

Interactive comment on “Aerosol plume transport and transformation in high spectral resolution lidar measurements and WRF-Flexpart simulations during the MILAGRO Field Campaign” by B. de Foy et al.

Anonymous Referee #2

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The paper is an examination of HSRL measured of aerosol plumes from the MILAGRO field campaign over Mexico City in 2006. The introduction is well written and informative, and the discussion of the HSRL technique and products is quite good. I am confused by some aspects of the model description, and—unfortunately—by the overall utility of the model. It seems that most of the aerosol classification is really from the lidar, and that’s well described, with little input from the model.

Lines 258 - 272: The discussion of the particle type index is confusing and could be clarified. If I understand the preceding discussion, there are urban and regional

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anthropogenic CO emissions, biomass burning emissions of CO from FINN, and dust emissions derived from prior WRF simulations. A scaling factor is used to convert from CO to PM_{2.5} (I think this is the scaling of 10-to-1 mentioned later in the paragraph). The dust needs to be handled separately, and owing to the uncertainties in the dust emissions the choice is made to scale the dust-to-PM_{2.5} as if the total of the dust PM_{2.5} were the same magnitude as the biomass burning PM_{2.5}. If I've got that right maybe it could be stated as such. Line 269 suggests I don't have that quite right: there's some application of this 10-to-1 conversion factor on the dust again, so maybe I have it backwards and the dust PM_{2.5} is being back converted to CO and that that is what is being carried in FLEXPART.

Lines 271 - 272: I also do not understand how the particle mean age is arrived at. You could have a lot of particles in a grid box either because of proximity to a source (young) or through convergence (maybe old). Are you keeping track then as well of the time at which each particle was emitted?

Figure 3: What does "UTM zone 14 coordinates" mean?

Figure 4 & 5, 6 - 11: Can you please clarify how the ellipses in these figures are determined? I understand they are qualitative in nature, but is could you clarify if the decision making process is based solely on the HSRL data, which it seems to be, or is somehow also being influenced by the FLEXPART results?

Line 347: Judging by the lengths of the transects and their orders in Figure 8 it appears the first transect was actually over the northern part of the basin.

Line 458: I'm confused at this point about the information in Table 1. My expectation is that the classifications illustrated are properties of different aerosol types as inferred from the lidar measurements (and possibly based on the literature, e.g., Catrall et al. 2005). But you state that the model results enter this table somehow as well. So this brings me back to the earlier question about the origins of the ellipses in Figure 4 & 5 and Figure 6 - 11. I understand that you want to bring the model into the discussion

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to put your typing of the aerosols on a better foundation, but I'm not really convinced that's been achieved. It seems to me the single biggest factor in where you choose to draw the ellipse is the 532 nm backscatter profile from the lidar, and there's a good consistency in the lidar measured properties to tell the story you are telling. The model results look confusing because of how difficult it is to get the one-to-one correspondence between the simulated and measured profile. I agree, this is difficult to do, but the modeling aspect seems weak, and I think Figure 12 confuses the issue. Your conclusion seems to be (line 485) that the model is only really helpful here for fresh biomass burning plumes, which appears to be your tightest grouping of points in Figure 12.

As a final point, the discussion offered in lines 497 - 503 seems kind of strange and not one I've encountered before. That doesn't mean it should be discounted, incidentally, but I wonder if it undermines what you're trying to do. The model is imperfect (seems to transport layers at too low of an altitude, large uncertainties in the proportioning of dust and other species, etc.); this should just be more thoroughly examined, I think.

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