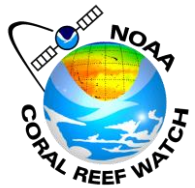
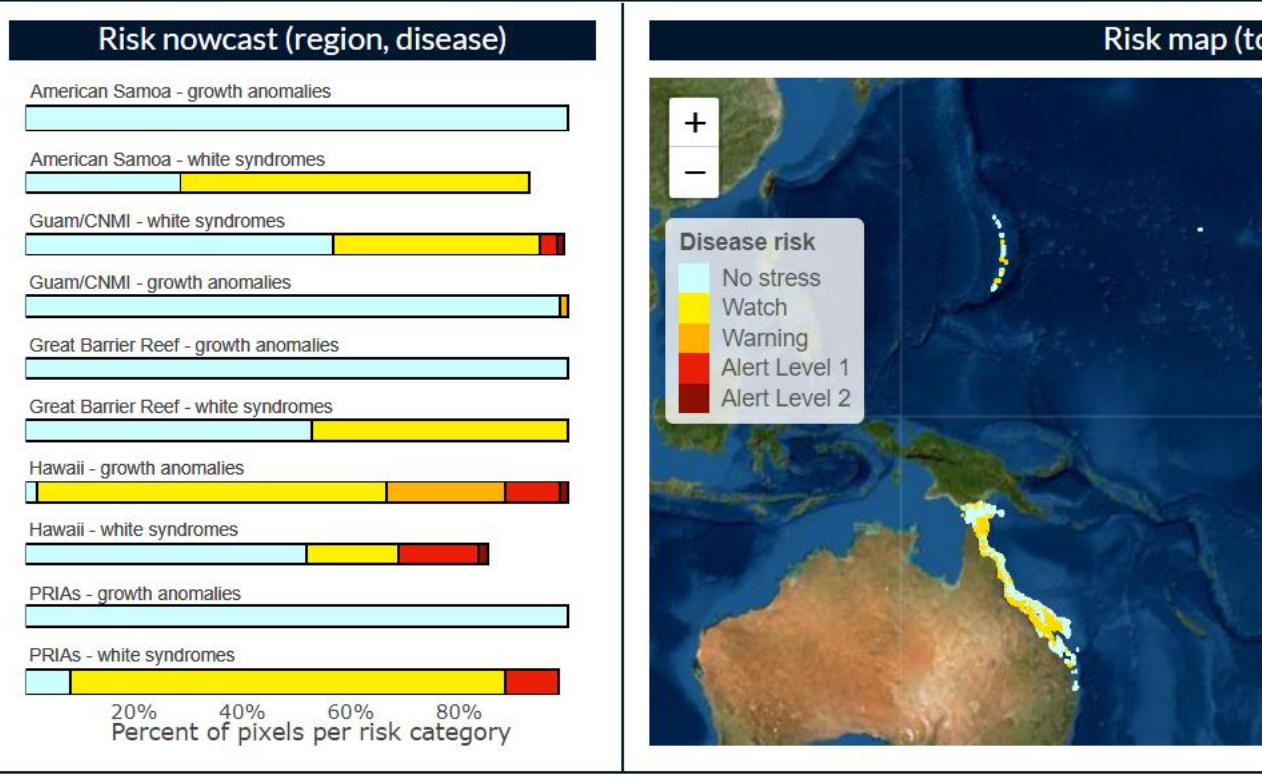
Optimizing Single-Sensor Satellite Ocean Color Data for Nearshore Reefs and Tropical Coastal Waters: Two Case Studies

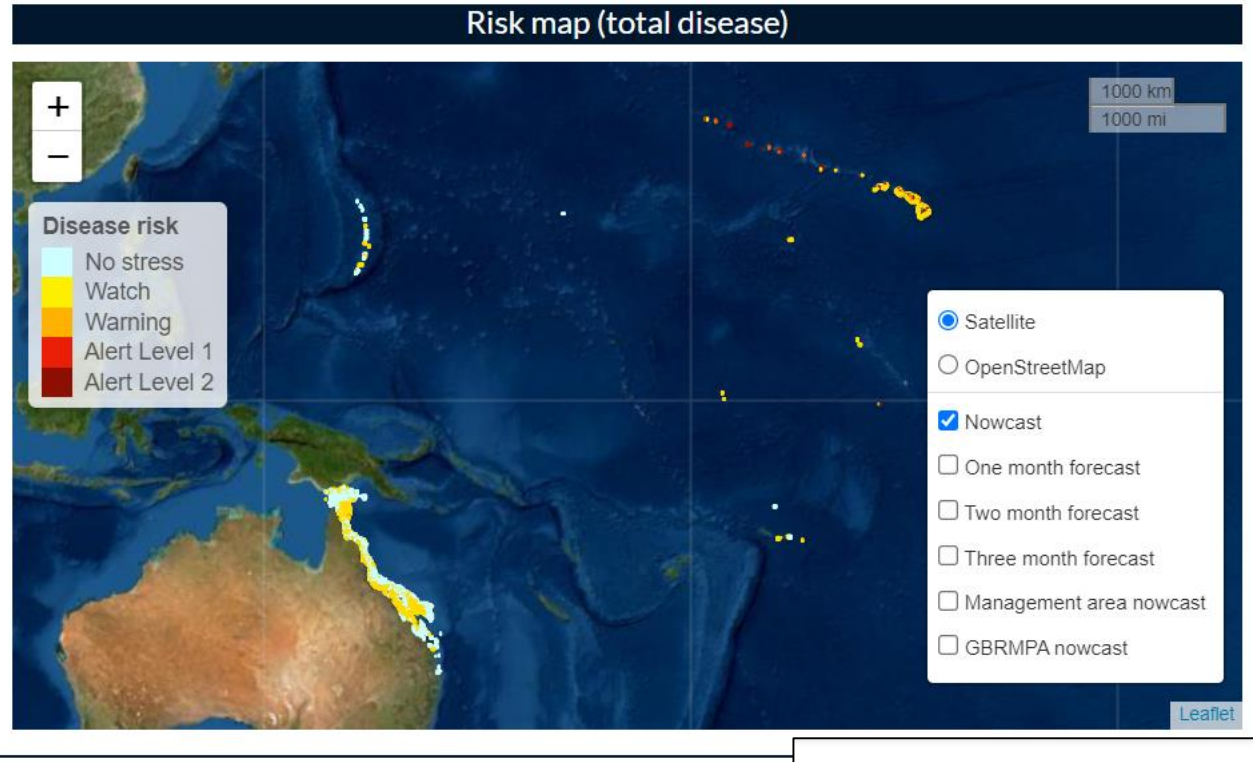
Erick F. Geiger, Scott F. Heron, William J. Hernández, Jamie M. Caldwell, Kim Falinski, Tova Callender, Austin L. Greene, Gang Liu, Jacqueline L. De La Cour, Roy A. Armstrong, Megan J. Donahue and C. Mark Eakin

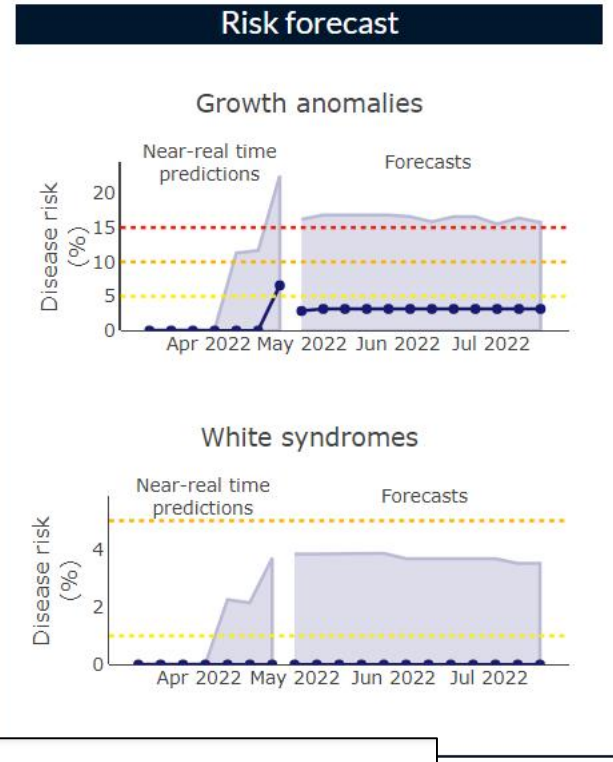


Coral disease predictions | Investigating scenarios | Historical data | About

Fore-C: Forecasting coral disease in the tropical Pacific





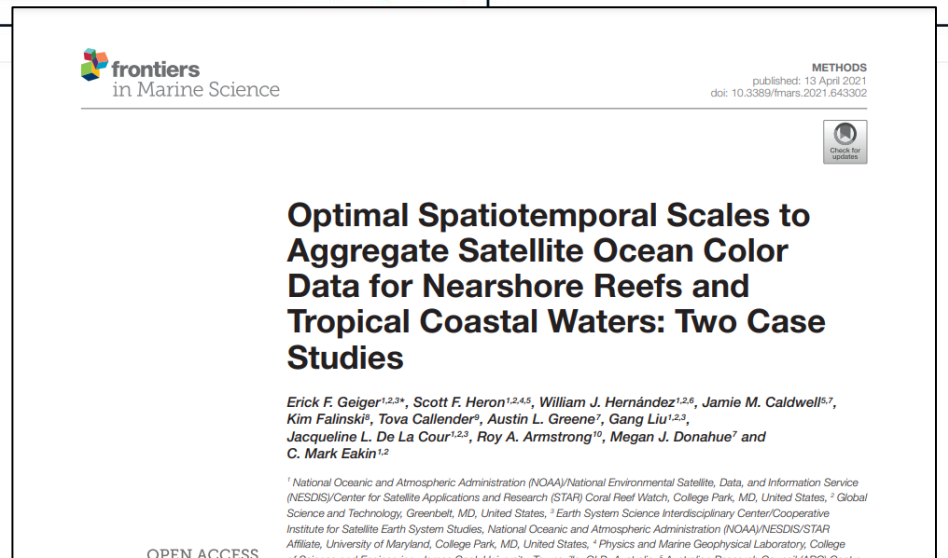


Last update: 2022-04-25

NASA Ecological Forecasting Program

Hawaii Institute of Marine Biology, University of Hawaii

NOAA Coral Reef Watch



frontiers in Marine Science

METHODS
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Optimal Spatiotemporal Scales to Aggregate Satellite Ocean Color Data for Nearshore Reefs and Tropical Coastal Waters: Two Case Studies

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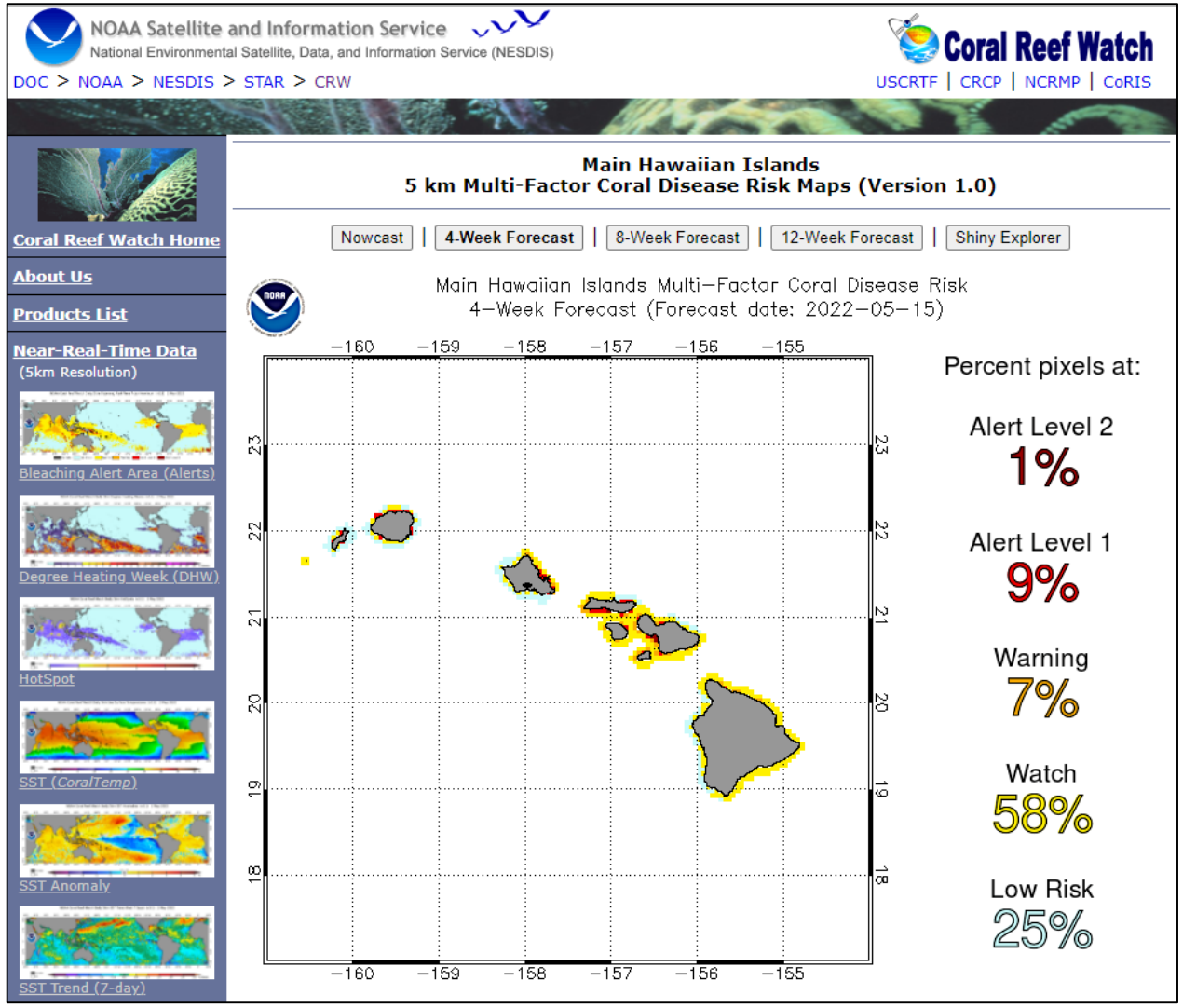
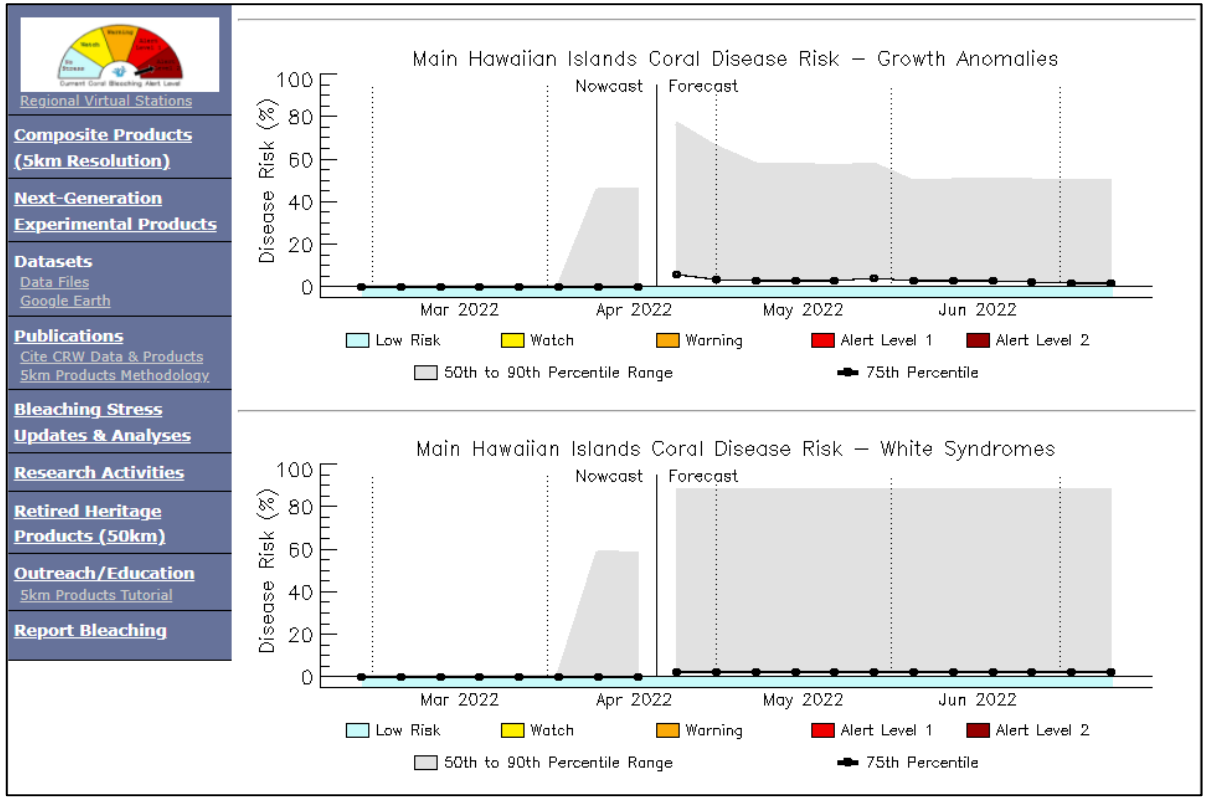
Experimental product on CRW page for several regions in the Pacific



https://coralreefwatch.noaa.gov/product/fore_c_v1/hawaii.php



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Brown water in Honokahua Bay, West Maui in January 2015. Photo credit: Bill Rathfon

Water quality as a disease driver

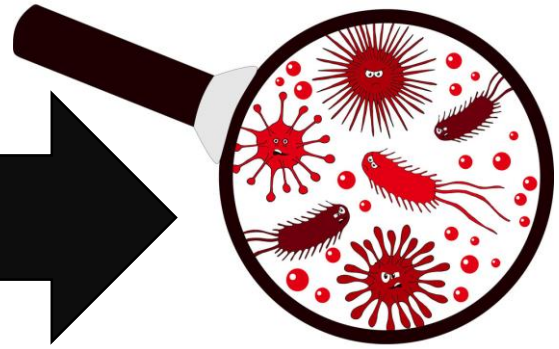
At what scales could ocean color data be useful for predicting coral disease?

How much data is available near the coast?

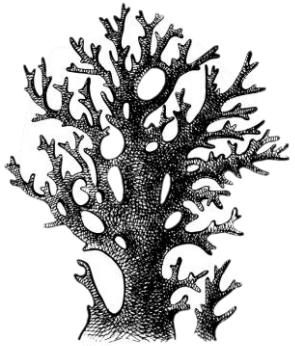
Can we maximize data availability while maintaining relationship to *in situ* data?

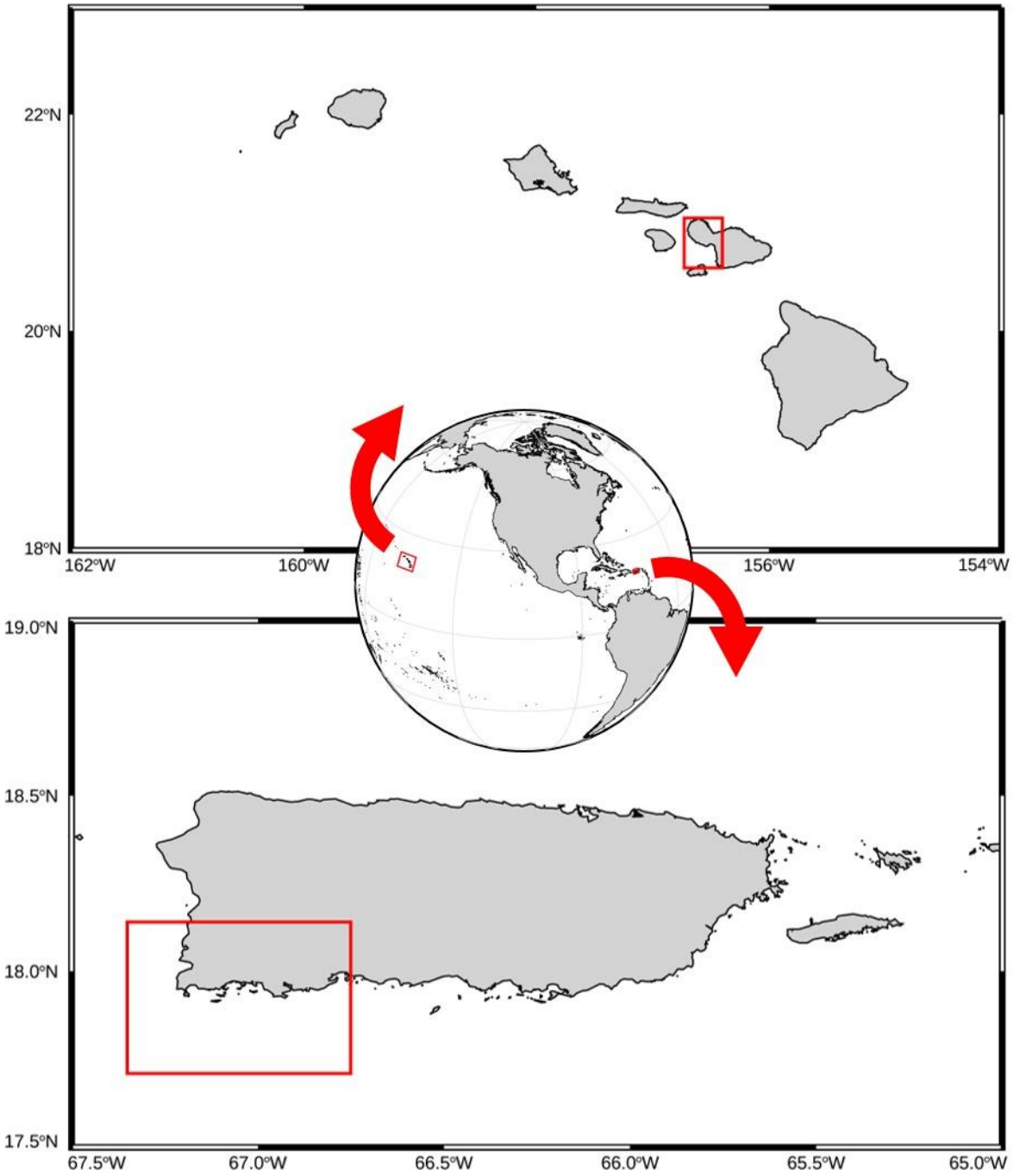
Chlorophyll-*a*
Turbidity

Pathogen growth, transport



Coral susceptibility, feeding





In situ data from two locations:

West Maui, Hawaii
La Parguera, Puerto Rico

Two types of data:

$K_d(490)$ collected by partners at UPR (William Hernandez, Roy Armstrong)

Onshore Turbidity data from Maui collected by Hui o Ka Wai Ola, a local water quality-monitoring group (http://huiokawaiola.com), and the Hawaii State Department of Health (Kim Falinski, Tova Callender)

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

DOC > NOAA > NESDIS > STAR > CRW

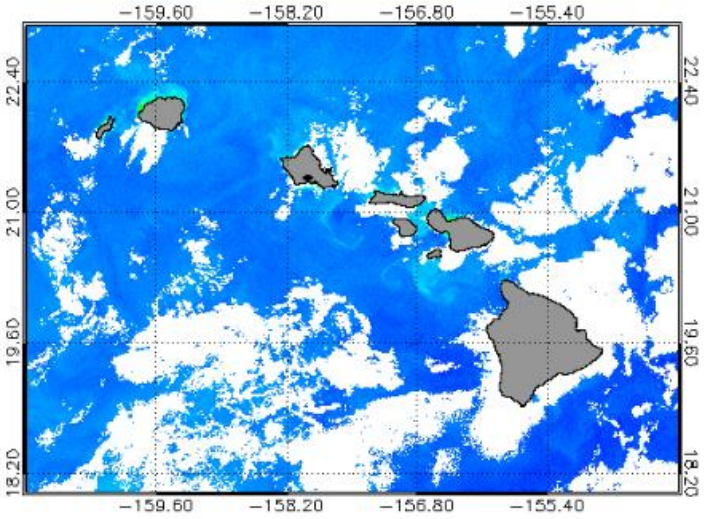
Coral Reef Watch

USCRTF | CRCP | NCRMP | CoRIS

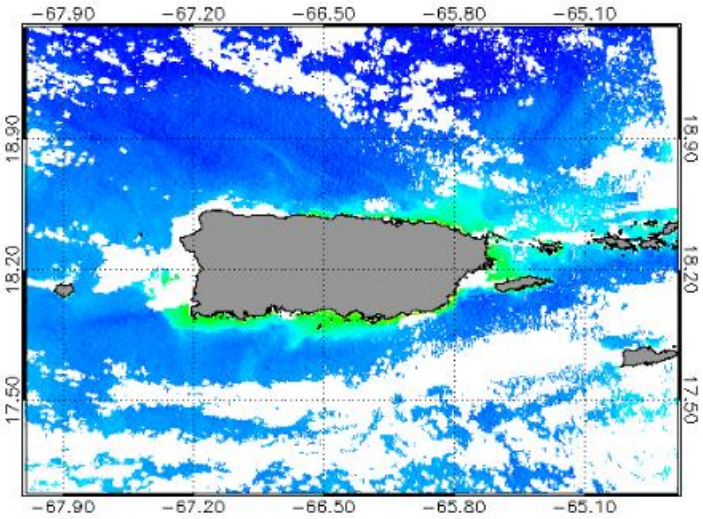
Daily 750m VIIRS Satellite Ocean Color Monitoring
(Version 1.0, experimental product, released May 10, 2018)

Click on an image below for region-specific ocean color products: Chlorophyll-a and $K_d(490)$

Main Hawaiian Islands



Puerto Rico



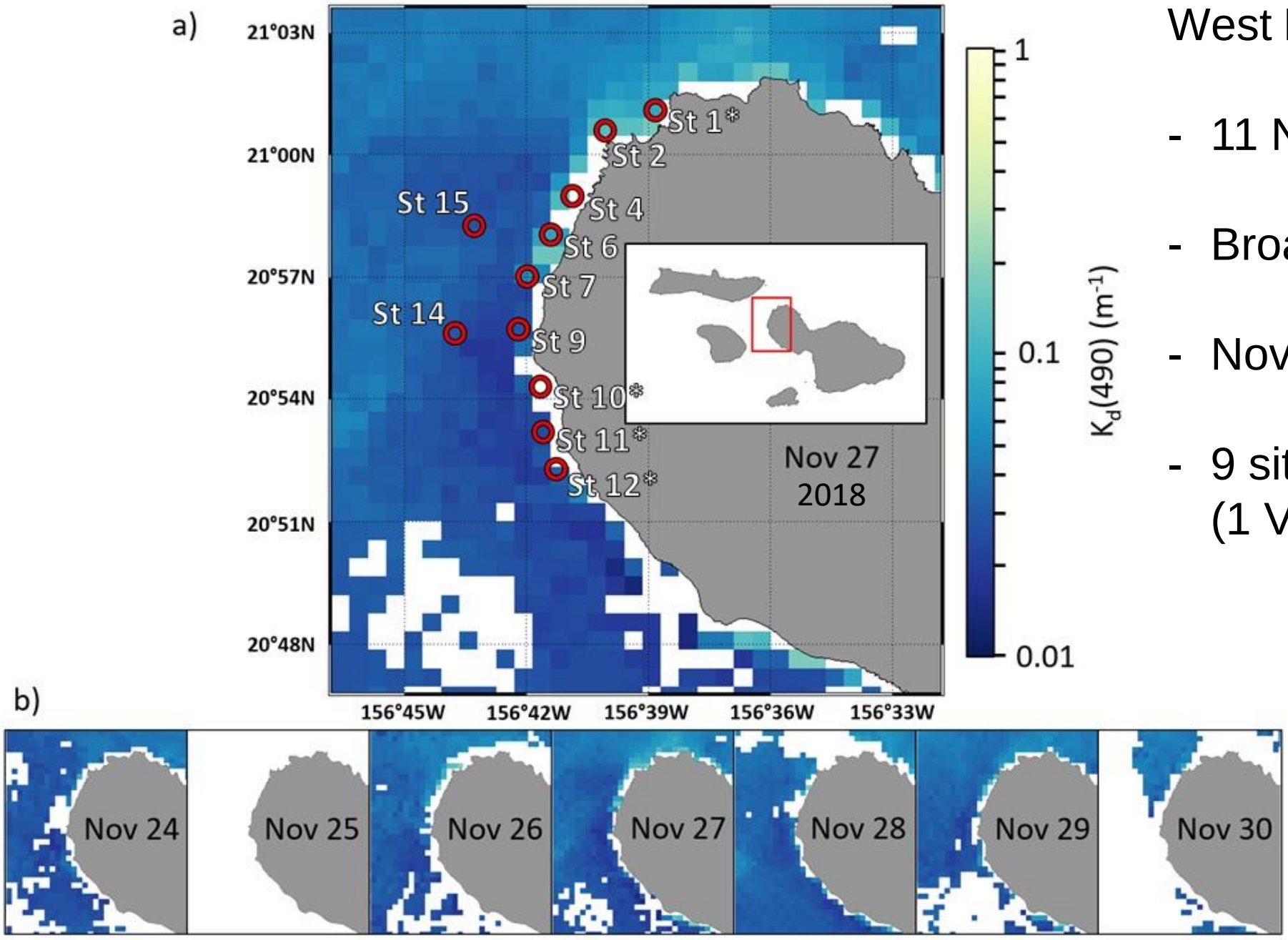
Product Description

NOAA Coral Reef Watch and NOAA/National Environmental Satellite, Data, and Information Service (NESDIS) Ocean Color Team are working closely with partners in the U.S. Coral Reef Task Force (USCRTF) Watershed Working Group (WWG) to develop satellite ocean color products for use over coral reefs. Data are from the Visible Infrared Imaging Radiometer Suite (VIIRS) onboard the Suomi National Polar-orbiting Partnership (S-NPP) satellite operated by the NOAA Joint Polar Satellite System (JPSS).

https://coralreefwatch.noaa.gov/product/oc/index.php

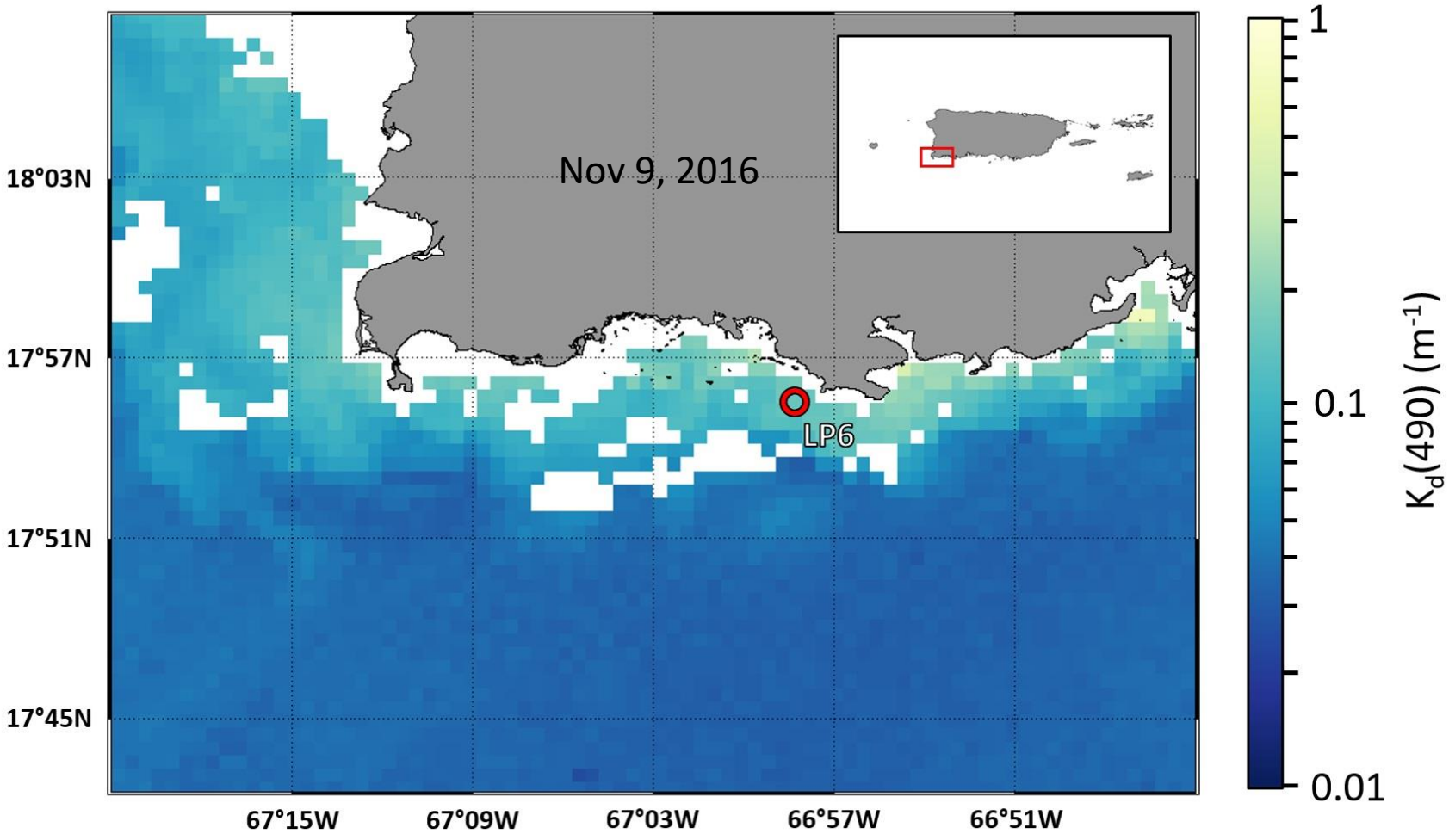
VIIRS

- 2012-present (long enough overlap with coral disease dataset)
- Science quality already produced by NOAA OC team and coastwatch
- Available at 750m (closer to reef scale)



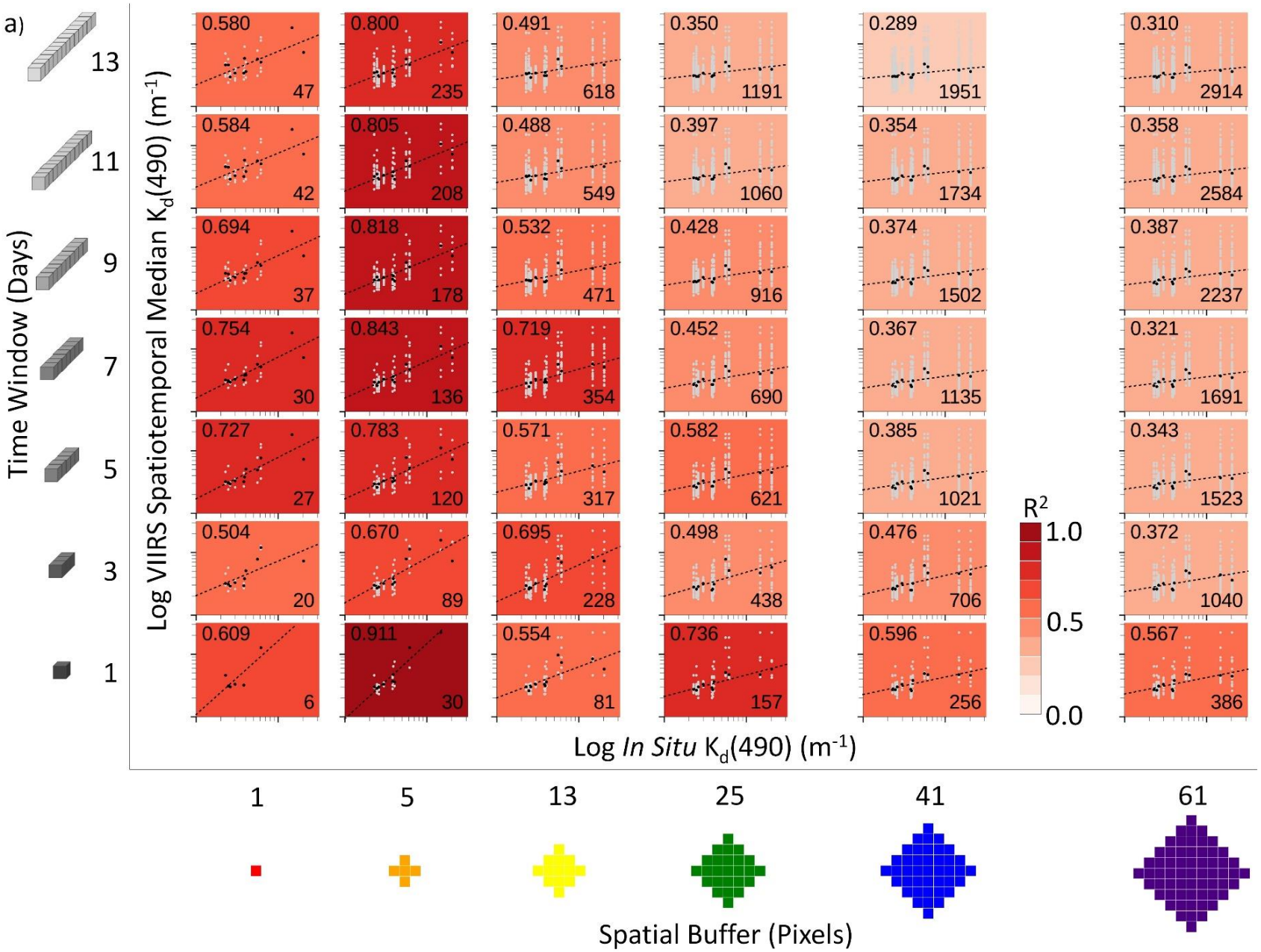
West Maui

- 11 Nearshore Sites
- Broad spatial domain
- Nov 26 and Nov 28, 2018
- 9 sites ~750m off the coast (1 VIIRS pixel)



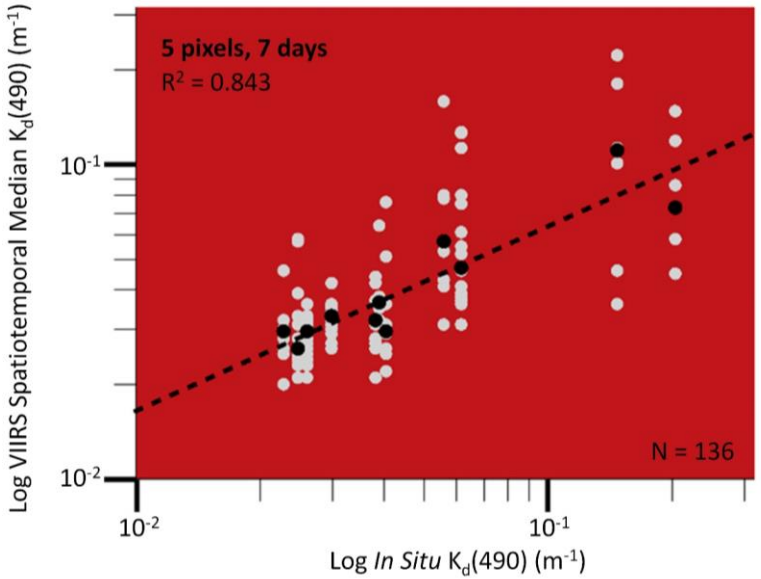
Puerto Rico

- 1 site
- 22 measurements from 2016-2019
- Longer temporal domain

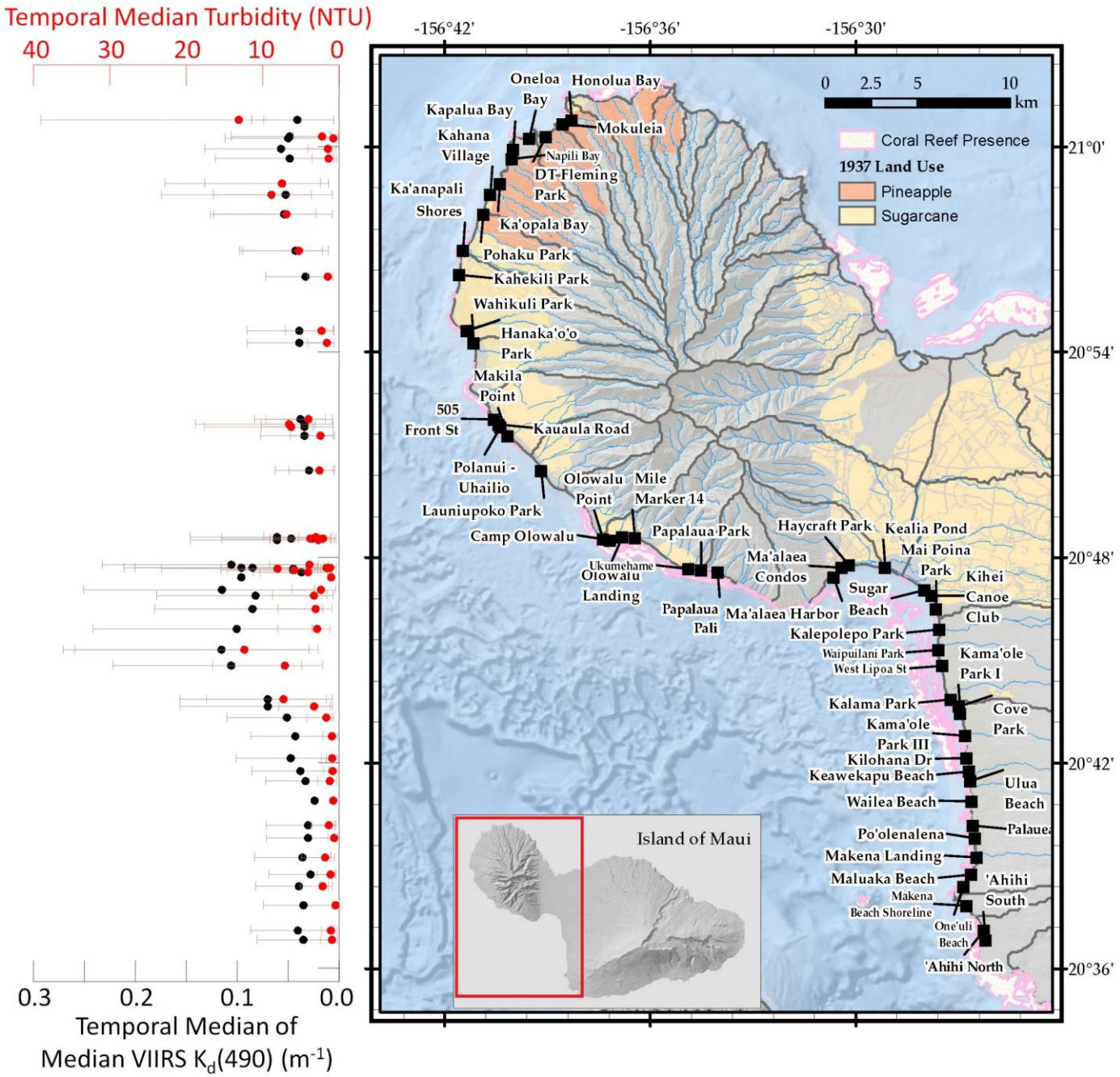


Maui

5-pixel, 7-day window

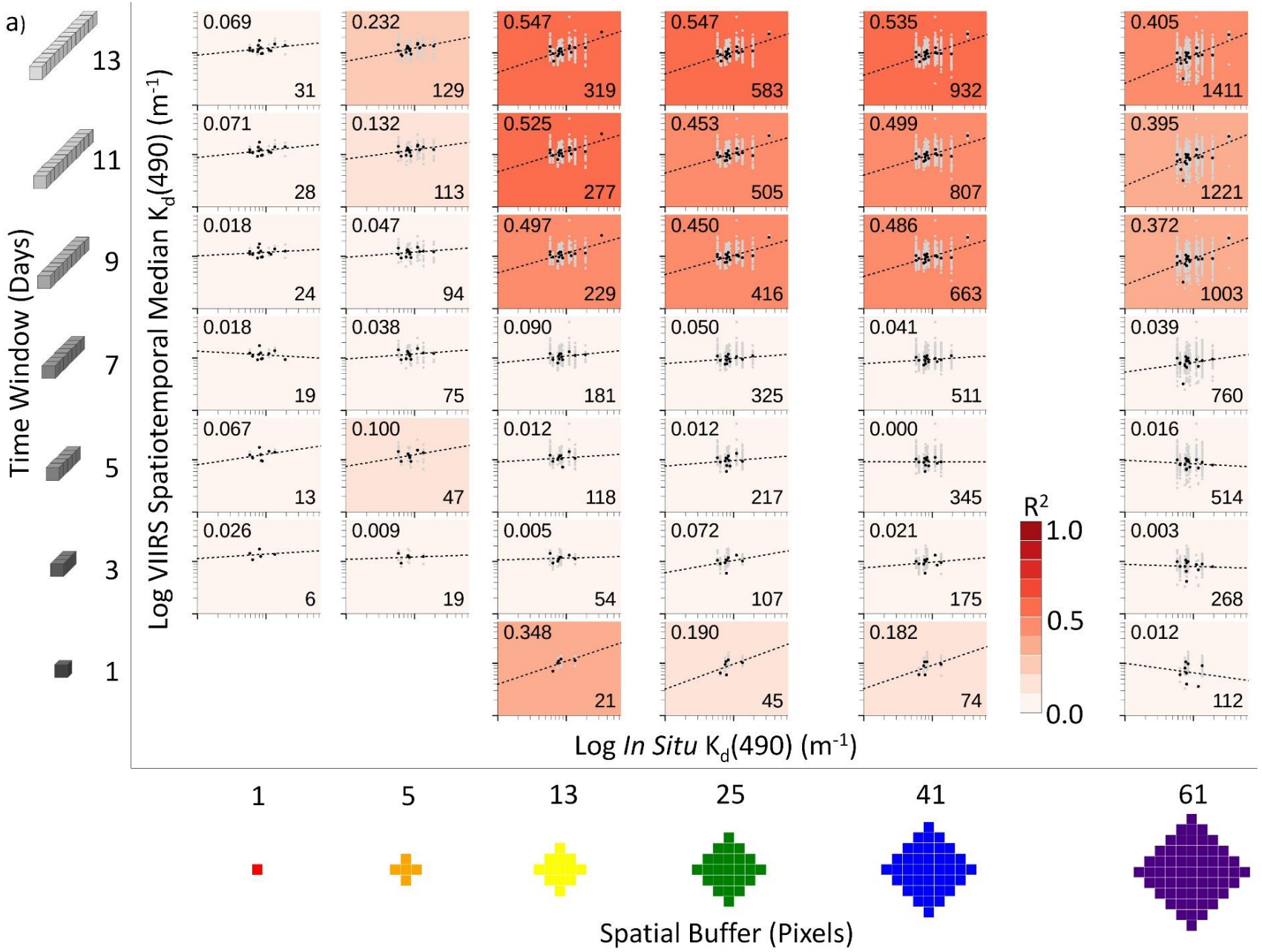


Median values from each spatiotemporal cube of VIIRS $K_d(490)$ were compared with *in situ* $K_d(490)$



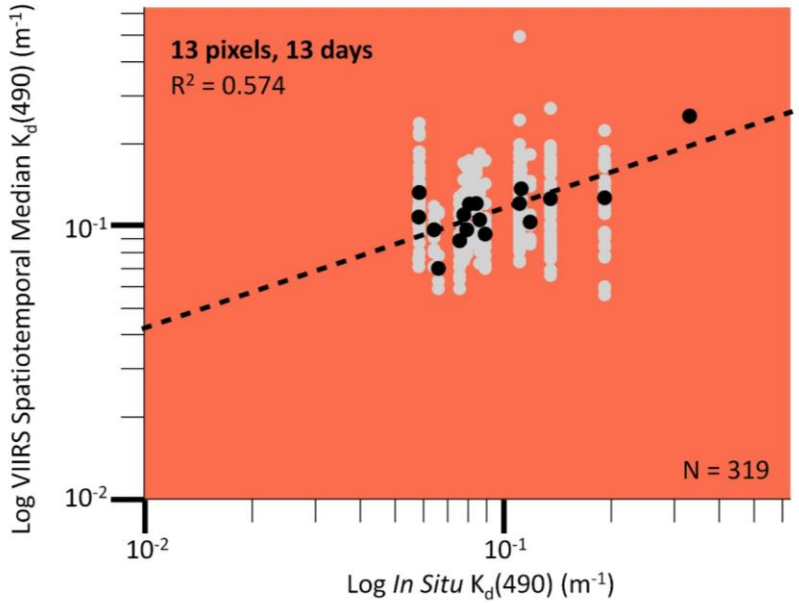
VIIRS K_d(490) and chronic states of turbidity

- 3 years of turbidity data collected from 2016-2019
- Temporal Median over 3 years of matched VIIRS data using the 5-pixel, 7-day aggregation window
- increase in both chronic VIIRS K_d(490) and turbidity from south to north follows known sedimentation patterns in Maui related to historic agricultural land use practices.

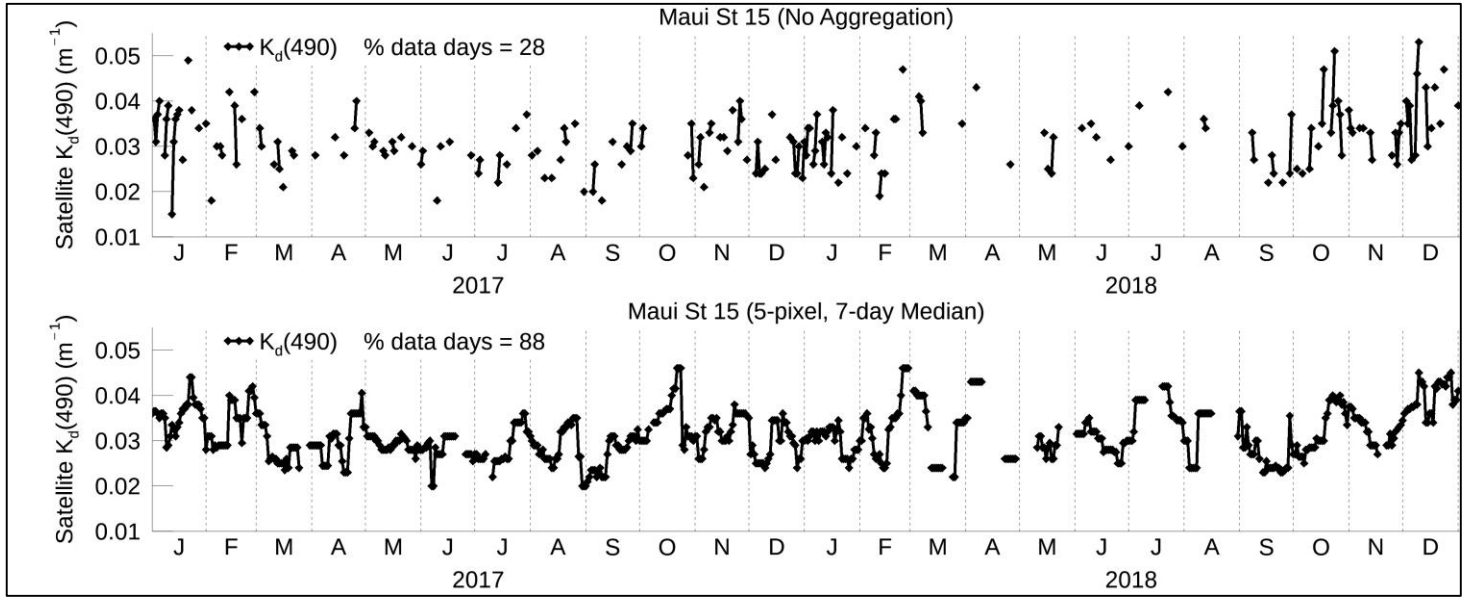


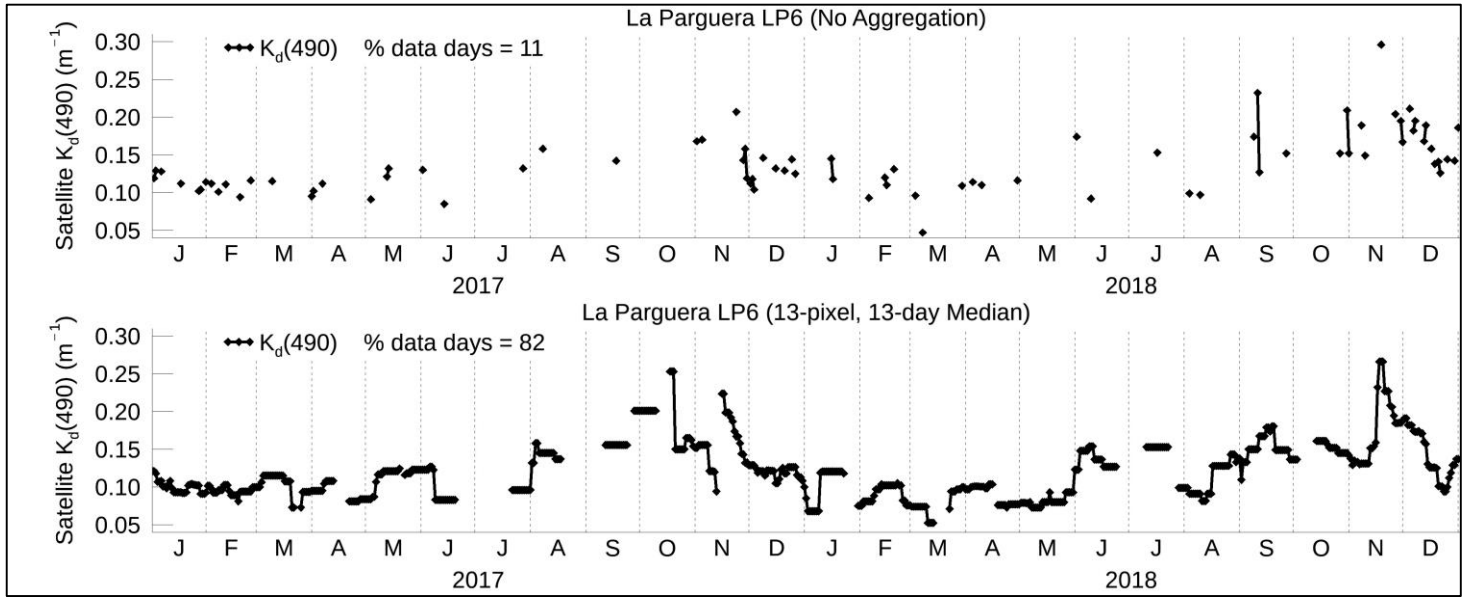
Puerto Rico

13-pixel, 13-day window



In situ values here represent dates at same location rather than different sites





Applying aggregation method yields more than 3x the available data days in Maui and more than 7x in PR

Some peaks dampened while others are captured and filled in from nearby pixels

More complete time series for testing different acute metrics for model inputs

Summary

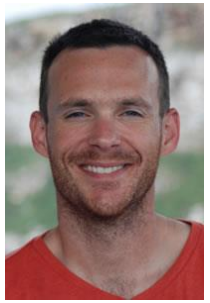
- Management tools using ocean color are limited by frequent data gaps

- This data aggregation method increases availability of data while successfully representing *in situ* data

- VIIRS $K_d(490)$ appear to be useful for monitoring and characterizing chronic states along the Maui coast where sediment input is known to be high and extends far offshore

- Our relationships in Maui and PR suggest aggregating over longer time scales produced better correlations than increasing spatial buffer size, however further analysis needed to categorically state this

Thank you from the NOAA Coral Reef Watch Team!!



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