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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A pervasive and persistent Asian dust event over North America during spring 2010: lidar and sunphotometer observations" *by* P. Cottle et al.

Anonymous Referee #1

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The paper focuses on ground-based lidar and sunphotometer measurements of aerosol layers passing over Canada, associated with transpacific dust transport in March-April 2010. The paper is well written, and an interesting study of the optical properties of dust and dust mixtures transported across the Pacific, as viewed from ground-based lidar. The main scientific conclusion, it appears, is the inference of chemical ageing of the dust in the free troposphere in transit across the North American continent. The authors haven't convinced me that their observations support that conclusion.

The paper provides a thorough detail description of the CORALNet, and AEROCAN

data sources.

The discussion of HYSPLIT simulations is a bit unclear. Ref: "back trajectories in 6 h intervals" - does 6 h refer to the time resolution of the met. data used (plausible), or the time step used (less plausible)? What is the time step and order of accuracy of the scheme used?

I don't see any reference to Figs. 1 and 2. First reference to a figure is to Fig.3.

p.30598, line 14: "Based on lidar observations" It would seem more logical to present the lidar observations (Figs. 4-6) before showing the model results that are used to interpret them.

Figure 3: The changes in orientation (e.g. from 3a – 3c) and different projection of the HYSPLIT maps compared with the NAAPS maps is not helpful. Also, the color scale used for the NAAPS maps lacks sufficient contrast for the reader to locate peak values over North America.

p.30600, line 24: what is "heterogeneous" about the "mixing with other aerosols." p.30601, lines 13-18: What's the meteorological context for this short-lived surface dust event, e.g, subsidence behind a cold front? This deduced impact on local air quality would be strengthened with some aerosol chemistry observations from ground sites, e.g. Whistler.

p.30603, lines 5-11, 16-19., and p.30607, lines 19-22: Chemical ageing of the dust associated with coating by acid pollutants (in the Asian airstream) should have tailed off (surface saturation) before the dust reaches North America (The Tang et al., and Li et al., papers concern uptake over East Asia). Can you definitively connect the dust observed over Egbert to the dust observed over Vancouver? That would seem critical to asserting some sort of additional "chemical ageing" in transit across the continent. Liu et al., (2012) show variability in particulate depolarization ratios in transpacific dust plumes, attributed to different Asian source regions. Do the trajectory calculations

suggest that the dusts observed at Vancouver and Egbert originate from the same or from different source regions?

Reference: Liu, Z., et al., Transpacific transport and evolution of the optical properties of Asian dust, J. Quart. Spect. Rad. Transf, 11 (2013) 24-33.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30589, 2012.