Open Exchange of Science Data through the World Data Center System – Impacts on Society

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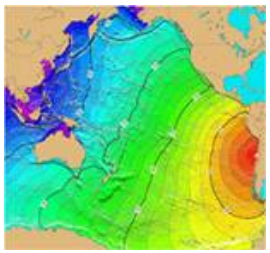
Scope of this Presentation

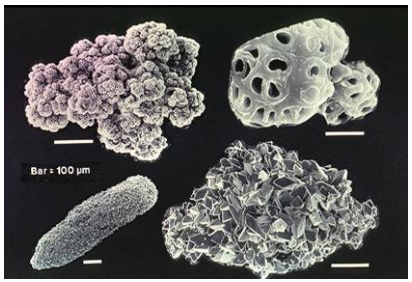
- A brief introduction to the WDC System
- An exploration of geomagnetic data exchange through the WDC and the benefits to society
- An exploration of tsunami-related data exchange through the WDC and benefits to society

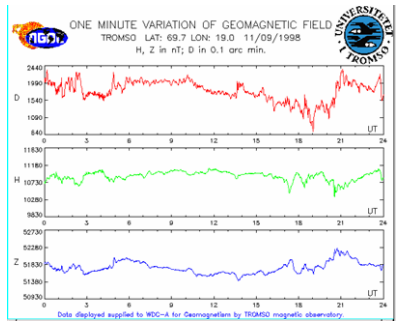
Mission Statement of the WDC System

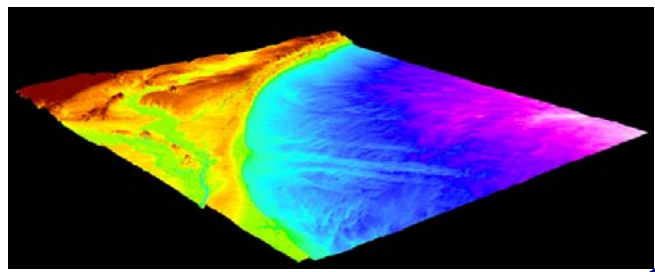
Data constitute the raw material of scientific understanding. The World Data Center system works to guarantee access to solar, geophysical and related environmental data. It serves the whole scientific community by assembling, scrutinizing, organizing and disseminating data and information.



DIVERS TAKE CORAL REEF SAMPLE.







Principles and Responsibilities

ICSU
International Council for Science

ICSU's Special Committee for the IGY established the World Data Center system to serve the IGY 1957-1958

The WDC system includes **52 Centers in 12 countries**

- **operated for the benefit of the international scientific community**
- resources required are responsibility of the host institution
- accept and store ICSU scientific program data
- publish catalogs of holdings
- exchange data among themselves
- hold no confidential or security-classified data
- data may be subject to privileged use by originators, for up to 2 years
- **provide data to scientists in any country at minimal charge or by exchange**
- accept any scientist as a visitor to work on site with data holdings
- WDCs report to the ICSU Panel as requested.

The WDC for SEG, Boulder

- Established in 1957
- Scientific data management of geophysical data
  - Geomagnetism, hazards (tsunami, earthquake, volcanic eruptions), gravity
  - Data, Metadata, delivery in standard (ISO, National, Community) formats
- Hosted by the U.S. National Oceanic and Atmospheric Administration (NOAA) / National Geophysical Data Center (NGDC)

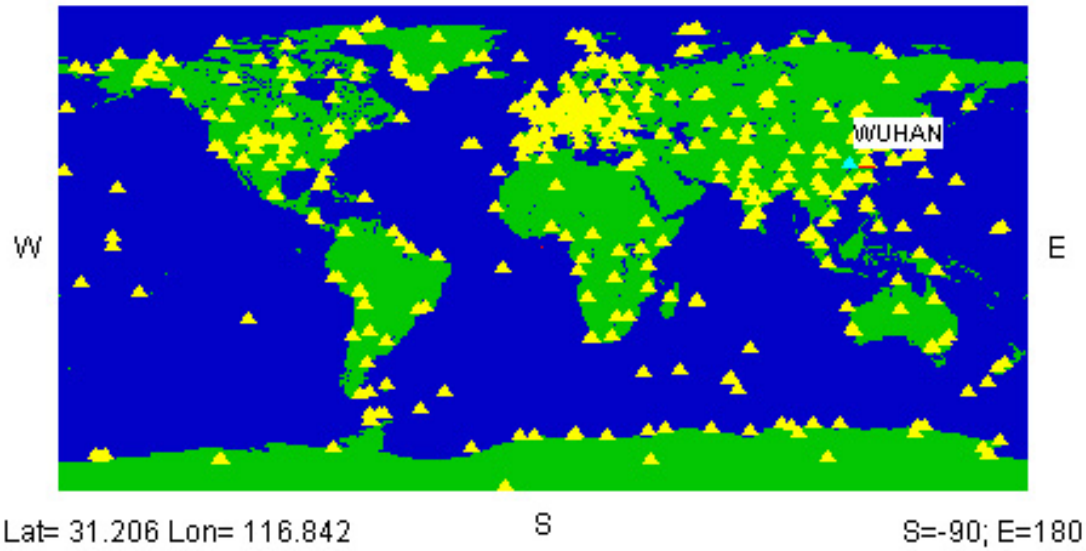
Exchange of Geomagnetic Data through the WDC System

Geomagnetic data is one of the original IGY data streams

Over 90 institutes in 72 countries supporting 200 magnetic observatories currently exchange geomagnetic data

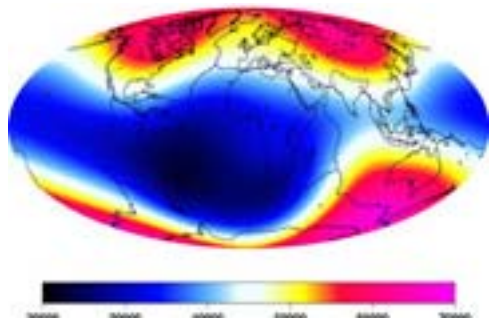
Global Exchange of Geomagnetic Data

- Data exchange through 7 ICSU World Data Centers
  - WDCs for Geomagnetism Copenhagen, Edinburgh, Kyoto, Mumbai
  - WDCs for Earth Geophysics Beijing, Boulder, Moscow
- Exchange supported by ICSU's International Association of Geomagnetism and Aeronomy (IAGA)
  - Partnerships with INTERMAGNET and other networks



Types of Data Routinely Exchanged

- Various Data Resolutions
  - Sub-minute, minute, and hourly data in near real-time*
  - Monthly and annual mean values for long-term studies of Earth's main magnetic field
- Minute and Hourly Mean Values
  - Global digital archive from 1901 (hourly) and 1969 (1-minute)
  - Analog archive (hourly paper and microfilm) from 1813
- Annual Mean Values
  - Global digital archive over 600 stations from 1813
- Data Submission
  - Digital virtual observatories (e.g. SPIDR in USA, Russia, Japan, South Africa, Australia, and China)
  - Digital submission via FTP, Internet, e-mail, CD-ROM
  - Yearbooks in paper and PDF format



* not all observatories routinely exchange 1-minute data

WDC-STP, Boulder SPIDR
Contact: Eric Kihn
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Benefits to Society

- Near real-time data forecast for space weather conditions
  - Health and safety of astronauts, communication systems, satellites
- Regional data for resource exploration, navigation, surveying
- Retrospective databases for basic research, climatologies, models for safe navigation, and many other applications
  - Primary uses of main field model
    - 32% for navigation
    - 17% for research
    - 12% for education
    - 7% for surveying

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Most GPS units built in the last 10 years include a model of Earth's magnetic field

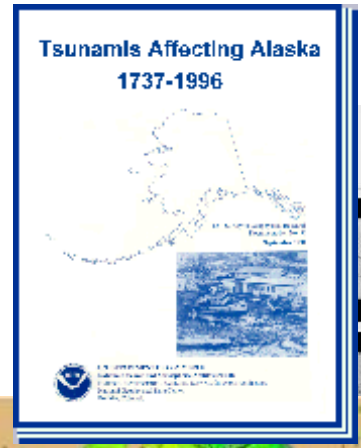
Exchange of Tsunami Data through the WDC System

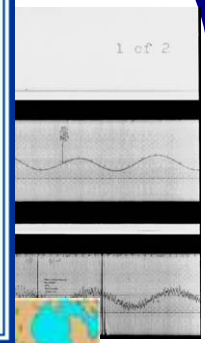
The WDC for SEG incorporated the WDC for Tsunamis in the 1970s

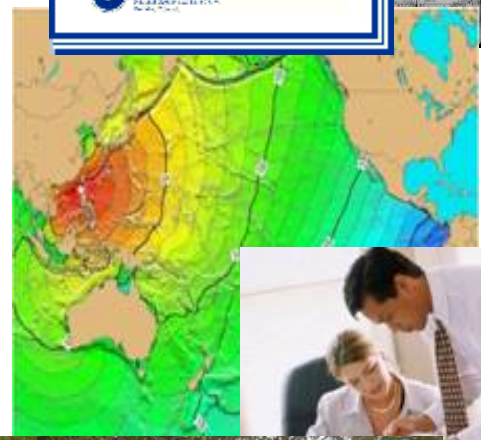
Archive data supporting tsunami research

Tsunami Data Activities through WDC

- Global database of historic events
  - Tsunami, significant earthquake and volcanic events databases 2000 BC to Present
- Archive of source documents
  - Tsunami, earthquake, volcanic eruption
- Archive of past event damage imagery
  - Prints, slides, digital imagery of damage
- Event-specific sea-level data
  - Marigrams, retrospective deep-ocean tsunameter, selected coastal tide station
- Inundation mapping US Coasts
- Visiting Scientist Program
  - Encouraging scientific collaboration by providing support for scientists to visit the WDC-SEG, Boulder.







Types of Data to Exchange

- Real-time data needs – Identifying danger and alerting at-risk areas
  - Seismic data for events of magnitude 6 and greater
  - Tsunameter data for deep-ocean verification (or cancellation) of event
  - Coastal water level data (stations registering tsunami arrival)
- Record of the past to prepare for the future
  - Past Tsunami Source Events (where, what, when, how big, how bad)
  - Tsunami Runup Locations (where, when, how high, what impact)
  - Imagery and descriptions of past damage – preserving visual record
- Data for forecast models to improve warnings and minimize damage
  - Deep-ocean bathymetry – tsunami travel times and propagation models
  - Within country: near-shore relief data for inundation models

Natural Hazards Contact:
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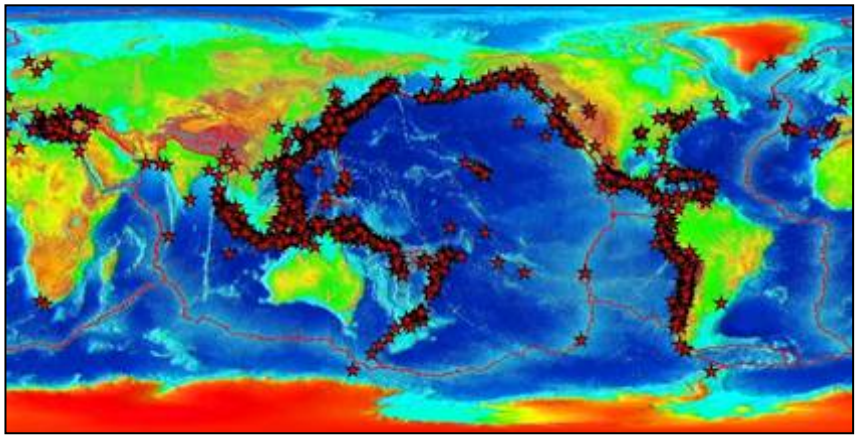
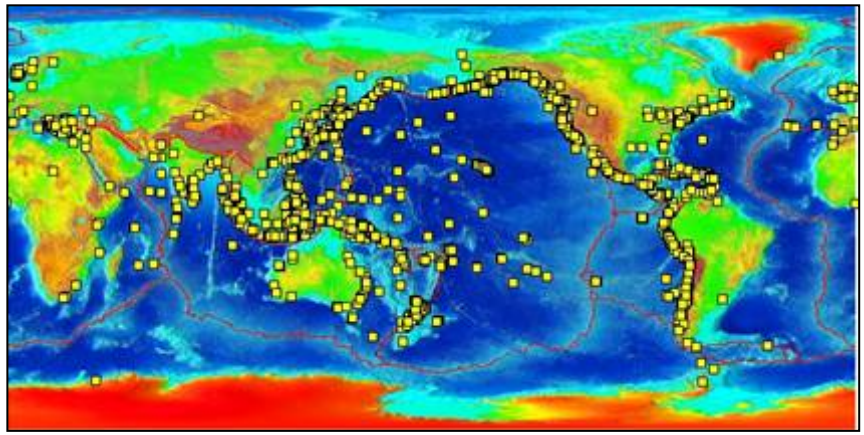


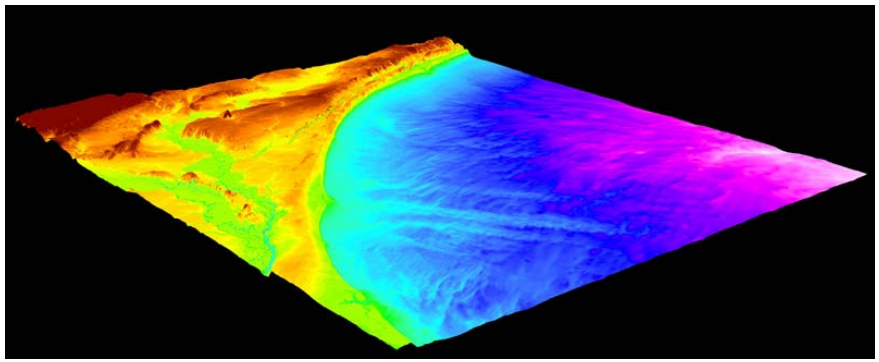
Events Generating Tsunamis



Tsunami Runup Locations

Current Tsunami Collaborations

- Visiting scientists projects include:
  - Socio-economic impact of tsunami
  - Regional past tsunami event catalogs
  - Tsunami event observational data and imagery
  - Technology exchange developing high-quality inundation maps



- Global Sea Level Observing System (GLOSS):
  - Integrate coastal water level event data with the historic tsunami event database
- Seismic observation networks share data for earthquake monitoring
- Hydrographic data exchange through the International Hydrographic Organization
  - Deep-ocean bathymetry and near-shore relief

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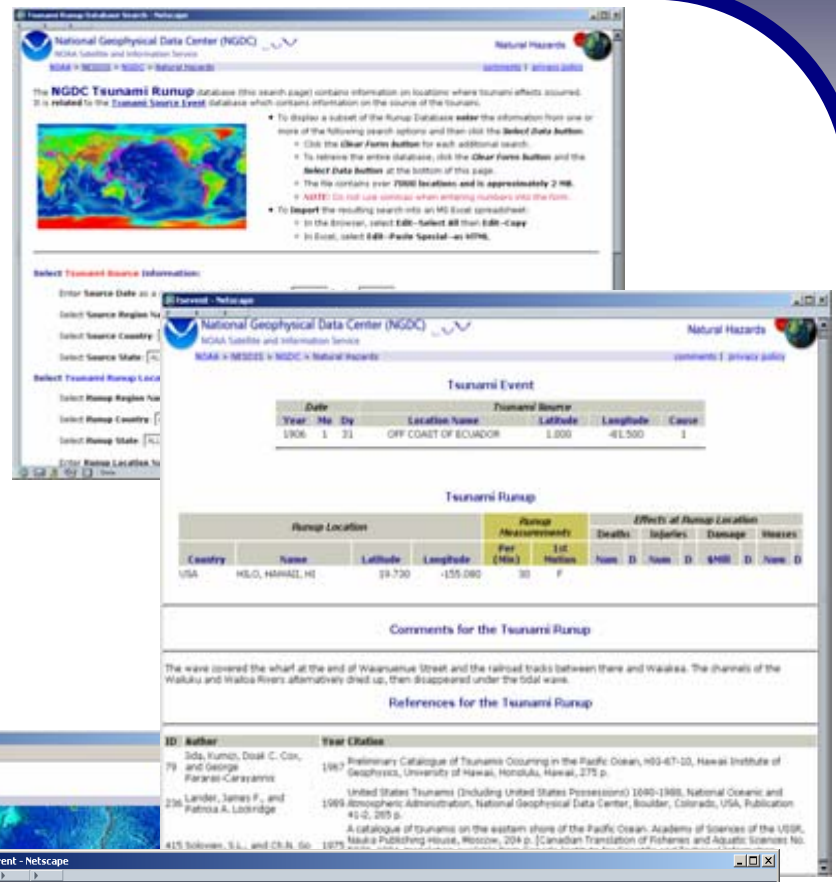
Lisa Taylor (Lisa.A.Taylor@noaa.gov) Bathymetry
Stuart Sipkin (Sipkin@usgs.gov) Seismology

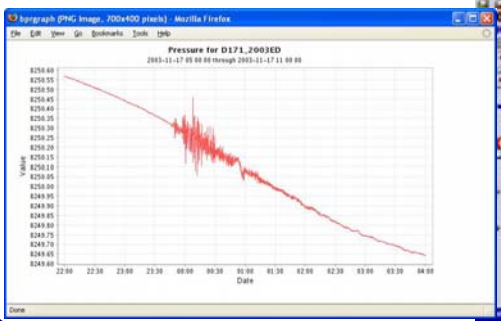
Benefits to Society

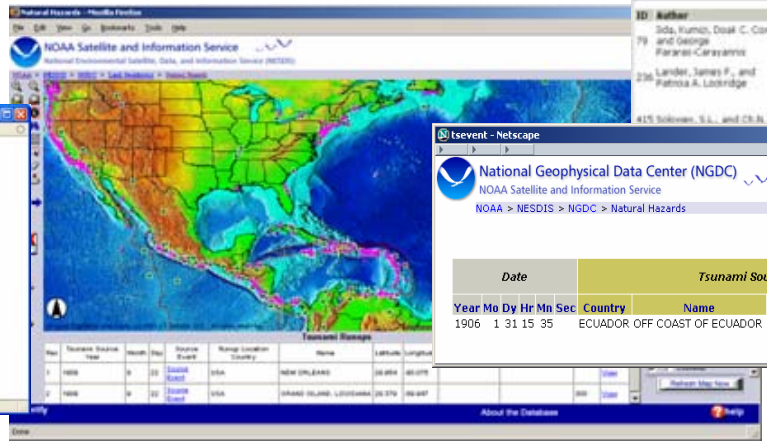
- Improved forecasts and warnings
  - Save lives
  - Minimize false evacuations
- Improved models help local communities design resiliency
  - Informed coastal zoning
  - Evacuation routes
- Resilient communities mean
  - less loss of life,
  - less long-term damage to infrastructure,
  - less economic impact

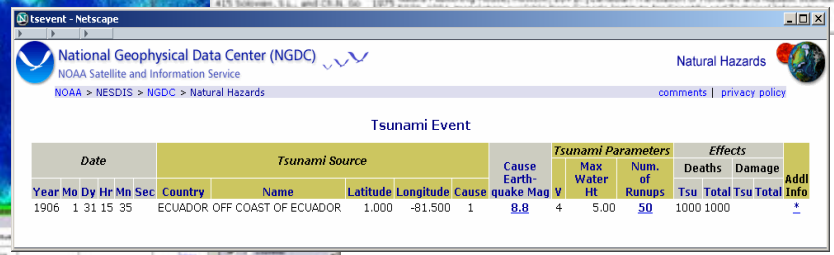
Changing Technology Improving Access

- Spatially-enabled Web databases
  - Integrate data from multiple sources
  - Spatial inquiries & WMS
  - Maps with multiple data layers
- XML/GML self-describing data formats
  - Standards improve exchange









Summary

- Geomagnetic data exchange through the WDC System
  - Functions extremely well for monthly and annual mean values
  - Still faces some challenges with digital 1-minute and hourly data
  - The community is working to improve exchange and to improve metadata
  - Has a long track-record of benefits to society, from navigation to space weather forecasts
- Tsunami data exchange through the WDC System
  - Is less mature than Geomagnetic exchange
  - Has well established and functioning exchanges of seismic data outside the WDC system
  - The community is working to improve exchange and develop standards for water level data
  - Faces challenges for some types of exchange
  - Has the potential to vastly improve forecast models and save lives

Conclusion

- The WDC System
  - Operates 52 Centers in 12 countries dedicated to ensuring long-term open access to data
  - Works with scientific community to develop standards and enable free flow of data
  - Welcomes visiting scientists
- Society benefits from exchange of data
  - Improved research, models, and forecasts save lives and minimize impacts
- Advances in web access to databases and GIS technologies
  - Enable powerful search and display options
  - Enable integration of data supporting GEOSS goals
- WDC Boulder, hosted by NOAA, strives to meet these needs
  - WDC for SEG Boulder responsibilities include Geomagnetism & Tsunami


Thank you!