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Interactive comment on "Gaseous elemental mercury (GEM) fluxes over canopy of two typical subtropical forests in south China" *by* Qian Yu et al.

Anonymous Referee #1

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The manuscript reports flux data measured by the aerodynamic gradient (AGM) method over the canopy at two low-land forest sites in South China over a one-year period. Although the context of this study does not introduce new science beyond what has been known, such long-term flux datasets in forest ecosystem are rare and deserve consideration for publication. The manuscript is organized, read well and carefully drafted given the data that it presents. The data reporting sections (Section 3.1 – Section 3.4) are appropriately supported by data and the depth of conclusions/implication can benefit from incorporating the recent findings obtained from mass balance study and stable mercury isotope investigation in forest ecosystems. Overall, I recommend publication of the manuscript and have the following minor comments. 1. The LAI

and other descriptive characterization (e.g., other predominant vegetative species, forest floor coverage, radiation transfer under canopy) of the two forest sites should be provided for better assessment of the forest site. 2. Appropriately determining the turbulent transfer coefficient (K) is critical for estimating AGM flux, yet it is not clear in the manuscript how K varies. It will be useful to report the estimated K values and its diurnal variation in different in different season for evaluation of the reasonableness of estimated K values. 3. The quality control statement of the AGM flux measurement is limited only to the detection of Hg vapor but did not consider other sources of bias (the long tubing, flow synchronization, intermittent sampling at the two level, etc.) that might introduce uncertainty to the flux measurement. Would it be a possibility that these variables can also be assessed to better represent the measurement uncertainty? 4. The characterization of the two sites (clean and contaminated) could cause confusion. Given the mean annual TGM concentrations (3.64 and 5.93 ng m-3), both locations should have been considered under the influence of regional Hg emission plumes. I suggest using "mildly polluted" and "moderately polluted" to avoid the confusion. 5. It would have been extremely useful if Hg flux was also measured over the forest floor under the canopy. Such data will help enhance the source/sink discussion of Section 3.4. 6. Recent characterization of stable mercury isotopes in foliage of various ages and litter, along with the quantification of litterfall production and Hg deposition through litterfall all indicate that forest ecosystem is a net sink for Hg in remote regions. Such data are also supported by the vertical gradient measurement of TGM concentration from forest floor through well above forest canopy, showing increasing TGM concentration with sampling height. The primary conclusions of this study appear to contradict these recent findings, even given the elevated TGM concentration in air. Since the flux data above forest floor are not reported in the manuscript, it is not possible to determine if it is the re-emission of contaminated soil that leads to the overall Hg source term. An in-depth discussion regarding these discrepancy will significantly enhance the scientific value of the manuscript.

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