
[EE] Evening Poster | M (Multidisciplinary and Interdisciplinary) | M-IS Intersection

[M-IS03] Interdisciplinary studies on pre-earthquake processes

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Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall 7, Makuhari Messe)

This session expands the interdisciplinary discussions on preparation process of earthquake and earthquake predictability by presenting the latest progress in studying the physically based pre-earthquake phenomena. New observations from space and ground have provided evidences, which may enhance better understanding of tectonic activity. The session anticipates talks that include but not limited to observations and analyses of seismic, electrical, electromagnetic, electro-chemical and thermodynamic processes related to stress changes in the lithosphere along with their statistical and physical validation. Presentations on the latest observational results associated with major earthquakes obtained by different methodologies are welcomed. The topics of the session are as follows but not limited.

- General discussion on earthquake preparation process and the physics of pre-earthquake signals
 - Theory, modeling, laboratory experiments, computational simulation for generation and propagation of pre-earthquake signals and their connection with seismic cycle
 - Multi-parameter observations, detection, and validation of pre-earthquake signals
 - Cross-disciplinary studies, practical and technical approaches for better understanding of earthquake preparation processes and their connection with seismicity
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[MIS03-P04] Earthquake Monitoring in Tokachi-oki Using the Temporal Variation of b-value

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Keywords: b-value, AIC, Mc

The relationship between the frequency-magnitude distribution (FMD) is described by the Gutenberg-Richter (GR) law, $\log_{10} N(M) = a - bM$. A coefficient b measures difference in the relative proportion of small and large earthquakes. And it was reported in many studies that b -value decreases prior to great earthquakes. It's essential to decide the Magnitude of Completeness (M_c), above which earthquakes are recorded completely so that the FMD will follow the GR law. The detectability varies in time, so we investigate the temporal variation of M_c and choose the biggest one to represent M_c for the whole analyzed period. To investigate temporal variation of M_c , we divided earthquakes into windows chronologically and applied the bootstrap method to randomly resample a subset for each window, then we estimated M_c of subset using the MAXC (maximum curvature) technique. We also divided earthquakes in windows and applied maximum likelihood estimation to each window for calculation of b -value. We use Akaike Information Criterion (AIC) to compare each b -value to the b -value

corresponding to the period of the normal seismicity. It shows significance of difference between 2 b-values if $\Delta AIC \geq 2$. We applied bootstrap approach to resample for the period which has normal seismicity, and calculate b-values of subset as the reference b-values. We compute AIC between b-value and reference b-values and counted the number of $\Delta AIC \geq 2$, and use the percentage (P) of $\Delta AIC \geq 2$ to evaluate the significance level of variation in b-value. In stead of comparing the b-value with a single reference b-value, we can estimate the difference of b-values objectively in this process.

As an example, we investigated the daily variation of b-values and P in Tokachi-oki region Japan, over 1990-2014. It shows that P increases significantly 3 months prior to the 2003 Tokachi-oki earthquake (M8.0), which suggests the significance of decrease of b-value. This result is capable to show that the b-value has a potential capability of predicting an impending earthquake of M8 class. The details will be given in the presentation.