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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evidence for ships emissions in the Central Mediterranean Sea from aerosol chemical analyses at the island of Lampedusa" *by* S. Becagli et al.

Anonymous Referee #1

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The paper report on measurements of the chemical composition (mainly V, Ni, sulphate) of aerosols collected on the island of Lampedusa during the 2004-2008 period. Data are used to identify and quantify the contribution of ship emissions on Central Mediterranean aerosols.

The dataset is, no doubt, valuable. But the elaboration/interpretation of it is often twisted and forced to demonstrate ship emission influences making use of assumptions groundless in some cases, and wrong in others. For these reasons, the paper, in the present form, does not meet ACP standards and the reviewer recommends for rejection.

My detailed comments:

- V and Ni are assumed as specific tracers for ship emissions. This assumption is not completely correct as V and Ni are tracers for any combustion process of heavy oils and not for ship emissions only. The V/Ni ratio could be specific marker for ship emissions but only in case the range of the ratio characteristic for ships emissions would be significantly different from that one for other heavy oil combustors.

- Ni/Si and V/Si ratios are introduced to distinguish cases dominated by heavy oil combustion from those most influenced by Saharan dust. The authors considered enriched samples those with a ratio V/Si (or Ni/Si) 10 times higher than that one specific for crustal sources. But what is the value for the latter and what the reference for it? And more, what this factor of 10 represents? It appears this limit has been arbitrary fixed by the authors. Furthermore, Figure 1 shows that this criterion fails, as a not negligible number of cases with Si concentrations larger than 800 ng m-3 shows a Ni/Si ratio 10 times higher than that one characteristic for crustal sources. The authors assume that Si concentrations larger than 800 ng m-3 identify Saharan dust events. And again, where this limit value comes from?

- The authors introduce also Vsol and Nisol as additional criteria to discriminate between crustal events and ship aerosol cases (lines 28-29) and set, in an arbitrary manner, a threshold of 6 ng m-3 for V sol claimed as a better tracer for antropic sources (line 25). In Table 1 they show a higher solubility for V and Ni in ship events than in pure Saharan dust events. This reviewer believes that in no case an extensive property, as Vsol, can be considered appropriate to discriminate different sources. For example, despite the lower solubility of V in natural aerosols, V concentrations larger than 6 ng m-3 can be reached during important dust events.

- The ratio Vsol/Nisol for events classified as anthropogenic-influenced (on the basis the Vsol > 6 ng m-3) does not differ significantly from that obtained for events classified as crustal, 2.98 vs 2.54, respectively. This indicates that i) either the ratio is not specific

ACPD

11, C14173–C14175, 2012

Interactive Comment

for one or the other source and/or ii) aerosols comes, in fact, from different sources and they are not pure Saharan dust or ship events.

- The method used to calculate back-trajectories is based on an oversimplifying assumption i.e. that wind follows a uniform and linear behavior both in terms of direction and speed. An assumption that can be true only for a very limited space and time, if at all. Back-trajectories should be calculated using more robust tools, e.g. HYSPLIT.

- The authors, making use of the entire available database i.e. without any data filtering, study the relation between nss-sulphate and the Vsol and proposed a criterion to estimate the contribution of ship emissions to nss-sulphate concentrations at Lampedusa, i.e. minimum regression slope, SO4/Vsol = 200. The authors assume that that for the points lying on the curve y=200x, nss-SO4 and Vsol arise from the same source, i.e. ship emissions. The approach is however not valid. For example, those points could represent aerosol dominated by crustal components as both nss-SO4 and Vsol are also characteristic components of dust and neither nss-SO4 nor Vsol have been corrected for dust contribution. Further, the fact that those points correlate does not necessary mean that nss-SO4 and Vsol come from the same source. Meteorological conditions can favor the accumulation of both components from different sources which then correlate.

- Finally, even if a properly derived criterion involving V and/or Ni had been available among the many mentioned in the ms, then this criterion would have traced the contribution of all heavy oil combustion emissions including not only mobile, as concluded by the authors, but also fixed sources which are neglected in the whole paper. To be completely rigorous.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 29915, 2011.

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