Trace Gas Fluxes in the Polar Seas: The Importance of Direct Observations and Improved Measurement Methods

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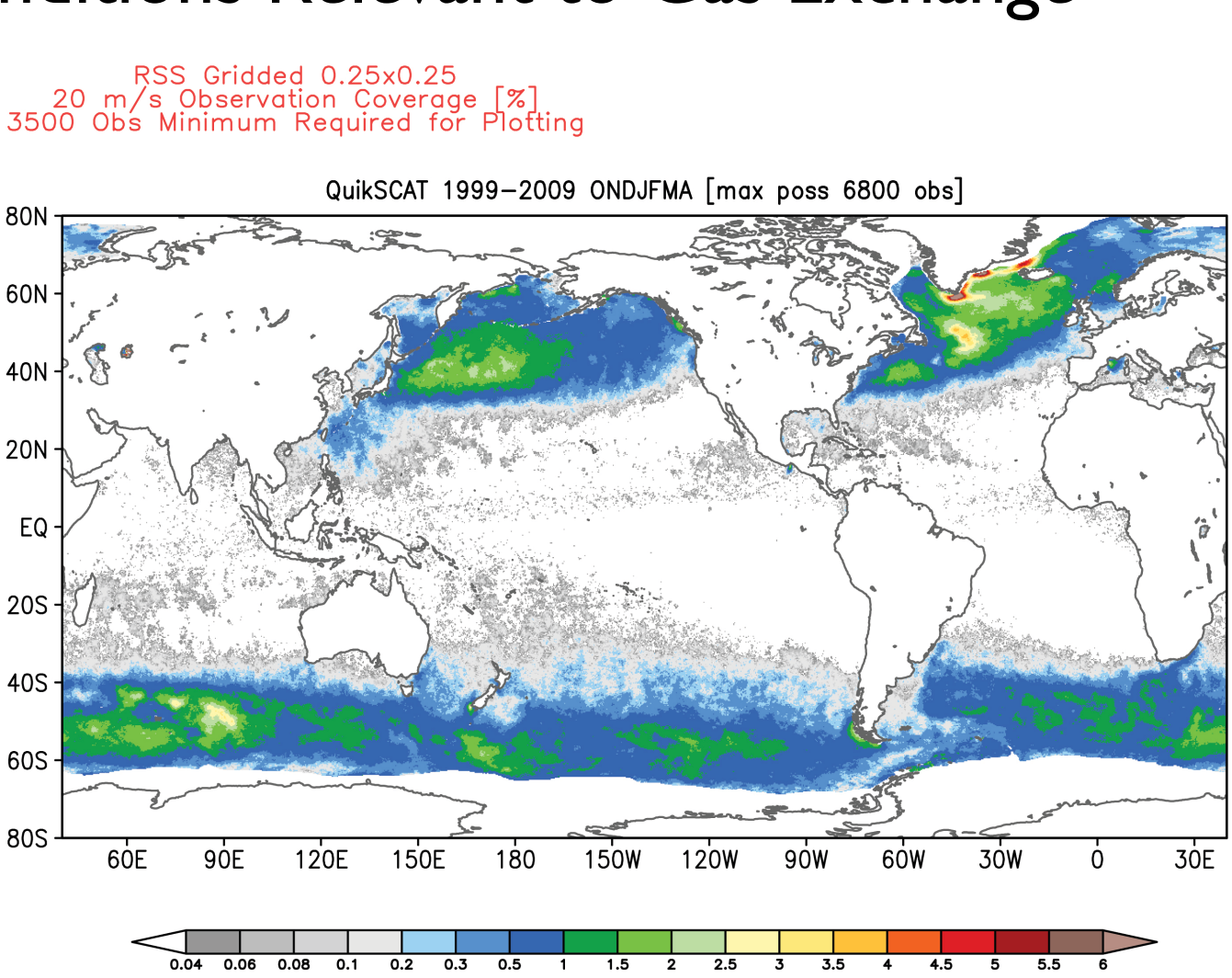
Polar Seas

Unique Conditions Relevant to Gas Exchange

- High winds
- Low SST
- Bio. Cycles
- Nat. Aerosols
- Sea Ice



Gas Transfer Modeling Issues

- Model representations of bubble-mediated gas exchange $k_{total} = k_v + k_b$
- Wind stress partitioning, sea state and the driving force for gas exchange

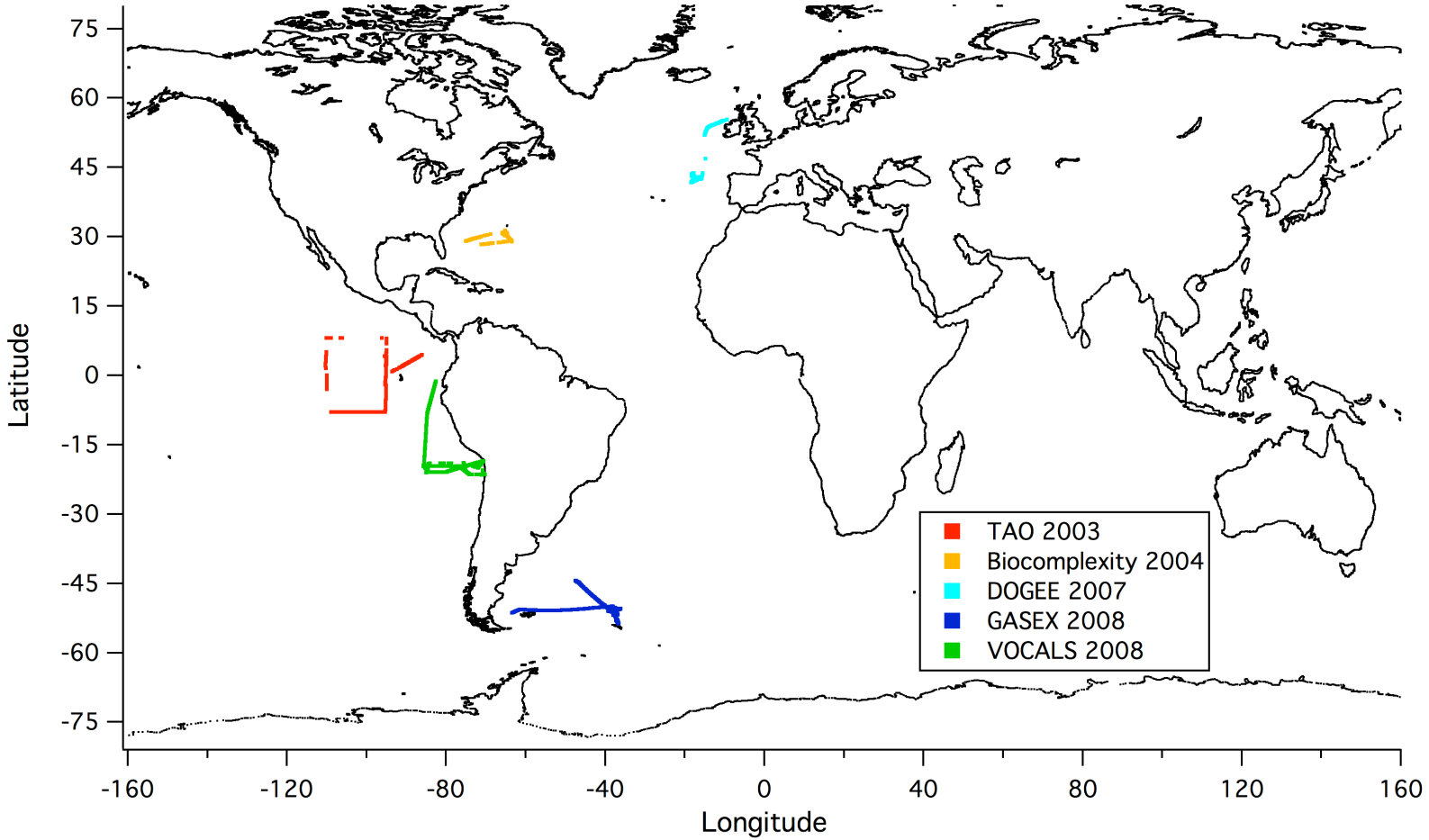
$$\tau_{total} = \tau_v + \tau_w$$

High latitudes present ideal conditions for observing these effects and developing refined model representations.

Measurement Challenges and New Developments

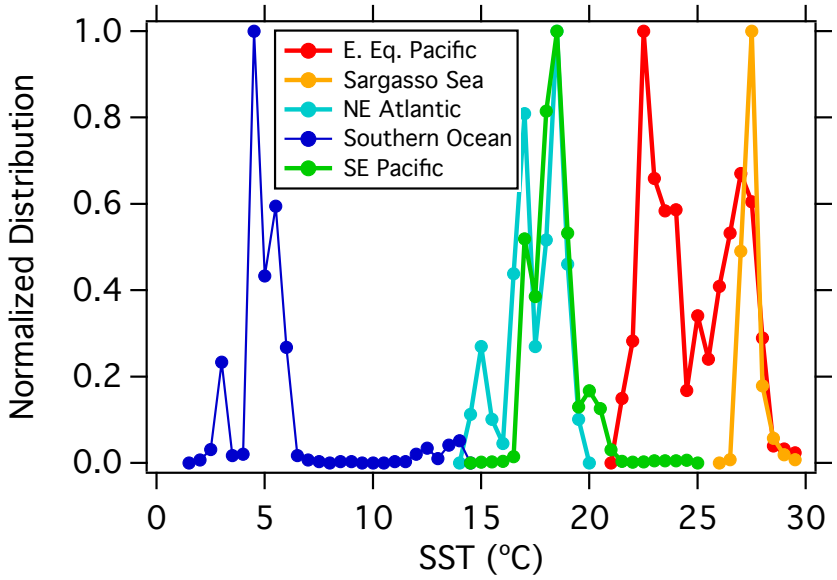
- DMS fluxes generally high quality.
- CO_2: water vapor and motion interferences, salt contamination of optics, "Webb effects" - corrections possible.
- New methods: CRDS for CO_2
- New techniques: other gases of widely different solubility: e.g. CO, acetone, SO_2, ozone

Field Projects: 2003-2008

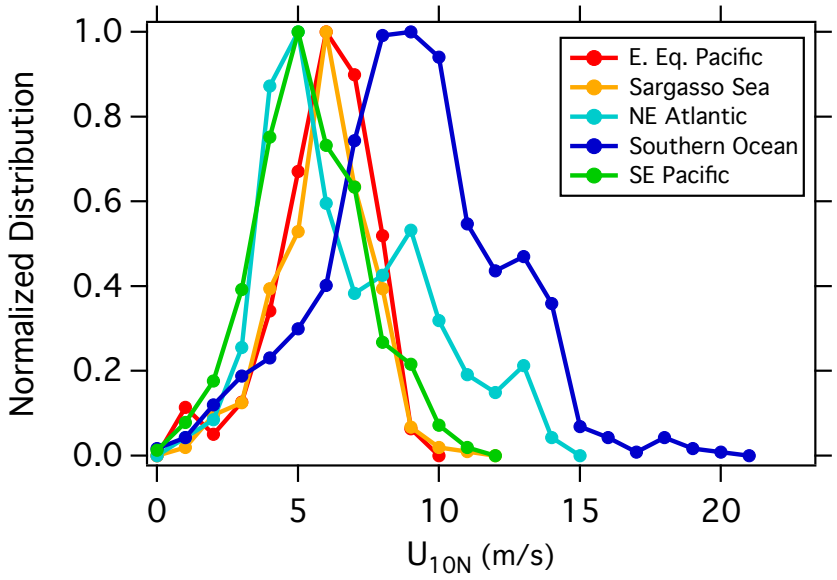


SST and Wind: All Projects

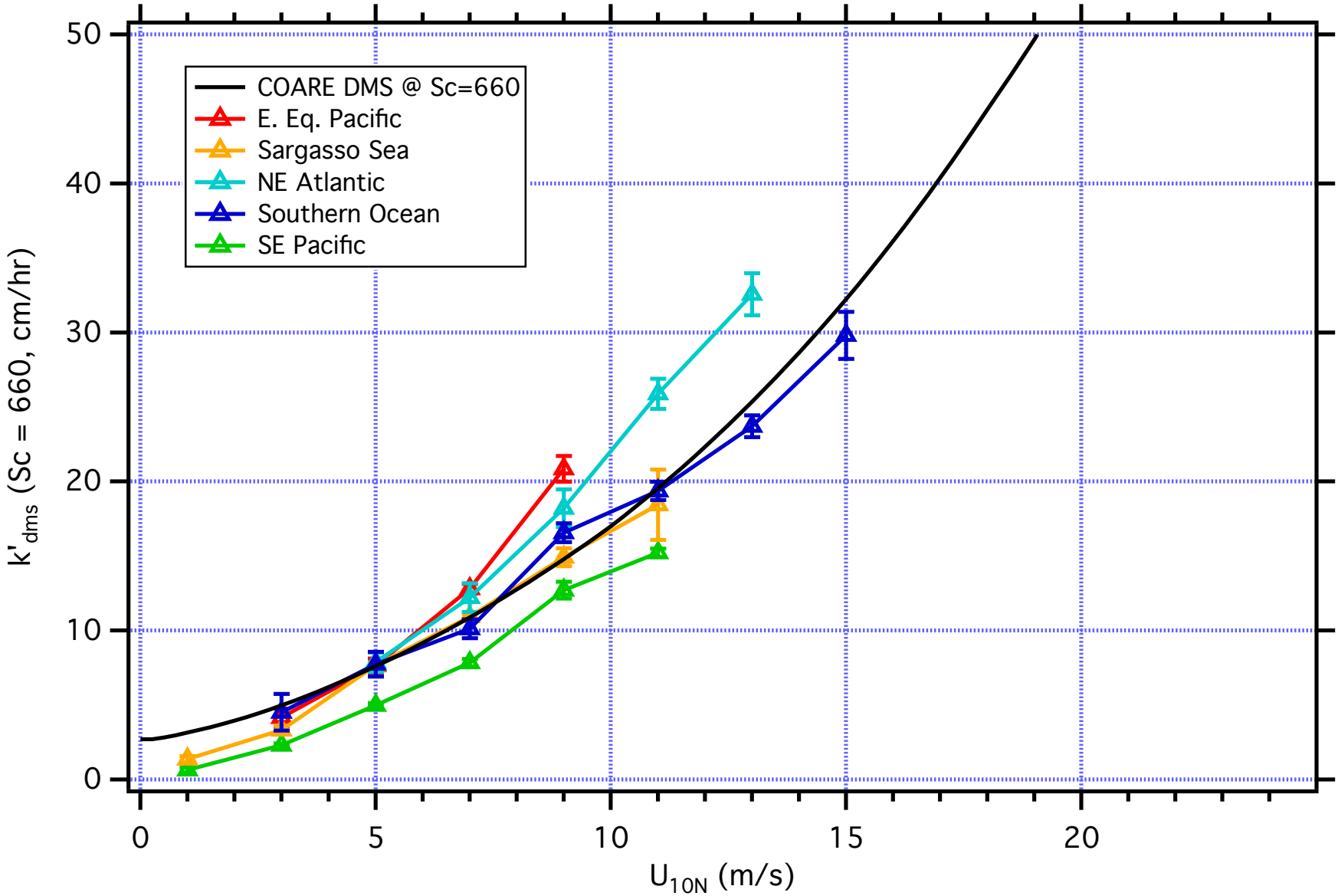
- SST observations over a wide range: 4°C to 27°C. GASEX is coldest.



- Bulk of data <10 m/s. Most high wind spd data from GASEX.



k_{dms} vs wind: 5 cruises



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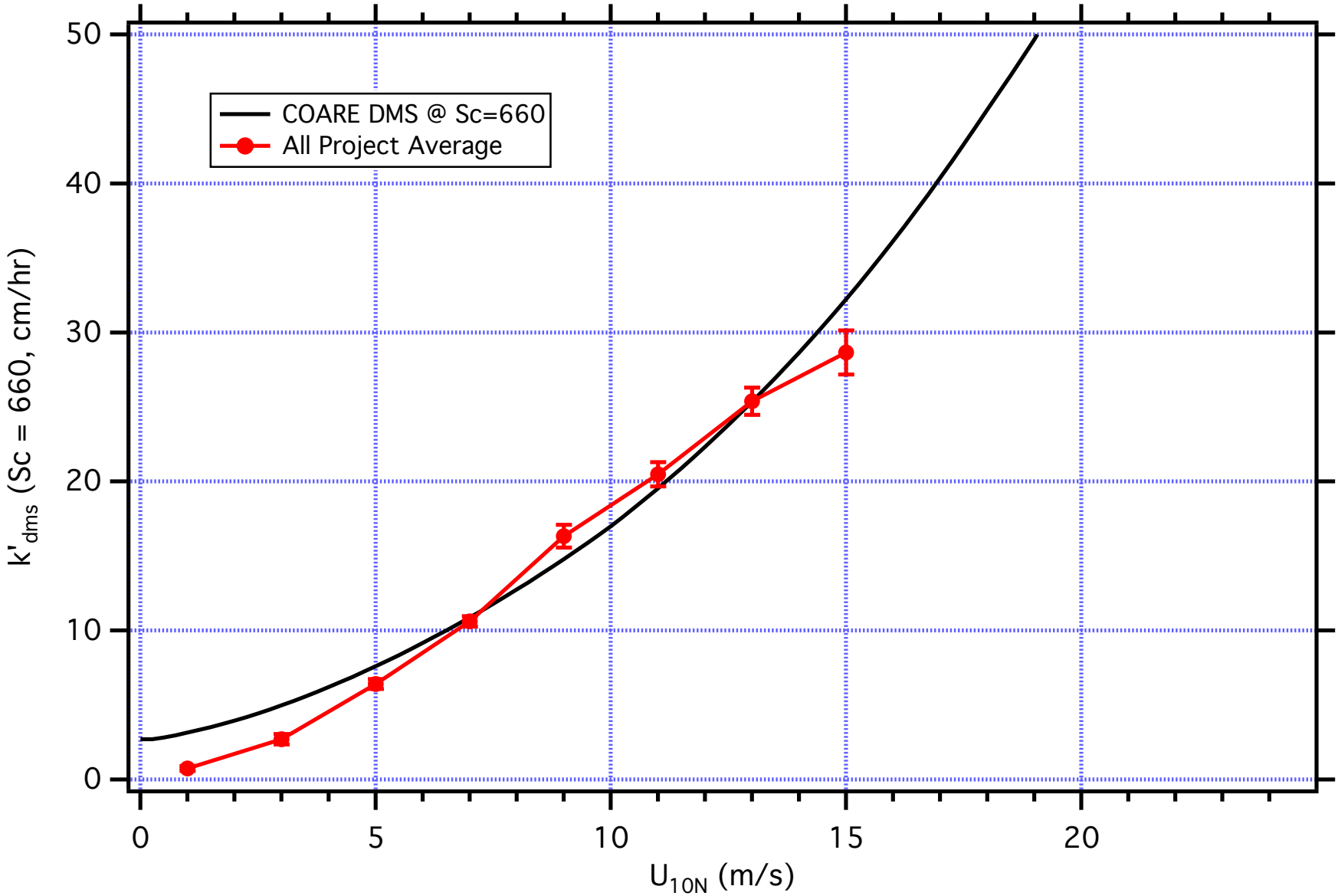
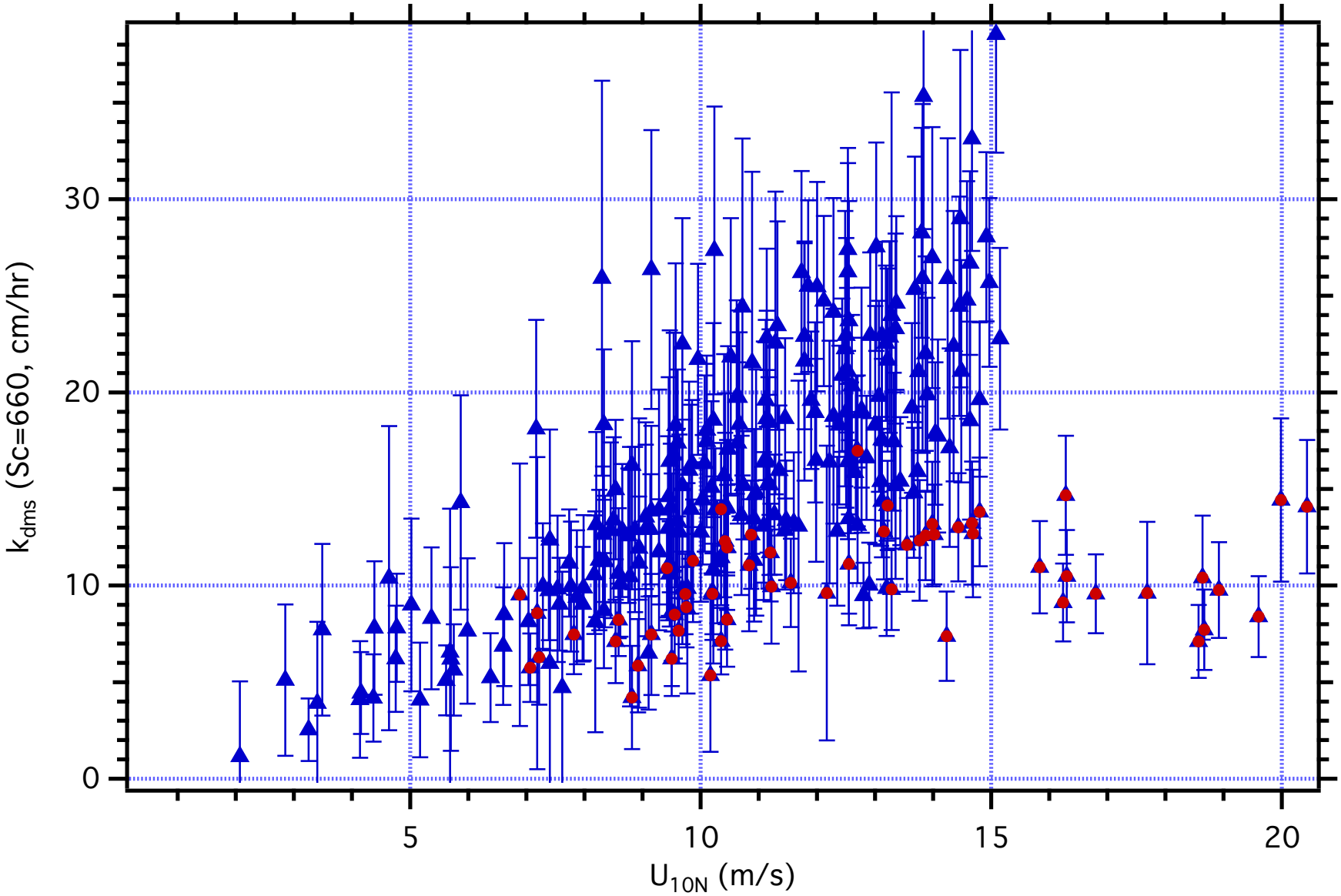
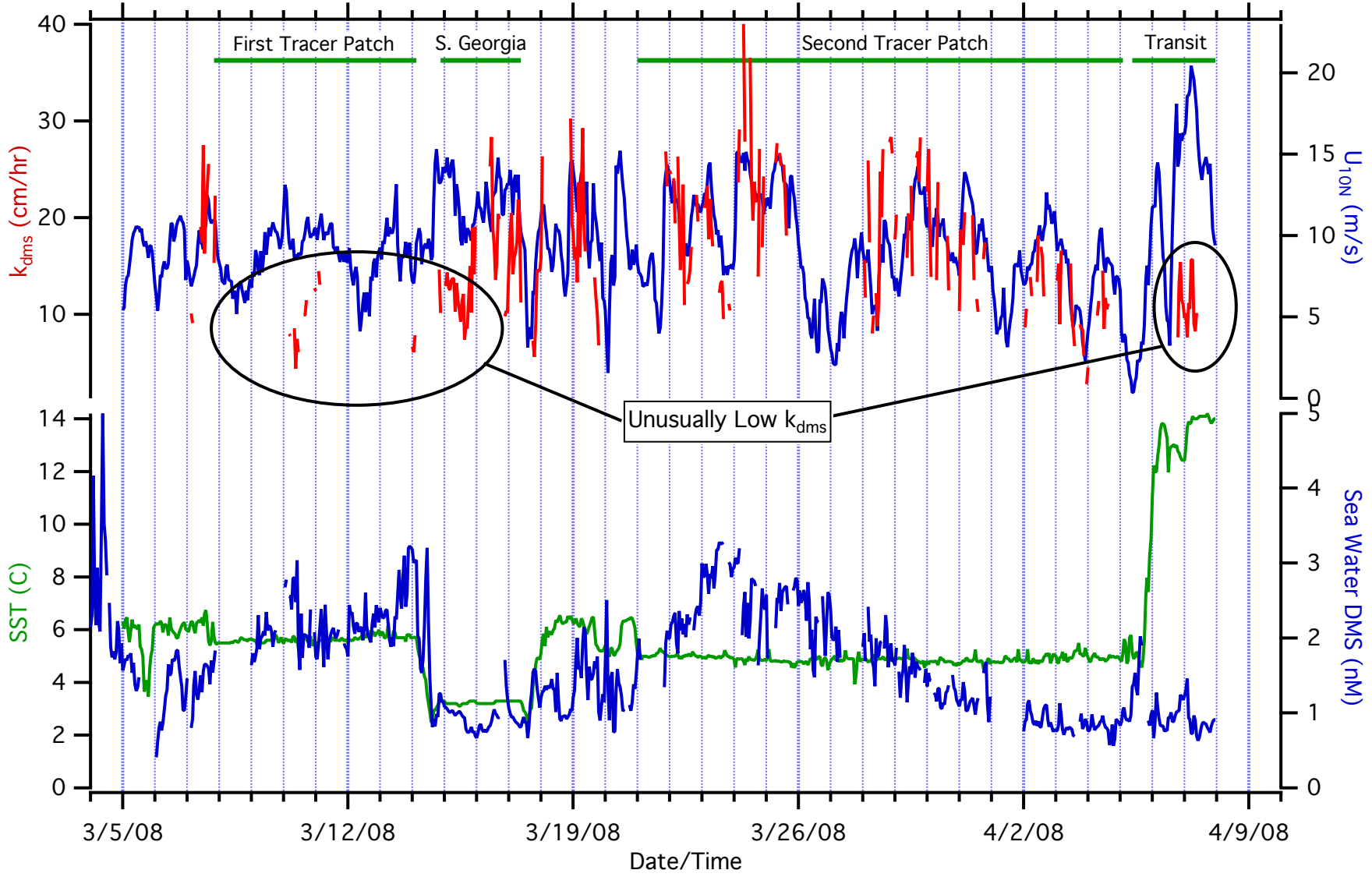


SO-GASEX: Hourly k_{dms}

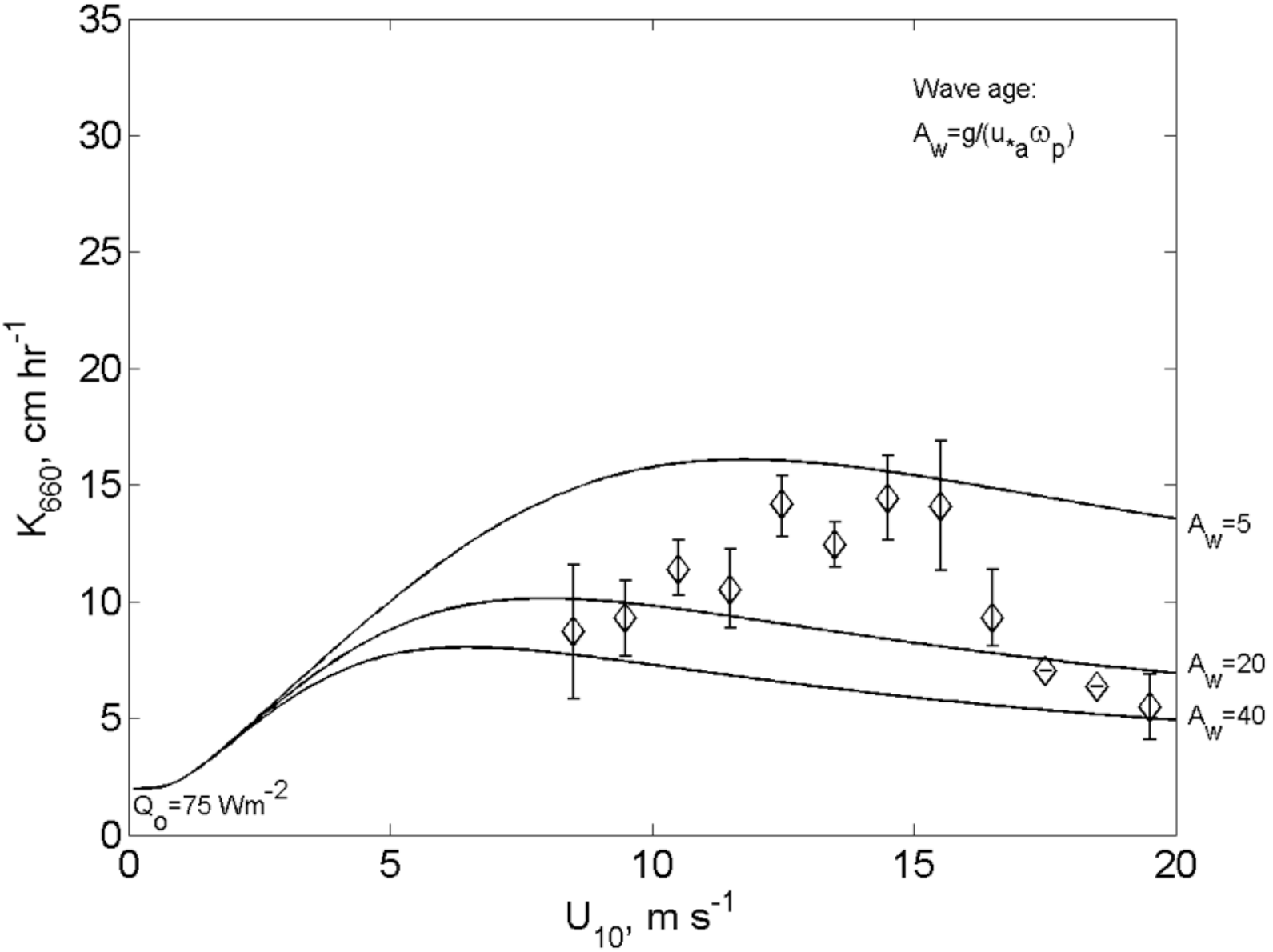
z/L < 0.05



SO-GASEX Time Series



Wave Age & Tangential Stress



k vs wind: S. Ocean