A Statistical Long-Range Atmospheric-Transport Model and Sensitivity of Modelling Results to the Input Parameters

Yahui Zhuang
Atomic Energy of Canada Limited
2251 Speakman Drive
Mississauga, Ontario
Canada L5K 1B2

ABSTRACT

A statistical long-range atmospheric-transport model for radioactively contaminated airborne materials has been developed and the model equations have been solved analytically to facilitate an analysis of the model sensitivity to the input parameters. The model divides the atmosphere and the underlying surfaces into four interactive compartments: dry air, wet air, ground and soil. The interaction among different compartments and the concentrations of contamination in each compartment are modelled by four coupled linear differential equations, using a set of statistical input parameters (average dry and wet periods, dry and wet deposition rates, and resuspension and soil fixation rates, etc.). The model is time-dependent, emphasizing the role of the atmosphere in redistributing contamination between the atmosphere and the underlying surfaces over a long period of time, and is best suited for long-term environmental assessments of air and ground contaminations.

The paper will discuss the impacts of the input parameters on the model in terms of their sensitivity to the modelled concentrations. It shows that the impact of resuspension rate on the model predictions becomes increasingly important at large distance and over a long period of time. Given the range of input values, the results of the sensitivity calculations can be used to quantify the uncertainty in model calculations of the spread of contaminated material from a continuous source in the air and on the ground during environmental assessment studies.