Supplement of

Impacts of ice-nucleating particles on cirrus clouds and radiation derived from global model simulations with MADE3 in EMAC

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

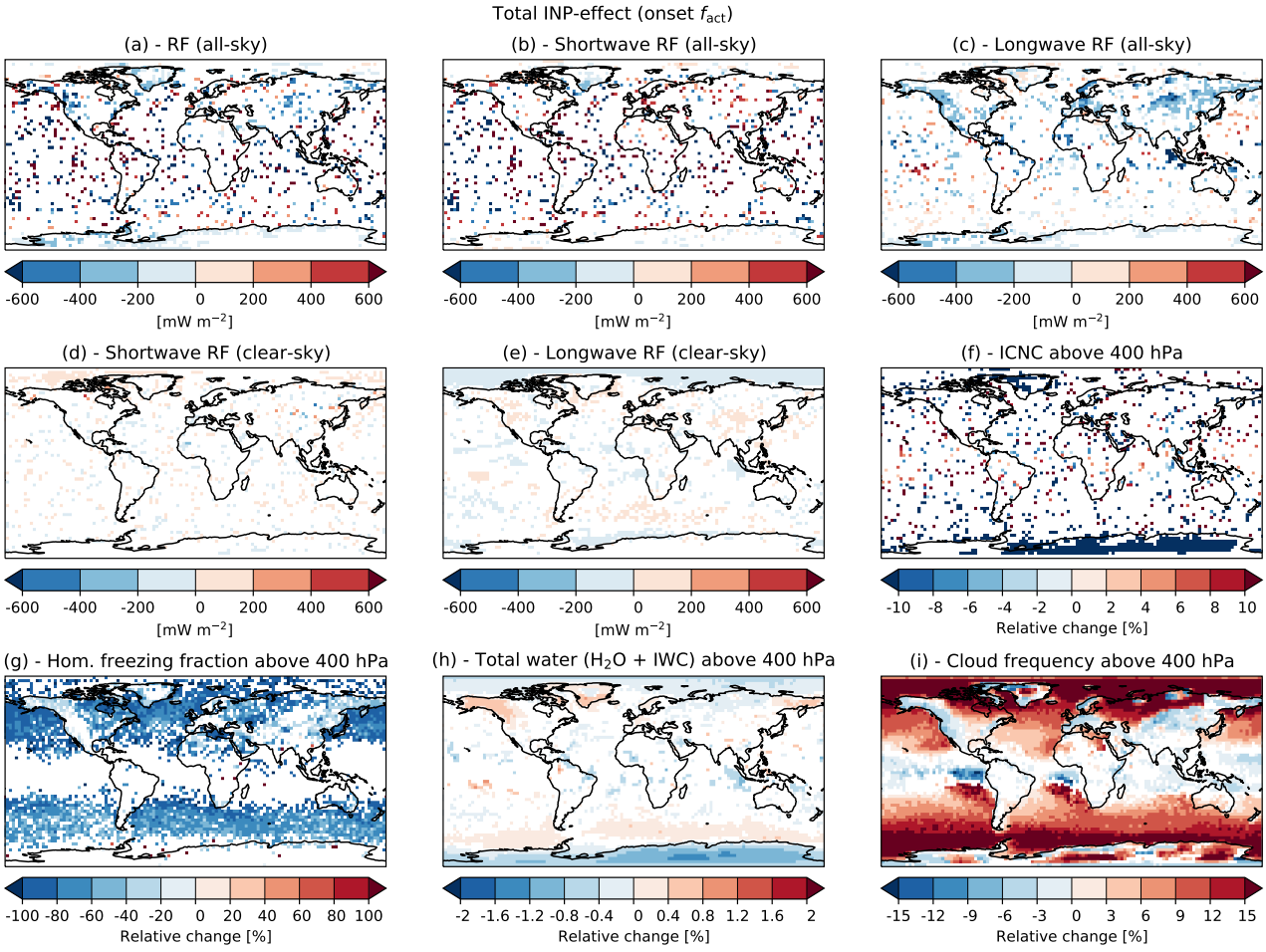

Figure S1. As in Fig. 1, but showing the geographic distribution of the simulated total INP-cirrus effect on the different radiation and cloud variables considering all INP types. Panels (a-e) represent radiative forcings at the top of the atmosphere, panels (f-i) show averaged cloud properties above 400 hPa.

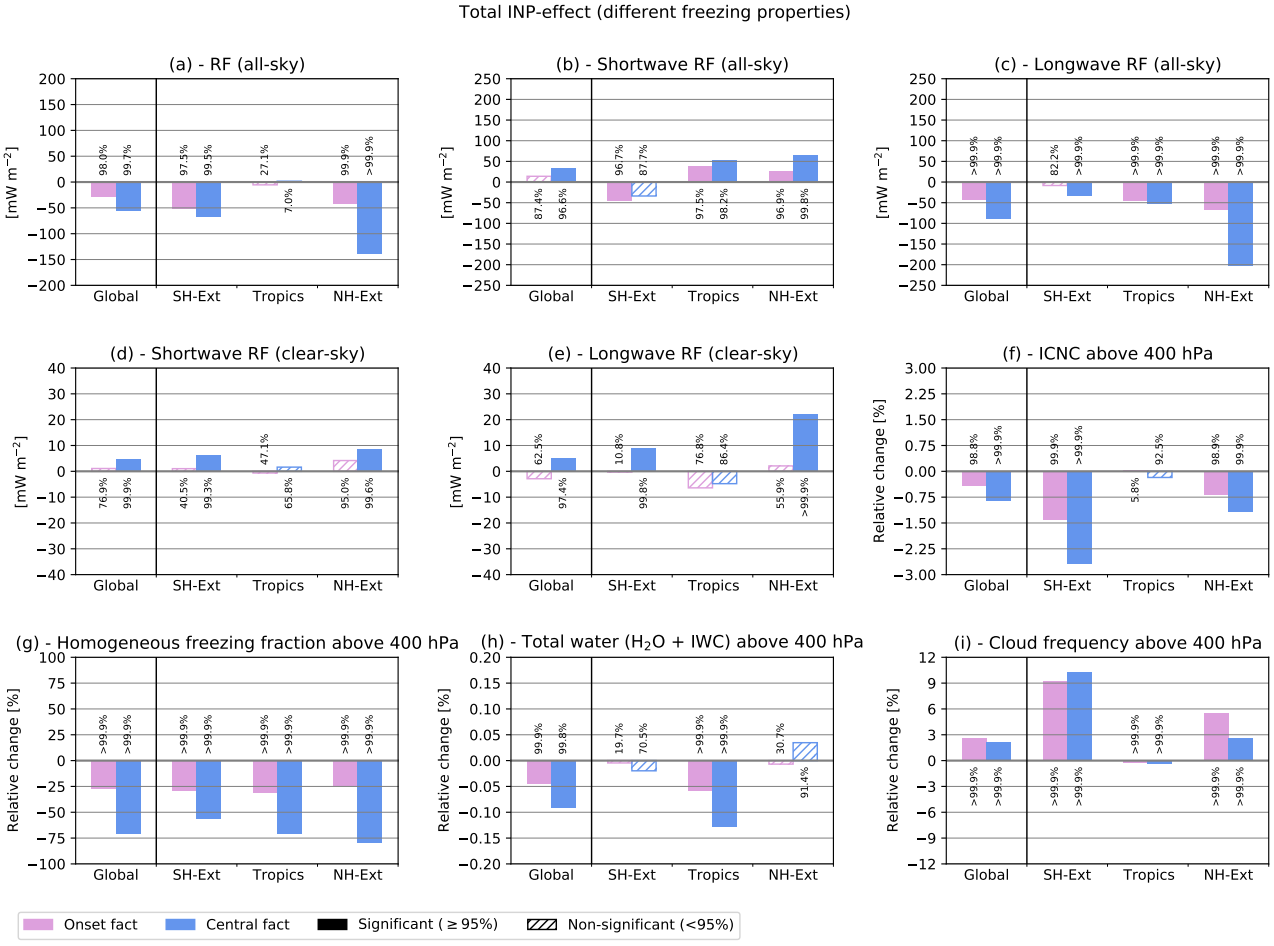

Figure S2. As in Fig. 2, but additionally showing all simulated variables from Fig. 1.

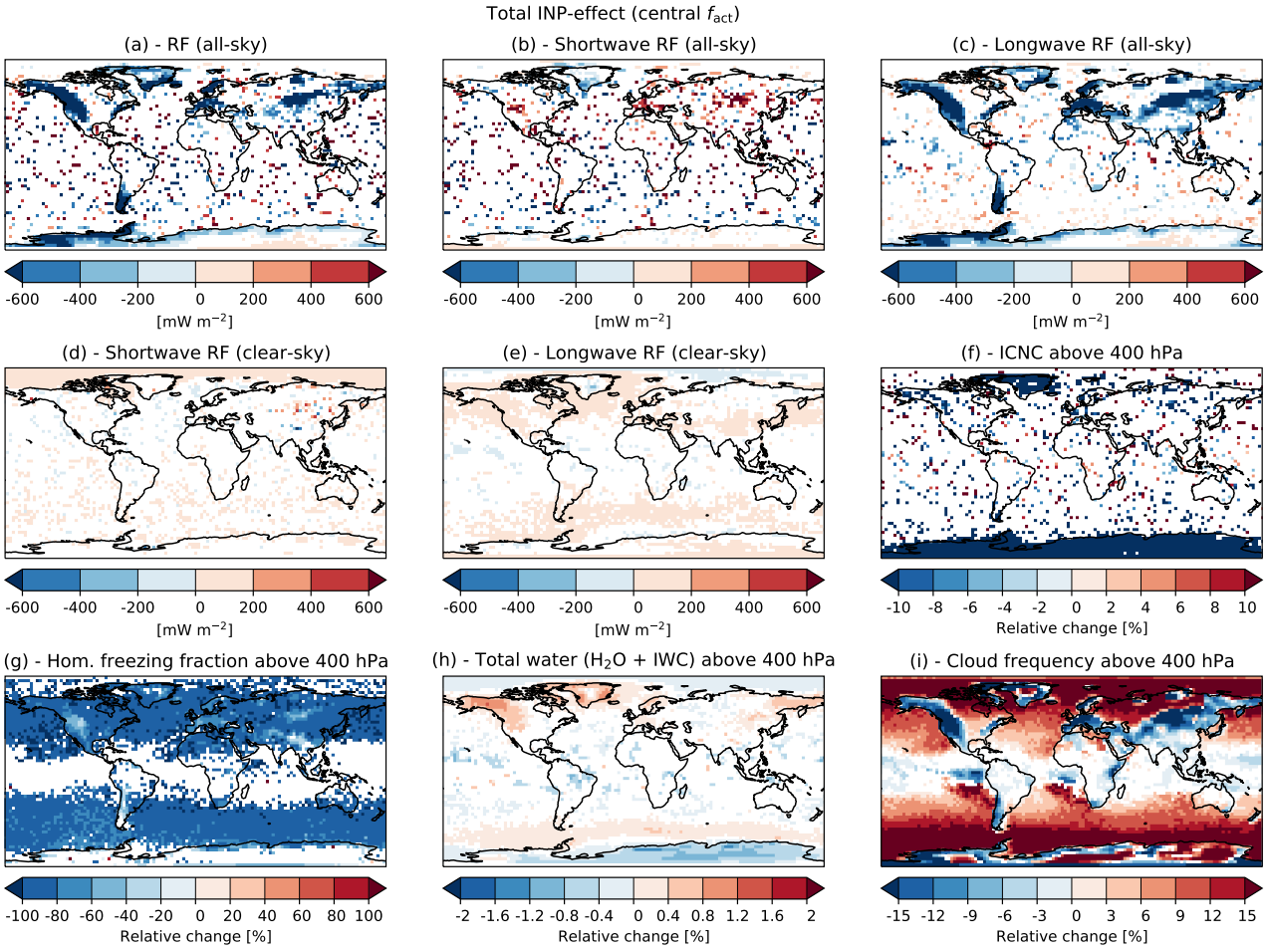

Figure S3. As in Fig. S2, but showing the geographic distribution of the simulated total INP-cirrus effect on the different radiation and cloud variables considering all INP types and an increased freezing potential of INPs (central f_{act}). Panels (a-e) represent radiative forcings at the top of the atmosphere, panels (f-i) show averaged cloud properties above $400\,\mathrm{hPa}$.

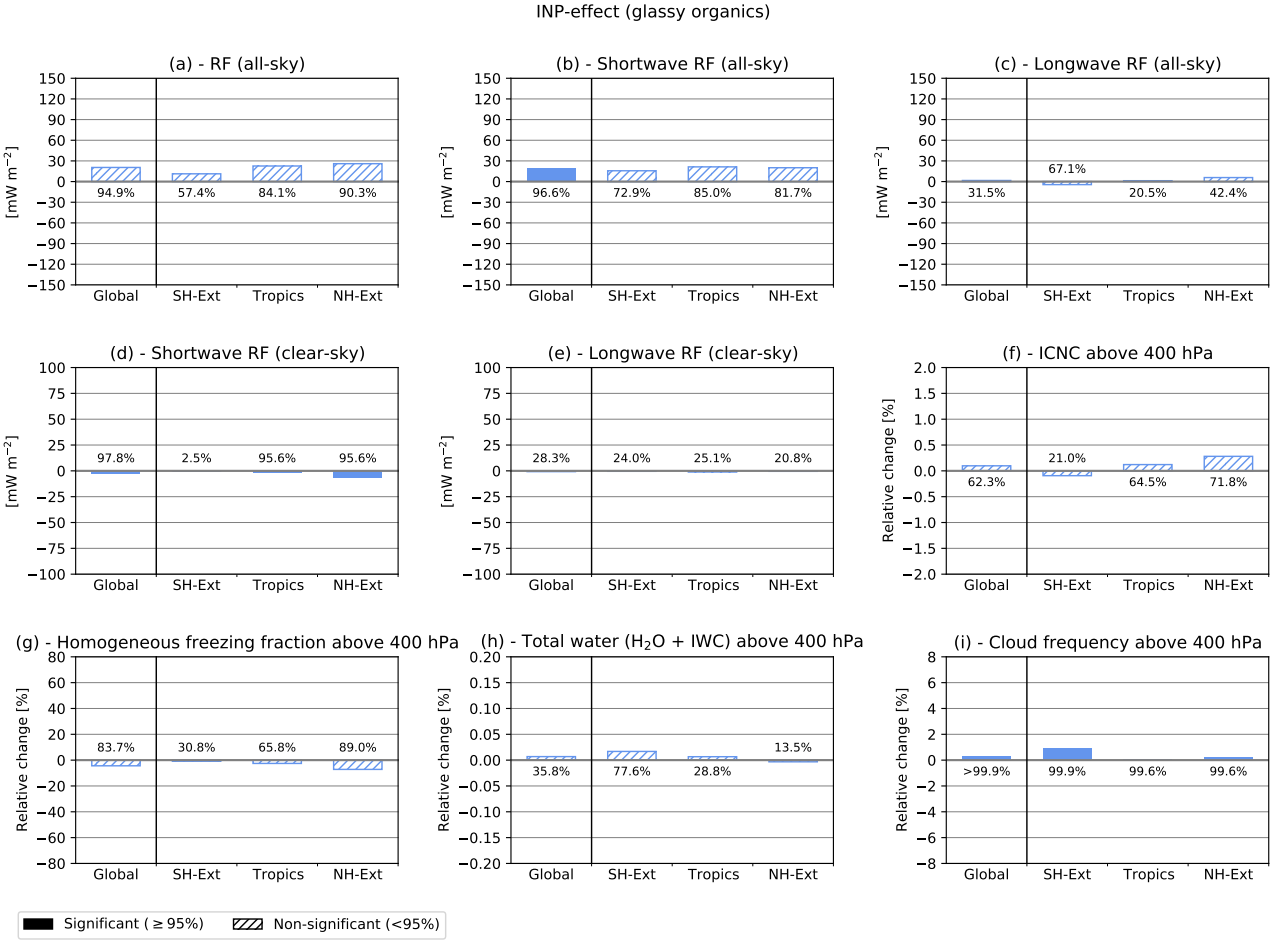

Figure S4. As in Fig. 4, but showing the INP-cirrus effect induced by glassy organics, calculated from the difference between a simulation including glPOM, DU and BC INPs, and a simulation including only heterogeneous freezing on DU and BC.

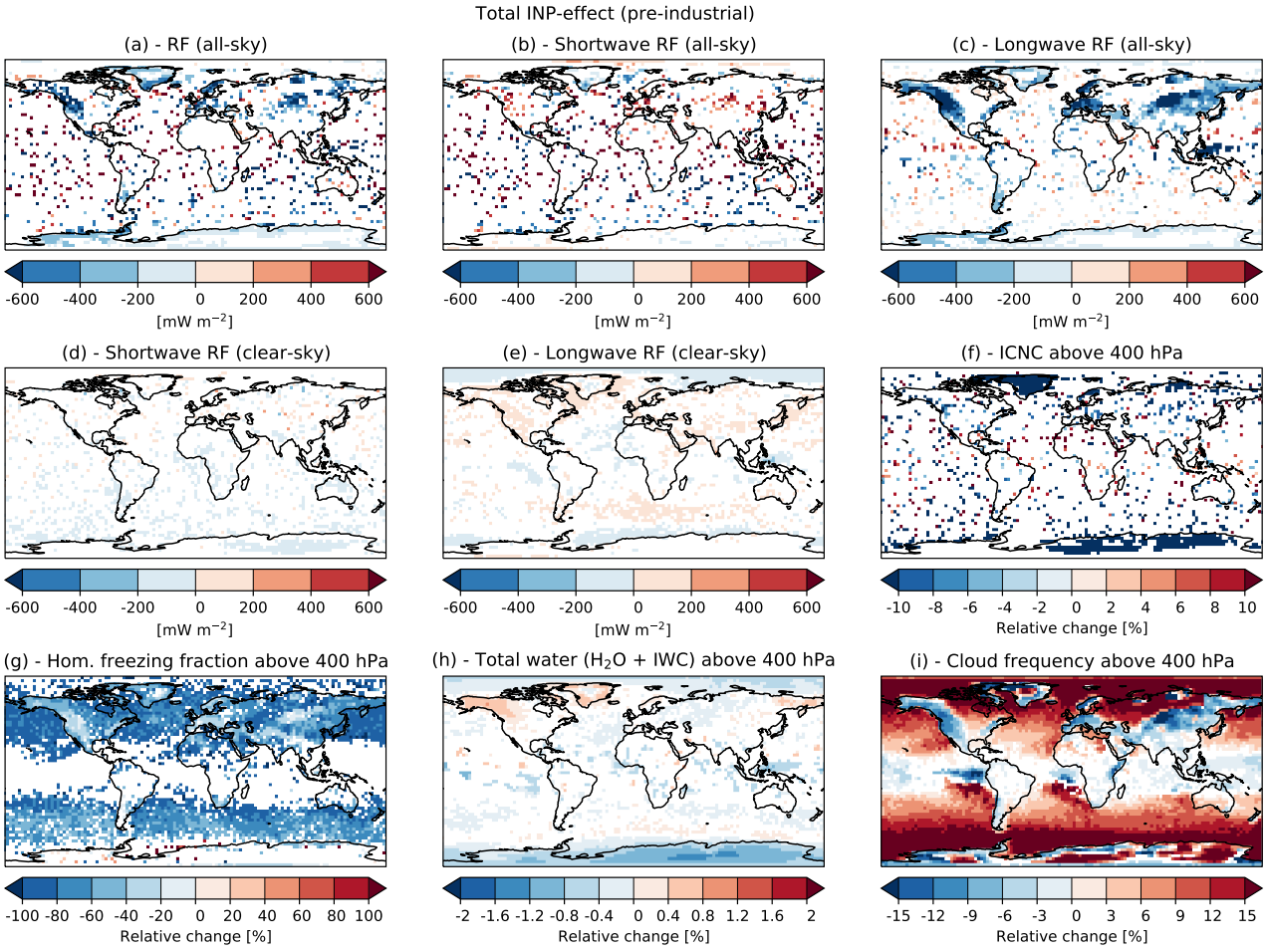

Figure S5. As in Fig. S3, but showing the geographic distribution of the simulated total INP-cirrus effect on the different radiation and cloud variables considering pre-industrial (1750) conditions. Panels (a-e) represent radiative forcings at the top of the atmosphere, panels (f-i) show averaged cloud properties above 400 hPa.

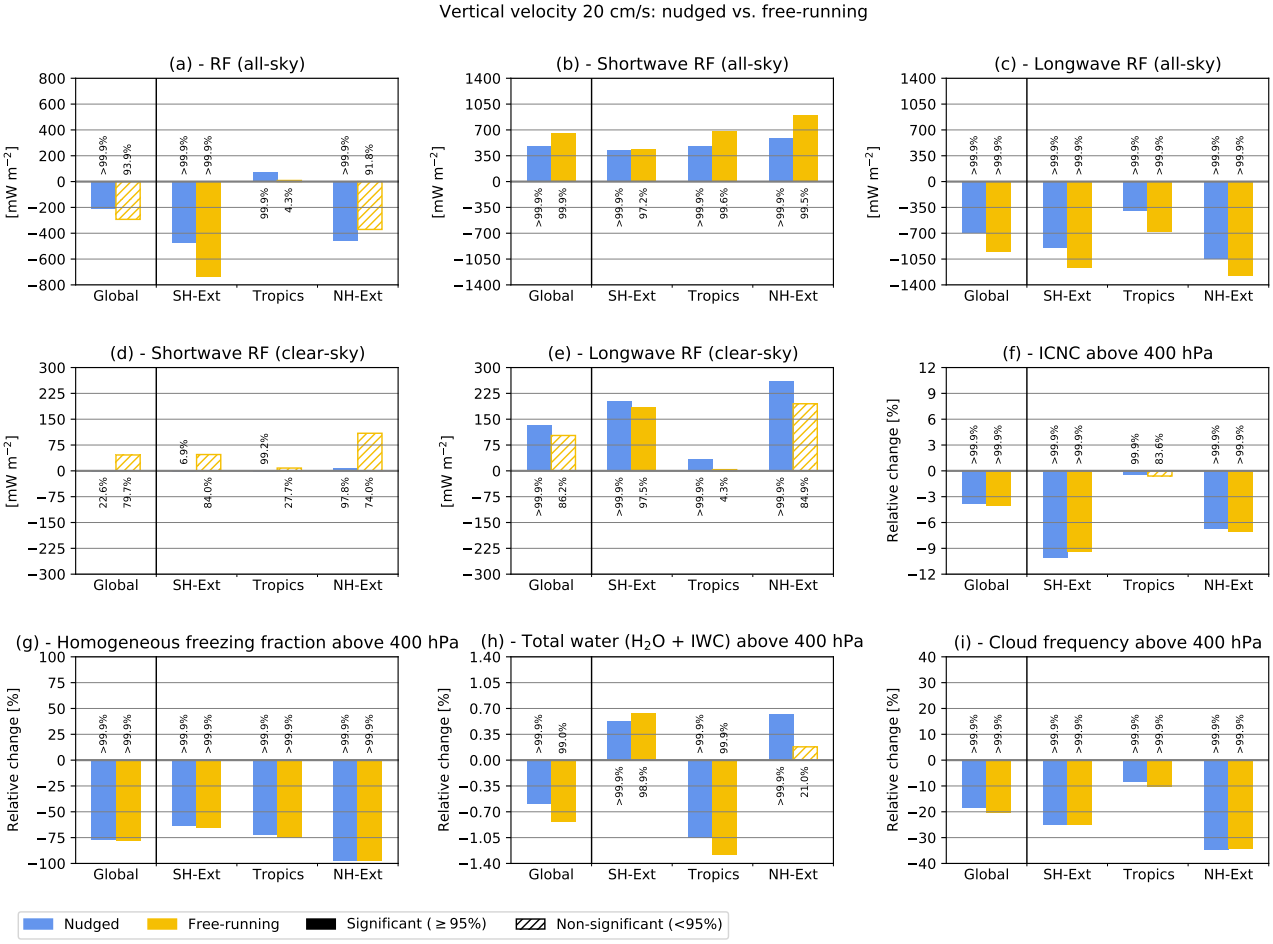

Figure S6. As in Fig. 1, but showing the total INP-cirrus effect for a prescribed vertical velocity of 20 $\mathrm{cm\,s^{-1}}$ simulated with a nudged (blue) and a free-running (yellow) model setup.

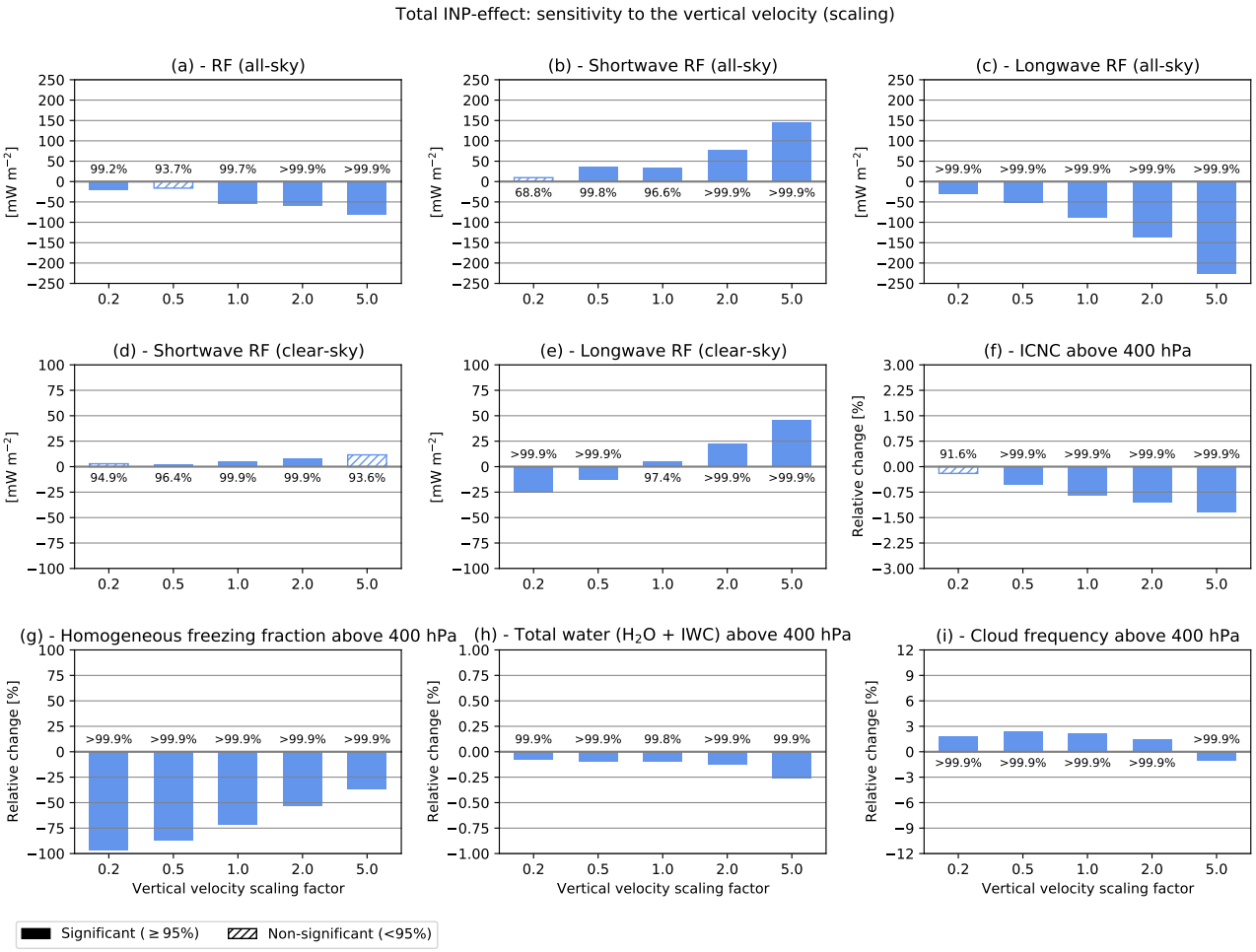

Figure S7. As in Fig. 6, but showing the sensitivity of the total INP-cirrus effect (enhanced ice-nucleating properties of INPs) to the scaling of the parametrized vertical velocity considering scaling factors of 0.2, 0.5, 1.0 (i.e. the reference case), 2.0, and 5.0.

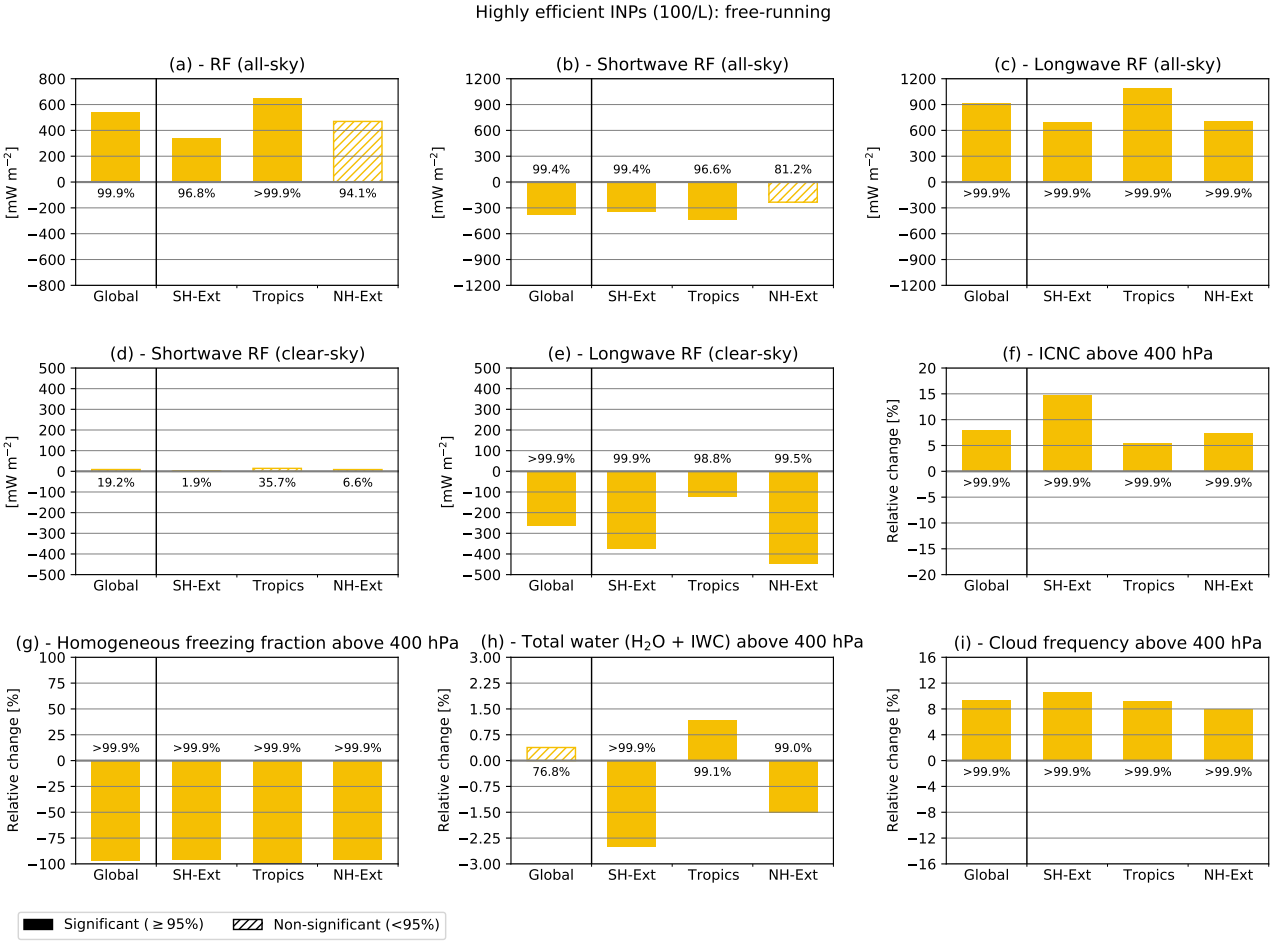

Figure S8. As in Fig. 1, but showing the INP-cirrus effect for highly efficient INPs ($100\,\mathrm{L}^{-1}$) for a free-running model setup.