

Title: Validation of Aquarius measurements using radiative transfer models at L-band

Authors: E. Dinnat, D. Le Vine, S. Abraham, P. de Mattheis, C. Utku

Aquarius/SAC-D was launched in June 2011 by NASA and CONAE (Argentine space agency). Aquarius includes three L-band (1.4 GHz) radiometers dedicated to measuring sea surface salinity. We report detailed comparisons of Aquarius measurements with radiative transfer model predictions. These comparisons were used as part of the initial assessment of Aquarius data. In particular, they were used successfully to estimate the radiometer calibration bias and stability. Further comparisons are being performed to assess the performance of models in the retrieval algorithm for correcting the effect of sources of geophysical “noise” (e.g. the galactic background, atmospheric attenuation and reflected signal from the Sun). Such corrections are critical in bringing the error in retrieved salinity down to the required 0.2 practical salinity unit (psu) on monthly global maps at 150 km by 150 km resolution.

The forward models making up the Aquarius simulator have been very useful for preparatory studies in the years leading to Aquarius’ launch. The simulator includes various components to compute effects of the following processes on the measured signal: 1) emission from Earth surfaces (ocean, land, ice), 2) atmospheric emission and absorption, 3) emission from the Sun, Moon and celestial Sky (directly through the antenna sidelobes or after reflection/scattering at the Earth surface), 4) Faraday rotation, and 5) convolution of the scene by the antenna gain patterns. Since the Aquarius radiometers turn-on in late July 2011, the simulator has been used to perform a first order validation of the data. This included checking the order of magnitude of the signal over ocean, land and ice surfaces, checking the relative amplitude of signal at different polarizations, and checking the variation with incidence angle. The comparisons were also used to assess calibration bias and monitor instruments calibration drift. The simulator is also being used in the salinity retrieval. For example, initial assessments of the salinity retrieved from Aquarius data showed degradation in accuracy at locations where glint from the galactic sky background was important. This was traced to an inaccurate correction for the Sky glint. .

We present comparisons of the simulator prediction to the Aquarius data in order to assess the performances of the models of various physical processes impacting the measurements, such as the effect of sea surface roughness, the impact of the celestial Sky and the Sun emission scattered at the rough ocean surface. We discuss what components of the simulator appear reliable and which ones need improvements. Improved knowledge on the radiative transfer models at L-band will not only lead to better salinity retrieved from Aquarius data, it will also allow be beneficial for SMOS or the upcoming SMAP mission.