



REMOTE TRIGGERING OF DEEP EARTHQUAKES - INDICATION FOR CRITICALITY OF SUBDUCTING SLABS

M. R. Riedel (1) and R. Tibi (2)

(1) Institute of Geosciences, University of Potsdam, Germany (miker@geo.uni-potsdam.de),
(2) Washington University, St. Louis, USA (tibi@seismo.wustl.edu)

Recent observations by Tibi et al. (2003) showed that deep-focus earthquakes can dynamically trigger further events in a subduction zone below 400 km depth at remote distances. Their detailed analysis of the 19 August 2002 Tonga deep earthquake sequences showed evidence for both static and dynamic triggering. Furthermore, they propose that the triggered events are caused by transient effects in regions near criticality, where earthquakes have otherwise - without external influences - difficulty to nucleate.

Here, we analyze the observed remote triggering of deep-focus earthquakes on the basis of a visco-elastic block slider model for ductile instabilities in the subducting lithosphere (Riedel, 2003). It shows, that the proposed triggering effect can be easily explained by a divergence of the correlation length of the stress transfer function near to "criticality", i.e. near to a critical unstable state of the subducting slab, where nucleation of ductile instabilities is prone to occur.

The existence of this critical state in the deformed subducting slab is mainly caused by large bending forces in the mantle transition zone and is largely promoted by the unusual slab viscosity structure resulting from a metastable olivine-spinel phase transformation (Karato et al., 2001).

References

S. Karato, M. R. Riedel, D. A. Yuen "Rheological Structure and Deformation of Subducted Slabs in the Mantle Transition Zone: Implications for Mantle Circulation and Deep Earthquakes" Phys. Earth Planet. Inter. 127 (2001) 83-108

M. R. Riedel "Modeling shear instabilities with block sliders: brittle and ductile" AGU fall meeting, San Francisco, USA (2003)

R. Tibi, D. A. Wiens and H. Inoue "Remote triggering of deep earthquakes in the 2002 Tonga sequences" Nature 424 (2003) 921-925