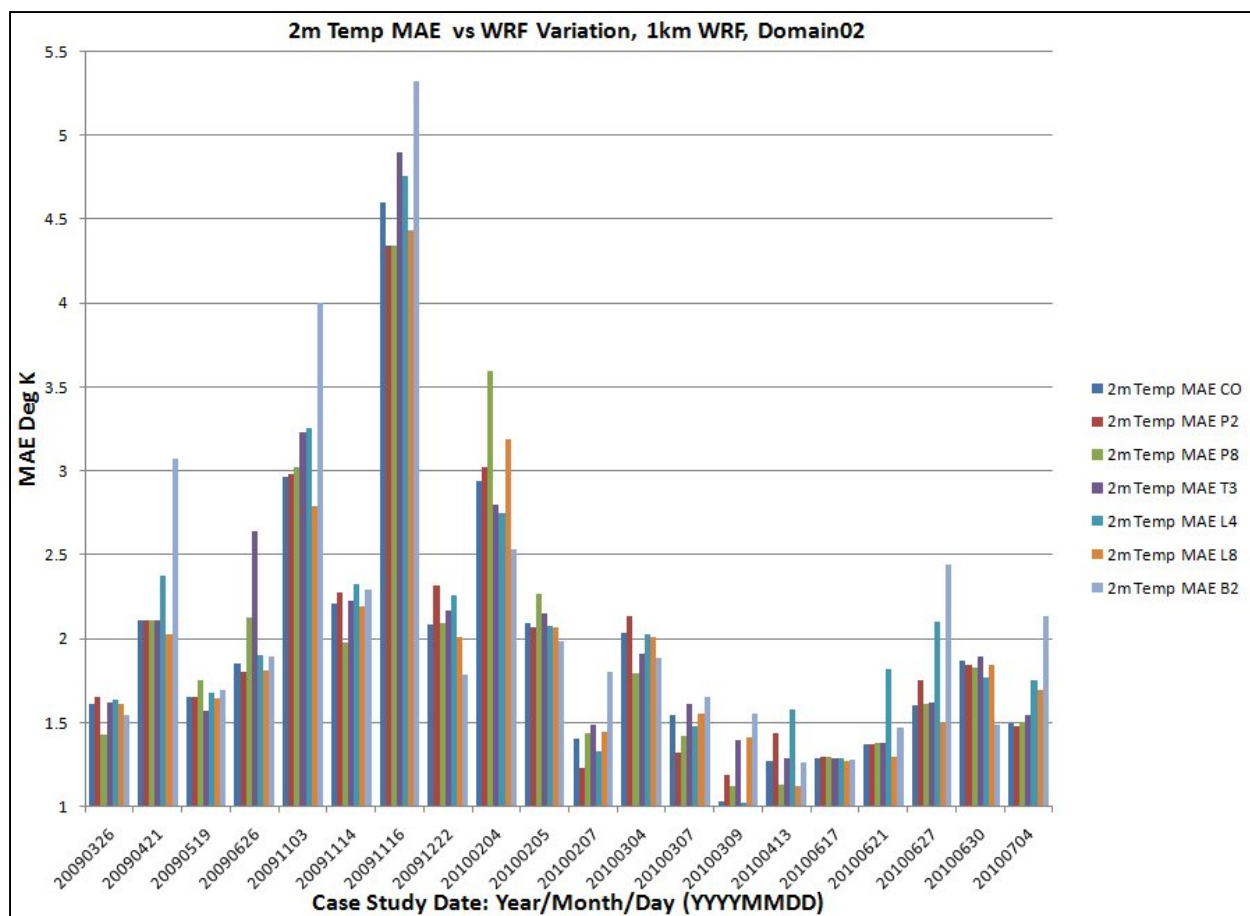


Figure A-56. Comparison of the 2-m air temperature MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

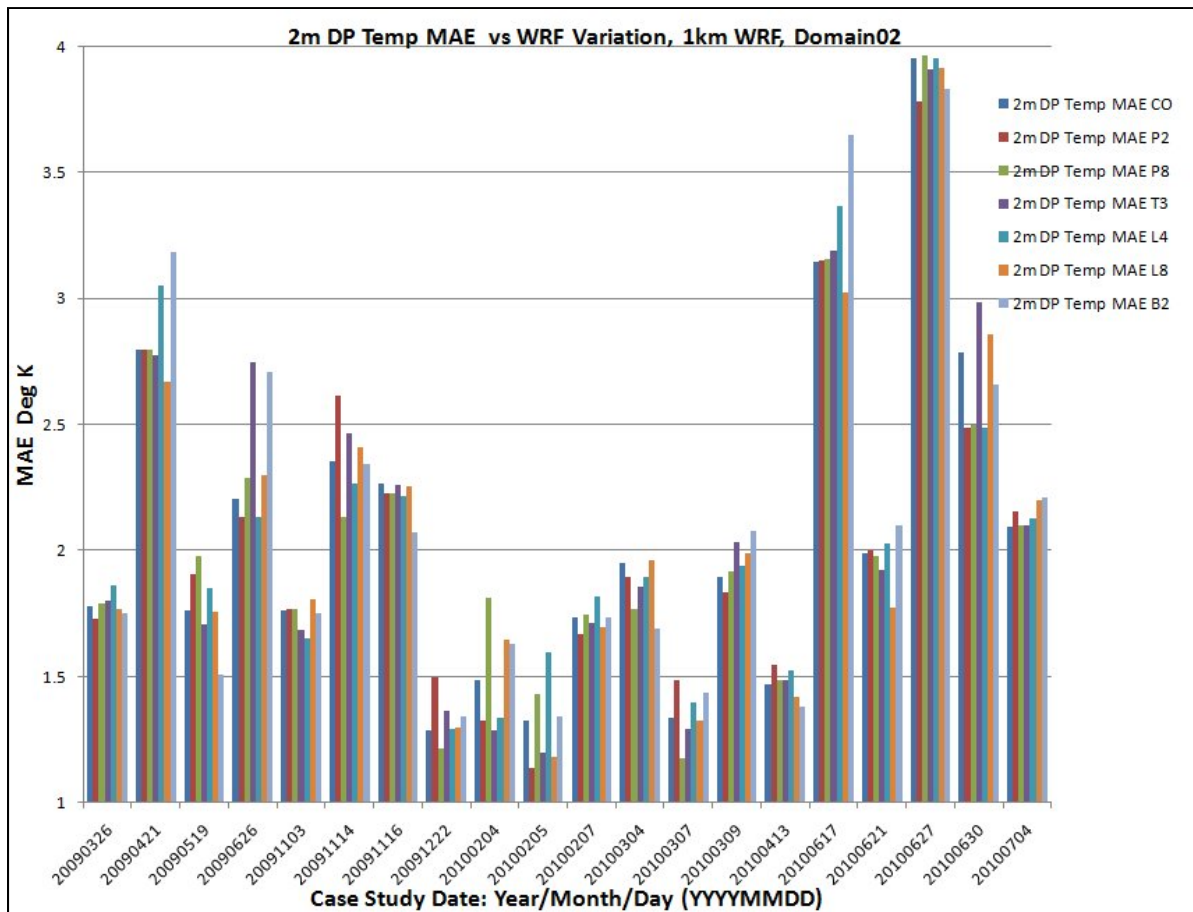


Figure A-57. Comparison of the 2-m dew point temperature MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

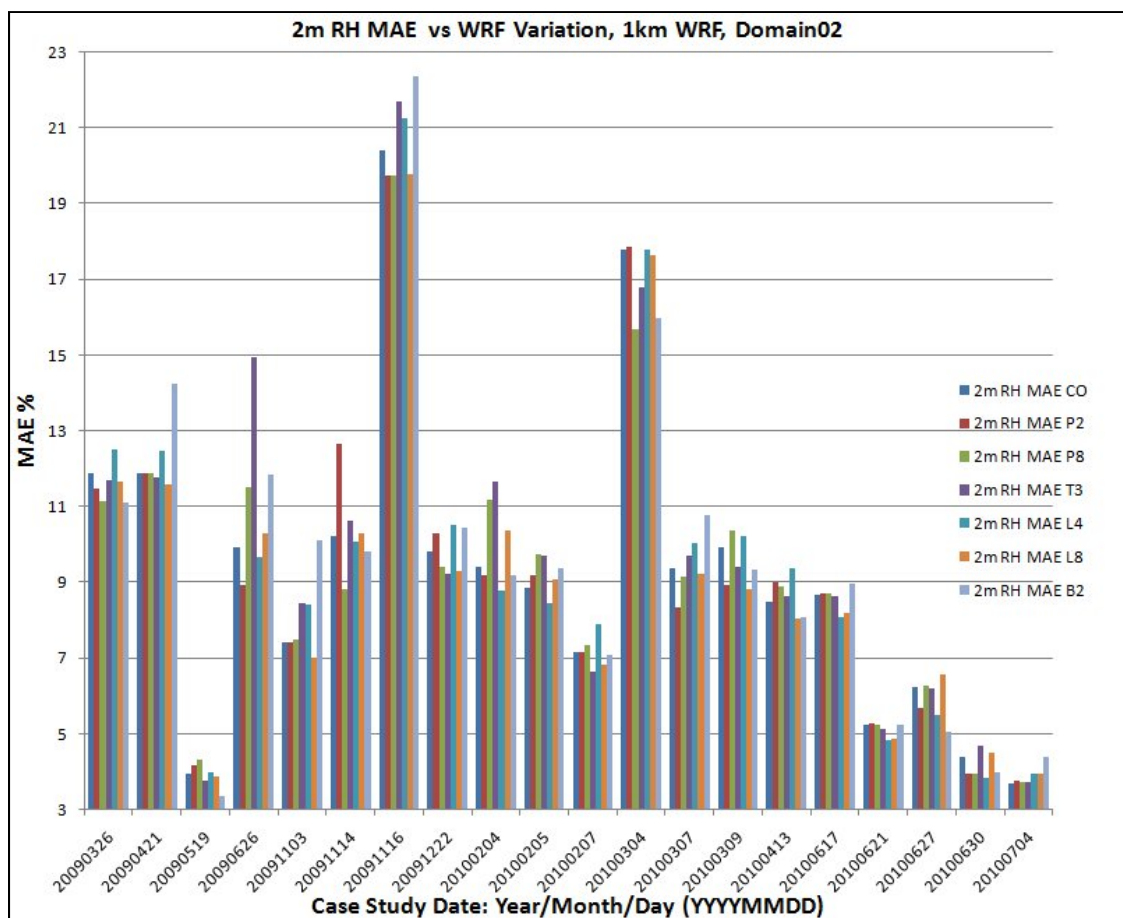


Figure A-58. Comparison of the 2-m relative humidity MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

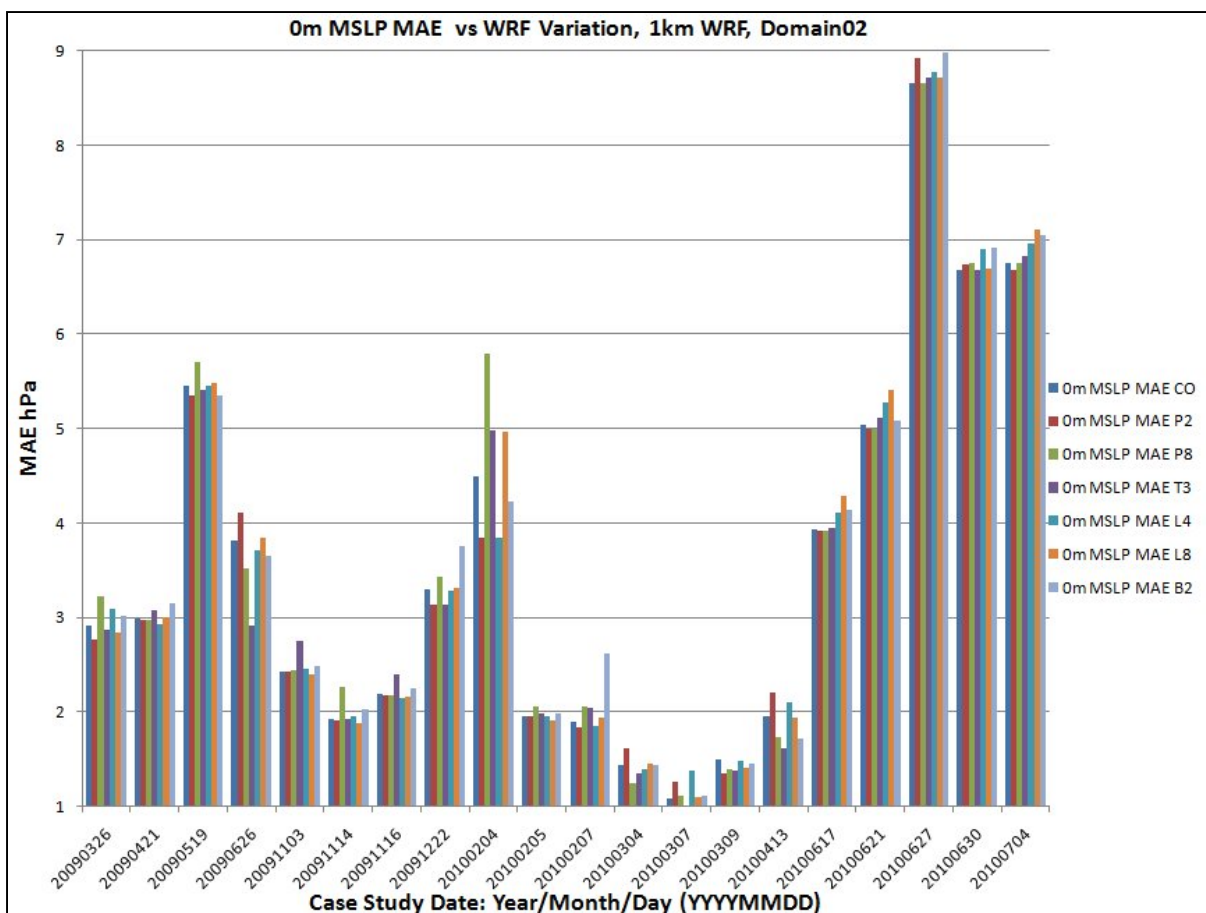


Figure A-59. Comparison of the mean sea level pressure MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

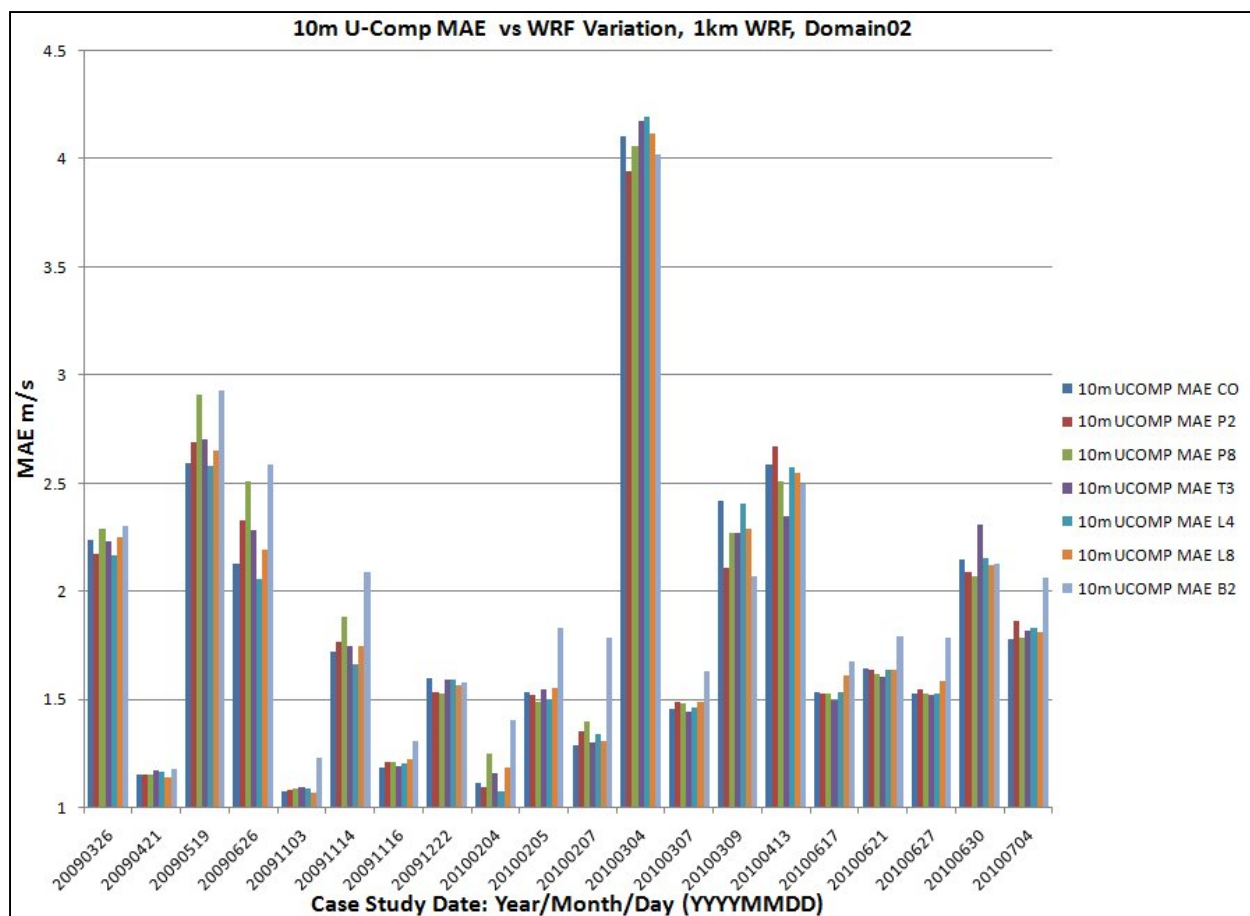


Figure A-60. Comparison of the 10-m U-component wind speed MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

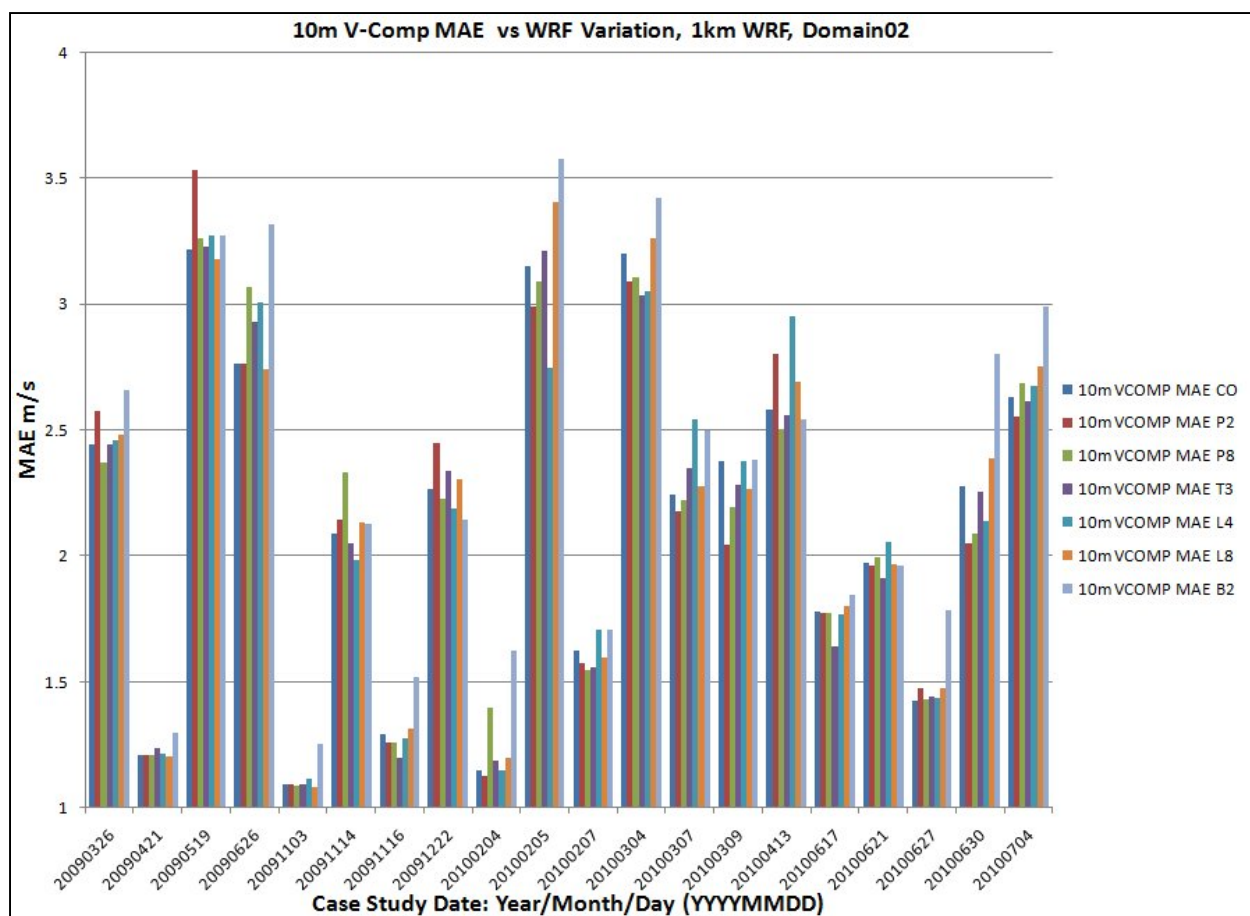


Figure A-61. Comparison of the 10-m V-component wind speed MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

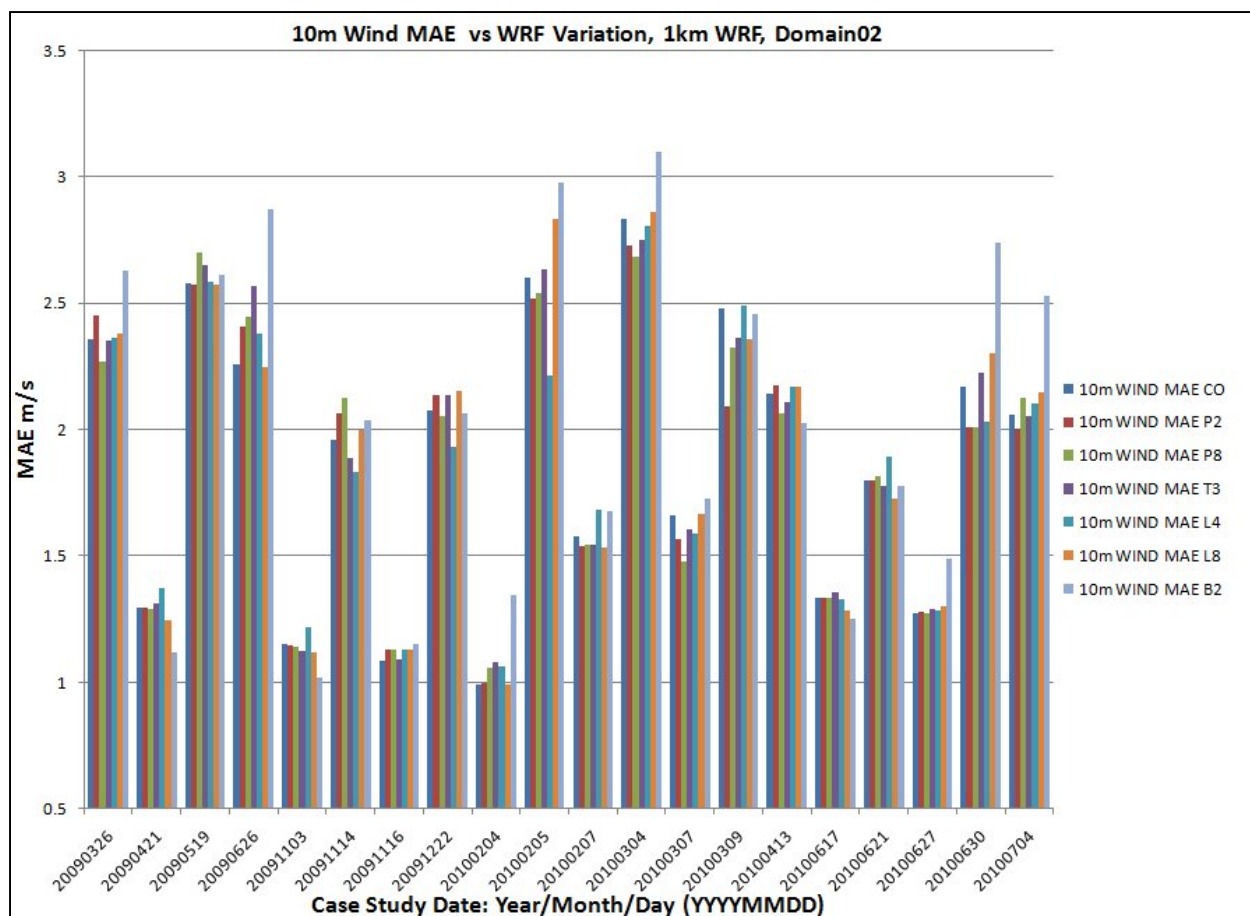


Figure A-62. Comparison of the 10-m wind speed MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

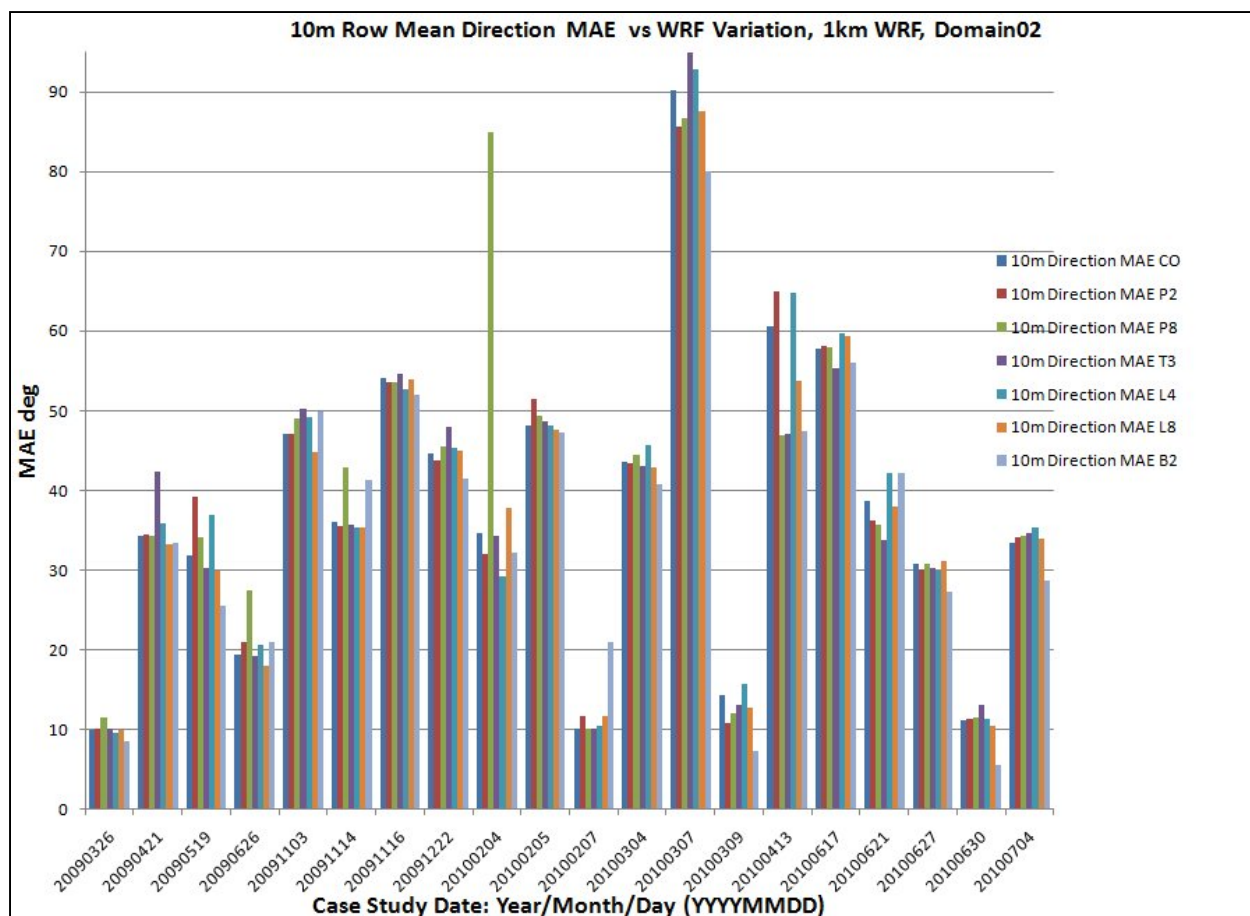


Figure A-63. Comparison of the 10-m row mean wind direction MAE statistic for 1-km WRF, Domain 2, for all parameter settings.

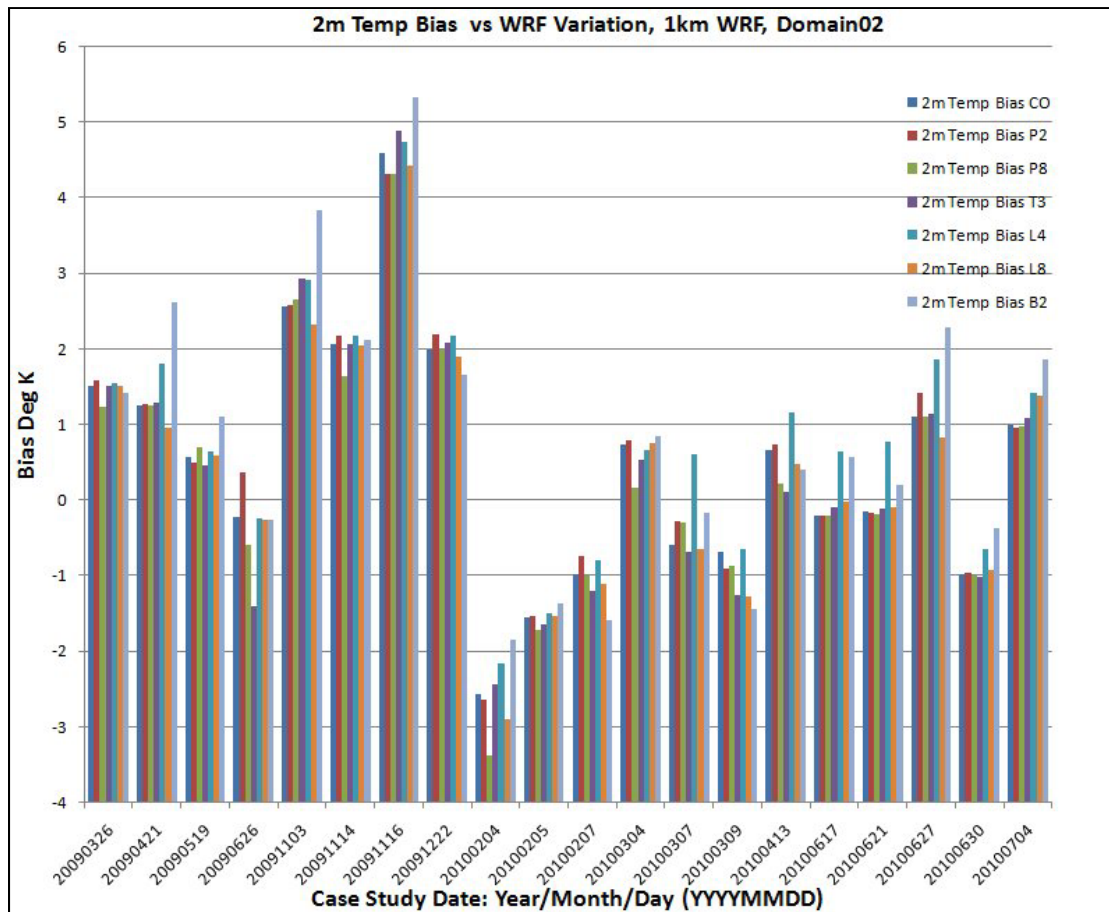


Figure A-64. Comparison of the 2-m air temperature Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

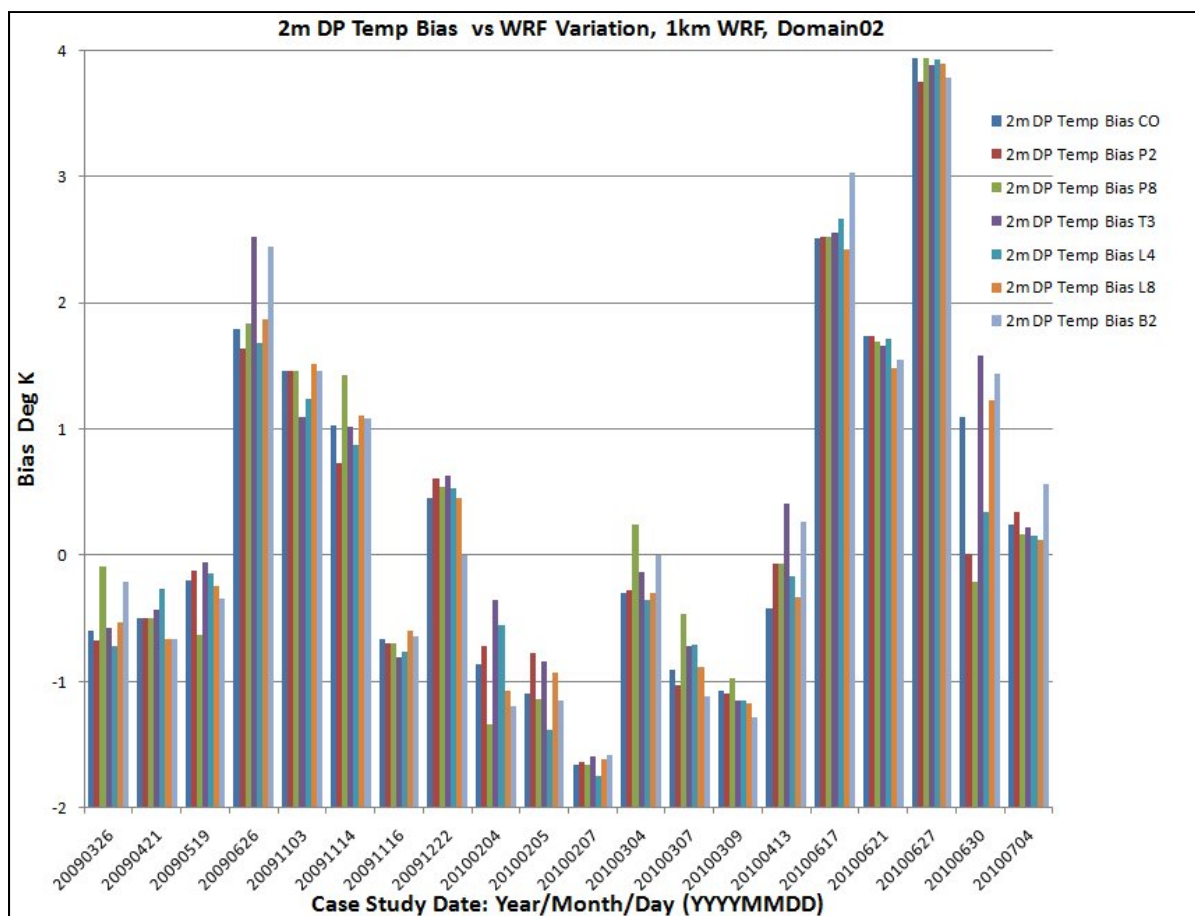


Figure A-65. Comparison of the 2-m dew point temperature Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

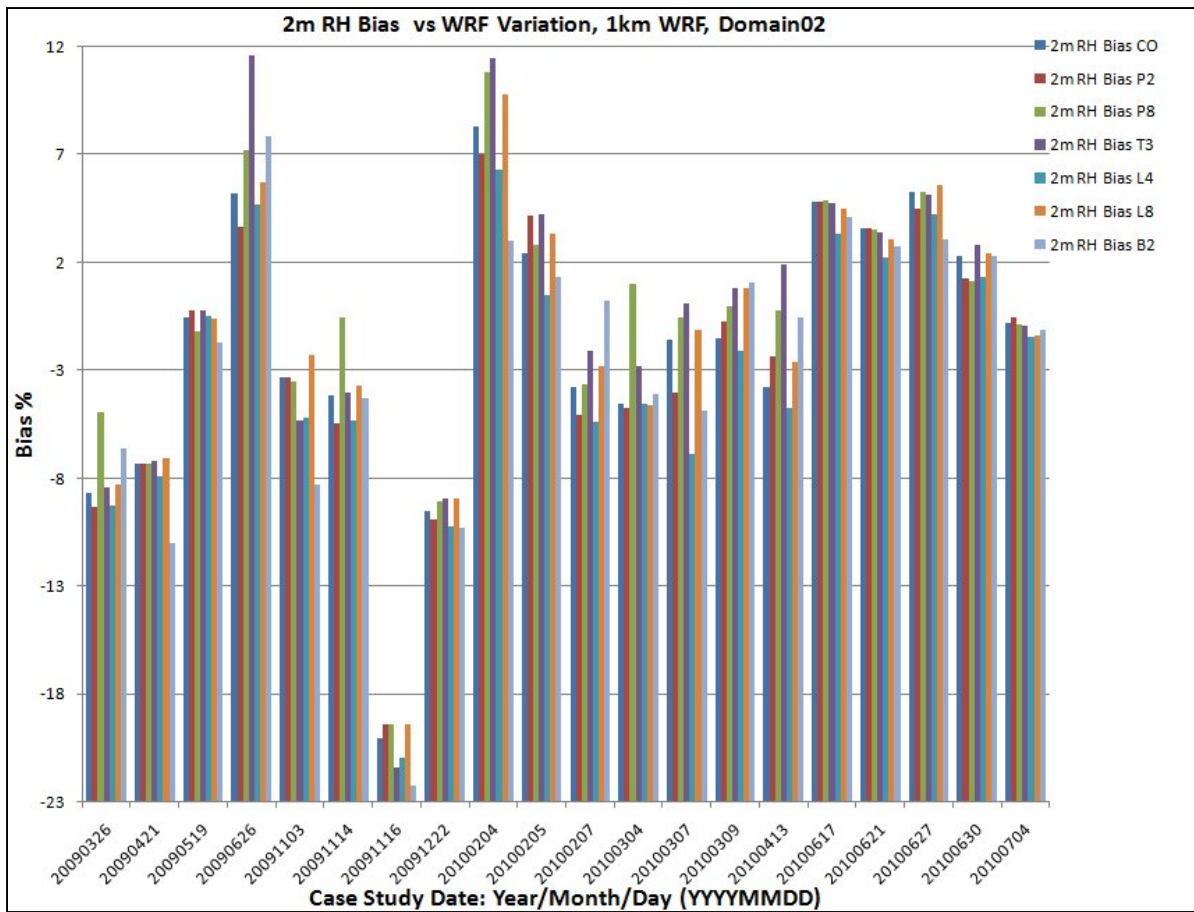


Figure A-66. Comparison of the 2-m relative humidity Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

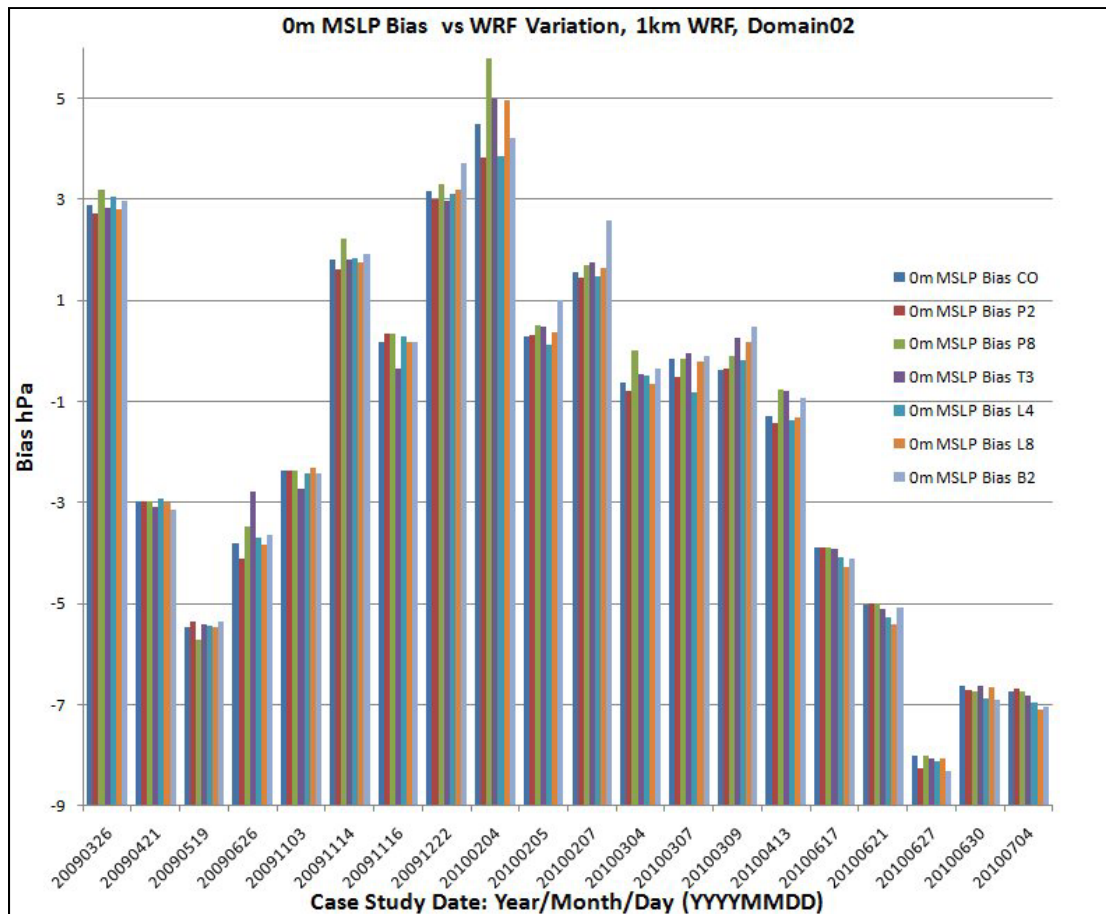


Figure A-67. Comparison of the mean sea level pressure Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

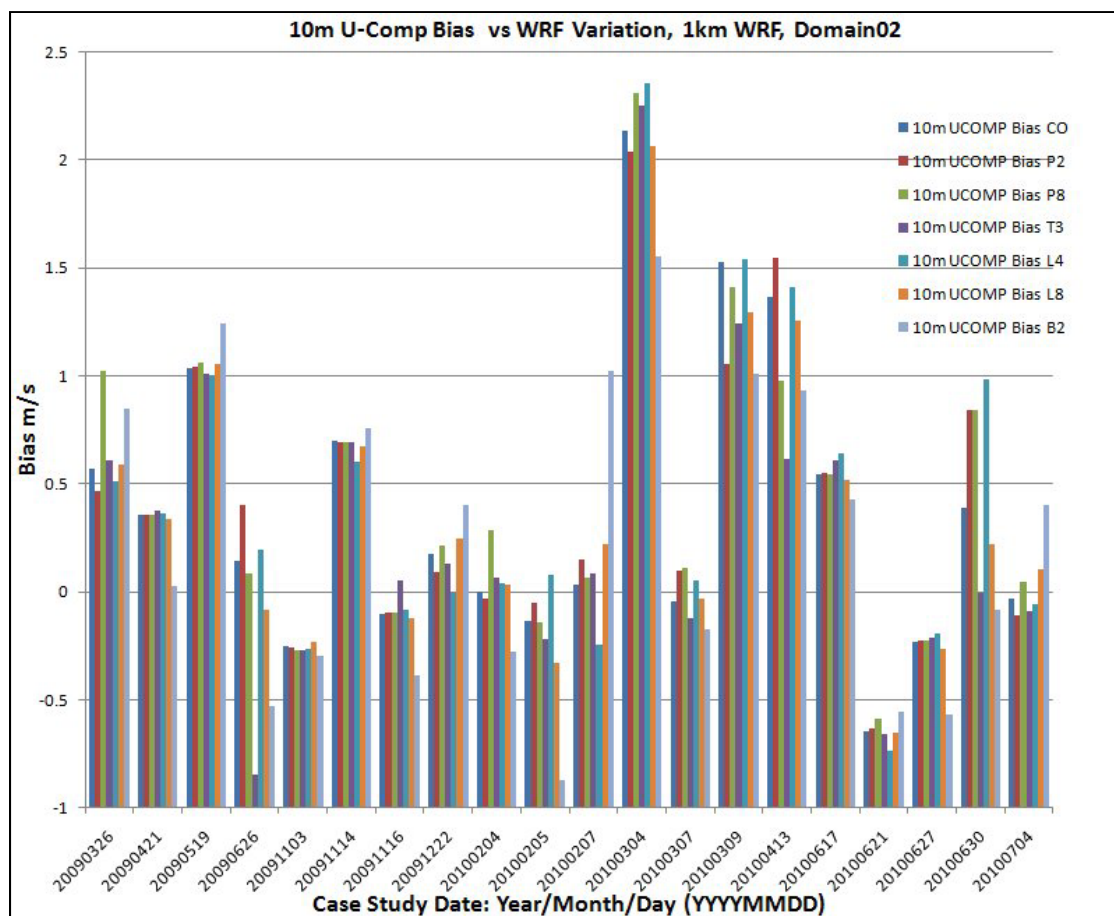


Figure A-68. Comparison of the 10-m U-component wind speed Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

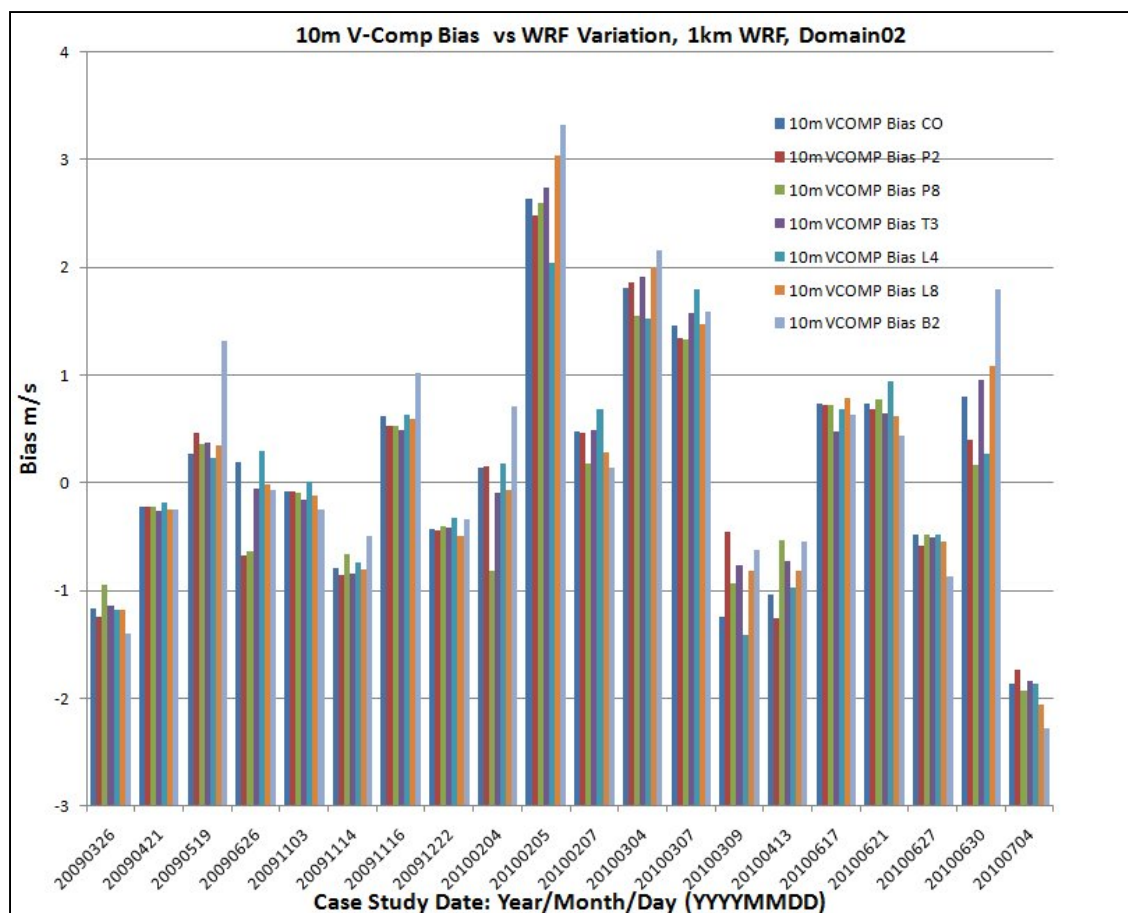


Figure A-69. Comparison of the 10-m V-component wind speed Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

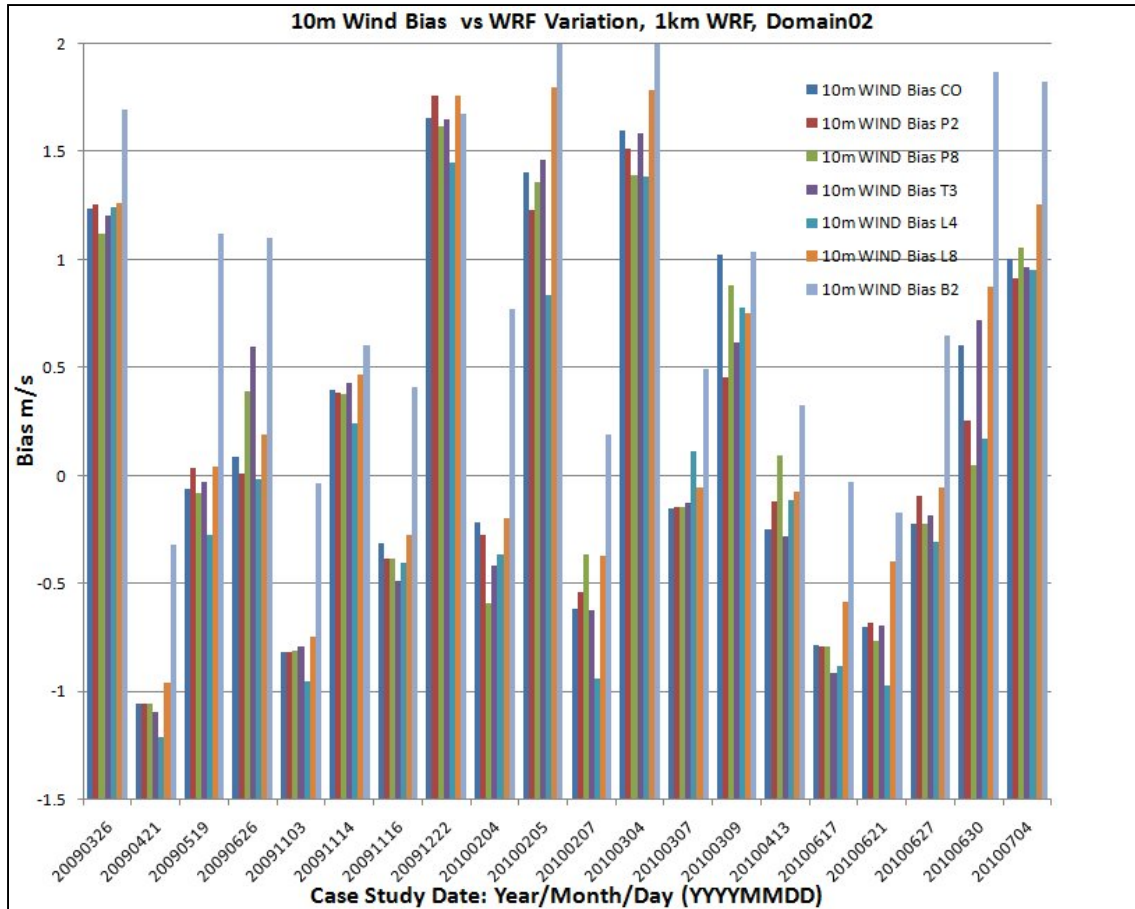


Figure A-70. Comparison of the 10-m wind speed Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

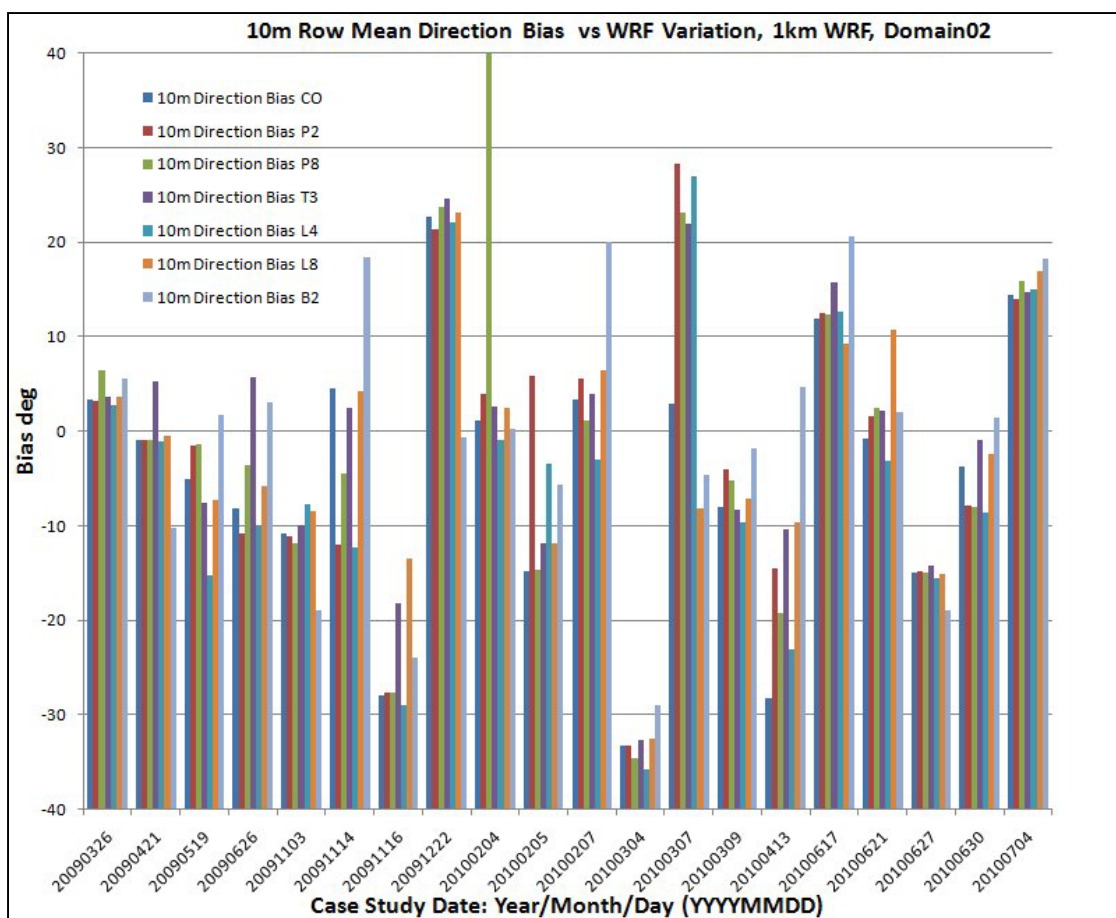


Figure A-71. Comparison of the 10-m row mean wind direction Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

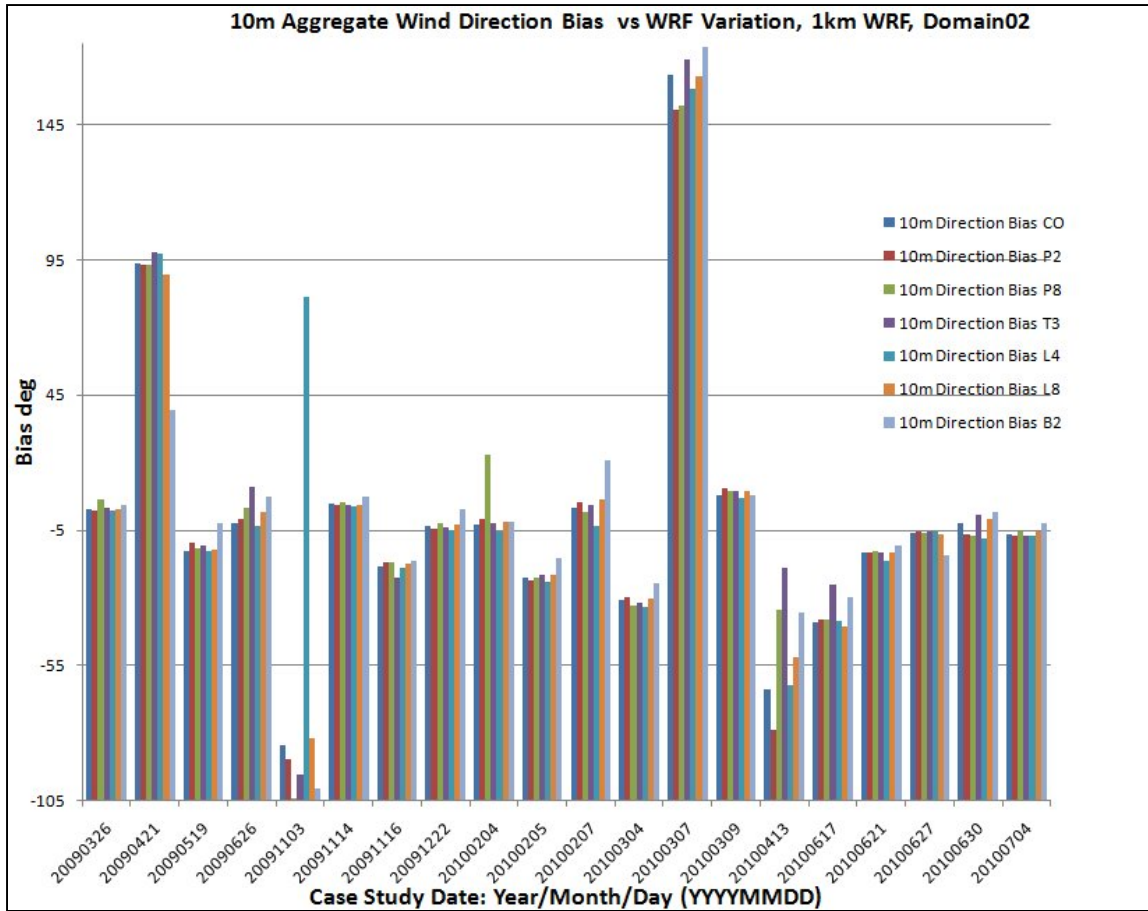


Figure A-72. Comparison of the 10-m aggregate wind direction Bias statistic for 1-km WRF, Domain 2, for all parameter settings.

Table A-2. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, Control setting.

DATE: <u>2009, 2010</u> Model/Domain Set: <u>m1o1_CO_sfc</u>																
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	0.01	1.75	2.27	11966	0.54	1.95	2.52	8189	0.60	10.77	14.10	8214	3.20	3.23	3.82	2472
20090421	-0.40	2.29	2.86	10878	-0.17	2.43	3.05	7778	-2.53	10.00	13.29	7828	-2.89	2.99	3.31	2387
20090519	0.78	2.17	2.78	9710	-1.13	2.56	3.28	6921	-4.44	8.61	11.94	6968	-5.51	5.57	6.03	2272
20090626	-0.11	2.07	2.67	11930	0.85	2.12	2.76	8392	3.48	12.13	15.77	8416	-3.65	3.82	4.28	2407
20091103	0.45	2.47	3.14	11557	-0.17	2.22	2.88	8951	-5.77	11.63	15.45	8947	-2.22	2.35	2.89	2475
20091114	0.75	1.87	2.40	11717	0.02	1.76	2.29	8497	-5.35	11.65	15.03	8499	1.88	2.17	2.71	2506
20091116	0.97	2.75	3.42	10991	0.02	2.21	2.78	7939	-7.58	14.24	17.45	7939	1.32	2.75	3.59	2335
20091222	0.62	2.01	2.62	12520	1.05	1.73	2.24	8975	-1.36	8.97	11.71	8973	1.73	2.26	2.78	2106
20100204	-1.17	2.78	3.49	12481	1.34	2.17	2.91	9271	9.85	12.93	16.30	9270	2.94	3.15	3.65	2183
20100205	-1.15	2.14	2.76	13118	0.33	1.58	2.10	9386	6.07	11.46	14.39	9386	0.84	1.76	2.31	2192
20100207	-1.11	2.07	2.74	13146	-1.35	1.89	2.42	9435	-3.49	11.17	15.22	9436	0.86	1.79	2.32	2216
20100304	-0.98	2.11	2.66	13089	0.35	1.68	2.12	9359	4.71	14.25	17.99	9358	1.01	1.71	2.16	2497
20100307	-0.99	2.28	2.97	12027	-0.88	1.87	2.55	8513	-1.52	13.14	16.90	8513	0.17	1.30	1.65	2369
20100309	-1.50	2.31	2.89	12855	-0.32	1.82	2.34	9172	5.24	12.80	16.38	9179	0.56	1.67	2.11	2384
20100413	-0.51	1.76	2.31	12489	0.08	1.56	2.06	8865	1.00	11.22	14.59	8865	0.51	1.73	2.16	2439
20100617	-0.38	1.80	2.28	12261	0.83	2.69	3.34	8620	2.11	9.44	12.65	8620	-2.21	2.46	3.04	2454
20100621	-1.10	2.11	2.66	12155	-0.18	2.48	3.29	8567	1.75	8.33	11.61	8567	-3.14	3.46	3.93	2439
20100627	0.05	1.99	2.54	10629	1.89	2.77	3.42	7977	3.12	8.29	10.57	7976	-5.91	6.08	7.19	2300
20100630	-0.10	2.06	2.64	11728	0.04	2.74	3.46	8552	-0.64	8.39	11.78	8552	-5.05	5.43	6.38	2302
20100704	0.21	1.88	2.41	11806	0.39	2.55	3.28	8545	-0.67	8.35	11.27	8545	-4.57	4.63	5.15	2395

Table A-2. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, Control setting (continued).

													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	-0.20	2.34	3.11	7958	-1.87	2.89	3.65	7958	1.61	2.82	3.56	8072	-7.97	8.55	25	-10.23	6759
20090421	0.15	1.17	1.59	8407	-0.20	1.17	1.56	8407	-0.50	1.23	1.61	8552	-1.97	37.99	25	-43.29	5700
20090519	0.98	2.28	3.00	7323	0.92	2.54	3.33	7323	0.91	2.35	2.99	7421	-13.67	21.40	25	-12.52	5795
20090626	0.29	2.04	2.76	8689	-0.03	2.17	2.93	8689	0.69	2.05	2.69	8767	-7.89	22.60	25	-12.71	6363
20091103	0.28	1.26	1.80	9463	0.10	1.13	1.56	9463	-0.18	1.27	1.73	9560	-19.99	28.11	25	-10.17	5421
20091114	0.80	1.92	2.63	8483	-0.94	2.13	2.81	8483	1.30	2.18	2.84	8572	-15.31	18.74	25	-4.87	5602
20091116	0.11	1.07	1.52	8106	0.20	1.08	1.54	8106	-0.37	1.11	1.55	8228	-27.10	30.73	25	-23.24	4442
20091222	0.62	1.75	2.57	8997	0.48	2.87	3.83	8997	1.89	2.60	3.52	9015	-2.54	26.01	25	43.08	5356
20100204	0.26	1.25	1.76	9616	0.29	1.22	1.66	9616	-0.07	1.29	1.75	9741	-7.78	18.08	25	-5.34	5435
20100205	0.34	1.60	2.18	9590	1.41	2.13	2.83	9590	1.03	2.00	2.66	9699	-8.44	10.98	25	-8.47	5716
20100207	-1.29	2.14	3.07	9397	0.13	1.56	2.08	9397	0.72	2.05	2.81	9572	-33.39	33.39	25	-36.63	6182
20100304	0.57	2.24	3.08	9317	1.23	2.52	3.23	9317	1.09	2.34	3.04	9334	-12.95	16.96	25	-20.68	6950
20100307	-0.18	1.51	2.03	8691	0.78	1.87	2.48	8691	0.39	1.71	2.27	8716	9.75	17.69	25	-9.50	5497
20100309	0.76	2.05	2.75	9032	-0.14	2.46	3.25	9032	1.34	2.46	3.23	9067	-8.05	21.71	25	13.07	6682
20100413	0.92	2.17	2.91	8810	-0.18	2.10	2.78	8810	0.83	2.00	2.58	8909	-27.29	27.99	25	-24.09	6610
20100617	0.62	1.68	2.31	8952	0.28	1.50	1.96	8952	0.14	1.50	2.00	9003	-15.97	26.83	25	6.29	6557
20100621	0.19	1.49	2.00	8920	0.11	1.62	2.15	8920	0.07	1.53	1.96	8976	6.77	14.24	25	15.74	6741
20100627	0.08	1.28	1.69	8302	-0.42	1.35	1.78	8302	-0.04	1.28	1.64	8418	5.20	16.44	25	1.76	5690
20100630	0.51	2.25	2.96	8634	1.91	3.04	3.86	8634	1.56	2.70	3.39	8695	-10.05	12.35	25	-9.03	7146
20100704	0.07	1.72	2.30	8734	-1.38	2.08	2.68	8734	0.57	1.77	2.26	8823	-37.57	37.86	25	-22.09	6427

Table A-3. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Control setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m1o2_CO_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.57	1.68	2.11	608	-0.57	1.80	2.37	608	-8.80	12.01	15.17	608	2.81	2.85	3.19	483
20090421	1.29	2.12	2.66	561	-0.52	2.78	3.27	587	-7.46	11.89	16.09	587	-3.03	3.03	3.21	442
20090519	0.60	1.68	2.10	578	-0.19	1.76	2.38	595	-0.59	3.91	5.07	595	-5.54	5.54	5.66	446
20090626	-0.19	1.88	2.27	593	1.83	2.21	2.75	578	5.16	9.72	11.65	578	-4.03	4.03	4.32	459
20091103	2.59	2.93	3.71	538	1.49	1.78	2.22	582	-3.37	7.38	9.04	582	-2.47	2.51	3.03	479
20091114	2.12	2.26	2.74	558	1.05	2.35	2.79	563	-4.34	10.21	12.65	563	1.71	1.85	2.17	468
20091116	4.68	4.70	5.26	539	-0.63	2.28	2.77	560	-20.28	20.83	22.89	560	0.02	2.21	2.59	471
20091222	2.04	2.15	2.61	514	0.48	1.32	1.58	520	-9.71	9.99	12.68	520	3.01	3.17	3.65	378
20100204	-2.37	2.77	3.36	570	-0.78	1.42	1.74	576	7.45	8.96	11.96	576	4.07	4.08	4.65	425
20100205	-1.51	2.08	2.65	578	-1.11	1.36	1.64	579	2.11	9.05	11.15	579	0.10	1.91	2.34	424
20100207	-0.95	1.49	1.76	591	-1.70	1.78	2.21	591	-4.25	7.49	9.86	591	1.32	1.76	2.09	424
20100304	0.81	2.07	2.59	609	-0.34	1.98	2.44	610	-5.17	17.98	21.64	610	-0.72	1.44	1.79	480
20100307	-0.52	1.53	1.92	595	-0.91	1.35	1.61	599	-1.97	9.42	11.64	599	-0.36	1.11	1.36	470
20100309	-1.25	1.49	1.75	609	-1.20	2.01	2.43	611	0.49	8.84	10.97	611	0.17	1.43	1.77	482
20100413	0.76	1.35	1.81	580	-0.46	1.49	2.01	579	-4.28	8.87	11.91	579	-1.42	2.00	2.47	462
20100617	-0.11	1.27	1.58	571	2.49	3.16	3.66	571	4.43	8.48	10.86	571	-3.98	3.99	4.41	471
20100621	-0.02	1.46	1.86	577	1.69	1.97	2.64	573	3.36	5.16	7.45	573	-5.24	5.24	5.45	463
20100627	1.11	1.65	2.26	574	3.92	3.94	4.28	589	5.28	6.29	7.47	589	-8.19	8.84	10.93	435
20100630	-0.93	1.87	2.25	650	1.08	2.74	3.46	631	2.21	4.27	5.73	631	-6.66	6.69	6.85	445
20100704	1.05	1.55	2.10	608	0.23	2.06	2.62	608	-0.96	3.64	5.12	608	-6.80	6.80	6.93	442

Table A-3. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Control setting (continued).

													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.56	2.19	2.78	586	-1.12	2.42	3.05	586	1.16	2.32	2.89	586	3.37	9.89	25	2.90	580
20090421	0.34	1.14	1.43	595	-0.21	1.21	1.51	595	-1.10	1.30	1.59	595	-1.70	32.93	25	89.20	502
20090519	0.97	2.54	3.16	537	0.29	3.19	4.25	537	-0.17	2.57	3.19	537	-4.13	31.92	25	-11.42	518
20090626	0.13	2.09	2.80	550	0.15	2.74	3.66	550	-0.03	2.24	2.92	550	-7.93	19.11	25	-1.97	526
20091103	-0.24	1.08	1.37	583	-0.07	1.10	1.48	583	-0.88	1.16	1.50	583	-9.89	46.54	25	-69.22	463
20091114	0.63	1.68	2.14	554	-0.76	2.09	2.78	554	0.30	1.94	2.58	554	3.80	36.31	25	3.93	487
20091116	-0.23	1.21	1.51	565	0.61	1.32	1.72	565	-0.30	1.11	1.40	565	-21.24	52.22	25	-11.71	436
20091222	0.18	1.52	1.96	514	-0.40	2.25	2.90	514	1.60	2.01	2.51	514	22.62	45.11	25	-2.87	403
20100204	-0.06	1.10	1.44	576	0.19	1.19	1.50	576	-0.20	0.99	1.27	576	3.13	30.27	25	-0.82	442
20100205	-0.09	1.47	1.85	574	2.67	3.17	3.95	574	1.35	2.58	3.25	574	-14.34	47.95	25	-23.06	473
20100207	0.00	1.31	1.68	586	0.39	1.62	2.07	586	-0.68	1.58	2.06	586	2.22	10.10	25	2.06	533
20100304	2.19	4.09	5.11	595	1.74	3.06	3.88	595	1.42	2.75	3.44	595	-33.59	43.71	25	-31.53	571
20100307	-0.10	1.42	1.83	596	1.43	2.21	2.81	596	-0.27	1.61	2.05	596	4.22	85.46	25	167.08	460
20100309	1.28	2.27	2.79	578	-0.92	2.32	3.11	578	0.47	2.38	3.06	578	-8.83	14.08	25	8.36	564
20100413	1.31	2.61	3.50	559	-0.76	2.54	3.35	559	-0.22	2.15	2.75	559	-24.01	55.12	25	-52.30	529
20100617	0.56	1.55	2.02	576	0.69	1.72	2.14	576	-0.82	1.31	1.68	576	13.24	58.81	25	-36.96	539
20100621	-0.62	1.57	1.96	563	0.76	1.93	2.47	563	-0.84	1.79	2.26	563	0.56	37.19	25	-13.17	536
20100627	-0.23	1.48	1.82	585	-0.53	1.44	1.85	585	-0.22	1.27	1.58	591	-16.01	31.85	25	-6.17	509
20100630	0.42	2.16	2.80	606	0.69	2.23	2.82	606	0.46	2.16	2.77	609	-4.11	11.63	25	-2.83	594
20100704	0.05	1.72	2.21	607	-1.78	2.55	3.22	607	0.87	1.97	2.59	607	15.63	33.40	25	-5.15	559

Table A-4. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Control setting.

DATE: 2009, 2010					Model/Domain Set: m2o2_CO_sfc											
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.51	1.61	1.99	608	-0.60	1.78	2.35	608	-8.67	11.88	15.09	608	2.89	2.92	3.27	483
20090421	1.26	2.11	2.65	561	-0.50	2.79	3.29	587	-7.33	11.88	16.08	587	-2.98	2.98	3.16	442
20090519	0.56	1.65	2.05	578	-0.20	1.76	2.39	595	-0.55	3.93	5.09	595	-5.46	5.46	5.58	446
20090626	-0.23	1.85	2.23	593	1.79	2.20	2.74	578	5.20	9.91	11.88	578	-3.81	3.81	4.15	459
20091103	2.56	2.97	3.73	538	1.46	1.76	2.21	582	-3.31	7.40	9.04	582	-2.36	2.42	2.93	479
20091114	2.06	2.21	2.70	558	1.03	2.35	2.80	563	-4.16	10.21	12.69	563	1.80	1.92	2.27	468
20091116	4.58	4.60	5.18	539	-0.66	2.26	2.71	560	-20.07	20.38	22.52	560	0.16	2.19	2.59	471
20091222	1.99	2.09	2.54	514	0.45	1.29	1.55	520	-9.52	9.81	12.49	520	3.15	3.30	3.79	378
20100204	-2.57	2.94	3.55	570	-0.86	1.49	1.82	576	8.30	9.41	12.52	576	4.49	4.49	5.02	425
20100205	-1.55	2.09	2.65	578	-1.09	1.32	1.62	579	2.41	8.87	10.97	579	0.29	1.95	2.40	424
20100207	-0.99	1.41	1.70	591	-1.67	1.74	2.16	591	-3.79	7.14	9.35	591	1.55	1.90	2.25	424
20100304	0.73	2.03	2.53	609	-0.30	1.95	2.42	610	-4.56	17.77	21.48	610	-0.63	1.44	1.79	480
20100307	-0.59	1.54	1.95	595	-0.91	1.34	1.60	599	-1.59	9.38	11.61	599	-0.16	1.08	1.36	470
20100309	-0.69	1.03	1.30	609	-1.08	1.89	2.34	611	-1.52	9.93	12.00	611	-0.37	1.50	1.82	482
20100413	0.66	1.27	1.73	580	-0.43	1.47	1.97	579	-3.80	8.49	11.62	579	-1.28	1.95	2.41	462
20100617	-0.21	1.29	1.61	571	2.51	3.15	3.69	571	4.81	8.67	11.18	571	-3.90	3.93	4.34	471
20100621	-0.15	1.37	1.77	577	1.74	1.99	2.68	573	3.58	5.24	7.43	573	-5.03	5.03	5.24	463
20100627	1.10	1.61	2.24	574	3.93	3.95	4.30	589	5.23	6.25	7.37	589	-8.00	8.65	10.80	435
20100630	-0.98	1.87	2.25	650	1.09	2.78	3.51	631	2.29	4.40	5.92	631	-6.64	6.67	6.82	445
20100704	0.99	1.50	2.04	608	0.24	2.09	2.66	608	-0.84	3.67	5.23	608	-6.75	6.75	6.89	442

Table A-4. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Control setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.57	2.24	2.84	586	-1.17	2.44	3.08	586	1.24	2.36	2.94	586	3.40	9.95	25	2.89	580
20090421	0.36	1.15	1.44	595	-0.22	1.21	1.52	595	-1.06	1.29	1.58	595	-0.93	34.30	25	93.85	502
20090519	1.03	2.59	3.24	537	0.26	3.22	4.32	537	-0.06	2.58	3.23	537	-5.02	31.84	25	-12.69	518
20090626	0.15	2.13	2.87	550	0.20	2.76	3.68	550	0.08	2.26	2.95	550	-8.24	19.40	25	-2.38	526
20091103	-0.25	1.08	1.38	583	-0.08	1.09	1.44	583	-0.82	1.15	1.46	583	-10.79	47.01	25	-84.29	463
20091114	0.70	1.72	2.21	554	-0.79	2.09	2.80	554	0.40	1.96	2.61	554	4.55	36.06	25	4.74	487
20091116	-0.11	1.18	1.47	565	0.62	1.29	1.67	565	-0.32	1.08	1.38	565	-27.96	54.06	25	-18.20	436
20091222	0.17	1.60	2.09	514	-0.43	2.26	2.94	514	1.66	2.08	2.61	514	22.71	44.70	25	-3.46	403
20100204	0.00	1.11	1.47	576	0.14	1.15	1.46	576	-0.22	0.99	1.28	576	1.14	34.67	25	-3.01	442
20100205	-0.13	1.53	1.94	574	2.63	3.15	3.97	574	1.40	2.60	3.30	574	-14.77	48.18	25	-22.61	473
20100207	0.04	1.29	1.65	586	0.48	1.62	2.08	586	-0.62	1.58	2.06	586	3.36	10.01	25	3.17	533
20100304	2.13	4.10	5.15	595	1.80	3.20	4.01	595	1.59	2.83	3.54	595	-33.29	43.48	25	-30.79	571
20100307	-0.04	1.46	1.88	596	1.45	2.24	2.84	596	-0.16	1.66	2.10	596	2.86	90.25	25	163.39	460
20100309	1.52	2.42	2.97	578	-1.24	2.38	3.17	578	1.02	2.48	3.21	578	-7.99	14.26	25	8.05	564
20100413	1.37	2.58	3.50	559	-1.04	2.58	3.38	559	-0.25	2.14	2.74	559	-28.31	60.54	25	-63.67	529
20100617	0.55	1.53	2.02	576	0.74	1.78	2.20	576	-0.79	1.33	1.70	576	11.93	57.80	25	-38.90	539
20100621	-0.65	1.64	2.07	563	0.73	1.97	2.54	563	-0.70	1.80	2.30	563	-0.87	38.59	25	-13.49	536
20100627	-0.23	1.53	1.89	585	-0.48	1.43	1.84	585	-0.22	1.28	1.59	591	-15.01	30.77	25	-6.01	509
20100630	0.39	2.15	2.79	606	0.80	2.28	2.86	606	0.60	2.17	2.78	609	-3.72	11.09	25	-2.42	594
20100704	-0.03	1.78	2.32	607	-1.86	2.63	3.32	607	1.00	2.06	2.72	607	14.47	33.47	25	-6.46	559

Table A-5. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, Physics2 setting.

DATE: 2009, 2010				Model/Domain Set: m1o1_P2_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	0.15	1.77	2.30	11966	0.55	1.95	2.52	8189	0.06	10.53	13.82	8214	3.02	3.08	3.69	2472
20090421	-0.40	2.28	2.86	10878	-0.17	2.43	3.05	7778	-2.53	9.99	13.29	7828	-2.89	2.99	3.31	2387
20090519	0.64	2.16	2.76	9710	-1.16	2.61	3.32	6921	-4.20	8.62	11.87	6968	-5.36	5.42	5.90	2272
20090626	0.08	2.06	2.65	11930	0.71	2.03	2.66	8392	2.12	11.33	14.76	8416	-3.80	3.95	4.37	2407
20091103	0.44	2.46	3.13	11557	-0.17	2.22	2.88	8951	-5.76	11.62	15.43	8947	-2.22	2.34	2.89	2475
20091114	0.88	1.93	2.45	11717	-0.06	1.79	2.31	8497	-6.45	12.27	15.57	8499	1.69	2.06	2.59	2506
20091116	0.75	2.65	3.31	10991	-0.06	2.20	2.77	7939	-7.13	14.14	17.33	7939	1.49	2.79	3.66	2335
20091222	0.75	2.06	2.65	12520	1.22	1.79	2.30	8975	-1.12	9.01	11.70	8973	1.62	2.14	2.65	2106
20100204	-1.41	2.87	3.56	12481	1.26	2.12	2.86	9271	10.17	13.21	16.55	9270	2.86	3.05	3.51	2183
20100205	-1.05	2.07	2.69	13118	0.41	1.53	2.05	9386	5.93	11.24	14.08	9386	0.75	1.77	2.33	2192
20100207	-1.11	2.08	2.76	13146	-1.32	1.87	2.40	9435	-3.46	11.08	15.14	9436	0.80	1.76	2.28	2216
20100304	-0.91	2.12	2.66	13089	0.38	1.67	2.11	9359	4.49	14.33	17.90	9358	0.85	1.68	2.13	2497
20100307	-0.92	2.25	2.95	12027	-0.95	1.92	2.62	8513	-2.35	13.00	16.81	8513	0.00	1.33	1.69	2369
20100309	-1.25	2.18	2.75	12855	-0.16	1.68	2.18	9172	4.61	12.44	15.82	9179	0.16	1.57	2.00	2384
20100413	0.06	1.69	2.22	12489	0.32	1.71	2.25	8865	-0.32	11.32	14.67	8865	0.00	1.78	2.20	2439
20100617	-0.41	1.80	2.28	12261	0.84	2.70	3.34	8620	2.25	9.41	12.59	8620	-2.20	2.45	3.03	2454
20100621	-1.10	2.12	2.67	12155	-0.19	2.48	3.29	8567	1.78	8.35	11.62	8567	-3.13	3.44	3.92	2439
20100627	0.34	1.99	2.58	10629	1.87	2.76	3.43	7977	2.52	8.05	10.40	7976	-6.12	6.29	7.38	2300
20100630	-0.04	2.07	2.65	11728	-0.18	2.74	3.49	8552	-1.03	8.41	11.81	8552	-5.14	5.50	6.44	2302
20100704	0.10	1.84	2.35	11806	0.45	2.52	3.24	8545	-0.25	8.07	10.78	8545	-4.47	4.53	5.05	2395

Table A-5. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, Physics2 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	-0.20	2.37	3.17	7958	-1.94	2.96	3.72	7958	1.70	2.89	3.65	8072	-7.83	8.56	25	-10.41	6759
20090421	0.15	1.17	1.59	8407	-0.20	1.17	1.56	8407	-0.50	1.23	1.61	8552	-1.75	37.67	25	-43.41	5700
20090519	1.05	2.33	3.05	7323	0.98	2.63	3.43	7323	0.98	2.42	3.06	7421	-14.25	21.61	25	-13.15	5795
20090626	0.38	2.03	2.76	8689	-0.16	2.17	2.98	8689	0.59	2.07	2.75	8767	-19.83	23.90	25	-18.25	6363
20091103	0.28	1.26	1.80	9463	0.10	1.13	1.56	9463	-0.18	1.26	1.73	9560	-20.01	28.19	25	-10.27	5421
20091114	0.84	1.93	2.65	8483	-0.96	2.17	2.88	8483	1.36	2.21	2.89	8572	-13.81	17.37	25	-4.58	5602
20091116	0.13	1.06	1.51	8106	0.18	1.07	1.53	8106	-0.39	1.11	1.55	8228	-28.71	32.32	25	-24.66	4442
20091222	0.65	1.80	2.61	8997	0.47	2.96	3.90	8997	2.00	2.67	3.59	9015	-1.78	25.76	25	42.76	5356
20100204	0.26	1.25	1.76	9616	0.32	1.22	1.67	9616	-0.06	1.30	1.76	9741	-6.71	18.11	25	-4.12	5435
20100205	0.37	1.61	2.17	9590	1.49	2.19	2.90	9590	1.12	2.06	2.70	9699	-9.14	11.67	25	-9.17	5716
20100207	-1.31	2.15	3.08	9397	0.11	1.55	2.06	9397	0.75	2.04	2.80	9572	-32.92	32.92	25	-36.12	6182
20100304	0.54	2.22	3.05	9317	1.22	2.52	3.24	9317	1.09	2.36	3.08	9334	-12.71	16.37	25	-20.14	6950
20100307	-0.21	1.50	2.02	8691	0.80	1.87	2.48	8691	0.39	1.71	2.27	8716	9.95	17.71	25	-9.31	5497
20100309	0.74	2.07	2.79	9032	-0.11	2.46	3.28	9032	1.39	2.48	3.28	9067	-5.98	21.03	25	13.44	6682
20100413	1.20	2.19	2.92	8810	-0.31	2.12	2.83	8810	0.85	2.02	2.59	8909	-30.21	30.66	25	-29.32	6610
20100617	0.62	1.68	2.31	8952	0.27	1.50	1.96	8952	0.14	1.50	2.00	9003	-15.91	26.99	25	6.14	6557
20100621	0.19	1.49	2.00	8920	0.12	1.62	2.15	8920	0.06	1.53	1.97	8976	7.04	14.06	25	16.27	6741
20100627	0.11	1.29	1.70	8302	-0.47	1.37	1.80	8302	0.01	1.28	1.64	8418	5.85	17.06	25	2.65	5690
20100630	0.62	2.24	2.92	8634	1.80	2.96	3.78	8634	1.44	2.65	3.32	8695	-11.44	13.62	25	-10.62	7146
20100704	0.08	1.69	2.26	8734	-1.30	2.02	2.62	8734	0.50	1.73	2.23	8823	-36.98	37.19	25	-21.32	6427

Table A-6. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics2 setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m1o2_P2_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.64	1.71	2.13	608	-0.66	1.74	2.34	608	-9.46	11.59	14.80	608	2.64	2.69	3.03	483
20090421	1.29	2.12	2.66	561	-0.52	2.78	3.27	587	-7.46	11.89	16.09	587	-3.03	3.03	3.21	442
20090519	0.55	1.68	2.12	578	-0.10	1.90	2.55	595	-0.27	4.17	5.45	595	-5.45	5.45	5.59	446
20090626	0.41	1.83	2.24	593	1.67	2.14	2.66	578	3.65	8.83	11.04	578	-4.34	4.34	4.57	459
20091103	2.61	2.95	3.71	538	1.49	1.78	2.22	582	-3.40	7.38	9.04	582	-2.47	2.51	3.02	479
20091114	2.23	2.34	2.74	558	0.74	2.62	3.05	563	-5.71	12.66	15.25	563	1.53	1.83	2.14	468
20091116	4.35	4.37	4.94	539	-0.68	2.23	2.69	560	-19.42	19.84	21.93	560	0.31	2.17	2.56	471
20091222	2.25	2.39	2.80	514	0.63	1.55	1.81	520	-10.13	10.52	12.88	520	2.84	2.97	3.43	378
20100204	-2.50	2.96	3.53	570	-0.70	1.33	1.63	576	6.40	8.78	11.50	576	3.55	3.56	4.08	425
20100205	-1.55	2.10	2.62	578	-0.79	1.14	1.38	579	4.15	9.63	12.07	579	0.14	1.91	2.34	424
20100207	-0.63	1.29	1.58	591	-1.64	1.68	1.99	591	-5.84	7.70	10.11	591	1.16	1.70	2.03	424
20100304	0.87	2.18	2.68	609	-0.29	1.91	2.39	610	-5.29	18.10	21.66	610	-0.91	1.64	2.05	480
20100307	-0.08	1.26	1.57	595	-1.01	1.48	1.75	599	-5.00	8.51	10.99	599	-0.76	1.35	1.64	470
20100309	-0.86	1.26	1.51	609	-1.04	1.80	2.28	611	-0.71	8.93	11.09	611	-0.46	1.41	1.73	482
20100413	0.88	1.50	1.95	580	-0.19	1.57	2.08	579	-3.31	9.23	12.33	579	-1.64	2.29	2.81	462
20100617	-0.11	1.27	1.58	571	2.49	3.16	3.67	571	4.44	8.50	10.87	571	-3.97	3.98	4.40	471
20100621	-0.04	1.45	1.85	577	1.68	1.97	2.64	573	3.36	5.16	7.44	573	-5.20	5.20	5.42	463
20100627	1.44	1.79	2.44	574	3.76	3.79	4.13	589	4.50	5.70	6.96	589	-8.45	9.10	11.14	435
20100630	-0.90	1.87	2.25	650	0.02	2.47	3.13	631	1.19	3.88	5.38	631	-6.71	6.74	6.89	445
20100704	1.00	1.52	2.06	608	0.35	2.11	2.70	608	-0.62	3.76	5.31	608	-6.72	6.72	6.86	442

Table A-6. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics2 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.46	2.13	2.68	586	-1.17	2.54	3.16	586	1.17	2.40	2.96	586	3.09	10.13	25	2.12	580
20090421	0.34	1.14	1.43	595	-0.21	1.21	1.51	595	-1.10	1.30	1.59	595	-1.75	33.00	25	88.54	502
20090519	0.99	2.66	3.33	537	0.45	3.50	4.79	537	-0.08	2.57	3.18	537	-1.00	39.02	25	-9.27	518
20090626	0.37	2.27	3.13	550	-0.72	2.76	3.73	550	-0.13	2.39	3.07	550	-10.22	20.18	25	0.21	526
20091103	-0.25	1.08	1.37	583	-0.07	1.10	1.48	583	-0.88	1.16	1.50	583	-9.78	46.97	25	-74.65	463
20091114	0.66	1.74	2.22	554	-0.84	2.14	2.86	554	0.31	2.05	2.77	554	-11.83	37.12	25	3.62	487
20091116	-0.09	1.18	1.46	565	0.50	1.21	1.58	565	-0.46	1.10	1.40	565	-25.96	52.83	25	-15.28	436
20091222	0.10	1.47	1.92	514	-0.41	2.43	3.11	514	1.70	2.07	2.61	514	21.80	44.58	25	-4.18	403
20100204	-0.06	1.08	1.42	576	0.20	1.15	1.47	576	-0.29	1.00	1.27	576	3.47	29.56	25	-0.45	442
20100205	0.01	1.48	1.86	574	2.46	3.02	3.81	574	1.14	2.50	3.15	574	17.54	48.77	25	-23.62	473
20100207	0.11	1.36	1.75	586	0.31	1.58	2.03	586	-0.58	1.55	2.04	586	4.09	11.72	25	4.08	533
20100304	2.08	3.94	4.90	595	1.83	2.92	3.75	595	1.37	2.62	3.32	595	-33.16	43.36	25	-30.40	571
20100307	0.08	1.45	1.86	596	1.40	2.23	2.92	596	-0.16	1.56	2.03	596	27.07	82.26	25	151.78	460
20100309	1.01	2.07	2.58	578	-0.50	2.04	2.68	578	0.30	2.07	2.66	578	-4.73	11.10	25	9.49	564
20100413	1.52	2.71	3.58	559	-1.15	2.80	3.68	559	-0.15	2.15	2.69	559	-27.60	64.40	25	-73.27	529
20100617	0.56	1.55	2.02	576	0.68	1.72	2.13	576	-0.83	1.31	1.68	576	13.68	59.02	25	-36.10	539
20100621	-0.61	1.57	1.96	563	0.71	1.91	2.45	563	-0.82	1.78	2.25	563	1.78	35.51	25	-12.79	536
20100627	-0.23	1.49	1.84	585	-0.62	1.47	1.87	585	-0.11	1.26	1.57	591	-15.92	31.00	25	-5.79	509
20100630	0.87	2.15	2.76	606	0.32	2.00	2.60	606	0.14	2.01	2.63	609	-8.19	12.05	25	-6.87	594
20100704	-0.04	1.76	2.26	607	-1.66	2.48	3.12	607	0.76	1.90	2.50	607	14.81	33.91	25	-6.00	559

Table A-7. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics2 setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_P2_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.58	1.65	2.01	608	-0.68	1.73	2.33	608	-9.33	11.47	14.71	608	2.72	2.77	3.12	483
20090421	1.26	2.11	2.65	561	-0.50	2.79	3.29	587	-7.33	11.88	16.07	587	-2.98	2.98	3.16	442
20090519	0.49	1.65	2.07	578	-0.12	1.91	2.56	595	-0.22	4.18	5.47	595	-5.35	5.35	5.50	446
20090626	0.37	1.80	2.18	593	1.64	2.13	2.65	578	3.66	8.92	11.15	578	-4.11	4.11	4.38	459
20091103	2.57	2.98	3.73	538	1.46	1.76	2.21	582	-3.34	7.40	9.05	582	-2.36	2.42	2.93	479
20091114	2.17	2.28	2.67	558	0.73	2.61	3.05	563	-5.47	12.64	15.26	563	1.62	1.91	2.24	468
20091116	4.32	4.34	4.93	539	-0.70	2.23	2.67	560	-19.39	19.75	21.87	560	0.34	2.17	2.57	471
20091222	2.20	2.32	2.71	514	0.60	1.50	1.75	520	-9.91	10.29	12.69	520	3.01	3.13	3.59	378
20100204	-2.64	3.02	3.60	570	-0.72	1.32	1.62	576	6.99	9.17	11.95	576	3.84	3.84	4.34	425
20100205	-1.53	2.06	2.57	578	-0.78	1.14	1.38	579	4.17	9.20	11.69	579	0.33	1.95	2.40	424
20100207	-0.75	1.23	1.50	591	-1.63	1.67	2.01	591	-5.10	7.17	9.34	591	1.44	1.83	2.18	424
20100304	0.79	2.13	2.61	609	-0.27	1.90	2.38	610	-4.77	17.86	21.55	610	-0.80	1.62	2.02	480
20100307	-0.28	1.32	1.65	595	-1.03	1.48	1.75	599	-4.02	8.35	10.80	599	-0.50	1.26	1.54	470
20100309	-0.90	1.19	1.46	609	-1.09	1.83	2.31	611	-0.78	8.92	10.99	611	-0.35	1.35	1.68	482
20100413	0.74	1.43	1.90	580	-0.07	1.54	2.04	579	-2.40	9.01	12.15	579	-1.42	2.20	2.71	462
20100617	-0.21	1.30	1.61	571	2.52	3.15	3.70	571	4.82	8.69	11.19	571	-3.90	3.92	4.33	471
20100621	-0.16	1.37	1.77	577	1.73	2.00	2.69	573	3.60	5.26	7.44	573	-5.00	5.00	5.21	463
20100627	1.42	1.76	2.42	574	3.75	3.78	4.13	589	4.45	5.67	6.88	589	-8.27	8.91	11.00	435
20100630	-0.96	1.85	2.23	650	0.01	2.49	3.15	631	1.24	3.95	5.49	631	-6.71	6.74	6.89	445
20100704	0.95	1.48	2.01	608	0.35	2.16	2.75	608	-0.53	3.78	5.42	608	-6.68	6.68	6.83	442

Table A-7. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics2 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.47	2.17	2.73	586	-1.24	2.57	3.19	586	1.26	2.45	3.01	586	3.12	10.18	25	2.12	580
20090421	0.35	1.15	1.45	595	-0.22	1.21	1.52	595	-1.06	1.29	1.58	595	-0.97	34.39	25	93.12	502
20090519	1.04	2.69	3.39	537	0.46	3.53	4.89	537	0.03	2.57	3.22	537	-1.54	39.17	25	-9.83	518
20090626	0.40	2.33	3.24	550	-0.67	2.76	3.77	550	0.01	2.41	3.07	550	-10.77	20.89	25	-0.61	526
20091103	-0.26	1.08	1.38	583	-0.08	1.09	1.44	583	-0.82	1.15	1.46	583	-11.09	47.11	25	-89.67	463
20091114	0.69	1.77	2.25	554	-0.85	2.14	2.86	554	0.38	2.07	2.78	554	-12.05	35.51	25	4.04	487
20091116	-0.10	1.21	1.50	565	0.53	1.26	1.63	565	-0.38	1.13	1.42	565	-27.66	53.53	25	-16.93	436
20091222	0.09	1.54	2.05	514	-0.44	2.45	3.16	514	1.76	2.14	2.71	514	21.33	43.67	25	-4.46	403
20100204	-0.03	1.09	1.45	576	0.16	1.12	1.43	576	-0.28	0.99	1.27	576	3.96	31.97	25	-1.09	442
20100205	-0.05	1.52	1.96	574	2.48	2.99	3.83	574	1.23	2.52	3.20	574	5.87	51.40	25	-23.37	473
20100207	0.15	1.35	1.73	586	0.46	1.57	2.03	586	-0.54	1.54	2.01	586	5.51	11.65	25	5.35	533
20100304	2.04	3.94	4.94	595	1.86	3.09	3.91	595	1.51	2.73	3.45	595	-33.19	43.38	25	-29.94	571
20100307	0.10	1.49	1.90	596	1.34	2.18	2.83	596	-0.15	1.56	2.01	596	28.31	85.55	25	150.58	460
20100309	1.05	2.11	2.64	578	-0.46	2.05	2.73	578	0.45	2.09	2.72	578	-4.11	10.79	25	10.34	564
20100413	1.55	2.67	3.54	559	-1.25	2.80	3.73	559	-0.12	2.17	2.69	559	-14.57	64.89	25	-78.85	529
20100617	0.55	1.53	2.02	576	0.72	1.77	2.19	576	-0.79	1.33	1.69	576	12.43	58.05	25	-38.12	539
20100621	-0.63	1.64	2.07	563	0.68	1.96	2.53	563	-0.68	1.80	2.30	563	1.49	36.19	25	-13.01	536
20100627	-0.23	1.54	1.92	585	-0.58	1.47	1.87	585	-0.09	1.28	1.59	591	-14.81	30.12	25	-5.47	509
20100630	0.84	2.09	2.71	606	0.40	2.05	2.64	606	0.25	2.01	2.62	609	-7.84	11.29	25	-6.46	594
20100704	-0.11	1.86	2.43	607	-1.73	2.55	3.21	607	0.91	2.00	2.63	607	13.88	34.10	25	-7.08	559

Table A-8. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, Physics8 setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m1o1_P8_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	-0.16	1.73	2.24	11966	0.83	1.96	2.53	8189	2.90	10.84	14.16	8214	3.46	3.48	4.04	2472
20090421	-0.40	2.28	2.86	10878	-0.18	2.42	3.04	7778	-2.53	9.99	13.28	7828	-2.88	2.99	3.31	2387
20090519	0.78	2.24	2.86	9710	-1.33	2.70	3.45	6921	-4.65	8.87	12.21	6968	-5.65	5.70	6.17	2272
20090626	-0.15	2.14	2.75	11930	0.61	2.05	2.66	8392	2.83	12.50	16.08	8416	-3.53	3.75	4.26	2407
20091103	0.43	2.46	3.13	11557	-0.19	2.22	2.87	8951	-5.78	11.63	15.42	8947	-2.22	2.34	2.89	2475
20091114	0.53	1.79	2.30	11717	0.26	1.78	2.29	8497	-3.03	11.29	14.47	8499	2.14	2.35	2.90	2506
20091116	0.75	2.65	3.31	10991	-0.06	2.20	2.77	7939	-7.13	14.14	17.33	7939	1.49	2.79	3.66	2335
20091222	0.53	2.04	2.64	12520	1.20	1.76	2.28	8975	-0.02	8.80	11.66	8973	1.88	2.35	2.87	2106
20100204	-1.78	3.09	3.82	12481	1.31	2.19	2.93	9271	12.97	15.13	19.20	9270	3.71	3.89	4.42	2183
20100205	-1.34	2.20	2.83	13118	0.30	1.63	2.16	9386	6.95	12.15	15.18	9386	0.96	1.84	2.42	2192
20100207	-1.18	2.07	2.73	13146	-1.08	1.78	2.29	9435	-1.62	10.91	14.88	9436	1.10	1.84	2.42	2216
20100304	-1.25	2.18	2.77	13089	0.63	1.72	2.19	9359	7.84	14.83	19.04	9358	1.44	1.89	2.37	2497
20100307	-1.00	2.28	2.98	12027	-0.63	1.86	2.53	8513	-0.07	13.52	17.42	8513	0.31	1.38	1.73	2369
20100309	-1.20	2.11	2.67	12855	0.13	1.81	2.29	9172	6.08	13.09	16.80	9179	0.25	1.57	2.00	2384
20100413	-0.86	1.88	2.50	12489	0.31	1.61	2.13	8865	4.25	12.28	16.47	8865	1.09	1.93	2.37	2439
20100617	-0.44	1.81	2.29	12261	0.82	2.70	3.36	8620	2.21	9.44	12.63	8620	-2.19	2.45	3.02	2454
20100621	-1.13	2.13	2.68	12155	-0.21	2.48	3.30	8567	1.84	8.36	11.65	8567	-3.12	3.43	3.91	2439
20100627	0.03	1.98	2.53	10629	1.87	2.75	3.40	7977	3.13	8.29	10.57	7976	-5.90	6.08	7.18	2300
20100630	-0.10	2.06	2.63	11728	-0.17	2.72	3.48	8552	-0.86	8.29	11.71	8552	-5.18	5.53	6.48	2302
20100704	0.21	1.94	2.48	11806	0.27	2.57	3.30	8545	-0.93	8.53	11.61	8545	-4.60	4.66	5.19	2395

Table A-8. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, Physics8 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	-0.14	2.33	3.06	7958	-1.75	2.82	3.58	7958	1.50	2.76	3.52	8072	-7.00	7.80	25	-9.09	6759
20090421	0.15	1.17	1.59	8407	-0.20	1.17	1.56	8407	-0.50	1.23	1.62	8552	-1.90	38.29	25	-43.07	5700
20090519	0.94	2.38	3.15	7323	0.86	2.51	3.29	7323	0.91	2.36	3.01	7421	-13.11	20.39	25	-12.65	5795
20090626	0.29	2.11	2.88	8689	-0.16	2.24	3.04	8689	0.83	2.13	2.80	8767	-14.46	25.22	25	-13.74	6363
20091103	0.28	1.26	1.80	9463	0.10	1.13	1.56	9463	-0.17	1.26	1.73	9560	-20.09	28.13	25	-10.43	5421
20091114	0.90	1.98	2.72	8483	-0.87	2.15	2.87	8483	1.33	2.22	2.90	8572	-14.02	18.08	25	-2.38	5602
20091116	0.13	1.06	1.51	8106	0.18	1.07	1.53	8106	-0.39	1.11	1.55	8228	-28.71	32.32	25	-24.66	4442
20091222	0.62	1.77	2.59	8997	0.50	2.85	3.81	8997	1.87	2.59	3.52	9015	-2.16	25.47	25	43.34	5356
20100204	0.29	1.26	1.78	9616	0.17	1.24	1.69	9616	-0.07	1.30	1.76	9741	-12.45	19.94	25	-13.03	5435
20100205	0.35	1.59	2.16	9590	1.41	2.14	2.85	9590	1.02	2.00	2.65	9699	-8.44	10.97	25	-8.44	5716
20100207	-1.21	2.08	2.97	9397	0.19	1.57	2.09	9397	0.64	1.99	2.73	9572	-33.87	33.87	25	-37.11	6182
20100304	0.49	2.23	3.05	9317	1.24	2.55	3.25	9317	1.06	2.34	3.03	9334	-10.54	16.08	25	-18.32	6950
20100307	-0.20	1.53	2.07	8691	0.79	1.92	2.55	8691	0.44	1.74	2.32	8716	10.20	18.01	25	-8.92	5497
20100309	0.80	2.12	2.84	9032	-0.28	2.53	3.33	9032	1.57	2.56	3.34	9067	-7.93	18.48	25	10.05	6682
20100413	0.83	2.17	2.89	8810	-0.06	2.14	2.81	8810	0.90	2.04	2.64	8909	-18.22	19.26	25	-20.12	6610
20100617	0.61	1.67	2.30	8952	0.27	1.50	1.96	8952	0.13	1.50	2.00	9003	-16.23	27.15	25	6.32	6557
20100621	0.19	1.49	2.00	8920	0.14	1.63	2.16	8920	0.05	1.53	1.98	8976	6.82	14.47	25	17.38	6741
20100627	0.08	1.28	1.68	8302	-0.42	1.35	1.78	8302	-0.04	1.28	1.64	8418	4.68	16.18	25	1.57	5690
20100630	0.57	2.21	2.90	8634	1.79	2.99	3.81	8634	1.45	2.67	3.36	8695	-10.83	13.28	25	-9.93	7146
20100704	0.10	1.73	2.33	8734	-1.43	2.13	2.76	8734	0.61	1.80	2.30	8823	-37.59	37.88	25	-22.11	6427

Table A-9. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics8 setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_P8_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.28	1.48	1.96	608	-0.05	1.79	2.27	608	-4.95	11.07	14.21	608	3.12	3.16	3.53	483
20090421	1.29	2.12	2.66	561	-0.52	2.78	3.27	587	-7.46	11.89	16.09	587	-3.03	3.03	3.20	442
20090519	0.72	1.77	2.24	578	-0.63	1.97	2.68	595	-1.24	4.28	5.53	595	-5.79	5.79	5.91	446
20090626	-0.56	2.16	2.59	593	1.86	2.29	2.83	578	7.12	11.40	13.91	578	-3.70	3.71	4.14	459
20091103	2.68	3.00	3.74	538	1.49	1.78	2.22	582	-3.61	7.48	9.12	582	-2.48	2.52	3.04	479
20091114	1.68	2.03	2.53	558	1.46	2.15	2.63	563	-0.64	8.81	11.08	563	2.14	2.19	2.52	468
20091116	4.35	4.37	4.94	539	-0.68	2.23	2.69	560	-19.42	19.84	21.93	560	0.31	2.17	2.56	471
20091222	2.08	2.19	2.61	514	0.58	1.25	1.50	520	-9.33	9.72	12.20	520	3.13	3.28	3.75	378
20100204	-3.13	3.41	4.02	570	-1.10	1.68	2.06	576	10.47	10.85	14.17	576	5.32	5.32	5.69	425
20100205	-1.61	2.22	2.84	578	-1.12	1.40	1.70	579	2.39	9.77	12.16	579	0.28	1.99	2.44	424
20100207	-0.88	1.50	1.77	591	-1.64	1.75	2.15	591	-4.15	7.80	10.24	591	1.46	1.91	2.26	424
20100304	0.26	1.83	2.33	609	0.25	1.82	2.24	610	0.52	15.87	19.44	610	-0.12	1.22	1.49	480
20100307	-0.20	1.41	1.75	595	-0.46	1.22	1.53	599	-1.15	9.21	11.43	599	-0.37	1.15	1.41	470
20100309	-0.81	1.19	1.46	609	-0.95	1.90	2.27	611	-0.24	10.38	12.82	611	-0.20	1.41	1.72	482
20100413	0.44	1.20	1.60	580	-0.17	1.51	2.05	579	-1.32	8.88	11.98	579	-0.99	1.78	2.19	462
20100617	-0.11	1.27	1.58	571	2.50	3.17	3.67	571	4.47	8.51	10.89	571	-3.97	3.98	4.40	471
20100621	-0.06	1.45	1.85	577	1.64	1.96	2.64	573	3.31	5.16	7.44	573	-5.19	5.19	5.41	463
20100627	1.11	1.64	2.26	574	3.93	3.95	4.29	589	5.30	6.30	7.48	589	-8.19	8.84	10.93	435
20100630	-0.98	1.86	2.25	650	-0.24	2.48	3.23	631	1.08	3.87	5.46	631	-6.72	6.75	6.89	445
20100704	1.01	1.55	2.10	608	0.15	2.08	2.63	608	-0.99	3.71	5.18	608	-6.79	6.79	6.93	442

Table A-9. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics8 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	1.01	2.25	2.81	586	-0.88	2.32	2.96	586	1.02	2.21	2.78	586	6.31	11.55	25	6.18	580
20090421	0.34	1.14	1.43	595	-0.21	1.21	1.51	595	-1.10	1.30	1.59	595	-1.65	32.94	25	88.35	502
20090519	1.02	2.86	3.66	537	0.36	3.25	4.42	537	-0.21	2.67	3.31	537	-1.77	33.92	25	-11.16	518
20090626	0.05	2.46	3.31	550	-0.69	3.06	4.09	550	0.29	2.40	3.06	550	-2.63	27.90	25	4.51	526
20091103	-0.26	1.09	1.38	583	-0.09	1.09	1.47	583	-0.87	1.15	1.49	583	-10.77	46.84	25	-94.24	463
20091114	0.65	1.83	2.35	554	-0.63	2.32	3.23	554	0.28	2.11	2.82	554	-5.51	43.58	25	4.76	487
20091116	-0.09	1.18	1.46	565	0.50	1.21	1.58	565	-0.46	1.10	1.40	565	-25.95	52.83	25	-15.28	436
20091222	0.20	1.45	1.90	514	-0.40	2.19	2.82	514	1.55	1.97	2.46	514	22.56	44.58	25	-2.52	403
20100204	0.20	1.19	1.55	576	-0.79	1.43	1.85	576	-0.60	1.03	1.34	576	60.96	77.21	25	41.02	442
20100205	-0.09	1.46	1.83	574	2.68	3.16	3.95	574	1.36	2.57	3.24	574	-14.53	48.91	25	-22.87	473
20100207	-0.01	1.44	1.84	586	0.12	1.54	1.93	586	-0.44	1.53	1.96	586	-0.25	9.73	25	0.56	533
20100304	2.25	3.98	5.00	595	1.54	3.12	3.90	595	1.27	2.72	3.37	595	-33.71	43.59	25	-32.29	571
20100307	0.10	1.43	1.85	596	1.32	2.22	2.88	596	-0.23	1.48	1.93	596	21.55	88.02	25	151.84	460
20100309	1.41	2.24	2.74	578	-0.98	2.25	2.94	578	0.73	2.33	2.98	578	-5.81	12.32	25	9.16	564
20100413	0.95	2.48	3.36	559	-0.40	2.57	3.46	559	0.15	2.07	2.76	559	-4.64	44.30	25	-31.08	529
20100617	0.56	1.55	2.02	576	0.68	1.72	2.13	576	-0.83	1.31	1.68	576	13.62	59.06	25	-36.17	539
20100621	-0.57	1.55	1.93	563	0.80	1.92	2.48	563	-0.89	1.78	2.26	563	1.37	35.45	25	-12.30	536
20100627	-0.23	1.48	1.82	585	-0.53	1.44	1.84	585	-0.22	1.27	1.58	591	-15.91	31.80	25	-6.07	509
20100630	0.90	2.10	2.71	606	0.08	2.08	2.74	606	-0.05	2.03	2.67	609	-8.60	11.89	25	-7.60	594
20100704	0.14	1.73	2.19	607	-1.85	2.61	3.28	607	0.94	2.04	2.65	607	17.07	33.96	25	-4.04	559

Table A-10. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics8 setting.

DATE: <u>2009, 2010</u>					Model/Domain Set: <u>m2o2_P8_sfc</u>											
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.23	1.43	1.85	608	-0.09	1.79	2.28	608	-4.92	11.13	14.31	608	3.20	3.22	3.61	483
20090421	1.26	2.11	2.65	561	-0.50	2.80	3.29	587	-7.34	11.88	16.08	587	-2.98	2.98	3.16	442
20090519	0.70	1.75	2.19	578	-0.64	1.98	2.70	595	-1.20	4.31	5.58	595	-5.71	5.71	5.84	446
20090626	-0.59	2.13	2.54	593	1.84	2.29	2.82	578	7.20	11.52	14.04	578	-3.47	3.51	3.97	459
20091103	2.64	3.02	3.76	538	1.46	1.77	2.21	582	-3.54	7.49	9.12	582	-2.38	2.43	2.94	479
20091114	1.64	1.98	2.49	558	1.43	2.13	2.62	563	-0.54	8.83	11.10	563	2.23	2.27	2.61	468
20091116	4.32	4.34	4.93	539	-0.70	2.23	2.67	560	-19.39	19.75	21.87	560	0.34	2.17	2.57	471
20091222	2.00	2.10	2.52	514	0.54	1.22	1.45	520	-9.05	9.41	11.97	520	3.29	3.44	3.92	378
20100204	-3.37	3.59	4.22	570	-1.34	1.81	2.21	576	10.80	11.17	14.59	576	5.79	5.79	6.12	425
20100205	-1.72	2.26	2.91	578	-1.14	1.43	1.73	579	2.81	9.73	12.13	579	0.50	2.05	2.51	424
20100207	-0.99	1.44	1.70	591	-1.66	1.74	2.17	591	-3.66	7.35	9.70	591	1.70	2.06	2.42	424
20100304	0.16	1.80	2.27	609	0.24	1.77	2.20	610	1.00	15.68	19.30	610	0.00	1.24	1.52	480
20100307	-0.31	1.42	1.79	595	-0.47	1.18	1.50	599	-0.57	9.14	11.34	599	-0.16	1.11	1.40	470
20100309	-0.88	1.12	1.41	609	-0.98	1.91	2.29	611	-0.04	10.36	12.72	611	-0.09	1.39	1.69	482
20100413	0.21	1.13	1.49	580	-0.06	1.48	2.03	579	-0.22	8.90	11.95	579	-0.77	1.74	2.11	462
20100617	-0.21	1.29	1.61	571	2.52	3.15	3.70	571	4.85	8.69	11.20	571	-3.89	3.92	4.33	471
20100621	-0.19	1.38	1.77	577	1.69	1.98	2.68	573	3.53	5.24	7.42	573	-4.99	4.99	5.21	463
20100627	1.10	1.61	2.24	574	3.94	3.96	4.31	589	5.24	6.26	7.38	589	-8.00	8.65	10.80	435
20100630	-1.01	1.83	2.22	650	-0.21	2.50	3.28	631	1.12	3.94	5.61	631	-6.73	6.76	6.90	445
20100704	0.96	1.51	2.05	608	0.16	2.10	2.66	608	-0.90	3.74	5.28	608	-6.75	6.75	6.90	442

Table A-10. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics8 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	1.02	2.29	2.87	586	-0.95	2.37	3.02	586	1.12	2.27	2.86	586	6.36	11.58	25	6.16	580
20090421	0.35	1.15	1.45	595	-0.22	1.21	1.52	595	-1.06	1.29	1.58	595	-0.89	34.32	25	93.01	502
20090519	1.06	2.91	3.75	537	0.36	3.26	4.48	537	-0.08	2.70	3.36	537	-1.36	34.09	25	-11.72	518
20090626	0.08	2.51	3.39	550	-0.63	3.07	4.11	550	0.39	2.45	3.12	550	-3.63	27.48	25	3.38	526
20091103	-0.27	1.09	1.39	583	-0.09	1.09	1.44	583	-0.81	1.14	1.46	583	-11.85	49.06	25	-104.41	463
20091114	0.69	1.88	2.40	554	-0.66	2.33	3.26	554	0.38	2.13	2.84	554	-4.54	42.93	25	5.29	487
20091116	-0.10	1.21	1.50	565	0.53	1.26	1.63	565	-0.38	1.13	1.42	565	-27.66	53.53	25	-16.93	436
20091222	0.22	1.53	2.04	514	-0.40	2.23	2.89	514	1.62	2.05	2.59	514	23.75	45.58	25	-2.51	403
20100204	0.28	1.25	1.62	576	-0.81	1.40	1.81	576	-0.59	1.06	1.38	576	60.62	84.87	25	22.88	442
20100205	-0.14	1.49	1.88	574	2.59	3.09	3.92	574	1.36	2.54	3.23	574	-14.61	49.42	25	-22.33	473
20100207	0.06	1.40	1.80	586	0.18	1.54	1.93	586	-0.37	1.54	1.97	586	1.11	10.01	25	1.74	533
20100304	2.31	4.06	5.10	595	1.54	3.11	3.92	595	1.39	2.68	3.36	595	-34.56	44.46	25	-32.93	571
20100307	0.11	1.48	1.93	596	1.33	2.22	2.87	596	-0.15	1.48	1.94	596	23.15	86.71	25	151.80	460
20100309	1.41	2.27	2.79	578	-0.94	2.19	2.90	578	0.88	2.32	3.00	578	-5.24	11.97	25	9.55	564
20100413	0.98	2.51	3.42	559	-0.54	2.51	3.27	559	0.09	2.07	2.71	559	-19.23	46.87	25	-34.21	529
20100617	0.54	1.53	2.02	576	0.72	1.77	2.19	576	-0.79	1.34	1.70	576	12.30	57.98	25	-38.12	539
20100621	-0.59	1.62	2.03	563	0.78	2.00	2.57	563	-0.77	1.81	2.32	563	2.39	35.67	25	-12.57	536
20100627	-0.23	1.52	1.89	585	-0.48	1.43	1.84	585	-0.22	1.27	1.59	591	-14.95	30.81	25	-5.81	509
20100630	0.84	2.07	2.68	606	0.17	2.09	2.76	606	0.05	2.01	2.67	609	-8.02	11.47	25	-6.89	594
20100704	0.05	1.78	2.31	607	-1.93	2.69	3.38	607	1.05	2.12	2.79	607	15.83	34.26	25	-5.62	559

Table A-11. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, 3Second setting.

DATE: 2009, 2010				Model/Domain Set: m1o1_T3_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	-0.03	1.74	2.26	11966	0.71	2.01	2.59	8189	1.81	11.02	14.43	8214	3.20	3.23	3.81	2472
20090421	-0.35	2.28	2.86	10878	-0.16	2.42	3.04	7778	-2.62	10.04	13.39	7828	-3.02	3.12	3.44	2387
20090519	0.70	2.12	2.73	9710	-1.06	2.56	3.27	6921	-4.12	8.56	11.91	6968	-5.44	5.49	5.95	2272
20090626	-0.89	2.48	3.21	11930	1.11	2.22	2.89	8392	8.19	14.97	19.29	8416	-2.67	3.09	3.67	2407
20091103	0.66	2.49	3.19	11557	-0.31	2.25	2.92	8951	-6.80	12.05	15.96	8947	-2.54	2.63	3.14	2475
20091114	0.74	1.88	2.40	11717	0.10	1.80	2.32	8497	-4.78	11.65	15.01	8499	1.88	2.16	2.71	2506
20091116	1.30	2.84	3.53	10991	0.24	2.23	2.82	7939	-7.93	14.56	17.92	7939	0.80	2.70	3.52	2335
20091222	0.69	2.02	2.63	12520	1.21	1.80	2.32	8975	-0.74	8.92	11.72	8973	1.59	2.15	2.66	2106
20100204	-1.18	2.85	3.59	12481	1.78	2.42	3.20	9271	12.93	15.39	19.53	9270	3.49	3.70	4.14	2183
20100205	-1.10	2.10	2.71	13118	0.61	1.61	2.16	9386	7.78	12.55	15.68	9386	0.97	1.80	2.33	2192
20100207	-1.10	2.00	2.66	13146	-1.18	1.85	2.39	9435	-2.35	10.93	15.01	9436	1.04	1.82	2.35	2216
20100304	-1.06	2.10	2.66	13089	0.58	1.71	2.17	9359	6.72	14.48	18.45	9358	1.16	1.76	2.22	2497
20100307	-0.97	2.25	2.93	12027	-0.62	1.87	2.53	8513	0.17	13.76	17.69	8513	0.30	1.39	1.76	2369
20100309	-1.54	2.35	2.93	12855	-0.15	1.87	2.38	9172	6.79	13.62	17.42	9179	0.66	1.66	2.10	2384
20100413	-0.75	1.86	2.45	12489	0.39	1.65	2.18	8865	4.14	12.51	16.45	8865	0.92	1.81	2.24	2439
20100617	-0.41	1.80	2.27	12261	1.02	2.74	3.39	8620	3.02	9.63	12.86	8620	-2.20	2.47	3.08	2454
20100621	-1.02	2.09	2.64	12155	-0.31	2.51	3.33	8567	1.29	8.28	11.61	8567	-3.26	3.55	4.03	2439
20100627	0.11	1.98	2.54	10629	1.80	2.75	3.41	7977	2.79	8.21	10.52	7976	-5.98	6.15	7.25	2300
20100630	-0.09	2.06	2.64	11728	0.11	2.76	3.50	8552	-0.57	8.42	11.80	8552	-5.05	5.43	6.38	2302
20100704	0.25	1.89	2.42	11806	0.35	2.54	3.28	8545	-0.83	8.35	11.31	8545	-4.64	4.69	5.22	2395

Table A-11. Error statistics for surface meteorological variables for 3-km WRF, Domain 1,
3Second setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	-0.26	2.34	3.10	7958	-1.76	2.83	3.57	7958	1.51	2.75	3.48	8072	-8.17	8.73	25	-10.55	6759
20090421	0.17	1.18	1.60	8407	-0.24	1.19	1.58	8407	-0.49	1.24	1.63	8552	-12.19	44.57	25	-46.38	5700
20090519	0.95	2.27	2.97	7323	1.05	2.64	3.40	7323	1.00	2.42	3.07	7421	-11.78	20.30	25	-10.94	5795
20090626	0.11	2.09	2.79	8689	0.06	2.19	2.90	8689	0.80	2.05	2.68	8767	-7.33	19.74	25	-1.68	6363
20091103	0.31	1.29	1.83	9463	0.10	1.13	1.56	9463	-0.14	1.27	1.74	9560	-19.46	27.10	25	-12.11	5421
20091114	0.79	1.91	2.63	8483	-0.93	2.12	2.80	8483	1.30	2.15	2.81	8572	-16.04	18.79	25	-5.02	5602
20091116	0.20	1.09	1.54	8106	0.13	1.09	1.56	8106	-0.41	1.13	1.58	8228	-34.25	36.75	25	-29.46	4442
20091222	0.62	1.78	2.60	8997	0.51	2.88	3.81	8997	1.87	2.60	3.51	9015	-2.98	26.03	25	43.33	5356
20100204	0.25	1.26	1.77	9616	0.23	1.23	1.68	9616	-0.08	1.29	1.74	9741	-8.90	17.52	25	-7.20	5435
20100205	0.30	1.59	2.15	9590	1.43	2.16	2.85	9590	1.02	2.00	2.64	9699	-7.61	10.24	25	-7.74	5716
20100207	-1.19	2.06	2.95	9397	0.14	1.57	2.08	9397	0.63	1.99	2.73	9572	-31.56	31.56	25	-34.90	6182
20100304	0.52	2.26	3.09	9317	1.28	2.52	3.22	9317	1.11	2.35	3.05	9334	-11.73	16.54	25	-19.64	6950
20100307	-0.26	1.56	2.09	8691	0.83	1.94	2.57	8691	0.49	1.75	2.32	8716	11.14	18.83	25	-7.78	5497
20100309	0.72	2.07	2.77	9032	-0.04	2.45	3.22	9032	1.35	2.44	3.20	9067	-5.75	20.86	25	14.92	6682
20100413	0.63	2.18	2.89	8810	-0.06	2.13	2.80	8810	0.78	2.01	2.57	8909	-19.58	21.09	25	-18.23	6610
20100617	0.56	1.66	2.28	8952	0.20	1.48	1.94	8952	0.12	1.50	2.00	9003	-17.21	26.68	25	3.86	6557
20100621	0.22	1.50	2.00	8920	0.10	1.62	2.13	8920	0.07	1.52	1.96	8976	5.91	13.29	25	15.64	6741
20100627	0.09	1.29	1.69	8302	-0.47	1.35	1.79	8302	-0.02	1.29	1.65	8418	6.31	17.25	25	1.38	5690
20100630	0.47	2.25	2.97	8634	1.93	3.02	3.84	8634	1.57	2.69	3.37	8695	-9.24	12.11	25	-8.28	7146
20100704	0.08	1.72	2.29	8734	-1.34	2.06	2.66	8734	0.55	1.76	2.24	8823	-37.01	37.28	25	-21.56	6427

Table A-12. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 3Second setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m1o2_T3_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.57	1.68	2.10	608	-0.55	1.81	2.39	608	-8.53	11.80	14.96	608	2.76	2.80	3.13	483
20090421	1.33	2.12	2.66	561	-0.44	2.77	3.27	587	-7.30	11.77	15.90	587	-3.13	3.13	3.30	442
20090519	0.49	1.60	2.00	578	-0.03	1.71	2.28	595	-0.27	3.76	4.89	595	-5.49	5.49	5.60	446
20090626	-1.36	2.65	3.24	593	2.55	2.77	3.37	578	11.50	14.82	17.66	578	-3.03	3.09	3.66	459
20091103	3.20	3.46	4.14	538	1.03	1.66	2.08	582	-6.49	9.71	11.49	582	-3.00	3.01	3.45	479
20091114	2.12	2.27	2.75	558	1.03	2.46	2.93	563	-4.24	10.63	13.10	563	1.72	1.84	2.17	468
20091116	4.92	4.93	5.40	539	-0.79	2.26	2.70	560	-21.45	21.78	23.78	560	-0.38	2.40	2.79	471
20091222	2.17	2.27	2.76	514	0.64	1.39	1.67	520	-9.47	9.75	12.53	520	2.77	2.96	3.43	378
20100204	-2.30	2.69	3.29	570	-0.39	1.20	1.51	576	10.38	10.61	13.94	576	4.63	4.63	5.04	425
20100205	-1.57	2.13	2.73	578	-0.85	1.20	1.50	579	3.75	9.99	12.34	579	0.26	1.90	2.30	424
20100207	-1.14	1.55	1.82	591	-1.58	1.72	2.19	591	-2.35	6.86	9.02	591	1.52	1.89	2.23	424
20100304	0.63	1.97	2.47	609	-0.16	1.89	2.33	610	-3.51	16.97	20.61	610	-0.59	1.35	1.69	480
20100307	-0.66	1.61	2.04	595	-0.70	1.28	1.56	599	0.11	10.16	12.33	599	-0.24	1.01	1.29	470
20100309	-1.28	1.50	1.76	609	-1.09	2.01	2.42	611	1.24	9.30	11.54	611	0.19	1.39	1.73	482
20100413	0.25	1.38	1.91	580	0.49	1.54	1.99	579	2.00	9.07	11.93	579	-0.93	1.64	2.09	462
20100617	-0.01	1.25	1.56	571	2.51	3.16	3.66	571	4.38	8.33	10.80	571	-4.03	4.04	4.45	471
20100621	0.04	1.47	1.87	577	1.59	1.87	2.55	573	3.13	4.95	7.33	573	-5.34	5.34	5.54	463
20100627	1.17	1.65	2.28	574	3.85	3.88	4.22	589	5.09	6.19	7.38	589	-8.27	8.92	11.00	435
20100630	-0.96	1.89	2.28	650	1.57	2.91	3.89	631	2.71	4.54	6.08	631	-6.69	6.72	6.88	445
20100704	1.14	1.60	2.17	608	0.21	2.07	2.63	608	-1.08	3.69	5.15	608	-6.89	6.89	7.02	442

Table A-12. Error statistics for surface meteorological variables for 3-km WRF, Domain 2,
3Second setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.61	2.19	2.76	586	-1.09	2.43	3.05	586	1.14	2.32	2.88	586	3.68	10.06	25	3.21	580
20090421	0.35	1.16	1.46	595	-0.25	1.24	1.54	595	-1.13	1.32	1.62	595	4.58	40.53	25	93.71	502
20090519	0.92	2.61	3.22	537	0.35	3.20	4.18	537	-0.17	2.60	3.25	537	-6.92	30.04	25	-10.07	518
20090626	-0.87	2.26	3.03	550	-0.06	2.91	3.83	550	0.50	2.54	3.24	550	5.97	18.90	25	11.19	526
20091103	-0.41	1.15	1.42	583	-0.18	1.12	1.52	583	-0.76	1.14	1.47	583	-2.87	56.88	25	-134.48	463
20091114	0.64	1.70	2.14	554	-0.83	2.03	2.65	554	0.34	1.88	2.46	554	2.02	36.17	25	3.52	487
20091116	0.06	1.16	1.42	565	0.46	1.15	1.52	565	-0.56	1.07	1.38	565	-17.40	54.03	25	-21.76	436
20091222	0.13	1.49	1.94	514	-0.39	2.35	2.98	514	1.63	2.07	2.59	514	24.58	47.45	25	-3.36	403
20100204	-0.07	1.13	1.47	576	-0.03	1.21	1.52	576	-0.37	1.05	1.36	576	8.23	29.59	25	4.15	442
20100205	-0.15	1.49	1.86	574	2.77	3.23	4.00	574	1.39	2.63	3.29	574	-12.68	48.36	25	-22.27	473
20100207	0.08	1.27	1.64	586	0.37	1.56	1.98	586	-0.66	1.51	1.98	586	3.26	10.00	25	3.92	533
20100304	2.26	4.11	5.10	595	1.87	3.02	3.82	595	1.44	2.74	3.40	595	-32.51	42.72	25	-32.11	571
20100307	-0.17	1.41	1.82	596	1.52	2.31	2.96	596	-0.23	1.55	2.00	596	10.72	94.58	25	171.20	460
20100309	1.20	2.23	2.74	578	-0.78	2.29	3.07	578	0.43	2.37	3.05	578	-8.75	13.38	25	8.82	564
20100413	0.38	2.33	3.19	559	-0.65	2.45	3.21	559	-0.37	1.97	2.54	559	-3.69	46.26	25	-7.43	529
20100617	0.59	1.50	1.96	576	0.46	1.63	2.04	576	-0.95	1.34	1.70	576	16.72	56.94	25	-23.39	539
20100621	-0.66	1.54	1.93	563	0.67	1.85	2.40	563	-0.82	1.75	2.23	563	1.88	33.98	25	-13.48	536
20100627	-0.22	1.46	1.80	585	-0.56	1.46	1.87	585	-0.17	1.27	1.58	591	-15.22	31.24	25	-5.63	509
20100630	0.05	2.33	3.11	606	0.90	2.24	2.85	606	0.65	2.24	2.86	609	-1.39	13.25	25	0.22	594
20100704	0.00	1.73	2.22	607	-1.78	2.55	3.21	607	0.84	1.96	2.57	607	16.18	34.81	25	-5.81	559

Table A-13. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 3Second setting.

DATE: 2009, 2010				Model/Domain Set: m2o2_T3_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.52	1.62	1.99	608	-0.58	1.80	2.38	608	-8.40	11.70	14.91	608	2.84	2.87	3.21	483
20090421	1.30	2.11	2.65	561	-0.43	2.77	3.28	587	-7.18	11.77	15.89	587	-3.08	3.08	3.26	442
20090519	0.45	1.57	1.94	578	-0.05	1.70	2.28	595	-0.25	3.76	4.88	595	-5.40	5.40	5.52	446
20090626	-1.40	2.64	3.23	593	2.52	2.75	3.36	578	11.59	14.95	17.83	578	-2.79	2.91	3.51	459
20091103	2.92	3.23	3.90	538	1.10	1.69	2.13	582	-5.36	8.45	9.98	582	-2.73	2.76	3.24	479
20091114	2.06	2.23	2.71	558	1.01	2.46	2.94	563	-4.04	10.64	13.16	563	1.81	1.92	2.28	468
20091116	4.89	4.90	5.39	539	-0.81	2.26	2.69	560	-21.42	21.68	23.73	560	-0.34	2.40	2.79	471
20091222	2.08	2.16	2.63	514	0.63	1.36	1.65	520	-8.94	9.23	11.97	520	2.97	3.13	3.61	378
20100204	-2.44	2.80	3.41	570	-0.35	1.29	1.60	576	11.48	11.66	15.31	576	4.99	4.99	5.34	425
20100205	-1.65	2.15	2.75	578	-0.84	1.20	1.50	579	4.22	9.71	12.07	579	0.49	1.98	2.41	424
20100207	-1.20	1.48	1.77	591	-1.59	1.71	2.20	591	-2.08	6.63	8.87	591	1.74	2.04	2.40	424
20100304	0.53	1.91	2.39	609	-0.13	1.86	2.31	610	-2.84	16.78	20.49	610	-0.47	1.34	1.67	480
20100307	-0.68	1.61	2.02	595	-0.71	1.29	1.55	599	0.09	9.69	11.84	599	-0.05	1.01	1.30	470
20100309	-1.26	1.39	1.67	609	-1.15	2.03	2.44	611	0.83	9.39	11.58	611	0.26	1.38	1.72	482
20100413	0.12	1.29	1.74	580	0.41	1.49	1.93	579	1.91	8.65	11.48	579	-0.79	1.61	2.04	462
20100617	-0.10	1.29	1.60	571	2.55	3.19	3.73	571	4.72	8.61	11.21	571	-3.93	3.95	4.35	471
20100621	-0.11	1.38	1.78	577	1.66	1.92	2.62	573	3.40	5.11	7.33	573	-5.11	5.11	5.32	463
20100627	1.13	1.62	2.25	574	3.88	3.91	4.26	589	5.13	6.19	7.35	589	-8.06	8.71	10.84	435
20100630	-1.02	1.89	2.29	650	1.58	2.98	4.01	631	2.80	4.69	6.32	631	-6.64	6.68	6.82	445
20100704	1.08	1.54	2.10	608	0.22	2.10	2.67	608	-0.96	3.71	5.27	608	-6.83	6.83	6.97	442

Table A-13. Error statistics for surface meteorological variables for 1-km WRF, Domain 2,
3Second setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.61	2.23	2.82	586	-1.14	2.44	3.08	586	1.21	2.35	2.93	586	3.66	10.09	25	3.17	580
20090421	0.38	1.17	1.49	595	-0.26	1.23	1.55	595	-1.09	1.31	1.61	595	5.32	42.27	25	97.97	502
20090519	1.01	2.70	3.35	537	0.37	3.23	4.24	537	-0.03	2.65	3.33	537	-7.61	30.29	25	-10.80	518
20090626	-0.85	2.29	3.09	550	-0.06	2.93	3.85	550	0.59	2.57	3.27	550	5.71	19.16	25	10.86	526
20091103	-0.27	1.09	1.38	583	-0.16	1.09	1.46	583	-0.79	1.12	1.42	583	-9.99	50.27	25	-95.63	463
20091114	0.70	1.75	2.21	554	-0.84	2.05	2.67	554	0.43	1.89	2.48	554	2.46	35.71	25	4.24	487
20091116	0.05	1.19	1.46	565	0.49	1.20	1.57	565	-0.49	1.09	1.40	565	-18.26	54.65	25	-22.66	436
20091222	0.13	1.59	2.09	514	-0.42	2.34	2.98	514	1.65	2.13	2.67	514	24.54	47.98	25	-3.92	403
20100204	0.07	1.16	1.50	576	-0.09	1.18	1.50	576	-0.42	1.08	1.40	576	2.58	34.36	25	-2.20	442
20100205	-0.22	1.55	1.96	574	2.74	3.21	4.02	574	1.46	2.63	3.33	574	-11.90	48.73	25	-21.41	473
20100207	0.09	1.30	1.67	586	0.49	1.55	1.99	586	-0.63	1.54	2.00	586	3.89	10.07	25	4.12	533
20100304	2.25	4.17	5.21	595	1.91	3.03	3.83	595	1.58	2.75	3.43	595	-32.62	43.02	25	-31.97	571
20100307	-0.12	1.44	1.87	596	1.57	2.35	3.00	596	-0.13	1.61	2.05	596	21.94	95.95	25	169.10	460
20100309	1.25	2.27	2.83	578	-0.77	2.28	3.08	578	0.62	2.36	3.08	578	-8.30	13.11	25	9.34	564
20100413	0.61	2.35	3.17	559	-0.72	2.56	3.32	559	-0.28	2.11	2.70	559	-10.45	47.15	25	-18.80	529
20100617	0.61	1.49	1.98	576	0.48	1.64	2.05	576	-0.92	1.35	1.71	576	15.80	55.37	25	-25.10	539
20100621	-0.66	1.60	2.03	563	0.65	1.91	2.47	563	-0.69	1.77	2.27	563	2.11	33.75	25	-13.51	536
20100627	-0.21	1.52	1.87	585	-0.51	1.44	1.85	585	-0.19	1.29	1.60	591	-14.27	30.24	25	-5.49	509
20100630	0.00	2.31	3.12	606	0.95	2.26	2.87	606	0.72	2.23	2.86	609	-0.89	13.12	25	0.71	594
20100704	-0.09	1.82	2.39	607	-1.84	2.61	3.32	607	0.97	2.05	2.73	607	14.64	34.64	25	-7.22	559

Table A-14. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, 40Levels setting.

DATE: 2009, 2010					Model/Domain Set:				m1o1_L4_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	0.03	1.78	2.30	11966	0.43	1.94	2.52	8189	-0.10	10.89	14.20	8214	3.35	3.38	3.95	2472
20090421	-0.18	2.33	2.92	10878	0.03	2.53	3.16	7778	-2.65	10.15	13.47	7828	-2.81	2.93	3.24	2387
20090519	0.71	2.17	2.77	9710	-1.09	2.61	3.32	6921	-4.27	8.59	11.92	6968	-5.44	5.51	5.97	2272
20090626	0.12	2.06	2.67	11930	0.86	2.13	2.79	8392	2.57	11.79	15.33	8416	-3.61	3.80	4.26	2407
20091103	0.58	2.51	3.20	11557	-0.28	2.21	2.88	8951	-6.61	11.89	15.75	8947	-2.19	2.32	2.87	2475
20091114	0.79	1.90	2.43	11717	-0.04	1.75	2.27	8497	-5.97	11.77	15.14	8499	2.03	2.28	2.83	2506
20091116	1.13	2.82	3.49	10991	-0.08	2.22	2.79	7939	-8.66	14.46	17.68	7939	1.43	2.78	3.62	2335
20091222	0.71	2.05	2.66	12520	1.06	1.73	2.25	8975	-1.93	9.05	11.71	8973	1.74	2.29	2.82	2106
20100204	-1.07	2.77	3.49	12481	1.26	2.13	2.86	9271	8.72	12.60	15.86	9270	2.82	3.06	3.49	2183
20100205	-1.06	2.12	2.74	13118	0.29	1.63	2.17	9386	5.32	11.21	14.08	9386	0.85	1.79	2.33	2192
20100207	-1.02	2.07	2.73	13146	-1.50	2.01	2.57	9435	-4.73	11.57	15.69	9436	0.84	1.80	2.33	2216
20100304	-0.93	2.09	2.64	13089	0.29	1.66	2.11	9359	3.97	14.04	17.62	9358	1.14	1.78	2.23	2497
20100307	-0.42	2.22	2.89	12027	-0.77	1.94	2.63	8513	-3.79	13.41	17.39	8513	-0.18	1.40	1.75	2369
20100309	-1.09	2.09	2.64	12855	-0.20	1.77	2.29	9172	3.57	12.55	15.86	9179	0.27	1.62	2.04	2384
20100413	-0.01	1.73	2.28	12489	0.20	1.63	2.15	8865	-0.72	11.35	14.71	8865	0.31	1.83	2.26	2439
20100617	0.11	1.76	2.26	12261	1.00	2.81	3.49	8620	1.22	9.32	12.55	8620	-2.33	2.58	3.22	2454
20100621	-0.55	2.10	2.64	12155	-0.12	2.55	3.39	8567	0.62	8.19	11.57	8567	-3.32	3.59	4.10	2439
20100627	0.56	2.06	2.67	10629	2.05	2.90	3.59	7977	2.40	8.07	10.45	7976	-6.00	6.17	7.27	2300
20100630	0.08	2.09	2.69	11728	0.13	2.75	3.49	8552	-0.57	8.40	11.87	8552	-5.16	5.51	6.46	2302
20100704	0.61	1.99	2.56	11806	0.46	2.61	3.37	8545	-1.30	8.56	11.62	8545	-4.74	4.78	5.31	2395

Table A-14. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, 40Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	-0.25	2.34	3.11	7958	-1.83	2.84	3.59	7958	1.49	2.77	3.51	8072	-8.64	9.20	25	-10.67	6759
20090421	0.15	1.16	1.58	8407	-0.20	1.16	1.55	8407	-0.63	1.26	1.65	8552	-2.32	42.06	25	-42.83	5700
20090519	0.97	2.21	2.92	7323	0.77	2.48	3.26	7323	0.68	2.27	2.89	7421	-15.93	23.60	25	-13.85	5795
20090626	0.39	2.01	2.73	8689	-0.15	2.16	2.93	8689	0.52	2.03	2.68	8767	-7.86	28.45	25	-20.82	6363
20091103	0.29	1.25	1.78	9463	0.10	1.12	1.54	9463	-0.29	1.27	1.73	9560	-19.88	30.79	25	-10.39	5421
20091114	0.81	1.88	2.60	8483	-0.96	2.08	2.76	8483	1.21	2.12	2.79	8572	-16.20	19.63	25	-5.21	5602
20091116	0.16	1.05	1.51	8106	0.19	1.06	1.51	8106	-0.49	1.11	1.57	8228	-32.05	34.55	25	-28.06	4442
20091222	0.64	1.71	2.54	8997	0.50	2.77	3.68	8997	1.71	2.48	3.36	9015	-3.57	27.79	25	43.70	5356
20100204	0.27	1.23	1.74	9616	0.26	1.19	1.62	9616	-0.21	1.28	1.73	9741	-9.54	18.75	25	-7.57	5435
20100205	0.47	1.56	2.14	9590	1.23	2.02	2.65	9590	0.79	1.87	2.47	9699	-12.17	14.70	25	-12.37	5716
20100207	-1.24	2.07	2.88	9397	0.24	1.54	2.07	9397	0.46	1.96	2.63	9572	-36.04	36.04	25	-39.15	6182
20100304	0.67	2.22	3.06	9317	1.21	2.48	3.19	9317	0.97	2.29	2.99	9334	-15.18	18.63	25	-22.75	6950
20100307	-0.15	1.52	2.05	8691	0.87	1.95	2.59	8691	0.43	1.73	2.31	8716	8.04	17.48	25	-11.81	5497
20100309	0.80	2.06	2.77	9032	-0.26	2.52	3.34	9032	1.41	2.51	3.28	9067	-10.13	22.59	25	10.29	6682
20100413	1.16	2.23	2.99	8810	-0.31	2.18	2.92	8810	0.92	2.09	2.69	8909	-31.03	31.62	25	-28.87	6610
20100617	0.70	1.68	2.31	8952	0.26	1.48	1.95	8952	0.07	1.51	2.01	9003	-14.55	29.97	25	4.89	6557
20100621	0.22	1.48	1.99	8920	0.16	1.62	2.15	8920	-0.01	1.54	1.98	8976	8.53	14.72	25	19.70	6741
20100627	0.13	1.26	1.68	8302	-0.43	1.33	1.76	8302	-0.15	1.27	1.64	8418	7.07	16.82	25	3.76	5690
20100630	0.58	2.31	3.01	8634	1.74	2.97	3.78	8634	1.46	2.66	3.36	8695	-11.07	13.94	25	-10.17	7146
20100704	0.10	1.72	2.31	8734	-1.41	2.12	2.74	8734	0.55	1.78	2.28	8823	-38.22	38.49	25	-21.74	6427

Table A-15. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 40Levels setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_L4_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.59	1.70	2.16	608	-0.69	1.87	2.45	608	-9.43	12.60	15.77	608	2.99	3.01	3.33	483
20090421	1.83	2.39	2.98	561	-0.27	3.05	3.56	587	-7.99	12.43	16.83	587	-2.97	2.97	3.14	442
20090519	0.68	1.72	2.14	578	-0.13	1.84	2.46	595	-0.57	3.99	5.14	595	-5.53	5.53	5.65	446
20090626	-0.20	1.93	2.31	593	1.72	2.14	2.76	578	4.62	9.51	11.56	578	-3.92	3.92	4.23	459
20091103	2.94	3.24	3.96	538	1.26	1.66	2.08	582	-5.29	8.44	10.19	582	-2.52	2.55	3.03	479
20091114	2.22	2.37	2.86	558	0.89	2.27	2.69	563	-5.53	10.13	12.64	563	1.77	1.88	2.21	468
20091116	4.76	4.78	5.30	539	-0.75	2.22	2.67	560	-20.99	21.32	23.38	560	0.26	2.14	2.54	471
20091222	2.22	2.32	2.76	514	0.56	1.31	1.60	520	-10.36	10.60	12.94	520	2.97	3.16	3.65	378
20100204	-2.07	2.63	3.22	570	-0.58	1.33	1.63	576	5.59	8.61	11.28	576	3.49	3.50	3.96	425
20100205	-1.47	2.08	2.64	578	-1.41	1.61	1.94	579	0.13	8.50	10.63	579	-0.03	1.94	2.37	424
20100207	-0.75	1.42	1.69	591	-1.76	1.84	2.32	591	-5.70	8.14	10.74	591	1.26	1.72	2.07	424
20100304	0.74	2.05	2.57	609	-0.37	1.92	2.39	610	-5.09	17.79	21.37	610	-0.57	1.40	1.75	480
20100307	0.67	1.54	1.94	595	-0.68	1.43	1.74	599	-7.17	10.26	12.92	599	-0.99	1.44	1.74	470
20100309	-0.64	1.12	1.39	609	-1.10	1.92	2.38	611	-1.93	10.18	12.33	611	-0.28	1.49	1.81	482
20100413	1.25	1.65	2.28	580	-0.25	1.54	2.04	579	-5.28	9.68	12.74	579	-1.57	2.18	2.72	462
20100617	0.75	1.31	1.71	571	2.67	3.39	3.93	571	3.00	7.87	10.27	571	-4.16	4.17	4.65	471
20100621	0.91	1.96	2.53	577	1.70	2.02	2.71	573	1.98	4.79	7.34	573	-5.50	5.50	5.72	463
20100627	1.88	2.13	2.77	574	3.88	3.91	4.29	589	4.15	5.43	6.81	589	-8.31	8.95	11.02	435
20100630	-0.61	1.82	2.25	650	0.35	2.46	3.01	631	1.28	3.76	5.18	631	-6.86	6.88	7.03	445
20100704	1.49	1.82	2.38	608	0.16	2.11	2.69	608	-1.54	3.94	5.36	608	-6.99	6.99	7.13	442

Table A-15. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 40Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.50	2.13	2.72	586	-1.12	2.43	3.06	586	1.15	2.33	2.89	586	2.70	9.60	25	2.49	580
20090421	0.36	1.16	1.45	595	-0.18	1.21	1.51	595	-1.24	1.38	1.68	595	-1.26	34.96	25	94.84	502
20090519	0.97	2.52	3.14	537	0.24	3.25	4.34	537	-0.34	2.57	3.18	537	-14.81	37.07	25	-12.10	518
20090626	0.20	2.04	2.70	550	0.24	2.99	3.86	550	-0.13	2.39	3.07	550	-9.80	20.51	25	-3.48	526
20091103	-0.26	1.10	1.39	583	0.01	1.13	1.51	583	-1.01	1.23	1.58	583	-1.78	51.07	25	68.10	463
20091114	0.55	1.62	2.09	554	-0.72	1.96	2.62	554	0.15	1.80	2.44	554	0.85	34.93	25	2.99	487
20091116	-0.08	1.19	1.47	565	0.59	1.23	1.60	565	-0.47	1.10	1.41	565	-27.63	51.91	25	-17.74	436
20091222	-0.01	1.49	1.93	514	-0.31	2.14	2.73	514	1.35	1.86	2.30	514	20.98	44.14	25	-4.86	403
20100204	-0.03	1.06	1.38	576	0.20	1.15	1.45	576	-0.36	1.04	1.32	576	1.55	26.93	25	-2.06	442
20100205	0.09	1.46	1.84	574	2.05	2.78	3.46	574	0.77	2.22	2.81	574	7.41	52.64	25	-24.18	473
20100207	-0.26	1.36	1.72	586	0.61	1.69	2.15	586	-0.97	1.67	2.18	586	-3.14	10.59	25	-3.33	533
20100304	2.35	4.16	5.19	595	1.50	3.01	3.87	595	1.26	2.79	3.51	595	-35.41	45.31	25	-33.28	571
20100307	0.08	1.46	1.88	596	1.79	2.53	3.22	596	0.04	1.54	2.02	596	29.44	88.02	25	156.97	460
20100309	1.50	2.39	2.91	578	-1.40	2.39	3.22	578	0.61	2.46	3.17	578	-10.14	16.19	25	6.56	564
20100413	1.47	2.69	3.62	559	-0.84	3.04	3.89	559	0.03	2.26	2.93	559	-22.49	64.14	25	-60.10	529
20100617	0.66	1.55	2.02	576	0.67	1.73	2.16	576	-0.95	1.34	1.71	576	12.99	60.80	25	-38.95	539
20100621	-0.72	1.61	2.03	563	0.93	2.01	2.55	563	-1.06	1.89	2.35	563	-1.12	40.44	25	-16.28	536
20100627	-0.22	1.48	1.81	585	-0.52	1.43	1.82	585	-0.31	1.28	1.59	591	-16.81	30.98	25	-6.19	509
20100630	1.01	2.16	2.78	606	0.20	2.12	2.71	606	0.08	2.02	2.64	609	-9.02	11.53	25	-8.31	594
20100704	0.03	1.76	2.24	607	-1.81	2.64	3.29	607	0.86	2.04	2.64	607	16.11	34.89	25	-5.48	559

Table A-16. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 40Levels setting.

DATE: 2009, 2010				Model/Domain Set: m2o2_L4_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.54	1.64	2.03	608	-0.72	1.86	2.45	608	-9.31	12.52	15.73	608	3.07	3.09	3.42	483
20090421	1.80	2.38	2.95	561	-0.27	3.05	3.59	587	-7.90	12.46	16.84	587	-2.93	2.93	3.10	442
20090519	0.63	1.68	2.08	578	-0.14	1.85	2.48	595	-0.52	3.98	5.15	595	-5.45	5.45	5.58	446
20090626	-0.25	1.90	2.27	593	1.68	2.14	2.75	578	4.69	9.65	11.77	578	-3.70	3.71	4.06	459
20091103	2.90	3.25	3.97	538	1.24	1.65	2.07	582	-5.23	8.41	10.17	582	-2.42	2.46	2.94	479
20091114	2.18	2.32	2.82	558	0.88	2.27	2.69	563	-5.35	10.08	12.61	563	1.85	1.96	2.30	468
20091116	4.74	4.76	5.30	539	-0.76	2.22	2.65	560	-20.97	21.26	23.36	560	0.28	2.15	2.55	471
20091222	2.18	2.26	2.70	514	0.53	1.29	1.57	520	-10.27	10.51	12.84	520	3.11	3.28	3.78	378
20100204	-2.17	2.75	3.34	570	-0.55	1.33	1.62	576	6.27	8.78	11.52	576	3.85	3.85	4.28	425
20100205	-1.51	2.07	2.65	578	-1.39	1.59	1.94	579	0.50	8.46	10.65	579	0.12	1.95	2.39	424
20100207	-0.79	1.33	1.62	591	-1.75	1.82	2.30	591	-5.41	7.90	10.40	591	1.47	1.85	2.22	424
20100304	0.67	2.03	2.52	609	-0.35	1.90	2.38	610	-4.59	17.77	21.34	610	-0.48	1.40	1.75	480
20100307	0.60	1.48	1.88	595	-0.71	1.40	1.72	599	-6.92	10.04	12.75	599	-0.82	1.37	1.66	470
20100309	-0.65	1.02	1.29	609	-1.15	1.94	2.41	611	-2.10	10.23	12.31	611	-0.20	1.48	1.80	482
20100413	1.16	1.58	2.23	580	-0.17	1.53	2.02	579	-4.72	9.35	12.24	579	-1.38	2.10	2.61	462
20100617	0.65	1.29	1.70	571	2.67	3.37	3.95	571	3.32	8.07	10.70	571	-4.09	4.11	4.58	471
20100621	0.76	1.81	2.38	577	1.72	2.03	2.77	573	2.19	4.84	7.35	573	-5.28	5.28	5.50	463
20100627	1.85	2.10	2.73	574	3.92	3.95	4.34	589	4.22	5.50	6.86	589	-8.12	8.77	10.89	435
20100630	-0.64	1.77	2.21	650	0.34	2.49	3.02	631	1.30	3.84	5.31	631	-6.87	6.89	7.04	445
20100704	1.42	1.75	2.31	608	0.15	2.13	2.70	608	-1.47	3.94	5.41	608	-6.96	6.96	7.11	442

Table A-16. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 40Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.51	2.16	2.77	586	-1.18	2.46	3.09	586	1.24	2.36	2.94	586	2.76	9.64	25	2.49	580
20090421	0.36	1.17	1.46	595	-0.19	1.21	1.51	595	-1.21	1.37	1.67	595	-1.13	35.88	25	97.48	502
20090519	1.00	2.58	3.22	537	0.22	3.27	4.38	537	-0.28	2.59	3.22	537	-15.25	36.88	25	-12.75	518
20090626	0.20	2.06	2.76	550	0.30	3.00	3.88	550	-0.01	2.38	3.07	550	-9.89	20.54	25	-3.61	526
20091103	-0.26	1.09	1.39	583	0.00	1.12	1.48	583	-0.96	1.22	1.53	583	-7.71	49.22	25	81.33	463
20091114	0.60	1.66	2.14	554	-0.74	1.98	2.65	554	0.24	1.83	2.48	554	-12.25	35.31	25	3.61	487
20091116	-0.08	1.20	1.49	565	0.63	1.27	1.65	565	-0.40	1.13	1.43	565	-28.96	52.59	25	-19.01	436
20091222	-0.01	1.59	2.08	514	-0.32	2.19	2.80	514	1.45	1.93	2.41	514	22.00	45.32	25	-5.03	403
20100204	0.04	1.07	1.39	576	0.18	1.15	1.45	576	-0.37	1.06	1.35	576	-0.89	29.26	25	-5.38	442
20100205	0.08	1.50	1.94	574	2.04	2.75	3.44	574	0.83	2.21	2.83	574	-3.51	48.12	25	-24.07	473
20100207	-0.25	1.34	1.68	586	0.69	1.71	2.17	586	-0.94	1.68	2.19	586	-3.07	10.42	25	-3.32	533
20100304	2.35	4.19	5.23	595	1.52	3.05	3.92	595	1.38	2.81	3.54	595	-35.78	45.75	25	-33.39	571
20100307	0.05	1.46	1.90	596	1.80	2.54	3.25	596	0.11	1.59	2.07	596	26.90	92.81	25	158.22	460
20100309	1.54	2.41	2.95	578	-1.41	2.37	3.20	578	0.78	2.49	3.22	578	-9.71	15.77	25	6.88	564
20100413	1.41	2.58	3.51	559	-0.98	2.95	3.79	559	-0.11	2.17	2.83	559	-23.03	64.79	25	-62.46	529
20100617	0.64	1.53	2.02	576	0.68	1.77	2.22	576	-0.88	1.33	1.70	576	12.57	59.75	25	-38.72	539
20100621	-0.73	1.64	2.07	563	0.94	2.06	2.60	563	-0.97	1.89	2.38	563	-3.11	42.15	25	-16.49	536
20100627	-0.19	1.53	1.88	585	-0.48	1.43	1.84	585	-0.31	1.29	1.61	591	-15.60	29.93	25	-5.36	509
20100630	0.98	2.15	2.78	606	0.27	2.14	2.75	606	0.17	2.03	2.64	609	-8.65	11.39	25	-7.88	594
20100704	-0.06	1.83	2.38	607	-1.87	2.68	3.36	607	0.95	2.10	2.74	607	14.98	35.40	25	-6.87	559

Table A-17. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, 80Levels setting.

DATE: 2009, 2010				Model/Domain Set: m1o1_L8_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	0.01	1.73	2.25	11966	0.60	1.95	2.53	8189	0.96	10.76	14.08	8214	3.13	3.16	3.76	2472
20090421	-0.49	2.27	2.84	10878	-0.28	2.39	3.01	7778	-2.49	9.92	13.22	7828	-2.92	3.02	3.34	2387
20090519	0.80	2.16	2.78	9710	-1.15	2.54	3.25	6921	-4.49	8.55	11.85	6968	-5.53	5.58	6.04	2272
20090626	-0.19	2.09	2.69	11930	0.86	2.12	2.76	8392	3.92	12.36	16.04	8416	-3.70	3.87	4.33	2407
20091103	0.38	2.45	3.11	11557	-0.16	2.24	2.89	8951	-5.44	11.60	15.39	8947	-2.22	2.34	2.89	2475
20091114	0.73	1.86	2.38	11717	0.06	1.77	2.29	8497	-5.03	11.60	14.96	8499	1.82	2.12	2.66	2506
20091116	0.88	2.69	3.36	10991	0.11	2.20	2.77	7939	-6.80	14.05	17.23	7939	1.37	2.74	3.58	2335
20091222	0.57	1.99	2.59	12520	1.05	1.72	2.23	8975	-1.05	8.91	11.69	8973	1.73	2.23	2.76	2106
20100204	-1.31	2.86	3.59	12481	1.44	2.23	2.97	9271	11.57	14.21	18.02	9270	3.28	3.47	4.00	2183
20100205	-1.18	2.14	2.76	13118	0.36	1.55	2.08	9386	6.42	11.56	14.50	9386	0.86	1.75	2.31	2192
20100207	-1.15	2.05	2.71	13146	-1.24	1.82	2.31	9435	-2.61	10.79	14.73	9436	0.94	1.77	2.32	2216
20100304	-0.99	2.10	2.66	13089	0.39	1.68	2.13	9359	5.03	14.32	18.12	9358	0.97	1.69	2.14	2497
20100307	-1.01	2.27	2.95	12027	-0.84	1.85	2.53	8513	-1.10	13.09	16.82	8513	0.15	1.30	1.64	2369
20100309	-1.53	2.32	2.90	12855	-0.29	1.81	2.33	9172	5.66	12.90	16.55	9179	0.48	1.65	2.08	2384
20100413	-0.58	1.76	2.30	12489	0.10	1.55	2.05	8865	1.58	11.32	14.75	8865	0.50	1.76	2.21	2439
20100617	-0.14	1.73	2.22	12261	0.80	2.64	3.29	8620	1.54	9.25	12.54	8620	-2.54	2.73	3.36	2454
20100621	-0.81	2.01	2.56	12155	-0.27	2.46	3.30	8567	1.07	8.19	11.49	8567	-3.48	3.71	4.22	2439
20100627	-0.03	1.99	2.53	10629	1.80	2.70	3.35	7977	3.16	8.26	10.52	7976	-5.96	6.13	7.23	2300
20100630	-0.05	2.05	2.64	11728	0.04	2.71	3.43	8552	-0.70	8.36	11.74	8552	-5.07	5.44	6.39	2302
20100704	0.54	1.94	2.50	11806	0.40	2.56	3.31	8545	-1.22	8.42	11.45	8545	-4.89	4.92	5.46	2395

Table A-17. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, 80Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	-0.19	2.35	3.10	7958	-1.88	2.90	3.65	7958	1.65	2.83	3.56	8072	-7.61	8.21	25	-10.07	6759
20090421	0.15	1.19	1.60	8407	-0.20	1.18	1.57	8407	-0.40	1.22	1.60	8552	-2.28	36.00	25	-43.84	5700
20090519	0.97	2.29	3.01	7323	1.04	2.59	3.38	7323	1.06	2.40	3.04	7421	-11.77	19.56	25	-11.23	5795
20090626	0.19	2.05	2.76	8689	0.01	2.18	2.90	8689	0.80	2.06	2.69	8767	-5.98	21.99	25	-6.55	6363
20091103	0.28	1.27	1.81	9463	0.12	1.16	1.58	9463	-0.09	1.28	1.74	9560	-19.41	27.66	25	-8.84	5421
20091114	0.78	1.94	2.65	8483	-0.92	2.16	2.84	8483	1.35	2.20	2.87	8572	-14.77	18.16	25	-4.82	5602
20091116	0.11	1.08	1.52	8106	0.20	1.10	1.56	8106	-0.30	1.12	1.56	8228	-26.72	30.82	25	-22.89	4442
20091222	0.60	1.77	2.59	8997	0.45	2.90	3.86	8997	1.97	2.64	3.58	9015	-1.99	24.73	25	42.23	5356
20100204	0.25	1.27	1.79	9616	0.29	1.25	1.71	9616	0.03	1.31	1.77	9741	-7.01	18.18	25	-4.58	5435
20100205	0.26	1.63	2.21	9590	1.51	2.21	2.94	9590	1.18	2.09	2.77	9699	-6.36	9.34	25	-6.28	5716
20100207	-1.24	2.13	3.06	9397	0.05	1.56	2.09	9397	0.84	2.04	2.82	9572	-30.74	30.74	25	-33.91	6182
20100304	0.51	2.26	3.10	9317	1.25	2.56	3.27	9317	1.20	2.39	3.09	9334	-11.58	16.17	25	-19.31	6950
20100307	-0.22	1.54	2.07	8691	0.81	1.92	2.53	8691	0.51	1.75	2.31	8716	10.57	18.27	25	-8.63	5497
20100309	0.73	2.07	2.78	9032	-0.12	2.46	3.26	9032	1.40	2.47	3.25	9067	-7.11	20.53	25	13.09	6682
20100413	0.91	2.20	2.93	8810	-0.15	2.14	2.82	8810	0.92	2.04	2.61	8909	-24.20	24.96	25	-23.42	6610
20100617	0.68	1.74	2.37	8952	0.29	1.53	2.01	8952	0.32	1.53	2.02	9003	-13.54	26.96	25	5.45	6557
20100621	0.29	1.54	2.05	8920	0.09	1.68	2.23	8920	0.31	1.57	2.01	8976	8.43	14.01	25	17.85	6741
20100627	0.06	1.30	1.71	8302	-0.44	1.37	1.81	8302	0.08	1.29	1.65	8418	4.52	16.31	25	0.75	5690
20100630	0.43	2.28	2.99	8634	2.02	3.12	3.95	8634	1.73	2.80	3.50	8695	-8.94	11.54	25	-7.83	7146
20100704	0.15	1.77	2.37	8734	-1.53	2.21	2.83	8734	0.80	1.85	2.34	8823	-37.60	37.94	25	-21.66	6427

Table A-18. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 80Levels setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_L8_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.56	1.67	2.10	608	-0.51	1.79	2.35	608	-8.46	11.77	14.93	608	2.72	2.76	3.12	483
20090421	0.99	2.04	2.54	561	-0.68	2.66	3.13	587	-7.19	11.60	15.70	587	-3.05	3.05	3.24	442
20090519	0.63	1.68	2.10	578	-0.24	1.76	2.35	595	-0.70	3.86	4.99	595	-5.57	5.57	5.68	446
20090626	-0.22	1.84	2.23	593	1.92	2.31	2.87	578	5.64	10.13	12.09	578	-4.05	4.05	4.34	459
20091103	2.37	2.76	3.56	538	1.55	1.83	2.28	582	-2.38	7.01	8.59	582	-2.43	2.48	3.02	479
20091114	2.10	2.24	2.73	558	1.13	2.41	2.86	563	-3.92	10.26	12.79	563	1.65	1.81	2.13	468
20091116	4.44	4.46	5.05	539	-0.58	2.25	2.74	560	-19.41	19.85	21.97	560	0.14	2.16	2.55	471
20091222	1.97	2.09	2.56	514	0.47	1.33	1.59	520	-9.23	9.57	12.43	520	3.03	3.18	3.65	378
20100204	-2.67	2.99	3.61	570	-0.98	1.57	1.96	576	8.71	9.59	12.73	576	4.54	4.54	5.09	425
20100205	-1.49	2.06	2.61	578	-0.92	1.21	1.48	579	3.02	9.29	11.44	579	0.19	1.86	2.29	424
20100207	-1.07	1.52	1.80	591	-1.64	1.72	2.11	591	-3.20	7.00	9.06	591	1.42	1.79	2.12	424
20100304	0.85	2.07	2.59	609	-0.33	1.99	2.46	610	-5.30	17.92	21.68	610	-0.76	1.45	1.81	480
20100307	-0.58	1.53	1.93	595	-0.89	1.34	1.60	599	-1.57	9.32	11.48	599	-0.41	1.13	1.38	470
20100309	-1.28	1.50	1.77	609	-1.12	1.95	2.37	611	1.05	8.76	10.91	611	0.10	1.42	1.74	482
20100413	0.63	1.23	1.67	580	-0.48	1.49	2.00	579	-3.56	8.52	11.62	579	-1.48	2.01	2.51	462
20100617	0.07	1.24	1.58	571	2.41	3.04	3.58	571	4.16	8.10	10.69	571	-4.35	4.36	4.84	471
20100621	0.02	1.38	1.76	577	1.43	1.74	2.44	573	2.85	4.81	7.19	573	-5.60	5.60	5.84	463
20100627	0.84	1.53	2.16	574	3.85	3.87	4.20	589	5.53	6.50	7.61	589	-8.25	8.89	10.98	435
20100630	-0.88	1.84	2.24	650	1.22	2.81	3.58	631	2.32	4.34	5.85	631	-6.68	6.71	6.86	445
20100704	1.44	1.76	2.35	608	0.13	2.16	2.72	608	-1.50	3.93	5.30	608	-7.15	7.15	7.30	442

Table A-18. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 80Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.58	2.20	2.78	586	-1.13	2.46	3.08	586	1.19	2.34	2.92	586	3.62	9.80	25	2.96	580
20090421	0.32	1.12	1.42	595	-0.23	1.20	1.51	595	-1.00	1.25	1.53	595	-1.43	31.56	25	83.49	502
20090519	1.00	2.60	3.24	537	0.34	3.16	4.17	537	-0.07	2.56	3.19	537	-6.41	30.03	25	-11.28	518
20090626	-0.10	2.15	2.79	550	-0.06	2.69	3.59	550	0.08	2.21	2.87	550	-5.42	18.13	25	2.30	526
20091103	-0.22	1.06	1.36	583	-0.11	1.09	1.47	583	-0.81	1.12	1.46	583	-16.20	42.31	25	-72.69	463
20091114	0.62	1.71	2.19	554	-0.78	2.13	2.84	554	0.37	1.97	2.64	554	3.63	35.83	25	3.67	487
20091116	-0.12	1.18	1.47	565	0.54	1.25	1.63	565	-0.37	1.09	1.39	565	-25.84	53.13	25	-15.35	436
20091222	0.27	1.51	1.95	514	-0.43	2.31	2.99	514	1.72	2.09	2.61	514	23.41	45.54	25	-1.88	403
20100204	-0.06	1.14	1.48	576	0.00	1.21	1.53	576	-0.18	0.96	1.24	576	5.32	32.28	25	2.35	442
20100205	-0.25	1.50	1.88	574	3.06	3.43	4.24	574	1.73	2.82	3.52	574	-12.21	47.43	25	-21.82	473
20100207	0.18	1.27	1.67	586	0.23	1.61	2.05	586	-0.47	1.53	1.99	586	5.44	11.21	25	5.33	533
20100304	2.10	4.08	5.11	595	1.96	3.15	3.95	595	1.61	2.80	3.48	595	-32.08	42.30	25	-30.64	571
20100307	-0.10	1.44	1.86	596	1.47	2.26	2.87	596	-0.17	1.62	2.06	596	-7.61	86.78	25	167.47	460
20100309	1.26	2.25	2.77	578	-0.81	2.29	3.06	578	0.56	2.35	3.03	578	-7.78	13.25	25	9.17	564
20100413	1.27	2.62	3.58	559	-0.74	2.59	3.46	559	-0.07	2.08	2.68	559	-23.51	53.82	25	-50.37	529
20100617	0.51	1.59	2.08	576	0.74	1.76	2.21	576	-0.65	1.27	1.63	576	11.09	60.66	25	-37.88	539
20100621	-0.59	1.56	1.98	563	0.63	1.91	2.48	563	-0.56	1.68	2.17	563	10.08	34.81	25	-12.28	536
20100627	-0.26	1.51	1.86	585	-0.58	1.49	1.89	585	-0.07	1.29	1.60	591	-15.51	31.85	25	-6.80	509
20100630	0.26	2.14	2.79	606	0.98	2.33	2.94	606	0.73	2.29	2.92	609	-2.79	11.16	25	-1.35	594
20100704	0.15	1.73	2.21	607	-2.01	2.68	3.35	607	1.15	2.05	2.64	607	17.56	33.87	25	-4.49	559

Table A-19. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 80Levels setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_L8_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.51	1.61	1.98	608	-0.53	1.77	2.34	608	-8.32	11.65	14.86	608	2.79	2.84	3.20	483
20090421	0.96	2.02	2.52	561	-0.67	2.67	3.14	587	-7.07	11.58	15.69	587	-3.00	3.00	3.20	442
20090519	0.59	1.65	2.05	578	-0.24	1.76	2.36	595	-0.65	3.88	5.00	595	-5.48	5.48	5.60	446
20090626	-0.27	1.81	2.19	593	1.87	2.30	2.85	578	5.69	10.30	12.29	578	-3.84	3.84	4.16	459
20091103	2.32	2.79	3.58	538	1.52	1.81	2.27	582	-2.29	6.99	8.58	582	-2.31	2.39	2.92	479
20091114	2.04	2.19	2.68	558	1.11	2.41	2.87	563	-3.75	10.29	12.84	563	1.74	1.88	2.22	468
20091116	4.41	4.44	5.05	539	-0.60	2.25	2.73	560	-19.38	19.76	21.92	560	0.17	2.17	2.55	471
20091222	1.90	2.01	2.47	514	0.45	1.30	1.56	520	-8.96	9.30	12.19	520	3.18	3.31	3.80	378
20100204	-2.90	3.19	3.81	570	-1.07	1.65	2.07	576	9.78	10.37	13.60	576	4.96	4.96	5.45	425
20100205	-1.54	2.07	2.61	578	-0.93	1.18	1.46	579	3.30	9.07	11.25	579	0.36	1.91	2.35	424
20100207	-1.11	1.45	1.73	591	-1.62	1.69	2.10	591	-2.85	6.82	8.81	591	1.63	1.93	2.28	424
20100304	0.75	2.01	2.52	609	-0.29	1.96	2.44	610	-4.62	17.62	21.47	610	-0.66	1.46	1.81	480
20100307	-0.65	1.55	1.96	595	-0.88	1.32	1.58	599	-1.12	9.21	11.38	599	-0.20	1.10	1.37	470
20100309	-1.29	1.41	1.69	609	-1.17	1.99	2.41	611	0.80	8.80	10.86	611	0.18	1.40	1.73	482
20100413	0.47	1.12	1.48	580	-0.34	1.42	1.91	579	-2.59	8.05	10.96	579	-1.32	1.94	2.42	462
20100617	-0.03	1.27	1.59	571	2.42	3.02	3.58	571	4.46	8.18	10.90	571	-4.27	4.29	4.76	471
20100621	-0.09	1.30	1.68	577	1.48	1.77	2.49	573	3.05	4.85	7.12	573	-5.40	5.40	5.64	463
20100627	0.83	1.50	2.14	574	3.89	3.91	4.25	589	5.57	6.56	7.64	589	-8.06	8.71	10.84	435
20100630	-0.93	1.84	2.25	650	1.23	2.86	3.65	631	2.41	4.50	6.06	631	-6.65	6.69	6.83	445
20100704	1.38	1.70	2.27	608	0.12	2.20	2.77	608	-1.37	3.96	5.39	608	-7.10	7.10	7.26	442

Table A-19. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 80Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.59	2.25	2.84	586	-1.18	2.48	3.11	586	1.26	2.38	2.97	586	3.66	9.84	25	2.96	580
20090421	0.34	1.14	1.45	595	-0.24	1.20	1.52	595	-0.96	1.24	1.53	595	-0.48	33.25	25	89.33	502
20090519	1.06	2.65	3.31	537	0.34	3.18	4.23	537	0.04	2.57	3.25	537	-7.33	29.90	25	-12.03	518
20090626	-0.08	2.19	2.86	550	-0.01	2.74	3.64	550	0.19	2.25	2.90	550	-5.87	17.98	25	1.94	526
20091103	-0.23	1.07	1.38	583	-0.12	1.08	1.44	583	-0.75	1.12	1.42	583	-8.50	44.75	25	-81.95	463
20091114	0.67	1.75	2.25	554	-0.81	2.13	2.85	554	0.47	1.99	2.66	554	4.28	35.40	25	4.31	487
20091116	-0.12	1.22	1.52	565	0.59	1.31	1.69	565	-0.27	1.13	1.42	565	-13.42	53.90	25	-17.37	436
20091222	0.25	1.56	2.06	514	-0.50	2.31	3.02	514	1.76	2.15	2.71	514	23.06	45.02	25	-2.79	403
20100204	0.03	1.18	1.55	576	-0.06	1.20	1.54	576	-0.20	0.99	1.29	576	2.42	37.77	25	-1.91	442
20100205	-0.33	1.55	1.98	574	3.03	3.40	4.27	574	1.80	2.84	3.58	574	-11.81	47.61	25	-21.28	473
20100207	0.22	1.31	1.69	586	0.29	1.59	2.05	586	-0.37	1.53	1.99	586	6.46	11.60	25	6.22	533
20100304	2.06	4.12	5.18	595	2.01	3.26	4.06	595	1.79	2.86	3.57	595	-32.60	42.83	25	-30.14	571
20100307	-0.03	1.49	1.91	596	1.47	2.28	2.88	596	-0.06	1.67	2.09	596	-8.16	87.55	25	163.04	460
20100309	1.29	2.29	2.83	578	-0.82	2.27	3.02	578	0.75	2.36	3.07	578	-7.10	12.68	25	9.41	564
20100413	1.26	2.55	3.51	559	-0.82	2.69	3.56	559	-0.08	2.17	2.77	559	-9.60	53.67	25	-51.80	529
20100617	0.52	1.61	2.13	576	0.78	1.80	2.28	576	-0.59	1.28	1.65	576	9.19	59.29	25	-40.50	539
20100621	-0.65	1.63	2.11	563	0.62	1.96	2.56	563	-0.40	1.73	2.24	563	10.76	37.93	25	-13.23	536
20100627	-0.27	1.59	1.98	585	-0.55	1.47	1.88	585	-0.06	1.30	1.63	591	-15.06	31.13	25	-6.77	509
20100630	0.22	2.12	2.75	606	1.09	2.39	2.98	606	0.88	2.30	2.93	609	-2.36	10.47	25	-0.91	594
20100704	0.10	1.81	2.35	607	-2.06	2.75	3.45	607	1.26	2.15	2.78	607	16.88	33.98	25	-5.28	559

Table A-20. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, MYJ BL setting.

DATE: 2009, 2010					Model/Domain Set:				m1o1_B2_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	0.37	1.57	2.03	11966	0.50	1.98	2.57	8189	-1.03	10.87	14.15	8214	3.33	3.35	3.94	2472
20090421	1.57	2.95	3.74	10878	-0.52	2.69	3.33	7778	-8.16	13.01	17.76	7828	-3.00	3.08	3.41	2387
20090519	1.82	2.56	3.28	9710	-1.51	2.76	3.51	6921	-7.10	9.84	13.81	6968	-5.39	5.44	5.92	2272
20090626	0.10	2.29	2.96	11930	0.81	2.13	2.78	8392	2.60	13.17	17.01	8416	-3.46	3.68	4.17	2407
20091103	2.41	3.44	4.38	11557	-0.27	2.26	2.92	8951	-11.60	15.02	19.88	8947	-2.25	2.38	2.93	2475
20091114	1.11	1.93	2.48	11717	-0.17	1.95	2.48	8497	-7.92	13.27	16.81	8499	2.00	2.26	2.80	2506
20091116	2.62	3.41	4.18	10991	-0.40	2.31	2.90	7939	-14.60	19.09	23.22	7939	1.36	2.78	3.63	2335
20091222	0.72	2.00	2.69	12520	0.39	1.54	2.01	8975	-5.43	10.57	13.80	8973	2.15	2.48	2.99	2106
20100204	0.17	2.46	3.21	12481	0.90	2.02	2.72	9271	1.24	11.85	14.87	9270	2.91	3.10	3.58	2183
20100205	-0.46	1.85	2.42	13118	-0.18	1.56	2.07	9386	0.13	11.58	14.77	9386	1.09	1.78	2.37	2192
20100207	-0.39	1.76	2.26	13146	-1.56	2.05	2.60	9435	-6.89	12.87	17.38	9436	1.42	1.92	2.53	2216
20100304	-0.51	1.92	2.46	13089	0.15	1.68	2.11	9359	1.35	14.20	17.80	9358	1.25	1.83	2.28	2497
20100307	0.11	2.03	2.63	12027	-1.42	2.22	3.10	8513	-8.38	15.78	20.20	8513	0.31	1.32	1.65	2369
20100309	-1.15	2.23	2.77	12855	-0.62	1.92	2.48	9172	1.96	12.94	16.32	9179	0.66	1.66	2.10	2384
20100413	-0.25	1.74	2.29	12489	-0.05	1.63	2.14	8865	-0.60	11.89	15.53	8865	0.75	1.84	2.28	2439
20100617	0.76	1.90	2.48	12261	0.70	2.83	3.52	8620	-1.20	9.69	13.18	8620	-2.35	2.58	3.23	2454
20100621	0.17	1.94	2.56	12155	-0.22	2.60	3.50	8567	-1.01	8.71	12.28	8567	-3.19	3.49	3.99	2439
20100627	1.87	2.64	3.41	10629	1.91	2.78	3.46	7977	-1.30	8.74	11.73	7976	-6.19	6.35	7.43	2300
20100630	0.88	2.19	2.87	11728	0.20	2.76	3.50	8552	-2.06	8.60	12.53	8552	-5.17	5.49	6.46	2302
20100704	1.68	2.37	3.01	11806	0.67	2.76	3.51	8545	-3.02	9.12	12.58	8545	-4.85	4.89	5.45	2395

Table A-20. Error statistics for surface meteorological variables for 3-km WRF, Domain 1, MYJ BL setting (continued).

													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.02	2.52	3.31	7958	-2.13	3.14	3.94	7958	2.28	3.14	3.92	8072	-5.20	5.77	25	-8.34	6759
20090421	0.11	1.31	1.73	8407	-0.18	1.35	1.76	8407	0.19	1.27	1.62	8552	-5.87	34.40	25	-44.59	5700
20090519	0.88	2.57	3.38	7323	1.54	2.87	3.69	7323	1.87	2.75	3.48	7421	-4.11	11.85	25	-5.78	5795
20090626	0.11	2.39	3.19	8689	0.19	2.50	3.28	8689	1.58	2.46	3.15	8767	-5.88	17.75	25	-1.27	6363
20091103	0.33	1.45	1.98	9463	0.28	1.41	1.88	9463	0.55	1.44	1.90	9560	-17.68	23.92	25	-0.86	5421
20091114	0.85	2.13	2.87	8483	-0.82	2.35	3.06	8483	1.76	2.46	3.18	8572	-9.90	13.94	25	-2.42	5602
20091116	0.02	1.23	1.66	8106	0.40	1.33	1.81	8106	0.30	1.24	1.64	8228	-21.61	28.29	25	-19.02	4442
20091222	0.47	1.93	2.74	8997	0.32	2.89	3.89	8997	2.28	2.78	3.74	9015	2.69	19.90	25	40.66	5356
20100204	0.24	1.45	1.98	9616	0.62	1.52	1.99	9616	0.71	1.51	1.98	9741	1.96	16.68	25	5.37	5435
20100205	-0.10	1.80	2.36	9590	1.88	2.51	3.23	9590	1.81	2.40	3.06	9699	0.76	6.11	25	0.83	5716
20100207	-1.16	2.28	3.32	9397	-0.25	1.72	2.23	9397	1.44	2.26	3.13	9572	-24.17	24.17	25	-27.32	6182
20100304	0.12	2.46	3.31	9317	1.35	2.77	3.53	9317	1.78	2.68	3.43	9334	-3.84	10.53	25	-11.17	6950
20100307	-0.47	1.77	2.33	8691	0.96	2.20	2.84	8691	1.21	2.04	2.62	8716	14.81	18.90	25	-3.15	5497
20100309	0.65	2.27	3.03	9032	-0.09	2.62	3.44	9032	1.90	2.74	3.57	9067	-0.61	14.70	25	12.44	6682
20100413	0.95	2.42	3.20	8810	0.37	2.37	3.09	8810	1.53	2.37	3.02	8909	-13.45	15.12	25	-13.09	6610
20100617	0.57	1.86	2.52	8952	0.46	1.69	2.17	8952	0.86	1.70	2.23	9003	-6.50	21.32	25	13.36	6557
20100621	0.31	1.72	2.27	8920	-0.07	1.83	2.39	8920	0.82	1.75	2.24	8976	5.89	12.73	25	10.33	6741
20100627	0.01	1.54	2.00	8302	-0.74	1.67	2.15	8302	0.80	1.53	1.92	8418	2.55	19.20	25	-2.98	5690
20100630	-0.26	2.73	3.54	8634	2.61	3.62	4.56	8634	2.92	3.55	4.38	8695	-0.64	9.39	25	-0.05	7146
20100704	0.25	1.98	2.64	8734	-1.86	2.55	3.22	8734	1.45	2.16	2.70	8823	-38.07	39.35	25	-22.36	6427

Table A-21. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, MYJ BL setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_B2_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.47	1.61	2.10	608	-0.22	1.74	2.32	608	-6.90	11.17	14.27	608	2.91	2.94	3.31	483
20090421	2.68	3.14	3.92	561	-0.95	3.31	3.85	587	-11.75	14.58	20.53	587	-3.20	3.20	3.37	442
20090519	1.14	1.74	2.22	578	-0.35	1.47	1.99	595	-1.82	3.37	4.46	595	-5.42	5.42	5.53	446
20090626	-0.24	1.94	2.37	593	2.38	2.66	3.17	578	7.51	11.60	13.87	578	-3.89	3.89	4.23	459
20091103	3.91	4.04	4.97	538	1.34	1.70	2.17	582	-8.89	10.42	13.08	582	-2.54	2.58	3.10	479
20091114	2.16	2.33	2.88	558	1.08	2.31	2.74	563	-4.58	9.88	12.41	563	1.82	1.94	2.27	468
20091116	5.37	5.37	5.90	539	-0.76	2.16	2.72	560	-22.72	22.82	25.30	560	0.15	2.25	2.62	471
20091222	1.82	1.97	2.59	514	0.02	1.37	1.73	520	-11.14	11.27	14.20	520	3.47	3.54	3.96	378
20100204	-1.50	2.36	2.88	570	-1.15	1.57	1.86	576	1.19	9.39	12.06	576	3.73	3.74	4.27	425
20100205	-1.24	1.94	2.40	578	-1.08	1.29	1.57	579	1.04	9.67	11.95	579	0.80	1.89	2.31	424
20100207	-1.53	1.82	2.09	591	-1.63	1.74	2.08	591	-0.36	7.04	9.46	591	2.35	2.44	2.80	424
20100304	0.96	1.95	2.47	609	-0.08	1.75	2.18	610	-5.05	16.25	19.71	610	-0.47	1.43	1.73	480
20100307	-0.09	1.65	2.03	595	-1.22	1.52	1.85	599	-5.84	11.10	13.75	599	-0.30	1.13	1.38	470
20100309	-1.43	1.63	1.87	609	-1.34	2.15	2.71	611	0.67	9.38	11.77	611	0.42	1.46	1.82	482
20100413	0.64	1.33	1.78	580	0.09	1.37	1.81	579	-1.93	8.17	10.87	579	-1.16	1.84	2.34	462
20100617	0.66	1.35	1.77	571	2.83	3.58	4.13	571	3.38	8.83	11.21	571	-4.20	4.22	4.69	471
20100621	0.27	1.55	1.98	577	1.58	2.05	2.76	573	2.72	4.96	7.42	573	-5.29	5.29	5.55	463
20100627	2.31	2.47	3.14	574	3.68	3.72	4.12	589	2.80	4.79	6.14	589	-8.51	9.15	11.20	435
20100630	-0.30	1.51	2.03	650	1.42	2.67	3.52	631	2.19	3.85	5.53	631	-6.89	6.90	7.05	445
20100704	1.91	2.19	2.74	608	0.56	2.13	2.67	608	-1.28	4.28	5.78	608	-7.10	7.10	7.30	442

Table A-21. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, MYJ BL setting (continued).

Date													10-m -ind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.84	2.22	2.88	586	-1.35	2.61	3.27	586	1.62	2.58	3.18	586	5.57	8.50	25	4.40	580
20090421	0.00	1.15	1.49	595	-0.23	1.28	1.61	595	-0.38	1.09	1.38	595	-9.60	31.20	25	36.48	502
20090519	1.17	2.81	3.62	537	1.30	3.21	4.23	537	0.94	2.52	3.21	537	2.03	25.11	25	-2.03	518
20090626	-0.55	2.49	3.36	550	-0.06	3.28	4.26	550	1.00	2.79	3.59	550	3.37	21.22	25	7.82	526
20091103	-0.30	1.19	1.53	583	-0.22	1.25	1.70	583	-0.13	1.01	1.34	583	-11.37	46.29	25	-99.92	463
20091114	0.70	2.05	2.57	554	-0.48	2.10	2.88	554	0.51	1.99	2.72	554	16.86	40.30	25	6.68	487
20091116	-0.39	1.26	1.56	565	0.96	1.46	1.86	565	0.32	1.08	1.37	565	-22.35	51.40	25	-14.83	436
20091222	0.28	1.58	2.12	514	-0.09	2.19	2.90	514	1.65	2.00	2.57	514	4.06	45.49	25	3.12	403
20100204	-0.43	1.36	1.77	576	0.79	1.61	2.02	576	0.78	1.32	1.66	576	4.62	30.42	25	2.96	442
20100205	-0.97	1.82	2.38	574	3.56	3.75	4.52	574	2.50	3.07	3.80	574	-5.04	46.52	25	-14.41	473
20100207	1.04	1.74	2.20	586	-0.12	1.71	2.10	586	0.23	1.64	2.05	586	18.92	19.83	25	19.50	533
20100304	1.47	4.00	5.11	595	2.17	3.31	4.14	595	2.03	3.04	3.77	595	-27.75	39.73	25	-24.16	571
20100307	-0.29	1.59	2.05	596	1.56	2.51	3.15	596	0.42	1.68	2.12	596	-2.97	82.54	25	-179.16	460
20100309	0.91	2.02	2.58	578	-0.56	2.37	3.05	578	0.85	2.40	3.07	578	-2.11	7.37	25	7.45	564
20100413	0.92	2.42	3.31	559	-0.60	2.59	3.50	559	0.21	2.00	2.66	559	3.68	45.39	25	-34.81	529
20100617	0.41	1.63	2.19	576	0.59	1.84	2.31	576	-0.08	1.20	1.55	576	22.16	57.52	25	-27.04	539
20100621	-0.50	1.82	2.30	563	0.47	1.89	2.47	563	-0.31	1.74	2.29	563	3.12	46.46	25	-9.73	536
20100627	-0.53	1.64	2.07	585	-0.87	1.63	2.10	585	0.49	1.33	1.71	591	-18.59	27.50	25	-13.24	509
20100630	-0.07	2.02	2.65	606	1.76	2.73	3.37	606	1.77	2.67	3.37	609	1.29	4.98	25	1.67	594
20100704	0.51	1.89	2.43	607	-2.24	2.90	3.57	607	1.68	2.34	2.91	607	19.38	28.91	25	-0.98	559

Table A-22. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, MYJ BL setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_B2_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.42	1.55	1.98	608	-0.21	1.75	2.34	608	-6.64	11.09	14.20	608	2.98	3.01	3.39	483
20090421	2.61	3.07	3.87	561	-0.66	3.18	3.72	587	-11.01	14.25	20.13	587	-3.15	3.15	3.34	442
20090519	1.10	1.70	2.15	578	-0.35	1.51	2.04	595	-1.74	3.34	4.42	595	-5.35	5.35	5.47	446
20090626	-0.27	1.89	2.31	593	2.44	2.71	3.24	578	7.84	11.86	14.12	578	-3.63	3.66	4.05	459
20091103	3.83	4.00	4.94	538	1.46	1.75	2.22	582	-8.28	10.10	12.78	582	-2.43	2.49	3.01	479
20091114	2.12	2.29	2.84	558	1.08	2.34	2.76	563	-4.29	9.82	12.43	563	1.91	2.02	2.36	468
20091116	5.32	5.32	5.87	539	-0.65	2.07	2.64	560	-22.26	22.34	24.93	560	0.18	2.26	2.63	471
20091222	1.66	1.79	2.35	514	0.00	1.34	1.70	520	-10.29	10.43	13.22	520	3.71	3.75	4.15	378
20100204	-1.86	2.53	3.09	570	-1.19	1.63	1.96	576	2.98	9.17	12.08	576	4.23	4.23	4.71	425
20100205	-1.37	1.98	2.48	578	-1.16	1.34	1.64	579	1.32	9.36	11.67	579	1.00	1.99	2.43	424
20100207	-1.58	1.80	2.08	591	-1.59	1.73	2.11	591	0.23	7.07	9.61	591	2.58	2.62	2.98	424
20100304	0.84	1.89	2.39	609	0.00	1.69	2.09	610	-4.09	15.97	19.38	610	-0.36	1.44	1.74	480
20100307	-0.17	1.65	2.04	595	-1.12	1.44	1.75	599	-4.90	10.77	13.34	599	-0.10	1.11	1.39	470
20100309	-1.45	1.55	1.80	609	-1.28	2.08	2.65	611	1.07	9.35	11.77	611	0.49	1.45	1.81	482
20100413	0.40	1.26	1.68	580	0.26	1.38	1.83	579	-0.55	8.09	10.70	579	-0.92	1.72	2.19	462
20100617	0.58	1.28	1.72	571	3.03	3.65	4.22	571	4.11	8.97	11.38	571	-4.12	4.14	4.62	471
20100621	0.20	1.47	1.96	577	1.55	2.10	2.82	573	2.73	5.25	7.77	573	-5.08	5.08	5.34	463
20100627	2.28	2.44	3.14	574	3.79	3.83	4.24	589	3.04	5.06	6.44	589	-8.33	8.97	11.06	435
20100630	-0.37	1.49	2.05	650	1.44	2.66	3.55	631	2.28	4.00	5.85	631	-6.90	6.91	7.05	445
20100704	1.86	2.13	2.67	608	0.57	2.21	2.76	608	-1.16	4.40	5.92	608	-7.05	7.05	7.26	442

Table A-22. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, MYJ BL setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.85	2.30	2.95	586	-1.39	2.66	3.33	586	1.69	2.63	3.25	586	5.58	8.52	25	4.40	580
20090421	0.02	1.18	1.52	595	-0.24	1.30	1.64	595	-0.32	1.12	1.40	595	-10.21	33.49	25	39.64	502
20090519	1.24	2.93	3.78	537	1.32	3.27	4.30	537	1.12	2.61	3.35	537	1.75	25.56	25	-2.63	518
20090626	-0.53	2.59	3.49	550	-0.07	3.32	4.30	550	1.10	2.87	3.70	550	3.03	21.03	25	7.50	526
20091103	-0.30	1.23	1.59	583	-0.25	1.25	1.68	583	-0.04	1.02	1.35	583	-18.99	49.96	25	-100.45	463
20091114	0.76	2.09	2.62	554	-0.50	2.13	2.93	554	0.60	2.04	2.77	554	18.34	41.22	25	7.52	487
20091116	-0.39	1.31	1.63	565	1.02	1.52	1.94	565	0.41	1.15	1.46	565	-23.97	52.00	25	-16.46	436
20091222	0.40	1.58	2.16	514	-0.34	2.14	2.85	514	1.68	2.06	2.67	514	-0.64	41.50	25	2.74	403
20100204	-0.28	1.40	1.84	576	0.70	1.62	2.01	576	0.77	1.34	1.69	576	0.17	32.23	25	-1.89	442
20100205	-0.87	1.83	2.40	574	3.32	3.58	4.43	574	2.33	2.98	3.74	574	-5.70	47.24	25	-15.08	473
20100207	1.02	1.78	2.23	586	0.14	1.71	2.16	586	0.19	1.68	2.11	586	20.03	21.00	25	20.61	533
20100304	1.55	4.02	5.16	595	2.16	3.42	4.24	595	2.13	3.10	3.86	595	-29.05	40.74	25	-24.81	571
20100307	-0.17	1.63	2.11	596	1.58	2.50	3.14	596	0.50	1.73	2.17	596	-4.58	80.03	25	173.75	460
20100309	1.01	2.07	2.66	578	-0.63	2.38	3.08	578	1.03	2.46	3.17	578	-1.77	7.29	25	7.72	564
20100413	0.93	2.50	3.43	559	-0.55	2.54	3.42	559	0.32	2.02	2.76	559	4.63	47.37	25	-35.33	529
20100617	0.43	1.67	2.22	576	0.63	1.85	2.33	576	-0.03	1.25	1.60	576	20.54	56.03	25	-29.70	539
20100621	-0.55	1.79	2.35	563	0.44	1.96	2.60	563	-0.17	1.77	2.38	563	1.94	42.12	25	-10.45	536
20100627	-0.57	1.79	2.27	585	-0.86	1.79	2.26	585	0.65	1.49	1.91	591	-18.99	27.29	25	-14.42	509
20100630	-0.08	2.13	2.80	606	1.80	2.80	3.48	606	1.86	2.74	3.45	609	1.37	5.61	25	1.87	594
20100704	0.40	2.06	2.68	607	-2.28	2.99	3.70	607	1.82	2.53	3.14	607	18.24	28.66	25	-2.30	559

Appendix B. Tabular and Graphical Error Statistics for Surface Meteorological Variables for the Three Combinations of WRF Spatial Resolution and Domain for both WRF Resolutions.

Appendix B contains tables and graphs of the error statistics of Bias or ME, MAE, RMSE and the total number of matched forecast-observation pairs (TOTAL) used in calculating the statistics for the following surface meteorological variables:

- Air temperature (degrees Kelvin, 2-m level)
- Dew point temperature (degrees Kelvin, 2-m level)
- Relative humidity (percent, 2-m level)
- Mean sea level pressure (HectoPascals, 0-m level)
- U-component wind speed (meters/second, 10-m level)
- V-component wind speed (meters/second, 10-m level)
- Wind speed (meters/second, 10-m level)
- Row mean wind direction (degrees, 10-m level)
- Aggregate wind direction (degrees, 10-m level)

Note: MET does not calculate RMSE for wind direction. MET does not calculate MAE for aggregate wind direction.

The tables (B-2 through B-15) with their associated figures (B-1 through B-63) are presented in the following order in table B-1 by WRF parameter setting.

Table B-1. Figures and tables of appendix B in the order they appear organized by WRF parameter setting.

Parameter Setting	Associated Figures and Tables
Control (CO)	3-km WRF, Domain 2 (m1o2)—table B-2 1-km WRF, Domain 2 (m2o2)—table B-3 and figures B-1–B-9
Physics2 (P2)	3-km WRF, Domain 2 (m1o2)—table B-4 1-km WRF, Domain 2 (m2o2)—table B-5 and figures B-10–B-18
Physics8 (P8)	3-km WRF, Domain 2 (m1o2)—table B-6 1-km WRF, Domain 2 (m2o2)—table B-7 and figures B-19–B-27
3Second (T3)	3-km WRF, Domain 2 (m1o2)—table B-8 1-km WRF, Domain 2 (m2o2)—table B-9 and figures B-28–B-36
40Levels (L4)	3-km WRF, Domain 2 (m1o2)—table B-10 1-km WRF, Domain 2 (m2o2)— table B-11 and figures B-37–B-45
80Levels (L8)	3-km WRF, Domain 2 (m1o2)— table B-12 3-km WRF, Domain 2 (m2o2)—table B-13 and figures B-46–B-54
MYJ BL (B2)	3-km WRF, Domain 2 (m1o2)—table B-14 1-km WRF, Domain 2 (m2o2)—B-15 and figures B-55–B-63

Table B-2. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Control setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m1o2_CO_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.57	1.68	2.11	608	-0.57	1.80	2.37	608	-8.80	12.01	15.17	608	2.81	2.85	3.19	483
20090421	1.29	2.12	2.66	561	-0.52	2.78	3.27	587	-7.46	11.89	16.09	587	-3.03	3.03	3.21	442
20090519	0.60	1.68	2.10	578	-0.19	1.76	2.38	595	-0.59	3.91	5.07	595	-5.54	5.54	5.66	446
20090626	-0.19	1.88	2.27	593	1.83	2.21	2.75	578	5.16	9.72	11.65	578	-4.03	4.03	4.32	459
20091103	2.59	2.93	3.71	538	1.49	1.78	2.22	582	-3.37	7.38	9.04	582	-2.47	2.51	3.03	479
20091114	2.12	2.26	2.74	558	1.05	2.35	2.79	563	-4.34	10.21	12.65	563	1.71	1.85	2.17	468
20091116	4.68	4.70	5.26	539	-0.63	2.28	2.77	560	-20.28	20.83	22.89	560	0.02	2.21	2.59	471
20091222	2.04	2.15	2.61	514	0.48	1.32	1.58	520	-9.71	9.99	12.68	520	3.01	3.17	3.65	378
20100204	-2.37	2.77	3.36	570	-0.78	1.42	1.74	576	7.45	8.96	11.96	576	4.07	4.08	4.65	425
20100205	-1.51	2.08	2.65	578	-1.11	1.36	1.64	579	2.11	9.05	11.15	579	0.10	1.91	2.34	424
20100207	-0.95	1.49	1.76	591	-1.70	1.78	2.21	591	-4.25	7.49	9.86	591	1.32	1.76	2.09	424
20100304	0.81	2.07	2.59	609	-0.34	1.98	2.44	610	-5.17	17.98	21.64	610	-0.72	1.44	1.79	480
20100307	-0.52	1.53	1.92	595	-0.91	1.35	1.61	599	-1.97	9.42	11.64	599	-0.36	1.11	1.36	470
20100309	-1.25	1.49	1.75	609	-1.20	2.01	2.43	611	0.49	8.84	10.97	611	0.17	1.43	1.77	482
20100413	0.76	1.35	1.81	580	-0.46	1.49	2.01	579	-4.28	8.87	11.91	579	-1.42	2.00	2.47	462
20100617	-0.11	1.27	1.58	571	2.49	3.16	3.66	571	4.43	8.48	10.86	571	-3.98	3.99	4.41	471
20100621	-0.02	1.46	1.86	577	1.69	1.97	2.64	573	3.36	5.16	7.45	573	-5.24	5.24	5.45	463
20100627	1.11	1.65	2.26	574	3.92	3.94	4.28	589	5.28	6.29	7.47	589	-8.19	8.84	10.93	435
20100630	-0.93	1.87	2.25	650	1.08	2.74	3.46	631	2.21	4.27	5.73	631	-6.66	6.69	6.85	445
20100704	1.05	1.55	2.10	608	0.23	2.06	2.62	608	-0.96	3.64	5.12	608	-6.80	6.80	6.93	442

Table B-2. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Control setting (continued).

													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.56	2.19	2.78	586	-1.12	2.42	3.05	586	1.16	2.32	2.89	586	3.37	9.89	25	2.90	580
20090421	0.34	1.14	1.43	595	-0.21	1.21	1.51	595	-1.10	1.30	1.59	595	-1.70	32.93	25	89.20	502
20090519	0.97	2.54	3.16	537	0.29	3.19	4.25	537	-0.17	2.57	3.19	537	-4.13	31.92	25	-11.42	518
20090626	0.13	2.09	2.80	550	0.15	2.74	3.66	550	-0.03	2.24	2.92	550	-7.93	19.11	25	-1.97	526
20091103	-0.24	1.08	1.37	583	-0.07	1.10	1.48	583	-0.88	1.16	1.50	583	-9.89	46.54	25	-69.22	463
20091114	0.63	1.68	2.14	554	-0.76	2.09	2.78	554	0.30	1.94	2.58	554	3.80	36.31	25	3.93	487
20091116	-0.23	1.21	1.51	565	0.61	1.32	1.72	565	-0.30	1.11	1.40	565	-21.24	52.22	25	-11.71	436
20091222	0.18	1.52	1.96	514	-0.40	2.25	2.90	514	1.60	2.01	2.51	514	22.62	45.11	25	-2.87	403
20100204	-0.06	1.10	1.44	576	0.19	1.19	1.50	576	-0.20	0.99	1.27	576	3.13	30.27	25	-0.82	442
20100205	-0.09	1.47	1.85	574	2.67	3.17	3.95	574	1.35	2.58	3.25	574	-14.34	47.95	25	-23.06	473
20100207	0.00	1.31	1.68	586	0.39	1.62	2.07	586	-0.68	1.58	2.06	586	2.22	10.10	25	2.06	533
20100304	2.19	4.09	5.11	595	1.74	3.06	3.88	595	1.42	2.75	3.44	595	-33.59	43.71	25	-31.53	571
20100307	-0.10	1.42	1.83	596	1.43	2.21	2.81	596	-0.27	1.61	2.05	596	4.22	85.46	25	167.08	460
20100309	1.28	2.27	2.79	578	-0.92	2.32	3.11	578	0.47	2.38	3.06	578	-8.83	14.08	25	8.36	564
20100413	1.31	2.61	3.50	559	-0.76	2.54	3.35	559	-0.22	2.15	2.75	559	-24.01	55.12	25	-52.30	529
20100617	0.56	1.55	2.02	576	0.69	1.72	2.14	576	-0.82	1.31	1.68	576	13.24	58.81	25	-36.96	539
20100621	-0.62	1.57	1.96	563	0.76	1.93	2.47	563	-0.84	1.79	2.26	563	0.56	37.19	25	-13.17	536
20100627	-0.23	1.48	1.82	585	-0.53	1.44	1.85	585	-0.22	1.27	1.58	591	-16.01	31.85	25	-6.17	509
20100630	0.42	2.16	2.80	606	0.69	2.23	2.82	606	0.46	2.16	2.77	609	-4.11	11.63	25	-2.83	594
20100704	0.05	1.72	2.21	607	-1.78	2.55	3.22	607	0.87	1.97	2.59	607	15.63	33.40	25	-5.15	559

Table B-3. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Control setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m2o2_CO_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.51	1.61	1.99	608	-0.60	1.78	2.35	608	-8.67	11.88	15.09	608	2.89	2.92	3.27	483
20090421	1.26	2.11	2.65	561	-0.50	2.79	3.29	587	-7.33	11.88	16.08	587	-2.98	2.98	3.16	442
20090519	0.56	1.65	2.05	578	-0.20	1.76	2.39	595	-0.55	3.93	5.09	595	-5.46	5.46	5.58	446
20090626	-0.23	1.85	2.23	593	1.79	2.20	2.74	578	5.20	9.91	11.88	578	-3.81	3.81	4.15	459
20091103	2.56	2.97	3.73	538	1.46	1.76	2.21	582	-3.31	7.40	9.04	582	-2.36	2.42	2.93	479
20091114	2.06	2.21	2.70	558	1.03	2.35	2.80	563	-4.16	10.21	12.69	563	1.80	1.92	2.27	468
20091116	4.58	4.60	5.18	539	-0.66	2.26	2.71	560	-20.07	20.38	22.52	560	0.16	2.19	2.59	471
20091222	1.99	2.09	2.54	514	0.45	1.29	1.55	520	-9.52	9.81	12.49	520	3.15	3.30	3.79	378
20100204	-2.57	2.94	3.55	570	-0.86	1.49	1.82	576	8.30	9.41	12.52	576	4.49	4.49	5.02	425
20100205	-1.55	2.09	2.65	578	-1.09	1.32	1.62	579	2.41	8.87	10.97	579	0.29	1.95	2.40	424
20100207	-0.99	1.41	1.70	591	-1.67	1.74	2.16	591	-3.79	7.14	9.35	591	1.55	1.90	2.25	424
20100304	0.73	2.03	2.53	609	-0.30	1.95	2.42	610	-4.56	17.77	21.48	610	-0.63	1.44	1.79	480
20100307	-0.59	1.54	1.95	595	-0.91	1.34	1.60	599	-1.59	9.38	11.61	599	-0.16	1.08	1.36	470
20100309	-0.69	1.03	1.30	609	-1.08	1.89	2.34	611	-1.52	9.93	12.00	611	-0.37	1.50	1.82	482
20100413	0.66	1.27	1.73	580	-0.43	1.47	1.97	579	-3.80	8.49	11.62	579	-1.28	1.95	2.41	462
20100617	-0.21	1.29	1.61	571	2.51	3.15	3.69	571	4.81	8.67	11.18	571	-3.90	3.93	4.34	471
20100621	-0.15	1.37	1.77	577	1.74	1.99	2.68	573	3.58	5.24	7.43	573	-5.03	5.03	5.24	463
20100627	1.10	1.61	2.24	574	3.93	3.95	4.30	589	5.23	6.25	7.37	589	-8.00	8.65	10.80	435
20100630	-0.98	1.87	2.25	650	1.09	2.78	3.51	631	2.29	4.40	5.92	631	-6.64	6.67	6.82	445
20100704	0.99	1.50	2.04	608	0.24	2.09	2.66	608	-0.84	3.67	5.23	608	-6.75	6.75	6.89	442

Table B-3. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Control setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.57	2.24	2.84	586	-1.17	2.44	3.08	586	1.24	2.36	2.94	586	3.40	9.95	25	2.89	580
20090421	0.36	1.15	1.44	595	-0.22	1.21	1.52	595	-1.06	1.29	1.58	595	-0.93	34.30	25	93.85	502
20090519	1.03	2.59	3.24	537	0.26	3.22	4.32	537	-0.06	2.58	3.23	537	-5.02	31.84	25	-12.69	518
20090626	0.15	2.13	2.87	550	0.20	2.76	3.68	550	0.08	2.26	2.95	550	-8.24	19.40	25	-2.38	526
20091103	-0.25	1.08	1.38	583	-0.08	1.09	1.44	583	-0.82	1.15	1.46	583	-10.79	47.01	25	-84.29	463
20091114	0.70	1.72	2.21	554	-0.79	2.09	2.80	554	0.40	1.96	2.61	554	4.55	36.06	25	4.74	487
20091116	-0.11	1.18	1.47	565	0.62	1.29	1.67	565	-0.32	1.08	1.38	565	-27.96	54.06	25	-18.20	436
20091222	0.17	1.60	2.09	514	-0.43	2.26	2.94	514	1.66	2.08	2.61	514	22.71	44.70	25	-3.46	403
20100204	0.00	1.11	1.47	576	0.14	1.15	1.46	576	-0.22	0.99	1.28	576	1.14	34.67	25	-3.01	442
20100205	-0.13	1.53	1.94	574	2.63	3.15	3.97	574	1.40	2.60	3.30	574	-14.77	48.18	25	-22.61	473
20100207	0.04	1.29	1.65	586	0.48	1.62	2.08	586	-0.62	1.58	2.06	586	3.36	10.01	25	3.17	533
20100304	2.13	4.10	5.15	595	1.80	3.20	4.01	595	1.59	2.83	3.54	595	-33.29	43.48	25	-30.79	571
20100307	-0.04	1.46	1.88	596	1.45	2.24	2.84	596	-0.16	1.66	2.10	596	2.86	90.25	25	163.39	460
20100309	1.52	2.42	2.97	578	-1.24	2.38	3.17	578	1.02	2.48	3.21	578	-7.99	14.26	25	8.05	564
20100413	1.37	2.58	3.50	559	-1.04	2.58	3.38	559	-0.25	2.14	2.74	559	-28.31	60.54	25	-63.67	529
20100617	0.55	1.53	2.02	576	0.74	1.78	2.20	576	-0.79	1.33	1.70	576	11.93	57.80	25	-38.90	539
20100621	-0.65	1.64	2.07	563	0.73	1.97	2.54	563	-0.70	1.80	2.30	563	-0.87	38.59	25	-13.49	536
20100627	-0.23	1.53	1.89	585	-0.48	1.43	1.84	585	-0.22	1.28	1.59	591	-15.01	30.77	25	-6.01	509
20100630	0.39	2.15	2.79	606	0.80	2.28	2.86	606	0.60	2.17	2.78	609	-3.72	11.09	25	-2.42	594
20100704	-0.03	1.78	2.32	607	-1.86	2.63	3.32	607	1.00	2.06	2.72	607	14.47	33.47	25	-6.46	559

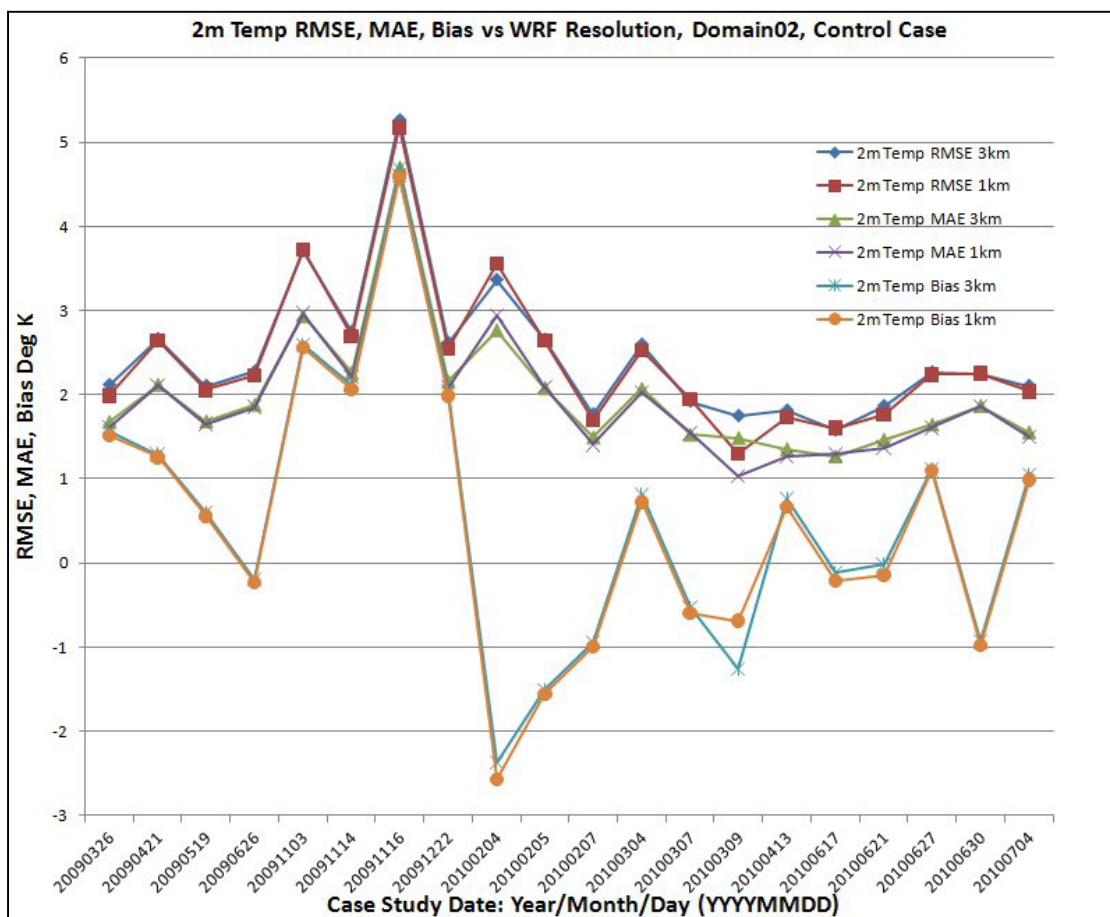


Figure B-1. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, Control setting.

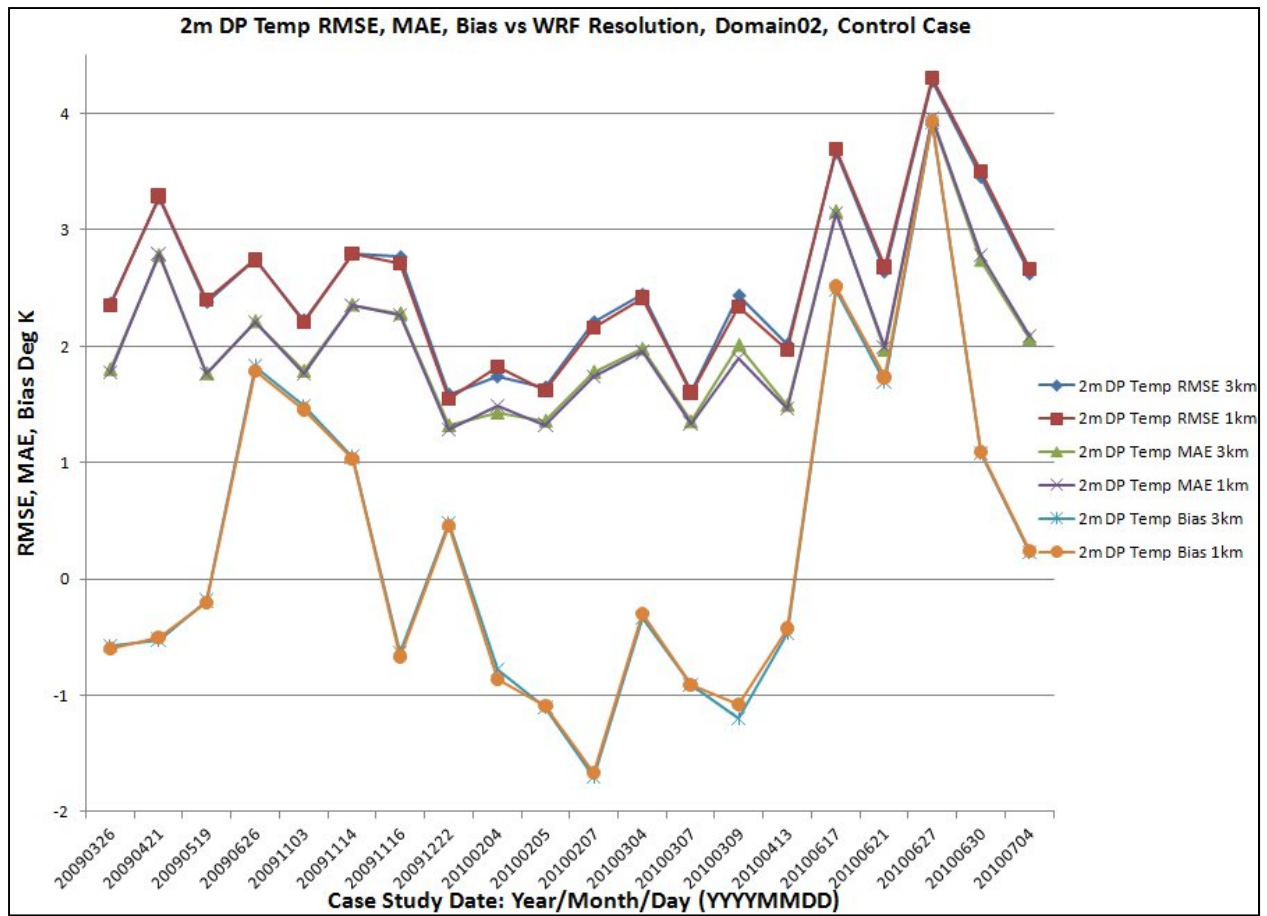


Figure B-2. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, Control setting.

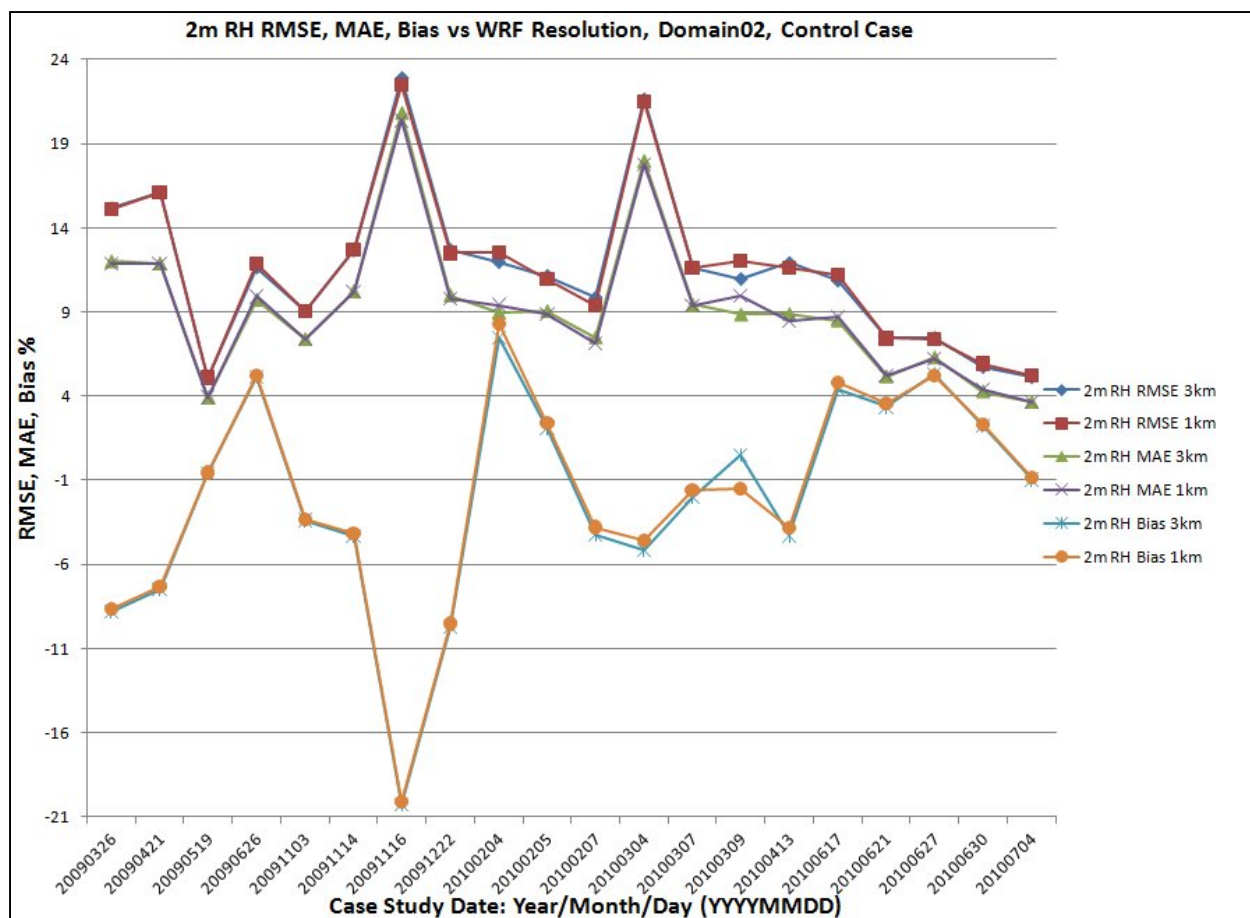


Figure B-3. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, Control setting.

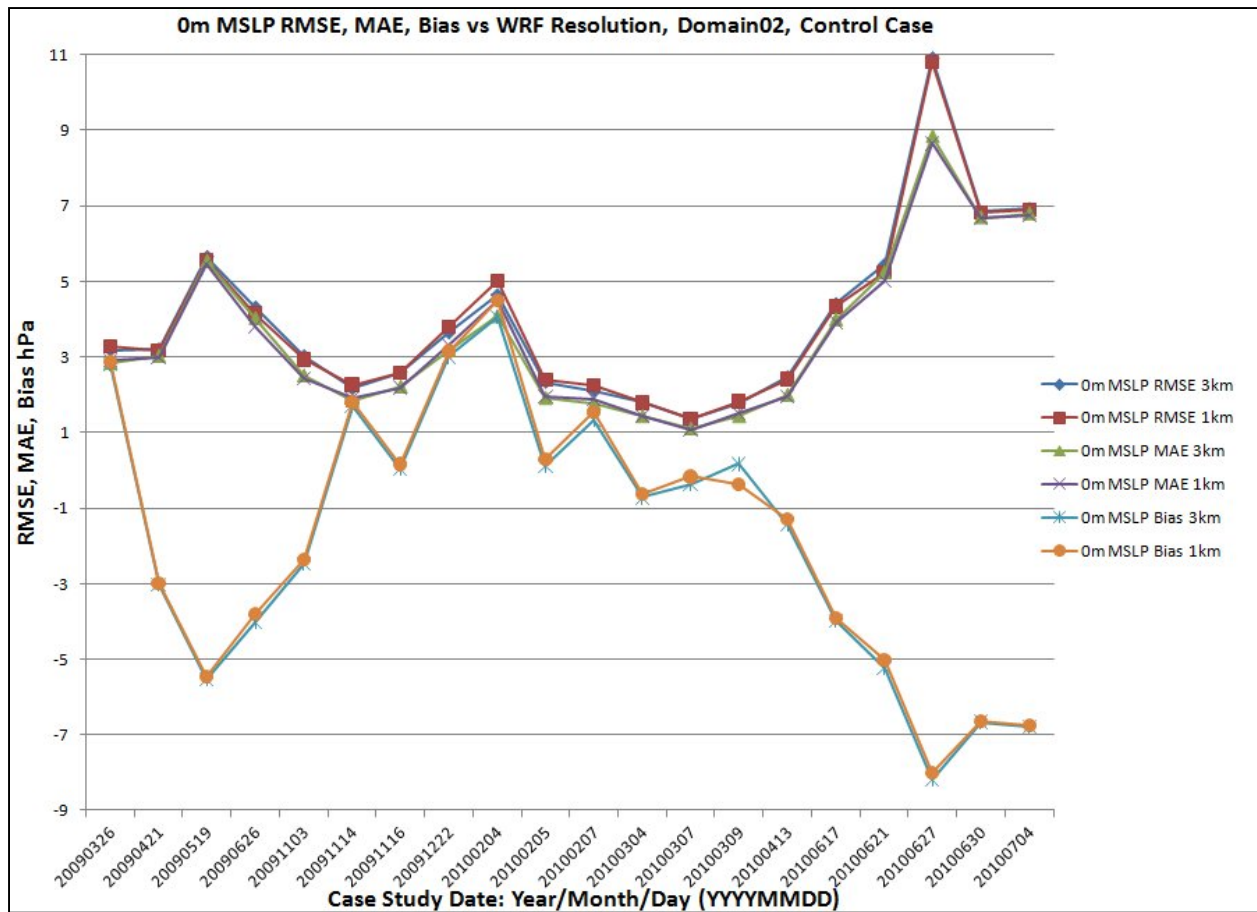


Figure B-4. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, Control setting.

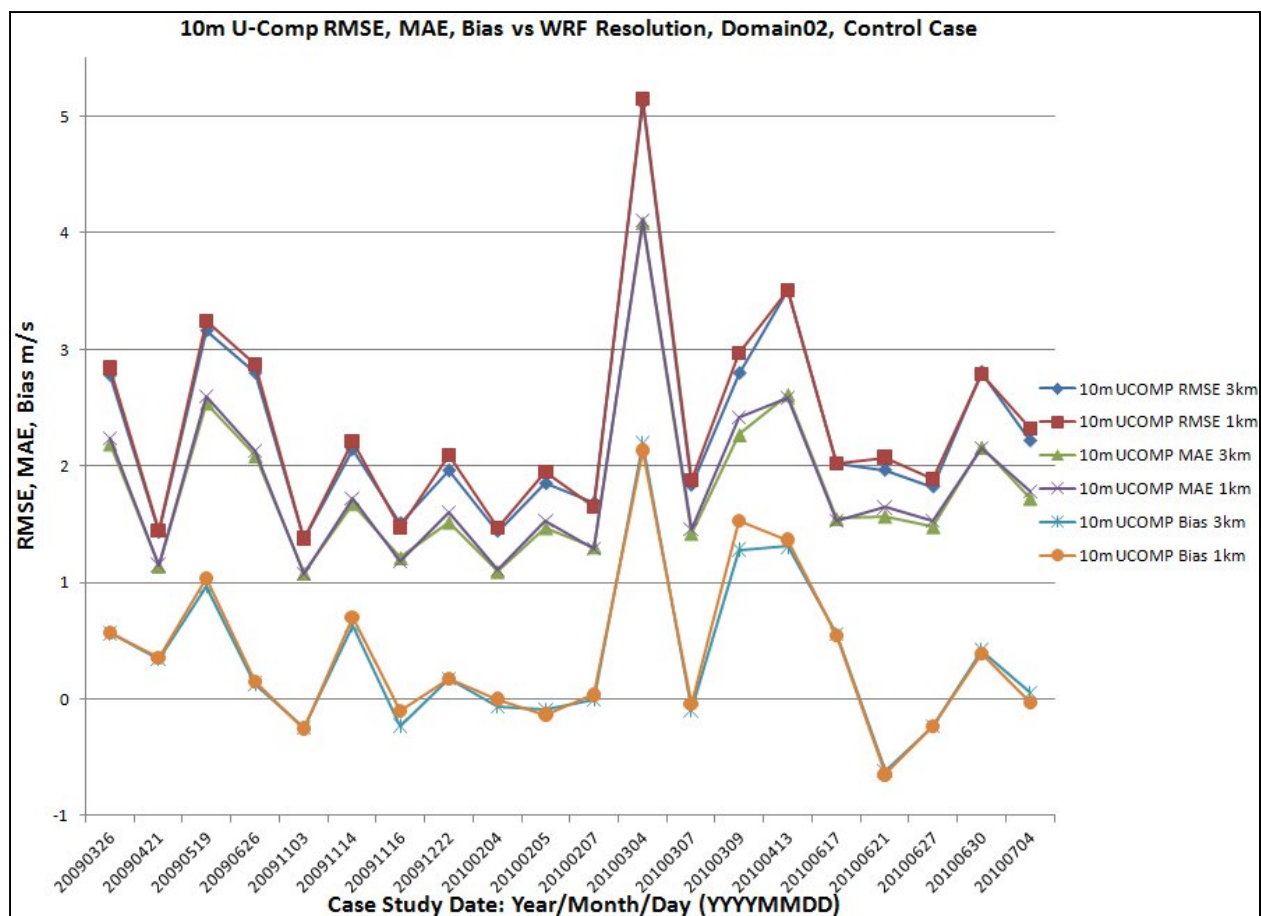


Figure B-5. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, Control setting.

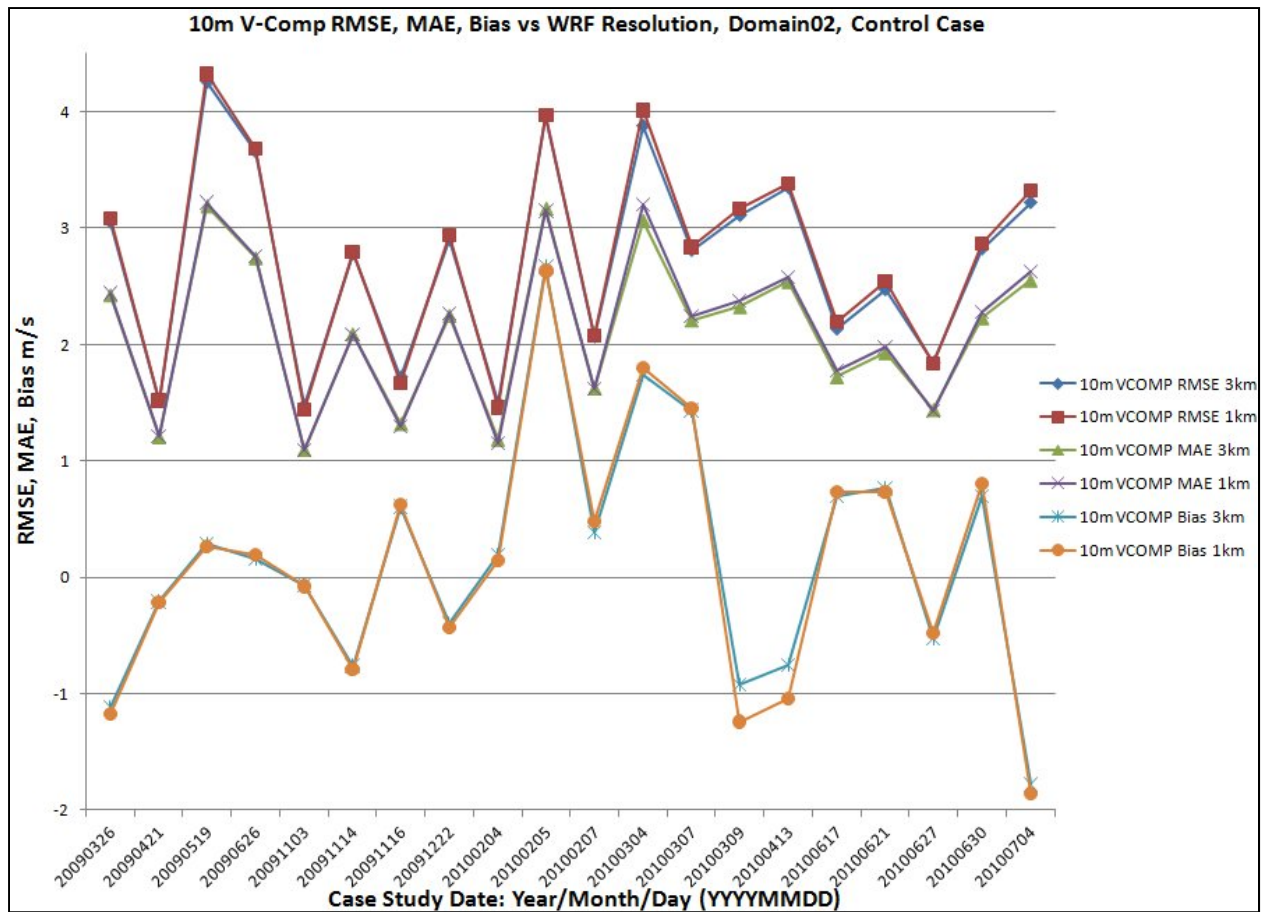


Figure B-6. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, Control setting.

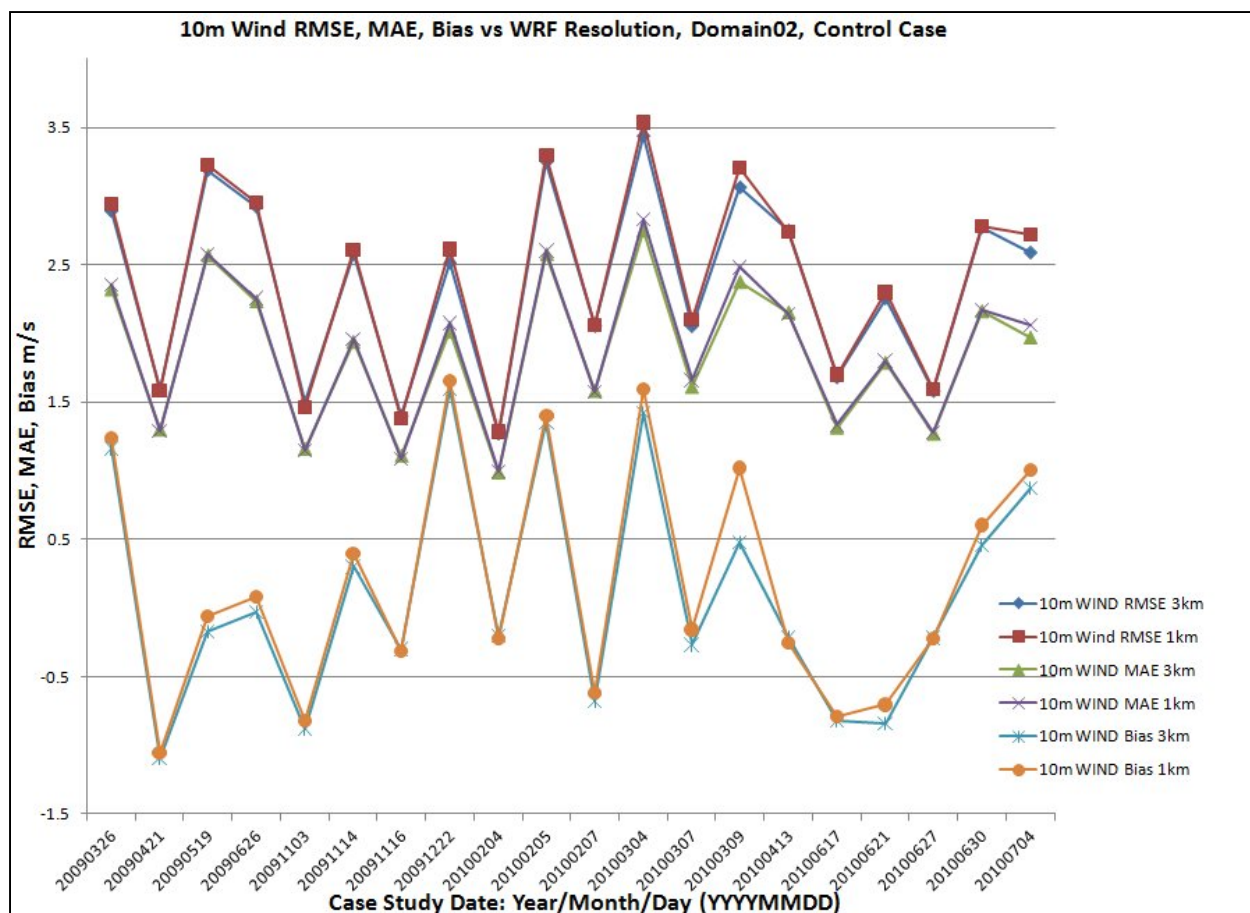


Figure B-7. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, Control setting.

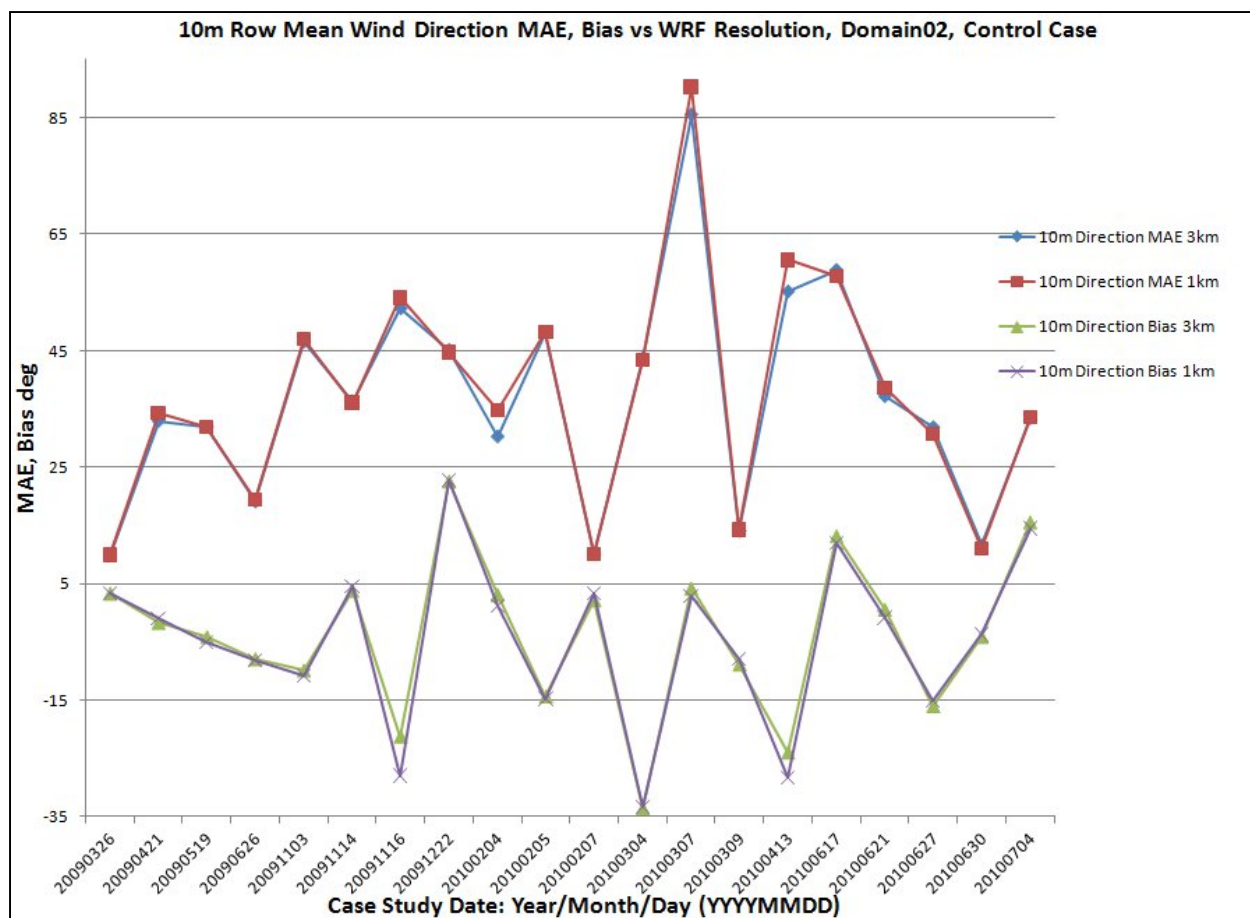


Figure B-8. Comparison of all 10-m row mean wind direction statistics for 3-km and 1-km WRF, Domain 2, Control setting.

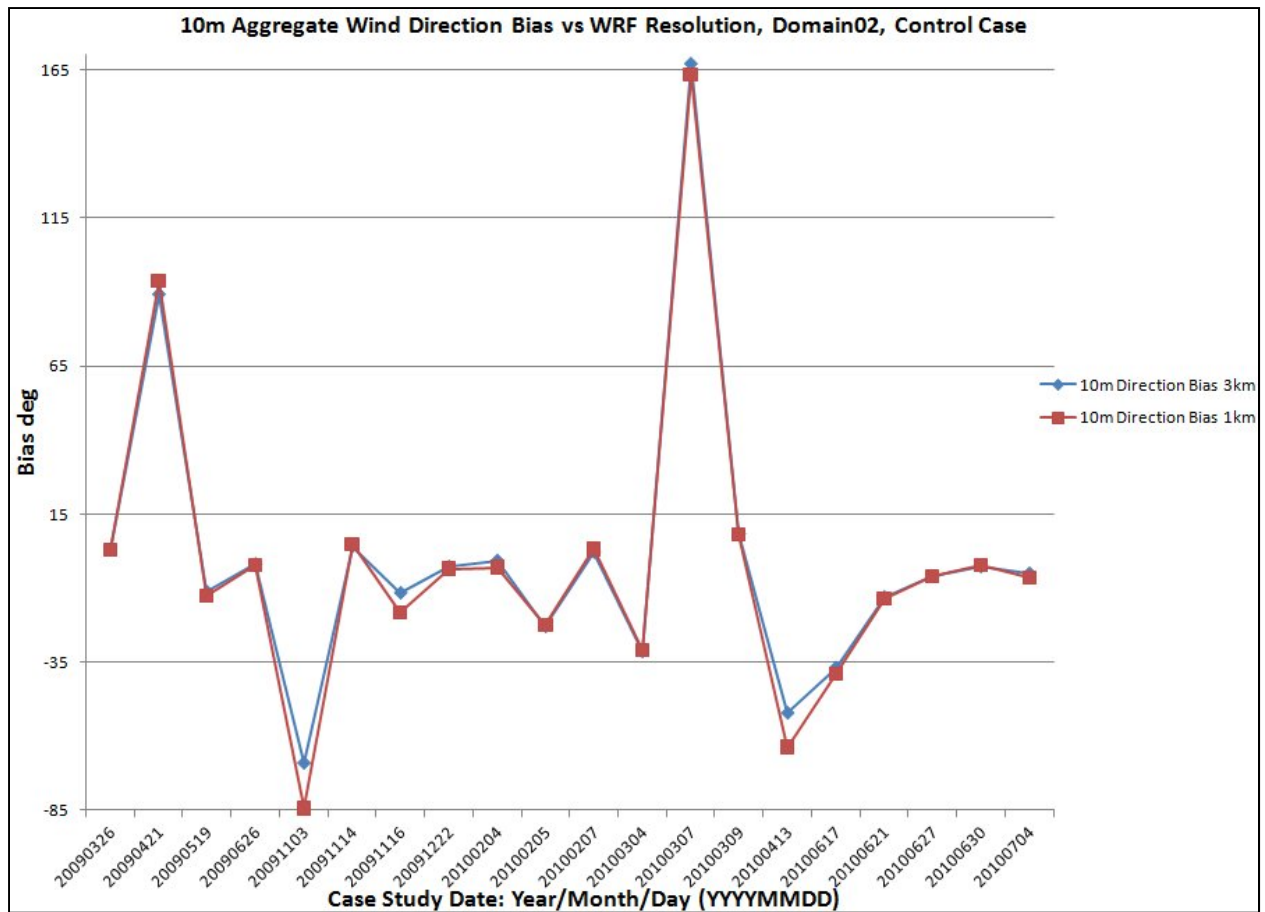


Figure B-9. Comparison of all 10-m aggregate wind direction statistics for 3-km and 1-km WRF, Domain 2, Control setting.

Table B-4. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics2 setting.

DATE: <u>2009, 2010</u>				Model/Domain Set: <u>m1o2_P2_sfc</u>												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.64	1.71	2.13	608	-0.66	1.74	2.34	608	-9.46	11.59	14.80	608	2.64	2.69	3.03	483
20090421	1.29	2.12	2.66	561	-0.52	2.78	3.27	587	-7.46	11.89	16.09	587	-3.03	3.03	3.21	442
20090519	0.55	1.68	2.12	578	-0.10	1.90	2.55	595	-0.27	4.17	5.45	595	-5.45	5.45	5.59	446
20090626	0.41	1.83	2.24	593	1.67	2.14	2.66	578	3.65	8.83	11.04	578	-4.34	4.34	4.57	459
20091103	2.61	2.95	3.71	538	1.49	1.78	2.22	582	-3.40	7.38	9.04	582	-2.47	2.51	3.02	479
20091114	2.23	2.34	2.74	558	0.74	2.62	3.05	563	-5.71	12.66	15.25	563	1.53	1.83	2.14	468
20091116	4.35	4.37	4.94	539	-0.68	2.23	2.69	560	-19.42	19.84	21.93	560	0.31	2.17	2.56	471
20091222	2.25	2.39	2.80	514	0.63	1.55	1.81	520	-10.13	10.52	12.88	520	2.84	2.97	3.43	378
20100204	-2.50	2.96	3.53	570	-0.70	1.33	1.63	576	6.40	8.78	11.50	576	3.55	3.56	4.08	425
20100205	-1.55	2.10	2.62	578	-0.79	1.14	1.38	579	4.15	9.63	12.07	579	0.14	1.91	2.34	424
20100207	-0.63	1.29	1.58	591	-1.64	1.68	1.99	591	-5.84	7.70	10.11	591	1.16	1.70	2.03	424
20100304	0.87	2.18	2.68	609	-0.29	1.91	2.39	610	-5.29	18.10	21.66	610	-0.91	1.64	2.05	480
20100307	-0.08	1.26	1.57	595	-1.01	1.48	1.75	599	-5.00	8.51	10.99	599	-0.76	1.35	1.64	470
20100309	-0.86	1.26	1.51	609	-1.04	1.80	2.28	611	-0.71	8.93	11.09	611	-0.46	1.41	1.73	482
20100413	0.88	1.50	1.95	580	-0.19	1.57	2.08	579	-3.31	9.23	12.33	579	-1.64	2.29	2.81	462
20100617	-0.11	1.27	1.58	571	2.49	3.16	3.67	571	4.44	8.50	10.87	571	-3.97	3.98	4.40	471
20100621	-0.04	1.45	1.85	577	1.68	1.97	2.64	573	3.36	5.16	7.44	573	-5.20	5.20	5.42	463
20100627	1.44	1.79	2.44	574	3.76	3.79	4.13	589	4.50	5.70	6.96	589	-8.45	9.10	11.14	435
20100630	-0.90	1.87	2.25	650	0.02	2.47	3.13	631	1.19	3.88	5.38	631	-6.71	6.74	6.89	445
20100704	1.00	1.52	2.06	608	0.35	2.11	2.70	608	-0.62	3.76	5.31	608	-6.72	6.72	6.86	442

Table B-4. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics2 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.46	2.13	2.68	586	-1.17	2.54	3.16	586	1.17	2.40	2.96	586	3.09	10.13	25	2.12	580
20090421	0.34	1.14	1.43	595	-0.21	1.21	1.51	595	-1.10	1.30	1.59	595	-1.75	33.00	25	88.54	502
20090519	0.99	2.66	3.33	537	0.45	3.50	4.79	537	-0.08	2.57	3.18	537	-1.00	39.02	25	-9.27	518
20090626	0.37	2.27	3.13	550	-0.72	2.76	3.73	550	-0.13	2.39	3.07	550	-10.22	20.18	25	0.21	526
20091103	-0.25	1.08	1.37	583	-0.07	1.10	1.48	583	-0.88	1.16	1.50	583	-9.78	46.97	25	-74.65	463
20091114	0.66	1.74	2.22	554	-0.84	2.14	2.86	554	0.31	2.05	2.77	554	-11.83	37.12	25	3.62	487
20091116	-0.09	1.18	1.46	565	0.50	1.21	1.58	565	-0.46	1.10	1.40	565	-25.96	52.83	25	-15.28	436
20091222	0.10	1.47	1.92	514	-0.41	2.43	3.11	514	1.70	2.07	2.61	514	21.80	44.58	25	-4.18	403
20100204	-0.06	1.08	1.42	576	0.20	1.15	1.47	576	-0.29	1.00	1.27	576	3.47	29.56	25	-0.45	442
20100205	0.01	1.48	1.86	574	2.46	3.02	3.81	574	1.14	2.50	3.15	574	17.54	48.77	25	-23.62	473
20100207	0.11	1.36	1.75	586	0.31	1.58	2.03	586	-0.58	1.55	2.04	586	4.09	11.72	25	4.08	533
20100304	2.08	3.94	4.90	595	1.83	2.92	3.75	595	1.37	2.62	3.32	595	-33.16	43.36	25	-30.40	571
20100307	0.08	1.45	1.86	596	1.40	2.23	2.92	596	-0.16	1.56	2.03	596	27.07	82.26	25	151.78	460
20100309	1.01	2.07	2.58	578	-0.50	2.04	2.68	578	0.30	2.07	2.66	578	-4.73	11.10	25	9.49	564
20100413	1.52	2.71	3.58	559	-1.15	2.80	3.68	559	-0.15	2.15	2.69	559	-27.60	64.40	25	-73.27	529
20100617	0.56	1.55	2.02	576	0.68	1.72	2.13	576	-0.83	1.31	1.68	576	13.68	59.02	25	-36.10	539
20100621	-0.61	1.57	1.96	563	0.71	1.91	2.45	563	-0.82	1.78	2.25	563	1.78	35.51	25	-12.79	536
20100627	-0.23	1.49	1.84	585	-0.62	1.47	1.87	585	-0.11	1.26	1.57	591	-15.92	31.00	25	-5.79	509
20100630	0.87	2.15	2.76	606	0.32	2.00	2.60	606	0.14	2.01	2.63	609	-8.19	12.05	25	-6.87	594
20100704	-0.04	1.76	2.26	607	-1.66	2.48	3.12	607	0.76	1.90	2.50	607	14.81	33.91	25	-6.00	559

Table B-5. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics2 setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_P2_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.58	1.65	2.01	608	-0.68	1.73	2.33	608	-9.33	11.47	14.71	608	2.72	2.77	3.12	483
20090421	1.26	2.11	2.65	561	-0.50	2.79	3.29	587	-7.33	11.88	16.07	587	-2.98	2.98	3.16	442
20090519	0.49	1.65	2.07	578	-0.12	1.91	2.56	595	-0.22	4.18	5.47	595	-5.35	5.35	5.50	446
20090626	0.37	1.80	2.18	593	1.64	2.13	2.65	578	3.66	8.92	11.15	578	-4.11	4.11	4.38	459
20091103	2.57	2.98	3.73	538	1.46	1.76	2.21	582	-3.34	7.40	9.05	582	-2.36	2.42	2.93	479
20091114	2.17	2.28	2.67	558	0.73	2.61	3.05	563	-5.47	12.64	15.26	563	1.62	1.91	2.24	468
20091116	4.32	4.34	4.93	539	-0.70	2.23	2.67	560	-19.39	19.75	21.87	560	0.34	2.17	2.57	471
20091222	2.20	2.32	2.71	514	0.60	1.50	1.75	520	-9.91	10.29	12.69	520	3.01	3.13	3.59	378
20100204	-2.64	3.02	3.60	570	-0.72	1.32	1.62	576	6.99	9.17	11.95	576	3.84	3.84	4.34	425
20100205	-1.53	2.06	2.57	578	-0.78	1.14	1.38	579	4.17	9.20	11.69	579	0.33	1.95	2.40	424
20100207	-0.75	1.23	1.50	591	-1.63	1.67	2.01	591	-5.10	7.17	9.34	591	1.44	1.83	2.18	424
20100304	0.79	2.13	2.61	609	-0.27	1.90	2.38	610	-4.77	17.86	21.55	610	-0.80	1.62	2.02	480
20100307	-0.28	1.32	1.65	595	-1.03	1.48	1.75	599	-4.02	8.35	10.80	599	-0.50	1.26	1.54	470
20100309	-0.90	1.19	1.46	609	-1.09	1.83	2.31	611	-0.78	8.92	10.99	611	-0.35	1.35	1.68	482
20100413	0.74	1.43	1.90	580	-0.07	1.54	2.04	579	-2.40	9.01	12.15	579	-1.42	2.20	2.71	462
20100617	-0.21	1.30	1.61	571	2.52	3.15	3.70	571	4.82	8.69	11.19	571	-3.90	3.92	4.33	471
20100621	-0.16	1.37	1.77	577	1.73	2.00	2.69	573	3.60	5.26	7.44	573	-5.00	5.00	5.21	463
20100627	1.42	1.76	2.42	574	3.75	3.78	4.13	589	4.45	5.67	6.88	589	-8.27	8.91	11.00	435
20100630	-0.96	1.85	2.23	650	0.01	2.49	3.15	631	1.24	3.95	5.49	631	-6.71	6.74	6.89	445
20100704	0.95	1.48	2.01	608	0.35	2.16	2.75	608	-0.53	3.78	5.42	608	-6.68	6.68	6.83	442

Table B-5. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics2 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.47	2.17	2.73	586	-1.24	2.57	3.19	586	1.26	2.45	3.01	586	3.12	10.18	25	2.12	580
20090421	0.35	1.15	1.45	595	-0.22	1.21	1.52	595	-1.06	1.29	1.58	595	-0.97	34.39	25	93.12	502
20090519	1.04	2.69	3.39	537	0.46	3.53	4.89	537	0.03	2.57	3.22	537	-1.54	39.17	25	-9.83	518
20090626	0.40	2.33	3.24	550	-0.67	2.76	3.77	550	0.01	2.41	3.07	550	-10.77	20.89	25	-0.61	526
20091103	-0.26	1.08	1.38	583	-0.08	1.09	1.44	583	-0.82	1.15	1.46	583	-11.09	47.11	25	-89.67	463
20091114	0.69	1.77	2.25	554	-0.85	2.14	2.86	554	0.38	2.07	2.78	554	-12.05	35.51	25	4.04	487
20091116	-0.10	1.21	1.50	565	0.53	1.26	1.63	565	-0.38	1.13	1.42	565	-27.66	53.53	25	-16.93	436
20091222	0.09	1.54	2.05	514	-0.44	2.45	3.16	514	1.76	2.14	2.71	514	21.33	43.67	25	-4.46	403
20100204	-0.03	1.09	1.45	576	0.16	1.12	1.43	576	-0.28	0.99	1.27	576	3.96	31.97	25	-1.09	442
20100205	-0.05	1.52	1.96	574	2.48	2.99	3.83	574	1.23	2.52	3.20	574	5.87	51.40	25	-23.37	473
20100207	0.15	1.35	1.73	586	0.46	1.57	2.03	586	-0.54	1.54	2.01	586	5.51	11.65	25	5.35	533
20100304	2.04	3.94	4.94	595	1.86	3.09	3.91	595	1.51	2.73	3.45	595	-33.19	43.38	25	-29.94	571
20100307	0.10	1.49	1.90	596	1.34	2.18	2.83	596	-0.15	1.56	2.01	596	28.31	85.55	25	150.58	460
20100309	1.05	2.11	2.64	578	-0.46	2.05	2.73	578	0.45	2.09	2.72	578	-4.11	10.79	25	10.34	564
20100413	1.55	2.67	3.54	559	-1.25	2.80	3.73	559	-0.12	2.17	2.69	559	-14.57	64.89	25	-78.85	529
20100617	0.55	1.53	2.02	576	0.72	1.77	2.19	576	-0.79	1.33	1.69	576	12.43	58.05	25	-38.12	539
20100621	-0.63	1.64	2.07	563	0.68	1.96	2.53	563	-0.68	1.80	2.30	563	1.49	36.19	25	-13.01	536
20100627	-0.23	1.54	1.92	585	-0.58	1.47	1.87	585	-0.09	1.28	1.59	591	-14.81	30.12	25	-5.47	509
20100630	0.84	2.09	2.71	606	0.40	2.05	2.64	606	0.25	2.01	2.62	609	-7.84	11.29	25	-6.46	594
20100704	-0.11	1.86	2.43	607	-1.73	2.55	3.21	607	0.91	2.00	2.63	607	13.88	34.10	25	-7.08	559

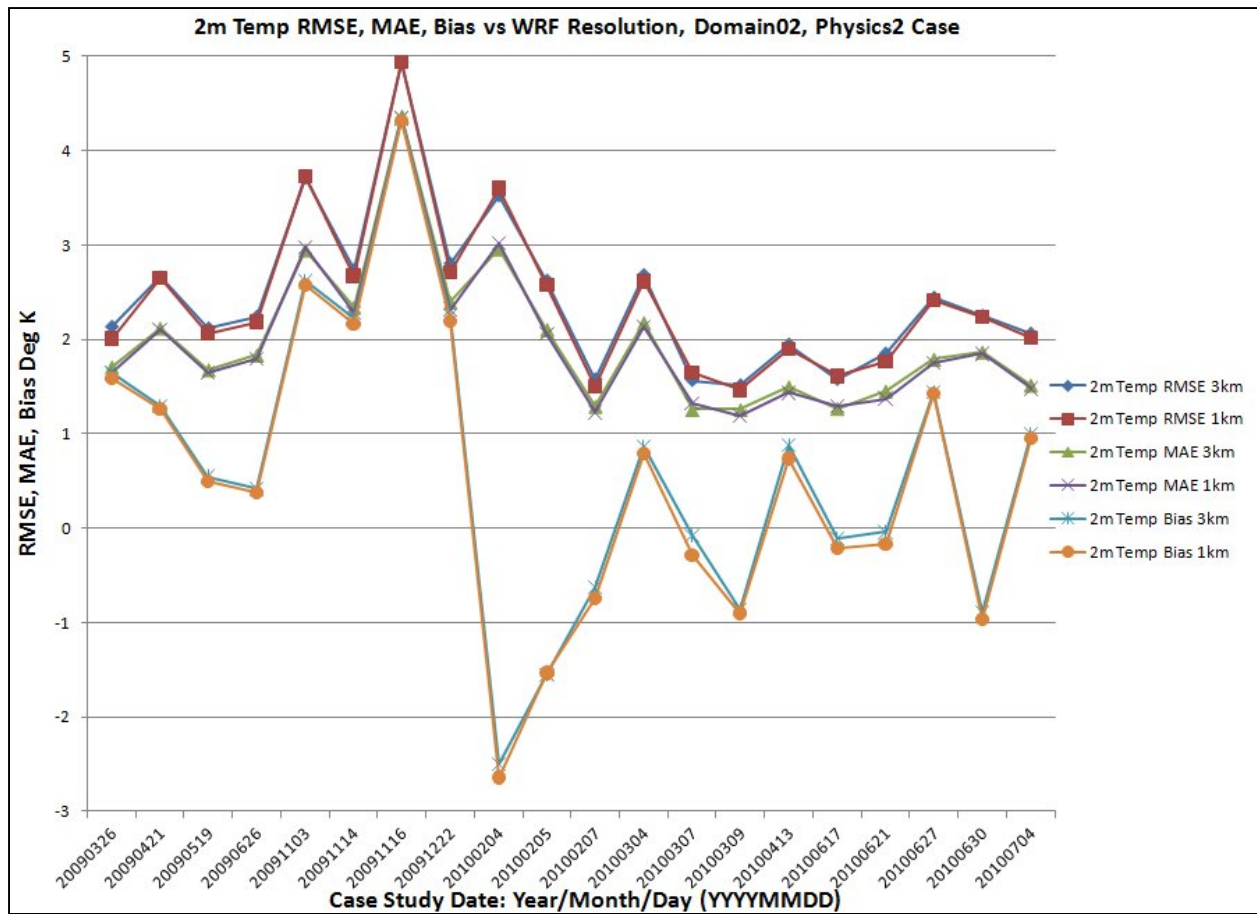


Figure B-10. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

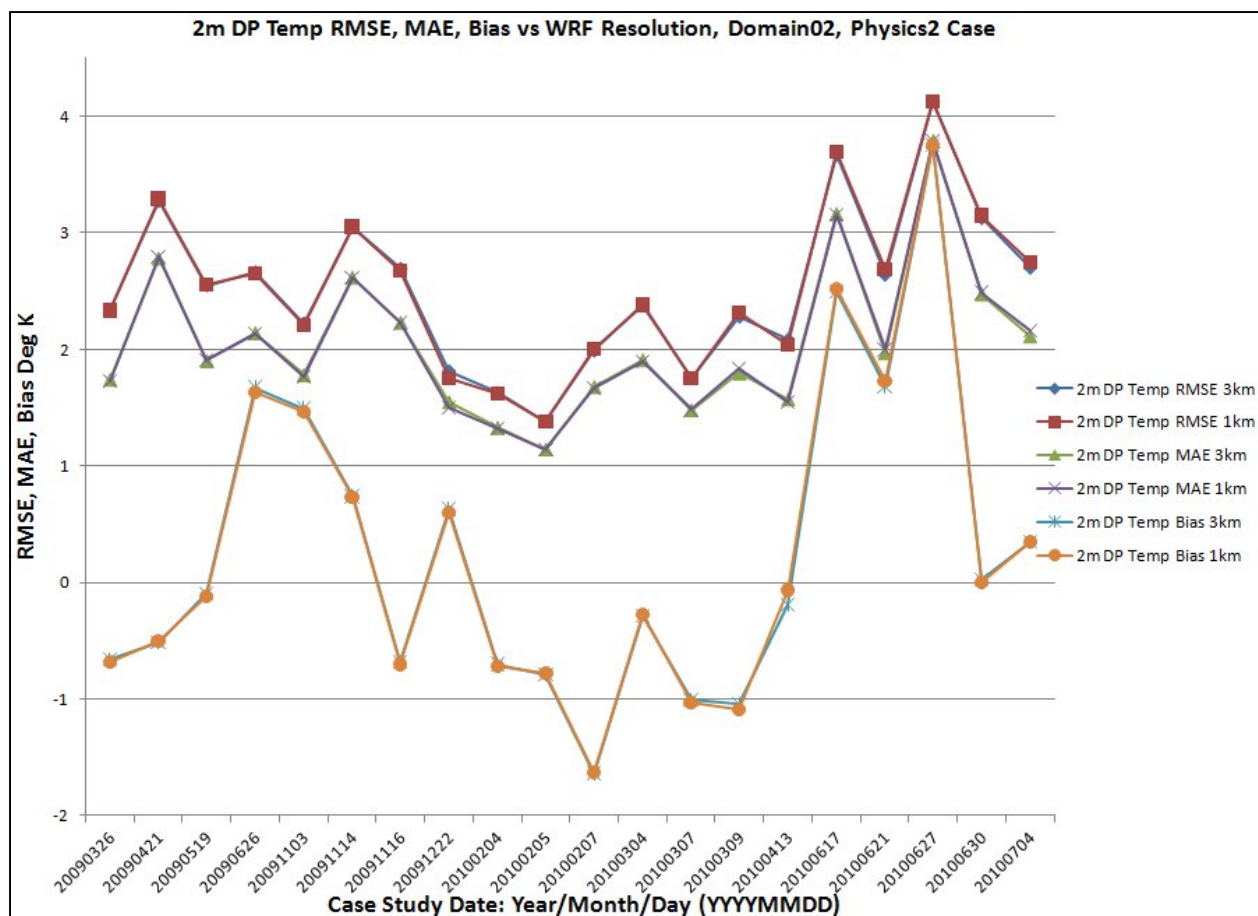


Figure B-11. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

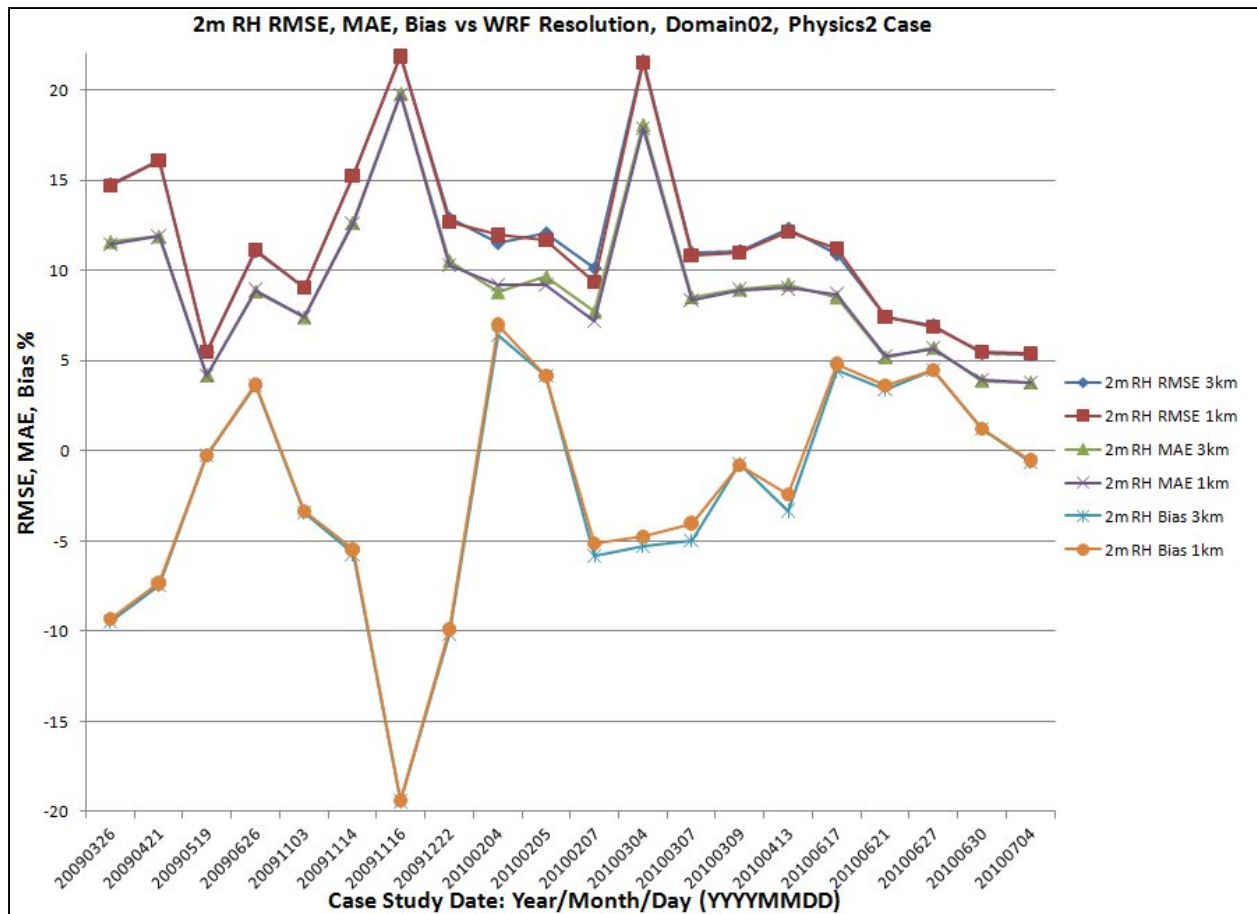


Figure B-12. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

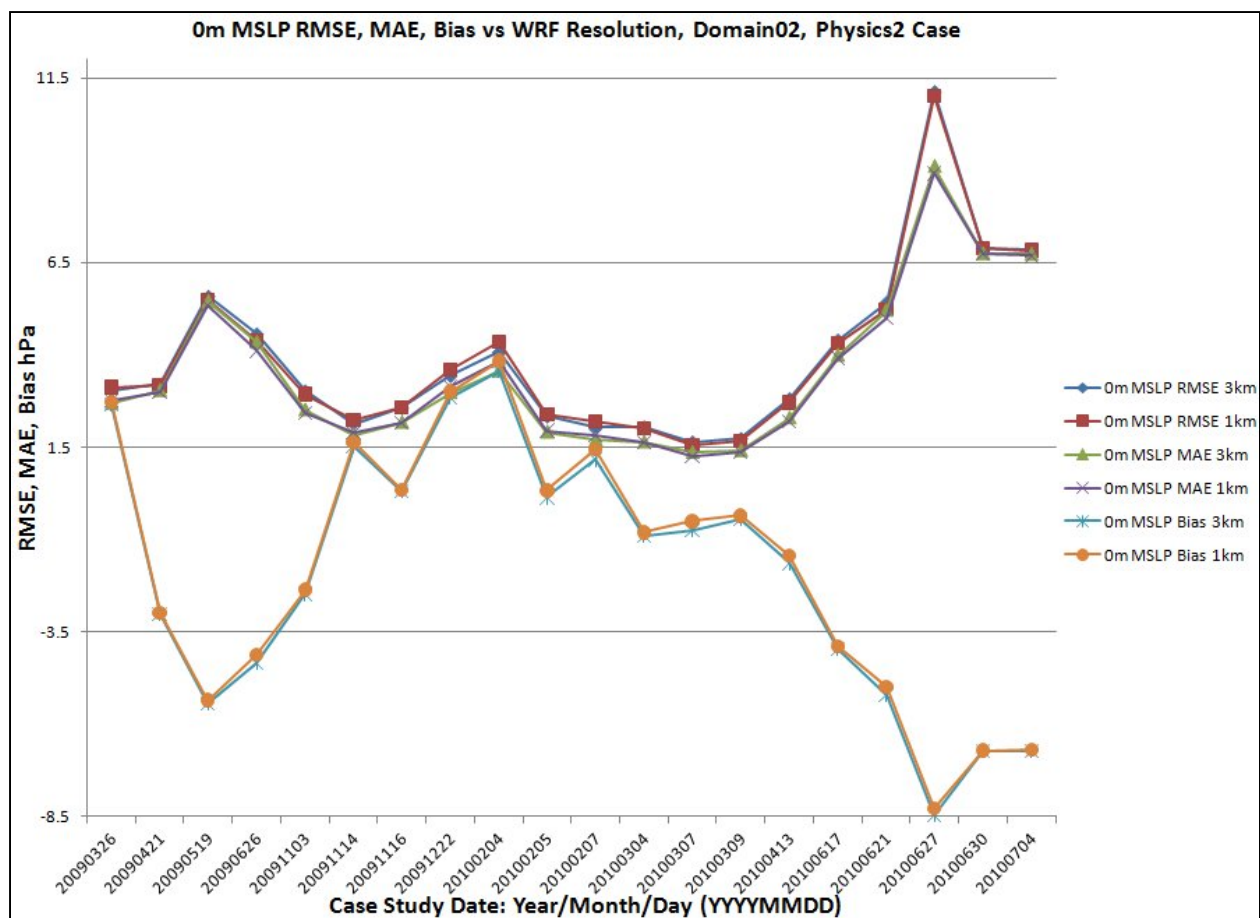


Figure B-13. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

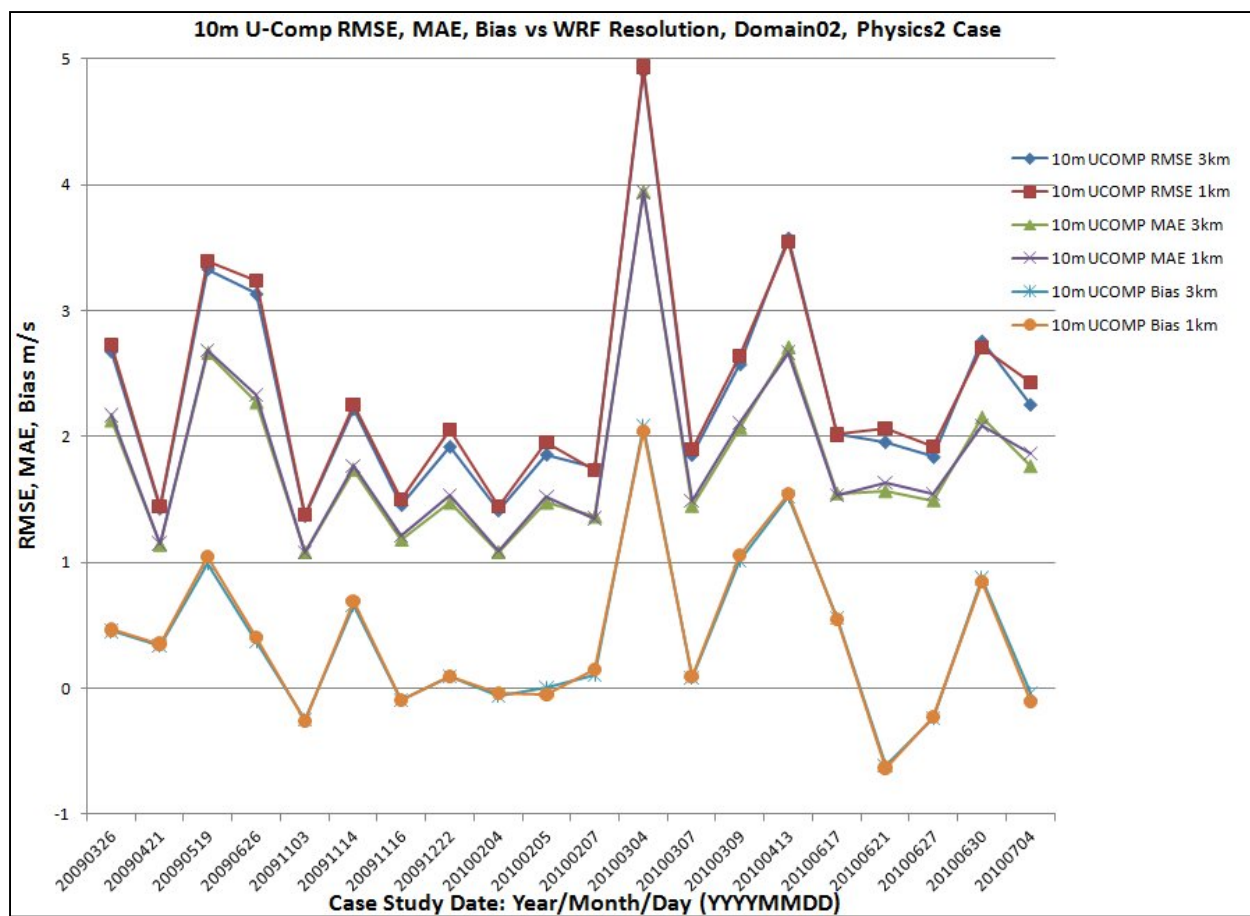


Figure B-14. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

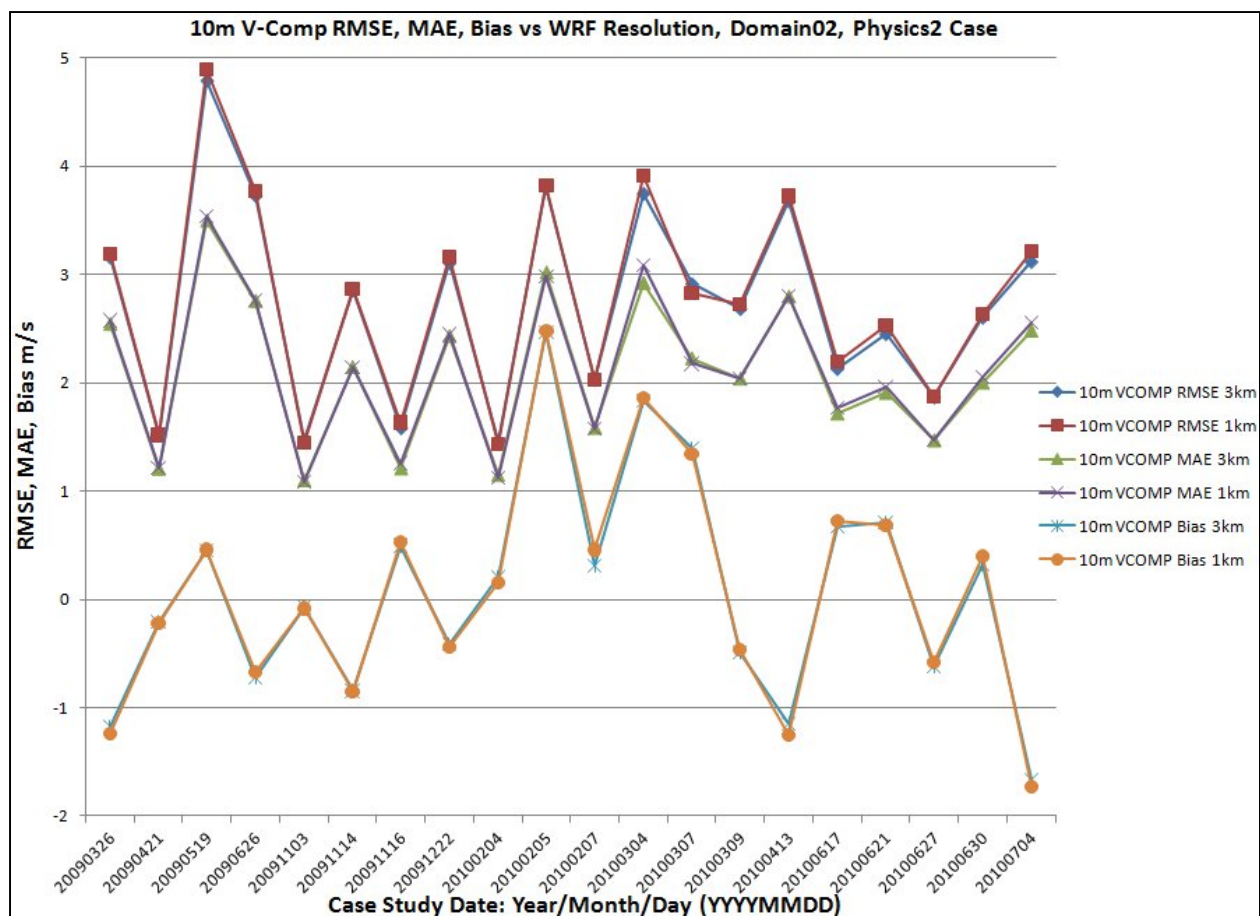


Figure B-15. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

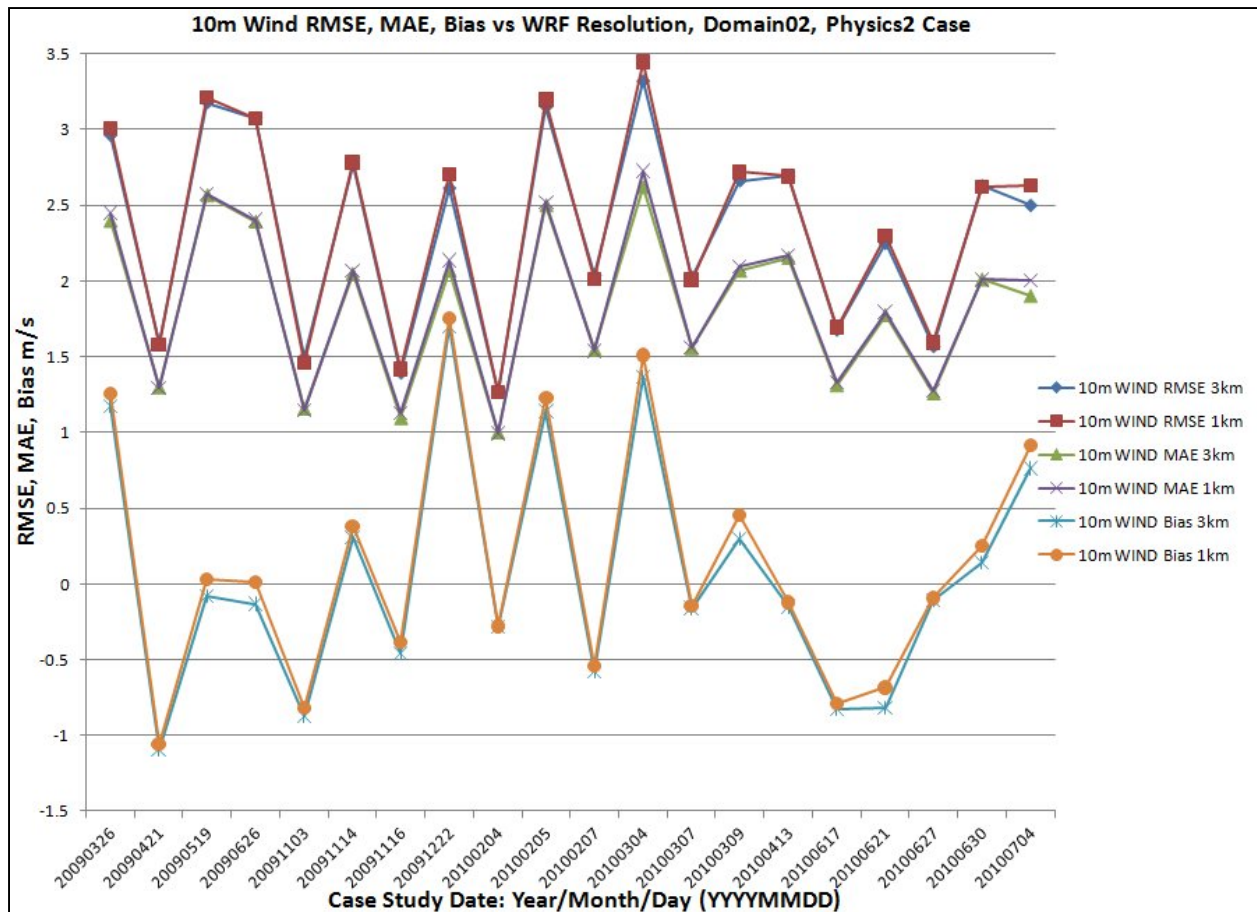


Figure B-16. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

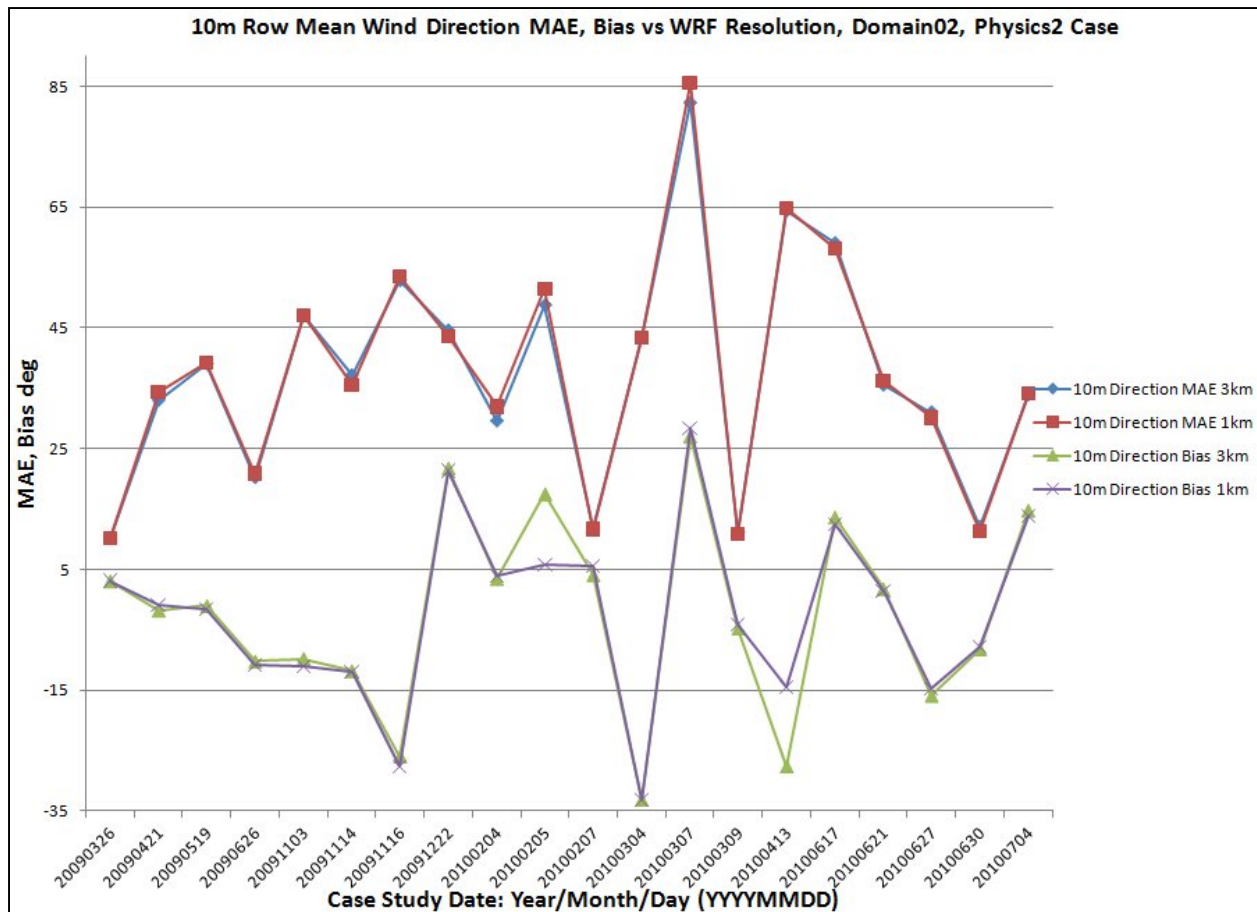


Figure B-17. Comparison of all 10-m row mean wind direction statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

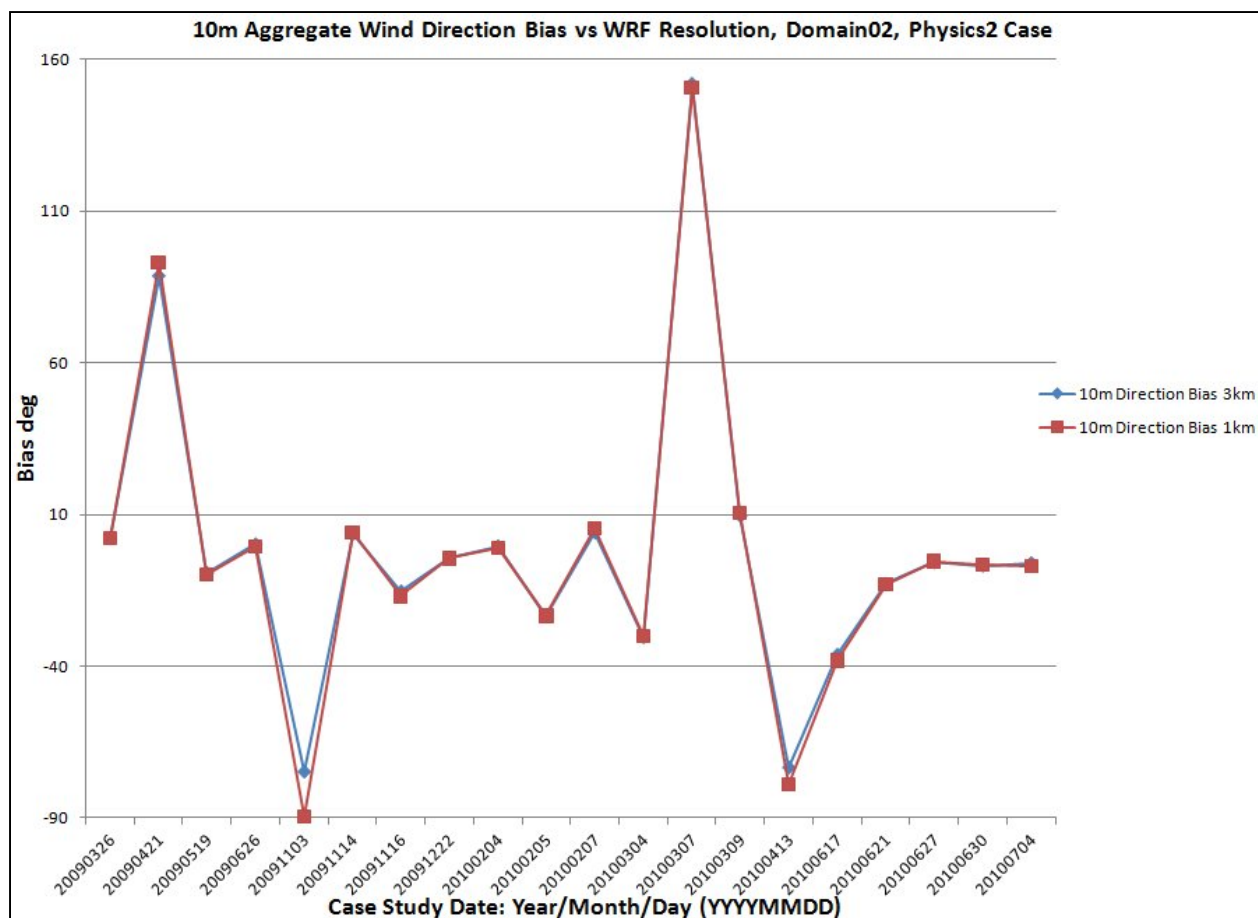


Figure B-18. Comparison of all 10-m aggregate wind direction statistics for 3-km and 1-km WRF, Domain 2, Physics2 setting.

Table B-6. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics8 setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_P8_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.28	1.48	1.96	608	-0.05	1.79	2.27	608	-4.95	11.07	14.21	608	3.12	3.16	3.53	483
20090421	1.29	2.12	2.66	561	-0.52	2.78	3.27	587	-7.46	11.89	16.09	587	-3.03	3.03	3.20	442
20090519	0.72	1.77	2.24	578	-0.63	1.97	2.68	595	-1.24	4.28	5.53	595	-5.79	5.79	5.91	446
20090626	-0.56	2.16	2.59	593	1.86	2.29	2.83	578	7.12	11.40	13.91	578	-3.70	3.71	4.14	459
20091103	2.68	3.00	3.74	538	1.49	1.78	2.22	582	-3.61	7.48	9.12	582	-2.48	2.52	3.04	479
20091114	1.68	2.03	2.53	558	1.46	2.15	2.63	563	-0.64	8.81	11.08	563	2.14	2.19	2.52	468
20091116	4.35	4.37	4.94	539	-0.68	2.23	2.69	560	-19.42	19.84	21.93	560	0.31	2.17	2.56	471
20091222	2.08	2.19	2.61	514	0.58	1.25	1.50	520	-9.33	9.72	12.20	520	3.13	3.28	3.75	378
20100204	-3.13	3.41	4.02	570	-1.10	1.68	2.06	576	10.47	10.85	14.17	576	5.32	5.32	5.69	425
20100205	-1.61	2.22	2.84	578	-1.12	1.40	1.70	579	2.39	9.77	12.16	579	0.28	1.99	2.44	424
20100207	-0.88	1.50	1.77	591	-1.64	1.75	2.15	591	-4.15	7.80	10.24	591	1.46	1.91	2.26	424
20100304	0.26	1.83	2.33	609	0.25	1.82	2.24	610	0.52	15.87	19.44	610	-0.12	1.22	1.49	480
20100307	-0.20	1.41	1.75	595	-0.46	1.22	1.53	599	-1.15	9.21	11.43	599	-0.37	1.15	1.41	470
20100309	-0.81	1.19	1.46	609	-0.95	1.90	2.27	611	-0.24	10.38	12.82	611	-0.20	1.41	1.72	482
20100413	0.44	1.20	1.60	580	-0.17	1.51	2.05	579	-1.32	8.88	11.98	579	-0.99	1.78	2.19	462
20100617	-0.11	1.27	1.58	571	2.50	3.17	3.67	571	4.47	8.51	10.89	571	-3.97	3.98	4.40	471
20100621	-0.06	1.45	1.85	577	1.64	1.96	2.64	573	3.31	5.16	7.44	573	-5.19	5.19	5.41	463
20100627	1.11	1.64	2.26	574	3.93	3.95	4.29	589	5.30	6.30	7.48	589	-8.19	8.84	10.93	435
20100630	-0.98	1.86	2.25	650	-0.24	2.48	3.23	631	1.08	3.87	5.46	631	-6.72	6.75	6.89	445
20100704	1.01	1.55	2.10	608	0.15	2.08	2.63	608	-0.99	3.71	5.18	608	-6.79	6.79	6.93	442

Table B-6. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, Physics8 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	1.01	2.25	2.81	586	-0.88	2.32	2.96	586	1.02	2.21	2.78	586	6.31	11.55	25	6.18	580
20090421	0.34	1.14	1.43	595	-0.21	1.21	1.51	595	-1.10	1.30	1.59	595	-1.65	32.94	25	88.35	502
20090519	1.02	2.86	3.66	537	0.36	3.25	4.42	537	-0.21	2.67	3.31	537	-1.77	33.92	25	-11.16	518
20090626	0.05	2.46	3.31	550	-0.69	3.06	4.09	550	0.29	2.40	3.06	550	-2.63	27.90	25	4.51	526
20091103	-0.26	1.09	1.38	583	-0.09	1.09	1.47	583	-0.87	1.15	1.49	583	-10.77	46.84	25	-94.24	463
20091114	0.65	1.83	2.35	554	-0.63	2.32	3.23	554	0.28	2.11	2.82	554	-5.51	43.58	25	4.76	487
20091116	-0.09	1.18	1.46	565	0.50	1.21	1.58	565	-0.46	1.10	1.40	565	-25.95	52.83	25	-15.28	436
20091222	0.20	1.45	1.90	514	-0.40	2.19	2.82	514	1.55	1.97	2.46	514	22.56	44.58	25	-2.52	403
20100204	0.20	1.19	1.55	576	-0.79	1.43	1.85	576	-0.60	1.03	1.34	576	60.96	77.21	25	41.02	442
20100205	-0.09	1.46	1.83	574	2.68	3.16	3.95	574	1.36	2.57	3.24	574	-14.53	48.91	25	-22.87	473
20100207	-0.01	1.44	1.84	586	0.12	1.54	1.93	586	-0.44	1.53	1.96	586	-0.25	9.73	25	0.56	533
20100304	2.25	3.98	5.00	595	1.54	3.12	3.90	595	1.27	2.72	3.37	595	-33.71	43.59	25	-32.29	571
20100307	0.10	1.43	1.85	596	1.32	2.22	2.88	596	-0.23	1.48	1.93	596	21.55	88.02	25	151.84	460
20100309	1.41	2.24	2.74	578	-0.98	2.25	2.94	578	0.73	2.33	2.98	578	-5.81	12.32	25	9.16	564
20100413	0.95	2.48	3.36	559	-0.40	2.57	3.46	559	0.15	2.07	2.76	559	-4.64	44.30	25	-31.08	529
20100617	0.56	1.55	2.02	576	0.68	1.72	2.13	576	-0.83	1.31	1.68	576	13.62	59.06	25	-36.17	539
20100621	-0.57	1.55	1.93	563	0.80	1.92	2.48	563	-0.89	1.78	2.26	563	1.37	35.45	25	-12.30	536
20100627	-0.23	1.48	1.82	585	-0.53	1.44	1.84	585	-0.22	1.27	1.58	591	-15.91	31.80	25	-6.07	509
20100630	0.90	2.10	2.71	606	0.08	2.08	2.74	606	-0.05	2.03	2.67	609	-8.60	11.89	25	-7.60	594
20100704	0.14	1.73	2.19	607	-1.85	2.61	3.28	607	0.94	2.04	2.65	607	17.07	33.96	25	-4.04	559

Table B-7. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics8 setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_P8_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.23	1.43	1.85	608	-0.09	1.79	2.28	608	-4.92	11.13	14.31	608	3.20	3.22	3.61	483
20090421	1.26	2.11	2.65	561	-0.50	2.80	3.29	587	-7.34	11.88	16.08	587	-2.98	2.98	3.16	442
20090519	0.70	1.75	2.19	578	-0.64	1.98	2.70	595	-1.20	4.31	5.58	595	-5.71	5.71	5.84	446
20090626	-0.59	2.13	2.54	593	1.84	2.29	2.82	578	7.20	11.52	14.04	578	-3.47	3.51	3.97	459
20091103	2.64	3.02	3.76	538	1.46	1.77	2.21	582	-3.54	7.49	9.12	582	-2.38	2.43	2.94	479
20091114	1.64	1.98	2.49	558	1.43	2.13	2.62	563	-0.54	8.83	11.10	563	2.23	2.27	2.61	468
20091116	4.32	4.34	4.93	539	-0.70	2.23	2.67	560	-19.39	19.75	21.87	560	0.34	2.17	2.57	471
20091222	2.00	2.10	2.52	514	0.54	1.22	1.45	520	-9.05	9.41	11.97	520	3.29	3.44	3.92	378
20100204	-3.37	3.59	4.22	570	-1.34	1.81	2.21	576	10.80	11.17	14.59	576	5.79	5.79	6.12	425
20100205	-1.72	2.26	2.91	578	-1.14	1.43	1.73	579	2.81	9.73	12.13	579	0.50	2.05	2.51	424
20100207	-0.99	1.44	1.70	591	-1.66	1.74	2.17	591	-3.66	7.35	9.70	591	1.70	2.06	2.42	424
20100304	0.16	1.80	2.27	609	0.24	1.77	2.20	610	1.00	15.68	19.30	610	0.00	1.24	1.52	480
20100307	-0.31	1.42	1.79	595	-0.47	1.18	1.50	599	-0.57	9.14	11.34	599	-0.16	1.11	1.40	470
20100309	-0.88	1.12	1.41	609	-0.98	1.91	2.29	611	-0.04	10.36	12.72	611	-0.09	1.39	1.69	482
20100413	0.21	1.13	1.49	580	-0.06	1.48	2.03	579	-0.22	8.90	11.95	579	-0.77	1.74	2.11	462
20100617	-0.21	1.29	1.61	571	2.52	3.15	3.70	571	4.85	8.69	11.20	571	-3.89	3.92	4.33	471
20100621	-0.19	1.38	1.77	577	1.69	1.98	2.68	573	3.53	5.24	7.42	573	-4.99	4.99	5.21	463
20100627	1.10	1.61	2.24	574	3.94	3.96	4.31	589	5.24	6.26	7.38	589	-8.00	8.65	10.80	435
20100630	-1.01	1.83	2.22	650	-0.21	2.50	3.28	631	1.12	3.94	5.61	631	-6.73	6.76	6.90	445
20100704	0.96	1.51	2.05	608	0.16	2.10	2.66	608	-0.90	3.74	5.28	608	-6.75	6.75	6.90	442

Table B-7. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, Physics8 setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	1.02	2.29	2.87	586	-0.95	2.37	3.02	586	1.12	2.27	2.86	586	6.36	11.58	25	6.16	580
20090421	0.35	1.15	1.45	595	-0.22	1.21	1.52	595	-1.06	1.29	1.58	595	-0.89	34.32	25	93.01	502
20090519	1.06	2.91	3.75	537	0.36	3.26	4.48	537	-0.08	2.70	3.36	537	-1.36	34.09	25	-11.72	518
20090626	0.08	2.51	3.39	550	-0.63	3.07	4.11	550	0.39	2.45	3.12	550	-3.63	27.48	25	3.38	526
20091103	-0.27	1.09	1.39	583	-0.09	1.09	1.44	583	-0.81	1.14	1.46	583	-11.85	49.06	25	-104.41	463
20091114	0.69	1.88	2.40	554	-0.66	2.33	3.26	554	0.38	2.13	2.84	554	-4.54	42.93	25	5.29	487
20091116	-0.10	1.21	1.50	565	0.53	1.26	1.63	565	-0.38	1.13	1.42	565	-27.66	53.53	25	-16.93	436
20091222	0.22	1.53	2.04	514	-0.40	2.23	2.89	514	1.62	2.05	2.59	514	23.75	45.58	25	-2.51	403
20100204	0.28	1.25	1.62	576	-0.81	1.40	1.81	576	-0.59	1.06	1.38	576	60.62	84.87	25	22.88	442
20100205	-0.14	1.49	1.88	574	2.59	3.09	3.92	574	1.36	2.54	3.23	574	-14.61	49.42	25	-22.33	473
20100207	0.06	1.40	1.80	586	0.18	1.54	1.93	586	-0.37	1.54	1.97	586	1.11	10.01	25	1.74	533
20100304	2.31	4.06	5.10	595	1.54	3.11	3.92	595	1.39	2.68	3.36	595	-34.56	44.46	25	-32.93	571
20100307	0.11	1.48	1.93	596	1.33	2.22	2.87	596	-0.15	1.48	1.94	596	23.15	86.71	25	151.80	460
20100309	1.41	2.27	2.79	578	-0.94	2.19	2.90	578	0.88	2.32	3.00	578	-5.24	11.97	25	9.55	564
20100413	0.98	2.51	3.42	559	-0.54	2.51	3.27	559	0.09	2.07	2.71	559	-19.23	46.87	25	-34.21	529
20100617	0.54	1.53	2.02	576	0.72	1.77	2.19	576	-0.79	1.34	1.70	576	12.30	57.98	25	-38.12	539
20100621	-0.59	1.62	2.03	563	0.78	2.00	2.57	563	-0.77	1.81	2.32	563	2.39	35.67	25	-12.57	536
20100627	-0.23	1.52	1.89	585	-0.48	1.43	1.84	585	-0.22	1.27	1.59	591	-14.95	30.81	25	-5.81	509
20100630	0.84	2.07	2.68	606	0.17	2.09	2.76	606	0.05	2.01	2.67	609	-8.02	11.47	25	-6.89	594
20100704	0.05	1.78	2.31	607	-1.93	2.69	3.38	607	1.05	2.12	2.79	607	15.83	34.26	25	-5.62	559

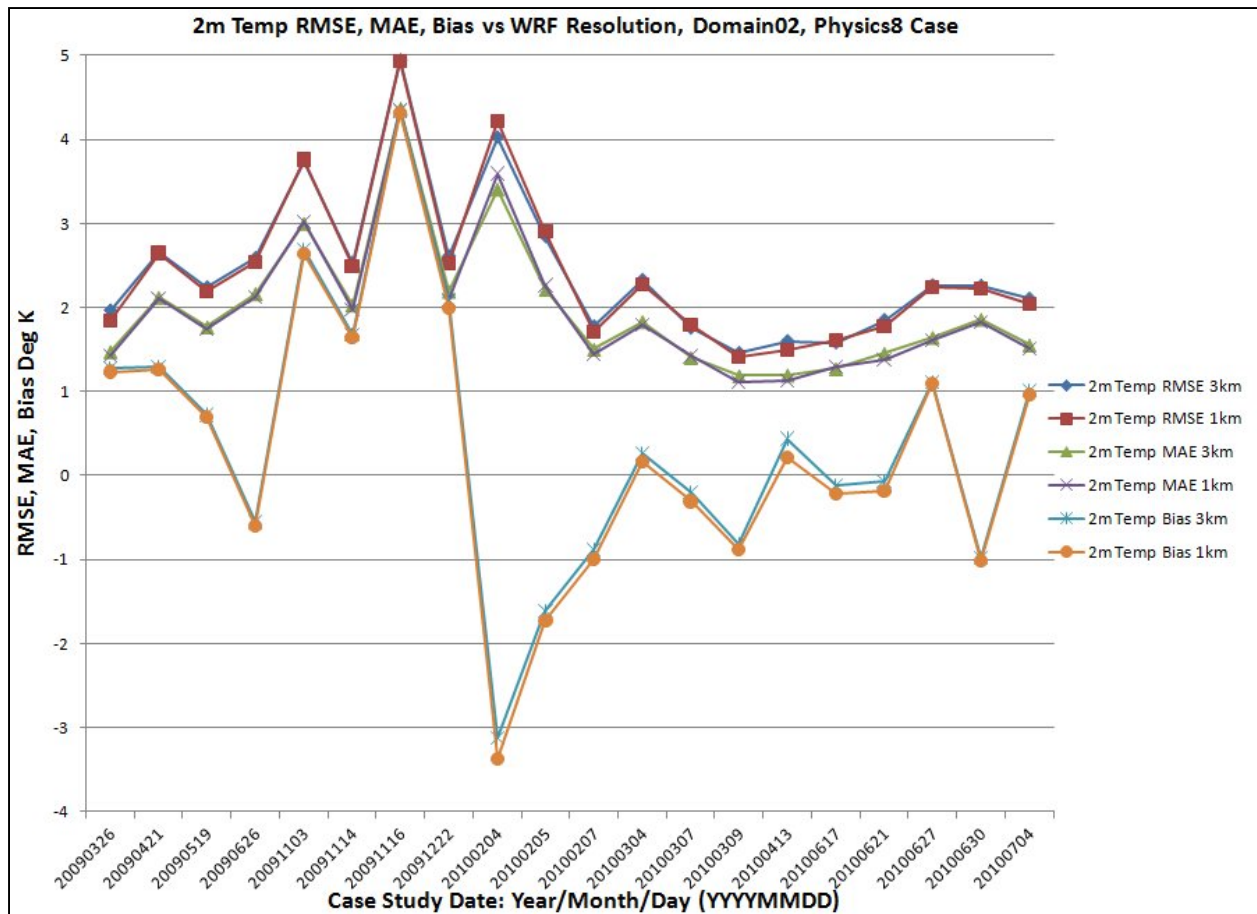


Figure B-19. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

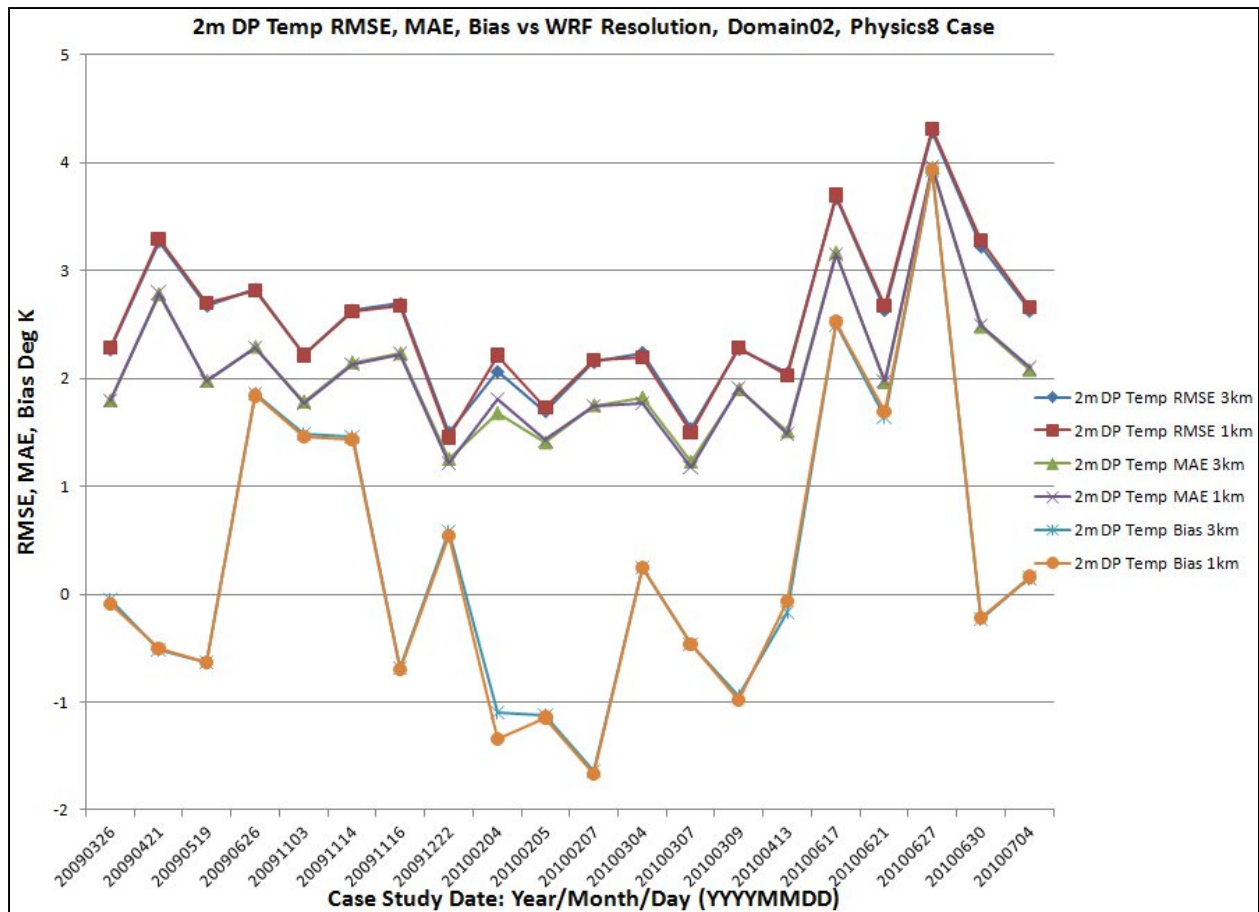


Figure B-20. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

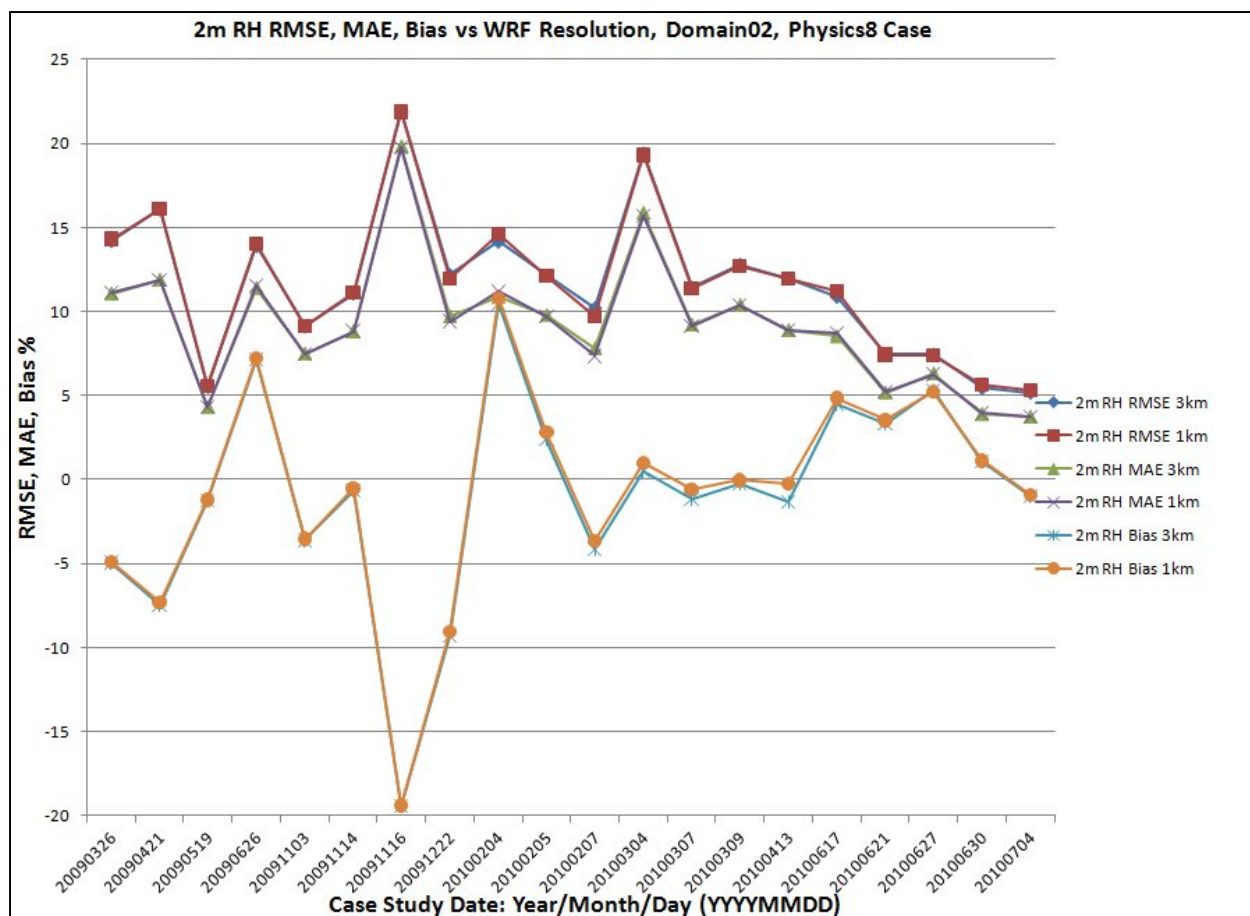


Figure B-21. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

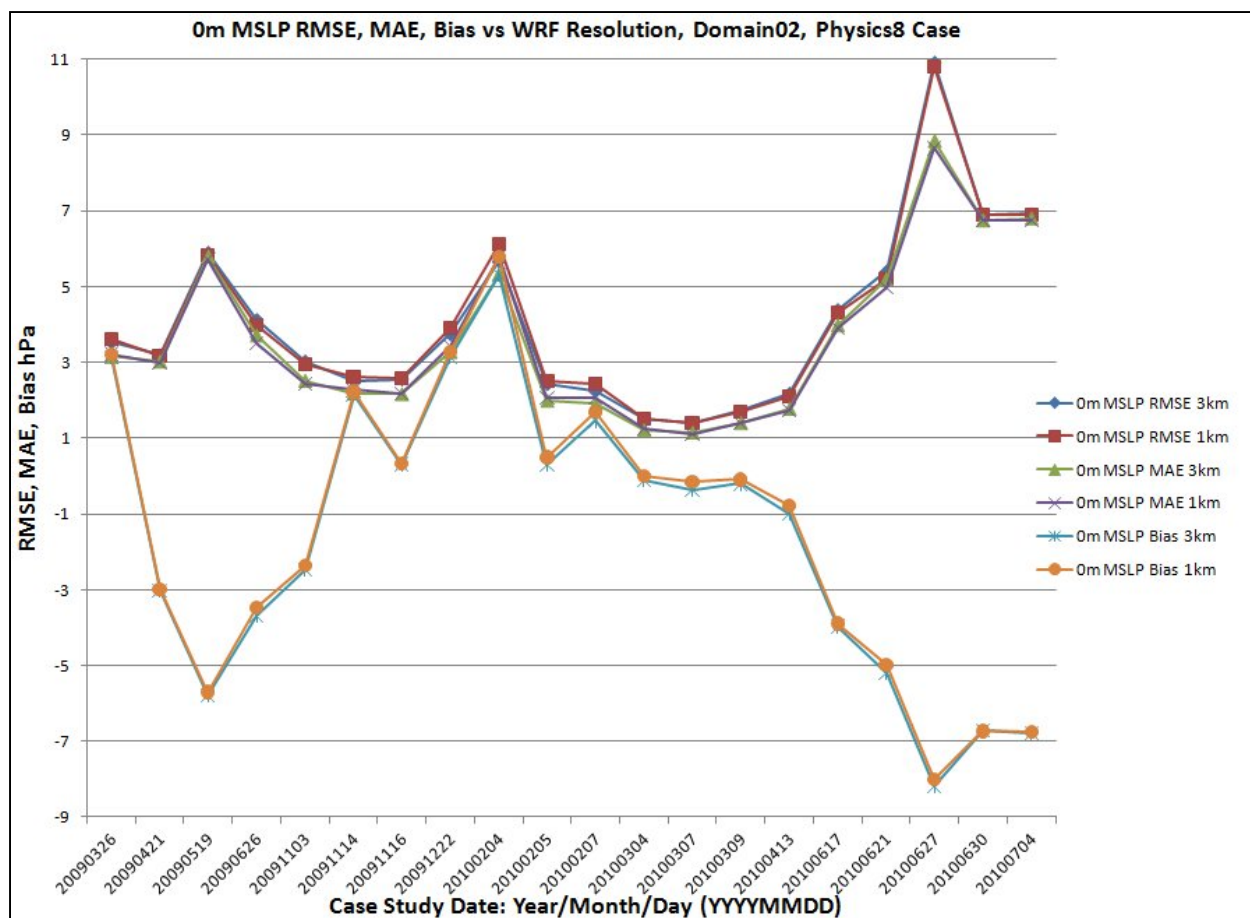


Figure B-22. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

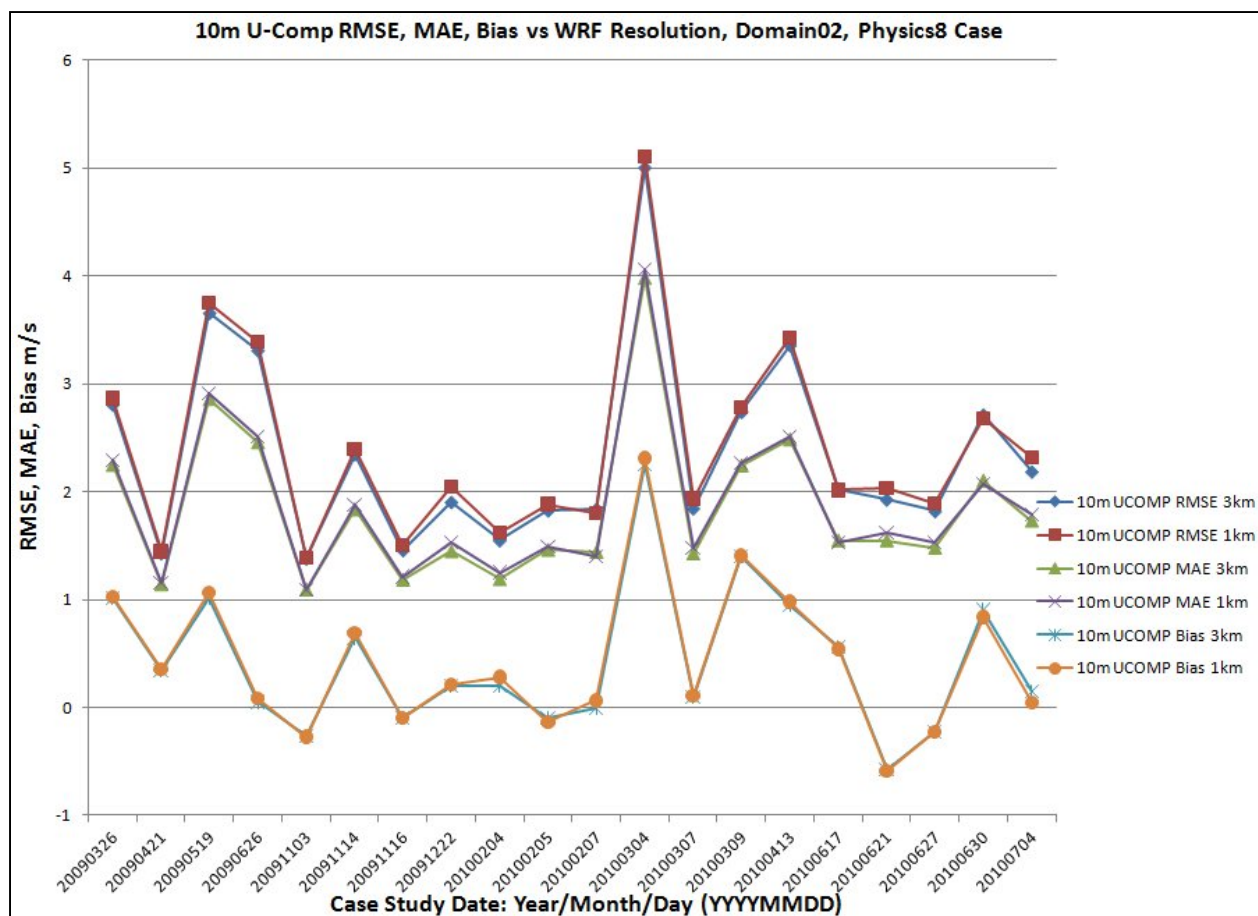


Figure B-23. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

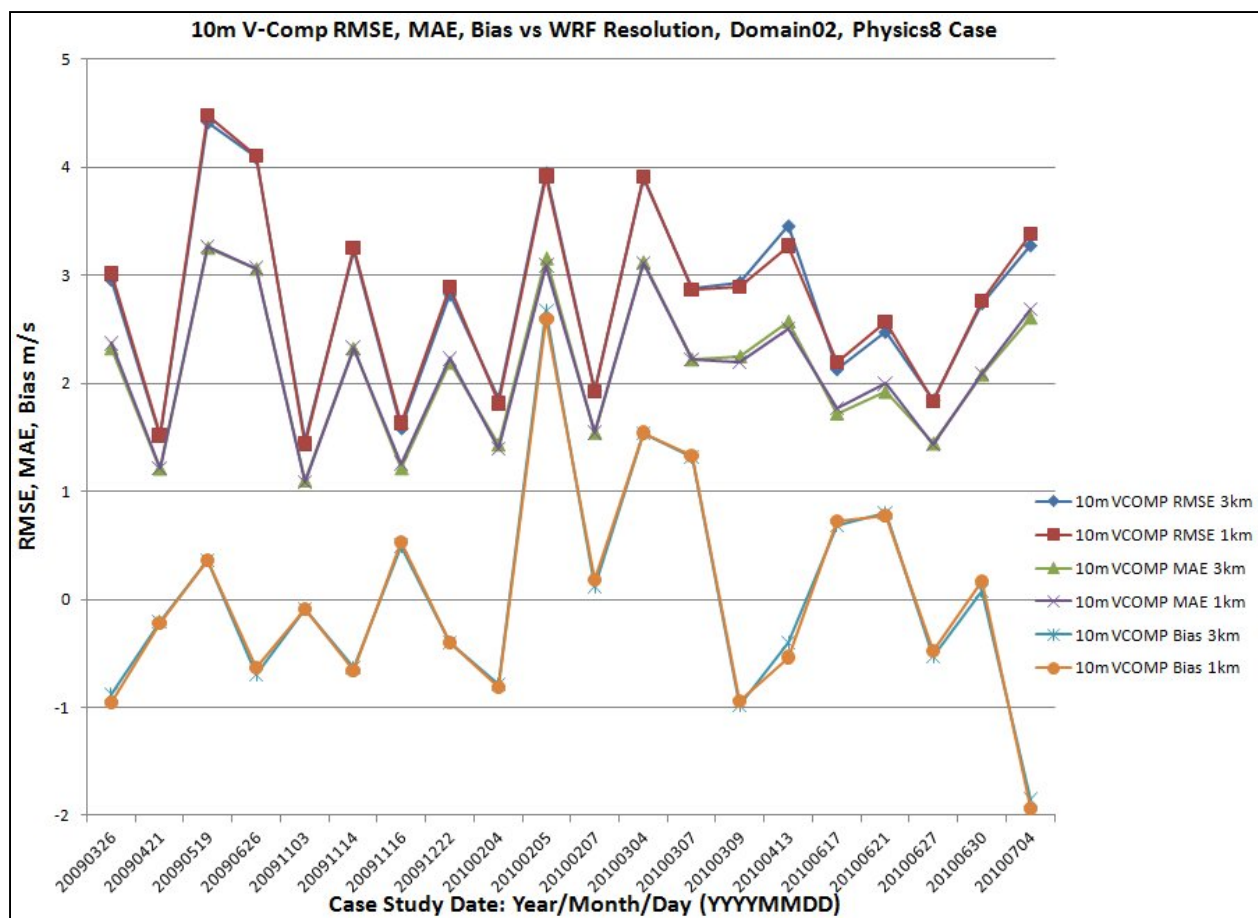


Figure B-24. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

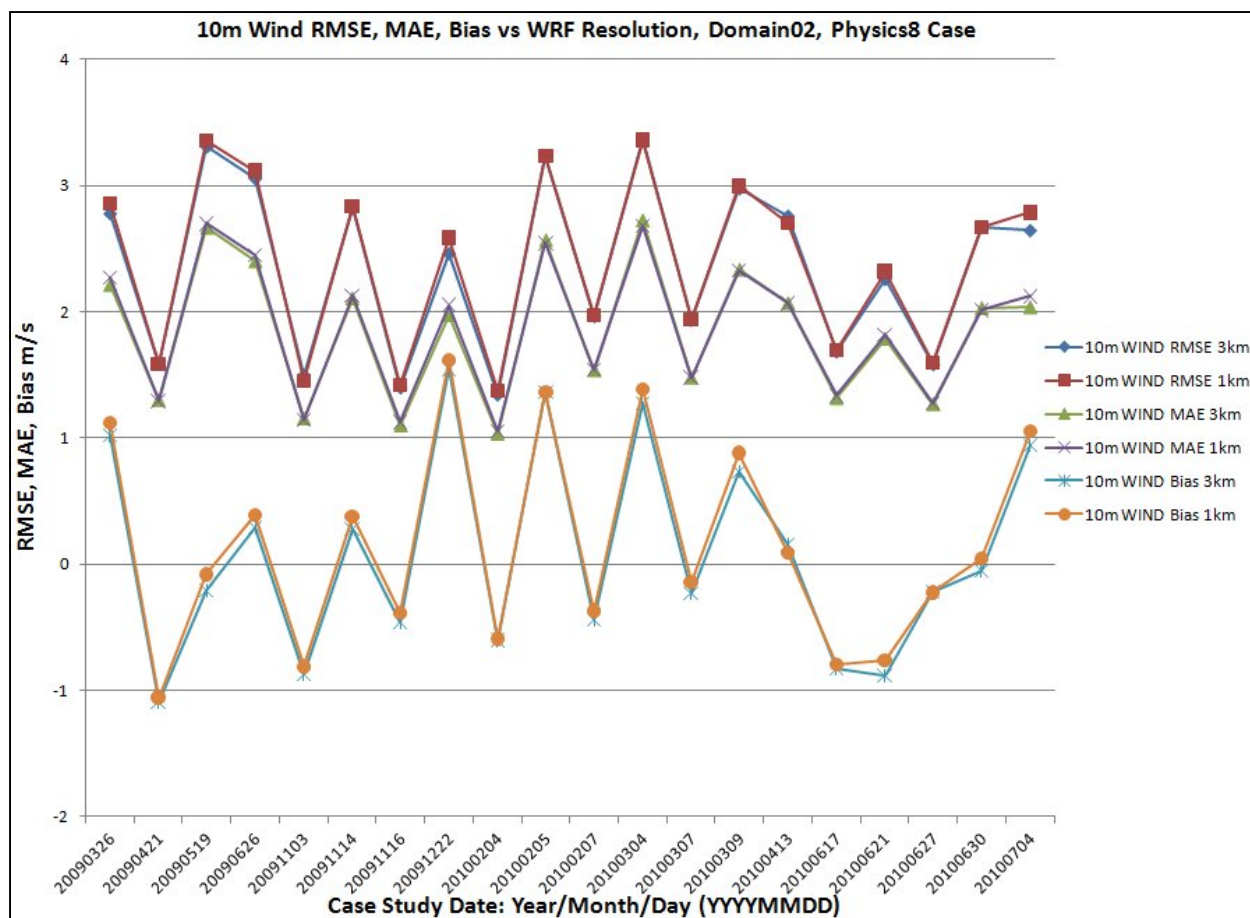


Figure B-25. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, Physics8 setting.

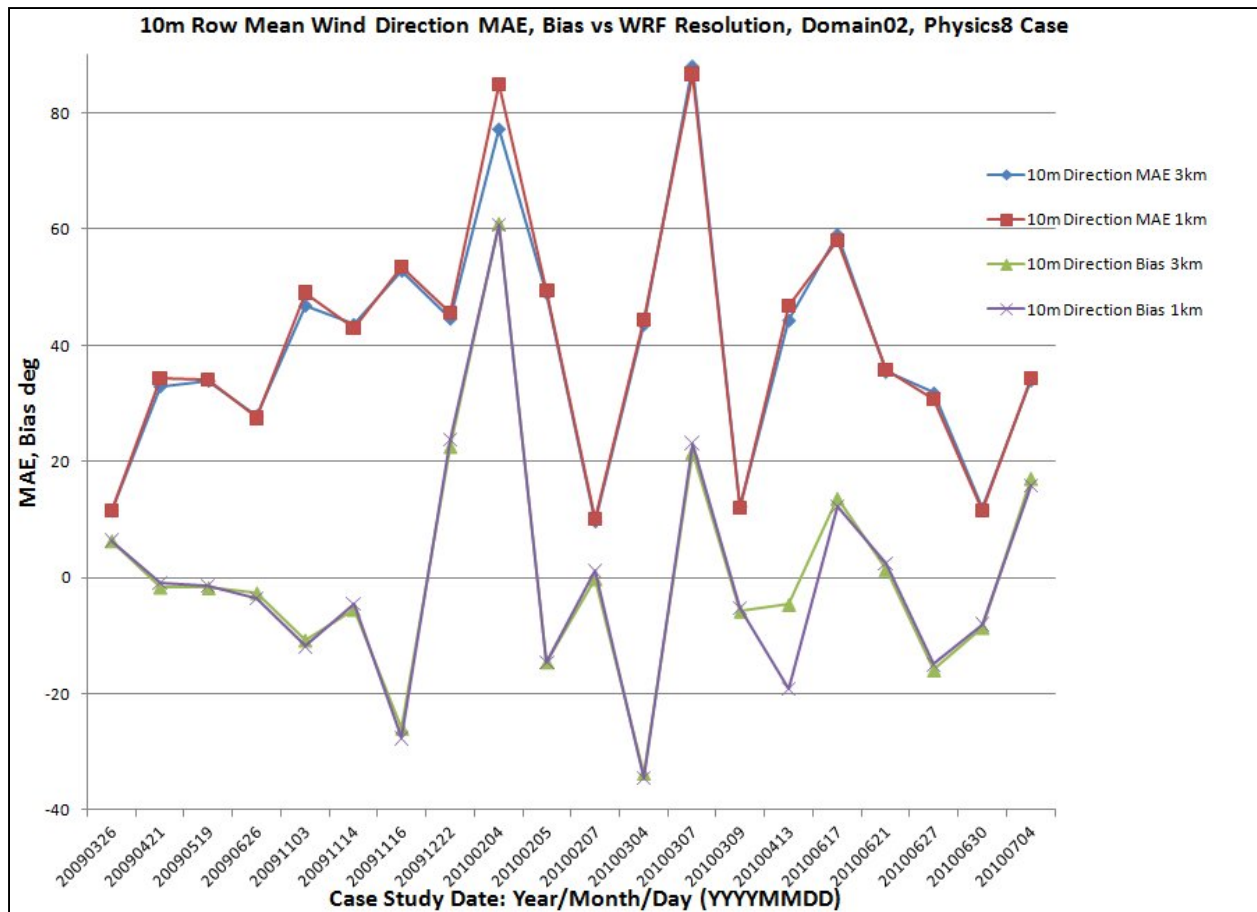


Figure B-26. Comparison of all 10-m row mean wind direction statistics (MAE and Bias only) for 3-km and 1-km WRF, Domain 2, Physics8 setting.

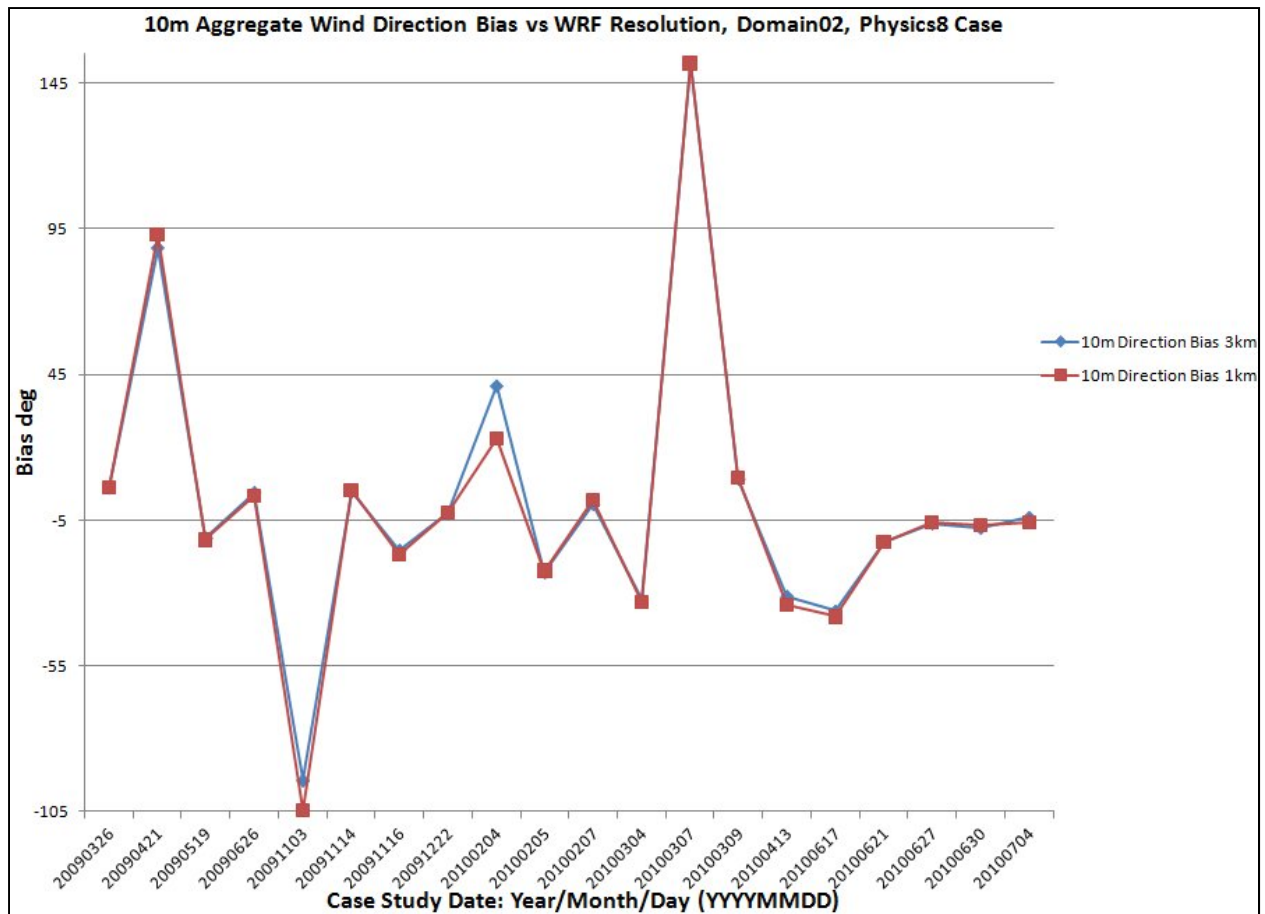


Figure B-27. Comparison of all 10-m aggregate wind direction statistics (Bias only) for 3-km and 1-km WRF, Domain 2, Physics8 setting.

Table B-8. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 3Second setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_T3_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.57	1.68	2.10	608	-0.55	1.81	2.39	608	-8.53	11.80	14.96	608	2.76	2.80	3.13	483
20090421	1.33	2.12	2.66	561	-0.44	2.77	3.27	587	-7.30	11.77	15.90	587	-3.13	3.13	3.30	442
20090519	0.49	1.60	2.00	578	-0.03	1.71	2.28	595	-0.27	3.76	4.89	595	-5.49	5.49	5.60	446
20090626	-1.36	2.65	3.24	593	2.55	2.77	3.37	578	11.50	14.82	17.66	578	-3.03	3.09	3.66	459
20091103	3.20	3.46	4.14	538	1.03	1.66	2.08	582	-6.49	9.71	11.49	582	-3.00	3.01	3.45	479
20091114	2.12	2.27	2.75	558	1.03	2.46	2.93	563	-4.24	10.63	13.10	563	1.72	1.84	2.17	468
20091116	4.92	4.93	5.40	539	-0.79	2.26	2.70	560	-21.45	21.78	23.78	560	-0.38	2.40	2.79	471
20091222	2.17	2.27	2.76	514	0.64	1.39	1.67	520	-9.47	9.75	12.53	520	2.77	2.96	3.43	378
20100204	-2.30	2.69	3.29	570	-0.39	1.20	1.51	576	10.38	10.61	13.94	576	4.63	4.63	5.04	425
20100205	-1.57	2.13	2.73	578	-0.85	1.20	1.50	579	3.75	9.99	12.34	579	0.26	1.90	2.30	424
20100207	-1.14	1.55	1.82	591	-1.58	1.72	2.19	591	-2.35	6.86	9.02	591	1.52	1.89	2.23	424
20100304	0.63	1.97	2.47	609	-0.16	1.89	2.33	610	-3.51	16.97	20.61	610	-0.59	1.35	1.69	480
20100307	-0.66	1.61	2.04	595	-0.70	1.28	1.56	599	0.11	10.16	12.33	599	-0.24	1.01	1.29	470
20100309	-1.28	1.50	1.76	609	-1.09	2.01	2.42	611	1.24	9.30	11.54	611	0.19	1.39	1.73	482
20100413	0.25	1.38	1.91	580	0.49	1.54	1.99	579	2.00	9.07	11.93	579	-0.93	1.64	2.09	462
20100617	-0.01	1.25	1.56	571	2.51	3.16	3.66	571	4.38	8.33	10.80	571	-4.03	4.04	4.45	471
20100621	0.04	1.47	1.87	577	1.59	1.87	2.55	573	3.13	4.95	7.33	573	-5.34	5.34	5.54	463
20100627	1.17	1.65	2.28	574	3.85	3.88	4.22	589	5.09	6.19	7.38	589	-8.27	8.92	11.00	435
20100630	-0.96	1.89	2.28	650	1.57	2.91	3.89	631	2.71	4.54	6.08	631	-6.69	6.72	6.88	445
20100704	1.14	1.60	2.17	608	0.21	2.07	2.63	608	-1.08	3.69	5.15	608	-6.89	6.89	7.02	442

Table B-8. Error statistics for surface meteorological variables for 3-km WRF, Domain 2,
3Second setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.61	2.19	2.76	586	-1.09	2.43	3.05	586	1.14	2.32	2.88	586	3.68	10.06	25	3.21	580
20090421	0.35	1.16	1.46	595	-0.25	1.24	1.54	595	-1.13	1.32	1.62	595	4.58	40.53	25	93.71	502
20090519	0.92	2.61	3.22	537	0.35	3.20	4.18	537	-0.17	2.60	3.25	537	-6.92	30.04	25	-10.07	518
20090626	-0.87	2.26	3.03	550	-0.06	2.91	3.83	550	0.50	2.54	3.24	550	5.97	18.90	25	11.19	526
20091103	-0.41	1.15	1.42	583	-0.18	1.12	1.52	583	-0.76	1.14	1.47	583	-2.87	56.88	25	-134.48	463
20091114	0.64	1.70	2.14	554	-0.83	2.03	2.65	554	0.34	1.88	2.46	554	2.02	36.17	25	3.52	487
20091116	0.06	1.16	1.42	565	0.46	1.15	1.52	565	-0.56	1.07	1.38	565	-17.40	54.03	25	-21.76	436
20091222	0.13	1.49	1.94	514	-0.39	2.35	2.98	514	1.63	2.07	2.59	514	24.58	47.45	25	-3.36	403
20100204	-0.07	1.13	1.47	576	-0.03	1.21	1.52	576	-0.37	1.05	1.36	576	8.23	29.59	25	4.15	442
20100205	-0.15	1.49	1.86	574	2.77	3.23	4.00	574	1.39	2.63	3.29	574	-12.68	48.36	25	-22.27	473
20100207	0.08	1.27	1.64	586	0.37	1.56	1.98	586	-0.66	1.51	1.98	586	3.26	10.00	25	3.92	533
20100304	2.26	4.11	5.10	595	1.87	3.02	3.82	595	1.44	2.74	3.40	595	-32.51	42.72	25	-32.11	571
20100307	-0.17	1.41	1.82	596	1.52	2.31	2.96	596	-0.23	1.55	2.00	596	10.72	94.58	25	171.20	460
20100309	1.20	2.23	2.74	578	-0.78	2.29	3.07	578	0.43	2.37	3.05	578	-8.75	13.38	25	8.82	564
20100413	0.38	2.33	3.19	559	-0.65	2.45	3.21	559	-0.37	1.97	2.54	559	-3.69	46.26	25	-7.43	529
20100617	0.59	1.50	1.96	576	0.46	1.63	2.04	576	-0.95	1.34	1.70	576	16.72	56.94	25	-23.39	539
20100621	-0.66	1.54	1.93	563	0.67	1.85	2.40	563	-0.82	1.75	2.23	563	1.88	33.98	25	-13.48	536
20100627	-0.22	1.46	1.80	585	-0.56	1.46	1.87	585	-0.17	1.27	1.58	591	-15.22	31.24	25	-5.63	509
20100630	0.05	2.33	3.11	606	0.90	2.24	2.85	606	0.65	2.24	2.86	609	-1.39	13.25	25	0.22	594
20100704	0.00	1.73	2.22	607	-1.78	2.55	3.21	607	0.84	1.96	2.57	607	16.18	34.81	25	-5.81	559

Table B-9. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 3Second setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_T3_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.52	1.62	1.99	608	-0.58	1.80	2.38	608	-8.40	11.70	14.91	608	2.84	2.87	3.21	483
20090421	1.30	2.11	2.65	561	-0.43	2.77	3.28	587	-7.18	11.77	15.89	587	-3.08	3.08	3.26	442
20090519	0.45	1.57	1.94	578	-0.05	1.70	2.28	595	-0.25	3.76	4.88	595	-5.40	5.40	5.52	446
20090626	-1.40	2.64	3.23	593	2.52	2.75	3.36	578	11.59	14.95	17.83	578	-2.79	2.91	3.51	459
20091103	2.92	3.23	3.90	538	1.10	1.69	2.13	582	-5.36	8.45	9.98	582	-2.73	2.76	3.24	479
20091114	2.06	2.23	2.71	558	1.01	2.46	2.94	563	-4.04	10.64	13.16	563	1.81	1.92	2.28	468
20091116	4.89	4.90	5.39	539	-0.81	2.26	2.69	560	-21.42	21.68	23.73	560	-0.34	2.40	2.79	471
20091222	2.08	2.16	2.63	514	0.63	1.36	1.65	520	-8.94	9.23	11.97	520	2.97	3.13	3.61	378
20100204	-2.44	2.80	3.41	570	-0.35	1.29	1.60	576	11.48	11.66	15.31	576	4.99	4.99	5.34	425
20100205	-1.65	2.15	2.75	578	-0.84	1.20	1.50	579	4.22	9.71	12.07	579	0.49	1.98	2.41	424
20100207	-1.20	1.48	1.77	591	-1.59	1.71	2.20	591	-2.08	6.63	8.87	591	1.74	2.04	2.40	424
20100304	0.53	1.91	2.39	609	-0.13	1.86	2.31	610	-2.84	16.78	20.49	610	-0.47	1.34	1.67	480
20100307	-0.68	1.61	2.02	595	-0.71	1.29	1.55	599	0.09	9.69	11.84	599	-0.05	1.01	1.30	470
20100309	-1.26	1.39	1.67	609	-1.15	2.03	2.44	611	0.83	9.39	11.58	611	0.26	1.38	1.72	482
20100413	0.12	1.29	1.74	580	0.41	1.49	1.93	579	1.91	8.65	11.48	579	-0.79	1.61	2.04	462
20100617	-0.10	1.29	1.60	571	2.55	3.19	3.73	571	4.72	8.61	11.21	571	-3.93	3.95	4.35	471
20100621	-0.11	1.38	1.78	577	1.66	1.92	2.62	573	3.40	5.11	7.33	573	-5.11	5.11	5.32	463
20100627	1.13	1.62	2.25	574	3.88	3.91	4.26	589	5.13	6.19	7.35	589	-8.06	8.71	10.84	435
20100630	-1.02	1.89	2.29	650	1.58	2.98	4.01	631	2.80	4.69	6.32	631	-6.64	6.68	6.82	445
20100704	1.08	1.54	2.10	608	0.22	2.10	2.67	608	-0.96	3.71	5.27	608	-6.83	6.83	6.97	442

Table B-9. Error statistics for surface meteorological variables for 1-km WRF, Domain 2,
3Second setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.61	2.23	2.82	586	-1.14	2.44	3.08	586	1.21	2.35	2.93	586	3.66	10.09	25	3.17	580
20090421	0.38	1.17	1.49	595	-0.26	1.23	1.55	595	-1.09	1.31	1.61	595	5.32	42.27	25	97.97	502
20090519	1.01	2.70	3.35	537	0.37	3.23	4.24	537	-0.03	2.65	3.33	537	-7.61	30.29	25	-10.80	518
20090626	-0.85	2.29	3.09	550	-0.06	2.93	3.85	550	0.59	2.57	3.27	550	5.71	19.16	25	10.86	526
20091103	-0.27	1.09	1.38	583	-0.16	1.09	1.46	583	-0.79	1.12	1.42	583	-9.99	50.27	25	-95.63	463
20091114	0.70	1.75	2.21	554	-0.84	2.05	2.67	554	0.43	1.89	2.48	554	2.46	35.71	25	4.24	487
20091116	0.05	1.19	1.46	565	0.49	1.20	1.57	565	-0.49	1.09	1.40	565	-18.26	54.65	25	-22.66	436
20091222	0.13	1.59	2.09	514	-0.42	2.34	2.98	514	1.65	2.13	2.67	514	24.54	47.98	25	-3.92	403
20100204	0.07	1.16	1.50	576	-0.09	1.18	1.50	576	-0.42	1.08	1.40	576	2.58	34.36	25	-2.20	442
20100205	-0.22	1.55	1.96	574	2.74	3.21	4.02	574	1.46	2.63	3.33	574	-11.90	48.73	25	-21.41	473
20100207	0.09	1.30	1.67	586	0.49	1.55	1.99	586	-0.63	1.54	2.00	586	3.89	10.07	25	4.12	533
20100304	2.25	4.17	5.21	595	1.91	3.03	3.83	595	1.58	2.75	3.43	595	-32.62	43.02	25	-31.97	571
20100307	-0.12	1.44	1.87	596	1.57	2.35	3.00	596	-0.13	1.61	2.05	596	21.94	95.95	25	169.10	460
20100309	1.25	2.27	2.83	578	-0.77	2.28	3.08	578	0.62	2.36	3.08	578	-8.30	13.11	25	9.34	564
20100413	0.61	2.35	3.17	559	-0.72	2.56	3.32	559	-0.28	2.11	2.70	559	-10.45	47.15	25	-18.80	529
20100617	0.61	1.49	1.98	576	0.48	1.64	2.05	576	-0.92	1.35	1.71	576	15.80	55.37	25	-25.10	539
20100621	-0.66	1.60	2.03	563	0.65	1.91	2.47	563	-0.69	1.77	2.27	563	2.11	33.75	25	-13.51	536
20100627	-0.21	1.52	1.87	585	-0.51	1.44	1.85	585	-0.19	1.29	1.60	591	-14.27	30.24	25	-5.49	509
20100630	0.00	2.31	3.12	606	0.95	2.26	2.87	606	0.72	2.23	2.86	609	-0.89	13.12	25	0.71	594
20100704	-0.09	1.82	2.39	607	-1.84	2.61	3.32	607	0.97	2.05	2.73	607	14.64	34.64	25	-7.22	559

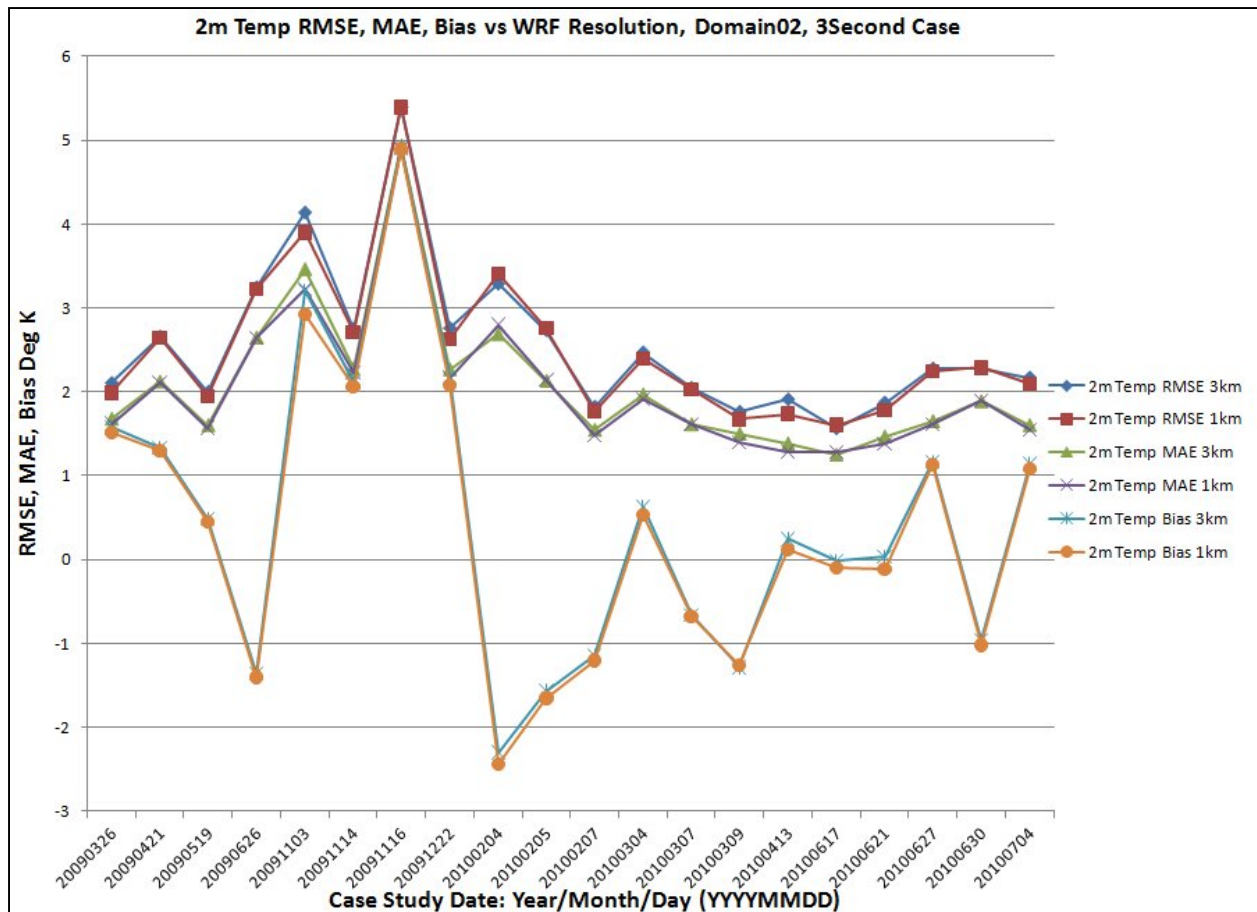


Figure B-28. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

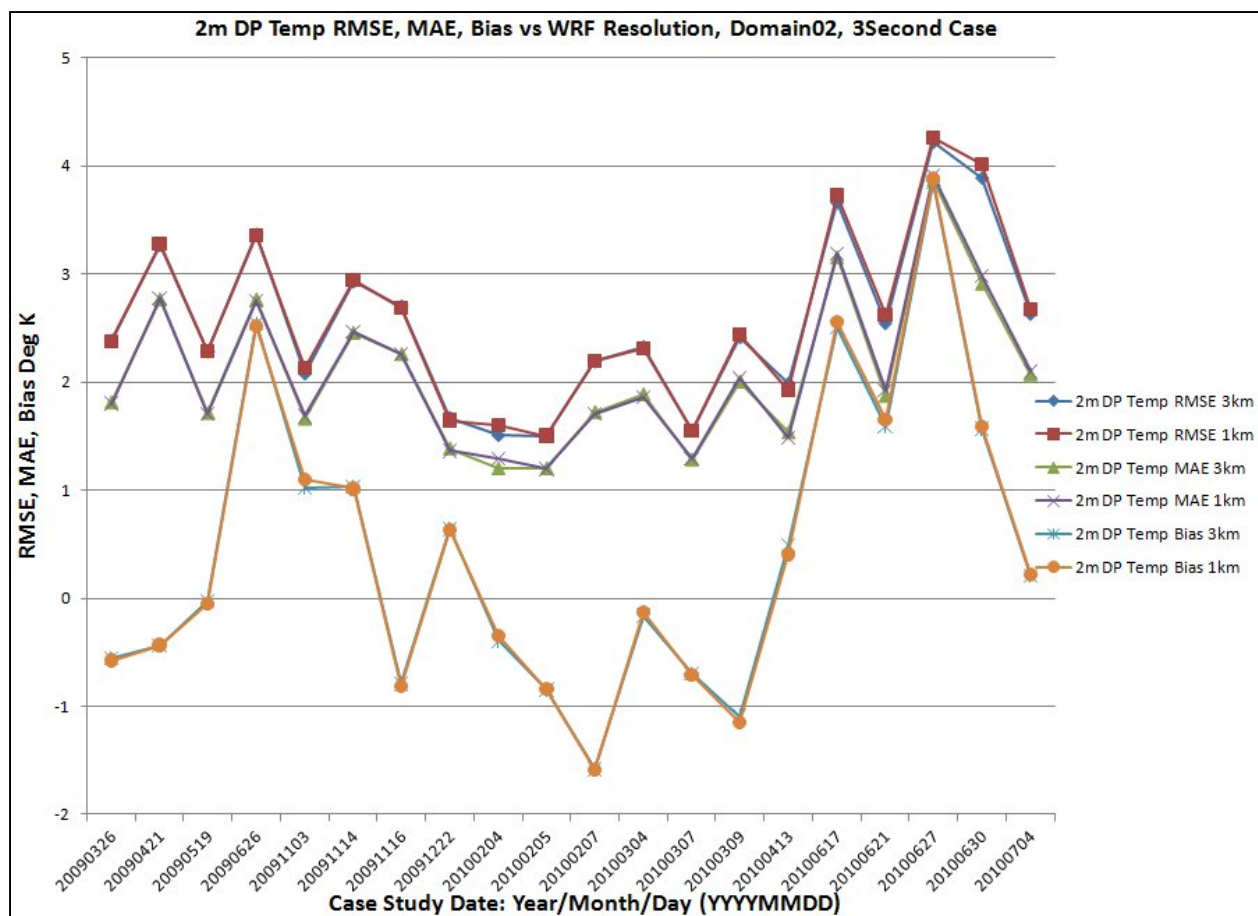


Figure B-29. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

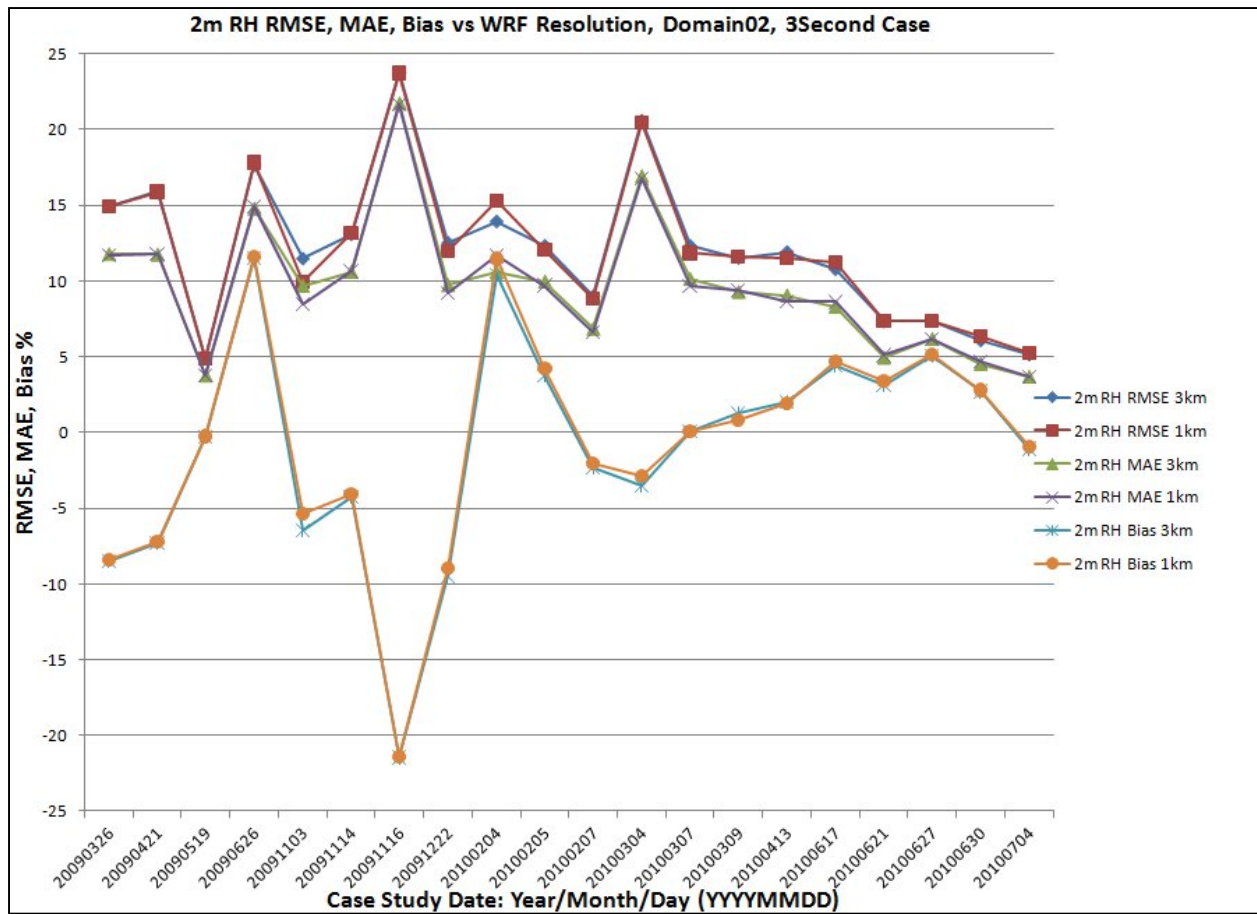


Figure B-30. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

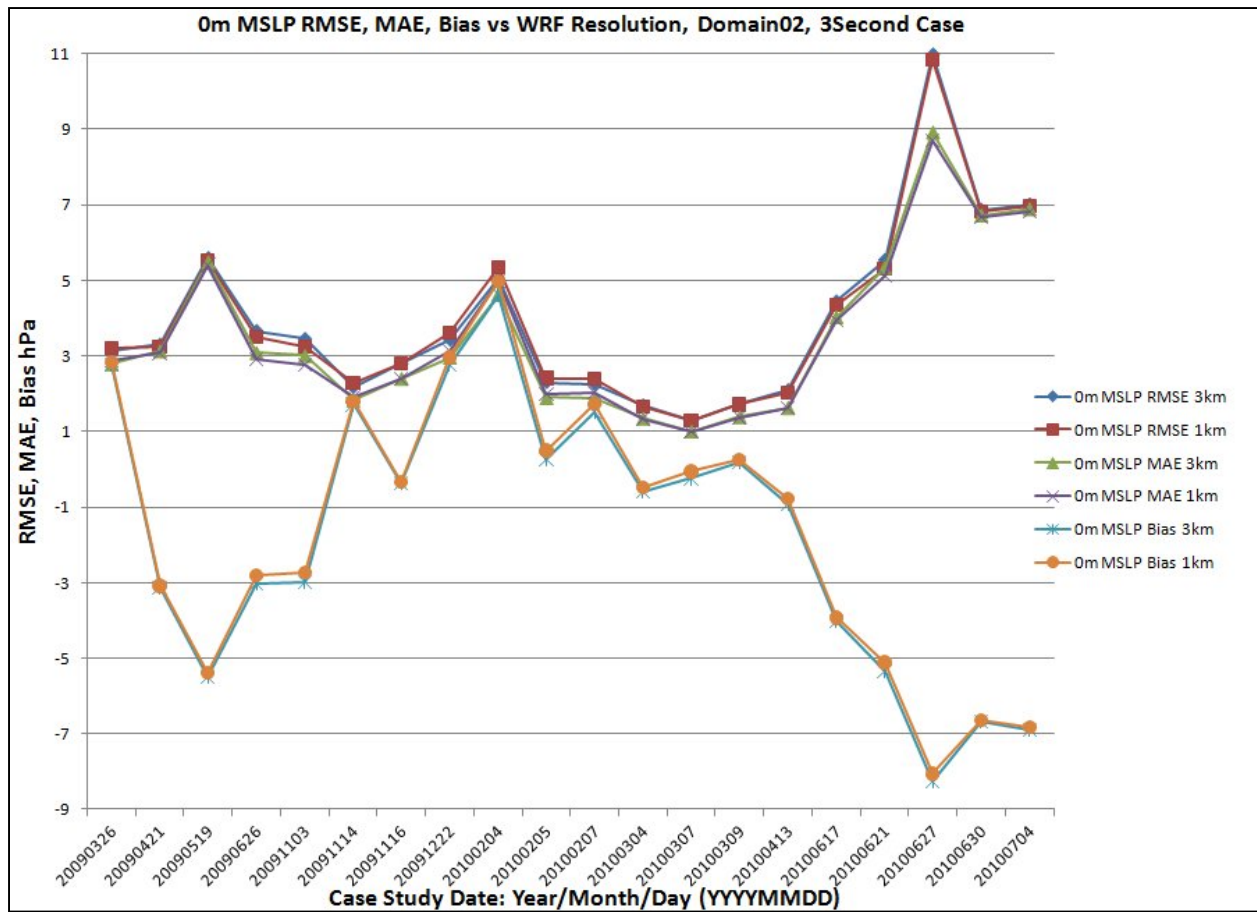


Figure B-31. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

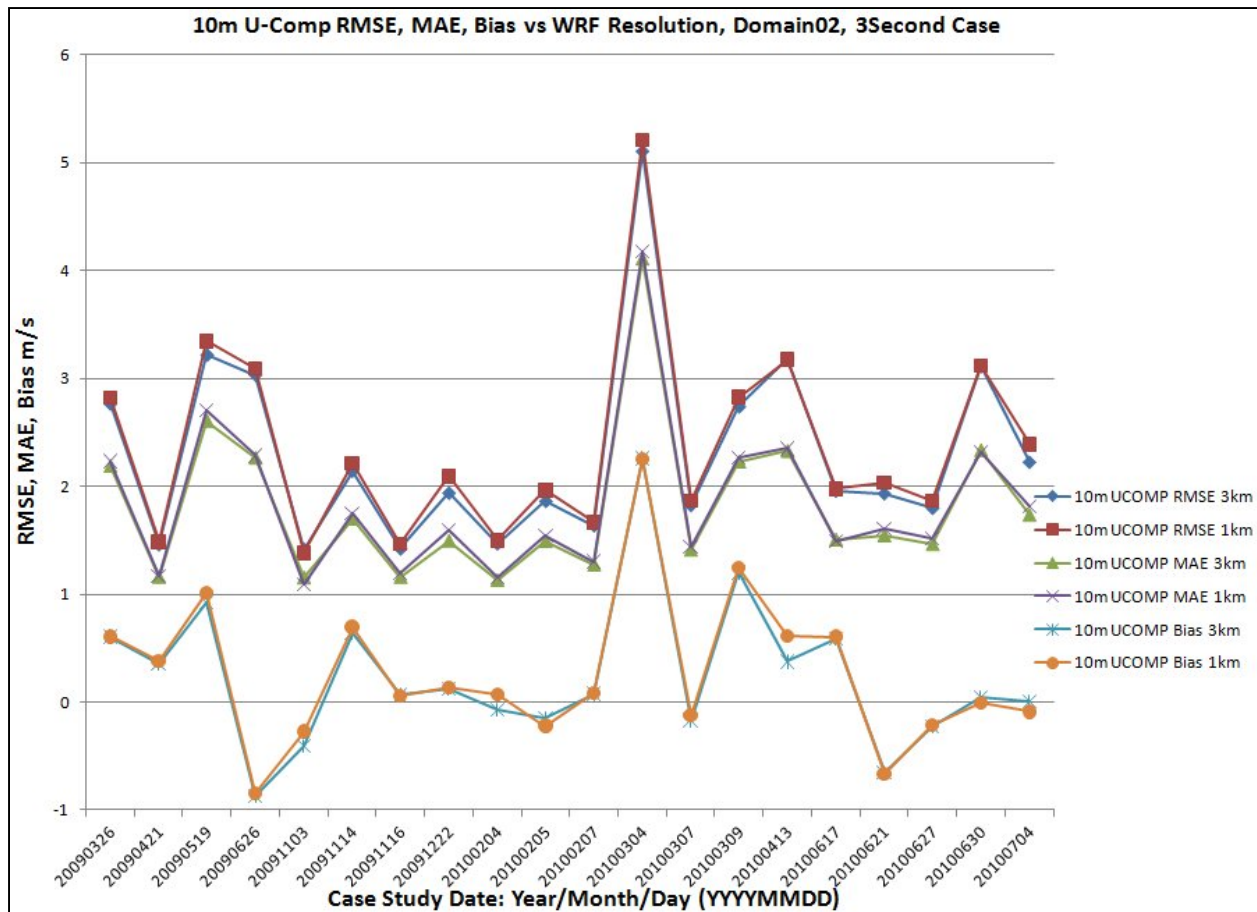


Figure B-32. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

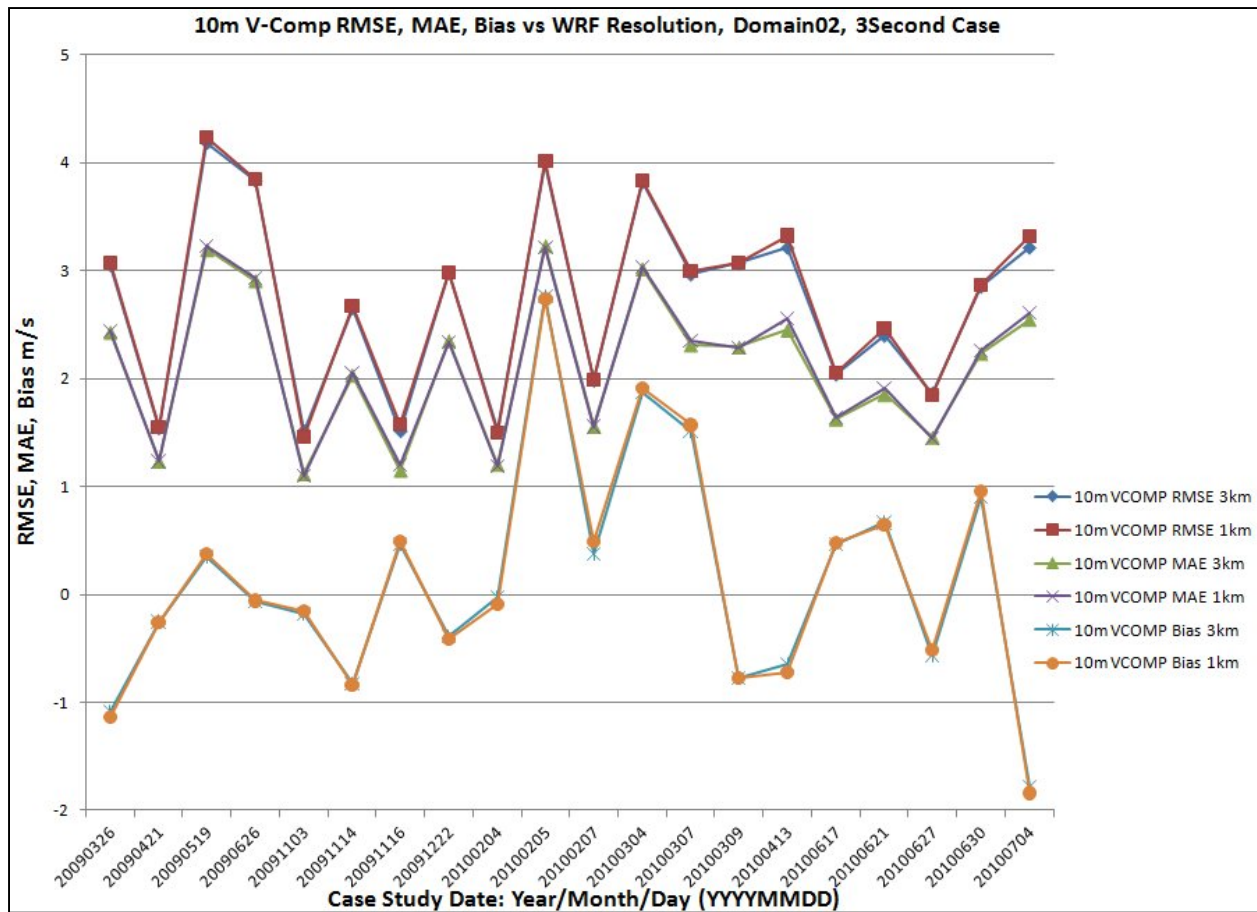


Figure B-33. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

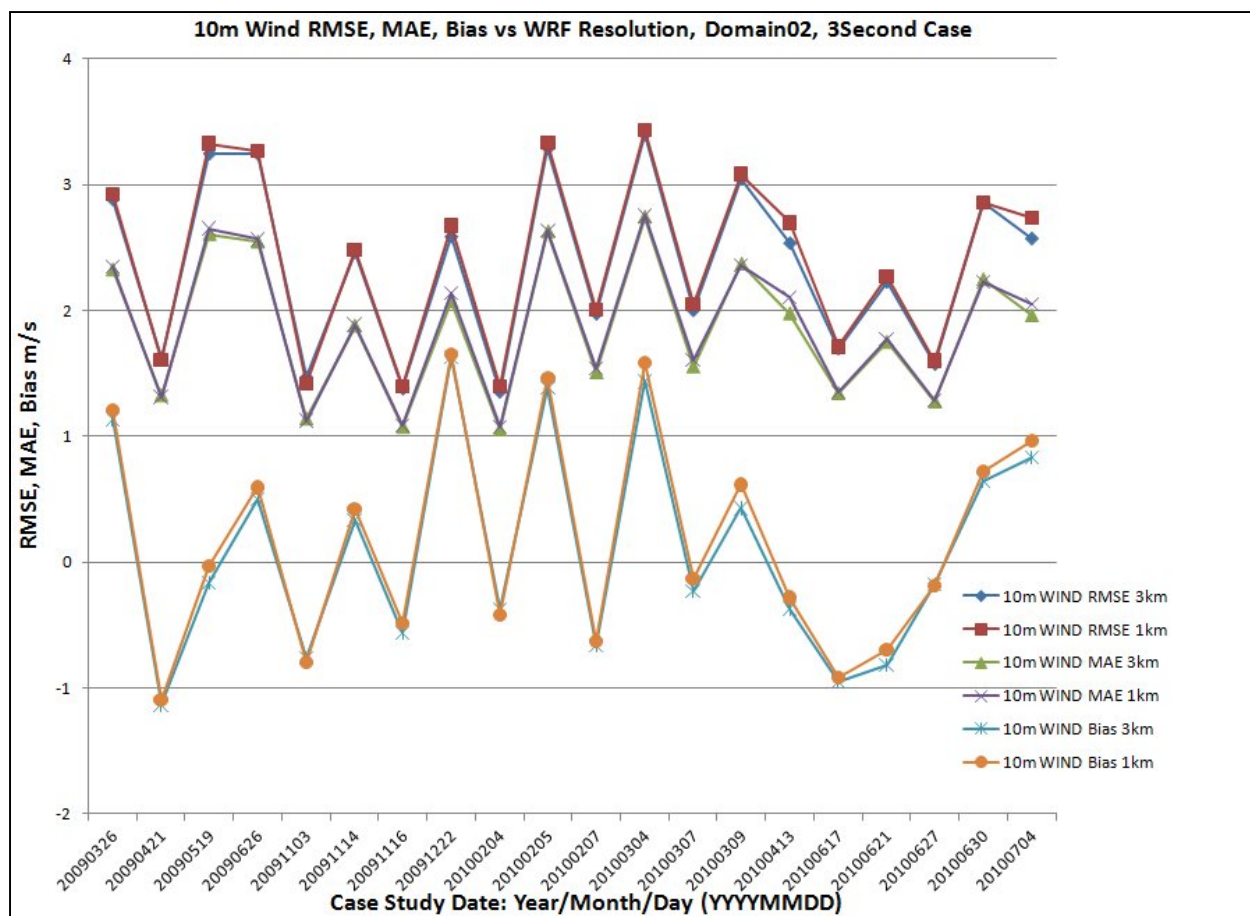


Figure B-34. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, 3Second setting.

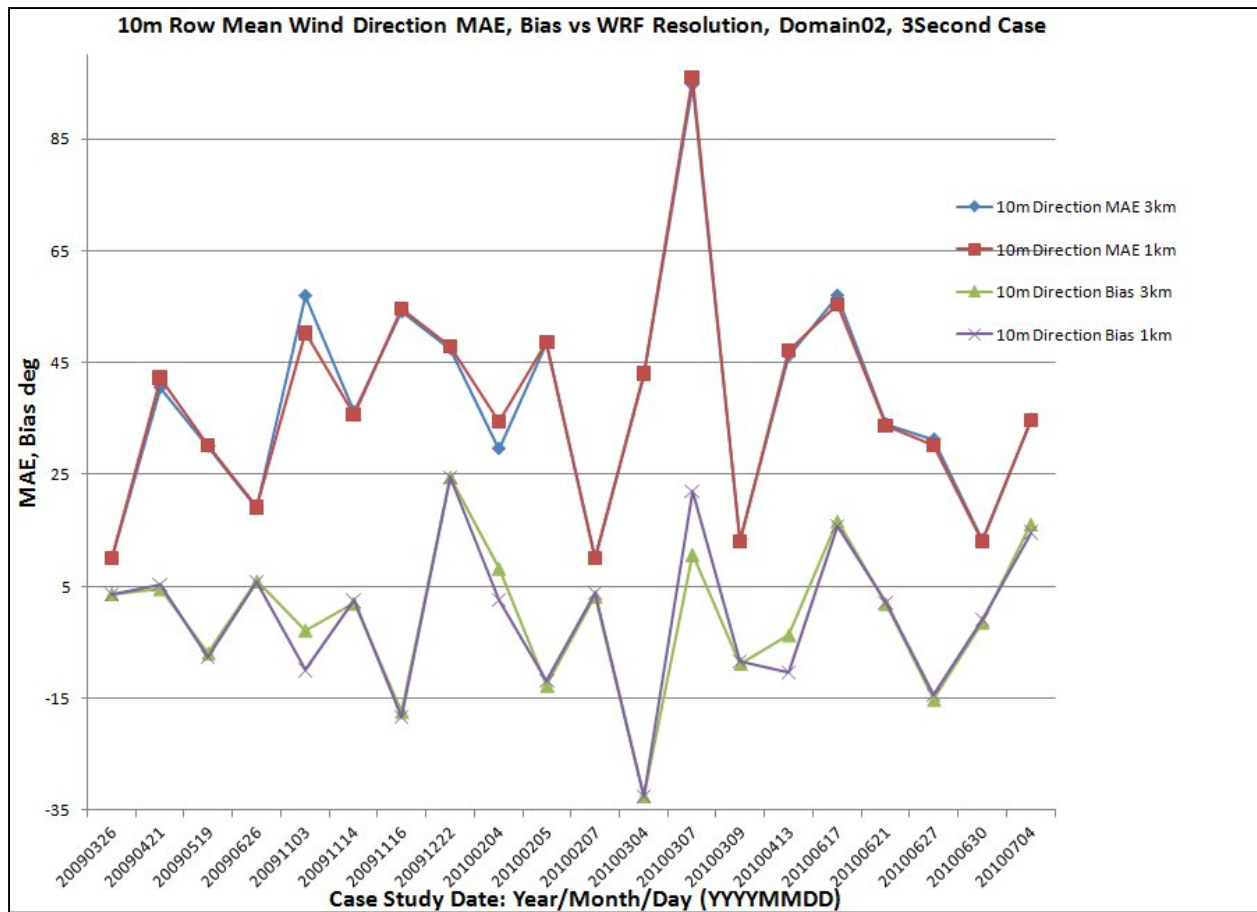


Figure B-35. Comparison of all 10-m row mean wind direction statistics (MAE and Bias only) for 3-km and 1-km WRF, Domain 2, 3Second setting.

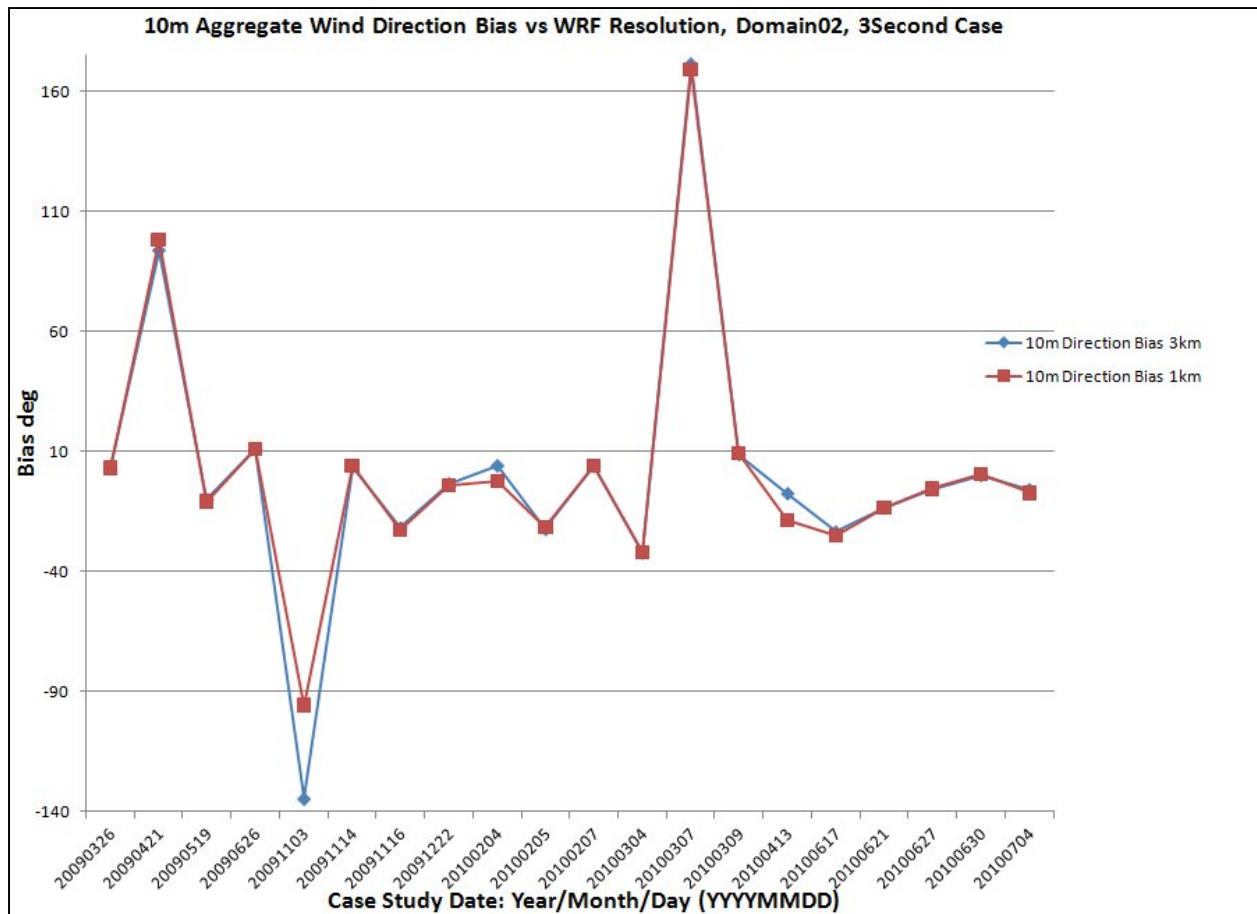


Figure B-36. Comparison of all 10-m aggregate wind direction statistics (Bias only) for 3-km and 1-km WRF, Domain 2, 3Second setting.

Table B-10. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 40Levels setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_L4_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.59	1.70	2.16	608	-0.69	1.87	2.45	608	-9.43	12.60	15.77	608	2.99	3.01	3.33	483
20090421	1.83	2.39	2.98	561	-0.27	3.05	3.56	587	-7.99	12.43	16.83	587	-2.97	2.97	3.14	442
20090519	0.68	1.72	2.14	578	-0.13	1.84	2.46	595	-0.57	3.99	5.14	595	-5.53	5.53	5.65	446
20090626	-0.20	1.93	2.31	593	1.72	2.14	2.76	578	4.62	9.51	11.56	578	-3.92	3.92	4.23	459
20091103	2.94	3.24	3.96	538	1.26	1.66	2.08	582	-5.29	8.44	10.19	582	-2.52	2.55	3.03	479
20091114	2.22	2.37	2.86	558	0.89	2.27	2.69	563	-5.53	10.13	12.64	563	1.77	1.88	2.21	468
20091116	4.76	4.78	5.30	539	-0.75	2.22	2.67	560	-20.99	21.32	23.38	560	0.26	2.14	2.54	471
20091222	2.22	2.32	2.76	514	0.56	1.31	1.60	520	-10.36	10.60	12.94	520	2.97	3.16	3.65	378
20100204	-2.07	2.63	3.22	570	-0.58	1.33	1.63	576	5.59	8.61	11.28	576	3.49	3.50	3.96	425
20100205	-1.47	2.08	2.64	578	-1.41	1.61	1.94	579	0.13	8.50	10.63	579	-0.03	1.94	2.37	424
20100207	-0.75	1.42	1.69	591	-1.76	1.84	2.32	591	-5.70	8.14	10.74	591	1.26	1.72	2.07	424
20100304	0.74	2.05	2.57	609	-0.37	1.92	2.39	610	-5.09	17.79	21.37	610	-0.57	1.40	1.75	480
20100307	0.67	1.54	1.94	595	-0.68	1.43	1.74	599	-7.17	10.26	12.92	599	-0.99	1.44	1.74	470
20100309	-0.64	1.12	1.39	609	-1.10	1.92	2.38	611	-1.93	10.18	12.33	611	-0.28	1.49	1.81	482
20100413	1.25	1.65	2.28	580	-0.25	1.54	2.04	579	-5.28	9.68	12.74	579	-1.57	2.18	2.72	462
20100617	0.75	1.31	1.71	571	2.67	3.39	3.93	571	3.00	7.87	10.27	571	-4.16	4.17	4.65	471
20100621	0.91	1.96	2.53	577	1.70	2.02	2.71	573	1.98	4.79	7.34	573	-5.50	5.50	5.72	463
20100627	1.88	2.13	2.77	574	3.88	3.91	4.29	589	4.15	5.43	6.81	589	-8.31	8.95	11.02	435
20100630	-0.61	1.82	2.25	650	0.35	2.46	3.01	631	1.28	3.76	5.18	631	-6.86	6.88	7.03	445
20100704	1.49	1.82	2.38	608	0.16	2.11	2.69	608	-1.54	3.94	5.36	608	-6.99	6.99	7.13	442

Table B-10. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 40Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.50	2.13	2.72	586	-1.12	2.43	3.06	586	1.15	2.33	2.89	586	2.70	9.60	25	2.49	580
20090421	0.36	1.16	1.45	595	-0.18	1.21	1.51	595	-1.24	1.38	1.68	595	-1.26	34.96	25	94.84	502
20090519	0.97	2.52	3.14	537	0.24	3.25	4.34	537	-0.34	2.57	3.18	537	-14.81	37.07	25	-12.10	518
20090626	0.20	2.04	2.70	550	0.24	2.99	3.86	550	-0.13	2.39	3.07	550	-9.80	20.51	25	-3.48	526
20091103	-0.26	1.10	1.39	583	0.01	1.13	1.51	583	-1.01	1.23	1.58	583	-1.78	51.07	25	68.10	463
20091114	0.55	1.62	2.09	554	-0.72	1.96	2.62	554	0.15	1.80	2.44	554	0.85	34.93	25	2.99	487
20091116	-0.08	1.19	1.47	565	0.59	1.23	1.60	565	-0.47	1.10	1.41	565	-27.63	51.91	25	-17.74	436
20091222	-0.01	1.49	1.93	514	-0.31	2.14	2.73	514	1.35	1.86	2.30	514	20.98	44.14	25	-4.86	403
20100204	-0.03	1.06	1.38	576	0.20	1.15	1.45	576	-0.36	1.04	1.32	576	1.55	26.93	25	-2.06	442
20100205	0.09	1.46	1.84	574	2.05	2.78	3.46	574	0.77	2.22	2.81	574	7.41	52.64	25	-24.18	473
20100207	-0.26	1.36	1.72	586	0.61	1.69	2.15	586	-0.97	1.67	2.18	586	-3.14	10.59	25	-3.33	533
20100304	2.35	4.16	5.19	595	1.50	3.01	3.87	595	1.26	2.79	3.51	595	-35.41	45.31	25	-33.28	571
20100307	0.08	1.46	1.88	596	1.79	2.53	3.22	596	0.04	1.54	2.02	596	29.44	88.02	25	156.97	460
20100309	1.50	2.39	2.91	578	-1.40	2.39	3.22	578	0.61	2.46	3.17	578	-10.14	16.19	25	6.56	564
20100413	1.47	2.69	3.62	559	-0.84	3.04	3.89	559	0.03	2.26	2.93	559	-22.49	64.14	25	-60.10	529
20100617	0.66	1.55	2.02	576	0.67	1.73	2.16	576	-0.95	1.34	1.71	576	12.99	60.80	25	-38.95	539
20100621	-0.72	1.61	2.03	563	0.93	2.01	2.55	563	-1.06	1.89	2.35	563	-1.12	40.44	25	-16.28	536
20100627	-0.22	1.48	1.81	585	-0.52	1.43	1.82	585	-0.31	1.28	1.59	591	-16.81	30.98	25	-6.19	509
20100630	1.01	2.16	2.78	606	0.20	2.12	2.71	606	0.08	2.02	2.64	609	-9.02	11.53	25	-8.31	594
20100704	0.03	1.76	2.24	607	-1.81	2.64	3.29	607	0.86	2.04	2.64	607	16.11	34.89	25	-5.48	559

Table B-11. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 40Levels setting.

DATE: 2009, 2010				Model/Domain Set: m2o2_L4_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.54	1.64	2.03	608	-0.72	1.86	2.45	608	-9.31	12.52	15.73	608	3.07	3.09	3.42	483
20090421	1.80	2.38	2.95	561	-0.27	3.05	3.59	587	-7.90	12.46	16.84	587	-2.93	2.93	3.10	442
20090519	0.63	1.68	2.08	578	-0.14	1.85	2.48	595	-0.52	3.98	5.15	595	-5.45	5.45	5.58	446
20090626	-0.25	1.90	2.27	593	1.68	2.14	2.75	578	4.69	9.65	11.77	578	-3.70	3.71	4.06	459
20091103	2.90	3.25	3.97	538	1.24	1.65	2.07	582	-5.23	8.41	10.17	582	-2.42	2.46	2.94	479
20091114	2.18	2.32	2.82	558	0.88	2.27	2.69	563	-5.35	10.08	12.61	563	1.85	1.96	2.30	468
20091116	4.74	4.76	5.30	539	-0.76	2.22	2.65	560	-20.97	21.26	23.36	560	0.28	2.15	2.55	471
20091222	2.18	2.26	2.70	514	0.53	1.29	1.57	520	-10.27	10.51	12.84	520	3.11	3.28	3.78	378
20100204	-2.17	2.75	3.34	570	-0.55	1.33	1.62	576	6.27	8.78	11.52	576	3.85	3.85	4.28	425
20100205	-1.51	2.07	2.65	578	-1.39	1.59	1.94	579	0.50	8.46	10.65	579	0.12	1.95	2.39	424
20100207	-0.79	1.33	1.62	591	-1.75	1.82	2.30	591	-5.41	7.90	10.40	591	1.47	1.85	2.22	424
20100304	0.67	2.03	2.52	609	-0.35	1.90	2.38	610	-4.59	17.77	21.34	610	-0.48	1.40	1.75	480
20100307	0.60	1.48	1.88	595	-0.71	1.40	1.72	599	-6.92	10.04	12.75	599	-0.82	1.37	1.66	470
20100309	-0.65	1.02	1.29	609	-1.15	1.94	2.41	611	-2.10	10.23	12.31	611	-0.20	1.48	1.80	482
20100413	1.16	1.58	2.23	580	-0.17	1.53	2.02	579	-4.72	9.35	12.24	579	-1.38	2.10	2.61	462
20100617	0.65	1.29	1.70	571	2.67	3.37	3.95	571	3.32	8.07	10.70	571	-4.09	4.11	4.58	471
20100621	0.76	1.81	2.38	577	1.72	2.03	2.77	573	2.19	4.84	7.35	573	-5.28	5.28	5.50	463
20100627	1.85	2.10	2.73	574	3.92	3.95	4.34	589	4.22	5.50	6.86	589	-8.12	8.77	10.89	435
20100630	-0.64	1.77	2.21	650	0.34	2.49	3.02	631	1.30	3.84	5.31	631	-6.87	6.89	7.04	445
20100704	1.42	1.75	2.31	608	0.15	2.13	2.70	608	-1.47	3.94	5.41	608	-6.96	6.96	7.11	442

Table B-11. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 40Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.51	2.16	2.77	586	-1.18	2.46	3.09	586	1.24	2.36	2.94	586	2.76	9.64	25	2.49	580
20090421	0.36	1.17	1.46	595	-0.19	1.21	1.51	595	-1.21	1.37	1.67	595	-1.13	35.88	25	97.48	502
20090519	1.00	2.58	3.22	537	0.22	3.27	4.38	537	-0.28	2.59	3.22	537	-15.25	36.88	25	-12.75	518
20090626	0.20	2.06	2.76	550	0.30	3.00	3.88	550	-0.01	2.38	3.07	550	-9.89	20.54	25	-3.61	526
20091103	-0.26	1.09	1.39	583	0.00	1.12	1.48	583	-0.96	1.22	1.53	583	-7.71	49.22	25	81.33	463
20091114	0.60	1.66	2.14	554	-0.74	1.98	2.65	554	0.24	1.83	2.48	554	-12.25	35.31	25	3.61	487
20091116	-0.08	1.20	1.49	565	0.63	1.27	1.65	565	-0.40	1.13	1.43	565	-28.96	52.59	25	-19.01	436
20091222	-0.01	1.59	2.08	514	-0.32	2.19	2.80	514	1.45	1.93	2.41	514	22.00	45.32	25	-5.03	403
20100204	0.04	1.07	1.39	576	0.18	1.15	1.45	576	-0.37	1.06	1.35	576	-0.89	29.26	25	-5.38	442
20100205	0.08	1.50	1.94	574	2.04	2.75	3.44	574	0.83	2.21	2.83	574	-3.51	48.12	25	-24.07	473
20100207	-0.25	1.34	1.68	586	0.69	1.71	2.17	586	-0.94	1.68	2.19	586	-3.07	10.42	25	-3.32	533
20100304	2.35	4.19	5.23	595	1.52	3.05	3.92	595	1.38	2.81	3.54	595	-35.78	45.75	25	-33.39	571
20100307	0.05	1.46	1.90	596	1.80	2.54	3.25	596	0.11	1.59	2.07	596	26.90	92.81	25	158.22	460
20100309	1.54	2.41	2.95	578	-1.41	2.37	3.20	578	0.78	2.49	3.22	578	-9.71	15.77	25	6.88	564
20100413	1.41	2.58	3.51	559	-0.98	2.95	3.79	559	-0.11	2.17	2.83	559	-23.03	64.79	25	-62.46	529
20100617	0.64	1.53	2.02	576	0.68	1.77	2.22	576	-0.88	1.33	1.70	576	12.57	59.75	25	-38.72	539
20100621	-0.73	1.64	2.07	563	0.94	2.06	2.60	563	-0.97	1.89	2.38	563	-3.11	42.15	25	-16.49	536
20100627	-0.19	1.53	1.88	585	-0.48	1.43	1.84	585	-0.31	1.29	1.61	591	-15.60	29.93	25	-5.36	509
20100630	0.98	2.15	2.78	606	0.27	2.14	2.75	606	0.17	2.03	2.64	609	-8.65	11.39	25	-7.88	594
20100704	-0.06	1.83	2.38	607	-1.87	2.68	3.36	607	0.95	2.10	2.74	607	14.98	35.40	25	-6.87	559

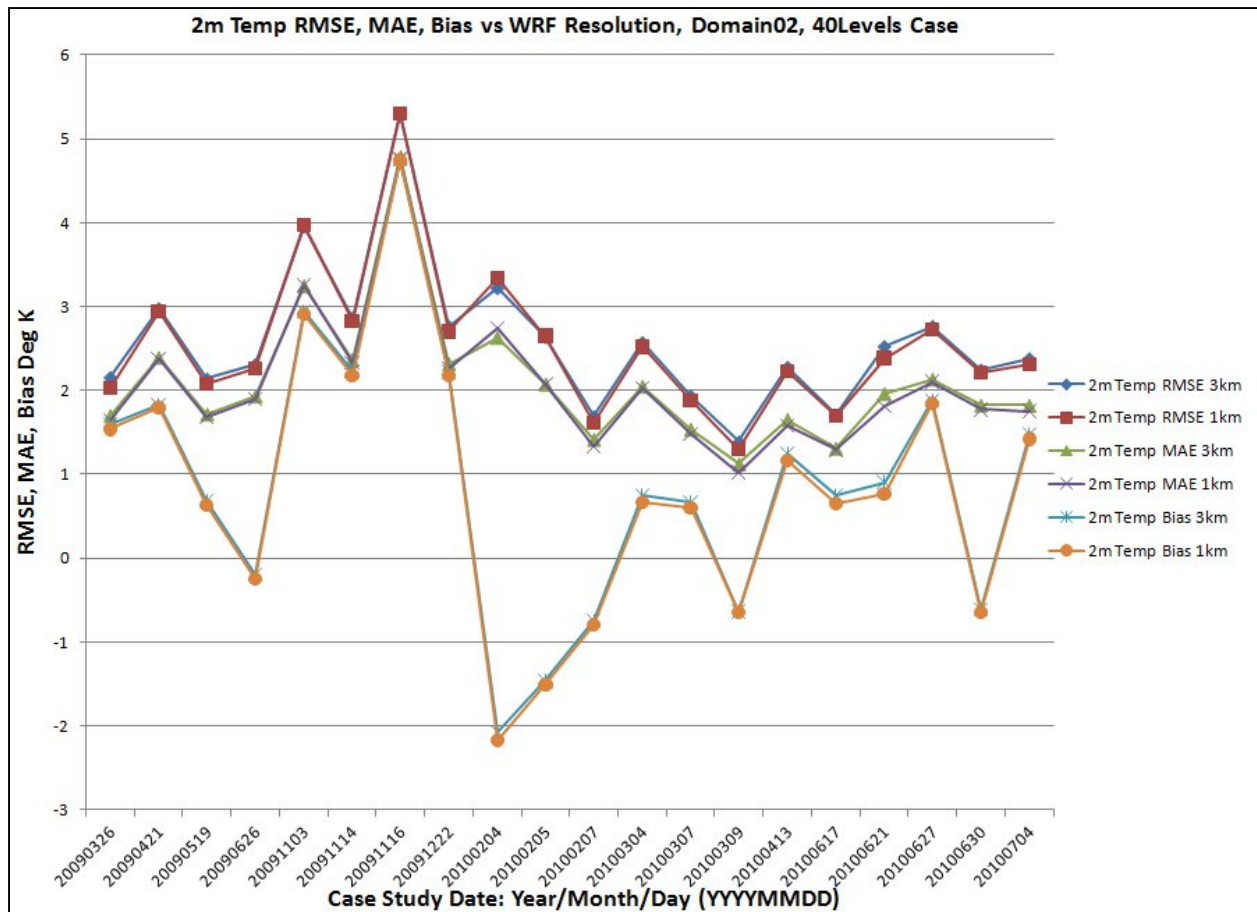


Figure B-37. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

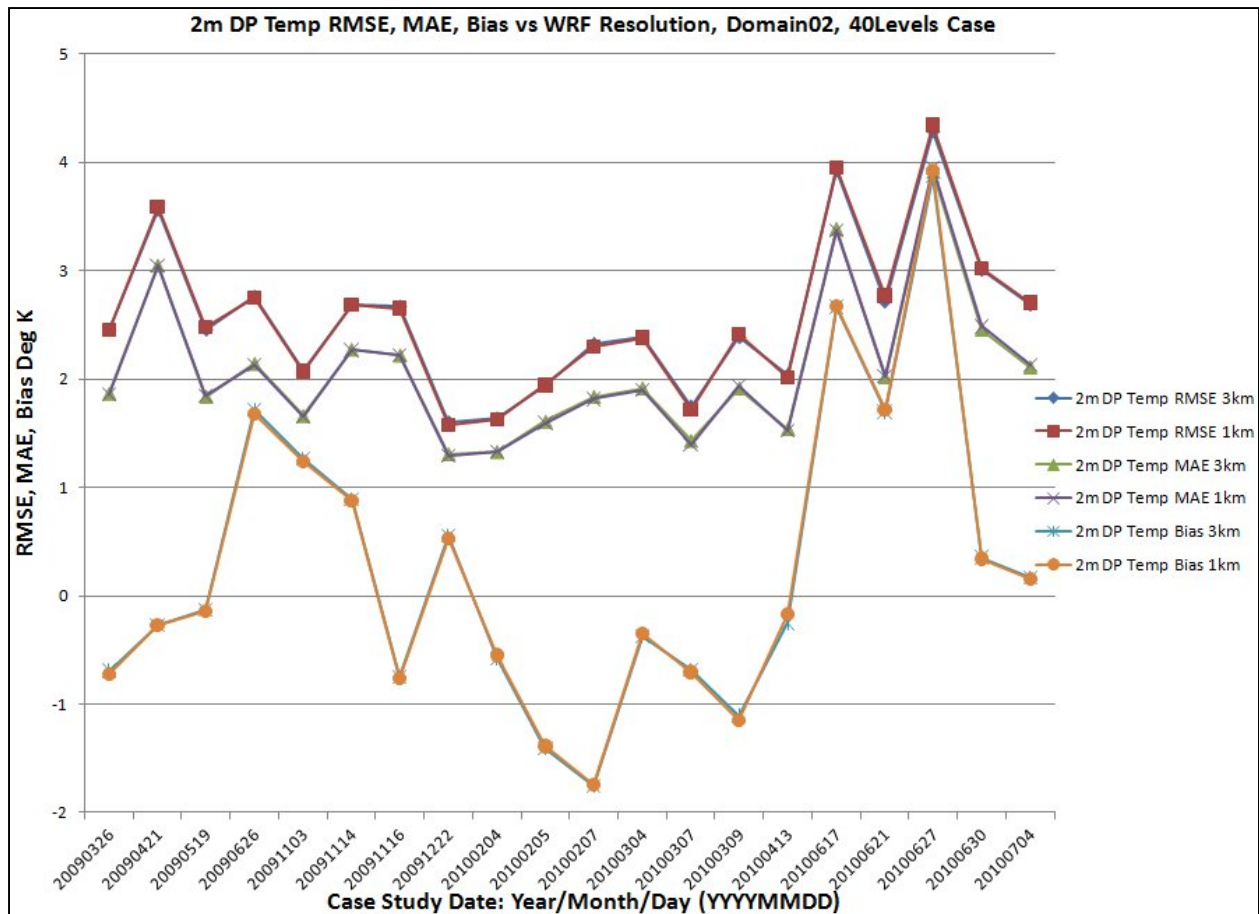


Figure B-38. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

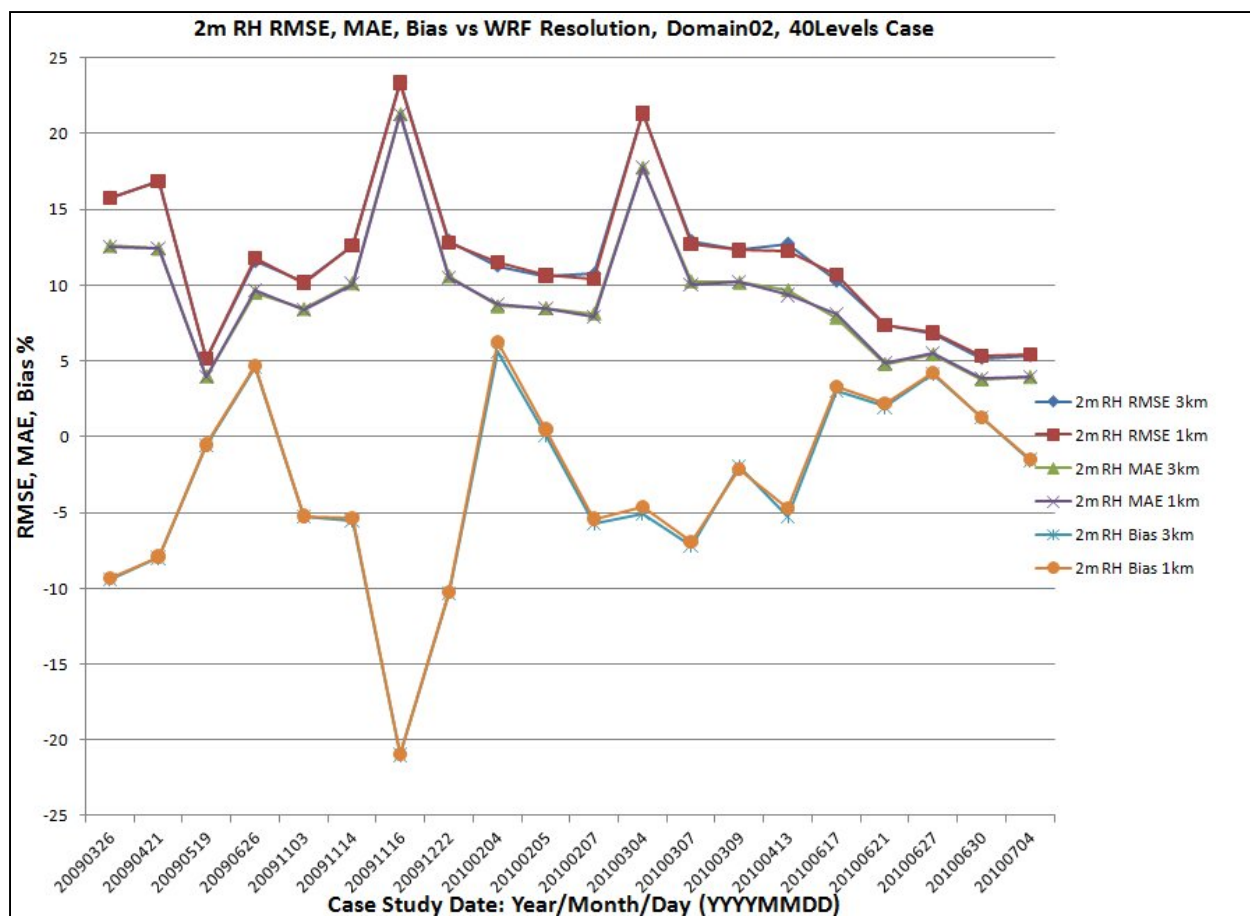


Figure B-39. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

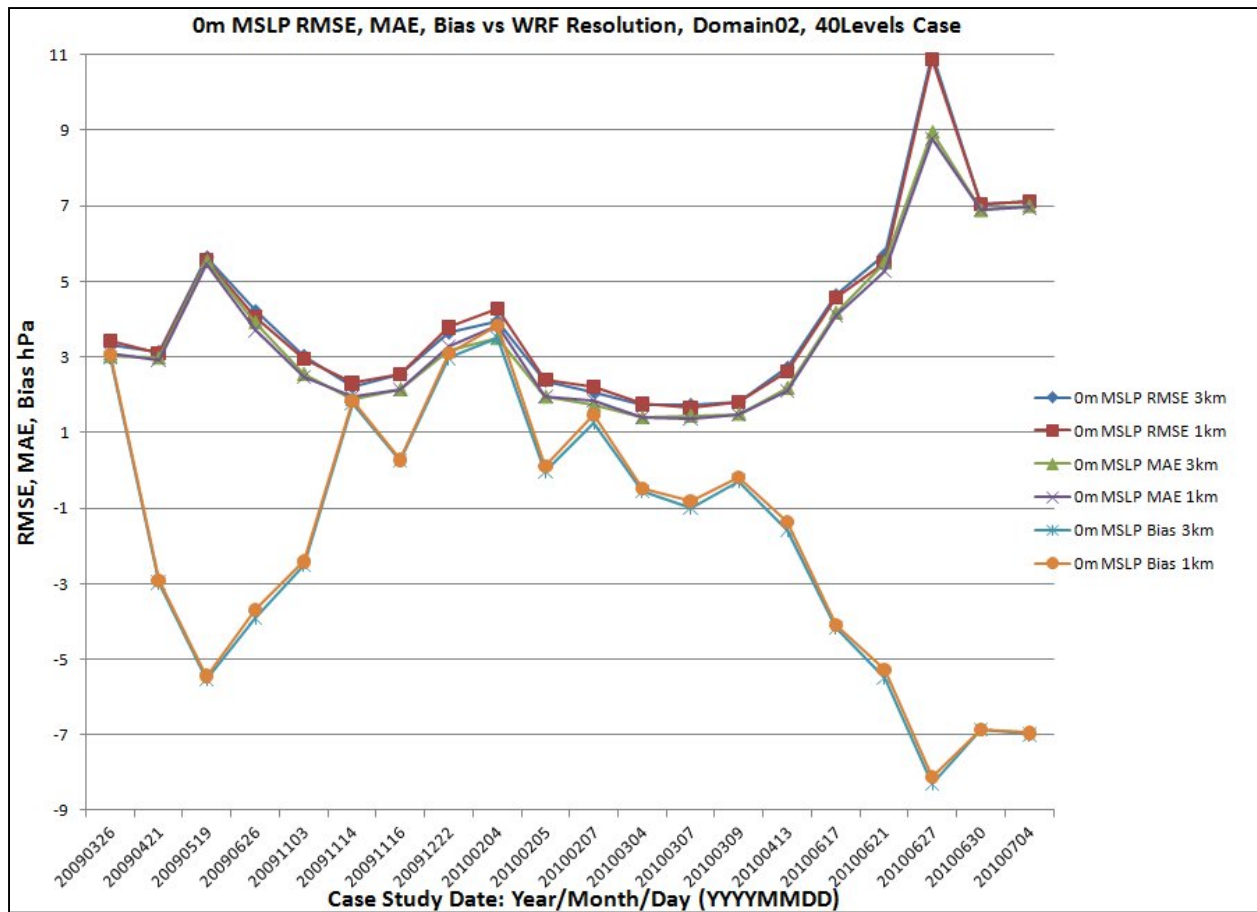


Figure B-40. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

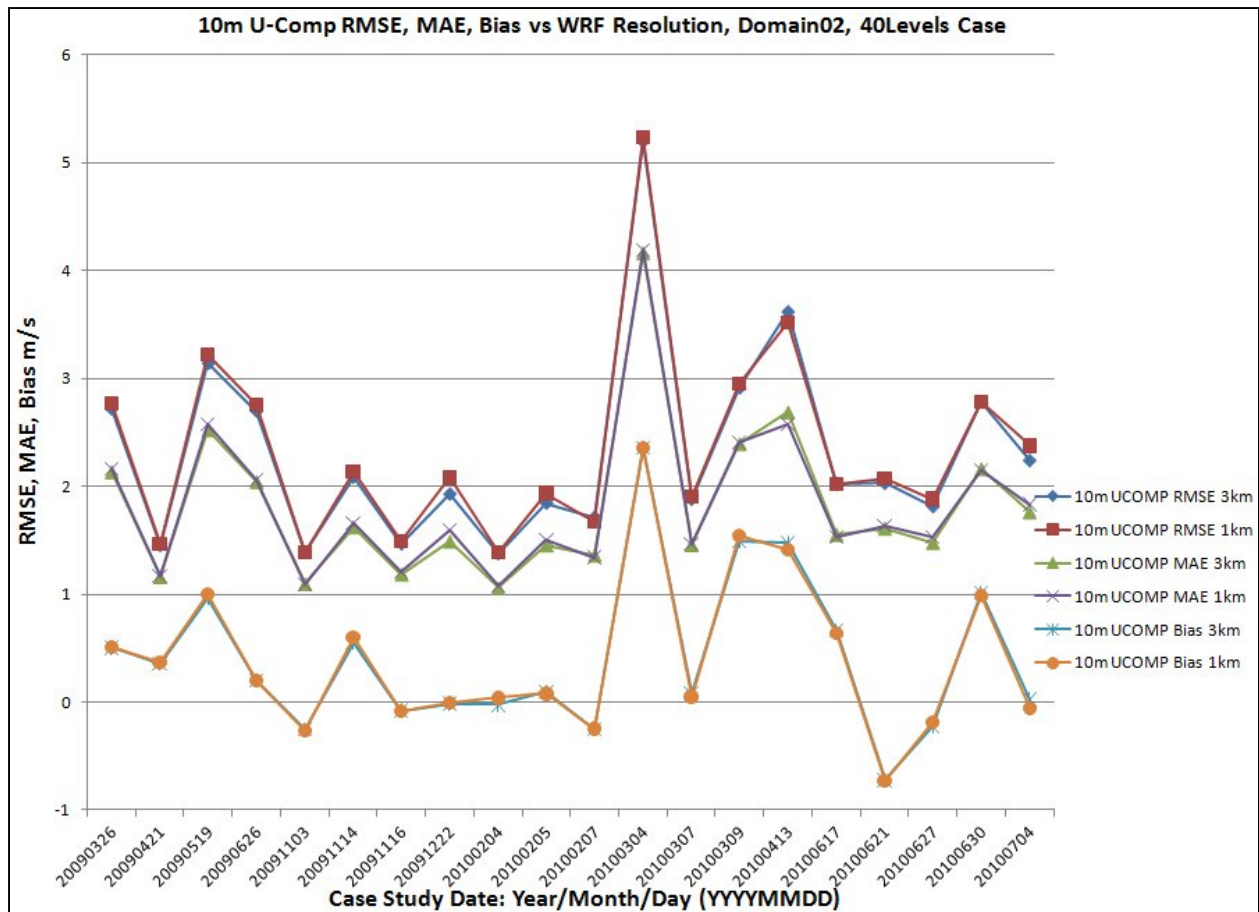


Figure B-41. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

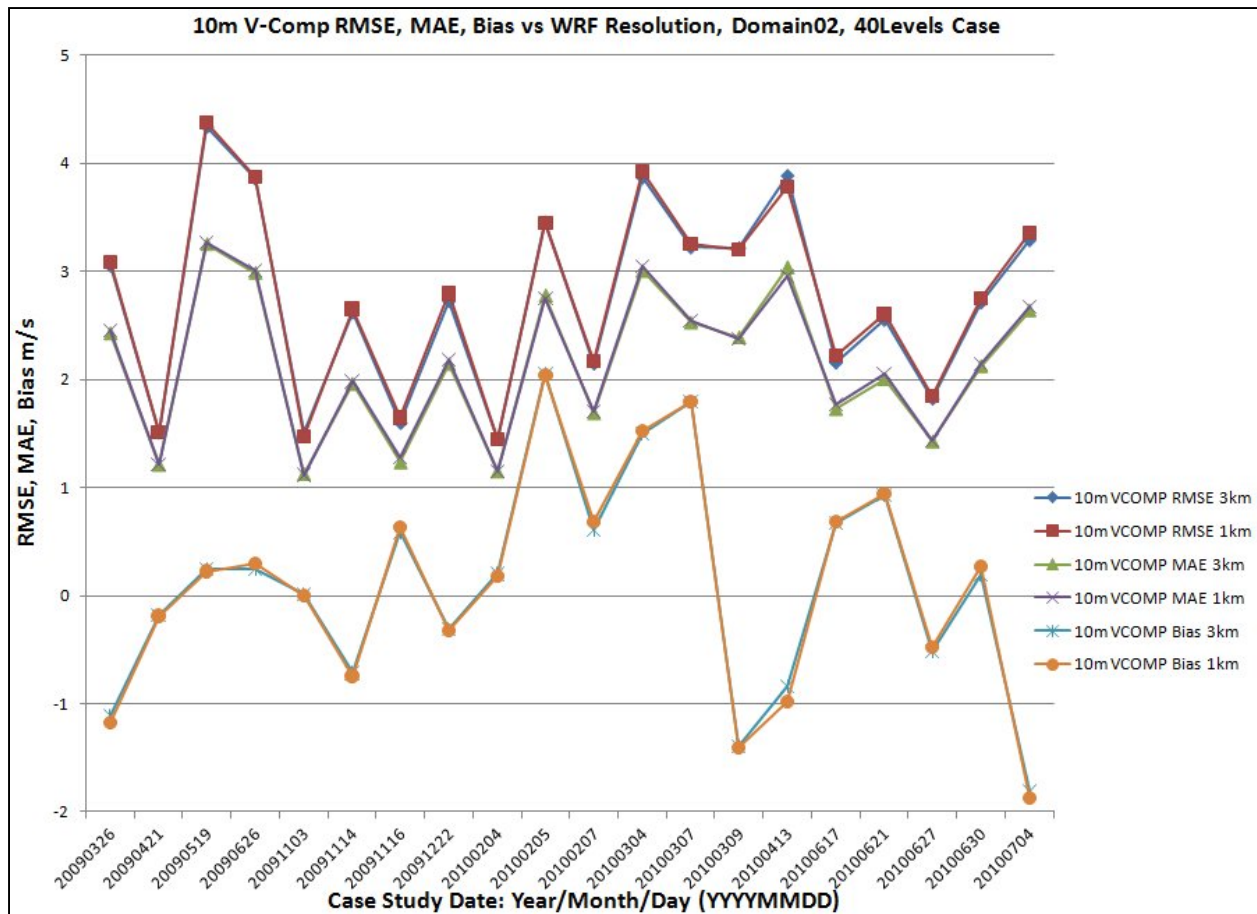


Figure B-42. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

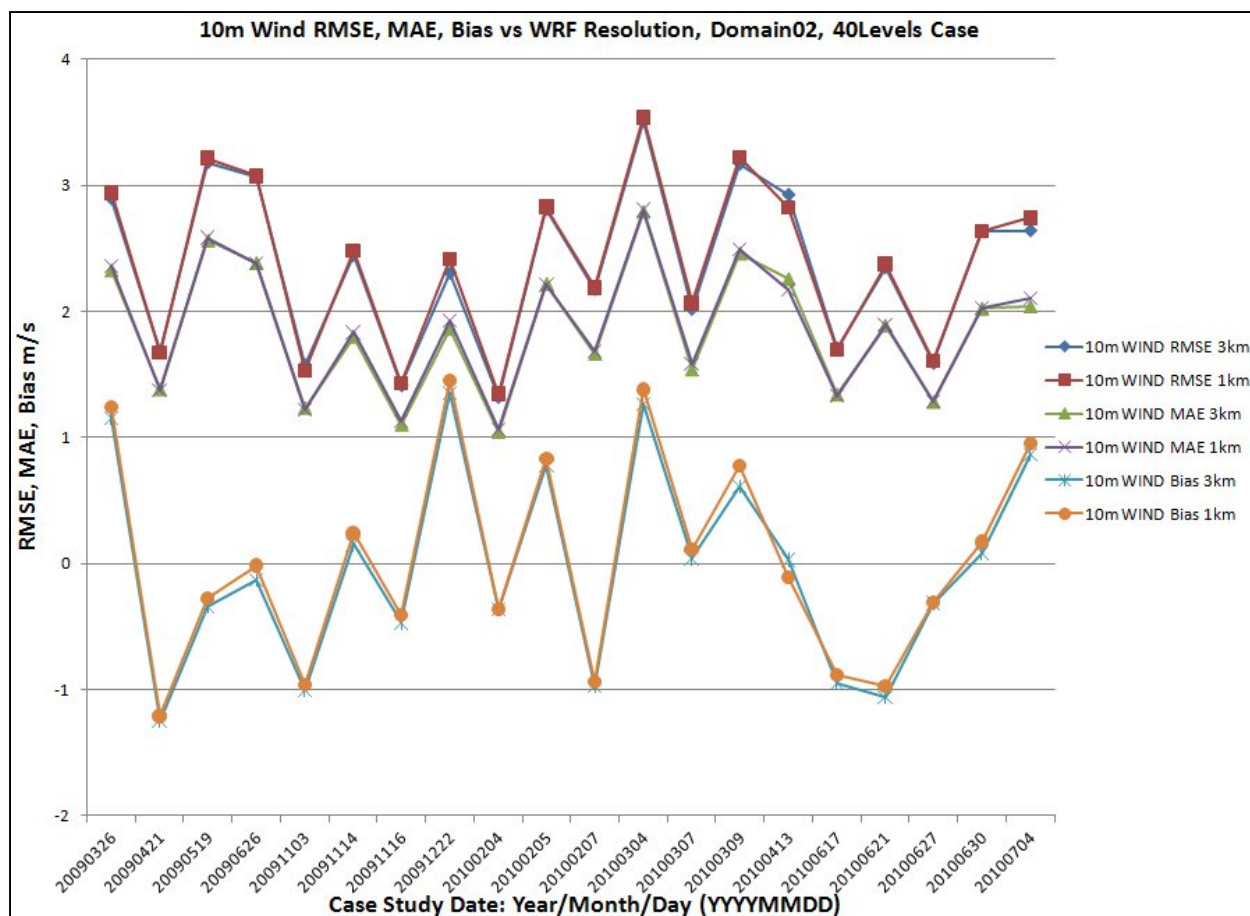


Figure B-43. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, 40Levels setting.

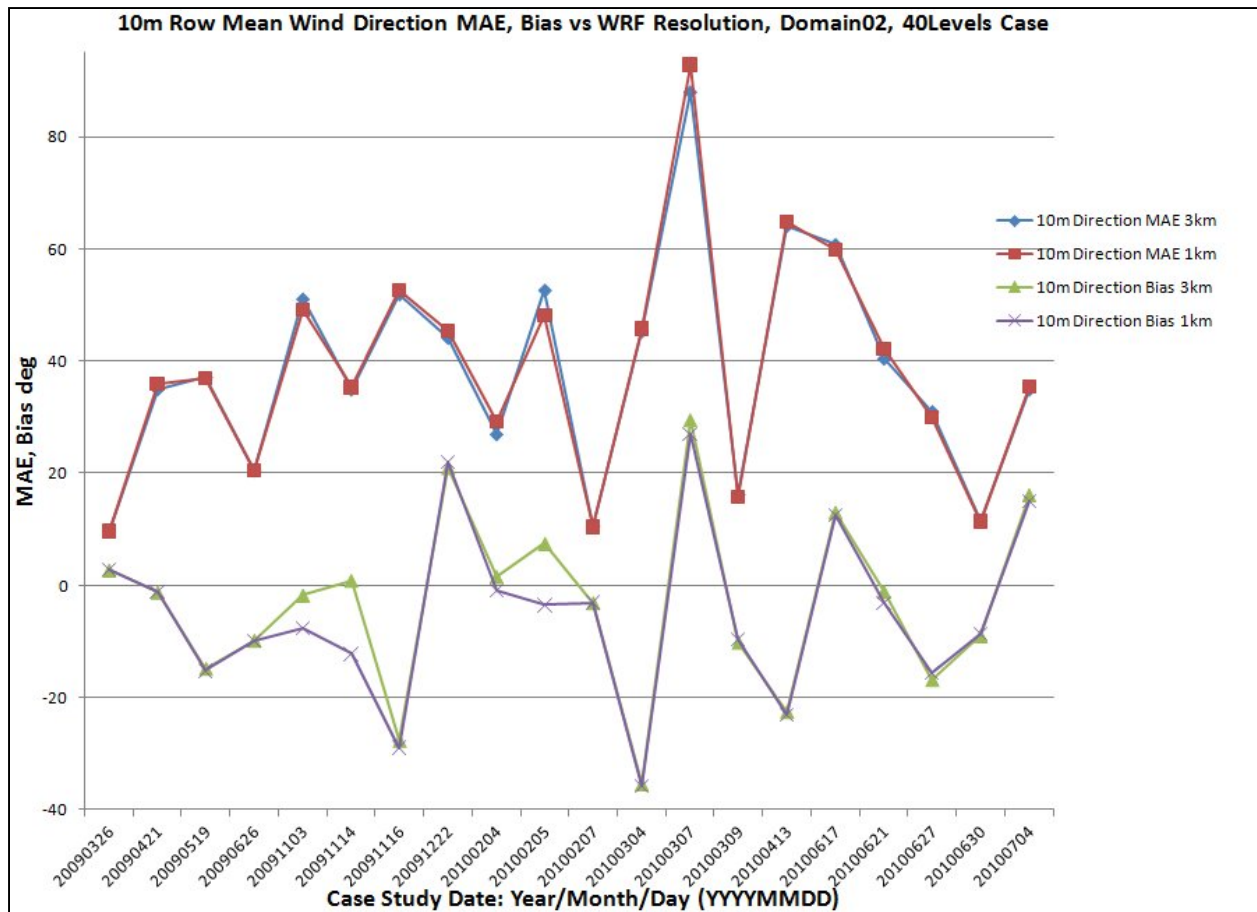


Figure B-44. Comparison of all 10-m row mean wind direction statistics (MAE and Bias only) for 3-km and 1-km WRF, Domain 2, 40Levels setting.

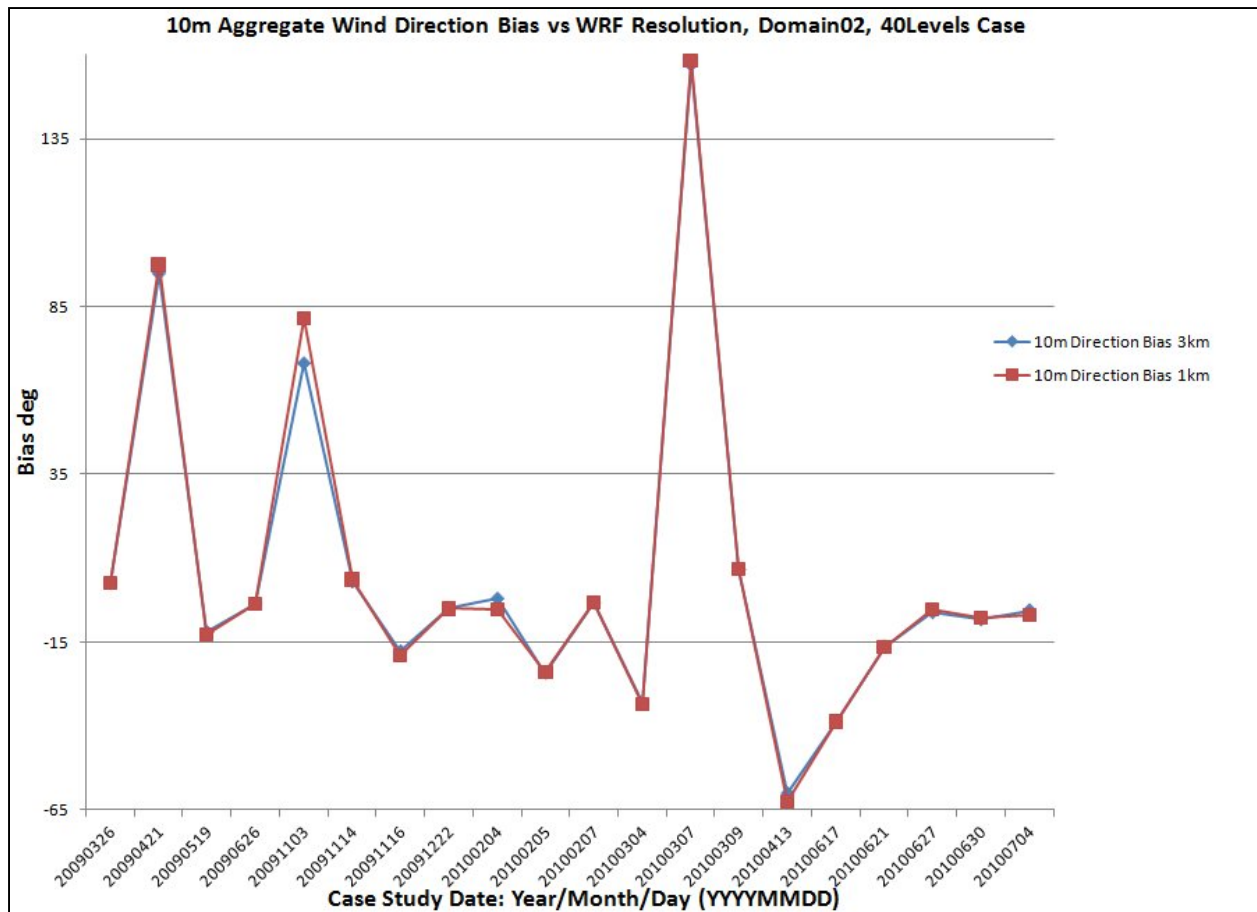


Figure B-45. Comparison of all 10-m aggregate wind direction statistics (Bias only) for 3-km and 1-km WRF, Domain 2, 40Levels setting.

Table B-12. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 80Levels setting.

DATE: 2009, 2010					Model/Domain Set:				m1o2_L8_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.56	1.67	2.10	608	-0.51	1.79	2.35	608	-8.46	11.77	14.93	608	2.72	2.76	3.12	483
20090421	0.99	2.04	2.54	561	-0.68	2.66	3.13	587	-7.19	11.60	15.70	587	-3.05	3.05	3.24	442
20090519	0.63	1.68	2.10	578	-0.24	1.76	2.35	595	-0.70	3.86	4.99	595	-5.57	5.57	5.68	446
20090626	-0.22	1.84	2.23	593	1.92	2.31	2.87	578	5.64	10.13	12.09	578	-4.05	4.05	4.34	459
20091103	2.37	2.76	3.56	538	1.55	1.83	2.28	582	-2.38	7.01	8.59	582	-2.43	2.48	3.02	479
20091114	2.10	2.24	2.73	558	1.13	2.41	2.86	563	-3.92	10.26	12.79	563	1.65	1.81	2.13	468
20091116	4.44	4.46	5.05	539	-0.58	2.25	2.74	560	-19.41	19.85	21.97	560	0.14	2.16	2.55	471
20091222	1.97	2.09	2.56	514	0.47	1.33	1.59	520	-9.23	9.57	12.43	520	3.03	3.18	3.65	378
20100204	-2.67	2.99	3.61	570	-0.98	1.57	1.96	576	8.71	9.59	12.73	576	4.54	4.54	5.09	425
20100205	-1.49	2.06	2.61	578	-0.92	1.21	1.48	579	3.02	9.29	11.44	579	0.19	1.86	2.29	424
20100207	-1.07	1.52	1.80	591	-1.64	1.72	2.11	591	-3.20	7.00	9.06	591	1.42	1.79	2.12	424
20100304	0.85	2.07	2.59	609	-0.33	1.99	2.46	610	-5.30	17.92	21.68	610	-0.76	1.45	1.81	480
20100307	-0.58	1.53	1.93	595	-0.89	1.34	1.60	599	-1.57	9.32	11.48	599	-0.41	1.13	1.38	470
20100309	-1.28	1.50	1.77	609	-1.12	1.95	2.37	611	1.05	8.76	10.91	611	0.10	1.42	1.74	482
20100413	0.63	1.23	1.67	580	-0.48	1.49	2.00	579	-3.56	8.52	11.62	579	-1.48	2.01	2.51	462
20100617	0.07	1.24	1.58	571	2.41	3.04	3.58	571	4.16	8.10	10.69	571	-4.35	4.36	4.84	471
20100621	0.02	1.38	1.76	577	1.43	1.74	2.44	573	2.85	4.81	7.19	573	-5.60	5.60	5.84	463
20100627	0.84	1.53	2.16	574	3.85	3.87	4.20	589	5.53	6.50	7.61	589	-8.25	8.89	10.98	435
20100630	-0.88	1.84	2.24	650	1.22	2.81	3.58	631	2.32	4.34	5.85	631	-6.68	6.71	6.86	445
20100704	1.44	1.76	2.35	608	0.13	2.16	2.72	608	-1.50	3.93	5.30	608	-7.15	7.15	7.30	442

Table B-12. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, 80Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.58	2.20	2.78	586	-1.13	2.46	3.08	586	1.19	2.34	2.92	586	3.62	9.80	25	2.96	580
20090421	0.32	1.12	1.42	595	-0.23	1.20	1.51	595	-1.00	1.25	1.53	595	-1.43	31.56	25	83.49	502
20090519	1.00	2.60	3.24	537	0.34	3.16	4.17	537	-0.07	2.56	3.19	537	-6.41	30.03	25	-11.28	518
20090626	-0.10	2.15	2.79	550	-0.06	2.69	3.59	550	0.08	2.21	2.87	550	-5.42	18.13	25	2.30	526
20091103	-0.22	1.06	1.36	583	-0.11	1.09	1.47	583	-0.81	1.12	1.46	583	-16.20	42.31	25	-72.69	463
20091114	0.62	1.71	2.19	554	-0.78	2.13	2.84	554	0.37	1.97	2.64	554	3.63	35.83	25	3.67	487
20091116	-0.12	1.18	1.47	565	0.54	1.25	1.63	565	-0.37	1.09	1.39	565	-25.84	53.13	25	-15.35	436
20091222	0.27	1.51	1.95	514	-0.43	2.31	2.99	514	1.72	2.09	2.61	514	23.41	45.54	25	-1.88	403
20100204	-0.06	1.14	1.48	576	0.00	1.21	1.53	576	-0.18	0.96	1.24	576	5.32	32.28	25	2.35	442
20100205	-0.25	1.50	1.88	574	3.06	3.43	4.24	574	1.73	2.82	3.52	574	-12.21	47.43	25	-21.82	473
20100207	0.18	1.27	1.67	586	0.23	1.61	2.05	586	-0.47	1.53	1.99	586	5.44	11.21	25	5.33	533
20100304	2.10	4.08	5.11	595	1.96	3.15	3.95	595	1.61	2.80	3.48	595	-32.08	42.30	25	-30.64	571
20100307	-0.10	1.44	1.86	596	1.47	2.26	2.87	596	-0.17	1.62	2.06	596	-7.61	86.78	25	167.47	460
20100309	1.26	2.25	2.77	578	-0.81	2.29	3.06	578	0.56	2.35	3.03	578	-7.78	13.25	25	9.17	564
20100413	1.27	2.62	3.58	559	-0.74	2.59	3.46	559	-0.07	2.08	2.68	559	-23.51	53.82	25	-50.37	529
20100617	0.51	1.59	2.08	576	0.74	1.76	2.21	576	-0.65	1.27	1.63	576	11.09	60.66	25	-37.88	539
20100621	-0.59	1.56	1.98	563	0.63	1.91	2.48	563	-0.56	1.68	2.17	563	10.08	34.81	25	-12.28	536
20100627	-0.26	1.51	1.86	585	-0.58	1.49	1.89	585	-0.07	1.29	1.60	591	-15.51	31.85	25	-6.80	509
20100630	0.26	2.14	2.79	606	0.98	2.33	2.94	606	0.73	2.29	2.92	609	-2.79	11.16	25	-1.35	594
20100704	0.15	1.73	2.21	607	-2.01	2.68	3.35	607	1.15	2.05	2.64	607	17.56	33.87	25	-4.49	559

Table B-13. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 80Levels setting.

DATE: 2009, 2010				Model/Domain Set: m2o2_L8_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.51	1.61	1.98	608	-0.53	1.77	2.34	608	-8.32	11.65	14.86	608	2.79	2.84	3.20	483
20090421	0.96	2.02	2.52	561	-0.67	2.67	3.14	587	-7.07	11.58	15.69	587	-3.00	3.00	3.20	442
20090519	0.59	1.65	2.05	578	-0.24	1.76	2.36	595	-0.65	3.88	5.00	595	-5.48	5.48	5.60	446
20090626	-0.27	1.81	2.19	593	1.87	2.30	2.85	578	5.69	10.30	12.29	578	-3.84	3.84	4.16	459
20091103	2.32	2.79	3.58	538	1.52	1.81	2.27	582	-2.29	6.99	8.58	582	-2.31	2.39	2.92	479
20091114	2.04	2.19	2.68	558	1.11	2.41	2.87	563	-3.75	10.29	12.84	563	1.74	1.88	2.22	468
20091116	4.41	4.44	5.05	539	-0.60	2.25	2.73	560	-19.38	19.76	21.92	560	0.17	2.17	2.55	471
20091222	1.90	2.01	2.47	514	0.45	1.30	1.56	520	-8.96	9.30	12.19	520	3.18	3.31	3.80	378
20100204	-2.90	3.19	3.81	570	-1.07	1.65	2.07	576	9.78	10.37	13.60	576	4.96	4.96	5.45	425
20100205	-1.54	2.07	2.61	578	-0.93	1.18	1.46	579	3.30	9.07	11.25	579	0.36	1.91	2.35	424
20100207	-1.11	1.45	1.73	591	-1.62	1.69	2.10	591	-2.85	6.82	8.81	591	1.63	1.93	2.28	424
20100304	0.75	2.01	2.52	609	-0.29	1.96	2.44	610	-4.62	17.62	21.47	610	-0.66	1.46	1.81	480
20100307	-0.65	1.55	1.96	595	-0.88	1.32	1.58	599	-1.12	9.21	11.38	599	-0.20	1.10	1.37	470
20100309	-1.29	1.41	1.69	609	-1.17	1.99	2.41	611	0.80	8.80	10.86	611	0.18	1.40	1.73	482
20100413	0.47	1.12	1.48	580	-0.34	1.42	1.91	579	-2.59	8.05	10.96	579	-1.32	1.94	2.42	462
20100617	-0.03	1.27	1.59	571	2.42	3.02	3.58	571	4.46	8.18	10.90	571	-4.27	4.29	4.76	471
20100621	-0.09	1.30	1.68	577	1.48	1.77	2.49	573	3.05	4.85	7.12	573	-5.40	5.40	5.64	463
20100627	0.83	1.50	2.14	574	3.89	3.91	4.25	589	5.57	6.56	7.64	589	-8.06	8.71	10.84	435
20100630	-0.93	1.84	2.25	650	1.23	2.86	3.65	631	2.41	4.50	6.06	631	-6.65	6.69	6.83	445
20100704	1.38	1.70	2.27	608	0.12	2.20	2.77	608	-1.37	3.96	5.39	608	-7.10	7.10	7.26	442

Table B-13. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, 80Levels setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.59	2.25	2.84	586	-1.18	2.48	3.11	586	1.26	2.38	2.97	586	3.66	9.84	25	2.96	580
20090421	0.34	1.14	1.45	595	-0.24	1.20	1.52	595	-0.96	1.24	1.53	595	-0.48	33.25	25	89.33	502
20090519	1.06	2.65	3.31	537	0.34	3.18	4.23	537	0.04	2.57	3.25	537	-7.33	29.90	25	-12.03	518
20090626	-0.08	2.19	2.86	550	-0.01	2.74	3.64	550	0.19	2.25	2.90	550	-5.87	17.98	25	1.94	526
20091103	-0.23	1.07	1.38	583	-0.12	1.08	1.44	583	-0.75	1.12	1.42	583	-8.50	44.75	25	-81.95	463
20091114	0.67	1.75	2.25	554	-0.81	2.13	2.85	554	0.47	1.99	2.66	554	4.28	35.40	25	4.31	487
20091116	-0.12	1.22	1.52	565	0.59	1.31	1.69	565	-0.27	1.13	1.42	565	-13.42	53.90	25	-17.37	436
20091222	0.25	1.56	2.06	514	-0.50	2.31	3.02	514	1.76	2.15	2.71	514	23.06	45.02	25	-2.79	403
20100204	0.03	1.18	1.55	576	-0.06	1.20	1.54	576	-0.20	0.99	1.29	576	2.42	37.77	25	-1.91	442
20100205	-0.33	1.55	1.98	574	3.03	3.40	4.27	574	1.80	2.84	3.58	574	-11.81	47.61	25	-21.28	473
20100207	0.22	1.31	1.69	586	0.29	1.59	2.05	586	-0.37	1.53	1.99	586	6.46	11.60	25	6.22	533
20100304	2.06	4.12	5.18	595	2.01	3.26	4.06	595	1.79	2.86	3.57	595	-32.60	42.83	25	-30.14	571
20100307	-0.03	1.49	1.91	596	1.47	2.28	2.88	596	-0.06	1.67	2.09	596	-8.16	87.55	25	163.04	460
20100309	1.29	2.29	2.83	578	-0.82	2.27	3.02	578	0.75	2.36	3.07	578	-7.10	12.68	25	9.41	564
20100413	1.26	2.55	3.51	559	-0.82	2.69	3.56	559	-0.08	2.17	2.77	559	-9.60	53.67	25	-51.80	529
20100617	0.52	1.61	2.13	576	0.78	1.80	2.28	576	-0.59	1.28	1.65	576	9.19	59.29	25	-40.50	539
20100621	-0.65	1.63	2.11	563	0.62	1.96	2.56	563	-0.40	1.73	2.24	563	10.76	37.93	25	-13.23	536
20100627	-0.27	1.59	1.98	585	-0.55	1.47	1.88	585	-0.06	1.30	1.63	591	-15.06	31.13	25	-6.77	509
20100630	0.22	2.12	2.75	606	1.09	2.39	2.98	606	0.88	2.30	2.93	609	-2.36	10.47	25	-0.91	594
20100704	0.10	1.81	2.35	607	-2.06	2.75	3.45	607	1.26	2.15	2.78	607	16.88	33.98	25	-5.28	559

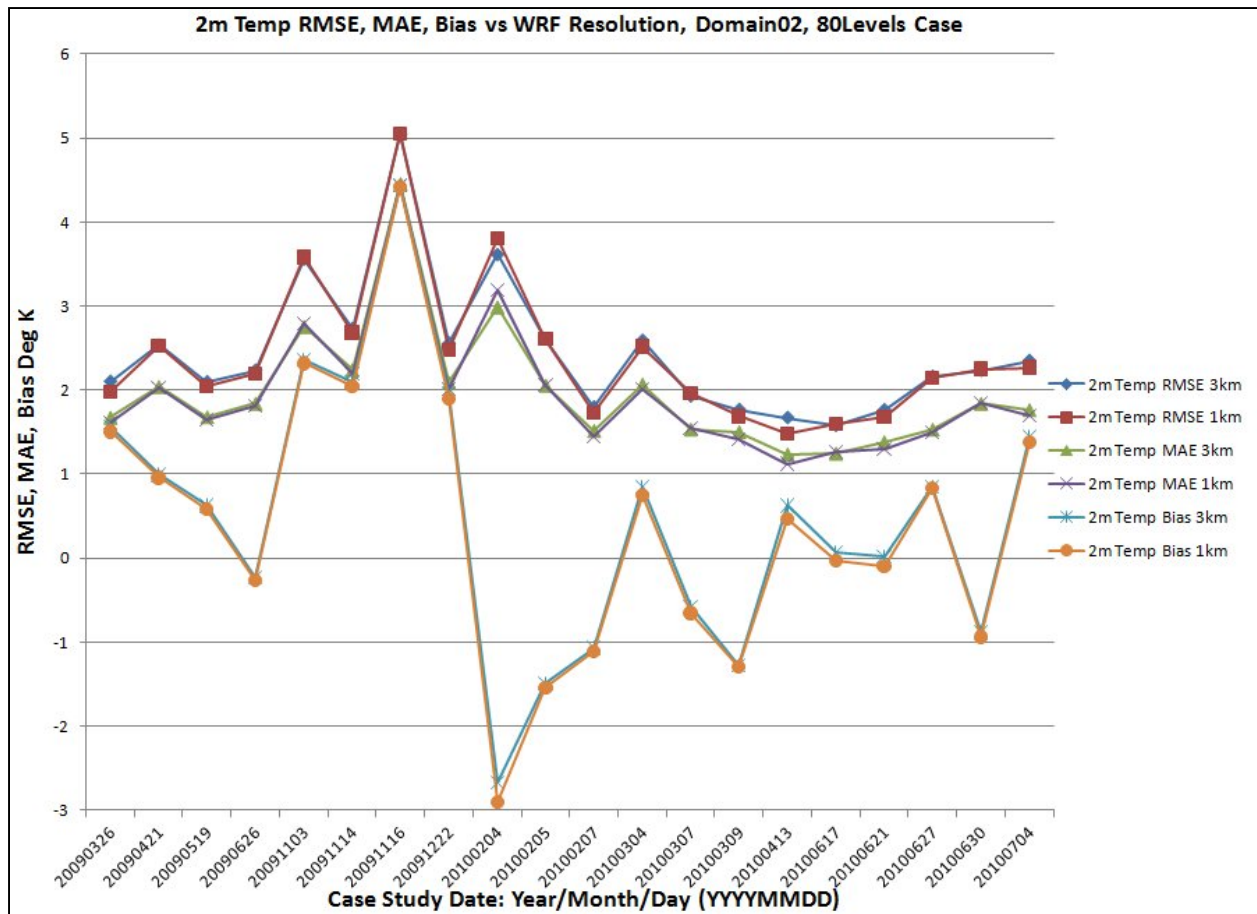


Figure B-46. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

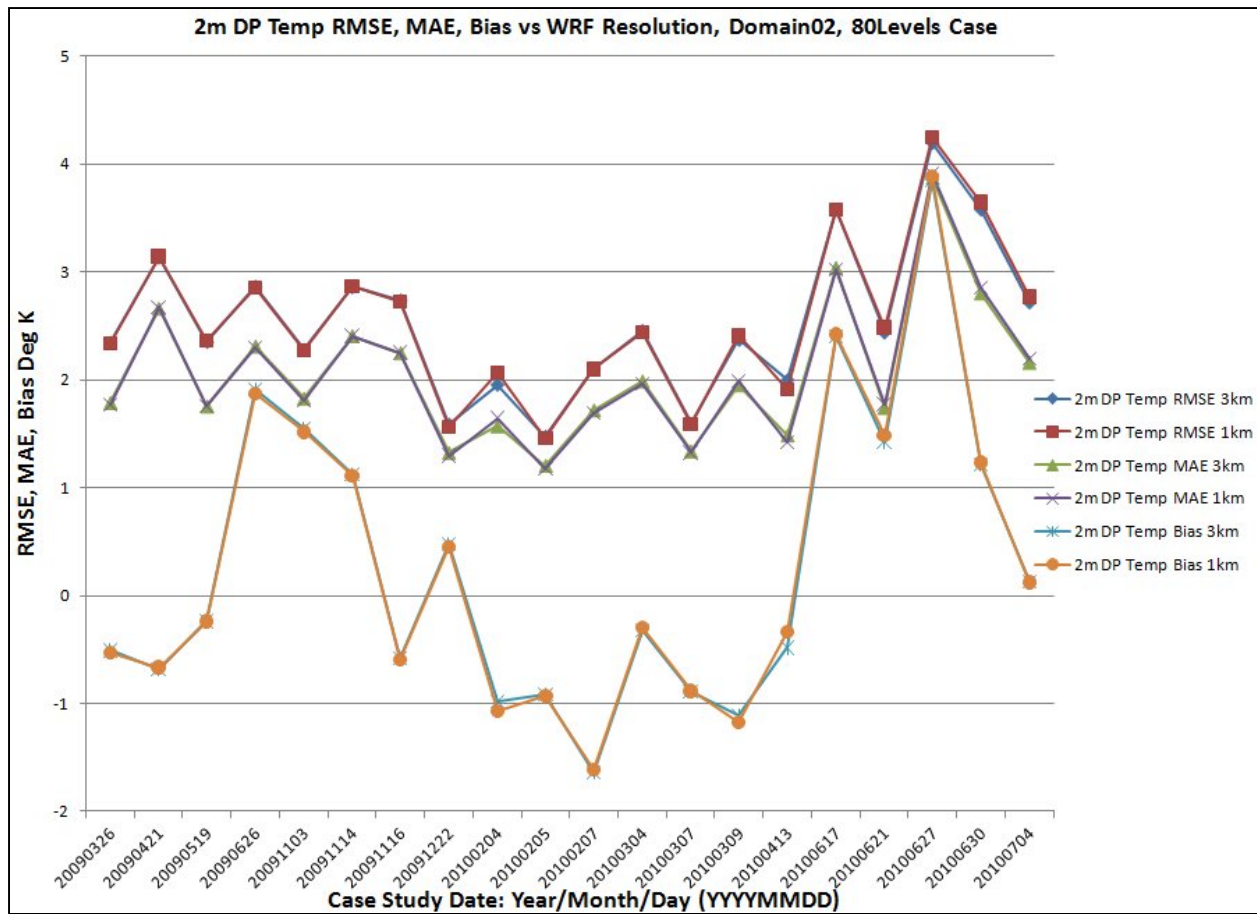


Figure B-47. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

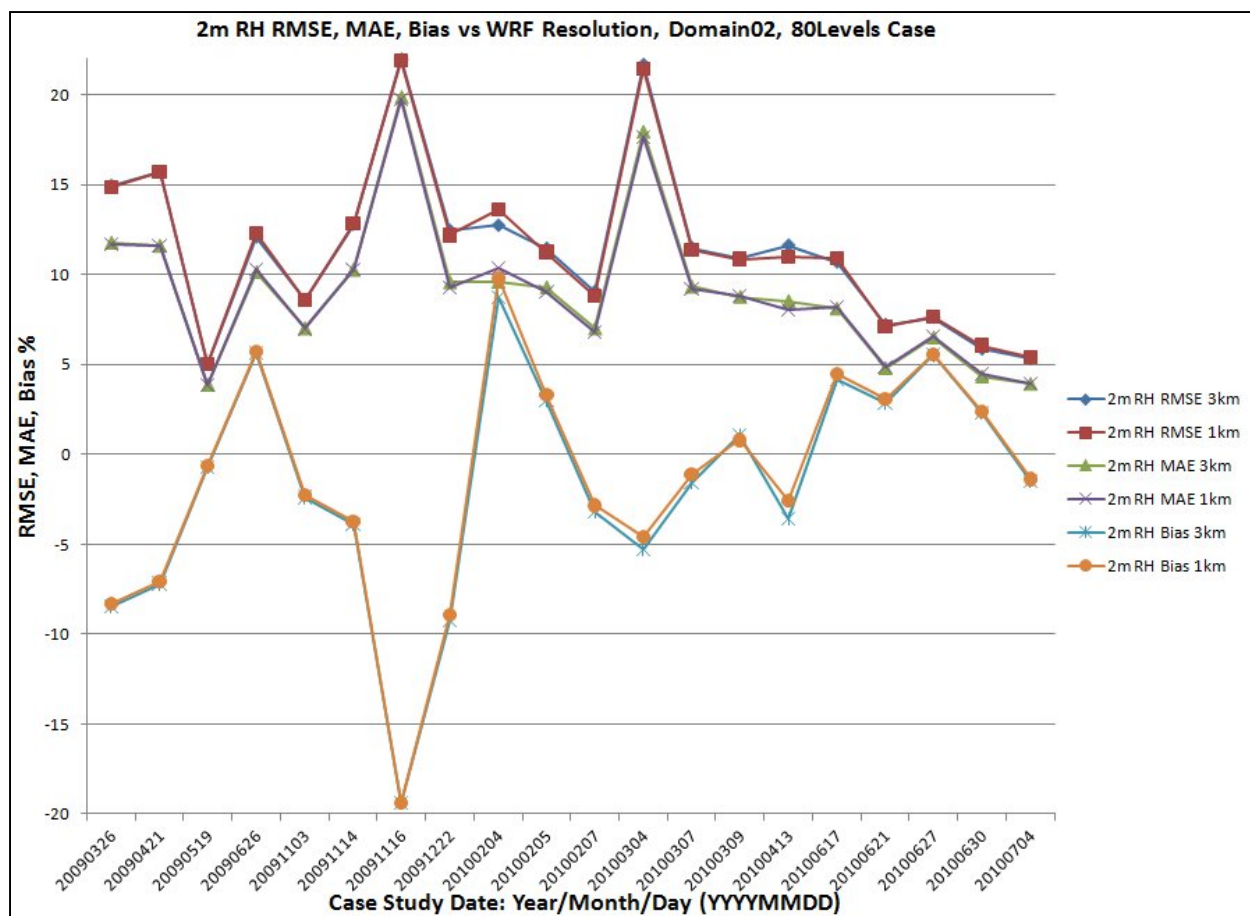


Figure B-48. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

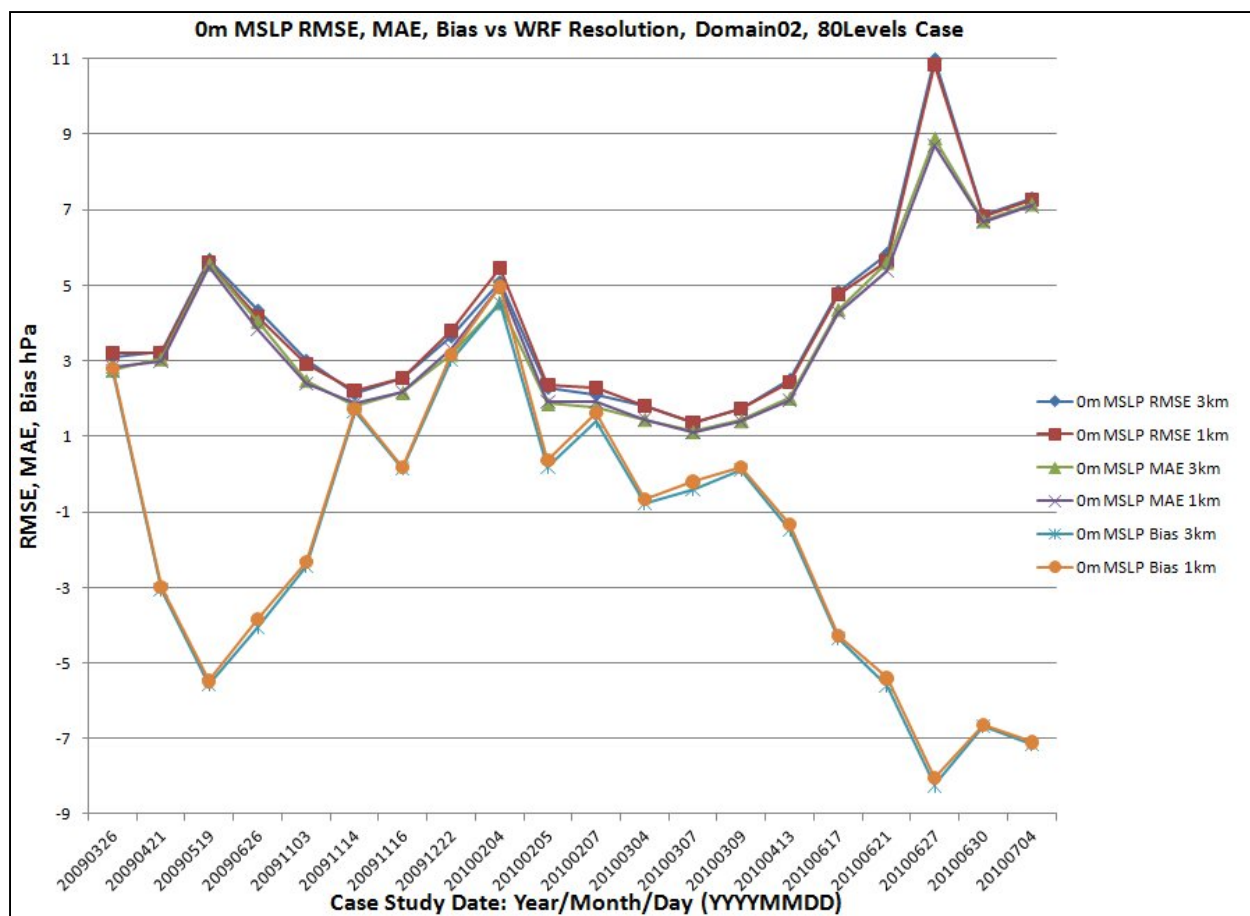


Figure B-49. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

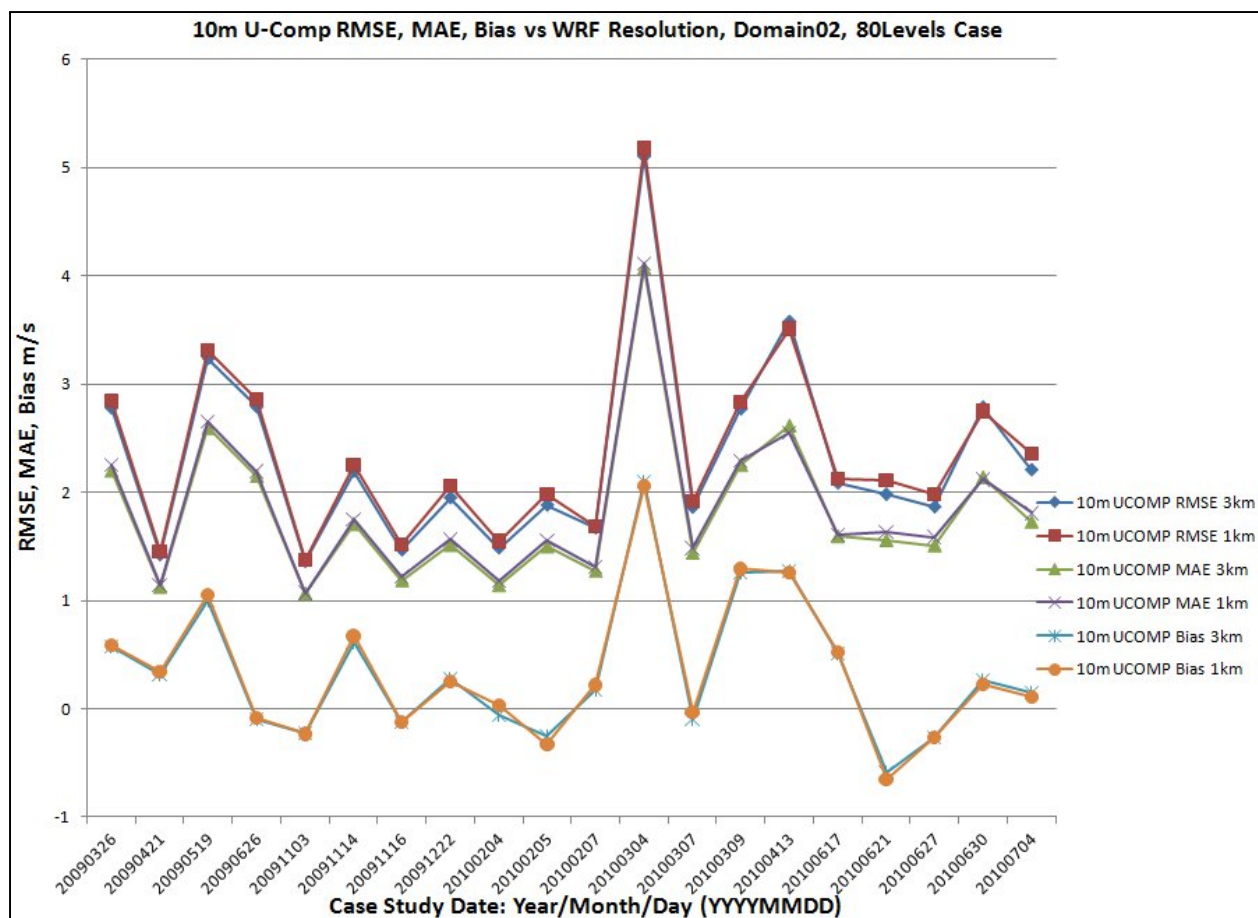


Figure B-50. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

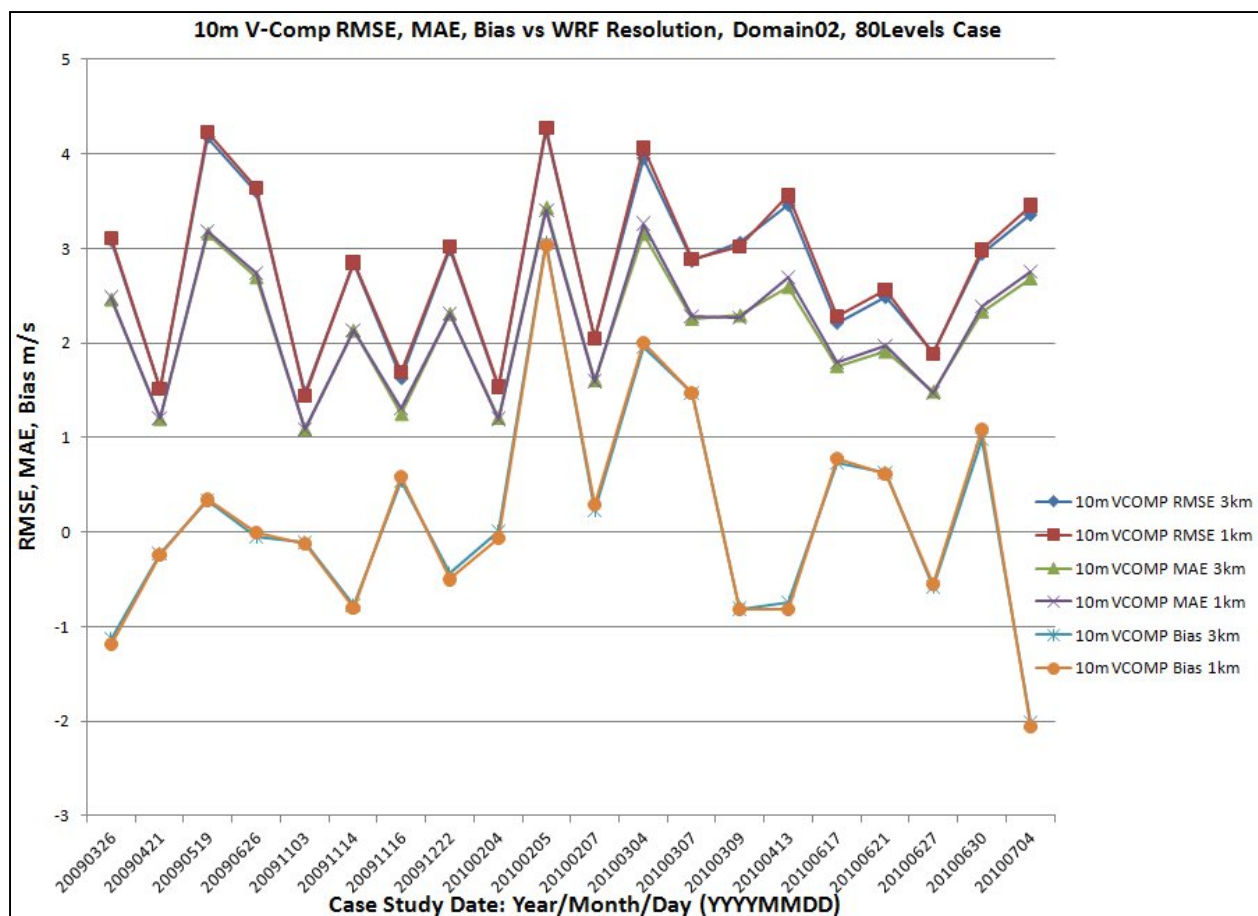


Figure B-51. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

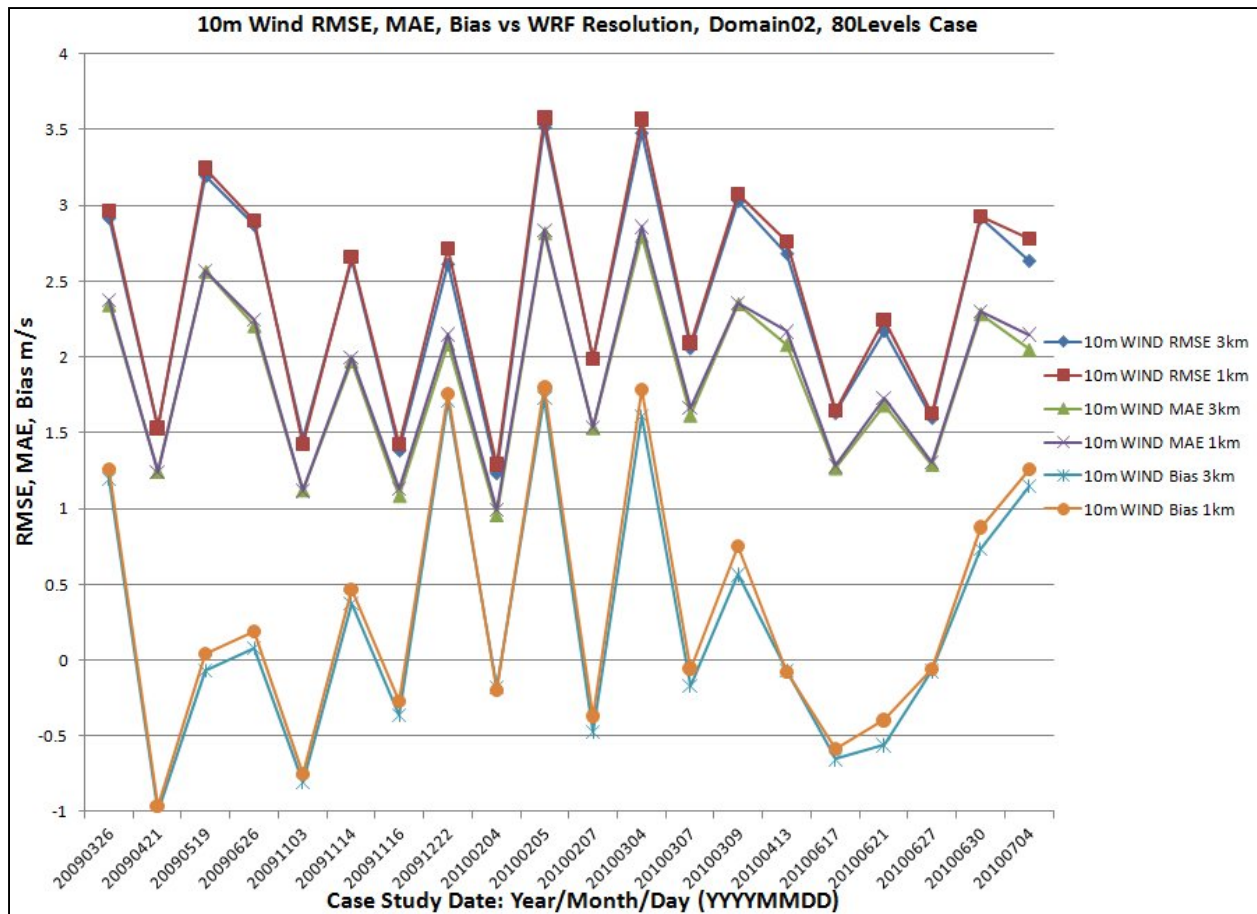


Figure B-52. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, 80Levels setting.

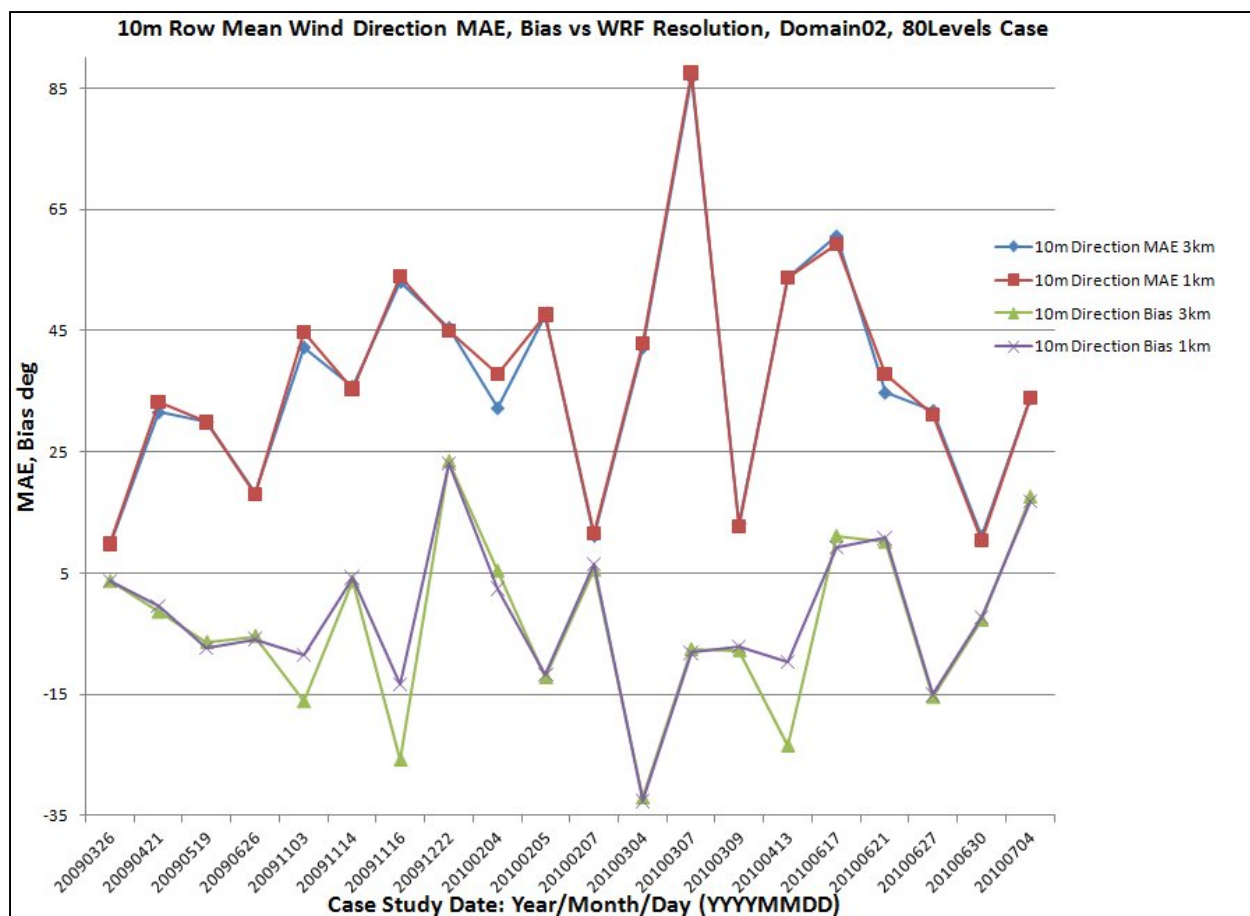


Figure B-53. Comparison of all 10-m row mean wind direction statistics (MAE and Bias only) for 3-km and 1-km WRF, Domain 2, 80Levels setting.

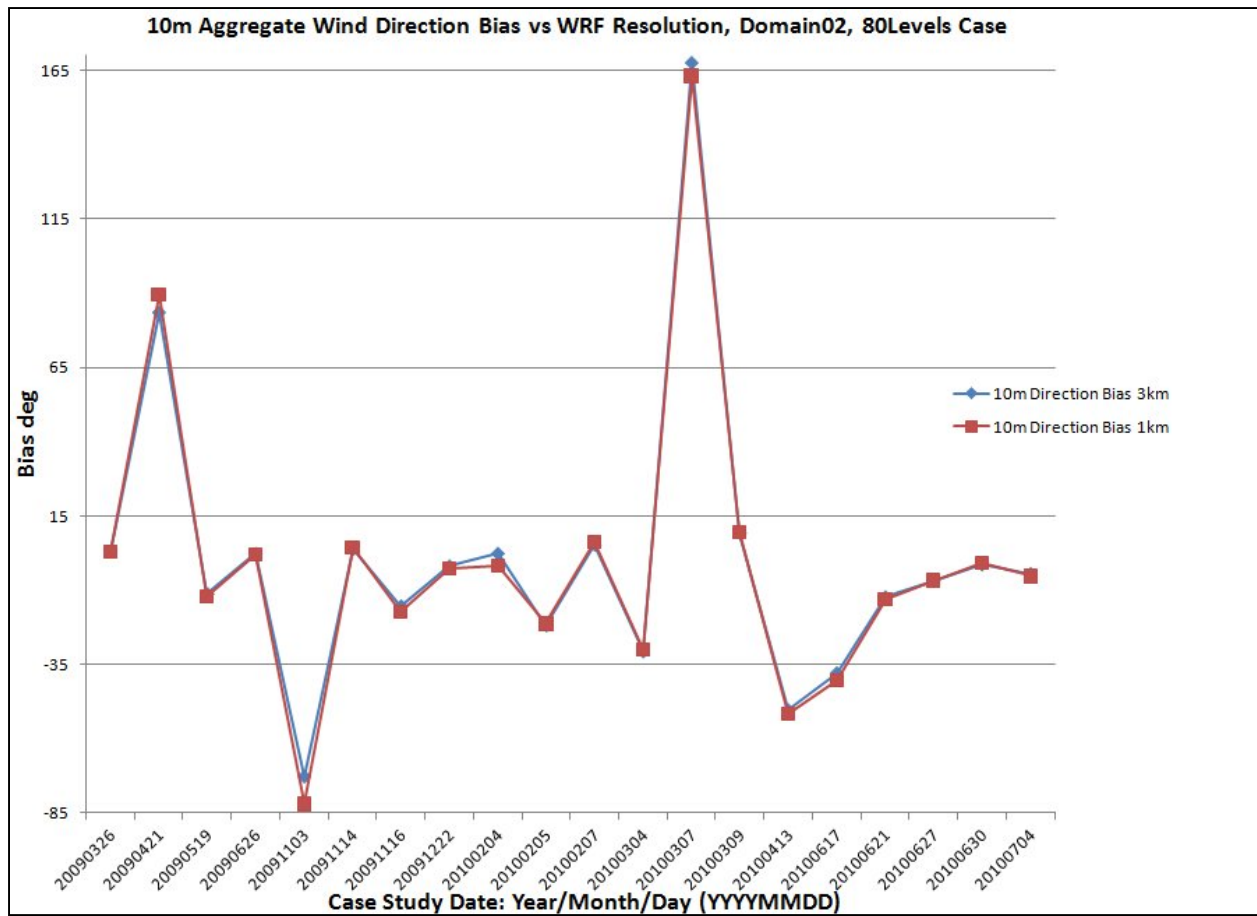


Figure B-54. Comparison of all 10-m aggregate wind direction statistics (Bias only) for 3-km and 1-km WRF, Domain 2, 80Levels setting.

Table B-14. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, MYJ BL setting.

DATE: 2009, 2010				Model/Domain Set: m1o2_B2_sfc												
Date	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.47	1.61	2.10	608	-0.22	1.74	2.32	608	-6.90	11.17	14.27	608	2.91	2.94	3.31	483
20090421	2.68	3.14	3.92	561	-0.95	3.31	3.85	587	-11.75	14.58	20.53	587	-3.20	3.20	3.37	442
20090519	1.14	1.74	2.22	578	-0.35	1.47	1.99	595	-1.82	3.37	4.46	595	-5.42	5.42	5.53	446
20090626	-0.24	1.94	2.37	593	2.38	2.66	3.17	578	7.51	11.60	13.87	578	-3.89	3.89	4.23	459
20091103	3.91	4.04	4.97	538	1.34	1.70	2.17	582	-8.89	10.42	13.08	582	-2.54	2.58	3.10	479
20091114	2.16	2.33	2.88	558	1.08	2.31	2.74	563	-4.58	9.88	12.41	563	1.82	1.94	2.27	468
20091116	5.37	5.37	5.90	539	-0.76	2.16	2.72	560	-22.72	22.82	25.30	560	0.15	2.25	2.62	471
20091222	1.82	1.97	2.59	514	0.02	1.37	1.73	520	-11.14	11.27	14.20	520	3.47	3.54	3.96	378
20100204	-1.50	2.36	2.88	570	-1.15	1.57	1.86	576	1.19	9.39	12.06	576	3.73	3.74	4.27	425
20100205	-1.24	1.94	2.40	578	-1.08	1.29	1.57	579	1.04	9.67	11.95	579	0.80	1.89	2.31	424
20100207	-1.53	1.82	2.09	591	-1.63	1.74	2.08	591	-0.36	7.04	9.46	591	2.35	2.44	2.80	424
20100304	0.96	1.95	2.47	609	-0.08	1.75	2.18	610	-5.05	16.25	19.71	610	-0.47	1.43	1.73	480
20100307	-0.09	1.65	2.03	595	-1.22	1.52	1.85	599	-5.84	11.10	13.75	599	-0.30	1.13	1.38	470
20100309	-1.43	1.63	1.87	609	-1.34	2.15	2.71	611	0.67	9.38	11.77	611	0.42	1.46	1.82	482
20100413	0.64	1.33	1.78	580	0.09	1.37	1.81	579	-1.93	8.17	10.87	579	-1.16	1.84	2.34	462
20100617	0.66	1.35	1.77	571	2.83	3.58	4.13	571	3.38	8.83	11.21	571	-4.20	4.22	4.69	471
20100621	0.27	1.55	1.98	577	1.58	2.05	2.76	573	2.72	4.96	7.42	573	-5.29	5.29	5.55	463
20100627	2.31	2.47	3.14	574	3.68	3.72	4.12	589	2.80	4.79	6.14	589	-8.51	9.15	11.20	435
20100630	-0.30	1.51	2.03	650	1.42	2.67	3.52	631	2.19	3.85	5.53	631	-6.89	6.90	7.05	445
20100704	1.91	2.19	2.74	608	0.56	2.13	2.67	608	-1.28	4.28	5.78	608	-7.10	7.10	7.30	442

Table B-14. Error statistics for surface meteorological variables for 3-km WRF, Domain 2, MYJ BL setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.84	2.22	2.88	586	-1.35	2.61	3.27	586	1.62	2.58	3.18	586	5.57	8.50	25	4.40	580
20090421	0.00	1.15	1.49	595	-0.23	1.28	1.61	595	-0.38	1.09	1.38	595	-9.60	31.20	25	36.48	502
20090519	1.17	2.81	3.62	537	1.30	3.21	4.23	537	0.94	2.52	3.21	537	2.03	25.11	25	-2.03	518
20090626	-0.55	2.49	3.36	550	-0.06	3.28	4.26	550	1.00	2.79	3.59	550	3.37	21.22	25	7.82	526
20091103	-0.30	1.19	1.53	583	-0.22	1.25	1.70	583	-0.13	1.01	1.34	583	-11.37	46.29	25	-99.92	463
20091114	0.70	2.05	2.57	554	-0.48	2.10	2.88	554	0.51	1.99	2.72	554	16.86	40.30	25	6.68	487
20091116	-0.39	1.26	1.56	565	0.96	1.46	1.86	565	0.32	1.08	1.37	565	-22.35	51.40	25	-14.83	436
20091222	0.28	1.58	2.12	514	-0.09	2.19	2.90	514	1.65	2.00	2.57	514	4.06	45.49	25	3.12	403
20100204	-0.43	1.36	1.77	576	0.79	1.61	2.02	576	0.78	1.32	1.66	576	4.62	30.42	25	2.96	442
20100205	-0.97	1.82	2.38	574	3.56	3.75	4.52	574	2.50	3.07	3.80	574	-5.04	46.52	25	-14.41	473
20100207	1.04	1.74	2.20	586	-0.12	1.71	2.10	586	0.23	1.64	2.05	586	18.92	19.83	25	19.50	533
20100304	1.47	4.00	5.11	595	2.17	3.31	4.14	595	2.03	3.04	3.77	595	-27.75	39.73	25	-24.16	571
20100307	-0.29	1.59	2.05	596	1.56	2.51	3.15	596	0.42	1.68	2.12	596	-2.97	82.54	25	-179.16	460
20100309	0.91	2.02	2.58	578	-0.56	2.37	3.05	578	0.85	2.40	3.07	578	-2.11	7.37	25	7.45	564
20100413	0.92	2.42	3.31	559	-0.60	2.59	3.50	559	0.21	2.00	2.66	559	3.68	45.39	25	-34.81	529
20100617	0.41	1.63	2.19	576	0.59	1.84	2.31	576	-0.08	1.20	1.55	576	22.16	57.52	25	-27.04	539
20100621	-0.50	1.82	2.30	563	0.47	1.89	2.47	563	-0.31	1.74	2.29	563	3.12	46.46	25	-9.73	536
20100627	-0.53	1.64	2.07	585	-0.87	1.63	2.10	585	0.49	1.33	1.71	591	-18.59	27.50	25	-13.24	509
20100630	-0.07	2.02	2.65	606	1.76	2.73	3.37	606	1.77	2.67	3.37	609	1.29	4.98	25	1.67	594
20100704	0.51	1.89	2.43	607	-2.24	2.90	3.57	607	1.68	2.34	2.91	607	19.38	28.91	25	-0.98	559

Table B-15. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, MYJ BL setting.

DATE: 2009, 2010					Model/Domain Set:				m2o2_B2_sfc							
	2-m Temperature (K)				2-m DewPoint Temp (K)				2-m Rel Humidity (%)				0-m MSL Pressure (hPa)			
Date	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL
20090326	1.42	1.55	1.98	608	-0.21	1.75	2.34	608	-6.64	11.09	14.20	608	2.98	3.01	3.39	483
20090421	2.61	3.07	3.87	561	-0.66	3.18	3.72	587	-11.01	14.25	20.13	587	-3.15	3.15	3.34	442
20090519	1.10	1.70	2.15	578	-0.35	1.51	2.04	595	-1.74	3.34	4.42	595	-5.35	5.35	5.47	446
20090626	-0.27	1.89	2.31	593	2.44	2.71	3.24	578	7.84	11.86	14.12	578	-3.63	3.66	4.05	459
20091103	3.83	4.00	4.94	538	1.46	1.75	2.22	582	-8.28	10.10	12.78	582	-2.43	2.49	3.01	479
20091114	2.12	2.29	2.84	558	1.08	2.34	2.76	563	-4.29	9.82	12.43	563	1.91	2.02	2.36	468
20091116	5.32	5.32	5.87	539	-0.65	2.07	2.64	560	-22.26	22.34	24.93	560	0.18	2.26	2.63	471
20091222	1.66	1.79	2.35	514	0.00	1.34	1.70	520	-10.29	10.43	13.22	520	3.71	3.75	4.15	378
20100204	-1.86	2.53	3.09	570	-1.19	1.63	1.96	576	2.98	9.17	12.08	576	4.23	4.23	4.71	425
20100205	-1.37	1.98	2.48	578	-1.16	1.34	1.64	579	1.32	9.36	11.67	579	1.00	1.99	2.43	424
20100207	-1.58	1.80	2.08	591	-1.59	1.73	2.11	591	0.23	7.07	9.61	591	2.58	2.62	2.98	424
20100304	0.84	1.89	2.39	609	0.00	1.69	2.09	610	-4.09	15.97	19.38	610	-0.36	1.44	1.74	480
20100307	-0.17	1.65	2.04	595	-1.12	1.44	1.75	599	-4.90	10.77	13.34	599	-0.10	1.11	1.39	470
20100309	-1.45	1.55	1.80	609	-1.28	2.08	2.65	611	1.07	9.35	11.77	611	0.49	1.45	1.81	482
20100413	0.40	1.26	1.68	580	0.26	1.38	1.83	579	-0.55	8.09	10.70	579	-0.92	1.72	2.19	462
20100617	0.58	1.28	1.72	571	3.03	3.65	4.22	571	4.11	8.97	11.38	571	-4.12	4.14	4.62	471
20100621	0.20	1.47	1.96	577	1.55	2.10	2.82	573	2.73	5.25	7.77	573	-5.08	5.08	5.34	463
20100627	2.28	2.44	3.14	574	3.79	3.83	4.24	589	3.04	5.06	6.44	589	-8.33	8.97	11.06	435
20100630	-0.37	1.49	2.05	650	1.44	2.66	3.55	631	2.28	4.00	5.85	631	-6.90	6.91	7.05	445
20100704	1.86	2.13	2.67	608	0.57	2.21	2.76	608	-1.16	4.40	5.92	608	-7.05	7.05	7.26	442

Table B-15. Error statistics for surface meteorological variables for 1-km WRF, Domain 2, MYJ BL setting (continued).

Date													10-m Wind Dir (deg)				
	10-m U-comp (m/s)				10-m V-comp (m/s)				10-m Wind Speed (m/s)				ROW_MEAN			AGGR	
	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	RMSE	TOTAL	ME	MAE	TOTAL	ME	TOTAL
20090326	0.85	2.30	2.95	586	-1.39	2.66	3.33	586	1.69	2.63	3.25	586	5.58	8.52	25	4.40	580
20090421	0.02	1.18	1.52	595	-0.24	1.30	1.64	595	-0.32	1.12	1.40	595	-10.21	33.49	25	39.64	502
20090519	1.24	2.93	3.78	537	1.32	3.27	4.30	537	1.12	2.61	3.35	537	1.75	25.56	25	-2.63	518
20090626	-0.53	2.59	3.49	550	-0.07	3.32	4.30	550	1.10	2.87	3.70	550	3.03	21.03	25	7.50	526
20091103	-0.30	1.23	1.59	583	-0.25	1.25	1.68	583	-0.04	1.02	1.35	583	-18.99	49.96	25	-100.45	463
20091114	0.76	2.09	2.62	554	-0.50	2.13	2.93	554	0.60	2.04	2.77	554	18.34	41.22	25	7.52	487
20091116	-0.39	1.31	1.63	565	1.02	1.52	1.94	565	0.41	1.15	1.46	565	-23.97	52.00	25	-16.46	436
20091222	0.40	1.58	2.16	514	-0.34	2.14	2.85	514	1.68	2.06	2.67	514	-0.64	41.50	25	2.74	403
20100204	-0.28	1.40	1.84	576	0.70	1.62	2.01	576	0.77	1.34	1.69	576	0.17	32.23	25	-1.89	442
20100205	-0.87	1.83	2.40	574	3.32	3.58	4.43	574	2.33	2.98	3.74	574	-5.70	47.24	25	-15.08	473
20100207	1.02	1.78	2.23	586	0.14	1.71	2.16	586	0.19	1.68	2.11	586	20.03	21.00	25	20.61	533
20100304	1.55	4.02	5.16	595	2.16	3.42	4.24	595	2.13	3.10	3.86	595	-29.05	40.74	25	-24.81	571
20100307	-0.17	1.63	2.11	596	1.58	2.50	3.14	596	0.50	1.73	2.17	596	-4.58	80.03	25	173.75	460
20100309	1.01	2.07	2.66	578	-0.63	2.38	3.08	578	1.03	2.46	3.17	578	-1.77	7.29	25	7.72	564
20100413	0.93	2.50	3.43	559	-0.55	2.54	3.42	559	0.32	2.02	2.76	559	4.63	47.37	25	-35.33	529
20100617	0.43	1.67	2.22	576	0.63	1.85	2.33	576	-0.03	1.25	1.60	576	20.54	56.03	25	-29.70	539
20100621	-0.55	1.79	2.35	563	0.44	1.96	2.60	563	-0.17	1.77	2.38	563	1.94	42.12	25	-10.45	536
20100627	-0.57	1.79	2.27	585	-0.86	1.79	2.26	585	0.65	1.49	1.91	591	-18.99	27.29	25	-14.42	509
20100630	-0.08	2.13	2.80	606	1.80	2.80	3.48	606	1.86	2.74	3.45	609	1.37	5.61	25	1.87	594
20100704	0.40	2.06	2.68	607	-2.28	2.99	3.70	607	1.82	2.53	3.14	607	18.24	28.66	25	-2.30	559

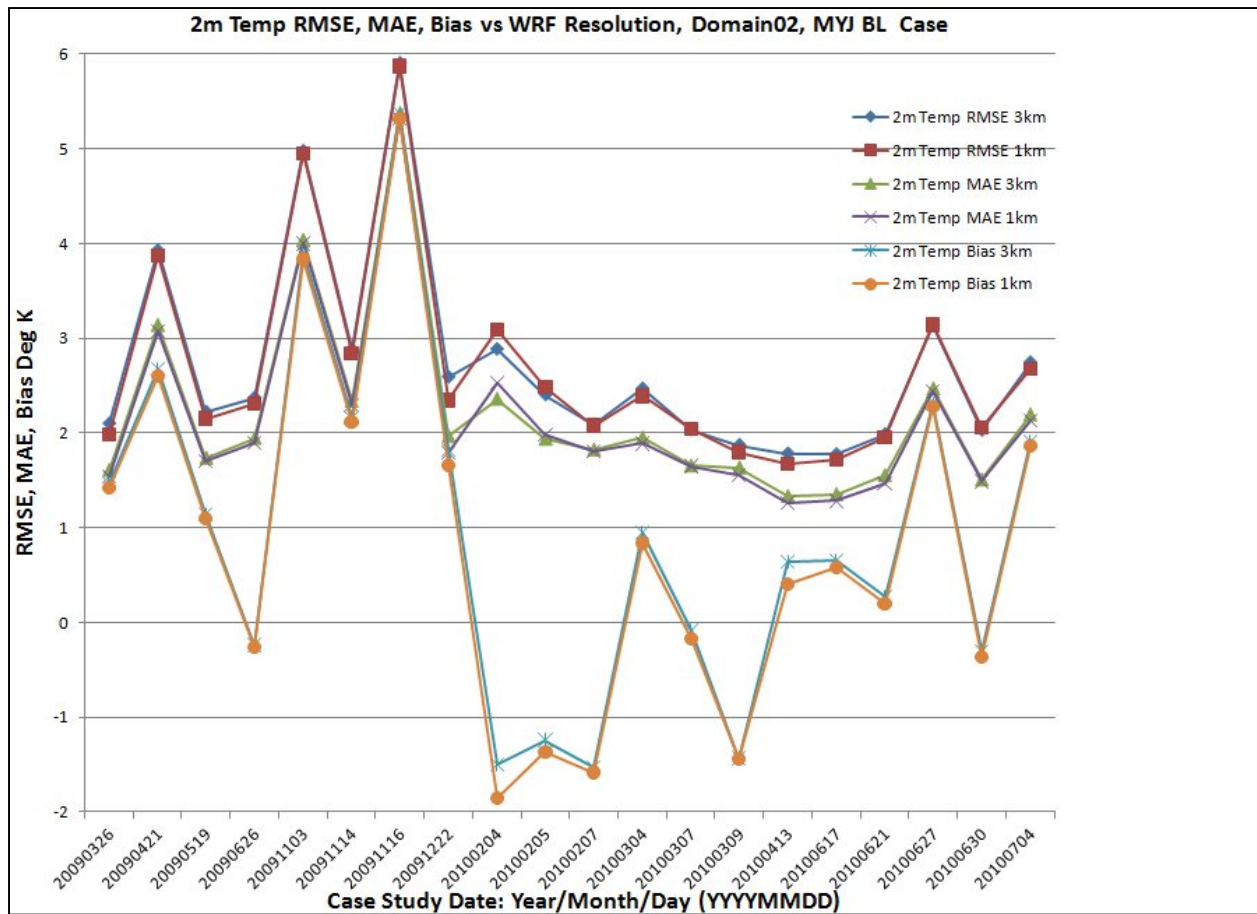


Figure B-55. Comparison of all 2-m air temperature statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

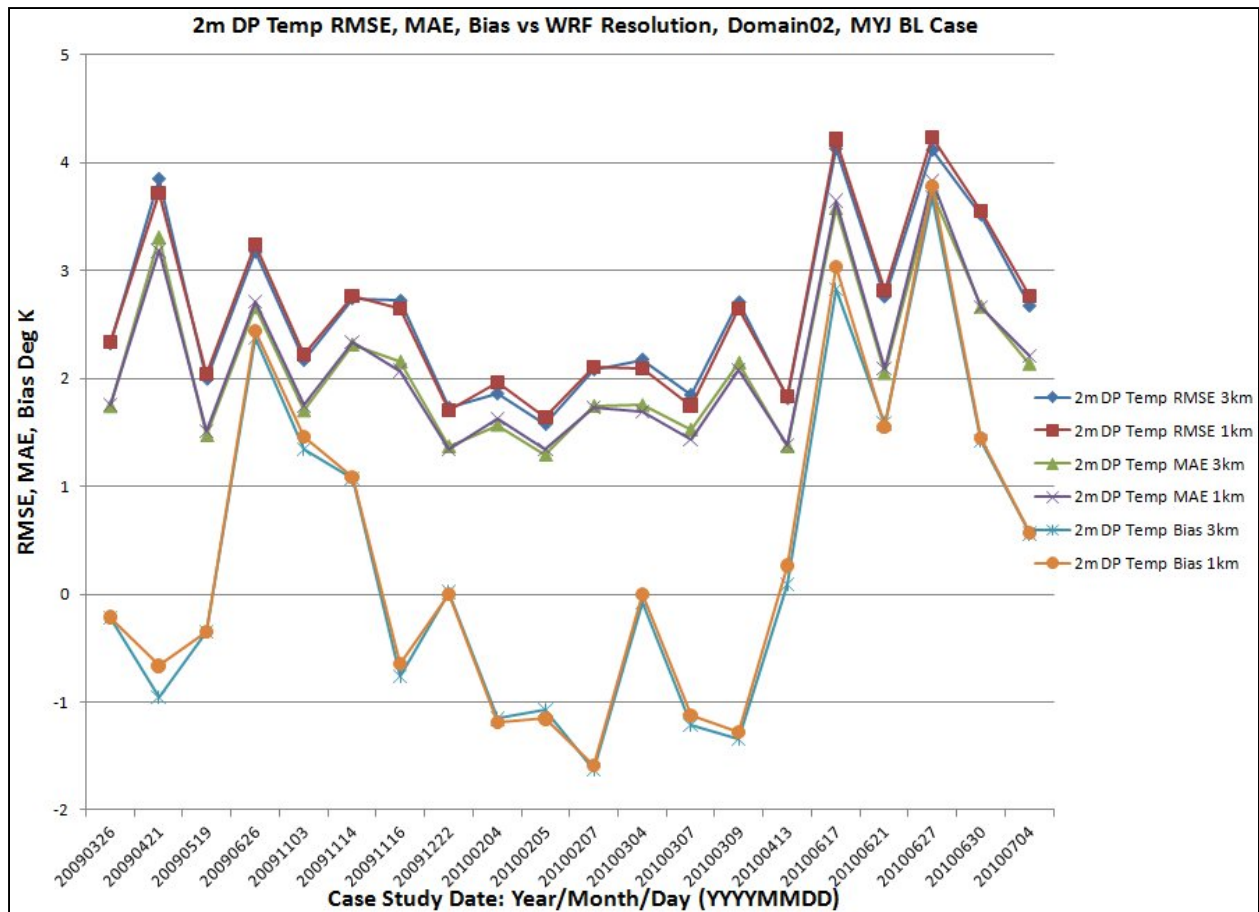


Figure B-56. Comparison of all 2-m dew point temperature statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

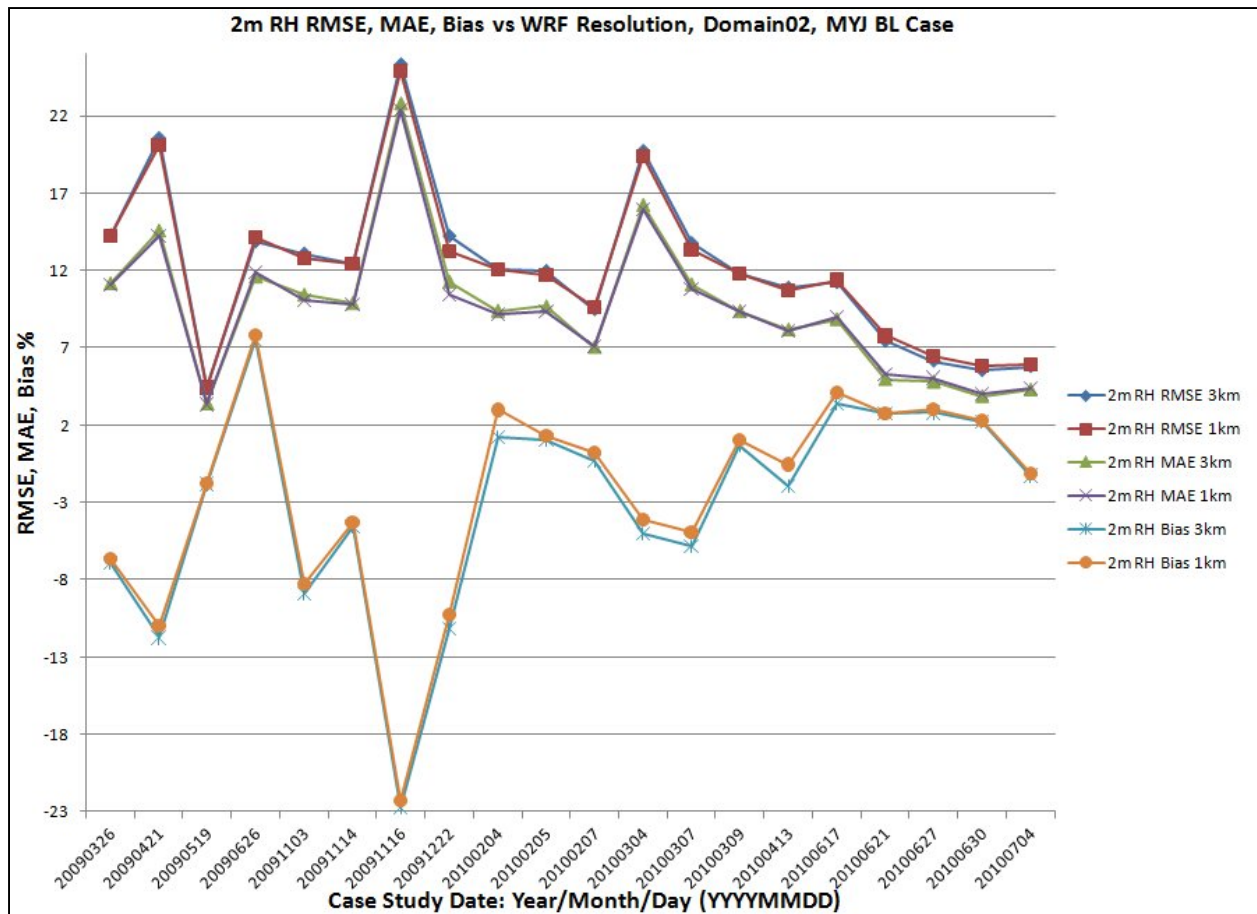


Figure B-57. Comparison of all 2-m relative humidity statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

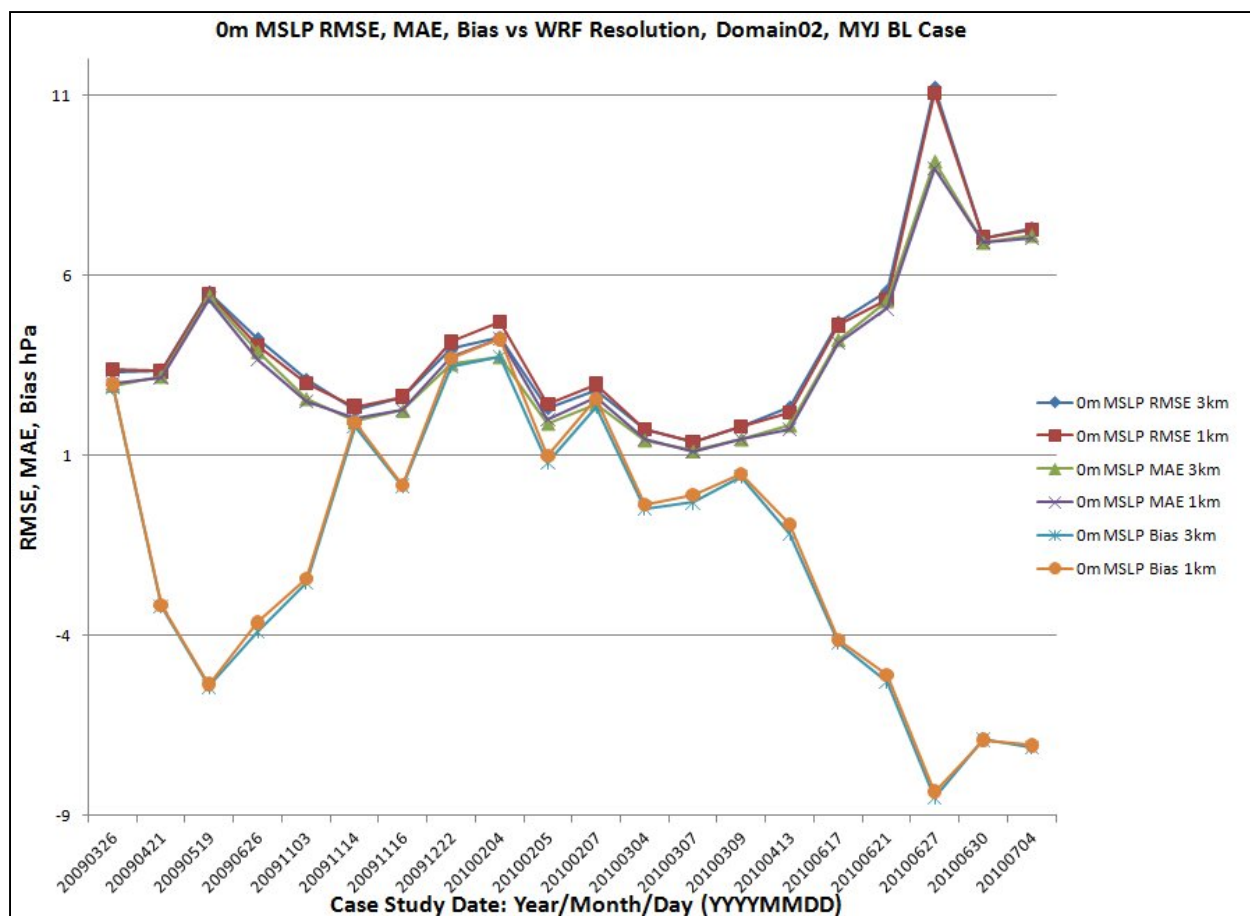


Figure B-58. Comparison of all mean sea level pressure statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

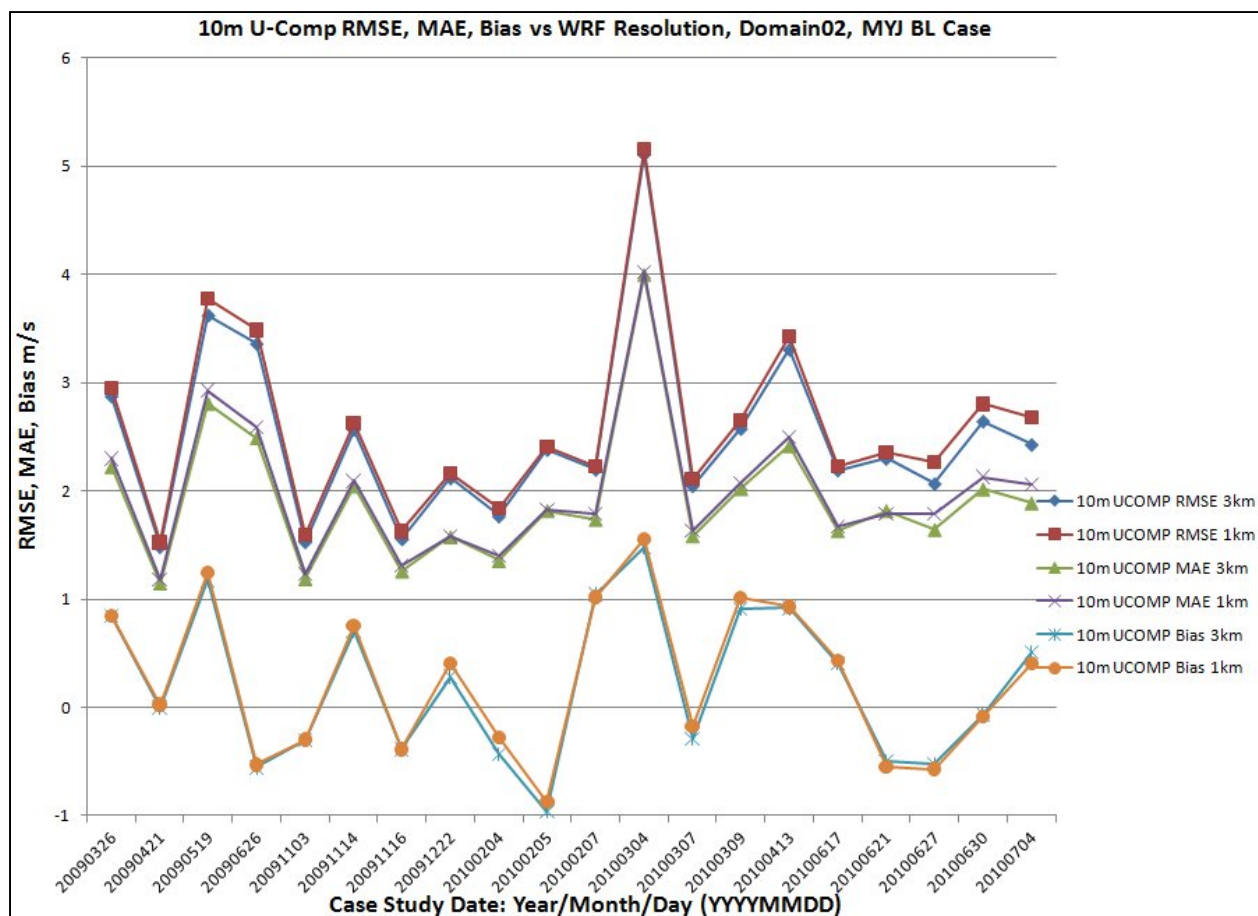


Figure B-59. Comparison of all 10-m U-component wind speed statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

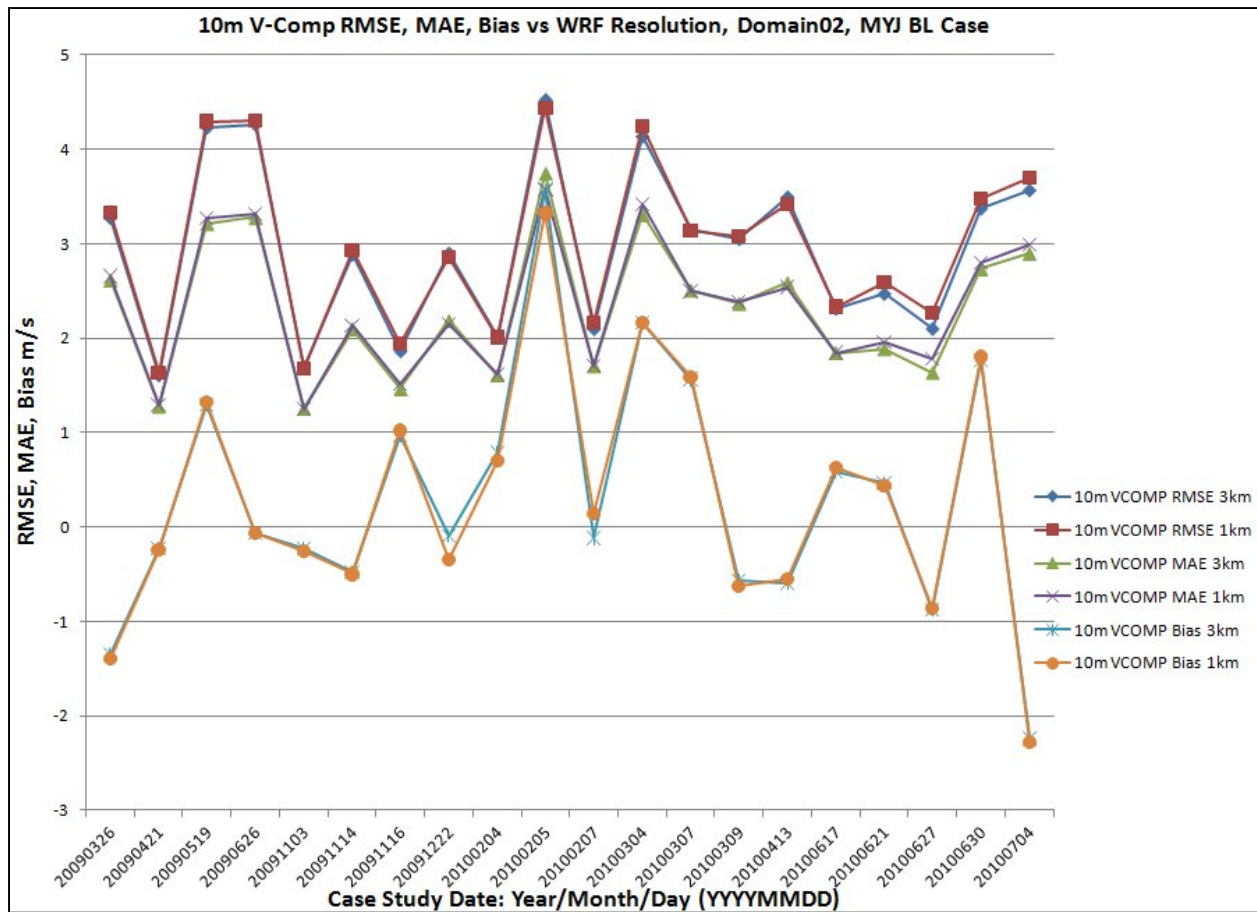


Figure B-60. Comparison of all 10-m V-component wind speed statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

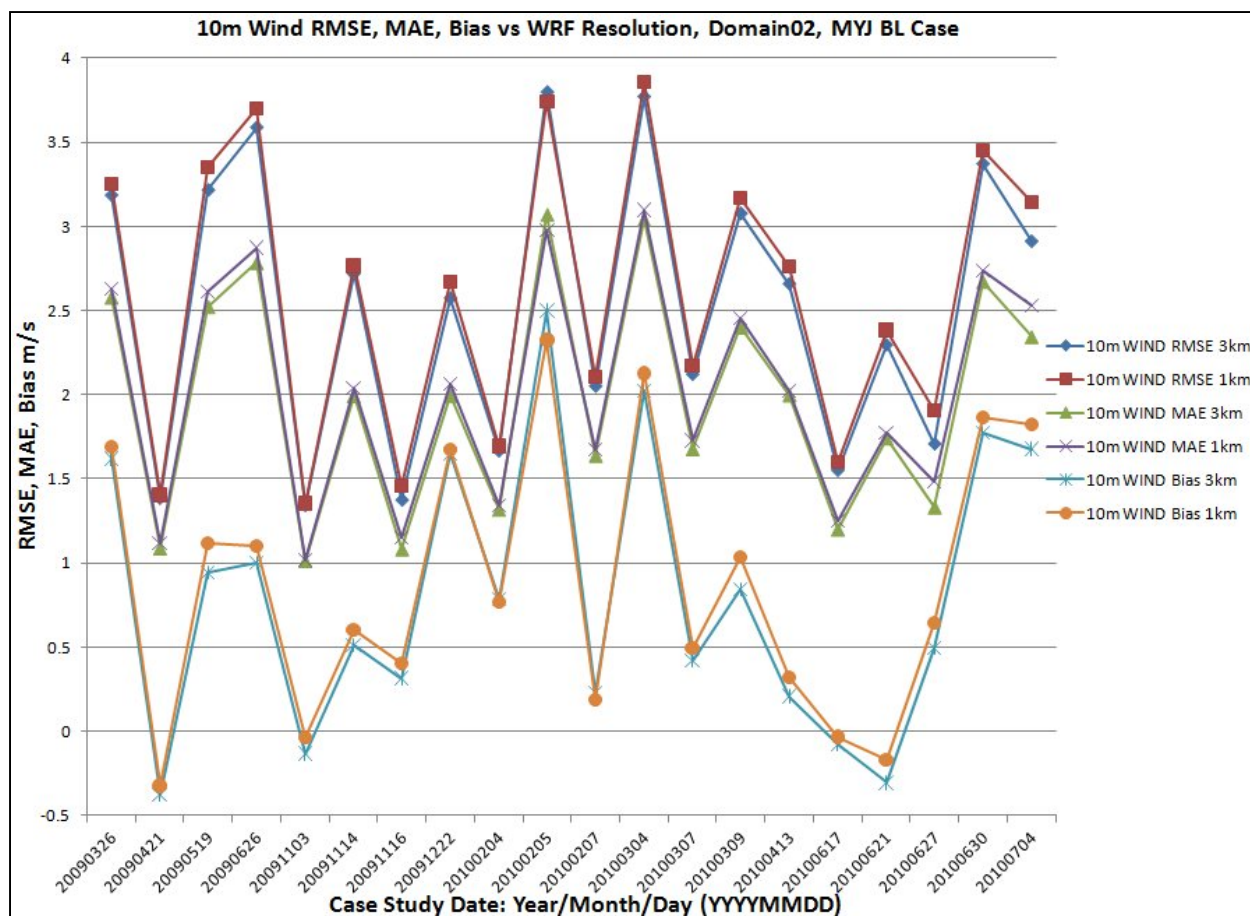


Figure B-61. Comparison of all 10-m wind speed statistics for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

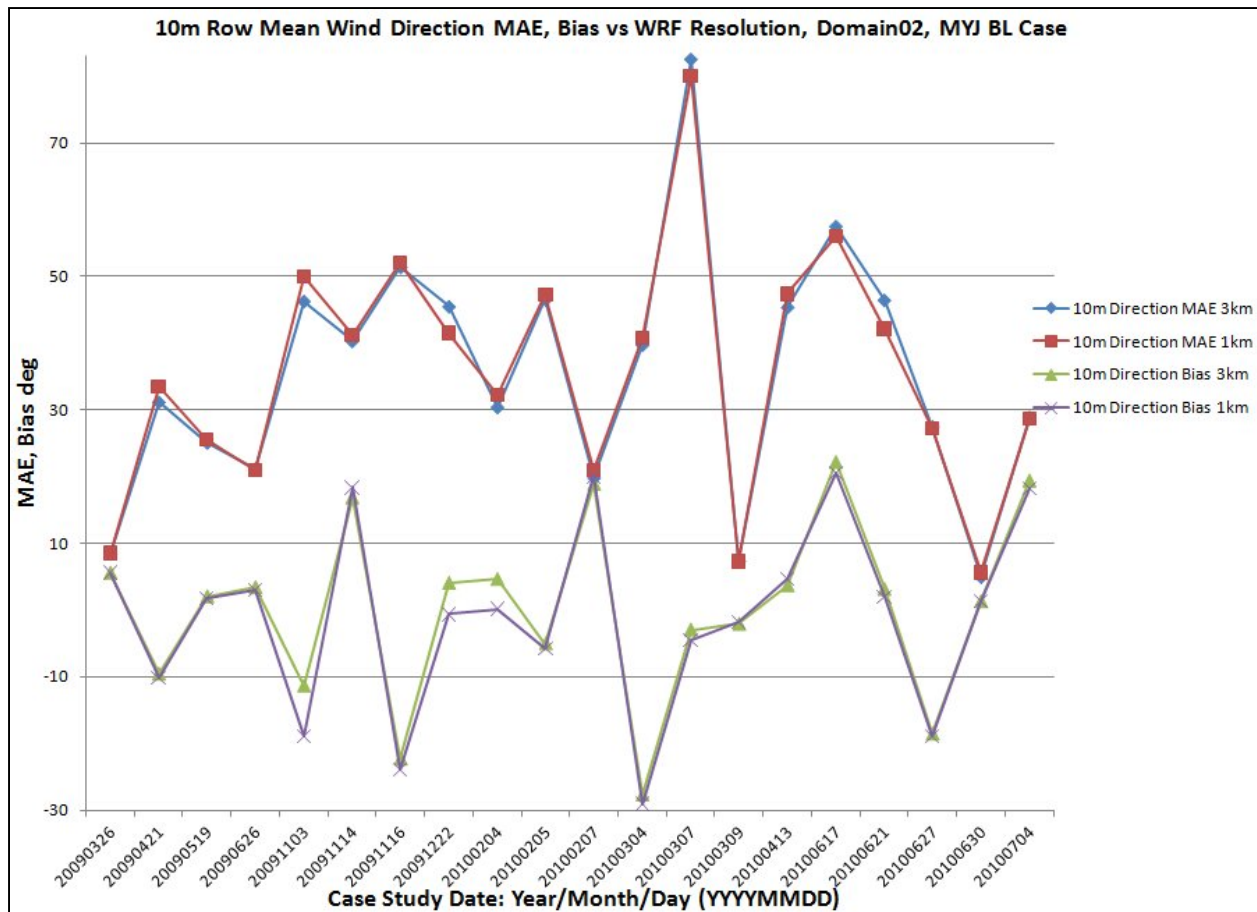


Figure B-62. Comparison of all 10-m row mean wind direction statistics (MAE and Bias only) for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

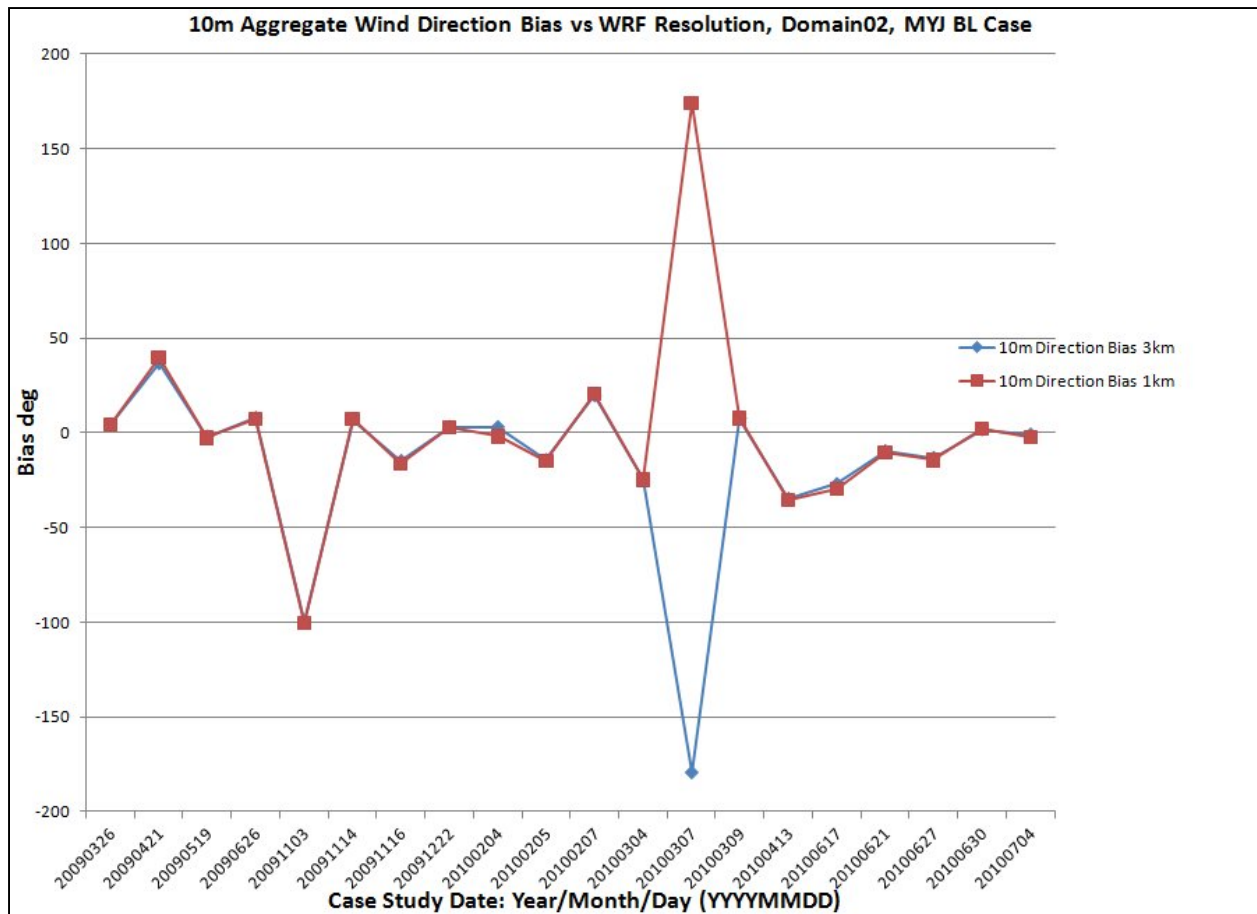


Figure B-63. Comparison of all 10-m aggregate wind direction statistics (Bias only) for 3-km and 1-km WRF, Domain 2, MYJ BL setting.

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Appendix C. Synoptic Weather Charts Showing the General Meteorological Situation for Each Case Study Day

Appendix C contains charts in the following order for each case study day:

- Surface weather analysis valid time 1200 UTC on case study day
- 500-millibar upper air analysis valid time 1200 UTC on case study day
- 24-hour accumulated precipitation for period ending 1200 UTC day after case study day
- Maximum and minimum surface temperatures for case study day

The charts appear in the order by case study day as shown in table C-1.

Table C-1. Figures of appendix C in the order they appear organized by case study day.

Case Study Day	Associated Figures
20090326	Figures C-1–C-4
20090421	Figures C-5–C-8
20090519	Figures C-9–C-12
20090626	Figures C-13–C-16
20091103	Figures C-17–C-20
20091114	Figures C-21–C-24
20091116	Figures C-25–C-28
20091222	Figures C-29–C-32
20100204	Figures C-33–C-36
20100205	Figures C-37–C-40
20100207	Figures C-41–C-44
20100304	Figures C-45–C-48
20100307	Figures C-49–C-52
20100309	Figures C-53–C-56
20100413	Figures C-57–C-60
20100617	Figures C-61–C-64
20100621	Figures C-65–C-68
20100627	Figures C-69–C-72
20100630	Figures C-73–C-76
20100704	Figures C-77–C-80

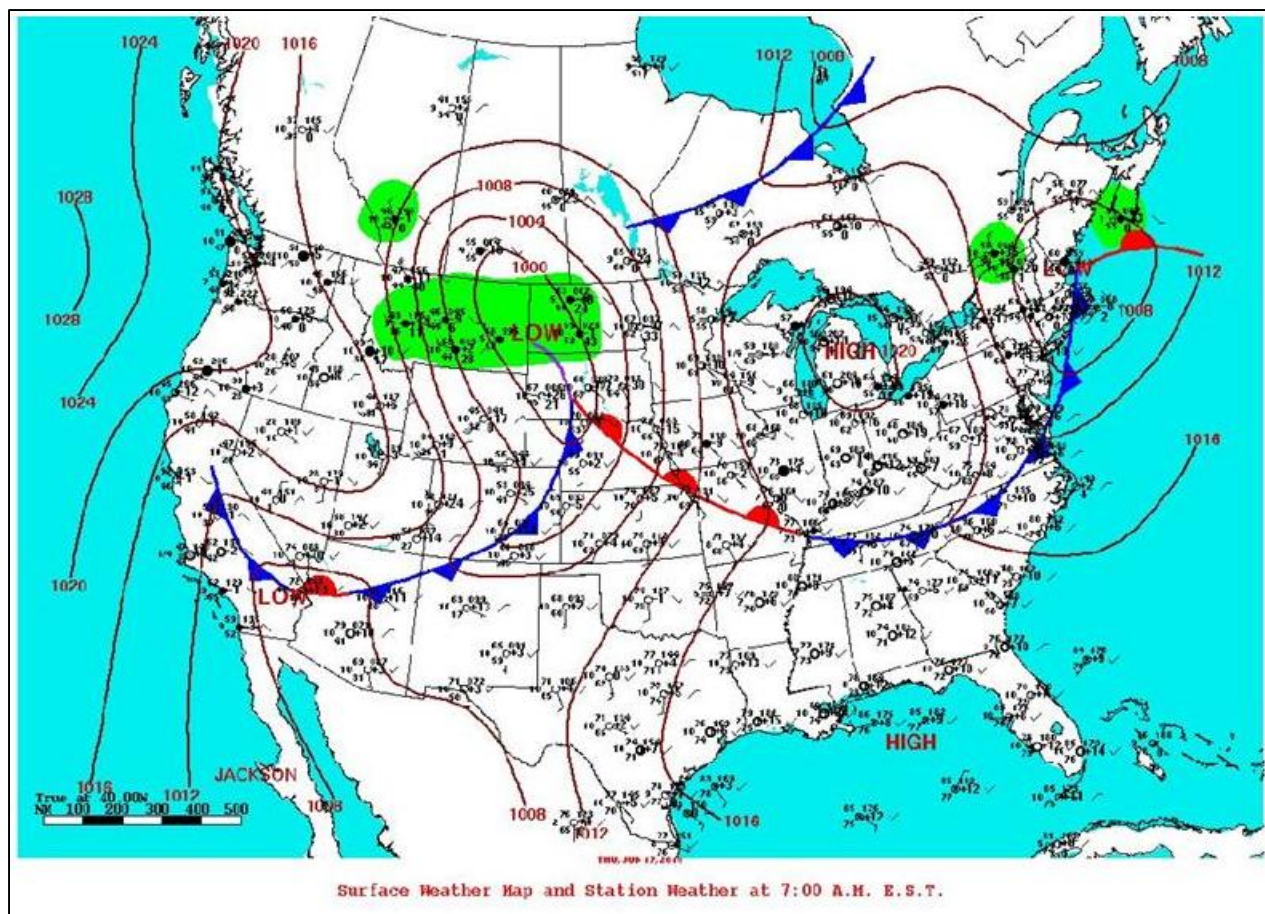


Figure C-1. Surface weather analysis valid time 1200 UTC, 20090326.

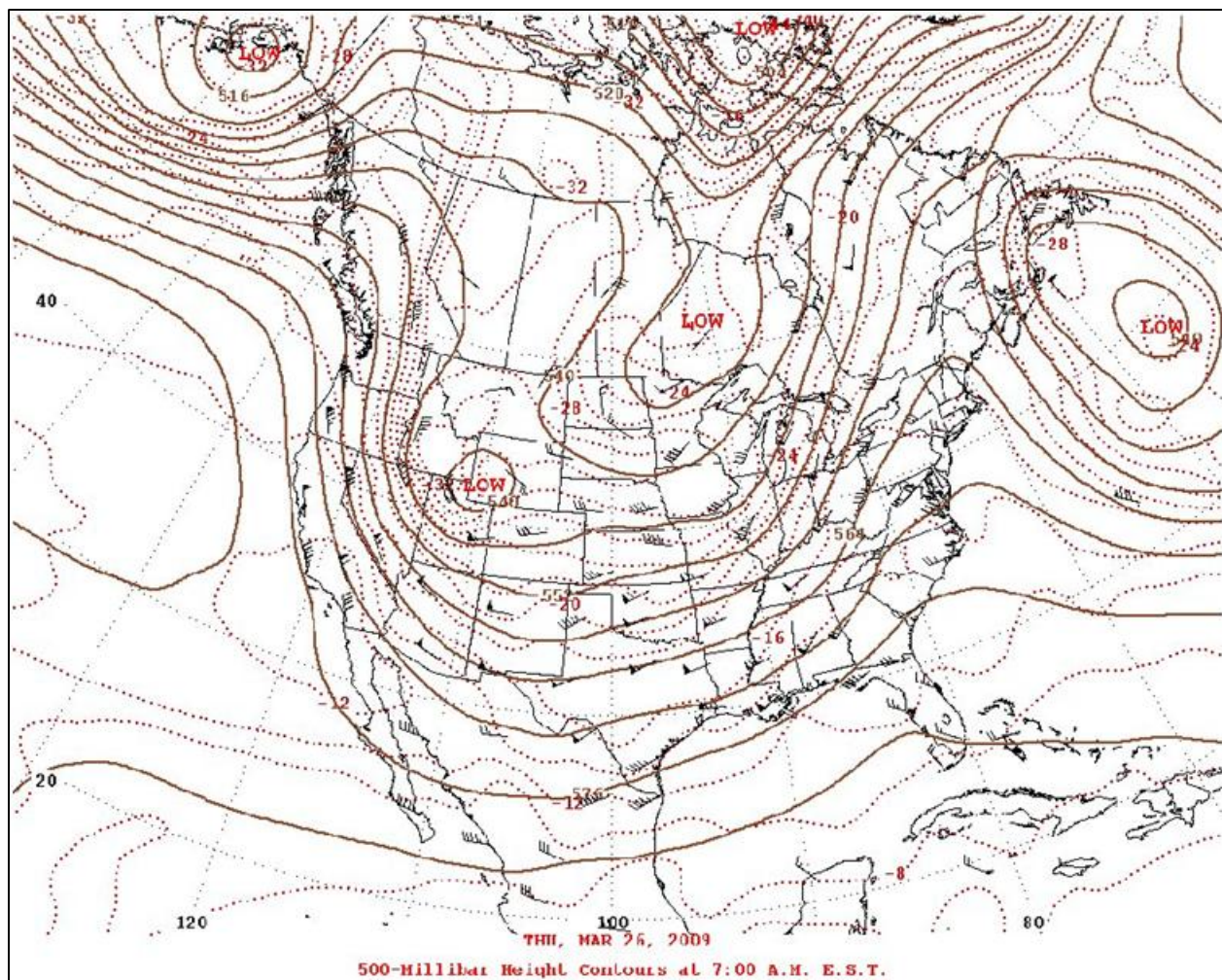


Figure C-2. 500-millibar upper air analysis valid time 1200 UTC, 20090326.

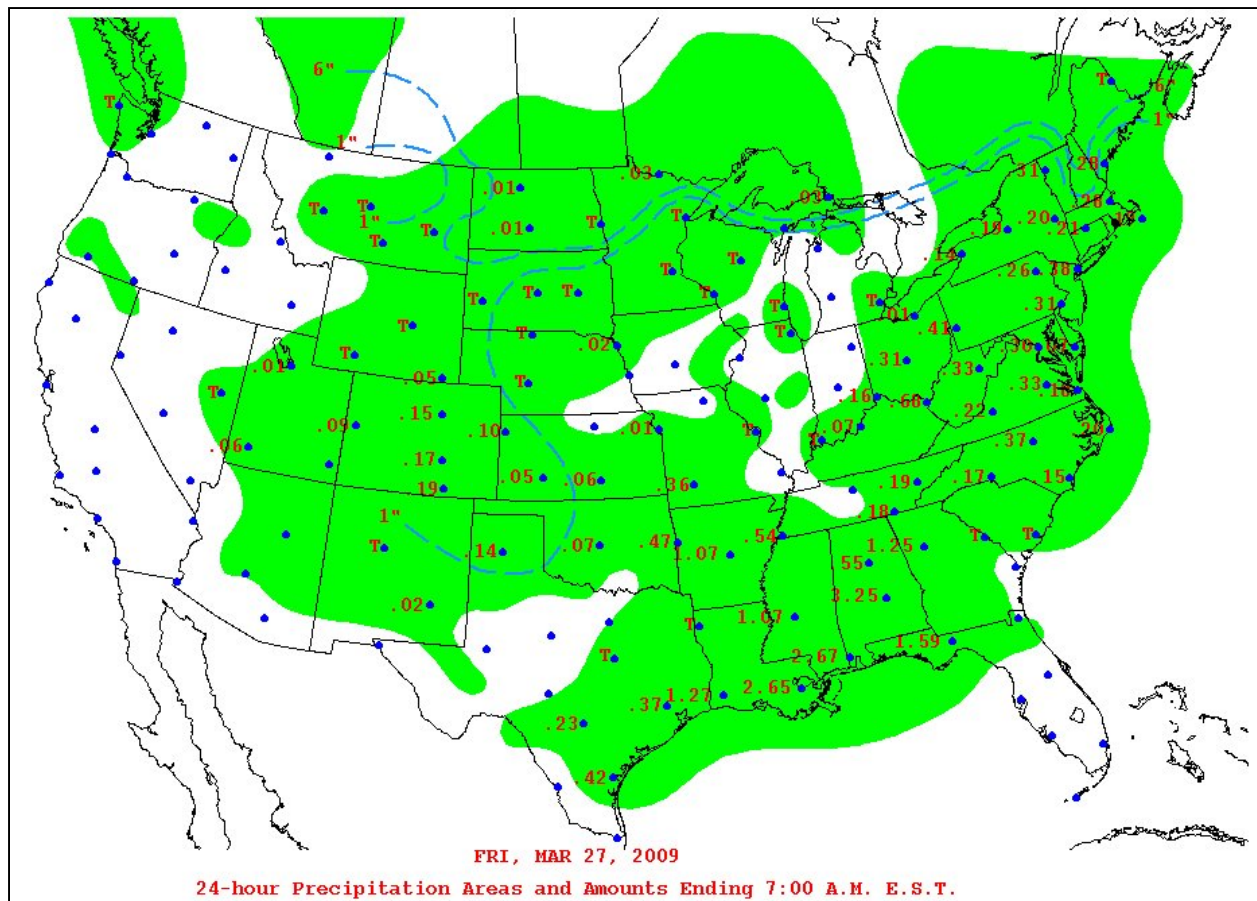


Figure C-3. 24-hour accumulated precipitation for period ending 1200 UTC, 20090327.

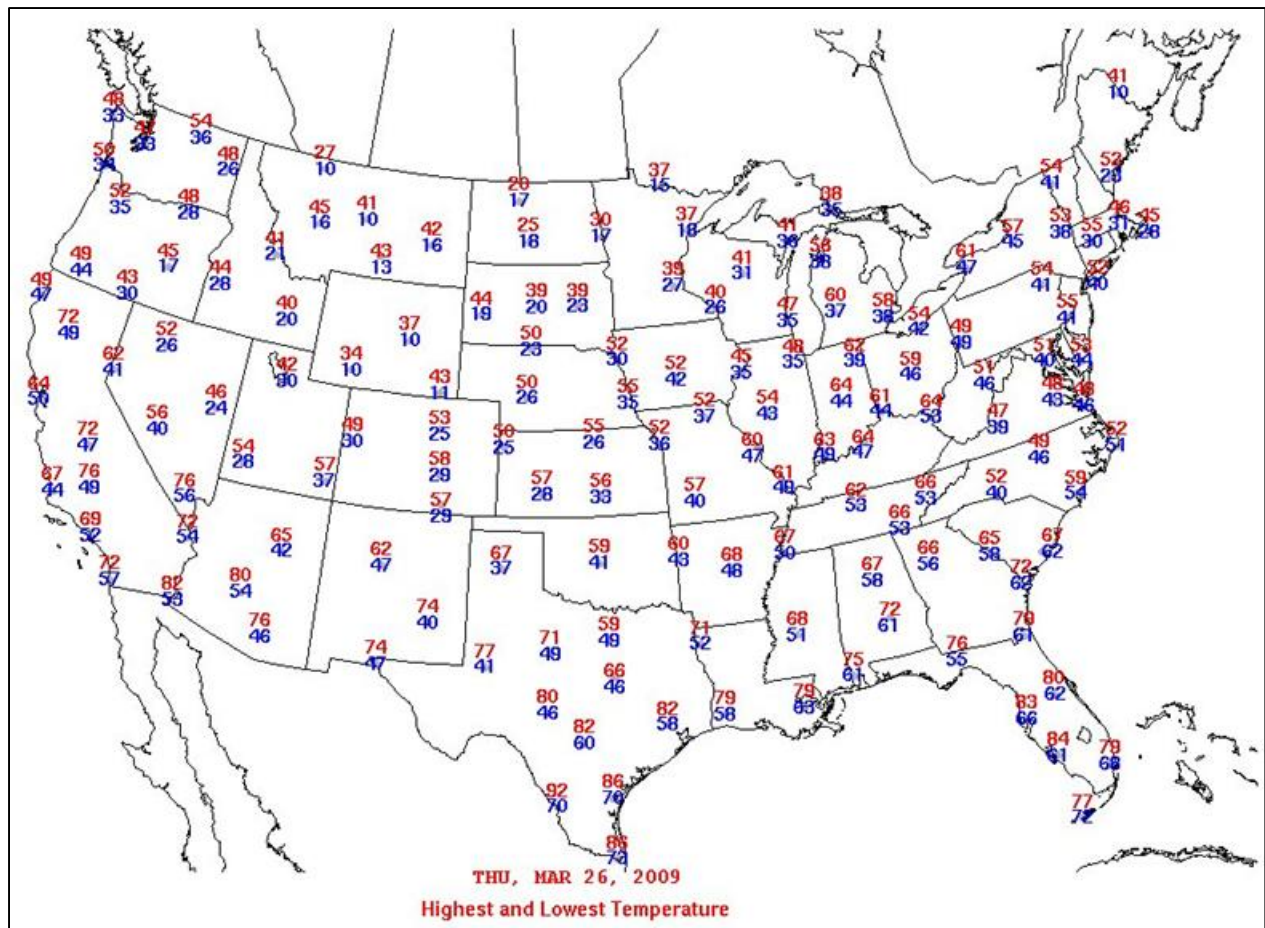


Figure C-4. Maximum and minimum surface temperatures for 20090326.

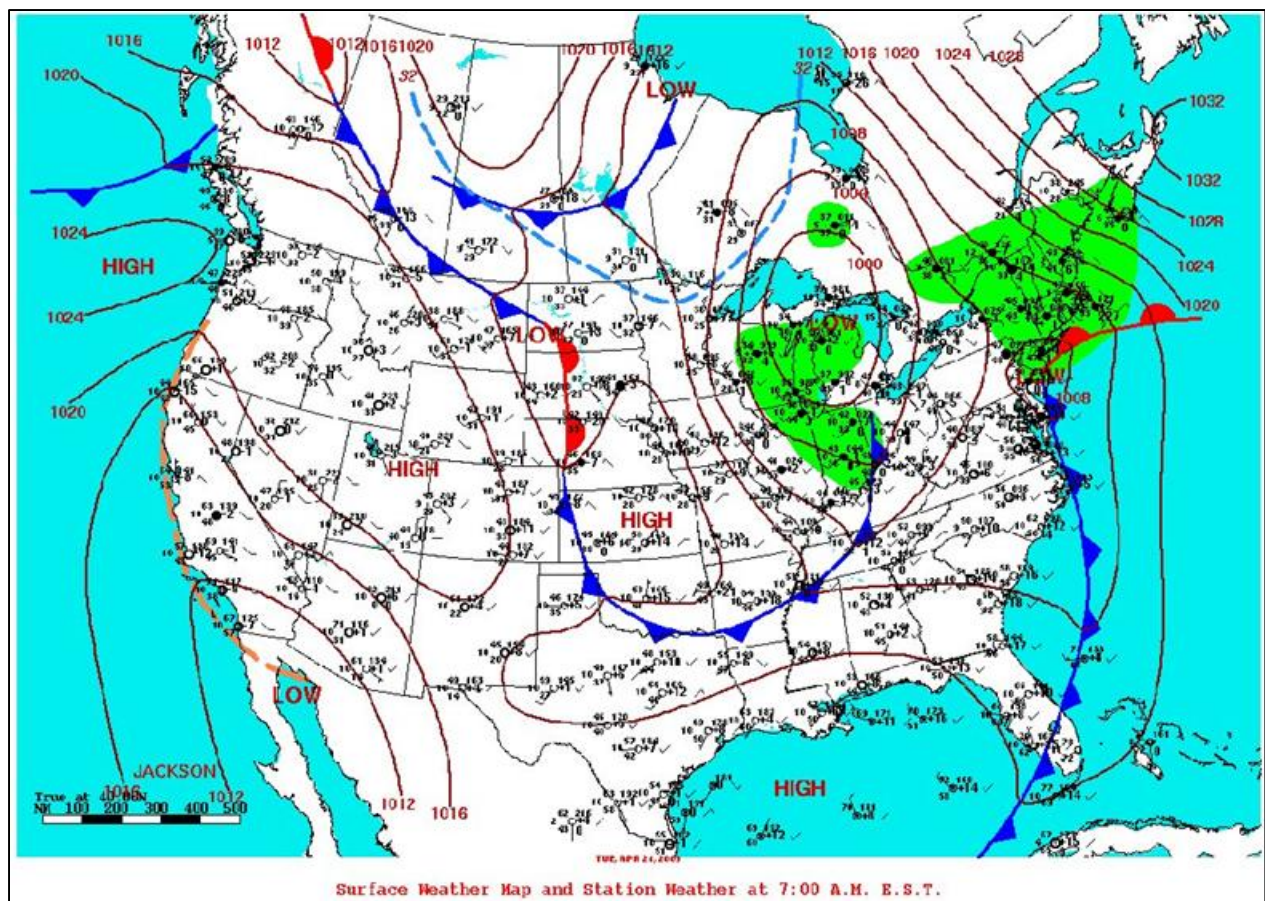


Figure C-5. Surface weather analysis valid time 1200 UTC, 20090421.

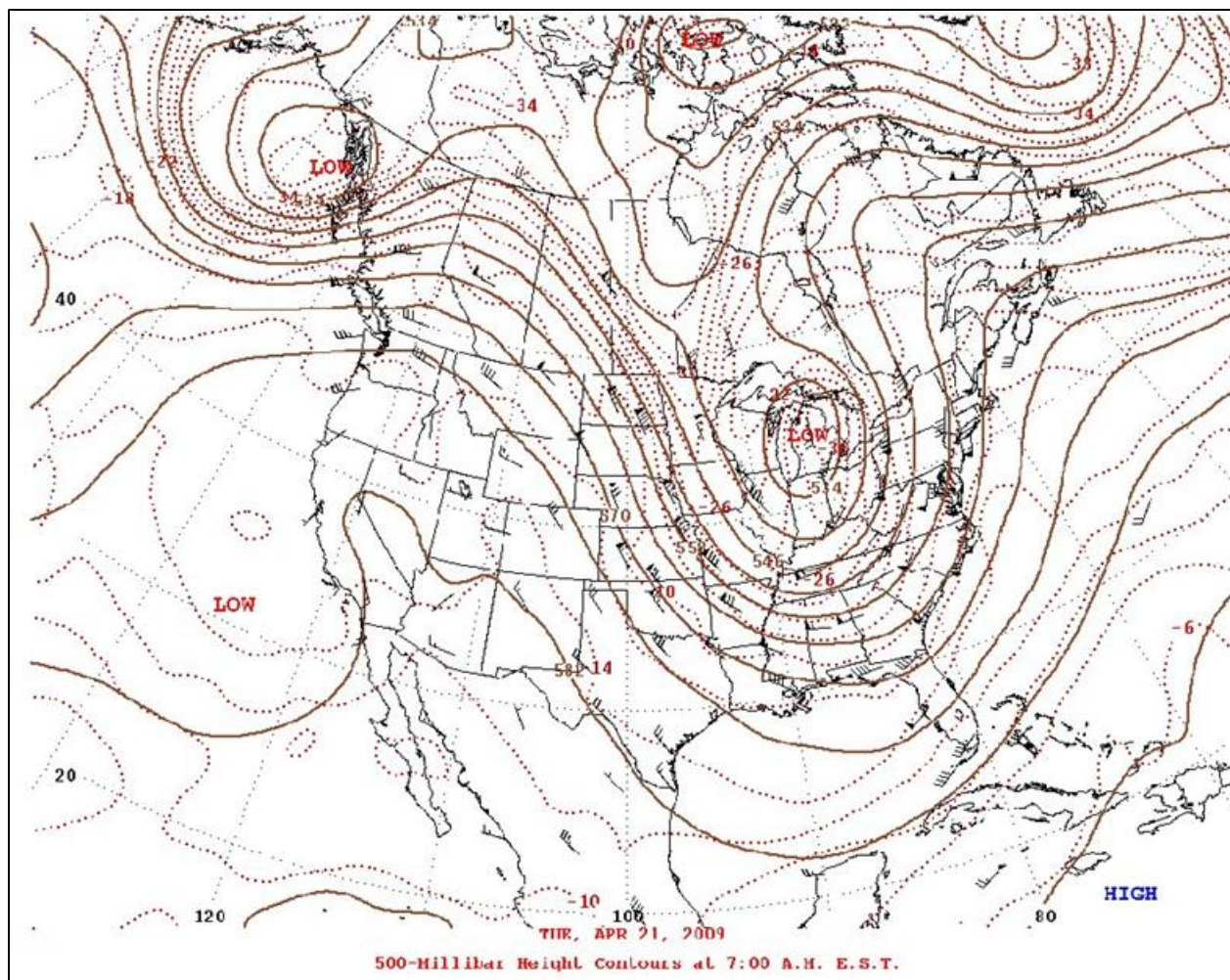


Figure C-6. 500-millibar upper air analysis valid time 1200 UTC, 20090421.

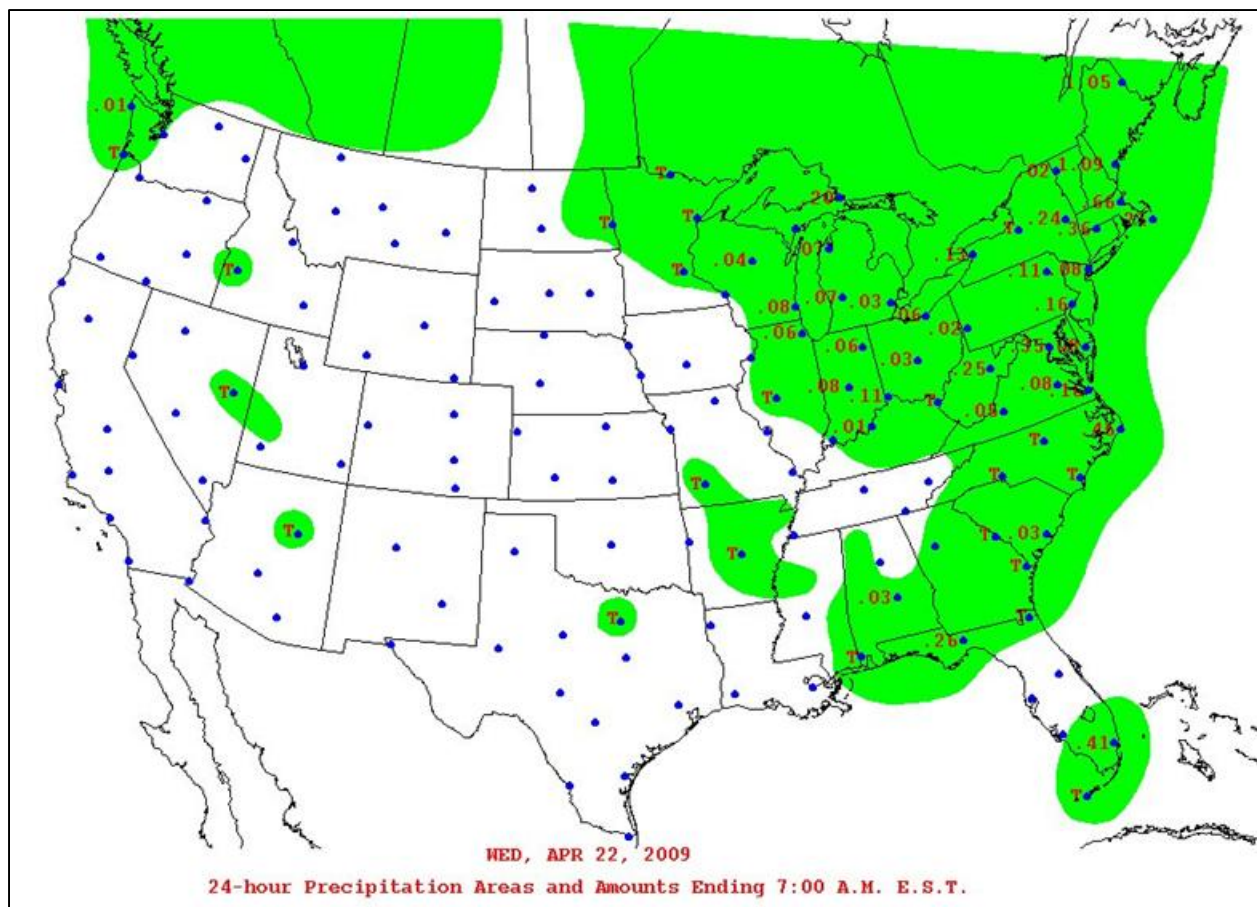


Figure C-7. 24-hour accumulated precipitation for period ending 1200 UTC, 20090422.

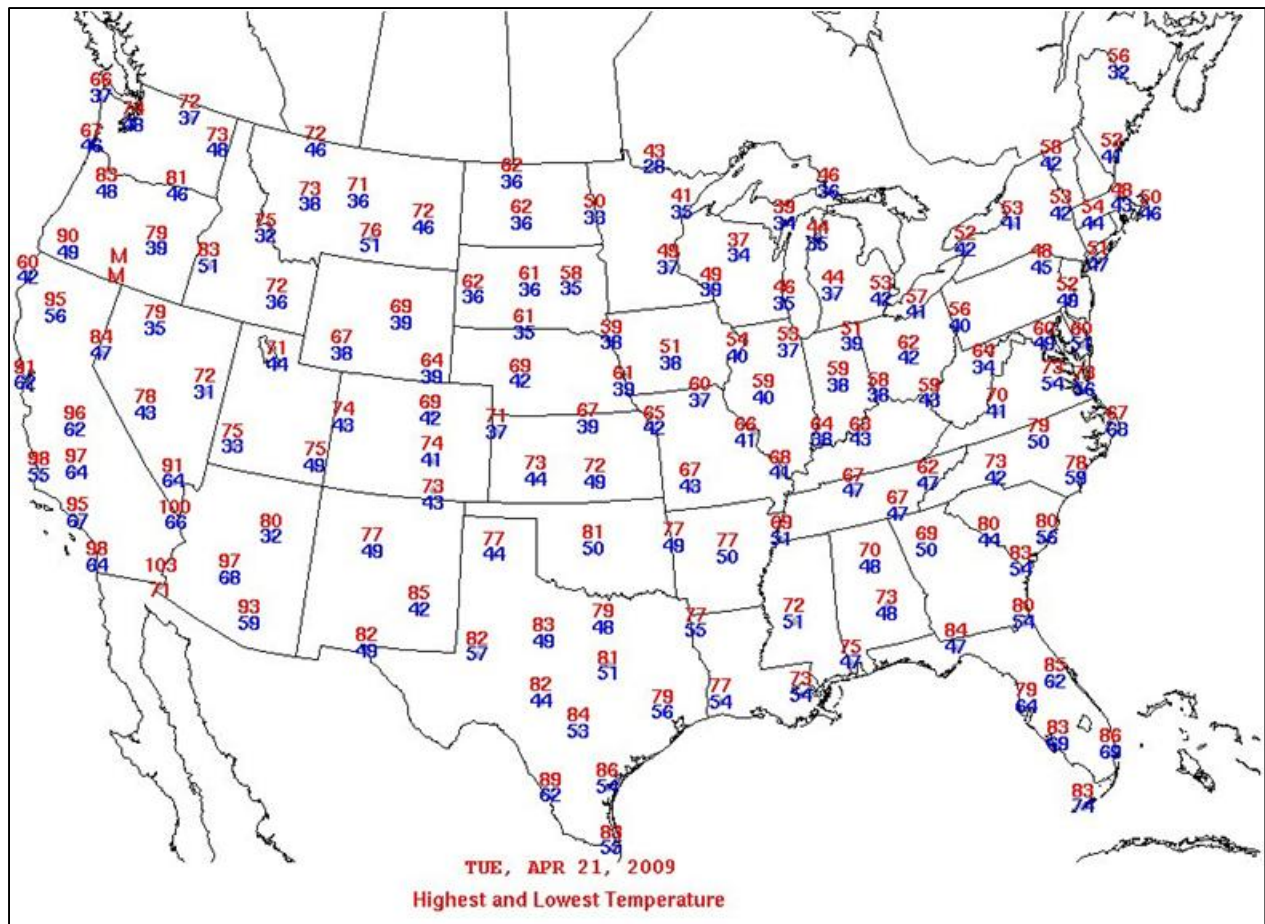


Figure C-8. Maximum and minimum surface temperatures for 20090421.

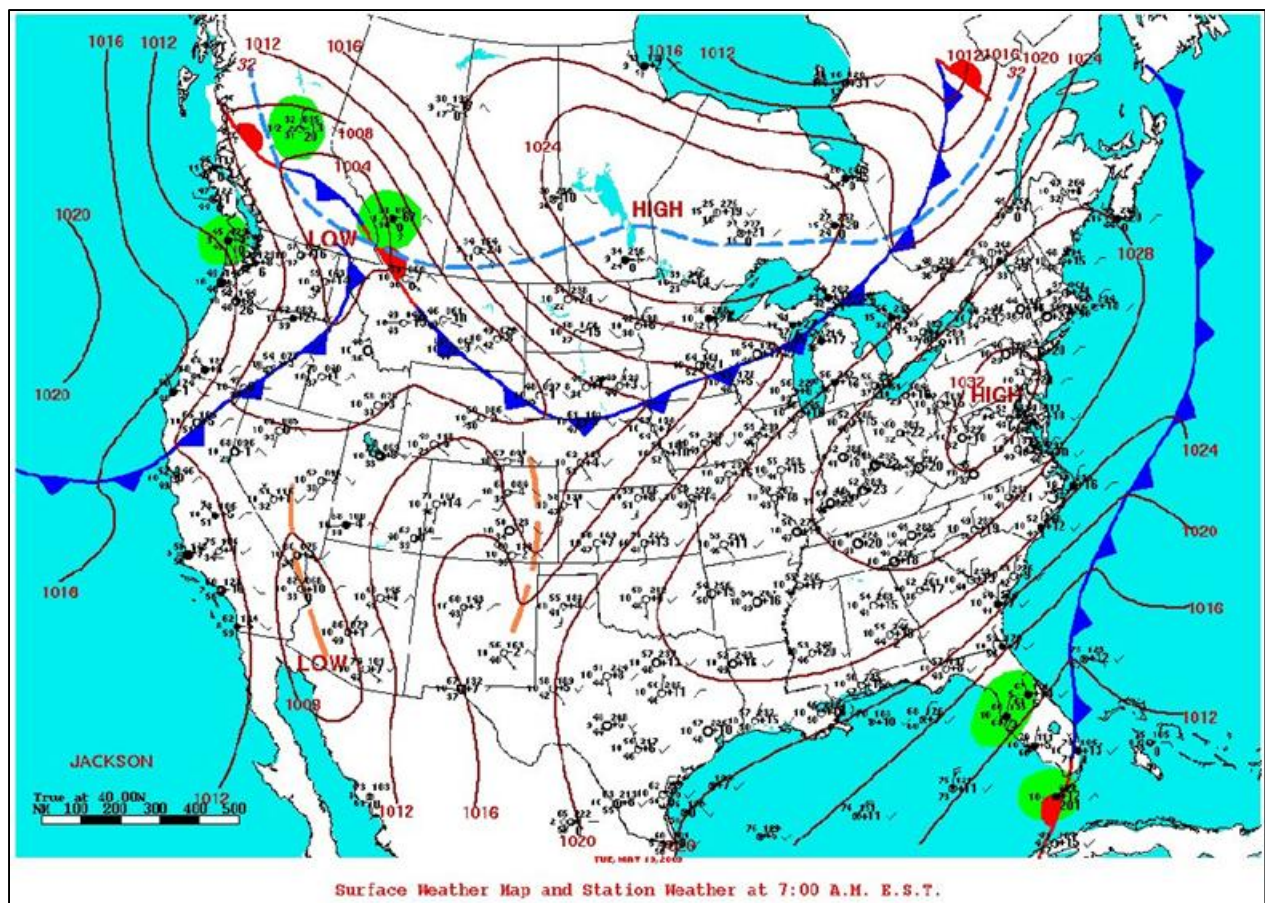


Figure C-9. Surface weather analysis valid time 1200 UTC, 20090519.

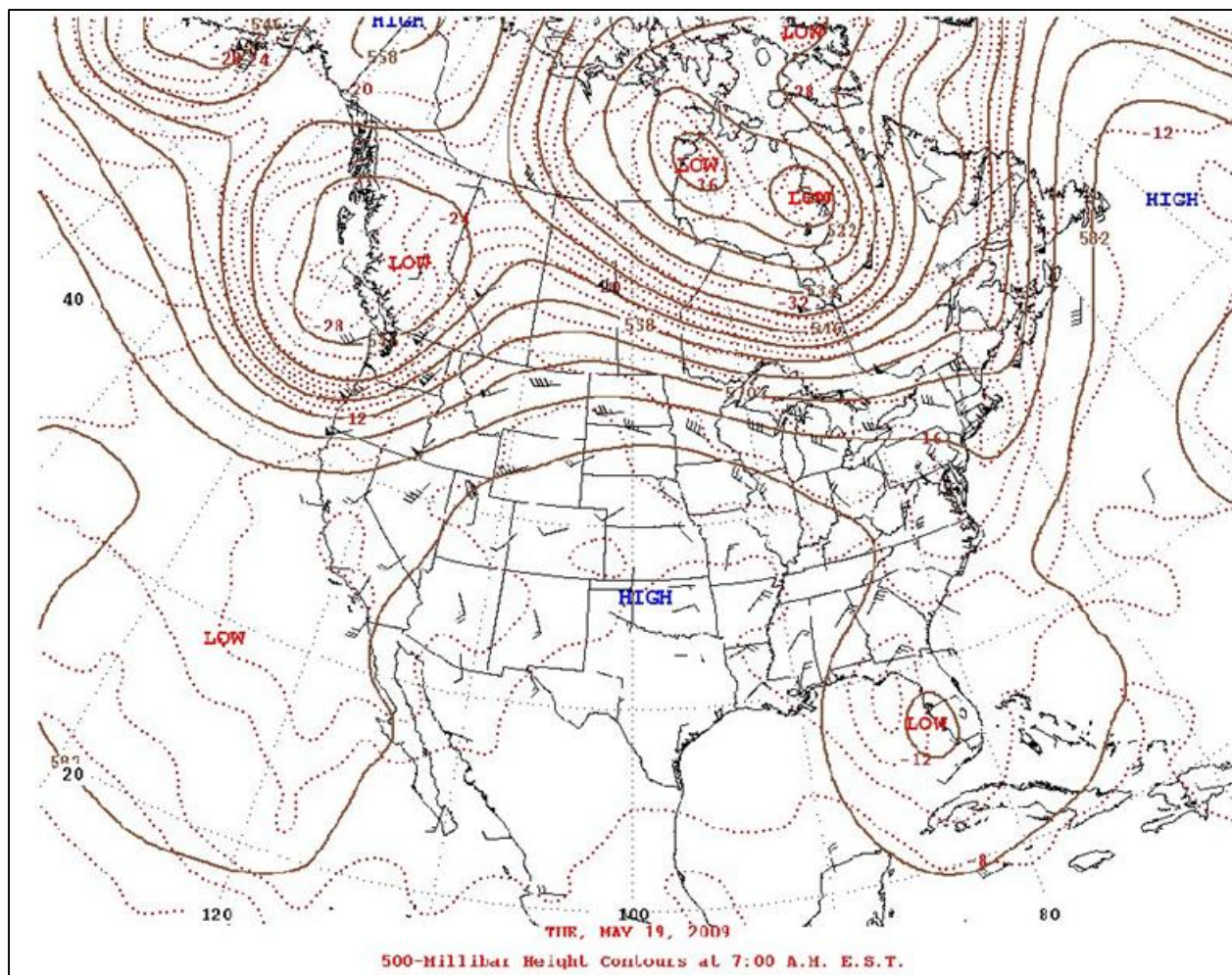


Figure C-10. 500-millibar upper air analysis valid time 1200 UTC, 20090519.

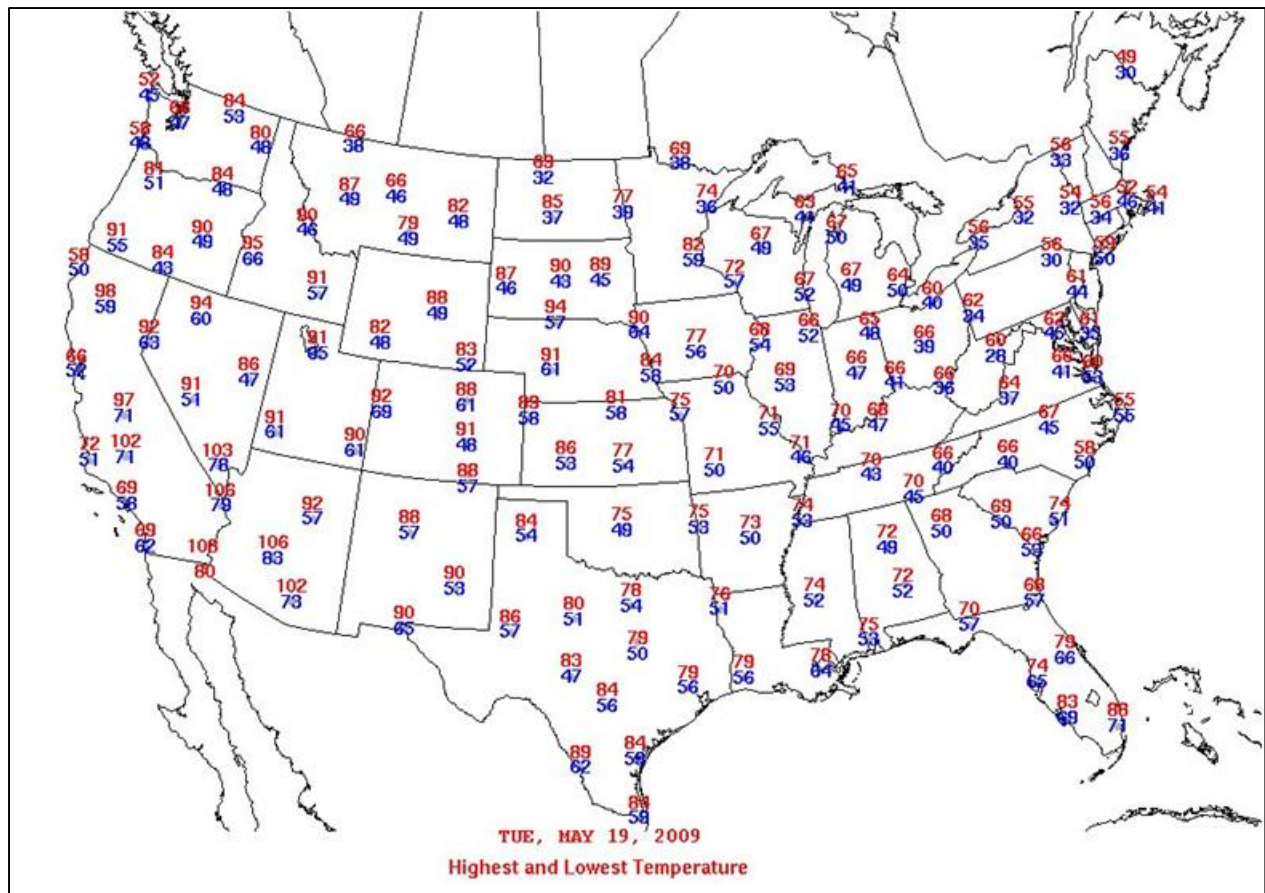


Figure C-12. Maximum and minimum surface temperatures for 20090519.

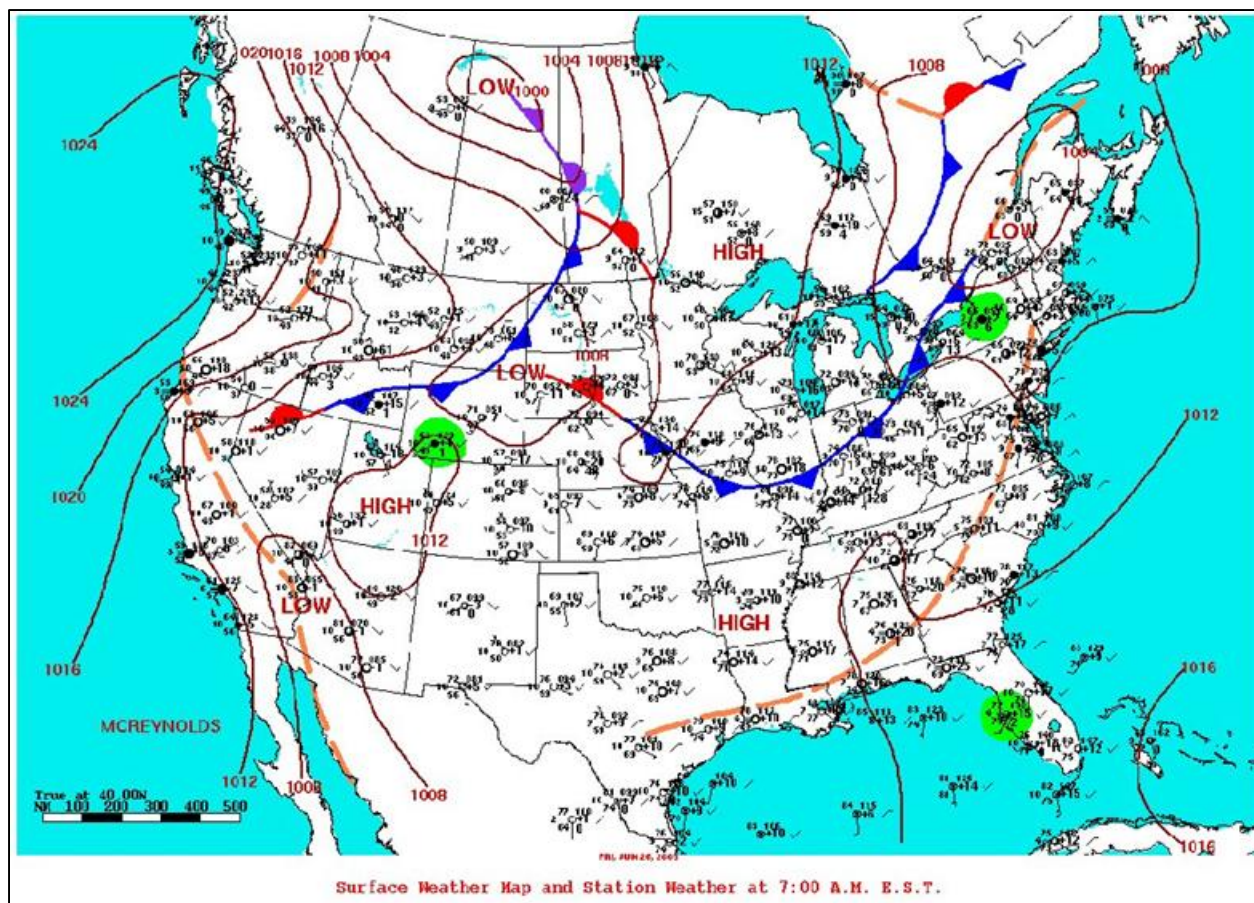


Figure C-13. Surface weather analysis valid time 1200 UTC, 20090626.

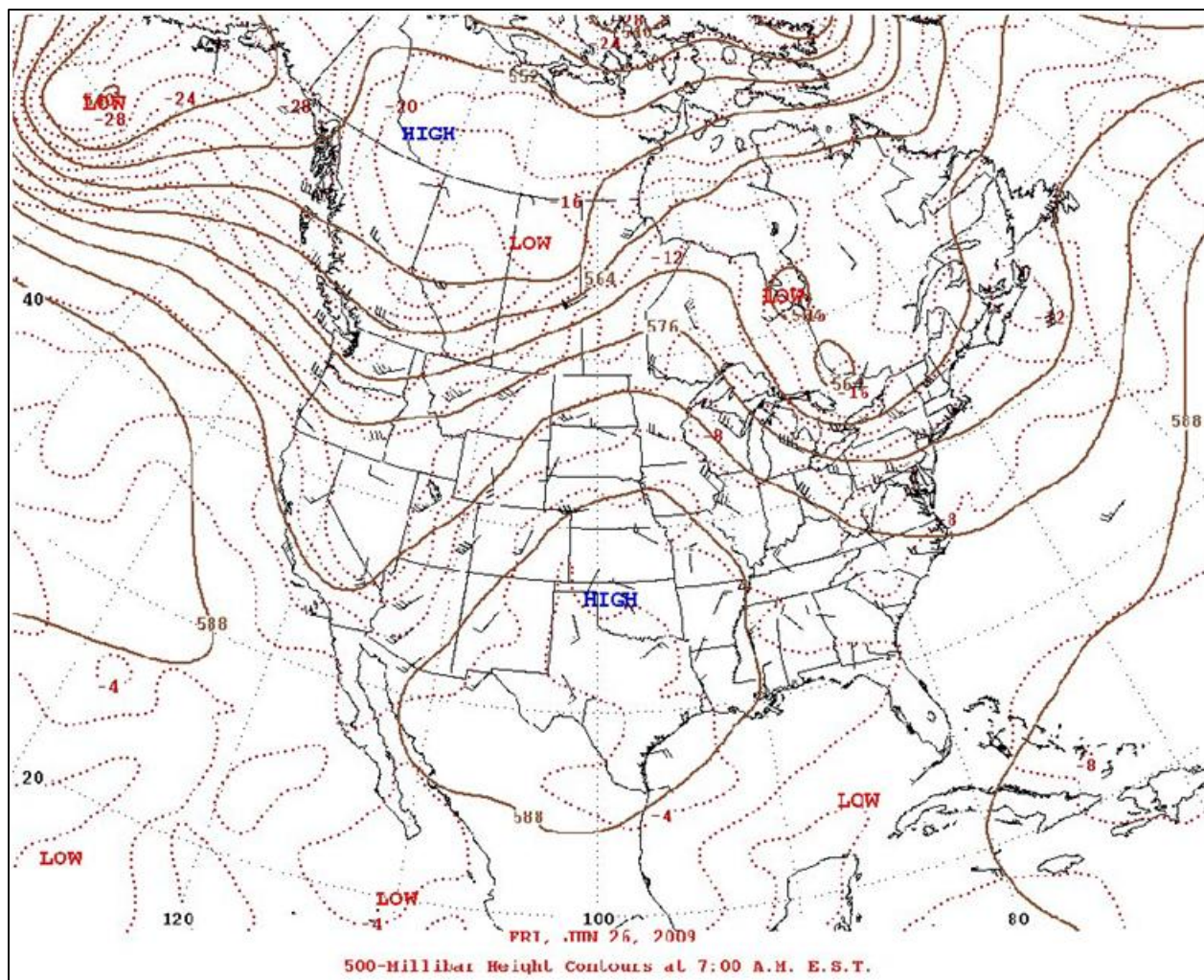


Figure C-14. 500-millibar upper air analysis valid time 1200 UTC, 20090626.

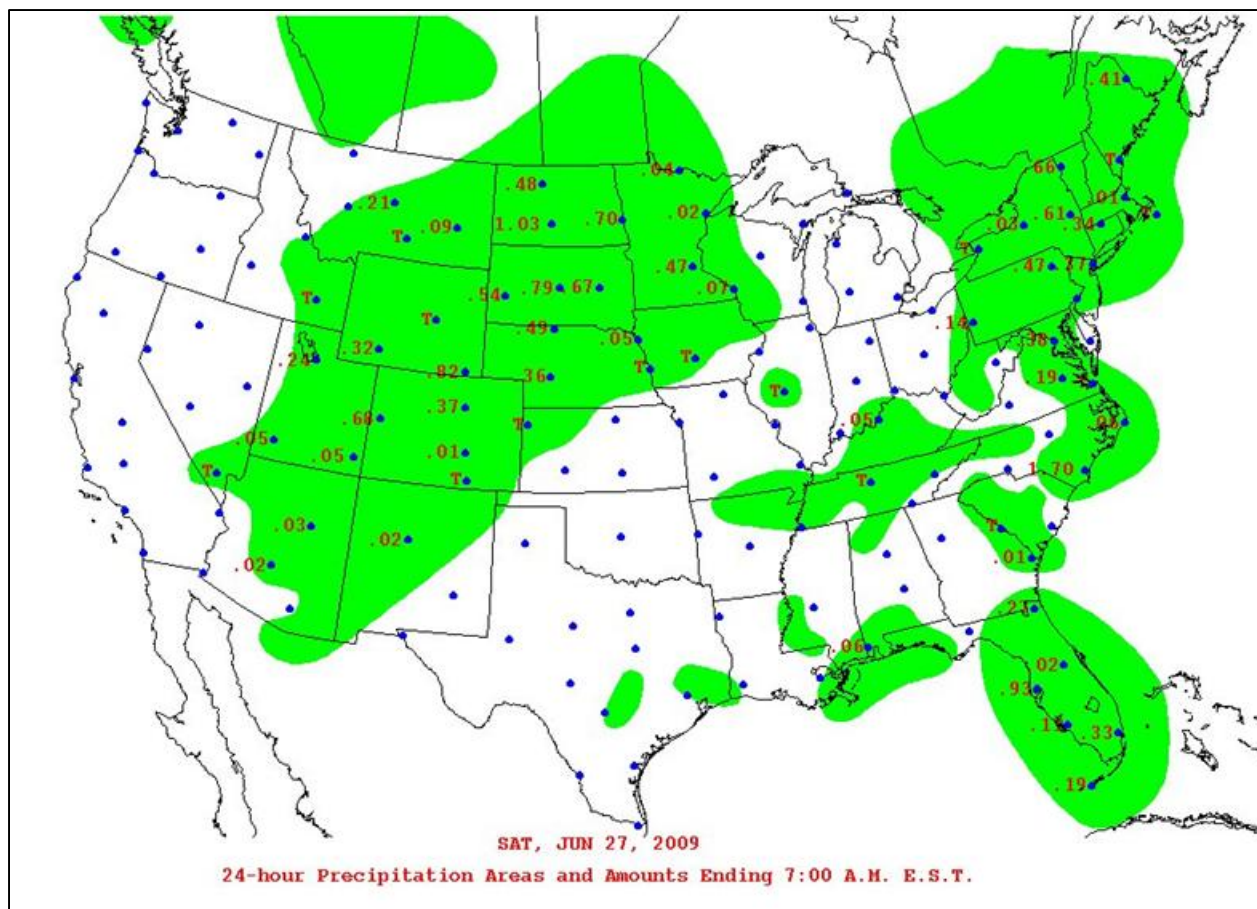


Figure C-15. 24-hour accumulated precipitation for period ending 1200 UTC, 20090627.

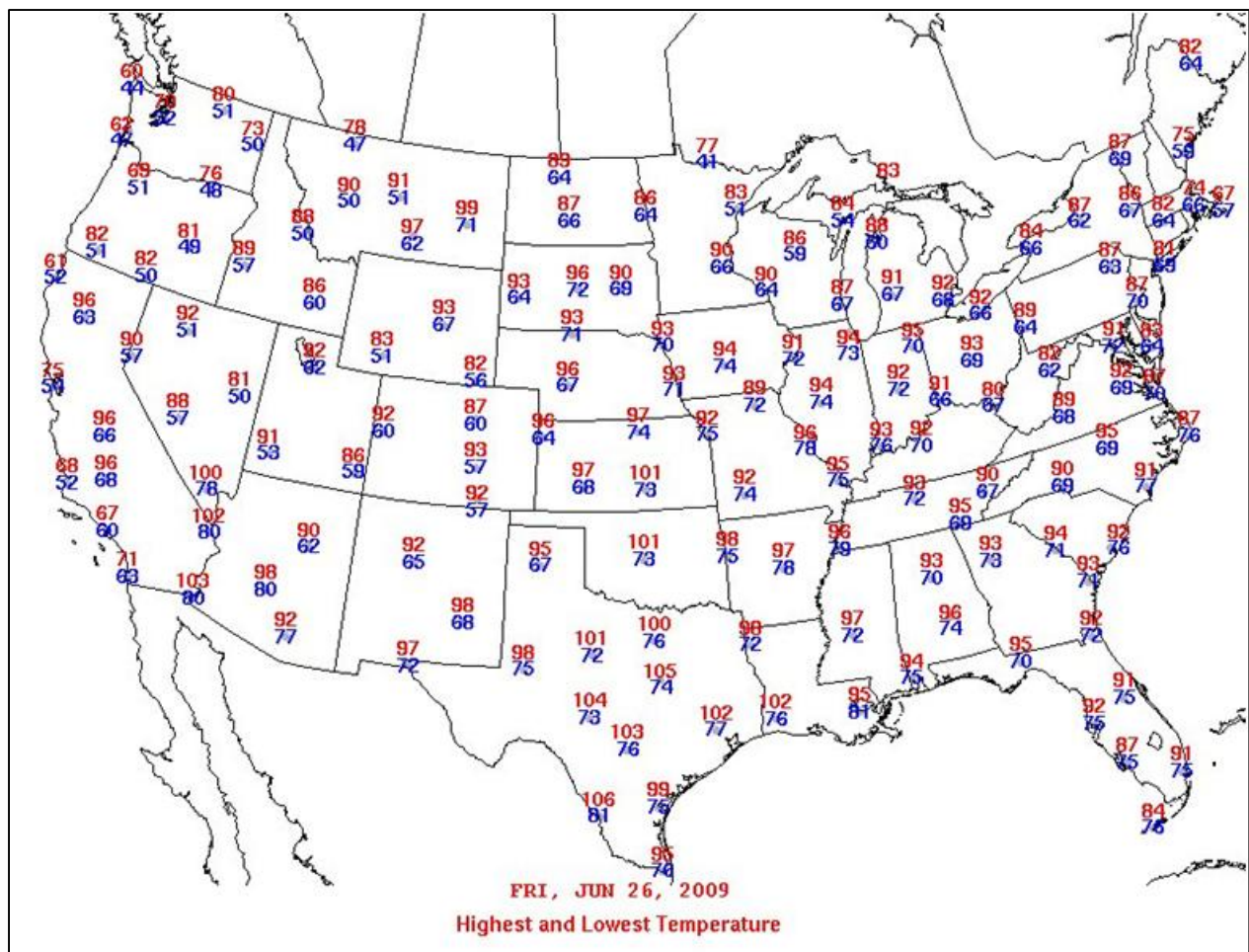


Figure C-16. Maximum and minimum surface temperatures for 20090626.

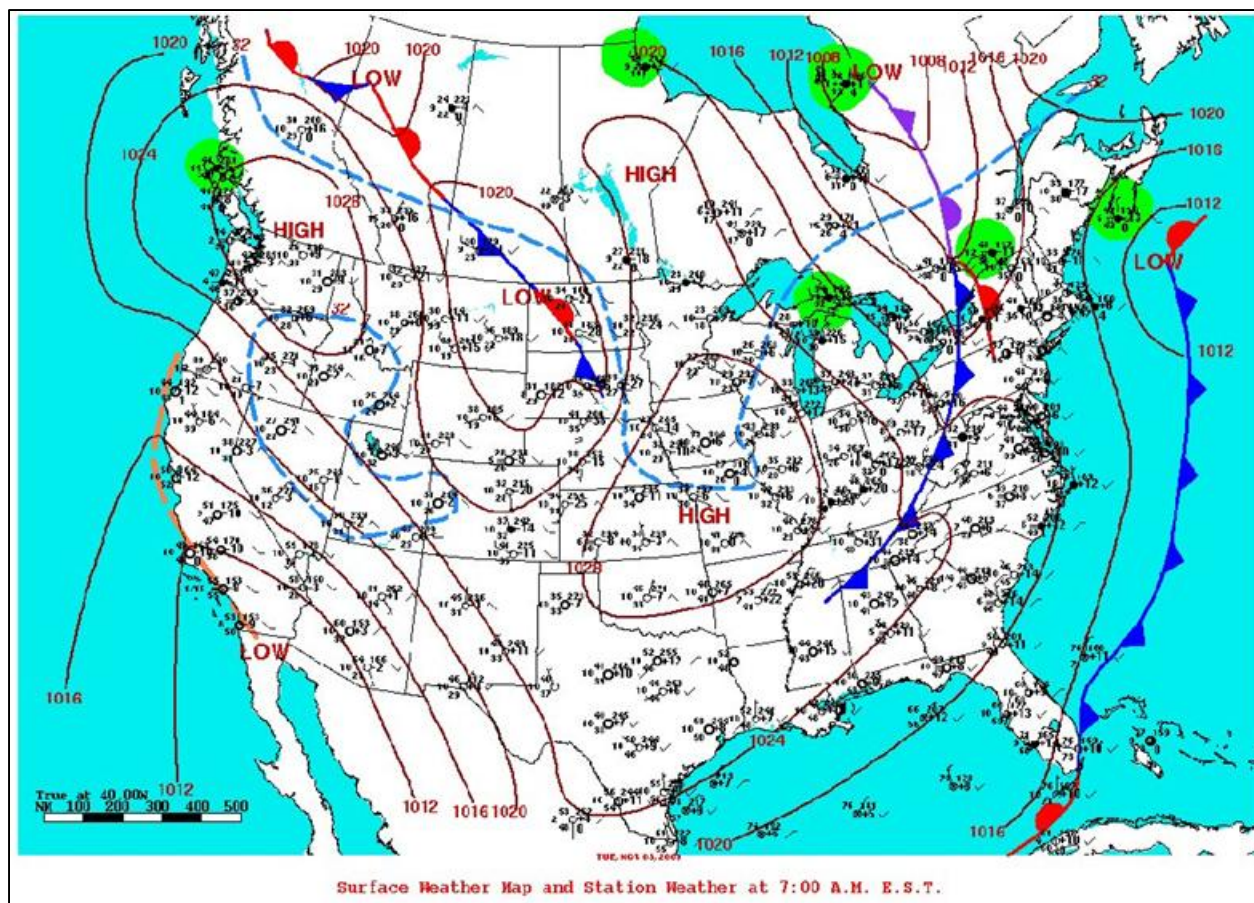
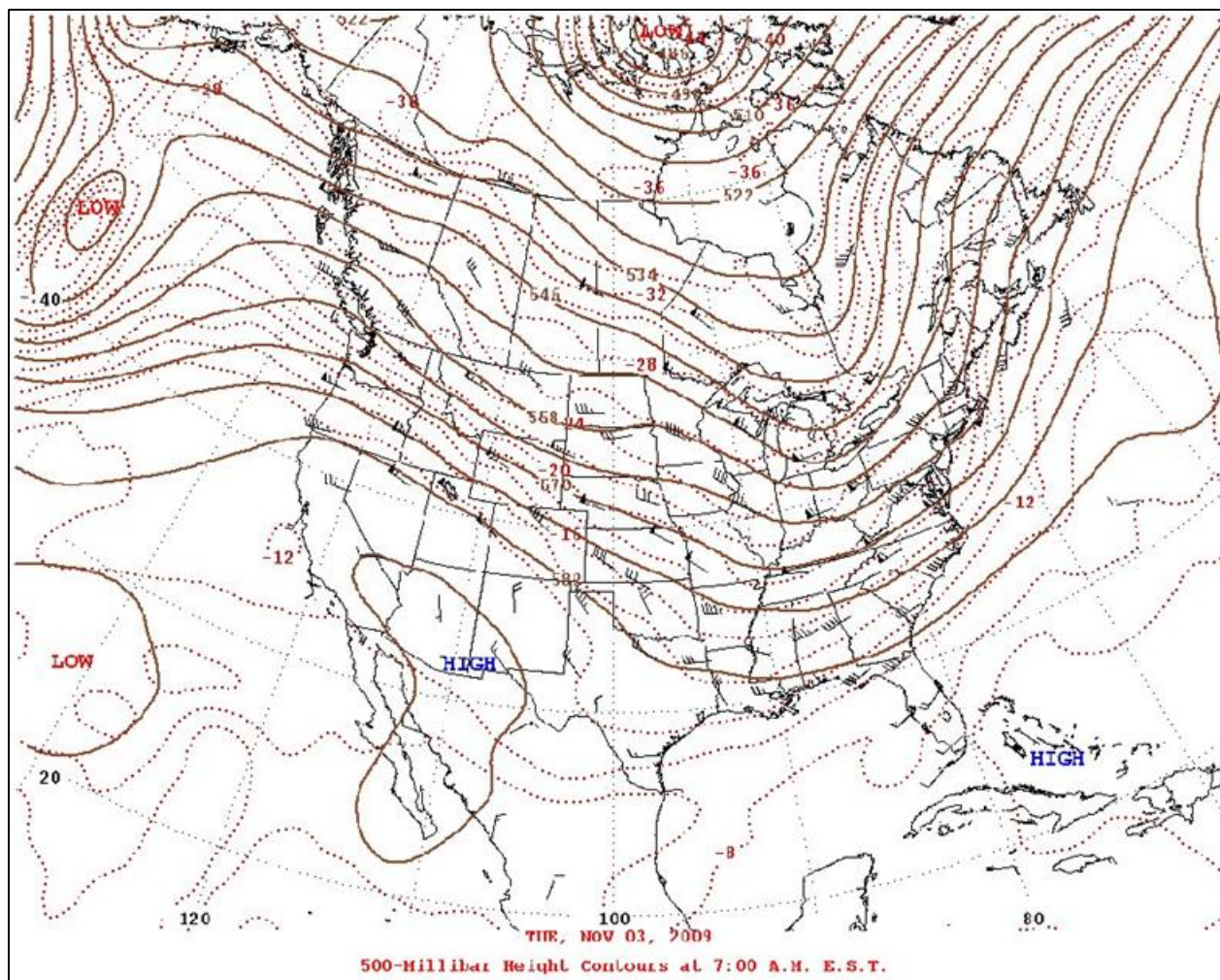


Figure C-17. Surface weather analysis valid time 1200 UTC, 20091103.



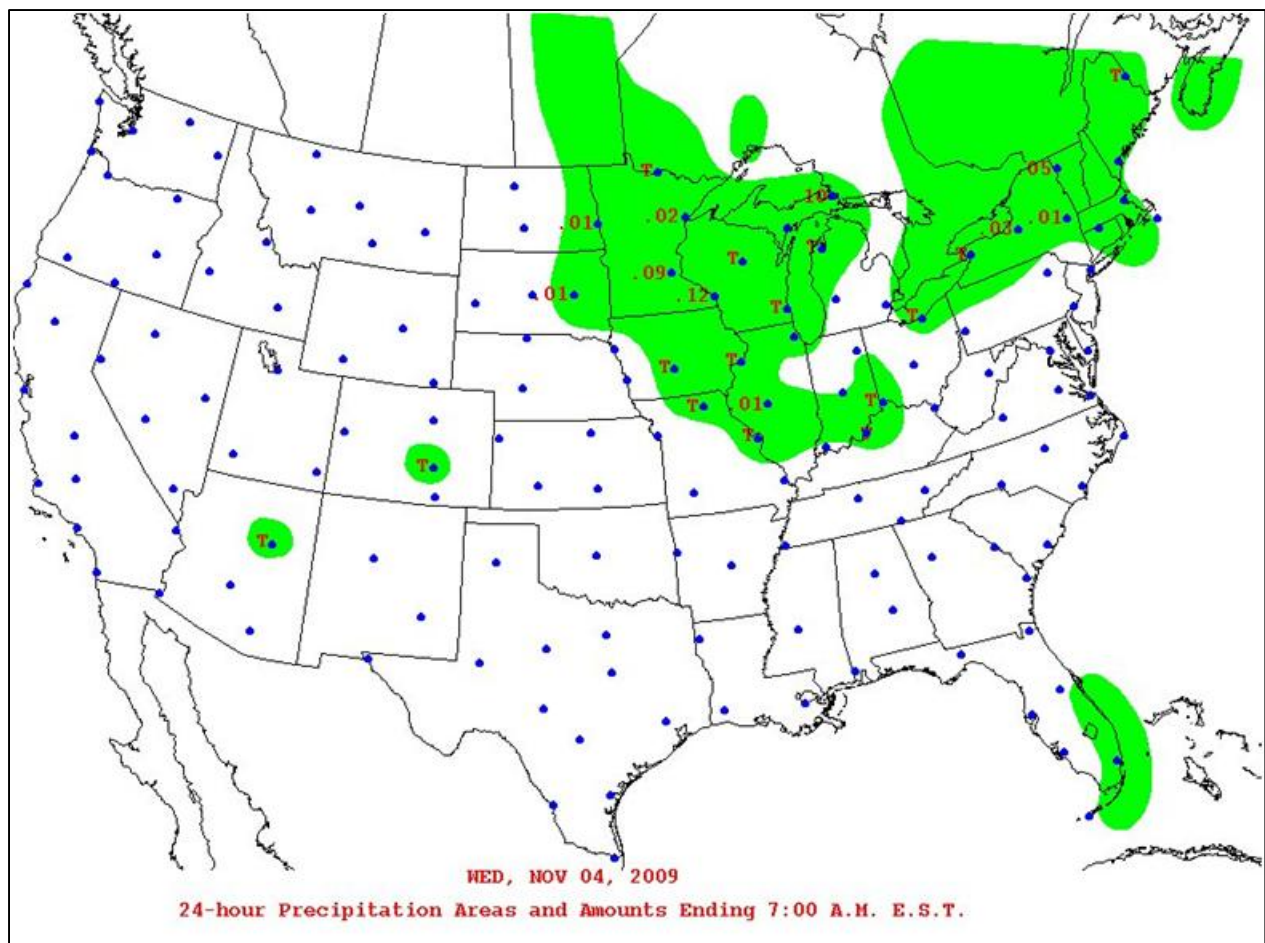


Figure C-19. 24-hour accumulated precipitation for period ending 1200 UTC, 20091104.

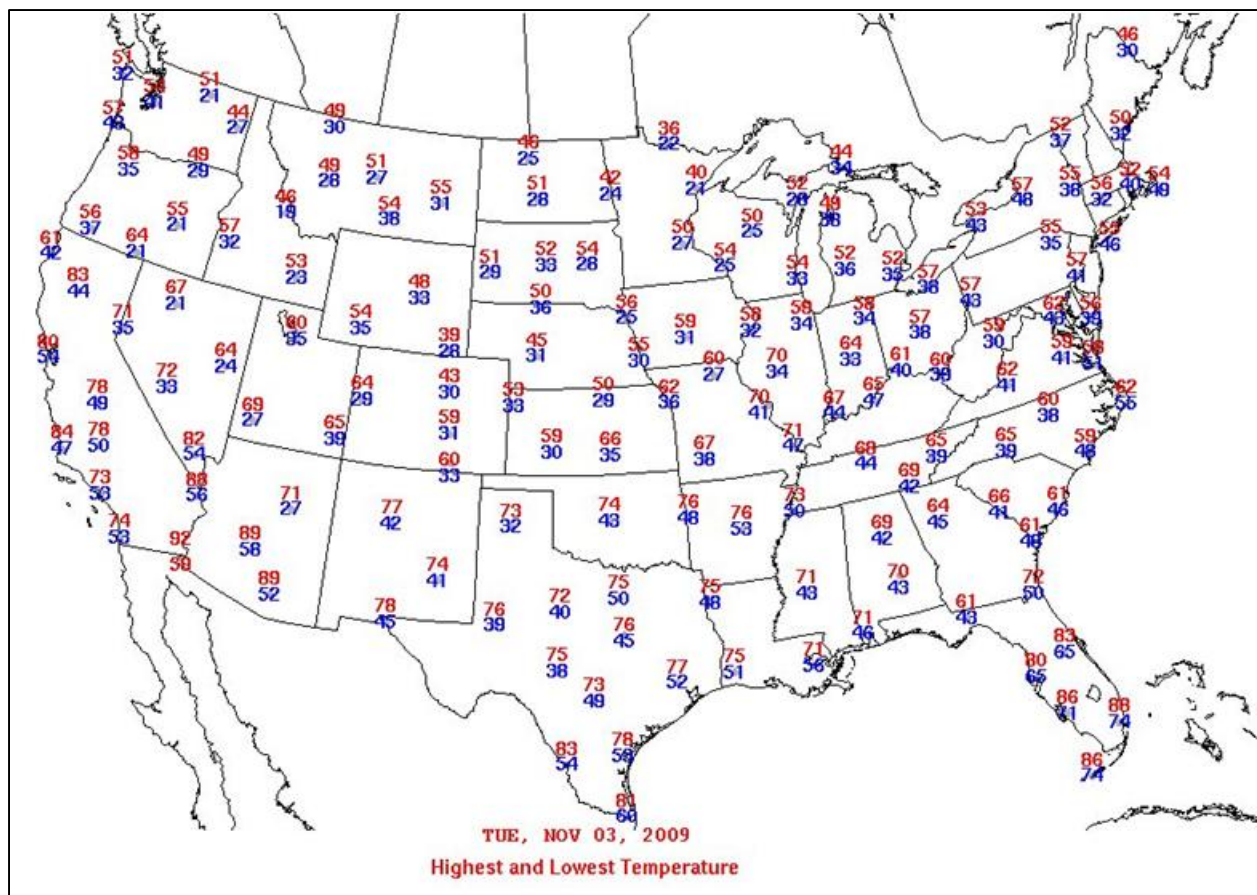


Figure C-20. Maximum and minimum surface temperatures for 20091103.

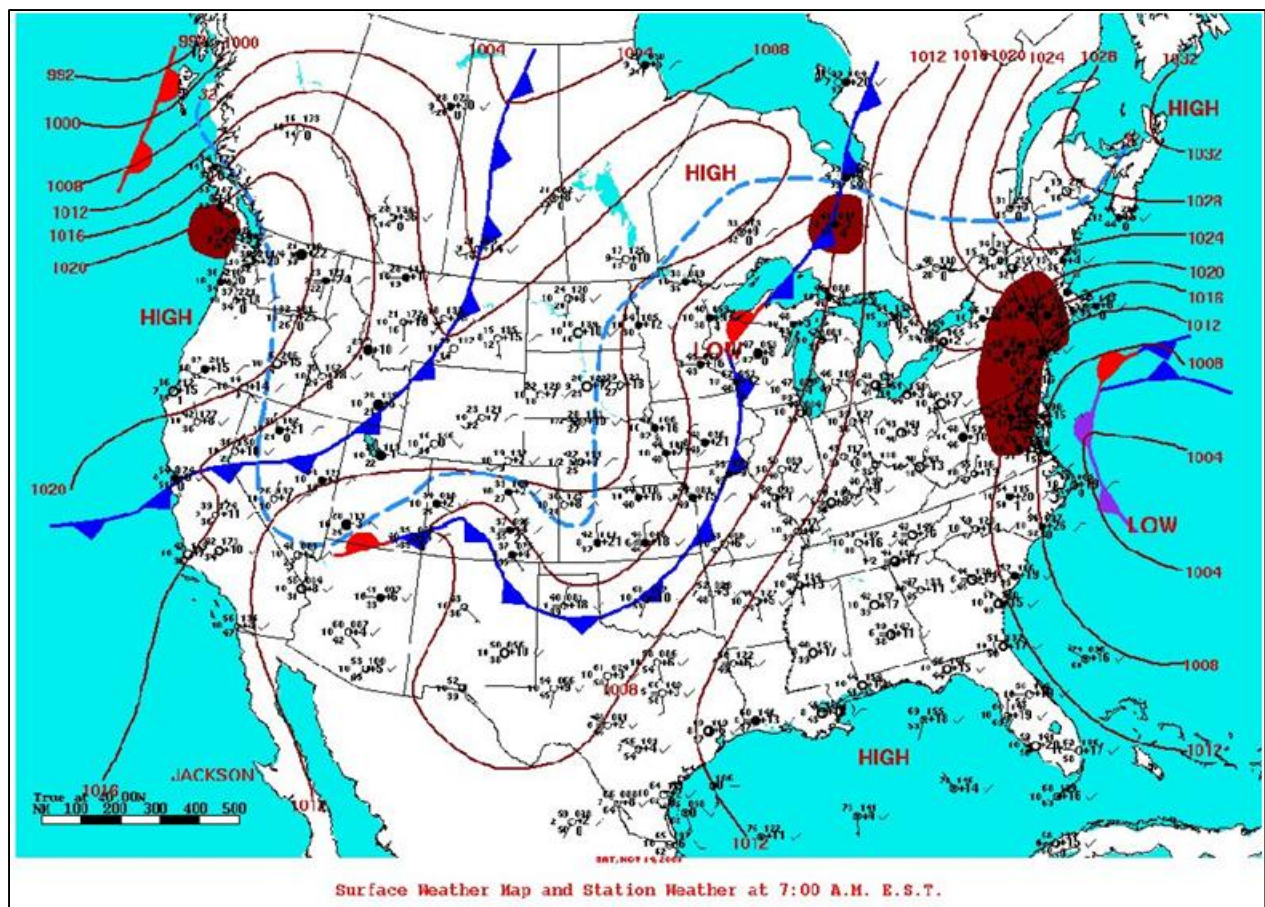
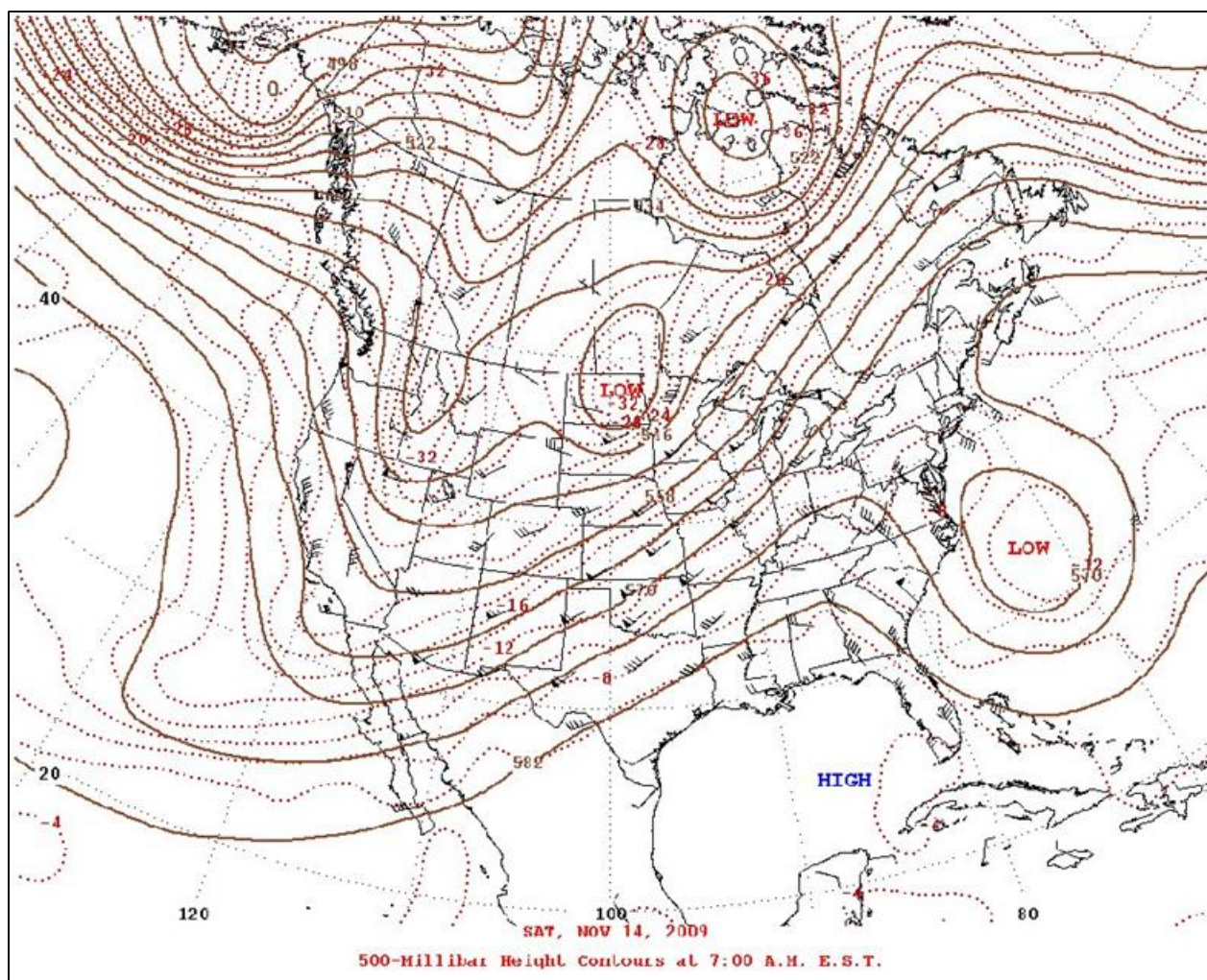


Figure C-21. Surface weather analysis valid time 1200 UTC, 20091114.



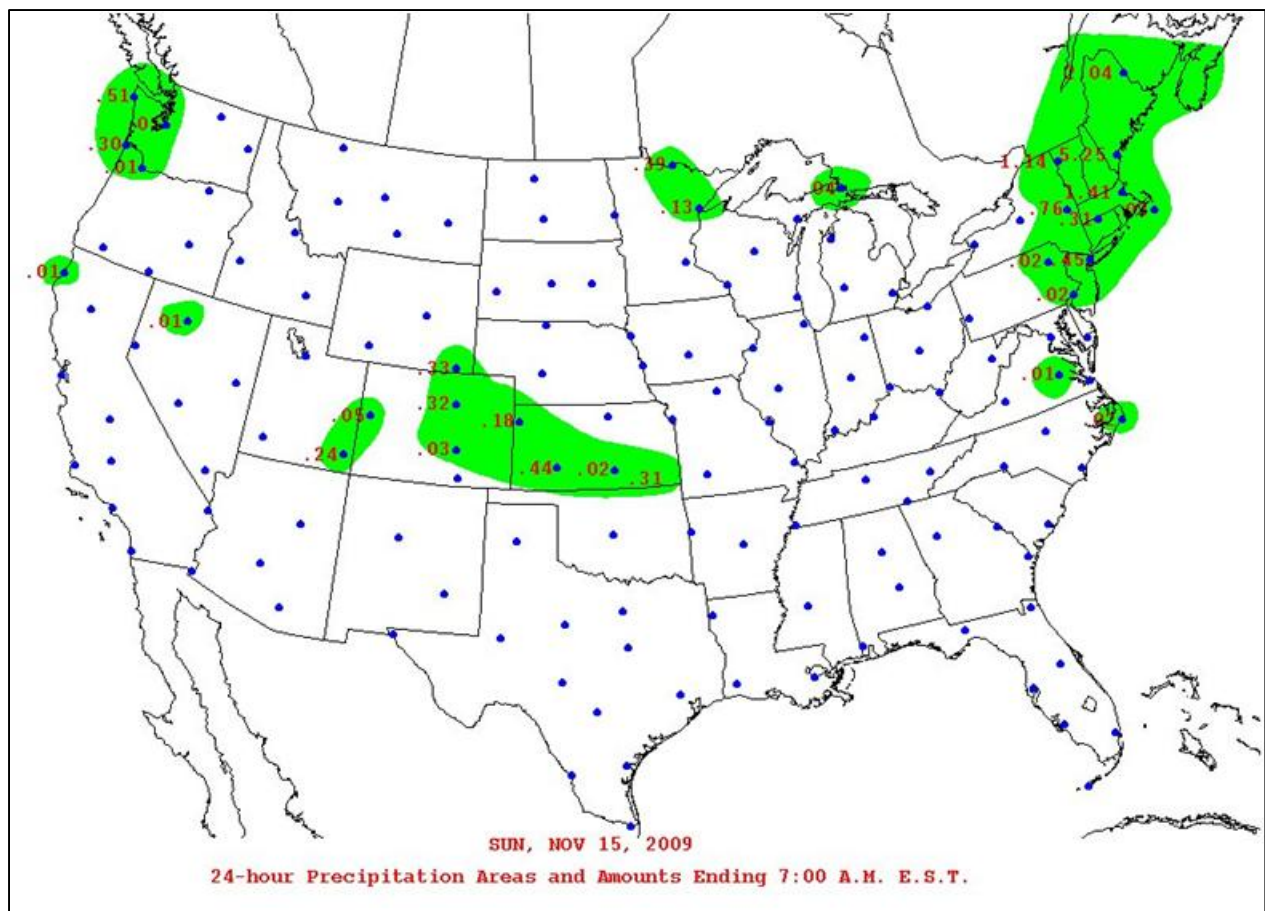


Figure C-23. 24-hour accumulated precipitation for period ending 1200 UTC, 20091115.

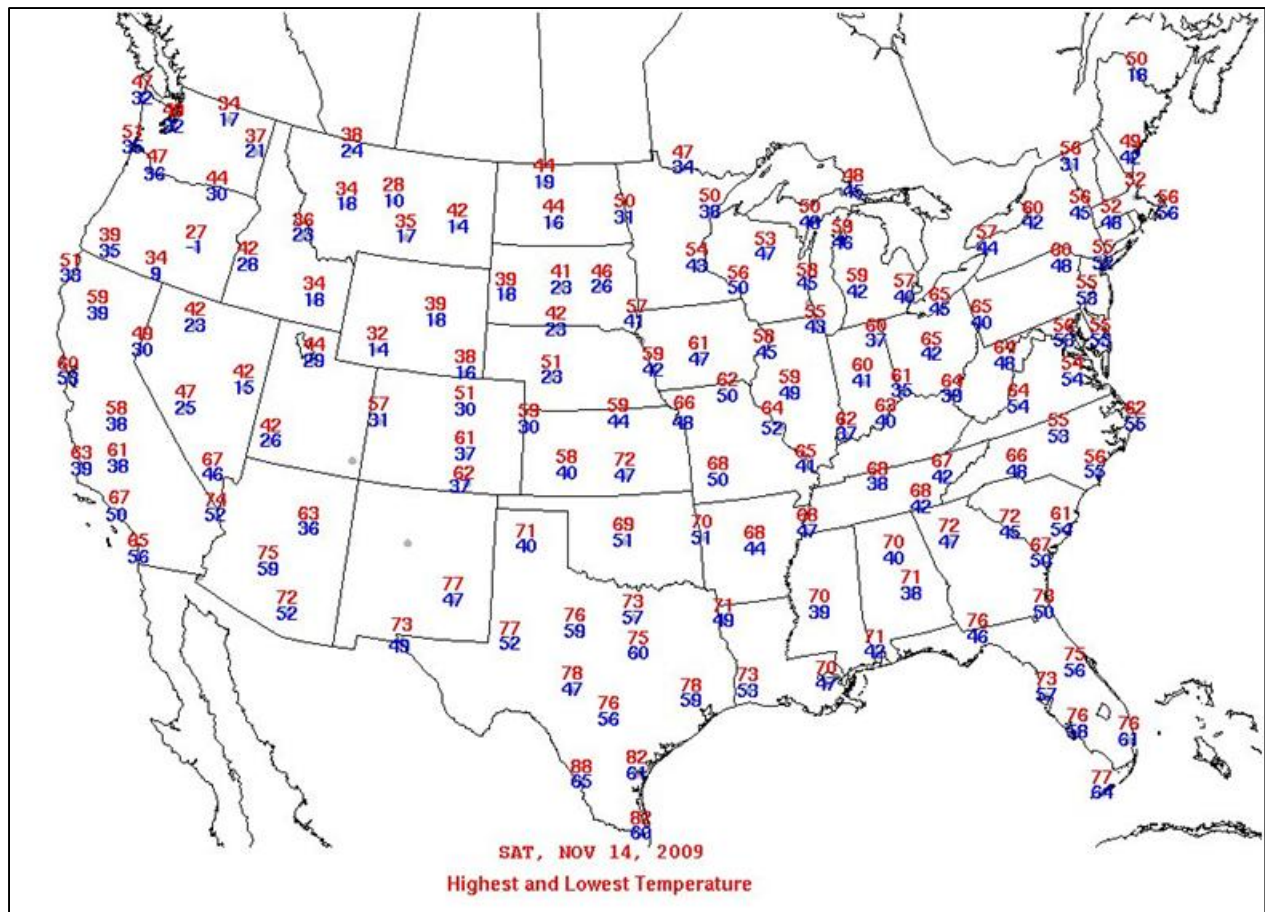


Figure C-24. Maximum and minimum surface temperatures for 20091114.

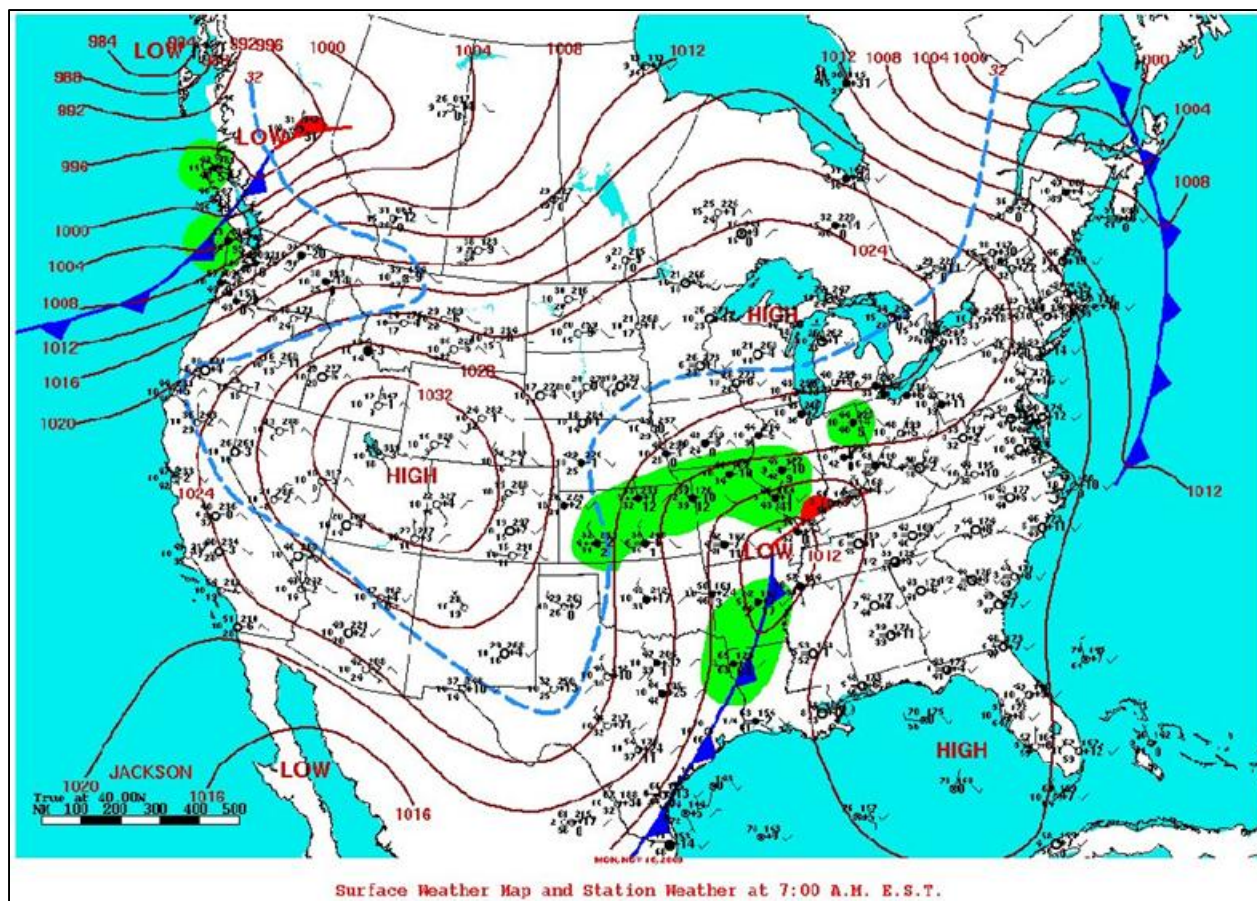


Figure C-25. Surface weather analysis valid time 1200 UTC, 20091116.

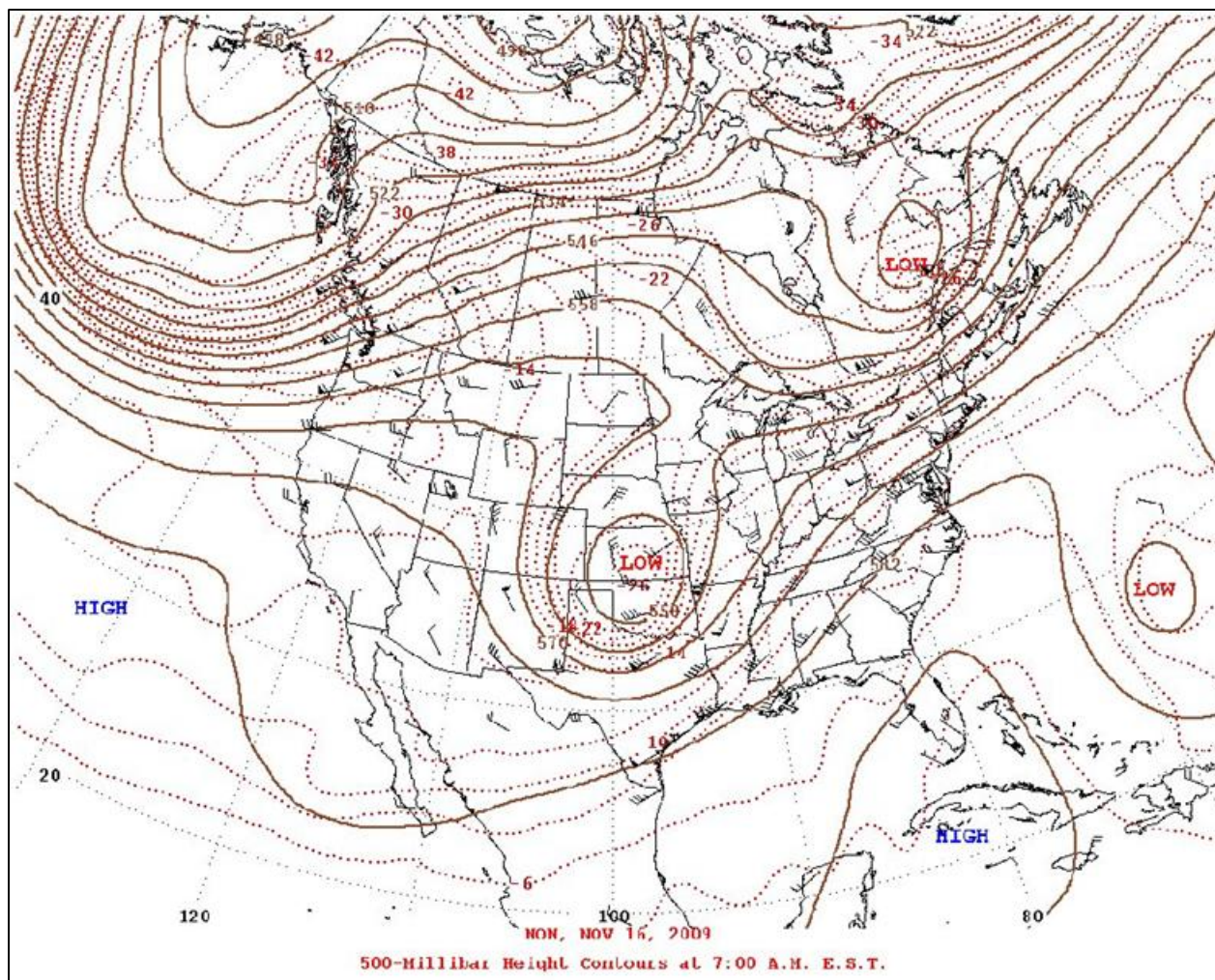


Figure C-26. 500-millibar upper air analysis valid time 1200 UTC, 20091116.



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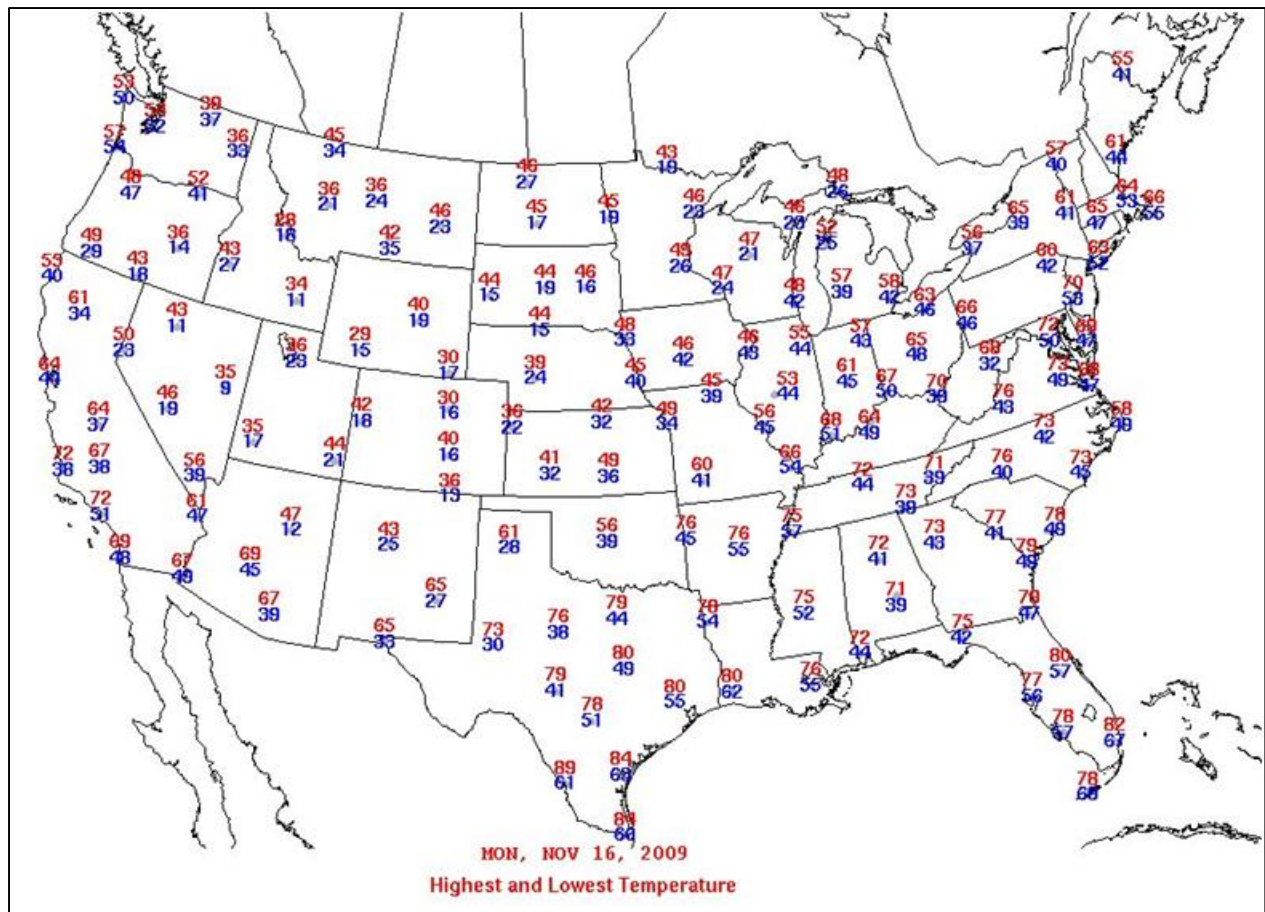


Figure C-28. Maximum and minimum surface temperatures for 20091116.

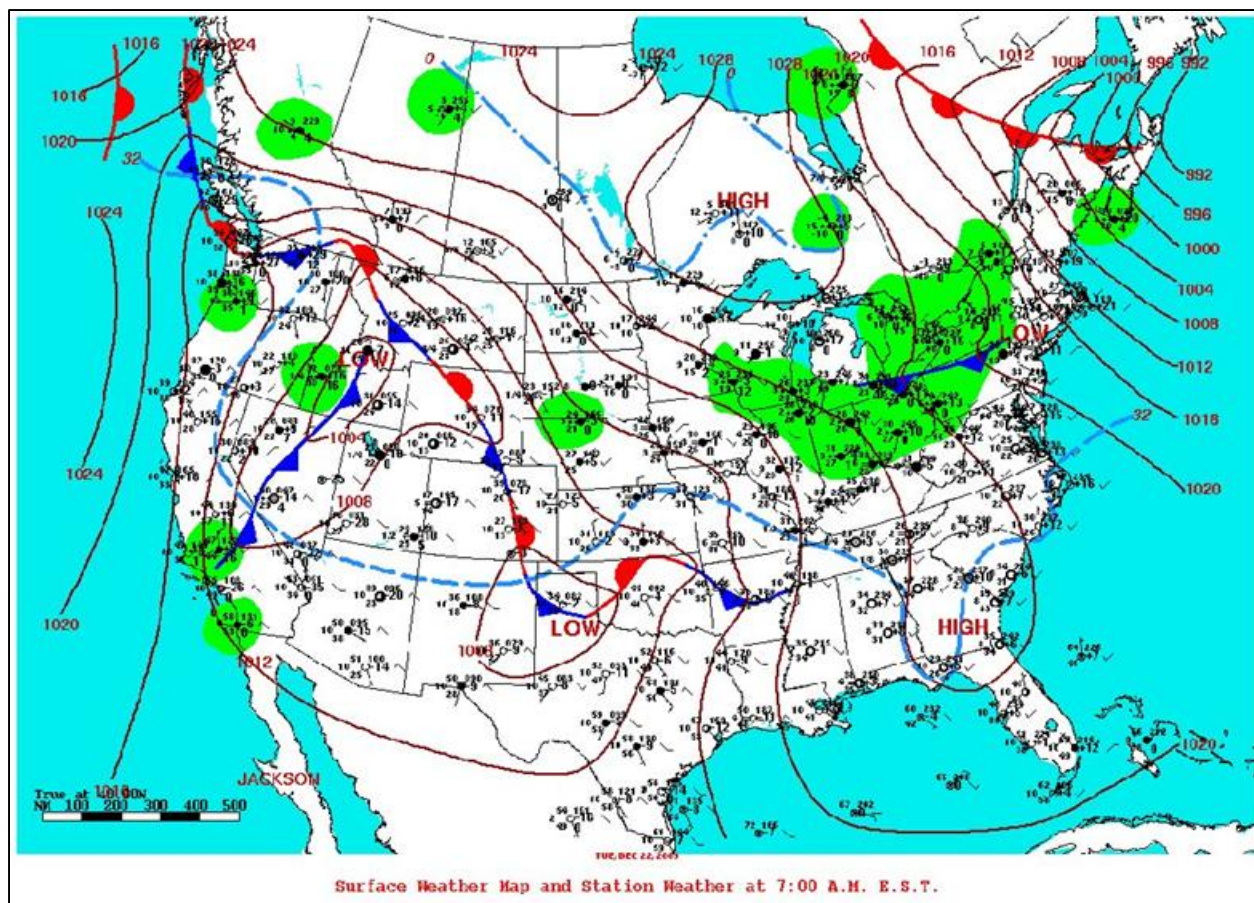


Figure C-29. Surface weather analysis valid time 1200 UTC, 20091222.

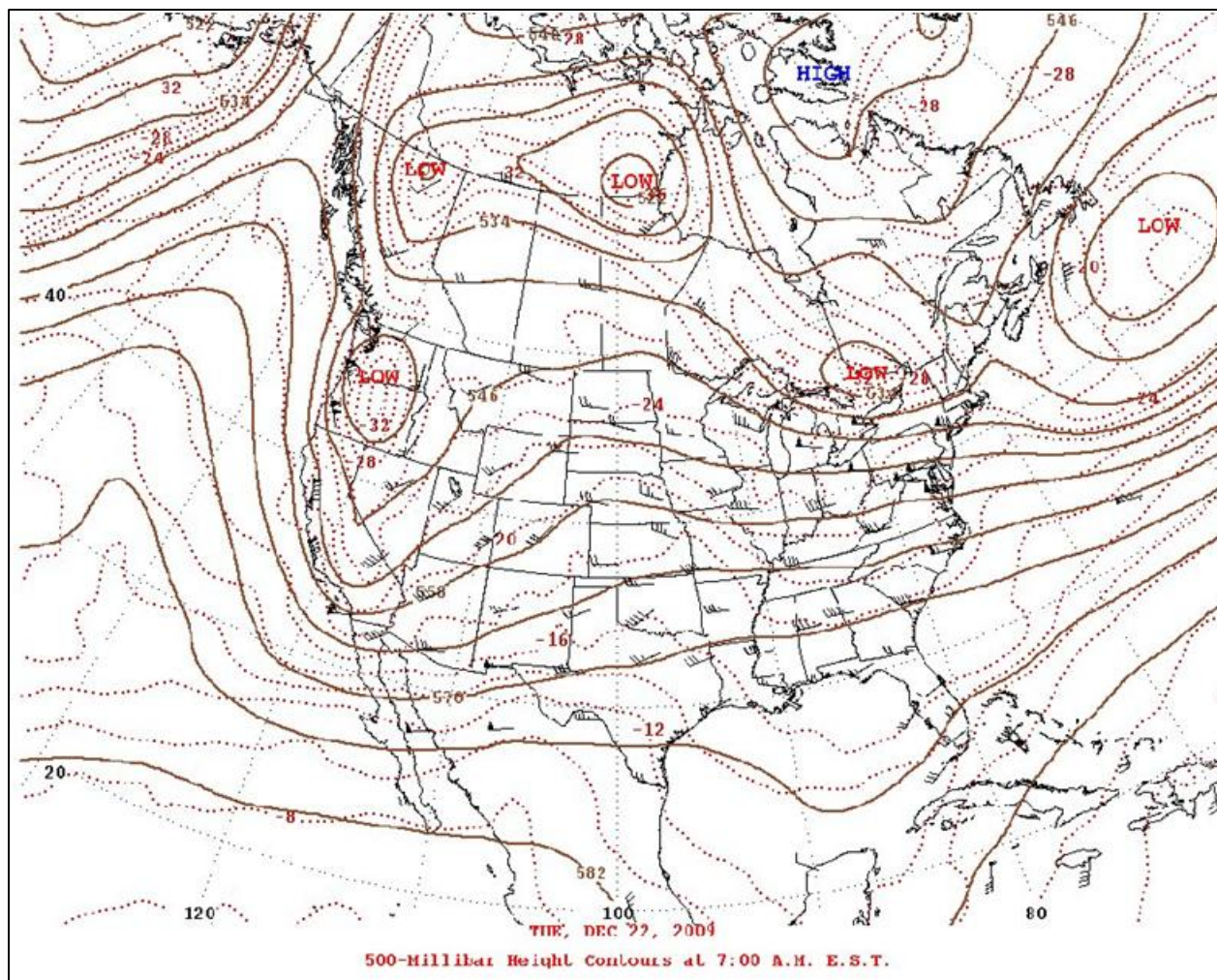


Figure C-30. 500-millibar upper air analysis valid time 1200 UTC, 20091222.

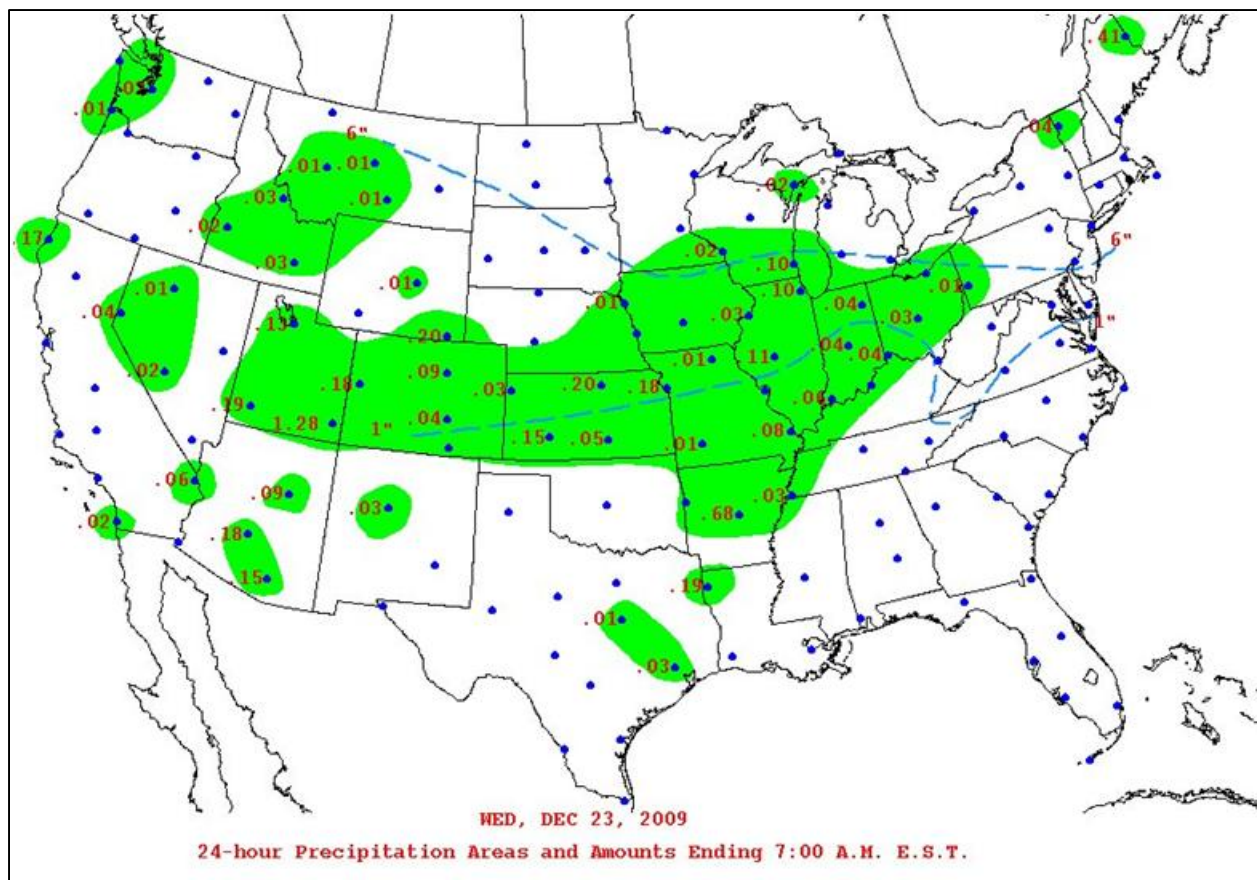


Figure C-31. 24-hour accumulated precipitation for period ending 1200 UTC, 20091223.

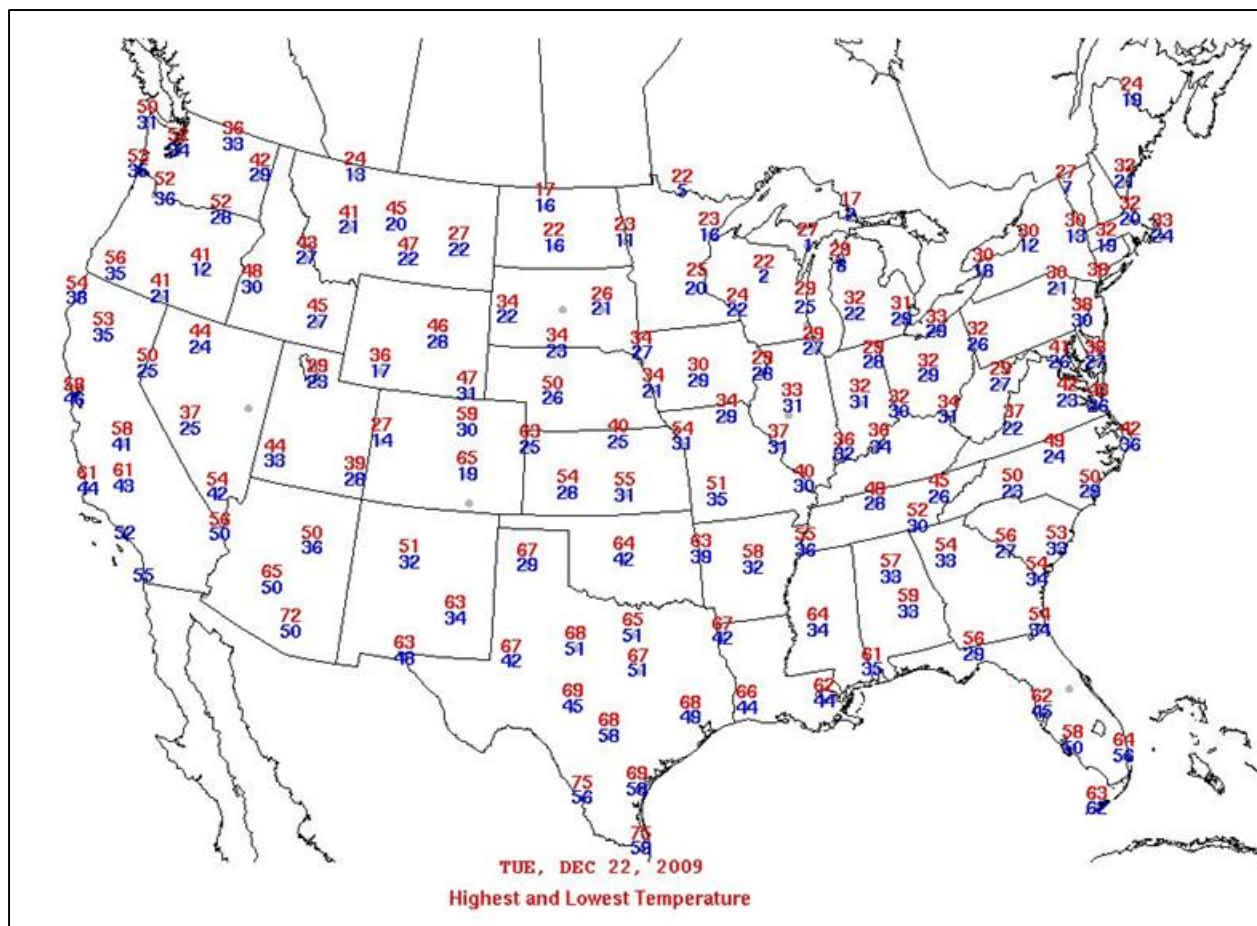


Figure C-32. Maximum and minimum surface temperatures for 20091222.

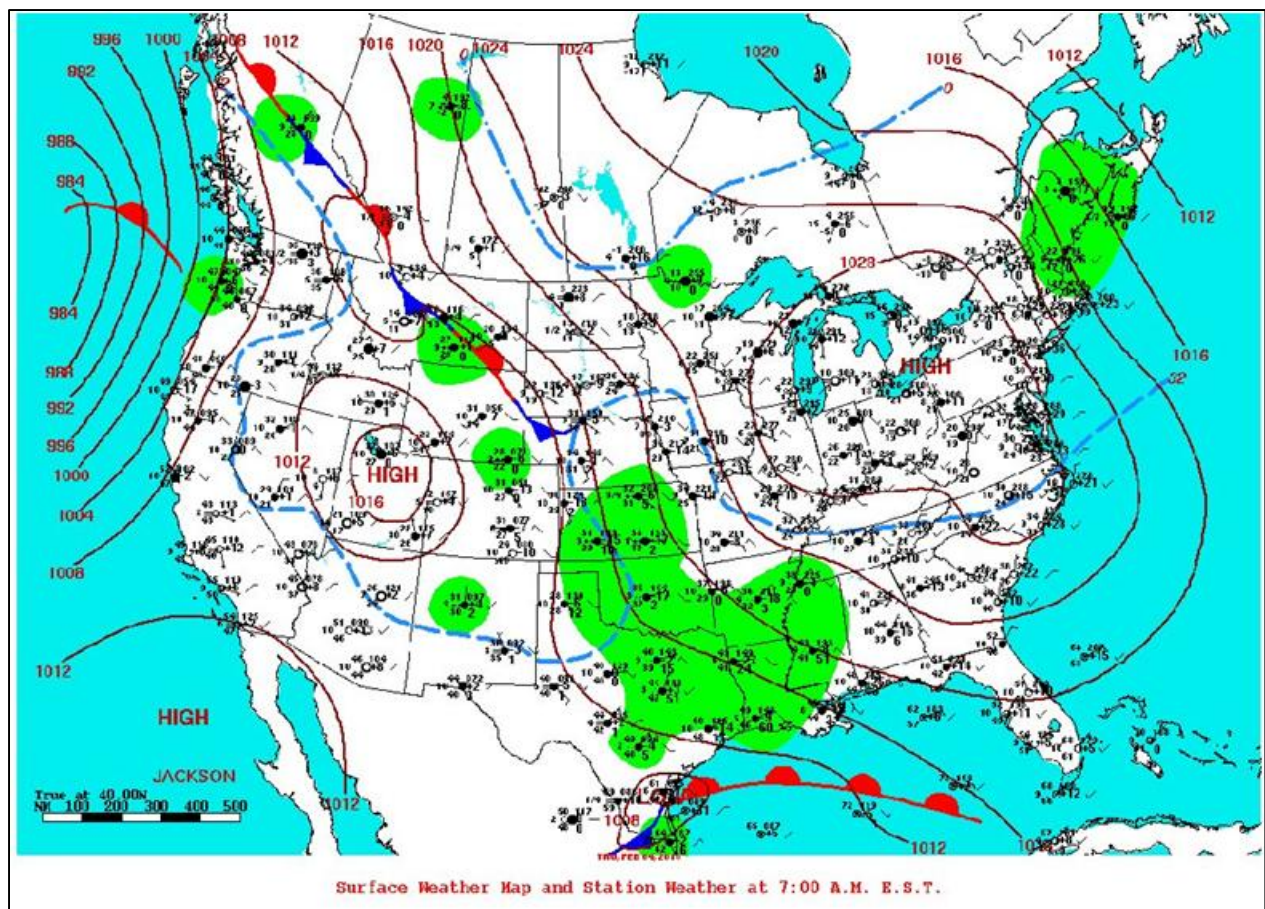


Figure C-33. Surface weather analysis valid time 1200 UTC, 20100204.

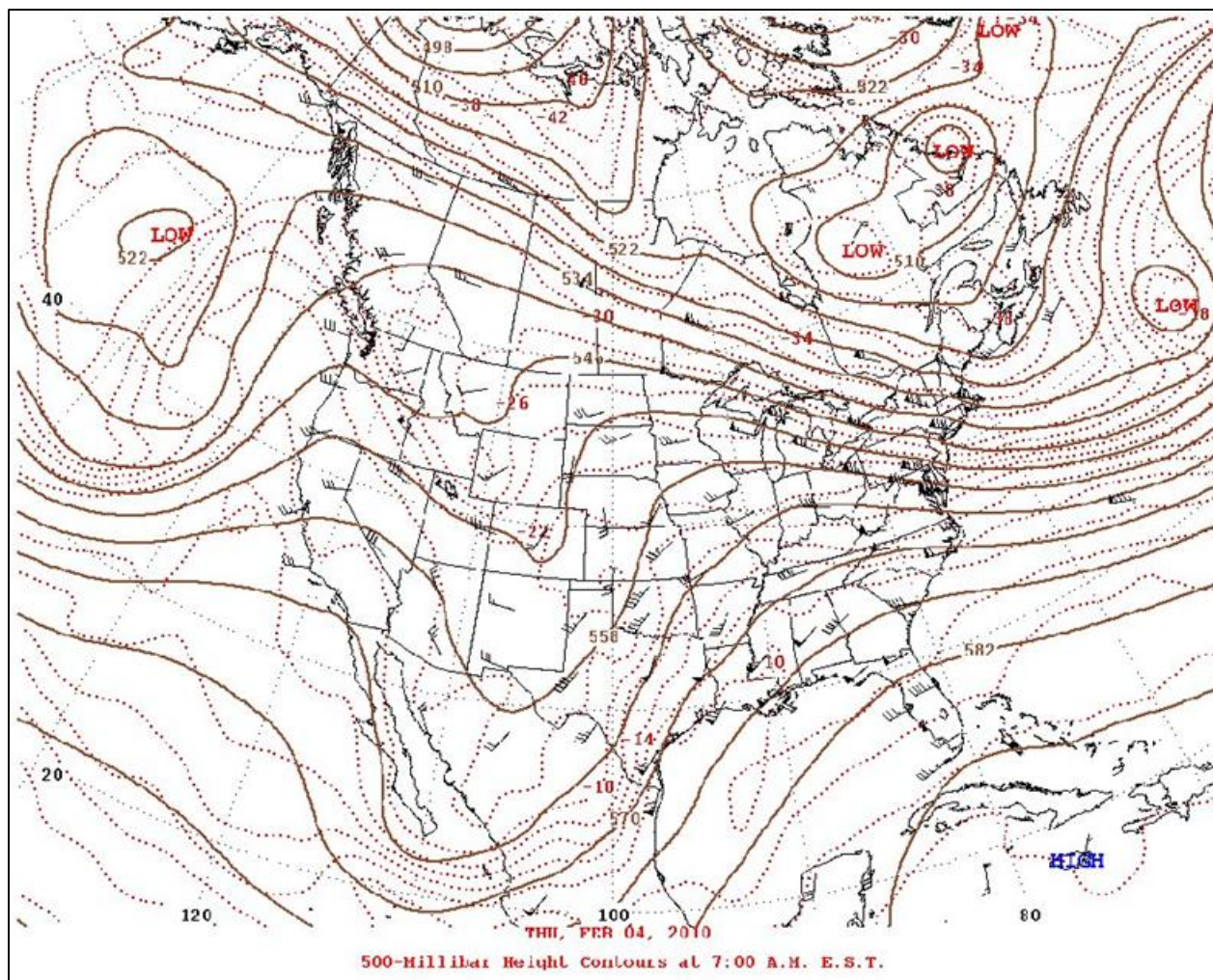


Figure C-34. 500-millibar upper air analysis valid time 1200 UTC, 20100204.

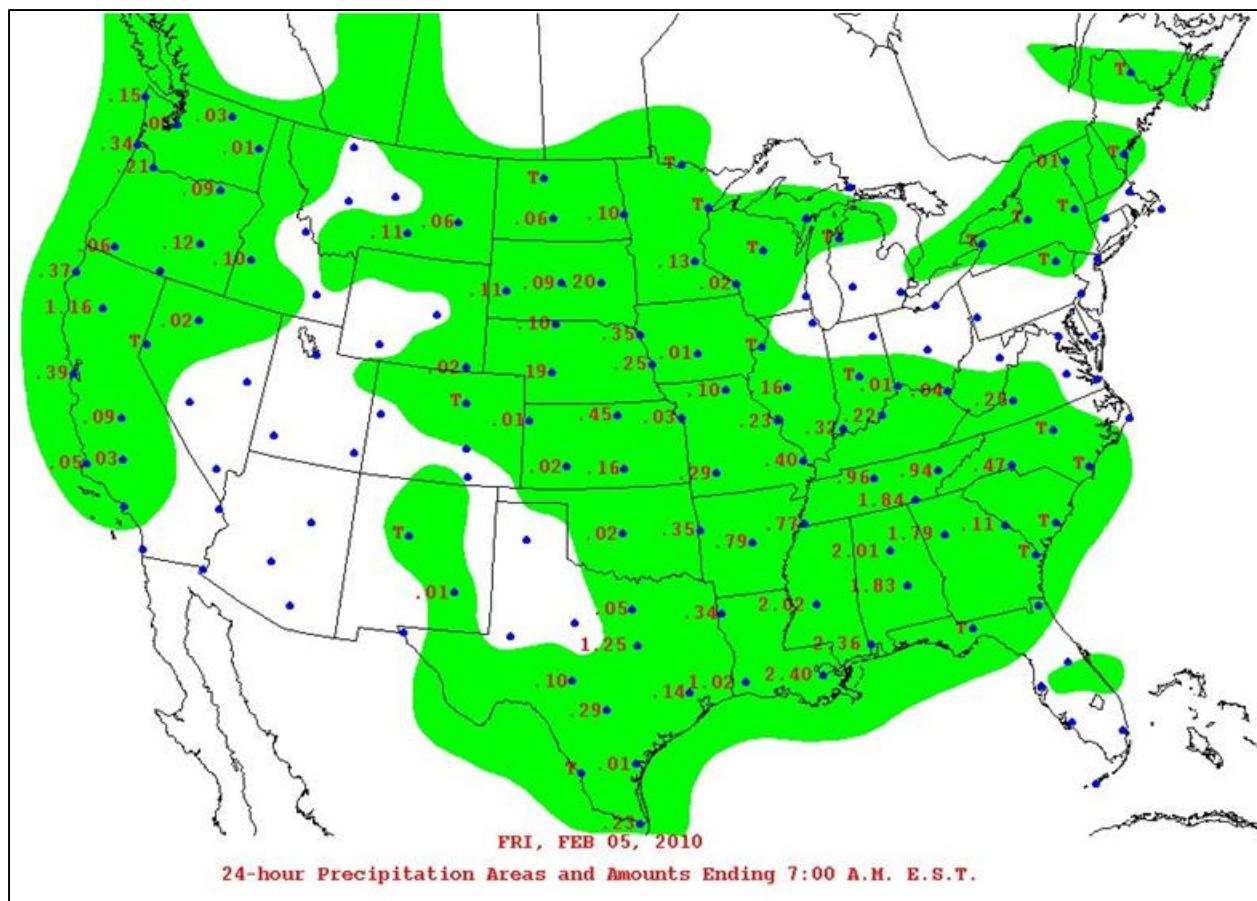


Figure C-35. 24-hour accumulated precipitation for period ending 1200 UTC, 20100205.

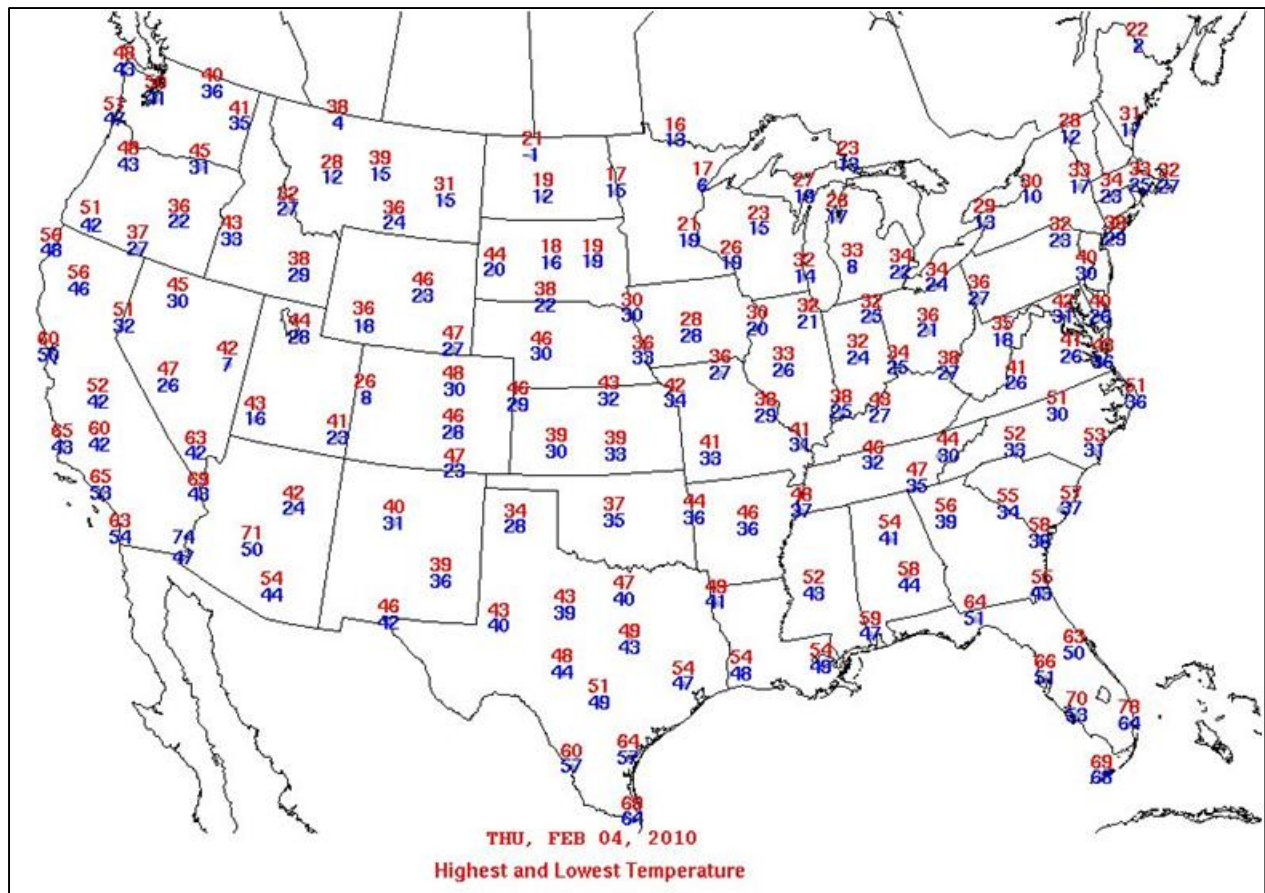


Figure C-36. Maximum and minimum surface temperatures for 20100204.

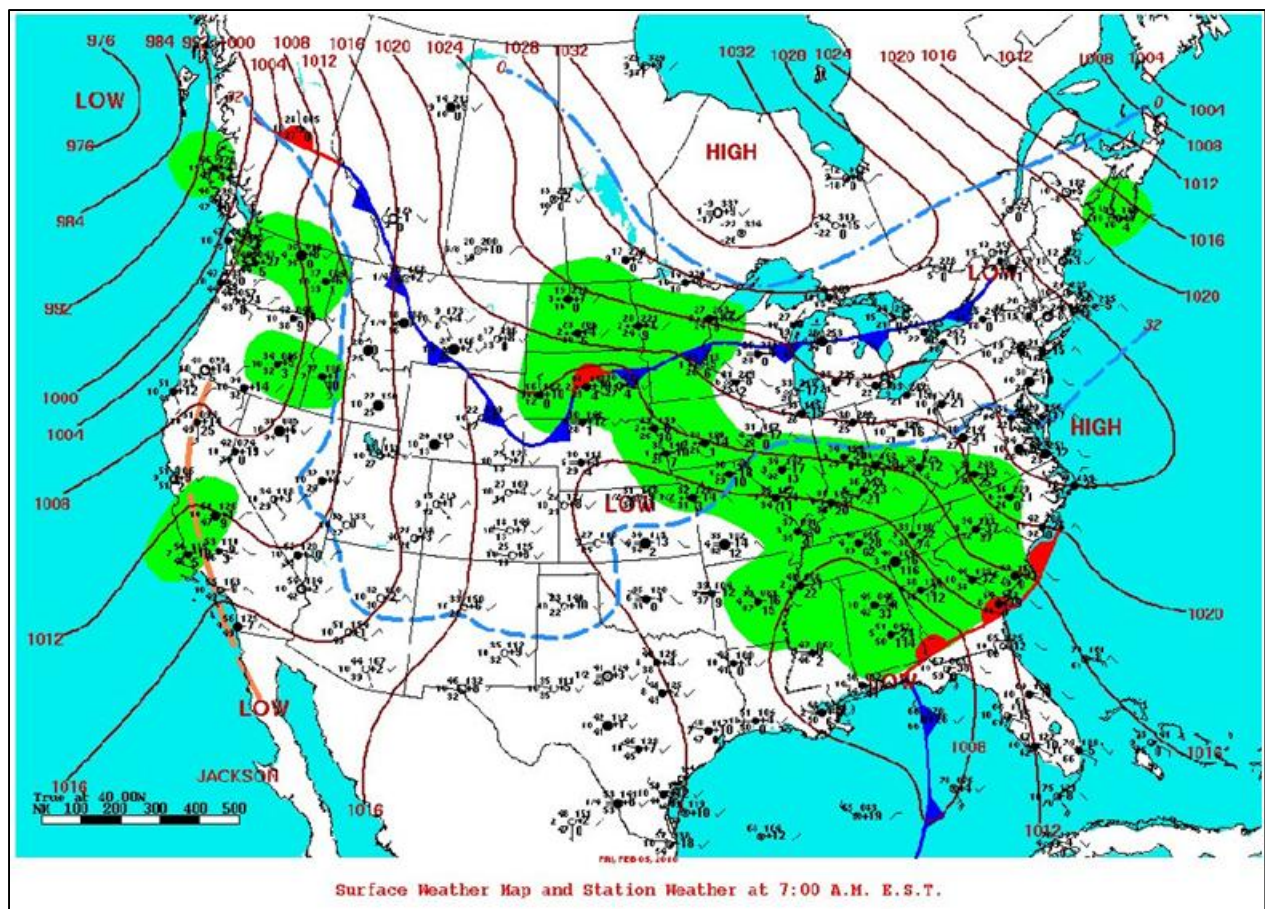


Figure C-37. Surface weather analysis valid time 1200 UTC, 20100205.

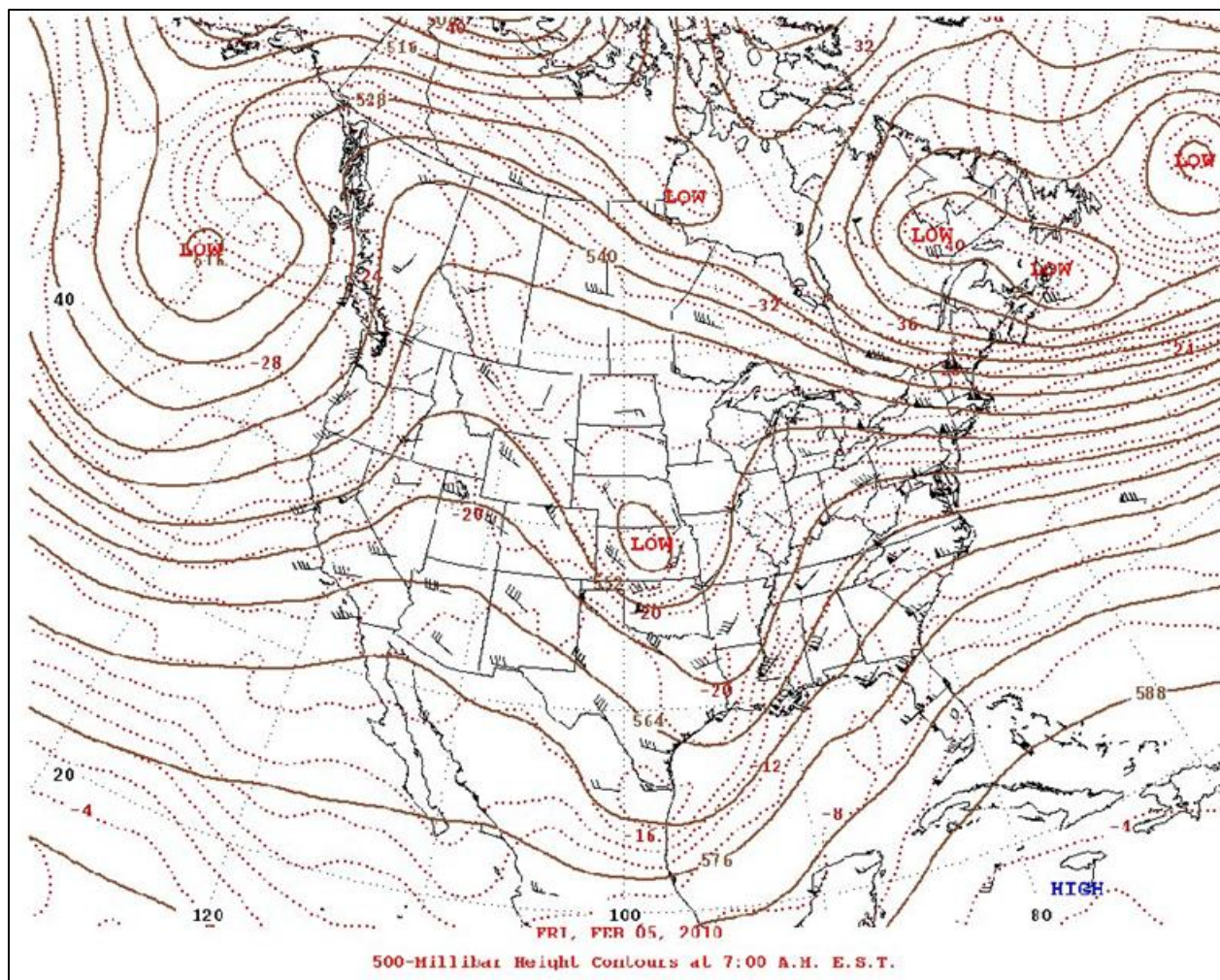


Figure C-38. 500-millibar upper air analysis valid time 1200 UTC, 20100205.

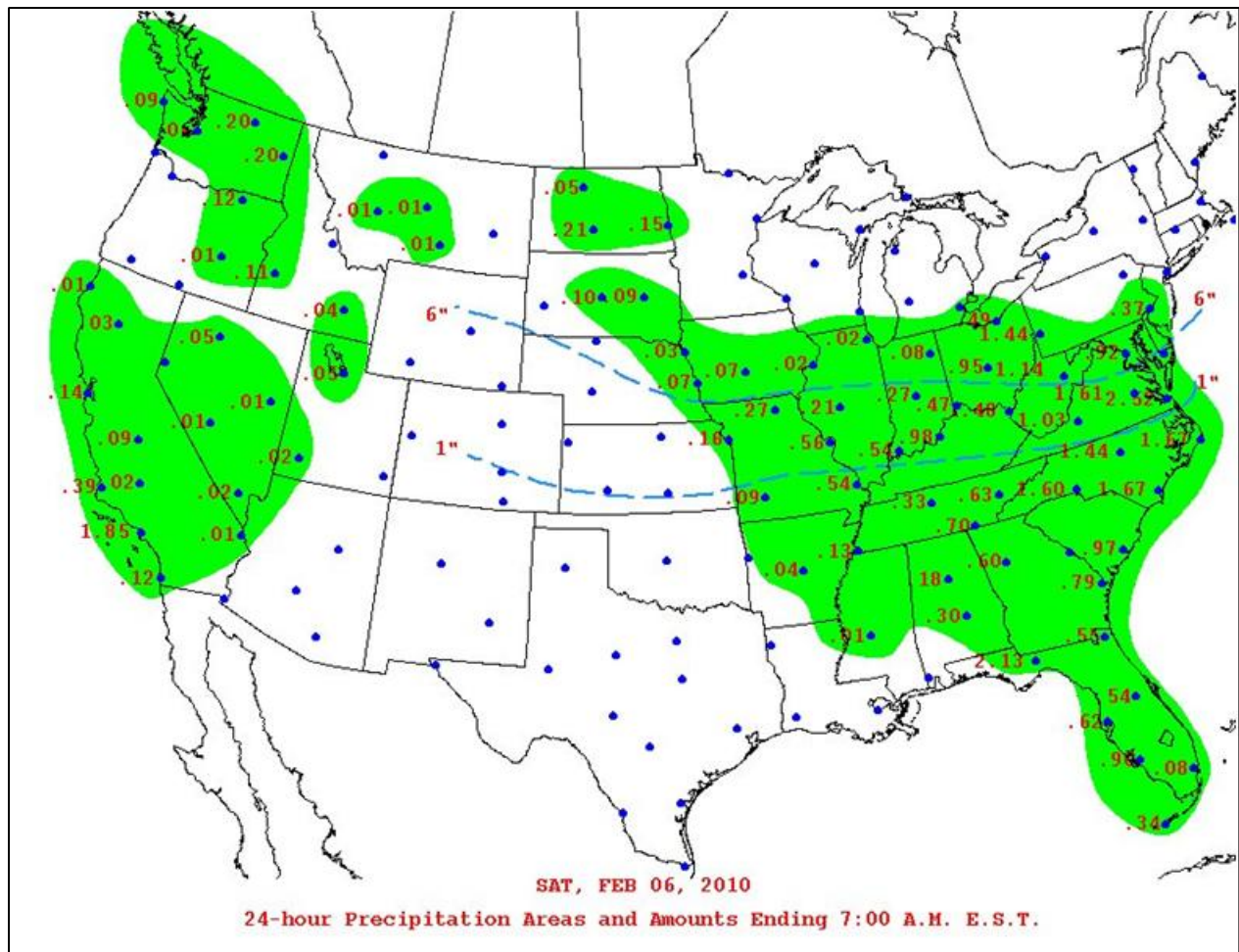


Figure C-39. 24-hour accumulated precipitation for period ending 1200 UTC, 20100206.

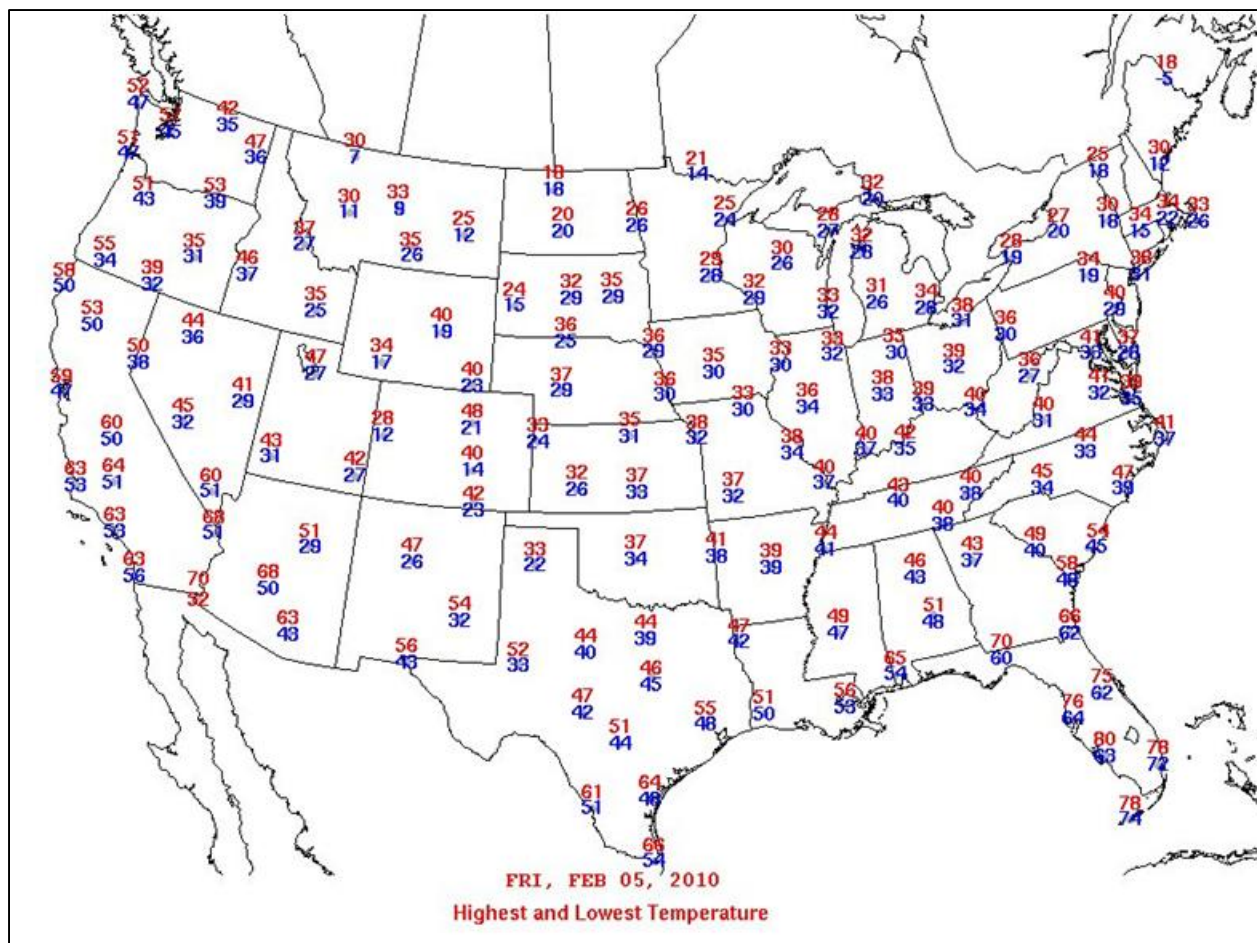


Figure C-40. Maximum and minimum surface temperatures for 20100205.

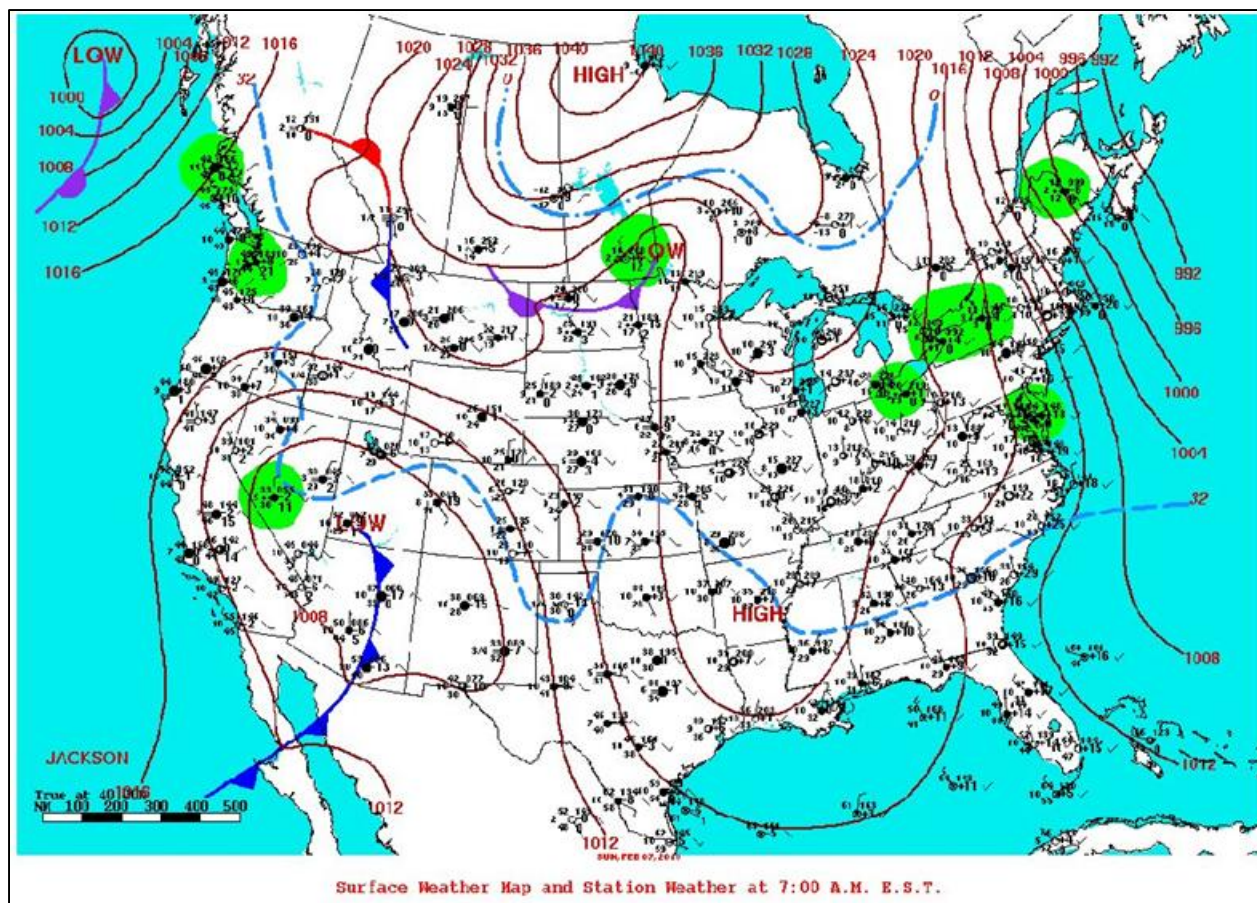


Figure C-41. Surface weather analysis valid time 1200 UTC, 20100207.

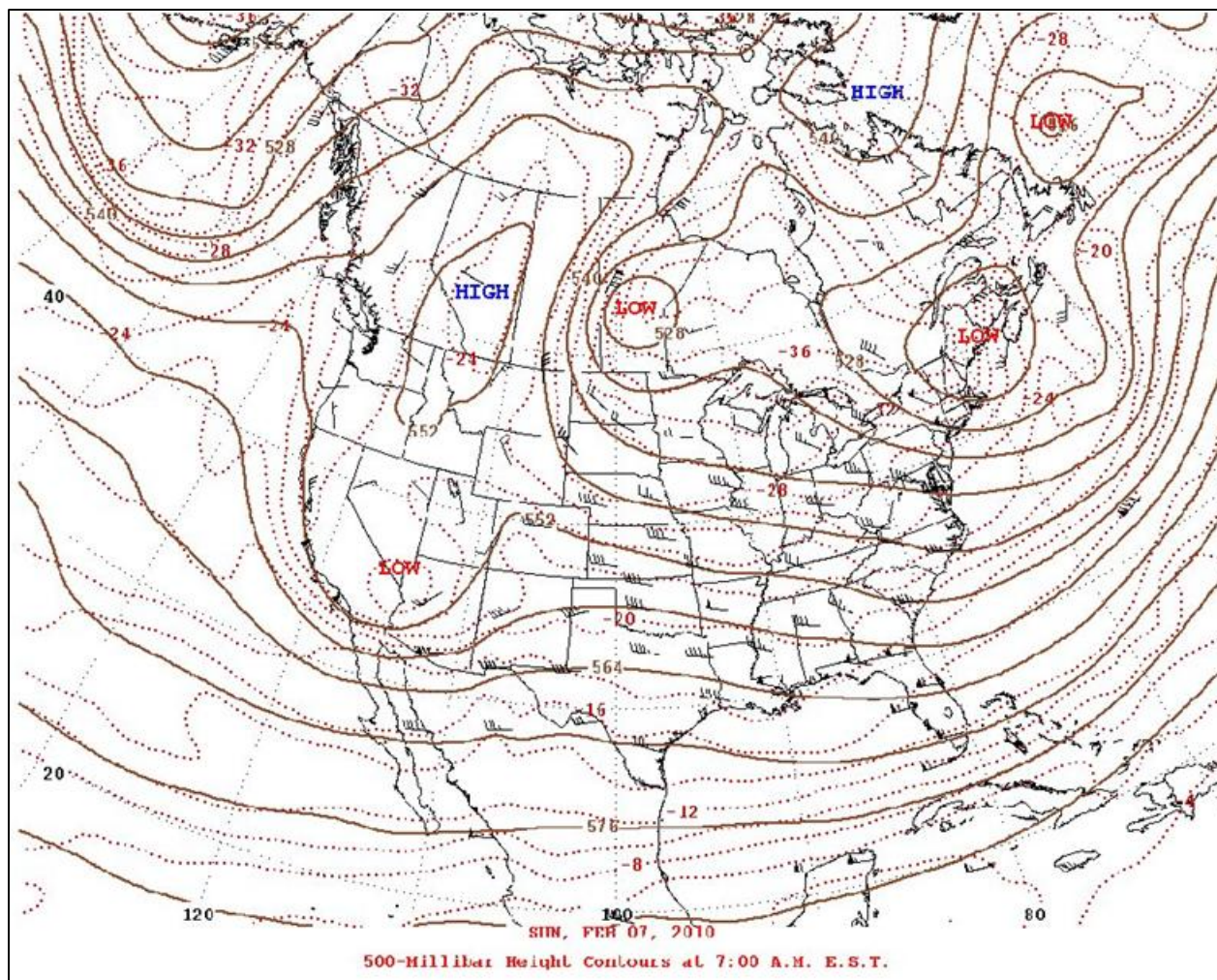
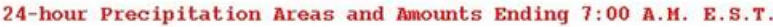


Figure C-42. 500-millibar upper air analysis valid time 1200 UTC, 20100207.



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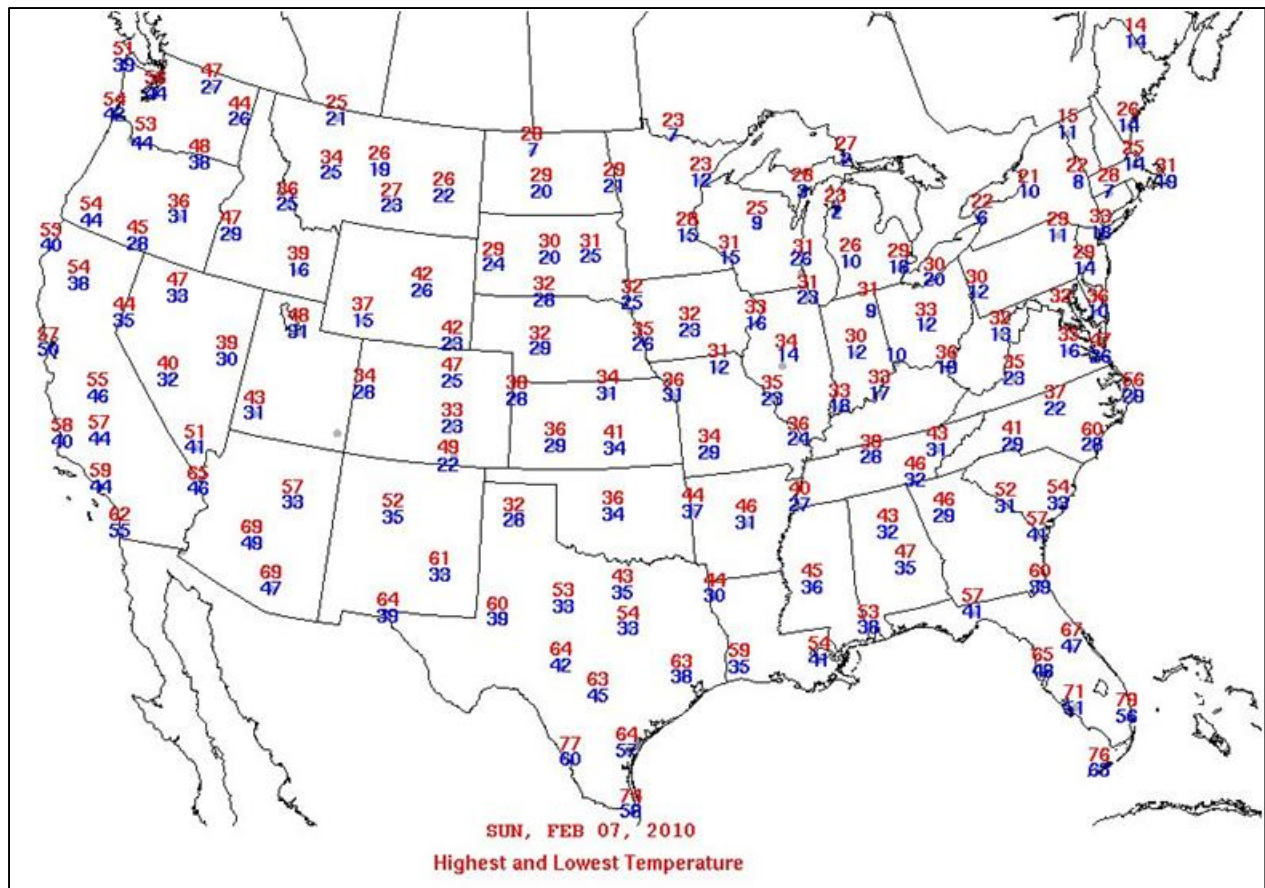


Figure C-44. Maximum and minimum surface temperatures for 20100207.

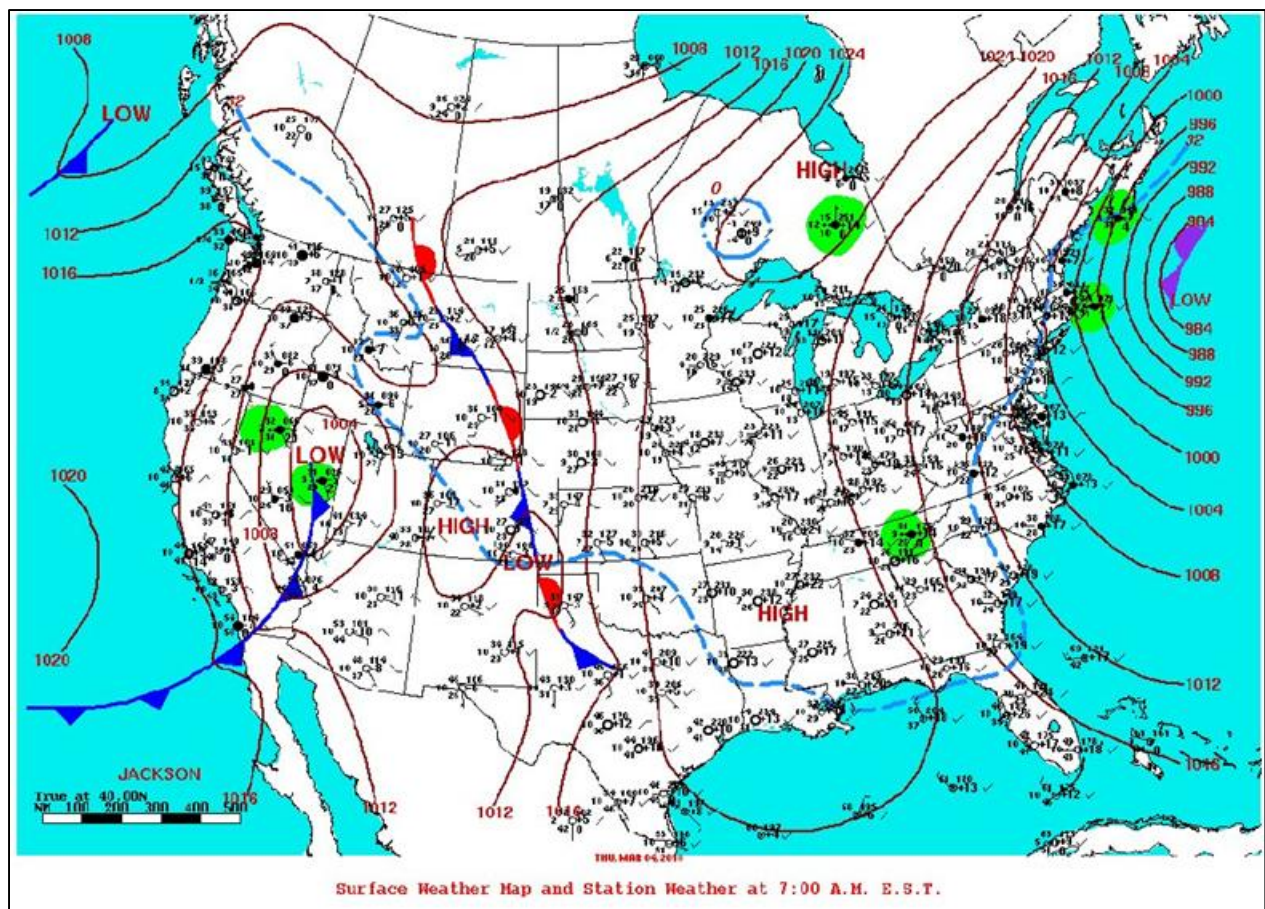


Figure C-45. Surface weather analysis valid time 1200 UTC, 20100304.

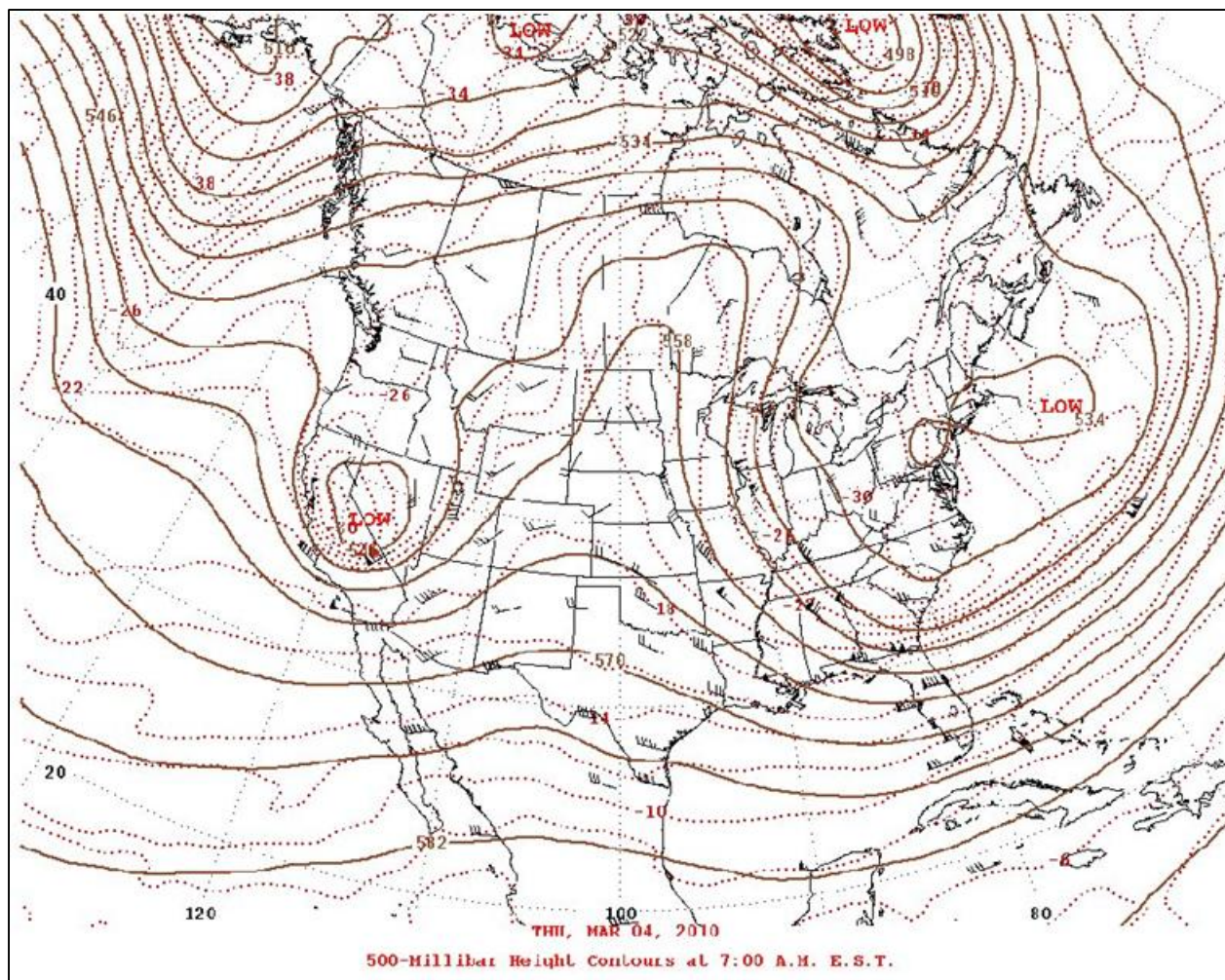


Figure C-46. 500-millibar upper air analysis valid time 1200 UTC, 20100304.

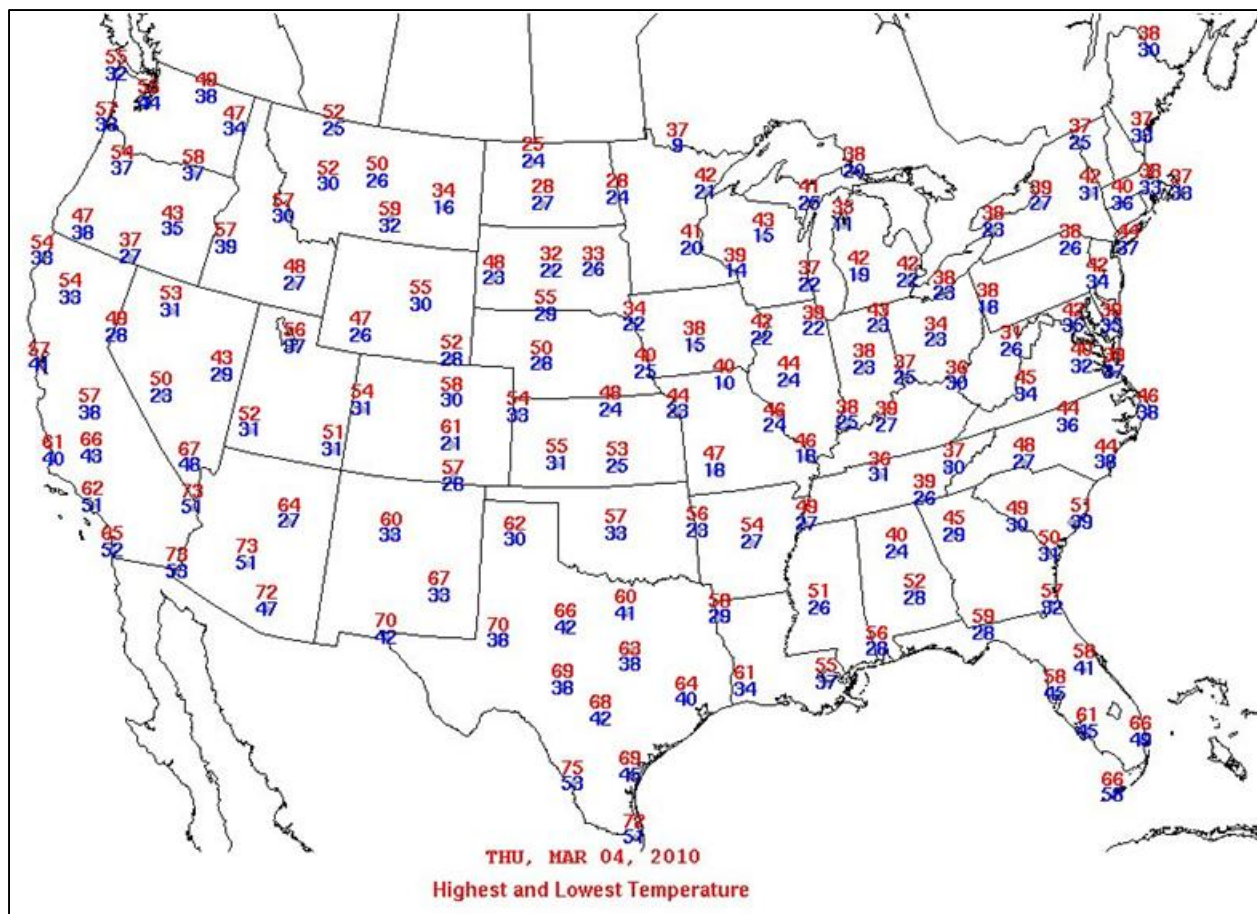


Figure C-48. Maximum and minimum surface temperatures for 20100304.

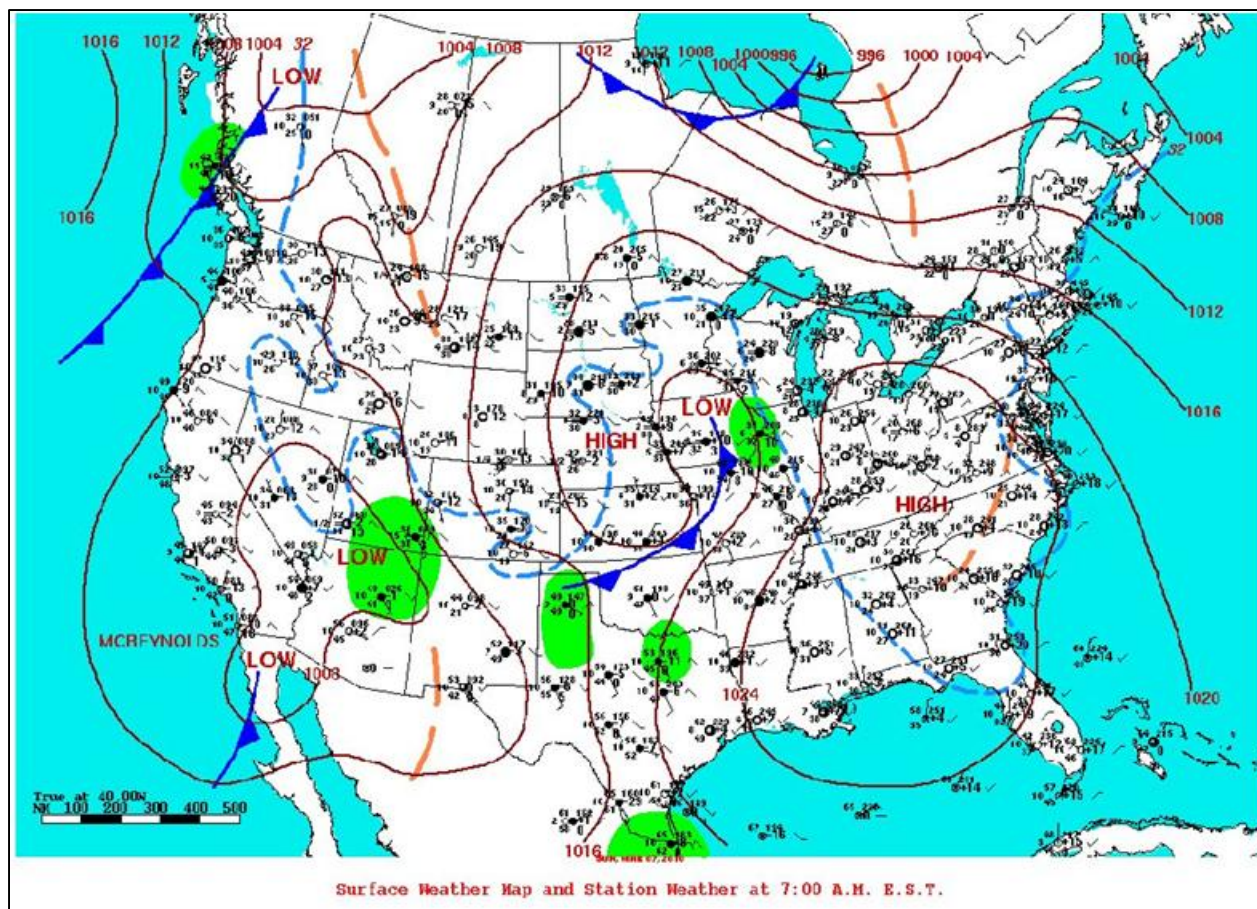


Figure C-49. Surface weather analysis valid time 1200 UTC, 20100307.

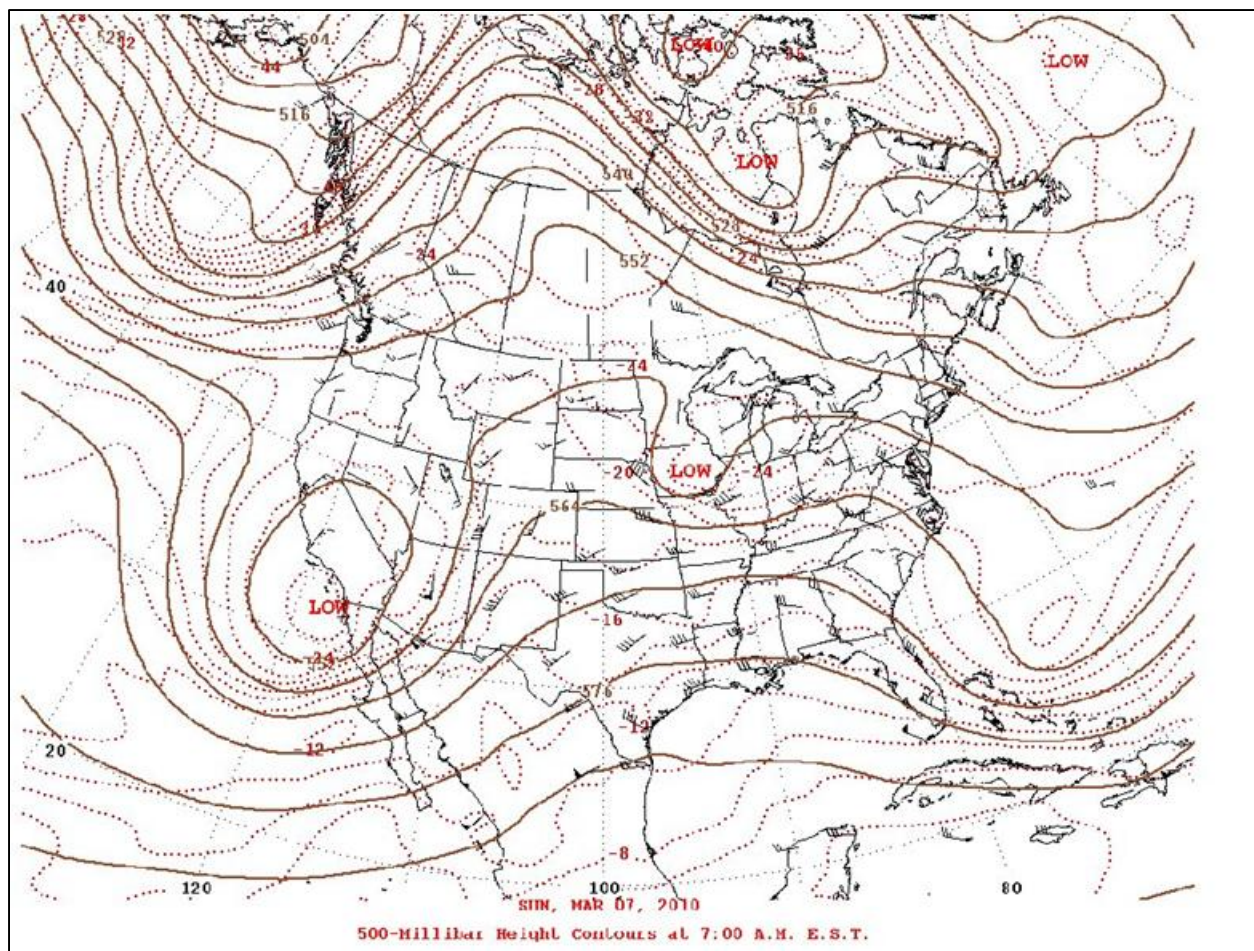
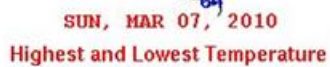


Figure C-50. 500-millibar upper air analysis valid time 1200 UTC, 20100307.



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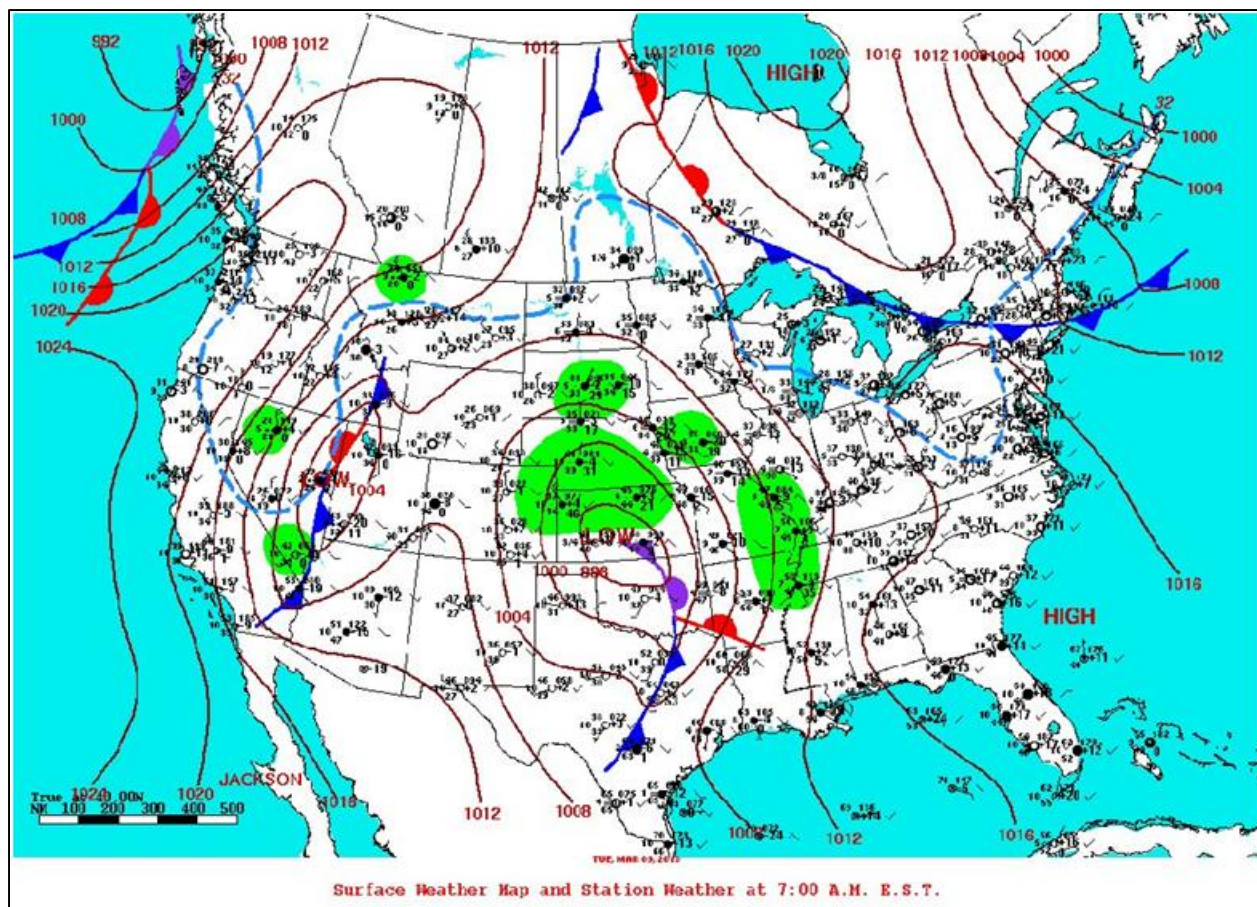


Figure C-53. Surface weather analysis valid time 1200 UTC, 20100309.

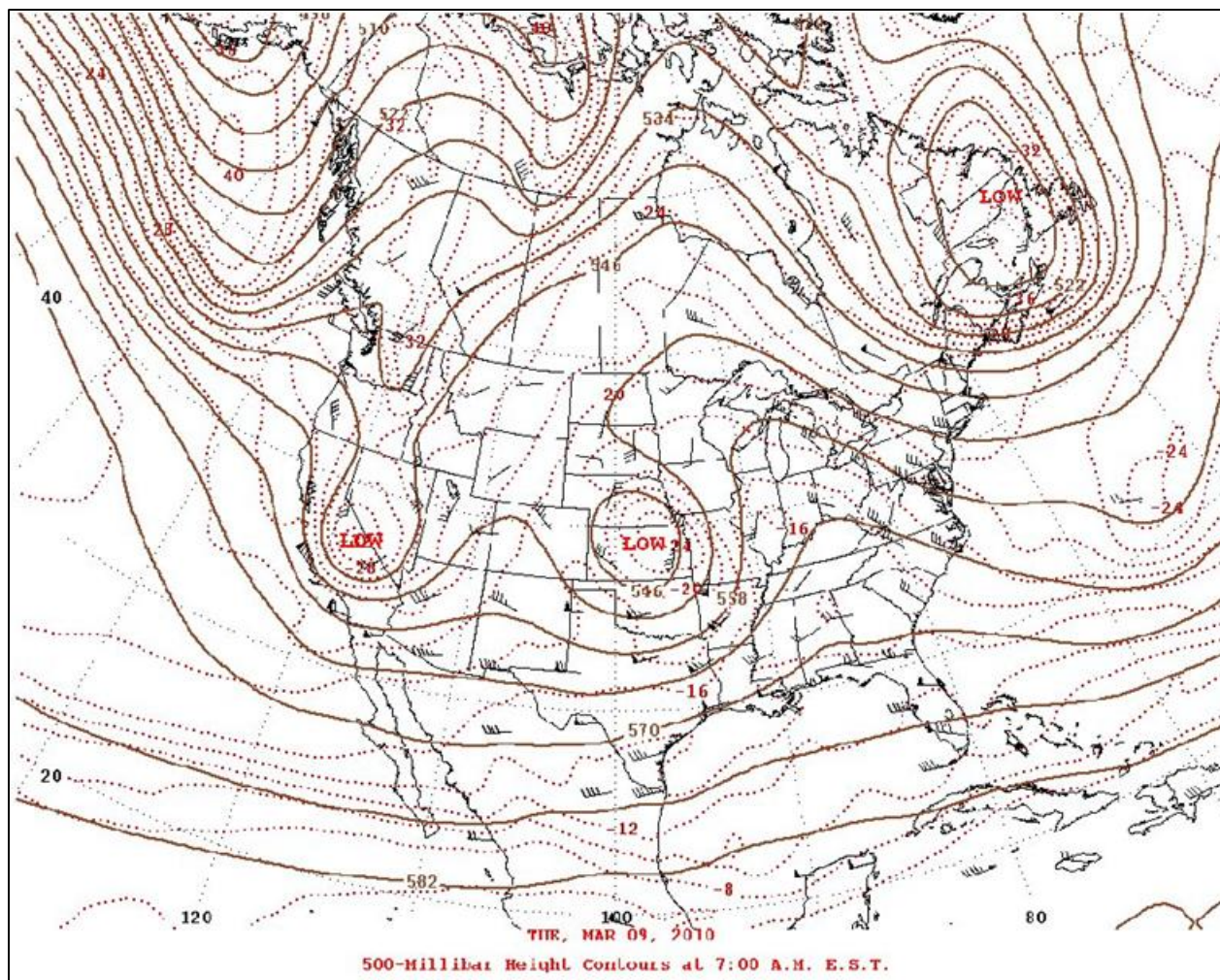


Figure C-54. 500-millibar upper air analysis valid time 1200 UTC, 20100309.

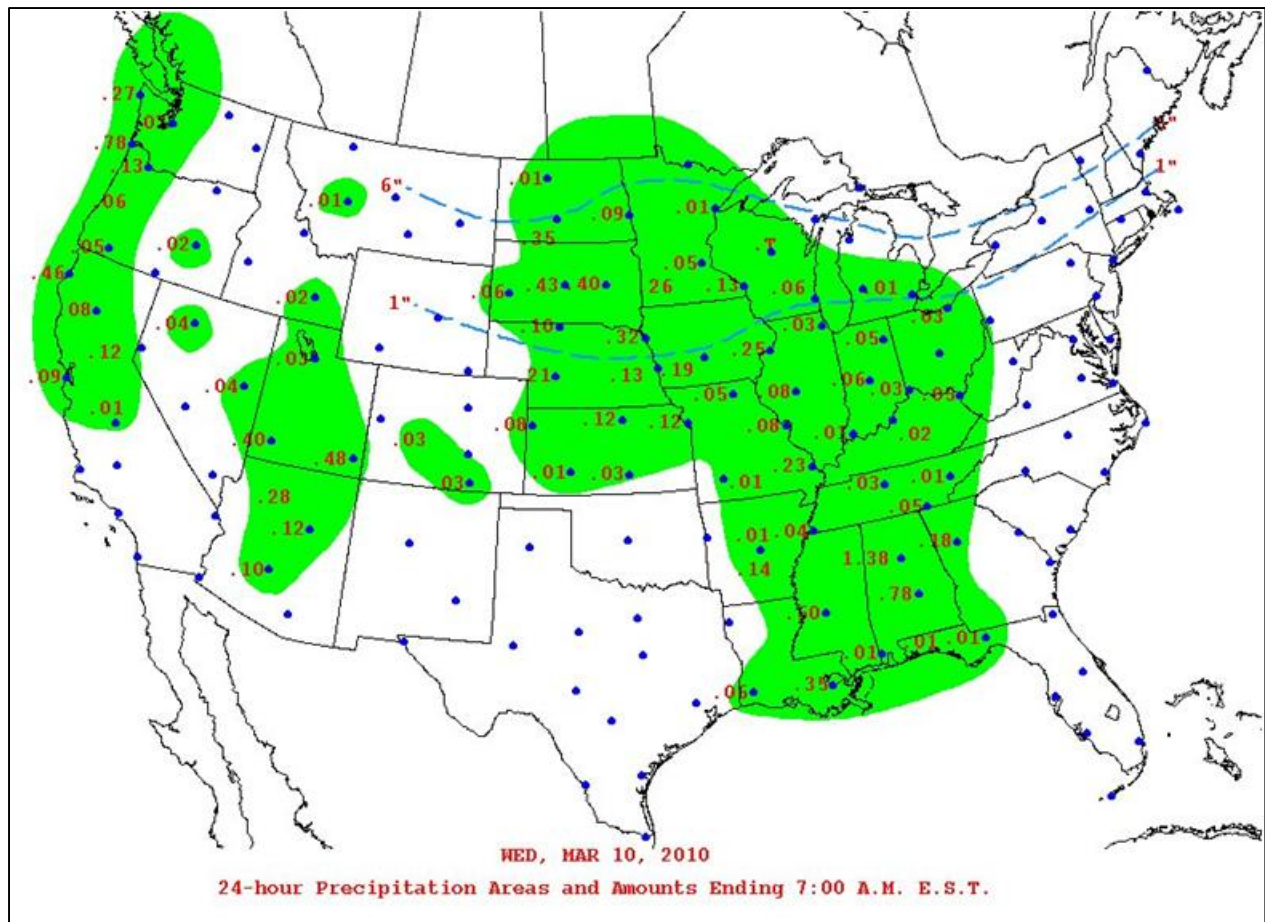


Figure C-55. 24-hour accumulated precipitation for period ending 1200 UTC, 20100310.

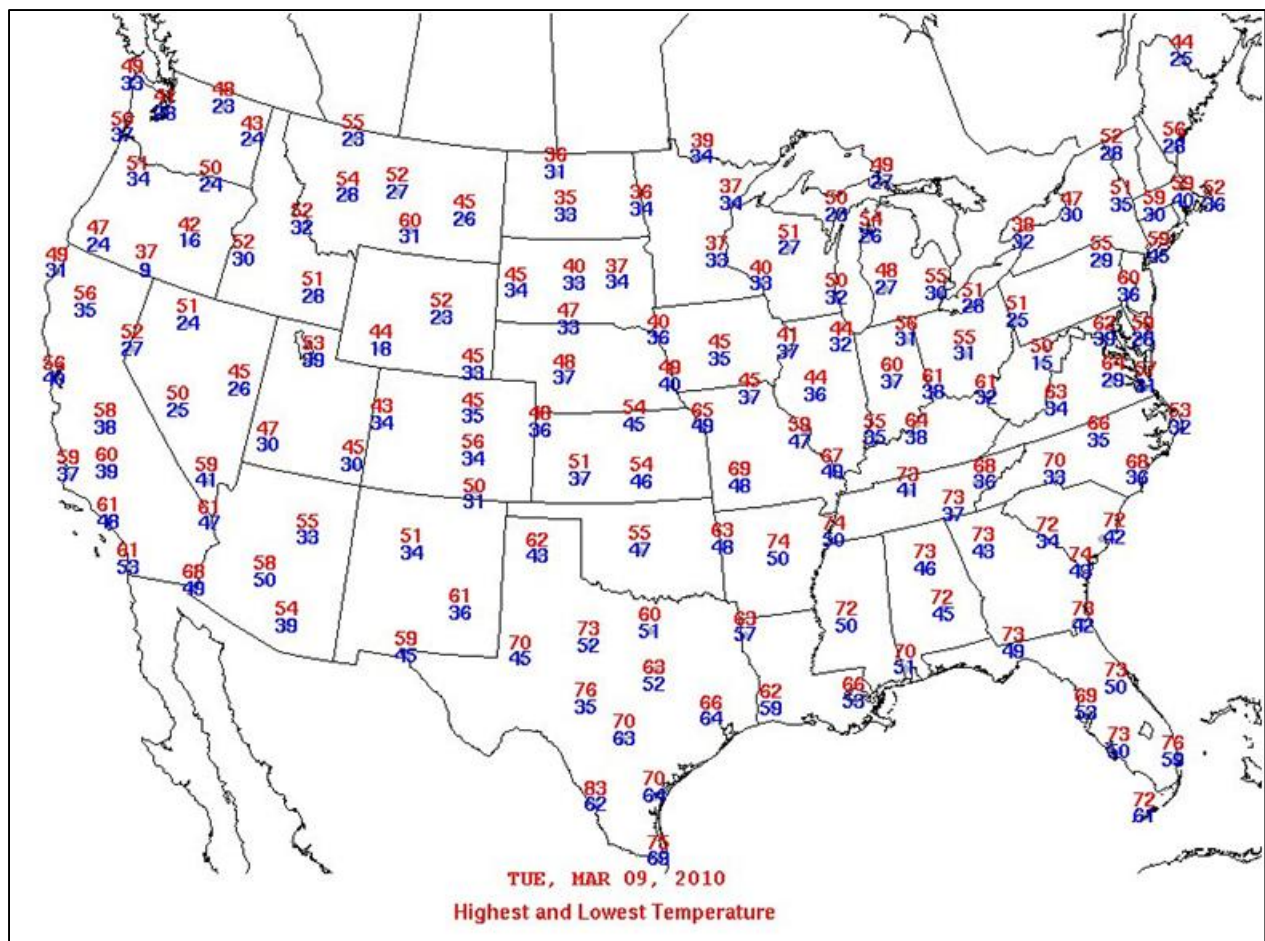


Figure C-56. Maximum and minimum surface temperatures for 20100309.

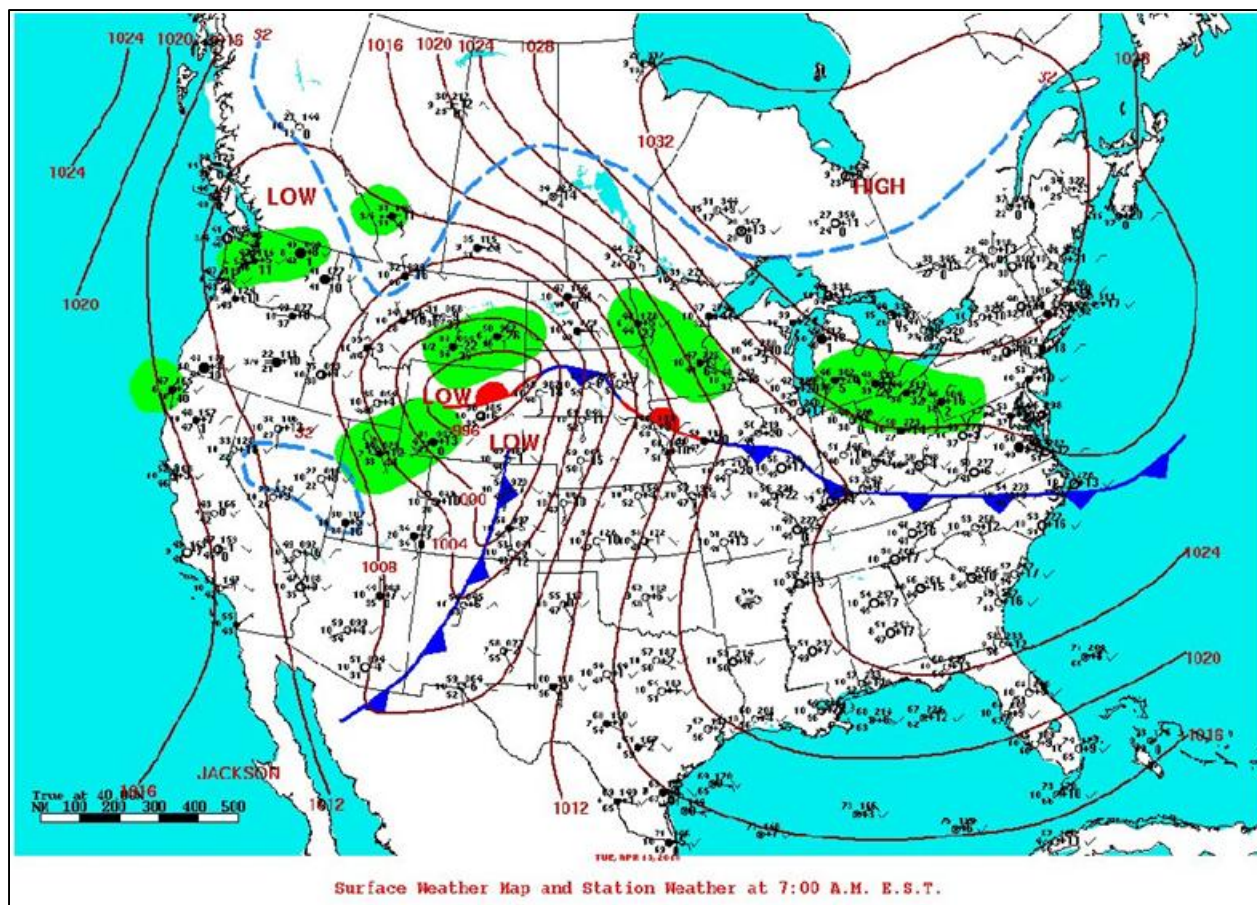


Figure C-57. Surface weather analysis valid time 1200 UTC, 20100413.

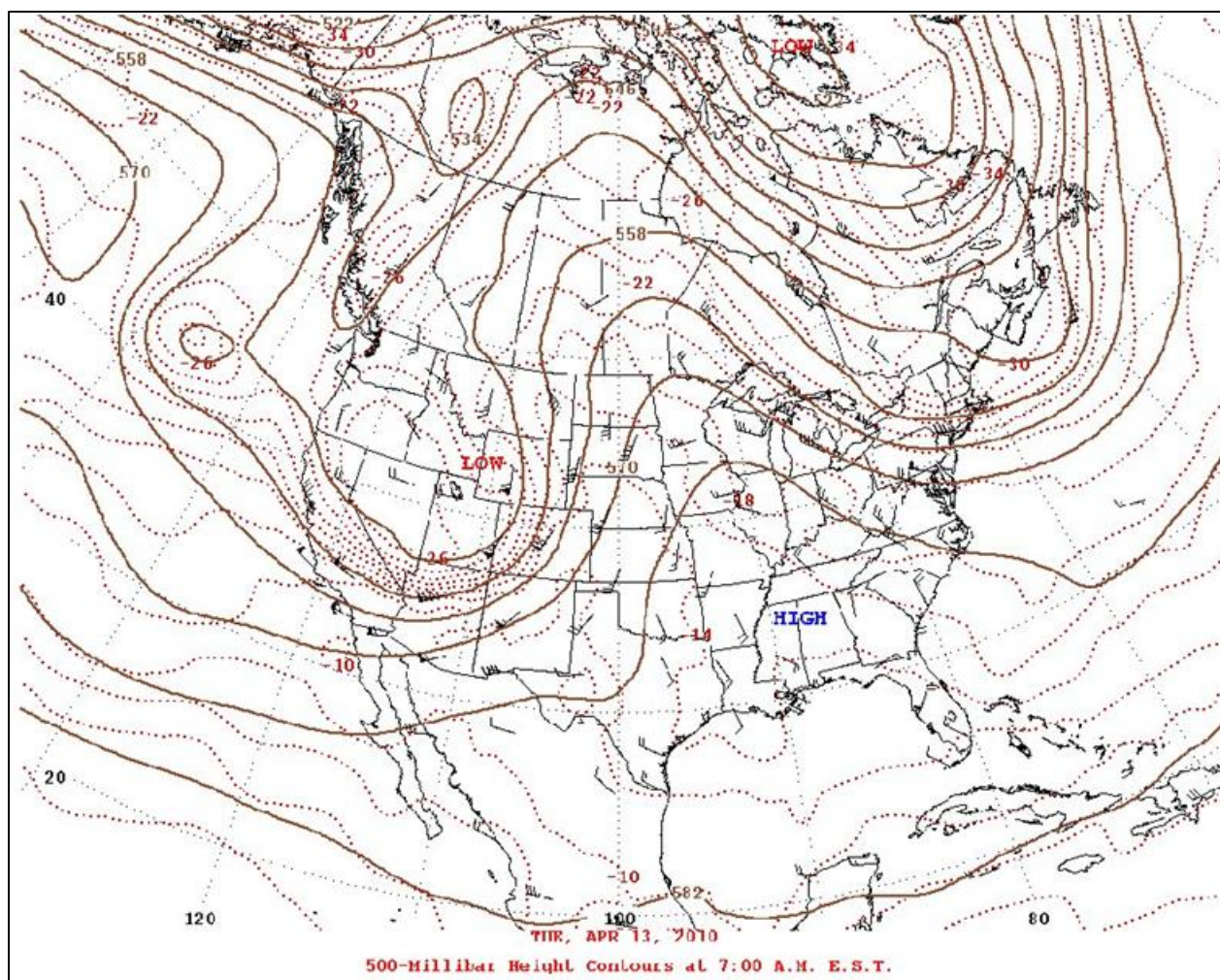


Figure C-58. 500-millibar upper air analysis valid time 1200 UTC, 20100413.

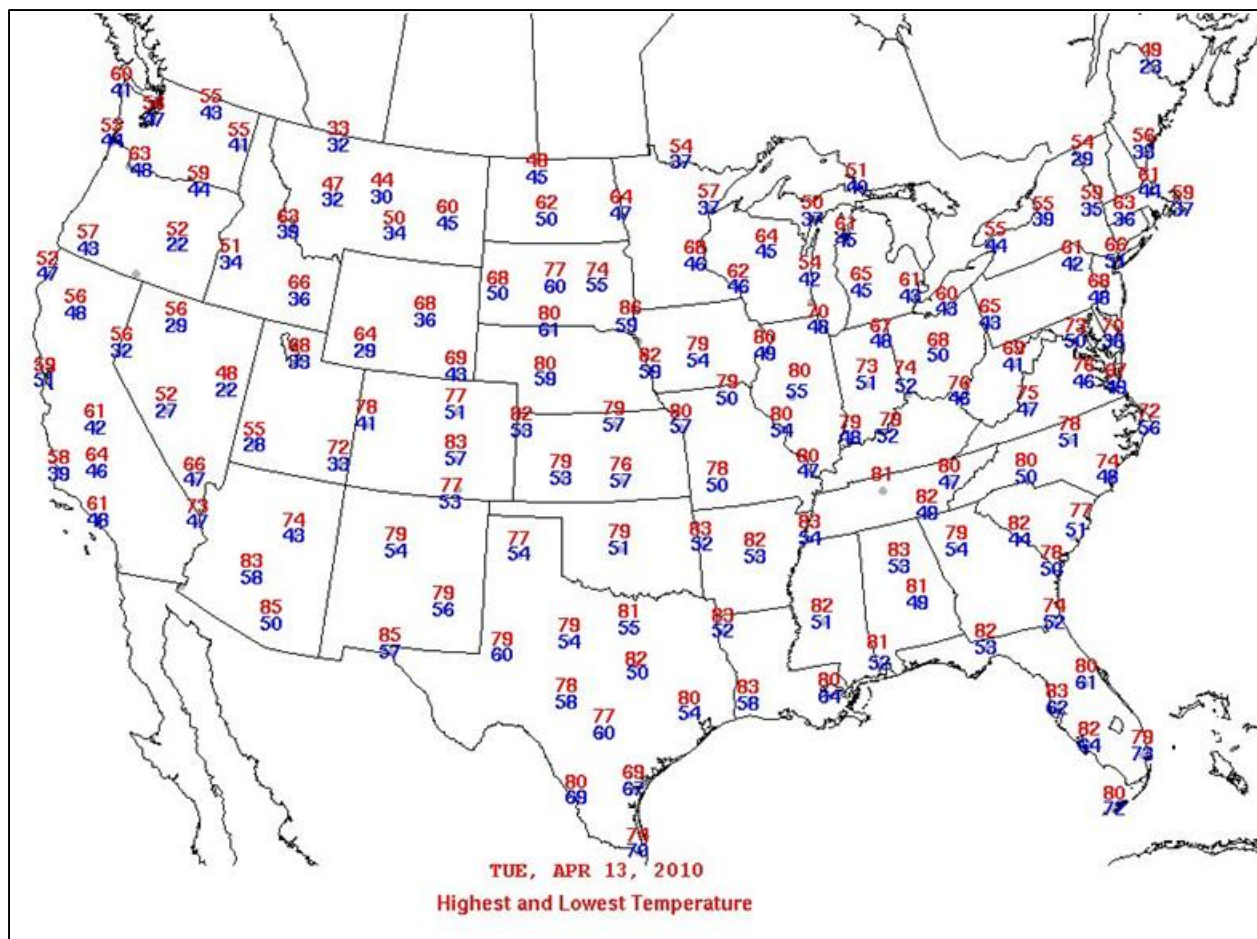


Figure C-60. Maximum and minimum surface temperatures for 20100413.

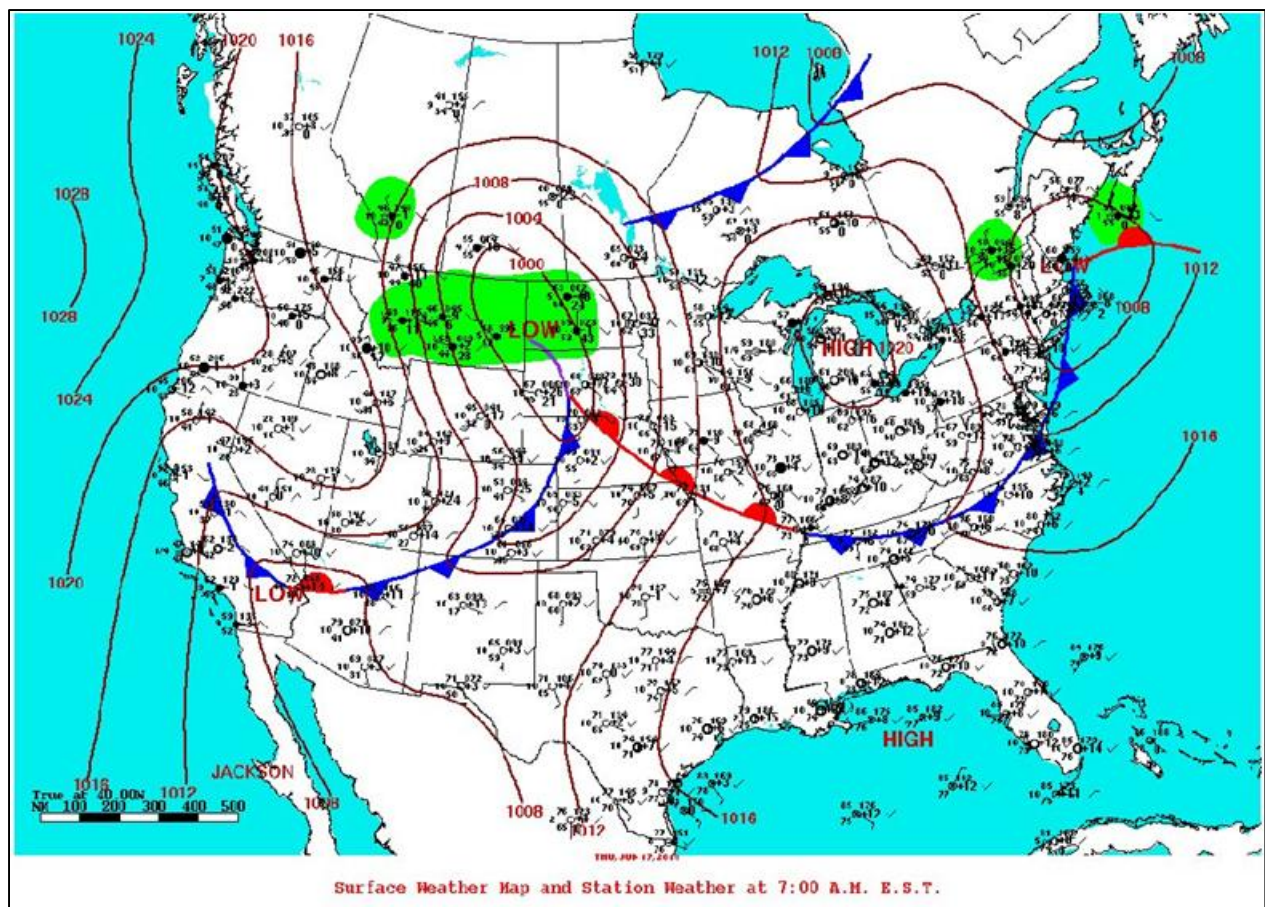


Figure C-61. Surface weather analysis valid time 1200 UTC, 20100617.

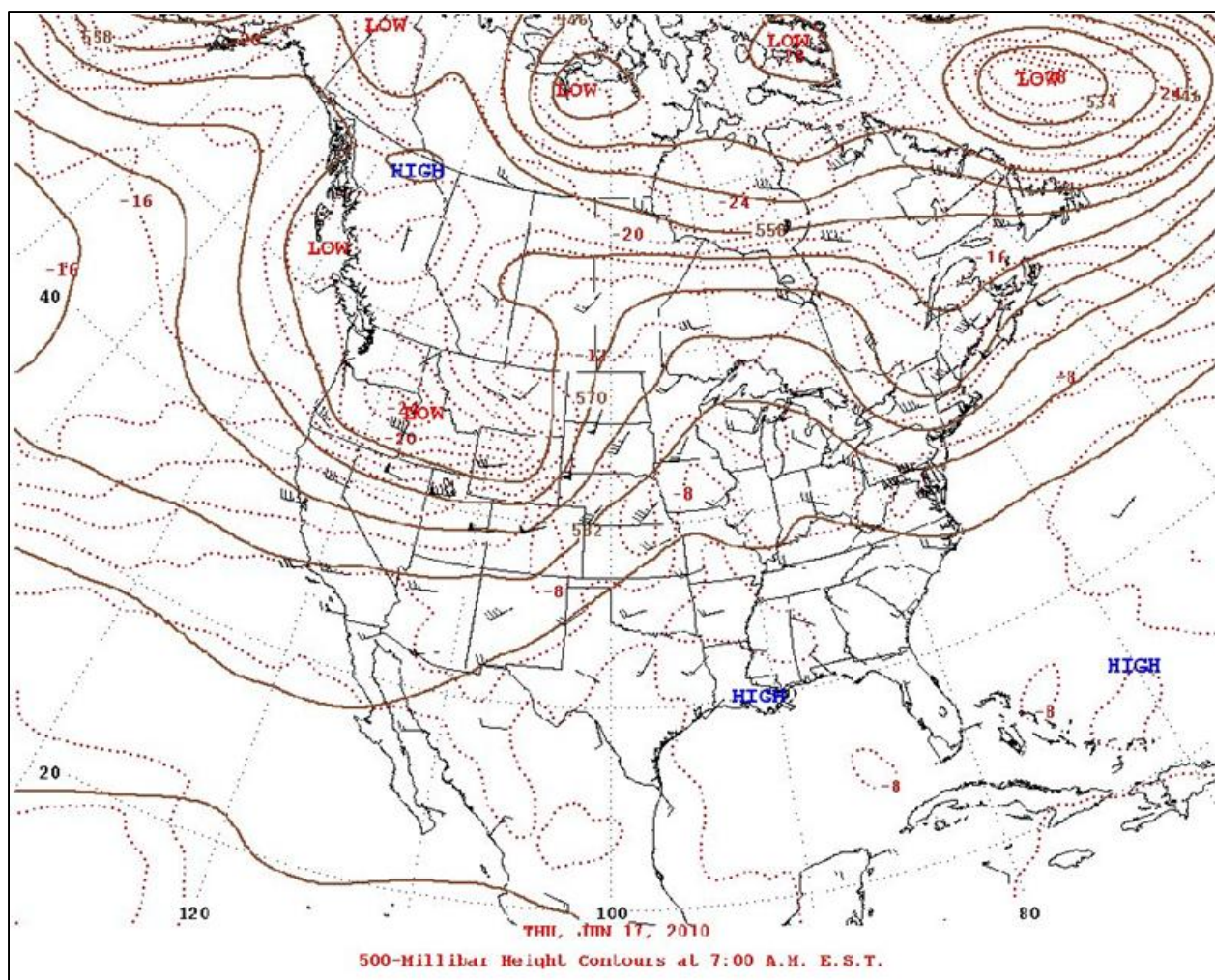


Figure C-62. 500-millibar upper air analysis valid time 1200 UTC, 20100617.

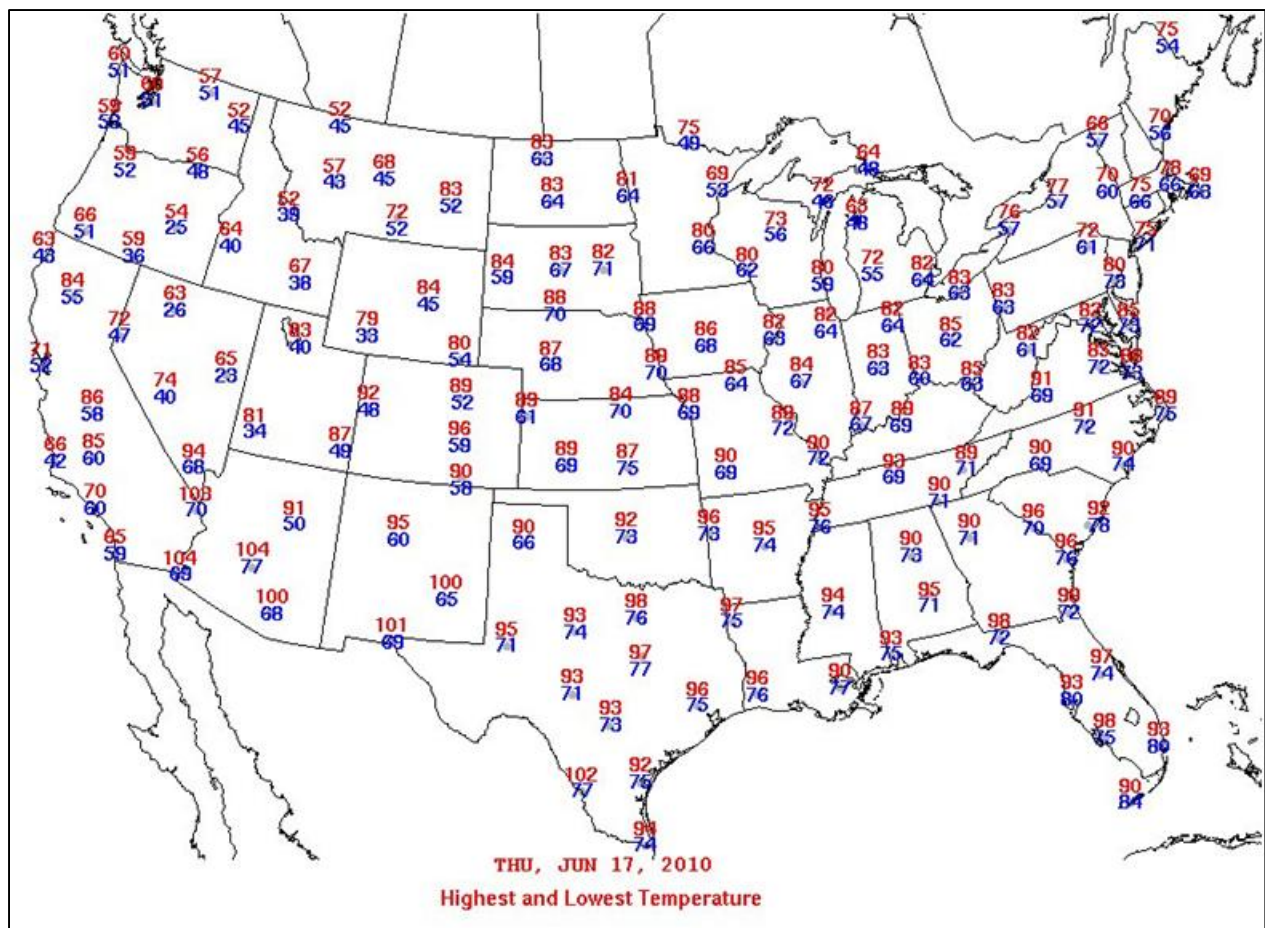


Figure C-64. Maximum and minimum surface temperatures for 20100617.

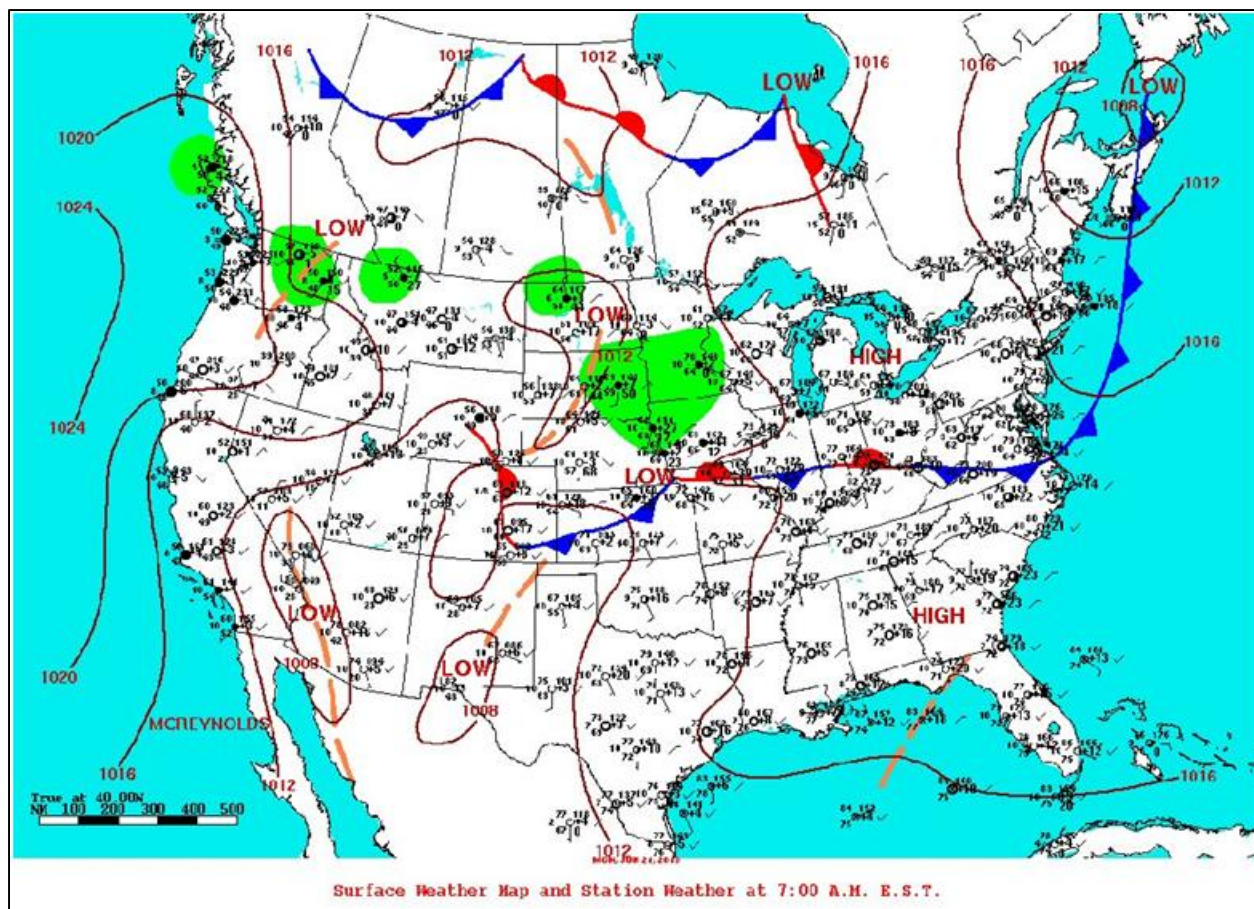


Figure C-65. Surface weather analysis valid time 1200 UTC, 20100621.

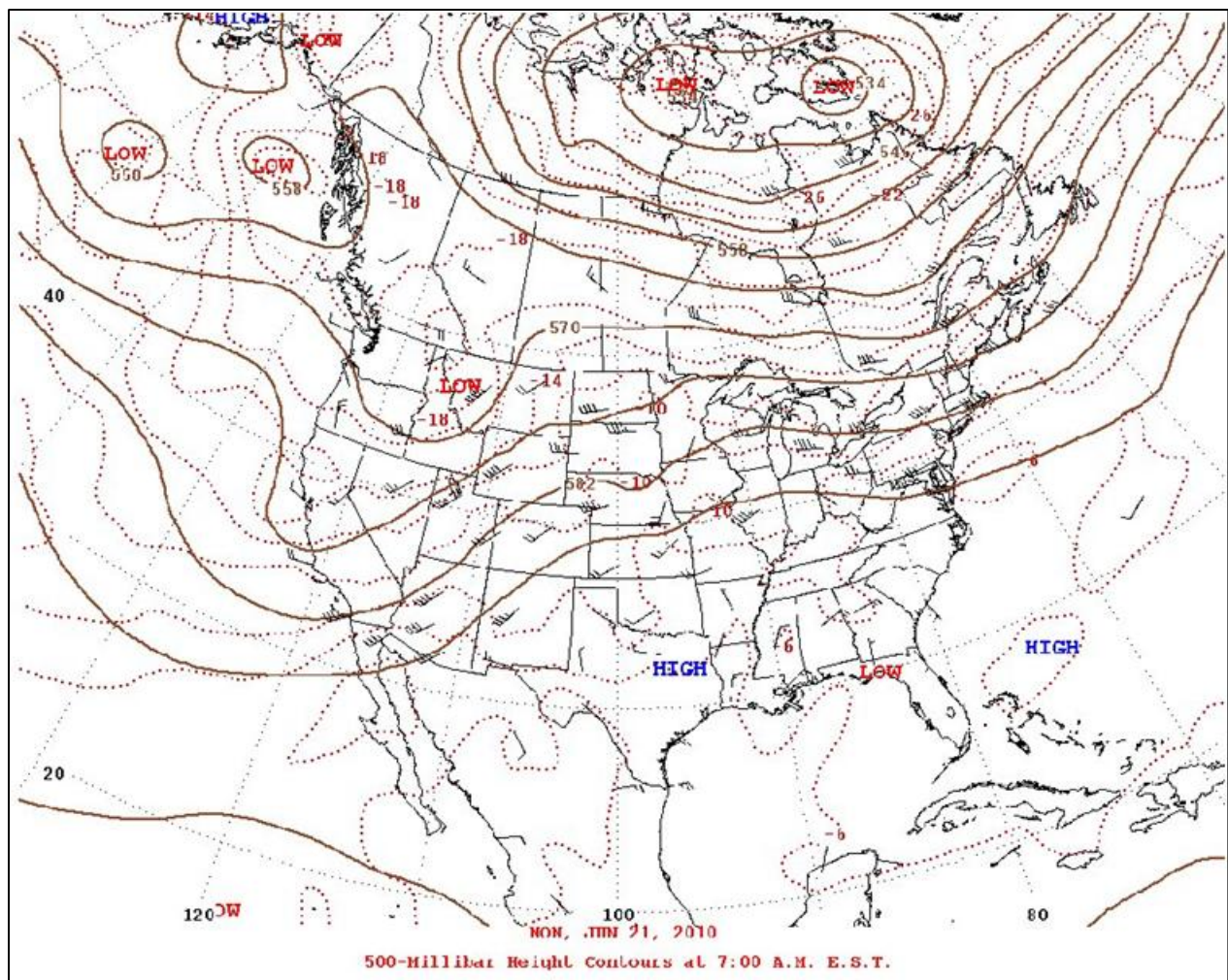


Figure C-66. 500-millibar upper air analysis valid time 1200 UTC, 20100621.

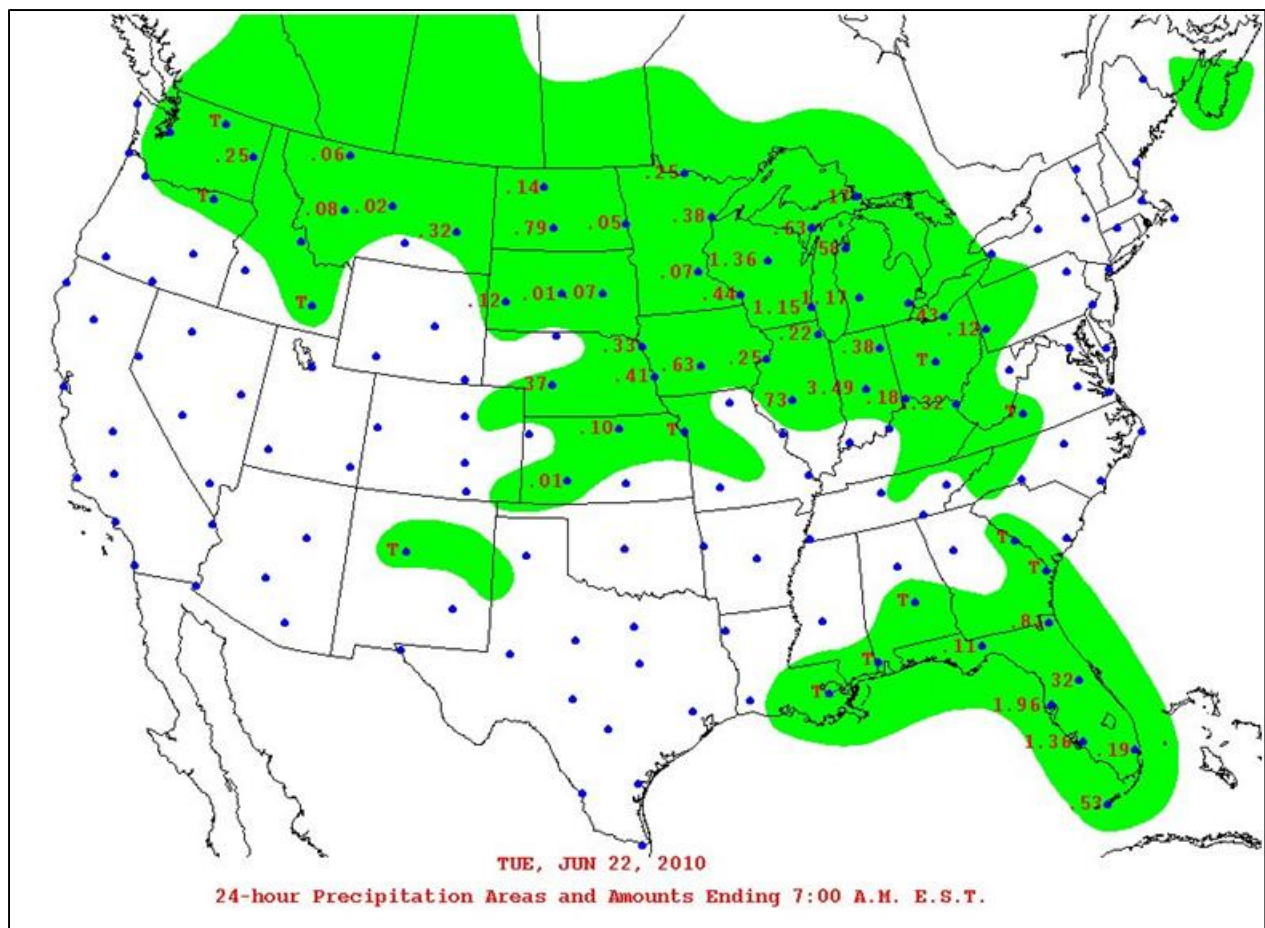


Figure C-67. 24-hour accumulated precipitation for period ending 1200 UTC, 20100622.

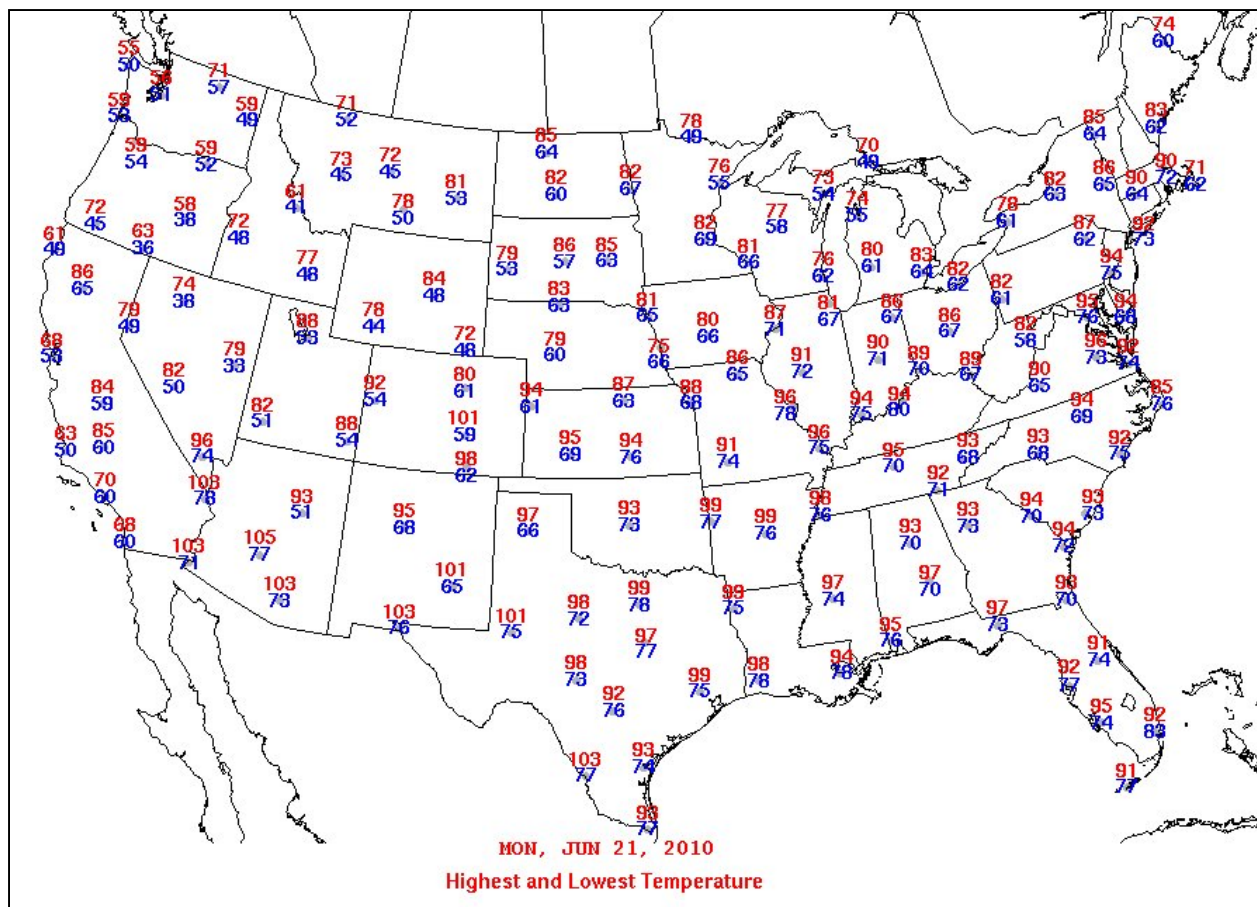


Figure C-68. Maximum and minimum surface temperatures for 20100621.

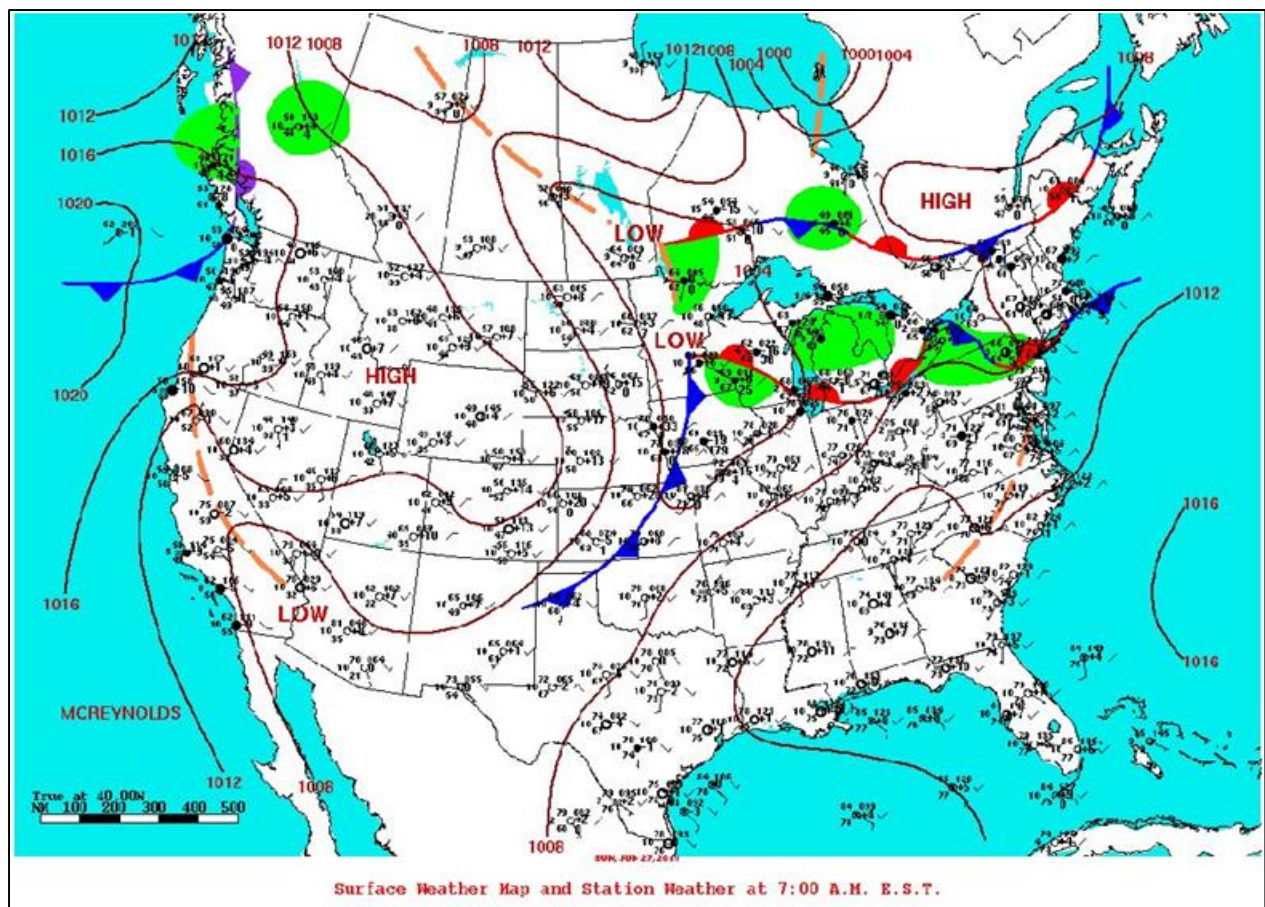


Figure C-69. Surface weather analysis valid time 1200 UTC, 20100627.

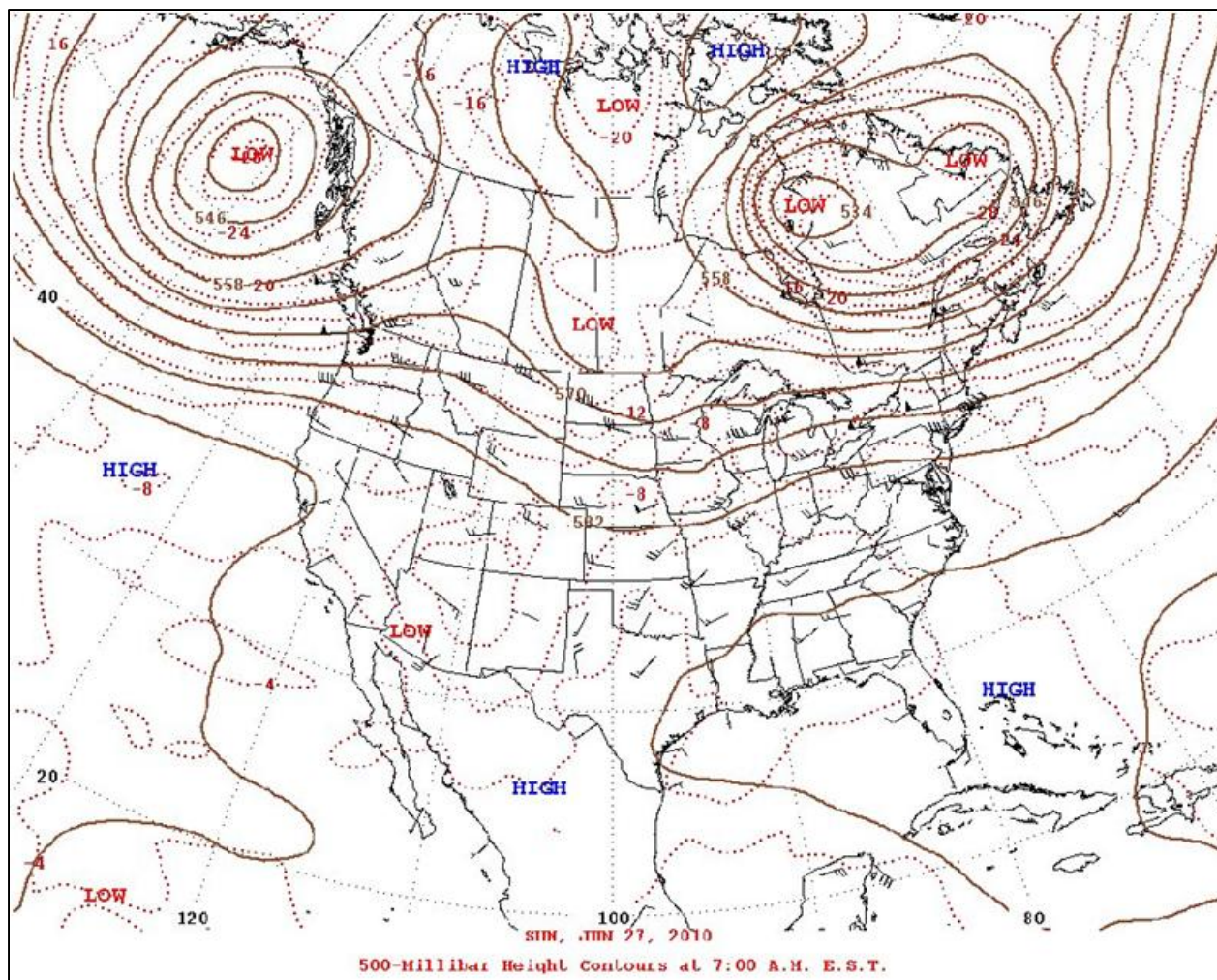


Figure C-70. 500-millibar upper air analysis valid time 1200 UTC, 20100627.

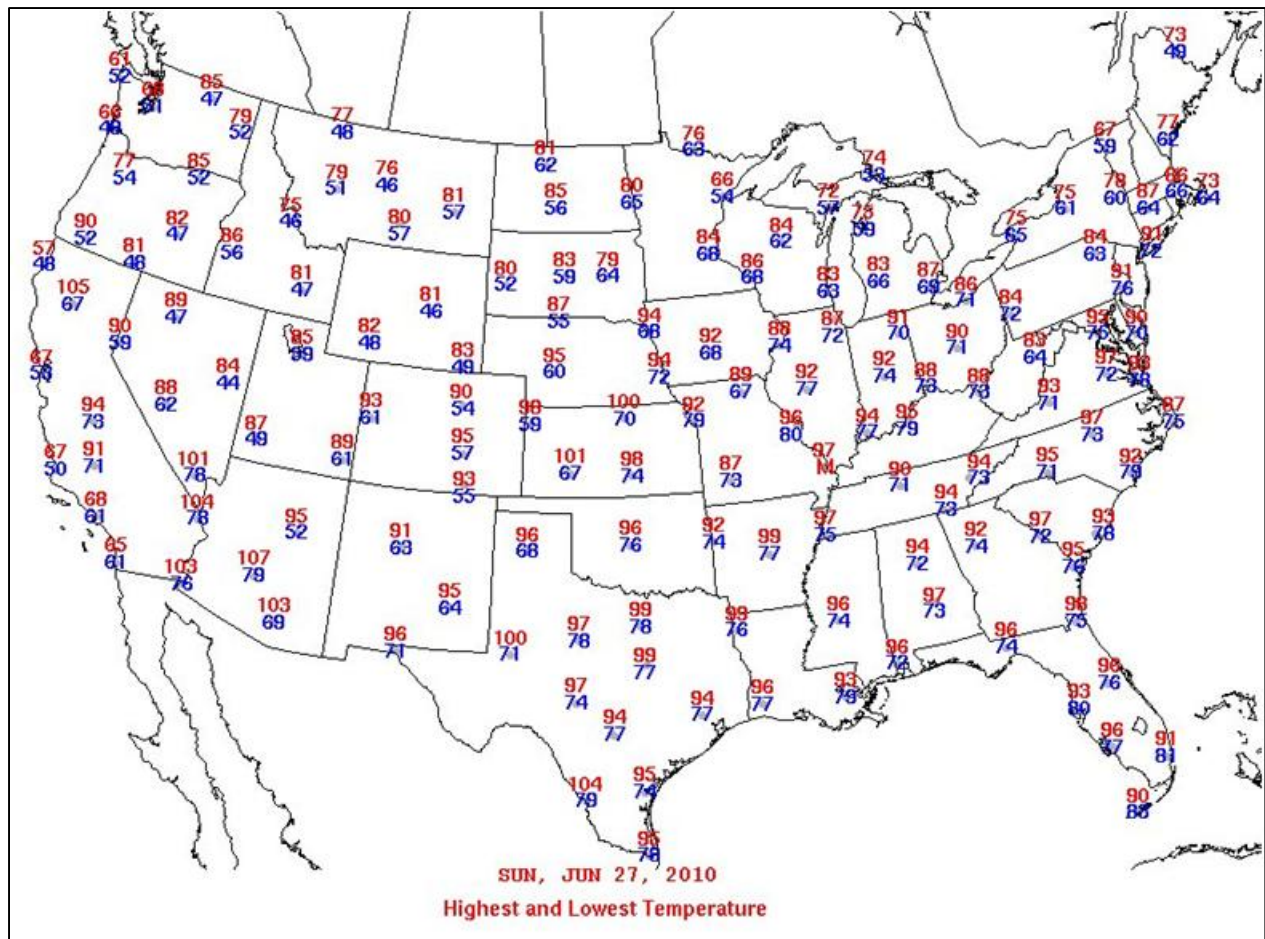


Figure C-72. Maximum and minimum surface temperatures for 20100627.

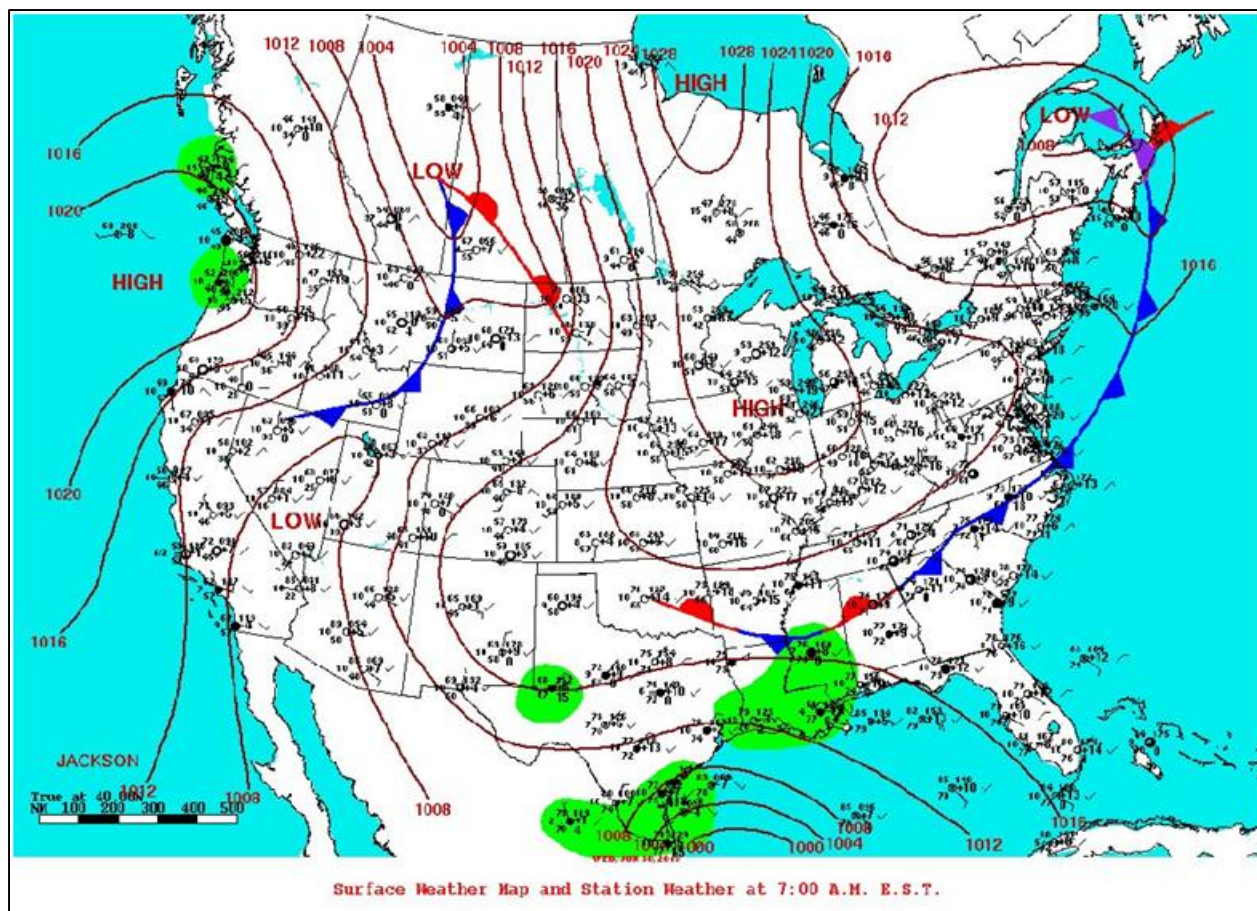


Figure C-73. Surface weather analysis valid time 1200 UTC, 20100630.

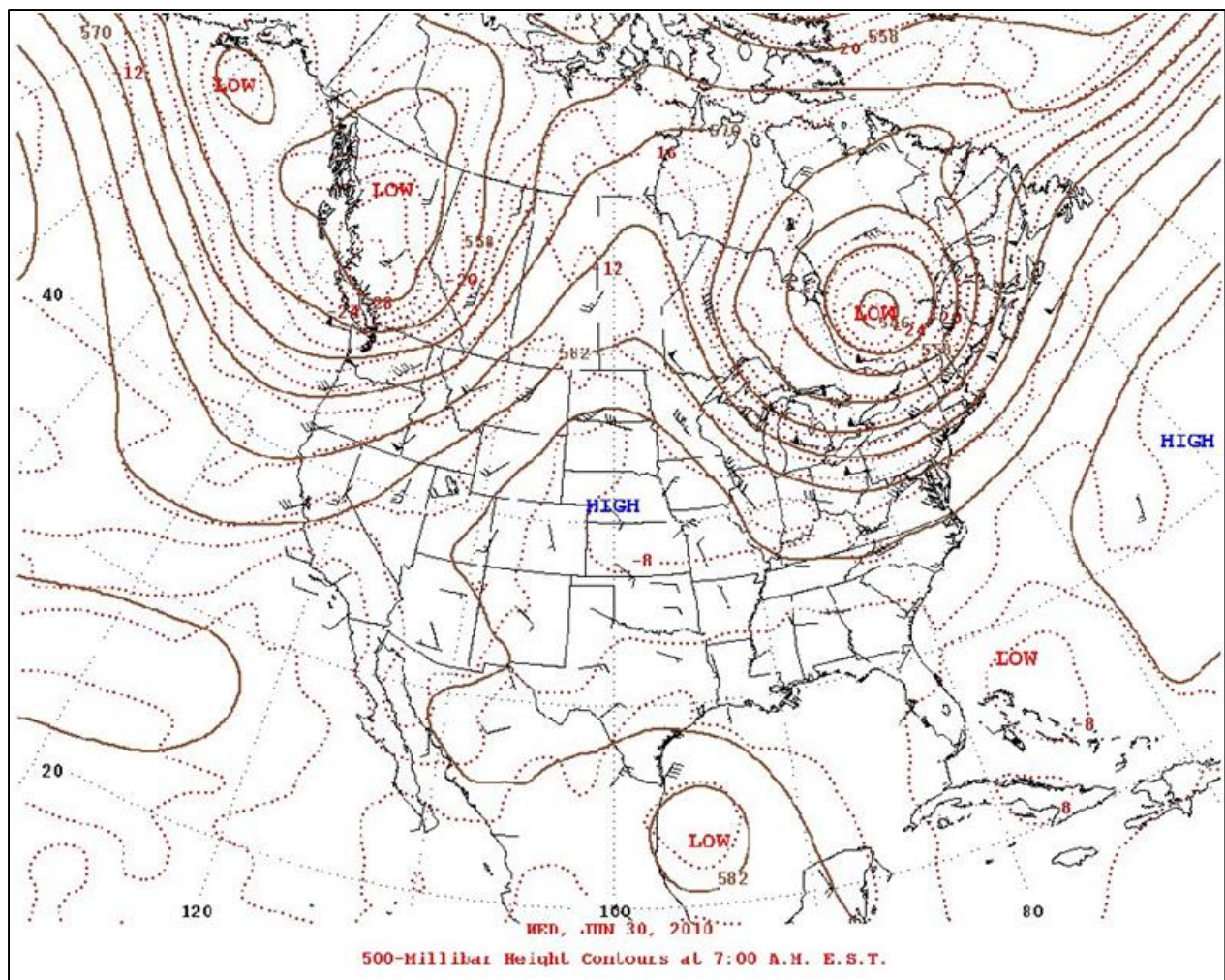


Figure C-74. 500-millibar upper air analysis valid time 1200 UTC, 20100630.

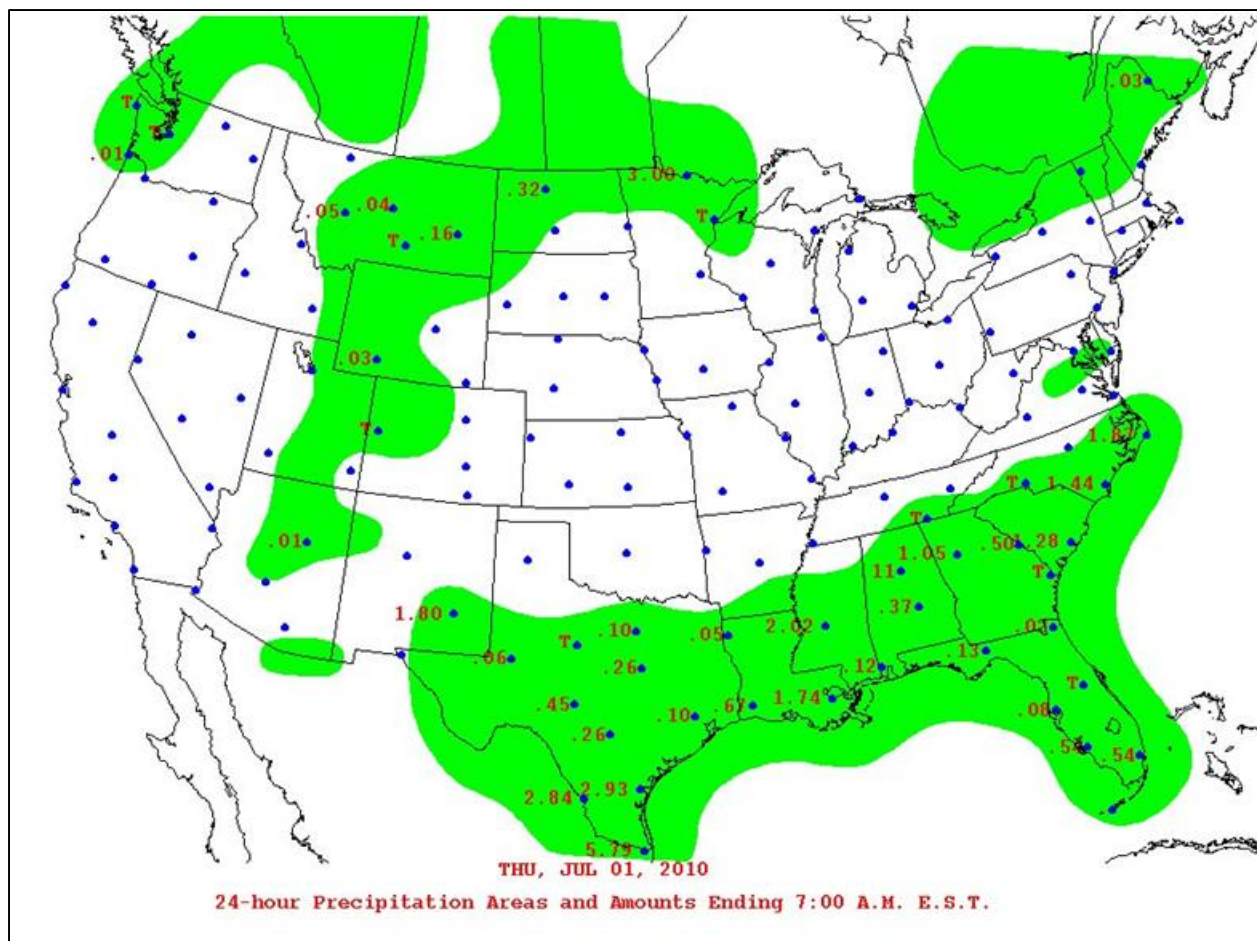


Figure C-75. 24-hour accumulated precipitation for period ending 1200 UTC, 20100701.

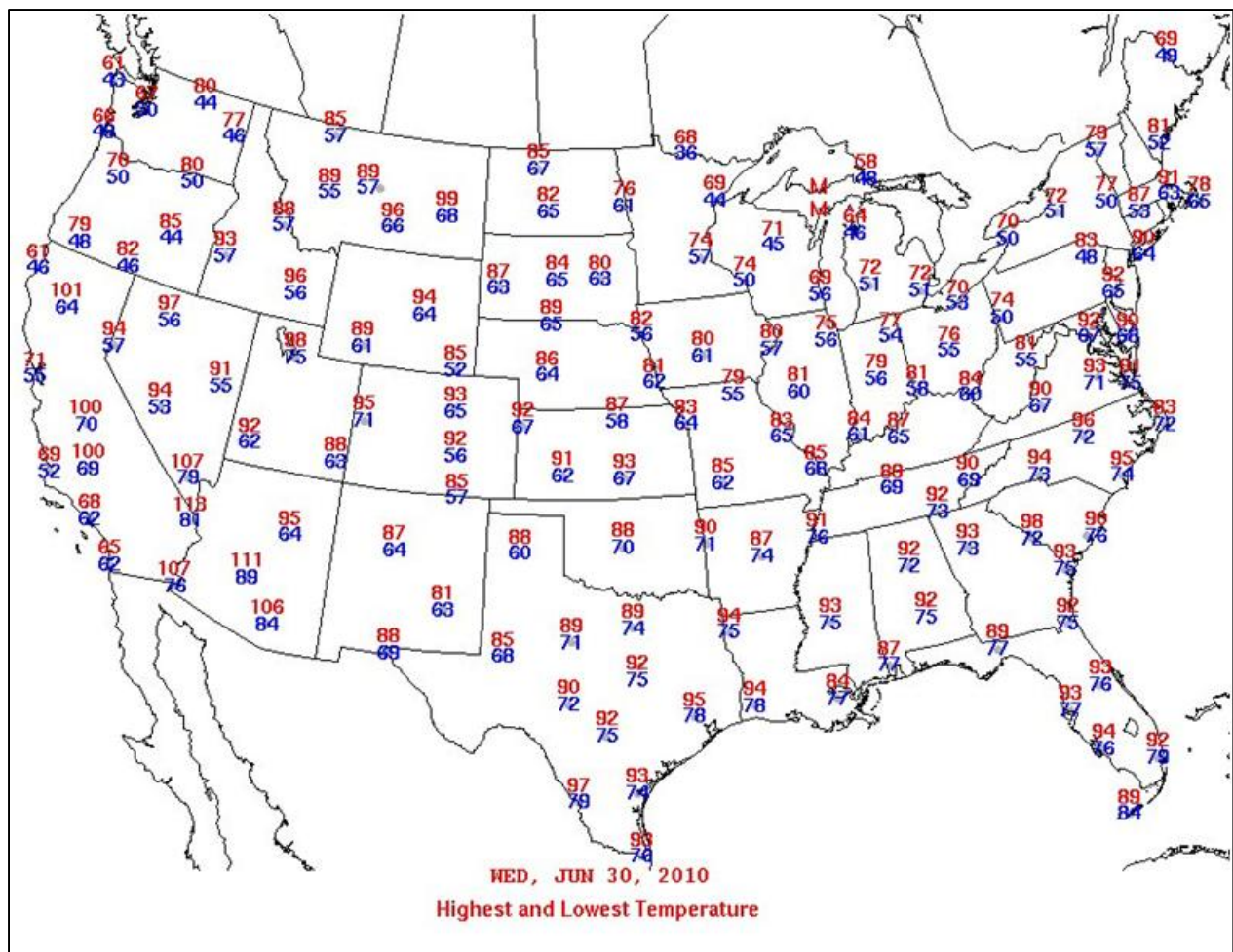


Figure C-76. Maximum and minimum surface temperatures for 20100630.

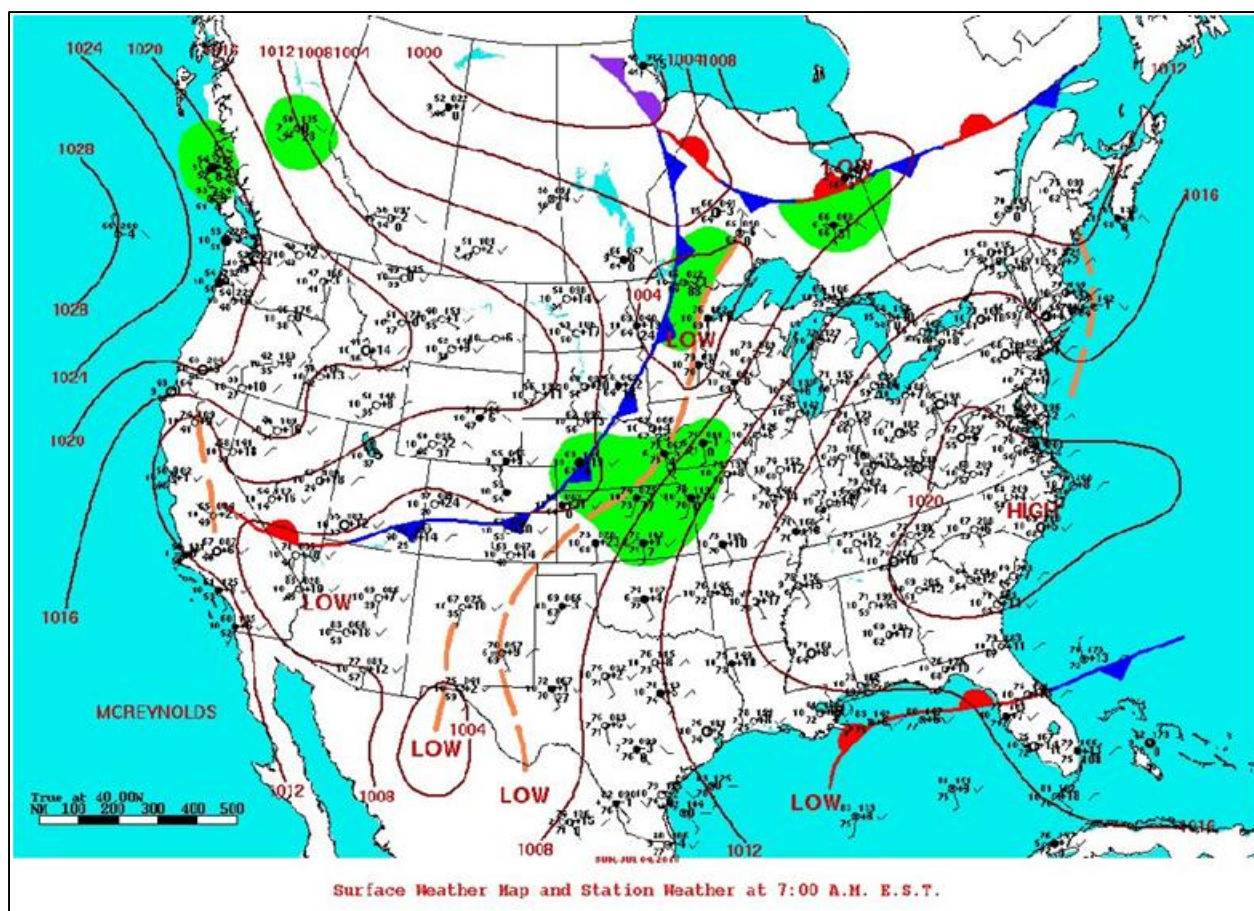


Figure C-77. Surface weather analysis valid time 1200 UTC, 20100704.

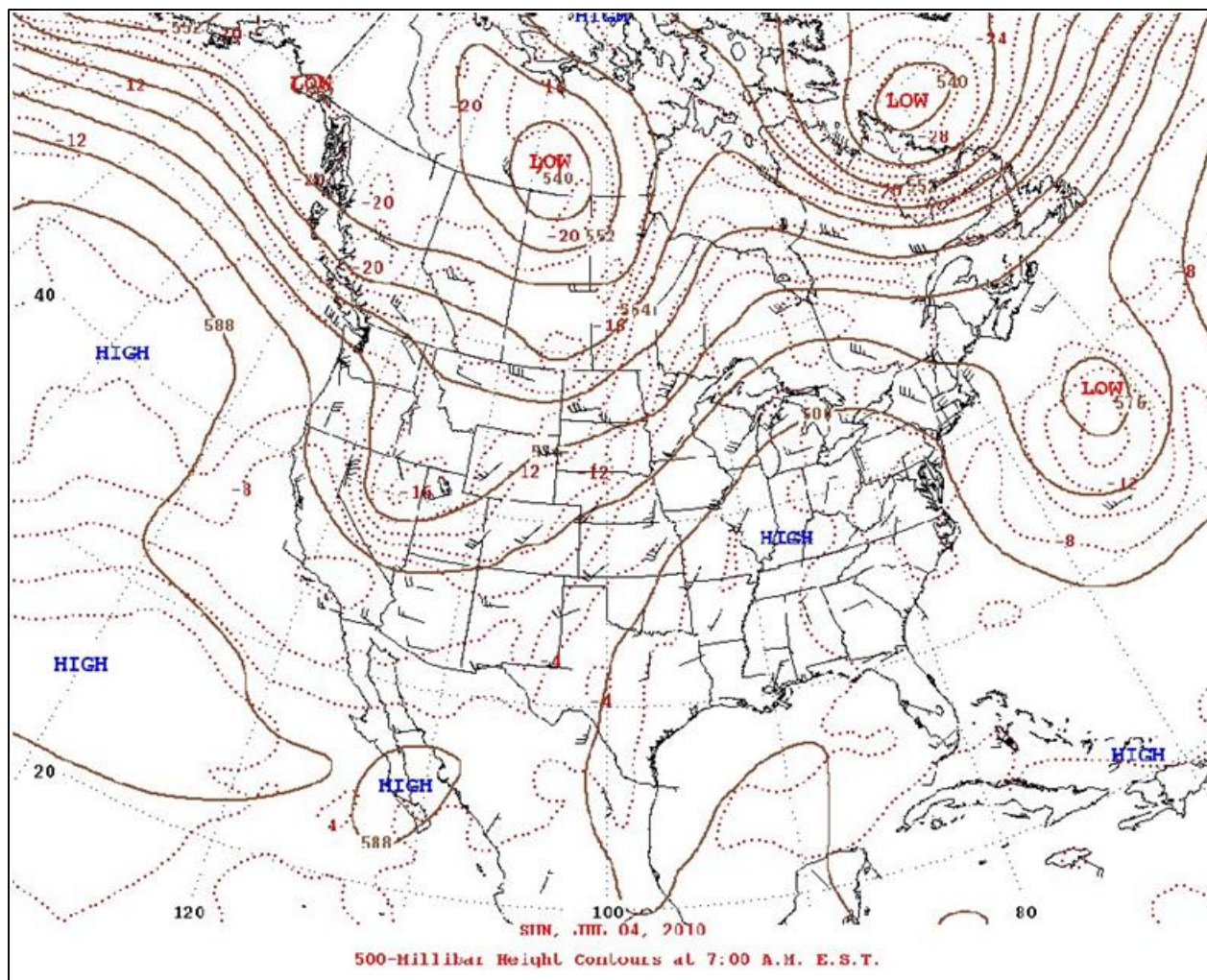


Figure C-78. 500-millibar upper air analysis valid time 1200 UTC, 20100704.

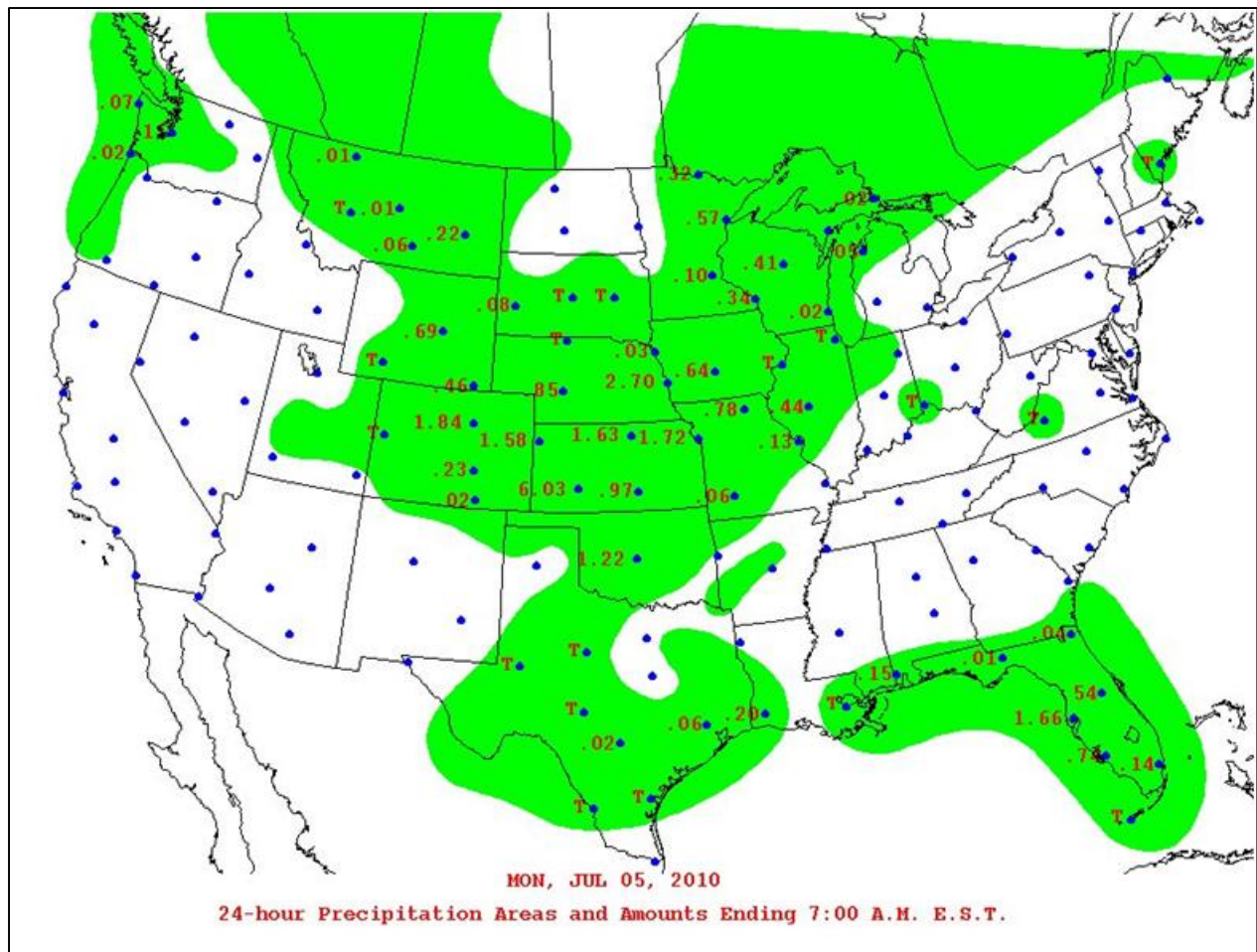


Figure C-79. 24-hour accumulated precipitation for period ending 1200 UTC, 20100705.

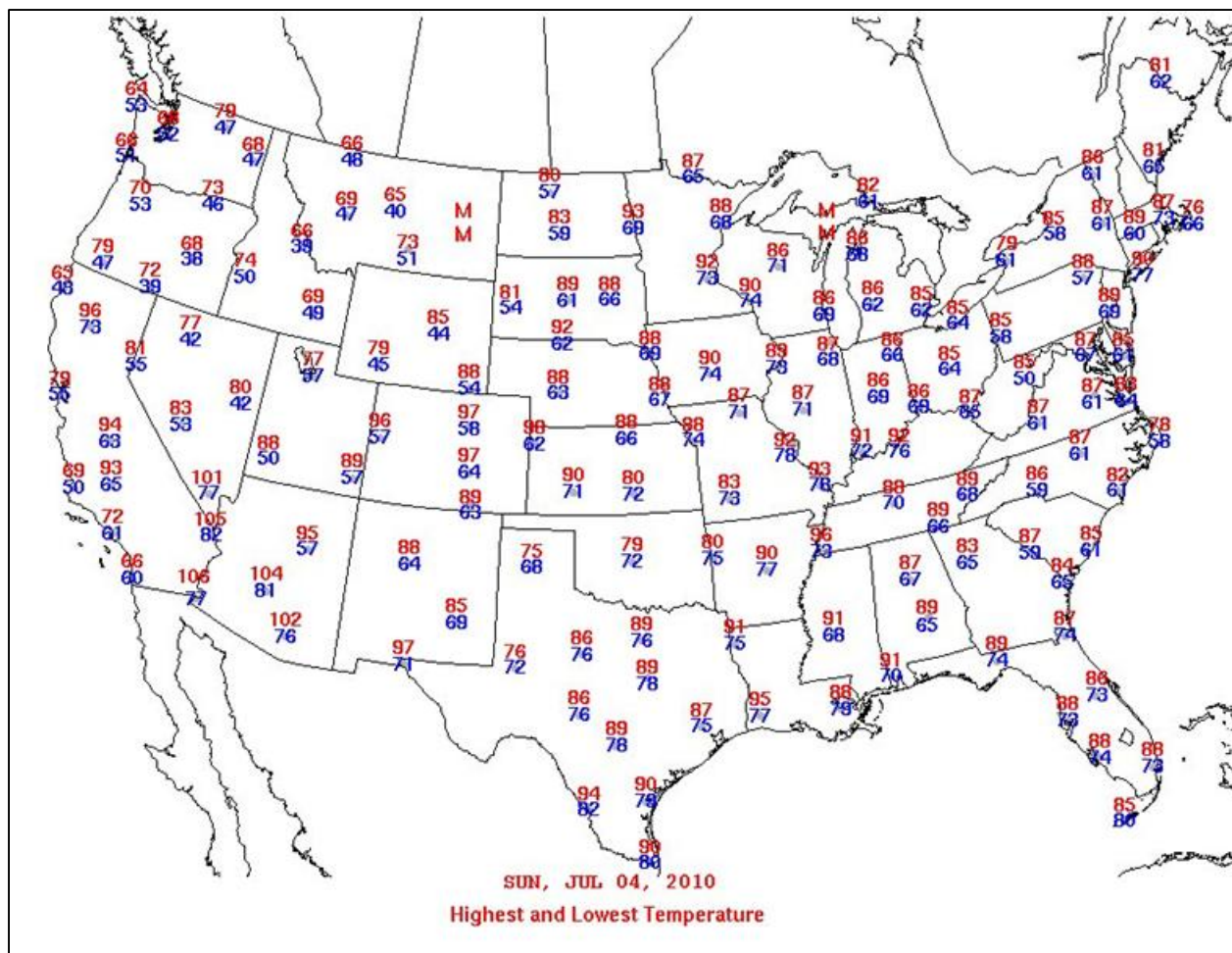


Figure C-80. Maximum and minimum surface temperatures for 20100704.

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List of Symbols, Abbreviations, and Acronyms

AFWA	Air Force Weather Agency
ARL	U.S. Army Research Laboratory
ARW	Advanced Research WRF
BED	Battlefield Environment Division
DCGS-A	Distributed Common Ground System-Army
DTC	Developmental Testbed Center
FAA	Federal Aviation Administration
MADIS	Meteorological Assimilation Data Ingest System
MAE	Mean Absolute Error
ME	Mean Error
MET	Model Evaluation Tools
MYJ	Mellor-Yamada-Janic
NCAR	National Center for Atmospheric Research
NCEP	National Centers for Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NRL	Naval Research Laboratory
NWP	Numerical Weather Prediction
RMSE	Root Mean Square Error
RTMA	Real-Time Mesoscale Analysis
USAF	United States Air Force
UTC	Coordinated Universal Time
WPPV3	WRF Post Processor Version 3
WRE-N	Weather Running Estimate-Nowcast
WRF	Weather Research Forecasting
YSU	Yonsei State University

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