Biases in RCM-CORDEX models over South America: possible origin and impact on the climate change signal

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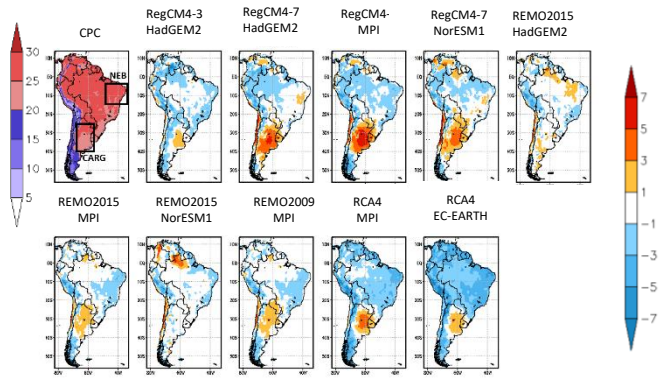

Figure 1. Observed mean surface temperature (panel 1) and temperature bias for the period 1979-2005 for DJF. Units are °C.

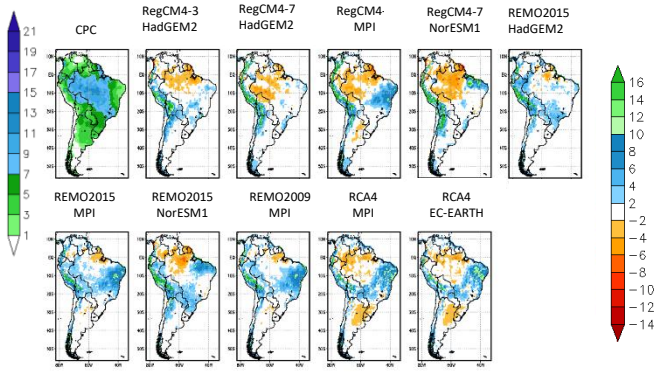

Figure 2. Observed mean precipitation (panel 1) and precipitation bias for the period 1979-2005 for DJF. Units are mm/day. .

A large warm bias was found over central Argentina (CARG) for most of the models. Results indicate that the possible origin of this bias is an overestimation of the incoming shortwave radiation, in agreement with an underestimation of the relative humidity at 850 hPa, variable that could be used to diagnose cloudiness.

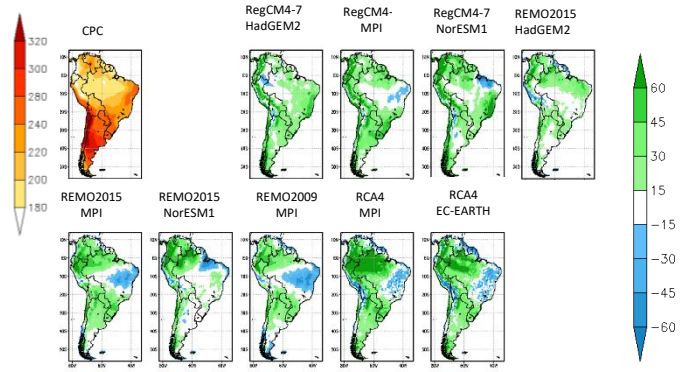

Figure 3. Same as Figure 1, but for surface downwelling shortwave radiation. Units are W/m2.

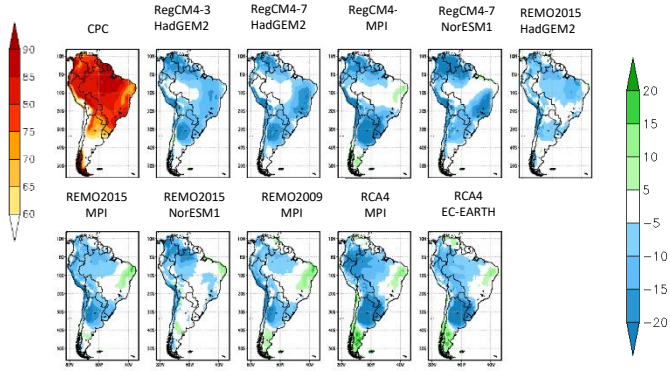

Figure 4. Same as Figure 1, but for 850 hPa relative humidity. Units are %.

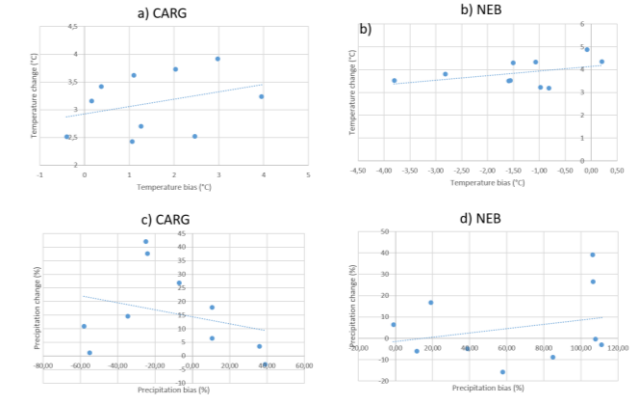

Figure 5: Scatter plot of mean change (y-axis) versus bias (x-axis) for the 10 models used in this study for DJF. a) Temperature for CARG, b) temperature for NEB, c) precipitation for CARG, d) precipitation for NEB. All the values were spatially averaged over the CARG and NEB regions.

Regarding precipitation, the largest biases were found over north east of Brazil (NEB), where most of the models overestimate the precipitation. This wet bias agrees with models' underestimation of both the moisture flux convergence (not shown) and the relative humidity at lower levels of the atmosphere.

The climate change signal could be affected by these systematic errors, considering that these biases may not be stationary. For both CARG and NEB regions, models with higher warm biases project statistically significant higher warming levels, mainly in the summer season. For precipitation, the relationship between the biases and the projected precipitation changes are only statistically significant for the NEB region, where models with larger wet biases present the highest positive precipitation changes during the warm season

To summarize, the results found in this study suggest that cloudiness maybe the variable that affects biases for both temperature and precipitation. It is known that clouds are parameterized in climate models, so maybe a revision of the parameters that drives the saturation of the air and the cloud formation is needed.