Atmos. Chem. Phys. Discuss., 13, C1672–C1674, 2013
www.atmos-chem-phys-discuss.net/13/C1672/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A decadal satellite analysis of the origins and impacts of smoke in Colorado" *by* M. Val Martin et al.

Anonymous Referee #1

Received and published: 26 April 2013

In this manuscript, the authors investigate the impact of fires on aerosol loading in Colorado through both the total column aerosol optical depth (AOD) and observations of surface PM2.5 in Colorado. The manuscript is clearly written on an interesting topic that is certainly of relevance to the ACP audience. I would, however, recommend several changes, some of the major, prior to acceptance.

Major Comments:

As described by the abstract, this paper investigates the impact of both local and transported smoke from fires on air quality in Colorado. Looking at Table 2, it was unclear to me why some major events, such as the Wallow Fire, were included as a part of the low fire impact years. Were these considered low impact simply because the fires themselves were not within the borders of Colorado? If so, doesn't this limit the study's

investigation to local transport events during the high fire impact years and bias the low-impact baseline with long-range transport events?

The use of MODIS AOD over western North America can be quite challenging. The authors have applied filtration based upon Zhang and Reid (2006), but this approach was developed for oceanic regions, and is likely not applicable here. Figure 2, for example, shows significant and unrealistic enhancements over parts of Nevada, questioning the filter's effectiveness. The removal of AOD above 1.5 as a part of this filter (p. 8237, L7) may also remove some important peaks during fire events. I would suggest the authors rather adopt the methods of Hyer et al., AMT, 2011, which extends the earlier work of Zhang and Reid to over land.

In light of the regional uncertainty in MODIS AOD, I would suggest that AERONET observations from Boulder should be incorporated into this study alongside MODIS. This station has been operational since 2001 and resides within the Front Range Corridor defined by the authors, so it could be an excellent source of validation.

My understanding of Figure 2 from Omar et al, 2009, is that the CALIOP retrieval over land distinguishes polluted continental aerosol from biomass burning aerosol based solely upon whether or not an aerosol layer is elevated. If this is the case, can this algorithm truly distinguish whether or not biomass burning plumes were impacting the surface, as suggested from Figure 5? Some further discussion is needed.

The paper would benefit from a better characterization of non-fire conditions, as compared to those observed during high active fire seasons. For example, how often do Colorado PM2.5 levels exceed national health standards in the absence of fire influence? Are fires effectively responsible for all the non-compliance days? Half of them? Background levels are briefly mentioned to be below 10 μg/m3, but I feel the paper could be much more effective if fire-related enhancements could be clearly placed in context.

Minor comments

p. 8245, L26-27 – For comparison purposes, it would be quite helpful if Figure 6 and Figure 5 provided consistent vertical units of pressure and/or altitude. p. 8247, L2 – "...swath is 4000 narrower..." Do you mean "4000x"? Figure 3b – The use of "/" to indicate a range of years could be confusing. I would suggest using "-" instead.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 8233, 2013.