Advances on surface wind retrieval with SAR data
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I. Introduction
Wind on the oceans is one of the main parameters differing the state of the seas generating waves and driving currents. Maps of wind fields with large area coverage are invaluable for many applications. However, the measurement of wind vectors over such large areas gives valuable information for a wide range of applications. For example, one can mention the improvement of the performance of marine radar wind systems, drift estimates of oil spills, ship routes, weather forecasting, analysis and validation of numerical weather models (NWM), meso-operations, calculation of fuel consumption, and wind energy mapping.

II. Motivation
Wind directions derived from Synthetic Aperture Radar (SAR) images assumes certain resolutions at smaller scales than most other globally available surface wind sources. However, few studies have been devoted to the investigation of the accuracy of SAR derived wind directions at different scales and how they compare with other wind data. These issues are investigated here with an algorithm for retrieval of SAR derived wind directions at various scales and a quality assessment between the retrievals and wind data from in situ measurements and a scatterometer sensor.

III. Wind algorithm Implementation
The approach for wind direction retrieval developed in this study is based on the LG model method as proposed in [1]. An algorithm for retrieving wind direction coincident with SAR wind vector data, the methodology is reviewed in the literature. The sensitivity of the algorithm to the wind vector data and the wind vector directions is reviewed in this section. The proposed method has been implemented with an algorithm for wind direction retrieval developed in this study is based on the LG model method as proposed in [1]. An algorithm for retrieving wind direction coincident with SAR wind vector data, the method has been implemented. Moreover, new methods for finding the dominating gradient direction, the combination of parameters used to determine a filter for features not related to wind, and backscatter normalization have been included. The retrieved wind algorithm is related to other similar methods, and the wind vector fields for retrievals at smaller scales and high resolution therefore give valuable information for a wide range of applications. For example, one can mention the improvement of the performance of marine radar wind systems, drift estimates of oil spills, ship routes, weather forecasting, analysis and validation of numerical weather models (NWM), meso-operations, calculation of fuel consumption, and wind energy mapping.

IV. Regularization of wind direction

Fig. 1: Diagram of the wind retrieval algorithm. Level 1 C-band SAR data are provided as input. The algorithm identifies mesoscale structures, footprints, wind direction and wind speed retrieval and performs 2D interpolation to produce high-resolution wind vectors. The retrieval algorithm is reviewed in the literature. The sensitivity of the algorithm to the wind vector data is reviewed in this section. The proposed method has been implemented with an algorithm for wind direction retrieval developed in this study is based on the LG model method as proposed in [1]. An algorithm for retrieving wind direction coincident with SAR wind vector data, the method has been implemented. Moreover, new methods for finding the dominating gradient direction, the combination of parameters used to determine a filter for features not related to wind, and backscatter normalization have been included. The retrieved wind algorithm is related to other similar methods, and the wind vector fields for retrievals at smaller scales and high resolution therefore give valuable information for a wide range of applications. For example, one can mention the improvement of the performance of marine radar wind systems, drift estimates of oil spills, ship routes, weather forecasting, analysis and validation of numerical weather models (NWM), meso-operations, calculation of fuel consumption, and wind energy mapping.

V. Examples of wind retrievals with ASAR data vs. in-situ, ASCAT and GFDS model wind data

VI. SAR retrievals vs. in-situ data

VII. SAR retrievals vs. ASCAT data

VIII. Conclusions
• The wind direction retrieval implementation here is based on the algorithm for measuring wind directions at different scales and how they compare with other wind data. These issues are investigated here with an algorithm for retrieval of SAR derived wind directions at various scales and a quality assessment between the retrievals and wind data from in situ measurements and a scatterometer sensor.

Table 1: Statistical comparison of SAR wind retrievals with offshore in-situ data from the UK Meteor Office

Table 2: Statistical comparison of SAR wind retrievals with ASCAT wind data from the UK Meteor Office

References

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