

Inter-comparison of SMOS and Aquarius observations

Passive microwave remote sensing at L-band is considered to be the most suitable technique to measure soil moisture and ocean salinity from space. The ESA's SMOS and the NASA's Aquarius/SAC-D are the two first satellite missions, carrying L-band radiometers on-board, measuring the global Earth's surface as brightness temperatures (TB). The two radiometers have important differences in the architecture of the instruments as well as in their operation principles. In order to verify the continuity and the consistency of the data over the entire dynamic range of observations, a comparison between one year of SMOS and Aquarius measured TB has been performed over key regions over land (Amazon rainforest and Sahara desert), ice (Dome-C in Antarctica) and sea (South Pacific ocean).

[Click here](#) to observe selected regions in Google Earth.

A global view of the comparison is shown in Fig. 1, which displays the annual mean of the two radiometers for the three Aquarius incidence angles (inner 29.36° , middle 38.49° and outer 46.29° beams). In South Pacific, Dome-C and Sahara, higher incidence angles imply lower TB at horizontal polarization and higher TB at vertical polarization. However, in the Amazon, the TB variation with incidence angle and polarization is not clear due to the vegetation scattering. As expected, there is a small difference between polarizations (TBV-TBH) for vegetation-covered soils.



Fig. 1 Aquarius TB vs. SMOS TB at (a) horizontal and (b) vertical polarizations.

The scatter plots in Fig. 2 show the correspondences between SMOS and Aquarius TB for the middle beam at horizontal

polarization, and the slopes obtained from a robust linear fit. Results show a higher linear correlation over land than over sea. A seasonal effect is clearly observed over ice, in Dome-C. Note that Aquarius is systematically measuring warmer TB than SMOS over all study areas and these differences are target dependent. This indicates there may be a non-linear relationship between the two radiometers, and not only a bias. In addition, a better agreement is obtained at horizontal than at vertical polarization.



Fig. 2 Scatter plots of Aquarius TB vs. SMOS TB at horizontal polarization over selected target regions: (a) Amazon rainforest, (b) Sahara desert, (c) South Pacific ocean, and (d) Dome-C in Antarctica. Slope values s from the robust linear fit are shown in the plots.

More details of this study are available in Pablos et al., 2014, [“SMOS and Aquarius Radiometers: Inter-Comparison over Selected Targets”](#), vol. 7, no. 7, in press, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, DOI: 10.1109/JSTARS.2014.2321455.

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