A global climatology of ice nucleating particles at cirrus conditions derived from model simulations with EMAC-MADE3

Christof G. Beer[1], Johannes Hendricks[1], and Mattia Righi[1]

[1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

Correspondence: Christof Beer (christof.beer@dlr.de)

This Supplement contains additional figures complementing the evaluation of our model results presented in Sect. 3, Sect. 4, and Sect. 5 of the paper. Details about each figure can be found in the corresponding sections of the paper as mentioned in the supplement figure captions.

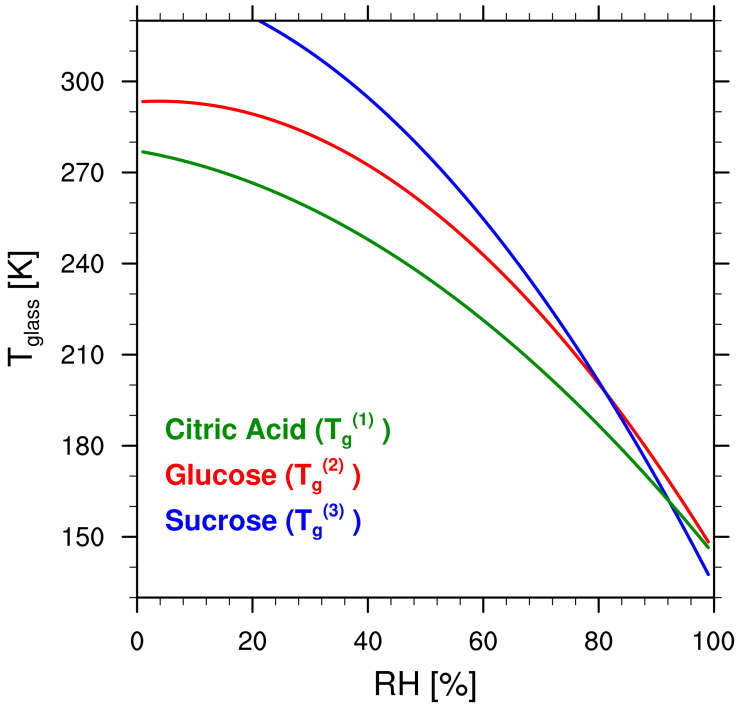

Figure S1. Experimentally determined $T_g(\mathrm{RH})$ curves according to Baustian et al. (2013) for the three different SOA proxies used in this study, i.e. citric acid (green), glucose (red), and sucrose (blue). See Sect. 3.2 in the paper for details.

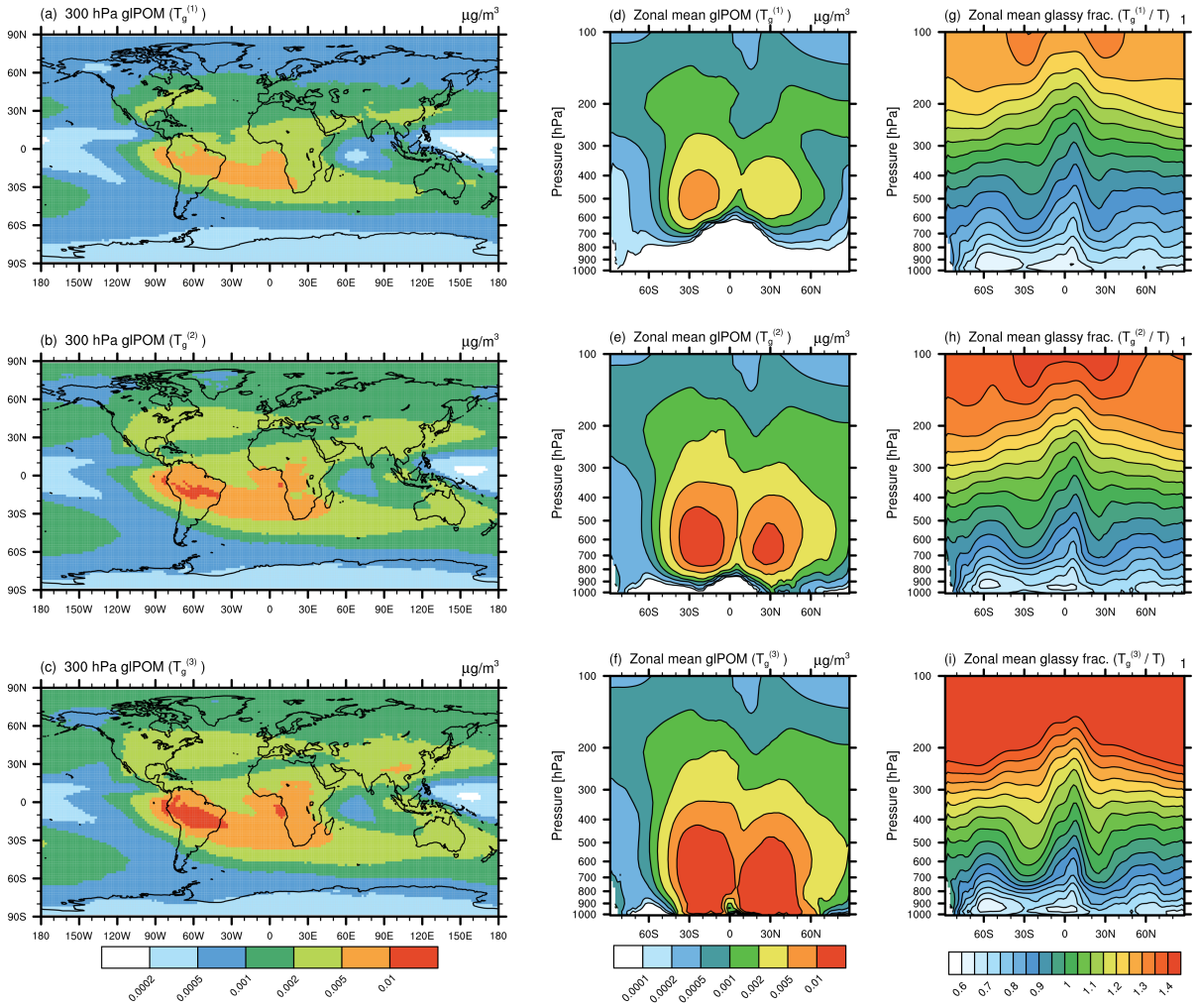

Figure S2. Similar to Fig. 2 but showing the global distribution of glPOM at the 300 hPa level in units of $\mu g\,m^{-3}$ (a, b, c), the zonally averaged vertical distribution of the glass transition temperature T_g in units of K (d, e, f), and the corresponding ratio T_g/T (g, h, i) for the three different representations of $T_g(\mathrm{RH})$. See Sect. 3.2 in the paper for details.

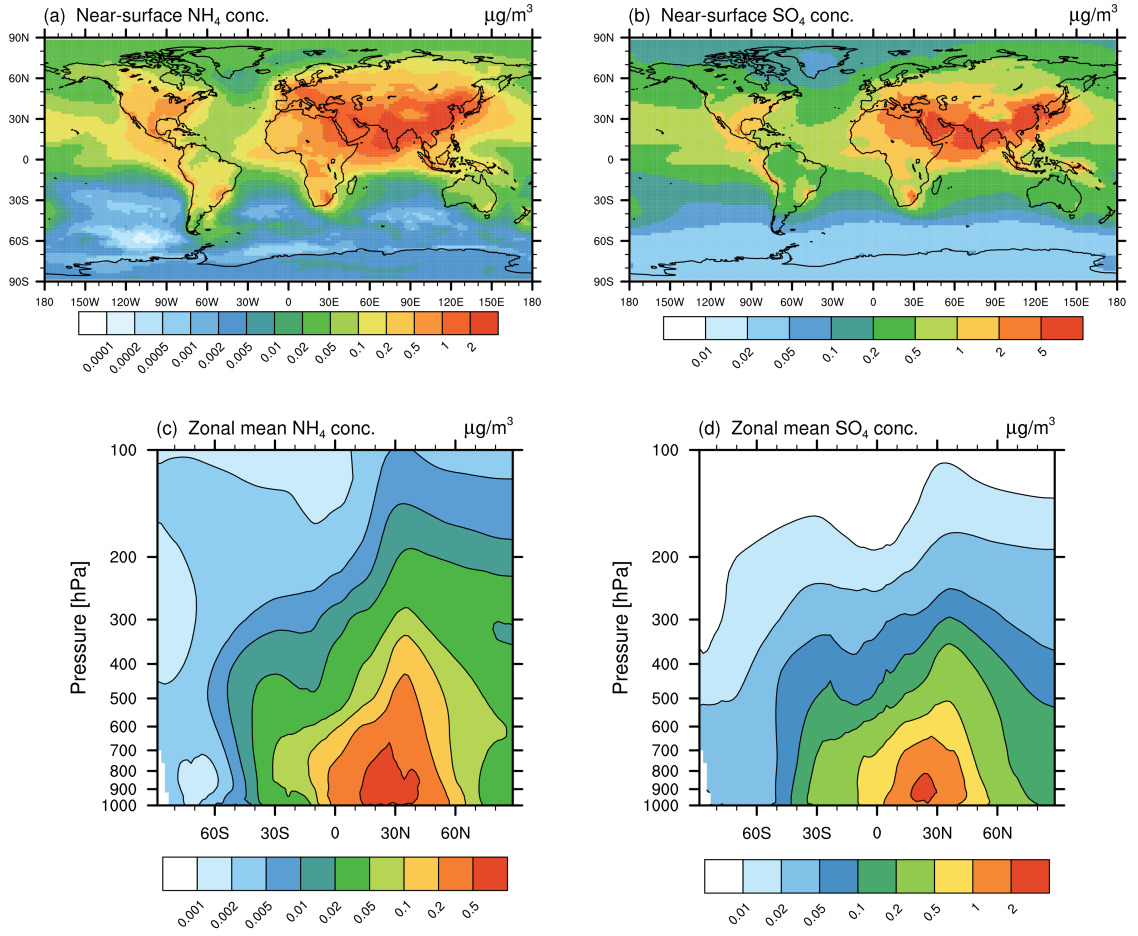

Figure S3. Global distribution of simulated mass concentrations of ammonium (NH_4) and sulfate (SO_4) (multi-annual mean, years 2010–2019). Mass concentrations in units of $\mu g\,m^{-3}$ are shown near the surface (a, b) and as zonal mean vertical distribution (c, d) for NH_4 and SO_4, respectively. See Sect. 4.3 in the paper for details.

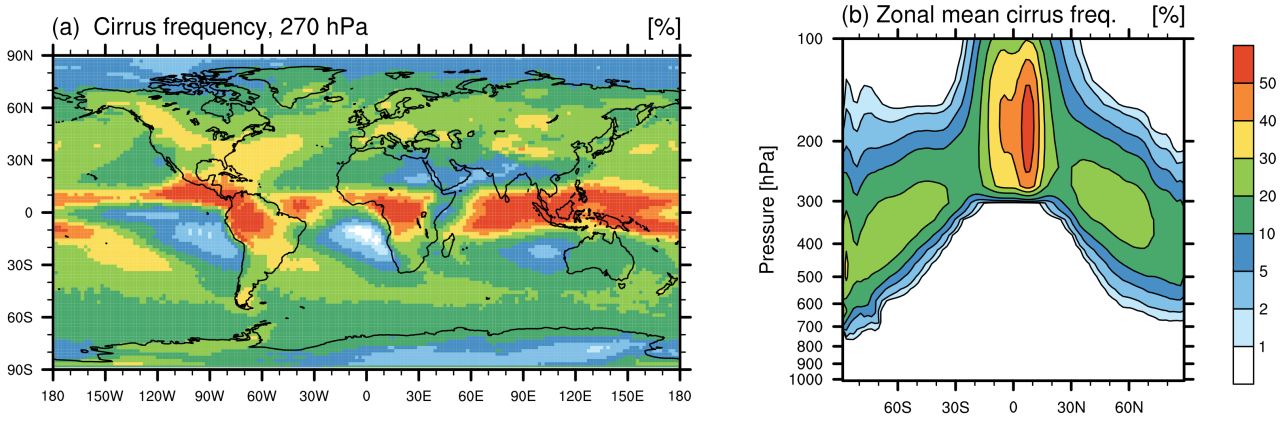

Figure S4. Global distribution of simulated cirrus cloud occurrence frequency (annual mean, years 2010–2019) calculated according to temperature ($T < -35\,^{\circ}\mathrm{C}$) and ice water content (IWC $> 0.5\,\mathrm{mg\,kg^{-1}}$), showing (a) cirrus frequency at 270 hPa and (b) zonal-mean cirrus frequency. See Sect. 5 in the paper for details.

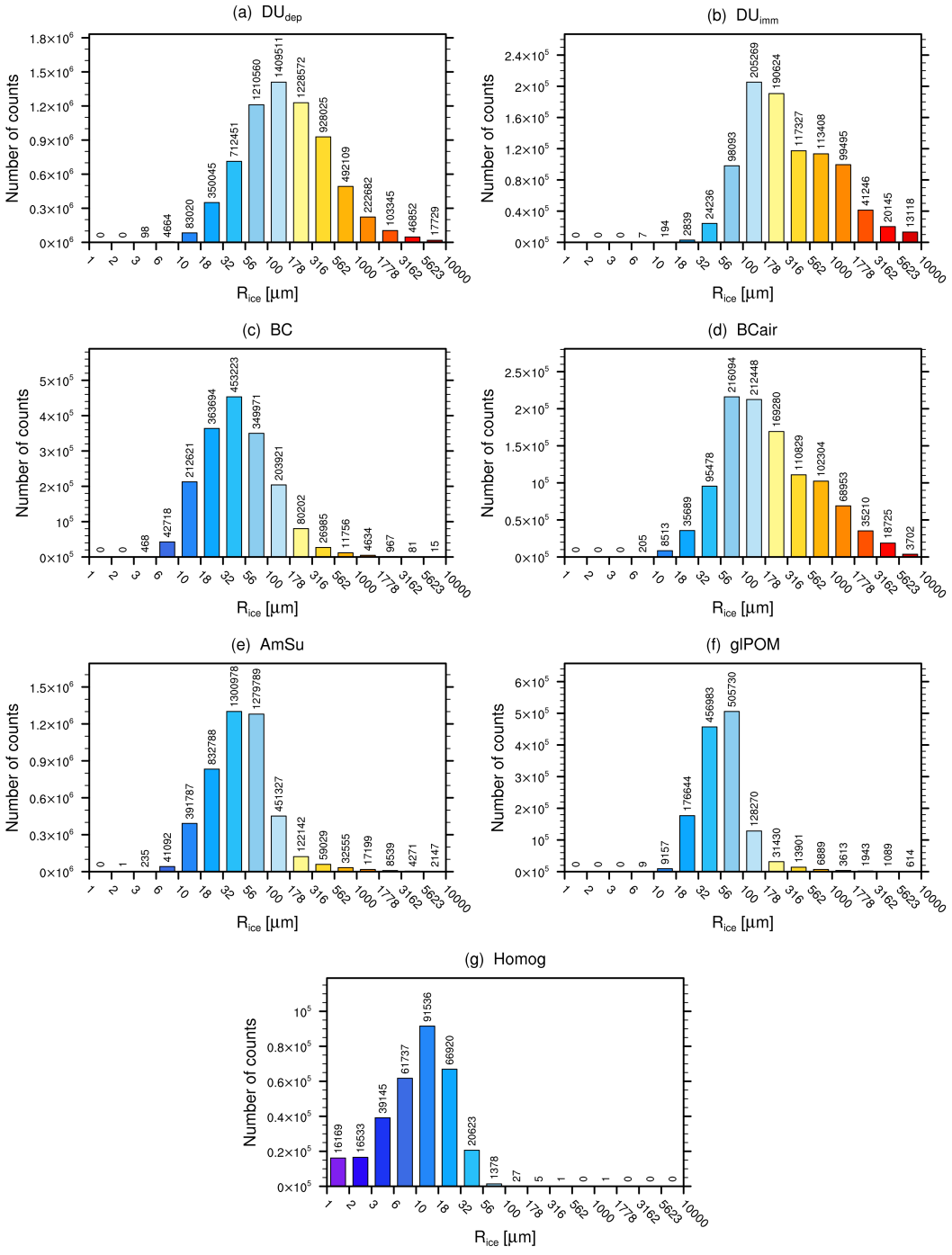

Figure S5. Simulated ice crystal radii (in units of µm) of newly formed crystals per freezing mode. The histograms are calculated from one simulated year (using the original 11-hourly model output), with four logarithmic bins per order of magnitude. Shown are (a) DU immersion, (b) DU deposition, (c) BC, (d) BCair, (e) AmSu, (f) glPOM, and (g) homogeneous freezing. Numbers above each bar represent actual counts. Note the different y-axis scales in each plot. See Sect. 5 in the paper for details.

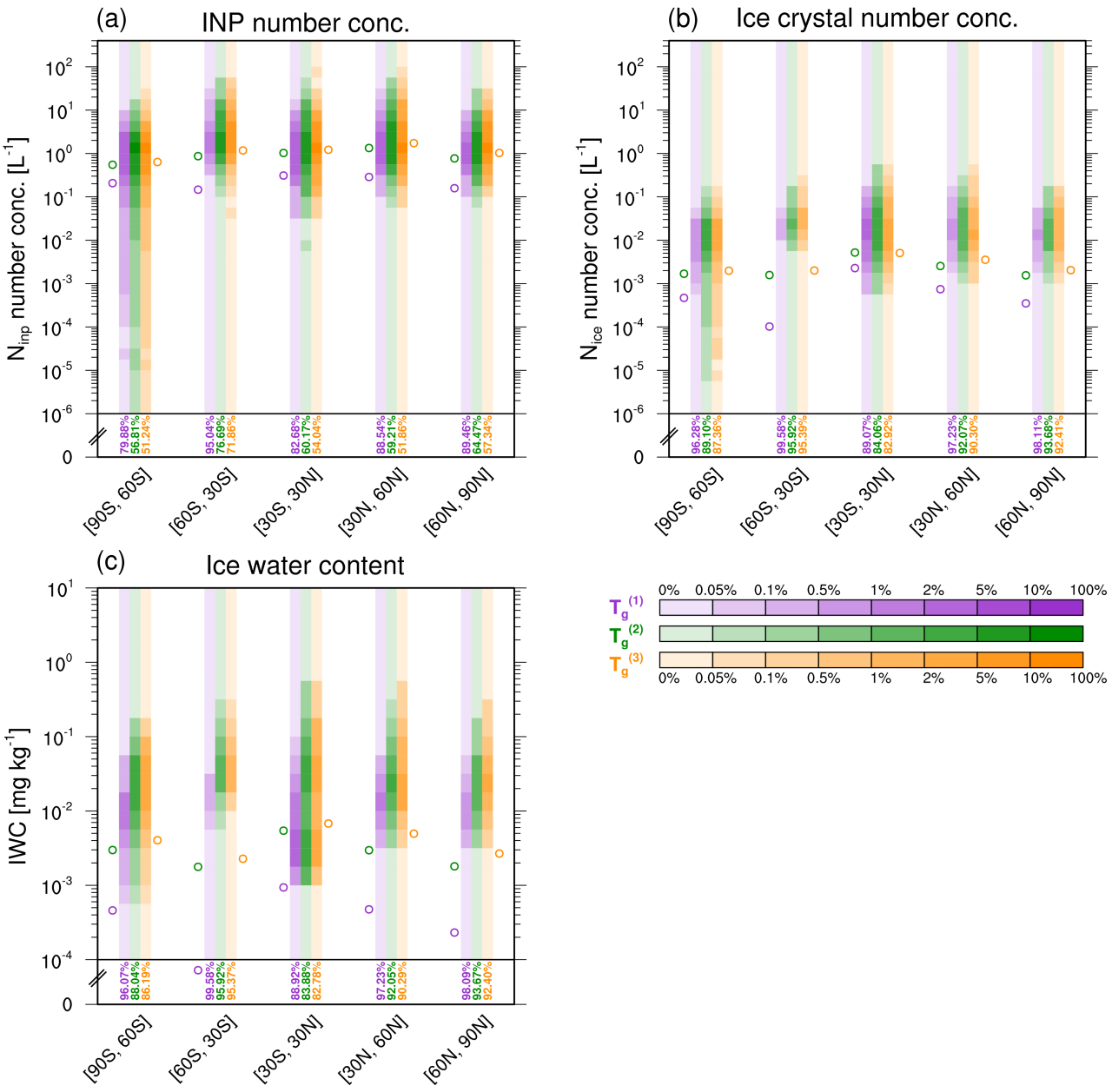

Figure S6. Similar to Fig. 6, but showing INP number concentrations, pristine ice crystal number concentrations, and ice water content for the three different representations of $T_g(\mathrm{RH})$ for glPOM, considering the SOA proxies citric acid ($T_g^{(1)}$), glucose ($T_g^{(2)}$), and sucrose ($T_g^{(3)}$). See Sect. 5 in the paper for details.