Geophysical Research Abstracts, Vol. 9, 02769, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02769
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# Effect of the land use on the heat flux dynamics in the ground based thermal experiments aimed for validating SMOS observations

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Heat flux is one of the components of the soil heat balance. The heat flux is determined by the magnitude of the energy source and a complex capability of absorbing energy and transporting it by the material body. The capability to store, release and transport of energy is determined by a complex of boundary and initial conditions as well as by particular physical properties, specific to the media. For the soil media, they are thermal properties and other characteristics related to the micro scale and macro scale structure and texture. The source characteristic is generally the heat flux incoming independently with radiation, with full respect to diurnal cycling and other periodically variable conditions. Most of the efforts in practical investigations and modelling are put on proper managing scales of the temporary and spatial variables involved in determination of the final product of energy balance. This work aims bounding the locally important factors, like thermal properties, temperature, the soil moisture etc. with large scale local conditions like land use, vegetation cover, topography and climate. The purpose of this work is to enable a validating link to other observations on a much larger scale, provided by satellite remote sensing means. The scope is taken on the subject variable of the soil moisture, in relation to the energy balance, and finding available correlation to independent observations from SMOS (Soil Moisture and Ocean Salinity Mission). The investigation is provided on the ground locally. The SMOS observations are provided globally.

It is assumed that the heat flux in soil is determined by the measured temperature gradient and thermal properties of soil, determined by modelling. The model of Usowicz is used to combine a series of environmental and physical variables into a common product of the thermal conductivity and the thermal diffusivity. The investigations are provided in a way covering diurnal cycling and spatial distribution of the properties on the local scale. The results come from two experiment sites, the bare soil and the grass-covered field, on the mineral silt loam soil. The grass covered compared to bare soil, compounds more organic matter and silt and less clay. The content of sand is similar under both land uses. The temperature gradient and soil moisture were measured by the TDR automatic data acquisition system in depth profiles. The profiles are sampled every 5 cm down to 30 cm below the surface. The time period of sampling is set on 15 min in at least two week intervals. The conclusions are the following. If the sand is a dominant component, then thermal properties of quartz dominate thermal properties. The effect of organic matter is much less. Dynamics of the thermal conductivity was mostly dependent on soil water content that was modified by rainfalls, evaporation and plant transpiration. The soil heat fluxes, as evaluated by the multiplication product of the temperature gradient and the thermal conductivity, were similar or different in both fields depending mostly on weather conditions and plant growth. The heat fluxes were greater under the bare soil than the grass-covered soil. The grass shield evidently protects soil against fast changes of irradiation but the roots provide water transport, temporary affecting soil moisture distribution and bringing the decrease of effective temperature and changes in thermal conductivity leading to the heat flux modification. The decrease of the thermal conductivity under grass cover was larger than under the bare soil.

This work was funded in part by the Polish Ministry of Science and Higher Education (Grant No. N305 046 31/1707).