

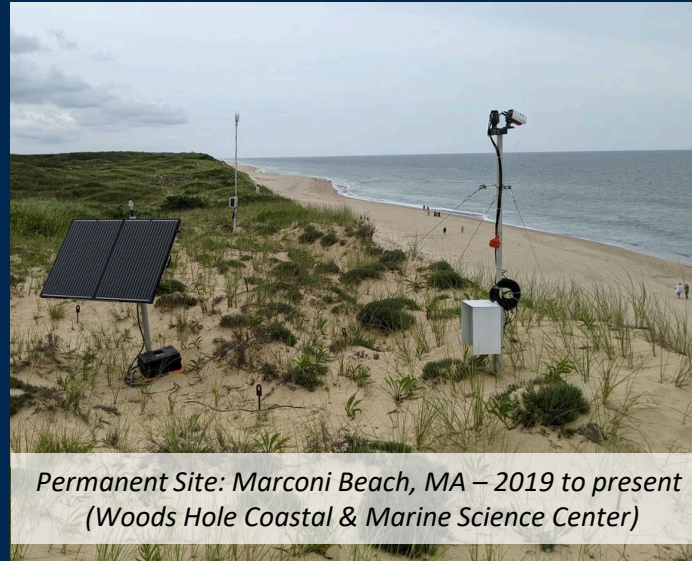
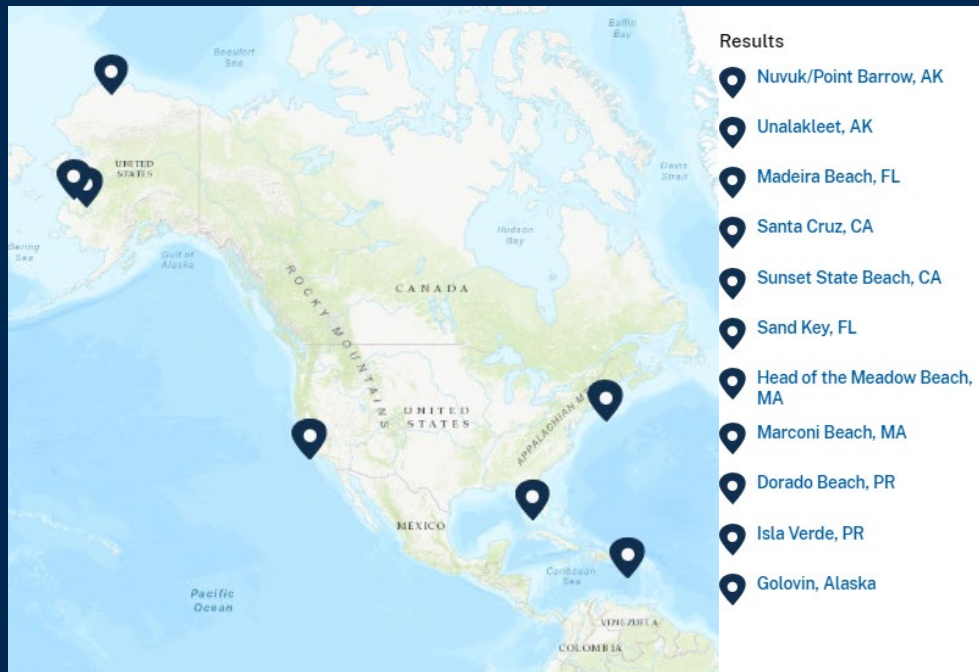


***USGS Coastal & Marine Hazards and Resources Program***

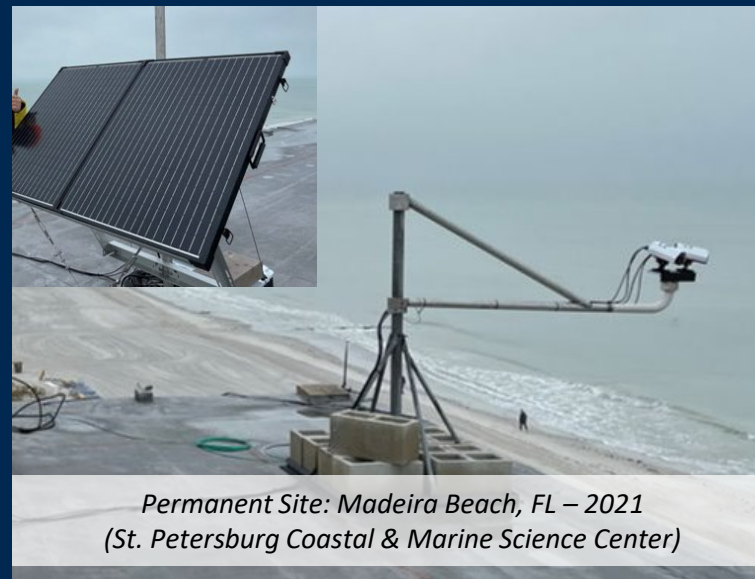
# **“CoastCam” Network**

# CoastCam Network

- Cameras deployed in 9 states/territories since 2017
- Can be a long-term (permanent) or short-term (temporary, mobile) installation



*Permanent Site: Marconi Beach, MA – 2019 to present  
(Woods Hole Coastal & Marine Science Center)*

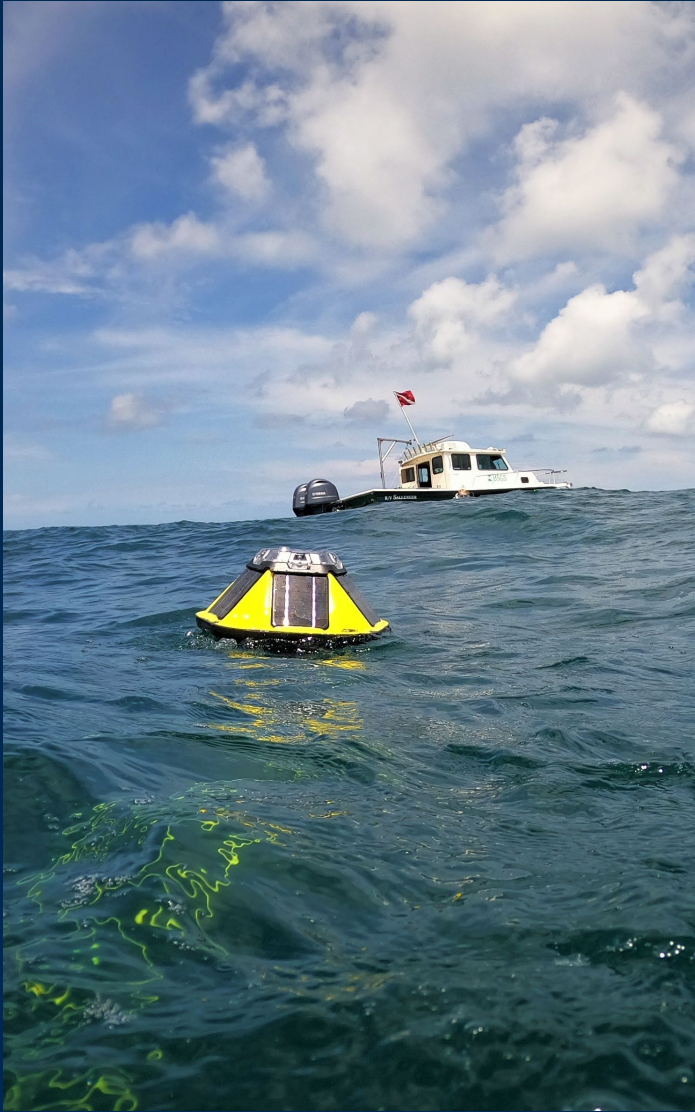


*Permanent Site: Madeira Beach, FL – 2021  
(St. Petersburg Coastal & Marine Science Center)*



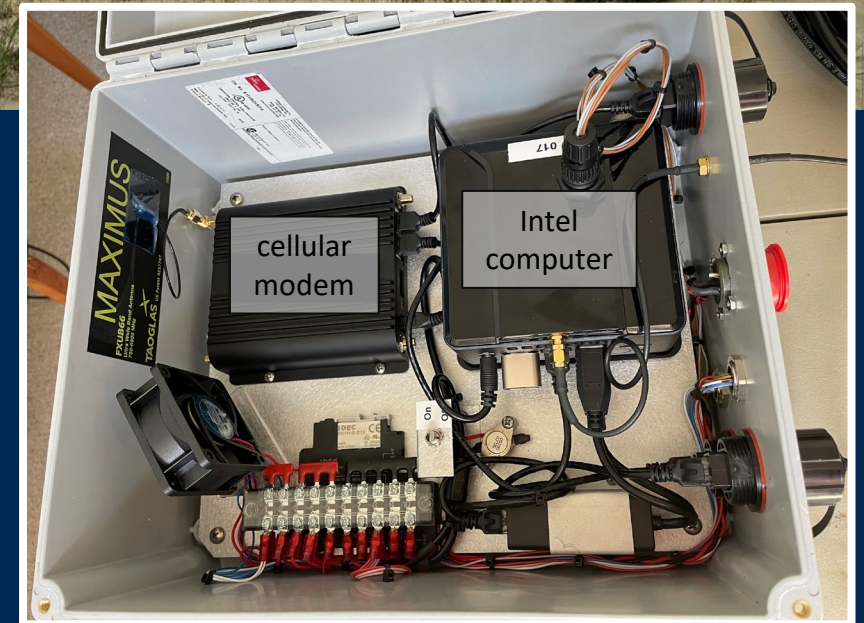
*Temporary Site: Pea Island National Wildlife Refuge, NC – DUNEX, 2021*

# CoastCam Network



# CoastCam: Hardware

- Commercial camera station (I2Rgus)
  - Design based on classic “Argus” system
  - 2 cameras
    - GigE, 5-12MP, 8-12mm lenses, solar shield
  - NUC Intel Computer
  - Cellular Modem / Network Connection
  - Battery + Solar Powered (or Power Outlet)
  - Infrastructure is site dependent



# CoastCam: Purpose

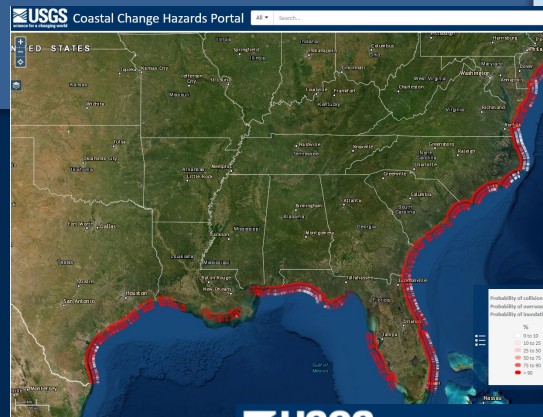
- Deploy and maintain system of cameras to monitor coastal change

- Develop image products to assess and quantitatively measure coastal processes

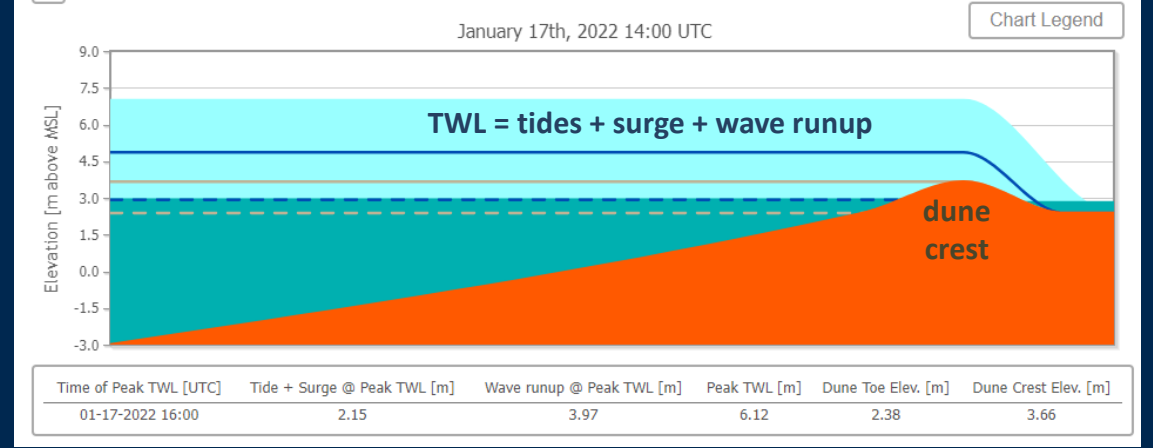
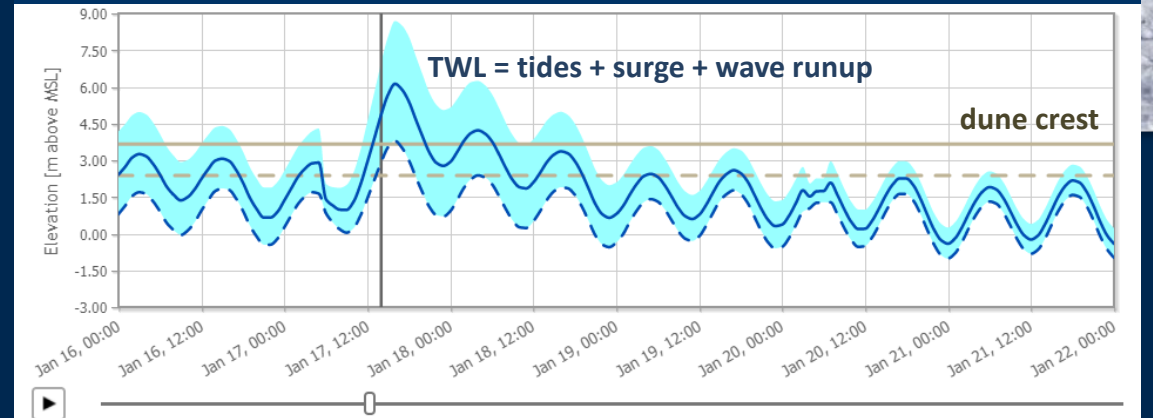
...with the goal of validating the operational

Total Water Level and Coastal Change Forecast

- Disseminate images and image products



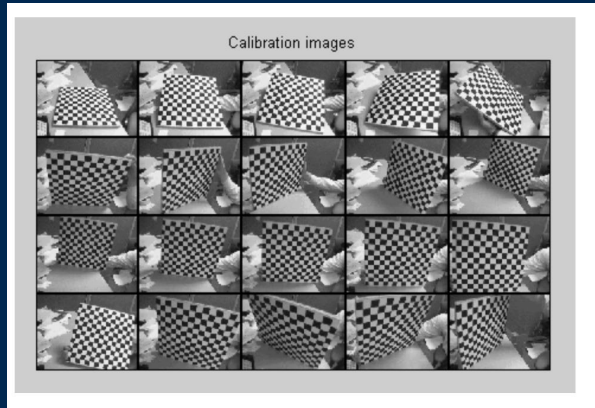
## USGS Total Water Level and Coastal Change Forecast Viewer



# CoastCam: Image Collection & Edge Products

## During deployment

0. Camera installation, intrinsic and extrinsic calibrations & surveys



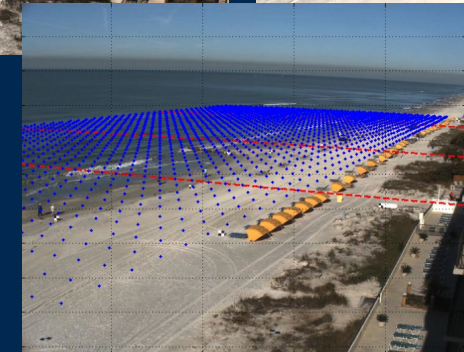
## Every (Daylight) Hour

1. Collect raw images for 17 minutes at 2Hz, once or twice an hour during daylight



2. Create image products:

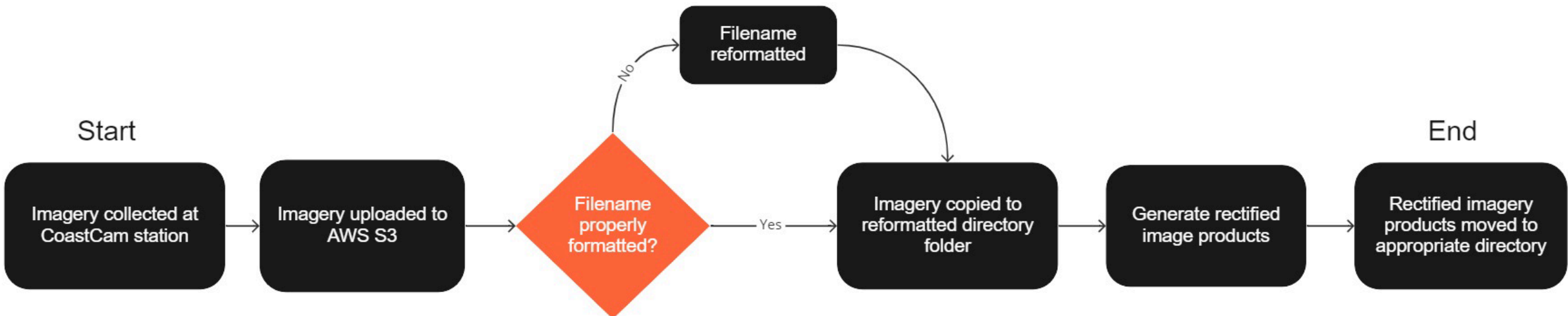
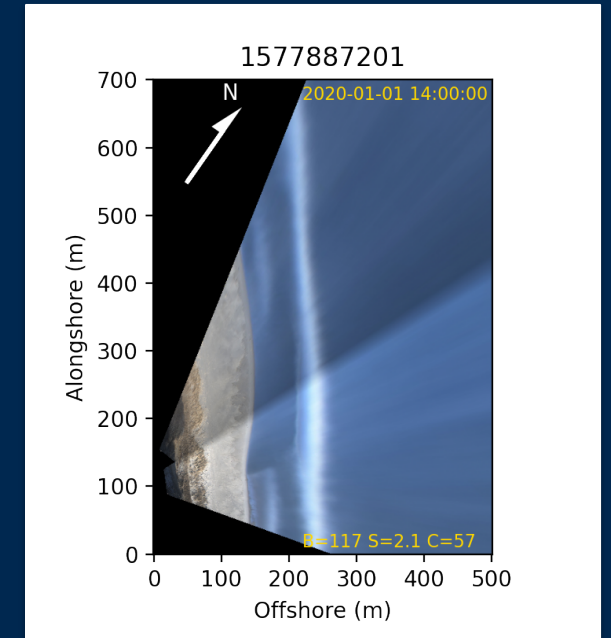
- snapshot
- time-exposure
- time-variance
- pixel timeseries
  - wave runup timestack
  - cBathy



# CoastCam: AWS Post-Processing

## 3. Web-based Services

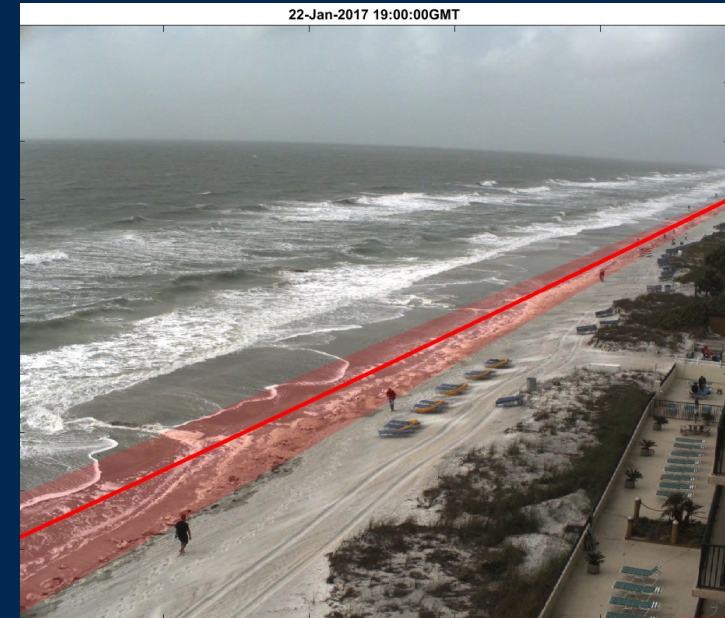
- Metadata saved on CHS in primary MySQL DB
- Image calibration metadata stored as EXIF tags for publication
- Image products saved on AWS S3
  - Utilize AWS Lambda functions for automated geo-rectification, image stability, feature extraction, etc.
  - Employ AWS Greengrass to facilitate data transfer to AWS S3 and minimize operational issues during network outages (e.g., storms)
  - Serve processed data online in real-time for model validation



# CoastCam: AWS Post-Processing

## 4. Serving data

- Image products released as provisional data
- Post-processed published via data release
- Future Goal:
  - Processed data online in real-time for model validation



ST. PETERSBURG COASTAL AND MARINE SCIENCE CENTER SCIENCE

## Video Remote Sensing of Coastal Processes ACTIVE

By St. Petersburg Coastal and Marine Science Center December 13, 2017

### Overview

Video observations of the coast are used to monitor a range of coastal processes; example changes in the shoreline position, both seasonally and due to long-term such as sea-level rise, and instances of beach and dune erosion during extreme events.

### Recent Images from Madeira Beach, Florida



A high resolution digital video camera is installed atop a at Madeira Beach, Florida, overlooking the Gulf of Mexico. The most recent snapshot and time-averaged images are shown. Images are used to examine a range of coastal processes: shoreline position, the presence of an offshore sandbar, and wave runup on the beach. Camera hosted by Shoreline ISL

This information is preliminary or provisional and is subject to being provided to meet the need for timely best science. The information has not received final approval by the U.S. Geological Survey (USGS) and is provided on the condition that neither the USGS nor the U.S. Government is liable for any damages resulting from the authorized or unauthorized use of this information.

Sources/Usage: Public Domain.



### Data Release

#### USGS CoastCam at Madeira Beach, Florida: Timestack Imagery and Coordinate Data

By Jenna A. Brown,<sup>1</sup> Margaret L. Palmsten,<sup>1</sup> Eric Swanson,<sup>2</sup> and Mark Buckley<sup>1</sup>

<sup>1</sup> USGS St. Petersburg Coastal and Marine Science Center, St. Petersburg, Florida

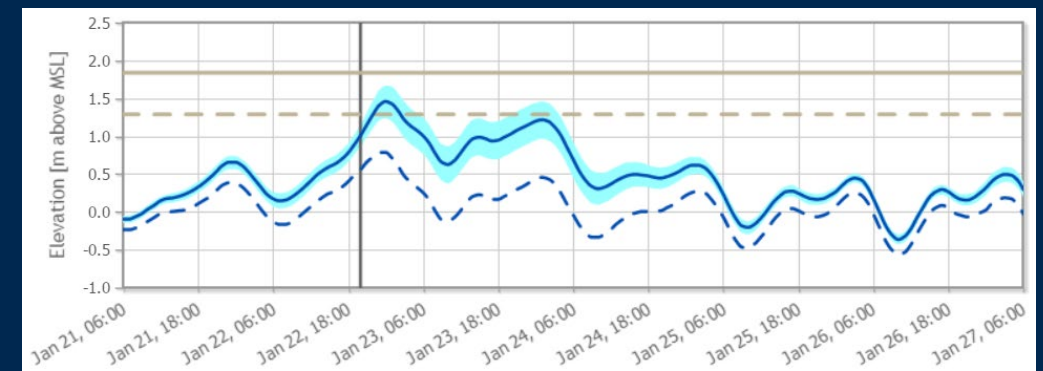
<sup>2</sup> Cherokee Nation System Solutions

#### Summary

A digital video camera was installed at Madeira Beach, Florida (FL) and faced west along the beach. Every hour during daylight hours, daily from 2017 to 2022, the camera collected raw video and produced snapshots and time-averaged image products. One such product is a "runup timestack". Runup timestacks are images created by sampling a cross-shore array of pixels from an image through time as waves propagate towards and run up a beach. Runup timestacks store the red, green, and blue or monochrome pixel intensity as a function of the cross-shore position as imagery for the sampling period, typically around 17 minutes. The images included in this data release were collected from January 21, 2017, to January 25, 2022. The camera is part of a U.S. Geological Survey (USGS) research project to study the beach and nearshore environment. USGS researchers analyzed the timestack imagery collected from this camera to remotely sense information such as elevation of wave runup. This camera is part of the USGS CoastCam network, supported by the Total Water Level/Coastal Change Project under the Coastal and Marine Hazards and Resources Program (CMHRP). To learn more about this specific camera visit <https://www.usgs.gov/central/speccms/science/video-remote-sensing-coastal-processes> and <https://cmgds.marine.usgs.gov/data/madeirabeach/>.

#### Data

File Name and Description	Metadata (XML format)	Metadata (text format)	Download File
madbeach_c1_2017-01_timestacks.zip			
Timestack imagery and coordinate data, in NetCDF format, at Madeira Beach, FL from January 2017 (nc)	<a href="#">madbeach_c1_timestacks_metadata.xml</a>	<a href="#">madbeach_c1_timestacks_metadata.txt</a>	<a href="#">madbeach_c1_2017-01_timestacks.zip (365 MB)</a>



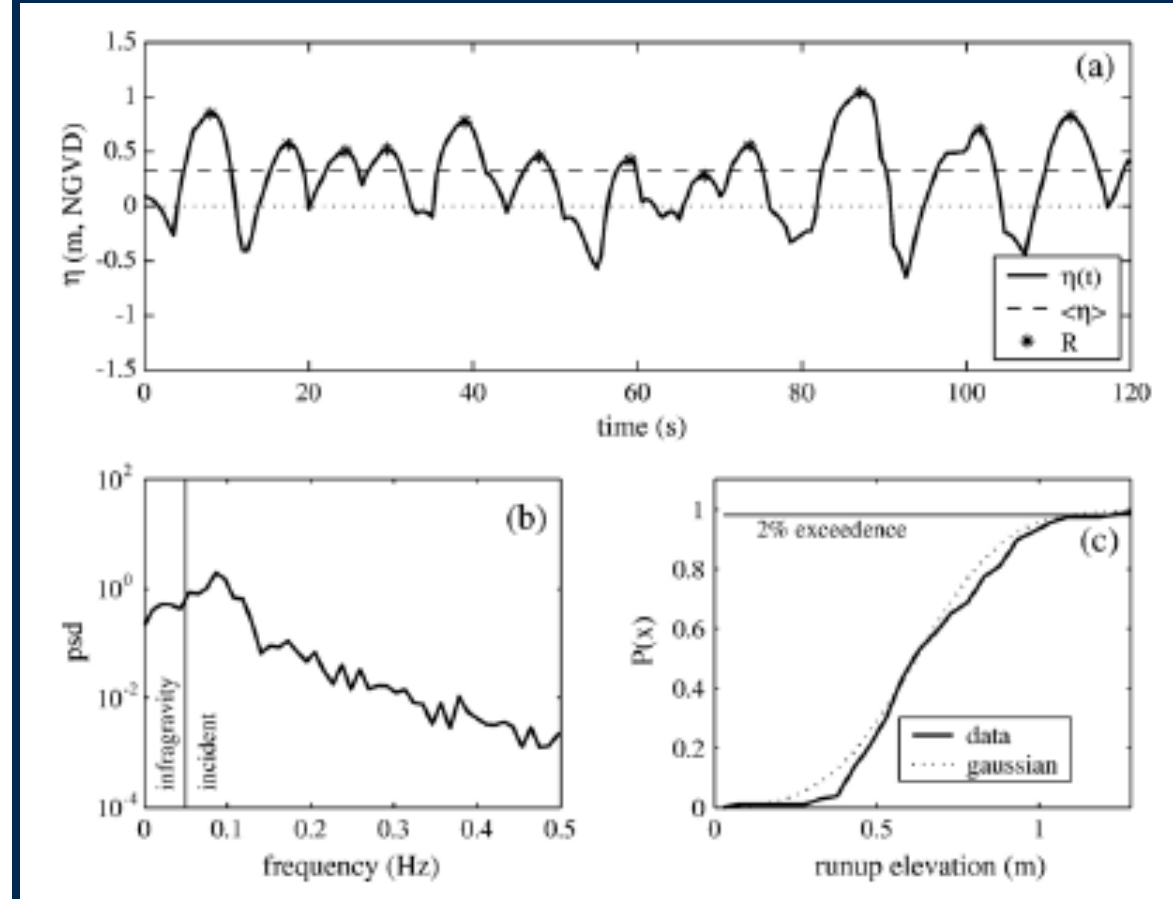
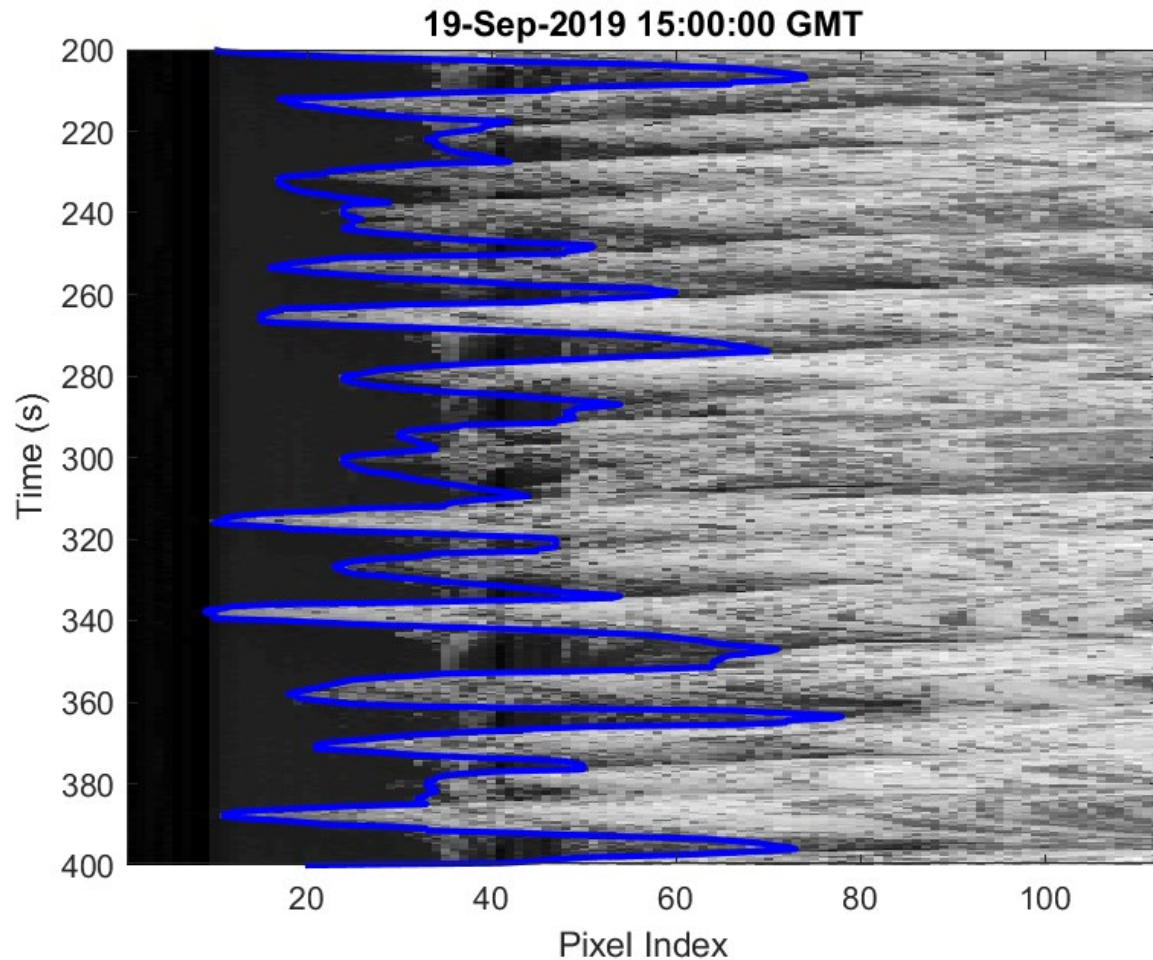


# CoastCam: Runup Edge Detection

- Automated wave runup detection

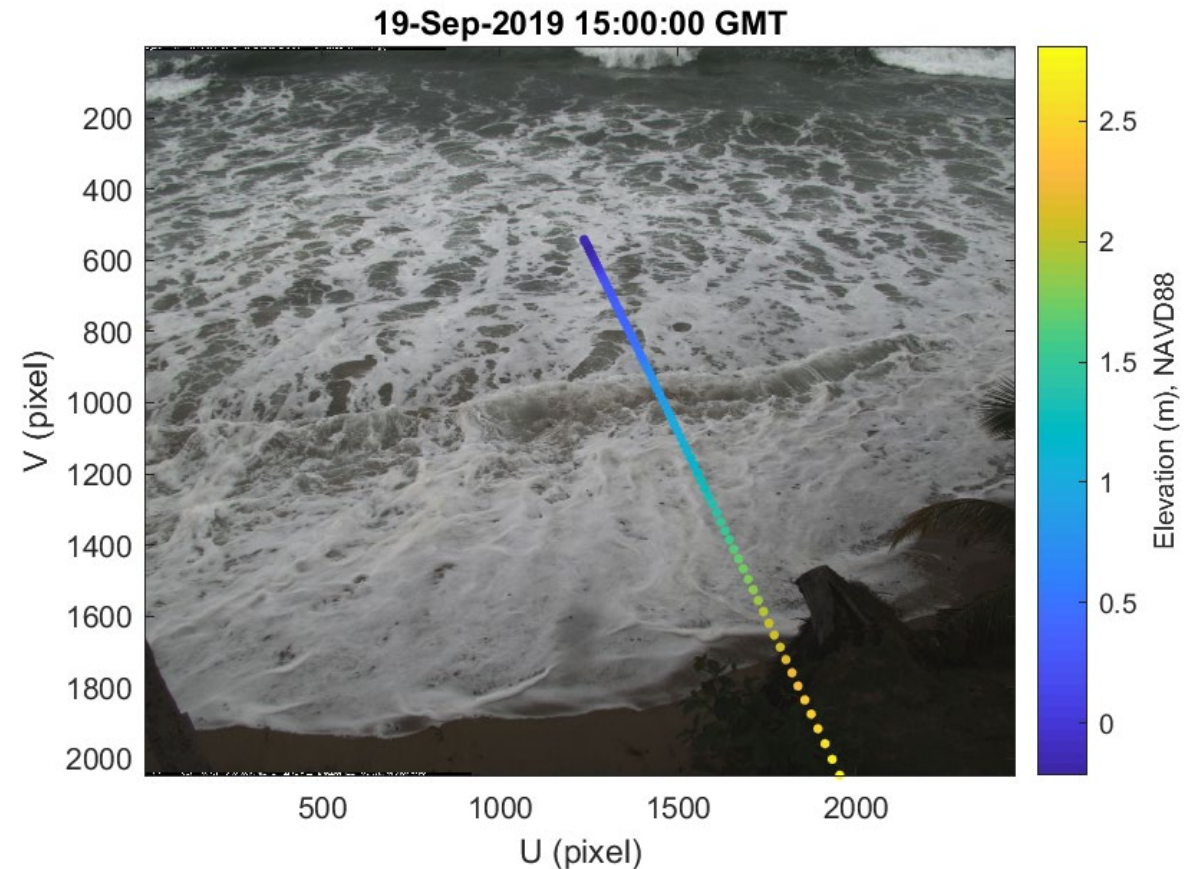
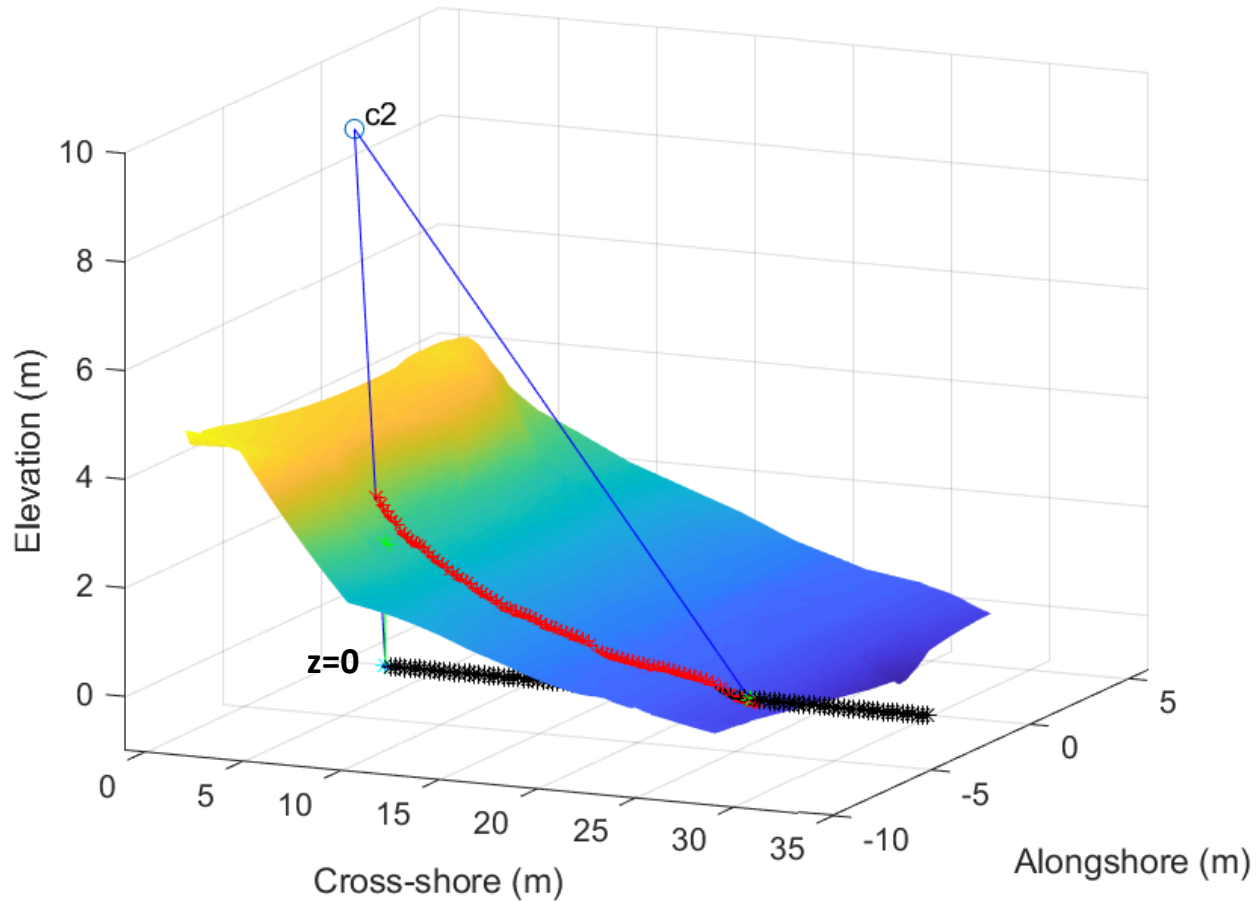
Wave runup and total water level observations from time series imagery at several sites with varying nearshore morphologies

Mark L. Buckley <sup>a</sup>, Daniel Buscombe <sup>b</sup>, Justin J. Birchler <sup>c</sup>, Margaret L. Palmsten <sup>a</sup>, Eric Swanson <sup>c</sup>, Jenna A. Brown <sup>d</sup>, Michael Itzkin <sup>e</sup>, Curt D. Storlazzi <sup>a</sup>, Shawn R. Harrison <sup>f</sup>

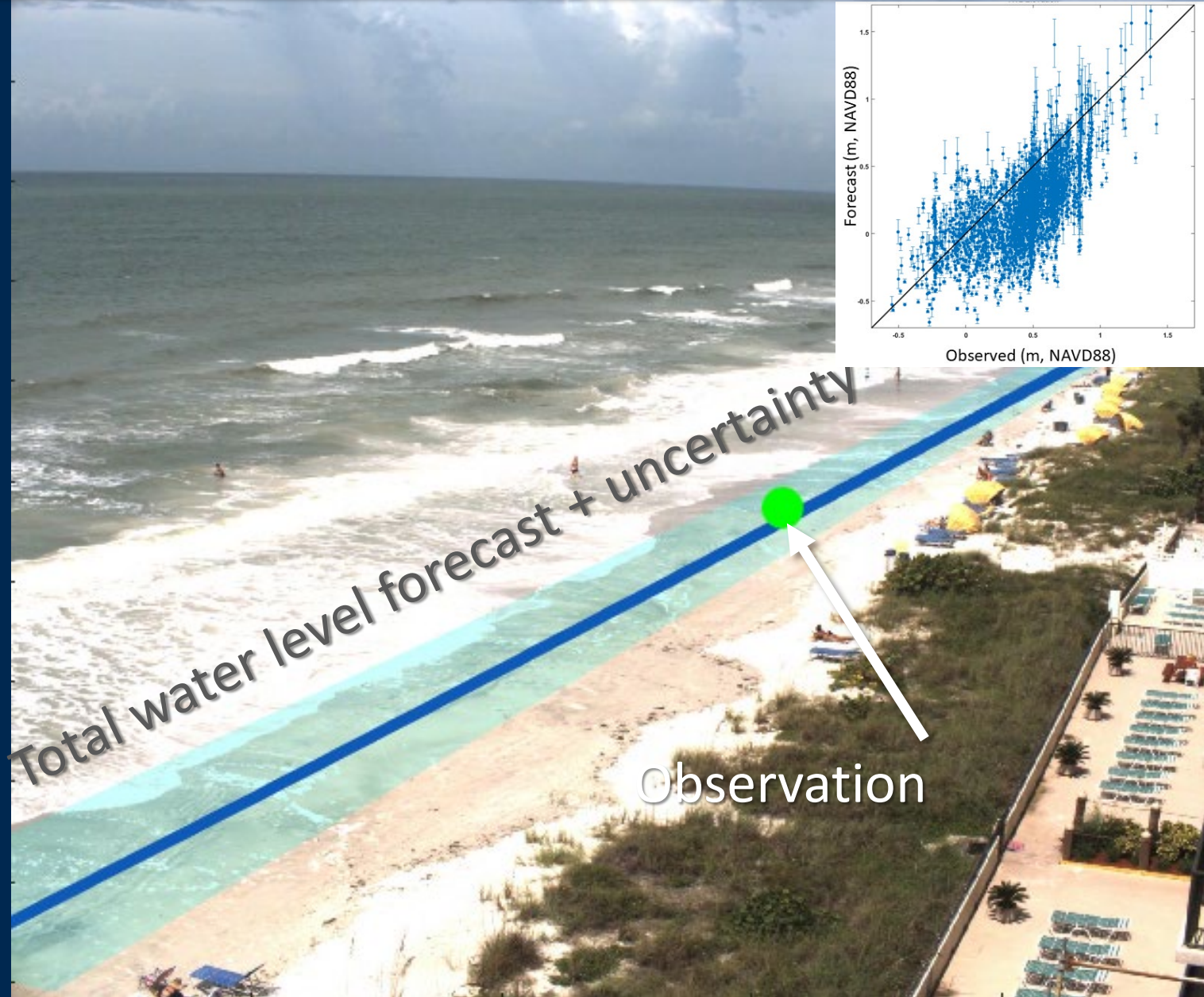
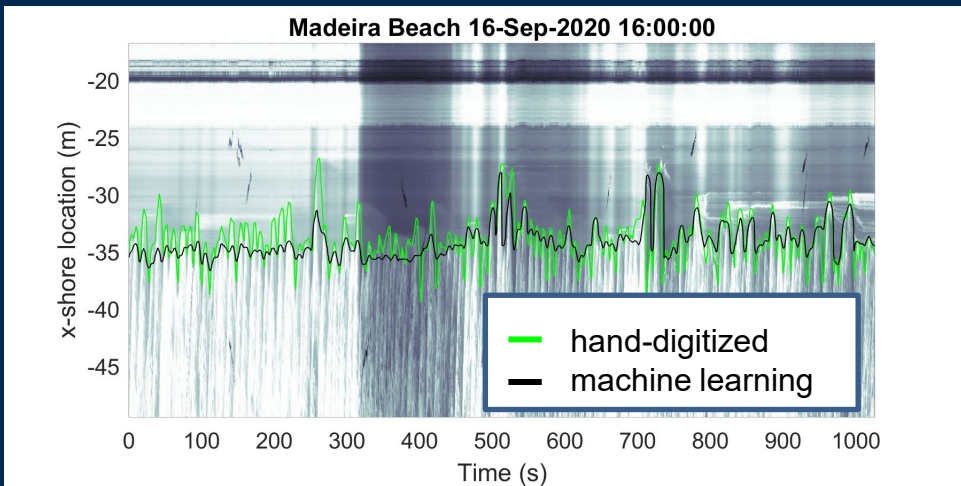
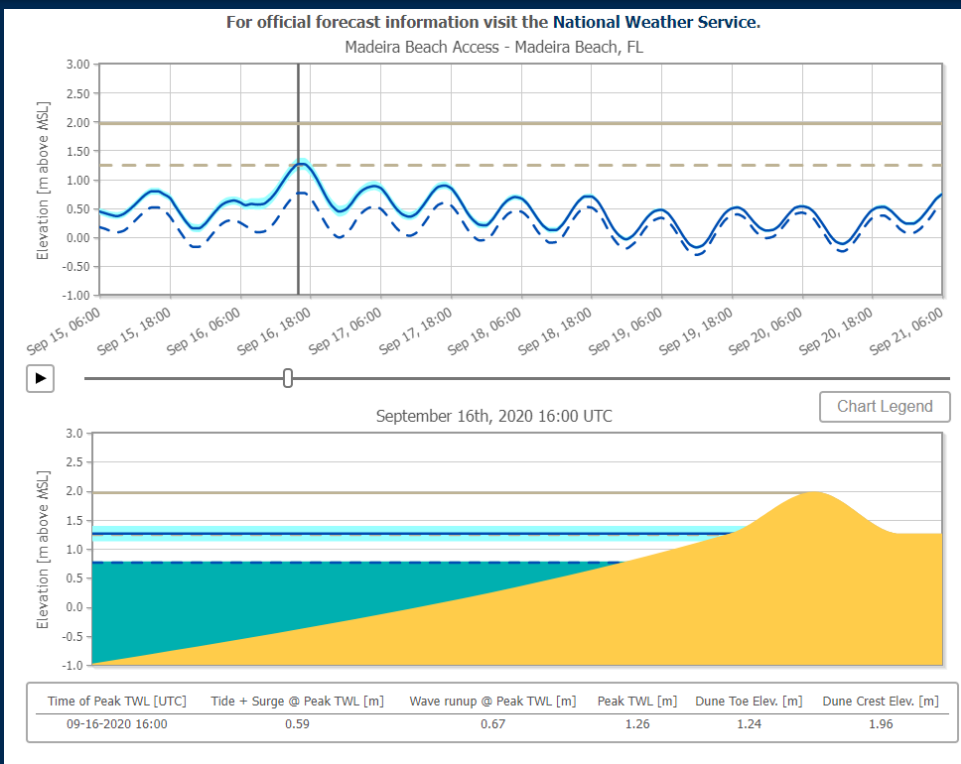


# CoastCam: Runup Processing

- Projecting wave runup onto beach profile elevation



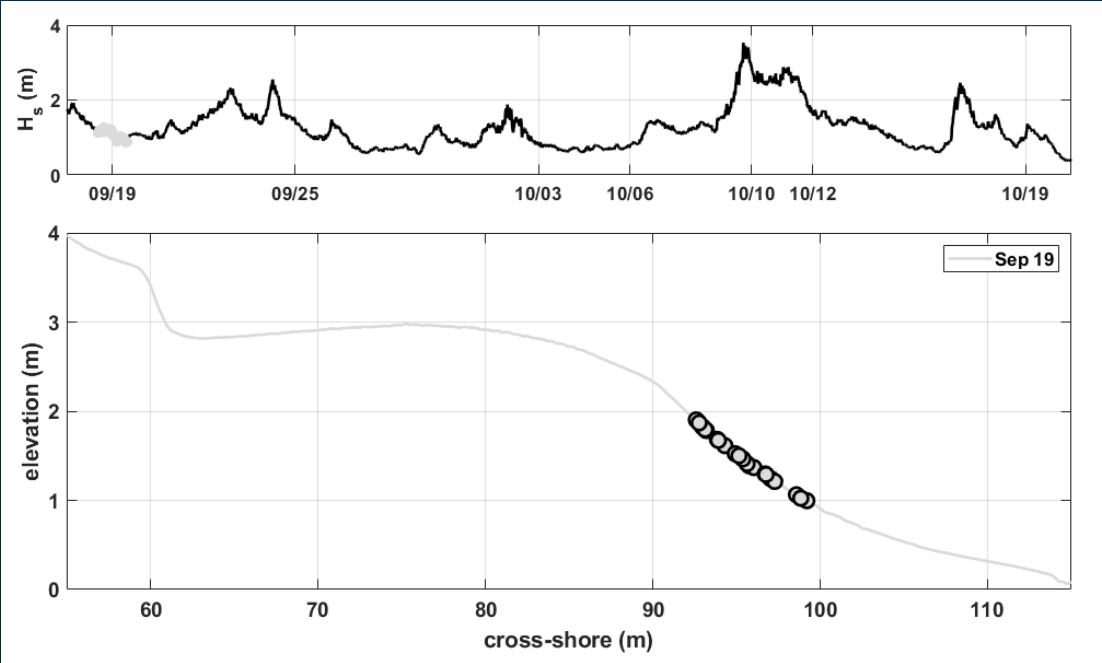
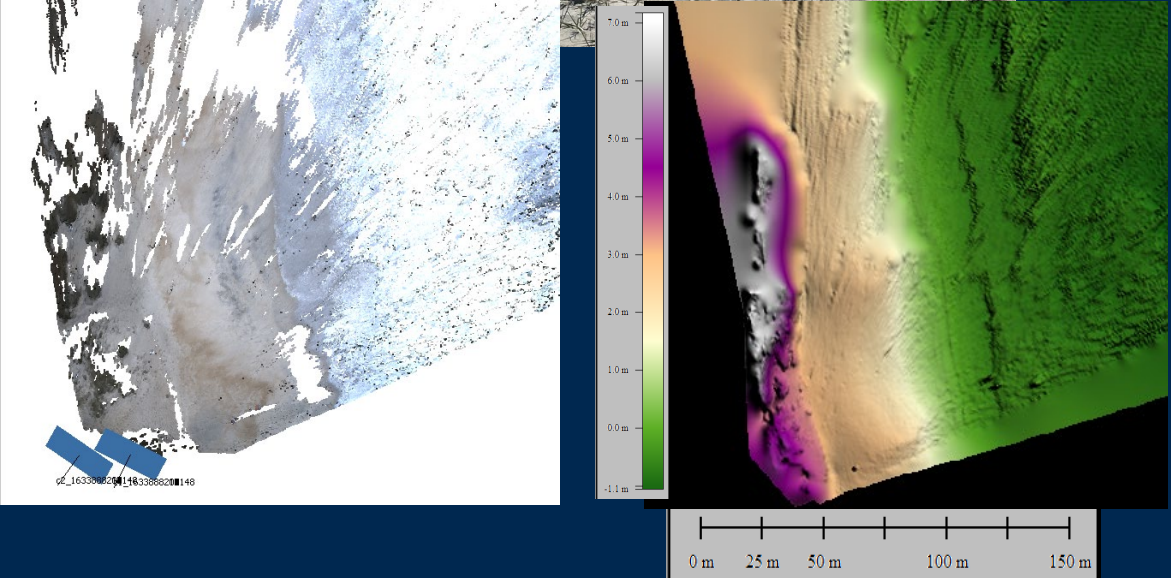
# CoastCam: Forecast Skill Assessments



# CoastCam: Stereo Imaging

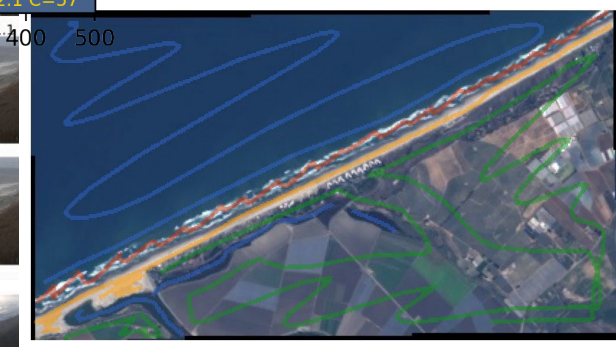
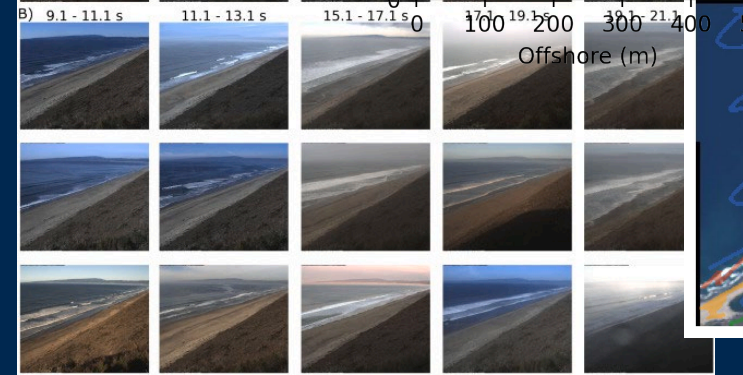
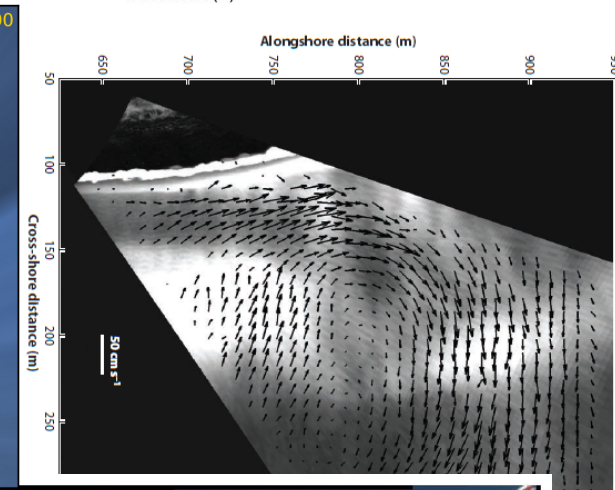
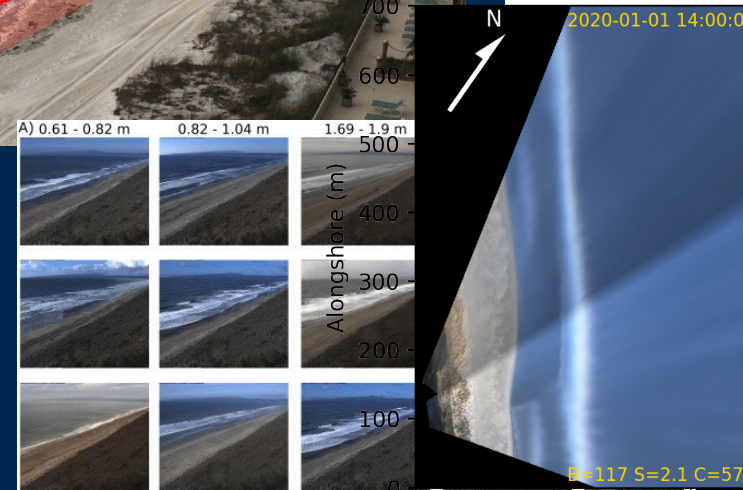
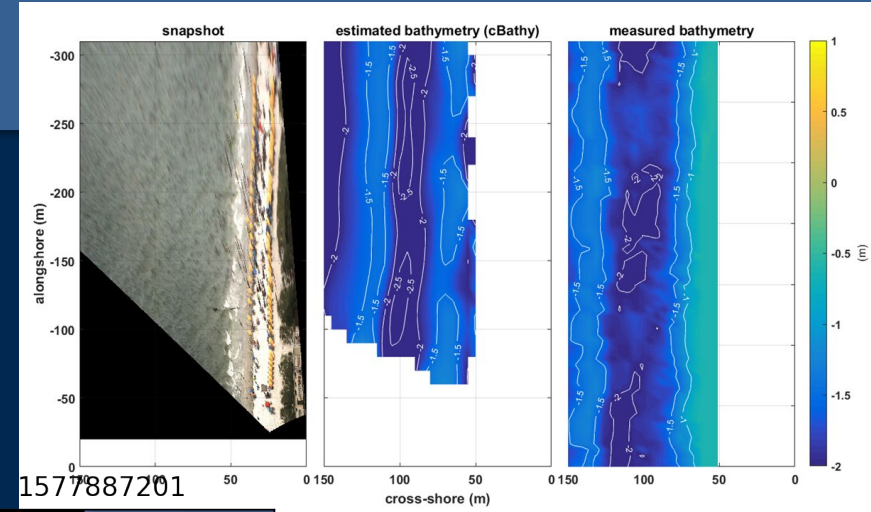
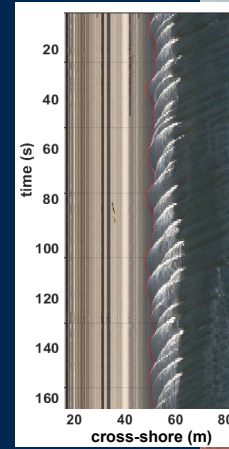


- Measure coincident TWL and beach profiles



# CoastCam: Applications

- Storm observations
- Shoreline position
- Nearshore bathymetry
- Beach morphology
- Wave runup and shoreline water levels
- Nearshore currents / Rip current identification
- Machine Learning:
  - Landcover classification / change
  - Optical wave gage



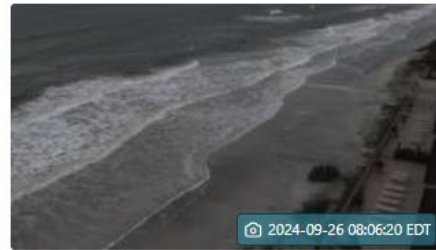
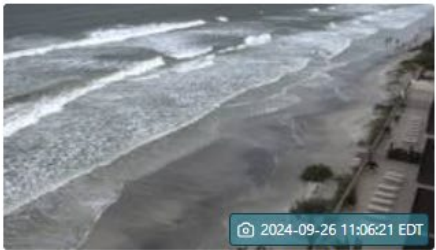
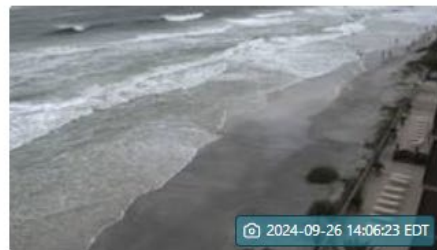
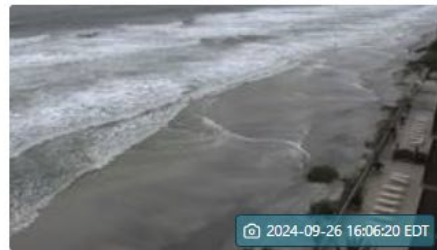
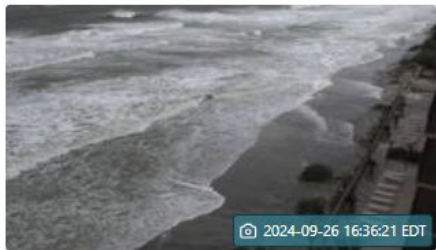
# CoastCam: WebCOOS



Cameras

Active | Archive | Live | Pending

© Mapbox © OpenStreetMap Improve this map





# Statistical image products

