

Global Seismicity Dynamics –Synchronicity in Correlated Seismicity of Global Subduction and Ridge Zone

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The global seismic data in the USGS catalogue are transformed to the seismic density of unit volume divided along global subduction zone and oceanic ridges between magnitude 4 to 5 from 1990 to 2018. The large data matrixes made by logarithmic transformation are decomposed into coefficient matrixes and orthogonal basis matrix by means of the deterministic PCA (Toriumi 2009, Toriumi 2010, Okada et al., 2017) and probabilistic PCA with LASSO. The results are shown by time series of correlated seismicity rates z_1 to z_3 for both global subduction zone and oceanic ridge and by intensity spectra of coefficients contributing to the z_1 to z_3 .

The time series of the correlated seismicity rate z_1 of the global subduction zone display the step-like increase from 1990 to 2018 with somewhat lowering before and after Tohoku-Oki earthquake but that of the z_2 does periodic secular trend having 20 years cycle with Gaussian noise. On the other hand, the time series of the correlated seismicity rate z_1 of the global oceanic ridge also appears as step like increase with some degree of undulation. The z_2 time series display the weak periodic spike clusters with large noise.

The relationship of z_1 between the global subduction zone and the global oceanic ridge clearly shows three clusters and general increase of them with advancing time in their diagram. It seems that three clusters of correlated seismicity rates z_1 and z_2 of subduction and ridge zones should be due to three times of the globally rapid change of plate motion during recent 30 years. Furthermore, the general trend of these clusters indicates clearly synchronous motion of the subduction and spreading of the plate.

References

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