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Passive microwave remote sensing of soil moisture: New venues and challenges in large-scale hydrology

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Surface soil moisture is a key variable of water and energy exchanges at the land surface / atmosphere interface. But currently there are no means to assess is on a global and timely fashion. One way to overcome this issue would be to use an adequate space-borne Instrument. The most promising instrument would then be an L-band microwave remote sensing sensors as they are able to provide estimates of surface soil moisture, on spatial and temporal scales compatible with applications in the fields of climatology, meteorology and large scale hydrology.

The ESA Earth Explorer Opportunity mission Soil Moisture and Ocean Salinity (SMOS is the first attempt to fulfil such a gap The Hydros mission being a second opportunity .SMOS is based upon an L-band 2-D interferometer It is thus an innovative concept of bi-dimensional aperture synthesis method to obtain surface measurement with an appropriate resolution from a tractable space-borne instrument.. Moreover, the sensor has new and very significant capabilities especially in terms of multi-angular view configuration SMOS is scheduled for launch in 2007. The Hydros concept relies on a real aperture system with revisit and spatial resolutions close to those of SMOS but with an active system operating at L band as well.. Hydros is scheduled for a 2010 launch which should provide an overlap with SMOS.

This paper will describe the SMOS concept in terms of instrument (characteristics an specifications) and will investigate the main aspects of the retrieval capabilities of the 2-D microwave interferometer for monitoring soil moisture, vegetation biomass and

sea surface salinity. The analysis is based on model inversion taking into account the instrument characteristics. The standard error of estimate of the surface variables is computed as a function of the sensor configuration system and of the uncertainties associated with the spatial measurements. Nevertheless, retrieving surface variables from such an instrument is not necessarily straightforward. Over land the main issues are linked to mixed pixels and topography. And might include RFI (Radio Frequency Interferences). Using other sensors/mission (ERS, MetOp, Aquarius), auxiliary data sets and assimilation techniques will be used to address these issues.

The presentation will give an overview of the SMOS level 2 processor concept together with the main products to be delivered over land including level 3 and 4 data sets. A particular attention will be devoted to the potential applications of SMOS (resp Hydros) in terms of large scale hydrology with potential methods and application to basin-scale hydrology, including dis aggregation techniques.