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Dense GPS derived deformation and rotation of intraplate blocks in Central Europe - comparison to seismicity and volcanism

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Intraplate deformation is often small but can nowdays be resolved from high precision GNSS velocity fields derived from decade-long time series and high precision network or point wise solutions if uncertainties are smaller than ~0.2 mm/a.

If local effects are discarded, dense velocity fields may resolve regional patterns of intraplate deformation and motion, which are related to the bending of lithospheric plates, to mantle upwelling, the diffuse or zoned deformation along structural weaknesses or faults, and the rotation of rigid blocks within a plate.

We derive for the first time, dense high precision network solutions at 323 GNSS stations in Germany and adjacent areas and resolve regions experiencing uplift with velocities of up to ~2 mm/a, rotational relative motions with angular velocities of ~0.7±0.3 mas/a, and horizontal shear along an extended, NS trending zone with strain rates in the range of 10-8 1/a.

We integrate European dense velocity solutions into our dataset to discuss the geodynamic context to European microplate motions, the Alpine collision, the structure of the European mantle, Quaternary volcanism and historical seismicity.

Unexpectedly, the zones of high horizontal strain rates only partly correlate to seismicity. Such a non-correlation between ongoing horizontal strain and seismicity has been recognized before. We discuss possible reasons for the absence of intraplate seismicity in regions experiencing recent strain, including the stress shadow effects if the strain buildup is reducing shear stresses from plate tectonics. The combination of GNSS derived dense velocity fields with time dependent seismicity models may change our current understanding of intraplate seismicity and impact the assessment of intraplate seismic hazard in future.