Atmos. Chem. Phys. Discuss., 8, S4193–S4197, 2008
www.atmos-chem-phys-discuss.net/8/S4193/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Asian dust outflow in the PBL and free atmosphere retrieved by NASACALIPSO and an assimilated dust transport model" *by* Y. Hara et al.

Anonymous Referee #2

Received and published: 27 June 2008

General comments :

This study is intended to understand physical processes of long-range transport of Asian dust from the source region to the far downstream region using the NIES lidar data, CALIPSO data and the assimilated results of dust transport model (RC4) for the Asian dust events occurred during 21-30 May 2007. The authors try to explain transport mechanisms of Asian dust in the planetary boundary layer and free atmosphere by forming an elevated dust layer and change of aerosols in the surface layer during the long-range transport period.

The analysis of lidar data in Fig. 3 is clear. However, Figs. 2, 6 and 7 are very

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Discussion Paper

confusing. Moreover, They state repeatedly in the manuscript, a low level dust outbreak behind the cold front of a low-pressure system and dust uplift in the warm sector of the low-pressure system, which are the main topics of this article, without indication of the their positions.

To improve the manuscript a)Authors should present the surface weather maps sequentially with the indications of a low pressure center and its associated fronts and the dust emission sites using the synoptic reporting data. b)Should elaborate the formation of the elevated dust layer by constructing longitudinal cross-section of the U-W wind vector and potential temperature across the dust source region as in Fig. 7e. c)The scatter diagram in the lower layer (Fig. 8a) should be reconstructed by confining the latitude band where the dust clouds are located. The CALIPSO path is extended from 30N to 60N so that the data obtained from L1-4, L1-6 and L1-8 (away from the source region) will contain anthropogenic aerosols sampled from the low latitude. That is why you have particles with low value of PDR. This does not mean the dust particles change to the internal mixing state.

This manuscript requires major revisions with much improved English to be accepted in ACP.

Specific Comments

Abstract

Abstract should be revised wholely.

2. Dust emission/transport

- Line 1 : RC4; Briefly describe the RC4 model.

- Line 2 : Please briefly describe the assimilation method using the dust extinction coefficient obtained from NIES lidar network.

- Line 10 : The simulation was performed from 21-31 May 2007 -> What is the spin-up

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time of the RC4 model to get the vertical profile of dust concentration as in Fig. 2a on 21 May?

- Line 19-20 : Total dust emission -> How do you get the total dust emission amount in which area?

3.1 Daily variation of meteorological

Fig. 2 is so complicated that it is hardly seen the significant features. It might be better to present the surface weather maps sequentially from 21 May to 31 May by indicating the low pressure center and its associated cold and warm fronts and dust rise sites. Some of parameters (such as MODIS cloud images) presented in Fig. 2 may be presented in the surface weather maps.

3.2 Time-height analysis

This section should be rewritten with more clearly indicating the position of cold front from the surface weather maps and the RC4 dust AOT distribution maps. Addition of a time series of RC4 dust AOT at the dust source region is required to examine the evolutionary features of the dust storm.

3.3 Cross-section analysis along the cold front movement

The cold front movement is not well delineated in this manuscript so that the description is not clear. It might be better to construct a vertical cross-section of potential temperature in Fig. 4 (middle). The interval of relative humidity isolines in Fig. 4 (middle) should be made large so as to be read easily. Construct Fig. 5 as the same in Fig. 4.

3.5 3-D structure of dust

This section does not give any more new information on the dust transport. Therefore it might be better to delete it and construct the E-W vertical cross sections of potential temperature and the U-W wind vector across the dust source region. This may provide the physical mechanism of the formation of the elevated dust layer.

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3.6 Correlation of color ratio and PDR

Fig. 8a is confusing because L1-2 is taken the data from the dust zone region only because the other latitude on the CALIPSO path is covered with clouds. However, the sampled particles along the L1-4, L1-6 ad L1-8 path are taken in a wide range of latitude belt (30N-60N). Some of anthropogenic particles which have low value of PDR in the low latitude are sampled and resulting in Fig. 8a. This means that the lowering PDR toward the downstream region may not be associated with internal mixing of dust particles. Taking the samples only in the dust layer zone will clarify this feature.

Minor Comments

P8716 on

-Line 5 results simulated using -> simulated results with

-Line 7 mitigated . . . of dust emission -> reduced overestimation of dust emission by 17 %

-Line 9 between . . .31.2-66.9% -> estimated by the model … by 31-70 %

-Line 11 to a long-range . . . region -> to the far downstream region

-Line 24 . . . has important influences? -> affects

-Line 26 . . . is usually transported . . . -> is usually trapped and transported P8717 on

-Line 1 . . . occasionally reaching -> , thereby providing a favorable condition to reach

-Line 27-28 sector of low pressure . . . lift up -> sector of a low pressure … importance of dust up-lift in the warm sector P8719 on

-Line 21-23 The large dust . . . history -> rewrite P8720 on

-Line 7-8 to catching . . . cloud layer -> in time, moreover the cold front with a cloud layer

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-Line 18-19 within the dry slot . . . China -> rewrite

-Line 25 continued . . . dust -> mobilized dust continuously

P8721 on

-Line 2 . . . in. . . layer -> in the elevated layer

-Line 8 . . . both with . . . NASA/CALIPSO -> with both NIES lidar network and NASA/CALIPSO

-Line 13 . . . without assimilation -> without Lidar data assimilation

-Line 22 . . . from 23 May to 26 May -> from 25 to 26 May P8722 on

-Line 12-13 . . . the southern part . . . line -> the southern part of Japan is controlled by the cold front

-Line 20 by 31.2-66.9 % -> by 31-70 %

-Line 21 results mitigate -> results reduce

-Line 24 . . . of the dust layer -> of the tick dust layer

-Line 15 . . . ,thought to . . . dust ->thought to be comprised mainly dust P8724

-Line 25 in Fig. 2 and 5 -> in Figs 3 and 5

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 8715, 2008.

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