Karlsruhe Institute of Technology

Geophysical Institute, Faculty of Physics

Scientific Achievements of the Karlsruhe Geophysical Institute 1964-2000– II.

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5. World Stress Map (WSM)

- Karl Fuchs initiated the global stress compilation as ILP Task Force.
- The WSM demonstrates characteristic regional patterns of tectonic stress for different tectonic settings.
- The modern version is available at www.world-stress-map.org

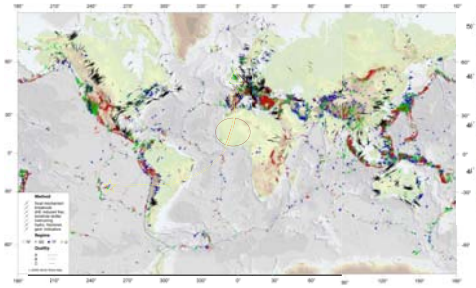


Fig.: The global stress map shows the distribution of the 11,346 data records with A-C quality.

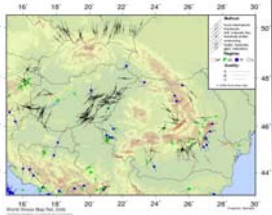


Fig.: Detailed stress map of the Pannonian Basin and the Carpathians, the focus of SFB 461.

6. Vrancea Seismicity

- Instrumental studies of natural and induced seismicity since 1974.
- Collaborative Research Center (DFG funded SFB) between 1996 and 2007 with the aim to understand intermediate depth Vrancea seismicity, quantify risk to the metropolitan area of Bucharest, and develop tools for mitigation.
- Tectonic model of detaching remnant slab as driving force of intermediate seismicity.

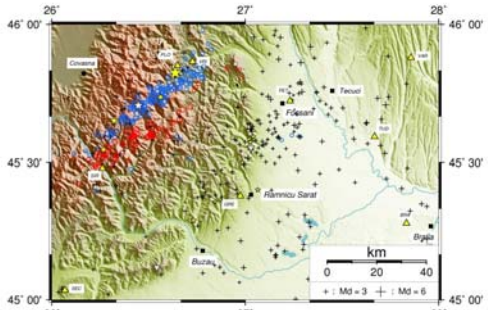


Fig.: Seismicity in Romania (blue and red cirles indicate the double seismic zone at intermediate depth, crosses are crustal events).

Fig.: Bucharest, 1977 earthquake.

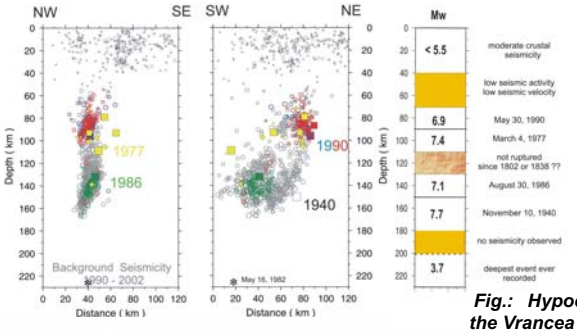


Fig.: Hypocentres in the Vrancea zone.

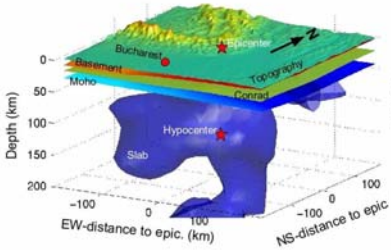


Fig.: High-velocity body (blue) from teleseismic tomography.

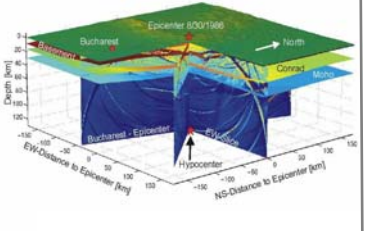
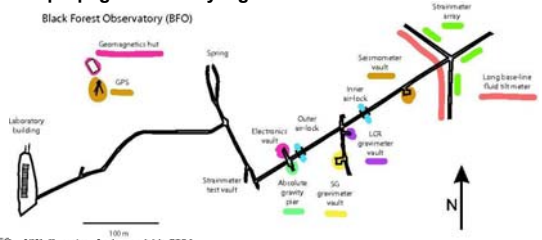


Fig.: Wave propgation simulation in the Vrancea zone.

7. Black Forest Observatory (BFO)

- The BFO is situated in a mine near Schiltach. There observations with a high signal-to-noise ratio are possible: first clear observation of toroidal mode ${}_0T_2$, global propagation of Rayleigh waves excited from volcanic eruptions etc.



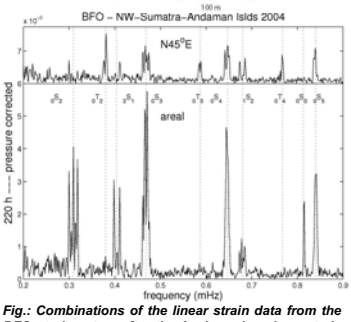


Fig.: Combinations of the linear strain data from the BFO strainmeters after the Aceh quake: shear strain on a vertical plane striking in N45°E-direction (top) and areal strain (bottom). Dotted vertical lines are located at the multiplet frequencies from model 1066A. All toroidal mode peaks are essentially absent in the areal strain spectrum. The relative amplitudes of spheroidal modes relative to the toroidal ones have strongly decreased in the shear strain. Especially ${}_0S_0$ is gone from the shear strain while it has very good SNR in the areal strain despite the low amplitude of about 10^{-11}.

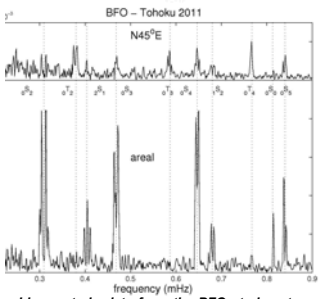


Fig.: Linear strain data from the BFO strainmeters after the Tohoku quake: shear strain on a vertical plane striking in N45°E-direction (top) and areal strain (bottom). Again the toroidal modes are essentially gone from the areal strain spectrum (a residual of 0T4 may still be identified), while they are enhanced relative to the spheroidal ones in the shear strain spectrum. 0S0, prominent in the areal strain albeit its small amplitude of 10^{-11}, is gone from the shear strain. 0T2 and 0T3 are clearly split. Dotted vertical lines represent degenerate multiplet frequencies from model 1066A.

8. Rhinegraben Seismicity

- The GPI was responsible for the seismic monitoring up to 1995.
- Seismicity maps were compiled and seismicity models were developed.

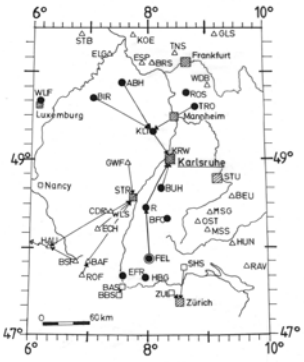


Fig.: The monitoring network was operated in real time with telemetry lines.

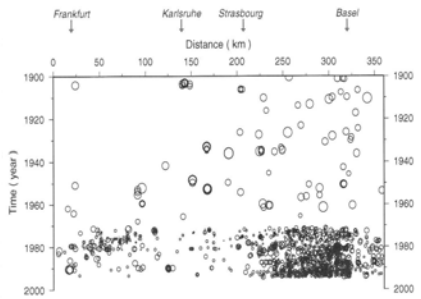


Fig.: Seismicity along the Rhinegraben from 1900 until 1995.

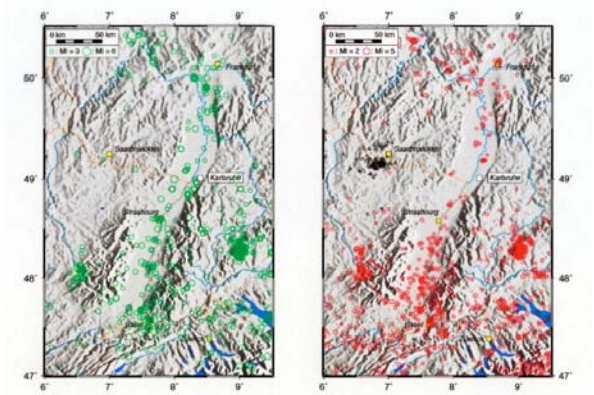


Fig.: Green and red circles represent the historic seismicity, respectively.