Figure S1. The occurrence frequency of layered cloud and seeder-feeder clouds plotted against the vertical distance between the clouds from 13:30 to 17:00 UTC in the control simulation.
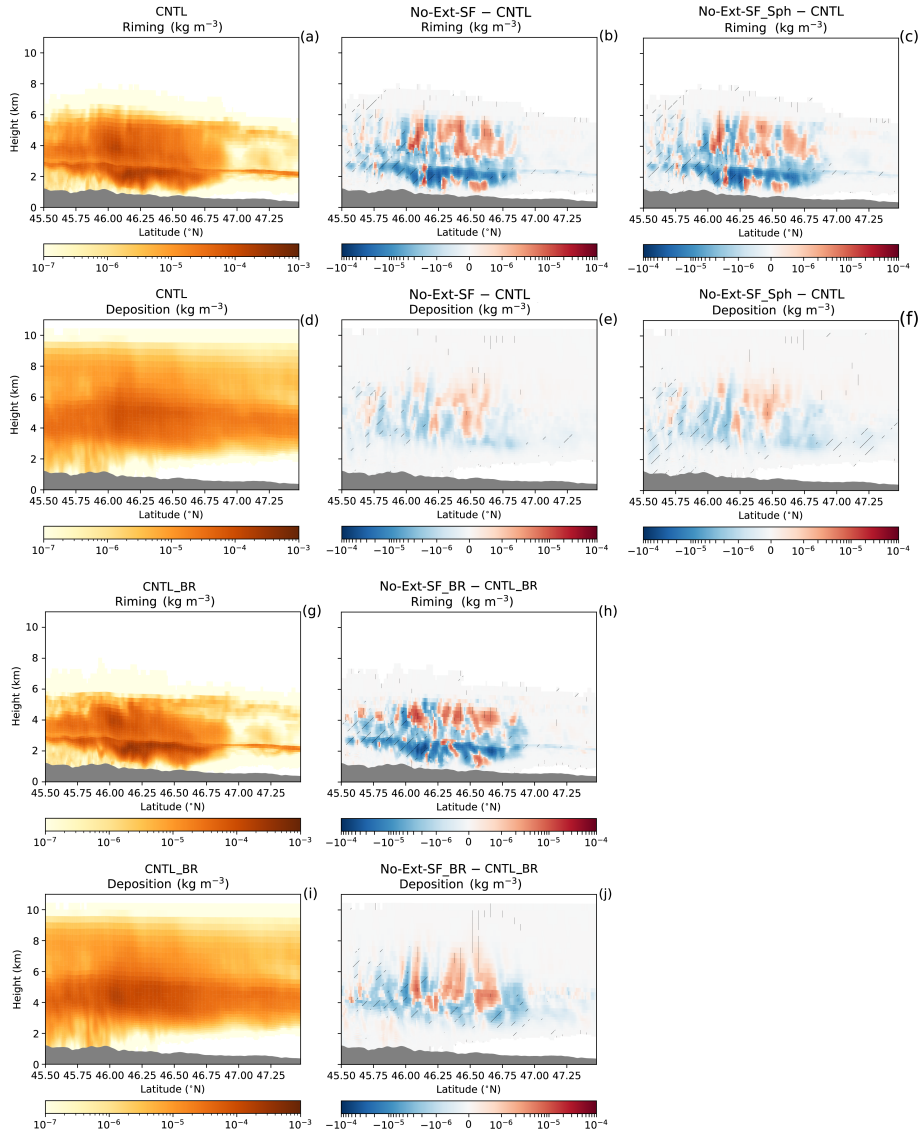
Figure S2. Cross-section of the growth of ice particles by riming **(a, g)** and deposition **(d, i)** for the CNTL and CNTL_BR simulation ensemble means respectively. **(b, c, e)**, are the differences between the sensitivity (No-Ext-SF and No-Ext-SF_Sph) and the CNTL simulation ensemble means. **(h, j)** are the differences between the No-Ext-SF_BR and CNTL_BR simulation ensemble means. The vertical (positive) and slanted (negative) black lines show where the differences are outside of the 95% confidence interval of the CNTL and CNTL_BR ensemble simulations. The cross-section is a zonal and temporal mean from 13:30 to 17:00 UTC.
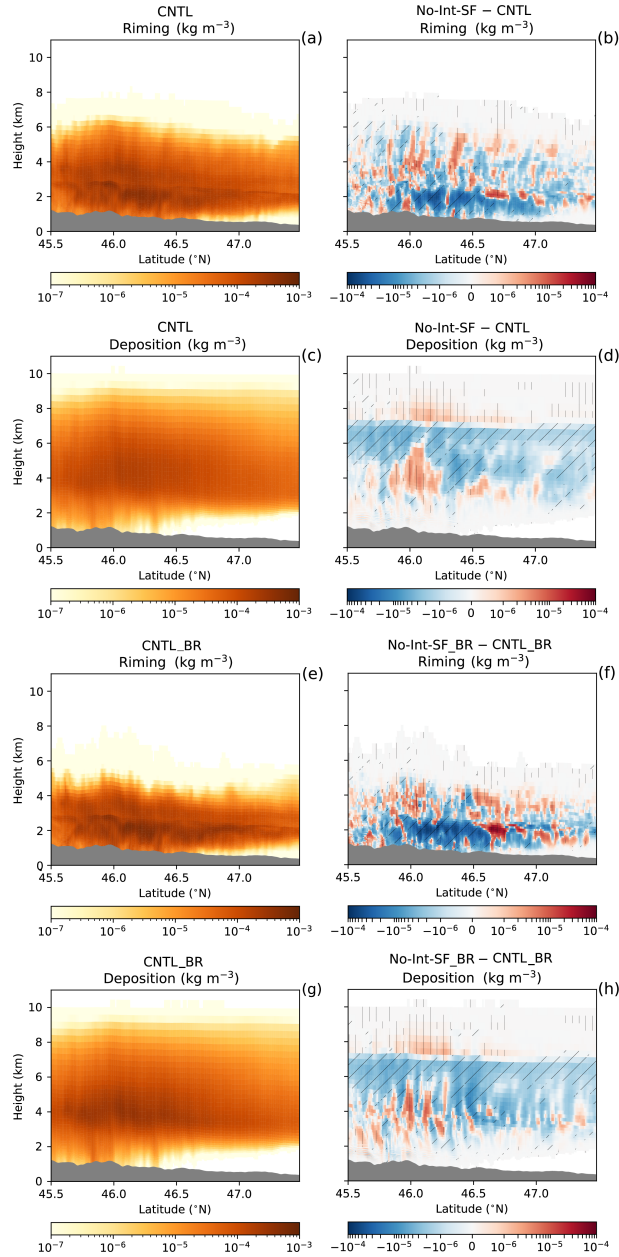
Figure S3. Cross-section of the growth of ice particles by riming (a and e) and, deposition (c and g) for the CNTL and CNTL_BR simulation ensemble means respectively. b), and d) are the differences between the No-Int-SF and the CNTL simulation ensemble means. f) and h) are the differences between the No-Int-SF_BR and CNTL_BR simulation ensemble means. The vertical (positive) and slanted (negative) black lines show where the differences are outside of the 95% confidence interval of the CNTL and CNTL_BR ensemble simulations. The cross-section is a zonal and temporal mean from 17:15 to 20:45 UTC.
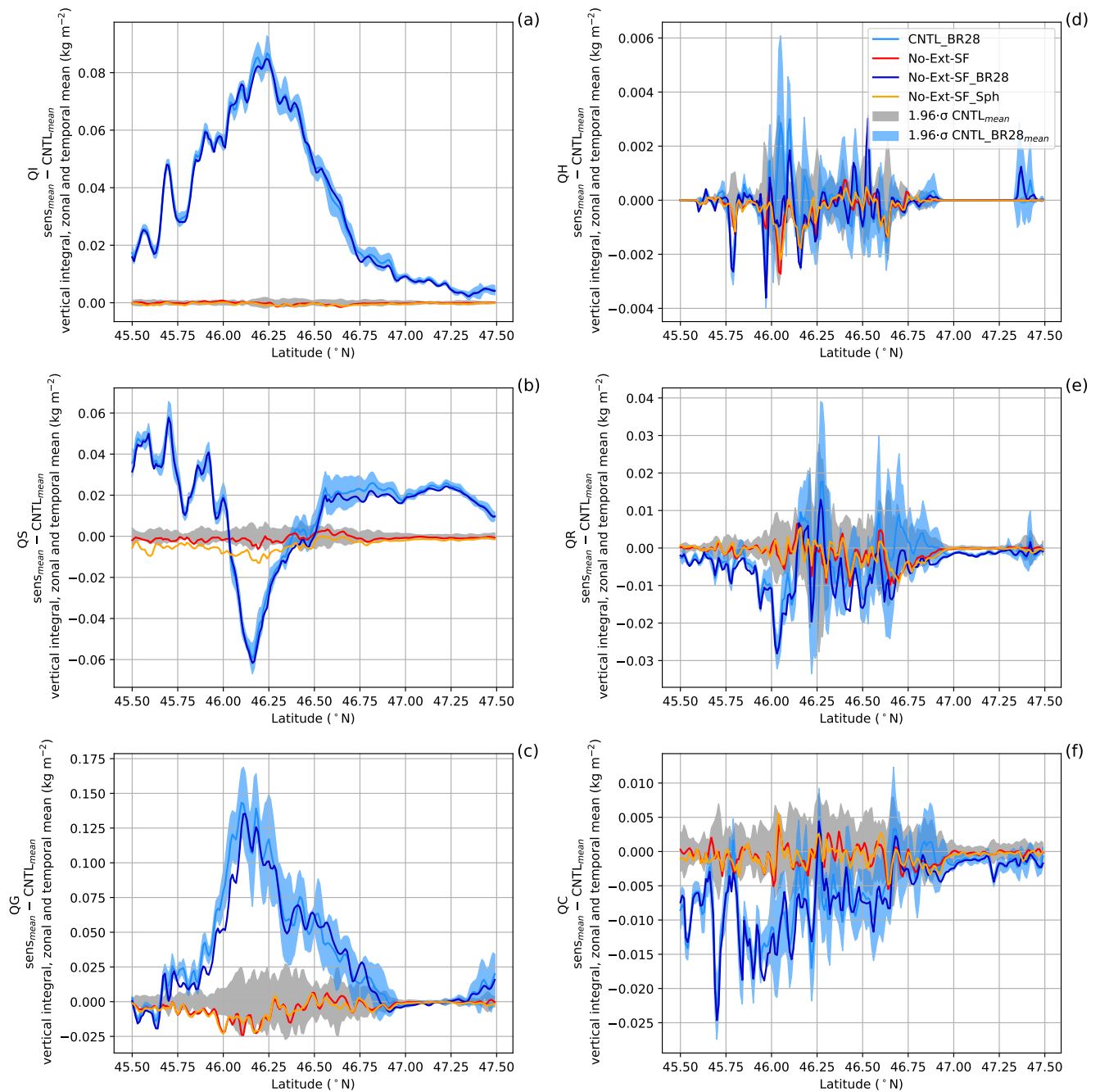
Figure S4. The impact of the external seeder-feeder process difference between the sensitivity simulation and the CNTL simulation ensemble means for the **(a)** ice crystal, **(b)** snow, **(c)** graupel, **(d)** hail, **(e)** raindrop and **(f)** cloud droplet mass mixing ratios from 13:30 to 17:00 UTC. The sensitivity simulations and the results from the CNTL simulation are No-Ext-SF (red line), No-Ext-SF_BR (blue line) and No-Ext-SF_Sph (orange line). The shaded areas signify the 95% confidence interval of the control simulation.
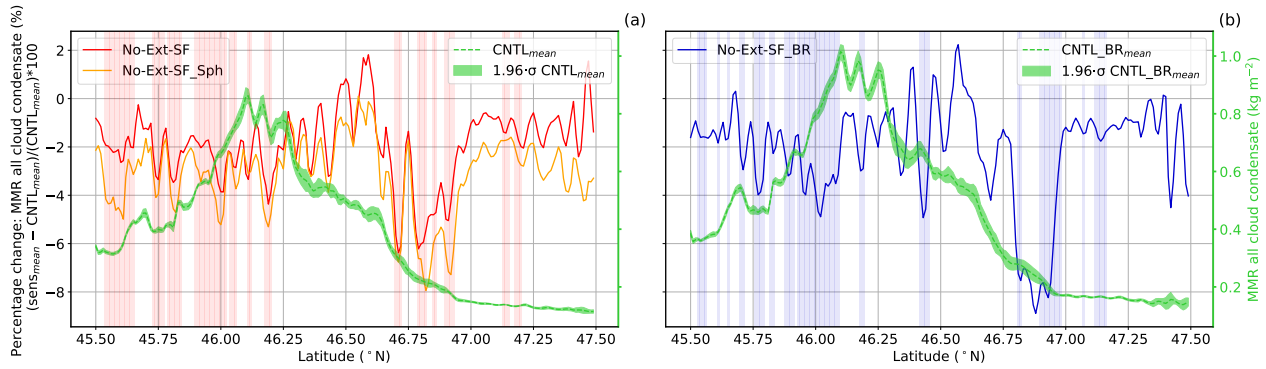
Figure S5. The percentage change of the mass mixing ratio of all cloud condensate between the sensitivity simulations and CNTL simulations ensemble means for the precipitation from 13:30 to 17:00 UTC. The sensitivity simulations are **(a)** No-Ext-SF (red line), No-Ext-SF_Sph (orange line) and **(b)** No-Ext-SF_BR (blue line). The dashed green line is **(a)** the CNTL mean in and **(b)** the CNTL_BR mean and the shaded green areas signify the 95% confidence interval of the control simulation. The shaded vertical bars are the significant changes of **(a)** the No-Ext-SF simulation from the CNTL simulation and **(b)** the No-Ext-SF_BR simulation from the CNTL_BR simulation. The plots are vertically integrated and, zonal and temporal means.
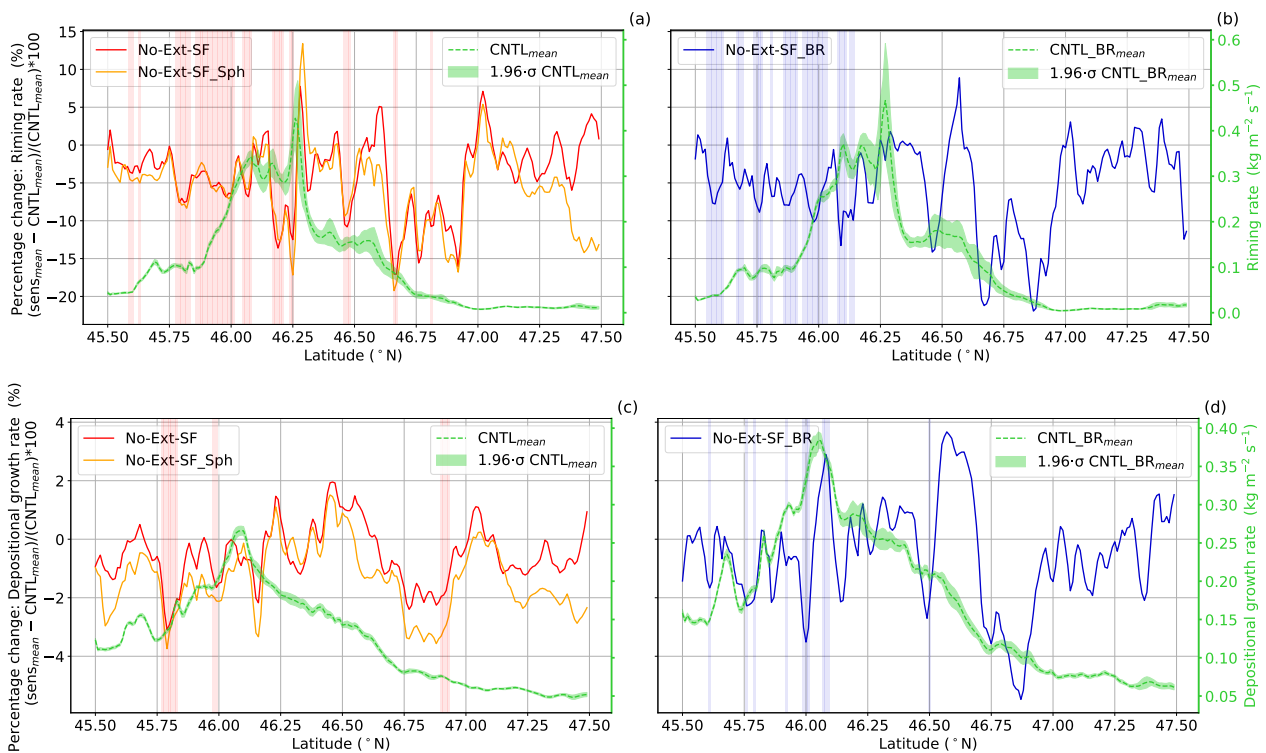

Figure S6. As Figure S3, but for the percentage change of **(a, b)** the riming rate and **(c, d)** the depositional growth rate.
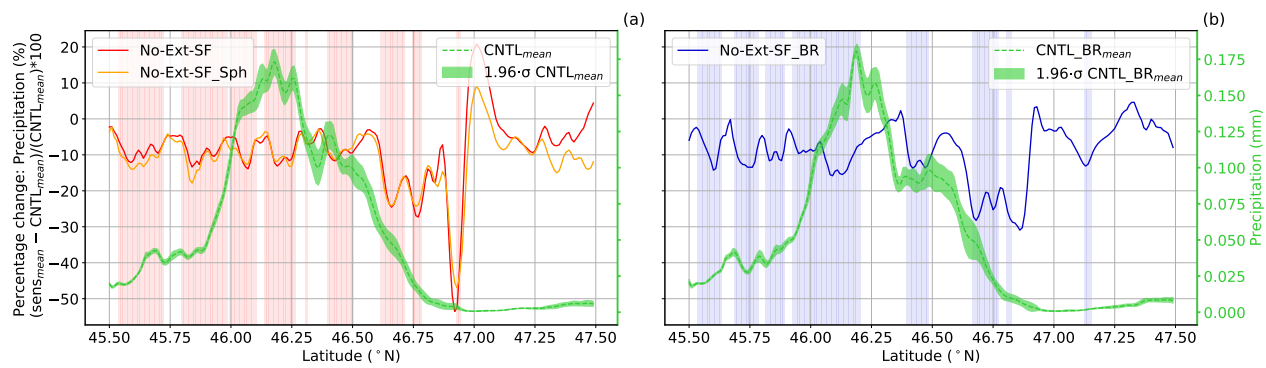
Figure S7. As Figure S3, but for the percentage change of precipitation. The plots are zonal and temporal means.
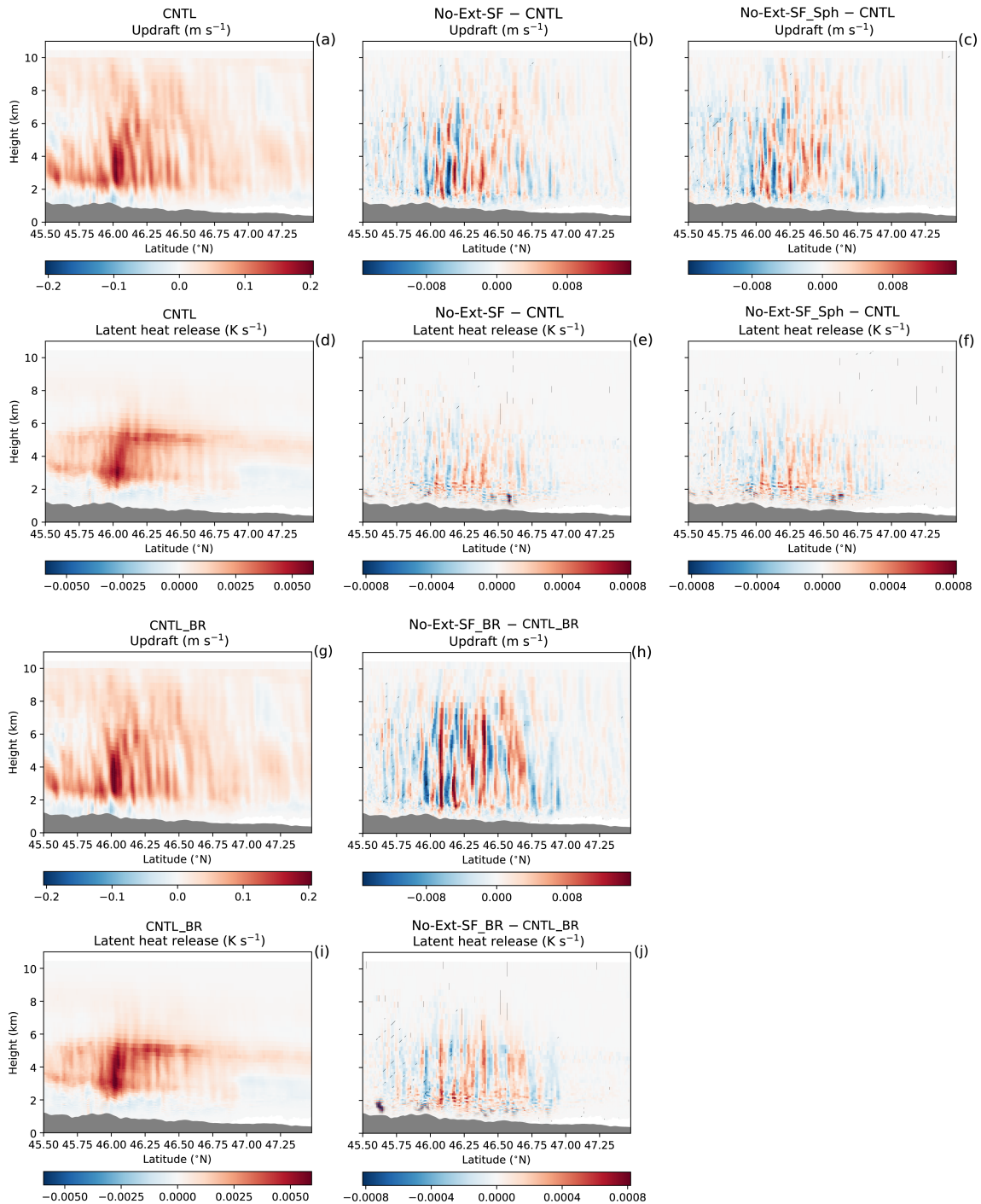
Figure S8. Cross-section of the updraft **(a, g)** and latent heat release **(d, i)** for the CNTL and CNTL_BR simulation ensemble means respectively. **(b, c, e, f)**, are the differences between the sensitivity (No-Ext-SF and No-Ext-SF_Sph) and the CNTL simulation ensemble means from 13:30 to 17:00 UTC. **(h, j)** are the differences between the No-Ext-SF_BR and CNTL_BR simulation ensemble means. The vertical (positive) and slanted (negative) black lines show where the differences are outside of the 95% confidence interval of the CNTL and CNTL_BR ensemble simulations. The cross-sections are zonal and temporal means.
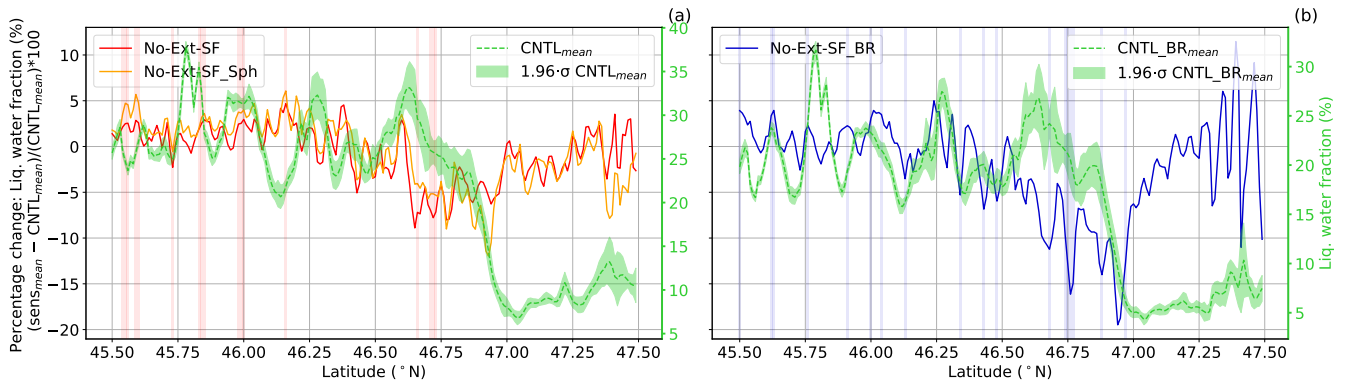
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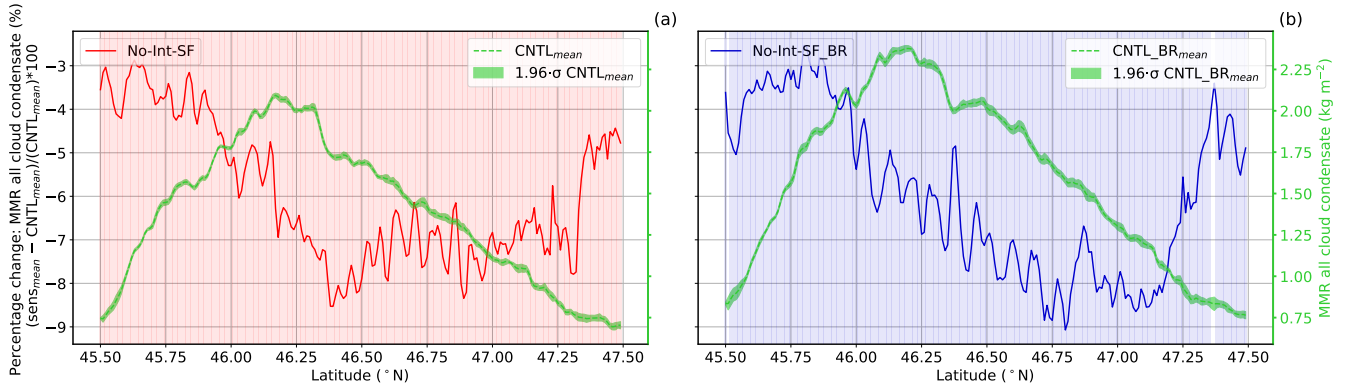**Figure S9.** As Figure S3, but for the percentage change of the liquid water fraction (LWF).

Figure S10. The percentage change of the mass mixing ratio of all cloud condensate between the sensitivity simulations and CNTL simulations ensemble means for the precipitation from 17:15 to 20:45 UTC. The sensitivity simulations are **(a)** No-Int-SF (red line) and **(b)** No-Int-SF_BR (blue line). The dashed green line in **(a)** is the CNTL mean and in **(b)** is the CNTL_BR mean and the shaded green areas signify the 95% confidence interval of the control simulation. The shaded vertical bars are the significant changes of **(a)** the No-Int-SF simulation from the CNTL simulation and **(b)** the No-Int-SF_BR simulation from the CNTL_BR simulation. The plots are vertically integrated and, zonal and temporal means.
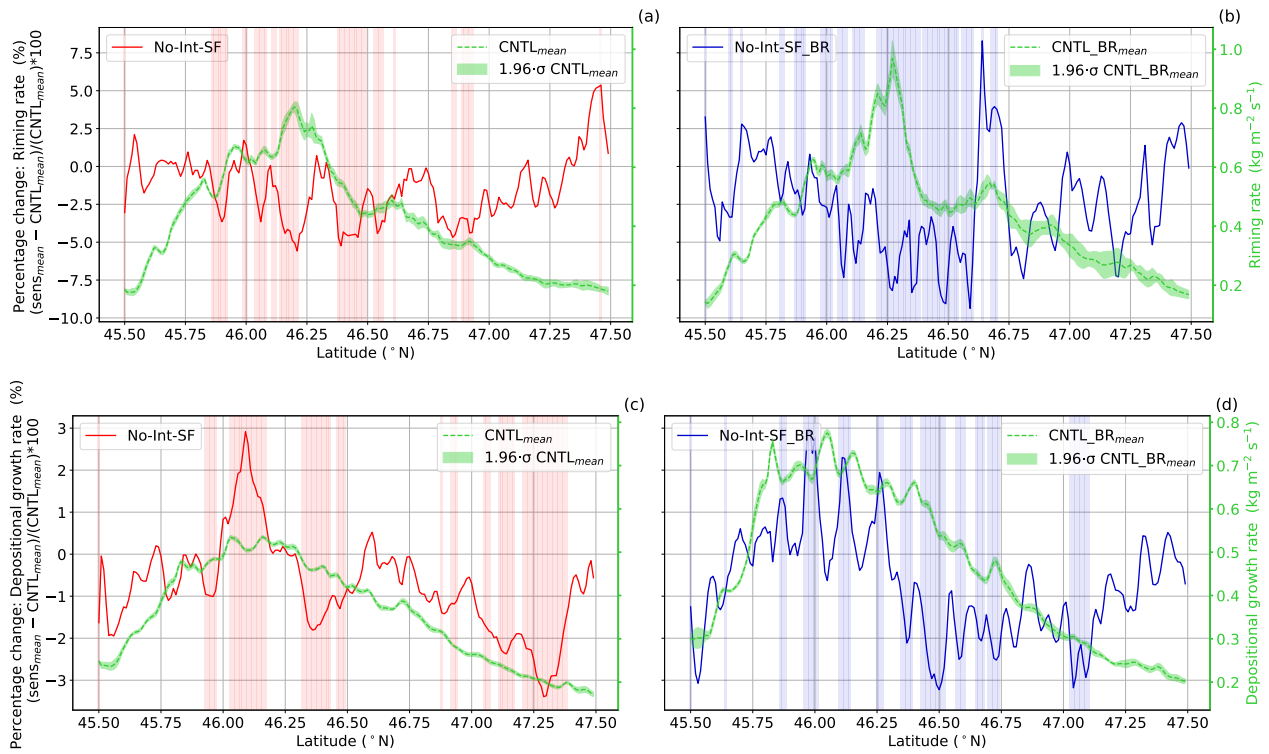
Figure S11. As Figure S9, but for the percentage change of **(a, b)** the riming rate and **(c, d)** the depositional growth rate.
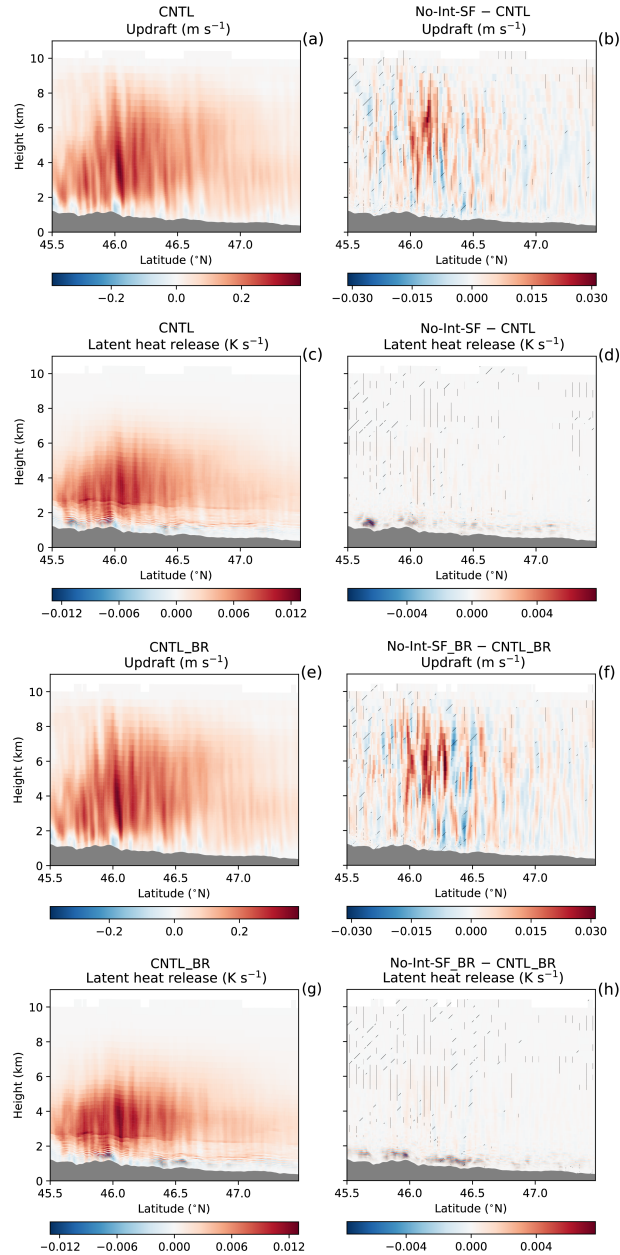
Figure S12. Cross-section of the updraft (**a, e**) and latent heat release (**c, g**) for the CNTL and CNTL_BR simulation ensemble means respectively. (**b, d**) are the differences between the No-Int-SF and the CNTL simulation ensemble means from 17:15 to 20:45 UTC. (**f, h**) are the differences between the No-Int-SF_BR and CNTL_BR simulation ensemble means. The vertical (positive) and slanted (negative) black lines show where the differences are outside of the 95% confidence interval of the CNTL and CNTL_BR ensemble simulations. The cross-sections are zonal and temporal means.
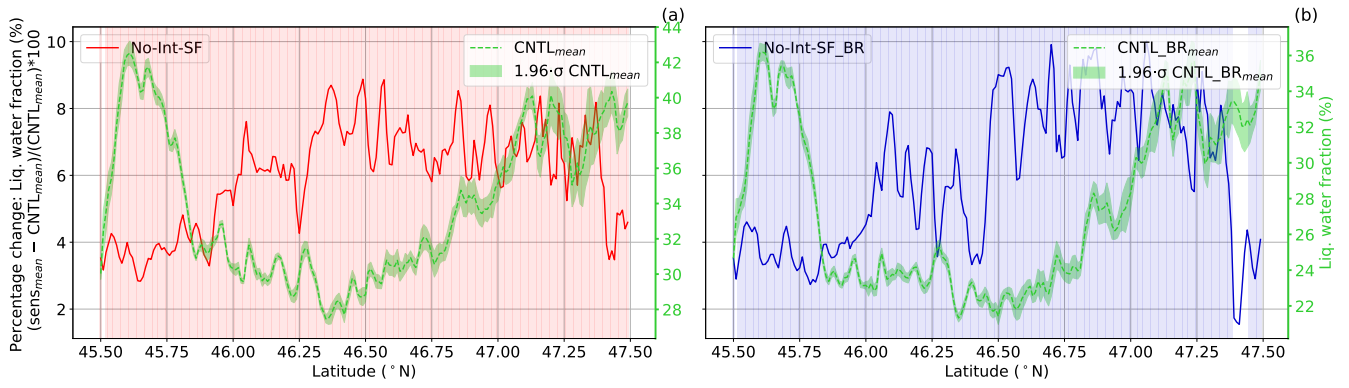
Figure S13. As Figure S9, but for the percentage change of the liquid water fraction (LWF).
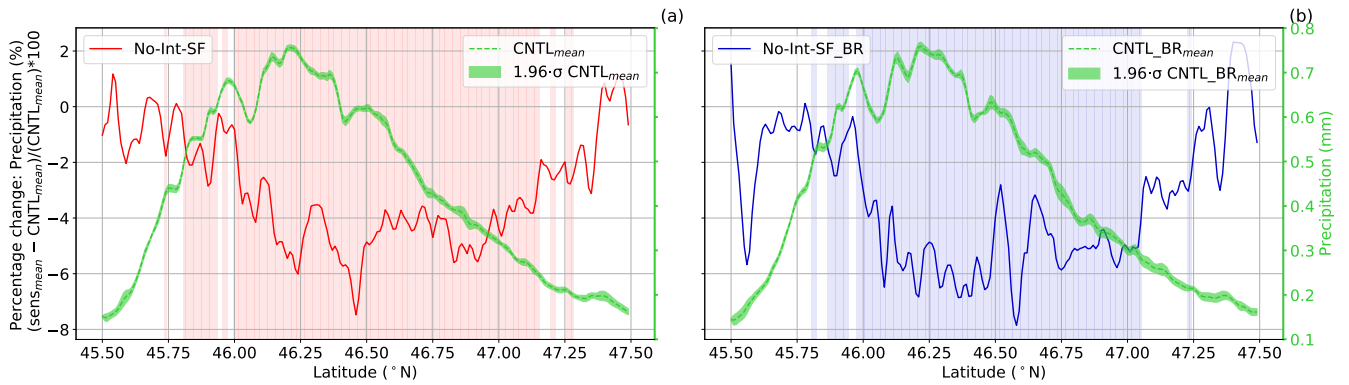

Figure S14. As Figure S9, but for the percentage change of precipitation. The plots are zonal and temporal means.
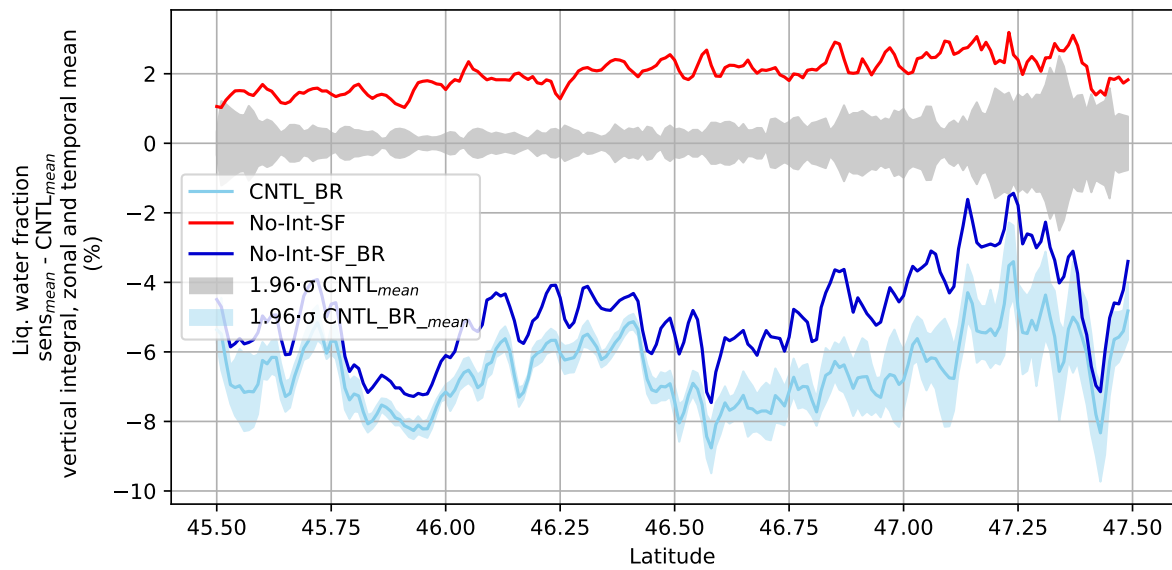
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Figure S15. The difference in the internal seeder-feeder process between the sensitivity and CNTL simulations ensemble means for the liquid water fraction where $0 \geq T \geq -35\,^{\circ}\mathrm{C}$ from 17:15 to 20:45 UTC. The sensitivity simulations are No-Int-SF (red line) and No-Int-SF_BR (blue line). The shaded areas signify the 95% confidence interval of the control simulation.