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The influence of global climate and local hydrological features over streamflow extremes. Case of study in a tropical Andean basin

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Hydrological extremes such as floods and droughts are the most common and threatening natural disasters worldwide. Particularly, tropical Andean headwaters systems are prone to hazards due to their complex climate conditions. However, little is known about the underlying mechanisms triggering such extremes events. In this study, the Generalized Additive Models for Location, Scale and Shape (GAMLSS) were used for investigating the relations between the Annual- Peak-Flows (APF) and Annual-Low-Flows (ALF), respecting to climate and land use/land cover (LULC) changes. Thirty years of daily streamflow data-sets taken from two Andean catchments of southern Ecuador are used for the experimental research. Global climate indices (CI), describing the large-scale climate variability were used as hypothetical drivers explaining the extreme's variations on streamflow measures. Additionally, the Antecedent-Cumulative-Precipitation (AP) and the Standardized-Precipitation-Index (SPI), and LULC percentages were also included as possible direct drivers – synthetizing local climate conditions and localized hydrological changes. The results indicate that AP and SPI clearly explain the extreme streamflow variability. Nonetheless, global variables play a significant role underneath the local climate. For instance, ENSO and CAR exert influence over the APF, while ENSO, TSA, PDO and AMO control ALF. Furthermore, it was found that LULC changes strongly influence both extremes; although this is particularly important for relative more disturbed catchments. These results provide valuable insights for future forecasting of floods and droughts based on precipitation and climate indices, and for the development of mitigation strategies for mountain catchments.