Atmos. Chem. Phys. Discuss., 3, S577–S582, 2003 www.atmos-chem-phys.org/acpd/3/S577/ © European Geophysical Society 2003



ACPD

3, S577–S582, 2003

Interactive Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

© EGS 2003

Interactive comment on "Hygroscopic properties of different aerosol types over the Atlantic and Indian Oceans" by A. Maßling et al.

A. Maßling et al.

Received and published: 20 May 2003

Dear referee,

thank you for your detailed discussion and hints. Here are my answers to your comments.

Comment number 1: I know that this is a very complex dataset. I have tried to make more links between the different parameters and methods presented in the paper in the new version. But I think it is a good way presenting the data in series, because otherwise the discussion can no longer be followed.

Comment number 2: This is done now.

Comment number 3: You are right, this has been found and is already changed in the new version.

Comment number 4: This is right, the ratio was not always higher, but we have no evidence for less cloud processing for that time period.

Comment number 5: This is discussed now and a plot of the ion balance is presented.

Comment number 6: This was already mentioned, but is now more emphasized.

Comment number 7: This is done now in the new version.

Comment number 8: In a first version of the manuscript, I did not have these sections 4.2-4.4. The discussion was very confusing and this was the reason for sectioning the different measured parameters. I think, since I have made some changes in the text, the sectioning makes the manuscript easier to read and to understand for the reader.

Comment number 9: Here, it is important to emphasize, that the continental influence can be verified although air masses had land contact several days before they reached the ship and this is written in the text. O. k., lines 15-22 are left out.

Comment number 10: Both are polluted air masses. This is true! But for period 9, there is something special, because these air masses crossed the continent right before they reached the ship. For this reason, we can see these nearly hydrophobic - nearly non aged - particles in the growth distributions.

Comment number 11: Sorry, this was a mistake. It is changed now in the new version.

Comment number 12: You are right. Sodium chloride was found during leg 1 and 3, but also during leg 2 (leg 2: here only for accumulation mode particles). The problem is that it only occurred sometimes for a short time period and that concentrations were in general very small for the marine air masses. Furthermore, we have no data for 250nm-particles for the first two time periods at 90 % RH. I have made changes in the text, which will explain this in more detail.

Comment number 13: Sorry, this was a mistake. It is changed now in the new version. Comment number 14: This is true. I have included a more intensive discussion on this **ACPD** 3, S577–S582, 2003

> Interactive Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

issue in the text now.

Comment number 15: This is changed now in the new version.

Comment number 16: O.k., this is left out now.

Comment number 17: You are right, probably these modes exist, but the system is not capable to separate!

Comment number 18: This is not always the case. We have made a study at a continental site in Germany. For this continental aerosol, we found - running a solubility model - that the hygroscopic behavior was different at 75% and at 90% RH. This is dependent - in my view - on a complex chemical composition for this site which means that at 90% RH most of the particle composition is soluble and at 75% RH some compounds are already crystallized! This seems not to be the case for the Aerosols99/INDOEX aerosol and is said in the text.

Comment number 19: Section 4.5.3 and 4.5.4 are now combined. There is now more information in the text in the new version.

Comment number 20: As discussed before, there was also found sea salt in the second stage for this time period. This is changed now in the chemistry chapter. There is a more detailed discussion now in the text.

Comment number 21: This is changed now in the new version.

Comment number 22: Yes, this behavior was typical for the determined dataset. There is now more general information in the text.

Comment number 23: Figure 5-6-7-8 are replaced by figures showing hygroscopic growth in dependence of dry size and air mass type and only for 55% and 90% RH.

Comment number 24: There is more information in the text now. The graph is simplified to point up the main differences. I think, including another curve makes the picture too complex.

3, S577-S582, 2003

Interactive Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

Comment number 25: You are right. This is a repetition and is now left out in the new version.

Comment number 26: This suggestion is included now in the new version.

Comment number 27: This is true. I did not mean internal mixing, but the fact that the HTDMA could not separate these modes. This is now stated more clearly in the text.

Comment number 28: There is now clearly stated in the text, which statements can be derived.

Comment number 29: This is added now in the new version.

Comment number 30: Sorry, but I can not agree with you. The overestimation at 30% and 55% RH is only very small, maybe a few percent. But the rise in growth from 75% to 90% RH is very obvious. You might find this for deliquescence salt components. But in our system, all particles are humidified to values higher than 85% RH before growth spectra are taken at 75%, 55%, and 30% RH as described in the text. In my view, there is only OC which can be responsible for this interesting behavior. (see also comment 16 from review 1 and my comment)

Comment number 31: The problem is the following. You always can try to fit several modes to a distribution which shows only one characteristic mode. The question is: what is physically reasonable? You do not know if these fractions really appear in two different modes. As the fractions are externally mixed, they can have at low RH the same growth factors! For this reason, we choosed a parameterization which only allows several modes if really observed in the growth distributions. Please notice, that - if there are two modes at low RH - these growth factors would only differ with a few percent. The sharp increase from 75% to 90% RH will have a reason in the chemical composition assuming that organic material plays an important role here.

Comment number 32-34: Solubility: As discussed in the paper, the uncertainty in calculation of soluble particle volume fractions is very high (~ 25 %). This makes conclu-

Interactive Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

sions much more difficult to draw. For these data, it seems to me, that the solubility calculations do not bring much progress for the paper as they express statements that already were made in the hygroscopic growth section. It is right that it would be interesting to make some closure studies with the chemistry data by using external and internal mixing, solubility and number fractions. But the uncertainty in chemical data and solubility calculation together do not allow us to make this closure for individual time periods. I have checked this and you can read this in my thesis (dissertation: Maßling, Leipzig, 2001). At the moment, a diploma student is working on a new sectional solubility model. We will try to present these solubility model in an individual paper (hopefully at the end of this year) and then show a comparison of different data (continental site/INDOEX). For this reason, I have decided to shorten the manuscript by leaving out the solubility section which will be presented in another paper in a more comfortable style. I think, that this manuscript is already long enough and contains a sum of interesting issues.

Comment number 35: The time periods summarized in the paper were assembled in an international Aerosols99/INDOEX workshop. We principally found marine air masses, continentally influenced air masses, and this special Indian Subcontinent air mass (period 9) which was extremely continentally influenced, because the transportation time was really short between the ship and the continent. A transport study would be difficult and allocated with high uncertainties, because a lot of trajectories (having the same origin, but showing differing transportation times between the ship and the continent) are here averaged to a certain time period. For this reason, we decided to characterize the air masses by their origins and not by their transportation times between the ship and the continent.

Technical corrections:

Comment number 1: This is done now.

Comment number 2: This is done now.

3, S577–S582, 2003

Interactive Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

Comment number 3: This is done now.

Comment number 4: This is done now.

Comment number 5: This is explained more clearly in the text now.

Comment number 6: This is left out, because there is a description in the text now.

Comment number 7: This is done now.

Comment number 8: This is done now.

Comment number 9: This is left out now.

Comment number 10: This is changed now. Referring to back trajectories, it was the Sahara Desert.

Comment number 11: This is done now.

Comment number 12: This is done now.

Comment number 13: This is left out now.

Comment number 14: This is changed now.

Comment number 15: This is changed now.

Figures:

Comment number 1: This is done now.

Comment number 2: This is done now.

Comment number 3: Figure 5-6-7-8 are replaced by figures showing hygroscopic growth in dependence of dry size and air mass type.

Comment number 4: This is explained in the caption now in the new version.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 135, 2003.

3, S577-S582, 2003

Interactive Comment

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper