IGARSS 2003,
July 21-25, 2003, Centre des Congrès Pierre Beaudis, Toulouse, France

ABSTRACT

The Hydrosphere State Mission (HYDROS): An Overview

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The Hydrosphere State Mission (HYDROS) has been selected as a possible mission for the NASA's Earth System Pathfinder Program (ESSP). The objective of the mission is to provide the first global scale measurement of Earth's soil moisture and land surface freeze/thaw conditions. The new data will lead to breakthroughs in weather and climate prediction and in the understanding of water, energy and carbon cycles.

The proposed instrument is a combined radar and radiometer system operating at 1.26 GHz and 1.41 GHz respectively. The radar and the radiometer share the aperture of a 6-meter antenna pointing at 35° with respect to nadir. The antenna is rotated at 14.6 rpm to provide a scanned swath of 1000 km. The large swath provides a global coverage of the Earth in 2 to 3 days with a temporal sampling less than 2 days at latitude above 50N. The radar measures HH, VV polarizations to retrieve the soil moisture; the HV polarization is used to produce a vegetation index. The radar is an unfocused SAR providing a variable resolution depending on the scan angle with respect to the satellite track. The radar data is averaged to provide a Level 3 product with a resolution of 3.0 km and a relative error of 1.0 dB over 70% of the swath. Over the 300 km central section of the swath, the radar resolution is degraded and only low-resolution radar data with no Doppler sharpening is collected. The radiometer measures V, H and U polarization to provide estimates of the moisture with a resolution of 40 km. It is expected that the combined radar/radiometer product will enhance the quality of the soil moisture retrieval. The satellite orbit is a sun-synchronous 6am/pm orbit at 670 km, but the high-resolution radar data is collected only over land and over the am portion of the orbit to reduce the data rate.

HYDROS is an alternative mission to OCO and AQUARIUS and is currently in a risk mitigation phase. It may be approved for a full formulation phase if it closes a list of risks that have been identified by ESSP. These risks include technical, science and partnering issues that are being addressed in a series of activities by organizations in the US, Canada and Italy.

The paper gives an overview of the HYDROS mission requirements and applications and presents a summary of the activities carried out as part of the risk mitigation phase. If the current activities are successful, HYDROS will be launched in 2007 for a minimum mission duration of two years.