Cooperative Institute for Oceanographic Satellite Studies (CIOSS)

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CIOSS Research Themes:

1. Satellite Sensors and Techniques
2. Ocean-Atmosphere Fields and Fluxes
3. Ocean-Atmosphere Models and Data-Assimilation
4. Ocean-Atmosphere Analyses

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CIOSS Theme 1: Satellite Sensors and Techniques

Coastal Ocean Applications and Science Team (COAST)

M. Abbott, C. Davis, R. Letelier, P. Strutton

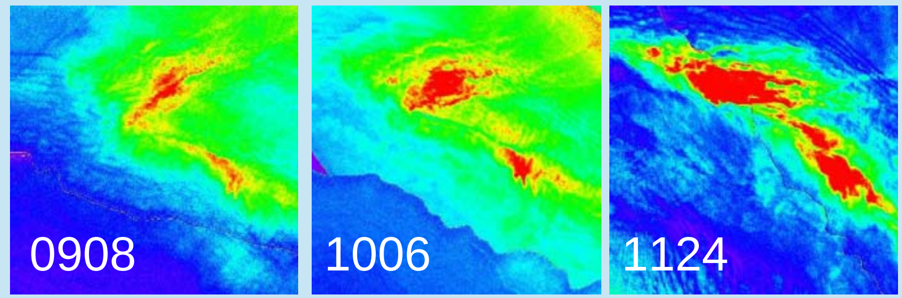
Airborne Hyperspectral Imagery of a Harmful Algal Bloom (HAB) to evaluate the temporal, spectral and spatial requirements for imaging the coastal ocean.

Recommendations:

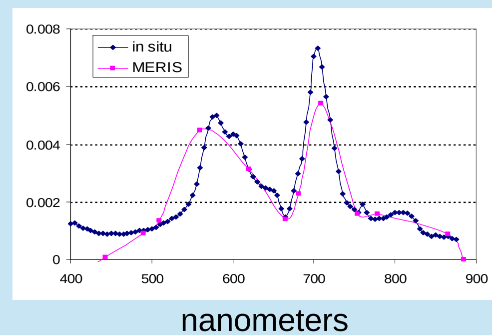
- **Spatial sampling 300 m with a goal of 100 m.**
- **Sampling frequency every 3 hours with a goal of hourly.**
- **MERIS channels with a goal of hyperspectral covering 380 to 1000 nm.**

Advised NOAA on HES-Coastal Waters imaging and Analysis of Alternatives.

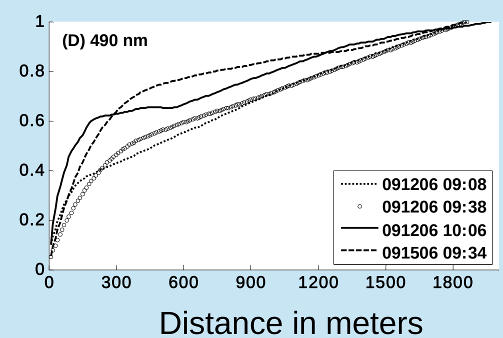
11/12/2006 Hourly changes in HAB (red area)



HAB spectral signature



Analysis of Spatial scales



CIOSS Theme 2: Ocean-Atmosphere Fields and Fluxes, Part 1

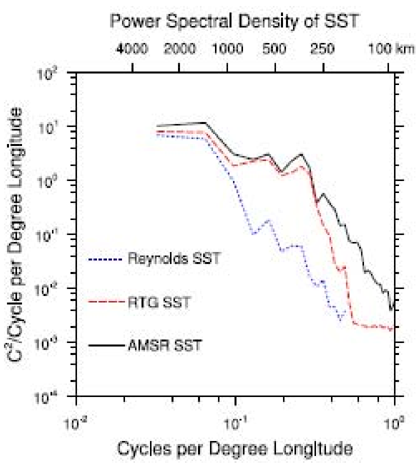
D. Chelton, Qingtao Song

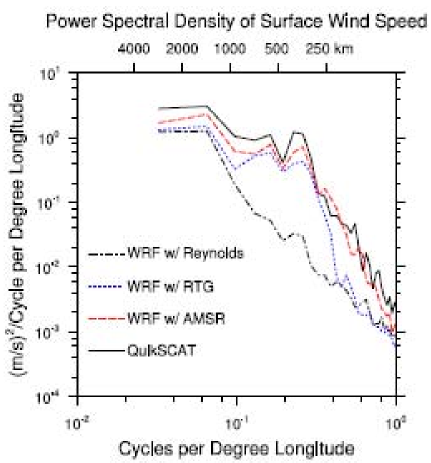
Conclusions from model simulations of surface wind speed response to SST in regions of strong SST fronts, e.g., the Agulhas Return Current Region where land influence is minimal:

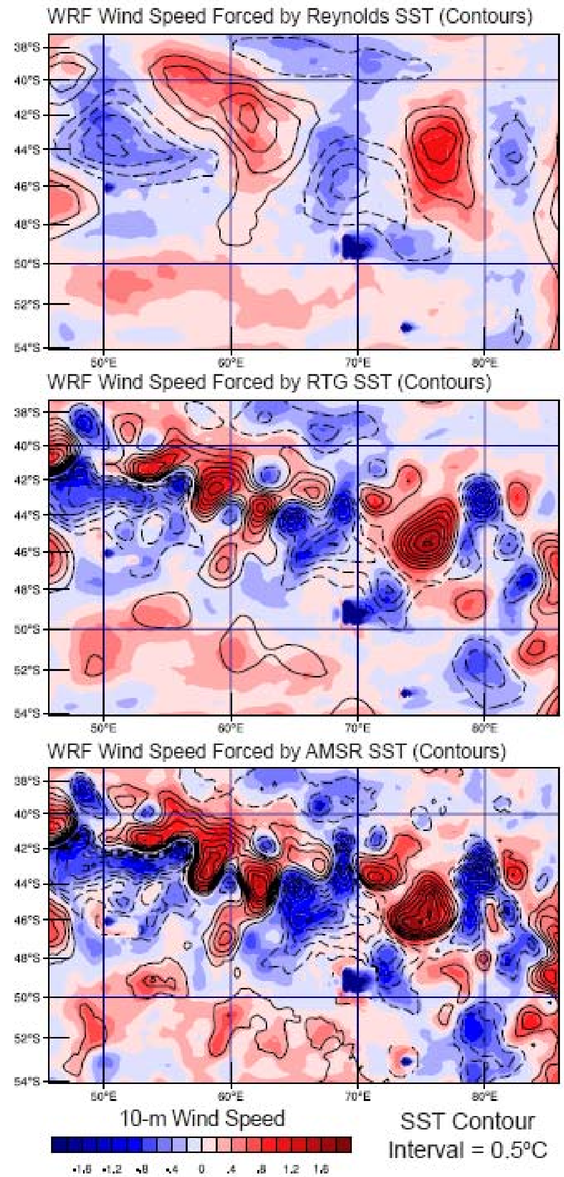
- *Surface wind fields from the NCEP Global Forecast System (GFS) model have much less energetic small-scale structure than QuikSCAT observations.*
- *Simulations with the Weather Research & Forecasting (WRF) model conclude that this is attributable to inadequate spatial resolution of the Reynolds SST fields that are used as the ocean surface boundary condition in the GFS model.*

Recommendations:

- *The resolution of GFS surface wind fields would be greatly improved by replacing the Reynolds SST boundary condition with the higher resolution NCEP Real-Time Global (RTG) SST fields, which are used in the NCEP North American Mesoscale (NAM) model and in the ECMWF model.*
- *Further improvements in the resolution of the SST boundary condition that are now available in the NCDC Daily OI SST analyses that include AMSR SST observations would result in even higher resolution surface wind fields on scales shorter than about 250 km.*







CIOSS Theme 2: Ocean-Atmosphere Fields and Fluxes, Part 2

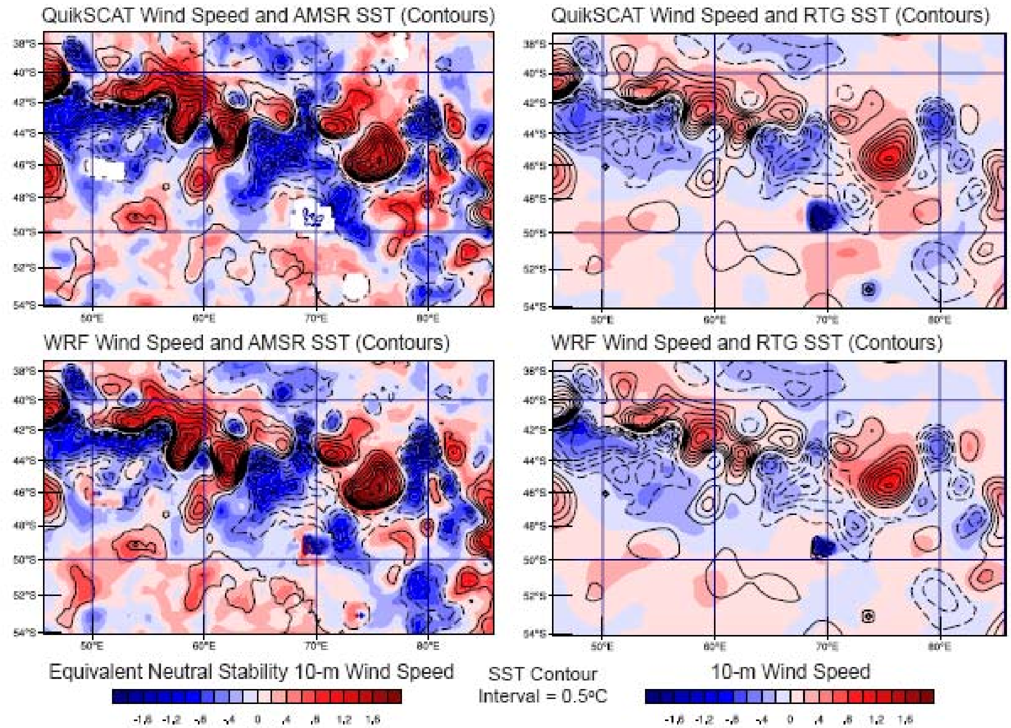
D. Chelton, Qingtao Song

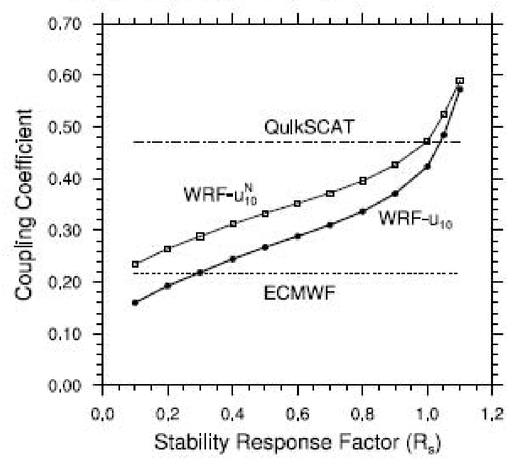
Conclusions from comparisons between model simulations and QuikSCAT observations of SST influence on surface winds in the Agulhas Return Current region where land influence is minimal:

- *The response of surface winds in the ECMWF model to SST forcing by the RTG SST fields is less than half as strong as the coupling observed from QuikSCAT.*
- *QuikSCAT winds are accurately reproduced by the Weather Research & Forecasting (WRF) model when the Grenier and Bretherton (2001) (GB01) dependence of vertical mixing on boundary layer stability is used.*
- *Sensitivity studies conclude that the WRF model reproduces the ECMWF model wind fields when vertical mixing is reduced to 30% of the GB01 parameterization, suggesting that vertical mixing dependence on stability in the ECMWF model is too weak by about a factor of 3.*

Recommendation:

- *The dependence of vertical mixing on boundary layer stability in the ECMWF model should be increased in order to reproduce the observed SST influence on surface winds more accurately.*
- *A similar change is likely needed for the NCEP GFS model, but this is difficult to ascertain because of the inadequate resolution of the Reynolds SST fields used as the surface boundary condition in the GFS model.*





The Grenier and Bretherton (2001) dependence of vertical mixing on boundary layer stability corresponds to a stability response factor of R_s=1.0.

CIOSS Theme 3: Ocean-Atmosphere Models and Data-Assimilation

G. Egbert, A. Kurapov, R. Samelson, E. Skyllingstad

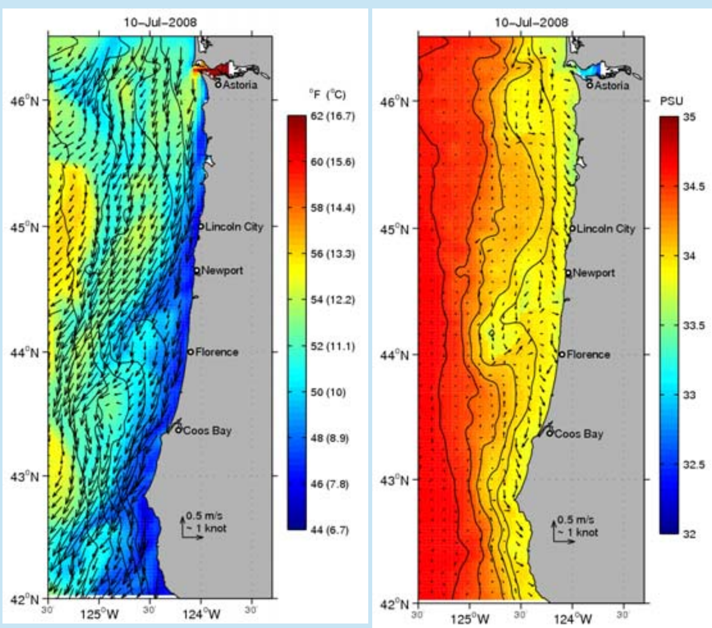
Results from two modeling projects are shown below. A real-time 48-hour forecast model is being run for the Oregon coast (left). A fully coupled (but idealized) Ocean-Atmosphere model is also being developed (right).

Pilot coastal ocean forecast system

http://www.orcoos.org

Surface currents and SST (left)

Bottom currents and salinity (proxy for dissolved oxygen) (right)



Model forced by NCEP (NAM) winds

Coupled ocean-atmosphere modeling in the coastal zone

Air-sea interaction during coastal upwelling can cause large local decreases in surface wind stress and heat fluxes over the band of cold, upwelled water next to the coast.