Geophysical Research Abstracts, Vol. 9, 09055, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09055

Subduction zone structure and related processes beneath central Costa Rica

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The subduction zone structure and related processes are interpreted using a 3-D velocity model and seismicity of central Costa Rica obtained by the means of local earthquake tomography. There are three prominent features that can be clearly identified from the velocity model and the earthquake distributions: 1) A 4-10 % high velocity perturbation down to 60 km depth related to the Cocos Plate subducting under Costa Rica. The earthquakes of intermediate depth are mostly located in the uppermost part of the slab and are supposed to be caused by dehydration embrittlement associated with metamorphic phase tranformations. 2) A 10-20 % velocity decrease reaching down to 20 km depth, along the trench which can be correlated with high deformation caused by the bending of the incoming plate and possibly the occurance of serpentinization. 3) Negative velocity perturbations under the volcanic arc which can be caused by high content of upwelling fluid and magma, confirming the fluid release from the slab. These interpretations are supported by petrological modelling based on the correlation between the seismic wave velocity, H2O content and metamorphic phase transformations. It provides a better insight into the origin of seismicity of the seismogenic zone, which is supposed to be generated by interactions of thermal, mechanical, hydrological and compositional processes in the subduction factory.