GPS data exploration for seismologists and geodesists
(http://reason.scign.org)

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0. Abstract

Over the past decade, GPS and seismic networks spanning the western US plate boundaries have produced vast amounts of data that need to be made accessible to both the geodesy and seismology communities. Unlike seismic data, raw geodetic data requires significant processing before geophysical interpretations can be made. This requires the generation of data-products (time series, velocities and strain maps) and dissemination strategies to bridge these differences and assure efficient use of data across traditionally separate communities.

"GPS DATA PRODUCTS FOR SOLID EARTH SCIENCE" (GDPSES) is a multi-year NASA funded project, designed to produce and deliver high quality GPS time series, velocities, and strain fields, derived from multiple GPS networks along the western US plate boundary, and to make these products easily accessible to geophysicists. Our GPS product dissemination is through modern web-based IT methodology. Product browsing is facilitated through a web tool known as GPS Explorer and continuous streams of GPS time series are provided using web services to the seismic archive, where it can be accessed by seismologists using traditional seismic data viewing and manipulation tools. GPS-Explorer enables users to efficiently browse several layers of data products from raw data through time series, velocities and strain by providing the user with a web interface, which seamlessly interacts with a continuously updated database of these data products through the use of web-services. The current archive contains GDPSES data products beginning in 1995, and includes observations from GPS stations in EarthScope's Plate Boundary Observatory (PBO), as well as from real-time real-time CGPS stations. The generic, standards-based approach used in this project enables GDPSES to seamlessly expand indefinitely to include other space-time-dependent data products from additional GPS networks.

The prototype GPS-Explorer provides users with a personalized working environment in which the user may zoom in and access subsets of the data via web services. It provides users with a variety of interactive web tools interconnected in a portlet environment to explore and save datasets of interest to return to at a later date. At the same time the GPS time series are also made available through the seismic data archive, where the GPS networks are treated as regular seismic networks, whose data is made available in data formats used by seismic utilities such as SEED readers and SAC. A key challenge, stemming from the fundamental differences between seismic and geodetic time series, is the representation of reprocessed of GPS data in the seismic archive. As GPS processing algorithms evolve and their accuracy increases, a periodic complete recreation of the the GPS time series archive is necessary.

Tool development, implementation, and output functions are being extended.

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1. Users get logins to the portal where they can select, explore, and model the data products and save their results for future sessions.

2. Select Sites

Select Sites - click on a site to dynamically view its time series, coordinates, rinex files, etc. This also adds the site to your site group for use elsewhere in the portal. Sites may be selected by using a graphical bounding box on the map. Portlets such as the Overview Portlet may be minimized.

(side notes)
Combines Geospatial Data with Time Series

Inter-portlet communication used to pass information

Clicking on site in SOMI shows information and adds site to analysis group

Site Selection using bounding box, metadata criteria, etc.

Selected sites can be saved and passed on to other portlets for processing

Linked with Geophysical Modeling Applications Allowing Direct Interaction between Modeler & Data Provider via Modeling Portal

2a. Download Products

Coordinates

Coordinates - coordinates may be displayed for different sources, including PBO, for sites in user-defined groups. A URL is provided to allow downloading of the selected data to a file.

REASoN processes all sites in western North America, back to 1990 (~1000) and can layer with other time series, such as PBO, for comparison.

2b. View Timeseries

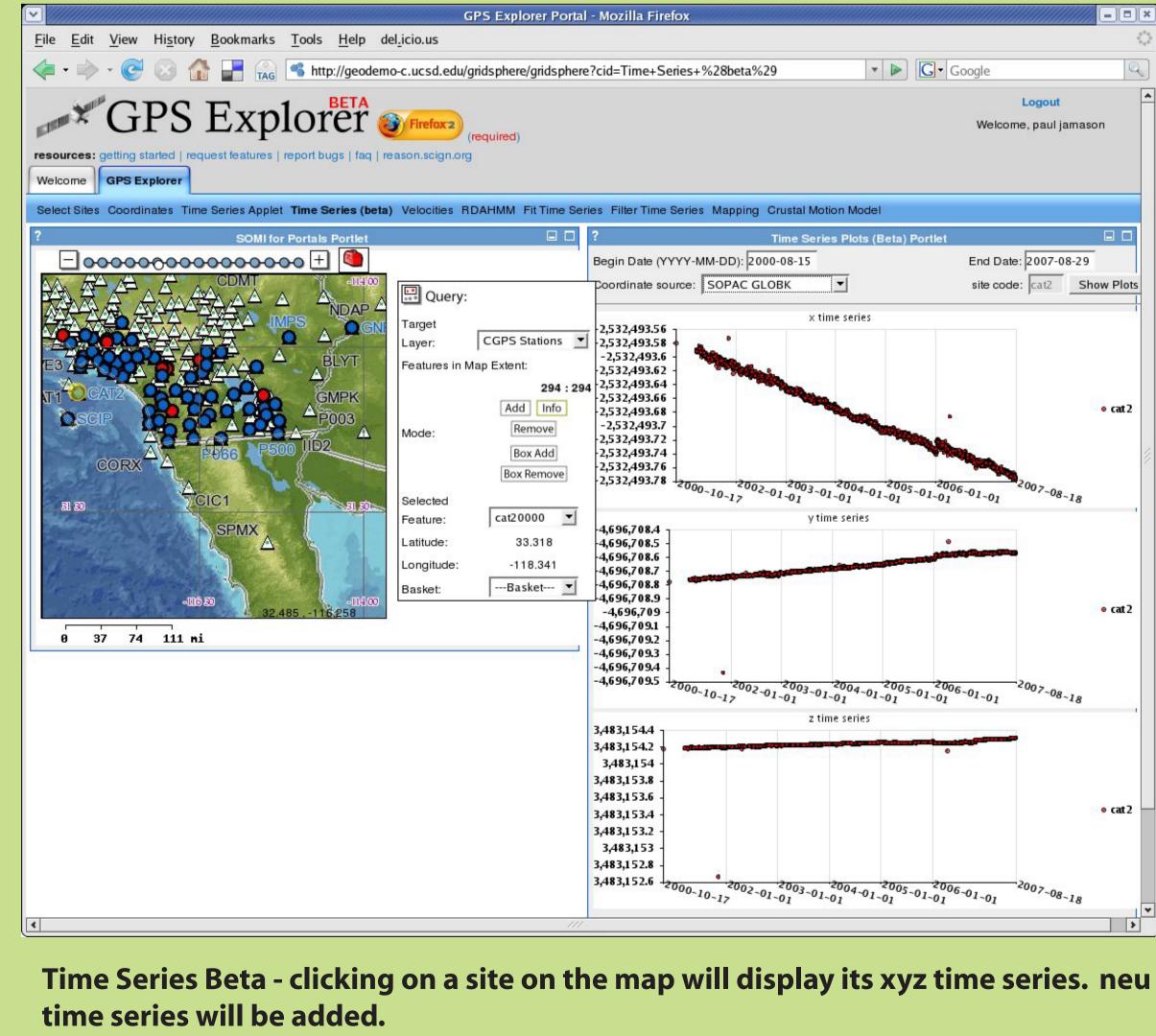Time Series Applet - north/east/up time series for various sources, including PBO may be displayed and layered for multiple sites.

Time Series Beta - clicking on a site on the map will display its xyz time series. neu time series will be added.

- Saved site groups are available throughout portal.
- User-customizable - can close portlets.
- Map position and displayed layers are retained throughout.

Velocities

Velocities - vector layers are available for the REASoN combination, SOPAC and PBO. Velocities for saved sites groups may be viewed/sent to url and are available for multiple sources.

Crustal Motion Model

Using the crustal motion model developed at SOPAC, users can obtain coordinates for any location in Southern California at any date, given an input location/date. Earthquake offsets and their post-seismic decay will be added to the model shortly.

cmm: coming soon - Inclusion of earthquake events

Strain

HORIZONTAL STRAIN 2006.7712

Dilatation

Shear

Submit your data: REASoN uses xml standards for data exchange via web services. You can submit and display your data by contacting us.

3. Filter and Model Timeseries

3a. Within GPS Explorer

st_filter: coming soon - Ability to allow offset input and removal from time series for improved modeling

Filter Time Series - regionally filter time series data for your site group by applying a principal component analysis. Various terms identified by the analysis may be removed in the residual data. Launch and monitor jobs, then view the resulting residual time series and first principal component maps.

RDAHMM - this time series modeling tool identified distinct periods in time series data. Time series are segmented into discrete modes according to the properties of the data. These modes are described by the statistics of the observations

3b. On your own platform

Rotation rate for NASA REASON data set (cGPS)

NASA REASON data set (cGPS)

Examples courtesy of Carl Tape, Caltech

GPS Explorer BETA *(required)*
Welcome, paul jamason
resources: getting started | request features | report bugs | faq | reason.scign.org
Welcome | GPS Explorer
Select Sites | Coordinates | Time Series Applet | Time Series (beta) | Velocities | RDAHMM | Fit Time Series | Filter Time Series | Mapping | Crustal Motion Model