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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ozone and carbon monoxide observations over open oceans on R/V *Mirai* from 67° S to 75° N during 2012 to 2017: Testing global chemical reanalysis in terms of Arctic processes, low ozone levels at low latitudes, and pollution transport" *by* Yugo Kanaya et al.

Anonymous Referee #1

Received and published: 9 February 2019

This manuscript provides a very nice and well-written presentation of a valuable data set of marine boundary layer ozone and CO observations, spanning the full latitudinal range of the North and South Pacific Oceans. As demonstrated in the paper, the data are valuable for understanding pollutant outflow from Asia and ozone destruction in the tropics. The data are also very useful for global atmospheric chemistry model evalu-

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ation. I recommend that the paper be published after a minor revision, as described below.

P1, line 21 Here the authors use the term “chemical transport models” as a general term to refer to all types of models that quantify atmospheric chemistry processes. As explained in the recent TOAR paper by Young et al. [2018], the general term should be “global atmospheric chemistry models”.

P5, line 9 Here it says that the TCR-2 chemical reanalysis relies on assimilation of TES ozone values. TES provided relatively dense global coverage from 2004 to 2010, but after 2010 the instrument slowly lost power and its observational range was steadily reduced from global coverage to just a few urban areas. How did this reduction in coverage affect the TCR-2 ozone values?

When reviewing previous studies of ocean surveys, the following paper should be referenced. This early study reported increasing ozone across the Atlantic Ocean, using ship-borne observations: Lelieveld, J., Van Aardenne, J., Fischer, H., De Reus, M., Williams, J. and Winkler, P., 2004. Increasing ozone over the Atlantic Ocean. Science, 304(5676), pp.1483-1487.

In addition to the TOAR paper by Schultz et al. [2017], reference should also be made to Gaudel et al. [2018], as this is the TOAR paper that describes ozone observations at remote locations in order to understand the trends of ozone that are important for climate studies.

Gaudel, A., et al. (2018), Tropospheric Ozone Assessment Report: Present-day distribution and trends of tropospheric ozone relevant to climate and global atmospheric chemistry model evaluation. Elem Sci Anth, 6(1), p.39. DOI: http://doi.org/10.1525/elementa.291

P2, line 11 The radiative forcing of ozone needs to be stated with its uncertainty: 0.4 +/- 0.2 W m-2

Figure 1 It's difficult to see the magenta dots that indicate the TOAR observations. Please make the dots a little larger. Also panel (a) is presented below panel (b). This is confusing and the order should be reversed.

Figure 2 The color scale runs from 0 to 600 which leaves most data points in the blue range of colors. This provides very little contrast and makes it difficult to see concentration gradients. Please try lowering the maximum value on the color scale from 600 to 400 or 300. This should provide greater contrast.

Figure 3 It's difficult to distinguish between the red and magenta trajectories. Please try using different colors.

Throughout the paper there are many instances in which an ozone or CO mixing ratio is described as a concentration. Technically, this is not correct as a concentration has units of mass/volume. To be consistent with SI metrology, any value in units of ppbv needs to be described as a mixing ratio. Furthermore, ppb needs to be listed as ppbv.

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