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The impact of different alignment strategies on the kinematic characterization of a regional GNSS network

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GNSS permanent stations are a fundamental tool for geodynamic analysis due to their capability to produce consistent time series of coordinates with a precision of a few millimetres. The coordinates can be estimated basing on GNSS data with two different approaches: differential and point positioning. The baselines between the sites belonging the network are estimate with a differencing approach. In order to compute the coordinates of the stations is also necessary to know the reference coordinates of a subset of sites to be used to perform the alignment to a well-defined reference system, typically ITRF. Reference coordinates are available through a SINEX file which contain triplet of coordinates together with triplet of linear velocities for each site. Due to this fact, the kinematic behaviour of the reference sites used to align the network can introduce signals in the time series of other sites and therefor influences in some way the kinematic of the whole network.
Differently, when the GNSS processing is performed through a Precise Point Positioning (PPP) approach, each site of the network is processed independently. All the coordinates are then directly expressed in the global reference system on which the ephemerids are aligned to.
The two processing approach nowadays lead to comparable precisions, at least while considering daily observations. Moreover the PPP is probably going to become the new standard due to the advantages in terms of flexibility and calculation time. Six years (2007-2012) of daily data from 13 EPN (European Permanent Network) stations located around Italian peninsula were processed both through the differencing and the PPP approaches. The baselines calculation was performed using the GAMIT software and the solutions were aligned to IGb08 through the EPN_A_IGb08.SNX.Z reference coordinates. The PPP processing was done through the GIPSY-OASIS II software package and the solutions were aligned to IGb08 applying the global transformation parameters provided by JPL.
All the time series were analysed using both Lomb-Scargle periodogram and the PCA (Principal Component Analysis). The linear velocities and the non-linear periodical signals were estimated. A common signal within all the PPP time series has been found. Having removed such signal the kinematic behaviour of all the stations became close to what we found for the time series calculated using the differencing approach.
Another set of PPP solutions aligned to the IGb08 were produced by applying ad hoc regional transformation parameters that were estimated basing on the same SINEX file previously used to align the baseline network. In such way the PPP time series shown signal contents much closer to ones obtained through the differencing approach.
The results are presented and discussed through PCA approach and are focusing on the impact that different methods for the alignment of the solution have onto the kinematic characterization of the time series.