UNIVERSITY OF HAWAI'I
SEA LEVEL CENTER

Operations and Research

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Global Ocean Monitoring and Observing
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

CIMAR
COOPERATIVE INSTITUTE FOR MARINE AND ATMOSPHERIC RESEARCH
UH • NOAA

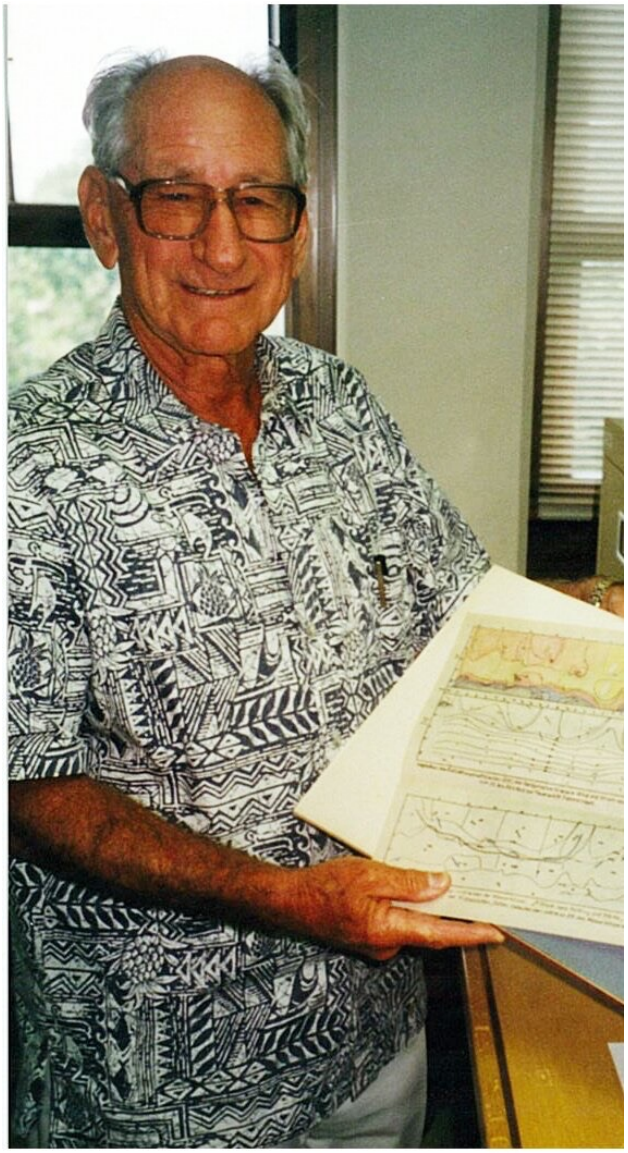
History

Using sea level to understand El Niño

- **Klaus Wyrtki**
  - Created a network of tide gauges across the Pacific.
  - Used sea level observations to make **fundamental advancements** in the modern understanding of El Niño.

- The **Pacific tide-gauge network** and **sea-level database** expanded under large international climate research efforts.
  - North Pacific Experiment (NORPAX, 1971–1980)
  - Tropical Ocean Global Atmosphere program (TOGA, 1985–1994)

- The **University of Hawaii Sea Level Center** (UHSLC) became an operational NOAA-funded entity in 1993.

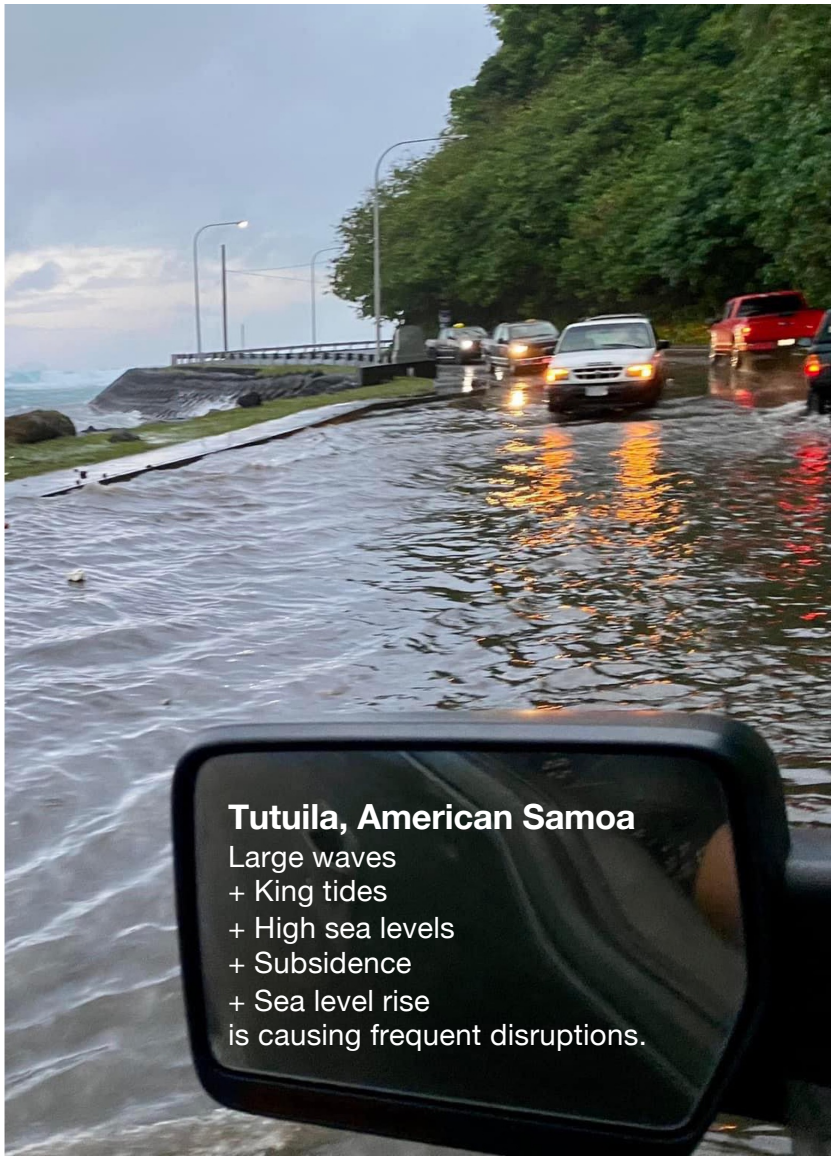


Global tide-gauge network

Global Sea Level Observing system (GLOSS)

What are tide-gauge observations used for?

- Coastal sea-level trends and climate impacts
- Tsunami warning and modeling
- Storm surge monitoring and research
- Tide predictions and vertical datums
- Calibration and validation of satellite altimetry
- Any many others …



Global tide-gauge network

Global Sea Level Observing system (GLOSS)

What is GLOSS?

- Established by UNESCO-IOC in 1985
- Part of GOOS; reports to IOC; coordinates with the Joint WMO-IOC Collaborative Board (JCB)
- Goal is to establish and maintain a well-designed, high-quality **in situ sea-level observing network** to support a broad user base
- Provides oversight, coordination, and capacity development

★ **The UHSLC is the primary U.S. partner in GLOSS.**

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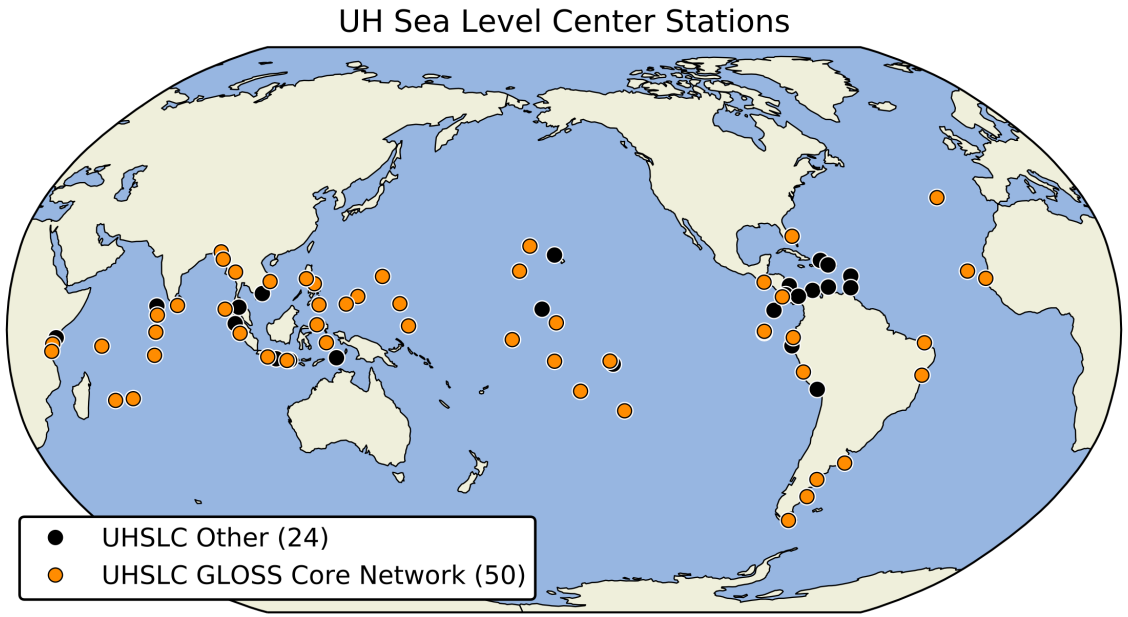
Role in GLOSS and NOAA

1. Operate a global network of 74 tide gauges

- Including about 20% of operational gauges in the GLOSS Core Network.
- Many in under-resourced locations
- Build capacity in host countries



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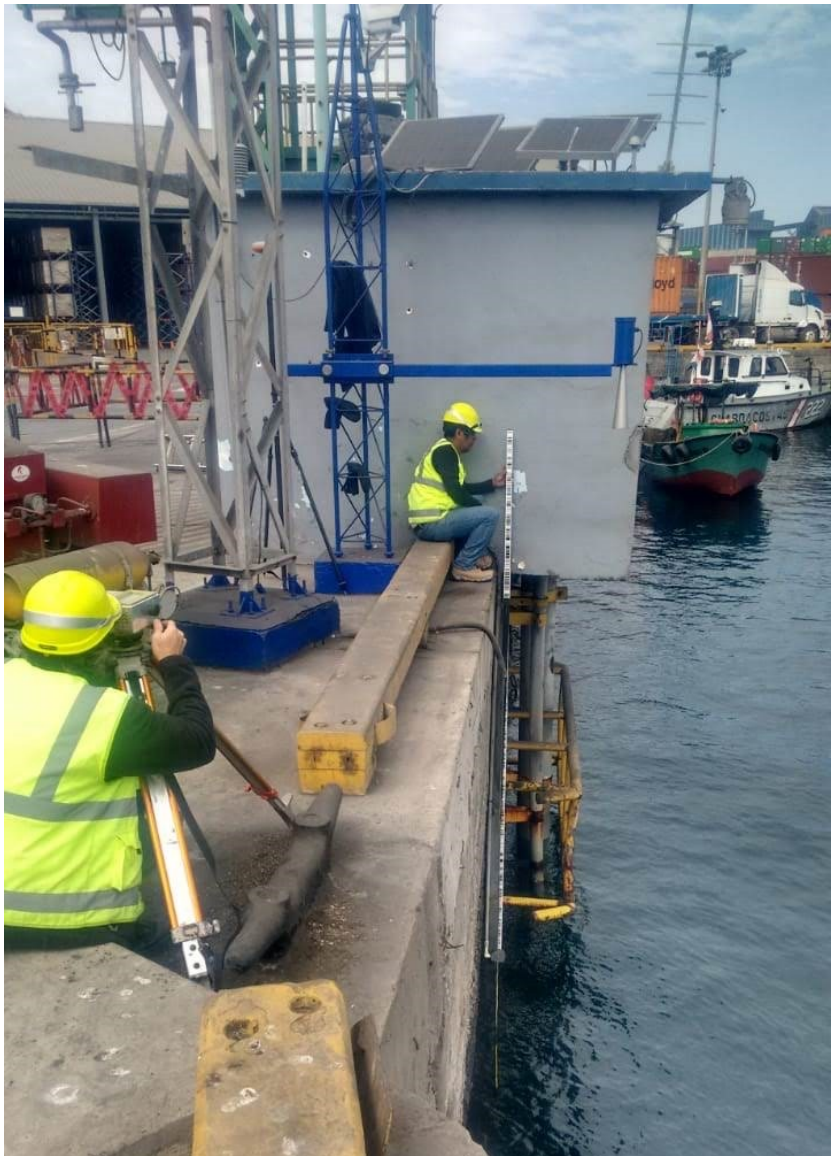


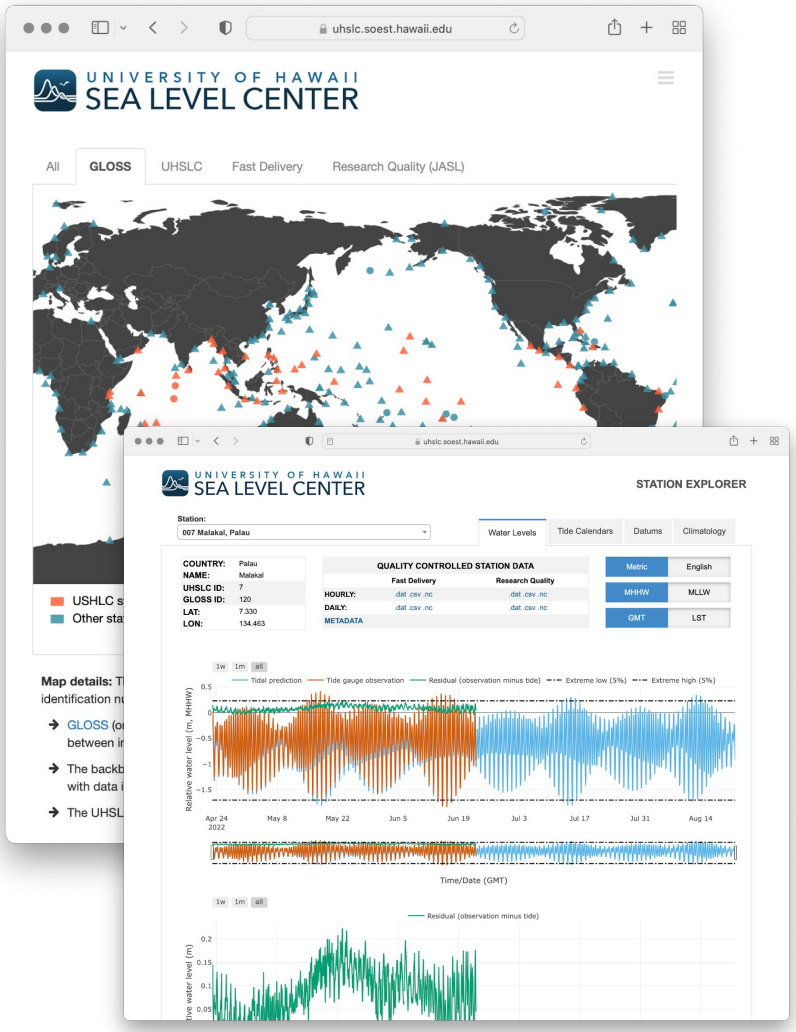
UHSLC technician working with a colleague in Indonesia.

UH Sea Level Center

Role in GLOSS and NOAA

2. Curate global tide-gauge data sets

- Datasets contain approximately **18k years of data** from almost 700 sites across 97 countries.
- UHSLC aggregates, quality controls, and distributes the tide-gauge data.
- Data curation is performed in partnership with a Hawai‘i-based NCEI liaison (Ayesha Genz).
- UHSLC datasets are **cited 50–100 times per year** in peer-reviewed literature.



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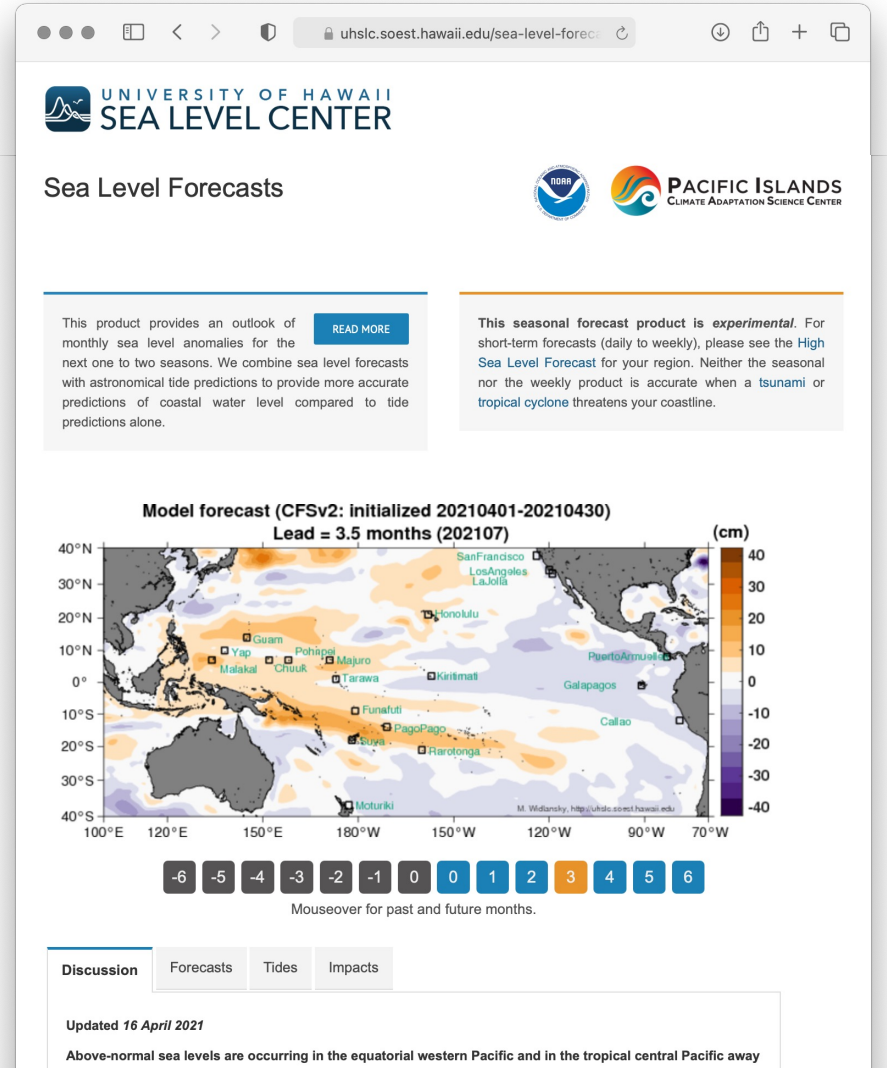
Role in GLOSS and NOAA

3. Research and product development

- Diverse portfolio of extramural research leveraging UHSLC resources and expertise
- Current projects funded by **multiple NOAA Programs** (MAPP, Pacific RISA, CO-OPS)
- Additional projects funded by NASA, USGS, DoD, and ONR
- Topics include:
  - Seasonal sea-level forecasts
  - 21st century projections of high-tide and compound flooding.
  - Assessing NOAA's 40-year reanalysis of hourly coastal water levels



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Role in GLOSS and NOAA

What are we working on now?

- Increase online data **interactivity** and value-added calculations
  - 10– and 100–year flood levels; sea-level trends; etc.
- Transition the UHSLC tide-gauge network to **Iridium** communications
  - Minimize data loss
  - Improve efficiency of maintenance operations
- Expand sea-level observing network in **American Samoa** for climate and tsunami applications
  - Main island (Tutuila) and other populated islands (Aunuʻu, Ofu-Olosega, and Taʻū)

Aunuʻu, American Samoa
Subsidence + SLR is causing frequent disruptions.

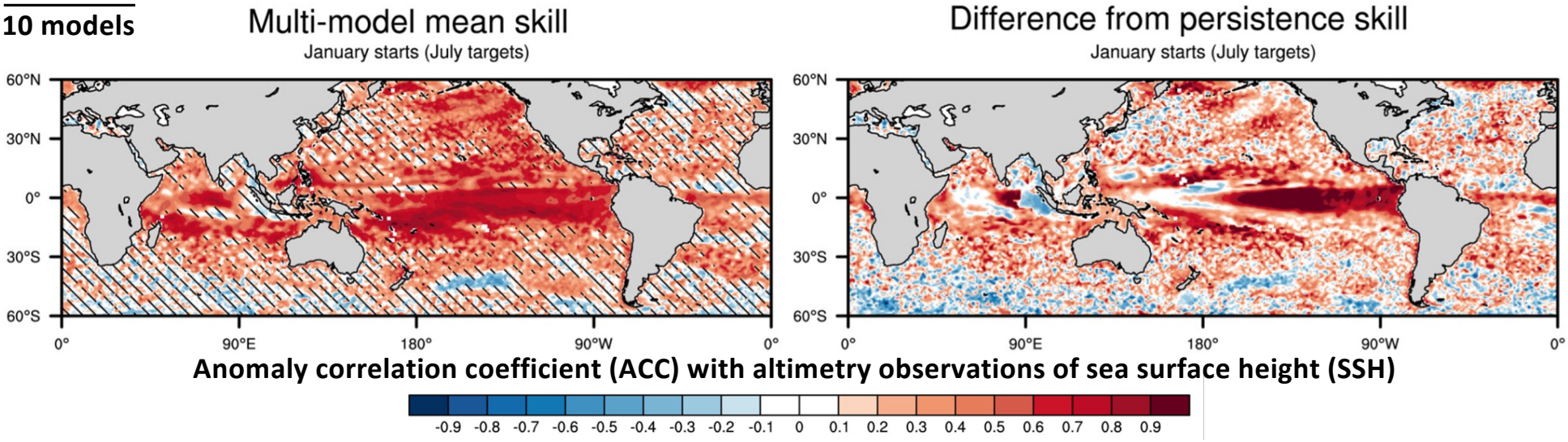
MAPP
Modeling, Analysis, Predictions, and Projections

FY2017
(PI: Merrifield)

Multi-model seasonal sea level forecasts for the U.S. Coast

Climate forecast systems are skillful in most of the tropics (**Pacific Islands product**), but perform poorly at higher latitudes and along some coasts (problematic for the U.S. East Coast).

10 models

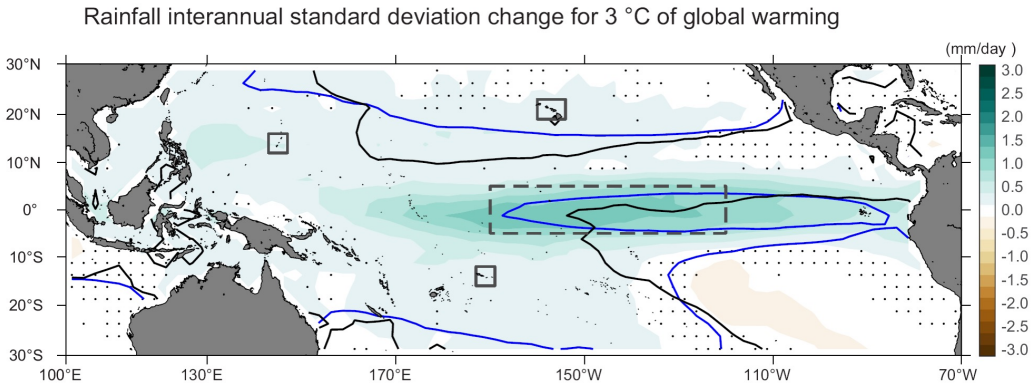


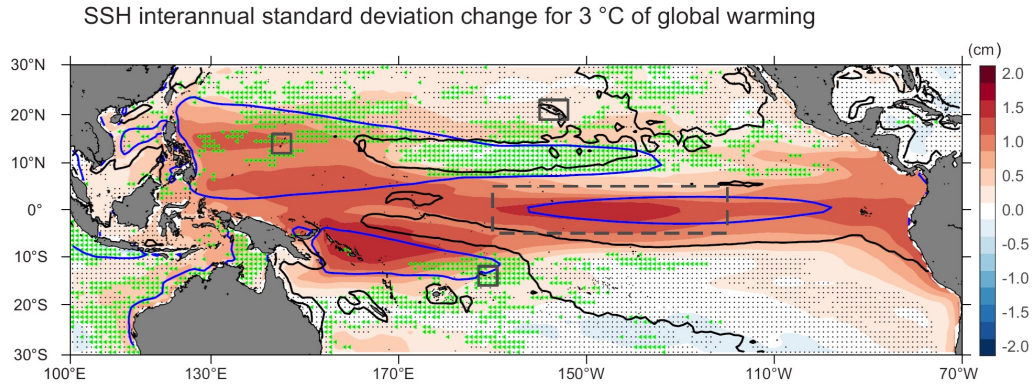
Analysis published by Xiaoyu Long (Postdoc @ UHSLC, 2017–2021)

MAPP
Modeling, Analysis, Predictions, and Projections

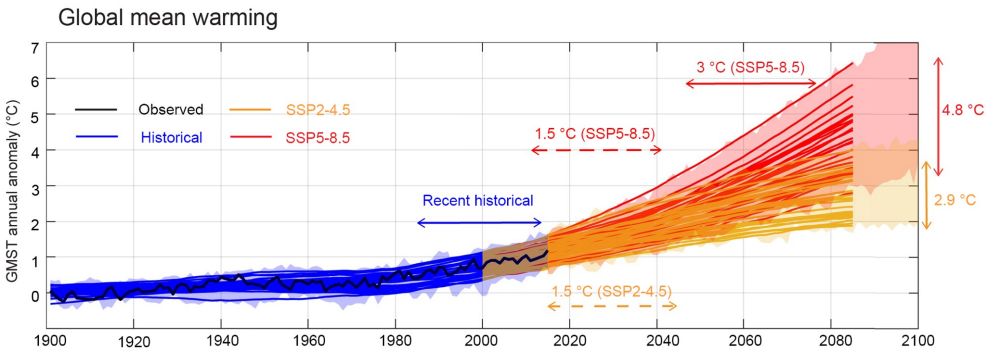
FY2019
(PI: Widlansky)

Assessing CMIP6 combined projections of changing sea levels and enhanced extreme rainfall events for determining coastal flood risks in the U.S.-affiliated Pacific Islands





We assess climate changes for particular warming amounts, which constrains uncertainty related to the future global warming rate (**CMIP6 atlas**).

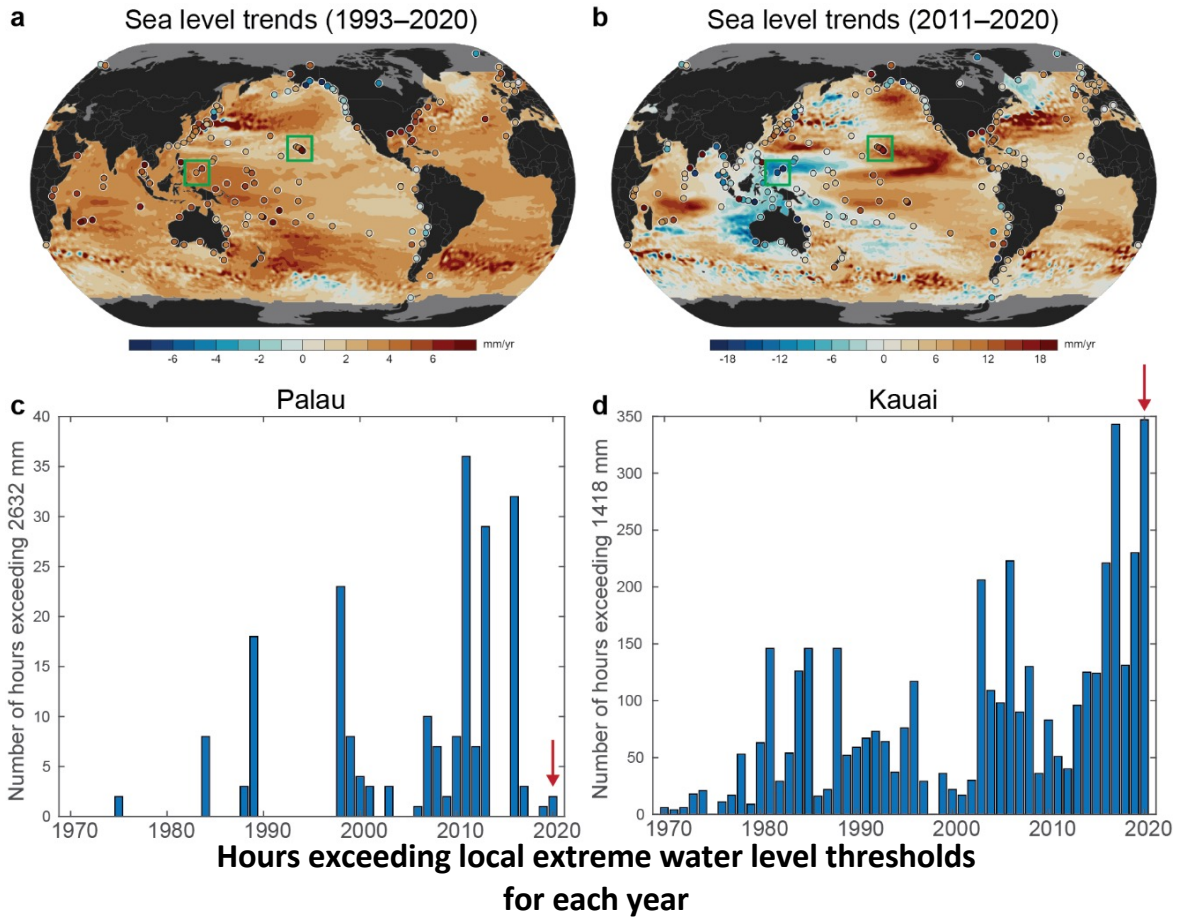


Analysis published by Laxmikant Dhage (Postdoc @ UHSLC, 2020–2022)

Pacific RISA
a NOAA RISA team

FY2021-5 year
(PI: Widlansky)

Tracking and Communicating Sea Level Conditions for Coastal Disturbances in Hawai‘i and the USAPI



Hours exceeding local extreme water level thresholds for each year

UHSLC contributes to the Pacific Islands Regional Climate Assessment (PIRCA).

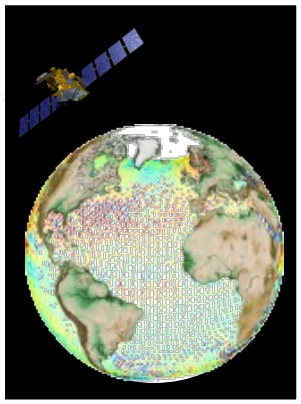
Web portal for additional sea level climatology and extremes information (Station Explorer).

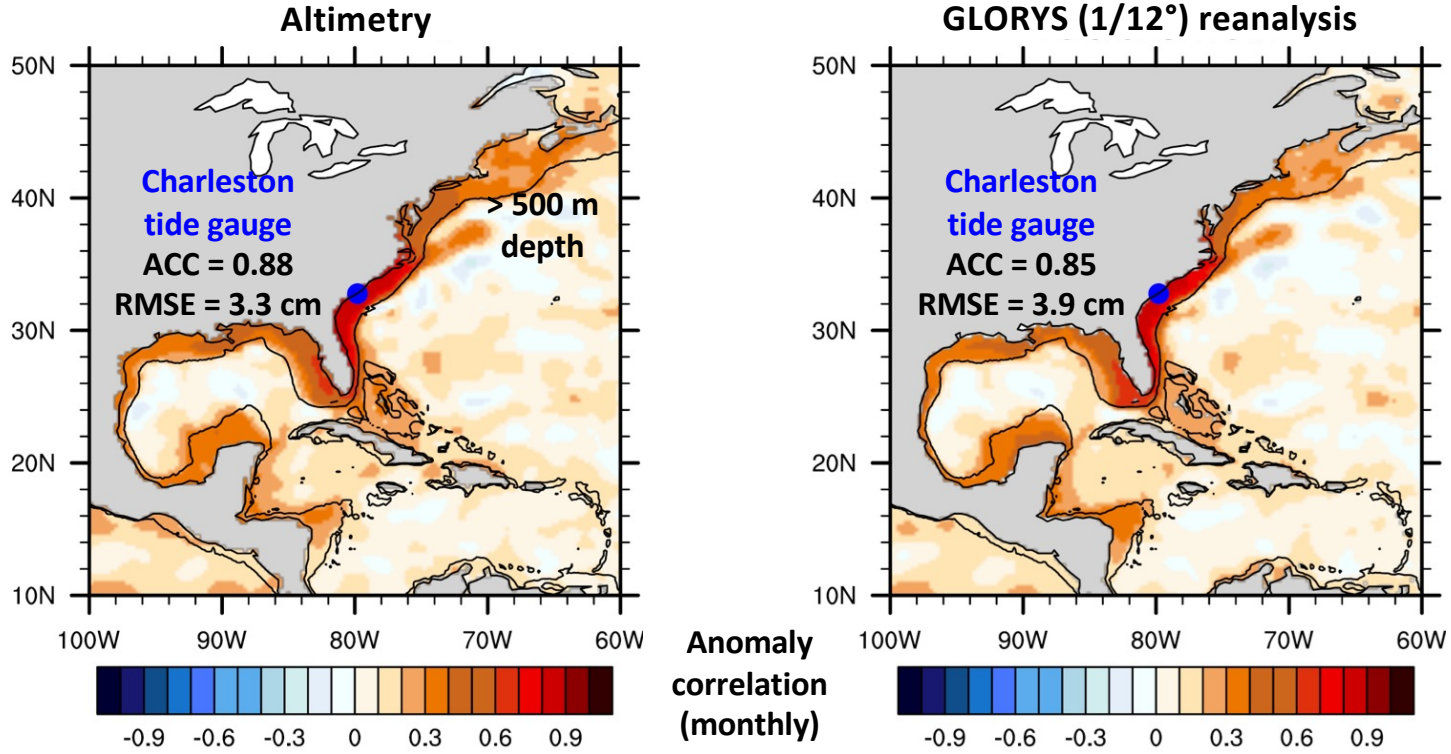
MAPP
Modeling, Analysis, Predictions, and Projections

FY2022
(PI: Widlansky)

Monitoring the climatology and extremes of coastal sea levels for the U.S. Coast

New ocean model reanalyses assimilating satellite observations of sea surface height are simulating more realistic coastal sea level variability (U.S. East Coast improvement).





Analysis in preparation by Xue Feng (Postdoc @ UHSLC, Sep 2022–present)

CIMAR Cooperative Institute for Marine and Atmospheric Research

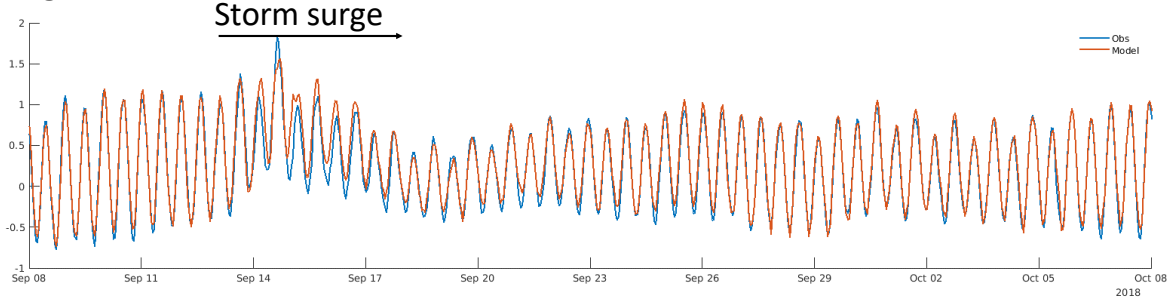
National Assessment of Contemporary and Future Coastal Flooding

FY2022 (UHSLC)

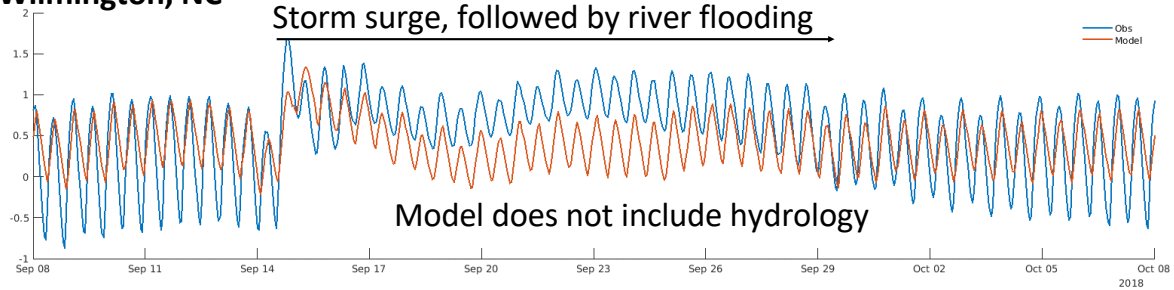
Assessment of NOAA's 40-year reanalysis of hourly water levels (~500 m coastal resolutions). Year 1 focus is validating model performance (tides and non-tidal residuals).

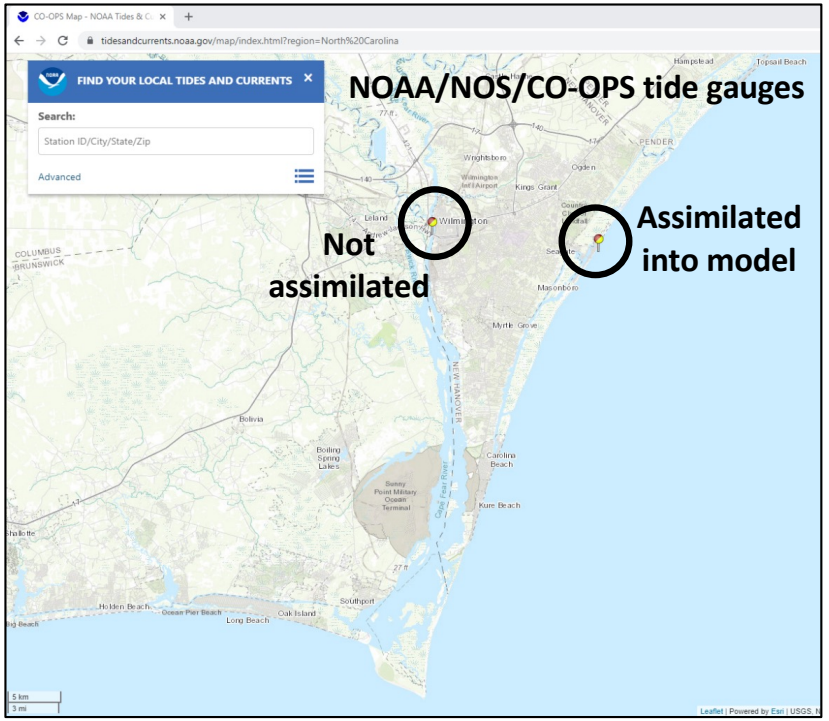
Observed and Simulated water levels
Hurricane Florence (2018)

Wrightsville Beach, NC



Wilmington, NC





Analysis in preparation by Linta Rose (Postdoc @ UHSLC, Oct 2022–present)