Atmos. Chem. Phys., 17, 6759–6778, 2017
https://doi.org/10.5194/acp-17-6759-2017


Atmospheric Chemistry and Physics
Open Access
EGU

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

**Leonardo A. Mingari[1,6,7], Estela A. Collini[2,6], Arnau Folch[3], Walter Báez[4], Emilce Bustos[4], María Soledad Osores[1,5,6], Florencia Reckziegel[4], Peter Alexander[1,7], and José G. Viramonte[4]**

[1]Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Buenos Aires, Argentina
[2]Servicio de Hidrografía Naval (SHN), Buenos Aires, Argentina
[3]Barcelona Supercomputing Center (BSC), Barcelona, Spain
[4]INENCO-GEONORTE (UNSa-CONICET), Salta, Argentina
[5]Comisión Nacional de Actividades Espaciales (CONAE), Buenos Aires, Argentina
[6]Servicio Meteorológico Nacional (SMN), Buenos Aires, Argentina
[7]Instituto de Física de Buenos Aires (IFIBA), Buenos Aires, Argentina

*Correspondence to:* Leonardo A. Mingari (lmingari@gmail.com)

Received: 24 September 2016 – Discussion started: 19 December 2016
Revised: 22 April 2017 – Accepted: 26 April 2017 – Published: 9 June 2017

**Abstract.** On 13 June 2015, the London Volcanic Ash Advisory Centre (VAAC) warned the Buenos Aires VAAC about a possible volcanic eruption from the Nevados Ojos del Salado volcano (6879 m), located in the Andes mountain range on the border between Chile and Argentina. A volcanic ash cloud was detected by the SEVIRI instrument on board the Meteosat Second Generation (MSG) satellites from 14:00 UTC on 13 June.

In this paper, we provide the first comprehensive description of this event through observations and numerical simulations. Our results support the hypothesis that the phenomenon was caused by wind remobilization of ancient pyroclastic deposits (ca. 4.5 ka Cerro Blanco eruption) from the Bolsón de Fiambalá (Fiambalá Basin) in northwestern Argentina. We have investigated the spatiotemporal distribution of aerosols and the emission process over complex terrain to gain insight into the key role played by the orography and the condition that triggered the long-range transport episode.

Numerical simulations of windblown dust were performed using the ARW (Advanced Research WRF) core of the WRF (Weather Research and Forecasting) model (WRF-ARW) and FALL3D modeling system with meteorological fields downscaled to a spatial resolution of 2 km in order to resolve the complex orography of the area. Results indicate that favorable conditions to generate dust uplifting occurred in northern Fiambalá Basin, where orographic effects caused strong surface winds. According to short-range numerical simulations, dust particles were confined to near-ground layers around the emission areas. In contrast, dust aerosols were injected up to 5–6 km high in central and southern regions of the Fiambalá Basin, where intense ascending airflows are driven by horizontal convergence.

Long-range transport numerical simulations were also performed to model the 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, we found difficulties to simulate transport through orographic barriers, whereas an alternative configuration, using a numerical scheme to more accurately compute the horizontal advection in abrupt terrains, substantially improved the model performance.

## 1 Introduction

On 13 June 2015, the London Volcanic Ash Advisory Centre (VAAC) warned the Buenos Aires VAAC about a possible volcanic eruption from the Nevados Ojos del Salado volcano, the highest volcano in the world (6879 m), located in the Andes mountain range on the border between Chile and Argentina. A volcanic ash cloud was detected by the infrared