Remote Sensing of the Ocean Using GPS Sea Reflections

Donald R. Thompson
Applied Physics Laboratory
The Johns Hopkins University

Recently, there has been considerable interest in the possibility of estimating various parameters of geophysical interest by measuring the signals from the Global Positioning Satellite (GPS) constellation reflected from the ocean surface. The basic idea is to make use of the time coding already present for standard GPS navigation to measure the time delay between reception of the direct-path signal from a particular GPS satellite and reception of the signal reflected from the ocean surface. This time delay may be accurately computed using the geometry of the GPS transmitter and the position of the receiver (determined by GPS navigation in the usual manner). The leading edge of the reflected signal emanates from the so-called "specular point" from which a perfectly flat surface would reflect the transmitted signal to the receiver. In contrast to the direct-path signal, which is received at a precise time depending on the location of the transmitter-receiver pair, the power in the reflected signal is spread in time depending on specific characteristics of the reflecting ocean surface roughness. Since the surface roughness is related to the local wind field (among other things), the width of the reflected waveform can, at least in principle, provide information about this quantity and other geophysical parameters.

In this talk, the basic physics that governs the scattering of GPS signals from a wind-roughened sea surface will be briefly reviewed in the context of a newly developed bistatic scattering model. We will then describe the results of recent experimental campaigns in which reflected GPS signals have been recorded in the vicinity of coastal buoys or research vessels where independent measurements of the surface wind vector were available. Comparisons between the measured waveforms and those predicted from our scattering model will be presented and discussed.

Friday, November 1, 2002

11:00 a.m., 234 Ames Hall