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Autonomous Wave Glider based Environmental Sampling in Support of Electromagnetic Maneuver Warfare

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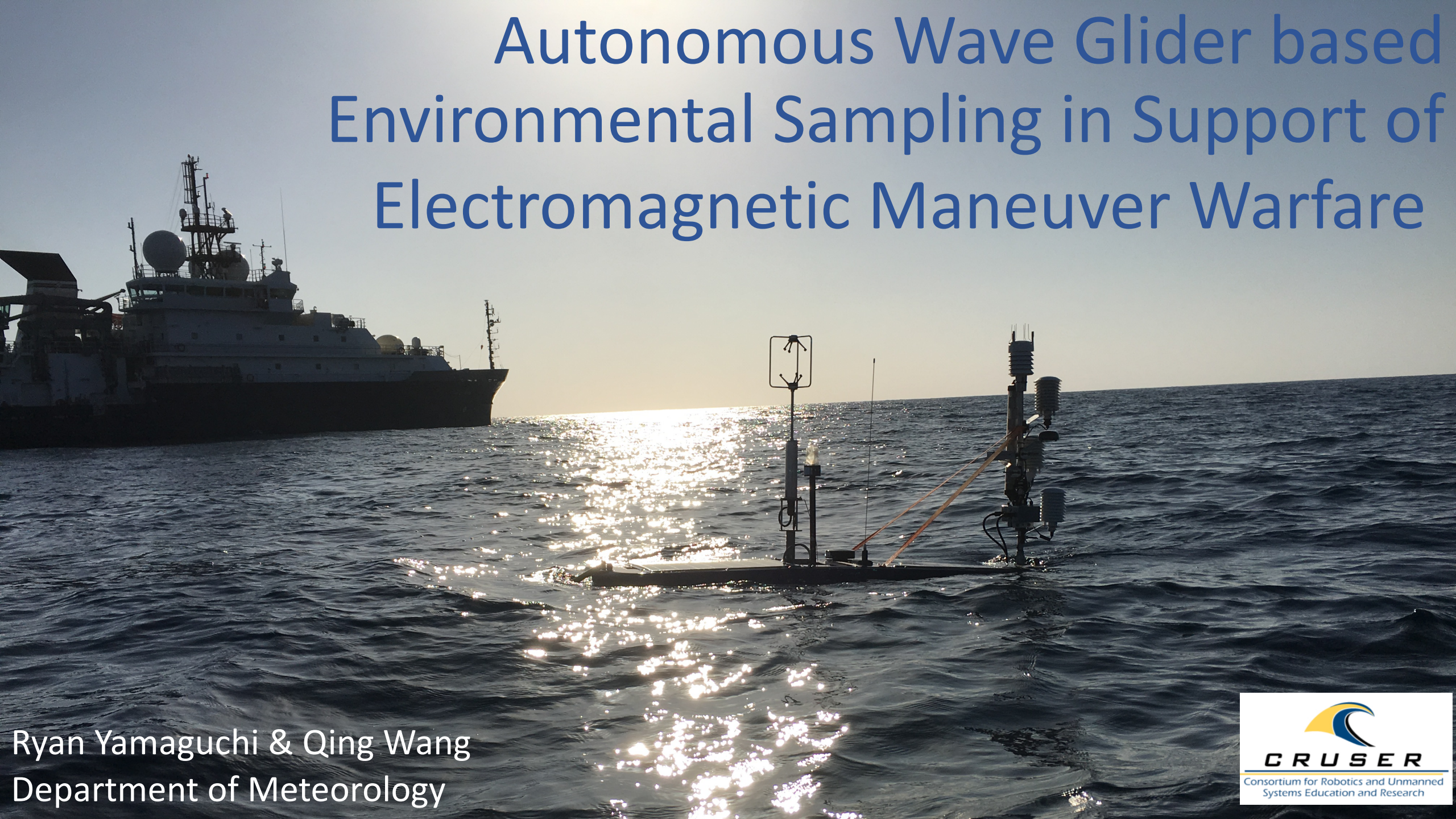
Autonomous Wave Glider based Environmental Sampling in Support of Electromagnetic Maneuver Warfare



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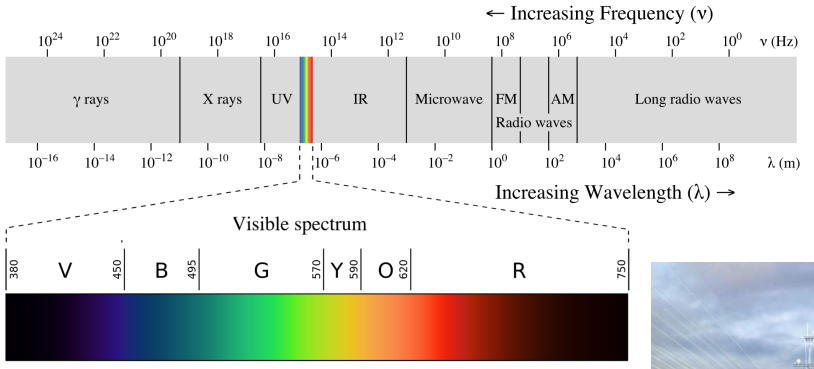
Electromagnetic Maneuver Warfare

Electromagnetic spectrum (EMS) is congested and needs to be used effectively to maintain dominance in battlespace environment.

Many surveillance, communication, and weapon systems are EM emitters.

The atmosphere is major contributor to anomalous propagation behaviors.

Cannot calibrate and compensate EM emitters with simple, standard atmosphere characterization.



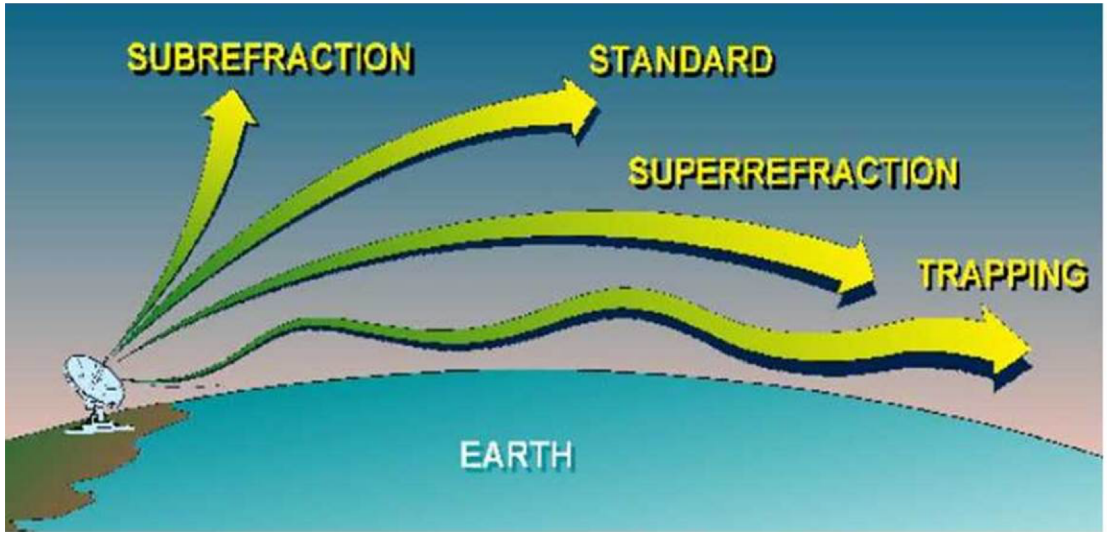
Atmospheric Effects

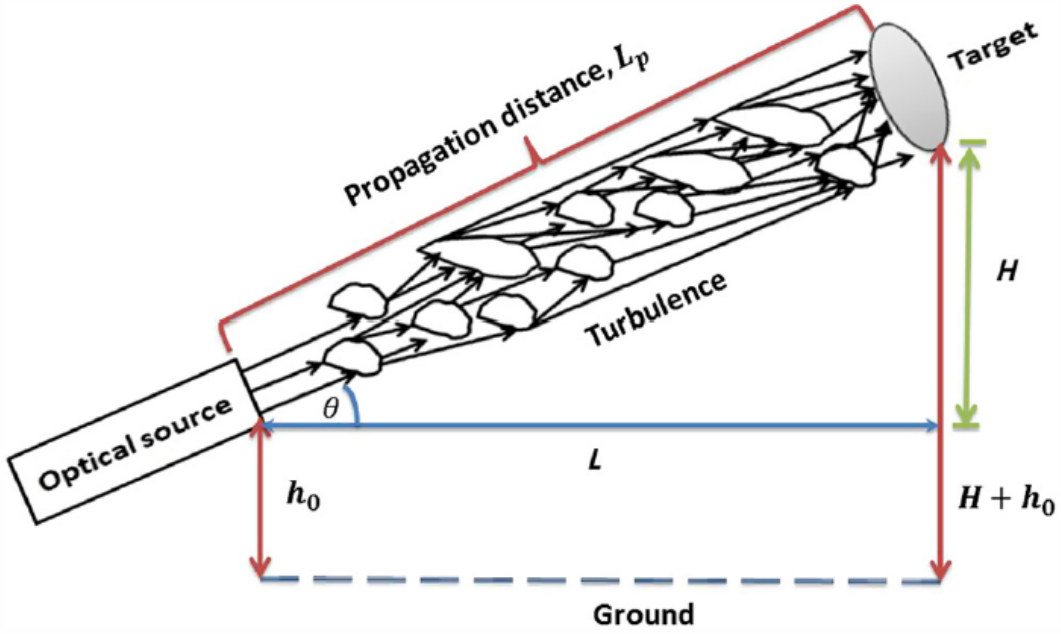
Strong temperature and humidity gradients and heterogeneities exist in atmospheric marine boundary layer (surface – 500m).

These result in index of refraction vertical gradients and fluctuations.

They affect EM/EO propagation by attenuation, RF ducts, and scintillation processes.

Combine with surface layer and propagation models to understand and forecast EM/EO phenomena in atmosphere.



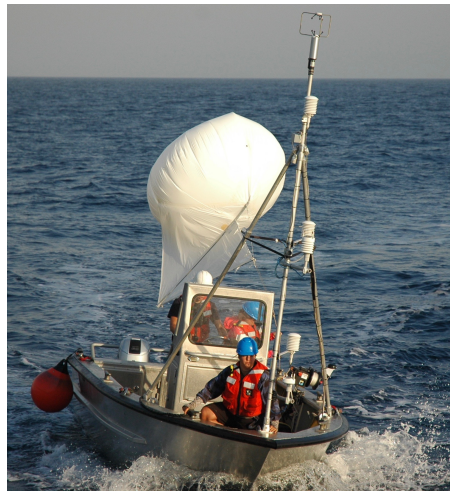


Marine Meteorological Measurements

Ships

Advantage: covers spatial coverage, maneuverable, handle large SWaP

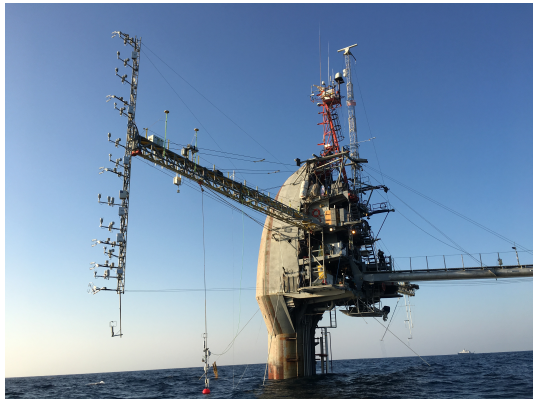
Disadvantage: expensive, flow distortions



Buoys

Advantage: long time series, relatively low manpower needs.

Disadvantage: expensive to deploy, low SWaP instruments needed.



Aircraft

Advantage: cover large spatial region in small time, maneuverable, handle large SWaP

Disadvantage: expensive, limited on-station time.

Liquid Robotics WaveGlider SV2

Navy nomenclature: Sensor Hosting Autonomous Remote Craft (SHARC).

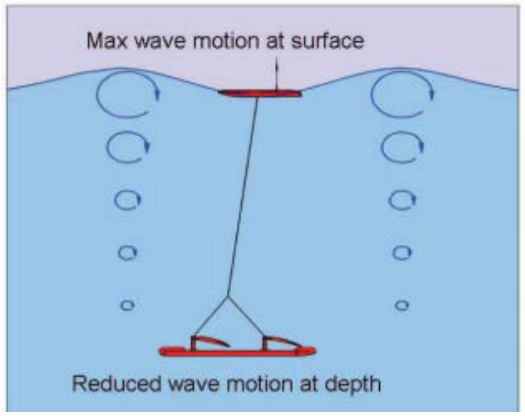
Harness wave and solar energy to propel SHARC and power instruments.

8 m long umbilical to sub tractor unit.

Data transfer and navigation with WGMS via Iridium DOD EMSS.

Proven, rugged design – traversed across the Pacific Ocean.

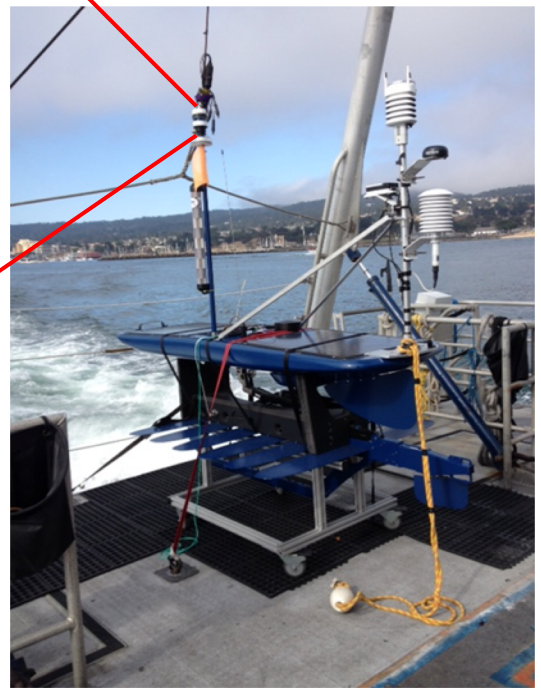
Easily deployable, mobile, minimum flow distortion



NPS Met Suite Design Iterations

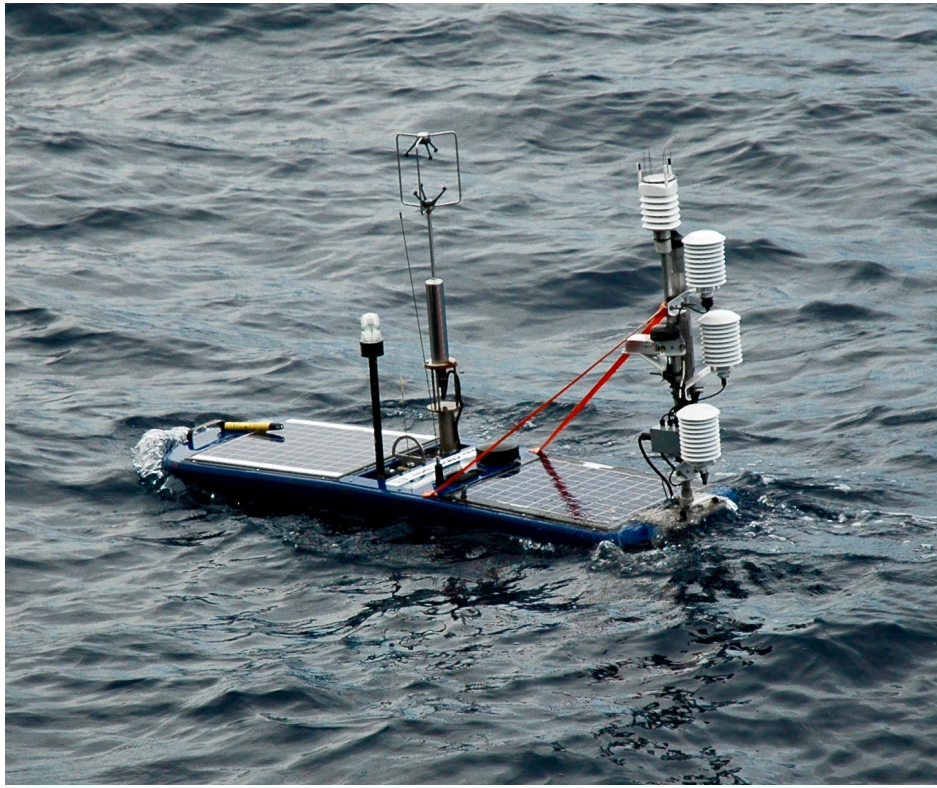
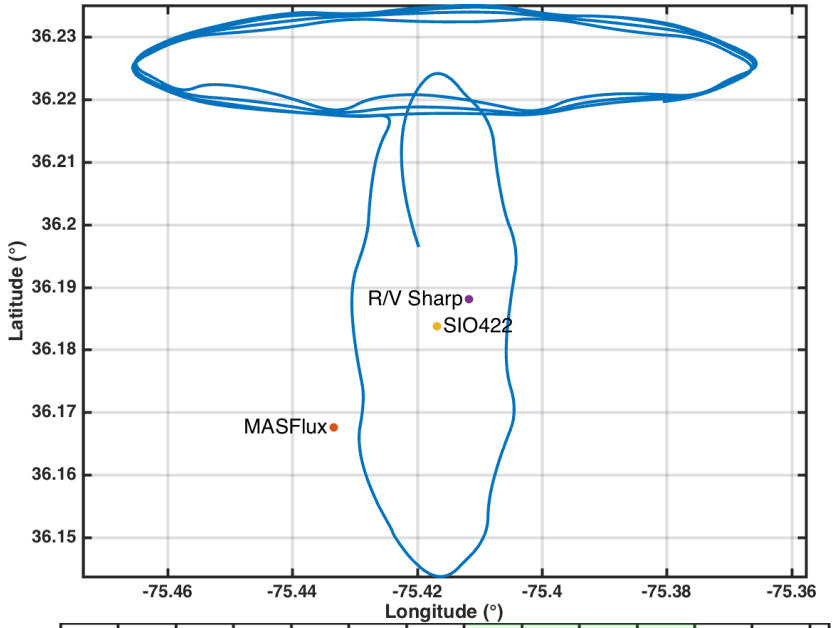
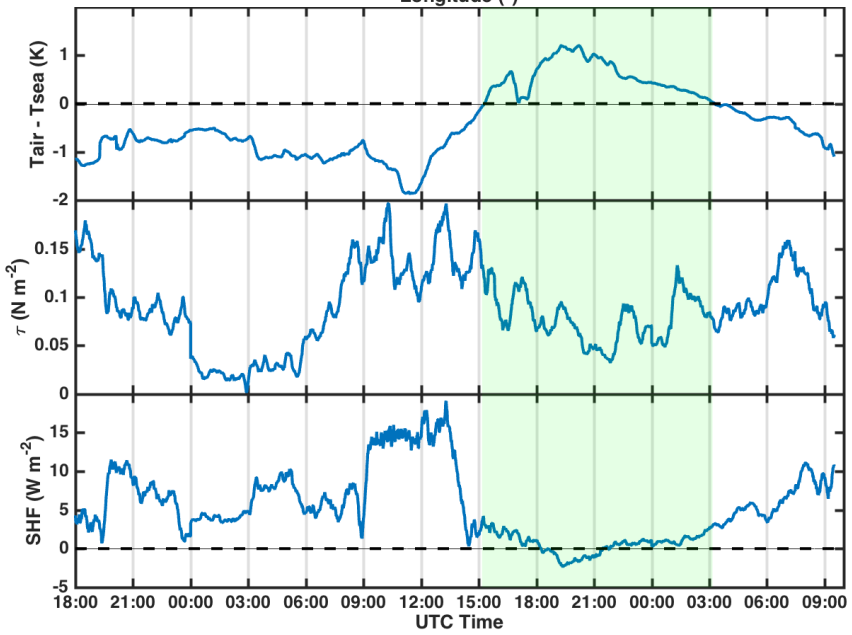
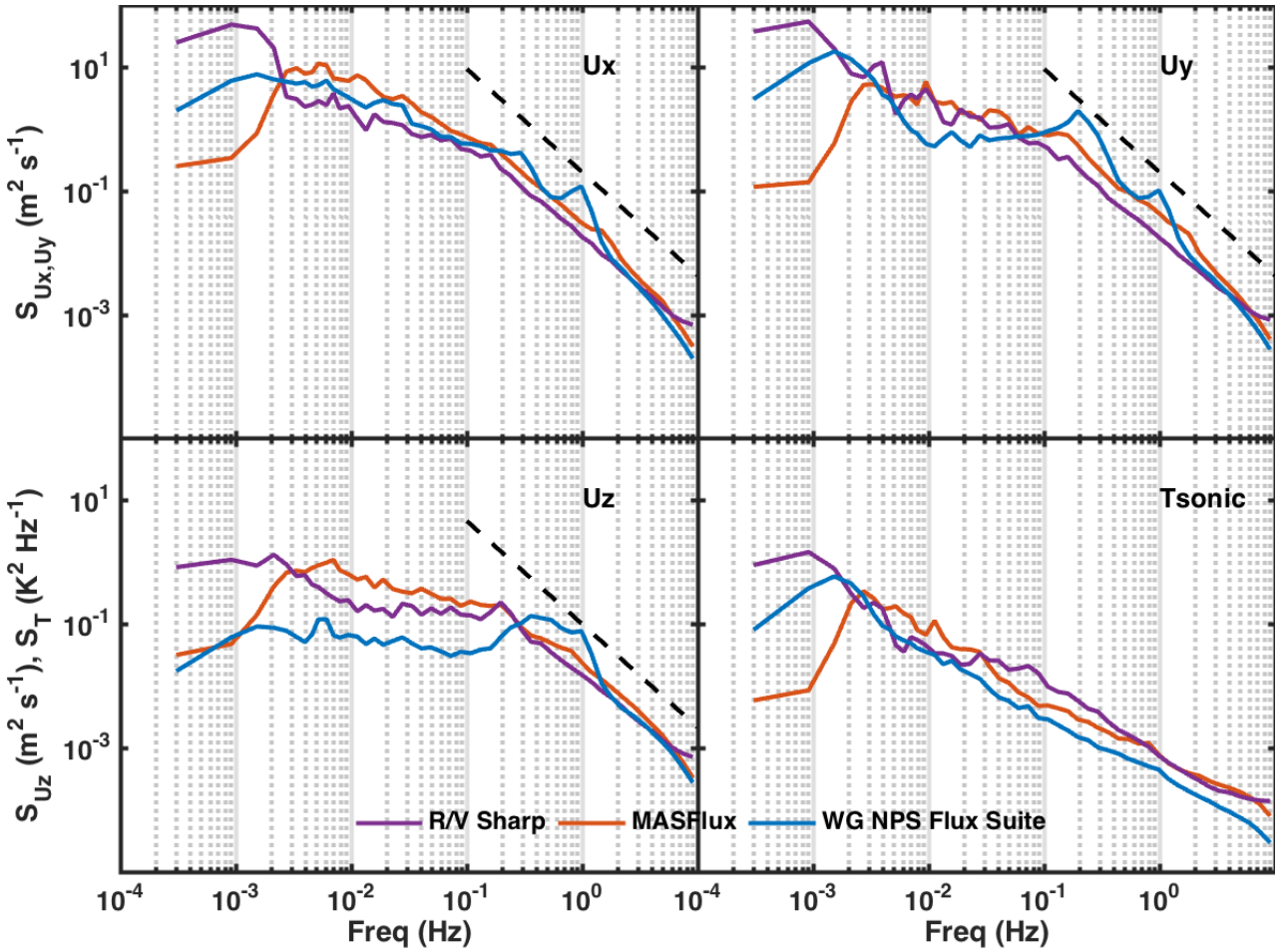
- **Adding robust mean measurements to include water vapor**
- **Adding turbulence sampling capability**

Mean Met



Turbulence v1

Turbulence v2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