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Time series of permanent GPS stations in Central Europe

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The definition and maintenance of a geodetic reference system by modern techniques requires systematic temporal changes of the position of the defining stations to be taken into account. Most of these drifts are accommodated by present day plate tectonics. If the lithospheric plate to which a given station belongs were perfectly rigid, then a simple plate model based upon rigid rotations about Eulerian poles would suffice to predict the horizontal coordinates of each station at any epoch, once the coordinates of that station are known at a reference epoch. In Europe, there are stations well located inside old, stable areas which may be considered rigid, but other stations are at or near continental margins undergoing active deformation, or are within a relatively recent portion of a tectonic unit subject to intraplate stress or volcanism. Velocities of stations in the most recent ITRF solutions do, in fact, exhibit departures from the NUVEL1A NNR plate model in Europe and elsewhere, but the reasons for these discrepancies are not always well understood. For example, if a particular station of the network exhibits a velocity anomaly relative to a reference velocity model, then it is of interest to understand the reasons for the anomaly, and its spatial extent, that is if it is local to that station, or if nearby stations are also affected, and with which tapering as a function of distance. As part of the research activities in support of the CEI/CERGOP and EUREF, the time series of coordinates of European Permanent Network (EPN) stations in the Alpine – Mediterranean – Dinarides region are examined both in the time and space domains, and hypotheses are formulated on the reasons of systematic departures from linearity. The time domain analysis consists in the construction of the Power Spectral Density and autocorrelation function of the time series of each coordinate for each station, the assessment of the type(s) of noise and periodicities, and an estimate of the uncertainty in the velocity. The space domain approach consists in

cross correlating time series of stations and investigating the cross correlation function as a function of the space separation between pairs of stations. The combined analysis in the space and time domains of the time series provides a description of small but non negligible changes of coordinates the permanent stations which should be taken into account if the realization of the reference system is to be as accurate as the coordinates of the defining stations.