



European sessions and datum definitions

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Abstract

The European geodetic VLBI network (also designated as the EUROPE network) has been operating in an area of geophysical interesting regions since 1990. The network configuration started with a core of six radio telescopes observing on a regular basis, with an average of six sessions per year. Today a number of fourteen radio telescopes almost regularly participates to the European sessions. In this work we have processed all European sessions since 1990 till the end of 2010. The adjustments have been performed under same conditions but with different datum definitions.

Statistical analysis of estimated parameters has been performed to evaluate if datum choice can influence the estimate goodness of parameters of interest.

Introduction of the problem and processing specifications

A common issue in all positioning problems, regardless of application or accuracy, is that of reference frame definition, also known as datum definition. This fundamental step establishes the coordinate system that reported positions will refer to, and is satisfied by specifying the key parameters of translation, rotation and scale. This paper has investigated some issues surrounding datum definition as applied to regional-area, like the European one, VLBI-based measurement networks [3].

All European VLBI sessions since 1990 till the end of 2010 have been processed two times with VieVS Software [2] using same default conditions but with two different datum definitions (that we call datum1 and datum2). In the single session adjustment, coordinates for all stations were estimated. On station coordinates present in the VTRF2008 catalogue the condition NNT (no-net-translation) and NNR (no-net-rotation) w.r.t. their a priori values was applied. What changed in datum definition was:

Datum1: all the 5 EOP parameters (x-pole, y-pole, dUT1, dX, dY) were estimated

Datum2: only 3 EOP parameters were estimated (nutation (dX, dY) was fixed).

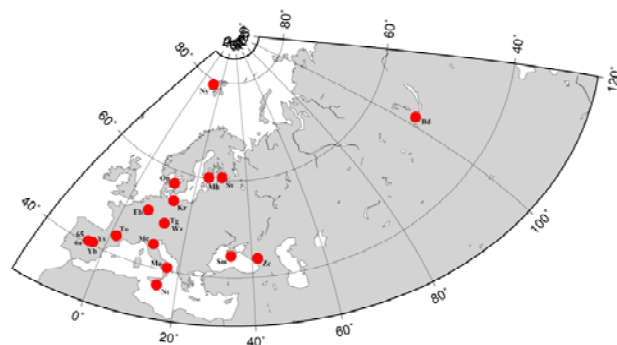


Fig. 1: Map of European VLBI stations: almost all stations are quite homogeneously distributed, big holes are present respect to Badary in particular but also Ny Alesund looks to be quite far away from the whole set of stations.

Quality of the whole set of coordinate estimates and investigation on possible differences due to datum definitions

For each European experiment and each station, the maximum eigenvalue magnitude (from now on, named maximum eigenvalue) has been calculated after extraction of the variance-covariances matrix (3x3) of each point coordinates. As can be seen from figure 2, the distribution of these maxima is almost the same for datum1 and datum2. The 87th experiment (08JAN21XA) has an anomalous behaviour for Noto, Metsahovi and in particular for Crimea, which could require a deeper investigation of the processing, correlation or observation performed for such stations. The whole set of data has a very good performance and deviations due to the different datum choice are negligible.

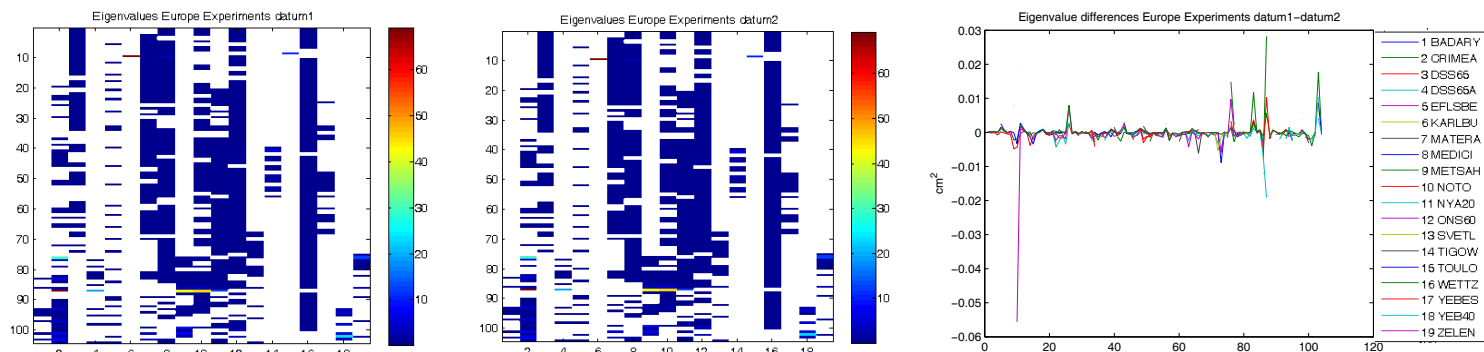


Fig. 2: Graphical representation of calculated maximum eigenvalue for each station (x-axis) and each experiment (y-axis) using datum1 and datum2. The last figure on the right represents eigenvalue differences between datum1 and datum2, along the x-axis there is number of experiment in this case.

Conclusions and further developments: In this work we have investigated on a method that can be useful to check the quality of a big amount of data at a glance. The method looks to be useful also for checking of possible disagreements in station coordinate estimations due to different datum choices. Further processing would be useful to check also the quality of other parameters usually estimated together with station coordinates to evaluate if possible differences can influence more these other parameters than the coordinates. It would be worthwhile to make same comparisons using also other datum choices.

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