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Precise satellite orbit determination for GPS radio occultation in near-real time (NRT)

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One of the CHAMP and GRACE mission objectives is to perform GPS radio occultation (RO) measurements to derive vertical profiles of the atmospheric parameters on global scale which are of use in numerical weather prediction and climate change related studies. To fulfil this mission objective, precise orbits and clock offsets for both, the GPS satellites involved and the Low Earth Orbiters (LEOs) are required, which are prerequisite for the derivation of the profiles. Effective application of the occultation profiles in weather forecast requires a delay between measurements and data availability of maximum 3 hours. To meet this time constraint, GFZ Potsdam has recently developed three independent near-real time (NRT) orbit processing systems for CHAMP and GRACE delivering NRT orbits of different precision and latency. The first processing system is based exclusively on Ultra Rapid (IGU) predicted GPS 15-minute orbits and clocks of the International GNSS Service (IGS) for subsequent in house generation of the LEO orbits. This system generates orbits with 3D position accuracies of 20-30 cm (˜0.3 mm/s for velocity) and a mean latency below 15 minutes. The second system is based on in house GPS NRT 5-minute orbits and clocks generated from 15-minute ground data files and produces more precise LEO orbits but with higher latency. The resulting 3D accuracy of the LEO orbits is in this case 10-15 cm (˜0.15 mm/s for velocity), the latency is below 35 minutes. The third system is based on IGU predicted orbits but 30-second clocks estimated using 15-minute ground data files. This system generates LEO orbits with a 3D accuracy of 5-10 cm (below 0.1 mm/s for velocity) and a latency of approximately 30 minutes. The systems can be easily extended for more LEOs delivering NRT data. Details of the processing systems as well as example occultation profiles based on the GPS and LEO NRT orbits will be presented.