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Permanent high-resolution temperature observations using Fiber-optic DTS to monitor soil water changes in the subsoil in a Mediterranean catchment: a synthesis of 1.5 years of data.

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The shallow weathering zone in Mediterranean catchments is extremely affected by soil water changes in space and time. In order to document the amount of water stored in the topsoil, an experimental hydrogeophysical monitoring site of soil temperature by Fiber-Optic Distributed Temperature Sensing (FO-DTS) was installed in 2015 at the Draix-Bléone hydrological observatory (South French Alps, Réseau de Basins-Versants / RBV) area, already observed by a large number of sensors over 15 years.
The FO-DTS setup consists of a 350 m long reinforced fiber optic cable installed at 0 m, -0.05 m, -0.10 m and -0.15 m of depths and crossing three different soil units consisting of argillaceous weathered black marls, silty colluvium under grassland and silty colluvium under forest. The soil temperature is measured every 6 minutes and every 0.5 m using a double-ended configuration.
The objective of this presentation is to discuss 20 months of temperature measurements (January 2016 - August 2017) acquired on the site. The changes in the soil temperature at various temporal scales (rainfall event, season) and for the three units are presented. We further compare the temperature inversion to estimate soil moisture calculation from the thermal diffusivity of the soils using other long-term soil moisture sensors. Several inversion strategies to estimate soil water content from the thermal diffusivity of the soils using simple and more complex thermal models. It shown that RMSE of thermal model are up to 0.23 K. Then, the coefficient correlation between soil moisture calculation and another sensor (EC5 Decagon, US) is 0.71. Some limitations of using this indirect technique for long-term monitoring are also presented.
The observed soil moisture time series indicate different processes of water infiltration at different velocities in relation to the presence of roots, changes in soil permeability and meteorological properties (rainfall and evapotranspiration).
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Keywords: Draix-Bléone, Fiber Optic-DTS, Soil temperature, Soil moisture, Long-term observation