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Changes in precipitation variability over South America from both CMIP3 and CMIP5 Models

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Previous works have shown that precipitation variability at both tropical and subtropical regions of South America exhibits considerably level of co-variability at a wide range of timescales ranging from synoptic, intraseasonal to interannual. Positive precipitation anomalies over the subtropical plains of La Plata Basin (LPB) region tend to occur in association with negative anomalies over the South Atlantic Convergence Zone (SACZ) region and vice versa. In addition, long-term future climate simulations project in general positive trends in summer precipitation over LPB. The objective of this paper is therefore to explore changes in the leading patterns of precipitation year-to-year variability in South America in the context of a climate change induced by GHG increment, and to explore how much of those changes account for the trends projected for the LPB mean summer precipitation. The leading pattern of precipitation variability (EOF1) was identified by an EOF analysis applied to austral summer rainfall anomalies of CMAP dataset and 18 CMIP3 model outputs for the period 1979-1999. It was found that 16 CMIP3 models are able to represent the EOF1 pattern characterized by a dipolar-like structure with centers of action of opposite sign over the LPB and the SACZ regions, respectively. However, models in general tend to locate the SACZ-related center further northeastward than observed. Similar diagnostic studies are currently being done for the recently available historical simulations of the WCRP/CMIP5 dataset. EOF1 was also identified for the CMIP3 XXI climate change simulations for SRESA1B scenario over the period 2001-2100. The corresponding time series was used to determine wet and dry active events in southeastern South America. It was found that an increase of the frequency of EOF1 positive events, which means an increase (decrease) of the frequency of wet events in LPB (SACZ) region, is in average projected for the second half of the XXI century by the multi-model ensemble. Such projected change is significantly larger than the inter-model variability for a subset of 9 models that also project positive precipitation trends in the mean summer precipitation conditions in the LPB. Wet events in the LPB associated to EOF1 activity seems to be promoted in present climate by a differential warming of the equatorial Pacific surface oceanic conditions compared to that in the Atlantic Ocean. The analysis of the results obtained from the CMIP3 XXI century simulations show that such conditions seem to intensify in the context of climate change. It is concluded that the positive trend of austral summer precipitation in LPB projected for the end of the XXI century by most of the CMIP3 CGCMs, seems to be associated with an increase of the frequency of events associated with the leading pattern of year-to-year variability. It is planned to assess those changes in the decadal predictions as well as in the long-term climate projections from the CMIP5 dataset, as soon as they become available.