



Long-term monitoring of temperature in the subsoil using Fiber Optic Distributed Sensing

Kusnahadi Susanto (1,2), Jean-Philippe Malet (1), Julien Gance (3), and Vincent Marc (4)

(1) Institut de Physique du Globe de Strasbourg, CNRS UMR 7516/EOST – Université de Strasbourg, France, (2) Universitas Padjadjaran, Bandung, Indonesia, (3) IRIS-Instruments, Orléans, France, (4) Université d'Avignon et des Pays de Vaucluse, UFR-ip Sciences, Technologies, Santé, France

Monitoring changes in soil water content in the vadose zone of soils is a great importance for various hydrological, agronomical, ecological and environmental studies. By using soil temperature measurements with Fiber-Optic Distributed Temperature Sensing (FO-DTS), we can indirectly document soil water changes at high spatial and temporal frequency. In this research, we installed an observatory of soil temperature on a representative black marl slope of the long-term Draix-Bléone hydrological observatory (South French Alps, Réseau de Basins-Versants / RBV). A 350 m long reinforced fiber optic cable was buried at 0.05, 0.10 and 0.15 m of depths and installed at the soil surface. The total length of the monitored profile is 60 m, and it three different soil units consisting of argillaceous weathered black marls, silty colluvium under grass and silty colluvium under forest. Soil temperature is measured every 6 minutes at a spatial resolution of 0.50 m using a double-ended configuration. Both passive and active (heating of the FO) is used to document soil water changes.

We present the analysis of a period of 6 months of temperature measurements (January-July 2016). Changes in soil temperature at various temporal scales (rainfall event, season) and for the three units are discussed. These changes indicate different processes of water infiltration at different velocities in relation to the presence of roots and the soil permeability. We further test several inversion strategies to estimate soil water content from the thermal diffusivity of the soils using simple and more complex thermal models. Some limitations of using this indirect technique for long-term monitoring are also presented.

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