An Eta Regional Climate Model: Model Development and Its Sensitivity in NAMIP Experiments to Gulf of California Sea Surface Temperature Treatment

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To examine seasonal climate predictability using regional models, in this study we developed and tested a high resolution Regional Climate Model (RCM). The model was based on the NCEP operational Eta model (as of 24 July, 2001, and also the version in the NCEP 25-year Regional Reanalysis), with changes made to make the model run over a longer time period and to update the Sea Surface Temperature (SST), sea ice, greenness fraction, and albedo fields on the daily basis. The model was run on the same large domain as does the operational Eta model with a resolution of 32 km and 45 levels, as used in the Regional Reanalysis. Presently, the model can be executed off of analyzed lateral boundary conditions of the NCEP Global Reanalysis I and II and predicted lateral boundary conditions from the NCEP global Seasonal Forecast Model (SFM).

To test the skill of the Eta RCM in predicting warm season precipitation anomalies and the sensitivity of the model to different initial conditions, one summertime case (1990) was chosen, as recommended by the North American Monsoon Experiment (NAME), representative of wet anomalies in the northwest Mexico region. Most previous studies of RCM seasonal simulation driven by analysis lateral boundary conditions and observed SST employed only "1-member" executions from one single initial condition date. In contrast, we executed 5 members whose initial conditions vary by one day. The study period is from June to September and the executions were started from late May and continued to early October. We use lateral boundary conditions from the NCEP Global Reanalysis II, ensemble mean of total precipitation for each month and 200 mb and 500 mb heights were examined , where the monthly mean precipitation was compared to the CPC unified daily precipitation data, and the 200 and 500 mb geopotential heights were compared to the NCEP Reanalysis data, respectively. As part of this study, we also tested the impact of the Gulf of California (GOC) Sea Surface Temperature (SST) on seasonal precipitation predictions. To do this, we use a special treatment for the GOC SST. Results are compared to those obtained using the ordinary 1-degree Reynolds SST.

The resulting ensemble mean shows that the Eta RCM successfully simulates and predicts the wet bias in total precipitation over the northwest Mexico

region in 1990 and has substantial member-to-member variability of seasonal precipitation. This suggests that previous RCM studies that employed only one member may be misleading by failing to represent the inherent internal variability. Comparison of results obtained from using different sources of GOC SST treatment indicates that the Eta RCM is sensitive to the choice of SST and shows a great variability in the simulated monthly and total precipitation, suggesting that an accurate source of SST are important to seasonal predictions.