

Ocean Surface Wind Estimation from Radar Satellites



Background

Surface wind is an essential parameter for ship navigation and the study of ocean. Satellite sensors such as synthetic aperture radar (SAR), microwave radiometer and radar scatterometer can produce information of ocean surface winds. SAR sensors are the ones that achieve finest spatial resolution independently of weather and environmental conditions.

The SAR instrument provides radar backscatter measurements influenced by surface roughness and terrain structure. The relation between surface winds and SAR measurements is determined by changes in backscatter of the ocean surface.

The project

Ocean surface wind speed can be retrieved from SAR data using empirical Geophysical Model Functions (GMFs) with a priori information of wind direction from external sources or wind streaks visible in SAR imagery. The widely used C-band (4-8 GHz) GMFs (e.g., CMOD5, CMOD5.N) are shown to be suitable for retrieving sea surface wind from C-band SAR sensors. However, new GMFs have been developed for SAR sensors at other microwave frequencies, such as L-band (0.5-1.5 GHz) and X-band (8-12 GHz).

Recently, much attention has been brought to future L-band SAR missions (e.g., TanDEM-L, SAOCOM-1A) for ocean surface monitoring. Within the next few years, there will be good availability of SAR data at multi-frequencies (L, C, and X-band). It is crucial to investigate the performance of the GMFs at different frequencies.

The goal of this master project is: 1) to implement a wind speed retrieval algorithm based on the L-band GMF (using ALOS-2 data); 2) to compare the results with that from the C-band and X-band GMF and analyze the difference under different weather conditions.

It will be a perfect project for students who want to get into radar remote sensing applications.

Prerequisites

Programming skills are required (Python or MATLAB). Successful completion of “Radar systems and application” is an advantage but not required. A broad interest in oceanography and remote sensing is preferable.

Supervisors

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