Geophysical Research Abstracts,
Vol. 11, EGU2009-6553, 2009
EGU General Assembly 2009

A passive Distributed Temperature Sensing approach to large-scale soil moisture validation

S.C. Steele-Dunne (1), M.M. Rutten (1), D. Krzeminksa (1), N.C. van de Giesen (1), T.A. Bogaard (1), J. Selker (2), and P. Sailhac (3)

(1) TU Delft, Civiele Techniek en Geowetenschappen, Delft, Netherlands (s.c.steele-dunne@tudelft.nl), (2) Department of Biological & Ecological Engineering, Oregon State University, Corvallis, OR 97331,USA., (3) Ecole et Observatoire des Sciences de la Terre, Universite Louis Pasteur, Strasbourg, France

Global monitoring of soil moisture is key to quantifying and understanding the exchanges of water and energy between the land surface and the atmosphere. ESA's Soil Moisture and Ocean Salinity (SMOS) Mission represents the first dedicated space-borne mission to observe soil moisture.

To validate the observations from SMOS, in-situ measurements must be made over a wide variety of soil and land cover types. In recent years, Distributed Temperature Sensing (DTS) has been used in a wide variety of applications including estimating the seepage in polders, to measuring flow into streams. Active DTS, in which the cables observe the response to a heat pulse, has been successfully used to measure soil moisture in several studies. The objective of this study was to investigate the potential of passive Distributed Temperature Sensing as a relatively portable, and inexpensive alternative approach to measuring soil moisture on a large-scale.

From June to September 2008, fibre-optic cables were used to monitor temperature at 5cm and 10cm depth at a field site at Monster in the Netherlands. Meteorological data, as well as independent soil temperature and soil moisture profile data were also recorded. Through its impact on diffusivity, soil moisture influences heat transport between the cables. Here, we demonstrate how solving for the optimum parameters of the advection-diffusion equation can yield a time-series of 3-hourly soil moisture.

We will also discuss the lessons learned from this experiment, and a new protocol for using this technique in future planned field experiments.