Computational Issues in Forecasting Earthquakes

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In recent times there has been increasing interest in forecasting earthquake occurrence. The official California earthquake forecast produced by the US Geological Survey is used to set earthquake insurance rates in California. It comprises a sequence of four model types: a fault model, a deformation model with slip rates and aseismicity factors, an earthquake rate model, and a probability model that gives a probability of occurrence for each earthquake during a specified (future) time interval. Another set of methods to compute earthquake forecasts use rates of small earthquakes ('seismicity-based models") to forecast the occurrence of large earthquakes. The more recent versions of these models are Poisson models with temporally non-homogeneous rates of activity. These include models based on activation and quiescence. These approaches use data-mining algorithms combined with the ANSS earthquake catalog. In this talk we describe a method for global earthquake forecasting that combines aspects of all these seismicity-

based approaches. The basic idea is to compute large earthquake probabilities using the number of small earthquakes that have occurred in a region since the last large earthquake. Each of these approaches has computational challenges associated with computing forecast information in real time. Using 25 years of data from the ANSS California-Nevada catalog of earthquakes, we show that real-time forecasting is possible at a grid scale of 0.1^{o}, but requires cloud computing approaches to be practical.