Atmos. Chem. Phys. Discuss., 3, S10–S15, 2003
www.atmos-chem-phys.org/acpd/3/S10/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical characteristics assigned to trajectory clusters during the MINOS campaign" *by* M. Traub et al.

Anonymous Referee #2

Received and published: 21 January 2003

General Comments:

This paper is an examination of the transport pathways influencing the MINOS study region during August 2001. Its goal is to establish links between in-situ chemical measurements and air mass origin and transport pathway. The trajectory analysis techniques are not new, but conducting this type of study above the eastern Mediterranean Sea certainly is new and could be an important contribution to the literature. However, before I recommend that this manuscript be published, further analysis is required in three areas.

The first is that much more information must be given on the vertical motion of the trajectories. Without knowledge of the altitude at which trajectories cross continental or marine regions (i.e. whether or not they pass through the marine boundary layer, or

Full Screen / Esc
Print Version
Interactive Discussion
Discussion Paper

the atmospheric boundary layer over land), it is difficult to be convinced that differences in trace gas mixing ratios are adequately explained by the transport patterns.

The second area that should receive more attention is the grouping of stratospheric air masses with tropospheric air masses. The NAONA pathway clearly has a strong influence from the stratosphere, making it difficult to draw conclusions about the anthropogenic influence on the chemical differences between the NAONA and South Asia pathways. Removing the trajectories strongly influenced by the stratosphere would make the comparison much more useful. Then the stratospheric trajectories should be examined separately. If these air masses were sampled simply due to the fact that the aircraft ascended into the stratosphere then they can be considered unimportant for tropospheric chemistry. However, if these air masses are active stratospheric intrusions, or the remnants of stratospheric intrusions (this seems to be the case for at least some of the trajectories in Figure 4), then the paper should address whether or not the stratosphere makes an important contribution to tropospheric ozone during August above the eastern Mediterranean.

Finally, it would be very helpful to the reader if the authors gave a general description of the meteorological situation associated with each trajectory cluster (similar to that given for the South Asian cluster).

Specific Comments:

The meteorological and transport description in Section 3 is very well done. A helpful addition to this description would be wintertime and summertime schematic drawings, showing the major meteorological features surrounding the Mediterranean with arrows showing the major transport pathways to the eastern Mediterranean.

Section 5. How were the trajectories clustered and how were the source regions determined? Was a clustering routine used or were they examined visually?

Section 5.1 When describing the trajectory paths describe the vertical motions as well.

ACPD

3, S10–S15, 2003

For example, do the western trajectories show more descending motion that the eastern traj? It would be helpful to indicate how many descended from the free troposphere into the atmospheric boundary layer (ABL) (you might simply look at all traj. that drop below 2 km), and how many remained above the ABL but then descended just as they approached the flight track. If you get distinct groups where some remain close to the surface but others are mostly in the free trop then check to see if this explains more of the chemical variance. It would also be very helpful to the reader to explain the typical meteorological situations associated with the different pathways. For example do the westerly traj. approach the flight region behind an advancing cold front (albeit in summer a weak cold front)? Presumably the meteorological situation would be very different for the easterly traj., and the reader should be informed of this.

The trajectory plots in Figure 2 are very small. They would be clearer if each panel were larger. Then focus on the actual trajectories so that they fill the panel. It would also be very helpful if the trajectories were colored according to their altitude.

Explain in more detail why you are examining 2-day trajectories. Aren't they the same as the 5-day traj, except you are only examining the first 48 hours? Do you expect that these shorter traj. will indicate more direct and faster transport, and bring fresher emissions to the eastern Mediterranean? Is the overall vertical motion different when trajectories are examined for two days rather than five days?

Section 5.2 What evidence is there that the 2-4 km trajectories from the west, that also pass over the Atlantic, would acquire high levels of pollution over the ocean? Are these oceanic polluted air masses from Europe or North America? Normally the transport times over the ocean lead to dilution and one would expect less pollution over the ocean than over heavily populated western Europe. Do the traj from the Atlantic pass through the ABL of western Europe where they can pick up pollutants, or do they travel to the flight region in the free troposphere?

Page 116, line 26-28 Make it clear that you are presenting mixing ratios for the 2-day

ACPD

3, S10–S15, 2003

trajectories, rather than the 5-day traj.

Section 5.4 Page 117 line 23-24 How many of the NAONA trajectories come from the lower troposphere above North America? What are the mixing ratios associated with these traj?

Page 118 As discussed in the "General Comments" above, remove the stratospheric traj. and conduct a separate analysis.

Page 118 line 28 The paper states that mixing ratios above 80 ppbv indicate a direct continental influence. Please clarify what you mean by "direct". Do you mean transport of just a few days? Very aged air masses can have summertime CO greater than 80 ppbv.

Technical Corrections:

Below are my suggestions for technical corrections. Words written in capital letters are words that I think should be added, or are words that I have substituted for other words.

Abstract, line 7 from the NORTH Atlantic Ocean

Abstract, line 14 mean TRACE gas mixing ratios

Abstract, line 15, higher than THOSE from western Europe

Page 108, line 23 long-range TRANSPORT of pollutants

Page 109, line 3 air mass TRANSPORT

Page 109, line 4 categorized INTO particular clusters

Page 109, lines 20 and 23 Use Section instead of Sect.

Pate 110, line 3 Average accuracy WAS 1%

Page 110, line 15 5% and 15%, RESPECTIVELY

Page 111, line 7 Monthly and INTERANNUAL variability

ACPD

3, S10–S15, 2003

Page 111, lines 11 and 12 Rearrange this sentence to read: leads to northerly flow in the lower atmosphere toward the Mediterranean area.

Page 111 line 15 under the DESCENDING branch

Page 112, line 16 Rearrange this sentence to read: the FLEXTRA trajectory model

Page 113 line 10 backward-trajectories WERE computed

Page 113 line 10 Replace the sentence beginning with "As starting pointĚ.", with: Trajectories were initialized at every minute along the Falcon flight tracks.

Page 113, line 15 I was a little confused with the discussion of trajectory ending and starting points. I think you mean to say: i.e. the INITIALIZATION points of the back trajectories. This implies, FOR EXAMPLE, THAT all trajectories with INITIALIZATION points between 4 and 8 km are attributed to one height level regardless of ALTITUDE 5 days earlier.

Page 113 line 21 Measured values WERE converted

Page 114 lines 9 and 10 Some trade gases are chemically formed from PRECURSOR gases that are emitted elsewhere.

Page 114, line 20 AS A RESULT, 184 of the 2690 computed back trajectories (6.8%) were disregarded.

Page 114 lines 22-25 Ě..we distinguish BETWEEN air masses from western Europe (notably France, Germany and northern Italy) and eastern Europe.

Page 116 line 16, Ěchange only slightly, AS nearly all 5-day trajectoriesĚ.

Figure 3 This image is not very clear. Please use a bright color for the fire locations and replace the shaded region with a box that outlines the defined region.

Figure 5 would be much clearer if the images were larger.

ACPD

3, S10–S15, 2003

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 107, 2003.