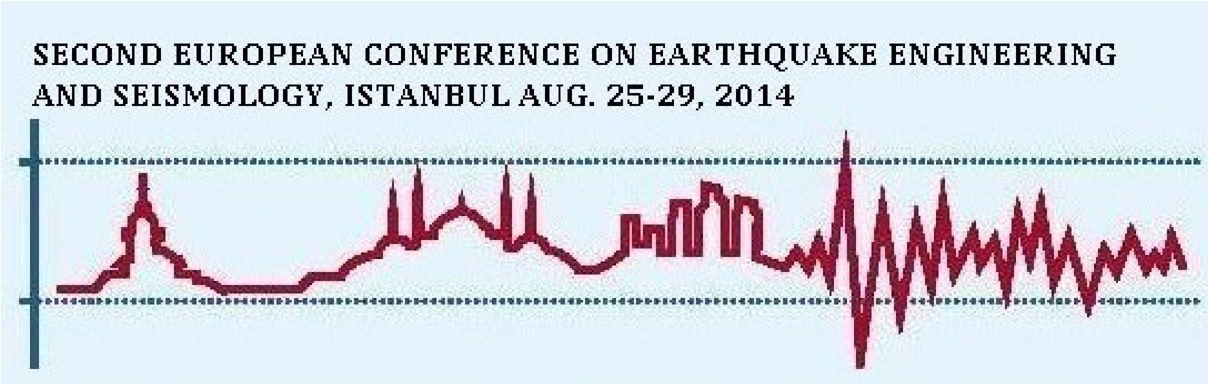

ASSESSING CHANGING PATTERNS IN ANTARCTIC ICEQUAKE ACTIVITY USING AUTOMATIC CLASSIFICATION TECHNIQES

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Global warming causes significant mobility of glaciers of any size (e.g. rapid retreat, glacier surges). The large variety of seismic signals generated by these processes are connected with ice berg calving, basal sliding and fracturing of ice. Therefore, evaluating cryogenic seismic events (i.e. changes of their occurrence in space and time) allows to monitor glacier dynamics and enables to draw conclusions about its cause.

However, classical seismological trigger mechanisms (e.g. STA/LTA) are unable to discriminate between tectonic and cryogenic seismic event types. Furthermore, the manual classification carried out by an expert is impractical for processing large volumes of continuous seismic data (e.g. several years of data). For that reason, we use a stochastical classifier called Hidden Markov Models to automatically recognize different seismic signal classes. This aims to contribute to a better understanding of cryogenic seismicity and its seasonal and decadal variations in Antarctica. We analyze data recorded at the Neumayer seismic network. Due to the lack of a general classification scheme for cryogenic seismic events observed at the Neumayer stations an intensive study of different types of cryogenic seismic events, their origin and their appearance in the seismogram is required first. The automatic classification can then be started from scratch as soon as interesting events are identified (Hammer et al., 2012). Our approach allows to learn classifier properties from a single waveform example and some hours of background recording. Hence, neither the tedious process of collecting training samples nor a time-consuming configuration of the classifier is required. Therefore, we minimize problems caused by the missing categorization scheme grown from longstanding expert knowledge. The method has been tested successfully in different environments (Hammer et al., 2012, 2013) supporting the idea of a gainful application in the antarctic setting.

We are able to identify two interesting event classes manually on the investigated data set. Both classes are clustered close to Neumayer network but in different backazimuthal regions. Based on this manual categorization we construct a classifier from corresponding signal types and start the automatic scanning process at a single station. Results show a clearly identifiable seismicity pattern. Both classes of detected events are strongly clustered in time over a period of months. Periodically repeating pattern of event occurrence are interrupted and/or superimposed by short term changes in the event rate. Variations in event occurrence can be caused by a variety of different aspects. The most plausible explanation of a tidal influence can not fully explain the observed pattern. For that reason we correlate the event rate additionally with other factors such as wind and incident solar radiation. Building on this, there also follows a rather long term observation: a changing seismicity pattern from summer to winter. Finally these first study then provides the basis for the investigation of a larger data set. Supported by the promising results we are confidently to detect further seasonal and decadal changes in seismicity patterns in Antarctica. Contributing to a better understanding of glacier dynamics and its embedding in the global warming context this analysis might greatly improve existing perspectives on polar seismology.

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