

# **DYNAMIC GEODETIC DATUMS; A CASE STUDY IN PAPUA NEW GUINEA**

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National geodetic datums that span tectonic plate boundaries and deforming zones are subject to distortion which increases in magnitude with time. Rigid plates and zones of plastic deformation deform linearly with time in an inertial reference system, however distortion near plate margins and zones of elastic deformation is often non-linear as a result of co-seismic and post-seismic displacement. Few countries in tectonically complex areas have implemented geodetic datums which include dynamic elements to allow for the temporal displacement of the datum realisation and spatial infrastructure resulting from tectonic deformation. Many online GPS processing services now provide users with centimetre accurate point positioning capability. Tectonic motion of the monuments that realise the datum with respect to an international terrestrial reference frame can be as much as 1 metre every decade with localised deformation exceeding 10 ppm per year. Such motions exceed many cadastral and engineering tolerances.

We have developed a strategy whereby national geodetic datums and survey networks in tectonically active regions can include a geodetic velocity field, strain dislocation models and other non-secular offset data in order to maintain the integrity of the datum. The goal is to develop a platform independent and user-friendly least-squares adjustment program which includes these dynamic elements, to enable geodetic surveyors to reduce geodetic measurements made in dynamic local networks to a reference epoch. The program will also have applications for the monitoring of geophysical hazards and localised crustal deformation.

We apply our program to the geodetic datum of Papua New Guinea, one of the world's most tectonically complex countries, located between the Australian and Pacific Plates, and including several smaller microplates, as an ideal case study to demonstrate the application of the program and the significant improvements in datum integrity as that can result.

1. G05, or G01
2. Geodynamics, or Positioning
3. Control Surveys, Inter-plate Crustal Motion, Techniques
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5. E
6. PC, OH

- 7. YES
- 8. NO
- 9. NONE