Review Comments

In this study, the authors investigated the contributions of anthropogenic and natural sources to atmospheric mercury in the marine environment in eastern China based on island, cruise, and inland campaigns. Correlation analyses were performed between TGM and meteorological factors. The TGM/BC ratios were calculated. PMF models were developed for two sites to disentangle anthropogenic and natural contributions, and correlations between BC and anthropogenic TGM were established. The sea-air exchange fluxes of mercury were estimated based on TGM and DGM. The impacts of anthropogenic emissions on marine Hg evasion were quantified. Overall, the study is well designed, and results from this study provide more evidence for the contribution of anthropogenic sources to TGM in the marine boundary layer in eastern China and the compensation effect of marine Hg evasion when the anthropogenic contribution is reduced. However, the methods part lacks some detailed information, and the results and discussion part needs improvement to address the novelty of this study. There are many speculative statements in the discussion part, the expression of which could be improved. Therefore, in my opinion, major revision is required before the manuscript is acceptable for publication on Atmospheric Chemistry and Physics.

Here are some specific comments:

1. Line 46: Typo of “can cycles”.
2. Lines 60–71: The statements of these literatures are inadequate. For example, Fu et al. (2018) and Wang et al. (2020) are not considered as qualitative assessment. They have provided quantitative evidence for the contributions of anthropogenic Hg emissions. I suggest these statements be rephrased.
3. Section 2.2: The QA/QC results for TGM/GEM measurement should be further illustrated. For example, what are the average duplication rates between A and B traps for the Tekran 2537B and the modified 2600 analyzer, respectively? What measures did the authors take to prevent or abate the impacts of high humidity on the Tekran analyzers?

4. Section 2.5: More illustration on the PMF method need to be included instead of just referring to the authors' previous study. For example, at least what indicators were used in the PMF model should be introduced. According to Section 3.3, air temperature (I assume it is air temperature instead of seawater temperature) has been included in the model. What unit did the authors use? I think Kelvin makes more sense than °C since the indicators need to be positive for applying PMF.
5. Lines 249–250: The reference here for background level in Northern Hemisphere is outdated. Please refer to more recent studies (e.g., Bencardino et al., 2024). It is also encouraged to give the value range in the text.
6. Lines 250–253: Similarly, it is recommended to list the mean values and standard deviations of TGM concentrations in these studies.
7. Lines 331–333: These TGM/BC ratio ranges are a bit strange. These values were automatically generated on mapping. I suggest the authors reset the ranges and use rounded values instead.
8. Lines 363–370: The method for measuring the concentrations of heavy metals at DSL was not mentioned in Section 2. Was it an online or offline method? How big was the dataset?
9. Figure 5 (c and d): It seems to me that the two relationships are quite similar. The relationship for JHI is highly influenced by the top right data point, which is not robust. Therefore, I suggest the authors integrate the data points of these two sites and establish a uniform relationship.
10. Figure 6 (a-d): These relationships are all based on nonlinear regressions which are not consistent with the linear assumption for PMF.
11. Lines 411–415: Could it be more likely that the Yellow Sea suffers more from the air masses from the North China Plain region which is more polluted than eastern China?

References:

Bencardino, M., D'Amore, F., Angot, H., Angiuli, L., Bertrand, Y., Cairns, W., Diéguez, M. C., Dommergue, A., Ebinghaus, R., Esposito, G., Komínková, K.,

Labuschagne, C., Mannarino, V., Martin, L., Martino, M., Neves, L. M., Mashyanov, N., Magand, O., Nelson, P., Norstrom, C., Read, K., Sholupov, S., Skov, H., Tassone, A., Vítková, G., Cinnirella, S., Sprovieri, F., and Pirrone, N.: Patterns and trends of atmospheric mercury in the GMOS network: Insights based on a decade of measurements, Environ. Pollut., 363, 125104, 2024.

Fu, X., Yang, X., Tan, Q., Ming, L., Lin, T., Lin, C.-J., Li, X., and Feng, X.: Isotopic Composition of Gaseous Elemental Mercury in the Marine Boundary Layer of East China Sea, Journal of Geophysical Research: Atmospheres, 10.1029/2018jd028671, 2018.

Wang, C., Wang, Z., and Zhang, X.: Characteristics of mercury speciation in seawater and emission flux of gaseous mercury in the Bohai Sea and Yellow Sea, Environ. Res., 182, 109092, 2020.