Developments in COOPEUS EarthSccope/EPOS Data Management Systems for Fostering International Collaborations in the Geosciences

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Collaborations for Building Interoperable Data Systems for Geodesy and Beyond
COOPEUS is a program supported by the European Union in cooperation with the US National Science Foundation with the aim of connecting Research Infrastructures and strengthening the cooperation between the US and the EU in the field of environmental research infrastructures. Through COOPEUS, UNAVCO has received funding from the NSF (SAVI) and its EarthScope programs that has facilitated enhancements to GSAC and cooperative interactions with European RIs for GSAC installation. This avenue of communications has helped to ensure that U.S. and European eInfrastructure/cyberinfrastructure developments are aligned as much a possible.

http://www.coopeus-eu.org
WP5 – Goal: A number of European networks are providing data for ground-based GNSS meteorology under several projects including E-GVAP and EUPOS (~3,000 stations). EPOS will likely be working with these groups to bring data and products (tropospheric delay products) into EPOS and COOPEUS. Currently a small subset of data are openly available through EUREF at the Royal Observatory of Belgium. UNAVCO will work with EUREF to enable web services consistent with the GSAC package. UNAVCO will also further develop its GSAC package to be standalone for use by smaller local or regional operational data centers. We will also work with EPOS to assess the applicability for EPOS and COOPEUS. Openly shared in 2012 ~350 GNSS Stations. In 2015 with prototype EPOS GSAC openly shared another ~350 stations. Federated query capability under development.

http://www.coopeus-eu.org
UNAVCO’s participation with installing GSAC at EPOS institutions has taken place under the auspices of COOPEUS, with development and support from NSF and travel support from COOPEUS.


Instituto Nazionale di Geofisica e Vulcanologia (Italy) Archive Grottaminarda.
- Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS, Udine, Italy
- EUREF Permanent Network Central Bureau (Belgium)
- SEGAL, University of Beira Interior (Portugal)
- National Observatory of Athens (Greece),
- RENAG (Nice, France),
- VEDUR / FutureVolc (Meteorological Office), Iceland,
- Dionysos Satellite Observatory, Higher Geodesy Laboratory (DSO-HGL/NTUA), National Technical University of Athens, Greece
Europe has challenged ORFEUS to establish the European Integrated Data Archive (EIDA; http://www.orfeus-eu.org/eida), a distributed data centre system that provides transparent access to high quality seismological data from large, interconnected data archives in Europe (Fig. 1). EIDA, established in November 2013, currently comprises of 10 European data centers (nodes) and contains more than 300 Terabytes of data from about 5000 stations (seismic velocity sensors, accelerometers, infrasound). The success of ORFEUS EIDA is reflected by more than 4000 users collecting data from EIDA at a daily request average of 30 Gigabytes.

Fig. 1. European seismic stations available through EIDA nodes (currently 9, blue squares). Stations in green are in operation, stations in orange have stopped their operation.
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The goal of GeoWS is to bring standardized web service access to data held by the funded data centers. GeoWS will ease the tasks of 1) Data Discovery 2) Data Access and 3) Data Usability. The web services leverage interfaces to REST style services where all information and query parameters can be included in a URL.

GeoWS Web Services: http://workspace.earthcube.org/geows/geows-web
GeoWS services are soon to be available through the GEO GEOSS Portal

As part of a Group on Earth Observations (GEO) activity, the GEOSS Portal provides an entry point for discovery, access, contributions, information, and services for Earth Observation data from all over the world. The portal also links world-wide community of practice in nine Societal Benefit Areas.

UNAVCO’s new EarthCube GEOWS web services are connected to the GEOSS Portal via an Accessor component supported by GI-cat and implemented as part of the EarthCube BCube brokering system. Brokering systems and portals such as the GEOSS Portal and NASA GCMD provide greater visibility and broader access and discovery of UNAVCO data resources and facilitate integration across disciplinary boundaries.

EarthCube GeoWS Project: [http://workspace.earthcube.org/geows/](http://workspace.earthcube.org/geows/)
EarthCube BCube Project: [http://workspace.earthcube.org/bcube/](http://workspace.earthcube.org/bcube/)
Geodesy Seamless Archive Centers (GSAC) Web Services – A Software Package for Geoscience Data Centers

- Start with existing repository and metadata
- Small set of required metadata; any optional metadata
- Download Java code from Sourceforge project
- Simple installation and configuration

Upon installation and configuration GSAC provides:
- Web user interface
- Operating web services
- Documentation for users of web services API
- Ability to federate with other GSAC centers

The UNAVCO GSAC searches the UNAVCO archives only. UNAVCO hosts data from ~3,500 stations from many countries providing continuous data.

Implementations of GSAC in European Repositories

Iceland

EUREF

Iberia

Italy

Greece

France

http://www.epos-eu.org
Motivation:
In our work with EPOS partners, and through NSF projects COCONet and TLALOCNet, areas for capacity building were identified and targeted.

Dataworks provides subsystems as open source software modules that can be employed by regional GNSS managers for small networks (e.g. tens of stations). Subsystems and modules include:

- GNSS downloading from the receiver
- Subsequent data management
- Metadata management using a streamlined database
- Web services based API
- Data and metadata distribution
- Scripts for mirroring of data and metadata using GSAC
Caribbean GNSS

The Continuously Operating Caribbean GPS Observational Network (COCOConet) project was funded by the NSF with the aim of developing a large-scale geodetic and atmospheric infrastructure at 30 countries in the Caribbean that will form the backbone for a broad range of geoscience and atmospheric investigations. Geodetic data products are available from the UNAVCO public data archive and regional data partners in the Caribbean using UNAVCO’s Dataworks system. All of the participants in the project have committed to a free and open data policy. Capacity building in science and infrastructure is a critical aspect of the project. The photo shows Dataworks training session at UNAVCO with collaborators from Barbados, Colombia, Mexico (TLALOCNet) and Nicaragua (remotely) who host regional archives and mirror sites. UNAVCO and UCAR are also sponsoring six COCOConet Graduate Fellowship awards.

Daison Lowe and Wayne Depradine from the Caribbean Institute for Meteorology and Hydrology in Barbados participating in Dataworks training with Stuart Weir and Fran Boler at UNAVCO in December 2014. (Photo Beth Bartel)
Geodetic data products are available from the UNAVCO public data archive and also from a regional data partner in Mexico using UNAVCO’s Dataworks system. All of the participants in the project have committed to a free and open data policy. Capacity building in science and infrastructure is a critical aspect of the project.

GSAC Federated Query Prototype

Federated GSAC in Europe
- Prototype to test concept and work through technical details of a full multi-repository federated query capability

Prototype Federated GSAC. In order to test the Federated GSAC software system a prototype service was made that included the EPOS Greek Noanet. EPOS Italian FReDNet and the Mexican TLALOCNet GSACS.

It is the intent of UNAVCO and EPOS for EPOS to further develop and to host the Federated GSAC capability in 2015-2016. This will link the other GSACs in Europe into a single web interface for joint searches of their holdings.
GEO Geohazards Supersites and Natural Laboratories (GSNL) is an initiative of the geohazard scientific community. The GSNL initiative provides access to spaceborne and in-situ geophysical data of selected sites prone to earthquake, volcano or other hazards. The initiative began with the "Frascati declaration" at the conclusion of the 3rd International Geohazards workshop of GEO held in November 2007 in Frascati, Italy. The recommendation of the workshop was "to stimulate an international and intergovernmental effort to monitor and study selected reference sites by establishing open access to relevant datasets according to GEO principles to foster the collaboration between all various partners and end-users". This recommendation is formalized in the GEO Work Plan as Component 2 of the GEO task DI-01.

UNAVCO supports data access and collaboration for GSNL and participates in the governance. Efforts to modernize and integrate data access and discovery using web services are underway.

http://www.earthobservations.org/index.html
Conclusions from multiple international cross project collaborative efforts

Conclusions: Some best practices to help foster more effective international collaborations

- Collaborative activity has inherent and tangible mutual benefit
  - Shared GPS instrumentation, data, products, software tools like the Dataworks/GSAC for GPS, science goals, technology, and capacity building
- Develop goodwill and trust among partners and collaborators
- Develop effective communications with face-to-face interactions
  - Such as in person GSAC installs in Europe, field installations, workshops, and training
- Provide, and ideally co-develop, open source eInfrastructure tools that help remove barriers to access and discovery of data, products and modeling
  - e.g. Dataworks/GSAC, GPS processing for position time series and UCAR WAF weather models
- Actively engage in capacity building
  - e.g. Dataworks training class for COCONet and TLALOCNet; student fellowships; Pan American Advanced Studies Institutes (PASI); to help collaborators to use the data and contribute to science research and papers
- Host meetings and workshops to stimulate ongoing innovation, activity, and enthusiasm for the project and to engage other stakeholders such as policy makers, emergency managers, the professional surveying community, and other science domains
- Build upon a long history of productive PI engagements with foreign collaborators (e.g. building observation networks leads to recognition of importance of shared data systems
- Plan for and provide actual funding for project implementation, sustainable operations and maintenance, collaboration, and capacity building
- Encourage standardization of data formats, protocols, web services and acknowledgements such as DOIs
- Have a plan for community engagement and for measuring impacts
- Have an effective and inclusive management and governance structure
GeoWS Unidata/UNAVCO
Integrative Data Viewer
(IDV)
(integrated data access, visualization, exploration)
UNAVCO – GPS Vectors from EarthScope PBO and associated networks
IRIS – Mantle Tomography (VP) from USArray and Porritt et al. 2014
Caltech – Geodynamic Models –
Topography 50Mya and present
Caltech Geodynamics (Mantle temperature) and a little patch of Topo from IEDA web service
Example from Unidata’s new GeoWS data subsetting service. Shown is the total precipitable water vapor in mm.
IEDA – MGDS High resolution Topography and Bathymetry
IEDA – MGDS High resolution Topography and Bathymetry

Submarine landslides in the Santa Barbara Channel as potential tsunami sources

Natural Hazards and Earth System Science


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Abstract

Recent investigations using the Monterey Bay Aquarium Research Institute (MBARI) Remotely Operated Vehicles (ROVs) "Ventana" and "Turbo" and interpretation of MBARI's EM 300 30 kHz multibeam bathymetric data show that the northern flank of the Santa Barbara Basin has experienced massive slope failures. Of particular concern is the large (13 km²) Goleta landslide complex located off Point Mugu near the town of Goleta, that measures 14.6 km long extending from a depth of 90 m to nearly 374 m deep and is 10.5 km wide. We estimate that approximately 1.75 km³ has been displaced by this slide during the Holocene. This feature is a complex compound submarine landslide that contains both surficial slump blocks and mud flows in three distinct segments. Each segment is composed of a distinct head scarp, down-dropped head block and a slide debris lobe. The debris lobes exhibit hummocky topography in the central areas that appear to result from compaction during down-slope movement. The toes of the western and eastern lobes are well defined in the multibeam image, whereas the toe of the central lobe is less distinct. Continuous seismic reflection profiles show that many buried slide debris lobes exist and comparison of the deformed reflectors with GGP DSDP Site 149, Hole 893 suggest that at least 300,000 years of failure have occurred in the area (Fisher et al., 1995). Based on our interpretation of the multibeam bathymetry and seismic reflection profiles we modeled the potential tsunami that may have been produced from one of the three surficial lobes of the Goleta slide. This model shows that a 10 m high wave could have run ashore along the cliffs of the Goleta shoreline. Several other smaller (2 km² and 4 km²) slides are located

H. G. Crotone et al.: Potential tsunamiogenic landslides

Fig. 11. The Goleta slide complex: (a) slope shaded EM300 multibeam bathymetric image showing multiple lobes, failure masses, slump blocks, and scar of the Goleta slide; classification of Goleta slide is made using terminology of Vannes (1970), (b) sub-components of Goleta and other slides in the Santa Barbara Channel showing the many lobes, flows, and blocks that produce this complex compound mass movement feature.
Future Plans

- EPOS funded for 3 more years will kickoff next phase of project in October, 2015

- UNAVCO will finish testing a prototyping a federated query capability that can be the basis for EPOS data center.

- EPOS will host a second GSAC coordination workshop in early 2016. This workshop will be a forum for existing GSACs and opportunity to define goals for continued software developments to benefit EPOS.

- UNAVCO has some remaining COOPEUS funds to participate in GSAC coordination efforts. Other developments funded through projects like EarthCube.