A Preliminary Analysis for Understanding Variations in Mountain Springs' Water Availability under Climate Change in Aosta Valley

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ABSTRACT BOOK

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COVER IMAGE:

Aerial cityscape image of Turin during sunset.

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The availability of freshwater resources in alpine mountain areas has been affected by the impacts of climate change on groundwater storage mechanisms. A web of complex interactions characterizes climate systems, and several potential effects of climate change in such areas remain largely unknown. Therefore, examining how groundwater storage mechanisms are changing in response to climate-driven agents is becoming increasingly crucial.

To comprehend the existing relationship between changes in weather conditions and water availability in the Aosta Valley region (Northwestern Italy) and how their trends have changed over the last decade, a 7-year discharge series of different Aosta Valley springs (Promise, Alpe Perrot, Promiod, Cheserod) and precipitation data of the related meteorological stations (Aymaville-Viayes, La Thuile-Villaret, Champdepraz, Sant Vincent) were analyzed. The extent of the correlations between springs discharge measurements and hydro-meteorological data was investigated. Besides, precipitation and flow rate trend analyses using the Mann–Kendall and Sen's slope trend detection tests were performed. The Aymaville-Viayes, La Thuile-Villaret, Champdepraz, and Sant Vincent meteorological stations revealed an overall decreasing trend in annual rainfall (mm), with a slight increase in intensity (mm/day) as a result of the reduction in rainfall events (number of rainy days). Nonetheless, based on the analysis of flow rate data relating to the associated springs, Alpe Perrot, Cheserod, and Promise show an overall increasing trend of discharge over time. Although the Cheserod and Promise springs were not found to be highly correlated with rainfall, their aquifers appear to positively respond to the modified climate conditions, increasing the amount of groundwater stored. The moderate correlation values of these two springs can be a consequence of several factors such as aquifer features, distance from the weather station, and solid precipitation amounts that supply water in the following hydrogeological year.

Being able to continuously monitor the effects induced by changed climatic conditions on water reserves through simplified analysis approaches such as those presented in this paper is increasingly necessary. Moreover, implementing future studies through in-depth analyses of soil infiltration, groundwater recharge and storage mechanisms are required to predict the mountain aquifers' behavior in changing climatic conditions.