Ocean Wave Slopes from XM-Radio Reflections for Brightness Temperature Corrections

Brightness temperature estimates are strongly dependent on the ocean surface roughness. This dependence must be corrected to retrieve salinity measurements from microwave radiometry. Bi-static radar using Global Navigation Satellite System (GNSS) signals as illumination sources have been shown to produce estimates of ocean roughness that are strongly correlated with brightness temperature. Retrievals of mean square slope (MSS), $\sigma^2$, can be parameterized to relate brightness temperature measurements. This one-dimensional slope variance $\sigma^2$ which characterizes the ocean state is estimated assuming an isotropic wave slope probability density function (PDF) inherent in the GPS bi-static radar equation.

Recent work has shown that digital communications signals at S-band offer several promising advantages over traditional GNSS reflectometry. XM satellite radio signals exhibit much higher transmitted power, and are located in geostationary orbit which yields a convenient scattering geometry unaffected by Doppler effects. By exploiting signals of opportunity from XM, it is hypothesized that a novel instrument can be designed to perform within NASA science requirements, at an order of magnitude reduction in size, weight, and power to correct the roughness effects in radiometer brightness temperature measurements.

This poster will present the results of MSS retrievals from XM reflectometry data acquired from a February 2012 airborne experiment over the Chesapeake Bay, VA. The estimates were compared to local buoy recordings of wind speeds. XM retrievals reflect ground truth at higher accuracy than GPS retrievals, due to the higher signal to noise ratio (~30 dB) of digital communication satellites.