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Numerical simulations of windblown dust over complex terrain: The Fiambalá Basin episode in June 2015

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On 13th June 2015, the London Volcanic Ash Advisory Centre (VAAC) warned to Buenos Aires VAAC, within the frame of inter-VAAC collaboration, about a volcanic eruption from the "Nevados Ojos del Salado" volcano (6,879 m), located on the Chilean-Argentinian border. A volcanic ash cloud was detected by the SEVIRI instrument on board the Meteosat Second Generation (MSG) satellites from 14:00 UTC on June 13th. Further studies concluded that the phenomenon was caused by remobilization of ancient pyroclastic deposits (4.5 Ka Cerro Blanco fallout) from the Bolsón de Fiambalá (Fiambalá Basin) in northwestern Argentina. Short-range numerical simulations of windblown dust from the Fiambalá Basin were performed using the WRF-ARW / FALL3D modeling system downscaling meteorological fields down to 2-km resolution in order to resolve the complex orography of the area. Results indicate that favorable conditions for dust uplift occurred at the north of the Fiambalá Basin, where orographic effects caused strong surface winds. Dust particles were in general confined to near-ground layers around the emission areas, thereby contributing to high near-surface concentration values. However, in the central and southern regions of the Fiambalá Basin, dust aerosols were injected up to 5-6 km high due to ascending airflows driven by horizontal convergence. Long-range transport numerical simulations were also performed to model dust cloud spreading over northern Argentina. Results of simulated vertical particle column mass were compared with the MSG-SEVIRI retrieval product. We tested two numerical schemes. With the default configuration of the FALL3D model, difficulties to simulate transport through orographic barriers were observed. An alternative configuration, using a numerical scheme to more accurately compute the horizontal advection in abrupt terrains, substantially improved the model performance.