QUALITY OF QUIKSCAT GRIDDED WINDS OVER THE BAY OF BENGAL

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Three QuikSCAT gridded datasets from May to August 2001 for 00 UTC and 12 UTC are compared over the Bay of Bengal (BB). This period is characterized by strong and highly persistent southwest surface winds, with occasional 6-10 day spans of low winds known as breaks in the monsoon. The first dataset is based on swath QuikSCAT wind estimates produced by Remote Sensing Systems (RSS) (*QuikSCAT*, 2001). These surface wind components are spatially interpolated to a 1°x1° latitude-longitude grid. Interpolation weights are inversely proportional to the distance between observation cell and grid point. An influence radius of 0.5° is chosen. Only data within ±45-min of 00 UTC or 12 UTC are used. This will be the reference dataset because observed winds are only modified by spatial interpolation within the satellite swath, with no temporal or gap filling.

The second wind dataset is a gridded field converted from objectively derived surface pseudostresses, which are produced online by the Center for Ocean-Atmospheric Prediction Studies at the Florida State University (FSU). The spatial-temporal interpolation is based on the minimization of a cost function with a background wind field representing an 8-day temporal average (*Pegion et al.*, 2000). This is a relatively complex and time-consuming procedure. Spatial resolution of this archive is 1°x1° and fields are available every 6 h. We will call this the “FSU” dataset.

A simpler algorithm for QuikSCAT wind gridding is used by Liu, Tang, and Polito (1998) at NASA’s Jet Propulsion Laboratory (JPL). Components of the QuikSCAT wind are objectively interpolated both in time and space to a 0.5°x0.5° regular grid using the method of successive corrections. This global surface winds archive has 12-h resolution and is also available online. We will call this the “JPL” dataset.

Scatterplots for northeast Sri Lanka exhibit noticeable diurnal variability in RSS wind speed (Figure 1a). The wind speed at 12 UTC (6 P.M. local time) is consistently lower than the speed at 00 UTC (6 A.M. local time) having the correlation coefficient (R_{12}) of 0.293. RSS wind sets lagged by 24 h have a higher R_{24} of = 0.784. This variability between 00 UTC and 12 UTC winds is not manifested over the central BB. Strong correlations exists both for 12-h (R_{12} = 0.803) and 24-h (R_{24} = 0.861) lags, as shown in Figure 1b.

The smoothing effect of temporal interpolation for JPL winds is evident in Figure 1c and 1d (as an apparent reduction of points scatter) for all regions. JPL winds show in general lower variance and higher correlation for 12-h time lags. A major change of R_{12} from 0.293 (RSS winds) to 0.542 (JPL winds) is observed over northeast Sri Lanka. Spatial distributions of R_{12} and R_{24} also show this difference off Sri Lanka (Figure 2), as well as generally higher correlations for JPL data compared to RSS data. FSU fields also exhibit similar smoothing features (not shown). We can conclude therefore that the spatial-temporal interpolation procedures used to create gridded QuikSCAT winds in the BB alter the original properties of QuikSCAT winds.

To further quantify the impact of diurnal variability on the quality of gridded fields, suppose that temporal interpolation procedures do not take into account the weak relationship between current and 12-h old winds in northeast Sri Lanka, and therefore the weight function is monotonically decaying with time. JPL and FSU winds interpolated with such weights would be generally underestimated at 00 UTC and overestimated at 12 UTC compared with the RSS reference values. Wind speed differences (RSS-JPL) and (RSS-FSU) are used here as a measure of this bias. The difference should be mostly positive at 00 UTC and mostly negative at 12 UTC if the above assumptions about the weight function are valid.

Indeed, histograms of these differences for northeast Sri Lanka (Figure 3a and 3c) show a tendency for positive values prevailing at 00 UTC and for negative values at 12 UTC. Note that this systematic shift between 00 UTC and 12 UTC in the distribution is not observed over the central BB (Figure 3b and 3d). This tendency is also manifested in JPL and FSU long-term mean fields for Northeast Sri Lanka, which show negative bias at 12 UTC and positive bias at 00 UTC (Figures not shown). The magnitude of this bias exceeds 2 ms $^{-1}$ at 00 UTC and 12 UTC.

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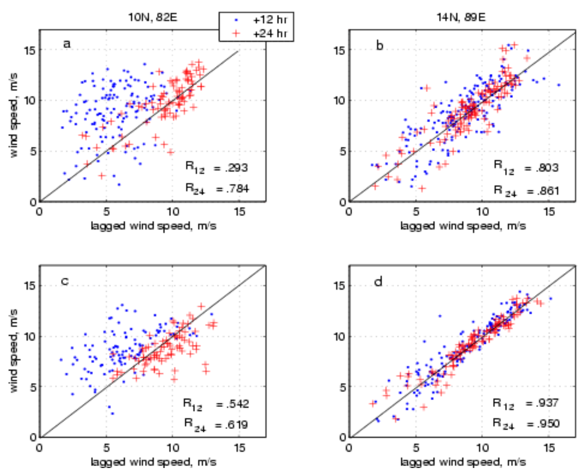

Figure 1. Scatterplots of the QuikSCAT wind speed for 12-h and 24-h time lag for Sri Lanka (a, c) and the central BB (b, d). R_{12} and R_{24} are correlation coefficients of the wind speed for 12-h and 24-h lags. The top (a,b) figures are for raw QuikSCAT data (RSS), and the bottom figures (c, d) are for gridded JPL data.

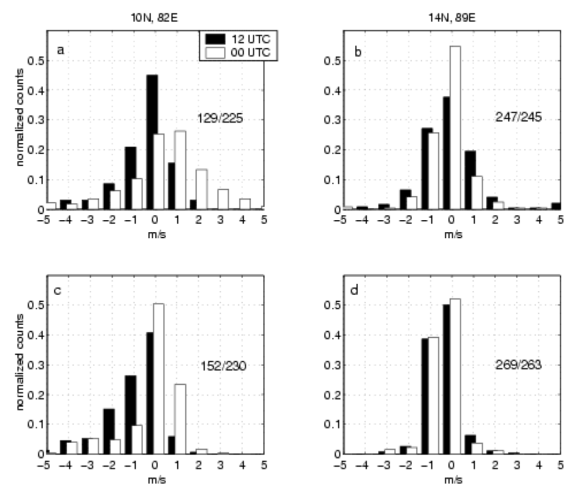

Figure 3. Histograms of wind speed difference between RSS and JPL datasets (a, b), and between RSS and FSU datasets (c, d). Counts in each bin are normalized by total number of observations, shown by numerator for 12 UTC and by denominator for 00 UTC.

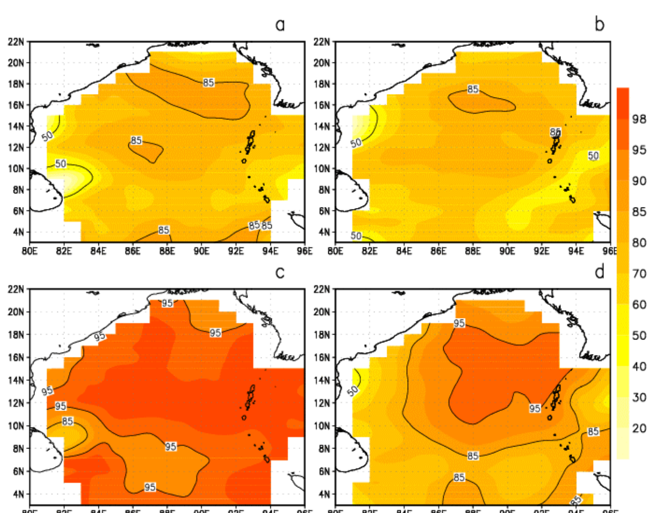

Figure 2. Geographical distribution of autocorrelation coefficients for the QuikSCAT wind speed at 12-h (a, c) and 24-h (b, d) time lags for RSS (a, b) and JPL (c, d) datasets. Correlation coefficients are multiplied by 100. Values of R_{12} and R_{24} are elevated for the JPL dataset compared with RRD winds. Note that low R_{12} values (< 0.5) for RSS winds (a) is concentrated in northeast Sri Lanka. This implies that wind speed interpolation from 00 UTC and 12 UTC and vice versa is not statistically justified in regions subject to diurnal wind variations such as Sri Lanka.