T3.5-P7

Comprehensive Seismic Monitoring: Developments at the USGS National Earthquake Information Center

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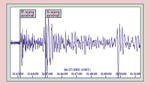
Acquisition

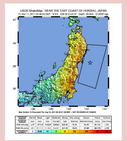
Data Sources

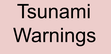
NEIC integrates automatically all near-real-time earthquake source parameters (e.g. location and magnitudes) and impact products (e.g ShakeMap) from all USGS-supported regional seismic networks and other contributing networks. NEIC acquires real-time waveform data from more than 120 seismic networks. Products automatically integrated into NEIC operations include:


Phase Data

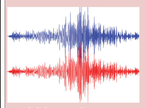

Moment Tensors

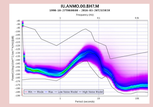

Vetted Catalogs


ShakeMaps

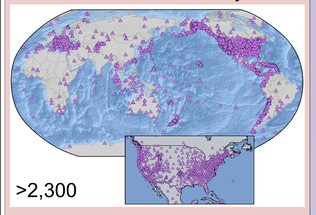

Tsunami Warnings


Macroseismic


Waveforms


Metadata

Real-time stations used by NEIC



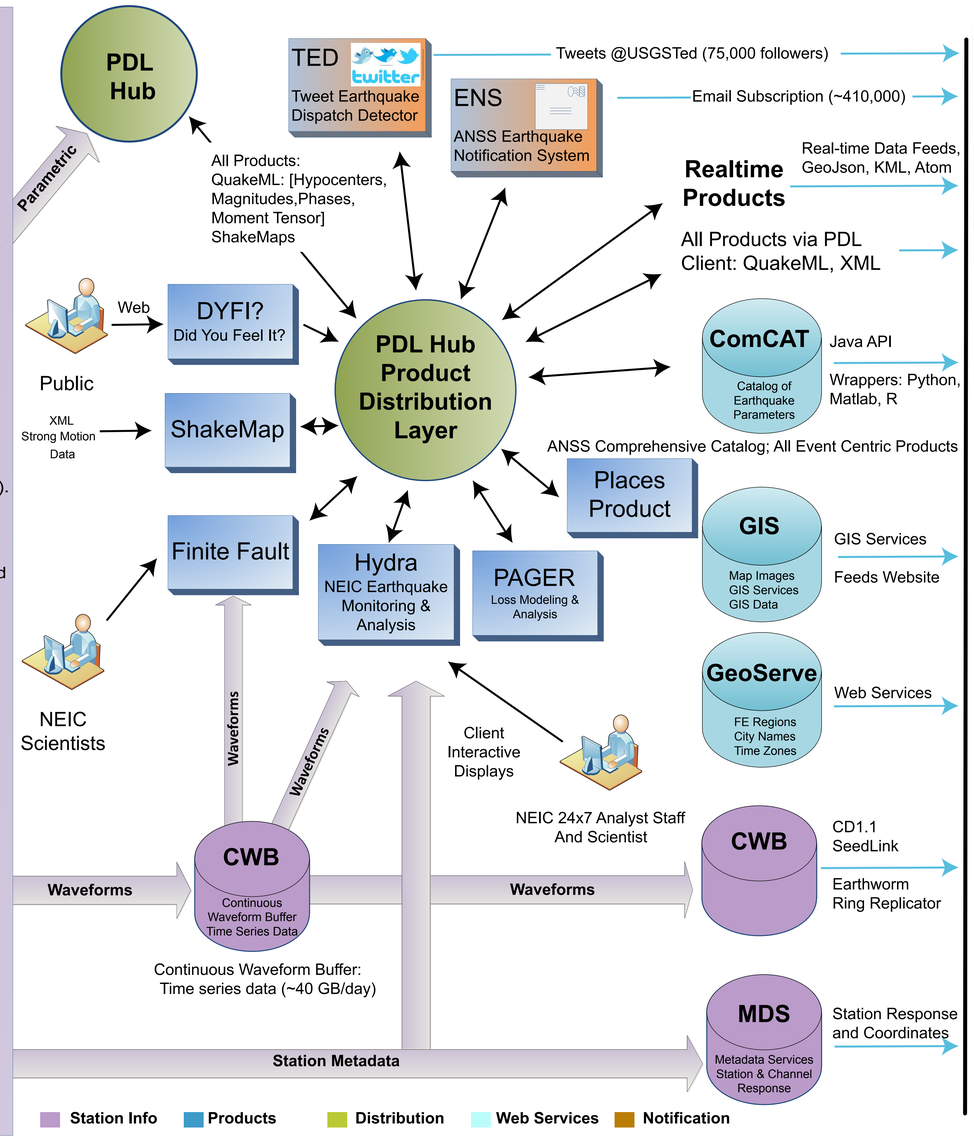
Product Distribution Layer (PDL)

distributes in real-time contributed source parameters (e.g. locations, magntiudes, moment tensor solutions), and other derived products from contributing networks routing them to NEIC systems via a PDL Hub. NEIC subsystems can then subscribe to receive products needed to improve source parameter characterization (e.g Finite Fault Modeling) or generation of new products (e.g. PAGER).

EDGE/CWB

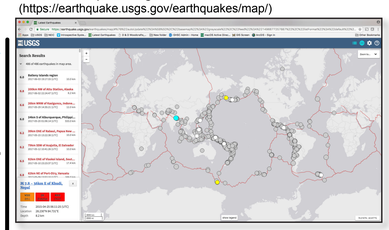
acquires waveform data (both realtime and delayed), station metadata and non-QuakeML parametric (e.g. REB). EDGE/CWB is capable of acquiring waveform data in the protocals: CD1.1, SeedLink, Reftek RTPB, Guralp SCREAM, Earthworm Import/Export, and Q330Lib. EDGE subsystems also check daily for updates to station metadata at ~100 known respositories. Updates to station information are automatically provided to the NEIC metadata services (MDS). NEIC is capable of self-discovery and self-configuration.

Processing



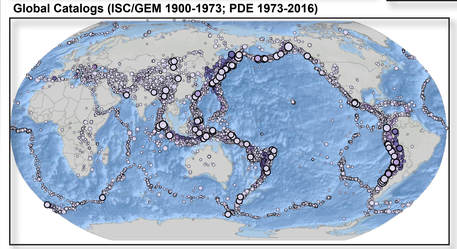
Products and Services

Recent Earthquake Pages and Searches
(https://earthquake.usgs.gov/earthquakes/map/)

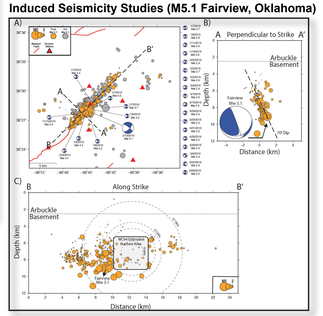


Earthquake Specific Pages and Products

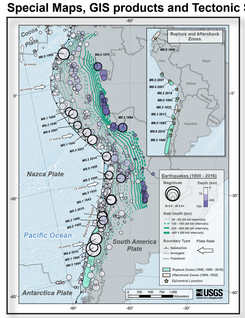
Global Catalogs (ISC/GEM 1900-1973; PDE 1973-2016)



Induced Seismicity Studies (M5.1 Fairview, Oklahoma)

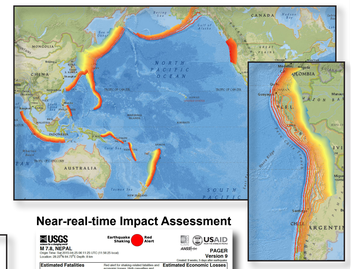


Special Maps, GIS products and Tectonic Summaries

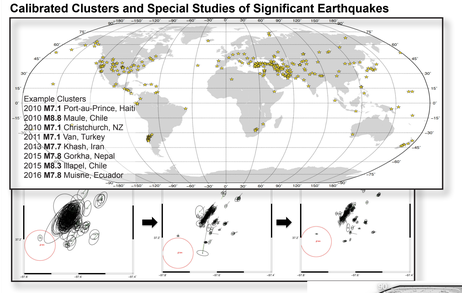


Seismotectonics of South America
The South American arc extends over 7,000 km, from the Chilean margin triple junction offshore of southern Chile to its intersection with the Panama fracture zone, offshore of the southern coast of Panama in Central America. It marks the plate boundary between the subducting Nazca plate and the South America plate, where the oceanic crust and lithosphere of the Nazca plate begin their descent into the mantle beneath South America. The convergence associated with this subduction process is responsible for the uplift of the Andes Mountains, and for the active volcanic chain present along much of this deformation front. Relative to a fixed South America plate, the Nazca plate moves slightly north of eastwards at a rate varying from approximately 80 mm/yr in the south to approximately 65 mm/yr in the north.

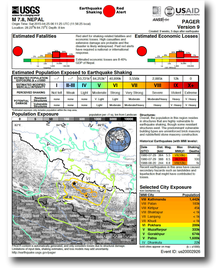
Subduction Zone Geometry (Slab1.0)



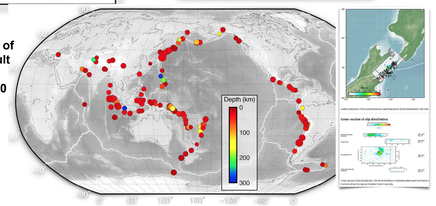
Calibrated Clusters and Special Studies of Significant Earthquakes



Near-real-time Impact Assessment



Database of Finite Fault Models since 1990



The USGS NEIC supports global emergency response, earthquake monitoring and catalog production by acquiring disparate data from more than 120 U.S. and international seismic networks, integrating and processing this data, and then distributing derived and integrated products. Data flowing through the NEIC includes waveforms, station metadata, and a diverse array of event centric products including: locations and magnitudes, moment tensors, associated and unassociated arrival times, ShakeMaps, impact assessment from Prompt Assessment of Global Earthquakes for Response (PAGER), tectonic summaries, maps, “Did You Feel It?” felt reports and city/region information. The system is designed to be fully self-discovery and self-configuring.

NEIC processing is a large scale effort of seamlessly integrating regional to global seismic data in numerous formats and protocols from many organizations to produce high-quality and time-critical earthquake response products. Integration of data and processing is accomplished by providing shared data services, well-documented process exchange standards (e.g. XML and JSON) and common distribution mechanisms (e.g. PDL and Kafka). The system also integrates archival source parameter data and numerous services to provide comprehensive access to all earthquake products (e.g. historical catalogs, finite fault models, GIS layers). This ensures a comprehensive ability to understand and evaluate seismicity and its relationship to tectonics and associated seismic hazards.