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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Long-term chemical characterization of tropical and marine aerosols at the CVAO: field studies (2007 to 2011)" *by* K. W. Fomba et al.

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This is a very interesting paper on chemical composition of PM10 aerosols in a marine

environment in Cape Verde. In the paper, authors analyzed the variability, the origin and the influence of long range transport of a set of ions, organic carbon and elemental carbon. Mineral dust is estimated and used for identifying periods of desert dust transport from North Africa. The analysis includes back-trajectories. The paper introduces an important data base that contributes to know about the chemical composition of aerosols transported through North African and the tropical North Atlantic.

I have just some minor constructive comments about the discussion of the origin of some chemical components (sulphate, nitrate, ammonium) during dust events. Chemical composition of aerosols is a topic of major interest in Izaña GAW observatory (http://www.atmos-chem-phys.net/11/6663/2011/acp-11-6663-2011.pdf). In this paper, I see that behavior of some components in CVAO is similar to that we observe in Izaña observatory, even if the CVAO and Izaña are within different parts of the troposphere: i) Izaña is in the free troposphere, where the aerosol background is extremely low (sea salt under detection limit), ii) CVAO is in the marine boundary layer, exposed to trade winds with important amounts of sea salt.

I will go through specific comments.

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SULPHATE

Authors said (section 3.3.3):

-The highest sulfate concentrations were strongly connected to Saharan dust events but not all dust events were responsible for the elevated sulfate concentrations.

The same behavior is observed in Izaña free troposphere site (http://www.atmos-chem-phys.net/11/6663/2011/acp-11-6663-2011.pdf).

Have authors done any other analysis about the origin of sulphate during dust events ?

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By using ammonium data, nss-sulphate may be split into two components:

Ammonium-sulphate (a-sulphate) + none-ammonium-sulphate (na-sulphate)

Inzaña, by using MCAR based backtrajectories analysis, we found that (above link):

-a-sulphate was strongly linked to transport from regions with important industrial emissions in Morocco, Algeria and Tunisia.

-na-sulphate was highly influenced by transport of some gypsum / anhydrite minerals from regions were dry lakes were abundant (in parts of Algeria and Tunisia), although anthropogenic na-sulphate may also contribute.

This discussion is not included in this paper (although authors cited potential influence of anthropogenic SO2 emissions in North Africa, without any other specification). Authors have already calculated back-trajectories and they have ammonium data as well. To do a similar analysis with the data collected in CVAO may contribute to identify other source regions of the pollutants mixed with dust; for example regions located southern than the Canary Islands for which Izaña is not sensitive (e.g. Mauritania). This could be included in this paper, or be subject of a further publication.

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AMMONIUM AND NITRATE

Authors said (section 3.3.5):

- Ammonium and nitrate showed no correlation amongst each other. Apparently, these ions had different major sources

During dust events at Izaña it is observed (above link) that:

-ammonium is present as a-sulphate mostly in the PM2.5 fraction, whereas nitrate is mostly present in the coarse fraction (2.5-10 microns) as a none-ammonium salt.

-both ammonium and nitrate are linked to transport from regions with important indus-

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trial emissions in Morocco, Algeria and Tunisia.

Probably, the lack of correlation between ammonium and nitrate is not a matter of source region, but probably to a question of thermodynamic stability of ammonium-nitrate.

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CALCIUM

In this paper, Ca is presented as soluble (Ca+2).

Unpublished data we have produced at Izaña shows that 64% of Ca (total elemental calcium) is as Ca+2, as average during dust events.

Section 3.3.6, authors said:

A strong correlation between nss-calcium and total calcium (with r2 = 0.98) during dust events 10 confirmed that the Saharan dust was the main source of nss calcium in these samples

What do authors mean with total calcium?, total elemental calcium (Ca) or total soluble Ca (Ca+2 = nss-Ca+2 + ss-Ca+2)?

As already said above, in Izaña Ca is linked to transport of evaporites dust minerals (CaCO3, gypsum and anhydrite) from dry lakes of North Africa.

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SUGGESTION

Because of the strong impact of dust events on the chemical composition of PM10, I think that it would be interesting that mean concentrations of each compound be also presented during none dust events and during dust events; e.g. included in Table 2.

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Finally, these are just some minor considerations that came to my mind after reading this interesting paper. Authors have a very nice data base which will be very useful for further studies. I hope these comments may help.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 3917, 2014.