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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of channel effect on Asian dust transport dynamics: a case in southeastern Asia" *by* C.-Y. Lin et al.

Anonymous Referee #2

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This study aims at a high impact event, i.e. a major dust storm affected populous residence areas thousands kilometers away from the source region. Both observations and models are used to describe the circumstances of this event, and the WRF model is used to simulate the impacts of topography. I am not yet fully convinced that the large spatial variation of the PM10 concentration is mainly due the topographic effects of mountains lie in the middle of the Taiwan Island. I would recommend publication of this paper with some revisions.

Major comments:

1. The impacts of topography on the dust storm transport:

Both Hysplit trajectories and GFS wind fields show that this dust storm moved toward

Taiwan from northeast direction. Intuitively, the northern tip and east-side of the island should be affected more than the west side. As shown in the previous study by this author, Lin et al. (2005, Atmos. Environ.), the ground sites on the east side of Taiwan (all the way to the HC site at the southern tip) are affected by dust storms much more frequently (Fig 7 there), which I think represent the climatology of the dust impacts on Taiwan's air quality.

While the 2010 March dust storm is a significant event, its transport pathway is somehow special. I think the large spatial difference of dust concentration on both sides of the island is mainly due to the location of the Pacific high-pressure system. The high-pressure centered to the east of Taiwan prevented the strong dust storm sweep though the whole island, i.e. only north and southwest of Taiwan is affected by this strong storm. The mountain range may help to enhance the dust transport along the Taiwan Strait through the channel effects, while it seems not the main reason for the large east-west spatial gradients.

2 Model and observation comparison is lacking.

a. Ground PM10 observations show very good spatial and temporal movement of this storm, we are wondering how well model can capture those features. The cross-session of the model in Fig 13 suggest that the gradient in model is less than that in observation. For example, Fig. 13 'd', the PM10 concentration around 600km line is pretty low, while at the 'CH' site, the observed PM10 is quite high.

b. Topography impacts on the simulated wind field: can authors show the comparison of control and QT vs. observations (at representative TEPA ground stations)? Since you used the data assimilation with GFS data (in both control and QT runs?), it would be interesting to see how they compare with the observations made at air quality sites as a relatively independent check.

3. Please see attached CALIPSO curtain plots (2010-03-21) along two tracks close to Taiwan, which show both composition and elevation of the aerosol types. It seems

dust mixed with anthropogenic aerosols (polluted dust) and smokes, and they came to Taiwan in a descending motion. It is not very clear how authors averaged the CALIPSO observation to get the vertical profile show in their paper, the aerosols in high altitude is somehow removed.

Other comments:

1. Page 26445, line 9, mentioned FGGE data, while author didn't specified how those data were used in this study? To drive the model? Validate the model?

2. Page 26449, line 6, 'In other word, . . .', it is not clear how could author reach this conclusion from the HYSPLIT result. Air mass reached HC site went through very similar pathways as other sites.

3. Page 26541, line 4, mountain channeling effect can explain the timing of the dust peak concentration at different sites, while it can't explain the large spatial gradient.

4. Page 26452, line 19, it should be 'As mentioned'.

5. Page 26457, line 20, we didn't see the comparison between model with ground observation, CALIPSO, and MODIS.

6. Fig. 3, those results are based on the WRF simulation or observations?

7. In Fig. 4, please outline the location of Taiwan Island and coastline. In other 2d maps, it would be nice if the island is outlined more clearly.

8. Line dust region is not used in other discussion

Attachment:

CALIPSO curtain plot of the two tracks close to the studied region on Mar. 21, 2010.

Two pieces of information that might be useful:

1. Based on CALIPSO data, it is mixed aerosols in this storm, including dust, polluted dust, and smoke.

2. Aerosol layer is very thick, all the way to about 8km vertically.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 26441, 2011.

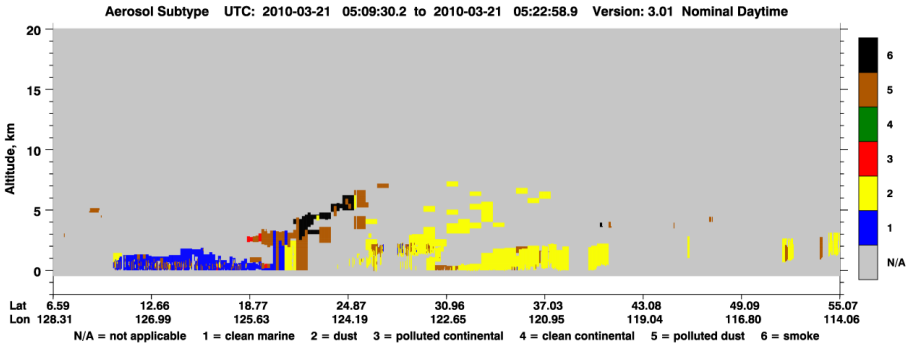

Fig. 1. CALIPSO Curtain Plot (2010-03-21 6z)

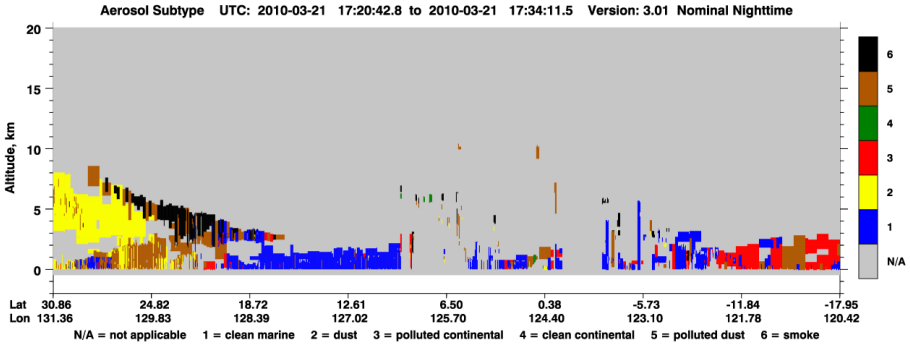

Fig. 2. CALIPSO Curtain Plot (2010-03-21 18z)