Supplement of Atmos. Chem. Phys., 22, 1515–1528, 2022
https://doi.org/10.5194/acp-22-1515-2022-supplement

Supplement of

Mapping gaseous dimethylamine, trimethylamine, ammonia, and their particulate counterparts in marine atmospheres of China's marginal seas – Part 2: Spatiotemporal heterogeneity, causes, and hypothesis

Yating Gao et al.

Correspondence to: Xiaohong Yao (xhyao@ouc.edu.cn)

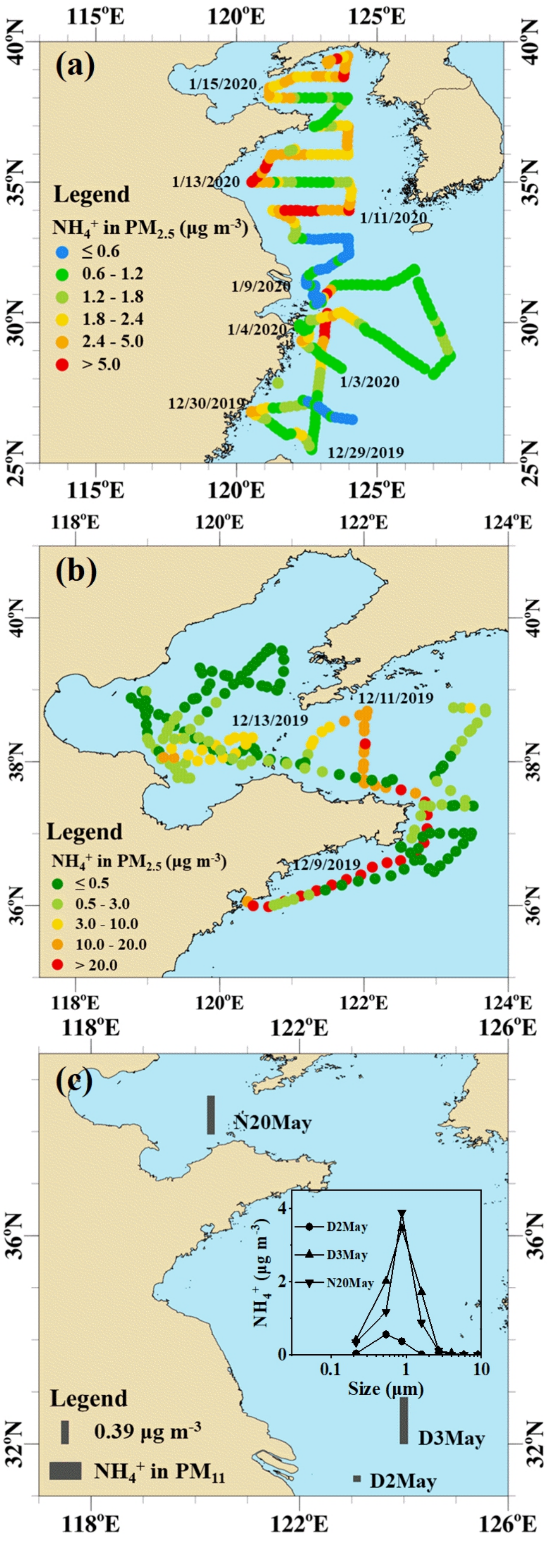

Figure S1: Map of particulate NH_4^+ in marine atmospheres during three campaigns: (a) Campaign B, (b) Campaign A, and (c) Campaign C, size distributions of particulate NH_4^+ was superimposed in (c). D2May, D3May, N20May represent samples collected in the daytime on May 2 and 3, 2012, and in the nighttime on May 20, 2012, respectively.

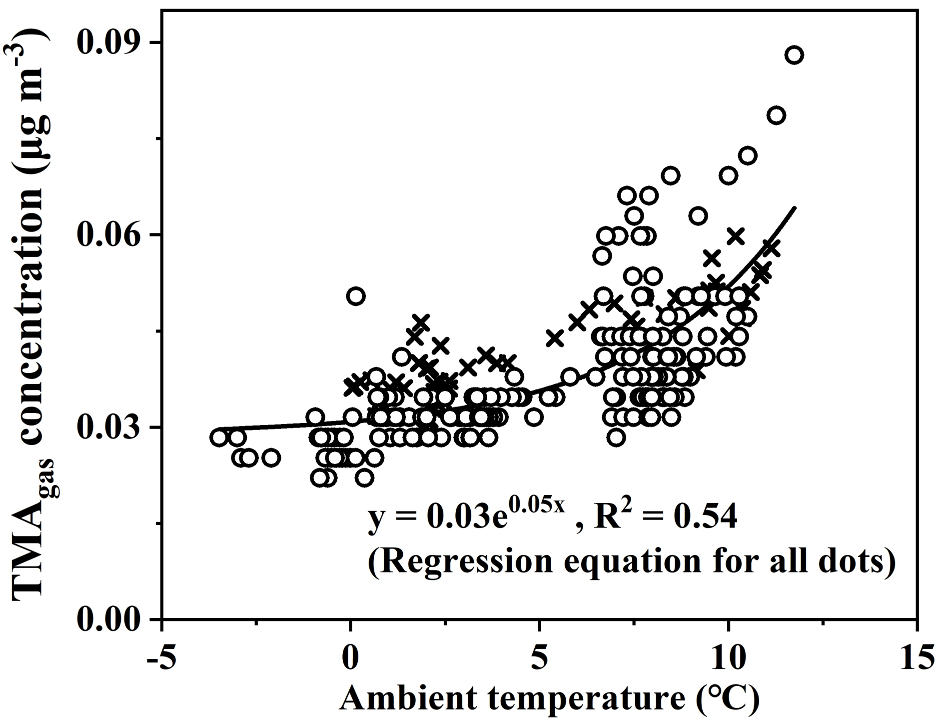

Figure S2: Correlation of TMA_{gas} with ambient temperature (open circle and cross represent data collected in Campaign B and a particular period of Campaign A, respectively).

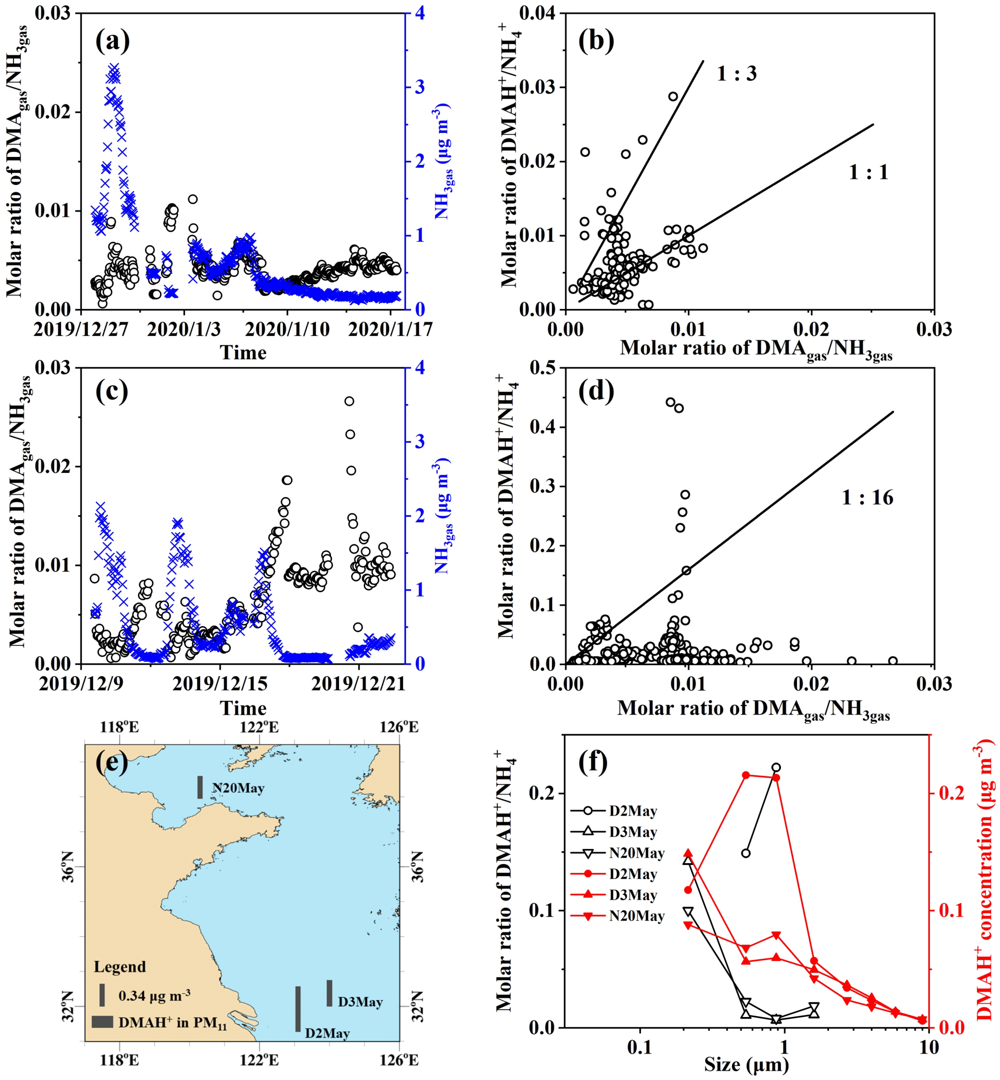

Figure S3: Time series of molar ratios of DMA_{gas}/NH_{3gas} (a) and (c) in Campaign B and A; correlation between DMA_{gas}/NH_{3gas} and $DMAH^+/NH_4^+$ (b) and (d) in Campaign B and A; map of particulate $DMAH^+$; (e) and size distributions of $DMAH^+/NH_4^+$ and mass concentrations of $DMAH^+$; (f) in Campaign C.

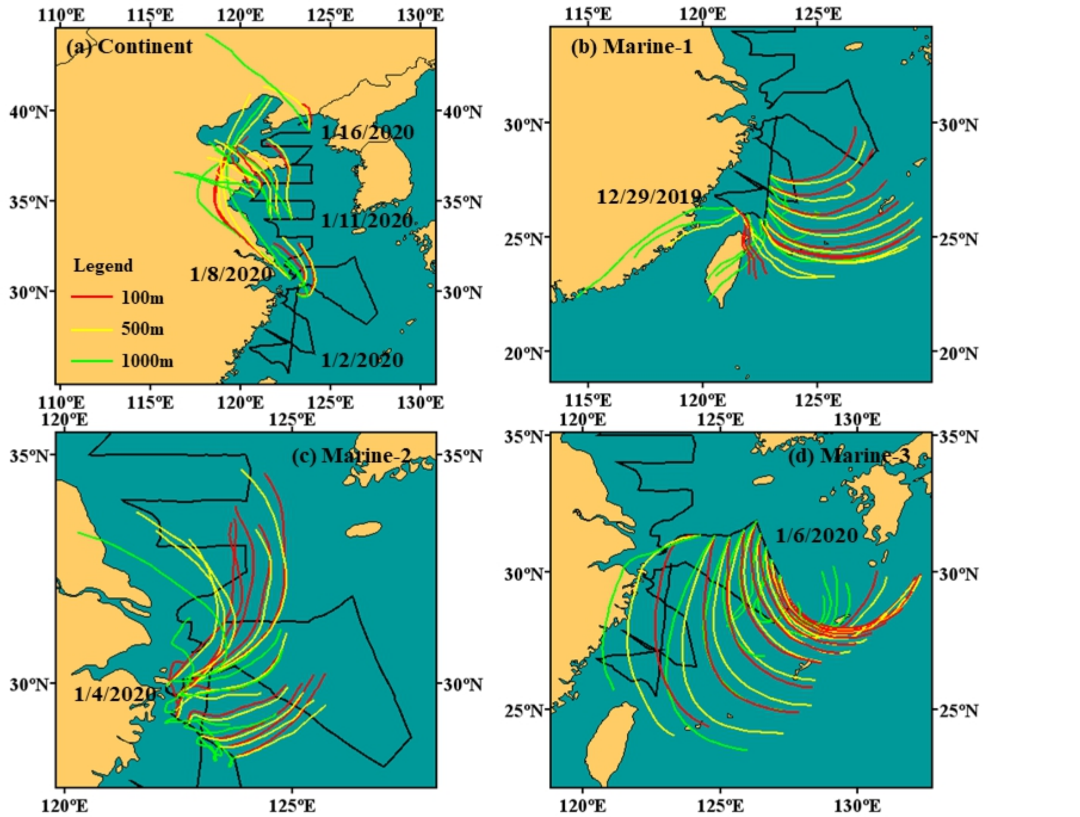

Figure S4: The 24-hr air mass backward trajectories at 100m, 500m, and 1000m above sea level during Campaign B corresponding to the samples (a) when the concentration of NH_4^+ exceeded 5 μg m^{-3}, (b) during $Peak_{TMAH}$-1, (c) during $Peak_{TMAH}$-2, and (d) during $Peak_{TMAH}$-3. The black solid lines represent the campaign cruises.

Equations S1-4

$$K_H(DMA) = aDMA/pDMA = mDMA \cdot \gamma_{DMA}/pDMA \quad \text{(S1)}$$

$$K_b(DMA) = (aDMAH^{+} \cdot aOH^{-})/(aDMA \cdot aH_2O)$$

$$= (mDMAH^{+} \cdot mOH^{-}/mDMA) \times (\gamma_{DMAH^{+}} \cdot \gamma_{OH^{-}}/(\gamma_{DMA} \cdot aH_2O)) \quad \text{(S2)}$$

$$mDMA_{(eff.)} = mDMA + mDMAH^{+} = pDMA \cdot K_H(DMA) \cdot [1 + K_b(DMA)/mOH^{-}] \quad \text{(S3)}$$

$$^{(eff.)}K_H(DMA) = mDMA(eff.)/pDMA \ = K_H(DMA) \cdot [1 + K_b(DMA)/mOH^{-}] \quad \text{(S4)}$$

where $^{(eff.)}K_H$ (DMA) is the effective Henry's Law constant of DMA, including the undissociated amine and aminium cation. K_H is the Henry's Law constant (mol kg^{-1} atm^{-1}), K_b is the base dissociation constant (mol kg^{-1}), the prefix m indicates molality (mol kg^{-1}), and p is the partial pressure (atm).

According to the Eqs. S1-4, the effective Henry's Law constant is a function of pH and temperature. The same is true for TMA and NH_3.