

Characteristics of ring-shaped seismicity at depths up to 110 km prior to large and great earthquakes in subduction zones of the Pacific

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Abstract We have been considering some seismicity characteristics at depths up to 110 km prior to 38 large and great earthquakes ($M_w=7.0-9.0$) in subduction zones of the Pacific. We revealed ring-shaped seismicity structures in three depth ranges: 0-33, 34-70 and 71-110 km. These structures are being formed during a few decades prior to large and great events with hypocenters at depths of 0-40 and 42-110 km. We call these events conditionally as shallow and deep ones correspondingly. The structures are characterized by threshold magnitude values: M_{t1} , M_{t2} and M_{t3} respectively. We analyzed differences of $M_{t1}-M_{t2}$, $M_{t2}-M_{t3}$ and $M_{t1}-M_{t3}$ values. It was established that parameters $M_{t2}-M_{t3}$ and $M_{t1}-M_{t3}$ are higher considerably for large shallow earthquakes in comparison to deep ones. Besides that, we found differences of mean $M_{t1}-M_{t2}$ values at the west and east of Pacific. We discuss the reasons of ring-shaped structures formation which most likely are connected with dehydration of the subducting plate material and deep-seated fluid migration. We estimate possibilities of depths prognosis for preparing large earthquakes using characteristics of ring-shaped seismicity structures. The data obtained are essential for shaking intensity forecast and also for tsunami danger estimate prior to large and great events in subduction zones.

Key words Shallow and deep earthquakes, ring-shaped seismicity structures, deep-seated fluids, forecast of the earthquake source depth.

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