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A multivariate assessment of climate change projections over South America using CMIP5 models

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A multivariate assessment of climate model projections over South America from the CMIP5 archive is presented. Change in near-surface temperature, precipitation, evapotranspiration, integrated water vapor transport (IVT), sea level pressure, and wind at multiple pressure levels is quantified across the multi-model suite and an assessment of model-to-model agreement on projected change performed. All models project warming by the mid- and late-21st century throughout the continent, with the highest magnitude projected over tropical regions. The CMIP5 models are in strong agreement that precipitation will decrease in all seasons over portions of Patagonia, especially along the northern portions of the current-climate mid-latitude storm track. This is consistent with a robustly projected poleward shift of the Pacific extratropical high and mid-latitude storm track indicated by a systematic increase in sea level pressure and decrease in westerly wind over Patagonia. Decreased precipitation for the months of September, October, and November is also projected, with strong model agreement, over portions of northern and northeastern Brazil, coincident with decreases in sea level pressure and increases in evapotranspiration. IVT is broadly projected to decrease over southern South America, coincident with the projected poleward shift of the mid-latitude storm track indicators, with increases projected in the vicinity of the South Atlantic Convergence Zone in austral spring and summer. Further decomposition of the thermodynamic and dynamic components to this change in IVT indicate that the projected decreases in the mid-latitudes are primarily driven by changes in circulation (i.e. dynamic) while the sub-tropical and tropical changes have a predominantly thermodynamic origin. Results provide a comprehensive picture of climate change across South America and highlight where projections should be interpreted with the most confidence.