

The Aquarius Salinity Retrieval Algorithm: Early Results

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The Aquarius L-band radiometer/scatterometer system is designed to provide monthly salinity maps at 150 km spatial scale to a 0.2 psu accuracy. The sensor was launched on June 10, 2011, aboard the Argentine CONAE SAC-D spacecraft. The L-band radiometers and the scatterometer have been taking science data observations since August 25, 2011.

The first part of this presentation gives an overview over the Aquarius salinity retrieval algorithm. The instrument calibration converts Aquarius radiometer counts into antenna temperatures (TA). The salinity retrieval algorithm converts those TA into brightness temperatures (TB) at a flat ocean surface. As a first step, contributions arising from the intrusion of solar, lunar and galactic radiation are subtracted. The antenna pattern correction (APC) removes the effects of cross-polarization contamination and spillover. The Aquarius radiometer measures the 3rd Stokes parameter in addition to vertical (v) and horizontal (h) polarizations, which allows for an easy removal of ionospheric Faraday rotation. The atmospheric absorption at L-band is almost entirely due to O₂, which can be calculated based on auxiliary input fields from numerical weather prediction models and then successively removed from the TB. The final step in the TA to TB conversion is the correction for the roughness of the sea surface due to wind. This is based on the radar backscatter measurements by the scatterometer. The TB of the flat ocean surface can now be matched to a salinity value using a surface emission model that is based on a model for the dielectric constant of sea water and an auxiliary field for the sea surface temperature. In the current processing (as of writing this abstract) only v-pol TB are used for this last process and NCEP winds are used for the roughness correction.

Before the salinity algorithm can be operationally implemented and its accuracy assessed by comparing versus in situ measurements, an extensive calibration and validation (cal/val) activity needs to be completed. This is necessary in order to tune the inputs to the algorithm and remove biases that arise due to the instrument calibration, foremost the values of the noise diode injection temperatures and the losses that occur in the feedhorns. This is the subject of the second part of our presentation. The basic tool is to analyze the observed difference between the Aquarius measured TA and an expected TA that is computed from a reference salinity field. It is also necessary to derive a relation between the scatterometer backscatter measurements and the radiometer emissivity that is induced by surface winds. In order to do this we collocate Aquarius radiometer and scatterometer measurements with wind speed retrievals from the WindSat and SSMIS F17 microwave radiometers. Both of these satellites fly in orbits that have the same equatorial ascending crossing time (6 pm) as the Aquarius/SAC-D observatory. Rain retrievals from WindSat and SSMIS F17 can be used to remove Aquarius observations that are rain contaminated. A byproduct of this analysis is a prediction for the wind-induced sea surface emissivity at L-band.