

# **Status of NWS Tropical Program:**

## Storm Surge

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# NWS Validated Requirement

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## Capabilities and Requirements Decision Support (CaRDS)

### CaRDS16-029: Probabilistic Inundation Guidance

AFS approves the requirement that **"robust probabilistic storm surge/inundation guidance is needed to support the total water level challenge"**

#### Resource Assessment:

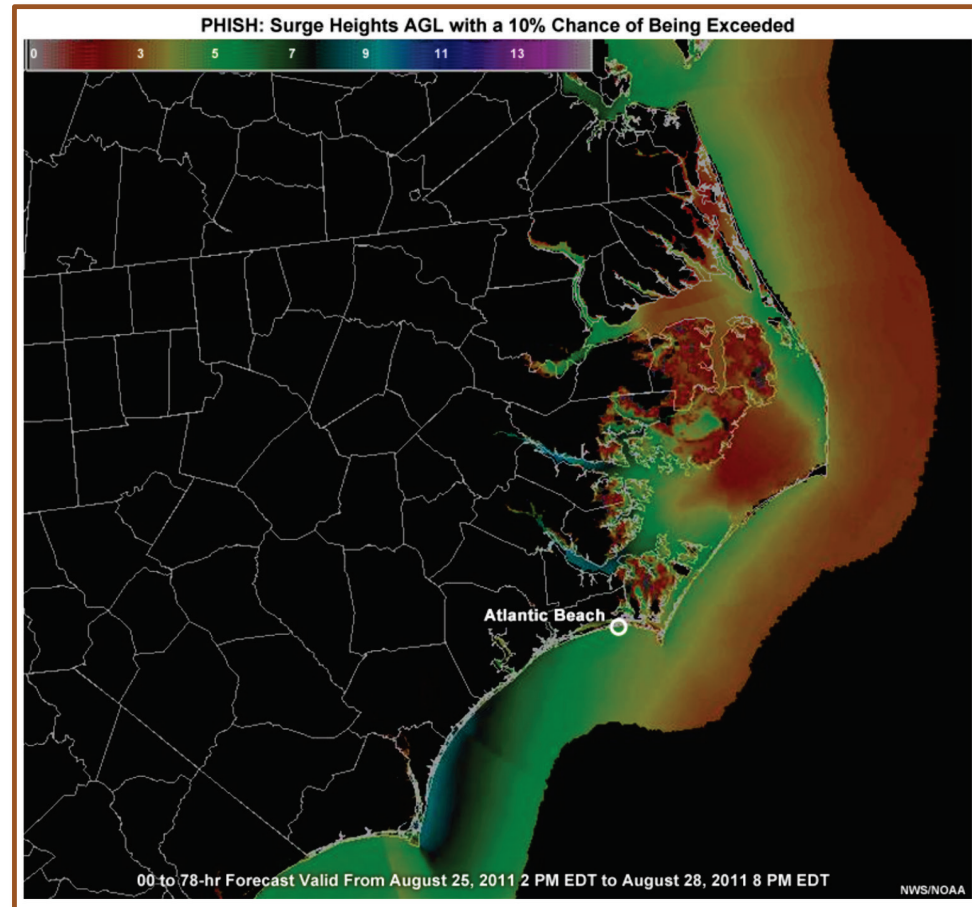
Almost as critical as the implementation of this guidance into official NWS data streams is the ability for forecasters to incorporate the data easily into the established forecast process in AWIPSII. **If forecasters cannot easily use the guidance to quickly assess the inundation threat and timing to issue life-saving warnings, the guidance is not viable.**

### CaRDS16-035: TWL and Inundation Guidance, Service, and Product Improvements

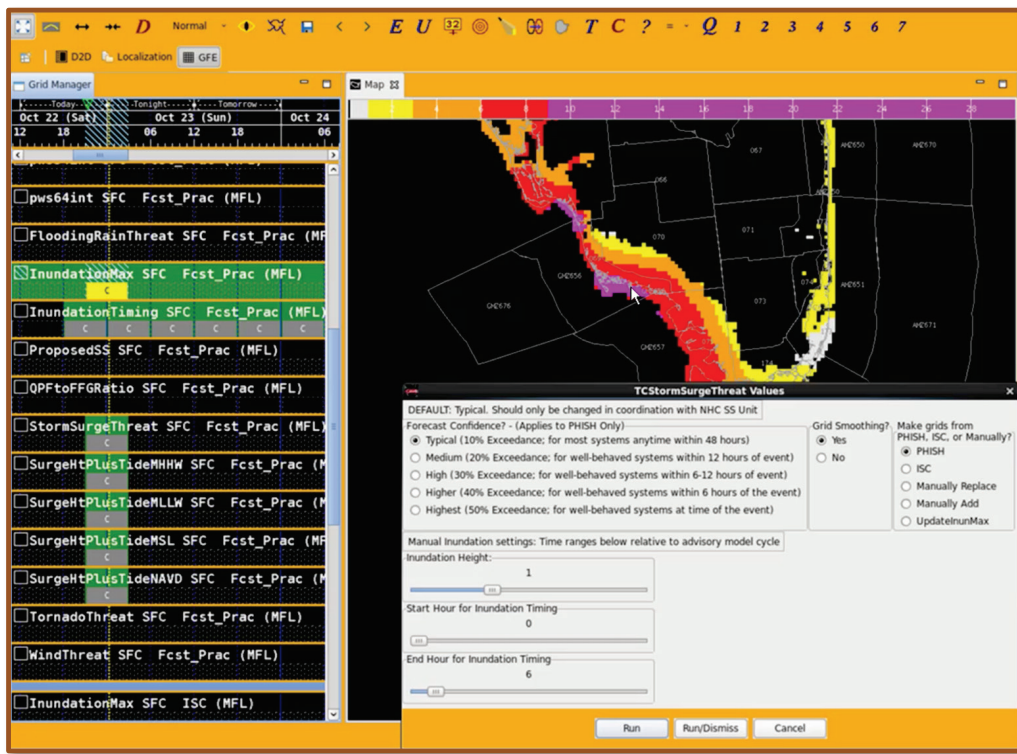
On hold pending decisions by the Coastal Integrated Water effort

# Limited Guidance Options

- Tropical surge models need to run on a 6-hourly operational timeline
- For a model to be able be used directly in support of W/Ws, its forecasts must be available in AWIPS
- PHISH (P-Surge) is the only probabilistic inundation guidance on the AWIPS SBN
- P-ETSS will not be on the SBN till 2018
- Need more robust robust probabilistic inundation guidance (i.e., multi-model, more members, etc.)



# Hurricane Threats and Impacts (HTI) – Storm Surge



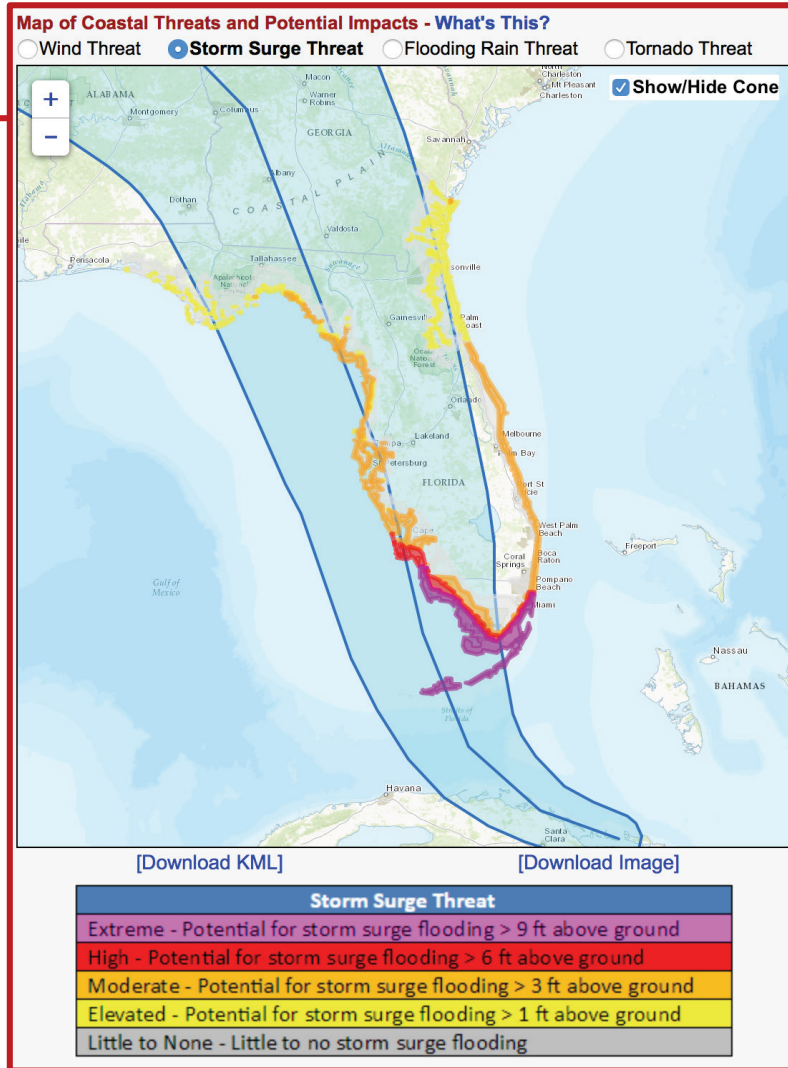
- Forecaster confidence determines the percent exceedance used to generate the surge grid data
- Confidence level starts at the most conservative (10% exceedance) and can increase as the event draws closer.
- 6-hourly InundationTiming (AGL) grids from the PHISH Incremental data
- InundationMax (AGL) grid created by compositing max values per grid point through 78HR
- PHISH, ISC, or Manual Replace options (P-ETSS option for 2018)



# HTI – Storm Surge Threat Grid

## \* STORM SURGE

- **LATEST LOCAL FORECAST:** Life-threatening storm surge possible
  - Peak Storm Surge Inundation: The potential for 2-4 feet above ground somewhere within surge prone areas
  - Window of concern: Begins early Thursday afternoon
- **CURRENT THREAT TO LIFE AND PROPERTY:** **Moderate**
  - The storm surge threat has remained nearly steady from the previous assessment.
  - Emergency plans should include a reasonable threat for dangerous storm surge flooding of greater than 3 feet above ground.
  - To be safe, earnestly prepare for the potential of significant storm surge flooding impacts. Evacuation efforts should now be brought to completion. Evacuations must be complete before driving conditions become unsafe.
  - Life-threatening inundation is possible. Failure to heed evacuation orders may result in serious injury or loss of life. Leave if evacuation orders are given for your area. Consider voluntary evacuation if recommended. Poor decisions may needlessly risk lives.
- **POTENTIAL IMPACTS:** **Significant**
  - Areas of inundation with storm surge flooding accentuated by waves. Damage to several buildings, mainly near the coast.
  - Sections of near-shore escape routes and secondary roads become weakened or washed out, especially in usually vulnerable low spots.
  - Major beach erosion with heavy surf breaching dunes. Strong and numerous rip currents.
  - Moderate damage to marinas, docks, boardwalks, and piers. Several small craft broken away from moorings, especially in unprotected anchorages.



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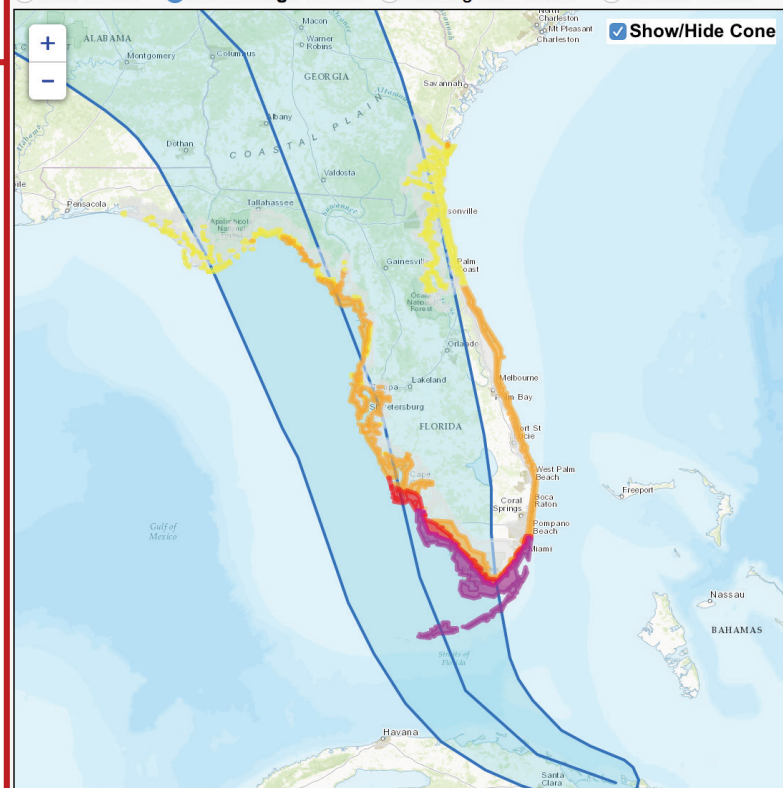
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## Map of Coastal Threats and Potential Impacts - What's This?

Wind Threat  Storm Surge Threat  Flooding Rain Threat  Tornado Threat



[\[Download KML\]](#)

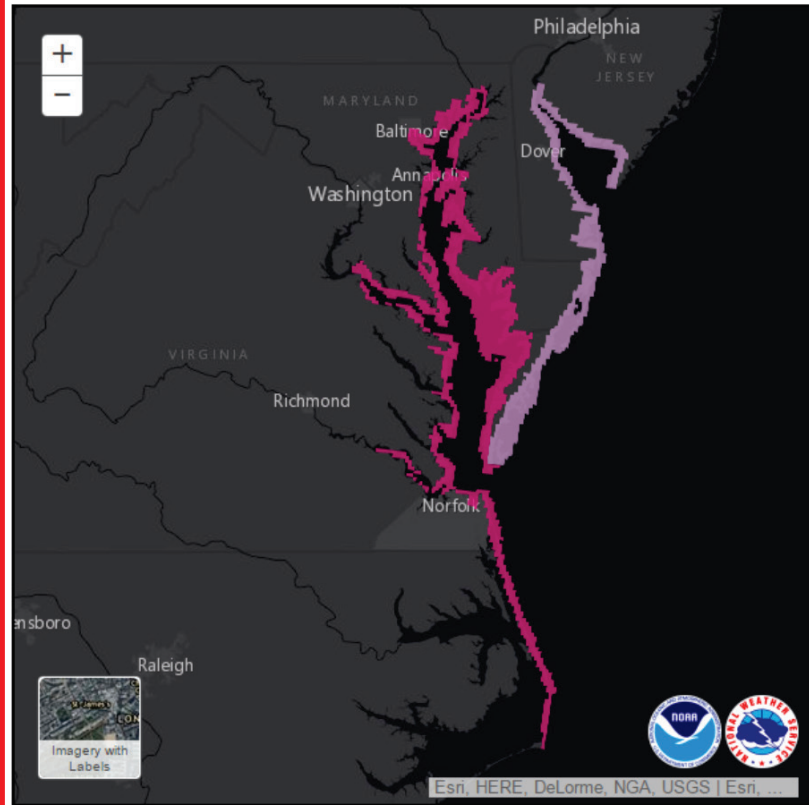
[\[Download Image\]](#)

### Storm Surge Threat

- Extreme - Potential for storm surge flooding > 9 ft above ground
- High - Potential for storm surge flooding > 6 ft above ground
- Moderate - Potential for storm surge flooding > 3 ft above ground
- Elevated - Potential for storm surge flooding > 1 ft above ground
- Little to None - Little to no storm surge flooding

# Operational Storm Surge Watch Warning

Hurricane Zelda  
Advisory 12 Issued: Fri Jul 04 2014 8 PM EDT



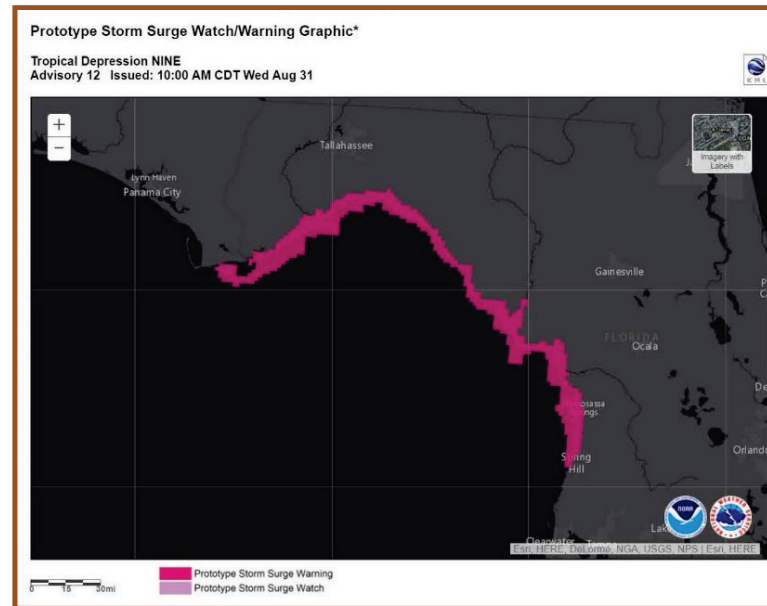
## STORM SURGE WATCH/WARNING:

- Operational in 2017 for the U.S. East and Gulf coasts
- Collaborated between local Weather Forecast Offices (WFOs) and NHC
  - NHC provides the synoptic scale expertise
  - WFOs fine-tune the warning area based on local knowledge
- First NWS grid-based warning (2.5km grid)
  - Not tied to entire counties or zones
  - Challenging dissemination and messaging



# Storm Surge Watch and Warning Communication

- SSWW is communicated using:
  - **Graphic on NHC website, including downloadable kml file**
  - NDFD grid (delayed availability)
  - Approximate representation in terms of zones (in National and WFO TCV products)
  - Approximate representation using coastal breakpoints in the
    - NHC Public Advisory
    - NWS WFO Hurricane Local Statement



## SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A Hurricane Warning is in effect for...  
\* Anclote River to Indian Pass Florida

A Storm Surge Warning is in effect for...  
\* Aripeka to Indian Pass Florida

# Storm Surge Values in NWS Products

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**The inundation values will be different in the various NWS products with storm surge information**

## **NHC Tropical Cyclone Public Advisory** (*TC-scale product*)

Provides the highest expected surge values within the area noted between coastal points

## **NHC Inundation Graphic** (*Point-specific product*)

Provides the “reasonable worse-case scenario” given historical forecast errors in hurricane track, size, and intensity at a given point

## **WFO TCV Product** (*WFO County-Warning-Area-scale product*)

As the event draws nearer, values in the WFO TCV trend toward expected values (for rescue/recovery decisions) rather than the “reasonable worst case scenario” (for evacuations decisions)

# Dissemination

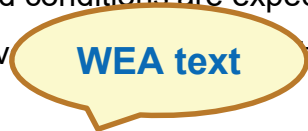
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# Common Alerting Protocol (CAP)

XML-based industry standard = low cost of entry for commercial developers

```
<event>Storm Surge Warning</event>
<urgency>Expected</urgency>
<severity>Extreme</severity>
<certainty>Likely</certainty>
<headline>Storm Surge Warning issued February 22 at 3:05PM EST by NWS...</headline>
<description>A Hurricane Warning means Hurricane wind conditions are expected...</description>
<instruction>Aggressively prepare for the potential of dev...</instruction>
<parameter><valueName>CMAMtext</valueName>
<value>NWS: Life-threatening storm surge danger. Check for possible evacuation orders.</value>
</parameter>
<polygon>35.44,-77.26 35.41,-77.23 35.36,-77.23 35.38,-77.28 35.33,-77.35 35.35,-77.39 35.41,-77.48 35.43,-77.47 35.40,-77.40 35.43,-77.36 35.41,-77.32 35.44,-77.26</polygon>
<polygon>35.48,-77.45 35.46,-77.47 35.49,-77.51 35.51,-77.50 35.48,-77.45</polygon>
```



# Where Else?



# MOMs/MEOWs to Support Storm Surge Watch/Warning



▲ LEGEND

Category 5 (SLOSH MOMs) Storm Surge Inundation

Inundation Height

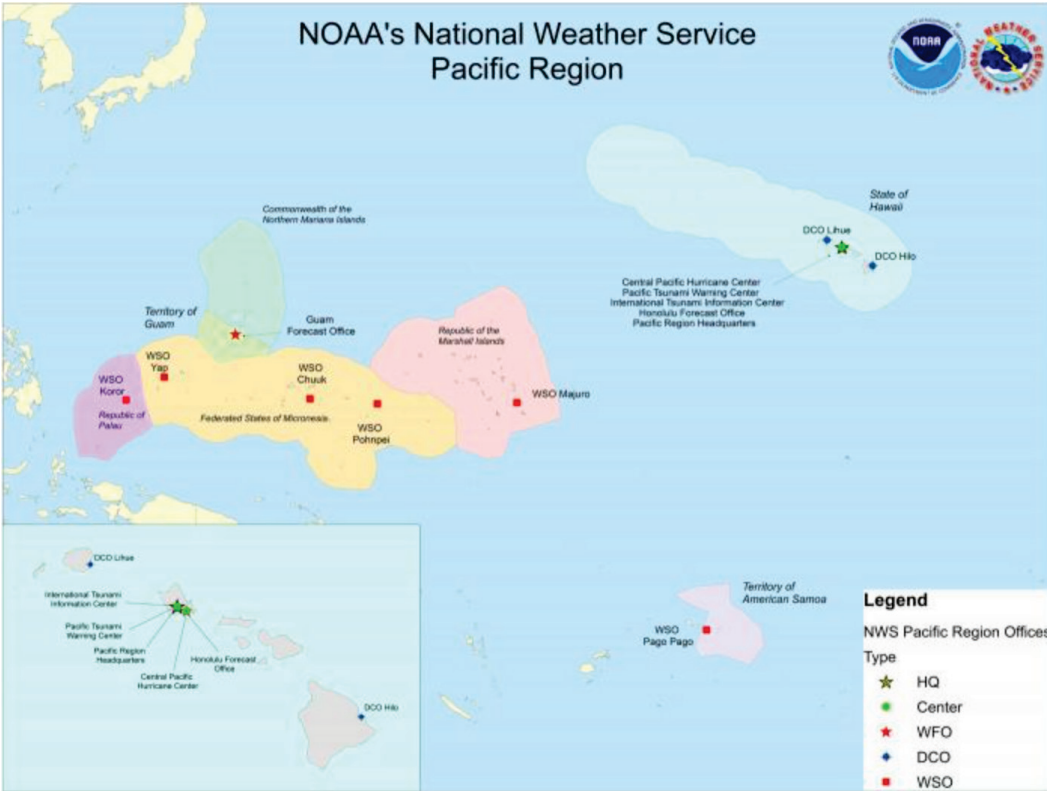
- Up to 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground

# NWS Areas of Responsibility Lacking Surge Guidance

- Areas that are vulnerable to powerful tropical cyclones
- Areas that are remote and require extensive planning to deliver goods and services
- Areas with limited planning resources

...and what about Southern California?

**Can the Pacific have the same level of service as the Atlantic?**



# Tropical Program Development Priorities

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1. SLOSH+waves P-Surge
2. Storm Surge W/W Tool Expansion
3. MOMs and MEOWs for Guam
4. P-Surge for Guam
5. MOMs and MEOWs for Southern California
6. P-Surge for Southern California
7. MOMs and MEOWs for American Samoa
8. P-Surge for American Samoa
9. Expansion of P-ETSS over NWS Pacific Areas of Responsibility and Puerto Rico/USVI
10. Innovation in inundation model ensembles and total water model ensembles



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## FY18 Tropical Program Surge-Related Milestones

Issuance Requirements for Tropical Cyclone Storm Surge Watches/Warnings in Puerto Rico and Hawaii

Requirements for tropical service improvements in Pacific and Western Regions (including SLOSH basin requirements)

Requirements for Effective Hurricane Messaging Course Curriculum for Pacific Offices

# Thank You

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