EXTRACTION OF COASTAL WAVEFIELD PROPERTIES FROM X-BAND RADAR

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The dynamic wave field in a high-energy coastal environment is investigated using frequency direction wave spectra obtained by nautical X-band radar imagery. Nautical radars are generally used for navigation and ship traffic control. Under various conditions (wind speed > 3m/s, significant wave height > 0.5m[1]), signatures of the sea surface (sea clutter) become visible in the near range (less than 3 nautical miles) of nautical radar images. Swell and wind sea waves become visible in nautical radar images as they modulate the sea clutter signal. Since standard X-band nautical radar systems allow to scan the sea surface with high temporal and spatial resolution, they are able to monitor the sea surface in both time and space. The combination of the temporal and spatial wave information allows the determination of unambiguous directional wave spectra.

Here, wave data collected from February-October 2005 at the US Army Corps of Engineers Field Research Facility (USACE-FRF) in Duck, North Carolina is presented.

1 Typical values, which can vary for different installations

For the radar wave measurements the Wave and surface current Monitoring System WaMoS II was connected to a Furuno FR-7112 X-Band radar with a 6 feet open antenna and an update rate of 2.5s (24 rpm). The radar covers a range from 240m - 2160m from the antenna with a spatial resolution of 7.5m. The wave analysis was carried out over an area of 3.7 km^2 located in relative homogeneous bottom topography, off the near shore breaker bar system, in a water depth of 8m -10m.

The WaMoS II wave measurements were compared to those obtained from a pressure gauge array located in the same area. Earlier WaMoS II validations provide a general indicator of the quality of the measurement performance as they were carried out for standard integral wave properties over all existing wave systems such as mean or peak wave parameters. Here a comparison by means of a wave spectral partitioning analysis (WSPA) provides a more detailed validation especially for bi- and multi modal sea states. The WSPA allows for a comparison of the heights, periods and directions of individual wind sea and swell components, as well as a tracking the evolution of specific wave systems. Such analysis methods have been successfully applied in a variety of wave model validations.

The data comparison was carried out for different sea state and wind conditions. Preliminary results of the data comparison show that the WaMos II system captures the temporal evolution of the individual wind sea and swell wave components entering the surf zone. A statistical error analysis of the isolated wind sea and swell wave systems provides a quantitative assessment of WaMoS II performance in a coastal setting.