Global seismicity dynamics - dimension reduction analysis of global seismicity

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Huge amounts of global seismicity data along the plate boundaries are very critical to understand the global mechanics of the plate motion together with relative velocity and subduction geometry. Especially, the continuous time series of seismicity of the subduction zone is of great importance to reconstruct the dynamical behavior within the several to several tens year global plate motion. In this paper, I would like to propose the new global seismicity dynamics based on the data-driven machine learning method using truly global seismic data stored in the international seismic database of USGS and ERI.
Recent studies of global seismic activity in the subduction zones reveals the repeating nature of the intermediate sized earthquakes, correlation of slow slip events, low frequency tremor, and normal earthquake , and correlated truncation of several asperities of the plate boundary. Further, it has been suggested that there is some degree of correlation between differential stress acting on the plate boundary and b value of the plate boundary seismicity, supporting that the correlation between buoyancy force of the plate and b value of seismic statistics appears weak. In the region of low b value statistics, the giant earthquake occurred a little bit frequently rather than the other region.
The global surveys of plate boundary seismicity were concerned with mainly the relations among occurrence of giant earthquake, slab characteristics, and the plate motion or the subduction geometry. It suggests that the physical model of subduction is possibly reconstructed by several to several tens examples of plate boundary characteristics. However, it seems to be obvious that huge amounts of seismicity data along the plate boundary zones including many seismicity time series now accumulating with time are most important data to reconstruct the global mechanics of plate motion.
In this paper, I would like to clarify the mechanical behavior of the truly global seismicity in the plate dynamics using the whole seismic data of the plate boundary. The method used here is the dimension reduction in which the observed seismicity vectors defined by time dependent number density of seismic spikes in the given volume of the plate boundary zone of the whole earth are uniquely projected on the low dimensional principal subspace of characteristic base vectors. Those characteristic base vectors are classified into two types; one is the aftershock seismicity of the world wide giant earthquakes, and the other is the strong correlation of plate boundary deformation. In this study, it is suggested that the mode of the latter changed repeatedly within ten years from quite period to murmured one.

Keywords: global seismicity analysis, dimension reduction, correlative plate motion

