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Determining hydroclimatic extreme events over the south-central Andes

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The south-central Andes in NW Argentina are characterized by a strong rainfall asymmetry. In the east-west direction exists one of the steepest rainfall gradients on Earth, resulting from the large topographic differences in this region. In addition, in the north-south direction the rainfall intensity varies as the climatic regime shifts from the tropical central Andes to the subtropical south-central Andes. In this study, we investigate hydroclimatic extreme events over the south-central Andes using ERA-Interim reanalysis data of the ECMWF (European Centre for Medium-Range Weather Forecasts), the high resolution regional climate model (COSMO-CLM) data and TRMM (Tropical Rainfall Measuring Mission) data. We divide the area in three different study regions based on elevation: The high-elevation Altiplano-Puna plateau, an intermediate area characterized by intramontane basins, and the foreland area. We analyze the correlations between climatic variables, such as specific humidity, zonal wind component, meridional wind component and extreme rainfall events in all three domains. The results show that there is a high positive temporal correlation between extreme rainfall events (90th and 99th percentile rainfall) and extreme specific humidity events (90th and 99th percentile specific humidity). In addition, the temporal variations analysis represents a trend of increasing specific humidity with time during time period (1994-2013) over the Altiplano-Puna plateau which is in agreement with rainfall trend. Regarding zonal winds, our results indicate that 99th percentile rainfall events over the Altiplano-Puna plateau coincide temporally with strong easterly winds from intermountain and foreland regions in the east. In addition, the results regarding the meridional wind component represent strong northerly winds in the foreland region coincide temporally with 99th percentile rainfall over the Altiplano-Puna plateau.