

# Calibration and Comparison of GPS Processing Algorithms for Detecting Vertical Deformations

<b>Degree:</b>	MSc (by research)
<b>Keywords:</b>	geodesy, GPS, deformation monitoring, data processing algorithms, reliability, calibration and validation
<b>Entry:</b>	Bachelors, preferably 1st class Honours, Postgraduate Diploma or Masters degree in geoscience, physics, mathematics, or any related discipline
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<b>Project Funding:</b>	Western Australian Centre for Geodesy
<b>Student Funding:</b>	The student will receive some assistance with the costs of thesis production and photocopying
<b>Resources:</b>	Many GPS processing packages, International GPS Service data, Australian regional GPS network data, synthetic GPS data, equipment to simulate vertical deformation
<b>Collaboration:</b>	International Association of Geodesy, International GPS Service, Geoscience Australia
<b>Starting Date:</b>	Unrestricted

## Project Description:

Many investigators rely on contemporary or *in situ* constraints on deformation using the Global Positioning System (GPS), where repeat and discrete measurements are used to determine the magnitude and velocity of the deformation. However, GPS-derived estimates of deformations are subject to the validity and applicability of the processing algorithms used. Moreover, *a priori* information on the expected deformation may influence the processing algorithms used, thus biasing the results and hence the conclusions. Accordingly, there is a need to calibrate the various deformation monitoring algorithms utilised so as to ensure that the correct inferences are made from GPS data.

The proposed project will involve research into the following:

- A comparison among research-based and commercial GPS processing packages for the detection of deformations on continental scales. These tests will use observed GPS data from a variety of sources, such as the Australian Regional GPS Network (ARGN) and the International GPS Service (IGS), as well as synthesised GPS data. Observed GPS data will be used over tectonically active areas to estimate the amount of deformation detectable with each package. Ultimately, these studies will ascertain the limitations and functionality of each package for deformation monitoring.

- The use of carefully controlled tests, where GPS data are collected on a device designed and constructed at Curtin University that can be moved by exactly known amounts. GPS data collected on this device will be post-processed using reference station GPS data, both close to the device and at continental scales from the IGS and ARGN. Comparison of the GPS-measured deformation with the actual deformation of the device will ascertain the amount of motion detectable by GPS at various spatial scales. This aspect of the project can use both commercial and research-based GPS processing software, as outlined in the above item.
- GPS-derived position solutions are dependent on the processing algorithms and models used. For instance, simply by changing the tropospheric model parameters can cause positions to change quite significantly. As such, changes in position may be incorrectly interpreted as deformation. Indeed, it is plausible that subjectivity can affect the GPS data processing, where the processing parameters are adjusted to deliver a solution that is compatible with *a priori* expectations of the deformation. A sensitivity analysis will be used to determine the magnitude of the effects of changing the GPS processing parameters. Both observed and synthesised GPS data, on local and continental scales, will be used in commercial and research-based GPS processing packages.

#### **Further Reading:**

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Coleman, R. and Lambeck, K. (1983) Crustal motion in south eastern Australia: is there evidence for it?

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