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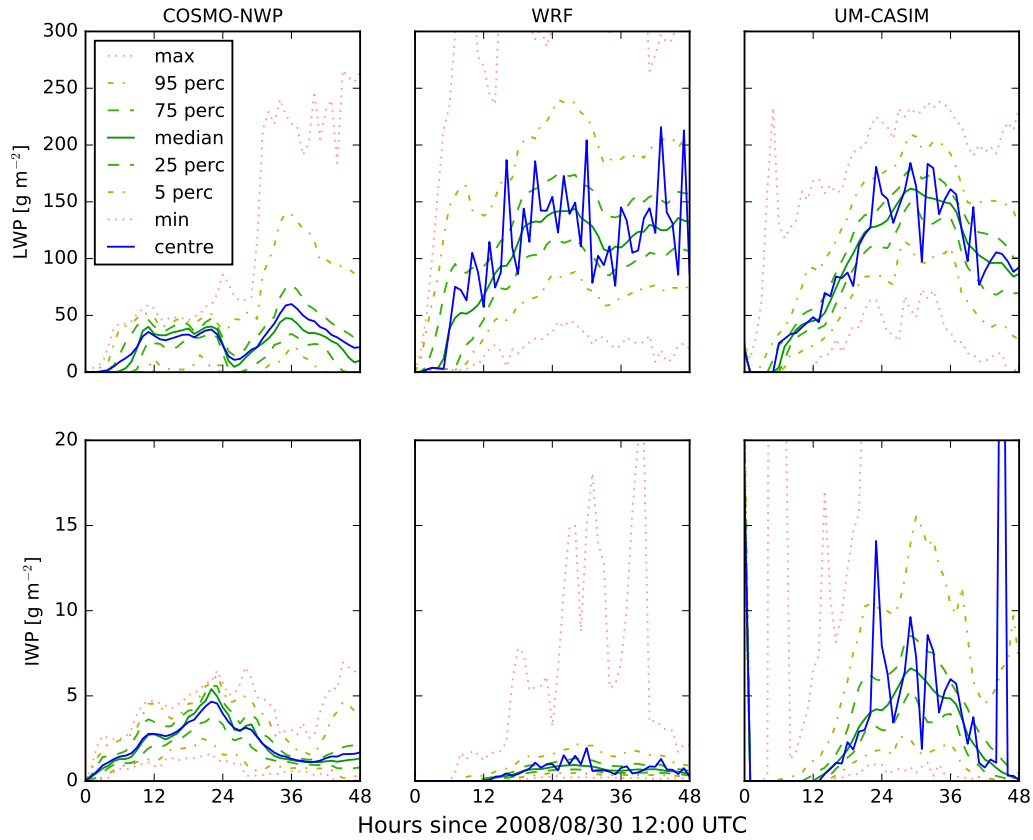
*Supplement of*

## **A model intercomparison of CCN-limited tenuous clouds in the high Arctic**

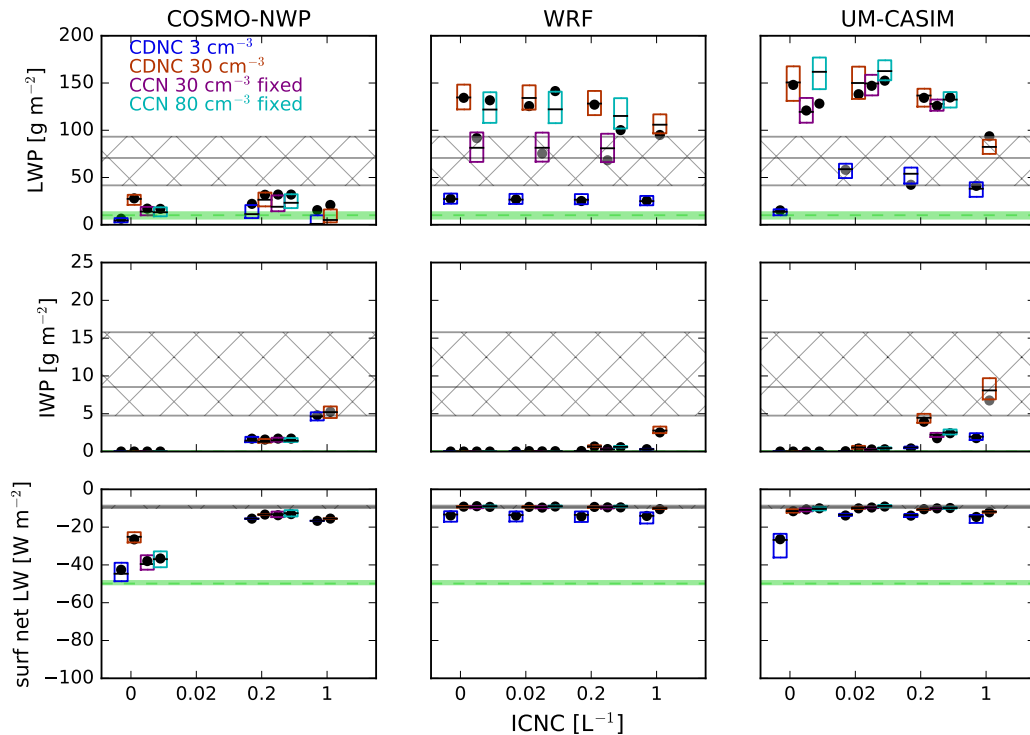
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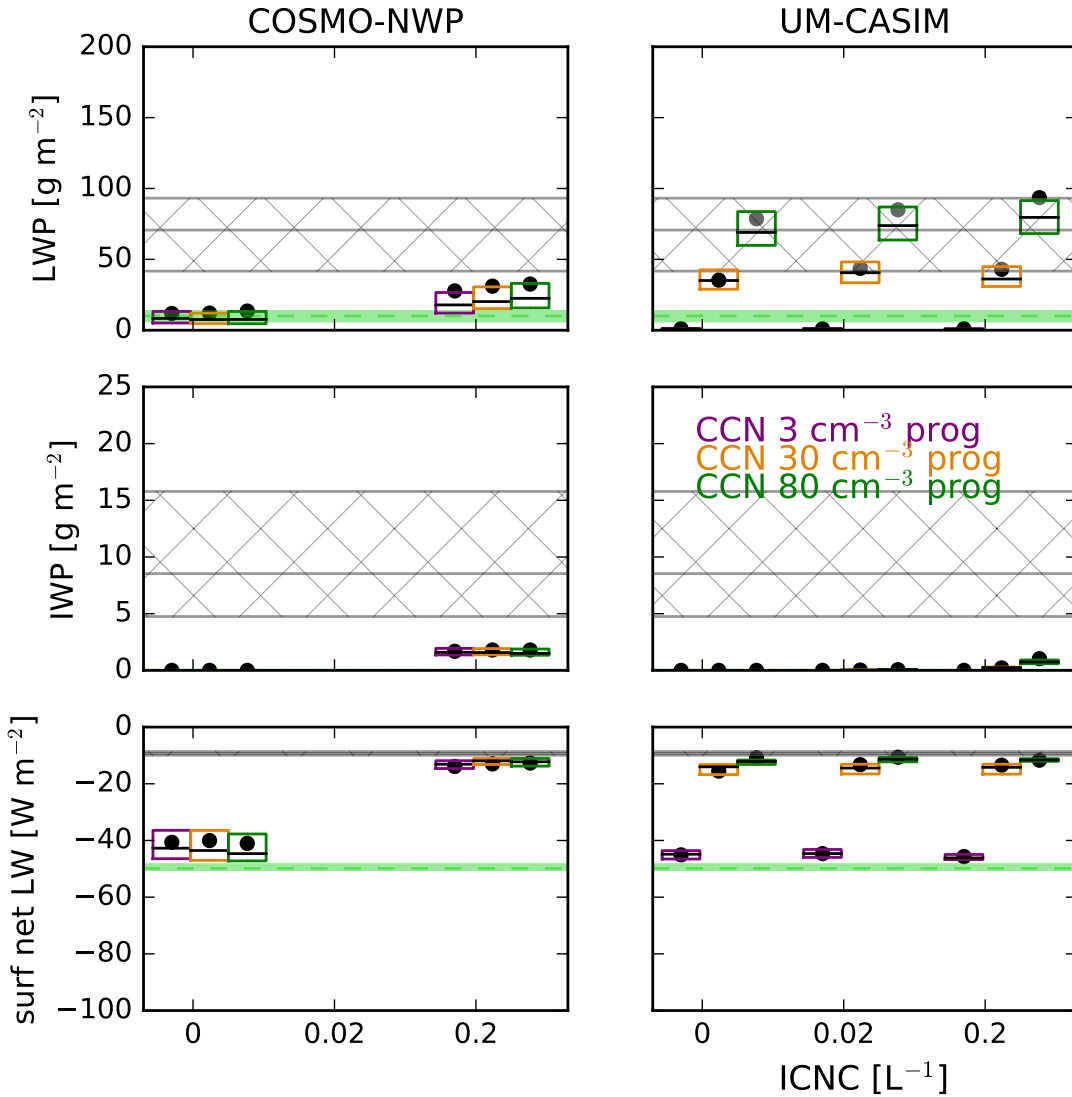
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**Figure S1.** Time-varying distributions of liquid water paths and ice water paths from COSMO-NWP, WRF, and UM-CASIM for the case with a prescribed CDNC of  $30 \text{ cm}^{-3}$  and ICNC of  $0.2 \text{ L}^{-1}$  (CDNC30\_ICNC0p20). All values are shown for a  $100 \text{ km}^2$  area in the centre of the domain. Red dotted lines give the area maximum and minimum values, orange dash-dotted lines give the 95<sup>th</sup> and 5<sup>th</sup> percentile values, green dashed lines give the 75<sup>th</sup> and 25<sup>th</sup> percentile values, green solid lines give the median values, and blue solid lines give the centre-of-domain values.



**Figure S2.** Water paths and net longwave radiation for all simulations without aerosol processing. Top row: liquid water path, middle row: ice water path, bottom row: surface net longwave radiation. Each subplot shows results from a single model. From left to right: COSMO-NWP, WRF, and UM-CASIM. Simulations with prescribed CDNCs of  $3 \text{ cm}^{-3}$  (CDNC03) and  $30 \text{ cm}^{-3}$  (CDNC30) are shown as blue and red boxes, respectively, and simulations with prescribed CCN concentrations of  $30 \text{ cm}^{-3}$  (CCN30fixed) and  $80 \text{ cm}^{-3}$  (CCN80fixed) are shown as purple and turquoise boxes, respectively. Within each subplot, the ICNC is increased from left to right as  $0 \text{ L}^{-1}$ ,  $0.02 \text{ L}^{-1}$ ,  $0.2 \text{ L}^{-1}$ , and  $1 \text{ L}^{-1}$ . Boxes show the interquartile range over a  $100 \text{ km}^2$  area in the centre of the domain, and the black horizontal lines denote the medians. Black dots show the centre-of-domain values (same as the black horizontal lines in Fig. 15). For all values, the median over model results after Aug. 31<sup>st</sup> 1200 UTC is shown. Hatched regions indicate observed interquartile range for the "cloudy" period, and the green shaded regions indicate the range for the "nearly-cloud-free" period.



**Figure S3.** Water paths and net longwave radiation for all simulations with aerosol processing. Top row: liquid water path, middle row: ice water path, bottom row: surface net longwave radiation. Each subplot shows results from a single model. Left column: COSMO-NWP. Right column: UM-CASIM. Simulations with an initial CCN concentration of 3  $\text{cm}^{-3}$  (CCN03prog), 30  $\text{cm}^{-3}$  (CCN30prog) and 80  $\text{cm}^{-3}$  (CCN80prog) are shown as purple, orange and green boxes, respectively. Within each subplot, the ICNC is increased from left to right as 0  $\text{L}^{-1}$ , 0.02  $\text{L}^{-1}$ , 0.2  $\text{L}^{-1}$ , and 1  $\text{L}^{-1}$ . Boxes show the interquartile range over a 100  $\text{km}^2$  area in the centre of the domain, and the black horizontal lines denote the medians. Black dots show the centre-of-domain values (same as the black horizontal lines in Fig. 15). For all values, the median over model results after Aug. 31<sup>st</sup> 1200 UTC is shown. Hatched regions indicate observed interquartile range for the "cloudy" period, and the green shaded regions indicate the range for the "nearly-cloud-free" period.