

Interactive comment on “Tropospheric NO₂, SO₂, and HCHO over the East China Sea, using ship-based MAX-DOAS observations and comparison with OMI and OMPS satellites data” by Wei Tan et al.

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Received and published: 21 August 2018

The manuscript “Tropospheric NO₂, SO₂, and HCHO over the East China Sea, using ship-based MAX-DOAS observations and comparison with OMI and OMPS satellites data” by Wei Tan et al. describes a nice combination of different measurement techniques to produce a very interesting data set of NO₂, SO₂ and HCHO VCDs to validate satellite retrievals. The individual measurement techniques are well established, so the paper is not presenting a novel idea, but rather a thoroughly executed concept to produce a very valuable satellite validation data set. The conclusions are clear, but could

go into more detail. Can the results be used to improve satellite retrievals over similar marine areas? Does this study prove that ship emissions in this area are stronger than previously assumed? The scientific methods are described in detail, but I'm still a little confused about the MAX-DOAS retrieval. You describe two types of retrievals, a VCD retrieval based on a geometric AMF from one elevation angle (plus zenith for reference) and a more precise one based on optimal estimation using the full scan of 7 angles. If you have the time to perform full scans, why do you include the first VCD retrieval? Did you compare the two results, the VCDs from single elevation angles and VCDs derived from the profiles?

The MAX-DOAS retrieval provides aerosol profiles as a first step to derive trace gas profiles. Did you look at the aerosol profiles as well? Do they justify using the trace gas VCD retrieval based on the geometric AMF which doesn't account for aerosols? For the retrieval you calculate dAMFs anyway, why do you use a geometric approximation then? This part could be described in more detail, in order to avoid confusion about the retrieval process. Using only 2 elevations is typically used in a mobile setup when the concentrations change quickly, e.g. in traffic, and a full scan typically in a fixed setup where you have enough time under stable conditions to scan several elevations angles. Maybe you switch between the two scanning modes depending on what scenario is more appropriate? Your spectrometer covers the range 300-460nm, why don't you use the 400-460nm wavelength range for the NO₂ retrieval, where NO₂ has pronounced absorption structures and is less influenced by O₃ absorption? The presentation of the results is well structured and the title and abstract reflect the contents of the paper perfectly. The language is okay but there are a few sentences that could need some improvements as follows:

page 2, line 56 "quantify kinds of the atmospheric trace gases" -> "quantify different kinds of atmospheric trace gases" (that sounds more fluent to me, but it's just a suggestion)

page 2 line57 "Based on the DOAS principle, the quantitative of the trace gases was

acquired from the narrow band absorption structures of the different trace gases , which were separated from the broad and parts caused primarily by the atmospheric scattering and their broad band absorption (Platt and Stutz, 2008)” -> “The DOAS principle makes use of the fact that narrow trace gas absorption structures can be separated from broad band absorption and atmospheric scattering (Platt and Stutz, 2008)” (or something like that)

page 2 line 59 “The named Multi-AXis-Differential Optical Absorption Spectroscopy (MAX-DOAS) instrument is designed . . .”->“The Multi-AXis-Differential Optical Absorption Spectroscopy (MAX-DOAS) instrument is designed . . .”

page 3 line 69 “. . .trace gases concentrations. . .” -> “. . .trace gas concentrations. . .”

page 4 l98 “The cruise of ship-based observation” -> maybe just “The measurement cruise”?

page 4 line99 “The ship-based measurements campaign” -> “The ship-based measurement campaign”

page 12 line254 “. . .impacted by the airflows transport. . .” -> “. . .impacted by airflow patterns. . .”

page 12 line258 “. . .showed the air masses were came from inland area . . .” -> “. . .showed the air masses coming from inland areas . . .”

line272 “These two data sets time agreed well. . .” -> “These two data sets time agree well . . .”

All in all the authors present valuable results in a well structured paper and I recommend publication in ACP after the above mentioned comments have been addressed.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-578>, 2018.

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