Recent trends in precipitation and streamflow in the Aconcagua River basin, central Chile

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Abstract In this paper, trends in streamflow and precipitation at the annual, seasonal and monthly timescales for different periods of records are analysed for the Aconcagua River basin in central Chile. In this mountainous basin in the dry Andes, water resources originate mainly from glaciers and seasonal snowcovers. The Mann-Kendall nonparametric test is used, and statistically significant trends are identified for each station on an annual, seasonal and monthly basis. Trends in streamflow are examined together with changes in precipitation and temperature. Analysis of correlation of the hydroclimatic variables with large-scale atmospheric circulation patterns such as the Southern Oscillation is also carried out. The main identified trend is a decrease in streamflow in the upper section of the basin, which is consistent at both the annual and seasonal scale. Changes in precipitation are not sufficient to explain the observed trend in runoff. Precipitation patterns, however, seem to have changed in the last 30 years, and results of seasonal trend analysis seem to indicate that there has been a shift in precipitation seasonality. Temperature at one station in the basin shows increasing trends at all temporal resolution. We argue that the decreasing trend in runoff might be explained by a decrease in glaciers and snowcover contribution to the total streamflow in the upper basin. Analysis of correlation reveals that both streamflow and precipitation are affected by ENSO events, and in particular that warm ENSO events are associated with an increase in winter and autumn precipitation, and an increase in summer streamflow.

Key words Aconcagua River basin; El Niño events; ENSO; hydroclimatic variability; Mann-Kendall test; SOI; trend analysis