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Abstract title: Aerosol dynamics and dispersion of radioactive particles

Name and Affiliation of the First Author: Pontus von Schoenberg, Department of Environmental Science and Analytical Chemistry, ACES & Swedish Defence Research Agency, FOI*Email of first author*: pontus.von.schoenberg@foi.se

Names and Affiliations of the Co-authors: Peter Tunved, ACES, Radovan Krejci, ACES and Niklas Brännström, FOI

Abstract text

Modelling of aerosol dispersion in the atmosphere can be done in many different ways. Traditionally dispersion models have quite rudimentary descriptions of the processes that change the aerosol size distribution and composition throughout the transport. These processes, aerosol dynamics, include wet and dry deposition, coagulation, condensational growth, chemical interactions, nucleation of new aerosols and the interaction between the released aerosol and the ambient atmospheric aerosol.

Using the trajectory box model CALM the importance of aerosol dynamics has been studied. The target of this study is to analyse the relevance of including more advanced aerosol dynamics into dispersion models that are used to track released radioactivity from a potential nuclear power plant accident. When all aerosol processes are involved a clear transformation of the radioactive particles can be seen towards the accumulation mode, approximately particles of sizes between 0.1 and 1 μm. If, for example only dry and wet deposition were modelled and the rest of the processes were left out, this is not the case. The time it takes for this transformation to occur differs from site to site and from trajectory to trajectory. However, we conclude that a certain care of addressing the aerosol processes is required especially near the sources of the dispersion. If a criteria for when the released substance has been transferred into the accumulation mode can be calculated, we argue that thereafter, the dispersion can be simulated as an accumulation mode aerosol with simplified aerosol dynamics focusing on deposition processes.

Motivation

Releases of radioactive material influence people and environment. A released aerosol have different impact depending on the size and the composition of the individual particles. The size and solubility affects internal dose for people and animals. It also determines the uptake in vegetation. It is therefore important to include aerosol dynamics in the dispersion model when relevant. We argue that this relevance is high close to the source, but decreases with the age of the released aerosol. Indeed aerosol dynamics is most important close to the source, and of little importance once accumulation mode has been attained.