GROUND BASED INVESTIGATION OF SOIL MOISTURE VARIABILITY

L. Brocca (1), M. Galli (1), M. Stelluti (1).

(1) Consiglio Nazionale delle Ricerche, Istituto di Ricerca per la Protezione Idrogeologica, Italy (l.brocca@irpi.cnr.it/Fax : +39-075-5014420)

Quantitative information on soil moisture before and during a rainfall event is an important evidence to accurately forecast the time and location of shallow landslides and floods. However, this information is difficult to obtain, particularly for large areas. To fill this gap, attempts have been made to determine soil moisture in the upper layer of the soil using various remote sensing techniques, spanning the range of frequencies from optical to microwaves. One of the limitations of the use of remotely sensed data, from satellite or airborne sensors, to ascertain soil moisture lays in the lack of quantitative ground measurements of water content. Recently, we had the opportunity to design and perform an experiment aimed at jointly acquiring measurements of surface soil water content at various locations and remotely sensed multi-spectral data. Volumetric soil moisture was monitored using a time domain reflectometer (TDR, Soilmoisture Equipment Corp.) The stainless-steel wave guide were 15 cm long and 5 cm apart, so that the total volume covered was about 750 cm^3 per sample. Multi-spectral data were obtained by the compact airborne spectrographic imager, CASI 2, on board a Dornier 228-101 research aircraft deployed by the NERC Airborne Remote Sensing Facility. The poster focuses on the acquisition of soil moisture measurements.

The area selected for the experiment is located in central Umbria, between the towns of Collazzone, to the North, and Todi, to the South, and it extend for 125 km^2 to the East of the Tiber River. For the area detailed lithological and multi-temporal landslide inventory maps were prepared though extensive field studies aided by the interpretation of multiple sets of aerial photographs. In the area crop out lake sediments, Plio-Pleistocene in age, chiefly clay, silty clay, sand and gravel. We identified eight plots where measurements of soil water content were made. The plots, square or rectangular in shape, range in size from 100m^2 to 600m^2, and cover a variety of topographic and morphological settings, from flat terrain to hummocky landslide areas. Some of the plots were selected to intersect the boundary of recent landslides. The corners of the plots were located using a GPS station. The TDR measurements were conducted systematically on a grid of 1x1, 2x2 or 4x4 meters. For each plot we acquired from a minimum of 96 to a maximum of 176 TDR measurements, for a total of 1500 data. TDR measurements were also made along profiles joining two plots or along a landslide steepest slope. The profiles were from 100 to 150 meters long, and measurements were conducted every 4 or 5 meters. The TDR measurements were conducted during

four days, on April 5^{th}, on April 15^{th}, on May 2^{nd} and on May 3^{rd}. On May 3^{rd} the NERC airborne CASI 2 acquired the multi-spectral data.

Preliminary analysis of the results reveals that: a) where TDR measurements were repeated two or three times, the absolute values changed but the spatial trends of "wetter" vs. "dryer" areas remained the same or similar, and b) there was a "significant" difference in the values of water content measured "inside" and "outside" a landslide area, and c) the geo-statistical analysis of the much larger plots shows a correlation length of about 20 meters.

This information will be compared with the data of surface temperature obtained from the remotely sensed multi-spectral sensor, when this information will become available to us.