

Vertical annual cyclic movement model of Mainland China and its analysis based on GPS observations

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The annual cyclic deformation of Earth's surface can be obtained indirectly using existing models. However, the reliability in local areas is affected by numerous uncertain factors such as indirect observation, inversion algorithms, and complex earth media. In this study, the vertical annual cyclic movement model of Mainland China is built based on the direct observation of deformation by 234 continuous Global Positioning System (GPS) stations and unified data processing using the multisurface function method (referred to as the GPS model). The GPS model shows that the weighted root mean square (WRMS) is reduced for 97% GPS stations after applying the model correction. The average, maximum, and minimum reductions in the WRMS are 11.6%, 37.2%, and -3.6%, respectively. Compared with the global Gravity Recovery and Climate Experiment model and surface loading models, the GPS model is closer to the actual change due to direct and actual deformation observations. Additionally, the GPS model can accurately reflect the detailed motion characteristics of Mainland China, particularly in the neighbouring regions with severe environmental quality changes. The GPS model is extremely important for practical applications and geoscience research, such as the elimination of the nonstructural annual cyclic motion in vertical crustal deformation monitoring, the detection of the annual cyclic changes in glacial ablation, river water levels, and vegetation growth, and the investigation of the relationship between the vertical annual cyclic deformation and microseismic activity.

Keywords: Annual Cyclic Movement, Amplitude, Phase, Global Positioning System, Mainland China