Geophysical Research Abstracts
Vol. 14, EGU2012-536, 2012
EGU General Assembly 2012

Sea state variability observed by high resolution satellite radar images

A. Pleskachevsky and S. Lehner
DLR, Wessling, Germany (andrey.pleskachevsky@dlr.de)

The spatial variability of the wave parameters is measured and investigated using new TerraSAR-X (TS-X) satellite SAR (Synthetic Aperture Radar) images. Wave groupiness, refraction and breaking of individual wave are studied. Space borne SAR is a unique sensor providing two dimensional information of the ocean surface. Due to its daylight, weather independency and global coverage, the TS-X radar is particularly suitable for many ocean and coastal observations and it acquires images of the sea surface with up to 1m resolution; individual ocean waves with wavelength below 30m are detectable.

Two-dimensional information of the ocean surface, retrieved using TS-X data, is validated for different oceanographic applications: derivation of the fine resolved wind field (XMOD algorithm) and integrated sea state parameters (XWAVE algorithm). The algorithms are capable to take into account fine-scale effects in the coastal areas. This two-dimensional information can be successfully applied to validate numerical models. For this, wind field and sea state information retrieved from SAR images are given as input for a spectral numerical wave model (wind forcing and boundary condition). The model runs and sensitivity studies are carried out at a fine spatial horizontal resolution of 100m. The model results are compared to buoy time series at one location and with spatially distributed wave parameters obtained from SAR. The comparison shows the sensitivity of waves to local wind variations and the importance of local effects on wave behavior in coastal areas. Examples for the German Bight, North Sea and Rottenest Island, Australia are shown.

The wave refraction, rendered by high resolution SAR images, is also studied. The wave ray tracking technique is applied. The wave rays show the propagation of the peak waves in the SAR-scenes and are estimated using image spectral analysis by deriving peak wavelength and direction. The changing of wavelength and direction in the rays allows detecting underwater structures (banks, reefs, shallows) and to obtain bathymetry in case a well-developed swell is imaged. Further, wave energy flux propagation towards the coast and its dissipation are obtained using the wave ray technique: wave height and wavelength are derived from TS-X image spectrum.

The height of individual breaking waves is obtained from SAR-image signatures and it is compared to the model results and the buoy measurements. The results show some lower amplitude of the breaking waves, when compared to model results in the shoaling zone. This effect could be explained by an actual stronger dissipation than the one given by the model in the investigated area (coral reefs).

Wave groups are detected for a cross sea and in storm condition in the ocean. The parameters of the wave groups are investigated and the conditions, which are responsible for their origin, are studied by numerical simulation using spectral wave model.