New VIIRS Satellite Ocean Color Products for Management of Land-Based Sources of Pollution over Coral Reefs

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Introduction

Land based sources of pollution (LBSP) are a major threat to corals that can cause disease and mortality, disrupt critical ecological reef functions, and impede growth, reproduction, and larval settlement.

NOAA's Coral Reef Watch (CRW) program and the NESDIS Ocean Color Team are developing new products to monitor LBSP over coral reef ecosystems using the **Visible Infrared Imaging Radiometer Suite** (VIIRS) onboard the S-NPP satellite.

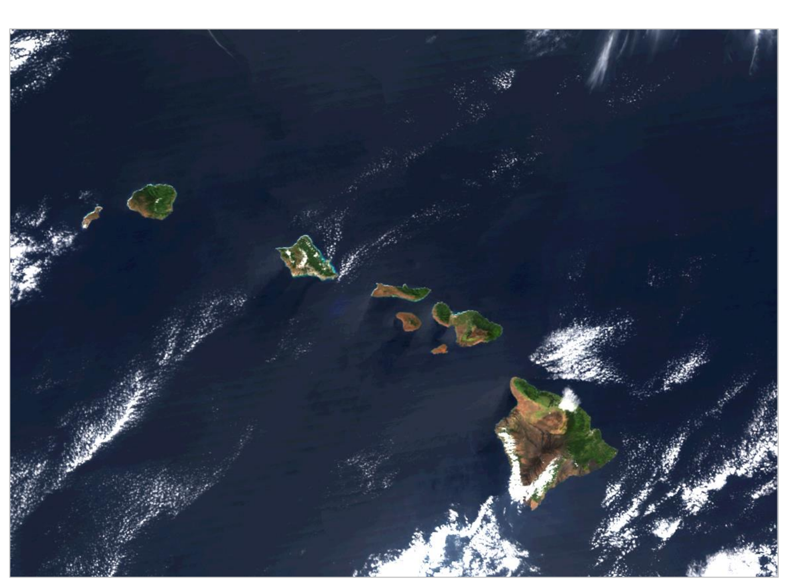
From VIIRS, near-real-time satellite products of **Chlorophyll-*a*** and **K_d(490)** are being developed for three U.S. Coral Reef Task Force priority watershed sites - Ka'anapali (West Maui, Hawai'i), Faga'alu (American Samoa), and Guánica Bay (Puerto Rico).

How Can Ocean Color Help Coral Reef Managers?

The color of coastal water is related to water quality.

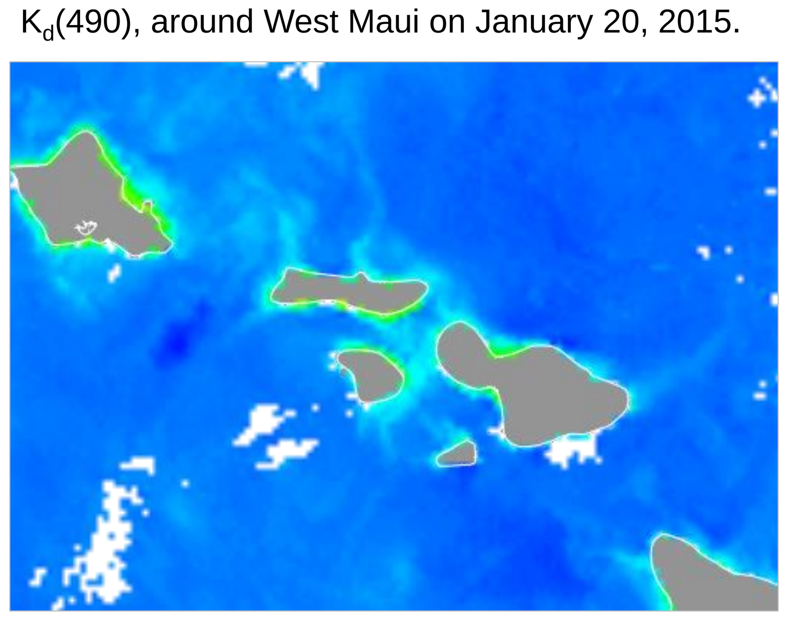
Satellite ocean color data provide a synoptic view of water quality.

(Right) A photo taken in January 2015 shows brown water in Honokahua Bay, West Maui. Photo credit: Bill Rathfon.



(Top) VIIRS true color image over Hawai'i on February 8, 2016 taken from NOAA View.

(Bottom) VIIRS Diffuse Attenuation Coefficient, K_d(490), around West Maui on January 20, 2015.



Of the many ocean color products, two are most commonly used for monitoring water quality:

Chlorophyll-*a*

A measure of phytoplankton biomass and nutrient status (**productivity**) used as an index of water quality.

K_d(490)

The diffuse attenuation coefficient at 490nm (or light blue in the visible spectrum).

Total organic and inorganic matter held in solution and suspension (**turbidity**) within the water column.

Ocean Color Tools for Reef Managers

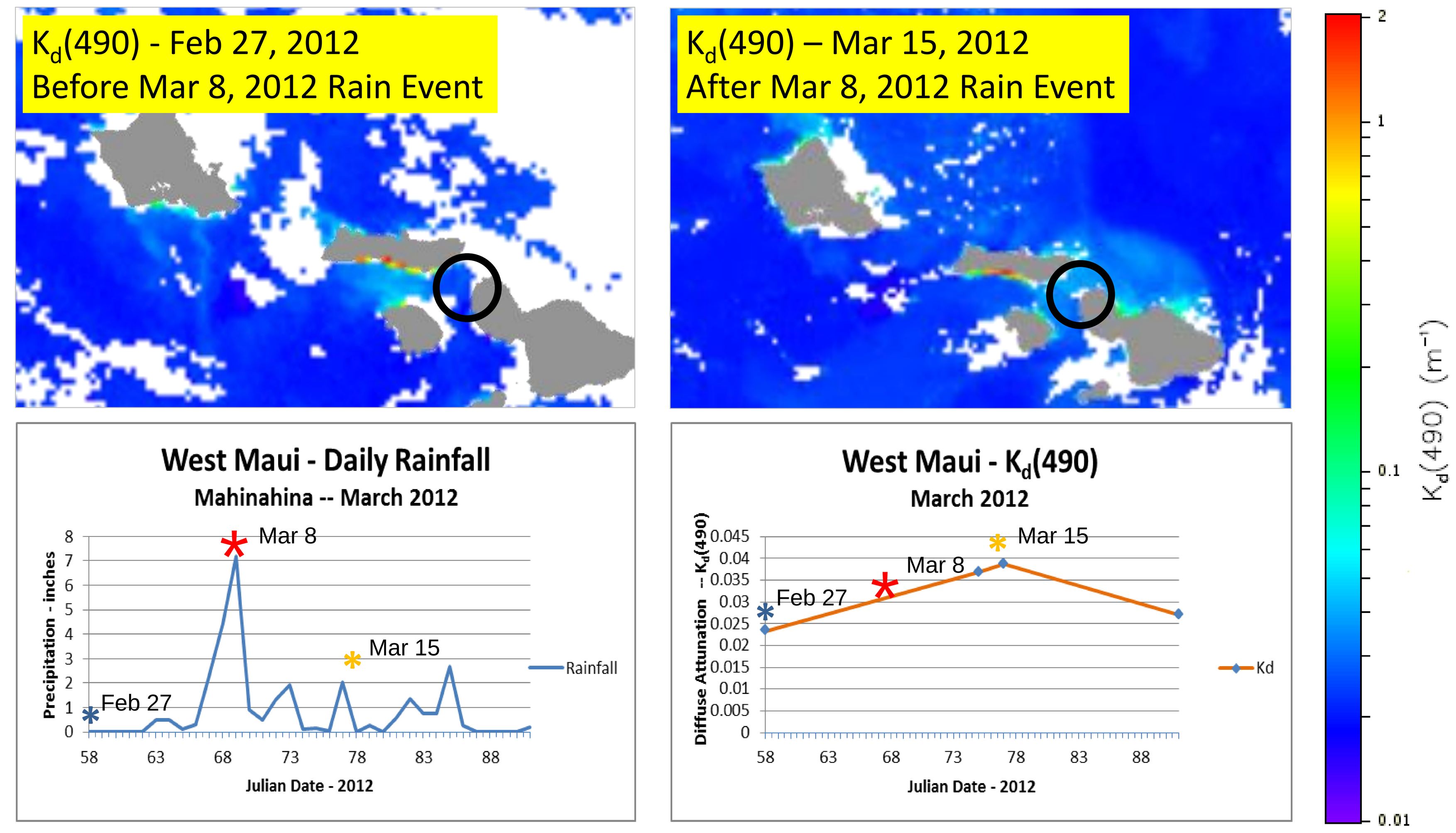


Figure 1. (Top left and right) VIIRS K_d(490) images for February 27 and March 15, 2012. Black circles indicate the West Maui watershed. (Bottom left) Daily rainfall amounts in Mahinahina from February 27 to March 31, 2012. (Bottom right) K_d(490) values near West Maui watershed for the same time period. The large rainfall event is associated with a local rise in K_d(490) or turbidity.

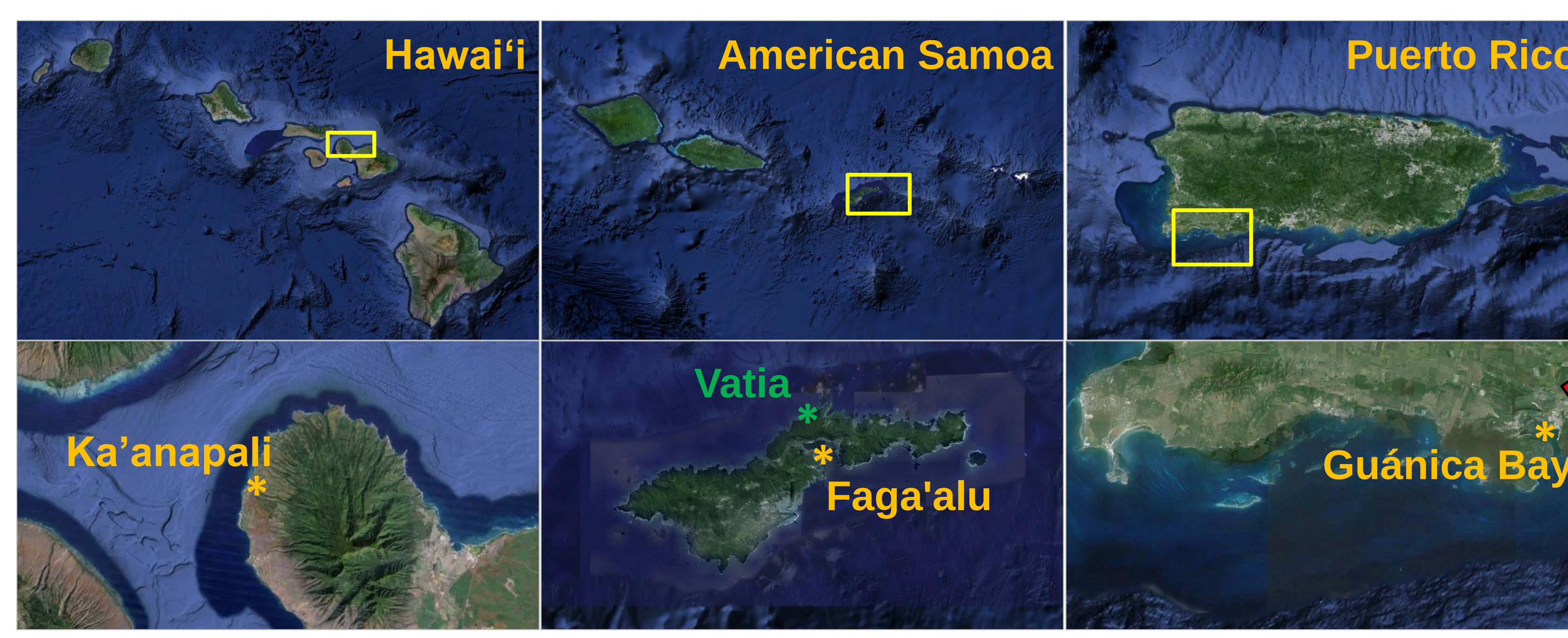
◂ Matching large rainfall events to satellite derived measurements for inspection by reef managers led to the development and refinement of the three priority watersheds and associated "Virtual Areas".

Virtual Areas

Establishing virtual areas around watersheds will enable calculation of plume statistics such as:

- Maximum and average levels of Chlorophyll-*a* and K_d(490)
- Monthly climatologies
- Variations from "baseline" levels through time

US Coral Reef Task Force Priority Watersheds



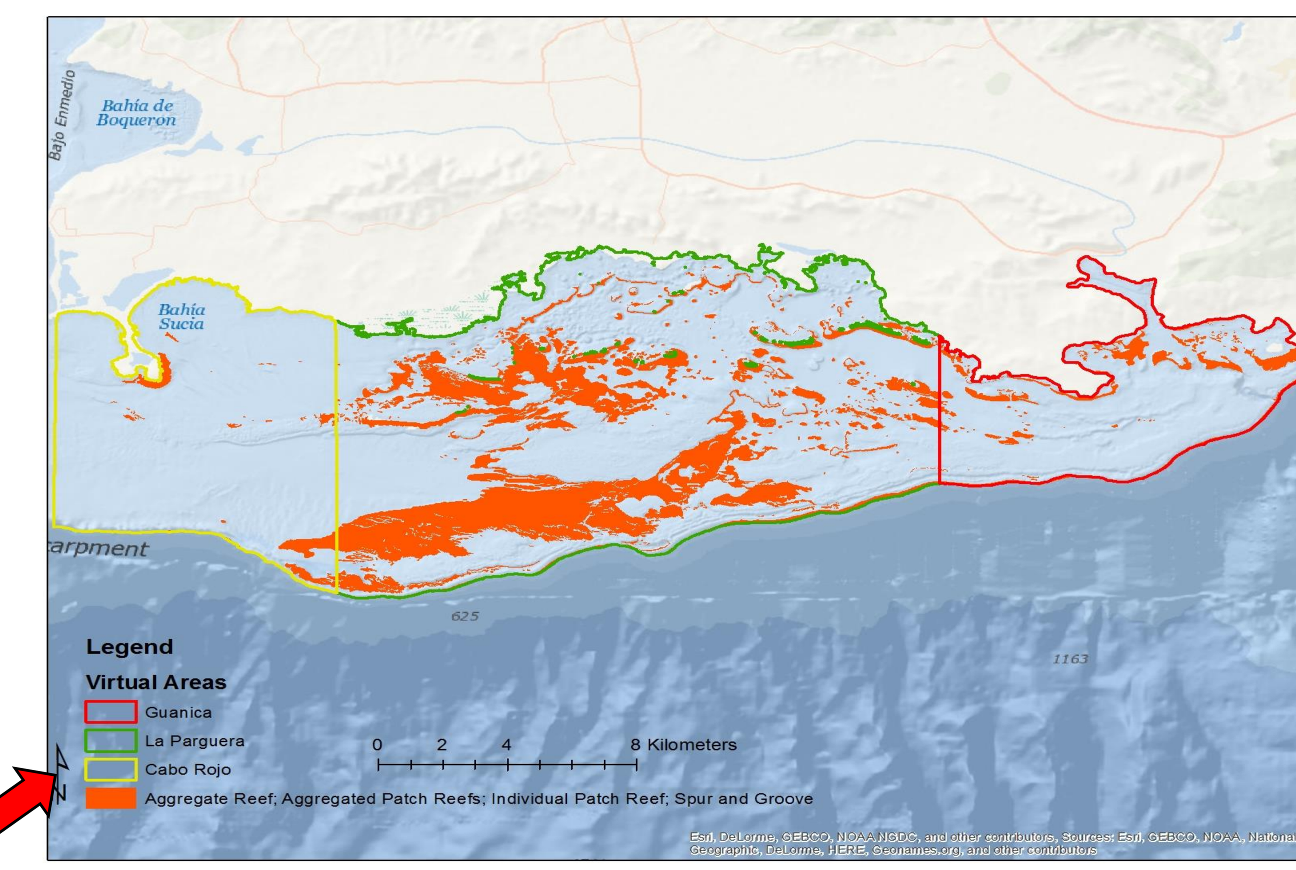
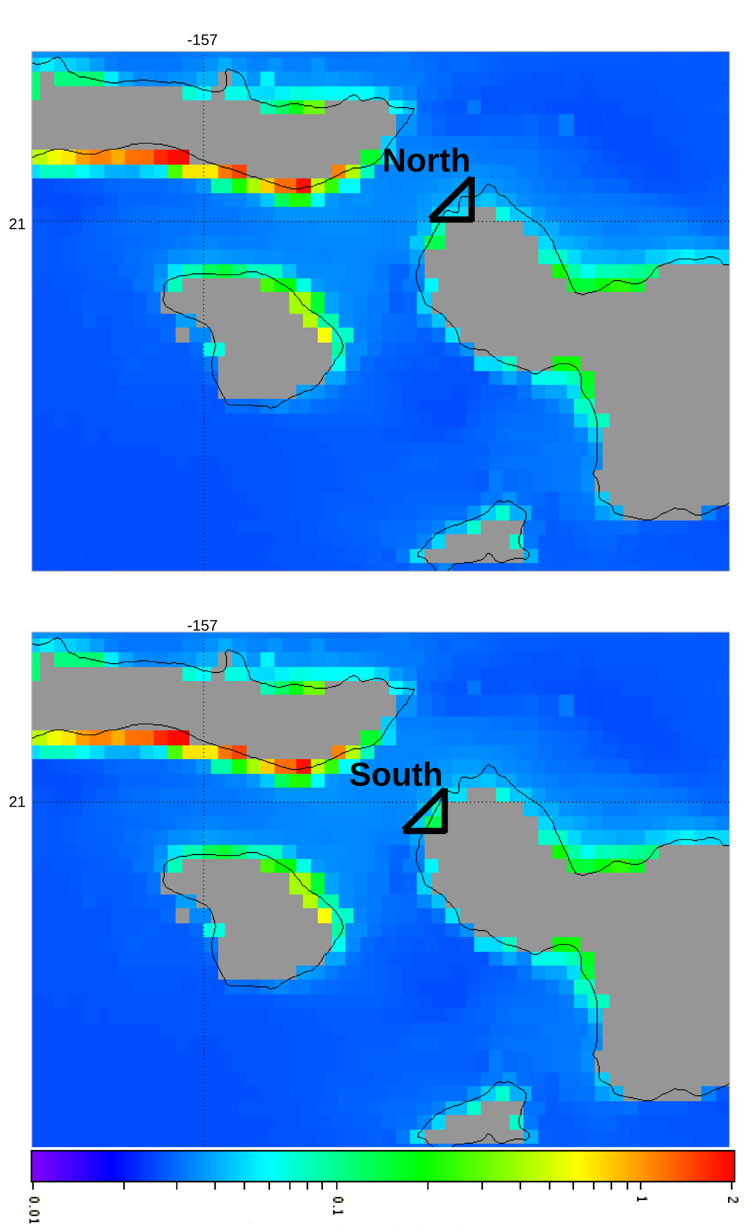
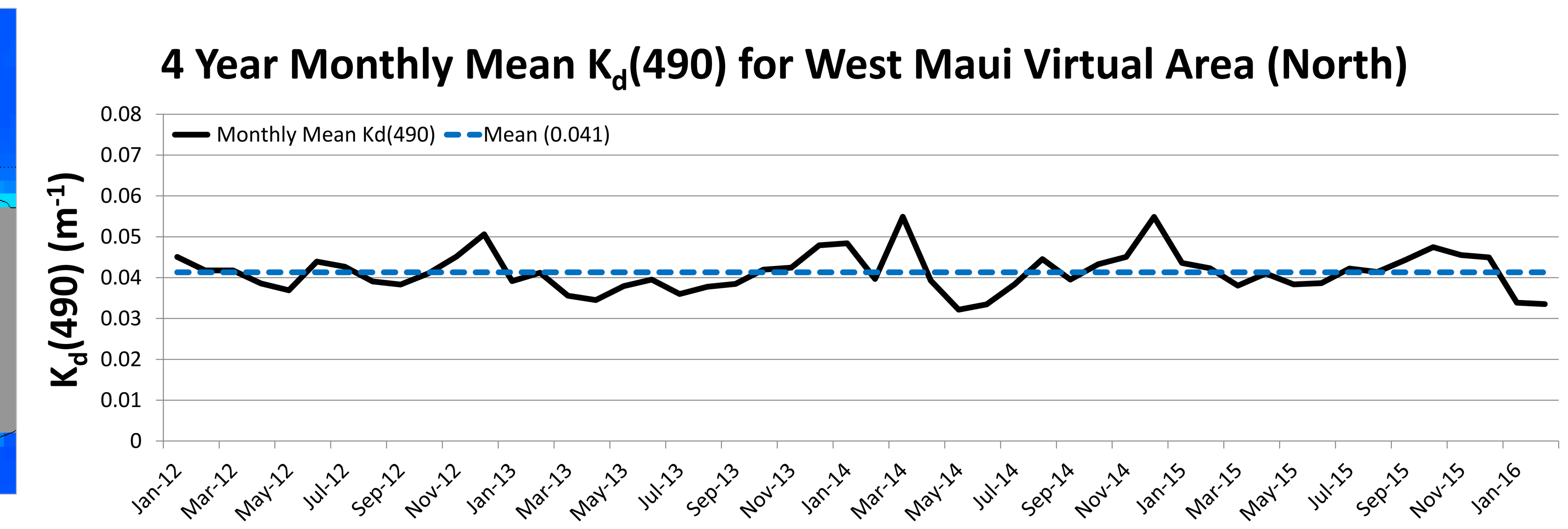


Figure 2. Southern Puerto Rico Virtual Area development at Guánica Bay (red outline), La Parguera (green outline), and Cabo Rojo (yellow outline). Also shown are the coral reef areas (orange). The current area for Guánica was developed after dialog with the Guánica Watershed Coordinator and analyzing K_d(490) and Chl-a from VIIRS. Virtual Areas are in development for all three U.S. Coral Reef Task Force priority watersheds. Figure credit: William Hernandez.

Climatology

Derived anomalies of Chlorophyll-*a* & K_d(490) will be generated over virtual areas in each watershed to analyze changes from "baseline" levels through time, allowing managers to gauge the severity of events.





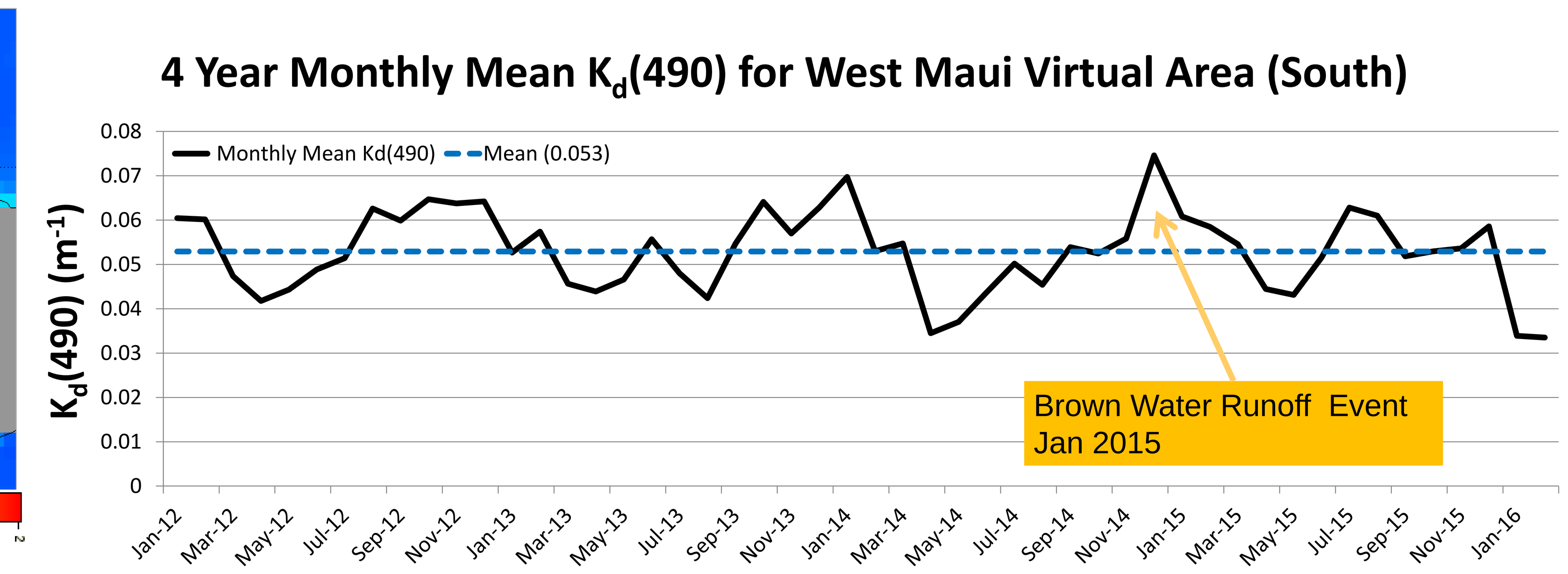


Figure 3. (Left) Average of monthly mean K_d(490) from Jan 2012 – Feb 2016 showing the north (top) and south (bottom) virtual areas. (Right) Time series of averaged monthly mean K_d(490) values and the mean value across all years from Jan 2012 to Feb 2016. The top time series monthly means were averaged in the black triangle in the top left image. The bottom time series monthly means were averaged in the black triangle in the bottom left image.