



Multi-GNSS real-time precise orbit/clock/UPD products and precise positioning service at GFZ

Xingxing Li, Maorong Ge, Yang Liu, Mathias Fritsche, Jens Wickert, and Harald Schuh

German Research Centre for Geosciences, GFZ, Geodesy and remote sensing, Potsdam, Germany (lixin@gfz-potsdam.de)

The rapid development of multi-constellation GNSSs (Global Navigation Satellite Systems, e.g., BeiDou, Galileo, GLONASS, GPS) and the IGS (International GNSS Service) Multi-GNSS Experiment (MGEX) bring great opportunities and challenges for real-time precise positioning service. In this contribution, we present a GPS+GLONASS+BeiDou+Galileo four-system model to fully exploit the observations of all these four navigation satellite systems for real-time precise orbit determination, clock estimation and positioning. A rigorous multi-GNSS analysis is performed to achieve the best possible consistency by processing the observations from different GNSS together in one common parameter estimation procedure. Meanwhile, an efficient multi-GNSS real-time precise positioning service system is designed and demonstrated by using the Multi-GNSS Experiment (MGEX) and International GNSS Service (IGS) data streams including stations all over the world. The addition of the BeiDou, Galileo and GLONASS systems to the standard GPS-only processing, reduces the convergence time almost by 70%, while the positioning accuracy is improved by about 25%. Some outliers in the GPS-only solutions vanish when multi-GNSS observations are processed simultaneously. The availability and reliability of GPS precise positioning decrease dramatically as the elevation cutoff increases. However, the accuracy of multi-GNSS precise point positioning (PPP) is hardly decreased and few centimeters are still achievable in the horizontal components even with 40° elevation cutoff.