An Online GPS time series analysis provider at GEODAC (www.geodac.net)

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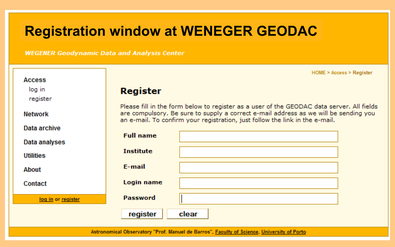
Introduction

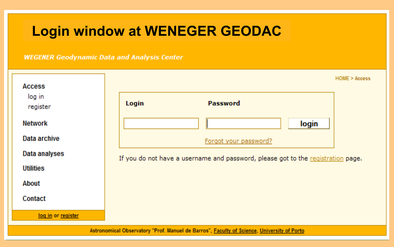
The analysis of time-series of GPS positions for plate tectonic research is an essential step to determine the observed velocities of the GPS stations. It has become common practice to include the temporal correlations of the noise inside these time-series to estimate not only a correct value of the velocity, but also to estimate a correct value of the uncertainty associated with this velocity. Nowadays, the Maximum Likelihood Estimation (MLE) method is the most commonly used method by researchers. Here we present a web service that provides all users an easy access to the application of this type of method to their own GPS solutions. We encourage the users to send us feedback of their experiences using this service.

Access to service

At the WEGENER GEOdynamic Data and Analysis Center (GEODAC), which can be accessed at www.geodac.net, we have implemented an automatic time-series analysis provider that can process GPS time-series in the GIPSY/Oasis format which is simply a plain ASCII file with on each row the date, year-fraction, X, Y and Z coordinates in metres. For example:

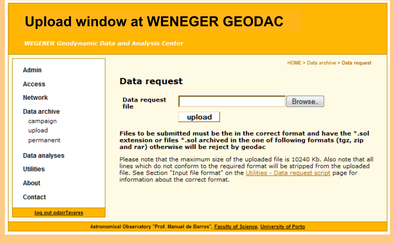
1997-03-25 1997.227397 4917536.2476 -815726.2473 3965857.3950
1997-03-26 1997.230137 4917536.2349 -815726.2525 3965857.3879





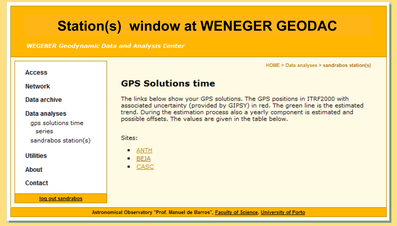
The user can, after free registration, login and upload his or her GPS solutions unto the website.

The file to be uploaded must be a single ASCII file in the GIPSY/Oasis format or a set of files archived in rar, zip or tgz in the same format.

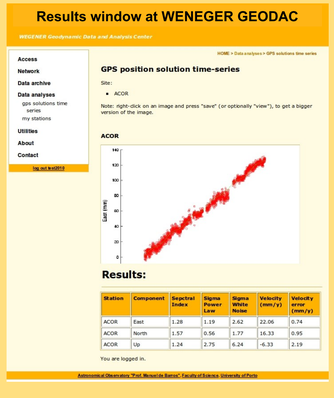


Data Analyses

After uploading his/her GPS solutions files into the website, the web service will automatically analyse them in a few hours. Our own time-series analysis software (Bos et al., 2008) will estimate the velocities of the North, East and Up component and the associated errors under the assumption that the noise is well described by a white plus power-law noise model.



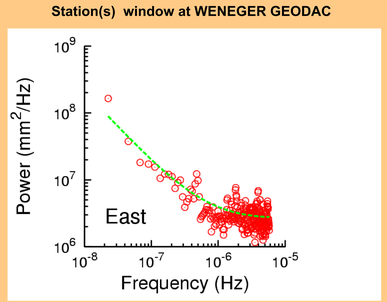
It must be noted that the data will be pre-processed to eliminate outliers by deleting all data points that fall outside the 3 times the interquartile range (Nikolaidis, 2002). During this estimation we include a seasonal cycle if the data-span is longer than 1000 days. After the computation has finished, plots of the data with the estimated trend and a table with the estimated velocities and uncertainties will be available on the GEODAC website. Gaps in the data will be interpolated. Offsets however, need to be removed before it can be accepted by our web service.

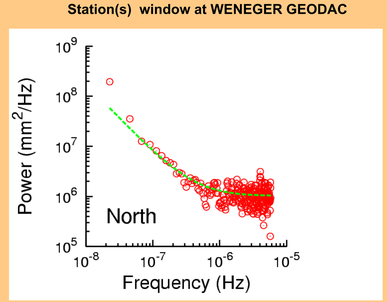


Since not all users may want their results to be available to the public, we have organized the GEODAC website into 3 access levels. Data from level-3 sites can be accessed by any (anonymous) user; data from level-2 sites can be accessed only by registered users. Data from level-1 sites is only visible to registered users and can only be accessed upon request by these users.

Power Spectra

The red circles in the following figures show for the CASC station the power spectra of the GPS residuals, that is the signal after subtracting a linear trend and a seasonal, for the East and North component. The green line is the fitted power-law plus white noise model which adequately describes the observed spectrum.





Future of this service

The GEODAC web service provides the geodetic community with an easy method for estimating the station velocity with a realistic error bar. Although free software exists to perform this task (such as CATS, from Williams, 2008), it is our belief that many users will find this service helpful due to its friendly use because it avoids the installation of additional software.
In the future we intend to extend our services to also provide non-tidal loading maps. The deformation due to the weight of the ocean tides is already on a routine basis included in the GPS analysis. The deformation due to atmospheric pressure can also be corrected for using the Atmospheric pressure loading service of Leonid Petrov or the Special Bureau for Loading. For non-tidal loading however, no such service yet exists.

References

Bos, M.S, Fernandes, R.M.S, Williams, S.D.P and Bastos, L., "Fast error analysis of continuous GPS observations", Journal of Geodesy, Vol. 82(3), 157–166, 2008.

Nikolaidis R (2002) Observation of Geodetic and Seismic Deformation with the Global Positioning System. University of California San Diego, 249

Williams, S.D.P. (2008): "CATS : GPS coordinate time series analysis software", GPS Solutions, Vol. 12(2), 147-153.

Acknowledgement

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