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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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This paper describes simulations of ash resuspension from a 4,400-year-old tephra deposit in the Fiambalá Basin, western Argentina, and examines the accuracy and limitations of current methods to calculate resuspension and transport across complex, mountainous terrain. The study is able to arrive at results close to the observed ones, after using a clever method to modify the vertical wind velocity in their model to account for complex terrain.

I think the paper is well organized, clearly written, the conclusions are justified by the data, and the results are significant in advancing our ability to model ash resuspension. I appreciate the full description of the meteorological situation that produced the

resuspension event. My main criticism is that in section 3.2, which describes the dust emission scheme, the math and some of the physical concepts could be explained more fully. Details are provided below.

I think that the criticisms below can be corrected with minor modification to the paper. I look forward to seeing the final version posted.

Larry Mastin

Specific comments

Page 1, Line 7: change "provided" to "provide"

Page 1, Line 16: change "cloud" to "clouds"

Page 2, line 2: remove "to" after "warned"

Page 2, line 11, add "a" before "product". And change "originated" to "originating"

Page 2, line 13, add "has" after "wind activity"

Page 2, line 14, change "in a major dust source" to "into a major dust source"

Page 4, line 5, change "high elevated" to "high-elevation"

Page 4, line 27: it would be useful to label the southern Puna and northern Pampean Ranges in Figure 1.

Page 5, lines 14-15, "Winds prevailing in middle and upper troposphere favour a dry winter climate over the Puna because the Andes block 15 the westerly flow from the Pacific Ocean". Could you perhaps add a range of latitudes after "over the Puna"? Without knowing what part of the Andes you're talking about, or exactly where the Puna is in Fig. 1, it's hard to know where the winds are favored.

Page 6, line 3. Mention that "PBL" means planetary boundary layer. Also on this line, by "experiments" do you mean model simulations?

Page 6, lines 3-5. I think the concepts mentioned in these lines would benefit from more explanation. What is friction velocity and how does the MYJ scheme provide it for the PBL scheme?

Page 6, lines 7-9. You need a reference for the Noah Land Surface Model, and for the Richard's equation.

Page 6, last line. I thought saltation was bouncing of grains along the ground surface.

Page 7, equation 1. Is alpha dimensionless? Or does it have the same dimensions as u^2 $(m2/s2)$?

Page 7, equation 3. Could you give the units of Q(d)? $(kg/m3)*(m3/s3)*(s2/m)=kg/(s*m)$? what is its physical meaning? Kilograms per second moved per meter downwind distance?

Page 7, equation 3. Is u^* defined? (I can't seem to find a definition). Wind speed at ground level?

Page 7, equation 4. What are the units of p(d) and p(d_s)? Are these mass fractions? Are the data binned?

Page 7, equation 5. I suggest you move the sentence after equation 7 (which explains w) to this point. What are the units of soil moisture? I'm still not sure what "gravimetric soil moisture in percent" is. Mass percent water in the soil?

Page 8, equation 6. What is gamma? An empirical fitting parameter? A physical property?

Page 9, line 26. Change "has propagated" to "had propagated"

Page 10, line 17. What is a two-way nested domain? A domain that is smaller in both x and y?

Page 11, lines 1-7. How did you define the ash source for the Fall3d model? Was the

flux into each source node in the Fall3d model calculated within that model, or was it calculated in the WRF/ARW model and used as input in the Fall3d model?

Page 11, line 33. "In this study, the mass is injected between the two lowest levels". What does this mean? Between the two lowest pressure levels in the WRF/ARW model? Within the second lowest cell in the Fall3d model?

Page 11, Section 5.3. Was the grain-size distribution assumed to be uniform throughout the model domain? Were you assuming that the source material existed only in the Fiambalá Basin?

Page 12, line 3. "the largest friction velocities occurring in steep terrain". How can one identify steep terrain in Figure 8?

Page 12, lines 9-16. It's interesting that u^* increases as you increase in model resolution. If you went to still higher resolution, would u^* continue to increase? How high must the resolution be in order to simulate a realistic value of u^*?

Page 12, lines 20-21. "the scales involved in the mesoscale model are not representative of the spatial scales pertinent to the dust emission processes (i.e., aeolian scales)." I'm not sure what an Aeolian scale is. Can you give an example?

Page 12, line 25. Change "recalculate" to "recalculating"

Page 12, line 27: "Furthermore, the 10-cm depth soil moisture appears to be unrepresentative of the soil surface conditions involved in the dust emission processes." What observations lead you to this conclusion?

Page 13, lines 19-20. Change "an important" to "a significant".

Page 14, line 2. I don't see a definition for x, X, y, Y, or z, Z. Also, in equations 8 and 9, you need to define U, V, W, C, and h.

Page 14, equation 9. This is a clever way to correct for the inaccuracies of low-level wind in a terrain-following coordinate system. Has it been described in any other pa-

pers?

Page 14, lines 24-25. "Comparisons among model output 25 and satellite imagery reveal that the modeled dust cloud is further north." Boy, I think the locations looked pretty darned close. However the modeled cloud is wider than the one in the satellite image.

Table 1:

–Terrain and land use. Could you be more specific than "USGS"? What dataset exactly? A footnote with a reference would be helpful.

–Initial and boundary. a footnote with a reference for ERA-Interim would be helpful.

–Minimum and maximum time steps. What does Delta-x mean? You must divide by the maximum wind speed to convert Delta-x (km) to seconds.

–Physics: you need some footnotes or references that explain what the PBL Scheme is (and what the PBL is), Eta Similarity, Eta, the Dudhia scheme, the RRTM scheme etc. Most of the terms under "dynamics" also need footnotes or references.

Figure 1 caption: I suggest mentioning that "OSSB volcanic lineament" refers to the Ojos del Salado-San Buenaventura volcanic lineament. Why do you say at the end of this caption "SRTM, ASTER GDEM is a product of METI and NASA, Imagery GI-Science Research Group @ Heidelberg University." Was this map derived from these data sources?

Figure 2: time on the x axis is local time? Times given in the text are UTC.

Figure 3 caption. You say that the dust clouds are the dashed lines? I don't see dashed lines. But I see pink regions outlined by black, which I assume are the dust clouds.

Figure 4 caption: change "Shaded contour" to "shaded green contour"

Figure 7a. Consider adding the boundaries of the Fall3d model, perhaps in gray outline.

Or maybe add it to Figure 7b if the domain is too small to be seen in Fig. 7a.

Figure 8. Is the outlined region the Fiambalá Basin? Perhaps mention this.

Figure 10. What is the outlined region? Why does the emitted mass abruptly end at the margins of the outlined region?

Figure 11. It's not exactly clear which tick marks the labels refer to on the x axis.

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