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# An investigation on GPS based local ties and eccentricity vector estimation

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The estimation of accurate eccentricity vectors between space geodetic instruments is

a varied holistic process that involves several different consequential steps. In order to obtain accurate estimates, each step of the estimation process has to be carefully considered and consistently handled. Therefore, local tie approaches, processing methods, proper geometrical modelings and accurate alignments are all fundamental, complex and connected parts of the process. Each part can be differently addressed and the different possibilities must be evaluated.

Ties validation is assessed through the evaluation of the discrepancies between the local tie results and the solutions derived by the involved space geodetic techniques (e.g.: Ray and Altamimi, 2004; Kruegel and Angermann, 2005). At the moment, scientific papers dealing with ties computations have focused their attention only on particular aspects of the process, not considering and treating all steps simultaneously, completely and consistently.

A partial view might prevent from obtaining striking agreements between tie's results and space geodetic solutions. A comprehensive work on local ties must simultaneously take into account main biases and systematic effects that influence the performances of the relevant geodetic instruments.

Nevertheless, a deep investigation of each single step is compulsory. In particular, a proper ITRF alignment of the eccentricity vector estimated using terrestrial observations is critical. As far as it is concerned, a GPS based local tie could overcome this issue, being the estimated eccentricity matter-of-fact framed into ITRF.

Furthermore, GPS based local ties would be much easier to perform and could therefore efficiently contribute to work out the problem of eccentricity estimation worldwide. We here investigate the possibility of estimating eccentricities between GPS and VLBI co-located instruments using only GPS rapid static observations. Estimations are obtained using the modified module GPS-CLEMeNT, developed for treating GPS solutions; in this case the network GPS solution has been performed through Bernese 5.0 software. The GPS derived eccentricity is compared with the terrestrial derived value whose estimation has been obtained using CLEMeNT software.

We outline the advantages originating from such a GPS based approach for local tie measurement and from a rigorous treatment of observations, where constraints and conditions related to the geometrical modeling characterize the computation process. We discuss the results and identify the shortcomings and advantages of the GPS based approach. We also compare two different GPS derived eccentricities, obtained alternatively using absolute and relative GPS antenna patterns.