Utilizing the NASA and NOAA Joint Ocean Surface Topography Mission and Modeled Wave Data to Assess Patterns and Trends in Sea-surface Height in the U.S. Affiliated Pacific Islands

Abstract

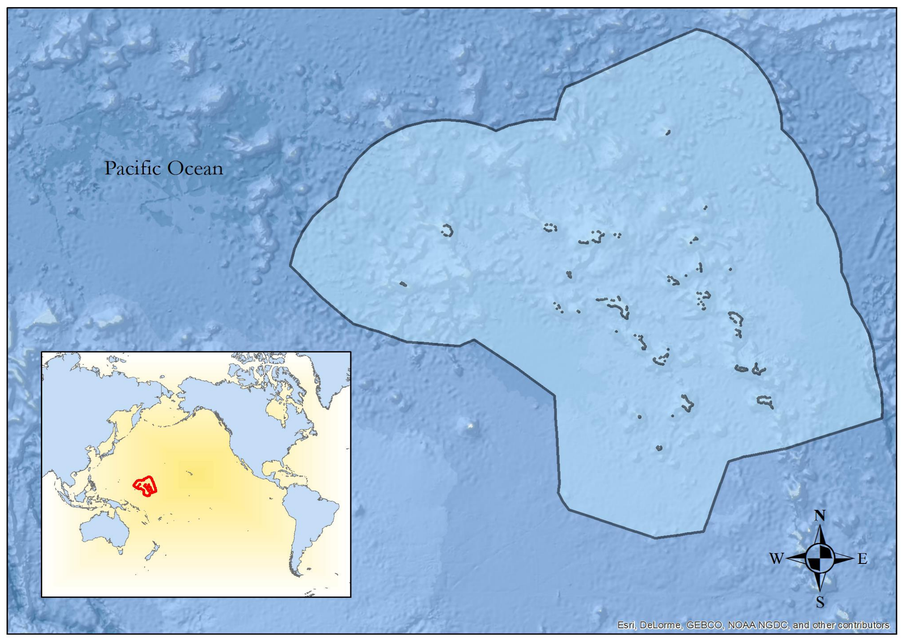
The project team partnered with the Regional Climate Services Director (RCSD) for the Pacific Region under NOAA National Centers for Environmental Information (NCEI) to analyze near-real time (i.e., weekly) spatial and temporal patterns and trends in sea-surface height (SSH) around the US Affiliated Pacific Islands (USAPI). Ocean Surface Topography Mission (OSTM) data and current tidal data from *in situ* measurements were used in conjunction with i*n situ* and satellite data from buoys, tide gauges, NASA's Sea Surface Height (SSH) climate record derived from the TOPEX/Poseidon mission and data from OSTM/Jason-2 and Jason-3, and a blend of satellites for NOAA's CoastWatch and OceanWatch. The team produced a significant wave height climatology, a wave direction climatology, a 1 week to 3 week outlook, and a categorical inundation risk metric to assess island inundation risk. End users will use the risk metric tool set climatologies and distribute this information to coastal hazard and climate adaptation decision makers in the USAPI.

Objectives

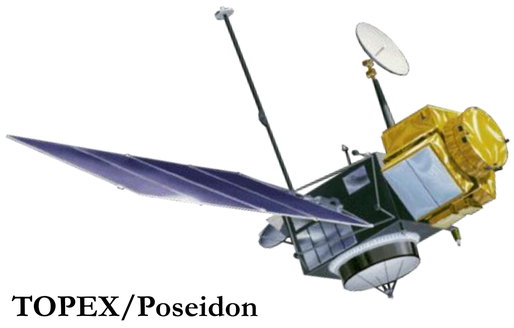
- **Create** climatologies for significant wave height (SWH) and wave direction in the Republic of the Marshall Islands
- **Calculate** frequency distribution of wave heights for each month
- **Integrate** SWH and wave direction with sea level anomalies (SLA) and tides to create an optimized coastal-inundation risk metric

Study Area

The Republic of the Marshall Islands



Earth Observations



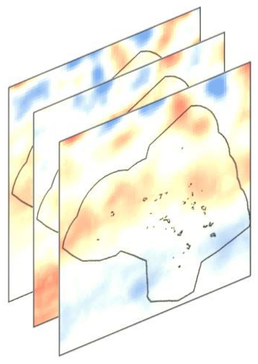
TOPEX/Poseidon
Radar altimeter
Spatial resolution: 1 degree
Temporal resolution: 10 days

OSTM/Jason-2 & Jason-3
Radar altimeter
Spatial resolution: ¼ degree
Temporal resolution: 10 days

Methodology

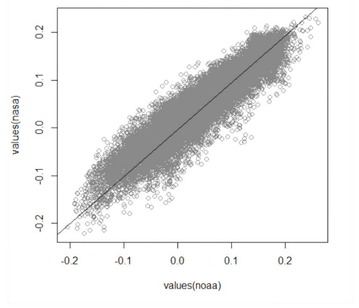
Data Collection

- WaveWatch III Hindcast
- NOAA OceanWatch
- NASA PODAAC
- NOAA NDBC
- UHSLC tide data



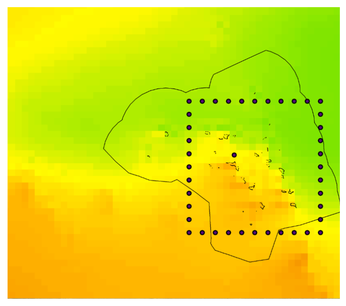
Processing

- Resample
- Aggregate
- Clip
- Compile into time series



Analysis & Validation

- Climatology
- Mean average difference (MAD) and correlation
- Distribution frequency

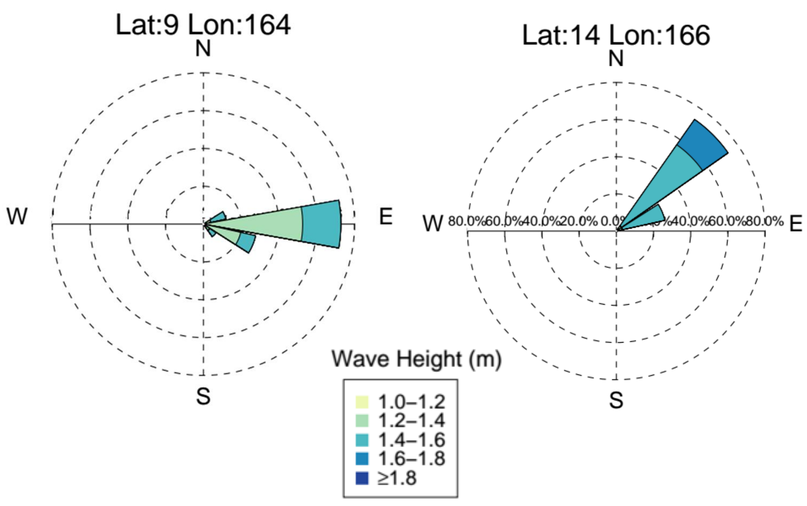


End Products

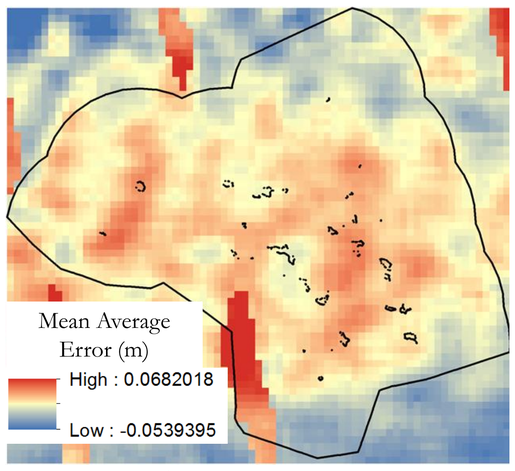
- Wave height and direction climatologies
- Virtual buoy stations for every 1° around RMI
- Risk metric

Results

Wave Roses

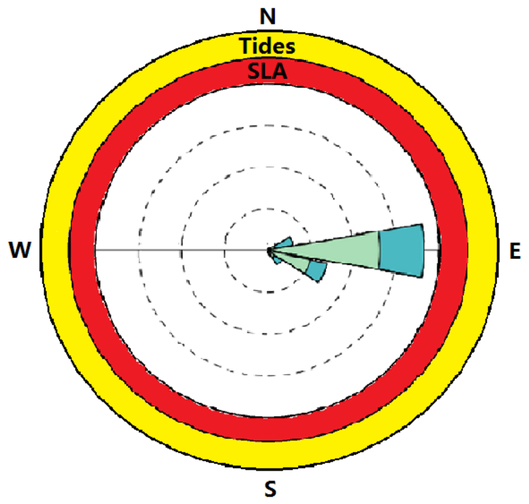


Comparison



Mean Average Error: 0.039 m
R-squared: 0.571

Risk Metric



Project Partners

- NOAA Regional Climate Services, Pacific Region
- NOAA Center for Satellite Applications and Research, Satellite Oceanography & Climatology Division
- University of Hawaii Sea Level Center

Team Members

India Young (Project Lead) | Alec Courtright | Kaitlin Walker | Saraneh Fitzgerald

Conclusions

- OceanWatch SLA imagery was found to be more accurate than UHSLC imagery.
- The risk metric developed by this project will improve disaster planning and mitigation efforts in the RMI.
- Wave climatologies for the RMI will inform decision makers, emergency managers, and forecasters of potential future inundation events.

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