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## Taiwan Semi-kinematic Reference Frame Based on Surface Deformation Model Derived from GNSS Data, 2003 to 2019

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Taiwan's current horizontal coordinate system, TWD97[2010], is a static geodetic datum located at the boundary between Eurasian and Philippine Sea plates. Due to the relative motions between different plates, the accuracy of TWD97[2010] has been constantly decreasing. To maintain the internal accuracy of a national coordinate system at a high level, establishing a semi-kinematic reference frame is a practical solution. The semi-kinematic reference frame includes a static datum and a surface deformation model that is composed of velocity grid models and displacement grid models. In this study, observations of 437 continuous GNSS stations from January 2003 to December 2019 were adopted to estimate the horizontal velocity fields in Taiwan. We also integrated twelve horizontal velocity fields between 2003 and 2018 from 785 campaign-mode GNSS sites surveyed by the Central Geological Survey to derive the horizontal grid velocity models using the Kriging spatial interpolation method. Six coseismic displacement grid models from 2010 to 2018 were constructed using the dislocation model based on published coseismic source models. Independent GNSS observations of 1400 stations collected by the National Land Surveying and Mapping Center (NLSC) between 2013 and 2018 were also used for exterior checking on the accuracy of the surface deformation model. In addition, the network-based RTK system in Taiwan established by NLSC, named e-GNSS, is proposed to be used for assessing the accuracy of the velocity model and for the decision on the timing of velocity model renewal.