WC/ATWC Operations

December 5, 2006

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NOAA/NWS/West Coast-Alaska Tsunami Warning Center

Presented to the Alaska Seismic Hazards Safety Commission
WC/ATWC Mission

• Protect life and property from tsunami hazard by providing tsunami information and warning bulletins to the AOR.
  – Operational objectives to carry out mission:
    • Analyze seismic events potentially dangerous to the AOR.
    • Determine their tsunami potential.
    • Predict tsunami arrival times.
    • Predict impact on coast when possible.
    • Provide timely and effective information and warning bulletins to the AOR through multiple communication paths.
  – Increase community preparedness and public tsunami education through TsunamiReady program and outreach.
  – Develop new processes and techniques to improve response.
WC/ATWC Quick History

• Built in 1967 in response to the 1964 “good Friday” earthquake / tsunami
• The Alaska TWS originally housed at three centers in Adak, Sitka, and Palmer
• By late-70’s, operations had condensed to Palmer
• 1981 Area-of-Responsibility (AOR) increased to include west coast and BC
• 2003 new facility constructed
• 2005 AOR increased to include east, Gulf, and Canadian Atlantic coasts
• 2005 staff increased to allow 24/7 in-house coverage
WC/ATWC Area-of-Responsibility

- WC/ATWC AOR
  - Western:
    - California
    - Oregon
    - Washington
    - British Columbia
    - Alaska
  - Eastern
    - U.S. Gulf of Mexico coast
    - U.S. Atlantic coast
    - Eastern Canada
- PTWC AOR:
  - Hawaii
  - Pacific outside WCATWC AOR
  - Interim Puerto Rico/VI/Caribbean
  - Interim Indian O.
Tsunami Strengthening Planned
Observational Network Improvements

- **Seismic network upgrade**
  - 9 Caribbean Global Seismic Network Quality Stations
  - PTWC Hawaii network
  - WCATWC network upgrade (NWS/TWEAK)

- **Tide Gage network**
  - 16 new NOS tide gages
  - Upgrade data transmission for NOS network
  - Four new Alaska tide gages installed (TWEAK supported)
  - Tsunami Mobile Alert Real Time (TWEAK supported)

- **DART network**
  - 32 new DARTs
  - Forecast model development

- **24/7 Tsunami Warning Centers**
WC/ATWC Staff

• 15 staff
  – Director
  – TWSO
  – 5 Sr. Watchstanders
  – 4 Watchstanders
    • Oceanography
    • Geophysics
    • Physical Science
  – 1 ITO
  – 1 Senior ET
  – 1 ET
  – Secretary

• Center staffed 24x7 with 2 staff.
Tsunami Warning Center Core Functions

- Acquire raw data:
  - Seismic data
  - Sea level data
- Process and analyze data:
  - Initial processing on seismic data
  - Post-processing seismic data
  - Display sea level data
  - Analyze sea level data in conjunction with pre-event modeling
- Disseminate Information
Seismic networks providing data to WC/ATWC

Seismic Data Centers with connections to the West Coast/Alaska Tsunami Warning Center

Legend
- CrestNet
- Internet
- Data Center

Map showing seismic data centers connected to WC/ATWC.
Seismic Data Network recorded at WC/ATWC – ~250 stations
Earthquake Data Processing

• WC/ATWC EarlyBird Seismic Processing System
• Developed for Fast evaluation of Big quakes
• Graphical interaction to refine automatic results
• Redundant backup operates concurrently (communications and hardware).
Earthquake Processing

- Initial processing defines location, depth, moment magnitude
- After initial message; post-processing
  - refine Mwp (5-15 minutes)
  - Computing Centroid Moment Tensor solution (about 15-20 minutes – NEIC method)
  - Computing Mw based on surface waves (20-60 minutes - Tahiti/PTWC method)
Sea Level Data Display and Analysis

- Data acquired at WC/ATWC from NOS, PTWC, and other centers’ sites
- 300+ tide gage signals
- 19 DART stations
- Data displayed with predicted tide and residuals
- Data real-time, triggered, or satellite delayed (hourly).
- Data merged with pre-computed forecasts to estimate impact.
Historic tsunami data can also be used to predict impact during an event.

- Compare earthquake size, observed and previous runups to estimate impact elsewhere.
- Valuable technique where historic data is plentiful (e.g. 9/25/2003 Japan event).
- NOAA/NGDC source of most data in tsunami warning center data bases.
# Procedural Thresholds – Events Near the West coast, BC, and Alaska

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<thead>
<tr>
<th>Magnitude</th>
<th>Area</th>
<th>Product</th>
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<tbody>
<tr>
<td>4.0-5.0</td>
<td>Within 50km of coast</td>
<td>Tsunami Information Statement</td>
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<tr>
<td>5.0-6.0</td>
<td>Within 150km of coast</td>
<td>Tsunami Information Statement</td>
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<tr>
<td>6.0-6.5</td>
<td>Within 250km of coast</td>
<td>Tsunami Information Statement</td>
</tr>
<tr>
<td>6.5-7.0</td>
<td>Offshore of near coast</td>
<td>Tsunami Information Statement</td>
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<tr>
<td>6.5+</td>
<td>Inland</td>
<td>Tsunami Information Statement</td>
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<tr>
<td>7.1-7.5</td>
<td>Pacific coast</td>
<td>Fixed warning (350km)</td>
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<td>7.6-7.8</td>
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<td>Fixed warning (1000km)</td>
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<td>Pacific coast</td>
<td>3 hour watch/3 hour warning</td>
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<tr>
<td>&gt;= 7.1</td>
<td>Bering Sea</td>
<td>Fixed warning for Bering Sea</td>
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<td>TSUPAC</td>
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Tsunami Warning Dissemination

- Main dissemination paths
  - FEMA-NAWAS
  - NWWS
  - FAA NADIN2
  - NWS Gateway/Line225

- Secondary paths
  - QDDS
  - Email
    - EM lists
    - TsunamiWatcher
  - Phone
  - Cell Phone Text Msg
  - RSS
  - Web
Performance Goals

- **Response Time:**
  - 5 minute in office
  - 10 minute after hours
- **Location:**
  - +/- 15km
- **Magnitude:**
  - +/- 0.2
Redundancy!

• Data Acquisition
  – Internet
  – Crestnet

• Processing
  – Two Independent Systems

• Message Communications
  – NWWS
  – NWS Circuits
  – FAA
  – NAWAS…..

• Facility
  – Backup Power, Comms., Internet
  – PTWC Backup Operational Center
Crescent City Tsunami Forecasts (cm)
Nov. 15, 2006

- Earthquake: 13:08, 40cm
- 3rd Wave: 04:30, 10cm
- 6th wave: 14:00, 88cm
- 1st wave: 11:38, 19cm
- Time (PST):
  - 03:00 to 15:00
  - Tsunami Amplitude (cm):
    - 0 to 100

Bulletins:
- Bulletin 1
- Bulletin 2
- Bulletin 3
- Bulletin 4
- Bulletin 5
- Cancellation

SIFT:
- unscaled

TW C:
- TWC
- TWC w/Shemya
- TWC w/DARTs
- Shemya
- Adak
- Midway

DARTs:
- w/DART

Cancellation:
- Bulletin 5