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Development of the EUREF Velocity Model - Status and Roadmap for Future Work

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Interplate and intraplate deformations are present all over Europe. They can be subdivided by their spatial or temporal nature as well as their magnitude. For example, different, partly overlapping processes are related to several geodynamic zones such as plate boundaries, micro-plates, volcanoes, (formerly) glaciated areas, hydrological basins etc. On the other side, there are long-term processes such as the Fennoscandian post-glacial rebound, episodic events such as earthquakes and many temporarily intermediate deformations from e.g. volcanic swelling or anthropogenic influences due to oil or gas extraction or CO_2 sequestration. The corresponding deformations of different scales are measured as three-dimensional crustal velocities by Global Navigation Satellite System (GNSS) reference stations with meanwhile sufficient detail and accuracy.

The IAG Reference Frame Sub-Commission for Europe (EUREF) working group on "Deformation models" aims at obtaining velocity models for Europe and adjacent areas and significantly improving the prediction of the time evolution of coordinates, thus overcoming the limitations in the use of the European Terrestrial Reference System 1989 (ETRS89). A general understanding of the physics behind such a velocity field is also a major goal. In particular, the working group will model and correct for interplate and intraplate deformations, while using the reference frame, and thus extend the useful lifetime of a realisation of the ETRS89. Hence, the purpose of this working group are twofold; first, pure scientific interests in improved knowledge of the surface deformations of Eurasia and adjacent areas, and second, providing a valuable tool in the management and use of the national realisations of the ETRS89. The work will strongly benefit from sophisticated infrastructures such as the European Plate Observing System (EPOS).

Key information for improved knowledge of crustal deformations is observed motions at stations. This includes station velocities, and possible station position shifts for the case of episodic events, where the European Permanent Network (EPN) is considered as the core infrastructure. However, a denser network of GNSS stations than EPN will be needed to sample the crustal deformations sufficiently well. The availability of velocity solutions including additional stations compared to the EPN stations provided by other initiatives and projects is therefore of high interest for this initiative. The key input for the working group is the EPN densification where the dense national permanent GNSS networks are integrated with the EPN on the weekly SINEX level.

There are three major activities for the development of this solution:

1. An evaluation of station velocities,
2. Development of a crustal deformation model for Europe, and
3. Consideration of such a deformation model in maintenance and use of national realisations of ETRS89.

The presentation will give an overview of the current status in the evaluation of station velocities based on initiatives and projects in the last two decades as well as an outlook to future work including details to the model development.