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ENSO impacts in the South America springtime climate: present and future projections of RegCM4-CMIP5

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The climate variability over the South America (SA) is mainly controlled by the El Niño-Southern Oscillation (ENSO) phenomenon. ENSO positive phase (El Niño; EN) is typically associated with below (above) normal precipitation over northern and northeastern (southeastern) of SA. The opposite signal is normally observed during the ENSO negative phase (La Niña; LN). In the context of CORDEX, the objective of this study is to investigate the ENSO precipitation signal over SA in the present and future climates. For this, we used an ensemble of RegCM4 projections driven by three global models (MPI-ESM-MR, GFDL-ESM2M and HadGEM2-ES). Basically, we investigated two scenarios (rcp4.5 and rcp8.5) during austral spring (September-October-November; SON) for present (P: 1975-2005), near future (N: 2020-2050), and far future (F: 2070-2098) climates. EN and LN years are defined according to the Oceanic Niño Index (ONI) that needs to be higher (lower) than a positive (negative) threshold for least 5 consecutive over-lapping seasons. For present climate, the number of EL and LN years simulated by HadGEM2-ES has a good agreement with the observations, while MPI-ESM-MR and GFDL-ESM2M underestimate the number of EN years. All global models project an increase (decrease) of EN (LN) years in the rcp8.5 far future climate scenario - except for GFDL-ESM2M which shows a slight decrease of EN years; on the other hand, for the near future climate there is a large discrepancy in this signal. For present climate, the composites indicate that all RegCM4 simulations capture the positive anomalies of rainfall over Southeastern of SA (SESA) associated with EN years. Individual RegCM4 simulations show some differences in the spatial pattern and intensity of rainfall anomalies during EN years compared with observations. The RegCM4 simulations ensemble for present climate shows a good representation of the observed anomalies. For near and future climates, all RegCM4 projections indicate an increase of SON precipitation over SESA and a decrease over the north-northeast of SA. However, the precipitation anomalies associated with EN years are weaker than that observed and simulated in present climate; this would be explained by EN events weaker in the future than in present climate as projected by global models.