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Geodetic monitoring of intra-plate velocities

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Still ongoing tectonic processes over the Eastern Alps lead to the extrusion of parts of the Eastern Alps towards the Pannonian basin and the Carpathians. The project ALPAACT (seismological and geodetic monitoring project of ALpine-PAnnonian ACtive Tectonics) investigates intra plate movements in the Austrian region. As part of the studies coordinate time series have been obtained for all 23 sites of a permanent GNSS network covering the area of interest. This presentation analyses possible error sources and artefacts that affect the quality of the time series.

The local GNSS network is located in the eastern part of Austria, between the Bohemian Massif in the North and the Styrian basin in the South and spreads out over the most active zones of the area. Geologists expect movements in the range of <1mm/year with exceptions up to 1.5mm/year.

The processed times series span the period from 2007 till end of 2010 with the exception of 2009. Daily coordinate solutions are calculated by means of the Bernese Software. All daily solutions are stacked to form the coordinate time series and finally station velocities have been derived. The data series are tied over the whole processing period to the global reference frame ITRF2000. To obtain a motion field with respect to the Eurasian plate the mean Eurasian rotational velocity has been subtracted from the ITRF velocities.

Significant discontinuities in the time series, especially in the height component, are mainly caused by equipment changes at the observation sites and data gaps. For this reason our investigations are restricted to the plane coordinates. Furthermore one site suffers from poor satellite geometry which maps into a remarkable degradation in the coordinate accuracy. A further inconsistency of the processing is introduced at GPS week 1400 when IGS started to align the orbit product to ITRF2005 instead of ITRF2000. The project aims at sub-mm/year accuracy of the obtained geodetic horizontal velocity information to constrain given tectonic models. Taking into account the marginal length of the GNSS time series this goal is hard to achieve, even in case of careful investigation and mitigation of systematic error sources which stem predominately from reference frame distortions.