S151-P001 **Room: Poster Session Hall** **Time: May 20**

Prediction of the earthquakes in the Wenchuan aftershock sequence

Christine Smyth[1]

[1] DPRI, Kyoto Univ.

The ability to accurately forecast aftershocks would be of crucial assistance in the recovery period following a large main shock. Here we statistically explore the Wenchuan aftershock sequence with the following two aims:

1. To ascertain if forward prediction of magnitude in the aftershock sequence is possible.
2. To determine if accurate prediction of the number of aftershocks larger than a certain magnitude in a discrete period of time is possible.

To investigate the first aim, Logistic Regression, Classification Trees, and ARIMA models were applied to the data. However, the logistic regression and classification tree showed no reliable forward prediction of magnitude. Therefore, an ensemble approach was taken. Ensembles combine many models in order to improve performance. The ensemble approach was Adaboost applied to classification trees. Here, Adaboost built many classification trees on subsamples of the data. Poorly predicted observational units (earthquakes) were increasingly included in the subsamples. The results of Adaboost with classification trees on this dataset were unsurprising. A training set with equal instances of greater than and less than magnitude four earthquakes could be almost perfectly predicted. However, applied to a test set the model lost substantial amounts of predictability. Further tuning of the model would be required to improve the test results and applicability to a larger magnitude threshold.

To investigate the second aim, this research suggests an ensemble approach which combines a long-term Omori-Utsu (Utsu 1961) (OU) or ETAS (Ogata 1988) model with a short-term Gutenberg-Richter (GR) distribution (Gutenberg and Richter 1944). Because of their well established nature, we used the OU and ETAS models as the basis of an ensemble model. The parameters of the model were calculated using all data available up to a point in time, and these parameters were used to forecast the number of earthquakes in a subsequent period of time (OU predictions or ETAS predictions). To build our GR model we divided the aftershock sequence into smaller discrete time periods. We then calculated the parameters of the GR distribution for each period, and used these parameters to predict the number of earthquakes in each subsequent period - GR predictions. The parameters of the GR distribution were calculated using shorter periods of time than the OU or ETAS parameters, and therefore the GR predictions can be considered as containing instantaneous information about the aftershock sequence. We then combined the OU or ETAS predictions with the GR predictions to create an ensemble prediction. The results show that for predicting the number of greater than magnitude four earthquakes the ensemble techniques outperformed the simpler models. However, for predicting greater than magnitude five earthquakes, no model was outstanding.

Author:
Christine Smyth, DPRI Kyoto Univ.
Jim Mori, DPRI Kyoto Univ.