Probabilistic assessment of long-term tectonic hazards for siting a HLW repository in Japan

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Japan is located in one of the most tectonically active areas in the world and long-term stability of the geological environment in the context of tectonics is a critical issue in the early stages of the three-stepped siting process consisting of the Literature Surveys, the Preliminary Investigations and the Detailed Investigations. It is generally agreed that the geological environment in Japan can be predicted over several tens of thousand years by extrapolating geological evidence from the last several hundreds of thousands of years. We therefore consider it is possible to evaluate the long-term behavior and impacts of tectonic activities, such as volcanism, faulting and uplift/erosion, deterministically to a certain extent from empirical assessment of geological evidence of the past. A probabilistic approach will also be employed in cases where a deterministic assessment would not provide adequate confidence.

NUMO has developed a probabilistic methodology with geoscientists from Japan, New Zealand, Switzerland, the UK and the USA for five years. It has the following features: (a) a comprehensive method from data gathering to feeding information for performance assessment, decision making and investigation planning, (b) a comprehensive method from data gathering to feeding information into performance assessment, decision-making and investigation planning, (c) applicability to the stages of Literature Surveys, planning of Preliminary Investigation programs and selection of Detailed Investigation Areas, (d) three timeframes of assessment: ~10,000 years, ~100,000 and ~1 million years, (e) underlying concept of conditional probability supported by deterministic/empirical understanding, (f) flexibility for iterative improvement by incorporating scientific progress and state-of-the-art technologies.

The methodology has been tested in two case study regions in Tohoku and Kyushu that have differing tectonic regimes and features. Tohoku has a distinct volcanic front controlling the location of polygenetic volcanoes and a current deformational regime dominated by subduction of the Pacific Plate. Kyushu is tectonically more complex, displaying strong rotational strains and a mix of polygenetic and monogenetic volcanism - with the future disposition of the latter being the more difficult to evaluate.

Outlines of the methodology and the main results of the case studies will be presented.