How do Spectrally Vast AR Thwart Attempts to Skillfully Forecast their Continental Precipitation?

Andrew Martin, *Center for Western Weather and Water Extremes, Scripps Institution of Oceanography, La Jolla, CA USA; mc@ucsd.edu*

Laurel DeHaan, *Center for Western Weather and Water Extremes, Scripps Institution of Oceanography, La Jolla, CA USA*

Reuben Demirdjian, *Center for Western Weather and Water Extremes, Scripps Institution of Oceanography, La Jolla, CA USA*

Sam Iacobellis, *Center for Western Weather and Water Extremes, Scripps Institution of Oceanography, La Jolla, CA USA*

F Martin Ralph, *Center for Western Weather and Water Extremes, Scripps Institution of Oceanography, La Jolla, CA USA*

David Reynolds, *Cooperative Institute for Research in Environmental Sciences Boulder, CO USA*

Precipitation from Atmospheric Rivers presents a unique forecast challenge because the critical spatial scales span a few km, i.e. local scales, to thousands of km, i.e. storm scales. A compartmentalized approach is often employed to simulate local and storm scales. We evaluate forecasts of well observed Atmospheric Rivers using a modeling system designed to simulate both the storm scales and the local scales at best operationally feasible resolutions. An unprecedented number of observations from within moderate to strong atmospheric rivers including airborne, balloon-borne, ground based and remotely sensed measurements have been gathered from the CalWater 2 intensive observing periods. These observations are used to investigate whether the uniquely configured West-WRF modeling system adds value to global model forecasts and to small domain regional model forecasts during atmospheric river events. The value added to atmospheric river water vapor transport, static stability, onshore precipitation and standard large-scale atmospheric fields is investigated using standard metrics of deterministic forecast skill. It is found that West-WRF skill in forecasting large scale features is comaprable to that of its parent global model. The impact of dynamic model error and boundary condition error on this finding is further investigated. The concomitant skill by West-WRF, its parent model and a small domain model in forecasting precipitation at local scales is also investigated. Situations in which improvement in precipitation skill are detected are investigated to understand the roles of more accurate linear orographic forcing or more accurate departures from linear theory.