Guidance on uncertainty analysis for radioecological models

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Objectives of the Guidance

This guidance provides modellers, risk assessors and managers with background information and state-of-the-art tools that allow either a qualitative or, if enough information is available, quantitative estimation of the overall uncertainty budget of radioecological models. Test cases offer practical examples on how different types of uncertainties can be quantified.

a) Effect of parameter uncertainty on CROM model output obtained with a probabilistic approach. A log-truncated probability distribution function for concentration ratio $C_{\text{Wet-lay}}$ for trees is used and the measured concentration of Pb-210 in the topsoil layer at the Belgian NORM site.

b) Application of a methodology based on a Bayesian approach for quantifying conceptual (structural) model uncertainty of equilibrium (EM) and kinetic models (KM) for the interception of wet-deposited radionuclides on plants. $f_i$ is the mass interception factor, S is the conceptual model uncertainty.

c) Analysis of scenario uncertainty of the AMIS box model used to quantify the fate of hot particles in the Sellafield intertidal beach region. Activities on y-axis are in Bq, Sc.1, Sc.2, Sc.3 are the different release scenarios considered.

d) Uncertainty analysis of normalised Cs-137 deposits in Fukushima coniferous forests, obtained by geostatistical modelling and used by the TRE4-advanced model. Effect of relative spatial uncertainty on modelled output depending on the portion of flight lines used.

Highlights of the Guidance

- Focus on a comprehensive uncertainty analysis, in which parameter uncertainty and other uncertainty contributions e.g. input uncertainty, conceptual model uncertainty, scenario uncertainty are considered and quantified.
- Consideration of specific challenges related to radioecological models, e.g. high percentiles and choice of adequate probability distribution functions, handling of parameter correlations, impact of natural variability.
- Highlighting the role of sensitivity analysis and links to other environmental disciplines.
- A list of good practices (recommendations) for dealing with uncertainty analysis in radioecology.