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SGD21-P01 Room:Convention Hall Time:May 27 18:15-19:30

Gravity variations and vertical displacements over the Japanese islands

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We are going to analyze satellite gravity data for the Japanese islands and discuss the characteristics of gravity variations in each region. To corroborate our results of gravity analysis, we shall show the comparison results with vertical crustal deformation from GNSS observation.

Keywords: time-variable gravity, vertical displacement, GRACE, GNSS, cryology, hydology

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Verification of the separation precision between tropospheric and coordinate parameters in kinematic PPP analysis

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Recently, kinematic GNSS analysis is generally used for crustal deformation phenomena within the day such as postseismic deformation after the large earthquake. The kinematic GNSS analysis, however, have a fundamental problem for the separation precision between unknown parameters such as the coordinate and tropospheric parameters, because of the both parameters have strong correlation between each others. In this study, we focused on the improvement of the separation precision between coordinate time series of kinematic GNSS and wet zenith tropospheric delay (WZTD).

We used GIPSY-OASIS II Ver. 6.3 software for the processing of whole sites of the GEONET in 10th March 2011. We applied the kinematic PPP strategy for the coordinate estimation. In the processing, we applied the every 6 hours nominal WZTD value as a priori information based on the ECMWF global numerical climate model. We also processed the data without a priori information for the comparison. In the processing, we assumed the white noise and random walk stochastic process for the coordinate time series and tropospheric parameters, respectively. These unknown parameters are very sensitive to assumed process noise parameters for each stochastic process. Thus, we also evaluated the effect of process noise value for WZTD parameter. We changed the value for the WZTD as (1) 1×10^{-8}, (2) 1×10^{-7} and (3) 1×10^{-6} (unit: km/sqrt(sec)).We named the model applied a priori information of WZTD as "A" , and named the A1, A2, and A3 model for the each different process noise parameter result. In the same way, we named the result without a priori value as "N" and named N1, N2, and N3 model represented the each process noise result.

Based on these results, we found that clear offset in estimated WZTD value appeared between result with or without a priori information. It suggests that the a priori information of WZTD may give the impact to the accuracy of the vertical coordinate time series. Furthermore, the standard deviations of estimated coordinate time series did not depend on the with/without a priori value of the WZTD. It strongly depends on the assumed process noise of the WZTD. For example, the standard deviations of UD component at 0430 (Imabari) site in each model of A1, A2, A3, N1, N2, N3 are 20.9, 26.0, 44.2, 20.8, 26.0, 44.2 (unit: mm), respectively. This results suggest that the assumption of optimal process noise may be important for the precision. In the presentation, we will propose the optimal value of process noise in order to obtain time series of kinematic GNSS analysis with high accuracy and precision from more data sets.

Keywords: GPS, kinematic PPP analysis, tropospheric delay

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The formation of equatorial flattening of the Earth

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The supercontinent Pangea is formed 330 Ma ago and followed with a sequence of breakup after 100 My. During the supercontinent Pangea occuured, the mantle convection of very long-wavelengths at spherical harmonic degree-1.After the African continent is formed a degree-2 structure,the Africa and Pacific superplumes show major upwellings(Zhong et.al.,2007;Zhang et al.,2010).The degree-2 structure for the present-day mantle with the Africa and Pacific superplumes is shown as the equatorial flattening of the present Earth. The evolution from the degree -1 to the degree-2 is due to change of the convective flows from a downwelling to a upwelling under the Pangea supercoontinent.Here we attempt to explain the formation of the equatorial flatterning by considering that chemical diffusion of a light element FeO compared with Fe into the OC(outer core) from the IC(inner core) through the ICB(inner core -outer core boundary)and from the mantle through the CMB(core-mantle boundary) respectively in the eastern hemisphere (40 deg.E-180 deg.E).Mass loss of the degree-1 in the mantle and the IC causes anisotropic mass distributions relative to the center of the Earth's gravity. The center of gravity of the mantle and the IC shift towards the western hemisphere(180 deg.W-40 deg.E).These shifts induce additional modes of Y221 to the Earth's geopotential. The fluid OC keeps an axially symmetric form. The Earth has an equatorial flattening form for a long time.The rotational speed of the mantle will be increase,but the rotational speed of the IC and OC will be decrease because of the radius of the IC increases and mass inflow from the mantle repectively.The thermal stable stratification near the CMB and the ICB increases thermal transport to the mantle.

Keywords: Pangea supercontinent, Africa continent, FeO diffusion, Earth's equatorial flattening, rotational speed, thermal transport