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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Springtime carbon episodes at Gosan background site revealed by total carbon, stable carbon isotopic composition, and thermal characteristics of carbonaceous particles" *by* J. Jung and K. Kawamura

Anonymous Referee #3

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Aerosol particles play an important role in atmospheric chemistry and physics. They have an impact on the Earth's radiation budget and thus on climate both on regional and global scales. The various direct and indirect sources of these particles, their complex composition and the change of composition - associated with that their chemical and physical properties - during atmospheric transport and aging makes it extremely diffcult to assess their impact quantitatively. To improve our knowledge in this respect and to develop appropriate mitigation strategies the sources and composition of aerosol particles have to be investigated using sophisticated approaches.

The paper reports investigations of aerosol particles from filter samples taken at the Gosan site on Jeju island. The authors provide a conclusive study on the origin of aerosol particles combining the information of chemical composition, stable carbon isotope ratios and thermal characteristics. They combine these different measurements with backward trajectories and satellite remote sensing data. This is a laborious but excellent approach to gather the necessary information of aerosol composition and source attribution. The paper contains new and interesting results and certainly merits publication in ACP. However, major revisions are needed before publication.

In many chapters the paper contains a lot of information and a lot of data which makes it a bit hard to read and to follow the arguments. Although I have presently no good idea how to do that, I suggest to improve the structure of the paper, maybe by presenting some of the information using additional Figures or Tables. English is not my native language, but to my mind the paper should be necessarily corrected by a native speaker

Major comments:

The abstract is too long and contains too much details. I suggest to shorten and rewrite the abstract describing the problem, the main approach, then highlighting one or two important results and the main conlusions.

How is a „carbon episode" defined. From Figure 2 it is not very clear how the authors distinguish between the different episodes. The differences are not really recognizable. Since obviously TC is used, what is the threshold and what is the reason for that? There is s significant difference between the pollen episodes in 2007 and 2008. What justifies this differentiation?

Actually, the separation into the different episodes is the weakest point of the whole paper and the main target for criticism. Reading the paper raised a number of questions concerning this point (not necessarily in the correct order).

The HYSPLIT trajectories give only a rough estimate of the origin of air masses. Usually, it is difficult to calculate trajectories within the PBL. The measurements were done at the ground. I do not know the conditions at the site, but what were the local effects that can significantly alter the composition of an air mass? Looking at Figure 4, the trajectories look very similar for the diefferent epsiodes. For which dates are the trajectories calculated? For instance, some of the red and white trajectories also pass over the Nei Mongol desert. Is there no advection of dust particles in these cases? How did you rule that out?

Samples were collected over several days. How did the back trajectories change during the sampling period? How did local effects such as local winds influence the samples? Is the strict separation into these espisodes justified looking at an ensemble of back trajectories for that period?

The plots given in Figure 3 give the MODIS data for two specific days to show the difference of the LTP an AD episodes. Do these data (AOT and Angstrom exponent) look the same for all days during these episodes? Are any of the back trajectories shown in Figure 4 for these days? How did the MODIS data and the back trajectories look like during the pollen episodes?

What exactly is the difference between the EC and NEC episodes? The back trajectories in both cases start somewhere in Mongolia. What parameters justify this distinction?

What justifies the distinction between the weak AD episode and the LTP episode? In the text the authors state that the trajectories originate in NEC in this case.

I suggest, the pollen epsiodes describe very local phenomena? What was the meteorological situation in these cases? What specifies a pollen episode? Did you sample only pollen during these episodes? Or was it a mixture with a large contribution of pollen? Are the corresponding data given in Table 2 really only pollen? How did you separate the pollen from other particles? What was the fraction of pollen during the

other episodes? The conlcusion given in the abstract (page 13868, lines 19-21) and also in the conclusion „The negative correlation ... These results suggest ..." is not clear to me. If 45 % of the TC was due to pollen, what was the rest?

The authors should specify what „authentic standard pollen" is? How is it prepared? How representative is it? What is the origin of oxalic acid on these pollen, the stable carbon isotope ratio of which is given in Table 3?

Can you give any information about the origin of the air masses outside of the „carbon episodes"? The carbon isotope ratios shown Figure 6a for the non-episode samples seem to indicate aged particles or aged organic compounds on these particles during these episodes.

I do not understand the interpretation on page 13879 regarding the TC/TN ratios as well as on page 13883 regarding citric acid and the respective carbon isotope ratios. I have the impression that there is a lot of speculation and their might be either a lot of other possible reeasons to explain the observed data. For instance, how large is the adsorption efficiency of citric acid? Is there any information available? Is it ever possible to load pollen or other particles with this compound during the last minutes or hours of transport to the measurement site? What is the distance of the tangerine plantation to the site and what is the transport time? How large is the plantation and how long are the „contact times" for citric acid to stick on the particles at the observed wind speeds? Is that a realistic explanation?

Summarising all these points I think the conclusions drawn from the results are not always comprehensible. Since the focus of this paper is an identification of the origin and composition of aerosol particles, it is absolutely necessary to clarify the distinction of the different episodes.

Minor points that should be clarified:

Figure 1 is not cited in the text.

Page 13873. lines 19-21: What type of standard was used? On page 13874 a C_{13} standard is mentioned, on page 13875 a mixture of alkanes. Which was used for what? What is an appropriate amount? What was the „theoretical“ value the measurements were compared with and how was it obtained?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 13867, 2011.