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Mitigation of ionospheric effects on Swarm GPS observations and kinematic orbits

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The Swarm mission launched on November 22, 2013 consists of three identical satellites in near-polar orbits, Swarm A and C flying almost side-by-side at an initial altitude of 460 km, Swarm B flying in a higher orbit of about 530 km. Each satellite is equipped with a high precision 8-channels dual-frequency GPS receiver for precise orbit determination. This also offers excellent opportunities to study the ionosphere and to provide temporal gravity field information derived from the kinematic orbits of the satellites for the gap between the Gravity Recovery and Climate Experiment (GRACE) and its follow-on mission (GRACE-FO).

However, observations from on-board GPS receiver are strongly disturbed by ionospheric scintillations, which degrades the kinematic orbits at the geomagnetic equator and at polar areas and thus the gravity field. Due to the different property of ionospheric scintillations, the GPS carrier phase observations suffer also from different types of disturbances.

In this contribution, in order to improve the quality of the kinematic orbits, we propose a new method to filter the high-frequency noise and repair the systematic errors in the phase observations, instead of eliminating or down-weighting the disturbed observations. The kinematic orbits and derived gravity field can be significantly improved. The systematic errors along the geomagnetic equator bands in the gravity field are also successfully eliminated.