# PacIOOS projects using Open Source GIS for web visualization

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# U.S. INTEGRATED OCEAN OBSERVING SYSTEM

PacIOOS
PACIFIC ISLANDS OCEAN OBSERVING SYSTEM

## Regional Associations


- IOOS is part of NOAA (National Ocean Service)
- 11 Regional Associations
- Stakeholder Driven

# PacIOOS REGION


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IOOS
Integrated Ocean Observing System

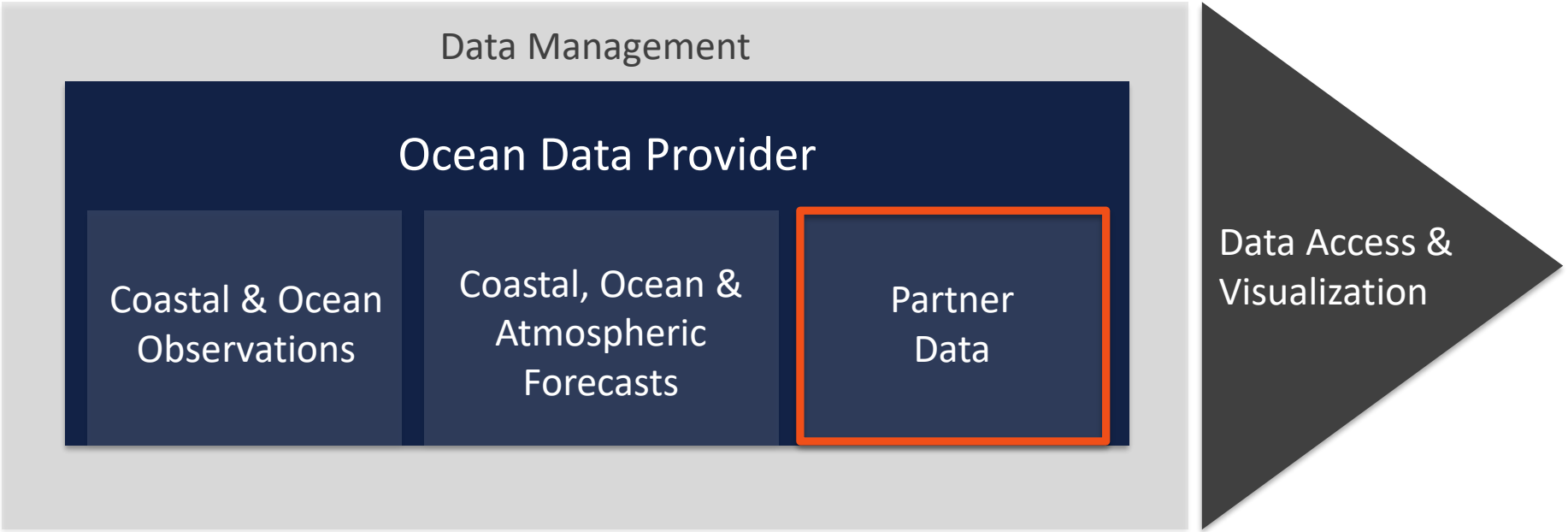
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
UNIVERSITY OF HAWAI'I AT MĀNOA

UNIVERSITY OF HAWAI'I
UA MAU KE EA O KA 'ĀINA I KA PONO
1907

# PACIFIC ISLANDS OCEAN OBSERVING SYSTEM

## What is PacIOOS?




***MISSION*** *- PacIOOS empowers ocean users and stakeholders throughout the Pacific Islands by providing accurate and reliable coastal and ocean information, tools, and services that are easy to access and use.*

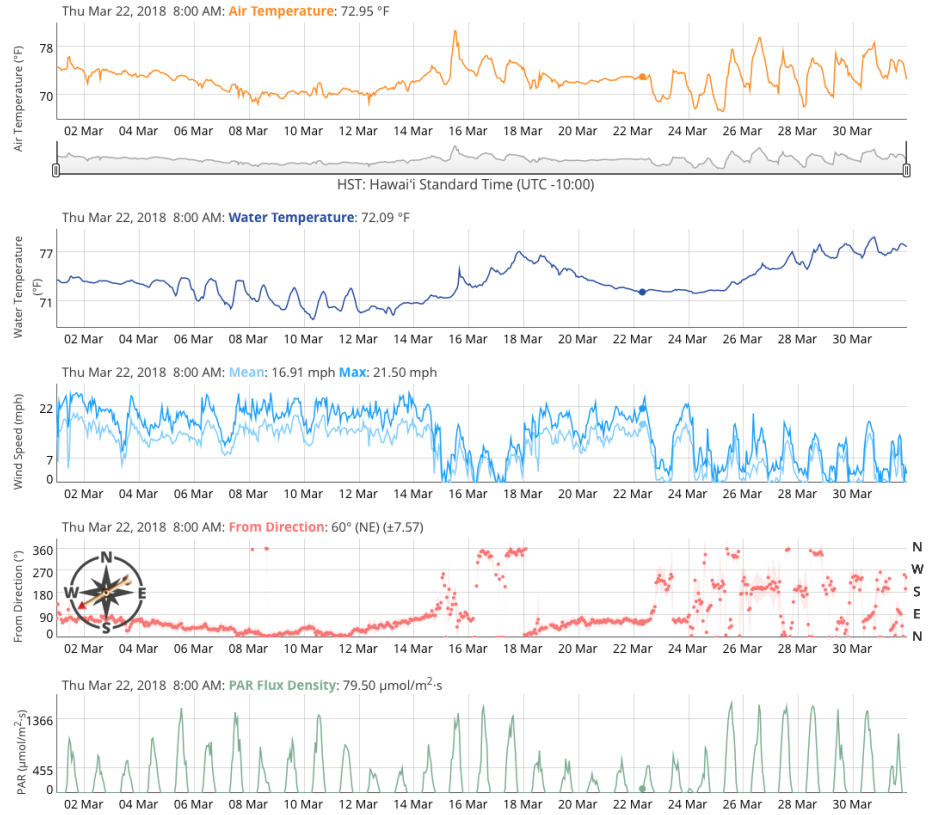
# PacIOOS WEBSITE

## Introduction

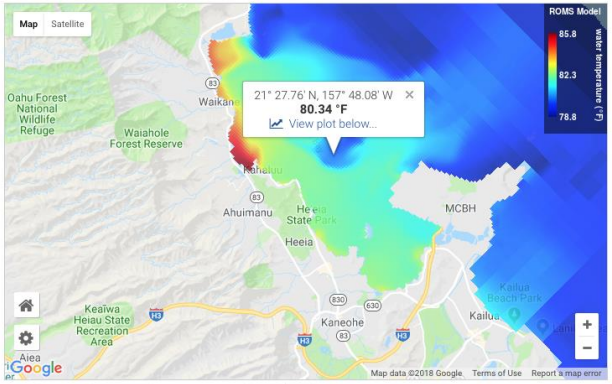
# PacIOOS WEBSITE

## Dynamic Data Plots

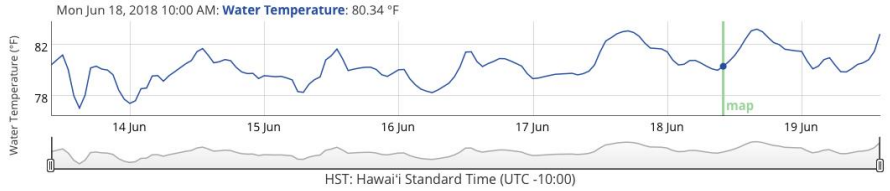
start date: time window: 30 days temperature: °F °C wind: mph knots km/h rain: in mm




date: Mon Jun 18, 2018 time: 10:00 AM HST (UTC-10) depth: -0.25 m unit: °F °C




plot: time depth time window: default



# PARTNER DATA VISUALIZATION

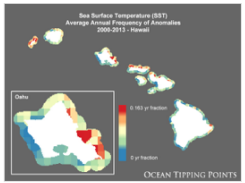
## Ocean Tipping Points

**Projects : Ocean Tipping Points: Hawai'i Case Study**

*Discovering when, where, and how ocean tipping points occur in diverse ecosystems*

Overview | Case Study | Findings | Value | Data | Partners | Data Sources

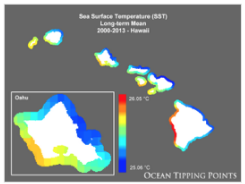
**Sea Surface Temperature (SST) Average Annual Frequency of Anomalies, 2000-2013 – Hawaii**




**id:** hi_otp_all_sst_anom_freq

**access methods:** WMS-C • WMS • WCS • GeoTIFF • KML • GeoServer • GeoExplorer • metadata

**Sea Surface Temperature (SST) Long-term Mean, 2000-2013 – Hawaii**




**id:** hi_otp_all_sst_avg

**access methods:** WMS-C • WMS • WCS • GeoTIFF • KML • GeoServer • GeoExplorer • metadata

**Sea Surface Temperature (SST) Standard Deviation of Long-term Mean, 2000-2013 – Hawaii**

- ✧ Provide partners with a 'one-stop-shop' to share project information
- ✧ Visualize project outcomes in a map viewer
- ✧ Provide data repository and public access

# PARTNER DATA VISUALIZATION

## Estimated Coral Cover in Hawai‘i

# PARTNER DATA VISUALIZATION

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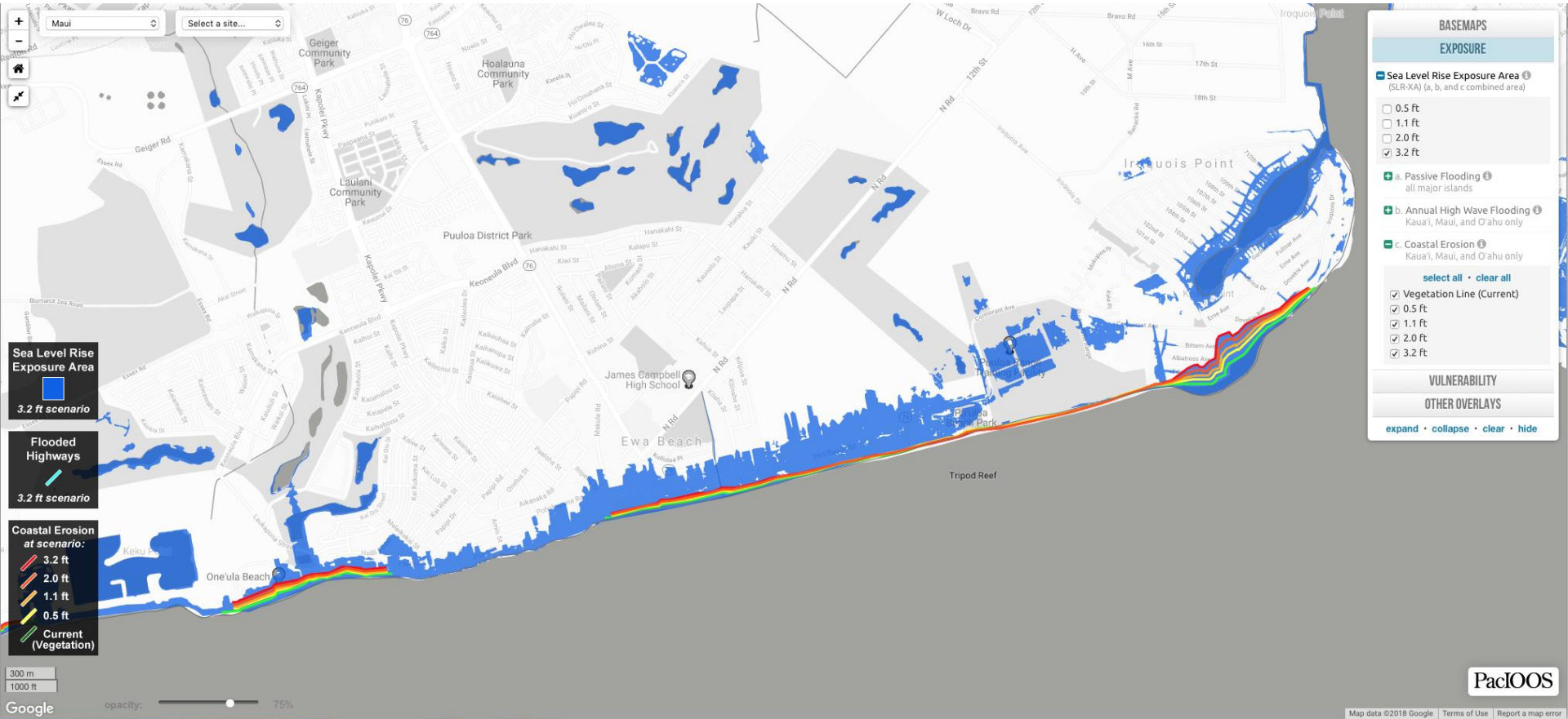
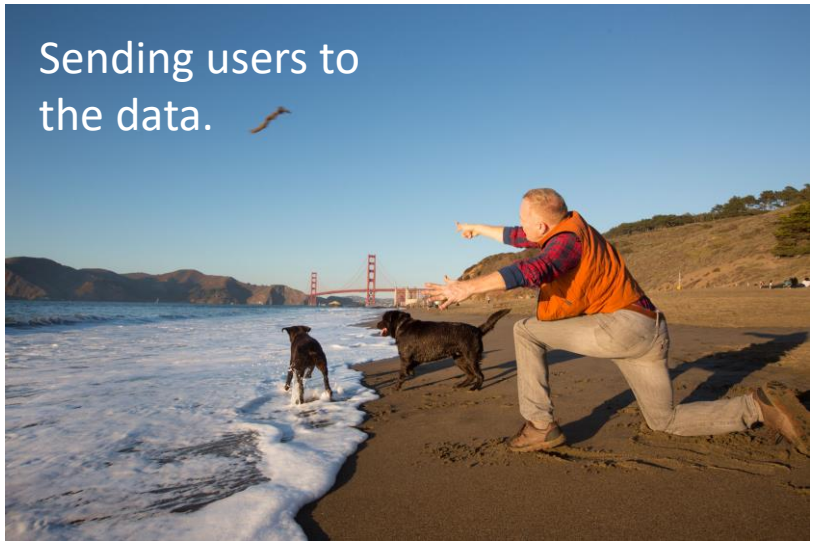
## Hawai'i Sea Level Rise Viewer

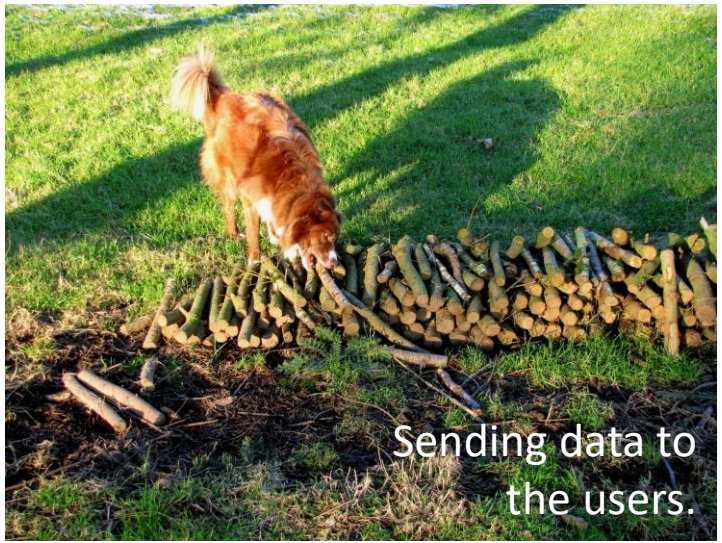


## Putting Data To Use

PacIOOS PACIFIC ISLANDS OCEAN OBSERVING SYSTEM ↔ USE




vs.



# SERVING DATA ON THE WEB

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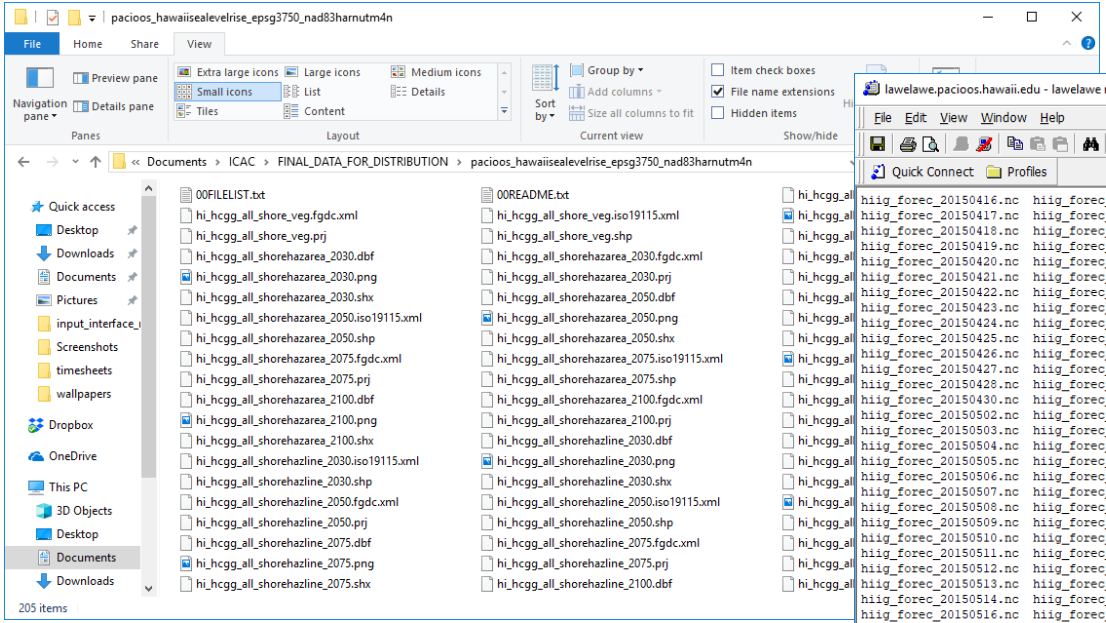
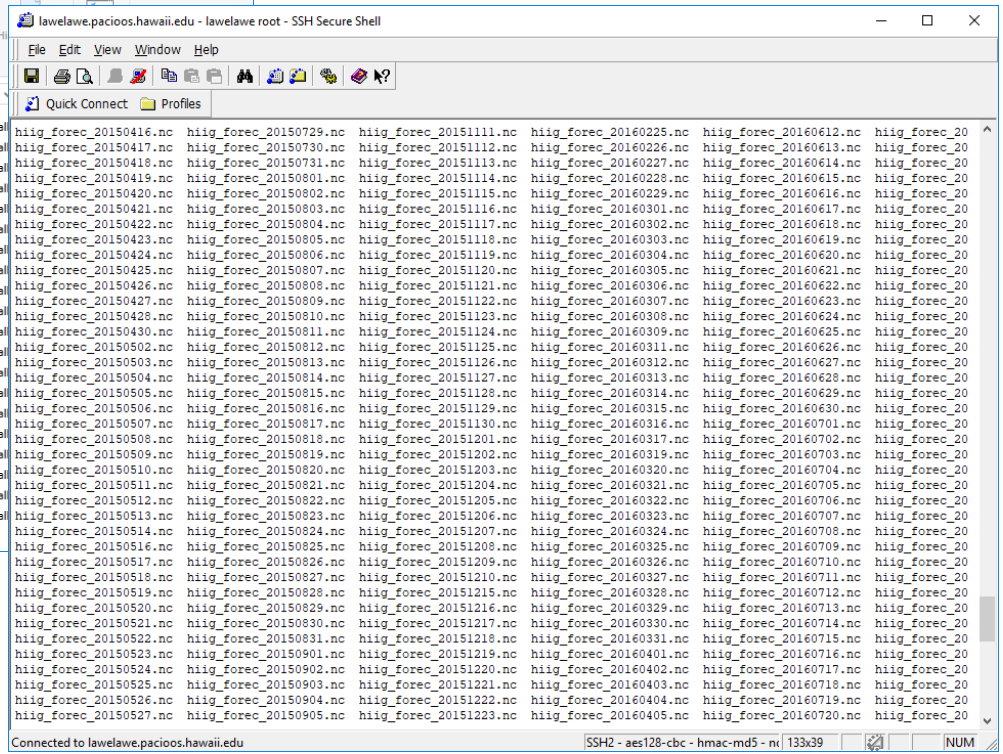
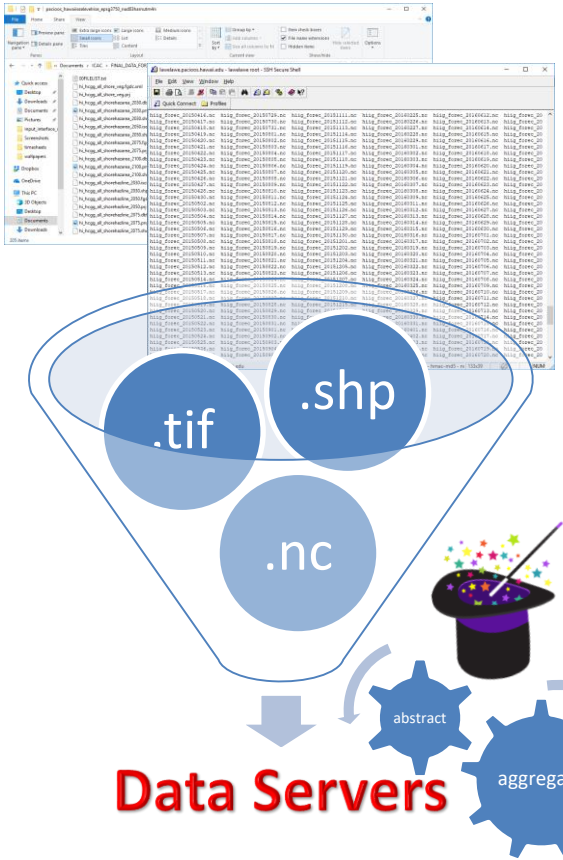
## Web Services



# SERVING DATA ON THE WEB

## Web Services




**Web Services**

- OPeNDAP
- WFS
- WMS

**REST** = Representational State Transfer

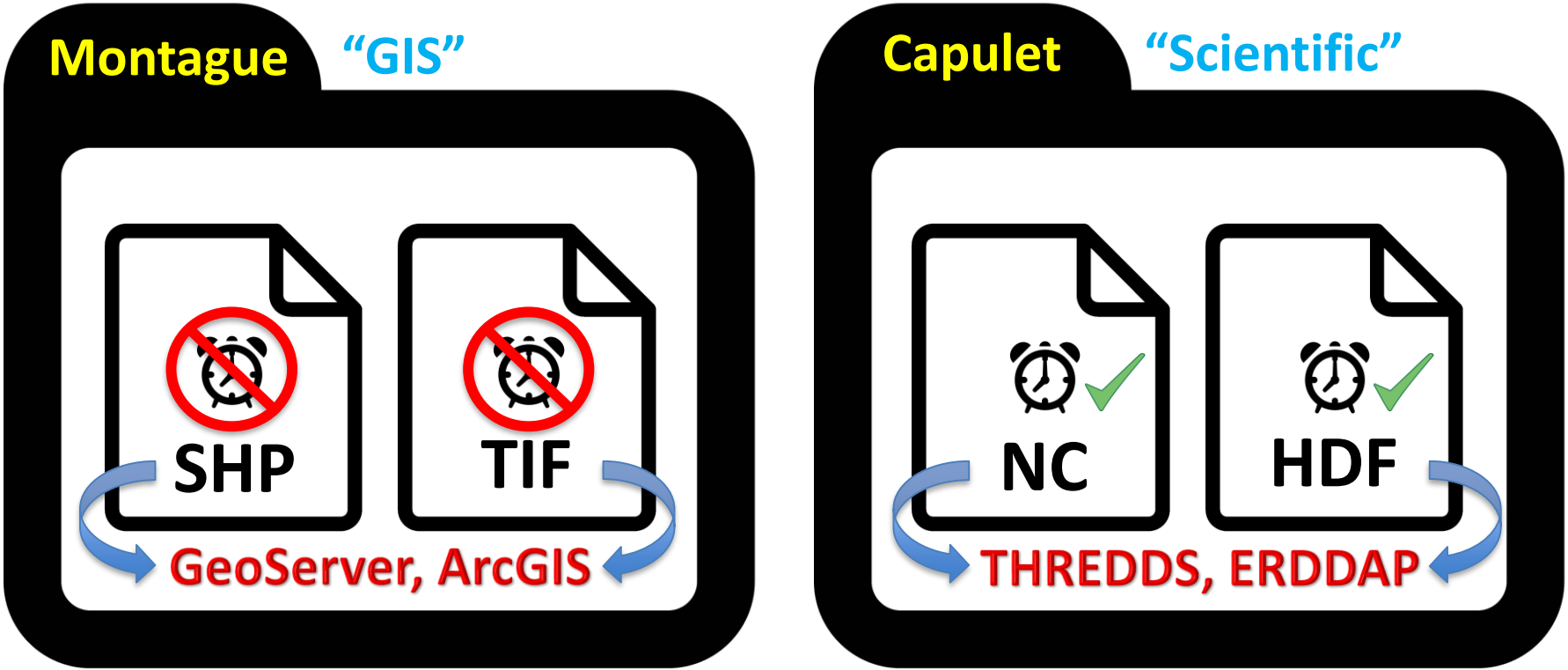
**API** = Application Programming Interface

~~http://some.address.org/directory/***filename.zip***~~

http://some.address.org/give-me?***dataset***&***place***&***time***&***format***

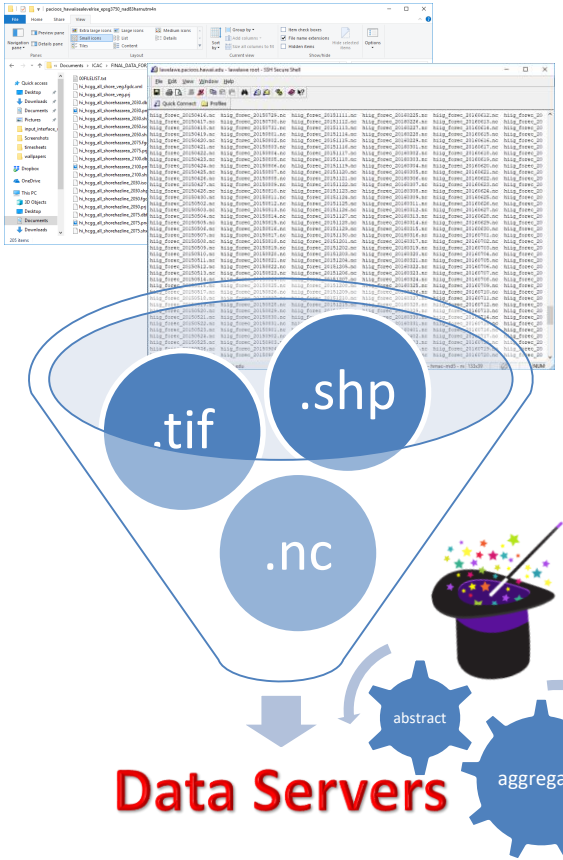
# SERVING DATA ON THE WEB

## A House Divided



# SERVING DATA ON THE WEB

## Web Services

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## Building A Web Interface

**One size fits all?**


**(One size fits *some*.)**

*Case in point: Montagues and Capulets.*

**vs.**

**Made to order.**

**JavaScript + Python**

# SERVING DATA ON THE WEB

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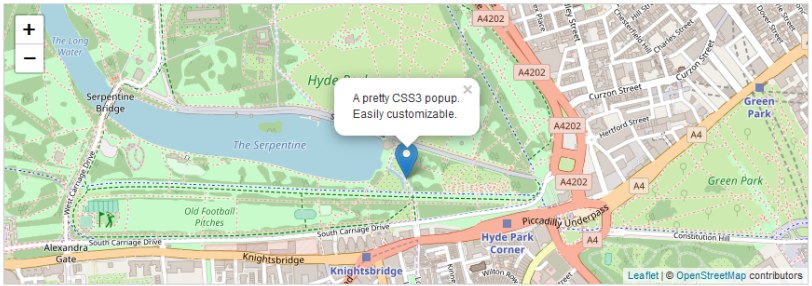
## Web Mapping APIs

Leaflet

an open-source JavaScript library
for mobile-friendly interactive maps

Leaflet is the leading open-source JavaScript library for mobile-friendly interactive maps. Weighing just about 38 KB of JS, it has all the mapping features most developers ever need.

Leaflet is designed with *simplicity*, *performance* and *usability* in mind. It works efficiently across all major desktop and mobile platforms, can be extended with lots of plugins, has a beautiful, easy to use and well-documented API and a simple, readable source code that is a joy to contribute to.



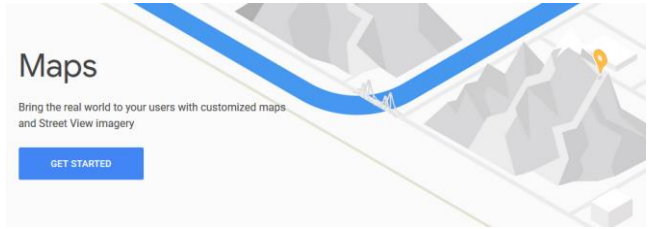

Here we create a map in the `'map'` div, add tiles of our choice, and then add a marker with some text in a popup:

```
var map = L.map('map').setView([51.505, -0.09], 13);

L.tileLayer('https://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png', {
    attribution: '&copy; <a href="https://www.openstreetmap.org/copyright">OpenStreetMap</a> contributors'
}).addTo(map);

L.marker([51.5, -0.09]).addTo(map)
    .bindPopup('A pretty CSS3 popup.<br> Easily customizable.')
    .openPopup();
```

Google Maps Platform




ADD A MARKER TO A MAP | ADD A MAP IN ANDROID | ADD A MAP IN IOS | APPLY CUSTOM STYLING


```
        https://developers.google.com
/maps/documentation/javascript/tutorial
    -->
    <link rel="stylesheet" href="/maps/documentation
/javascript/cgc/demos.css">
  </head>
  <body>
    <div id="map"></div>
    <script>
      function initMap() {
        var myLatLng = {lat: -25.363, lng: 131.044};

        // Create a map object and specify the DOM
element
        // for display.
        var map = new
google.maps.Map(document.getElementById('map'), {
          center: myLatLng,
          zoom: 4
        });

        // Create a marker and set its position.
        var marker = new google.maps.Marker({
          map: map,
          position: myLatLng,
          title: 'Hello World!'
        });
      }

    </script>
    <script src="https://maps.googleapis.com/maps/api
/js?key=YOUR_API_KEY&callback=initMap"
        async defer></script>
  </body>
</html>
```

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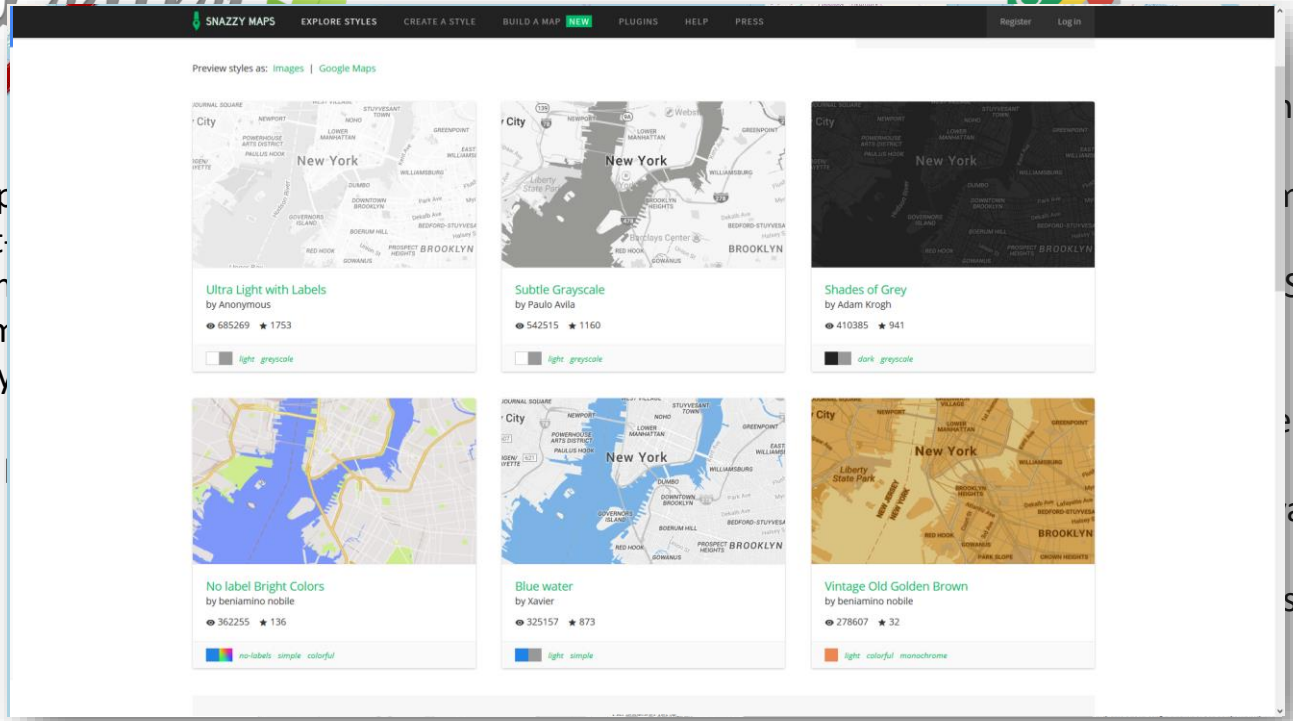
## Leaflet vs. Google Maps API

Native OGC

No basemap
with Leaflet
Esri, Stamen
Maps basem
kinda klugey

Third-party




nagery).

Styling Wizard

nu up to you.

ation services.

ss key) and

# SERVING DATA ON THE WEB

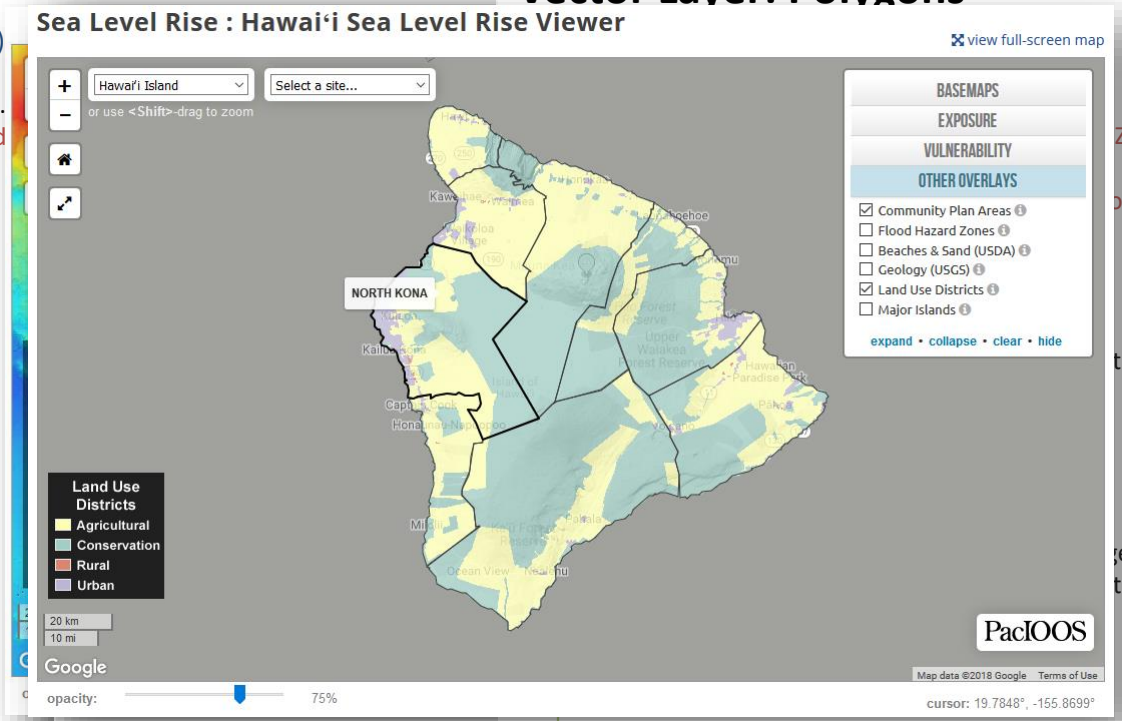
## Leaflet JavaScript

### Raster Layer:

```
// Bathymetry (HMRG 50-m)

var bathymetry = L.tileLayer.
  'http://oos.soest.hawaii.ed
  {
    layers: 'z' ,
    version: '1.1.1' ,
    styles: 'boxfill/bathy' ,
    format: 'image/png' ,
    transparent: true ,
    opacity: 0.75 ,
  }
);
```

### Vector Layer: Polygons




```
Zoning/MapServer/24/query?

ope&inSR=4326&outFields=*&retu

t + '</b>' );

getBounds().getWest(),
t() );

}
);
```

***Thank you!***

***Any questions?***

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