Non-Linear Crustal Deformation Modeling for Dynamic Reference Frame: A Case Study in Peninsular Malaysia

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SUMMARY

Series of major to great earthquakes struck the Sundaland platelet since December 2004 due to convergence between Indian and Australian plates along its western and southern boundaries. Since then the plate has been undergoing significant co-seismic and post-seismic afterslip deformation that is continuously distorting geocentric reference frame within affected countries such as Malaysia. The deformation produced coordinate shift in geodetic network thus, causing errors in Global Positioning System (GPS) / Global Navigation Satellite System (GNSS) satellite measurements which limits its accuracy for high precision positioning applications. In addition, the afterslip deformation exhibits on-going non-linear motion that needs to be modelled for maintaining accuracy of the geocentric reference frame in Peninsular Malaysia. This paper reports the work of crustal deformation modeling the spatio-temporal crustal deformation due to Mw >7.9 earthquakes that is affecting geocentric reference frame and geospatial accuracy in Peninsular Malaysia. The fundamental works involved determination of co-seismic and post-seismic deformation to account for the non-linear effect of the crustal deformation. The study has found that afterslip deformation model enabled to minimize the effect of non-linear motion on geodetic network less than 2cm of accuracy. The work is crucial in order to improve the stability of reference frame due to great earthquakes especially in Peninsular Malaysia.