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Using of bayesian networks to estimate the probability of „NATECH“ scenario occurrence

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In the twentieth century, implementation of Bayesian statistics and probability was not much used (may be it wasn′t a preferred approach) in the area of natural and industrial risk analysis and management. Neither it was used within analysis of so called NATECH accidents (chemical accidents triggered by natural events, such as e.g. earthquakes, floods, lightning etc.; ref. E. Krausmann, 2011, doi:10.5194/nhess-11-921-2011). Main role, from the beginning, played here so called „classical“ frequentist probability (ref. Neyman, 1937), which rely up to now especially on the right/false results of experiments and monitoring and didn′t enable to count on expert′s beliefs, expectations and judgements (which is, on the other hand, one of the once again well known pillars of Bayessian approach to probability). In the last 20 or 30 years, there is possible to observe, through publications and conferences, the Renaissance of Baysssian statistics into many scientific disciplines (also into various branches of geosciences). The necessity of a certain level of trust in expert judgment within risk analysis is back?

After several decades of development on this field, it could be proposed following hypothesis (to be checked): „We couldn′t estimate probabilities of complex crisis situations and their TOP events (many NATECH events could be classified as crisis situations or emergencies), only by classical frequentist approach, but also by using of Bayessian approach (i.e. with help of prestaged Bayessian Network including expert belief and expectation as well as classical frequentist inputs). Because – there is not always enough quantitative information from monitoring of historical emergencies, there could be several dependant or independant variables necessary to consider and in generally – every emergency situation always have a little different run.“

In this topic, team of authors presents its proposal of prestaged typized Bayessian network model for specified NATECH scenario (heavy rainfalls AND/OR melting snow OR earthquake –> landslides AND/OR floods -> major chemical accident), comparing it with „Black Box approach“ and with so called „Bow-tie approach“ (ref. C. A. Brebbia, Risk Analysis VIII, p.103-111 , WIT Press, 2012) - visualisation of development of the scenario with possibility to calculate frequencies (TOP event of the scenario, developed both ways down to initation events and upwards to end accidental events, using Fault Tree Analysis and Event Tree Analysis methods). This model can include also possible terrorist attack on the chemical facility with potential of major release of chemical into the environmental compartments (water, soil, air), with the goal to threaten environmental safety in the specific area.

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