

## L/S-band Radiometer Measurements of a Saltwater Pond

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In October and November 2001, L and S-band radiometer measurements were made of a salt-water pond, as a function of salinity and temperature, to verify the accuracy of current salt-water microwave emission models. Having accurate microwave emission models is necessary for future satellite missions to measure Sea Surface Salinity (SSS) as proposed in the GSFC/JPL Aquarius mission.

The PALS L/S-band radiometric instrument (Wilson et.al. 2001) was mounted at a 45-degree incidence angle looking down on the salt-water pond. A grid of PVC pipes was used to circulate the salt water in the pond. A pump was used at low speed to constantly circulate the water, and no waves were present during measurements. A gas heater was in series with the pump to heat the water during the measurements. After a set of measurements, water chillers were used to cool the water down for the next evening's measurements. To increase the salinity level, sea salt was mixed with filtered reverse osmosis water and fed into the pond through the pump line. To decrease the salinity, filtered reverse osmosis water was added to the pond. Two new thermosalinograph instruments were used in opposite sides of the pond to measure the average salinity and temperature of the water. There were also four (4) temperature probes located in each corner. All measurements were made after sunset to eliminate any solar interference. On October 26, November 3 and 10, measurements were made with a constant salinity of 35 psu and a constant temperature to measure changes in the background radiation. These data showed excellent agreement within 0.05 K. This smoothed background data was subtracted from all the salinity measurements to correct for the small background changes from the sky.

Most of the data were taken at fixed salinity levels of 25, 35 and 40 psu over a temperature range of 8 to 32 C. These measurements cover most of the range expected in the oceans to be measured by the proposed Aquarius instrument. The peak to peak variation of the individual daily measurements was 0.25 K. The rms difference between the average curves and the Klein and Swift model (Klein and Swift, 1977) is 0.1 K, which corresponds to a salinity error < 0.2 psu. This demonstrates the excellent stability of this measurement system and that these measurements are in excellent agreement with the Klein and Swift SSS model. The conclusion from this set of controlled measurements with a complete microwave radiometer system, is that over the range of salinity and temperature observed in the ocean, the Klein and Swift model, with minor corrections, will provide accurate salinity predictions with < 0.2 psu error.

### References:

1. W. J. Wilson, S. H. Yueh, S. J. Dinardo, S. Chazanoff, A. Kitiyakara, F. K. Li, and Y. Rahmat-Samii, "Passive Active L- and S-band (PALS) Microwave Sensor for Ocean Salinity and Soil Moisture Measurements," *IEEE Trans. Geosci. Remote Sensing*, **39**, 1039-1048, May 2001.
2. L. A. Klein and C. T. Swift, "An Improved Model for the Dielectric Constant of Sea Water at Microwave Frequencies," *IEEE Trans. Antennas and Propagation*, **25**, 104-111, January 1977.