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Automatic upper level circulation type classification applied to precipitation in the Outer Tropical Andes of Perú

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The Outer Tropical Andes (OTA) feature a strong seasonal cycle in precipitation, with a dry winter and a rainy summer. This has important implications for the mass balance of the highly vulnerable tropical glaciers present in the area, strongly dependent on the variability of precipitation. This study intends to apply the circulation typing approach to the identification of the main atmospheric drivers of rainfall and snowfall fluctuations over the OTA region in both the dry and the wet seasons. While that methodology has been profusely employed in other parts of the globe, no circulation types over the OTA have been defined as yet, partly due to the challenges posed by elevation and relief. Initially, K-means is performed, separately for each season, on the 500-hPa and 200-hPa-level height daily data in the region (95^0W-65^0W, 0^0-30^0S) over the period 1981-2016. The dataset dimension is previously reduced via Principal Component Analysis (PCA), keeping the modes that explain 99% of the field's variance. The selection of the number of clusters (K) follows the procedure proposed by Pham et al. (2005). Their evaluation function f(K) is computed for different values of K up to 50, and the number of classes corresponding to minimum f(K) is selected. The upper limit of 50 is fixed so as not to explore K ranges exceedingly far from the number of classes advisable for our sample size (15-20, Spekat et al. 2010). The clusters responsible for relevant deviations of normal precipitation values are identified and discussed. In this way, we identify those synoptic patterns that influence precipitation in OTA of Peru, with special emphasis on the impact of extratropical synoptic systems. Possible caveats stemming from the use of 500-hPa and 200 hPa height in this high-altitude region are checked, and alternative variables sought for.

References

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