

Reviewer#2

Atmospheric organic nitrogen plays an increasingly recognized role in nitrogen cycling, yet its contribution from marine biological processes remains poorly constrained in coastal environments. This study investigates WSON in total suspended particulate matter collected over one year at a coastal urban site in Bangkok, Thailand. By combining chemical measurements, PMF source apportionment, air-mass trajectory analysis, and a trajectory-based chlorophyll-a exposure metric, the manuscript demonstrates that sea spray aerosols associated with marine biological activity represent a substantial source of WSON under marine-influenced conditions. Overall, the manuscript is well written, and conclusions are generally supported by the presented results. The following suggestions are provided to the authors for further revision before the final publication.

Response: We appreciate the reviewer's recognition of our work. We have revised the manuscript carefully in response to all comments and suggestions.

1. *Page 9, lines 265-267: The observed negative correlation between TSP and precipitation is statistically significant and consistent with wet scavenging effects. However, given the relatively low R^2 value, precipitation alone appears to exert a secondary control on TSP variability. The authors may consider slightly revising the wording to better reflect the limited explanatory power of precipitation in this relationship.*

Response: Thank you for this important comment. The original phrasing may have overstated the role of precipitation. We have revised this sentence to better reflect that precipitation explains only part of the variability in TSP.

Revised text on page 11, lines 321–328:

“A significant negative correlation was identified ($R^2 = 0.22$, $p < 0.001$), consistent with a contribution from wet scavenging, although the relatively low explanatory power indicates that emissions, transport, and precipitation history along the air-mass pathway also substantially influenced TSP variability.”

2. *Page 10, lines 272-273, 278-279: The statements “underscoring the relevance of water-soluble nitrogen in this region” and “suggesting possible common sources or formation pathways” are rather general and add limited interpretive value.*

Response: Thank you for this suggestion. In the revised manuscript, we have deleted the phrase “underscoring the relevance of water-soluble nitrogen in this region”. We have also revised “suggesting possible common sources or formation pathways” to “indicating that WSON variability was linked to overall aerosol loading and co-varied with inorganic nitrogen across the dataset”.

Deleted text on page 12, line 333.

Revised text on page 12, lines 340– 343:

“WSON correlated positively with both TSP ($r = 0.65$, $p < 0.01$) and WSIN ($r = 0.51$, $p < 0.01$) (Figure S6), indicating that WSON variability was linked to overall aerosol loading and co-varied with inorganic nitrogen across the dataset.”

3. *Page 10, lines 294-297; Page 11, lines 303-308: The discussion of wet scavenging effects on WSON and the WSON/WSIN ratio is somewhat difficult to follow and appears internally inconsistent. On the one hand, wet scavenging is invoked to partly explain the lower WSON levels during marine-influenced periods, which largely coincide with the rainy season. On the other hand, the lack of a significant correlation between WSON and precipitation is used to argue that WSON exhibits distinct scavenging behavior compared to WSIN.*

Response: Thank you for pointing this out. In the revised manuscript, we separated two ideas more clearly. First, lower WSON during marine-influenced periods may reflect a combination of cleaner marine transport, seasonal rainfall, and reduced continental inputs. Second, the absence of a significant WSON–precipitation correlation indicates that precipitation alone does not explain WSON variability at the integrated daily timescale. We therefore no longer use this result to argue for a distinct scavenging mechanism of WSON, but only to indicate that WSON was less directly coupled to precipitation than WSIN in this study.

Revised text on page 12–13, lines 365–371:

“Taken together, these patterns suggest that the lower WSON concentrations during marine-influenced periods likely reflected a combination of reduced continental and combustion-related influence, differences in transport history, and atmospheric processing. Seasonally higher rainfall may also have contributed, but because no significant direct correlation was found between WSON and precipitation (Figure S5b), precipitation alone cannot explain the observed WSON variability.”

Revised text on page 13, lines 386– 394:

“Precipitation may alter the WSON/WSTN ratio through differential scavenging: WSIN species (e.g., NO_3^- , NH_4^+) are efficiently removed by rainfall (Matsumoto et al., 2019b; Nehir and Koçak, 2018), as WSIN showed stronger correlations with precipitation (Figure S5c, d). By contrast, the absence of a significant WSON–precipitation correlation indicates that WSON variability in this dataset was less directly coupled to precipitation, rather than supporting a distinct scavenging mechanism.”

4. *Page 13, lines 374-377: Nitroaromatics represent only a subset of nitrogen-containing organic species contributing to WSON. If their role is considered important, I suggest either providing supporting quantitative evidence or moderating the wording to reflect the limited compositional constraints.*

Response: The original phrasing was too specific given the compositional constraints of this study. We therefore revised the statement and no longer imply that nitroaromatics represent a dominant fraction of WSON. Instead, they are referred to only as one possible subset of nitrogen-containing organic aerosol.

Revised text at page 16, lines 472–477:

“During continental conditions, SOA remained the primary source ($41\% \pm 26\%$), likely reflecting multiple secondary formation pathways of nitrogen-containing organic aerosol, of which nitroaromatics may represent one possible subset of these compounds (Xie et al., 2017).”

5. *Page 13, line 378: The reported range “33%–37.7%” shows inconsistent significant figures. Please consider revising the values to a consistent precision.*

Response: Thank you for pointing this out. We have revised the reported range to a consistent precision and checked the manuscript for similar formatting inconsistencies.

6. *Page 15, lines 410-425: The discussion sections about extensive background statements on marine productivity and SSA-related processes could be condensed to improve clarity and to emphasize the novel results of the present study.*

Response: Thank you for this suggestion. We have condensed this section to reduce general background and place greater emphasis on the novel findings of the present study.

Revised text at page 19, lines 528–547.

“SSA is dominated by inorganic sea salt but can also comprise an important organic fraction derived from ocean-surface materials (Prather et al., 2013; Quinn et al., 2014; Schiffer et al., 2018). Previous studies have linked marine biological productivity to the organic enrichment of SSA (O’Dowd et al., 2015; Violaki et al., 2015), and Chl-a has often been used as a broad proxy for ocean-surface biological conditions (Facchini et al., 2008; O’Dowd et al., 2004). Given the substantial contribution of SSA-associated WSON to total WSON and WSTN during marine-influenced periods in our study, we further examined whether marine productivity was related to its variability.”

7. *Page 16, lines 438-440: The conclusion that marine biogenic organic matter is a primary source of WSON during marine air-mass influence is mainly based on correlation analyses. While the observed relationships are suggestive, correlation alone does not provide sufficient evidence to establish source dominance.*

Response: The original statement overinterprets the correlation as causal evidence. We have revised this part. We now state that AEC may covary with marine transport conditions, meteorology, and other seasonally structured processes, that correlation alone does not establish source dominance, and that the observed relationship is interpreted only as being consistent with an important marine-biogenic enhancement of SSA-associated WSON, while shipping and other anthropogenic co-influences cannot be fully excluded.

Revised text at page 20, lines 565–571.

“However, AEC may also covary with marine transport conditions, meteorology, and other seasonally structured processes, and correlation alone does not establish source dominance. Taken together, the PMF results, reduced terrestrial influence, and the positive AEC relationship are consistent with an important marine-biogenic enhancement of SSA-associated WSON during marine-influenced periods, although shipping and other anthropogenic co-influences cannot be fully excluded.”