



## Supplement of

## Aerosol midlatitude cyclone indirect effects in observations and high-resolution simulations

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Fig. S 1 An example of the CERES data used to create the daily-mean albedo. Each panel shows a 3-hour mean albedo from January 1 2005.



Fig. S 2 Cyclone-mean albedo as a function of cloud fraction. Each subplot shows a different maximum solar zenith angle (SZA) allowed in the 3-hourly data averaged to create the daily-mean data.



Fig. S 3 Rain rate and total precipitation rate in the UM versus warm conveyor belt (WCB) flux (predicted from the UM water vapor path (WVP) and wind speed within 2000 km of the cyclone center). Model resolution is noted in the legend. GCM-surrogate resolution is denoted LR and convection-permitting resolution is denoted HR. Two simulations are contrasted. A low aerosol control with 100 cm<sup>-3</sup> accumulation aerosol near the surface and a high aerosol experiment where accumulation mode aerosol is increased to 2000 cm<sup>-3</sup> between 30°-60°N. A one to one relationship between precipitation rate or rain rate and the WCB flux is shown as a solid black line. The linear fit with 95% confidence is noted in the legend.



Fig. S 4 As in Fig. 6c, but showing cyclone-mean frozen water path.



Fig. S 5 The zonal mean shortwave (SW) radiative flux to space averaged over the duration of the simulations in the convectionpermitting (HR) and GCM-surrogate (LR) simulations at low and high aerosol concentration. Differences between low and high aerosol simulations are shown in the bottom plot.



Fig. S 6 As in Fig. 6, but instead of stratifying by CDNC<sub>SW</sub> cyclones are stratified by CDNC averaged over the cyclone as a whole in (a,b,d).



Fig. S 7 As in Fig. S 6 but using the entire south side of the composite.



Fig. S 8 As in Fig. S 6 but using only the south-east quadrant of the composite.



Fig. S 9 As in Fig. 10, but with a maximum allowed SZA of 30° in the 3 hourly CERES data used to calculated albedo.



Fig. S 10 As in Fig. S 9 but with a maximum SZA of 60°.



Fig. S 11 as in Fig. S 9 but with no SZA restriction.



5 Fig. S 12 As in Fig. 15, but using MERRA2-inferred CDNC<sub>sw</sub> instead of MODIS.



Fig. S 13 As in Fig. 16, but using MERRA2-inferred CDNC<sub>SW</sub>.



5 Fig. S 14 As in Fig. 17, but showing cyclones within 30° latitude of Iceland.



Fig. S 15 As in Fig. 17, but showing cyclones at all northern hemisphere latitudes.