L-Band Retrieval of Ocean Surface Salinity and Wind Using Aquarius' Combined Active-Passive Data

SIMON YUEH, WENQING TANG, ALEXANDER FORE, AND AKIKO HAYASHI
JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLGOY

Aquarius is a combined passive/active L-band microwave instrument developed to map the salinity field at the surface of the ocean from space. The primary science objective of this mission is to monitor the seasonal and interannual variation of the large scale features of the surface salinity field in the open ocean with a spatial resolution of 150 km and a retrieval accuracy of 0.2 psu globally on a monthly basis. The measurement principle is based on the response of the L-band (1.413 GHz) sea surface brightness temperatures to sea surface salinity. To achieve the required 0.2 psu accuracy, the impact of sea surface roughness (e.g. wind-generated ripples and waves) must be corrected to better than a few tenths of a degree Kelvin.

The Aquarius/SACD has been operating since August 24, 2011. The data acquired since then have been used to develop the geophysical model functions (GMF) of L-band brightness temperatures and backscatter. The ancillary data for GMF development include the SSM/I wind speed, NCEP wind speed and direction, and NOAA WaveWatch 3 (WW3) analyses. We have created two types of GMFs, one accounting for the effects wind speed and direction and the other one including the significant wave height as additional modeling parameter.

We have applied both types of GMFs for salinity and wind retrieval using the Combined Active-Passive (CAP) algorithm. The accuracy of wind speed retrieval for rain-free conditions is estimated to be about 0.8 m/s (RMS), and the wind direction accuracy is also excellent at above 10 m/s wind speeds. The monthly averaged global gridded SSS products, retrieved using the GMF parameterized using wind alone, is in the range of 0.4 to 0.5 psu, which appears to be dominated by some systematic regional biases. We examined the impact of significant wave height on retrieval by bringing in the NOAA WW3 as one of the ancillary inputs. We find that the SSS retrieval accuracy can improve by about 10 percent with the monthly average accuracy reaching as low as 0.35 psu. If the errors caused by wave height and other error sources are independent, the SSS retrieval errors caused by the wave height itself would be about 0.15 to 0.2 psu. This paper demonstrates that the roughness effects of wind and wave effects can be accurately modeled using the NCEP wind and WW3 model to allow accurate SSS retrieval.