# NCEI WATER LEVEL REPORT – Tsunami

UPDATE
August 20, 2021

## Services

### Recent Tsunami July 29, 2021

NCEI is responsible for archiving and processing tsunami water level data from the National Data Buoy Center's (NDBC) Deep-ocean Assessment and Reporting of Tsunamis (DART) network, the Center for Operational Oceanographic Products and Services (CO-OPS) tsunami capable tide stations, and the National Tsunami Warning Center's (NTWC) tide stations. NCEI/CIRES scientists quality-controlled and de-tided data capturing a small tsunami generated by a magnitude 8.2 Alaska earthquake on July 29, 2021. The event did not cause significant damage, but it is unique as the tsunami was observed at all DARTs along the Alaska Peninsula and Aleutian Islands. At coastal tide gauge stations, the two largest observations were made at Old Harbor, Alaska (NTWC) and at Sand Point, Alaska (CO-OPS). The tsunami was observed at most Alaskan tide gauges, as well as northward facing Hawaiian and U.S. West Coast tide gauge stations--the latter were amplified as local seiches (resonant oscillations in harbors). Water level data from NTWC stations are received by NCEI in near real-time (every 15 minutes), archived, and quality-controlled and de-tided by NCEI on a regular schedule. Currently, NCEI receives water level data from PTWC stations in Hawaii once per year (January). In the future, NCEI hopes to bring in PTWC water level data in near real-time, similar to NTWC, so that observations in the Hawaiian Islands can be similarly processed soon after an event. The July 29th tsunami water level webpage provides public access to the quality-controlled and de-tided data.

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## Map Layer for Historical Marigrams

A map layer showing the locations of historical marigrams (1854-1994) has been added to NCEI's Natural Hazards Map Viewer. Select "Historical Marigrams" layer (blue diamonds) from the left-hand-side menu on the map.

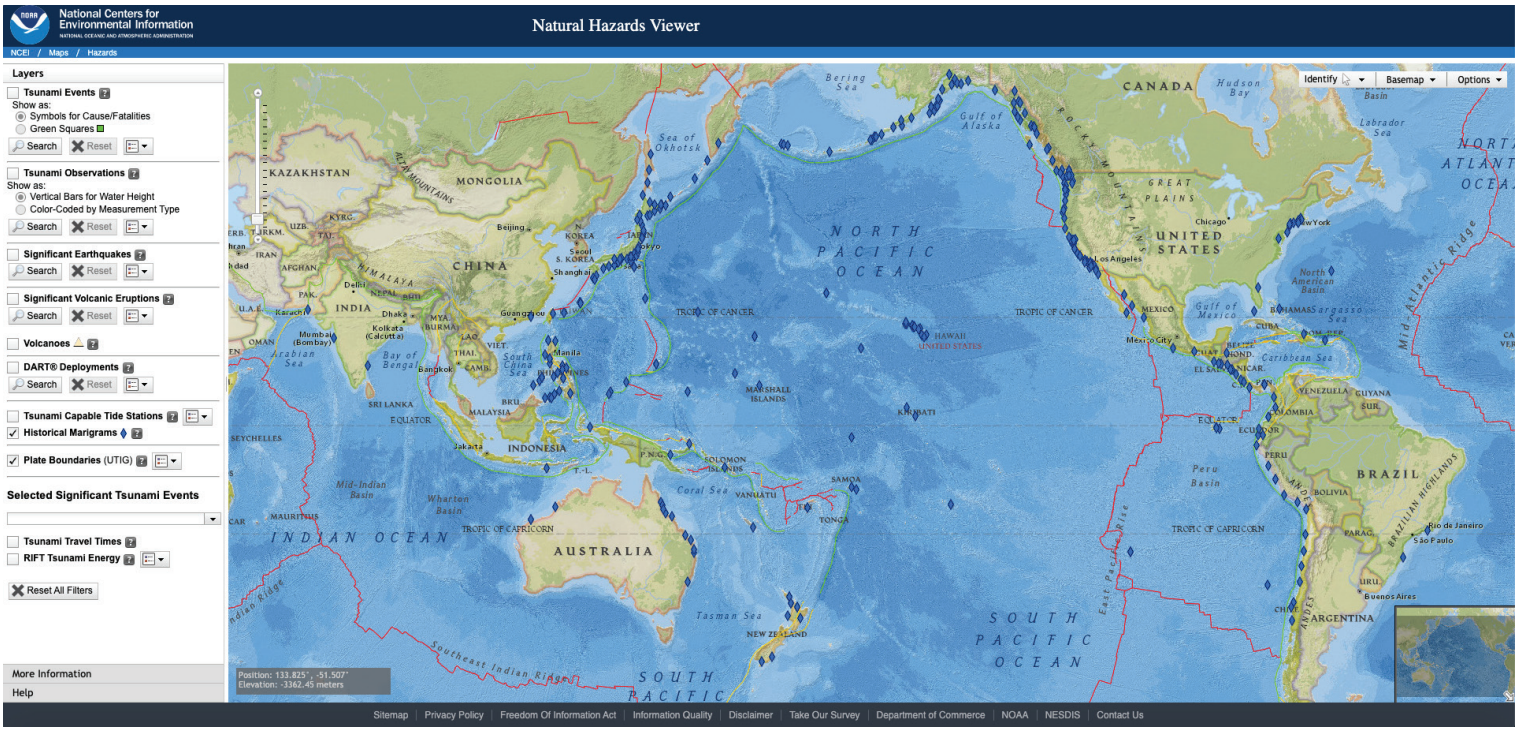


*Figure 1: Map layer for historical marigram locations (blue diamonds), collected during tsunami events between 1854 and 1994 worldwide.*

## More Tsunami Marigrams Online

NCEI stewards a collection of more than 3700 high-resolution, scanned images (TIFF) of paper tide gauge records, capturing worldwide observations of more than 390 tsunami events from 1854 to 1994. These marigrams are an important instrumental record of past tsunami events, useful for validating tsunami propagation and inundation modeling when digitized into time-series data. Until recently, only 7% (about 250) of these marigram images were available for direct download from NCEI's HazEL Marigram Search (Figure 2). We now have 71% (about 2650) of these marigrams online, covering 380 tsunami events. The columns circled in red on the accompanying figure of the HazEL Marigram Search Results provide links to low-resolution scan previews (JPEG) and high-resolution, full record scans (TIFF). We also improved the low-resolution, scan previews by merging multiple days of TIFF files for a given marigram into a composite sequence, rather than showing just a single image from one day. Figure 3 shows the scan preview from the December 20, 1946, tsunami event observed at Callao, Peru, formed from two TIFF images (also available directly at https://www.ngdc.noaa.gov/hazard/data/marigrams/1770/call_19461220.jpg). If you are interested in seeing specific images online, please contact us at haz.info@noaa.gov. We hope that with increased accessibility to these images, we'll see greater use by the tsunami research community and find support for completing the remaining 29%.

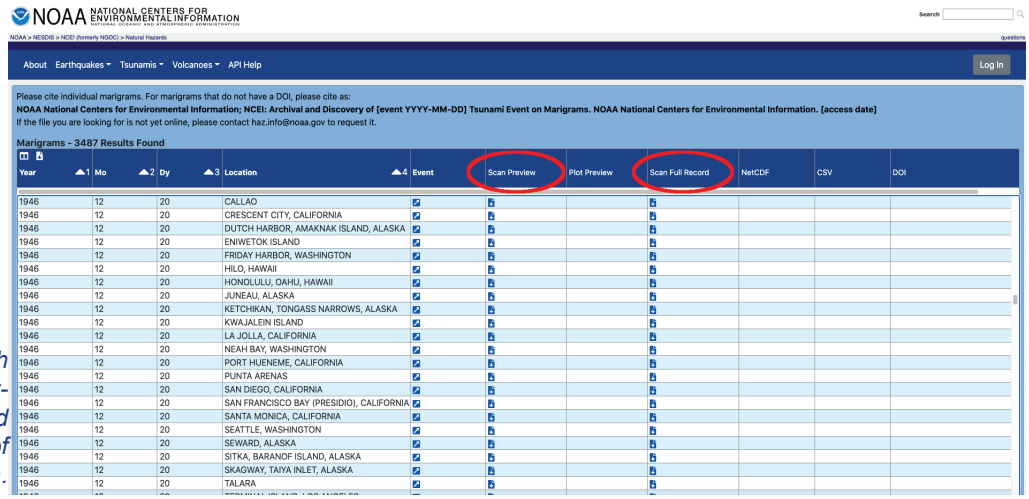


*Figure 2: NCEI Marigram Search Results showing links to download low-resolution scan previews (JPEG) and high-resolution, full record scans (TIFF) of analog tide gauge records (marigrams).*

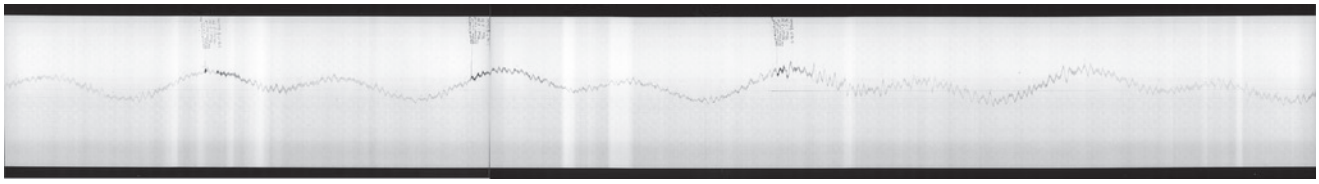

*Figure 3: Scan preview from the December 20, 1946, tsunami event observed at Callao, Peru, formed form two TIFF images in sequence.*

## Backfilling NDBC DART Data Archive

NCEI has received and archived two Deep-ocean Assessment and Reporting of Tsunamis (DART) ocean bottom pressure data packages from two sites maintained by NOAA's National Data Buoy Center (NDBC) in the Pacific Ocean. These two data packages were identified by NDBC as having not been submitted to NCEI by careful examination of gaps appearing in NCEI's DART data inventory timeline, initially published in 2016 and updated thereafter. The period of coverage is 2015-2017 for a site west of California (46411), and 2016-2017 for a site near the western Aleutians (21415). The data have been quality-controlled and tides. The data and products may be viewed and downloaded from NCEI at these web pages: 21415 and 46411. The processed records produced by NCEI are used to validate tsunami models in support of the NOAA Tsunami Program. The inventory timeline visualization continues to demonstrate its usefulness!

## Submission Agreement Refresh for NDBC's DART Data

NCEI has updated the language of the Submission Agreement (SA) with NDBC for DART data that was first created by NGDC in 2013. The new agreement reflects changes to contact information and data submission approach and schedule, and includes detailed information on the DART II and DART 4G data and metadata formats. It is expected that the new SA will be accepted by both parties this month.

## 2020 PTWC Water Levels Quality-Controlled and De-tided

In February's Update, we reported the receipt of one year (2020) of 10-second-resolution of water level data from nine tide gauge stations in Hawaii operated by the National Weather Service's Pacific Tsunami Warning Center (PTWC). These data have now been quality-controlled and harmonic analysis performed by George Mungov to remove tidal signals. In contrast with the single-year analysis conducted by the Center for Operational Oceanographic Products and Services (CO-OPS), NCEI processes the entire data record (now eight years of data) at once, in order to better remove some of the longer period tidal components and provide more accurate predictions. These products have been converted to netCDF and CSV formats at NCEI and are available for discovery and access via the tide gauge layer of the Natural Hazards Map Viewer and via the tide gauge data inventory timeline. This work supports the NOAA Tsunami Program and NESDIS's goal of strengthening the support of NOAA's data stewardship needs.

## Promoting the Tsunami Archive at EGU

NCEI gave a short talk on "Products and Services Available from U.S. NOAA NCEI Archive of Water Level Data" at the European Geophysical Union (EGU) General Assembly on April 27. The talk took place during a session on tsunamis. The display materials are available at https://presentations.copernicus.org/EGU21/EGU21-8027_presentation.pdf.

## UNESCO Publication on 1945 Makran Earthquake and Tsunami

In March, an IOC Brochure was published by UNESCO titled, "Karachi effects of the Makran earthquake and tsunami of November 1945: Mercury spilled, tide gauge impaired, seawalls overrun, boats displaced, mosque flooded." Co-author Lindsey Wright created a digital timeseries of the Karachi tide gauge marigram used in this document. This record features 17 days of inked curves spanning November 15 to December 1, 1945, and documents several data anomalies that coincide with recorded effects of the event in Karachi and the surrounding areas. The marigram and digital timeseries can be accessed at https://www.ngdc.noaa.gov/hazel/view/hazards/tsunami/marigram-data?location=KARACHI.