Geophysical Research Abstracts
Vol. 16, EGU2014-1730, 2014
EGU General Assembly 2014

Remote sensing of soil moisture using Loran-C signals

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Accurate knowledge of wide-area soil moisture is essential for atmospheric and hydrological studies. In recent years, efforts worldwide have focused on the use of microwave imaging sensors on-board satellites such as SMOS to derive this information from the interpreted brightness temperature of the Earth. However, the frequency of data retrieved this way is often limited by the revisit period of the remote sensing platforms.

In this study, we explore the feasibility of using 100 kHz Loran-C radio navigation signals, transmitted continuously from ground-based stations, for the estimation of soil moisture on wide-areas. This technique is based on the measured time delay of the surface wave component, which is influenced by land surface and atmospheric dynamics. It was found that variations in the propagation time of Loran-C surface waves may be representative of short-term ground electrical conductivity changes along the propagation path, which are believed to have a direct link with soil properties.

Using Loran-C time delays measured at the University of Bath, it has been shown that the proposed method, combined with model data, can be used for the remote sensing of soil moisture where improved temporal sampling is required. This allows for further validation and improvement.