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Understanding the atmospheric connection between the western Amazon and the Altiplano: A modelling approach

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The relationship between precipitation over the southern tropical Andes (STA; 20°S-12°S) and the Bolivian High has been revisited in a recent study (Segura et al., 2020). Western Amazon convection during the austral summer (DJF), which is located on the western side of the regional Hadley cell associated with the mature phase of the South America Monsoon System (SAMS), has been proposed as a new mechanism controlling interannual precipitation in this Andean region. This change in the controlling mechanisms is associated with the recent intensification of this regional Hadley cell, in particular, convection over the western Amazon, which has decreased the atmospheric stability in most of western tropical South America, including the southern tropical Andes. In this study, we explore the relationship of precipitation over the STA and these two atmospheric mechanisms by using the WRF model on a global scale to simulate 38 December-February seasons (1980-2017). First, we performed a series of experiments by changing the scheme of parametrization to select the one reproducing two characteristics of the SAMS: the regional Hadley Cell and the Bolivian High. On the other hand, the best set of parameterization schemes, even if reproducing these two climatic features, presented bias in precipitation and atmospheric circulation over South America. Additionally, WRF could not reproduce the long-term variability of precipitation over the STA. Aside from these expected biases, precipitation over the STA is also related to both identified mechanisms (the Bolivian High and the regional Hadley cell) in WRF simulation. Using the moist static energy approach, we explore the reasons for the relationship between the precipitation over the STA and western Amazon convection. In the following experiment, we explore the influence of western Amazon convection on the regional circulation over South America by no permitting the development of deep convection in this Amazonian region.