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Soil water content spatial pattern estimated by thermal inertia from air-borne sensors

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Remote sensing of soil water content from air- or space-borne platforms offer the possibility to provide large spatial coverage and temporal continuity. The water content can be actually monitored remotely in a thin soil layer, usually up to a depth of 0.05m below the soil surface. To the contrary, difficulties arise in the estimation of the water content storage along the soil profile and its spatial (horizontal) distribution, which is closely connected to soil hydraulic properties and their spatial distribution. A major goal of the scientific group is to develop a practical and robust procedure for estimating spatial variability of soil hydraulic properties. This will be done by estimating water contents throughout the soil profile by integrating remotely sensed surface water contents and hydrological modeling, the latter used in a deterministic/stochastic framework.

As a first step, in this work, we will show some preliminary results from aircraft images analysis and their validation by field campaign data on a 4 ha bare soil located in the Sele plain, South of Italy. The main data were collected by thermal and multispectral cameras during two flights performed at sunrise and at noon, each at two different altitudes (about 500 and 900 m a.s.l.).

The airborne sensors provided data for retrieving land surface temperatures and surface heat fluxes with a very high spatial resolution. The surface water content pattern, as deduced by the thermal inertia estimations, was compared to the surface water contents map measured in situ by time domain reflectometry. A reasonable agreement was found between the remotely sensed water contents pattern and the ground point-scale water contents map. Moreover, remotely monitoring from two different altitudes gave the opportunity to verify the effects of the spatial resolution on the surface water content estimation. The sensors displayed a reasonable capability to deliver surface soil water content distributions at the desired resolution.