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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Attribution of Atmospheric Sulfur Dioxide over the English Channel to Dimethylsulfide and Changing Ship Emissions" *by* Mingxi Yang et al.

Anonymous Referee #1

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General comments

This is a well written and novel paper which uses observations from the Point Penlee Atmospheric Observatory to explore the importance of ship and biogenic sources to SO2 over the English Channel. The measurements reported are a valuable indicator of the effectiveness of Sulfur emission reduction schemes. The scientific questions explored are well within the scope of ACP and I recommend publication after the following minor recommendations are addressed.

Specific comments

Page 2 line 17 suggest 'source to' replaced with 'contributor to'

Line 20 " aerosols resulting from ship emissions contribute to tens of thousands of cases of premature mortality" Suggest insert 'cases of'

Page 4 line 2 "SO2 and O3 were blanked simultaneously"- blanked could be mistaken for capped off. Suggest 'blank measurements of SO2 and O3 were made simultaneously. . ."

Line 4 "We checked the calibration of the SO2 instrument occasionally" – be more specific about frequency – whether monthly, yearly etc

Page 4 line 8. SO2 measured at a height of 2m and CO2 at 18m. This is a significant height difference and I wonder might lead to de-coupling of air masses sampled at different heights? (particularly important for FSC calculations). Is there a measure of wind direction, speed at these two heights for comparison?

Page 4 Results A map of the Southern part of UK with the location of the observatory is needed to give perspective to where the observatory sits in relation to Plymouth Sound and the English Channel. This is provided in Yang et al 2016 but would also be useful here. Currently statements such as Page 4 line 24-25 "The wind sector between 110 and 250 deg is completely unobstructed by land" is not obvious looking at Fig 1.

Page 4 line 22 The wind rose shows 2 distinct dominant wind directions (SW and NNE). Suggest add a sentence describing land use/potential sources to the NNE.

More generally, the wind rose shows there is a low frequency of winds from the SE, with data from this direction an important focus of the paper. Could the authors describe how many hours of data they have used from the SE and SW directions respectively in their analyses?

Line 26 "Winds from between 50 and 110 deg face the eastern side of the Plymouth Sound, which is busy with ship traffic." Please provide an estimate of the volume of ship traffic for both the English Channel and Plymouth Sound.

Page 5, line 5 "The lowest SO2 mixing ratios were observed in the western, terrestrially-

influenced wind sector in both years" It's not clear from Fig 1 that western direction is terrestrially influenced, hence need for a more regionally-scaled map

Page 5 line 13 "A lower, broader peak in SO2 can also be observed between about 18:30 to 20:00 UTC." This SO2 peak seems to correspond with a decrease in O3, but not an increase in CO2 which would be expected to be enhanced alongside SO2. Please comment on this.

Line 19 ". . .as well as the busiest part of the shipping lanes." Could a figure be included which shows the shipping density in the SE versus the SW direction?

Page 6, line 14 "Recently-calibrated transmission efficiencies from the manufacturer (Ionicon, Austria) and kinetic reaction rates from Zhao and Zhang (2004) were used to derive the DMS mixing ratio." As DMS was not specifically calibrated during measurements, please provide an estimate of measurement uncertainty. Please comment on how this uncertainty impacts the diel amplitude of DMS and the calculated mixing ratio of SO2 from oxidation of DMS.

Page 8 Line 29 In addition to the horizontal distribution of ship plumes, please comment on the likely vertical distribution of ship plumes observed at PPOA, which may be especially important given the different inlet heights of SO2 and CO2.

Page 9 line 6 "A ship 100 km away would have a plume that is observable for nearly an hour". Suggest add 'theoretically' to this sentence, as significant dilution of plume over 100km would make detecting enhancement of SO2 and CO2 very difficult?

Page 10 line 13 – how does the absolute FSC % from PPOA compare with recent estimates by Kattner and Beecken 2015?

Page 10 line 18 – please comment on how different inlet heights of SO2 and CO2 may add to uncertainty in estimating FSC

Line 22 "Long-term records of another tracer (e.g. nitrogen oxides or particle number)" Suggest that black carbon would be a better indicator for ship exhaust than particle

number, as particle number may be enhanced by local biogenically driven events.

Typing/technical errors Page 10, Line 20 A higher SO2' remove apostrophe after SO2

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