Earth rotation parameters from GPS-only, GLONASS-only, Galileo-only, and the combined GPS+GLONASS+Galileo solutions

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The European GNSS –Galileo can be considered as fully serviceable with 24 active satellites in space since late 2018. Galileo satellites have a different revolution period than that of GPS and GLONASS, and moreover, two additional Galileo satellites are orbiting in an eccentric orbit which helps to decorrelate some global geodetic parameters.

This contribution shows results from Galileo-only, GPS-only, GLONASS-only, and the combined multi-GNSS solutions with a focus on Earth rotation parameters based on the 2-year dataset. Earth rotation parameters are analyzed in both daily and sub-daily time resolution. We discuss the system-specific issues in individual GNSS-derived series and resonances between satellite revolution periods and Earth rotation.

We found that the Galileo-based and GLONASS-based parameters are inherently influenced by the spurious signals at the frequencies which arise from the combination of the satellite revolution period and the Earth rotation. For the Earth rotation parameters, which are estimated with a resolution of 24h, the largest spurious signals are visible at 3.4 days for Galileo and 3.9 days for GLONASS. In the sub-daily domain of polar motion, the spurious signals dominate at 34 hours for Galileo and 21 hours for GLONASS.

On the other hand, we observe a systematic drift of GPS-based UT1-UTC values with a magnitude of 8.1 ms/year which is due to the revolution period of the GPS satellites that is equal to half of the sidereal day and causes a deep 2:1 resonance. For Galileo, the UT1-UTC drift is sixteen times smaller than that of GPS and equals just to 0.5 ms/year. GLONASS-derived pole coordinates show large spurious offsets with respect to GPS and Galileo solutions, as well as with respect to the IERS-C04-14 series. The best results of Earth rotation parameters can be obtained from the combined GPS+Galileo+GLONASS solutions, however, some system-specific issues still remain in the combination.

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