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# Annual and seasonal assessment of the hydrological signature of mountain areas in semiarid regions from the evolution of selected vegetation covers and derived indicators.

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In semiarid areas, the vegetation-soil-water interphase between the atmosphere and the catchment morphology is a complex continuum whose dynamics is influenced by and reciprocally affects the hydrological regime. The evolution of soil uses, and the associated impact of water resources storing and demand, is one of the major local drivers of the short- and medium-term changes of the fluvial regime even in not highly modified areas such as mountains. Moreover, the vegetation reacts the atmospheric conditions and soil moisture changes and its dynamics, although highly non-linear under non-controlled conditions, reflects the hydrological signature on the catchment. Altitude plays a key role in the spatial distribution of species in these areas in a dynamic equilibrium among the atmosphere, soil and ecosystem conditions over time.

This work shows the capability of monitoring natural vegetation covers for tracing the hydrological signature throughout a catchment in semiarid mountain areas. For this, the evolution of the vegetation fraction cover on different time scales was analysed from a 15-yr series of Landsat TM data, and the available historical vegetation and soil use cartography, and the results were tested against both the precipitation and temperature observed patterns, and the hydrological modelling of snow and runoff in the Sierra Nevada area, southern Spain, with altitudes ranging from 1000 to 3479 m a.s.l. From the results, a clustering reclassification of the vegetation covers led to identifying selected covers as bioindicators of the i) snow regime on an annual an seasonal basis, b) precipitation on an annual basis, and c) the antecedent condition of the fluvial regime on an annual basis. Some sensitive threshold intervals were also identified for each clustered class. Multivariate analyses of the results in terms of altitude, facing, soil type, and catchment was also performed, and some trends were identified, with different significance level depending on the chosen indicator.

The results highlight the need for blending modelling and ground and remote sensing data sources to monitor trend shifts of the hydrological signature throughout the catchment and the impact of snow retreat in the area during the recent decades. The monitoring of these bio-indicators allows for the early detection of changes in the eco-hydrological dynamic equilibrium in these areas, and the assessment and post-implementation revision of adaptation plans in these regions.

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