Supplement for
Cloud albedo increase from carbonaceous aerosol

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16 **Table S-1.** Component list for ion chromatographic analysis of the PILS sample

Component	Description
Dionex Ion Chromatographs	ICS 2000 with Eluent Generation, Temperature control and Degassing
Anions	
Eluent	25 mM Potassium Hydroxide - 10 min. inorganic analysis
Flow	1 ml/min
10-Port Valve	Alltech
Trace concentrator columns	TAC-ULP1 Ultra Low Pressure Trace Concentrator Column
Analytical and guard columns	AS11 HC & AG11 HC
Self Regenerating Suppressor	ASRS Ultra
Cations	
Eluent	25 mM Methanesulfonic Acid - 10 min. inorganic analysis
Flow	1 ml/min
10-Port Valve	Alltech
Trace concentrator columns	TCC-ULP1 Ultra Low Pressure Trace Concentrator Column
Analytical and guard columns	CS12 & CG12
Self Regenerating Suppressor	CSRS Ultra

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Figure S-1. Comparison of the measurements of the cloud liquid water content (LWC) with the adiabatic LWC for the profiles of flights 1 and 2. The measurements are from the PMS King probe, the Nevzorov probe and the PMS FSSP-100 integrated droplet size distribution. The adiabatic profiles are from the model calculations. The data from the King probe are used for the calculations in the paper.

26 **Figure S-2.** Cloud light extinction measurements from the Gerber Cloud Integrating
27 Nephelometer (CIN) compared with the scattering coefficient calculated from the PMS
28 FSSP-100 droplet size distributions for the profiles of flights 1 and 2.

Figure S-3. Time series of altitude, aerosol particle number concentrations >140 nm ($APNC_{140}$) and cloud droplet number concentrations (CDNC) for flights 1 and 2. Observations are for the periods when cloud was profiled and sampling was conducted above, in and below cloud at level intervals. The CDNC are from the two FSSP-100 probes (serial numbers 096 and 124) corrected for coincidence and probe dead times (Baumgardner et al., 1985), and the $APNC_{>140}$ is from the PCASP-100X.

Figure S-4. Time series of sodium in the aerosol (measured with the PILS) and the number concentrations of particles $>0.54\ \mu\text{m}$ aerodynamic diameter and $>2\ \mu\text{m}$ aerodynamic diameter for flight 2. The relative increase in particles $>2\ \mu\text{m}$ at lower altitudes and the association of sodium with increased concentrations of these larger particles suggest the presence of sea salt particles.

51 **Figure S-5.** Log-normal representation of measured cloud base aerosol size distributions
52 used for modelling.

Figure S-6. Vertical gust speeds while flying level during flights 1 and 2. The values of one standard deviation of the measured gust speeds are 14 cm s^{-1} for flight 1 and 50 cm s^{-1} for flight 2; the means of the gust speeds for each flight segment are zero. The ranges of the gusts are approximately 20 cm s^{-1} for flight 1 and 100 cm s^{-1} for flight 2.

Figure S-7. Examples of the simulated profiles of relative humidity just below and above cloud base. The air is supersaturated with respect to water where the relative humidity exceeds 100%. Cases of weak solubility of the OM (5 g L^{-1}) and pure H_2SO_4 are shown for both flights 1 and 2. The water supersaturation decreases when the aerosol is all sulphuric acid due to the more rapid rate of water uptake by this chemical component.