

Figure S1. Seasonal (summer-left and winter-right) zonal means of ice crystal number concentration ($ICNC$, [L^{-1}]) for the default simulation KL+LD and the relative percentage changes of BN+LD, KL+BN, and BN+BN with respect to it (i.e. $(experiment - DEF)/|DEF| \cdot 100$), computed where $ICNC^{DEF} \geq 1 L^{-1}$. The isolines at 273 K and 238 K and the tropopause (dotted line) are seasonal means.

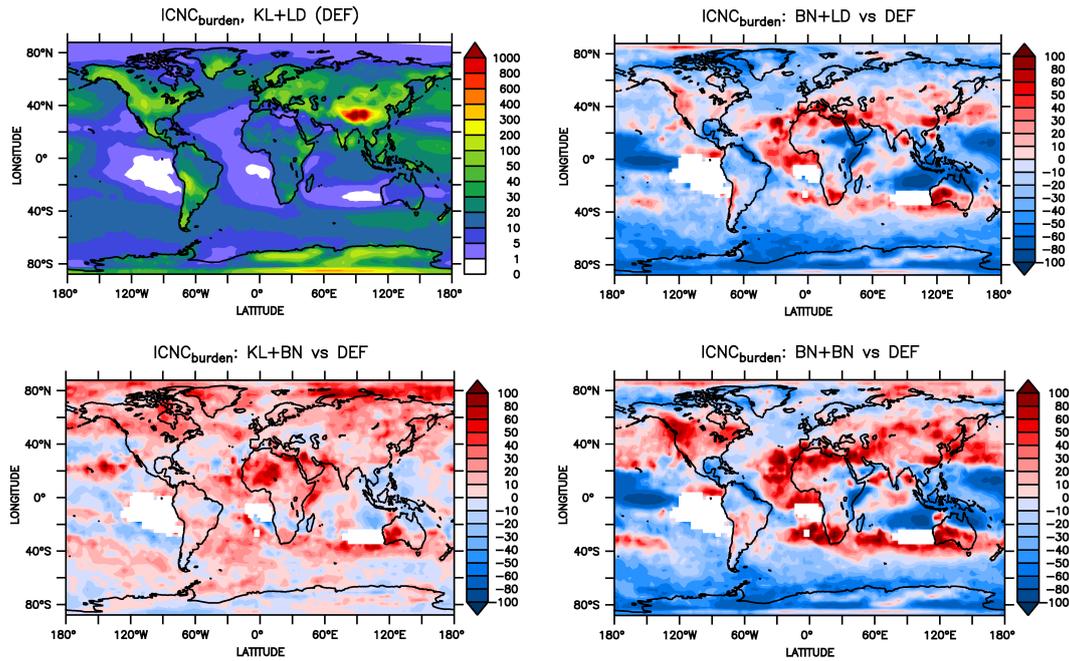


Figure S2. Annual means of vertically integrated ice crystal number concentration ($ICNC_{burden}$, [$10^8 m^{-2}$]) for the default simulation and the relative percentage changes of BN+LD, KL+BN, and BN+BN with respect to it (i.e. $(experiment - DEF)/|DEF| \cdot 100$), computed where $ICNC_{burden}^{DEF} \geq 10^8 m^{-2}$.

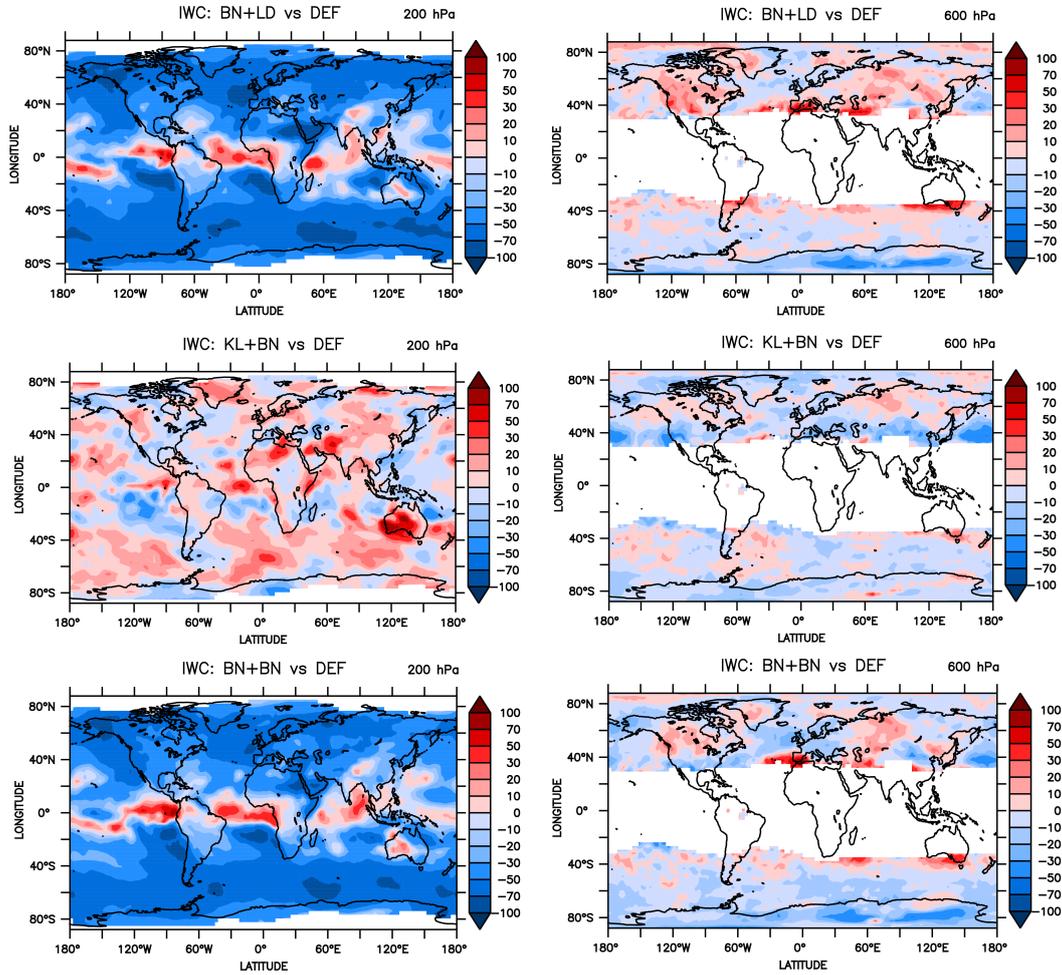


Figure S3. Relative percentage changes of annual means of ice water content (IWC , [mg kg^{-1}]) at 200 hPa (cirrus regime) and 600 hPa (mixed-phase regime) for BN+LD, KL+BN, and BN+BN with respect to the default simulation (i.e. $(\text{experiment} - \text{DEF})/|\text{DEF}| \cdot 100$), computed where $IWC^{DEF} \geq 0.1 \text{ mg kg}^{-1}$.

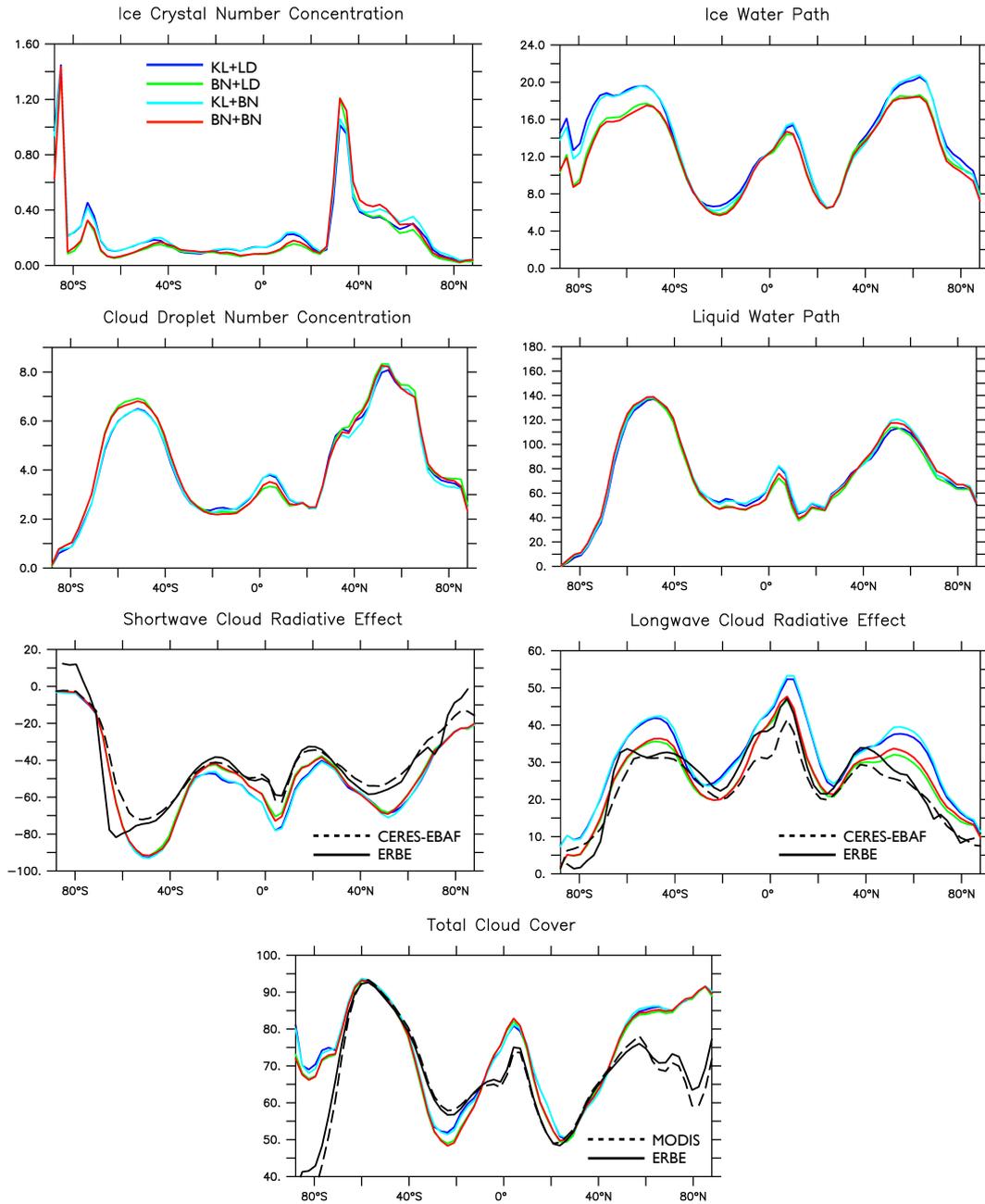


Figure S4. Annual zonal means of vertically integrated number concentration of cloud droplets ($CDNC_{burden}$, [10^{10} m^{-2}]) and ice crystals ($ICNC_{burden}$, [10^{10} m^{-2}]), non-precipitable liquid water path (LWP , [g m^{-2}]) and ice water path (IWP , [g m^{-2}]) averaged over the whole grid-boxes, shortwave and longwave cloud radiative effects ($SCRE$, $LCRE$, [W m^{-2}]), total cloud cover (TCC , [%]). Colored lines refer to the experiments: KL+LD (blue), BN+LD (green), KL+BN (light blue) and BN+BN (red). Black lines refer to satellite observations.

cloud_param	4	<i>cloud scheme</i>	<i>Lohmann et al., 2010</i>
ncdnc	3	<i>CDNC scheme</i>	<i>UAF</i>
nicnc	3	<i>ICNC - cirrus regime</i>	<i>BN09</i>
limm_BN09	T	<i>ICNC - mixed phase regime</i>	<i>BN09</i>
lcover	F	<i>cloud cover calculation</i>	<i>Sundqvist</i>
l_cdnc_calc	T	<i>CDNC parameterisation calculations</i>	
i_cdnc_calc	7	<i>CDNC parameterisation calculation</i>	<i>UAF</i>
i_cdnc_cpl	7	<i>CDNC parameterisation feedback</i>	<i>UAF</i>
aer_stream	'gmxe_gp'	<i>aerosol model for cdnc coupling</i>	<i>GMXe</i>

Figure S5. Setup of cloud.nml for the simulation BN+BN. The first two columns show the parameter names and the corresponding values selected for BN+BN, respectively. The third column describes the meaning of the parameters. The fourth column indicates the meaning of the values in the second column.