Assembling geophysical datasets from Austria

Arneitz P., Gerner A., Meurers B., Bokelmann G.

Department of Meteorology and Geophysics (IMGW), University of Vienna

patrick.arneitz@univie.ac.at, andreas.gerner@univie.ac.at, bruno.meures@univie.ac.at, goetz.bokelmann@univie.ac.at

Abstract

The role of geophysics becomes more important in public life due to economical and scientific reasons, as well as in connection with natural hazards. In Austria a variety of geophysical disciplines are applied by different companies (e.g. OMV, RAG) and by public institutions (e.g. GBA, ZAMG). For the interpretation of results in each discipline additional information from other branches is crucial.

First steps have been taken to collect available results of geophysical surveys in Austria. A presentation of gravimetric, magnetic, tomographic and seismic hazard data among others is intended to compare them on a qualitative basis. This can serve as a basis for judging needs for further campaigns and comparison with geological data.

Current collection

The current collection includes:
- earthquake catalogs, instrument parameters (IRIS), seismic hazard maps
- velocity models (vp, vs) and Moho depths in the region of the Eastern Alps
- geological units and faults extracted from digital maps (GBA) or online resources
- potential field data (magnetics, gravimetry)
- horizontal and vertical movements (IRTF2008), stress maps (GFZ)
- topography data: SRTM3, GTOPO30 (USGS), GEBCO

Below some selected datasets are shown and described. They underline the importance of interdisciplinary considerations and are meant to encourage discussion.

Figures

Fig. 1: Peak ground acceleration with a 10 % chance of exceedance in 50 years, corresponding to a return period of 475 years (Giardini et al., 1999). Earthquake locations (circles) were taken from the ZAMG catalog.

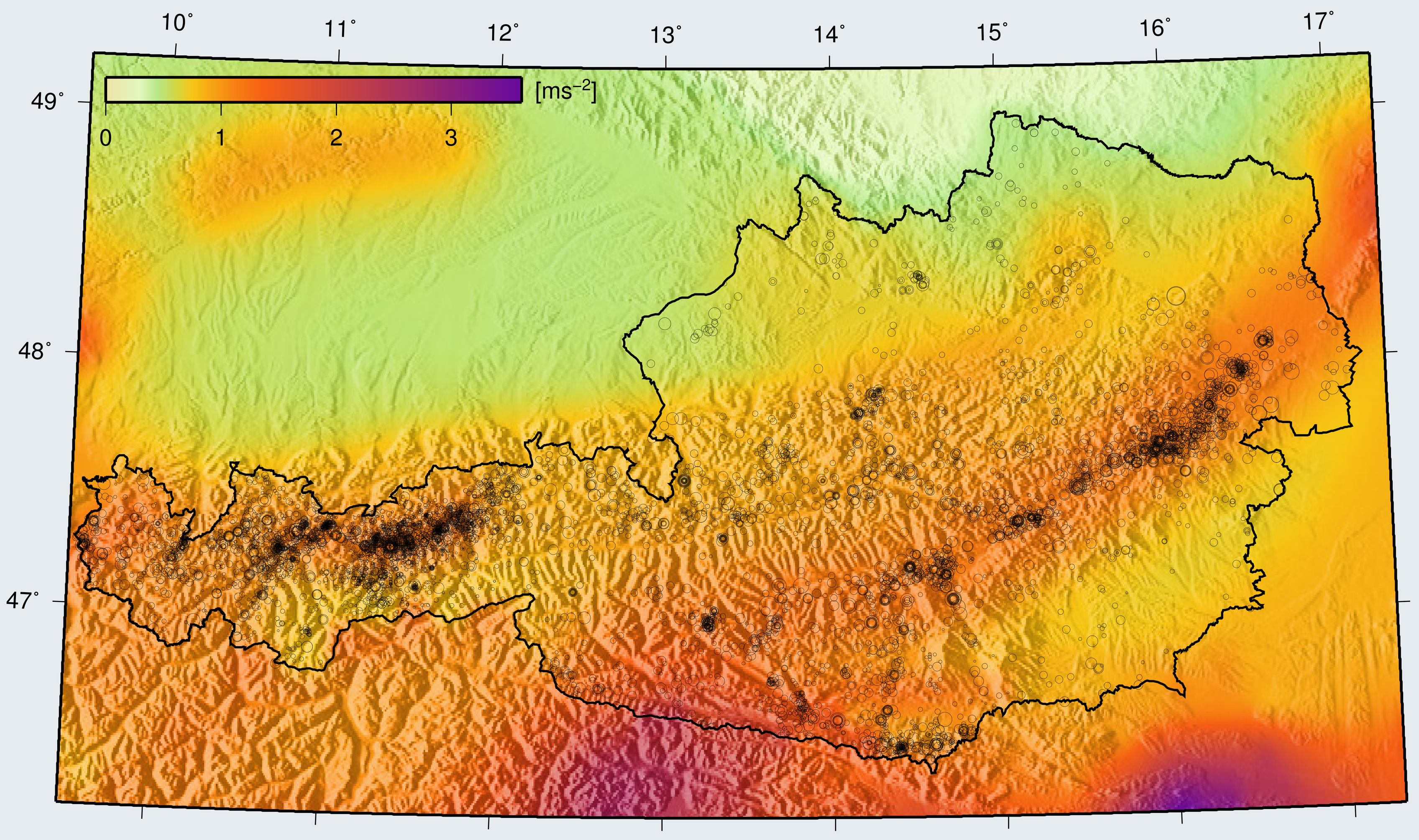
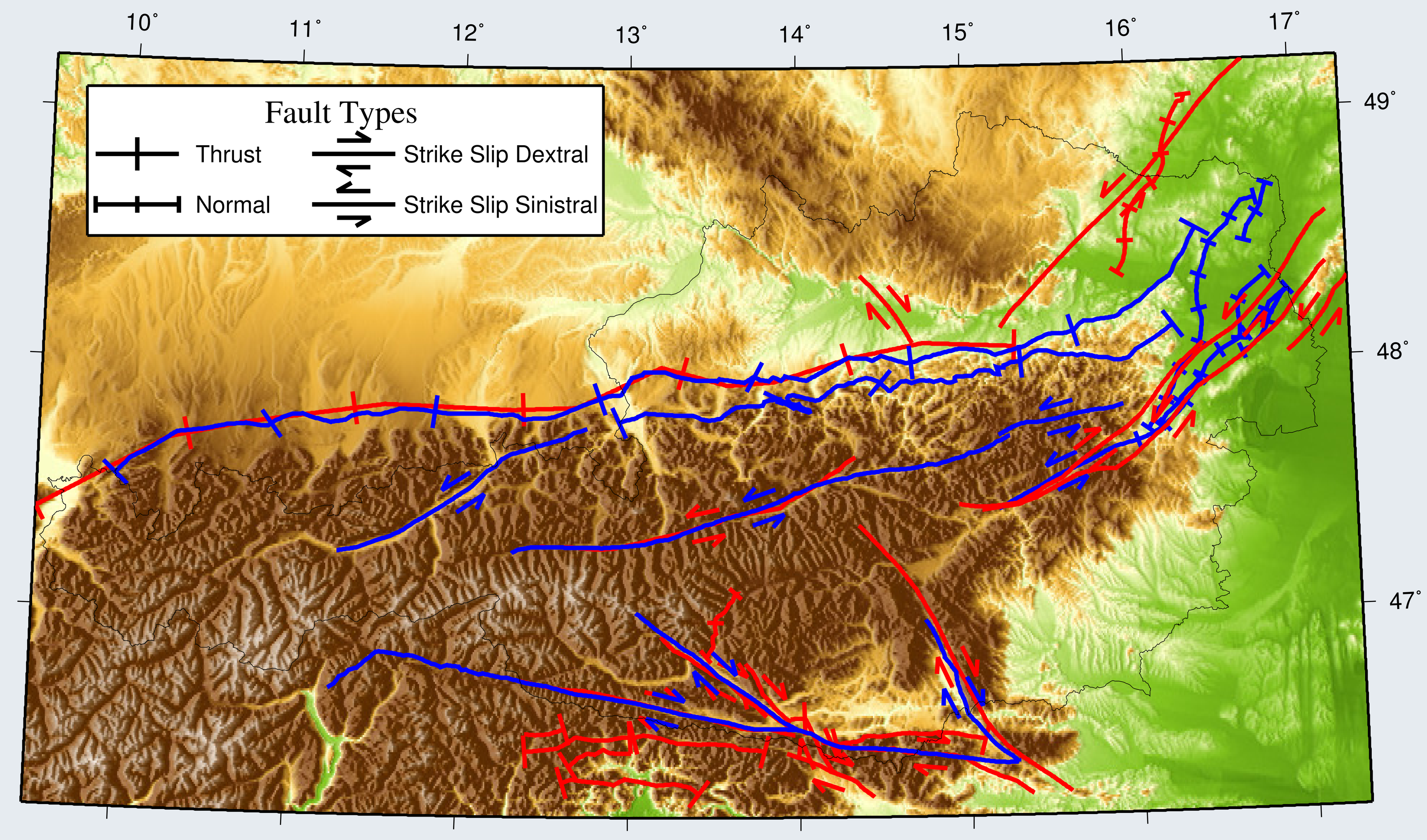


Fig. 2: Faults represented in blue were extracted from digital geological maps (GBA); red ones were provided by Peter Bird (Howe & Bird 2010). The GTOPO30 (USGS) dataset was used to image topography.



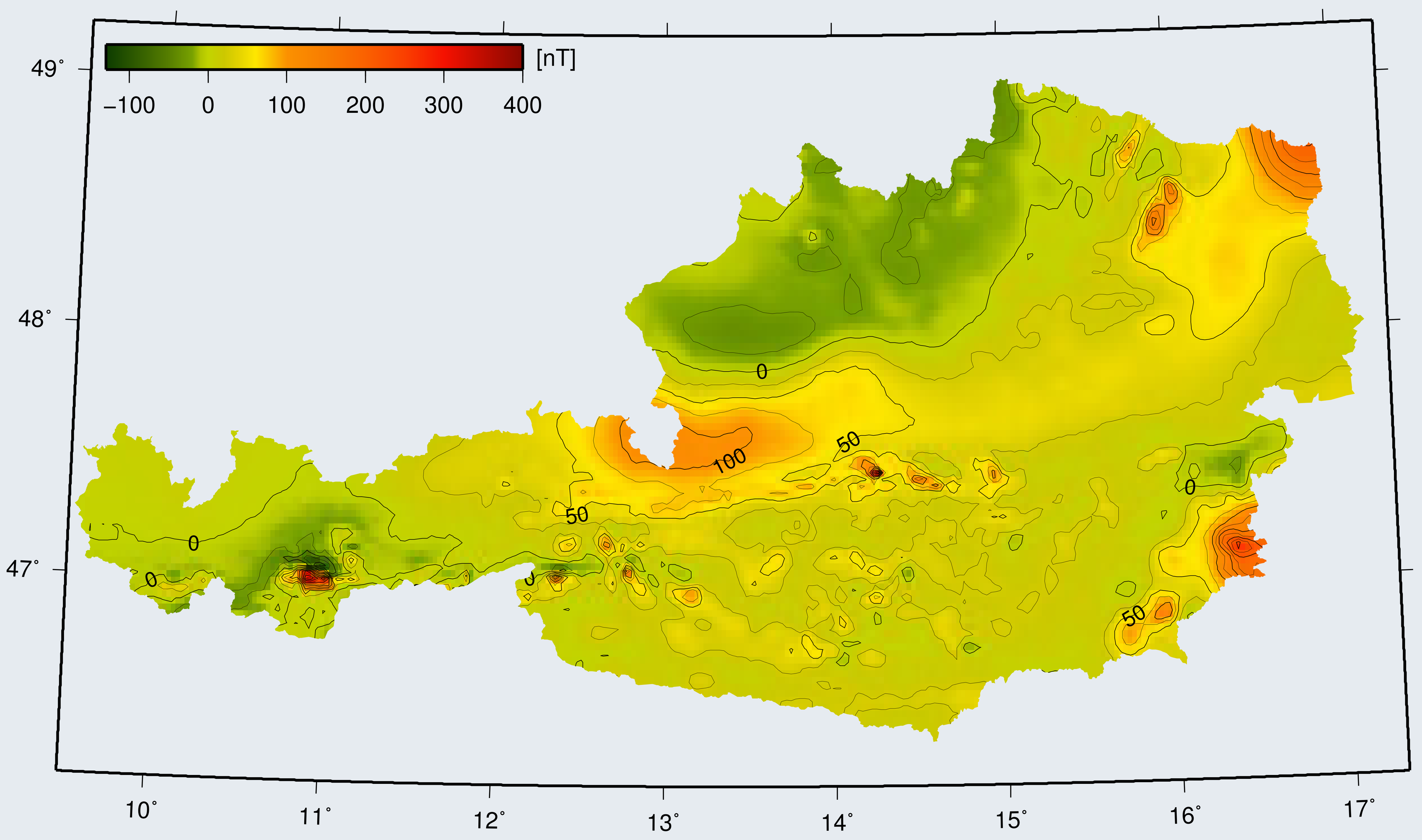


Fig. 3: Magnetic residual field derived from aerial surveys (1977-1982) continued to a common height of 3000 m above sea level (Blaumoser, 1991).

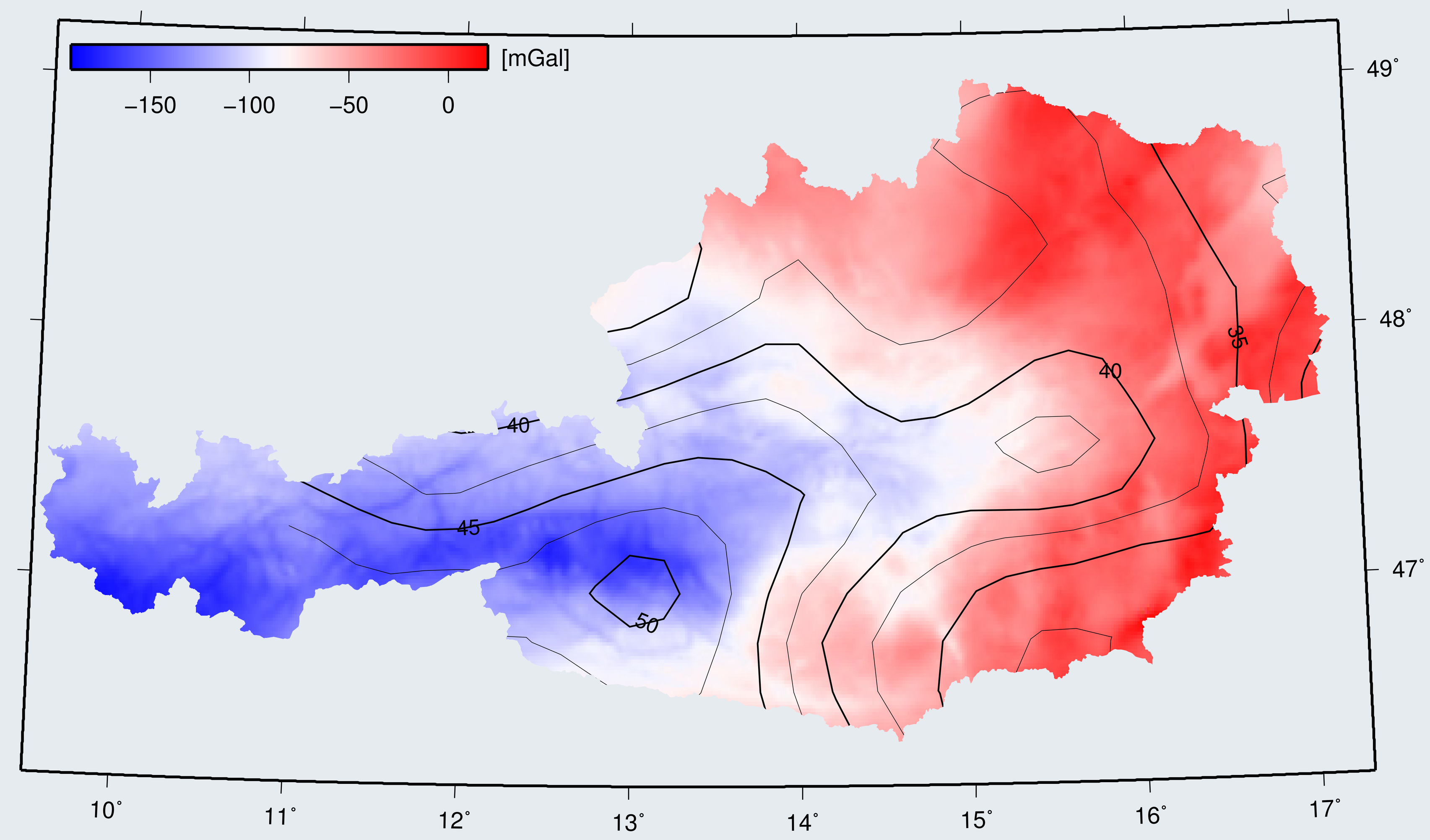


Fig. 4: Bouguer Anomaly map based on the orthometric height system (Meurers & Ruess, 2009) and contour lines depict Moho depths in km (Behm et al., 2007).

Seismicity and geology

Earthquake locations from the ZAMG catalog are illustrated in Fig. 1. Such information was used by Giardini et al. (1999) to compile a map of the probable level of ground shaking associated with the recurrence of earthquakes, also presented in Fig. 1. Moreover, earthquake locations in some cases show a clear relation with faults presented in Fig. 2. Fault locations are under debate in several places; see the difference of faults extracted from digital geological maps (GBA) and available online resources (Howe & Bird, 2010).

Potential field data

Aeromagnetics (Fig. 3) can help identify borders of geological units. For example, the "Berchtesgardener Anomaly" of about 100 nT could be caused by remaining oceanic crust, whereas in the Styrian Basin tertiary volcanic activity is apparent (Blaumoser, 1991). As gravity reflects density distributions in the subsurface, crustal thickness can be inferred. In Fig. 4 the Bouguer Anomaly map (Meurers & Ruess, 2009) is compared with Moho depths derived from P-wave velocities (Behm et al., 2007).

References

Behm, M., Brückl, E., Chwatal, Thybo, H., 2007. Application of stacking and inversion techniques to three-dimensional wide-angle reflection and refraction seismic data of the Eastern Alps, Geophysical Journal International, doi:10.1111/j.1365-246X.2007.03393.x.

Blaumoser, N., 1991. Eine erste gesamte aeromagnetische Karte von Österreich und ihre Transformation, Mitt. Österr. Geol. Ges., 84, S 185-203.

Giardini, D., Grünthal, G., Shedlock, K., Zhang, P., 1999. Global seismic hazard map, scale 1:35,000,000, Global Seismic Hazard Assess. Proj.,U. N. Int. Decade of Nat. Disast. Reduct., Int. Lithosphere Program, Swiss Seismol. Serv., Zurich, Switzerland.

Howe, T. C., Bird, P., 2010. Exploratory models of long-term crustal flow and resulting seismicity in the Alpine-Aegean orogen, Tectonics, 29, TC4023, doi:10.1029/2009TC002565.

Meurers, B., Ruess, D., 2009. A new Bouguer gravity map of Austria, Austrian Journal of Earth Sciences, Vol. 102, 62-70, Vienna.