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Soil moisture and Vegetation parameters retrieval from ASAR data at catchment scale: Matera case study

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Monitoring the spatial and temporal variability of soil moisture and vegetation cover parameters, at catchment scale, is of major importance for a better comprehension of the water cycle on land surfaces. In the past, a vast number of experimental and theoretical studies relating radar measurements to soil and vegetation parameters have been conducted. Such studies have widely demonstrated the sensitivity of Synthetic Aperture Radar (SAR) measurements to soil moisture content and vegetation biomass. The inverse problem of retrieving soil and vegetation parameters from the observed radar response of the surface has been also widely investigated. The most promising algorithms use change detection techniques applied to multi-temporal SAR data.

However to date the performance of these algorithms, especially in terms of robustness and accuracy, has been limited. Two main causes have prevented the development of robust and accurate inversion algorithms at high resolution: a) the difficulty in solving retrieval problems having more than one unknown (i.e. soil moisture, soil roughness, vegetation biomass, crop structure, etc.) using single-parameter radar measurements as provided by the first generation of spaceborne SAR systems (i.e. ERS, JERS, RADARSAT); b) the difficulty in providing a priori information on surface parameters to appropriately constrain the retrieval problem.

The launch of the new European ENVISAT system, with on board the Advanced-SAR system able to provide C-band SAR data at two polarizations and at different incidence angles, is expected to increase the robustness and accuracy of retrieval algorithms for agricultural areas.

In this context, an experimental study on the Matera site (Italy) has been initiated in 2003. The test site is an agricultural area devoted to wheat cultivation and located in

the Bradano basin in the south of Italy. Over this area multi-temporal ASAR data have been acquired, roughly every weak, since February 2003. The acquisitions have been carried out in alternating polarization mode at different polarization and incidence angles. Coincidentally, ground data such as soil moisture content, soil roughness, wheat biomass, LAI etc., have been collected.

The measurements were co-funded by the European Space Agency and the Italian Space Agency and were aimed at developing and assessing new SAR retrieval algorithm for land applications.

In this paper results of this experimental campaign will be presented and implications for development of retrieval algorithms based on ASAR data will be discussed.