

On the observed summer precipitation increase over South Eastern South America and the inability of WCRP/CMIP3 models to adequately reproduce it

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South Eastern South America has experienced a strong positive trend in summer precipitation within a large region including central and northern Argentina, Uruguay, Paraguay and southern Brazil. The observed changes during the last half of the 20th Century have reached 40% in some areas leading to significant impacts in water management and agriculture. The WCRP/CMIP3 ensemble of coupled models strongly underestimates the observed increase in rainfall within the region. Absence of the trend in the CMIP3 multi-model ensemble mean could be because 1) it is a result of natural variability or 2) the models underestimate the regional precipitation response to radiative forcing. This work explores both possibilities by examining the regional dynamical changes associated with the precipitation increase, their potential link to large-scale patterns of climate variability and change and the ability of the CGCMs to reproduce them. Particular focus is put on the role of the South Atlantic Convergence Zone including controls on variations in its strength and location and how it responds to climate change via both dynamical and thermodynamical mechanisms. The influences of regional processes and topographic features that are not correctly represented in climate models due to resolution constraints are discussed as plausible sources of model error in reproducing both climate variability and climate change.