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Determination of water fluxes in the unsaturated zone and submarine groundwater discharge in Mediterranean river basin environments through pilot observational techniques.

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Mediterranean basin is considered as being highly susceptible to climate changes, especially as arid and semi-arid climate conditions as well as periodic draughts have caused a series of water-related rising problems. This issue becomes more pronounced in coastal river basins, which usually suffer major anthropogenic pressures such as growing water demands for drinking and irrigation purposes. Until today, our capability to observe crucial components of these hydrological sensitive systems -hence accurately estimating the water budget within the catchment- is still poor. Precise measurements of the: (i) downward movement of precipitation through the unsaturated zone, (ii) return flow of moisture from the land to the atmosphere via evaporation, and (iii) submarine groundwater discharge (SGD) have always been challenging in-situ observational techniques.

The presented strategy is focused on the localization and quantification of SGD in order to identify either freshwater losses to the ocean or land- sea contamination pathways and on monitoring water fluxes within the unsaturated zone. Evrotas River, which is located in S. Greece and is topographically well defined by the surrounding mountainous zones of Sparta, will serve as a reference site, representing a typical Mediterranean coastal catchment.

Monitoring of the evaporation processes, direct infiltration from precipitation and moisture content fluctuations within the vadoze zone, can be achieved by the installation of specially developed TDR waveguides -installed with the aim of direct push vibro-coring methods- in significant depths within the unsaturated zone. The identification and measurement of the SGD is planned to be achieved through a combination of different aqueous tracers such as stable isotopes, naturally occurring radioisotopes as well as physical water parameters. The research will be supported and complemented by a land-side modeling approach based on topographical relief analysis through digital elevation data (DEM).

It is envisaged that this research concept will result in a more precise “closing” of the water budget -by considering all the components and dynamics of the hydrological cycle based on in situ pilot observational techniques- being in a good position to detect and understand the ongoing subtle changes in the hydrological cycle of a typical Mediterranean coastal river basin.