Assessing the Impact of Not Using a Deformation Model

Nic Donnelly (New Zealand), Chris Rizos, Craig Roberts (Australia) and Chris Crook (New Zealand)

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SUMMARY

The ready access to accurate positioning in terms of global coordinate systems means that crustal movement through plate tectonics and earthquakes now impacts on the use of coordinates to identify and locate physical features. Within global reference frames the coordinates of apparently fixed features are continuously changing. To provide consistent coordinates for fixed features measured at different times, national geodetic datums increasingly include gridded time dependent transformation functions, deformation models, that relate the national datum to global reference frames. However, such deformation models are typically not implemented in the surveying and GIS software used by most spatial professionals, such as surveyors. While software and tools to use the deformation model may be provided by the national geodetic agency, these introduce additional steps into a processing workflow and may require time-consuming reformatting of data. In many cases, spatial professionals are working on projects over relatively small areas, connecting to local passive control marks. The relative deformation is assumed to be negligible and the deformation model is not used. But this assumption of negligible deformation is not always valid. Clearly the definition of a “small area” and “local control” in this context depends on the rate of deformation across the area of interest. The accuracy specifications for the project must also be considered. This paper outlines how spatial professionals can make an informed decision about whether they need to apply the deformation model, by comparing relative deformation rates published by the national geodetic agency with the maximum uncertainties permitted for their application. While the extents of the project are usually fixed, it is often possible to include additional local control to reduce the impact of relative deformation if this is found to be significant. An example from the city of Wellington, New Zealand is used to demonstrate the process. In this area, failure to apply the deformation model could introduce a discrepancy of approximately 10cm in coordinates over the 20km between one side of the city and the other. By considering the impact of deformation, surveyors and other spatial professionals are able to assure themselves that they are not inadvertently introducing deformation-related biases into their coordinates. Alternatively, where deformation is a significant issue for the project, they can be assured that additional work to use the deformation model is justified.