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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A subsiding regional forest fire aerosol layer at Whistler, BC: implications for interpretation of mountaintop chemistry observations" *by* I. G. Mc Kendry et al.

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We find the comments from MF regarding the possibility of sloping layers (perhaps created by wind shear) that are advected across the lidar to be interesting and constructive. This leads us to consider amending the original manuscript to accommodate the possibility of such a phenomenon and to alert others to the possibility when interpreting such data from a single station. However, on the basis of the data available to us we were unable to produce evidence that points conclusively to either explanation.

Furthermore, in a sense MFs alternative explanation bolsters our central argument,

that the consideration of chemical time series at mountaintop observatories requires careful consideration of the three dimensional aspects of the problem. On this basis we are happy to accommodate this possibility.

That said, after reconsidering the data in light of MF's comments we thought very carefully about issues of scale and on balance decided that we still felt that the dominant process (but perhaps not the only process) in this case was subsidence. We based this on:

(1) the fact that the calculated synoptic scale subsidence is consistent with the rate (slope) estimated from the lidar data. Subsidence was definitely a process at play and our observations are consistent with it.

(2) the large scale of the plume (Fig 4) evident in the satellite retrievals, and the distance of Whistler from the fire sources suggest to us that at the synoptic scale, the processes/features that produce sloping layers may not maintain their coherence. That is, the smoke emanated from a number of fires at a significant distance from Whistler It is our view that in the absence of some kind of frontal boundary, any sloping smoke feature may not remain intact as a result of wind shear, and topographic effects associated with the deep mountain convective boundary layer (3-4km) known to develop over this region during summer.

(3) the simultaneous and consistent pattern evident in both the UBC and Whistler lidar data. If the sloping pattern was a mesoscale feature produced be wind shear and advected through the region then we might expect to see some difference between two sites $\sim$125km apart. Furthermore, satellite smoke detections (Fig1 below) show a broad smoke layer already over Whistler on 28/29 August, the day before that examined in the manuscript. We suggest that subsidence of this pre-existing layer is perhaps more likely than advection of a sloping layer across the Whistler ceilometer.

To us, this suggests that in this case, the observations imply a regional scale plume and regional scale process of which subsidence is the best and most likely explanation.

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That said, in the absence of other data upstream, we cannot rule out the explanation RF proposes. Consequently we would very much like to integrate the essence of RMs comments into the text of the manuscript. It would be far stronger as a result.

Finally, as suggested, we took the opportunity to examine the CALIPSO overpass on 29 August (Fig 2 below). The aerosol subtype product for the north to south overpass (below) does show smoke (in black) extending to an elevation of 4km. Unfortunately the overpass is normal to the wind direction (northeasterlies) and aligned with the Whistler/Vancouver UBC axis. It is difficult therefore to infer any slope to the layer. What is apparent is that before the day on which we focus, the smoke appears to be at an elevation higher than Whistler peak (2.1km) and is located in a zone characterized by synoptic scale subsidence.

Again we appreciate the thoughtful comments. It has given us a whole new perspective to consider.

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Interactive Comment

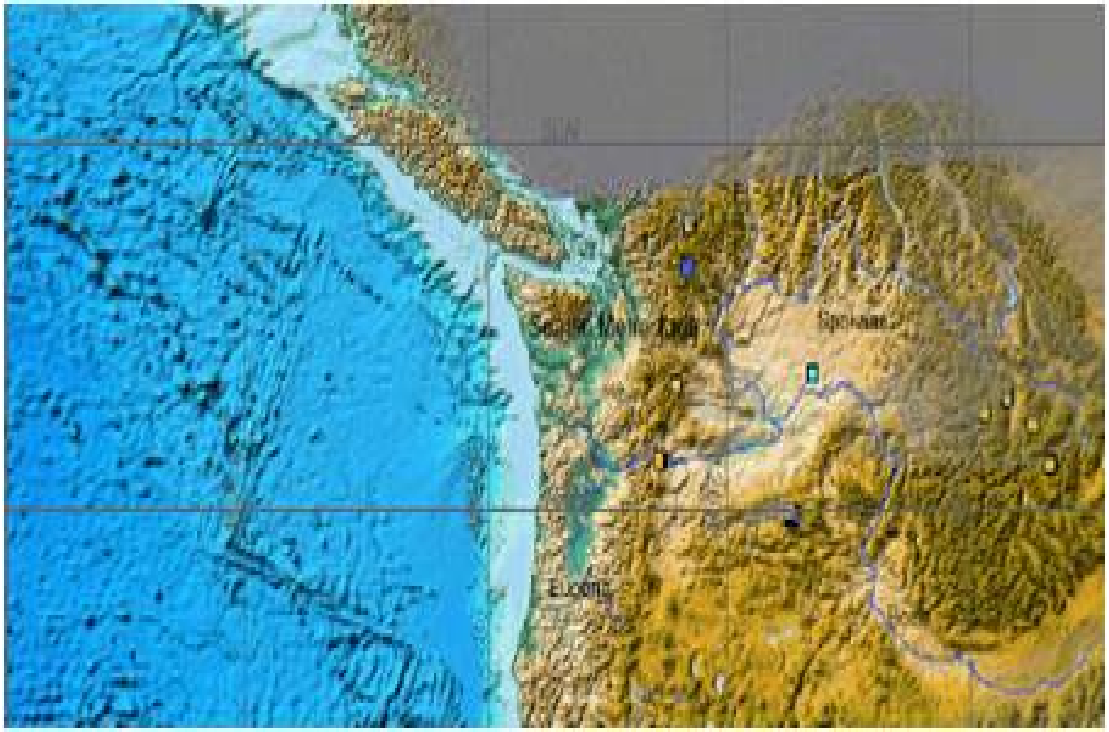

Fig. 1. Satellite smoke detection Aug 28-29 2009

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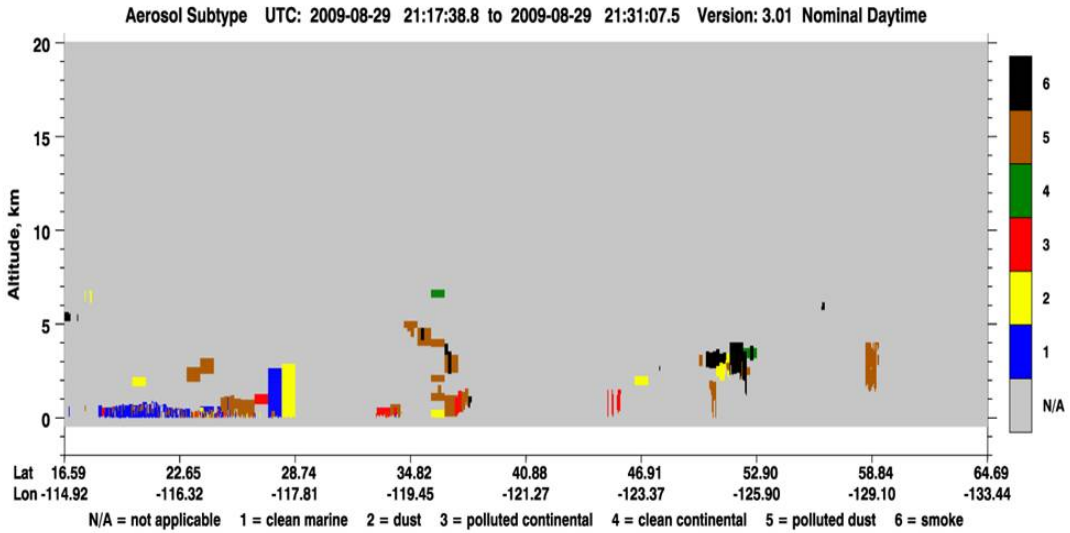

Fig. 2. CALIPSO overpass aerosol subtype product

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