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Interactive comment on "Colorado air quality impacted by long range transport: A set of case studies during the 2015 Pacific Northwest fires" *by* Jessie M. Creamean et al.

Anonymous Referee #2

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The manuscript presents an observation-based analysis of Colorado air quality impacted by long range transport of smoke particles from 2015 Pacific Northwest fires. Overall, the analysis is semi-qualitiatve at most; no transport modeling work is done, nor source-receptor relation is established with robustness. Synoptic chart and satellite data are used together to show the smoke transport pathways, but no new knowledge gained here. The manuscript argues that there is significant dust associated with smoke plume, but again, no figures to show where and when dust are uplifted. Can the dust be from great plains (such as west Nebraska) and not from fire region? it is a very interesting idea that biomass burning can uplift dust and such dust can transport with smoke plumes. The manuscript needs to show more quantiative supports for this

idea, either from analysis, modeling, or combined. Strong wind will uplift the soil dust, regardless. Specific concerns are listed below.

1. The manuscript's abstract and introduction gives readers an impression that the subject of the study is forest fires. But, in fact, in many cases, the fires studied here are fires in agcricultural areas (section 3.2). During the study time period, how much percentage of fires are from forest fires? This question is important because forest fires normally are bigger, inject smoke particles higher into the atmosphere for long range transport. Agricultural fires are smaller and don't injection smoke particles into the middle troposphere, but smoke particles from these fires can still transport in long distance and can be uplifted into the middle part of the atmosphere during the transport process. Together with the following papers, these points should be discussed either in the introduction or in the section 3.2 and 3.3.

Peterson, D., E. J. Hyer, and J. Wang , 2014: Quantifying the potential for high-altitude smoke injection in North American boreal forest using the standard MODIS fire products and sub-pixel-based methods, J. Geophys. Res. Atmos., 119, 3401-3419.

Colarco, P. R., M. R. Schoeberl, B. G. Doddridge, L. T. Marufu, O. Torres, and E. J. Welton, 2004: Transport of smokefrom Canadian forest fires to the surface near Washington, D.C.: Injection height, entrainment, and optical properties, J. Geophys. Res.,109, D06203, doi:10.1029/2003JD004248.

Wang, J., S. A. Christopher, U. S. Nair, J. S. Reid, E. M. Prins, J. Szykman, and J. L. Hand, 2006: Mesoscale modeling of Central American smoke transport to the United States: 1. "Top-down" assessment of emission strength and diurnal variation impacts, J. Geophys. Res., 111, D05S17, doi:10.1029/2005JD006416.

2. Line 46-47. Smoke particles not only affect clouds - so called indirect effect. They also have a semi-direct effect that affect cloud and atmospheric lapse rate through absorbing aerosols. In particular, when absorbing aerosols are above clouds, the semi-direct effect can be enhanced.

Ge, C., J. Wang , and J. S. Reid, 2014: Mesoscale modeling of smoke transport over the Southeast Asian Maritime Continent: coupling of smoke direct radiative feedbacks below and above the low-level clouds, Atmos. Chem. Phys. , 14, 159-174.

3. The paper used K and S as marker for biomass burning particles. However, it is good to use non-soil K instead of total K, as in Wang et al. (2006) and Kreidenweis et al. (2001). In addition, do biomass burning particles contain Ca, Al, etc.?

Kreidenweis, S. M., L. A. Remer, R. Bruintjes, and O. Dubovik, 2001: Smoke aerosols from biomass burning in Mexico: Hygroscopic smoke optical model, J. Geophys. Res., 106, 4831–4844.

4. Figure 18. how do you define relative mental mass concentrations? Relative to what? it should be in the figure caption. Figure 19 can be an interesting figure, but presenting the results in total amount for different specifies is confusing. More PM2.5 of course will have more chemical species. Relative percentage of these species with respect to total PM2.5 can be interesting to shown. In addition, any statistically significant test is conducted for panel a, -d. For example, in panel, there are significant variation of soil in small PM2.5 that can overlap with variation of soil in large PM2.5.

5. Line 314. "Dust and smoke from fires extended to 10 km". there is no evidence here that dust are from fires. Synoptic charts and back trajectory analysis show there is a high possibility that dust particles may from western part of Nebraska.

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