ESTIMATING AN EMPIRICAL SMOS FORWARD MODEL AND ITS CO-VARIANCE FOR OCEAN SALINITY BY THE USE OF NEURAL NETWORKS

Crepon Michel, Estelle Obligis, Sylvie Labroue, Carlos Mejia, Sylvie Thiria
LOCEAN, IPSL/UPMC, 4 place Jussieu, Paris, Seine, France 75005

One of the critical issues for SMOS ground segment is the inversion algorithm which will be used to retrieve the sea surface salinity (SSS) from the SMOS brightness temperatures. Most of the scientists have chosen an inversion processing based on a forward model, developed with theoretical or semi empirical models. This forward model allows simulating brightness temperatures, given a triplet of geophysical parameters (sea surface salinity, sea surface temperature and wind speed). Its used to retrieve the Sea Surface salinity by applying a variationnal inversion method, the so-called iterative method, which tries to adjust a quadratic cost function between the SMOS measured brightness temperatures and the simulated ones. The cost function implies the knowledge of the co-variance of the forward model. The development of this inversion method is suitable because it allows to take into account pixel by pixel the different SMOS measurements at different incidence angle. Unfortunately most of the forward models are theoretical models based on physical considerations. The physic of SMOS is complex and very difficult to model. Furthermore in-situ experiments with radiometers on board of plane poorly simulate the SMOS measurements. In the present paper, we propose to estimate an empirical SMOS forward model and its co-variance by the use of Neural Networks during the commissioning phase of the SMOS flight. This forward model computes the brightness temperatures from the salinity, the incidence angle, the SST, the wind. The model will be calibrated with SMOS measurements co-located with in-situ salinities. It is expected that this forward model will take into account all phenomena, inaccurately modeled (foam), or not modeled at all (swell) at that time, or even not identified (wiggles) by physical model. We also propose to estimate the model covariance with a specific neural methodology which has been developed for the GMF of scatterometer measurement. These empirical covariances will be introduced in the cost function of the variationnal (iterative) method. In order to prepare the SMOS mission, we have done a feasibility study by using simulated data sets The use of this neural forward model is of great interest to help the scientists to improve their understanding of the modelling errors in the forward model. The neural forward model tuned on SMOS measurements co-located with in-situ salinities will provide the best statistical estimate of the SMOS forward model in a Beyesian context. This NN model will be then compared to theoretical model. We can expect an improvement of the knowledge of surface physics of the ocean and especially to improve our knowledge in ocean surface emissivity modeling .