Geophysical Research Abstracts,
Vol. 10, EGU2008-A-12095, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-12095
EGU General Assembly 2008

Probabilistic threshold definition of early warning systems to natural hazards

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Early warning systems are emerging as efficient tools for preventing and mitigating risks associated to natural hazards. The value of opportunity these bring to detect potential signals associated to the development of natural threats is what allows to trigger counter measures that may help to reduce if not eliminate, the hazard (active), the vulnerability or the consequences (passive).

Since the issuing (or not) of a warning is associated to the collection of different sources of information (field data, lab data, numerical models, and expert's beliefs), it is relevant to manage their uncertainties in a causal and associative manner. Bayesian networks suits well this purpose by establishing a clear and transparent format to estimate the state of probability associated to the threat's potential triggering factors, the threat's kinematics, and its consequences. Moreover, Bayesian Networks fulfils the risk definition within a decision making framework, serving as a warning index that encapsulates all participating sources of information.

Under the previous setting, defining the warning thresholds is a critical task for the operation of the early warning systems. This work introduces a probabilistic methodology for the assessment of the warning levels thresholds by relying on the optimal behaviour of the warning system provided that a 'prior' state of information has been outlined for its operation.

Assuming that the system cannot be calibrated in most of the cases due to the lack of data, the prior state of information is fundamental for the definition of the thresholds of the warning level. This is carried out smoothly through the Bayesian network by sim-

ulating potential risk scenarios given prescribed information about the dependencies between participating information sources, and about prescribed order and locations of the thresholds.

For the purpose of illustrating the application of the method, a work in progress Bayesian network as defined for the risk assessment of the tsunamigenic Åkness rockslide is discussed. Results show probability density functions associated to the likelihood of occurrence of a warning given a threshold definition.