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OceanObs19 Summary of Remote Sensing for Ocean Surface Winds and Stress

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This is a summary of the OceanObs19 white paper on remotely sensed winds and stress. The strengths and weaknesses of different types of remotely sensed winds are discussed, along with the current capabilities for remotely sensing winds and stress. Community needs are summarized, including operational applications and discovery. These needs are summarized in terms of spatial and temporal resolution associated with the phenomena related to these needs. This sets the stage for the technical capabilities of future missions. There are clearly multiple approaches that could be taken to achieve large subsets of these needs. Suggested future missions are briefly mentioned in the context of these needs. Needs for constellations are addressed as well as needs for individual satellites.

There is broad agreement across many oceanographic communities on the improvements needed for future wind sensors. These recommendations include:

1. Enhanced temporal coverage through an international virtual constellation to follow the fast, small transient mesoscales;
2. Improved spatial resolution to better address mesoscale variability, improve coastal sampling, and make visible the areas between rain bands in tropical cyclones;
3. Instrument intercalibration for extreme winds (strong and weak);
4. Improved understanding of in situ and SFMR calibration at extreme winds to be used in the above calibration;
5. In situ wind references (including surface currents) to calibrate and intercalibrate satellite winds; and
6. Local bias correction in NWP to follow the BLUE paradigm and improve gridded products;

The accuracy requirements for surface winds and stress are highly dependent on the phenomena and the spatial/temporal scales of the variability associated with the phenomena. These complications are summarized in a figure. There are trade-offs is resolution and random errors that can be used to optimize different types of technologies for specific applications. Currently, both bias and systematic errors are important at 25 km and at finer scales random errors will dominate on shorter timescales. Some of the smaller-scale processes (physical-biological interactions) are influenced more by horizontal shear than by the magnitude of the wind or stress, and therefore have very little sensitivity to systematic errors.