1   *Supplement of*

2   **Relative Importance of High-Latitude Local and Long-Range Transported**

3   **Dust to Arctic Ice Nucleating Particles and Impacts on Arctic Mixed-Phase**

4   **Clouds**

5   Yang Shi et al.

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7   **Table S1.** Arctic burden efficiency (1e-3 mg m^{-2}) (mg m^{-2} s^{-1})$^{-1}$.

	Annual	MAM	JJA	SON	DJF
Arc	15.88	20.96	20.82	10.49	15.10
NAm	1.99	2.78	3.78	1.68	0.84
NAf	0.62	1.11	0.50	0.35	0.32
CAs	2.58	2.66	4.11	2.51	1.01
MSA	0.76	1.50	0.45	0.49	0.63
EAs	2.42	2.19	2.99	2.02	2.75
RoW	0.00	0.00	0.00	0.00	0.01

9   **Table S2.** Yearly (2007 to 2011) averaged HLD emission flux (Tg yr^{-1}) in CTRL and HLD_half.

	CTRL	HLD_half
2007	129.2	64.2
2008	213.8	103.4
2009	114.2	50.8
2010	127.1	53.2
2011	137.8	56.7
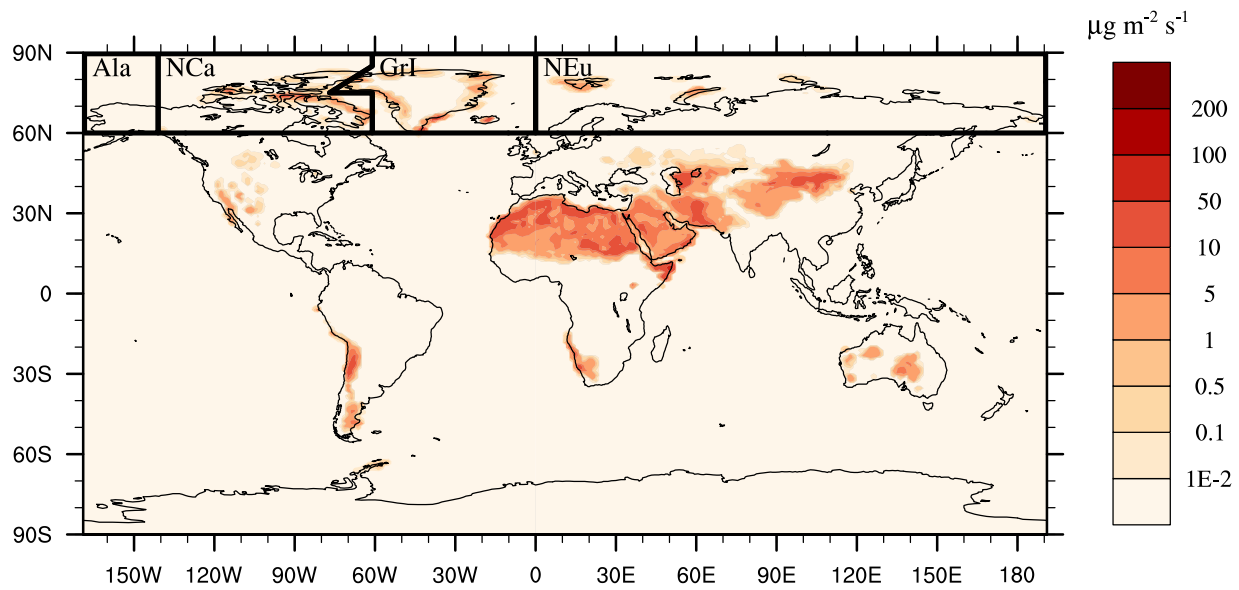
Figure S1. Same as Figure 1a, but with four sub-sources tagged in the Arctic (Ala: Alaska, NCa:

North Canada; GrI: Greenland and Iceland; NEu: North Eurasia).

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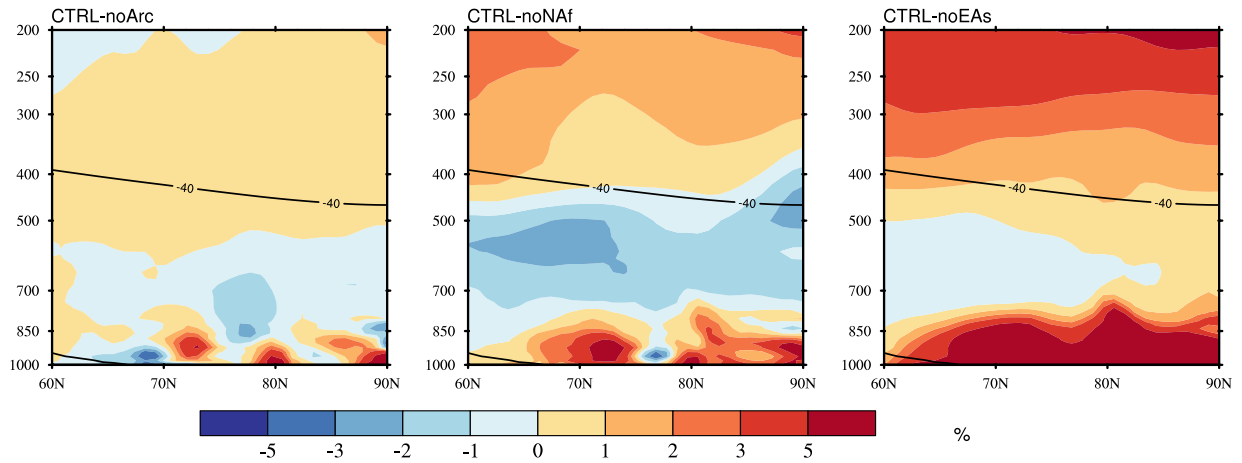
Figure S2. Percentage difference of zonal averaged dust concentration between CTRL and

sensitivity experiments (i.e., noArc, noNAf, noEAs). Black contours are zonal averaged

temperatures in $^{\circ}$C.

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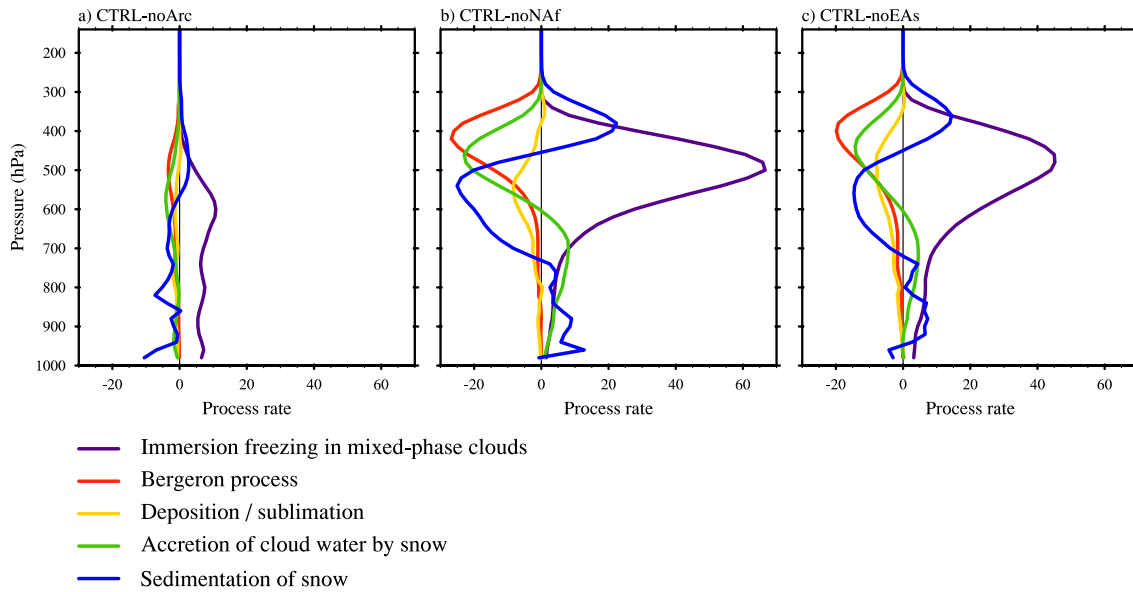
Figure S3. Process budget analysis associated with total ice water tendencies from cloud microphysical processes in the Arctic (unit: 1e-3 µg kg^{-1} s^{-1}). Only the processes that have large changes are shown in this figure.

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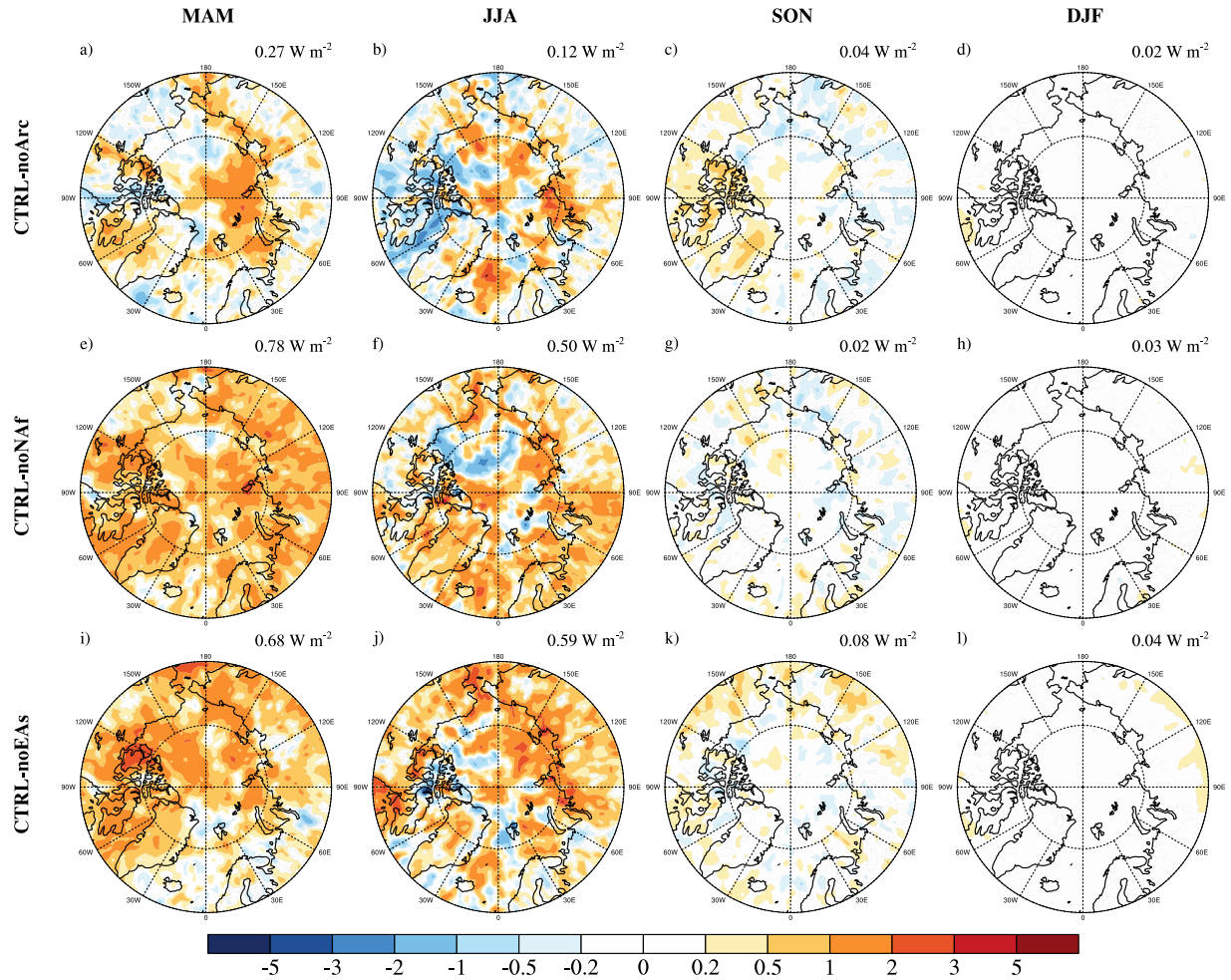
Figure S4. Seasonal changes in shortwave downwelling radiative flux at the surface (unit: W m^{-2})

caused by dust INPs from Arctic (top panel), North Africa (middle panel), and East Asia (bottom

panel). The numbers are averaged radiative flux differences in the Arctic.

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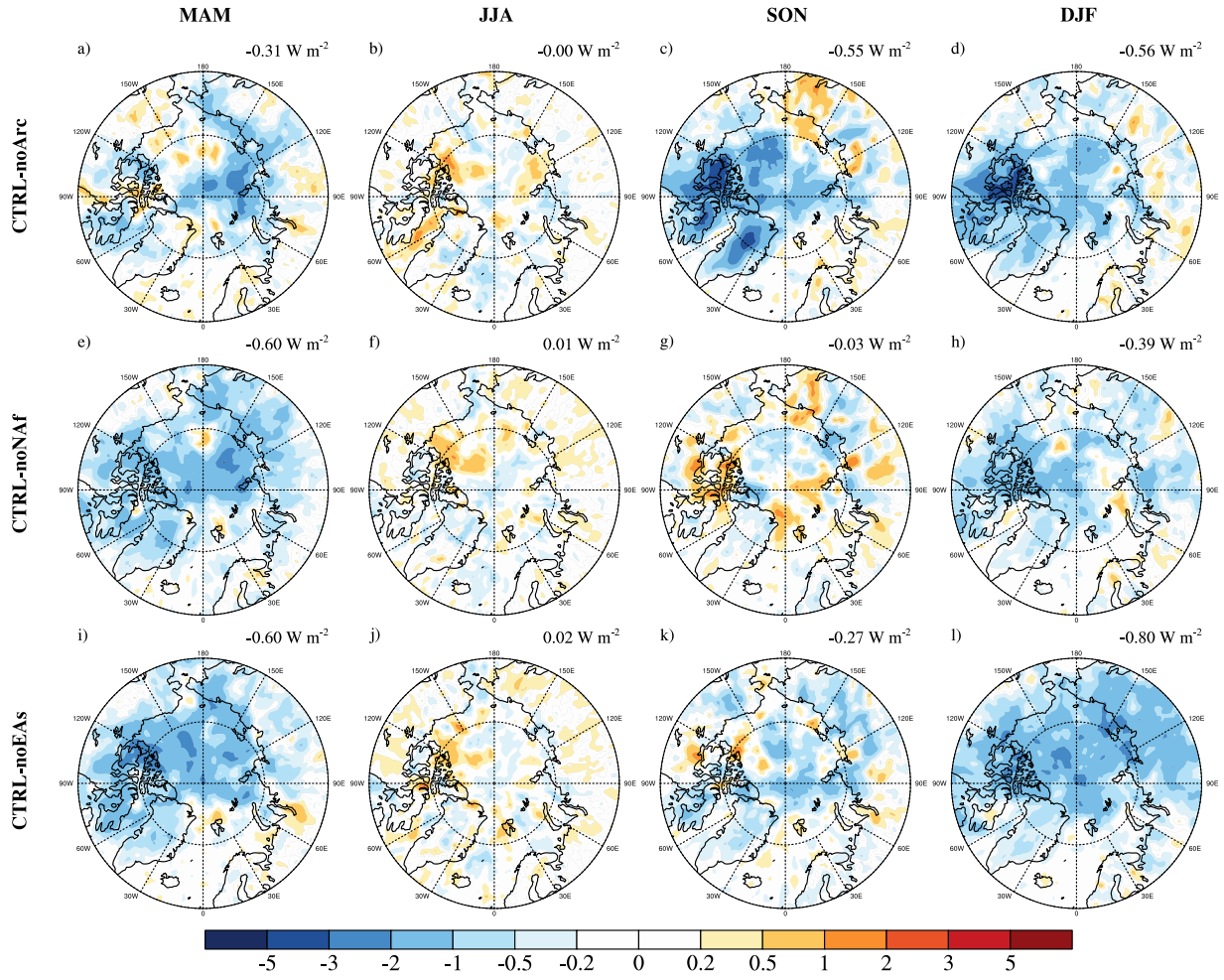
Figure S5. Same as Figure S4, but for longwave downwelling radiative flux.

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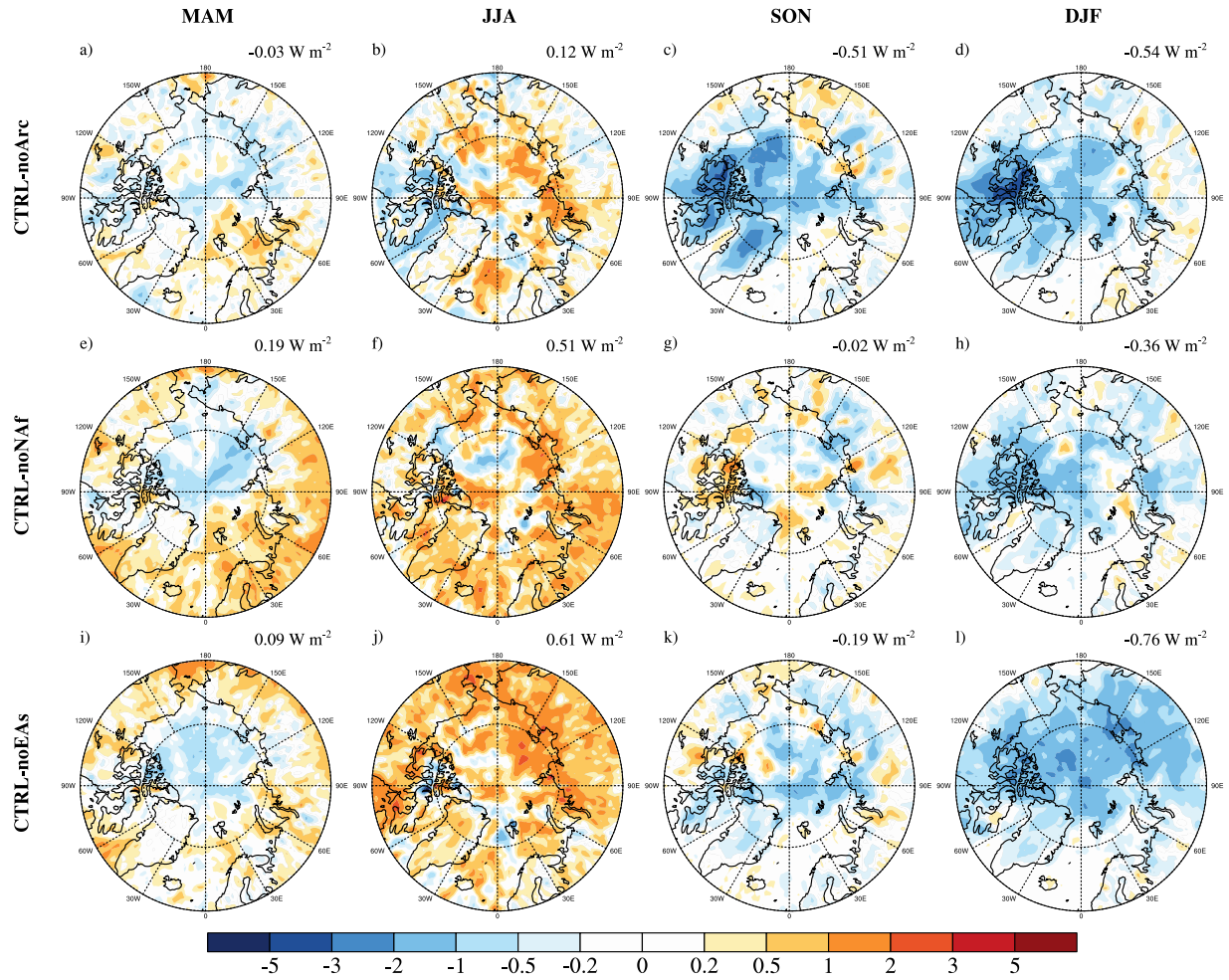
Figure S6. Same as S4, but for net downwelling radiative flux.

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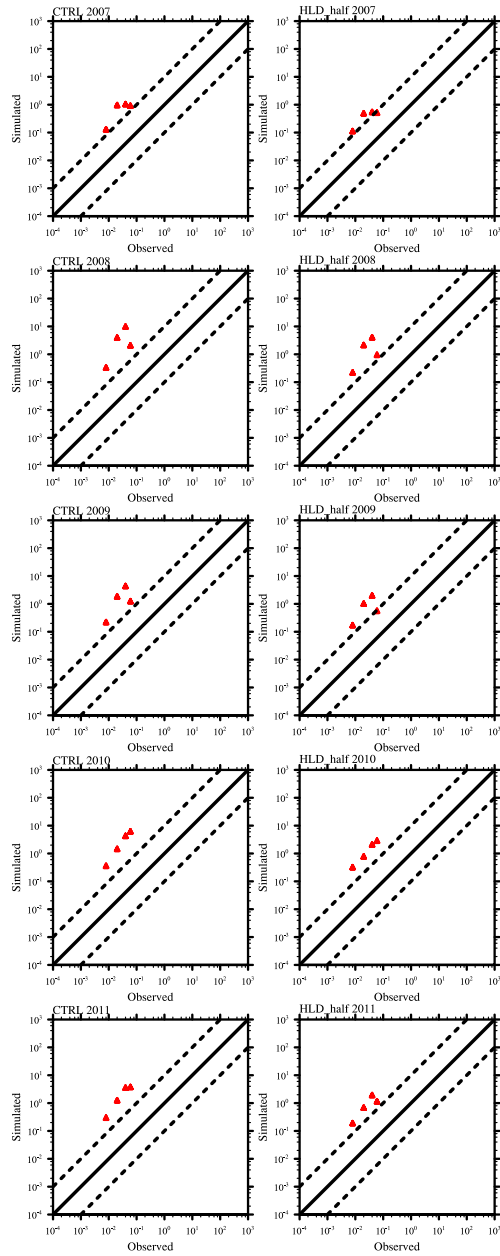
Figure S7. Yearly (2007 to 2011) comparisons of dust deposition fluxes in the Arctic

(Greenland) for CTRL and HLD_half. The locations of the markers are shown by the red

triangles on Figure 2d. Unit: g m^{-2} yr^{-1}.

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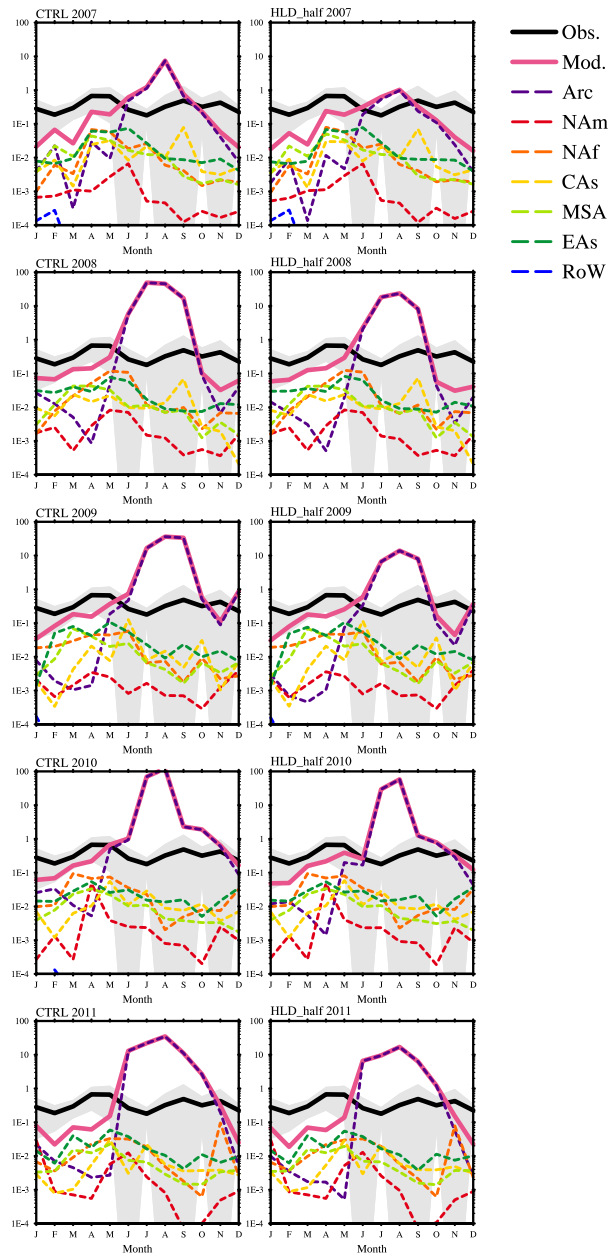
Figure S8. Yearly (2007 to 2011) comparisons of surface dust concentrations at Alert station for

CTRL and HLD_half. Unit: µg m^{-3}.

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