Reduction of uncertainty of marine wind fields for ocean response modeling by utilizing the QuikSCAT dataset

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The accuracy of marine surface wind fields has been limited intrinsically by the poor coverage and accuracy of in-situ data. Therefore, ocean response model hindcast studies for climate assessment have been forced to either tolerate use of wind fields with bias and poor resolution of the high energy cores of tropical cyclones and intense extratropical cyclones or adopt time consuming interventional kinematic analysis techniques for wind field preparation. While earlier scatterometer marine surface wind data sets from the SEASAT (SASS), ADEOS (NSCAT) and ERS (SCAT) missions demonstrated the promise of such data to the routine production of high quality marine wind fields, the continuous four+ year data base from the SeaWinds instrument on QuikSCAT provides the opportunity not only to produce a very high quality multi-year global marine wind data set, but a means to identify and correct at least the systematic component of errors that continue to characterize the marine wind fields of even the most recent historical atmospheric "reanalysis" project data sets. In this paper we first review the latest evidence on the accuracy and suitability for wind field analysis of wind measurements from in-situ (ships, buoys, platforms, coastal stations) and remotely sensed (satellite altimeters and scatterometers) wind data sources. We present new results on the accuracy and upper limit of the dynamic range of SeaWinds data based on comparisons of SeaWinds with a large number of collocated measurements made by anemometers with "top of derrick" exposure on offshore platforms in the North Sea and Norwegian Sea. Next, we describe how the SeaWinds measurements may be used to identify and minimize systematic errors in the reanalysis products. Finally, we describe an optimum method for wind field analysis which combines wind measurements, after they are properly adjusted for reference height, boundary layer stratification, marine exposure and averaging interval, reanalysis and NWP products, after minimization of systematic errors in same using the QuikSCAT data base, and (where tolerable) analyst expertise, in an interactive objective kinematic analysis (IOKA) approach. Examples are given of the maximum skill achievable in ocean response modeling when such models are forced by accurate winds.