Increased Accuracy in the Measurement of the Dielectric Constant of Seawater at 1.413 GHz

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This paper describes the latest results for the measurements of the dielectric constant at 1.413 GHz by using a resonant cavity technique. The purpose of these measurements is to develop an accurate relationship for the dependence of the dielectric constant of sea water on temperature and salinity which is needed by the Aquarius inversion algorithm to retrieve salinity. Aquarius is the major instrument on the Aquarius/SAC-D observatory, a NASA/CONAE satellite mission launched in June of 2011 with the primary mission of measuring global sea surface salinity to an accuracy of 0.2 psu. Aquarius measures salinity with a 1.413 GHz radiometer and uses a scatterometer to compensate for the effects of surface roughness.

The core part of the seawater dielectric constant measurement system is a brass microwave cavity that is resonant at 1.413 GHz. The seawater is introduced into the cavity through a capillary glass tube having an inner diameter of 0.1 mm. The change of resonance frequency and the cavity Q value are used to determine the real and imaginary parts of the dielectric constant of seawater introduced into the thin tube.Measurements are automated with the help of software developed at the George Washington University.

In this talk, new results from measurements made since September 2010 will be presented for salinities of 30, 35 and 38 psu with a temperature range of 0°C to 35° C in intervals of 5°C. These measurements are more accurate than earlier measurements made in 2008 because of a new method for measuring the calibration constant using methanol. In addition, the variance of repeated seawater measurements has been reduced by letting the system stabilize overnight between temperature changes. The new results are compared to the Kline Swift and Meissner Wentz model functions. The importance of an accurate model function will be illustrated by using these model functions to invert the Aquarius brightness temperature to get the salinity values. The salinity values will be compared to co-located insitu data collected by Argo buoys.