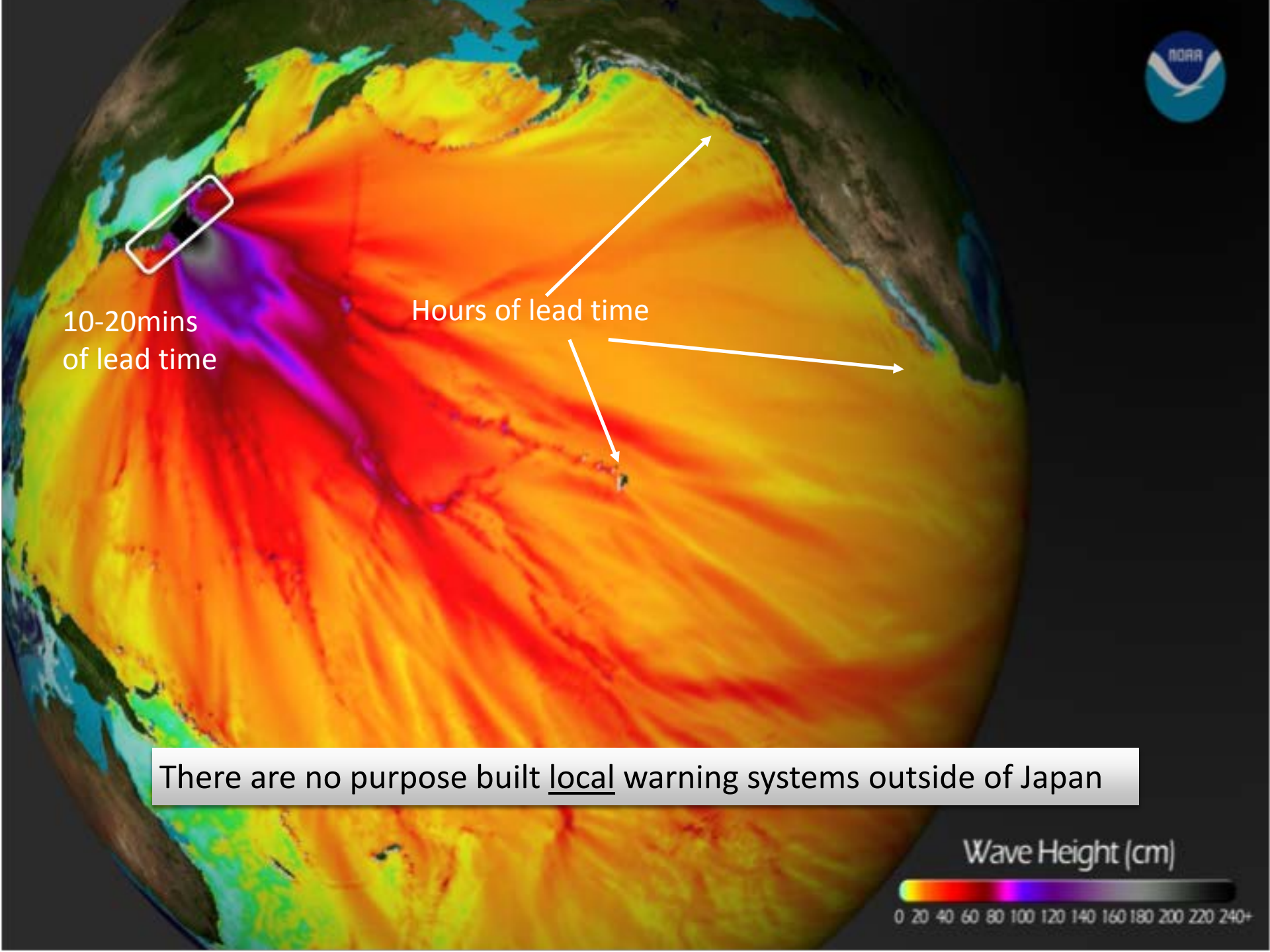
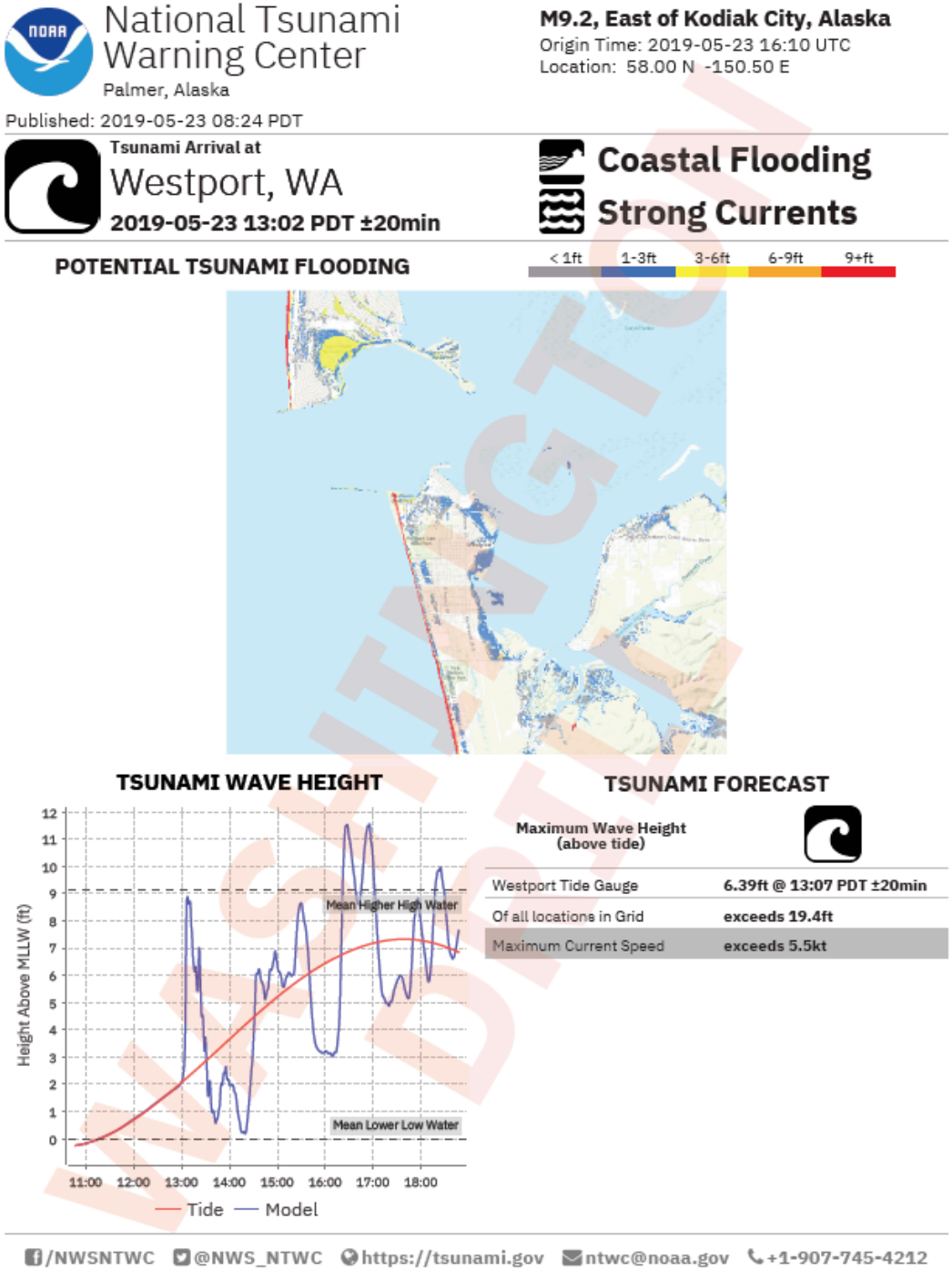
GNSS-data into SIFT for Near-field Tsunami Forecast

Diego Arcas, NOAA/PMEL

Marie Eble, NOAA/PMEL

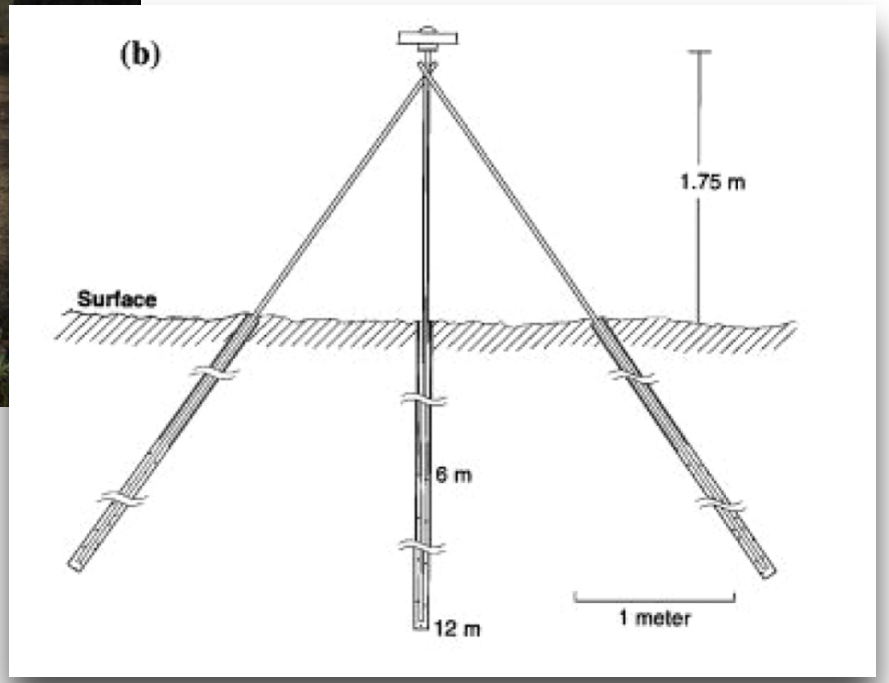


There are no purpose built local warning systems outside of Japan



- Typical arrival times of the first tsunami waves are 10-20mins
- Our goal: Local tsunami forecasts (and thus warning) in 3-5mins
- Our partners: TWCs, UW, UofO, CWU, NASA
- Our immediate focus region: The west coast of the US and Alaska
- Our hopeful ambition: Local warnings at all subduction zones that have a GNSS network

A path forward: Real-time Geodetic GNSS Stations



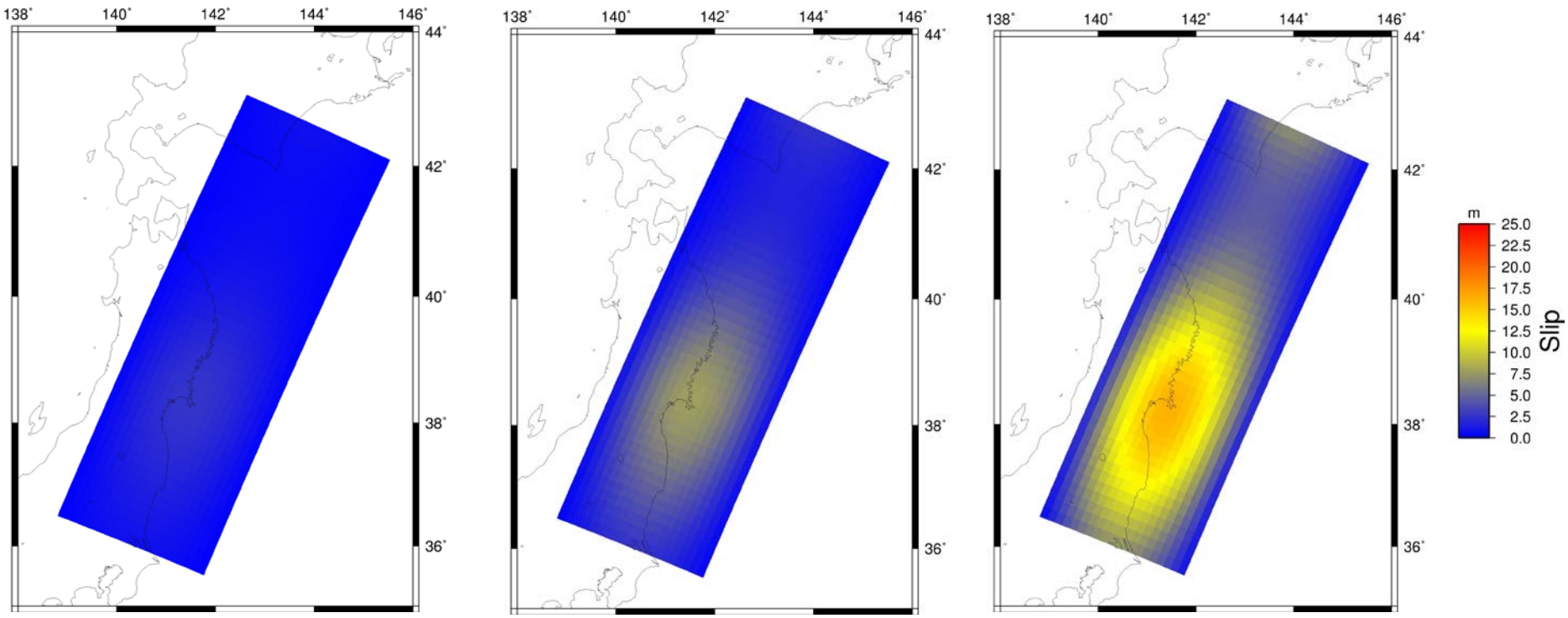
2011 Japan Even 1Hz Real-time Geodetic data

Time series of GPS dislocations.

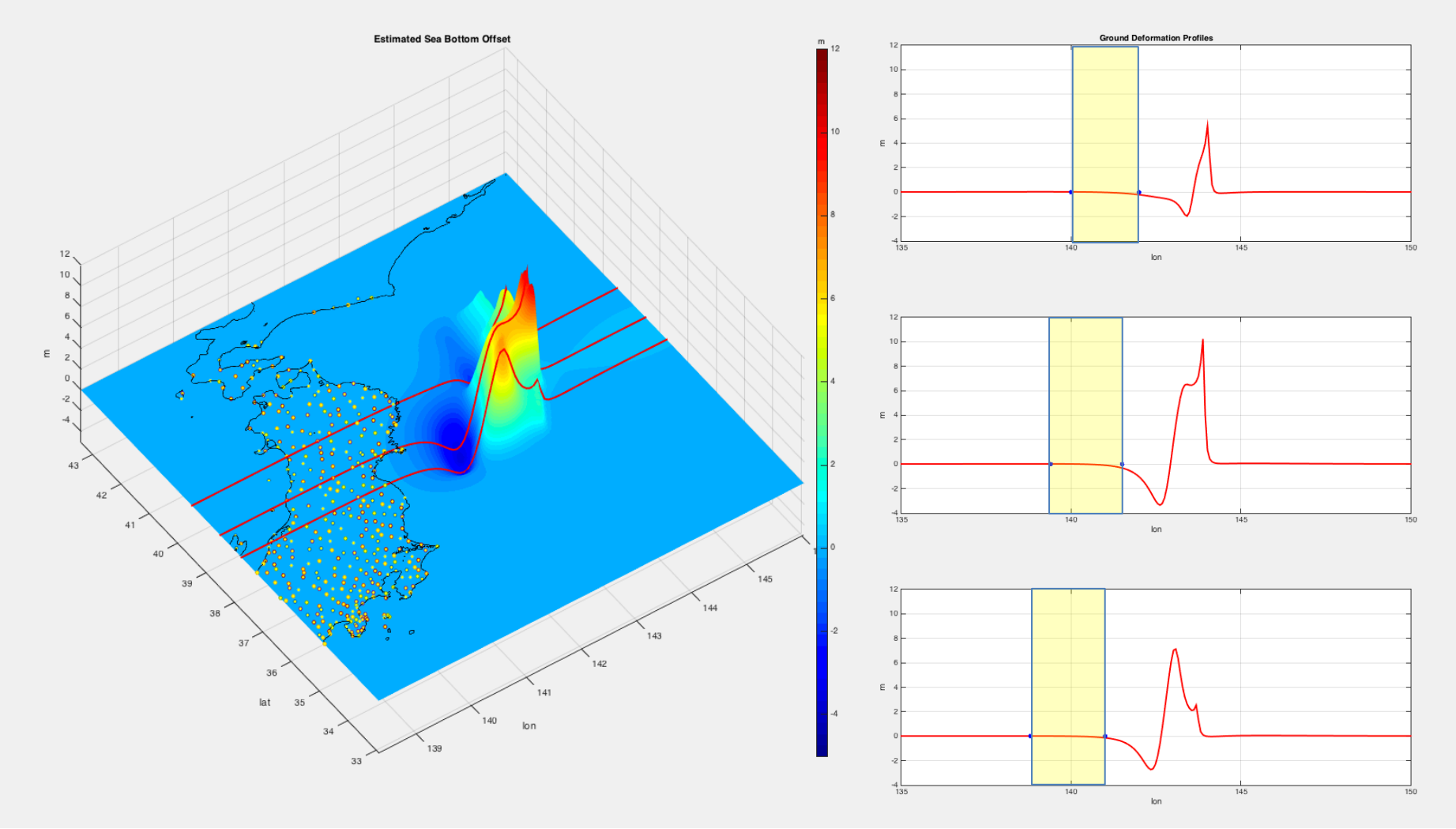
GPS can rapidly constrain earthquake moment

2011 Tohoku Estimates

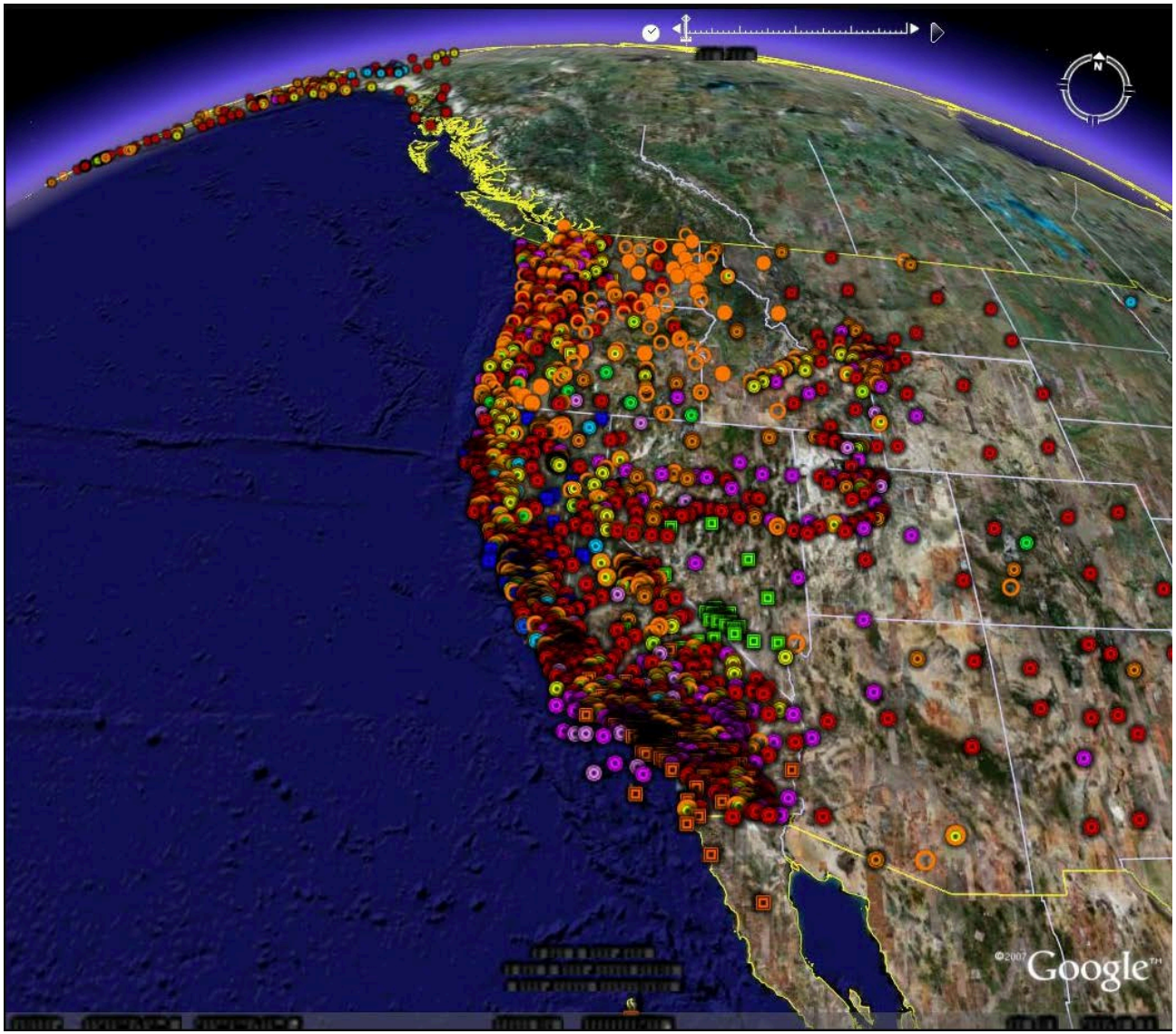
+60s: Mw 8.47 +90s: Mw 8.80 +120s: Mw 9.04



Cross-Sections of predicted ground deformation showing region of GPS observations at the continental margin



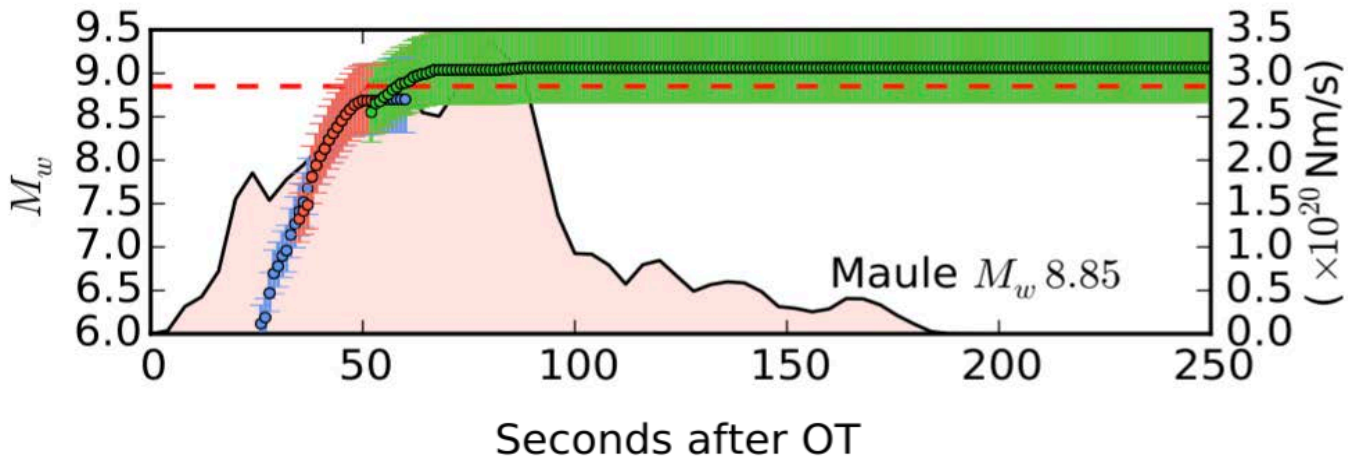
GPS Locations for more than 1500 stations from along Pacific/North American Plate



- Pacific Northwest Geodetic Array (PANGA)
- EarthScope's Plate Boundary Observatory
- Western Canadian Deformation Array
- USGS Networks

Real-time GNSS: GFAST

- G-FAST: a real-time GNSS inversion code developed at UW
- Written in C++ (fast!) with Python wrappers
- Being deployed at NOAA
- Solves for
  - **Magnitude**
  - Style of faulting
  - Heterogenous slip



Melgar et al., GRL, 2015
Crowell et al., SRL, 2018

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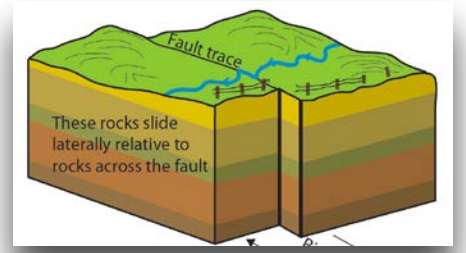

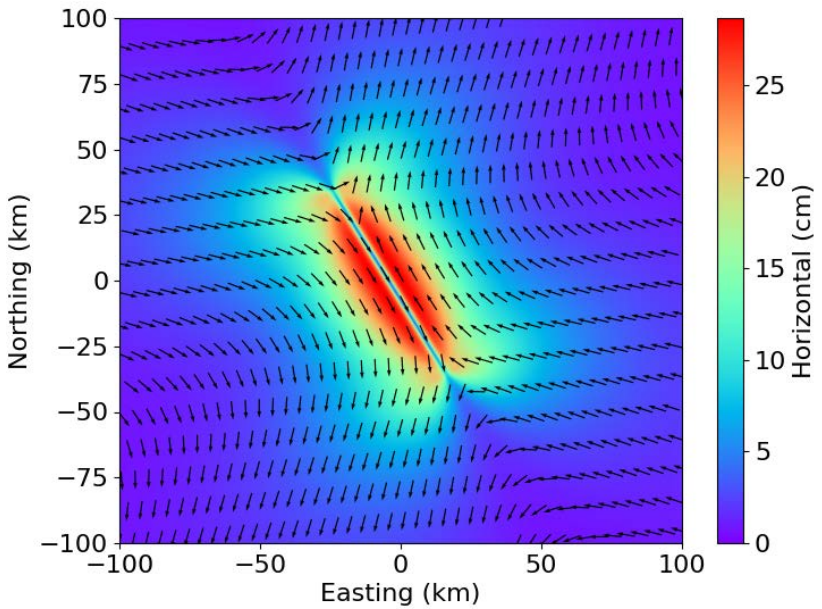

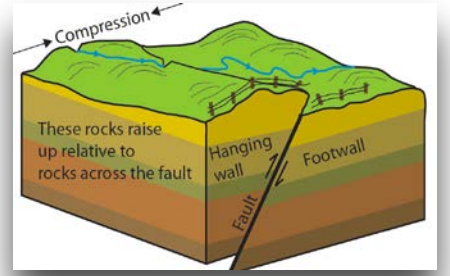

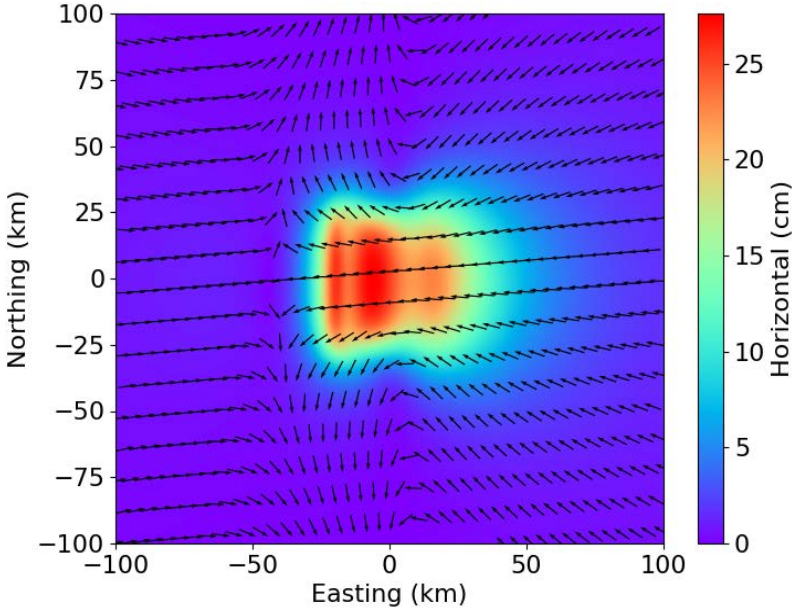

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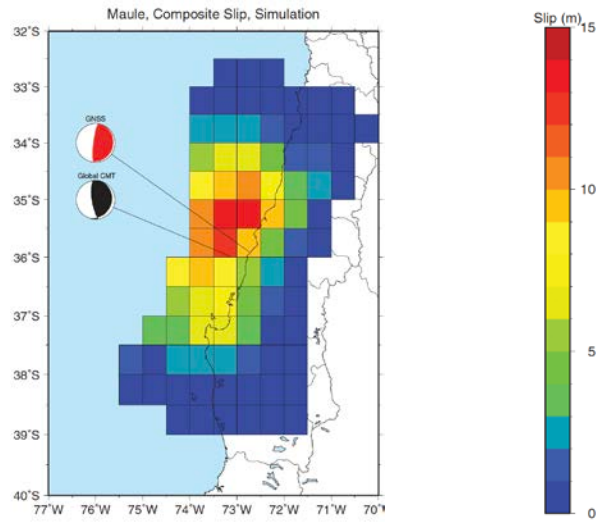
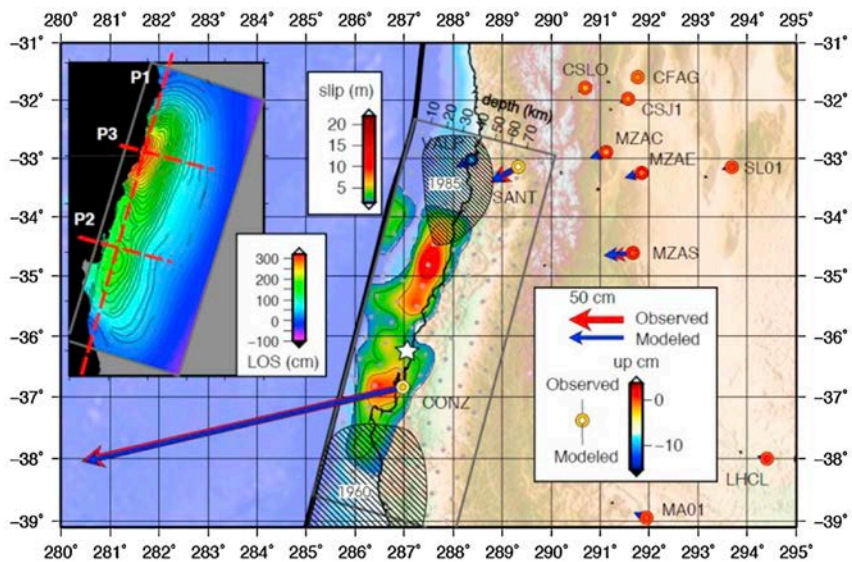
Real-time



Post-processed



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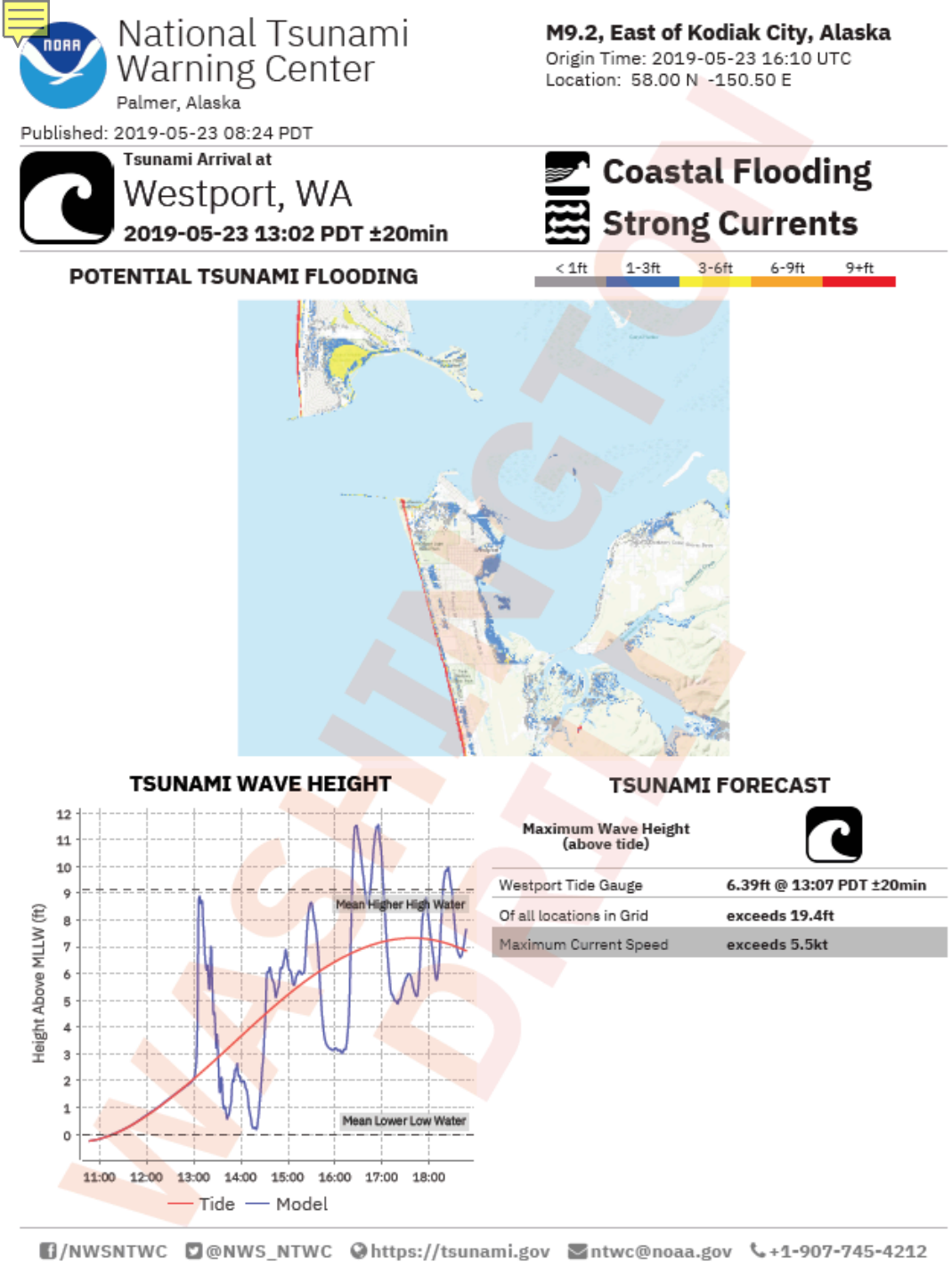
GPU tsunami solver operational at NOAA. Basin wide models in 1-2mins.



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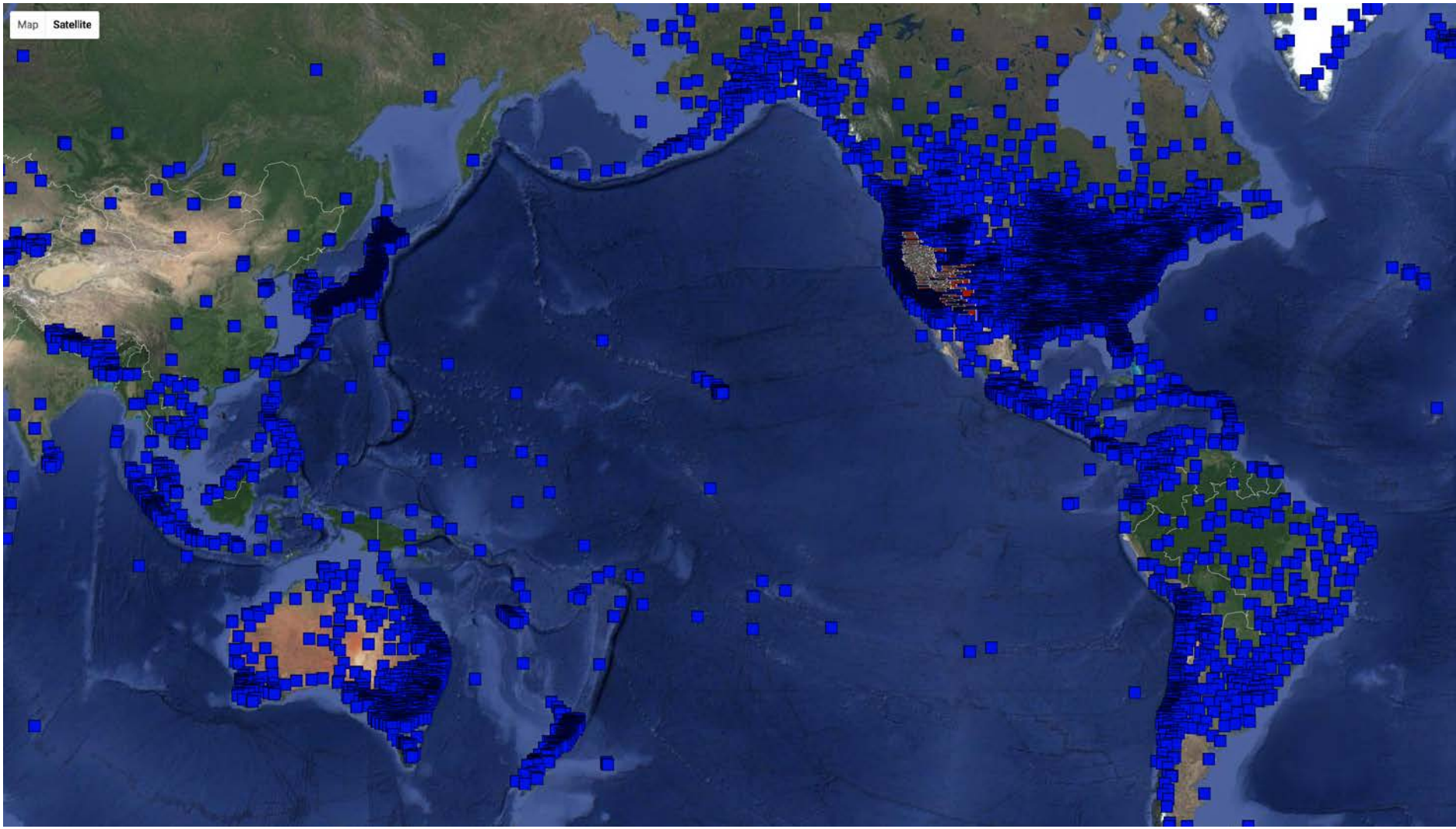
The global GNSS network



Thank you

Questions?