Introduction

Direct observations of near-surface winds are crucial for the calibration and validation of estimated winds by satellite-based platforms like scatterometers. For more than 18 years, the Woods Hole Oceanographic Institution (WHOI) operates several moored buoys in the Atlantic (NTAS, SPURS1) and Pacific Ocean (Stratus, WHOTS, SPURS2). These buoys are well equipped with redundant meteorological observations systems that sample all wind-relevant parameters in 1-min resolution. This unique dataset is used to investigate the buoy performance and assess measurement errors, in particular flow distortion. Those errors are then related to satellite-based scatterometer observations of winds, which are different from direct buoy observations.

Data

Buoy data: time series of wind speed and direction (port and starboard), air temperature, humidity, ocean currents, and SST >> Equivalent neutral winds (two parameterizations: LKB (Liu et al., 1979) and COARE3.0 (Fairall et al., 2003)) >> averaged 25-km equivalent buoy winds (Lin et al., 2015)

Scatterometer: QuikSCAT and ASCAT daily gridded (0.25°) fields with two observ/ per day (from Remote Sensing Systems [www.rems.com])

Buoy vs. scatterometer

- Scatterometer grid point closest to buoy site
- Buoy data within 30 seconds to satellite overflight
- 48-pt RMS (roughly a month)

Flow Distortion

80% of all buoy deployments show similar structure, eventually 23 out of 45 deployments are used

A similar structure is even observed, when either the starboard or the port sensor is replaced with a satellite estimate

After application of the estimated flow distortion error, the systematic error is reduced and the relative difference is below 2%

Conclusion

A RMS of 0.5-0.7 m/s is observed when comparing wind speeds at WHOI buoys with scatterometers. A detailed investigation of more than 18 years of wind observations at the buoys was performed. Flow distortion error of ~5% relative wind speed difference are the main result, indicating the importance of the position of the sensor on the buoy. Generally, the flow distortion is responsible for ~30% of the total RMS. Compared to scatterometer observations, the flow distortion still can be observed. This systematic error can be removed from the data. After correction for the flow distortion, random errors remain, e.g. averaging errors from the colocation of scatterometer and a “wrong” viscosity correction.

References