

Interactive comment on “Numerical simulations of windblown dust over complex terrain: The Fiambalá Basin episode in June 2015” by Leonardo A. Mingari et al.

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Received and published: 9 January 2017

Summary

Mingari et al. present a study on the meteorological controls on the resuspension of mineral dust from the Fiambala Basin in Argentina. I very much enjoyed reading this paper. It presents an interesting and novel approach to considering the importance of topography when modelling resuspension episodes and I believe represents an important contribution to this field. However, I do have some questions about how the source is set-up in the modelling approach, outlined below, and I would like this to be clarified before publication.

C1

1. Please can you provide further details on how the source area was defined and how the emission was implemented in the modelling?

1.a. How did you define the horizontal grid for the source and is your emission flux independent of this?

On Page 7, line 22 you state that the dust flux is estimated at each point of the deposit. How are these points defined, and at what resolution? My comment relates to your finding that as the horizontal resolution of the met data is increased the total mass emitted increases (Page 12, Line 14). Do you think this is related to a change in the friction velocities in the met data? Or, could it be due to you increasing the number of points from which you can emit particles? As you increase the resolution of your met data grid do you increase the resolution of your source? Does the resolution of the grid from which you can release particles vary or is it independent from the met data grid? Perhaps I just misunderstand how your set-up works here. I wonder if this would be also easier to understand if units for the dust flux presented in Section 3.2.1 were given. Is this in units of mass per metre squared per second?

1.b. Did you identify the whole Fiambala Basin as a possible source area? Please provide details on how this was defined.

1.c. Why did you choose the Shao emission scheme? My understanding was that Folch et al. (2013) showed that using the Westphal scheme best reproduced observations of ash resuspension events during 2011 in Central Patagonia?

2. Do you make a distinction between volcanic ash and dust and do you think you need a different emission scheme when modelling the resuspension of mineral dust as opposed to fresh volcanic ash deposits? Can this be accounted for in your threshold friction velocity? In relation to this it might then be worth mentioning in the Introduction that resuspension events of volcanic ash occur in other areas of the world, including Alaska and Iceland. Indeed the London VAAC provide daily resuspended ash forecasts to the Icelandic Met Office (see Leadbetter et al. 2012, JGR, doi:10.1029/2011JD016802).

C2

3. Please clarify what particle size range you released. On page 7 Line 25 you state that the source term was calculated for particles with diameter less than 60 microns. However, on Page 11 you state that you used a log normal distribution with particles ranging in diameter from 0 phi to 8 phi (1 mm – 4 microns). Also, you suggest that only particles with diameter less than 60 microns can be suspended, but there have been observations of much larger volcanic ash grains being resuspended in Iceland (up to 177 microns, see Liu et al., 2014, Ash mists and brown snow: Remobilization of volcanic ash from recent Icelandic eruptions, J. Geophys. Res. Atmos., 119, doi:10.1002/2014JD021598).

4. Please also clarify how the particles were released. On page 12, Line 3, you state that the mass was injected between 10 and 160 m a.gl. Was this as a uniform distribution? Also, how did you decide on the top height of 160 m a.g.l?

5. Please comment as to whether your approach to represent soil moisture in your calculation of the threshold friction velocity accounts for precipitation and wetting and drying of the deposit. You note that there is an offset in the observed ash in the satellite retrievals and the peak modelled mass loadings. You suggest that this could be related to the height of the ash in the atmosphere, with the peak height occurring later in the event. But, I would interpret Figure 14 as showing that the satellite detection period continued into Sunday 14th June 2015 when the modelled ash cloud height was very low. Could the offset be related to the time needed to wet and dry deposits as noted in the study by Leadbetter et al. (2012), or is your application of the threshold friction velocity capturing this behaviour?

6. Finally, please can you provide more detailed Figure captions, so that the reader can interpret the figures without having to refer back to the text. The caption for Figure 11 states that the results are very sensitive to the horizontal resolution of the WRF met fields; it would be nice to expand on this. The caption for Figure 2 states that the signatures of a zonda episode are observed, again please expand on this. And, Figure 16, what is the 'alternative configuration'?

C3

Minor Comments

In the abstract you refer to 'further studies' which concluded that the observed ash cloud was from a resuspension event. This comes across as an unsubstantiated comment. Perhaps you could re-word, or introduce the Collini et al. (2015) reference.

Page 1, line 12, indicated should be indicate.

Page 1, Line 16, addition of 'the' such that the sentence reads: '.....were also performed to model THE dust cloud spreading.....'

Page 2, Line 24, please re-word. For example: 'These eruptions blanketed a vast area of Patagonia in Argentina with volcanic ash'.

Page 2, Line 33, replace 'particularly'. For example: 'However, studies focussed on

Page 4, Line 17, re-word sentence. For example: 'The Cerro Blanco Volcanic Complex (CBVC) is located ON the eastern edge of the Ojos del Salado-San Buenaventura volcanic lineament (Fig. 1) and IS defined as a nested calderas system with ASSOCIATED domes and pyroclastic deposits'

Page 4, Line 32, spelling correction: 'Wind activity continued to mobilize this pyroclastic material until today turning the Fiambalá Basin INTO one of the major dust sources in North-Western Argentina'

Page 5, Line 26. What does ARW stand for when referring to the core of the WRF model?

Page 6, Line 19. You state that you use the Ganser scheme to calculate the particle settling velocity. Do you assume the particles are spherical or assign a shape parameter?

Page 7. Please clarify the introduction to the vertical flux scheme. I think the initial sentence needs to be re-worded. What experiment are you referring to when you state

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that: 'The experiment confirms that the saltation ...'

Page 8, Line 3. Please re-word this sentence, for example: 'Note that the effect of the roughness elements on the threshold friction velocity is not considered'.

Page 8, Line 15. Please re-word this sentence, for example: 'Dusty winds with gusts OF up to 90 km/h CAUSED A RANGE OF PROBLEMS, such as trees.'

Page 9, Line 2. I am not sure I understand what is meant by 'a strong drying'. Please clarify.

Page 9, Line 11. Please correct spelling and re-word, for example: 'The dust product is AN RGB (Red-Green-Blue) composite based upon infrared channels, WHICH ALLOWS suspended dust TO BE DETECTED during both THE day and night TIME.

Page 9, Line 27. Should read: 'Green shaded AREA'.

Figure 4. What are the purple/blue areas that are shaded?

Page 11. What are theta-e contours?

Page 12, Line 27. Spelling Mesoscale.

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-851, 2016.