

ngtitleSupplementary Material for 'Can we trust empirical marine DMS parameterisations within projections of future climate?'

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Supplementary Material for 'Can we trust empirical marine DMS parameterisations within projections of future climate?'

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As described in section three of the main text, it has been necessary to modify our use of the Simo (2002) and the Anderson (2001) parameterisations to account for the Earth System model's inaccuracies in predicting the near-surface vertical distribution of chlorophyll. The model simulates a global annual average surface chlorophyll concentration of 0.93 mg m^{-3} and 0.92 mg m^{-3} in the Simo (2002) and Anderson (2001) model runs respectively, approximately twice that predicted from SeaWiFS imagery (Yoder and Kennelly, 2005). To prevent the simulated high chlorophyll causing an over-prediction of surface ocean [DMS], we choose to exclude diatom chlorophyll from the calculations, on account of their low DMS production (Yoch, 2002; Keller et al., 1989). Considering just non-diatom surface chlorophyll our model simulates a global annual average surface chlorophyll concentration of 0.51 mg m^{-3} in both the Simo (2002) and the Anderson (2001) experiments, comparable with globally averaged

SeaWiFS chlorophyll data (Yoder and Kennelly, 2005). Excluding diatom chlorophyll from our calculations of DMS using both the Simo (2002), and the Anderson (2001) parameterisations does not have a major impact on either the spatial (figure 1) or seasonal (figure 2) distribution of DMS production. Although future shifts in the non-diatom to diatom ratio simulated by the model would be amongst the most robust indications that we might expect future changes in surface ocean [DMS], we have been unable to test how realistic the interactive calculation of surface ocean [DMS] would be under these situations.

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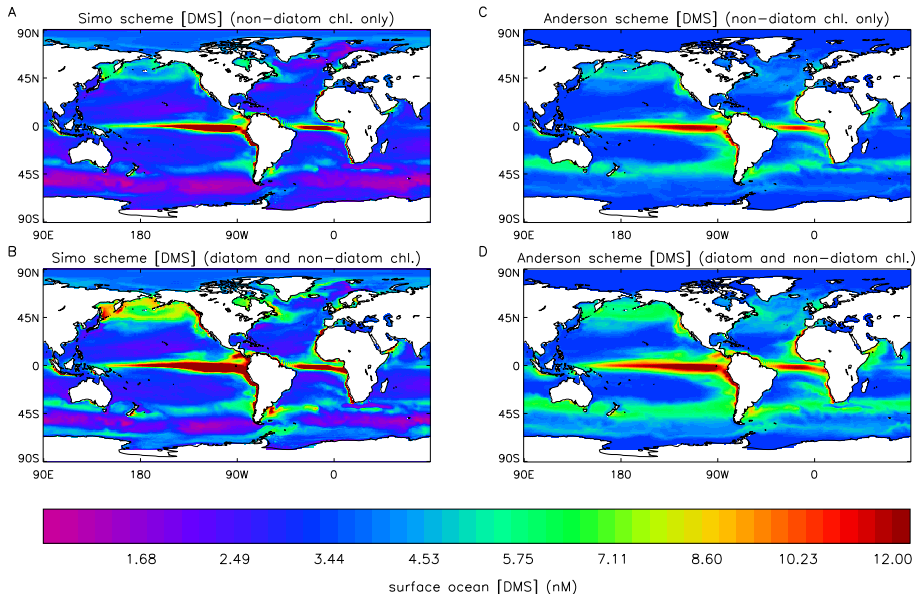


Fig. 1. Annually averaged surface ocean DMS concentrations calculated using the Simo (2002) parameterisation from model non-diatom surface chlorophyll and mixed layer depth fields. B) Annually averaged surface ocean DMS concentrations calculated using the Simo (2002) parameterisation from model total surface chlorophyll and mixed layer depth fields. C) Annually averaged surface ocean DMS concentrations calculated using the Anderson (2001) parameterisation from model non-diatom surface chlorophyll, nitrate and solar radiation fields. D) Annually averaged surface ocean DMS concentrations calculated using the Anderson (2001) parameterisation from model total surface chlorophyll, nitrate and solar radiation fields. Figure parts a and b have been calculated from the eight year model simulation in which surface ocean [DMS] was interactively calculated using the Simo (2002) scheme, parts c and d of the figure have been calculated from the eight year model simulation in which surface ocean [DMS] was interactively calculated using the Anderson (2001) scheme. Although both model simulations included an interactive DMS scheme, the data presented in this figure have been calculated off-line using monthly mean data for the parameterisations' input fields, and therefore the specific [DMS] presented here does

not feed-back on the model's climate. Furthermore, because calculations have been undertaken using monthly mean data, rather than instantaneous data from each model time-step (i.e. each hour), the averaging of extreme values means that the exact values presented in this figure differ from those presented elsewhere in the paper. Broad agreement in the spatial distribution of surface ocean [DMS] between a and b, and c and d respectively indicates that only issues associated with using just non-diatom chlorophyll in the model [DMS] calculations (rather than total surface chlorophyll) can be regarded as second order relative to the disparity between observed (Yoder and Kennelly, 2005) and modelled chlorophyll. figure

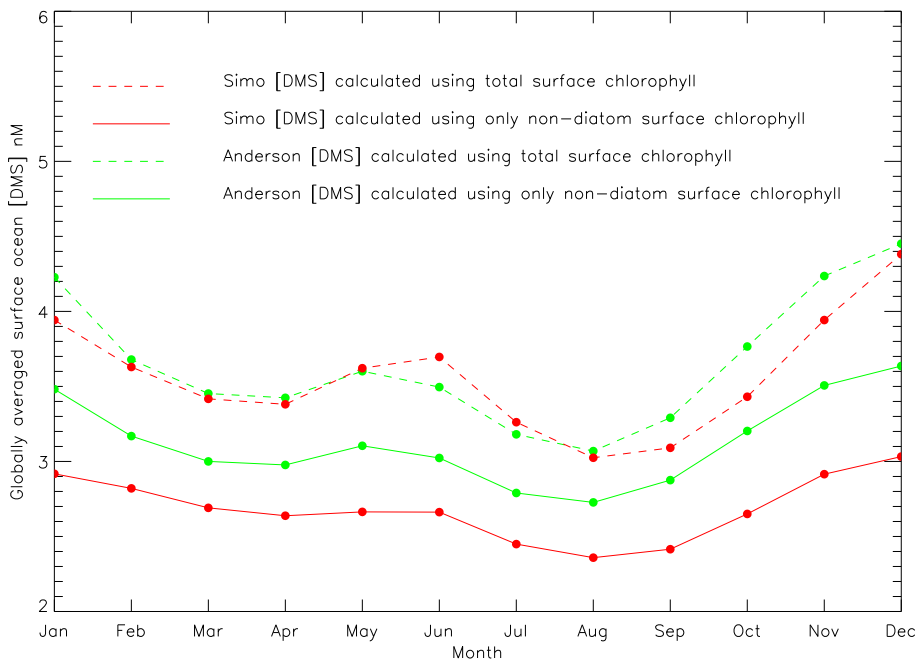


Fig. 2. Mean seasonal cycle of surface ocean [DMS] calculated using the Simo (2002) parameterisation

(red) and Anderson (2001) parameterisation (green) from monthly mean model fields of non-diatom surface chlorophyll (solid lines), total surface chlorophyll (dashed lines), mixed layer depth, surface nitrate concentrations and daily mean shortwave irradiance. The Simo (2002) data have been calculated from the eight year model simulation in which surface ocean [DMS] was interactively calculated using the Simo (2002) scheme. The Anderson (2001) data have been calculated from the eight year model simulation in which surface ocean [DMS] was interactively calculated using the Anderson (2001) scheme. Broad agreement between the shape of the seasonal cycles for the two Simo (2002) curves and the two Anderson (2001) curves respectively indicates that using just non-diatom chlorophyll in the model [DMS] calculations (rather than total surface chlorophyll) can be regarded as a second order issue relative to the disparity between observed (Yoder and Kennelly, 2005) and modelled chlorophyll. Although both model simulations included an interactive DMS scheme, the data presented in this figure have been calculated off-line using monthly mean data for the parameterisations' input fields, and therefore the specific [DMS] presented here does not feed-back on the model's climate. Furthermore, because calculations have been undertaken using monthly mean data, rather than instantaneous data at each model time-step (i.e. each hour), the averaging of extreme values means that the exact values here differ from those presented elsewhere in this paper.

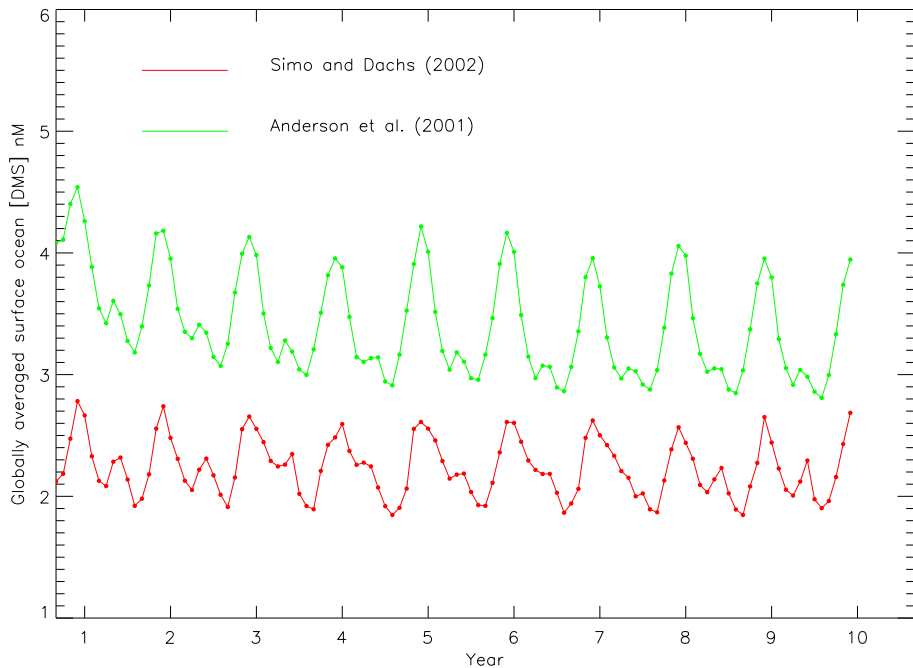


Fig. 3. Model experiments using the Simo (2002) (red) and Anderson (2001) (green) parameterisations were run for ten model years each, starting from a pre-industrial climate spun up using DMS fields from the Kettle et al. (2000) climatology. An initial drift in the simulated DMS data resulted in the first two model years of data being discarded from subsequent analysis.