

# ***Interactive comment on* “Estimation of Reactive Inorganic Iodine Fluxes in the Indian and Southern Ocean Marine Boundary Layer” by Swaleha Inamdar et al.**

## **Anonymous Referee #2**

Received and published: 9 April 2020

The paper by Swaleha Inamdar et al shows new and simultaneous measurements of iodine oxide (IO), ozone (O<sub>3</sub>) in the gas phase, and sea surface iodide (I<sup>-</sup>; SSI) concentrations during the ISOE-9 ship campaign in the Indian Ocean and Southern Ocean in January-February 2017. These measurements are complemented with previously published ship based measurements in the Indian Ocean and Bay of Bengal and with different available parametrizations to compute the iodine (I<sub>2</sub>) and hypoiodous acid (HOI) fluxes. This study includes important new results which should be publishable after a detailed and careful major revision of the manuscript taking all comments into account.

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## General comments:

Earlier studies: The paper misses to refer to other iodine ship based studies, such as Hepach et al (2016), where iodocarbons, IO, and many different biological parameters were observed and possible biological production mechanisms were discussed. A positive correlation between iodine sources and biology and a biology control is not a new result. This has to be taking into account in the abstract, introduction, discussion, and conclusions of your results. There were earlier ship based measurements of atmospheric IO, I<sub>2</sub> and ozone, f.e., in the tropical West Pacific during e.g. the SHIVA campaign (Pfeilsticker et al 2013) and in the Indian Ocean with the OASIS campaign (Krüger et al 2015) which should be mentioned and related to.

Indian Ocean: What about the strong seasonality of the Indian Ocean, physical and biological, which may play an important role for the interpretation of your results? This needs to be included in the introduction and the discussion (see Schott and McCreary 2001; SIBER Report No. 1, 2011). Your paper should go beyond a correlation based only discussion. What are the mechanisms in the Indian Ocean: Any biology, ocean and atmospheric circulation impacts? It would be very interesting to get some more details on the spatial distribution of your observed in-situ quantities compared to satellite and/or global model data, adding maps of e.g. SST, Chl-a, wind, SSI/I<sub>2</sub>.

Measurement, flux parametrization, and model details, errors and uncertainties:

What are the error bars of the measurements especially of SSI and what are the uncertainties of the flux estimates? This needs a careful and detailed discussion in the ms. The observed SSI (Chance et al 2019b under review) study is not available to the readership so that we cannot find any information about the kind of measurements nor the quality. What was the measurement strategy (day vs night time, how often etc)? Where were the surface water iodide measurements carried out onboard of the ship and when? Does the diurnal cycle play a role? Substantial measurement details are missing and need to be added to understand your ship measurement and study design

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better.

For the observed meteorological data, surface wind is conventionally given as 10 min averages and then there are gusts (instantaneous wind). Currently, you use hourly averages which lead to a smoothing of the average wind speed and thus impact your flux parametrization calculations which are based on a threshold limit of 14 m/s. Next, at which altitude levels onboard of the ship were your wind and others quantities measured? Conventionally 10 m surface wind is used for flux calculations. What did you use and on what are the flux parameterisations based on? The measurement section, data and graphs need a thorough and detailed revision.

Substantial details are also missing for the flux parametrization. How well do the estimated iodine fluxes explain observed surface atmospheric I<sub>2</sub> concentrations? What are the largest uncertainties also in contrast to the common bulk parametrizations of air-sea fluxes which have a very high (>50%) uncertainty especially with regard to the role of the wind ?

What are the main chemistry transport and chemistry climate model uncertainties? What is the role of the meteorology and ocean surface (composition and circulation); is this consistently taken into account in these two models compared to your observations?

Specific comments:

Line 127-129: Grossmann et al 2013 and others published remote open ocean data. Please rephrase the sentence.

Table 1: There are no 2014 measurements listed in the third column although you mention this in the table caption, abstract, introduction etc.

Technical corrections:

Figures and figure captions: The graphs and figure captions are not self-explaining and not presented in a consistent way. The acronyms are mostly not introduced nor are the

figures easy to relate to each other, f.e. ozone in Figure 4 and 5 is it the same? What is PF; I assume Polar Front and where is this in Fig 5? All your figures and figure captions need a thorough revision.

#### References:

Hepach, H. et al., Biogenic halocarbons from the Peruvian upwelling region as tropospheric halogen source, *Atmos. Chem. Phys.*, 16, 12219–12237, 2016.

Krüger K. et al, OASIS-research cruises SO234-2 and SO235 of R/V SONNE in summer 2014 in the tropical Indian. . . , *The Indian Ocean Bubble*, Issue No., 3, Aug. 2015.

Pfeilsticker K. et al, The SHIVA Western Pacific Campaign in Fall 2011, *Malaysian Journal of Science* 32 (SCS Sp Issue), 141-148, 2013.

Schott, F.A. and McCreary, J.P., 2001. The monsoon circulation in the Indian Ocean. *Progress In Oceanography*, 51(1): 1-123.

SIBER Report No.1, Sustained Indian Ocean Biogeochemistry and Ecosystem Research, 2011. Research, 2011.

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