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Objective criteria of non double couple seismic sources revealing and some insites of its distribution in island arches

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Non double couple seismic sources are considered in framework of the hypothesis that the process of seismic rupture can be viewed as a result of complicated fault geometry and its segmentation. The study focuses on the comparison of the deformation modes of the NDC sources with the states of stresses in its vicinity. The states of stresses are revealed using as a first approximation summation of seismic moment tensors. A measure of NDC part of moment tensor or deformation mode is described by the value of seismic moment tensor matrix determinant as its sign determines the mode of seismotectonic deformation. Analytical approach is found to reveal reliability of NDC measure taking into consideration the values of seismic moment tensor (CMT) errors. Thus, criterion of reference of the source to NDC-type is preservation of CMT matrix determinant (Det(Mij) sign within the limits of area of its definition that is inside of a six-measured cube [Mij – Eij, Mij + Eij], i, j = 1, 2, 3 (Eij – errors of CMT components definition). For this purpose the program counting function Det (Mij) in units of a grid, covering area [Mij - Eij, Mij + Eij] (i, j = 1, 2, 3) was used.

The attempt of the statistical analysis of different depth intervals seismicity structure in island arches with use the above technique was undertaken. As examples the Kuriles-Kamchatka arch and Tonga arch were considered. As information basis CMT catalogue of the strongest earthquakes of the world with 1976 for 2007 received and constantly increased by research group of the Harvard University of the USA was used.

Relative numbers of NDC seismic sources depending on magnitude and depth and seismotectonic deformation mode in various intervals of depths were studied. It has been established, that the relative number of NDC-type earthquakes quickly grows with magnitude - from 0.1 - 0.4 at MW = 5 up to 0.6 - 0.9 at MW $\geq$ 6.5. At the same time there is no significant dependence of relative number of NDC-type earthquakes versus depth within each magnitude interval. However, the situation is those, that for depths less than 70-80 km number of the events occurring in conditions of a mode of compression (Det(Mij) < 0), is counterbalanced by number of events described a mode of tension (Det(Mij) > 0) so on the average in this interval of depths the situation as though corresponds to DC-sources.

The results on investigation seismotectonic deformation mode in various intervals of depths are those:

In different segments of Kuriles-Kamchatka arch (43[U+25E6] - 55[U+25E6]N) change of seismotectonic deformation mode with depth essentially differs, that, possibly, reflects some distinction in geodynamic conditions. In all segments of an arch the areas characterized by average NDC-mechanisms are traced, and most brightly average NDC-mechanisms are expressed in the Southern segment of an arch (43[U+25E6] - 47[U+25E6]N) - here they are presented on all intervals of depths except for the uppermost layer (up to 80 km), and is the least bright - in the Central segment of the Kuriles-Kamchatka arch (47[U+25E6] - 51[U+25E6]N).

It is interesting to compare the results on Kuriles-Kamchatka arch with those for the Tonga arch that concerns to extreme Southwest frame of Pacific Ocean and being the area of three lithosphere plates joint. It is possible to note the certain similarity in seismotectonic deformation mode changes with depth between Southwest segment of the Kuriles-Kamchatka arch and Southwest part of Tonga arch. In case of a southwest part of an island arch Tonga the average mechanism is characterized by a mode of compression on depths 0 - 150 km and 250 - 700 km, a part of the interval concerning intermediate depths (151 - 250 km), is characterized by tension mode. Average mechanisms, since depths more than 150 km, everywhere concern to NDC-type, and the tension mode on depths more than 250 km is replaced by a mode of compression. This situation almost in accuracy repeats those for a southern segment of Kuriles-Kamchatka arch.

Thus, it is possible to consider established, that average mechanisms of NDC-type are widely widespread on

greater depths in areas of island arches while average mechanisms in an earth's crust and the top part of lithosphere everywhere in this areas satisfy double couple mode of deformation. It can point out to some differs in seismicity nature on greater depths and lithosphere.

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