National TWC SOPs – Using PTWC
New Products for Threat Assessment:
Criteria Tables, Message Templates

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Overview

- Oct 1, 2014 PTWC to discontinue issuing Warning, Watch, Information Bulletins to PTWC countries.

- Instead, PTWC will issue Messages with Tsunami Forecasts (est wave heights or amplitudes)

- Sent by email only to Country TWFPs

- TWFP/NTWC will be responsible for issuing Warning, Watch, Information Alert for its own country emergency
Country NTWC tsunami event SOPs:

- **Alert Criteria Table** (PTWC Enhanced Products User’s Guide) Appendices VI, VIII) gives alert thresholds and Emergency Response actions
- **Message templates** (Appendix VII) facilitates quick std responses. Checklists remind Duty Staff during event
- **High-level Communication Flow Chart** shows primary agencies / stakeholders of warning chain
  intl Tsunami Service Providers => Natl / Local Warning and Emergency Authorities => Public
- Planning efforts develop **Timeline-driven SOPs** describing Time, Who, What, How, and To whom.
- **Exercises** practice and improve TWC / TER SOPs
Alert Criteria Table

- Thresholds are used to assign Alert Levels (Warning, Advisory, Watch, Information)
- Alert Levels correspond to country’s Forecast Maximum Coastal Wave Amplitude and/or earthquake magnitude
- Emergency Response Actions correspond to Alert Level
Countries may wish to further customize by assigning different thresholds for different source regions. Two situations:

- **NO QUANTITATIVE PTWC FORECAST.**
  PTWC Information Statement or Threat Message within 10 min after M6.5+ earthquake.

- **QUANTITATIVE PTWC FORECAST PRODUCT**
  PTWC Threat Message, ~30 min after large earthquake with tsunamigenic potential.
  - Warning / Watch Alerts (1.0 m threshold)
  - Warning / Advisory / Watch Alerts (0.3 / 1.0 m thresholds)
### Alert Criteria Table

**OT + 10 min: No PTWC Forecast**

1. **Criteria Table**
   - **NO QUANTITATIVE PTWC FORECAST PRODUCT**

   Criteria Table for NTWC tsunami alerts and emergency response actions based upon the initial PTWC product, typically issued within 10 minutes of any large Pacific earthquake, prior to the computation of a quantitative tsunami forecast. Key criteria for each situation are indicated in bold red letters.

<table>
<thead>
<tr>
<th>PTWC Product Type</th>
<th>Earthquake Parameters</th>
<th>Potential Tsunami Type</th>
<th>Are Possible Hazardous Tsunami Waves Indicated for Your Country or Area</th>
<th>Threatened Coast</th>
<th>Time left to Initial Wave Arrival (ETA)</th>
<th>NTWC Alert Level for Threatened Coast</th>
<th>Emergency Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tsunami Information Statement</strong></td>
<td>Magnitude of 6.5-7.0, or on land, or ≥ 100 km depth</td>
<td>None or Very Minor</td>
<td>No</td>
<td>None</td>
<td>Not applicable</td>
<td>INFORMATION</td>
<td>No action required</td>
</tr>
<tr>
<td><strong>Tsunami Threat Message</strong></td>
<td>Magnitude of 7.1-7.5, undersea or very near the sea, and &lt; 100 km depth</td>
<td>Local Tsunami</td>
<td>Yes</td>
<td>&lt; 300 km from earthquake</td>
<td>&lt; 1 hr typical</td>
<td>WARNING</td>
<td>Evacuate threatened coast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>≥ 300 km from earthquake</td>
<td>Not given</td>
<td>INFORMATION</td>
<td>Monitor subsequent messages</td>
</tr>
<tr>
<td></td>
<td>Magnitude of 7.6-7.8, undersea or very near the sea, and &lt; 100 km depth</td>
<td>Regional Tsunami</td>
<td>Yes</td>
<td>&lt; 1000 km from earthquake</td>
<td>&lt; 3 hrs typical</td>
<td>WARNING</td>
<td>Evacuate threatened coast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>≥ 1000 km from earthquake</td>
<td>Not given</td>
<td>INFORMATION</td>
<td>Monitor subsequent messages</td>
</tr>
<tr>
<td></td>
<td>Magnitude of 7.9 and greater, undersea or very near the sea, and &lt; 100 km depth</td>
<td>Basin-wide Tsunami</td>
<td>Yes</td>
<td>Potential for a basin-wide tsunami</td>
<td>&lt; 3 hours</td>
<td>WARNING</td>
<td>Evacuate coast within 3 hours of ETA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td></td>
<td>3 to 6 hours</td>
<td>WATCH</td>
<td>Prepare to evacuate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td></td>
<td>&gt; 6 hours</td>
<td>INFORMATION</td>
<td>Monitor subsequent messages</td>
</tr>
</tbody>
</table>

**NOTES:**

- In a local tsunami situation, in order to provide the fastest alert, earthquake magnitude criteria should be used. Issuance of a Warning, Watch, or Information is dependent on the magnitude of the earthquake and its closeness to coastlines. Smaller magnitude earthquakes that are closer to the coast may warrant issuance of a Warning.
- Local tsunami warning threshold criteria based solely on magnitude should be determined after examining a country’s historical earthquake tsunami hazard. In some places, the local tsunami magnitude threshold may need to be lower than M7.1. The M7.1 threshold is used by PTWC for its Caribbean Tsunami Watch Service and was used by the PTWC for its Indian Ocean Tsunami Watch Service.
- The 3-hour time criteria is based on the amount of time required for a country to safely complete a coastal evacuation. The 3-hr threshold used by PTWC is considered a conservative, but reasonable time criteria. Historically, the value is from a requirement from Hawaii State Emergency Management Agency as the time required to safely evacuate all coasts of the State of Hawaii. Each country should consider their situation.
# Alert Criteria Table

**OT + 30 min: Quantitative PTWC Forecast – 1 m**

<table>
<thead>
<tr>
<th>PTWC Product Type</th>
<th>Earthquake Parameters</th>
<th>Maximum Tsunami Wave Amplitude Indicated for Your Country or Area</th>
<th>Threatened Coast</th>
<th>Time left to Initial Wave Arrival</th>
<th>NTWC Alert Level for Threatened Coast</th>
<th>Emergency Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsunami Threat Message</td>
<td>Magnitude of 7.1 or greater, undersea or very near the sea, and &lt; 100 km depth</td>
<td>≥ 1 m</td>
<td>Sections of coast with forecast amplitudes ≥ 1 m</td>
<td>&lt; 3 hrs</td>
<td>WARNING</td>
<td>Evacuate threatened coast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 to 6 hrs</td>
<td>WATCH</td>
<td>Prepare to evacuate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt; 6 hrs</td>
<td>INFORMATION</td>
<td>Monitor for subsequent forecasts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 1 m</td>
<td>None</td>
<td>INFORMATION</td>
<td>INFORMATION</td>
<td>Monitor for subsequent forecasts</td>
</tr>
</tbody>
</table>

**NOTES:**

- Threatened coast information can be gotten from the public text message, coastal forecast amplitude maps or the KMZ file. If only the Public Text message is used, then the entire country should be placed in a Warning.
- The 3-hour time criteria is based on the amount of time required for a country to safely complete a coastal evacuation. The 3-hr threshold used by PTWC is considered a conservative, but reasonable time criteria. Historically, the value is from a requirement from Hawaii State Emergency Management Agency as the time required to safely evacuate all coasts of the State of Hawaii. Each country should consider their situation.
# Alert Criteria Table

OT + 30 min: Quantitative PTWC Forecast – 0.3 / 1 m

<table>
<thead>
<tr>
<th>PTWC Product Type</th>
<th>Earthquake Parameters</th>
<th>Maximum Tsunami Wave Amplitude Indicated for Your Country or Area</th>
<th>Threatened Coast</th>
<th>Time left to Initial Wave Arrival</th>
<th>NTWC Alert Level for Threatened Coast</th>
<th>Emergency Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tsunami Threat Message</strong></td>
<td>Magnitude 7.1 or greater, undersea or very near the sea, and &lt; 100 km depth</td>
<td>≥ 1 m</td>
<td>Sections of coast with forecast amplitudes ≥ 1 m</td>
<td>&lt; 3 hrs</td>
<td>WARNING</td>
<td>Evacuate threatened coast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 to 1 m</td>
<td>Sections of coast with forecast amplitudes 0.3 to 1 m</td>
<td>3 to 6 hrs</td>
<td>WATCH</td>
<td>Prepare to evacuate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 0.3 m</td>
<td>None</td>
<td>&gt; 6 hrs</td>
<td>INFORMATION</td>
<td>Monitor for subsequent forecasts</td>
</tr>
</tbody>
</table>

| | | | | > 6 hrs | INFORMATION | Evacuate beaches and harbors |
| | | | | 3-6 hrs | WATCH | Prepare to evacuate |
| | | | | | INFORMATION | Monitor for subsequent forecasts |

### NOTES:
- Threatened coast information from public text message, coastal forecast amplitude maps or the KMZ file. If only the Public Text message is used, then the entire country should be placed in a Warning.
- The 3-hour time criteria is based on the amount of time required for a country to safely complete a coastal evacuation. The 3-hr threshold used by PTWC is considered a conservative, but reasonable time criteria. Historically, the value is from a requirement from Hawaii State Emergency Management Agency as the time required to safely evacuate all coasts of the State of Hawaii. Each country should consider their situation.
Message Products for Alert Levels

- User’s Guide – Appendix VII
- Emphasize NTWC and NDMO/DMO are authorities, not PTWC or other international
- Create Templates for easy fill-in (or automatically fill-in with incoming PTWC message). Basic text does not change. Duty Staff only need to fill in event information.
- **Include Review option:** If automated process or GUI used, need to make sure there are ‘REVIEW BEFORE SEND’ and ‘MANUAL ENTRY’ options
Message Products for Alert Levels

• Mimic EXISTING PTWC Text Bulletin (Warning, Watch, Information)

• **Structure:** Header, EQ Info, Evaluation, Forecast (if applicable), Recommended Actions (depending on Threat Level), ETA, Potential Impacts, Tsunami Observations, Next Update and Additional Info

• **Customize for country**
  • Use Local Time
  • Replace PTWC with Country’s NTWC
  • Retain only country locs (for threat, ETA). Delete other
  • Specify Local Authority for Public Safety Action (Evacuation), Contact info / how to obtain evac status
  • Specify update schedule
New Products – Sharing of TWFP products

Decide whether to share Graphical Products (currently only to TWFP by email)

• Which Products to share
• To Whom
• Should products be adjusted / customized before sharing?
• Need to socialize/train for shared products
NTWC – TER SOPS

- Identify Stakeholders. Specify roles.
- Describe end-to-end (detection to evacuation)
- Warning Communication Flow Chart
  - Who does What
  - Distant / Regional – Local
  - Warning, Watch, Information Alerts
- Timeline-driven SOPs
  - Who does What and When
  - Time, Products, Actions
Example – Tsunami Warning Communication Flow

**WSO MAJURO SOP**

**PTWC**

**ISSUE PRODUCTS**

- **NEW ENHANCED TSUNAMI PRODUCTS**
- **TEXT PRODUCTS TO ALL, INCL PUBLIC**

**WSO MAJURO**

Analysis of Product and Determination of threat

**NEMCO**

Notify the NDC Chair (with recommendations)

Further Analysis

**ISSUE:**

- **WATCH** (Potential Threat 3-6 hrs)
- **WARNING** (Potential Threat <3 hrs)

**Coordinate Evacuation**

- Public Safety - Traffic Control
- MOE - Shelter/Transportation
- MIA - Manage shelter
- Municipalities - support coordination
- PW - road cleaning/heavy equipments

**EOC Activated**

**General Public of Marshall Islands**
Example – Tsunami Warning Communication Flow

YAP STATE, FSM - LOCAL TSUNAMI OR < 2 HRS

1. Strong earthquake, shaking and natural tsunami
   - PTWC
   - JMA
   - Threat detection and issue advisory and products
   - Text, Graphical and statistical forecast products
   - Yap Weather Service
     - Inform
     - State DCO/Governor
     - Warning/evacuation issued
     - Analysis of potential threat and formulate recommendations - issue warning and evacuation or to issue advisory and continue to monitor

2. GENERAL PUBLIC OF YAP STATE
   - Recorded WSO
   - Website
   - Municipal chiefs
   - V6AI - YAP
   - FSM TC
   - Police
   - HF/VHF stations

COORDINATION OF YAP STATE RESPONSE and ACTIVATION OF STATE EOC & EVACUATION
- State agencies
- Red Cross
- NGO’s
- Mayors
- School Principal
- Private Sector
- IOM
- National agencies
Timeline-driven SOPs

- Planning for seamless, effective response. Manage expectations.
- Specify critical actions / decision points. What decision, and when it must occur
- Add TIME to Communication Flow Chart
- When, What, Who, How, To whom

<table>
<thead>
<tr>
<th>EVENT</th>
<th>TIME (When)</th>
<th>ACTIVITY (What actions)</th>
<th>AUTHORITY (Who)</th>
<th>MEDIUM (How)</th>
<th>TO (Target audience)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ Occurs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess Threat - Tsunami might come</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evacuate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tsunami comes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safe to return / Declare “All Clear”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### EXAMPLE: TIMELINE-DRIVEN SOP

**TSUNAMI SCENARIO:** Distant Tsunami (8 hrs to arrive)

**TIMELINE-DRIVEN INFORMATION FLOW AND SOP for REPUBLIC OF MARSHALL ISLANDS**

Draft 0.2, April 2014, ITIC

**Notes:**
- PTWC will issue 1st Message in 5-15 min, 2nd Message in 30-60 min, and as new information received and/or regularly (nominally hourly). PTWC Text, Graphical, Statistical Forecast Products only to PTWS TWFP (WSO Majuro) by email; PTWC Text Product is public and goes to many and posted on PTWC web site.
- **WSO** will issue TIS, Watch, Warning based on PTWC Messages and monitoring of earthquake and tsunami as it propagates across the Pacific. Updates as new information received and/or regularly

<table>
<thead>
<tr>
<th>TIME (HRS AFTER EQ)</th>
<th>TIME (HRS BEFORE WAVE ARRIVAL)</th>
<th>EVENT</th>
<th>ACTIVITY - ACTION (WHAT IS DONE AND BY WHOM / INFO AVAILABLE)</th>
<th>AUTHORITY (WHO FROM)</th>
<th>MEDIUM (HOW)</th>
<th>TO (TARGET)</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8</td>
<td>EQ Occurs</td>
<td>WSS on Duty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.08</td>
<td>7.8</td>
<td>0005</td>
<td>PTWC EQ Observatory Message</td>
<td>PTWC</td>
<td>CISN (internet) Alarm / PTWC Email</td>
<td>All with CISN, or WSO</td>
<td>Unknown</td>
</tr>
<tr>
<td>0.12</td>
<td>7.75</td>
<td>0007</td>
<td>PTWC Message 1 – earthquake info WSO read and interpret message</td>
<td>PTWC</td>
<td>Email, Fax, Phone from WFO Guam, EMWIN?</td>
<td>WSO</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>7.5</td>
<td>0030</td>
<td>PTWC Message 2 – W-phase Forecast. WSO read and interpret message</td>
<td>PTWC</td>
<td>Email, Fax, Phone from WFO Guam, EMWIN?</td>
<td>WSO</td>
<td>3ft forecast in RMI</td>
</tr>
<tr>
<td>0.75</td>
<td>7.25</td>
<td>0045</td>
<td>TIS</td>
<td>WSO issues?</td>
<td>Fax, Phone, ?</td>
<td>NDMO</td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>8-6</td>
<td>0000-0200</td>
<td>Large earthquake occurred Read &amp; Interpret PTWC Bulletins. WSO assess hazard (check for historical impact (online NGDC, offline TsuDig), monitor Tide Tool, contact WFO Guam/PTWC as needed). Inform &amp; coordinate with NDMO.</td>
<td>WSO</td>
<td>Fax, Phone, ?</td>
<td>Natl Govt</td>
<td>Possible Tsunami at source. Waiting for confirmation</td>
</tr>
<tr>
<td>Time</td>
<td>Zone</td>
<td>Time</td>
<td>Action</td>
<td>Details</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>--------</td>
<td>---------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1.5</td>
<td>7-6.5</td>
<td>0100-0130</td>
<td>PTWC Message 3</td>
<td>PTWC Message - Forecast after DART readings, near-source tsunami observations. WSO read and interpret message.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0200</td>
<td>Watch</td>
<td>WSO recommends to NDMO/NDC to issue Watch. Get Ready / Prepare, Do NOT Evacuate at this time. Inform Public</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.25</td>
<td>5.75</td>
<td>0215</td>
<td>Activate EOC</td>
<td>NDMO Watch Staff notify Cabinet / NDC / Stakeholder Agencies, etc to report to EOC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-5</td>
<td>6-3</td>
<td>0200-0500</td>
<td>Tsunami confirmed near source</td>
<td>Read &amp; Interpret PTWC Messages. Monitor tsunami progress across Pacific. Consult with WFO Guam, PTWC or ITIC if needed. Update expected RMI threat. Inform &amp; coordinate with EOC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>5.5</td>
<td>0230</td>
<td>PTWC Message 4</td>
<td>PTWC Message – observations. WSO read and interpret message.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>0300</td>
<td>Watch</td>
<td>WSO recommends to NDMO/NDC to issue Watch, hourly update. Report obs as tsunami propagates across Pacific</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>4.5</td>
<td>0330</td>
<td>PTWC Message 5</td>
<td>PTWC Message – observations. WSO read and interpret message.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0400</td>
<td>Watch</td>
<td>WSO recommends to NDMO/NDC to issue Watch, hourly update. Report obs as tsunami propagates across Pacific</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>5.5</td>
<td>0430</td>
<td>PTWC Message 5</td>
<td>PTWC Message – observations. WSO read and interpret message.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>0500</td>
<td>Warning</td>
<td>WSO recommends to NDMO/NDC to issue Warning</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WSO: Email, Fax, Phone from WFO Guam, EMWIN?
NDMO: Fax, Phone, ?
Cabinet, NDC, Stakeholder Agencies, etc: Phone, ?
WSO issues? | Fax, Phone, ?
NDMO: 4ft updated forecast in RMI
NDMO: Phone, ?
Cabinet, NDC, Stakeholder Agencies, etc: Phone, Radio, etc
May be dangerous to RMI

4ft flooding expected
<table>
<thead>
<tr>
<th>Time</th>
<th>Code</th>
<th>Activity</th>
<th>Message</th>
<th>EOC</th>
<th>Communication Channels</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.25</td>
<td>2.75</td>
<td>0515 Evacuate</td>
<td>Various EM activities, such as Roadblocks, Vulnerable Communities (Outer Islands)/ Special Needs Population / Schools evacuation notification and evacuation, Critical Infrastructure notification and response, Ports and Harbors, Airport, etc</td>
<td>Natl EOC</td>
<td>Radio, TV, etc</td>
<td>Public</td>
</tr>
<tr>
<td>6, 7</td>
<td>2, 1</td>
<td>0600, 0700 Warning</td>
<td>WSO recommends to NDMO/NDC to continue Warning, provide observations</td>
<td>WSO issues</td>
<td>Fax, Phone, ?</td>
<td>NDMO, State/Local EMO</td>
</tr>
<tr>
<td>5-8</td>
<td>3-0</td>
<td>0500-0800 Tsunami propagating across Pacific</td>
<td>Read and Interpret PTWC Messages. Monitor tsunami progress across Pacific. Update expected RMI threat. Inform and coordinate with EOC</td>
<td>WSO</td>
<td></td>
<td>Natl Govt</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0800 Warning, Tsunami arrives</td>
<td>WSO reports tsunami observations in RMI</td>
<td></td>
<td></td>
<td>First wave 6ft high</td>
</tr>
<tr>
<td>8-13?</td>
<td>0 to -5?</td>
<td>0800 and later Dangerous tsunami waves continue to arrive</td>
<td>WSO monitors local sea level gauges to determine when dangerous tsunami waves have stopped arriving. Inform and coordinate with EOC. Make and receive calls giving observations/impact/damage</td>
<td>WSO</td>
<td></td>
<td>Later arriving waves may be &gt; 6ft</td>
</tr>
<tr>
<td>?</td>
<td>?</td>
<td>?</td>
<td>Warning Cancellation</td>
<td>WSO</td>
<td></td>
<td>State / Local / Natl Govt</td>
</tr>
<tr>
<td>?</td>
<td>?</td>
<td>?</td>
<td>Search and Rescue</td>
<td></td>
<td></td>
<td>Waves small (&lt;1 ft)</td>
</tr>
<tr>
<td>?</td>
<td>-12?</td>
<td>2000 Safe to return</td>
<td>NDMO / State / Local Authorities issue All-Clear for populations to return to evacuated zones</td>
<td></td>
<td></td>
<td>State DCO</td>
</tr>
</tbody>
</table>
Final Guidance

- Remember Goal: Early warning to save lives
- Successful warning must be in time, understood, and actionable (e.g., Warning => Evacuate)
- If you have a local threat (< 30-45 min), Education is priority. People must 1. Act on Natural Warnings, 2. Self-Evacuate - do not wait for NTWC warning
- NTWC to issue Alert using pre-determined criteria. Duty Staff know what to look for in PTWC products
- NTWC can decide Alert Level using only Public Text product (e.g., map forecast height to Warning). NTWC does NOT need to use all products (these add value, further detail).
Thank You

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