SUBSEASONAL PREDICTABILITY OF SEA LEVEL IN THE HAWAIʻIAN ISLANDS

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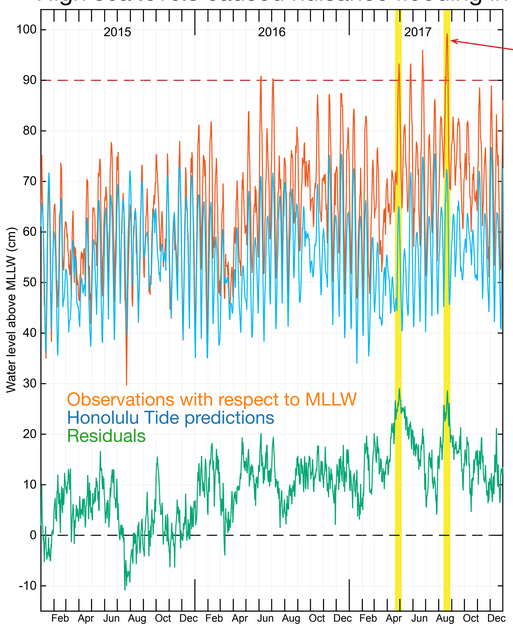
PURPOSE **To investigate the predictability of daily-averaged sea level anomalies to build toward solutions for mitigating inundation risks.**

1. RECORD BREAKING SUMMER IN 2017

- Hawaii experienced record-high sea levels during 2017
- High sea levels caused nuisance flooding in vulnerable coastal areas



Anomalous Events

- Hourly value > 90 cm
  - Entire record: 58
  - Summer 2017: 25
- Daily max value > 90 cm
  - Entire record: 40
  - Summer 2017: 15

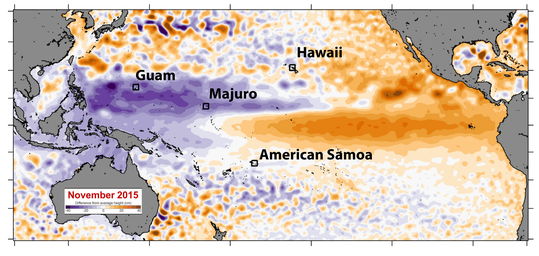
← Figure of daily max sea levels

2. BARRIERS WITH CURRENT FORWARD DYNAMICAL MODELS

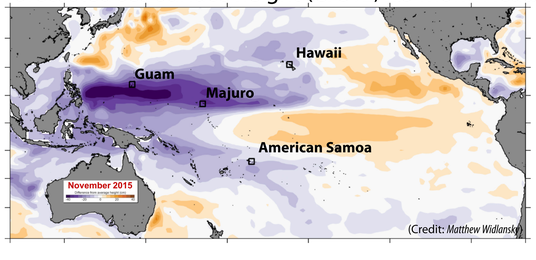
Sea level prediction at mid-latitudes (e.g., Hawaii) have low skill, likely due to mesoscale variability

- Low latitudes show high skill (e.g. Majuro)
- High latitudes show low skill (e.g. Hawaii)

Observed sea surface height (CMEMS, trend removed)

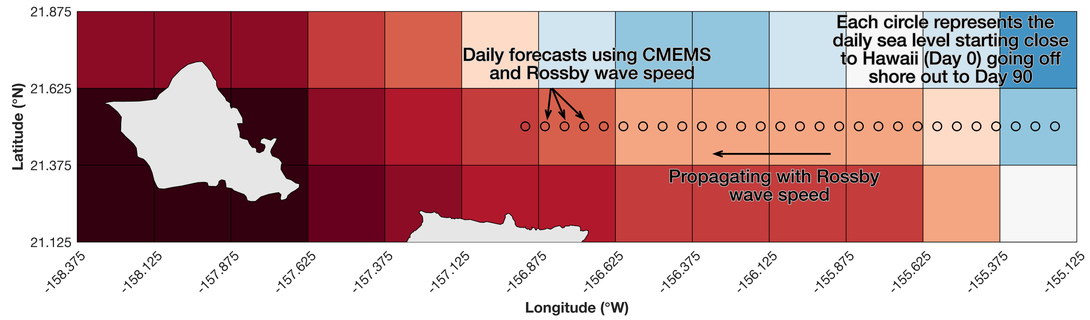


Forecasted sea surface height (CFSv2, 2.5 month lead)



3. SUBSEASONAL SEA LEVEL FORECAST USING OBSERVATIONS

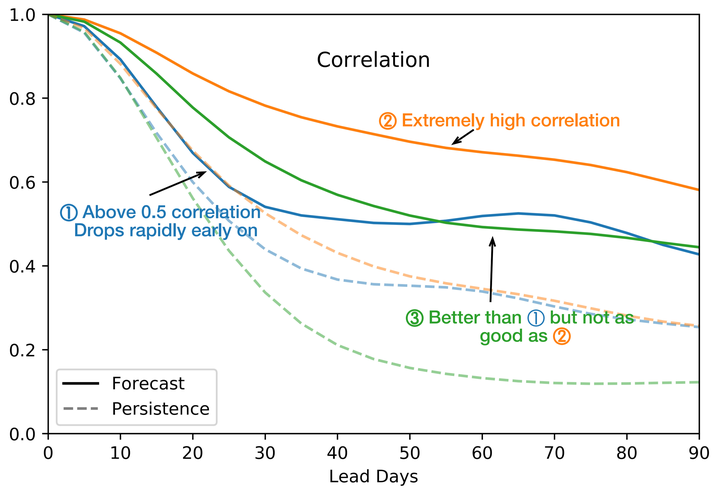
- Focused on leveraging observed westward propagation that sea level anomalies exhibit over a range of timescales
- Daily near-real-time gridded altimetry (CMEMS) was used to specify upstream sea level at each site with propagation speeds based on first baroclinic mode Rossby wave speeds

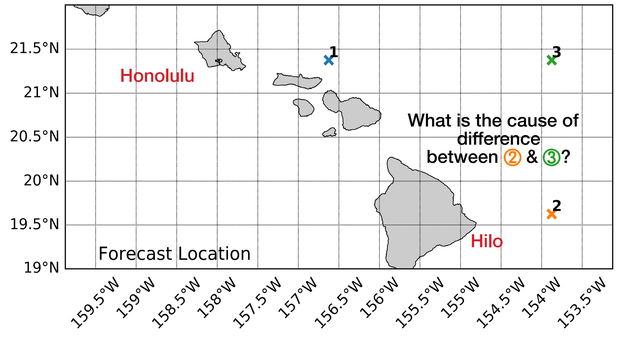


- Forecasts with 90-day lead time
- Propagate sea level to Hawaii using Rossby wave speed
- Daily forecast for entire CMEMS record (~20 years)

4. WHERE CAN THE CMEMS FORECAST BE USED?

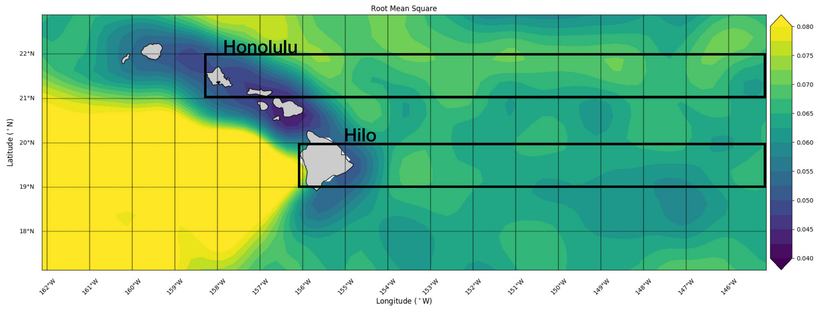
- Skill of the predictions exceeds persistence at most locations
- Skill is highly dependent on location





5. RMS OF SSH TO CHARACTERIZE MESOSCALE VARIABILITY

More variability at the latitude of Honolulu vs latitude of Hilo



6. SUMMARY AND FUTURE WORK

- Subseasonal numerical sea level predictions are not skillful at higher latitudes - including the latitudes of the Hawaiian Islands
- Hypothesis was using Rossby wave speeds and CMEMS will generate high skills
- Study revealed barriers that we do not fully understand
- Sea level predictions at Hilo are better than Honolulu
- Going to look into dynamical explanations of revealed barriers
- At Hilo we may be able to make useful predictions