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

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

convener:Katsumi Hattori(Department of Earth Sciences, Graduate School of Science, Chiba University), Jann-Yenq Liu(Institute of Space Science, National Central University, Taiwan), Dimitar Ouzounov(Center of Excellence in Earth Systems Modeling &Observations (CEESMO) , Schmid College of Science &Technology Chapman University, Orange, California, USA, 共同), Qinghua Huang(Peking University)
Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, 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

[MIS03-P01]Statistical analysis of pre-seismic electron density anomalies with using Ionosonde data, over Japan

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Earthquake activity has had a great impact on human life. Even now in the 21st century, the damage caused by the earthquake has occurred unchanged, especially the damage caused by the 2011 off the Pacific coast of Tohoku Earthquake and the accompanying tsunami is remembered. In order to reduce such large-scale damage, short-term earthquake forecast is regarded as important. Recently, various electromagnetic phenomena related to seismic activity are being reported and researches focusing on ionospheric disturbances related to seismic activity have been active in recent years. One method to observe earthquake-related ionospheric disturbance is to detect the disturbance of the ionosphere by the Ionosonde data and GPS - TEC (Total Electron Contents) data. In particular, observation of the ionosphere using Ionosonde has been done for a long time, in comparison with GPS data. Then, more detailed statistical analysis and case analysis could be available. Therefore, in this study, we decided to perform statistical analysis of ionospheric disturbance preceding large earthquake over 60 years of 1958-2017 using Ionosonde data.

In this research, we use Ionosonde data observed at Kokubunji operated by the National Institute of Information and Communication Technology (NICT), Japan and perform statistical analysis. Parameters studied in this research are NmF2, hmF2, h’F, and foEs. They are corresponding to the maximum

electron density of the F2 layer, the altitude showing NmF2, the apparent altitude of the F2 layer, and the critical frequency of the Es layer, respectively. For each parameter, 15 days backward median and its’ interquartile range (IQR) were calculated, and the lower and upper thresholds for anomalies are defined by median value +1.5 IQR and median value -1.5 IQR, respectively. For earthquake, we use the Japan Meteorology Agency (JMA) catalog. We select earthquakes with magnitude of 6 or greater and depth less than 40 km within 1000 km radius from Kokubunji station for the analysis. During the analyzed period of 1958-2017, there are 352 earthquakes and 257 occurrence days. We apply the superposed epoch analysis (SEA) to investigate statistical significance in correlation between Ionospheric anomalies and earthquake occurrence. We also verify the magnitude dependence.

The results shows that there is a significant positive anomalies in NmF2 and the lead time is about 6-10 days with magnitude dependence. With respect to parameters related to altitudes such as hmF2 and h'F, variations are observed depending on the conditions, and it is not able to say that there is a correlation with the earthquake. Regarding foEs, at present it cannot be concluded that there is a clear correlation with earthquakes and further investigation will be required. The details will be shown at the presentation.