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A Reconstruction of South American Hydroclimatology

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A regional modeling system for weather and climate studies at the Federal University of Rio de Janeiro (UFRJ), Brazil will assimilate satellite-based products to generate high-resolution downscaled analyses over South America. The Tropical Rainfall Measuring Mission (TRMM) Multisatellite Precipitation Analysis (TMPA; Huffman et al., 2007) will provide the precipitation analyses that will be used in this South American climate reconstruction. TMPA provides 3-hourly satellite-based precipitation estimates using data collected from low and high earth orbit satellites, combined with available gauge analyses. Ultimately TRMM will expand to the Global Precipitation Measurement (GPM; Shi et al., 2010) mission, which will then provide the satellite-based products for this climate reconstruction. The regional modeling system will employ an updated version of the 28-layer atmospheric Regional Spectral Model (RSM; Juang et al., 1997), with 10-km horizontal resolution.

RSM uses trigonometric functions as the basis functions and computes time-dependent perturbations that are complemented with base fields from the driving global model. RSM is coupled to the four-layer (0-10, 10-40, 40-100, and 100-200 cm) Noah Land-Surface Model (Noah LSM; Mitchell et al., 2004). The new RSM includes a Scale-Selective Bias-Correction (SSBC) scheme (Kanamaru and Kanamitsu, 2007), similar to the spectral nudging technique of von Storch et al. (2000) and Miguez-Macho et al. (2004). The spectral nudging technique is an attempt to preserve large-scale features from the global solution in the regional domain during long-term integration. Preserving large-scale information in the regional domain might also help to correct errors caused by incorrect feedback due to parameterized terms (Nunes and Roads, 2009). The Simplified Arakawa-Schubert (SAS; Hong and Pan, 1998) was assigned as the cumulus convection parameterization for this reconstruction. The RSM SAS was built to complementary work with the boundary layer diffusion scheme based on Troen and Mahrt (1986) nonlocal diffusion. The turbulent diffusivity coefficients are functions of the boundary layer heights and scale parameters derived from similarity (Hong and Pan, 1996).

To assess its reliability, precipitation from the regional modeling system will be compared to several precipitation datasets available for South America, including the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center (CPC) daily precipitation analysis. In addition to precipitation, other variables from the NCEP-DOE AMIP II Reanalysis (R-2; Kanamitsu et al, 2002), the European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis (ERA-40; Uppala et al., 2005), and the new interim reanalysis (ERA-Interim), as well as available station point data, will be used in the evaluation of the regional modeling system.

Preliminary results showing the positive impact on the reconstruction of the South American climatologic patterns, due to the assimilation of satellite-based products, will be discussed at the meeting.