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Precise point positioning for deformation monitoring using post-mission and real-time precise orbit and clock products

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To dates thousands of permanent GPS receiver stations have been deployed worldwide for various purposes. Such stations have been used to form network of different scales to support the monitoring of crustal deformations. The processing of continuous data available from a network with a large number of GPS stations however poses a significant challenge to practical implementation. The conventional approach has been based on differential baseline processing techniques but the computational time increases in proportion to the cubic of the number of GPS stations included in the network [Zumberge et al., 1997]. An approach known as Precise Point Positioning (PPP) has become an efficient alternative which is capable of significantly reducing the computational time. First proposed by Zumberge et al. (1997), PPP has since then found wide applications from positioning, time transfer to atmosphere research.

This paper focuses on the discussion of two aspects for the application of PPP technology to deformation monitoring applications. The first aspect deals with the modeling of observations with a focus on the mitigation of different error sources and the modeling of parameters to be estimated along with coordinate parameters. It is expected the discussion would help develop improved data processing strategies for the purpose of crustal deformation monitoring. The second aspect investigates the obtainable positioning accuracy using PPP. This refers to the accuracy with dual-frequency GPS observations from a single GPS receiver and position determination using both post-mission and real-time precise orbit and clock products. For the latter case, the position determination can be conducted on-site which has the potential to facilitate real-time or near real-time detection of crustal deformation due to for instance earthquakes.

This provides significant time-saving compared to the differential approach and current PPP data processing strategy with post-mission precise orbit and clock products. Data from GPS stations in the IGS networks and a real-time local station will be used to facilitate the numerical analysis presented in this paper.