

Interactive comment on “Revising global ozone dry deposition estimates based on a new mechanistic parameterisation for air-sea exchange and the multi-year MACC composition reanalysis” by Ashok K. Luhar et al.

Anonymous Referee #3

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1 Overview

The work described in this manuscript builds on the previous work of Luhar et al., 2017 in which the authors developed a more detailed, process based, two layer parametrization for dry deposition of ozone to oceans. In this study the two layer parametrization is refined and then implemented in the UKCA model. The model output is combined with MACC reanalysis data to calculate new estimates for global ozone deposition to wateroceans and total global ozone deposition. These new estimates are considerably

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less than current estimates of global ozone deposition. The model output combined with MACC reanalysis data is also used to analyse inter-annual trends in ozone dry deposition.

2 General comments

Overall this manuscript is well written and describes an improved parametrization for ozone dry deposition to water. The improved parametrization addresses uncertainty in deposition of ozone to water, which is the main driver of uncertainty in global ozone dry deposition.

The manuscript is generally well laid out and the figures are clear. My main comments refer to Section 2. This section is quite important as it describes the new deposition parametrization, but it is a bit hard to follow.

(i) It would be helpful if the authors could include a diagram of the different layers that form within the sea surface micro layer (e.g. reaction-diffusion sub-layer, bottom layer) that shows a summary of the processes (e.g. chemistry, chemistry/turbulence and reaction with iodide) that occur for in each layer and the main equations that are used to parameterize these processes.

(ii) I think it would also be helpful in Section 2 if the authors could more clearly describe how their improved scheme differs from that described in Luhar et al., 2017.

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3 Specific comments

3.1 Section 1

P4, L13-14: Consider rephrasing to “A more appropriate parametrisation for K_t which varies **with** z_m in the viscous sublayer...” to improve the readability and meaning of the sentence.

P4, L20-22: Could the authors provide a brief description of the “asymptotic behaviour” (also mentioned in the abstract). Or refer the reader to section 2.1.

3.2 Section 2

P5, L20-22: Consider rephrasing to “The second layer, **which is** deeper than the reaction-diffusion sublayer, ...” to improve the readability and meaning of the sentence.

P6, L12-13: Consider rephrasing to “The first two, namely the flux at the water surface ($z = 0$) obtained using Eq. (4) should be equal **to** F_0 and the concentration at the interface...” to improve the readability and meaning of the sentence.

Figure 1 caption: Consider rephrasing to “Figure 1: Variation of the oceanic component of ozone dry deposition velocity multiplied by ozone solubility as a function of sea surface temperature (SST, °C), **(a, c)**; and reactivity a (s^{-1}), **(b, d)**. Curves determined using the two-layer deposition scheme (Eq. (16)) for several c_0 values used in $\delta m = c_0 l m$, **(a, b)** and several δm values, **(c, d)**. The variations obtained using the one-layer deposition scheme with (Eq. (18)) and without (Eq. (19)) waterside turbulent transfer (i.e. reaction-diffusion only) are also shown. The waterside friction velocity (u^*w) used was 0.01 m s^{-1} .” to improve the readability.

3.3 Section 5.2

P21, L5-10: Can the authors suggest why there are larger ozone dry deposition velocities in the Northern Hemisphere?

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