Examining surface temperature regimes in localized coastal upwelling zones using ECOSTRESS

ECOSTRESS Science and Applications Team Meeting - April 12, 2022

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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?

ECOSTRESS
Coastal scenes
8/2018-8/2021
(n=96,262)

ECOSTRESS
Total scenes
8/2018-8/2021
(n=196,865)
Gulf of Maine

Earth's Fastest Warming Ocean Regions

Warming Rate Percentile: 1982-2021

Data Source: OISSTv2, rankings below 80th percentile masked.

We can examine temperature variability in coastal inlets and inland lakes with ECOSTRESS which would be impossible with sensors like MODIS and VIIRS.
## Transect near Damariscotta, ME

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

ECO LST (DegC) - 19 SEP 2021 0558 GMT
ECOSST Split-Window SST algorithm

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

\(a_0, a_1, a_2\) 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)

\(\theta\) = 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

No. of Pixels

ECOSTRESS SST/LST (DegC)

MODASST

ECOSST

ECOLST

MODIS-Aqua SST

1710 GMT

ECOSTRESS LST - 1730 GMT
Example scene - 02 AUG 1950 GMT

MODA SST

ECOSTRESS LST

ECOSTRESS SST

MODIS-Aqua 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

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What’s Next? - Collection 2

ECOSTRESS_L1B_RAD (Band 4)  
(W/m²/sr/um)  
2/25/2021  
Collection 1

ECOv002_L2G_RAD (Band 4)  
4/7/2022  
Collection 2

Questions?