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Modelling transport and deposition of caesium and iodine from the Chernobyl accident using the DREAM model

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A tracer model, DREAM (the Danish Rimpuff and Eulerian Accidental release Model), has been developed for modelling transport, dispersion and deposition (wet and dry) of radioactive material from accidental releases, as the Chernobyl accident. The model is a combination of a Lagrangian model, that includes the near source dispersion, and an Eulerian model describing the long-range transport. The MM5v2 model is used as a meteorological driver. The performance of the transport model has previously been tested within the European Tracer Experiment, ETEX, which included transport and dispersion of an inert, non-depositing tracer from a controlled release. The focus of this paper is the model performance with respect to the total deposition of 137Cs, 134Cs and 131I from the Chernobyl accident, using different relatively simple and comprehensive parameterizations for dry- and wet deposition. The performance, compared to measurements, of using different combinations of two different wet deposition parameterizations and three different parameterizations of dry deposition has been evaluated, using different statistical tests. The best model performance, compared to measurements, is obtained when parameterizing the total deposition combined of a simple method for dry deposition and a subgrid-scale averaging scheme for wet deposition based on relative humidities. The same major conclusion is obtained for all the three different radioactive isotopes and using two different deposition measurement databases. Large differences are seen in the results obtained by using the two different parameterizations of wet deposition based on precipitation rates and relative humidities, respectively. The parameterization based on subgrid-scale averaging is, in all cases, performing better than the parameterization based on precipitation rates. This indicates that the in-cloud scavenging process is more important than the below

cloud scavenging process for the submicron particles and that the precipitation rates are relatively uncertain in the meteorological model compared to the relative humidity. Relatively small differences are, however, seen in the statistical tests between the three different parameterizations of dry deposition.