A Bayesian approach for an SAC-D/Aquarius Soil Moisture product

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Several retrieval algorithms were developed to retrieve soil moisture from passive remote sensing data. The most commonly used are the Single Channel Algorithm (SCA), the Dual Channel Algorithm (DCA) and LPRM. All these algorithms rely on the omega-tao model to link brightness temperature (Tb) and surface dielectric and geometric properties, and differ among them on the polarization channels they use and the minimization scheme implemented [1]. LPRM and DCA make use of TbH and TbV to retrieve soil moisture and optical depth. One disadvantage of both previous algorithms is their sensitivity to noise in both TbH and TbV. On the other hand, SCAH (SCAV) uses only TbH (TbV) to retrieve soil moisture using optical depth as an auxiliary input to the retrieval algorithm (usually derived from an optical proxy). The main disadvantage of relying on optical depth to retrieve soil moisture is that if optical depth is not well known, SCA will have poor performance. In practice, accurate knowledge of optical depth is tricky. In general, optical depth is obtained through the vegetation parameter *b* (a land cover dependent parameter, empirically derived, not unique values found on literature) and vegetation water content, VWC (derived from different proxies and models that result in different VWC values). All these retrieval implementations also need ancillary parameters as necessary auxiliary inputs.

In this paper, a novel retrieval algorithm (BRA, Bayesian Retrieval Algorithm) is developed, which uses Bayesian inference to retrieve soil moisture and optical depth from both H & V channels. Bayesian likelihood is derived in a non parametric manner, in such a way to be a function of ancillary parameters uncertainties (uncertainties in the parameters needed for the retrieval). As a major advantage, prior knowledge for soil moisture and optical depth can be directly included as inputs to BRA to improve the retrieval. The advantages of BRA compared to previously mentioned retrievals are: i) errors on the retrieved variables can be estimated in an univocal way, ii) it gives the possibility to use prior information about the retrieved variables (provided by other sensors or in situ historical data), iii) it can handle uncertainties on the ancillary parameters.

The comparison of the retrieval performance of the different algorithms was carried out using an Observing System Simulation Experiment developed for the Aquarius/SAC-D L-band radiometer [2]. A first version of the operative algorithm is

under evaluation. This version is customized for Pampas Plains (Argentina), and includes specific ancillary data for the area (landcover, local VWC information priors). Moreover, several proxies to vegetation optical depth are being tested (RVI, NDVI and SMOS optical depth). Argentinean radiometer MWR data is used as proxy of skin temperature over vegetated areas.

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References

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