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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying pollution inflow and outflow over East Asia through coupling regional and global models" *by* M. Lin et al.

Anonymous Referee #1

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Overall comments:

In the paper two regional models (WRF-Chem and CMAQ) are coupled to a global model (MOZART). The focus of the paper is on export events from East Asia, and on import of air pollutants from Europe (in the regional model the import is derived using lateral boundary concentrations from the global model.

The paper convincingly shows that the regional models give a more detailed (and improved) description of the outflow from the Asian continent compared to the global model. The improvement is attributed to better resolution in the regional models, but also to an inability to capture deep convection events in the global model. As stated in

the paper, the parametrisation of convection should be improved in the global model, and this may to some extent change the conclusions somewhat, as this may result in pollution plumes being lifted to higher altitudes.

Results from a large set of models, including the MOZART model, have been uploaded to the HTAP server in Julich. In the HTAP companion papers/reports (see below) it is showed that the calculated range in import/export to/from the main continents differs substantially between these individual models. Here the regional models are compared to just one of these models. The authors should comment on how the export in and out of East Asia from the MOZART model compares to other global models, and the possible effects any model updates since the time when the HTAP model results were submitted.

An interim report and several papers have been publishes within the framework of HTAP. The authors refer to most of them, but not all.

Specific comments:

Page 1: Introduction A description of intercontinental transport in and out of East Asia (and other regions) is included in the HTAP interim report and partially also in companion HTAP papers. References to these publications could be included in the text here.

Specific comments: Page 112, lines 8 - 22 Calculated effects of transport to North America and to EAST Asia are also discussed in the companion HTAP papers, and results from these papers could be included in the discussion here.

Page 113, line 7 Surface ozone, aerosols and oxidised N deposition also included in TF HTAP (2007).

Page 113, line 10 The Ellingsen et al. (2008) paper is based on a different dataset than HTAP.

Page 115, line 24 How often were the chemical boundary condition updated?

Page 120 Why not include WRF-CMAC in Figure 2/descussion for comparison (as in Figure 4)? The pattern for PAN is remarkable similar to CO even though PAN is not a primary pollutant.

Page 120 line 22, Figure S3 Again, CO and PAN are very similar. Do you add any new information by showing PAN on top of CO?

Page 122 Figure 5 Refer also to Figure 3, showing the geographical (lat lon) position of the flight track.

Page 125 - 127 Discussion on export uncertainty I do agree that finer scale (regional) models is the main reason for the improved simulation of tracer vertical transport, but... In the companion HTAP publications the import (export) sensitivity of pollutants between the continents vary significantly between the models, and as stated on Page 124, line 14 - 15 the MOZART model is slightly lower than the ensemble mean. This should be better reflected in the discussion on uncertainty.

Could some of the discussion in this section be moved to the introduction?

Page 131 132 Time evolution .....

The lifetime of CO should be long compared to the residence time of air in the regional model(s)? It is surprising then that CO levels at Mt. Hua and Mt. Happo seems to be lower throughout the column in the regional model(s) all the time?

Figure S5 There is no NO2, middle panel as stated in the figure caption.

HTAP companion papers included in reference list: TF HTAP (2007), Fiore et al. (2009), Reidmiller et al. (2009), Sanderson et al. (2008), Casper-Anenberg et al. (2009).

Adittional HTAP companion papers that should be cited:

Citation: Shindell, D. T., Chin, M., Dentener, F., Doherty, R. M., Faluvegi, G., Fiore, A. M., Hess, P., Koch, D. M., MacKenzie, I. A., Sanderson, M. G., Schultz, M. G., Schulz,

M., Stevenson, D. S., Teich, H., Textor, C., Wild, O., Bergmann, D. J., Bey, I., Bian, H., Cuvelier, C., Duncan, B. N., Folberth, G., Horowitz, L. W., Jonson, J., Kaminski, J. W., Marmer, E., Park, R., Pringle, K. J., Schroeder, S., Szopa, S., Takemura, T., Zeng, G., Keating, T. J., and Zuber, A.: A multi-model assessment of pollution transport to the Arctic, Atmos. Chem. Phys., 8, 5353-5372, 2008.

Citation: Jonson, J. E., Stohl, A., Fiore, A. M., Hess, P., Szopa, S., Wild, O., Zeng, G., Dentener, F. J., Lupu, A., Schultz, M. G., Duncan, B. N., Sudo, K., Wind, P., Schulz, M., Marmer, E., Cuvelier, C., Keating, T., Zuber, A., Valdebenito, A., Dorokhov, V., De Backer, H., Davies, J., Chen, G. H., Johnson, B., and Tarasick, D. W.: A multi-model analysis of vertical ozone profiles, Atmos. Chem. Phys. Discuss., 9, 26095-26142, 2009.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 109, 2010.