

Project Description

The research project will use the WERA HF Radar system to provide simultaneous measurement of ocean surface currents and ocean waves. The system provides oceanographic data within a 120-degree Radar coverage area at ranges to 200km. Oceanographic High Frequency Radars are based on the Bragg-scattering concept. Electromagnetic waves (EM) sent to the ocean are backscattered on surface waves of exactly half the radio wavelength. The ocean is generally covered by waves of many different wavelengths and directions (continuous spectrum), so there are always trains of waves propagating toward and away from the radar. The return signal from either train will be Doppler-shifted by the wave velocity, which is known exactly by the gravity wave dispersion relationship. Thus the spectrum of the return echoes consists of two peaks, symmetric with respect to the transmit frequency, in the absence of currents. If the waves ride on an ocean current, the return signal is further Doppler-shifted by the radial component of the current, which can be readily estimated. Wind direction can be inferred from the amplitude of the main peaks, and multiple scattering allows the extraction of spectral information on the ocean wave field.

At HF, EM wave can propagate in a "trapped" ground wave along the conductive surface of the ocean. The useable range of the ground wave depends on attenuation, and increases with decreasing frequency, approximately $\text{range(km)} * \text{frequency(MHz)} = 2000$, thus 32 MHz = 60 km, 16 MHz = 125 km, 8 MHz = 250 km; the actual range varies greatly depending on EM background noise, and on the type of signal modulation. Attenuation increases and thus range decreases as salinity decreases, and as sea state increases.

The U.S. Commission on Ocean Policy recently released its final report to Congress and the President. One of the recommendations is the need for a nationwide ocean and coastal observing system. The system entails a network of instrumentation coastwide that is vital to the next generation of predictive modeling and a whole host of commercial and scientific applications. The southeast has initiated building such a network of installations - the SouthEast Atlantic Coastal Ocean Observing System (SEACOOS). The HF radar installation covered by this license application is part of SEACOOS.