

Dynamical downscaling of precipitation in the South America: analysis of the spectral nudging and the variability of the CMIP5 data

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In 2013 and 2014 the southeast region of Brazil was affected with hystorical droughts and consequent widespread shortage of water supply. Climate projections are essential for adequate planning of water resources in South America, both in the year and decadal scales. Regional climate projections of the Coupled Model Intercomparison Project Phase 5 (CMIP5) are prone to substantial variability and uncertainties due to specific parameterizations, resolution and bias, for example. The dynamical downscaling of large scale projections using regional atmospheric models are interesting tools to represent lower scale features of the circulations and consequently the precipitation, important for surface hydrological processes. The objective of this study is to evaluate the precipitation in the current climate for South America using some CMIP5 model projections, and to discuss the effect of different dynamical downscaling to quantify continental scale rainfall. We used the projections of seven models in the period between 1981 to 2003, and estimated indexes concerning temporal and spatial distribution of rainfall, which included precipitation extremes year around. The dynamical downscaling with Weather Research and Forecasting model (WRF) was run between November 1994 and March 1995, with initial and boundary conditions from the CESM model. The results showed a dry bias for INM-CM4 and IPSL-CM5A-LR projections partly in Brazil and Uruguay, and for most models in the Amazon region. The correlation of projected precipitation with observations showed lower skills to simulate extremes, such as events above 20 mm day⁻¹, especially in spring and summer. The WRF downscalled simulation used different options of spectral nudging that increased the ability to represent the local circulation as shown by the kinetic energy spectrum, and the large scale continental rainfall. The quantile-quantile plot in the southeast region of Brazil showed a good agreement between the 15th to 90th percentiles, indicating potential benefits in using regional models.