Atmos. Chem. Phys. Discuss., 12, C10030–C10031, 2012
www.atmos-chem-phys-discuss.net/12/C10030/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol pollution potential from major population centers" *by* D. Kunkel et al.

Anonymous Referee #1

Received and published: 3 December 2012

General

The paper presents interesting simulation results concerning the impact of megacities on the state of air pollution on a local, regional to larger scale. The material is original and clearly deserves publication.

Some 'critial' remarks:

Page 4: The authors seem to make the point (only this point) that convective lifting is the main process to bring aerosol pollution from the polluted boundary layer into the free troposphere. However, aerosol long-range transport occurs in the free troposphere and is prodominantly connected to frontal activities (e.g., large scale lifting in warm conveyor belts, similar to the vertical water vapour transport into the middle

and upper troposphere, finally producing cirrus at the top of the troposphere). So the question is: Is such a vertical aerosol transport well implemented in these atmospheric circulation models? I have my doubts when I compare the amount of aerosols advected around the world and frequently seen by lidar networks and also by CALIPSO, and when comparing these observations with model outputs. Atmospheric models often underestimate the horizontal aerosol transport, remove the aerosol too quickly because assuming that most of the aerosol is in the boundary layer.

Furthermore, I have my doubts that the aerosol transport across coastal areas (connected with complicated features of changing boundary layer heights from deep continental boundary layer to shallow boundary layer) is well considered in models. The upper part of the polluted continental boundary layer becomes part of the free troposphere over oceans and can be transport without any limitation in time (except in cases with washout). Sea breeze effects occur in addition and lift material into the free troposphere. These impacts are of importance because most megacities are close to or at the coast.

So, these aspects should be discussed in the paper too. Section 2.1.2 deals with injections into the free troposphere. This section is appropriate for such a disussion.

Section 3: This is a typical approach in the model community: Comparison of model results with model results! Is that convincing? The only way (to convince also non-modelers) is, however, to compare model results with the 'reality', i.e. with observations (e.g., real features of the observed aerosol long range transport as, for example, observed with MODIS over the Ocean, see Kaufman, JGR, 2005, smoke and dust aerosol transport from Africa towards North and South America).

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 25389, 2012.