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# What relevant information can terrestrial photography provide hydrologists with? A case study in Mediterranean Mountainous areas

María José Perez-Palazon (1), Pedro Gómez-Giraldez (1,2), Pedro Torralbo (1), Rafael Pimentel (1), Javier Herrero (1), Maria Patrocinio González-Dugo (2), and María Jose Polo (1)

(1) Fluvial Dynamics and Hydrology Research Group—Andalusian Institute for Earth System Research (IISTA), University of Córdoba, Campus Rabanales, Edificio Leonardo da Vinci, Área Ingeniería Hidráulica, 14071 Córdoba, Spain, (2) Fluvial Dynamics and Hydrology Research Group—IFAPA. Alameda del Obispo, 14011, Córdoba

Mountain areas constitute biodiversity reservoirs and also water supply systems to watersheds downstream. In Mediterranean regions the scarcity of water resources and the observed trend towards torrentiality and aridity conditions pose a risk for the sustainability of ecosystem services related to water supply and hydrological conditions. Particularly, vegetation distribution and phenology is strongly dependent on the climatic conditions, and shifts in the hydrological regime may impact significantly such patterns. However, the usually difficult access has resulted in less density of monitored areas, not very long time-series of relevant variables, and time-consuming and costly field campaigns to monitor trends and changes.
Time-lapse camera imagery has already shown its usefulness to complement standard weather stations in mountain areas (snow domain, vegetation greenness, etcetera) as well as ground-truth data to validate remotely sensed information. But this data source contains indirect information that can provide with relevant basis to retrieve, validate or test different hypothesis and results in ecohydrology studies.
This work presents the potential of terrestrial photography for monitoring additional eco-hydrological variables as a complementary information to the conventional weather stations data sets. For this, two pilot cases of Mediterranean mountain systems are presented in this work: first, a plot site in the National and Natural Park of Sierra Nevada Mountains, as an example of alpine ecosystem under Mediterranean conditions; secondly, an experimental site in the Cardeña and Montoro Natural Park, a “dehesa” site (oak-savanna) in northern Andalusia

The results show the capability of this technique, coupled to conventional weather stations, to monitor weather states relevant for the ecosystems and hydrology further than the standard precipitation and temperature variables (occurrence of fog, hail, snowfall or frost events), snow dynamics (snow covered area, snow depth), vegetation development states (greenness, cover fraction, height), and phenological states (bud formation, blooming, fruiting), and other variables on a qualitative level (soil colour, rill formation).

The flexibility to fix snap frequency and the possibility of automated treatment of the images make of this method a cost-effective approach to understand the nature of changes in the ecohydrological regime in these areas on different time scale, and complement standard monitoring networks.

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