A Comparative Study of LAPMOD and CALPUFF for Odour Impact Assessment: model sensitivity and validation

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Abstract

In the context of atmospheric dispersion modelling, understanding the influence of model parameters on predictions is crucial for improving the accuracy of simulations and making informed decisions regarding environmental management and safety. Sensitivity analysis provides a systematic framework for assessing how variations in parameters affect model outcomes, enabling users to identify the most significant factors and optimize predictions. This research focuses on the sensitivity analysis of the lagrangian particle model LAPMOD, which has not yet been widely explored in the scientific literature, by implementing a point source and an area source for odour impact assessment. The simulated odour impact maps are compared to the results obtained from CALPUFF model. Additionally, it discusses a validation study about LAPMOD and CALPUFF by comparing modelled concentrations with experimental datasets from LNG short-term releases at the Naval Weapons Center in California. From the results of the sensitivity study, it emerges that the different types of formulations for the calculation of the Kernel seem to be the parameter that most influences the simulated odor impact. In particular, based on theoretical considerations and observing the modelled results, the Gaussian kernel appears to be the most physically acceptable. The comparison between LAPMOD and CALPUFF reveals that, while in the case of point source emissions the findings between the two models appear generally comparable, in the simulation of area sources the deviations seem more significant, with a tendency

towards an underestimation by LAPMOD compared to CALPUFF (excluding the immediate vicinity of the source, i.e. below 50 m). Finally, the validation suggests that, at least for short-term releases, both models seem to perform adequately, although CALPUFF demonstrates better performance (average CALPUFF FAC2 = 79%; average LAPMOD FAC2 = 51%).