Estimating Soil Heat Flux using Distributed Temperature Sensing

J.H.A.M. Jansen¹, P.M. Stive¹, N.C. van de Giesen¹, Scott W. Tyler², S.C. Steele-Dunne¹, L. Williamson²

¹Water Resources Section, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, Netherlands; ²University of Nevada, Reno, USA

The often smallest component of the surface energy balance, surface heat flux is often assumed to have low spatial variability. The standard measurement technique, which makes use of a heat flux plate, is thus considered to be appropriate. In this paper a method is presented to measure the spatial variability in surface heat flux. A custom-designed plow system deploys three fiber optic cables at three different depths close to the soil surface. Distributed Temperature Sensing is then used to gather temperatures with a spatial and temporal resolution of 1 m and 30 seconds respectively. These measurements clearly indicate large spatial variability in surface heat flux along a 70 meter stretch. Variations up to 100% between points 15 meter apart can be seen. This demonstrates the need for distributed soil heat flux measurements.