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Evaluation of the FALL3D model using WRF-ARW fields for the 2008 Chaitén eruption

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With the aim to improve forecasts of volcanic ash dispersion and deposition over Argentina a number of experiments were made running the FALL3D dispersion model coupled with the WRF-ARW model for the 2008 Chaitén eruption, Chile. FALL3D is an Eulerian model based on the advection-diffusion-sedimentation equation which runs at scales from synoptic to local and uses a second order finite differences explicit scheme on a terrain-following vertical coordinate system. The model results include time-dependent 2d and 3d variables (e.g. airborne ash concentration at selected flight levels, cloud column load, or deposit thickness) and tracking at selected locations. We first consider the 2 May 2008 eruptive phase (starting time 3:30UTC) and compare the effect of different source terms, namely Point source, Suzuki distribution and Buoyant Plume theory. Model results are compared with sequences of MODIS satellite images combined with ash detection algorithms based on the Brightness Temperature Difference using the 11 and 12 μm channels and the improved algorithm centered near 4, 11 and 12 μm channels. These methodologies are useful for discriminating between volcanic ash plume and meteorological clouds and also, to some extent, to retrieve the atmospheric concentration of ash. On the other hand, deposit thickness measurements are employed to evaluate the goodness of each of the source terms considered. The eruption influence on the reduction of the visibility documented by nearby synoptic stations from the Argentine National Meteorological Service sparsely distributed over the model domain is also analyzed. Finally, we compare with outputs from the HYSPLYT dispersal model that was used operationally by the Buenos Aires VACC to forecast the atmospheric ash concentrations during the whole Chaitén eruptive period. This work constitutes a preliminary assessment of the application of FALL3D in the Argentine National Meteorological Service using WRF-ARW and the 2008 Chaitén eruption as a test case, and can be considered as a starting point for the application of the modeling strategy to other volcanoes of the region.