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Reply on RC2

Dihui Chen et al.

Author comment on "Mapping gaseous dimethylamine, trimethylamine, ammonia, and their particulate counterparts in marine atmospheres of China's marginal seas – Part 1: Differentiating marine emission from continental transport" by Dihui Chen et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-258-AC2, 2021

(1) Between lines 140-145, the comparison was made between two different time periods and this might be meaningless unless the authors can provide strong rationale to do so. Also, conclusions made on the origin of the particulate $TMAH^+$ between lines 177-178 were based on similar comparison. Can the authors be sure that the $TMAH^+$ concentration was highest in summer than in any other seasons?

Response: The measurement data at the same coastal site during the period on November 15 to December 1 in 2019, two weeks before the campaign, were added in supplement material. The data also showed that the concentrations of TMA_{gas} were extremely low and close to the limit of detection. The corresponding concentrations of $TMAH^+$ observed were also extremely low and mostly undetectable during the cold period. Both the summer and the cold season data allow to draw the conclusion, i.e., the continental transport of TMA_{gas} and particulate $TMAH^+$ to downwind marine atmosphere was likely negligible.

(2) What are the backgrounds or interferences for both NH_3 and NH_4^+, the gaseous amines, aminum from the URG and potentially affect the measurement results?

Response: We speculate that the comments related to the deputy loop volume installed on the low-pressure injection valve. The limits of detection (LOD) for ions in AIM-IC are largely adjustable and almost completely determined by the user-chosen volume of the loop. We adopted the loop volume at 250 -2000 μL for measurements in different atmospheres to lower the LOD and gain reasonably accurate concentrations of these species. In this study, 250 μL loop was used by considering that high NH_{3gas} concentrations may occur in the marine atmosphere. The information has been added in the revision.

In our measurements, the major interference to aminium measurements was derived from the unexpected occurrence of K^+ interference. This had been mentioned in the method section and more data has been added in the revision.

Since 2014, we tried to measure NH_{3gas} and amine gases in various marine atmospheres. However, no reasonable data can be gained until 2018. We combined multiple NH_{3gas} analyzers and off-line denuder samplings during two cruise campaigns in 2016-2017, and found dew evaporation on the vessel surface with sunrise in the morning to be the major

positive sampling artifacts of these basic gases. To solve the problem, we designed a specific container to house the AIM-IC and set the container on the front deck, where human activities were rare, to measure NH_3, DMA_{gas}, TMA_{gas} and their particulate counterparts in $PM_{2.5}$. The approach works well based on simultaneous measurements made by the AIM-IC and denuder samplers in other cruise campaigns. In addition, we made intercomparison between the AIM-IC and denuder samplers in various coastal atmospheres since 2012. We didn't find high background and other interferences, except K^+ interference (Teng et al., 2017).

(3) The authors claim that the TMA and $TMAH^+$ are mainly from sea spray aerosols and hence they can be used as tracers for other basic compounds. Do the authors have any evidences between concentrations of the above two species and concentrations of sea spray aerosols or their makers? In addition, how confidence is for the measurements of the above two species?

Response: Na^+ in $PM_{2.5}$ over the marine atmosphere far away from the continents should be mainly derived from marine sources, especially the increased concentrations of Na^+ in $PM_{2.5}$ with increasing wind speeds at 10 m s^{-1}. In the revision, the sentence has changed to "while accompanying with high concentrations of Na+ under high wind speeds as commonly assumed to be indicators of sea spray aerosols (Feng et al., 2017)."

The increased TMA_{gas} with increasing wind speeds in the remote marine atmosphere is also an important evidence to release TMA_{gas} through the air-sea exchange. Theoretically, increasing wind speeds in the remote marine atmosphere should decrease concentrations of TMA_{gas} derived from those emissions other than the air-sea exchange.

Please see our response to Comment 2.

(4) Rather minor: there are no section numbers for introduction and the second section.

Response: Sorry for this and corrected.