Ammonium dynamics in the South China Sea-Kuroshio and the mid-Atlantic Shelf Break frontal zones

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Study Area

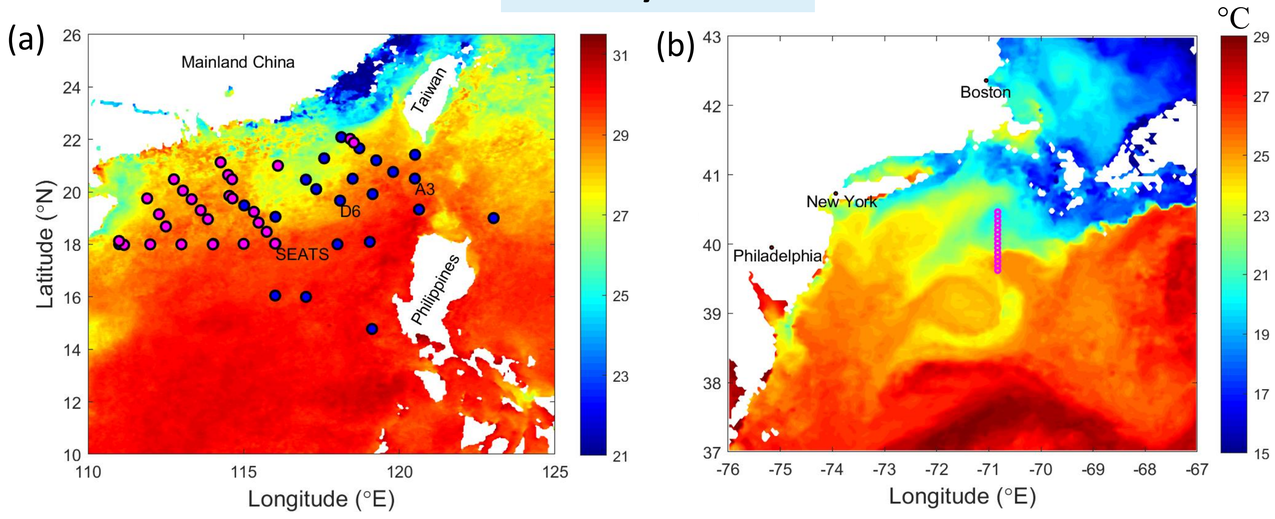

Figure 1. Sampling stations at two frontal zones: (a) the South China Sea-Kuroshio during May 19th - July 14th, 2014 (blue circles) and May 15th - June 5th, 2016 (purple circles); and (b) the mid-Atlantic Shelf Break frontal zone during July 5th-July 19th, 2019. Also superimposed with monthly-mean sea surface temperature in May 2014 (a) and (b) 8-day mean sea surface temperature during July 12th – 19th, 2019.

T-S Diagram

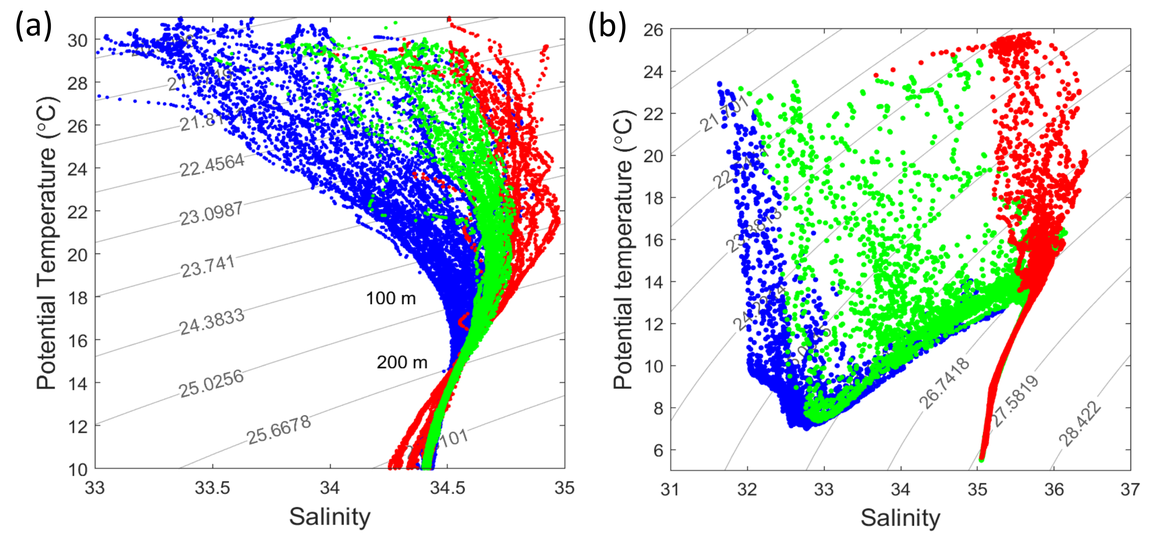

Figure 2. Map of potential temperature (θ) versus salinity (θ-S diagram) for the sampling stations in (a) the South China Sea in summer 2014 (blue dots) and spring 2016 (green dots) contoured by the potential density (sigma,), also shown the Kuroshio (red dots) collected from the cruise in 2014; and (b) the mid-Atlantic Shelf Break frontal zone in summer 2019, showing shelf (blue dots), front (green dots) and slope (red dots) water masses.

Ammonium and Nitrite Profiles

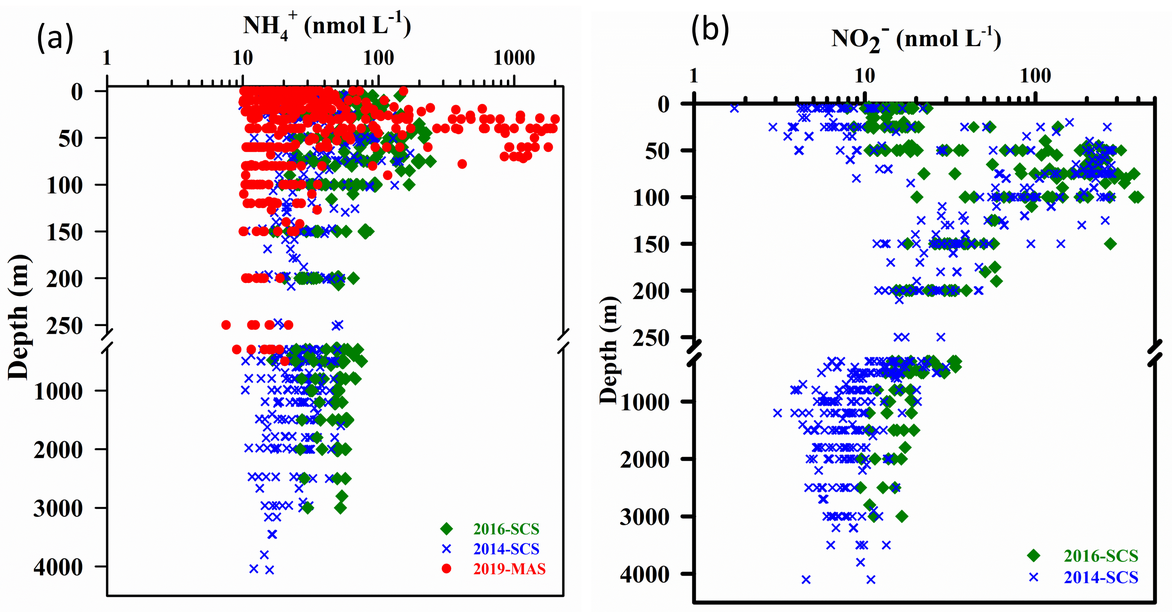

Figure 3. Vertical distribution of (a) ammonium (NH_4^+) concentrations and nitrate (NO_2^-) in the South China Sea during summer 2014 and spring 2016 and the mid-Atlantic Shelf Break (concentrations are plotted in log scale).

Two Types of Ammonium Patterns

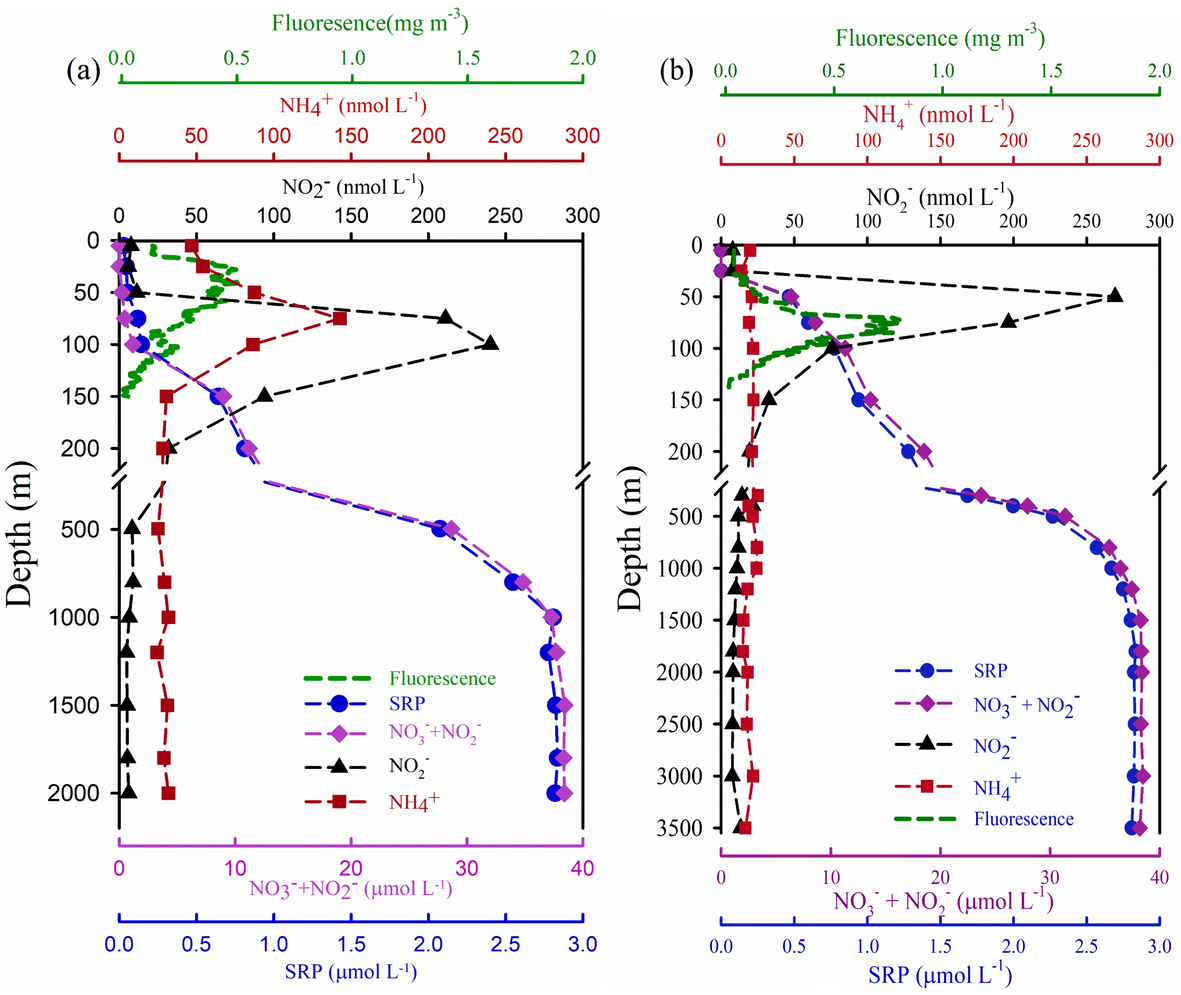

Figure 4. Depth profiles of fluorescence, soluble reactive phosphorus (SRP), nitrate + nitrite (NO_3^-+NO_2^-), NO_2^- and ammonium (NH_4^+) concentration at stations A3 (a) and G4 (b) illustrating two types of NH_4^+ patterns.

Ammonium Inventories

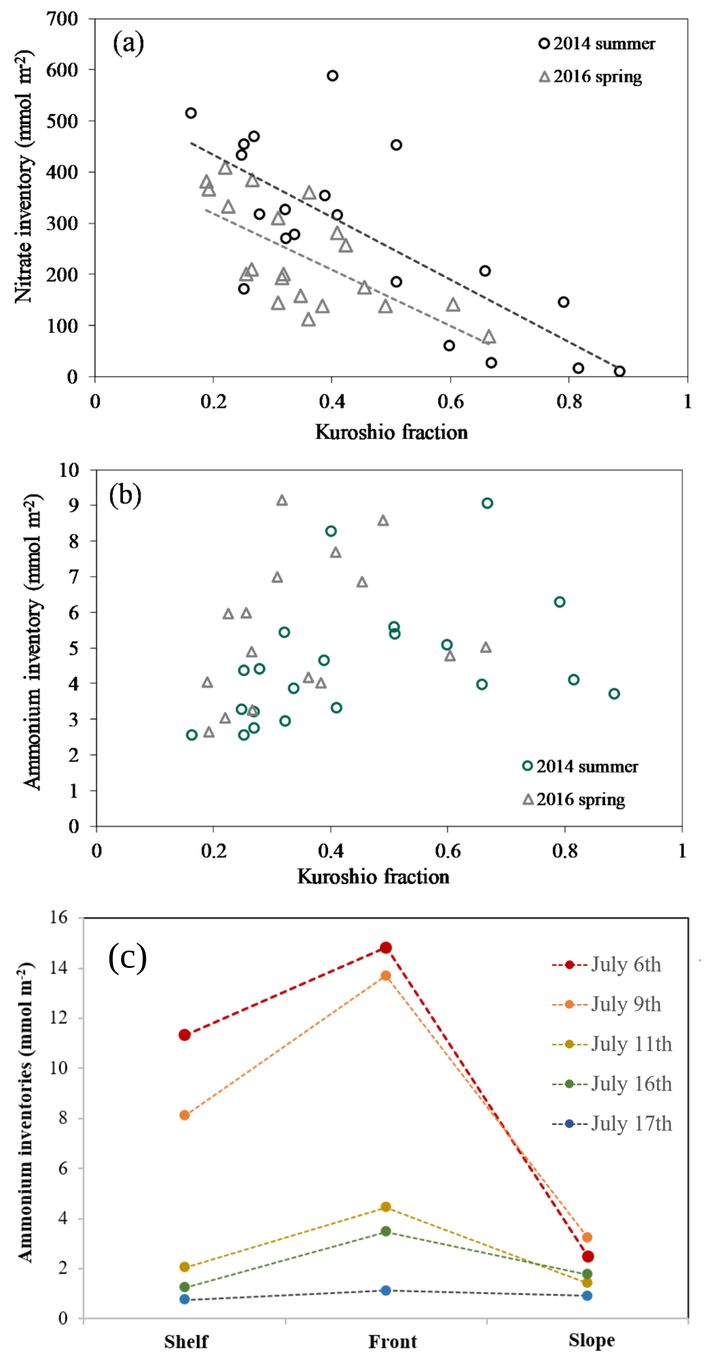

Figure 5. Relationship between field-observed (a) nitrate (NO_3^-) inventory and the station-vertically integrated Kuroshio water fraction and (b) ammonium (NH_4^+) inventory and the station-integrated Kuroshio water fraction in summer 2014 and spring 2016. (c) ammonium inventories at the shelf, front and slope, showing ammonium accumulation at the front.

Dissolved Matter

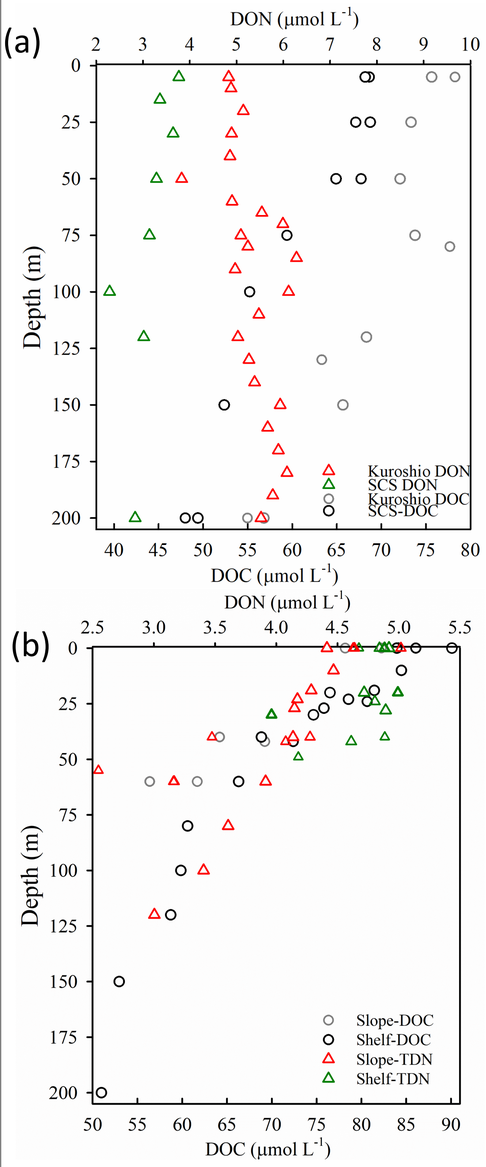

Figure 6. Vertical depth distribution of dissolved organic nitrogen (DON) (triangles) and dissolved organic carbon (DOC) (circles) concentrations in (a) the upper 200 m of the South China Sea (SCS) and (b) the mid-Atlantic shelf break front, showing that DOC in the SCS endmember was up to ~10 μmol L^{-1} lower than that of Kuroshio, and DON was up to ~ 3 μmol L^{-1} lower than that of Kuroshio.

Conclusions

- High- precision data sets for nanomolar level ammonium and nitrite were reported for the first time in the northern South China Sea
- Ammonium maximum was observed at some stations but not others while nitrite displayed subsurface maxima at all stations
- Elevated ammonium inventory were observed at both frontal zones

Funding from

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