36. An Evaluation of the NOAA Weather-Chemistry Model During the NOAA New England Forecasting Pilot Program and the Texas AQS 2000 Field Experiment

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NOAA has recently implemented a coupled weather-chemistry forecasting model that combines a modified version of the fifth-generation Penn State/NCAR Mesoscale Model (MM5) and the chemical mechanism of the Regional Acid Deposition Model Version 2. In this model, the transport of chemical species (grid-scale and sub-grid scale) is treated simultaneously with meteorology. Photolysis, biogenic emissions, and deposition are also calculated "online". The chemical fields are initialized with the previous forecast to take into account the effect of accumulation. The emission inventory is compiled with databases from EPA and local state agencies. This model has been tested in the NOAA New England Air Quality Pilot Studies (2002) and the Texas Air Quality Study (2000). In this research, the real-time forecasts of the coupled model are compared to observations and other air-quality forecasting models. The focus of the research is on the evaluation of the performance of the coupled model in the prediction of the surface/planetary boundary layer structure and its impact on the surface ozone concentration. The observational datasets used in the research include those from wind profilers, rawinsondes, aircraft and surface meteorological measurements. Two high surface ozone episodes that occurred during the two aforementioned field programs are investigated. The figures shown here are two examples of the type of comparisons that were made. It is clear from this comparison for the Texas Air Quality Study 2000 case that the model possesses a cold bias at low-levels and an easterly wind bias in the lower troposphere. Model observation comparisons reveal that the PBL is colder than observed when the prevailing low level winds are from the Gulf of Mexico than when the low-level winds are from inland. Other comparisons also indicate that the forecasted land-sea breeze cycle is in good agreement with the wind-profiler observations, but differences do exist in the wind direction and speed. The coupled model-observation comparison for the NOAA New England Forecasting Pilot Program 2002 case indicates that for this time period the model has cold bias over the land near the coast. In this case, although the forecasted wind directions are in good agreement with observations, the forecasted wind speeds are overestimated compared with the observations. Further examination of the comparison results indicate that the model forecast errors can be attributed to errors in both model physics and initialization. These results will eventually lead to better model parameterizations of the physical processes that impact weather and air-quality forecasts.

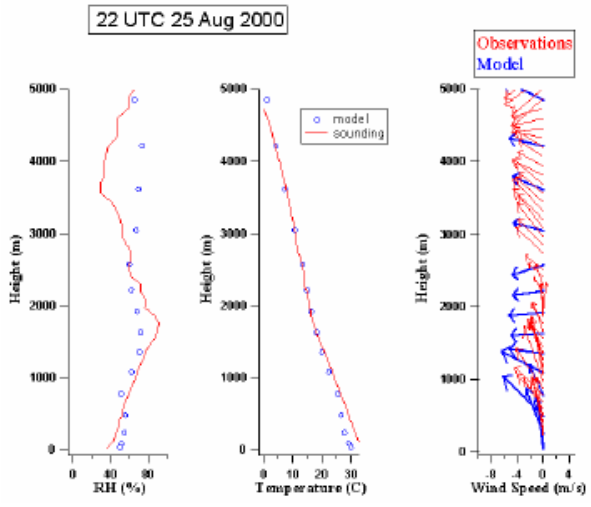

Figure 1. Comparison of the observed and forecasted soundings at 95.54°W 29.9°5 N for the Texas Air Quality Study 2000 case.

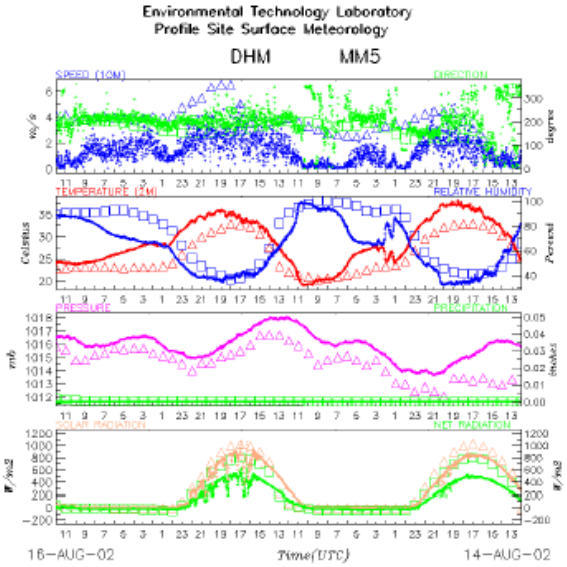

Figure 2. The time series of model forecast and surface observations at Pease, NH, for the NOAA New England Forecasting Pilot Program 2002 case. Open symbols (squares and triangles) are model forecasts, and filled symbols are observations.