Title:
Effects of resolution and spectral nudging in simulation the effects of wintertime atmospheric river landfalls in the western US

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Abstract:
Landfalling atmospheric rivers (ARs) play a crucial role in the climate of the US Pacific coast region as they are frequently related with heavy precipitation and flash flooding events. Thus, the capability of climate models to accurately simulate AR landfalls and their key hydrologic effects is an important practical concern for WUS, from flood forecasting to future water resources projections.

In order to examine the effects of model configuration, including the resolution and spectral nudging, in simulating the climatology of key weather events in the conterminous US, a NASA team has performed a hindcast experiment using the GEOS5 global and the NU-WRF regional models for Nov 1999 - Oct 2010. This study examines the skill of these hindcasts, with different models and their configurations, in simulating key footprints of landfalling ARs in the WUS region. Using an AR-landfall chronology based on the vertically-integrated water vapor flux calculated from the MERRA2 reanalysis, we have analyzed the observed and simulated precipitation and temperature anomalies associated with wintertime AR landfalls along the US Pacific coast. Model skill is measured using metrics including regional means, a skill score based on correlations and mean-square errors, and Taylor diagrams in four WUS Bukovsky regions. Results show that the AR-related anomalies of precipitation is more reliable than of surface temperatures. Model skill also varies according to regions. The AR temperature anomalies are well simulated in most of the WUS region except PNW. For precipitation, simulations with finer spatial resolution tend to generate larger spatial variability and agree better with the PRISM data in most regions. Such a resolution dependence of spatial variability is not found for temperatures; e.g., the MERRA2 reanalysis often outperforms, with similar spatial variability and higher pattern correlations with the PRISM data, finer-resolution NU-WRF runs in simulating temperature variations within subregions. Results from this study will be summarized to assist future (regional) climate experiments for climate change impact assessments and developing adaptation/mitigation strategies, the key elements of the National Climate Assessment.

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