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Precise Orbit Determination of Low Earth Orbiters Based on Helmert Transformation

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A method based on Helmert transformation is presented in reduced-dynamic Precise Orbit Determination (POD). Unlike the traditional dynamic POD approach, which uses code and phase observations directly, the model takes kinematic orbits as pseudo-measurement and sets up the Helmert transformation between kinematic and dynamic-integrated orbits. One advantage of this approach is the reduction of parameters. A set of programs was developed. Based on the programs, kinematic and reduced-dynamic POD were performed for the CHAMP and GRACE satellite over a period of 2 weeks. Intermediate results show that reduced-dynamic orbits of CHAMP have a 3D RMS of 25cm comparing with PSO orbits of GFZ, and 3D RMS has the same magnitude for the reduced-dynamic orbits of GRACE comparing with GNV1B orbits of JPL. However, these results are severely impacted by the kinematic trajectories. Another factor can be improved in our model is the calibration of bias and scales parameter. With these improvements, best performance of the model may be expected.