Dispersion of Passive Scalars in the Aare Valley

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Abstract

The Paul Scherrer Institute (PSI) predicts the dispersion of radioactive particles emitted from two main sources to estimate the dose rate at the PSI and its surroundings. Currently, the Gaussian plume model ESS41 is used for this purpose. The predicition capability of this model is not appropriate for taking into account the varying atmospheric background states and, especially, the dispersion of the plume in the complex topography. Therefore a new dispersion model shall be developed for overcoming the weaknesses of typical Gaussian models.

An evaluation of different numerical models allowing both a high spatial resolution and a great flexibility yielded EULAG as a suitable modelling system for our particular purpose (Smolarkiewicz et al., 2007). First tests were conducted to simulate the wind field in an urban environment. As in Smolarkiewicz et al. (2007) immersed boundaries are used to mimick the urban structure in the computational domain. Here, we use the well-documented benchmark data from the Mock Urban Setting Test (MUST) for validation. MUST was an experimental field study attempting to simulate an ideal urban boundary layer. From tracer experiments flow field and instantaneous plume concentration data were obtained.

The next step to build up a new dispersion modelling system consists of introducing a simplified PSI geometry with a few cubical buildings and a large river (the Aare) inside the computational domain with a size of about 500 by 500 m^2. Simulations with a passive tracer shall be performed under different thermal stratifications. The simulation results of both the MUST setup and the idealised PSI setup will be presented.