Hybridspectral Alternative for Remote Profiling of Optical Observations for NASA Satellites (HARPOONS)

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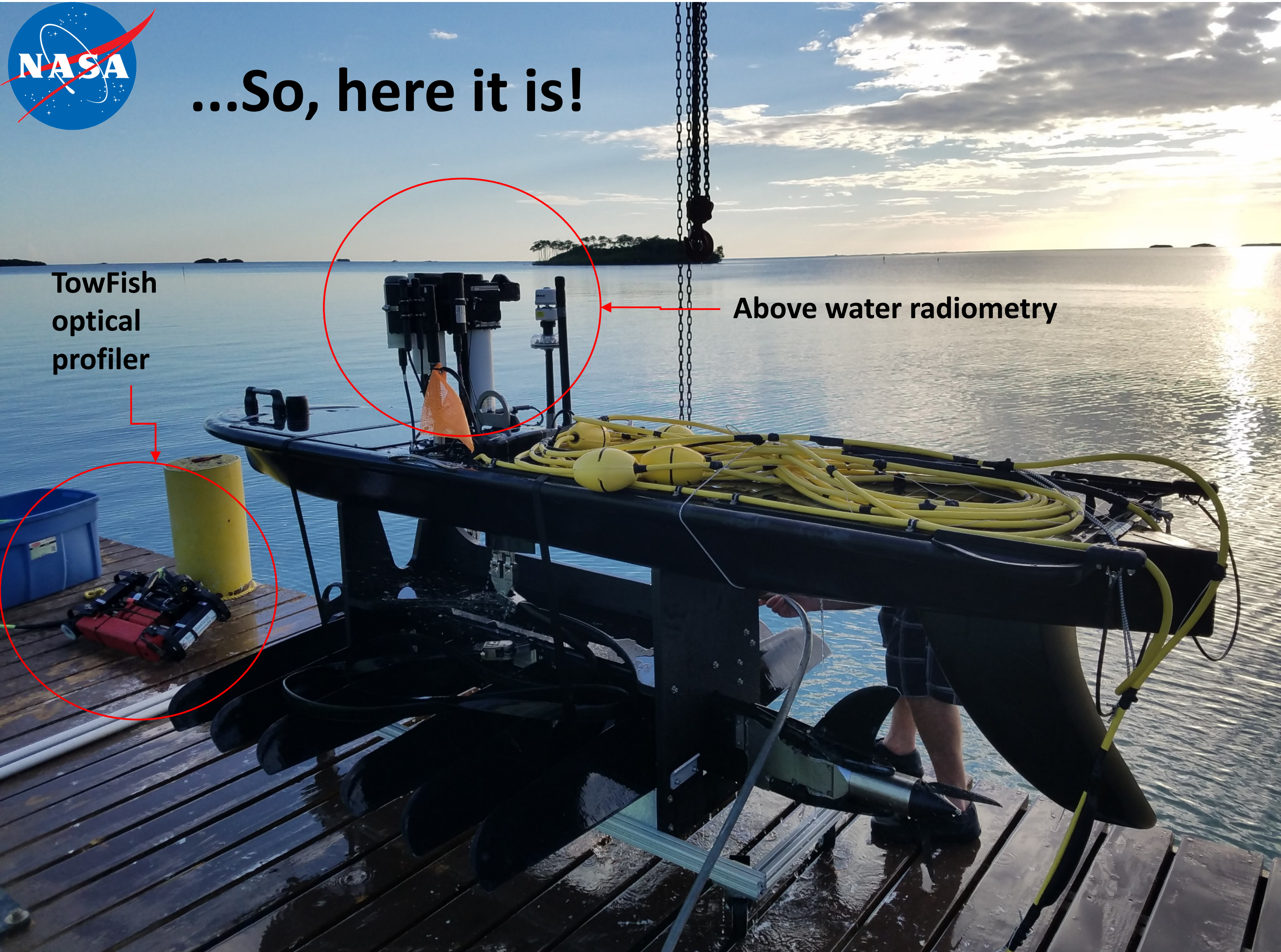
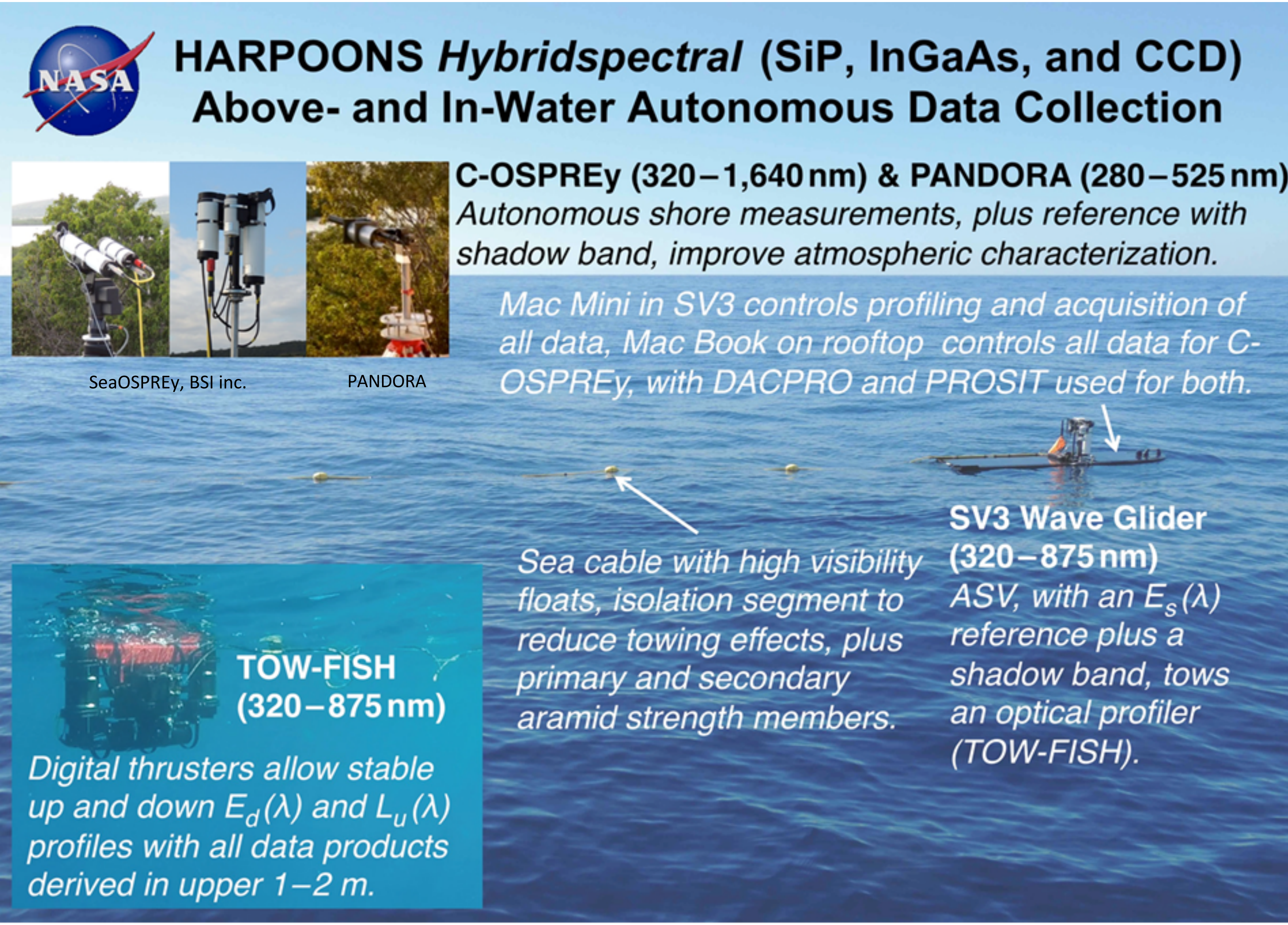
Motivations

- Ocean color requires vicarious calibration.
- Current systems are large, fixed, expensive to maintain, may not meet PACE requirements.
- Have multiple systems deployed in multiple locations.
- A system that is based on commercial, off the shelf (COTS) components.
- Use a deployment strategy that targets good weather windows to minimize the environmental effects on the optics, and the normal risks of being constantly deployed at sea.
- Have an atmospheric characterization component.
- Have a validation component.

...So, here it is!



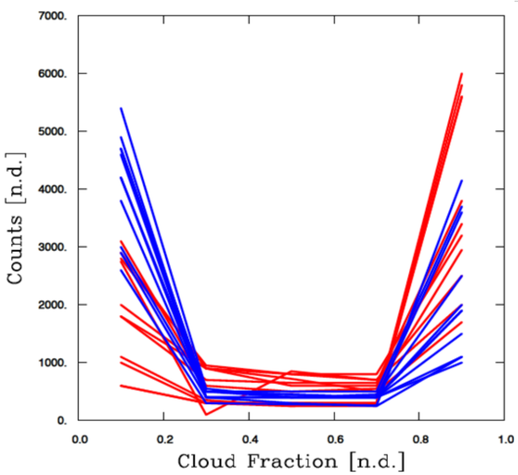

HARPOONS Hybridspectral (SiP, InGaAs, and CCD)
Above- and In-Water Autonomous Data Collection
C-OSPREy (320 – 1,640 nm) & PANDORA (280 – 525 nm)
Autonomous shore measurements, plus reference with shadow band, improve atmospheric characterization.
SeaOSPREy, BSI inc.
PANDORA
Mac Mini in SV3 controls profiling and acquisition of all data, Mac Book on rooftop controls all data for C-OSPREy, with DACPRO and PROSIT used for both.
SV3 Wave Glider
(320 – 875 nm)
ASV, with an $E_s(\lambda)$ reference plus a shadow band, tows an optical profiler (TOW-FISH).
Sea cable with high visibility floats, isolation segment to reduce towing effects, plus primary and secondary aramid strength members.
TOW-FISH
(320 – 875 nm)
Digital thrusters allow stable up and down $E_d(\lambda)$ and $L_u(\lambda)$ profiles with all data products derived in upper 1 – 2 m.

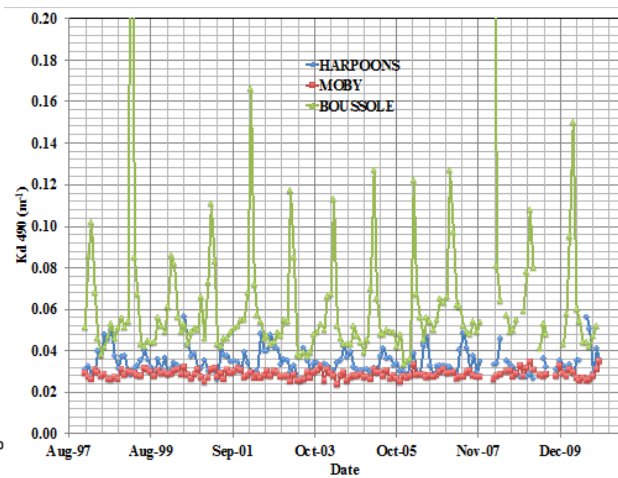
Deployment site

South West Coast of P.R. ~15 nm from field station,
Department of Marine Sciences, University of P.R.

Criteria:

1. **Easy, inexpensive logistics**
2. **Appropriate water type**
3. **Low cloud cover**
4. **Good atmosphere (marine aerosols)**





Comparing cloud cover fraction between HARPOON and MOBY using cloud cover climatology from MODIS cloud product. Blue line =HARPOONS, red line = MOBY.

Comparison between monthly average Kd 490 values for HARPOONS, BOUSSOLE, and MOBY.

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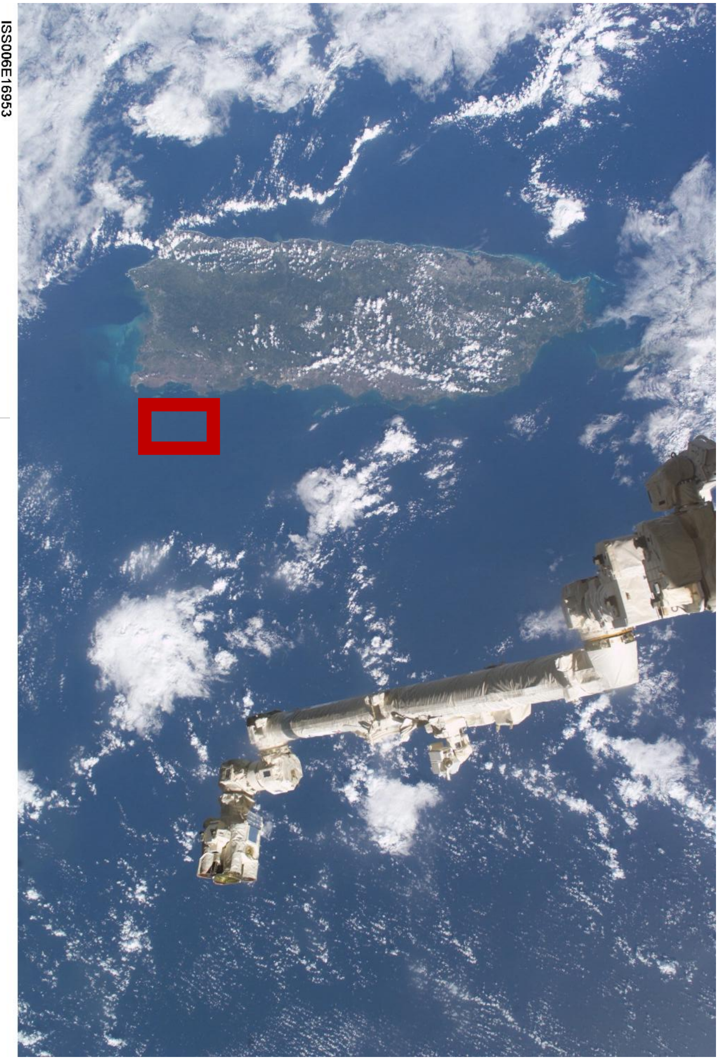
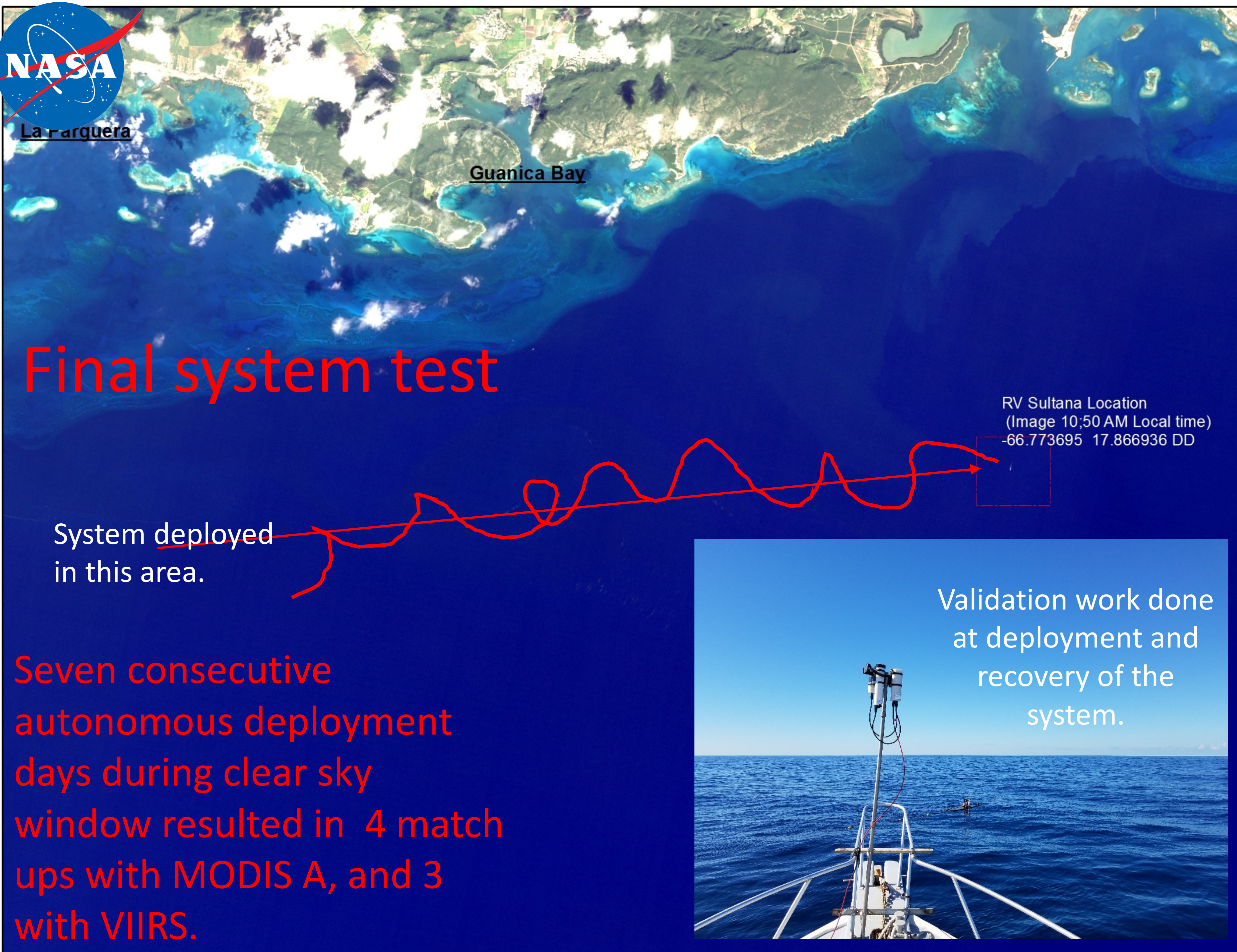


Final system test

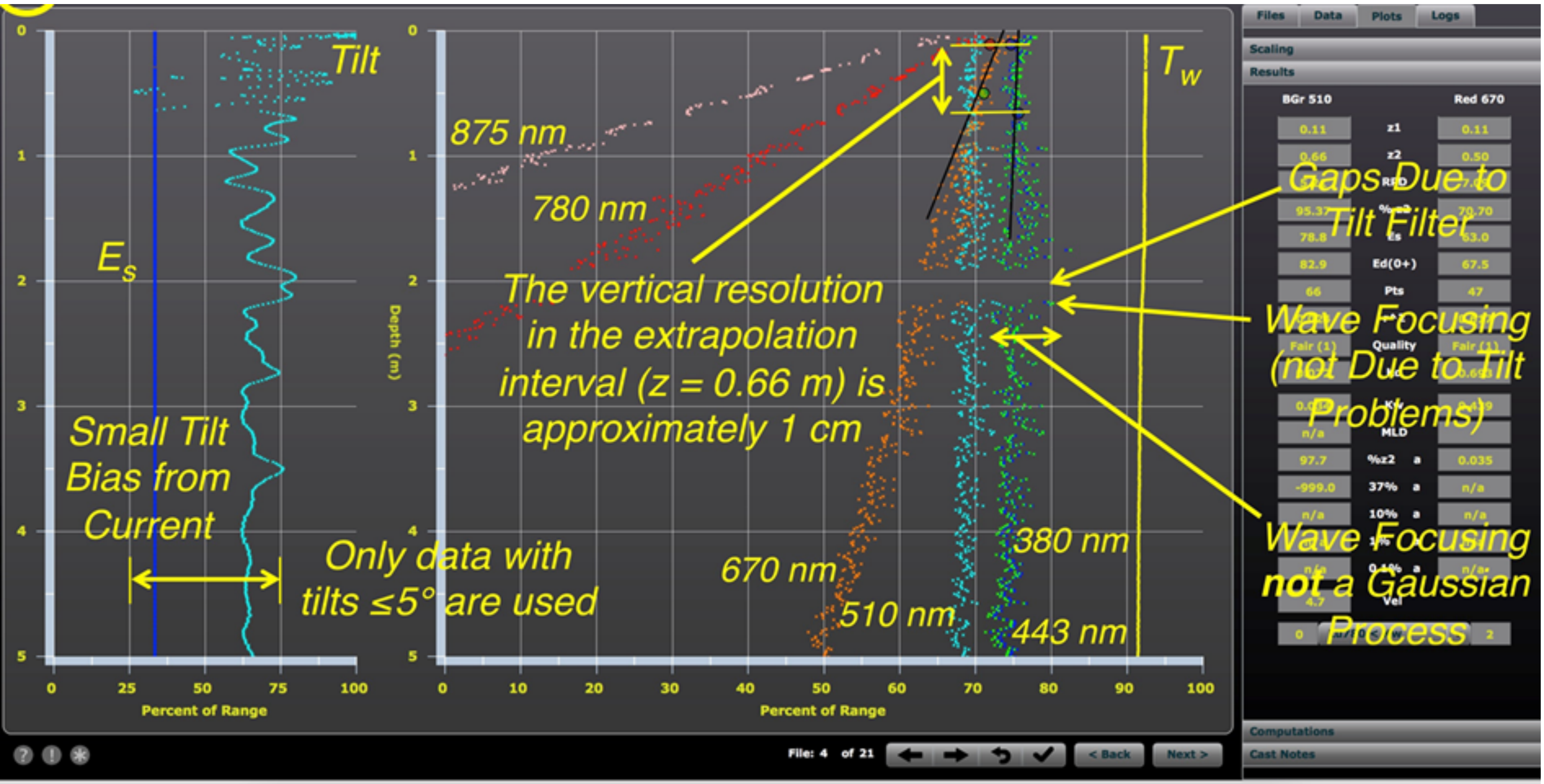


System deployed in this area.

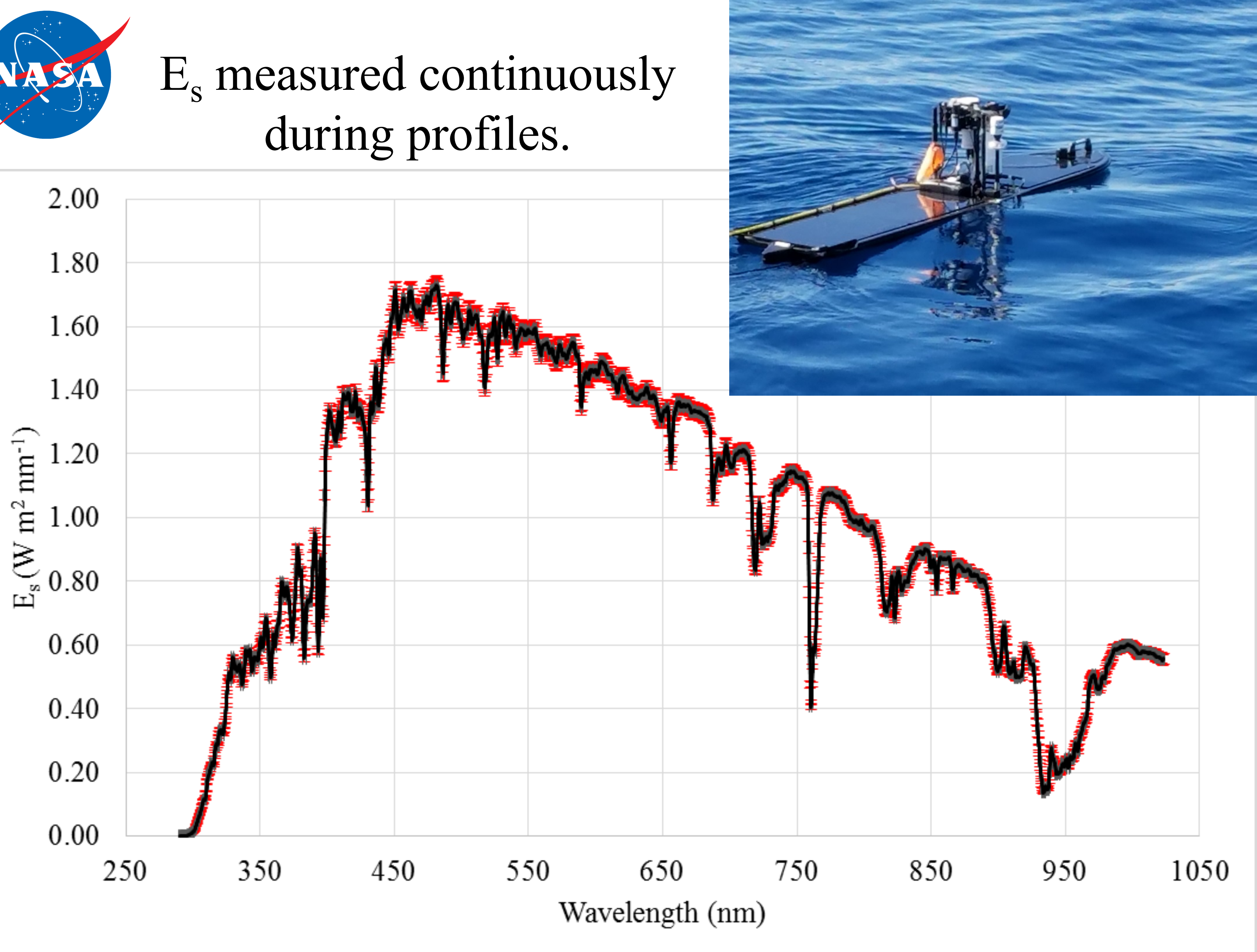
Seven consecutive autonomous deployment days during clear sky window resulted in 4 match ups with MODIS A, and 3 with VIIRS.

Validation work done at deployment and recovery of the system.

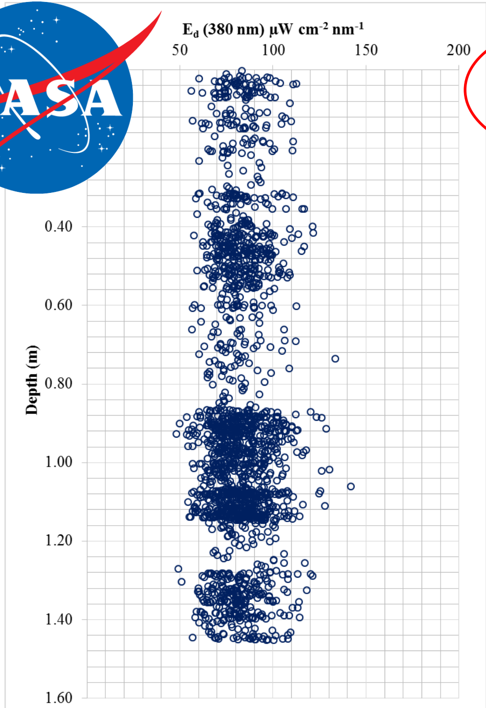
Example of data display

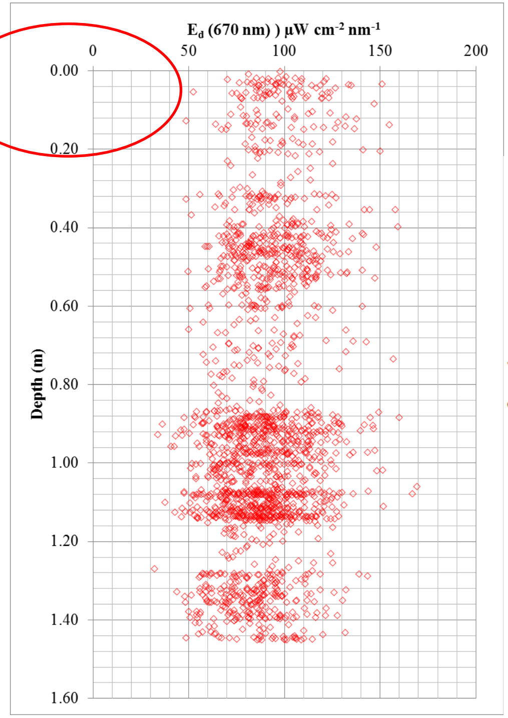


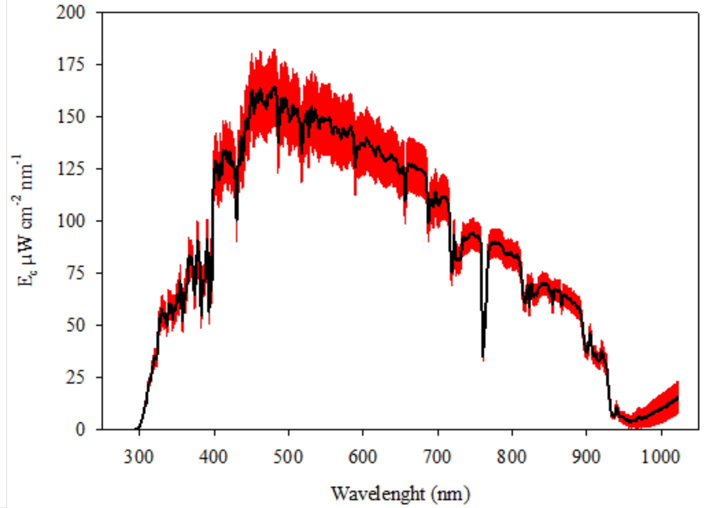
E_s measured continuously during profiles.

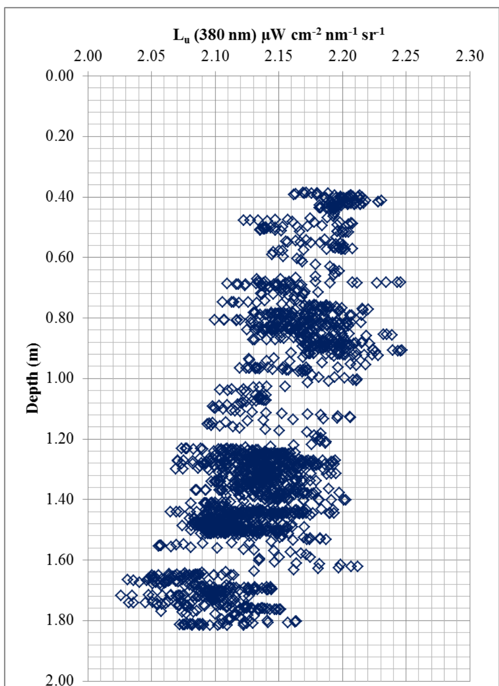


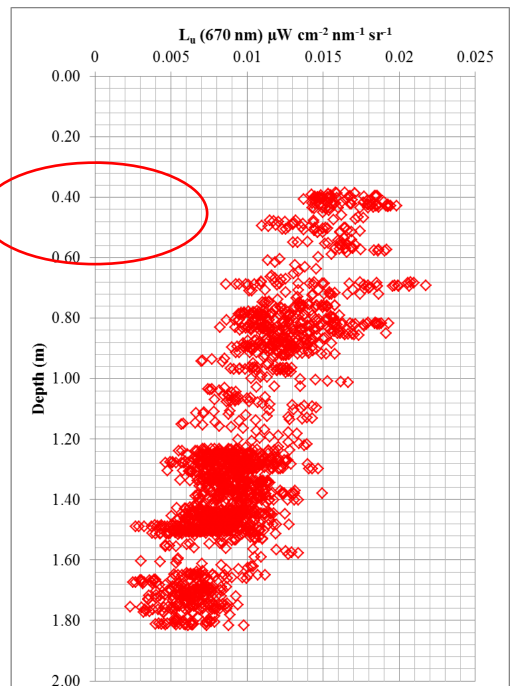
Some real data collected during fully autonomous tests of the system.

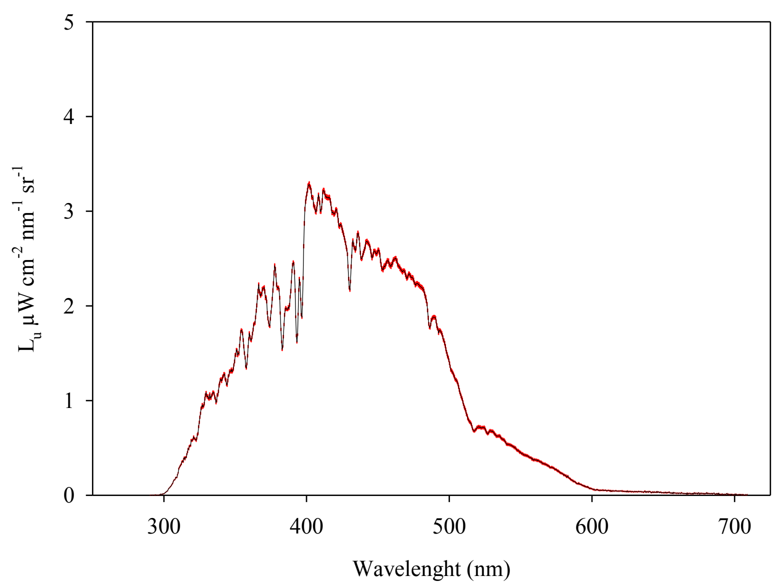












Conclusions

- HARPOONS works as advertised.
- Further engineering work underway to be able to profile independently of the SV3 waveglider. The SV3 is an expensive system, so we are exploring diversification.
- Deployments strategy (to target good weather windows) was demonstrated in P.R.
- All raw and processed data, documentation, and software are being posted in the project web site (to go active soon).
- All data collected will be submitted to SeaBASS by the end of September, 2017.
- Project is closing up in September on time and on budget.
  - The cost - $2.8 M for three years covered hardware procurements (SeaOSPREy, PANDORA, waveglider, towfish, etc...), engineering, integration, software, and three field deployments.