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Numerical simulation of radiation fog in complex terrain

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The interest for micro-scale modeling of the atmosphere is growing for environmental applications related, for example, to energy production, transport and urban development. The turbulence in the stable layers where pollutant dispersion is low and can lead to strong pollution events. This could be further complicated by the presence of clouds or fog and is specifically difficult in urban or industrial area due to the presence of buildings.

In this context, radiation fog formation and dissipation over complex terrain were therefore investigated with a state-of-the-art model. This study is divided into two phases. The first phase is a pilot stage, which consist of employing a database from the ParisFog campaign which took place in the south of Paris during winter 2006-07 to assess the ability of the cloud model to reproduce the detailed structure of radiation fog. The second phase use the validated model for the study of influence of complex terrain on fog evolution.

Special attention is given to the detailed and complete simulations and validation technique used is to compare the simulated results using the 3D cloud model of computational fluid dynamical software Code_Saturne with one of the best collected in situ data during the ParisFog campaign. Several dynamical, microphysical parameterizations and simulation conditions have been described.

The resulting 3D cloud model runs at a horizontal resolution of 30 m and a vertical resolution comparable to the 1D model. First results look very promising and are able to reproduce the spatial distribution of fog. The analysis of the behavior of the different parameterized physical processes suggests that the subtle balance between the various processes is achieved.