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Projected Changes in Austral Summer Rainfall in Southeastern South America

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Mean conditions and interannual variability of austral summer rainfall in southeastern South America are studied in 20 coupled general circulation models (CGCMs) from the WCRP/CMIP3 dataset. Both current-climate conditions and the SRES-A1B climate-change scenario are evaluated. Focus is made in analyzing precipitation changes in the La Plata Basin (LPB) in the subtropics and the South Atlantic Convergence Zone (SACZ), key component of the South American Monsoon System, in the tropics.

Differences of the mean summer precipitation between 2079-2099 and 1979-1999 are systematically examined in order to explore the regional climate change signal. 12 models show changes of opposite sign for LPB and SACZ regions. Among them, 10 models project an increase of summer precipitation in LPB and a decrease in the SACZ region, while 2 models project the contrary.

The ability of the CGCMs in representing the space and time features of the observed rainfall interannual variability was also assessed. The leading patterns of variability were isolated by an EOF analysis applied to austral summer rainfall anomalies for the period 1979-1999. The leading pattern (EOF1) is characterized by a dipole-like structure with centers of action of opposite sign over the LPB and SACZ regions, which is in favour of a seesaw for the two regions. The assessment reveals that 16 models are able to represent the EOF1 dipole structure. A common model bias is however that the center related to SACZ is shifted northeastward with respect to the observed counterpart.

EOF1 was also isolated for the climate change scenario over the period 2001-2100. 18 models represent the dipole structure of the observed EOF1 and only a few of them still represents a northeastward displaced SACZ. Wet and dry extreme events were identified from the leading principal component. 13 models show, from the first to second half of the XXI century, an increase of the frequency of wet extreme events in LPB and a decrease of the number of dry extreme events in LPB while only 4 models show the opposite behavior. Moreover, models projecting by the end of the XX1 century an increase of summer precipitation over LPB (12) also project an increase of the frequency of wet extreme events. On the other hand in the SACZ region, 10 models project a decrease of frequency of dry extreme events and a decrease of wet extreme events.

It is then concluded that the increase of austral summer precipitation in LPB projected for the end of the XXI century by most of the CGCMs, and already discussed in previous publications like the IPCC-AR4, seems to be associated with an increase of the frequency of wet extreme events over the region and a decrease of wet extreme events in the SACZ regions. More detailed discussions on the related uncertainties will also be presented.