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Simulating the behaviour of the Self-Organising Seismic Early Warning Information Network

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A Self-Organizing Seismic Early Warning Information Network (SOSEWIN) is being developed as part of the SAFER (Seismic eArly warning For EuRope) and EDIM (Earthquake Disaster Information systems for the Marmara Sea region, Turkey) projects.

The SOSEWIN consists of sensor nodes (SN) made up of low-cost components that provide a lower accuracy than classical, more expensive seismic stations. This, however, will be compensated for by the network forming much denser arrays, numbering in the order of hundreds and at later stages, thousands, of nodes. Evaluating the behaviour of such a huge system from event detection up to issuing an early warning message is a difficult task that can only be fulfilled by the use of computer simulations. This approach allows the possibility of varying certain components, such as the detection algorithms and alarming protocols, and several network parameters, such as the nodes' quantity, arrangement and density. The superior question to be answered is, which combination results in the longer early warning times.

In this presentation we will focus on a specific, two-hierarchy alarming protocol. It follows the basic idea to avoid false alarms whereas a sufficient number of nodes must decide whether an earthquake event has occurred. The design of two hierarchies reduces traffic within the network, which potentially increases the early warning time. A Leader Node (LN) is the head of a group of SNs (first hierarchy). If the majority of SNs in such a group detect an event within a certain time interval, the LN will raise a group alarm that is communicated to neighbouring LNs (second hierarchy). Whenever a third group has issued a group alarm, its LN will transmit an early warning message throughout the network and to end users outside of the network.

Clustering the network into groups for the alarming protocol is a research topic regarding special seismological and wireless requirements, such as monitoring a sufficient geographic area and wireless link quality for example. An interesting question for evaluation by computer simulations is the behaviour of the clustering algorithm while dynamic changes in network topology.