PNG2020 a new semi-kinematic geodetic datum for Papua New Guinea

Richard Stanaway (Papua New Guinea), Edwin Nidkombu and Lui Gawi

Key words: GNSS/GPS; Positioning; Reference frames

SUMMARY

A new geodetic datum for Papua New Guinea, PNG2020 was approved and funded for development by the PNG Government in May 2024. The need to modernise the geodetic datum has been motivated by the very significant and complex tectonic setting of PNG. This complexity has been exemplified by very rapid microplate rotations, plate boundary strain accumulation, large earthquakes and volcanism. PNG arguably has the most complex and rapid tectonic regime globally. All of these tectonic effects have significantly distorted the current datum PNG94 cumulatively since its realisation in 1996. □□Use of modern positioning systems such as precise GNSS operate in global geodetic reference frames such as the current ITRF2020. A feature of these global frames is that coordinates of ground-fixed locations continuously change with stable tectonic plate rotation and episodic seismic displacement. The kinematic nature of these global frames precludes their effective use for cadastral mapping, engineering, geological and mining surveys. A high precision velocity model is required to transform ITRF2020 (or similar) coordinates to a fixed epoch used for user applications in deforming zones such as PNG. Updating the reference epoch of the PNG geodetic datum from 1st January 1994 (PNG94) to the 1st January 2020 (PNG2020) will isolate all modelled and un-modelled tectonic effects resulting in distortion of the datum over that period. Furthermore, the newer epoch will mean that GNSS precise positioning will be closer to the national datum.□□This paper will present the progress on development of the new datum to date. Static GNSS observations are currently being undertaken by the geodetic section of the Office of the Surveyor General (OSG) in collaboration with PNGUoT and the private sector. The observations are on a widespread network of geodetic stations and permanent survey marks (PSM) around PNG and the entire archive of static GNSS observations from 1992 to the present day will be re-analysed in order to estimate a new velocity field for PNG. The model will form part of a deformation model which includes displacements from known seismic events and will be published using the recently released geodetic grid exchange format (GGXF) developed by OGC. The

velocity model will be used to transform ITRF2020 positions to PNG2020 with high precision. A similar static displacement grid will be developed for transformations between PNG94, AGD66 and PNG2020. These transformation models will greatly assist the GIS community is aligning spatial data referenced in the different datums. □