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Quantifying Sensible Weather Forecast Variability

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LONG-TERM GOALS

The long-term goal of this research is to examine the tactical scale environmental predictability and provide a methodology by which it may be operationally assessed or monitored.

OBJECTIVES

Sensible weather occurs on small scales and the development and evolution of these small scale features depends strongly on the larger scale environment. Synoptic scale variability is represented by the individual members in a well-designed ensemble modeling system. The objective of this research is to quantify the local scale variations in sensible weather elements, like fog, due to larger scale variability. The sensitivity of selected weather elements to synoptic scale background variance will be quantified to identify when local scale predictability may be high or low.

APPROACH

The basic approach that will be used to investigate the tactical-scale sensible weather forecast sensitivity is to conduct a variety of numerical model experiments. The time range of interest is the 0-48h forecast of sensible weather elements of operational interest.

Sensible weather elements are generally not explicitly forecast by numerical models but will be derived algorithmically using appropriate combinations of explicitly forecast variables. These algorithms will be applied across a set of ensemble forecasts to determine the ensemble-based probability of occurrence for a particular weather element.. The NCEP GFS-based ensemble will provide basis for generating probabilistic forecasts of a variety of sensible weather elements in the 0-48 h time period. Deterministic mesoscale forecasts for the region are available from a 3km resolution forecast from COAMPS and will be used to derive mesoscale sensible weather forecasts that are tuned to this model. Additional COAMPS model runs will be conducted using the NCEP ensemble members to initiate COAMPS forecasts to produce a mesoscale ensemble based on the predicted synoptic scale variance. Since the NCEP ensemble represents synoptic variability, the mesoscale forecasts will vary due only to the local forcing differences that arise from slightly different synoptic conditions. These experiments will be used to systematically test the mesoscale variance that is likely to be driven by larger scale processes.

WORK COMPLETED

Work completed during the past year has primarily been to get the COAMPS ensemble model running and to develop output methods and tools to examine the data. The COAMPS model was compiled and is running on the NPS High Performance Computing facility. The model can be initialized with larger scale model fields obtained from NCEP. Deterministic runs from the NCEP GFS analyses can be done with the inner nest of the COAMPS model at 3km resolution. In addition, NCEP GFS Ensemble members are being collected and used to initiate COAMPS forecasts with slightly perturbed synoptic scale initial states. The ensemble runs of COAMPS are used to generate mesoscale forecasts of low clouds and visibility for the Monterey Bay region in order to assess the sensitivity of these sensible weather elements to the background synoptic scale forcing. The model has been run on 10 cases where low clouds either initially formed or evolved over the day to assess the ability of COAMPS to generate the evolution under a range of reasonable synoptic forcings.

The COAMPS ensemble forecast output requires tools to extract useful cloud and visibility forecast parameters at specific locations. A method to extract point forecast profiles for specified verification sites has been developed. This tool is used to generate forecast statistics to use in developing algorithms as well as to assess the variability in the prediction of these parameters.

RESULTS

Preliminary results based on a limited number of cases and analysis methods show that COAMPS sensible weather element forecasts are only partially captured by the ensemble variance of relevant parameters. The spread in sensible weather forecasts generated by the synoptic scale variability in the NCEP ensemble appears to be too narrow with nearly all members giving very similar mesoscale sensible weather forecasts. The local variations that arise due to coastal forcing is not sufficient to give enough spread in the COAMPS ensemble to capture the observed likelihood of low cloud and visibility evolution. Efforts to develop some statistical postprocessing are planned to determine whether appropriate calibration can be done to improve the value of the forecasts.

IMPACT/APPLICATIONS

Potential impacts of this research are postprocessing tools that can be applied to COAMPS forecasts to alert forecasters to periods of high sensitivity in specific sensible weather parameters.

RELATED PROJECTS

None.