

Review for manuscript:

S. K. Shin et al. (2015), Vertical variation of optical properties of mixed Asian dust/pollution plumes according to pathway of air mass transport over East Asia, ACPD, 15, 3381–3413.

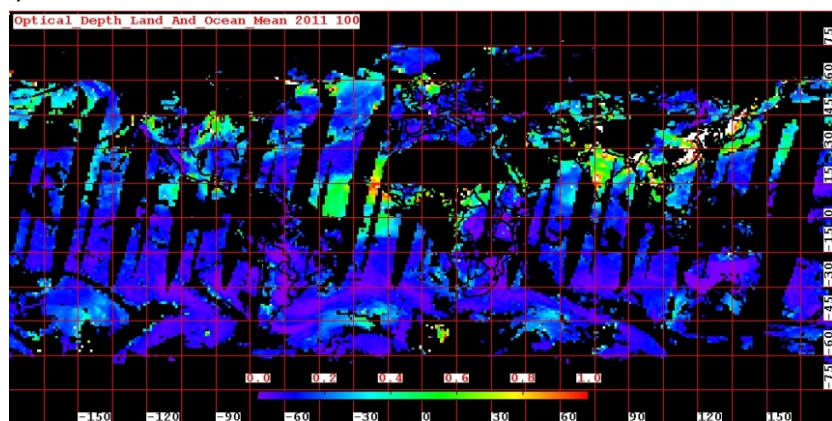
The present study investigates dust plumes over East Asia observed by a Multi-Wavelength Raman Lidar at the Gwangju Institute of Science and Technology in the Republic of Korea. The first long-term measurements from this site are presented. A comprehensive analysis of typical LIDAR quantities is used to characterize the observed aerosol from dust plumes which are partially mixed with anthropogenic aerosol from industrialized areas in China. While these observations are important for the aerosol community and should be published, the discussion could be improved to make the results attractive for a wider audience, e.g. by more interpretation of derived LIDAR quantities. Evidence is given for the pollution of the dust plume with anthropogenic aerosol, a very interesting and currently not-well understood problem, but the method is not convincing. I encourage the authors to improve their method through using satellite observations instead of MACC for the classification of MP and LP events and revising the comparison of pollution magnitudes at different levels (see main comments below). These changes would give a more solid basis for the discussion and add value to the implications of their findings. The overall organization and presentation of the results are good. I recommend publication in ACP after revision of the manuscript.

Main comments:

- Section 2.1: State how the linear depolarization ratio and the Angstrom exponent is typically interpreted for aerosol characteristics. Add typical ranges of values for all final quantities that you derive from the measurements so that the reader can better assess the uncertainty of your results later in the manuscript.
- pp. 3392, l. 21-22: It seems you do not trust the model data, but it remains unclear in the text why this is the case. Please specify your criticism.

There are retrieved AODs from satellite products available, e.g. from MODIS. Using those (example below) instead of MACC would eliminate the model uncertainty for your investigation. The model currently determines the classification of your observations in LP and MP events, the differences of which are small (Fig. 5). However, the model uncertainty prevents to conclude that other factors dominate (pp. 3392, l. 11-13), since you can not be sure that the classification with the model data is correct.

For instance for the 10 April 2011 from LAADS Web:



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(http://ladsweb.nascom.nasa.gov/browse_images/mid.html?date=04%2F10%2F2011+00%3A00%3A00&browseFileID=714424165&browseType=Global¶meter=BAOD&satellite=Terra&archiveSet=51&productFileID=714424228)

- pp. 3396, l. 9-21: Why have you chosen the transport time as a critical factor for pollution? Most pollution occurs in the PBL so that predominantly dust plumes at low-levels should be polluted. Here, winds are weak resulting in slow transport compared to upper levels where strong winds result in a quicker transport. Using the transport time as a measure of pollution magnitudes is due to these wind differences misleading.

Minor comments:

- pp. 3384, l. 6: “comparably strong” Please add what you relate to.
- pp. 3384, l. 10-12: Refer to Fig. 1 for the locations of the deserts.
- pp. 3384, l. 9: “field” better speak of balance or budget.
- pp. 3386, l. 11: “tracer” better to say proxy
- pp. 3388, l. 11: Add that these are lower thresholds for the identification of dust, i.e. dust is identified when the value exceeds the thresholds.
- pp. 3388, l. 18: Introduce S by name and refer to Fig. 2 d.
- pp. 3391, l. 6-7: The choice of words is misleading as I assume you did not run MACC yourself. Provide reference.
- pp. 3394, l. 13-23: Add arguments/discuss why the values differ for mixed and likely-pure dust (more absorption, more scattering?)?
- pp. 3394, l. 27: “below or below” replace one with above
- pp. 3395, l. 2-4: The boundary layer height over mid-latitudes does rarely reaches a depth of 3 km. The paper by Basha et al. (2009) investigates a tropical station at 13.5N, which does not apply for conditions in Korea and China.
- pp. 3395, l. 14: Spelling of HYSPLIT
- pp. 3395, l. 28: “as” us
- Figure 1: If there are other loess regions than the Loess Plateau, please name them or speak of a single loess region in the caption.