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A new approach of surface flux measurements using DTS

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Estimation of surface fluxes is a difficult task, especially over lakes. Determining latent heat flux (evaporation), sensible heat flux and ground heat flux involves measurements and (or calculations) of net radiation, air temperature, water temperature, wind speed and relative humidity. This research presents a new method to measure surface fluxes by means of Distributed Temperature Sensing (DTS). From 0.5 m above lake level to 1.5 m under lake level DTS was applied to measure temperature. Using a PVC hyperboloid construction, a floating standalone measuring device was developed. This new setup distinguished itself by the open construction, so it is almost insensitive to direct radiation. While most of the lake ground heat changes occur very close to the lake surface, most measuring methods only obtain rough results. With this construction it was possible to create a spiral shaped fiber-optic cable setup, with which a vertical spatial resolution of 0.02 m and a temporal resolution of 1 min was obtained. The new method was tested in the deep Lake Kinneret (Israel) from 6 October, 2011 to 11 October, 2011and in the shallow Lake Binaba (Ghana) from 24 October, 2011 to 28 October, 2011. This study shows that with the developed method it is possible to capture the energy fluxes within the top water layer with a high resolution. When the old low resolution method was compared with the new high resolution method, it could be concluded that the impact of the surface fluxes in the upper layer is high on the energy balance on a daily scale. During the measuring period it was possible to use the temperature measured by the DTS to determine the sensible heat flux, the latent heat flux and the ground heat flux of both lakes.