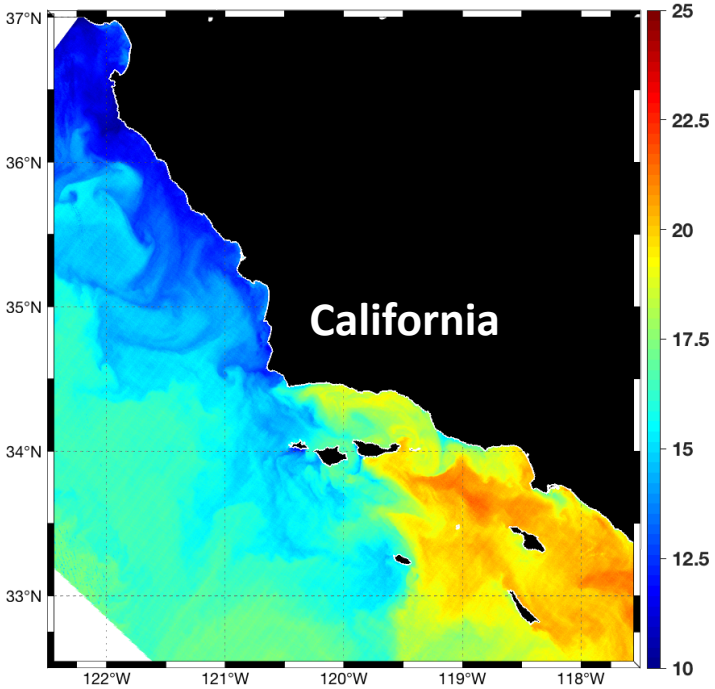
Examining surface temperature regimes in localized coastal upwelling zones using ECOSTRESS

ECOSTRESS Science and Applications Team Meeting - April 12, 2022

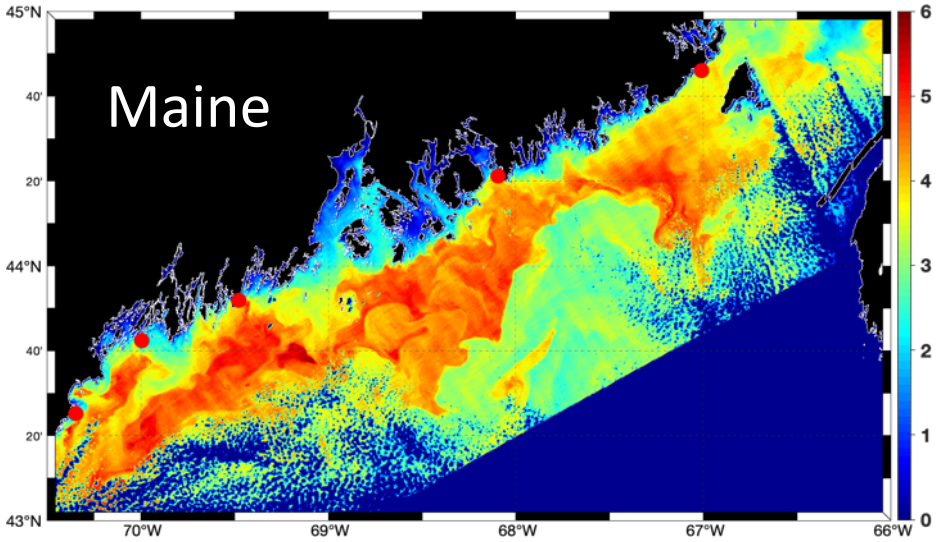
Dan Otis (PI)
Frank Muller-Karger (Co-I)
University of South Florida, College of Marine Science

Glynn Hulley (Collaborator)
NASA JPL



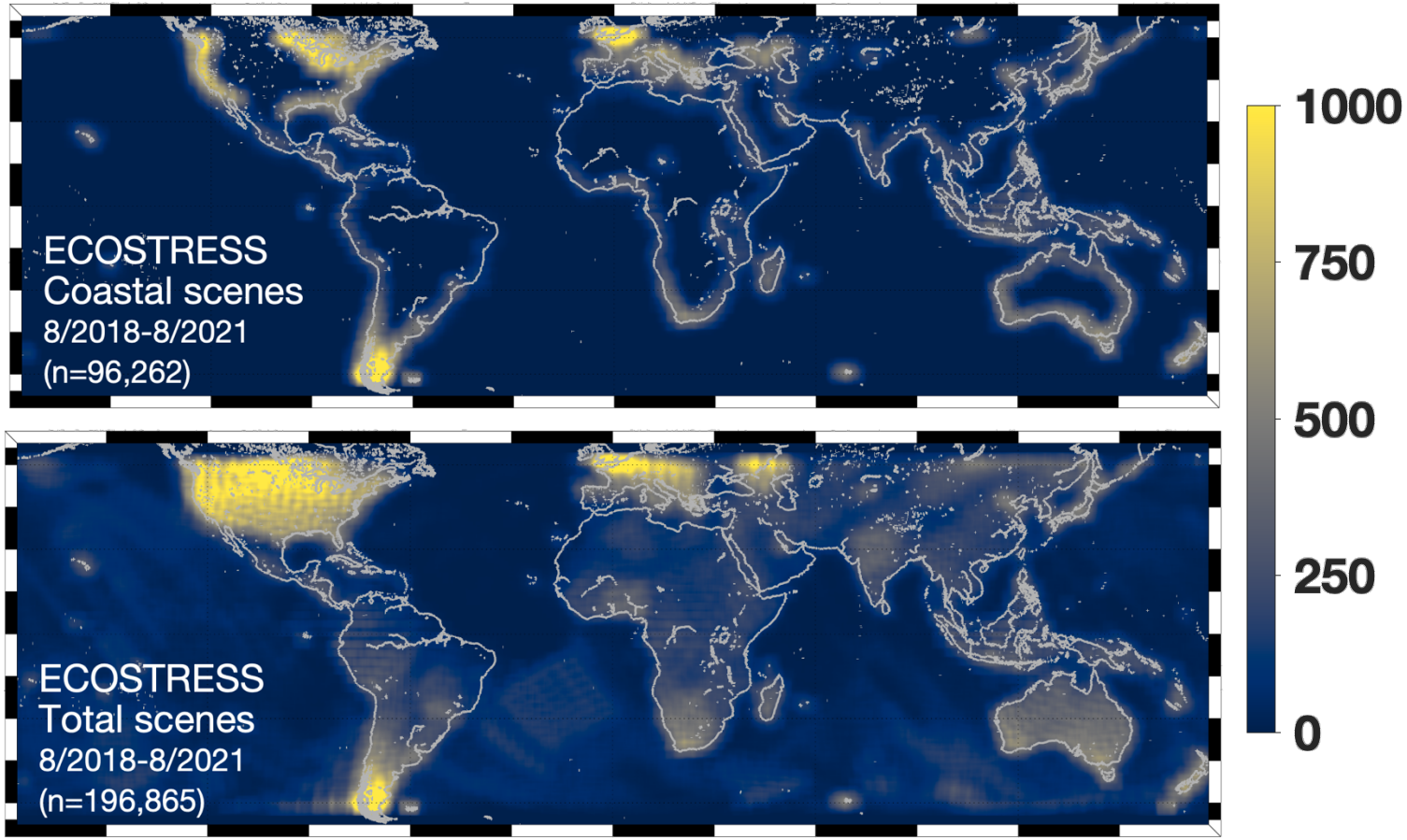
Motivation to use ECOSTRESS over water

- High spatial resolution
- Non-uniform overpass times
- Ability to extract data up to and across the water-land interface

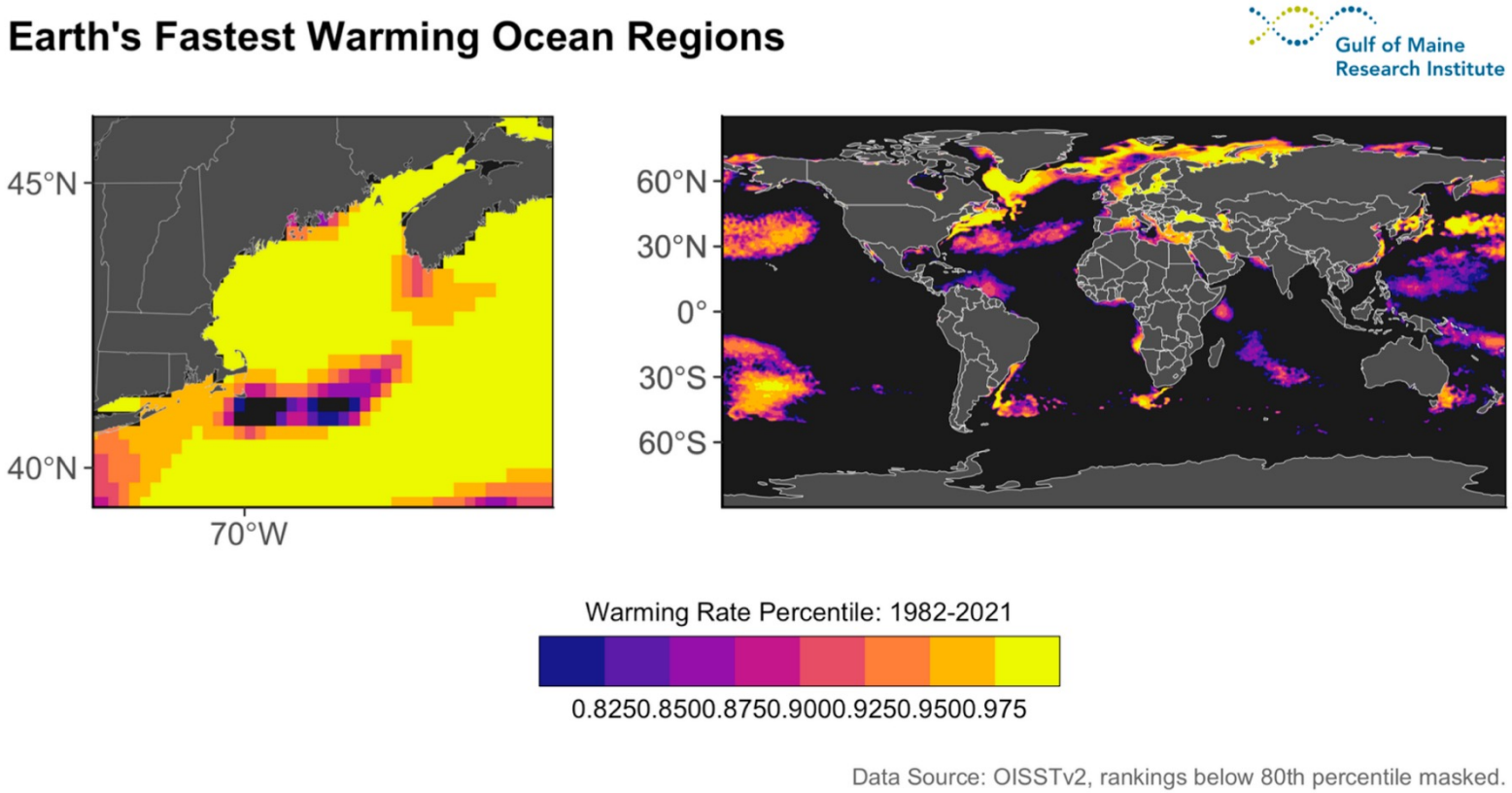


Composite of two ECOSTRESS scenes
Gulf of Maine - January 14, 2019

Where does ECOSTRESS sample?

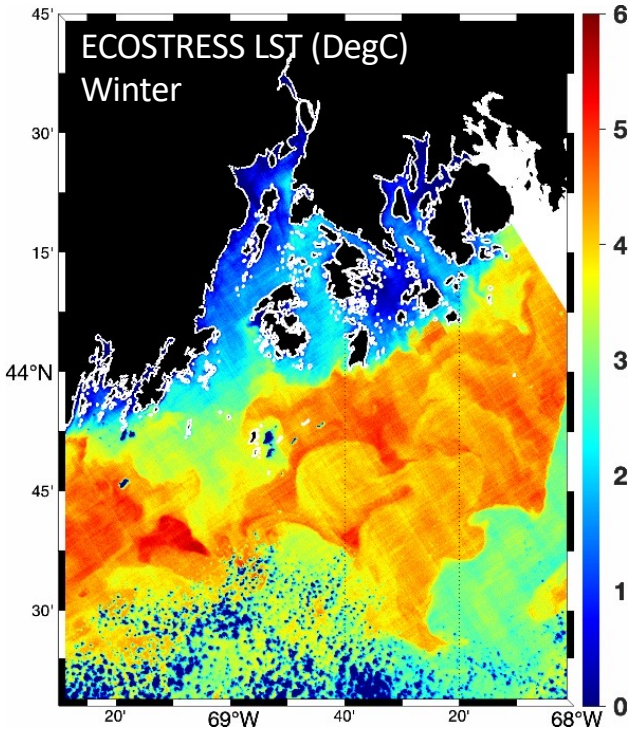


Gulf of Maine

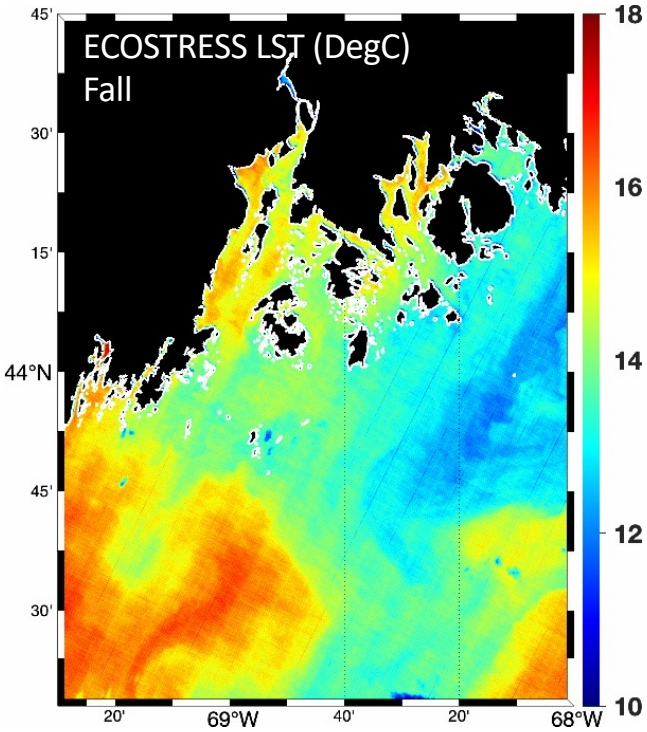


"Gulf of Maine Warming Report", Gulf of Maine Research Institute, (https://www.gmri.org/) 3/28/22

We can examine temperature variability in coastal inlets and inland lakesw with ECOSTRESS which would be impossible with sensors like MODIS and VIIRS.



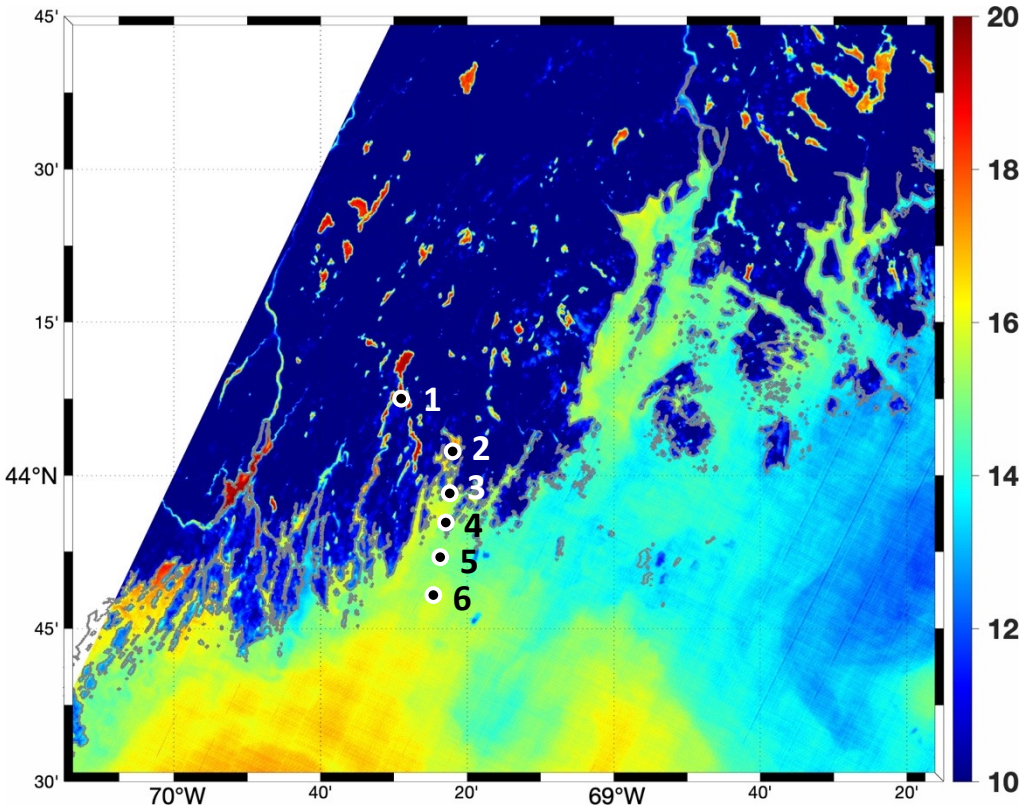
14 JAN 2019 0338 GMT



19 SEP 2021 0558 GMT

Transect near Damariscotta, ME

Site	Min	Max	2021 max	Range
1	-2.5	26.8	30.3	29.3
2	-0.5	20.7	22.2	21.2
3	0.9	17.2	20.3	16.3
4	1.7	16.8	19.4	15.1
5	2.7	17.3	19.4	19.8
6	3.1	18.1	19.2	15.0



ECO LST (DegC) - 19 SEP 2021 0558 GMT

ECOSST Split-Window SST algorithm

$$SST = a_0 + a_1 T_{B4} + a_2(T_{B4} - T_{B5}) + a_3(T_{B4} - T_{B5})\big(1 - sec(\theta)\big)$$

a_0, a_1, a_2 and a_3 coefficients for ECOSTRESS determined as in Hulley et al. (2011)

T_{B4} = ECOSTRESS Band 4 brightness temperature (10.6 micron)

T_{B5} = ECOSTRESS Band 5 brightness temperature (12 micron)

θ = Sensor view angle

Satellite matchups between MODIS and ECOSTRESS

11 daytime image pairs w/time offset < 3h hours

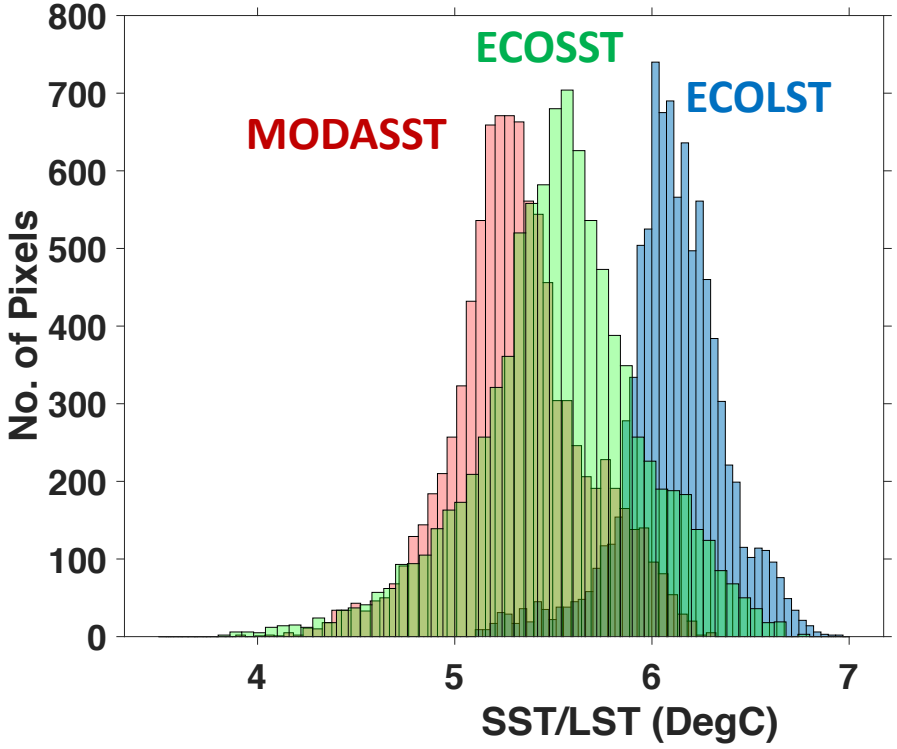
- MODIS Aqua 1-km SST (OBDAAC)
- ECOSTRESS full scenes from Earthdata Search

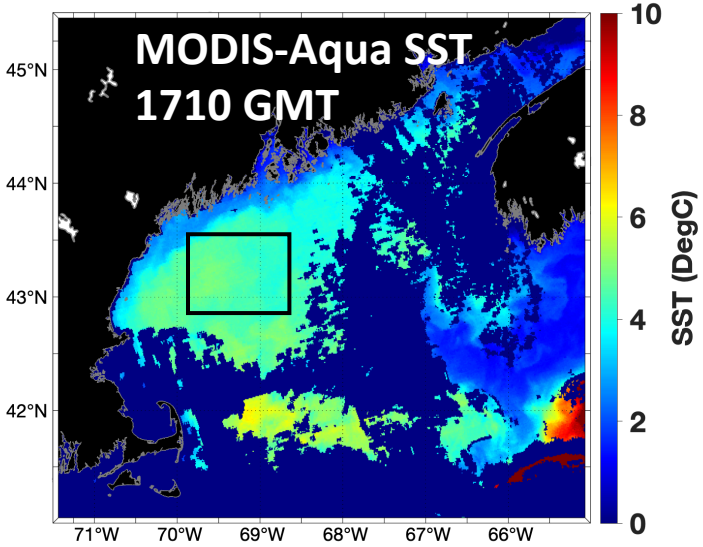
1 x 1 Degree MCSST coefficients, along with ECOSTRESS LST, SatZen, TB4, and TB5 were gridded to MODIS 1-km grid to allow direct comparison

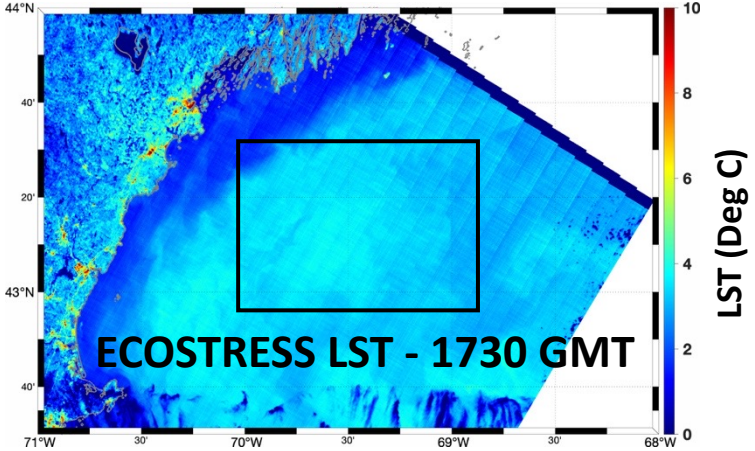
Coefficients retrieved from LUT using lat/lon and time of image

Clouds masked based on MODIS SST Quality flag

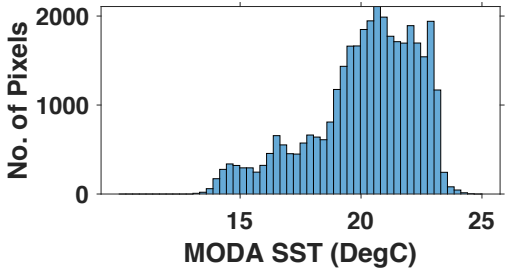
Example scene - 22 FEB 2019 1730 GMT

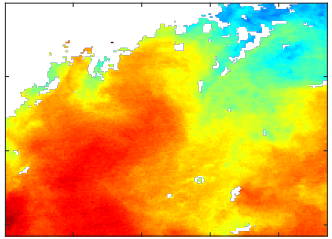




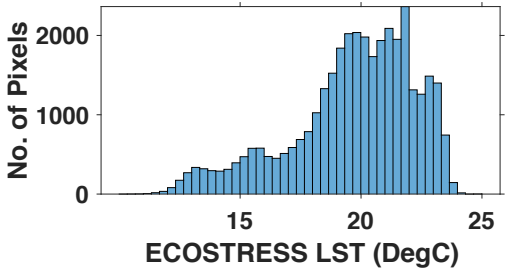


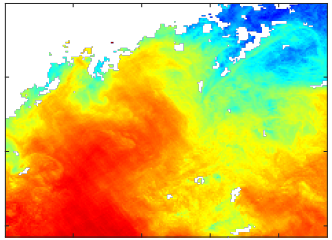
Example scene - 02 AUG 1950 GMT



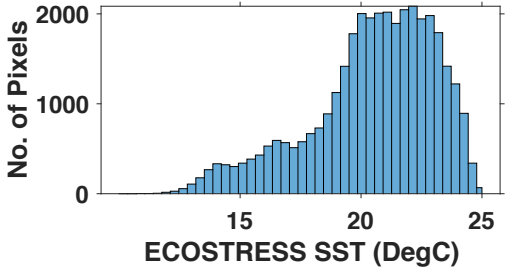


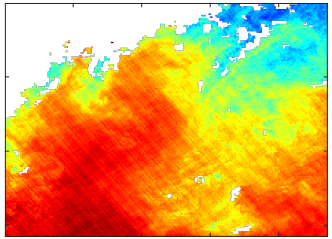
MODA SST



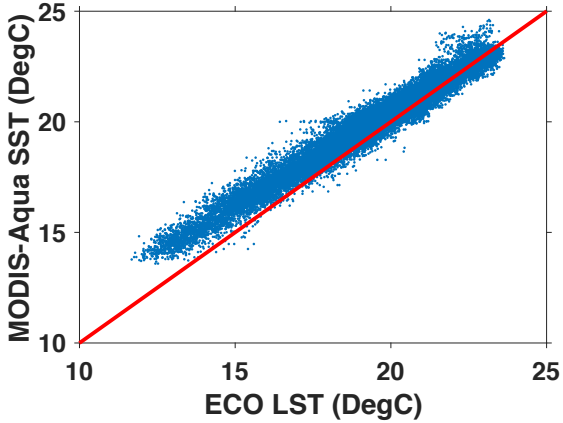


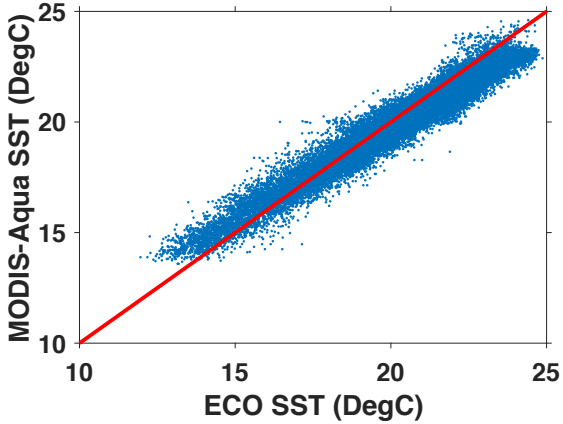
ECO LST GRIDDED





ECO SST GRIDDED

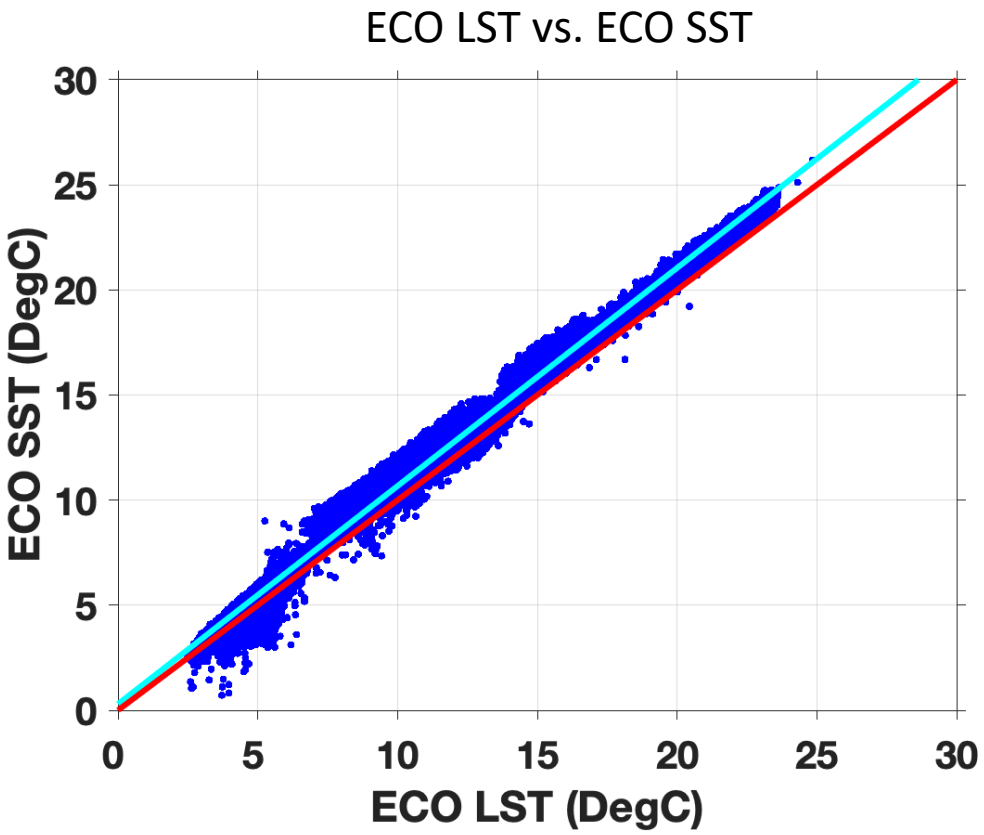




MODIS and ECOSTRESS matches

11 image pairs; ~154,000 pixels

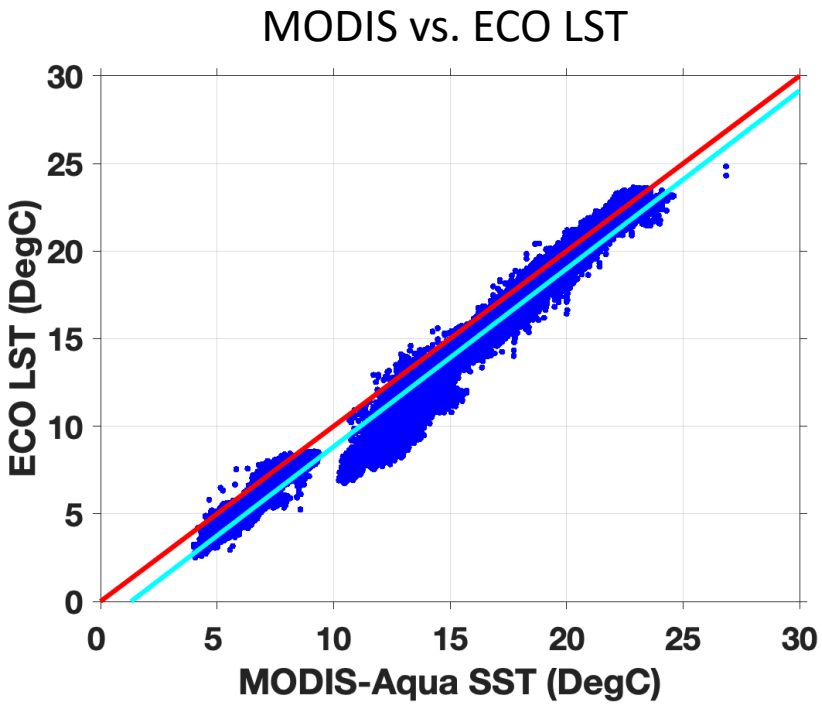
Red = 1:1 ; **Lt. Blue = Best fit**

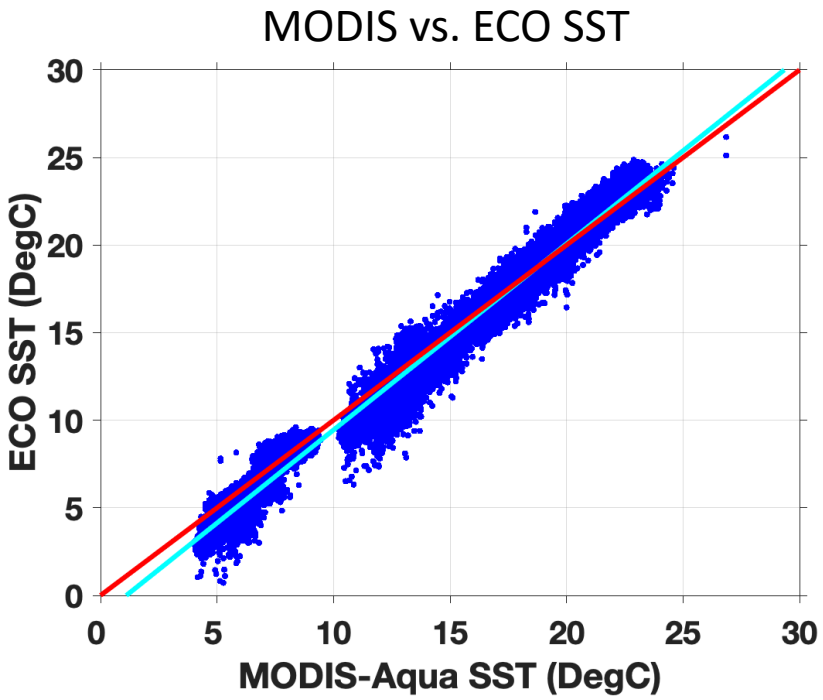


MODIS and ECOSTRESS matches

11 image pairs; ~154,000 pixels

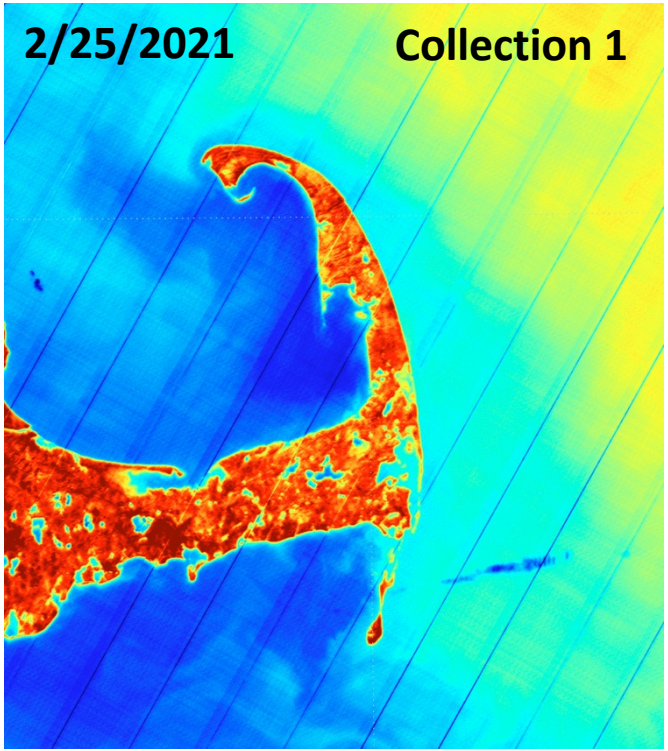
Red = 1:1 ; **Lt. Blue = Best fit**



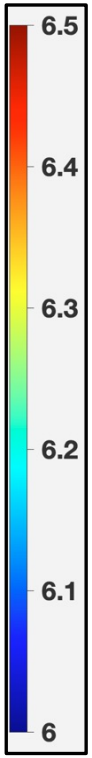


What's Next? - Collection 2

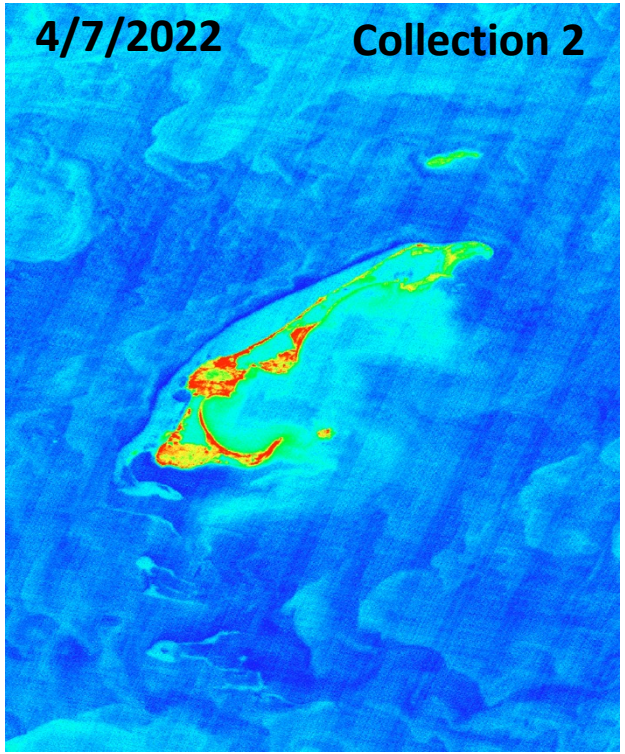
Questions?



ECOSTRESS_L1B_RAD (Band 4)



(W/m^2/sr/um)



ECOv002_L2G_RAD (Band 4)