

Monitoring and Modelling of On-going Deformation of the WECEP area, the MOMODE Project

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In March 2007 an outline proposal for the project MOMODE (Monitoring and Modelling of On-going Deformation in Central Europe) had been submitted to ESF for funding in the framework of the EUROCORES programme TOPO-EUROPE. This project, which unfortunately was rejected by ESF for non-transparent reasons, was considered as a geodetic-geophysical contribution to the TOPO-WECEP (Western and Central European Platform) initiative. The general objective of the proposed Collaborative Research Project MOMODE is monitoring and modelling the recent and on-going evolution of the Earth's topography in the natural laboratory of the WECEP region. Three principal aims have been identified in the outline proposal:

1. Combination of data sets from different countries and institutions to develop unified maps of recent crustal motion at local and regional scales,
2. Consistently linking different geodetic observation methods such as GNSS (Global Navigation Satellite Systems), geodetic levelling, absolute gravity and PS-InSAR (Persistent Scatterer SAR Interferometry),
3. Integration of the kinematic observations with data from the World Stress Map project by means of a 4D numerical model to quantitatively assess the geodynamic processes controlling Earth's crustal deformation.

The regional focus of the MOMODE project is fixed to the Alpine foreland between the Alps/Jura and the North Sea and from the Massif Central to the Bohemian Massif. For this region the inherent advantages of various geodetic observation methods should be assessed, aiming at a consistent combination and a rigorous geodetic deformation analysis on a sound statistical background:

- **GNSS.** Various GNSS networks have been established in the WECEP area, such as EUREF/EPN (Europe) and national permanent networks. This data spans periods of few years up to a decade and should be re-evaluated according to homogeneous evaluation procedures, producing horizontal and vertical motion components and deformation parameters at large-to-local scales with unprecedented accuracy and homogeneity.
- **Levelling.** Repeated precise levelling campaigns have been carried out since ~80 years in various European countries. With the support of the ordnance surveys in different countries MOMODE should provide a unique opportunity to jointly analyse trans-national levelling networks to derive consistent vertical displacement rates with sub-millimetre accuracy.
- **Gravity.** Repeated absolute gravity measurements should be performed on a network of eight sites, consisting of already existing and about four new sites. All sites should be collocated with GNSS stations to derive information about mass transfer and deep processes in the Earth.
- **PS-InSAR.** PS-InSAR is a novel method to gain information about deformations with increased spatial density and sub-millimetre accuracy. First results and experiences obtained in a few local areas should be extended to larger regions where displacement rates from precise levellings and GNSS are available.

The derived consistent displacement rates serve as independent constraints for a 4D numerical model. Aim of this modelling is (1) to integrate the kinematic data with the information on the contemporary stress field from the World Stress Map project and (2) to quantify the geodynamic processes controlling the deformation and stress field pattern. So far, on a European scale, only coarse 2.5D finite element (FE) models with lateral resolution of ~100 km exist. Based on new detailed data an improved generation of numerical models has been envisaged accounting for the 3D structural and rheological complexities with spatial resolution of <5 km.

An international team of research groups was prepared to act as partners within the Collaborative Research Project, comprising the following institutions:

- ETH Zürich/Swisstopo, Switzerland
- EOST Strasbourg, France
- Delft University of Technology, The Netherlands
- Czech Academy of Sciences, Prague, Czech Republic
- Wrocław University, Poland

Since the application was rejected by ESF, other possibilities for funding have been and will be considered. At present an application to DFG is reviewed aiming at the collection and evaluation of existing repeated levelling data in the trinational area of the Upper Rhine Graben and the surrounding region (see the planned structure of the levelling network in Fig. 1). Other ideas and initiatives for funding partial aspects of the MOMODE project are welcome.

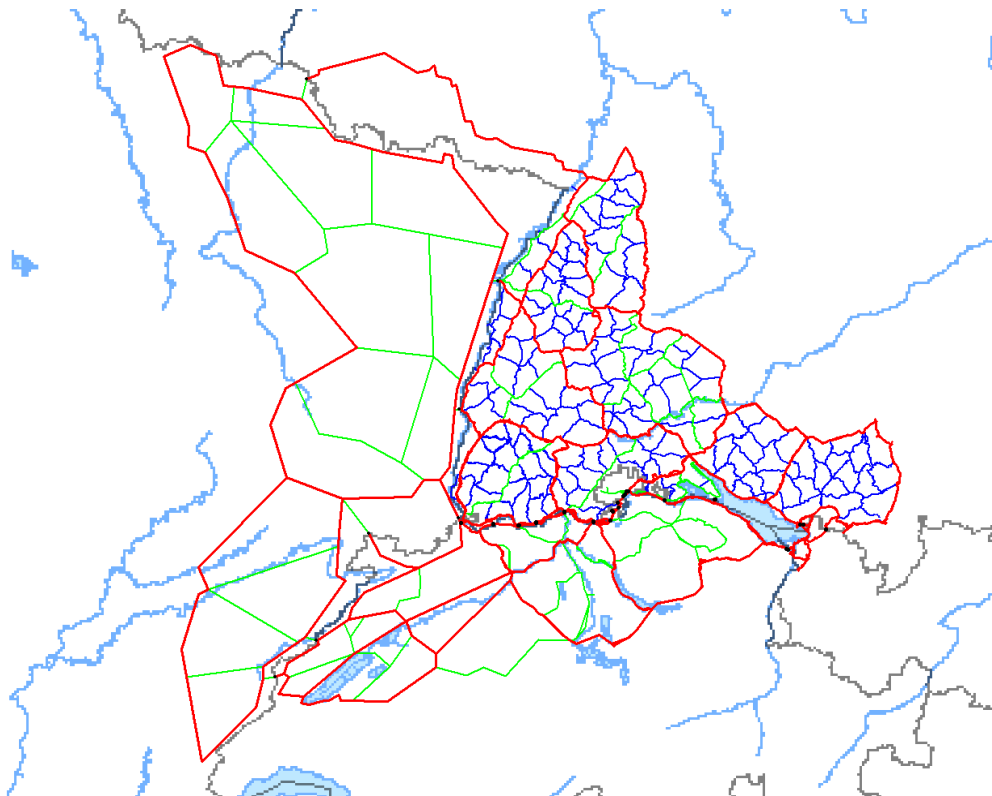


Fig. 1: Line map of the projected tri-national levelling network