The Cryosphere

Supplement of

The effect of partial dissolution on sea-ice chemical transport: a combined model–observational study using poly- and perfluoroalkylated substances (PFASs)

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S1 Introduction

Here, we present two figures to support the main analysis. The main results of the paper are replicated with the critical Rayleigh number, Ra_c, and desalination strength, ϵ, as $Ra_c = 4.89$ and $\epsilon = 5.84 \times 10^{-4}$ kg(m^{3}s)$^{-1}$, following Griewank and Notz (2015).

5 **S2 Results**

Fig. S1 shows the derived tuning parameters for each chemical of interest for Methods B, C, and D when the model was run with tuning parameters from Griewank and Notz (2015). Fig. S2 shows the model performance for Methods A through D. These figures are discussed in the main text, in Section 4.
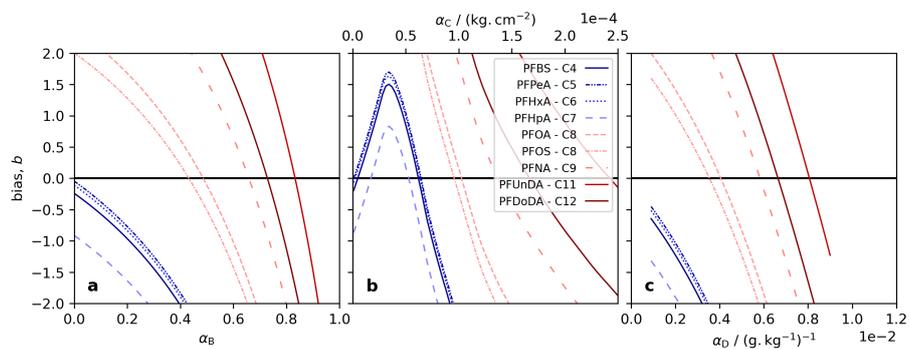
Fig. S 1. Model tuning for each PFAS. The bias, b, was calculated as the sum of the difference between measurements and co-located model layers in three tuning runs. Each panel shows results for a different decoupling method: a) simple decoupling, tuned using α_B; b) surface area adsorption, tuned using α_C; and c) salinity mediated decoupling, tuned using α_D. The best performing α give b closest to 0 (black line). Tuning parameters for desalination were taken from Griewank and Notz (2015).
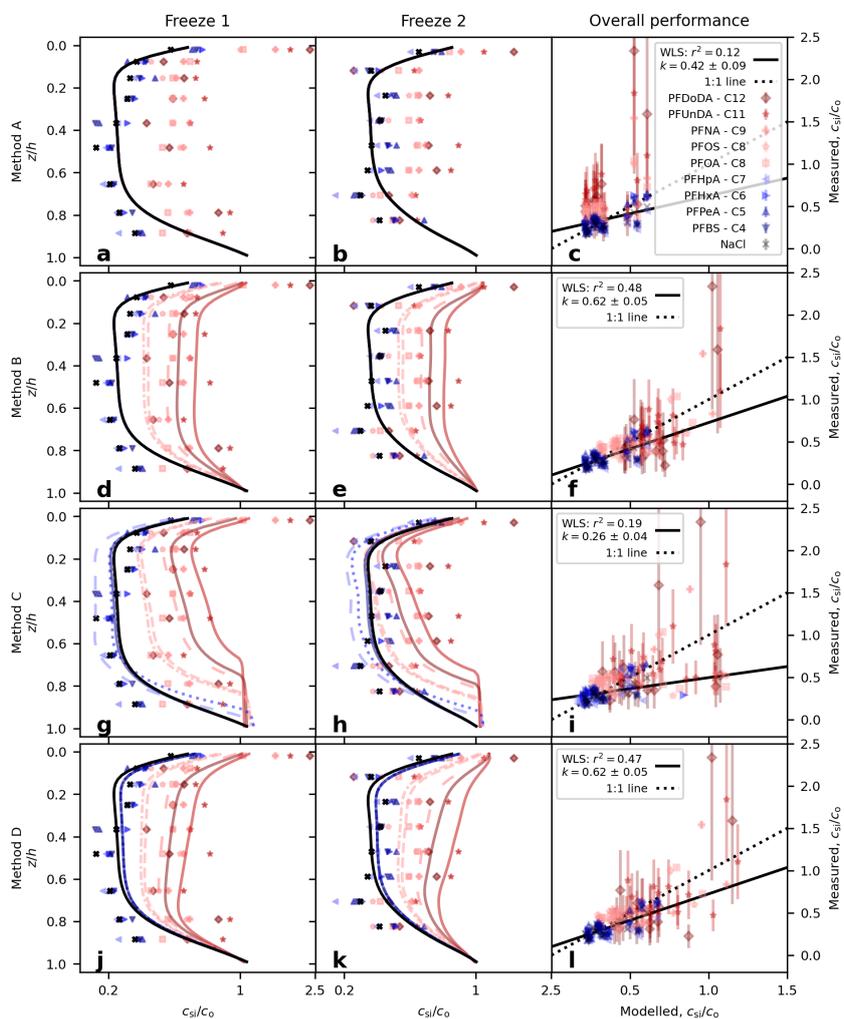
Fig. S 2. Comparison of modelled and measured concentration for: Method A, perfectly dissolved chemicals (a, b, c); Method B, simple decoupling (d, e, f); Method C, surface area adsorption (g, h, i); and Method D, salinity mediated decoupling (j, k, l). Depth profiles are shown for Freeze 1 (a, d, g, j) and Freeze 2 (b, e, h, k). Modelled against measured concentrations are shown in panels c, f, i, and l, alongside the best fit weighted least squares (WLS) regression (black line, gradient k with one standard error and coefficient of determination r^2 shown in legend) and the theoretical 1 to 1 line for perfect model behavior (dotted black). Concentration for the profiles is given on a log scale to highlight separation between the profiles. Tuning parameters for desalination were taken from Griewank and Notz (2015).

References

10 Griewank, P. J. and Notz, D.: A 1-D modelling study of Arctic sea-ice salinity, The Cryosphere, 9, 305–329, https://doi.org/10.5194/tc-9-305-2015, 2015.