Elastic stress field reconstruction in the Nankai Trough area based on WSM and drilled data

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We use the stress trajectories method (STM) to evaluate the stress state in the vicinity of the Nankai Trough. The approach allows estimating the principal horizontal stresses distribution in horizontal plane based on the discrete data on principal stresses orientations. We use World Stress Map (WSM, 2008) to reconstruct the stress state. 10 data of A-C quality have been detected in the area (1^{o}x1^{o}). The number of data allows using complex polynomials of up to second degree for approximation of the complex potentials in the plane elastic problem. It has been found that the linear approximation provides minimum residual from data. The reconstructed fields present the stress trajectory pattern (shown in Figure 1(a)) and the normalized field of maximum normalized shear stress (Figure 1(b)).
Then we used 11 in-situ stress measurements from the wells in Nankai Trough Seismogenic Zone (NanTroSEIZE expeditions 314-316, 319, 322, 338, 348) for comparison with the reconstructed stress trajectories. These are shown in Figure 1(a) by blue segments with a small circle at its middle, while the red segments represent the WSM data. It is evident from the figure that the included data agrees well with the reconstructed trajectories.
The results presented in the figure demonstrate the existence of an isotropic point where the principal stresses are equal to each other. In the vicinity of this point we can observe a sharp change in the stress trajectories. It is evident from Figure 1(b) that in the vicinity of this point the maximum shear stress magnitudes are much smaller than at the periphery of the examined area. The isolines of maximum shear stress are close to ellipses. It is worth to note that the long semi-axes of these ellipses are sub-parallel to the plate margin located in the investigated area. Bearing in mind that the dip of the subducting crust has N-W orientation which is orthogonal to the family of the stress trajectories shown in Figure 1 and therefore it is sub-parallel to the second family of trajectories which mechanically means that the shear stress on the plate margin is relatively small. This result requires further discussion from the geomechanical point of view.

Keywords: NanTroSEIZE, In-situ stress, Stress trajectories method

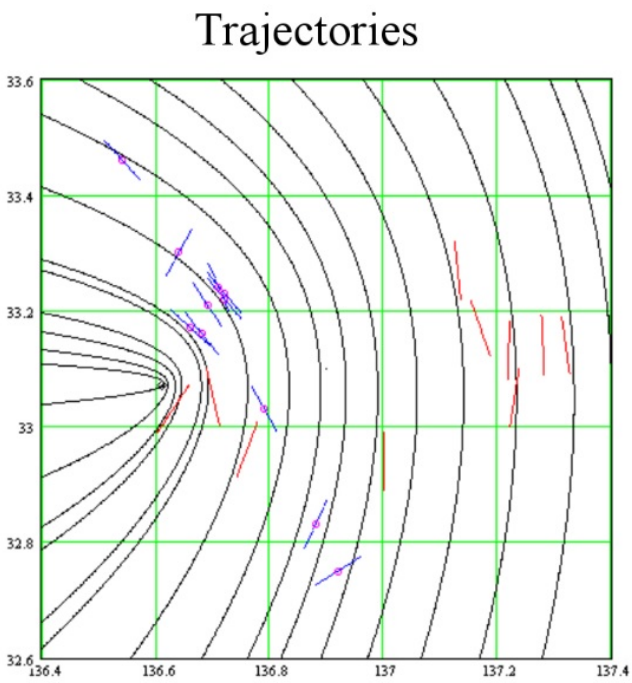

Fig. 1(a)

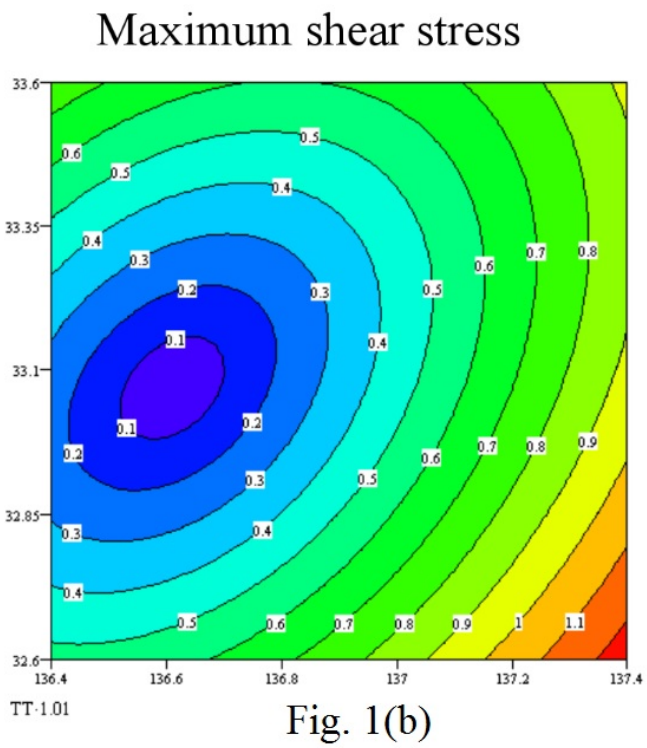

Fig. 1(b)

