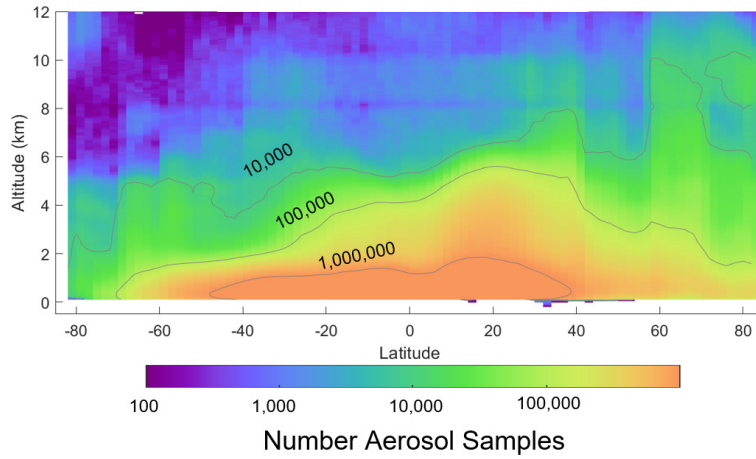


**Figure S1. Total number of aerosol samples prior to data filtering for 2007–2016 at day, all-sky.**



**Figure S2. Zonal total number of aerosol samples prior to data filtering for 2007–2016 at day, all-sky.**

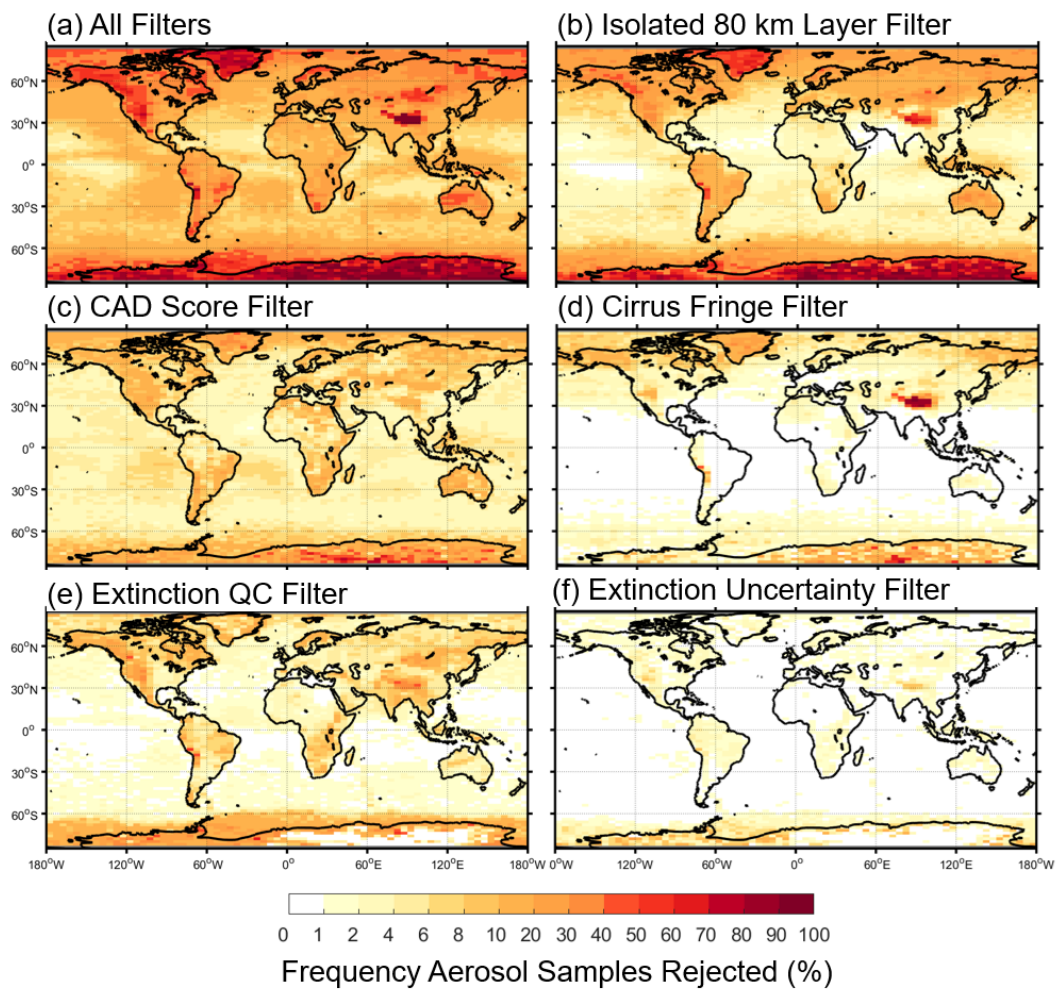
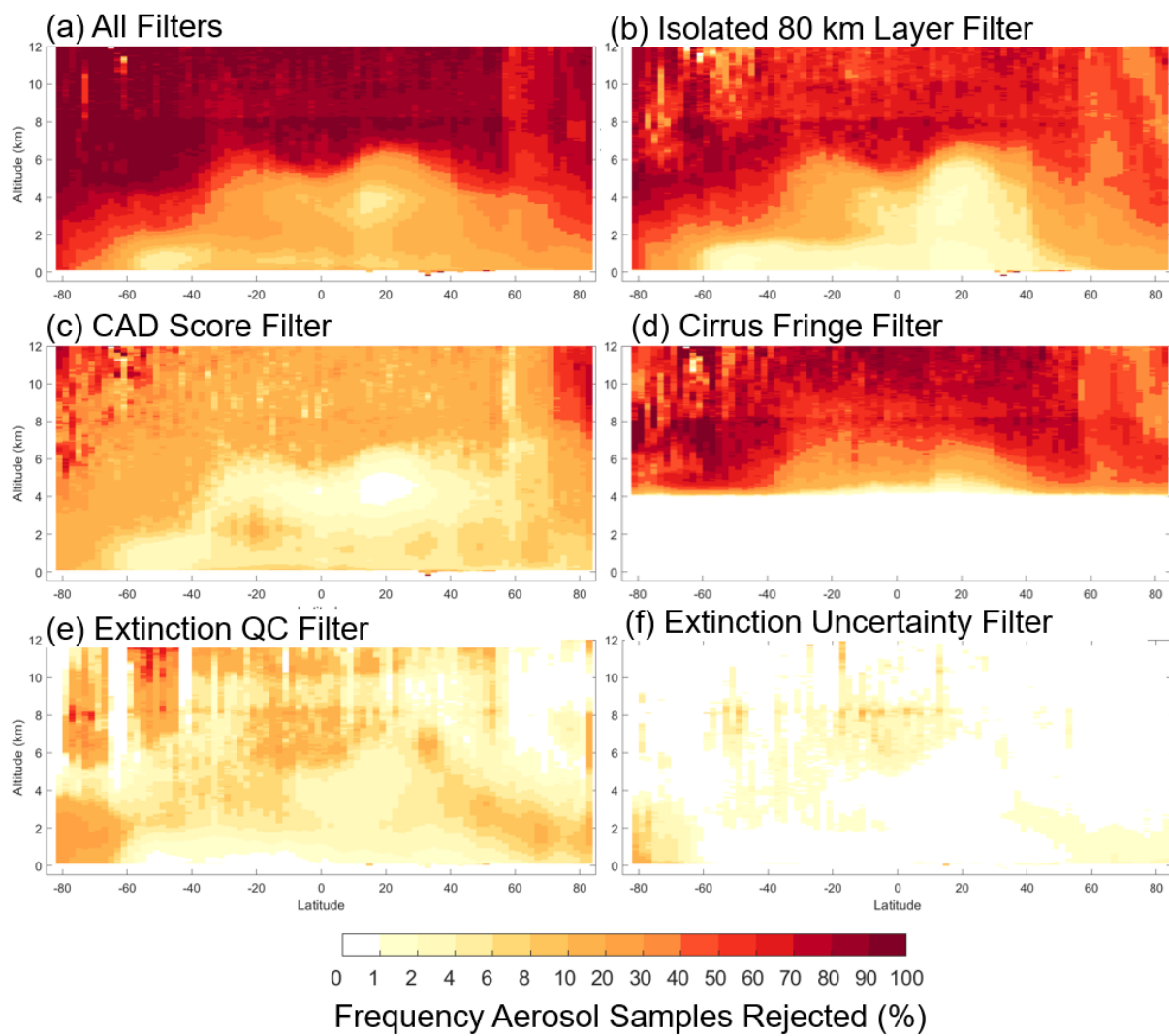
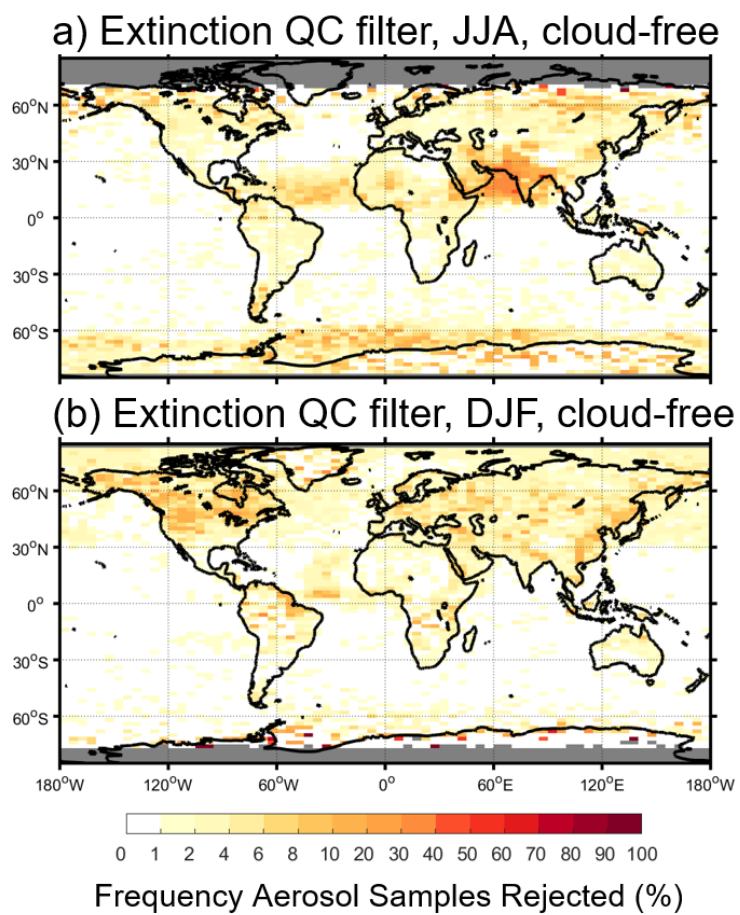


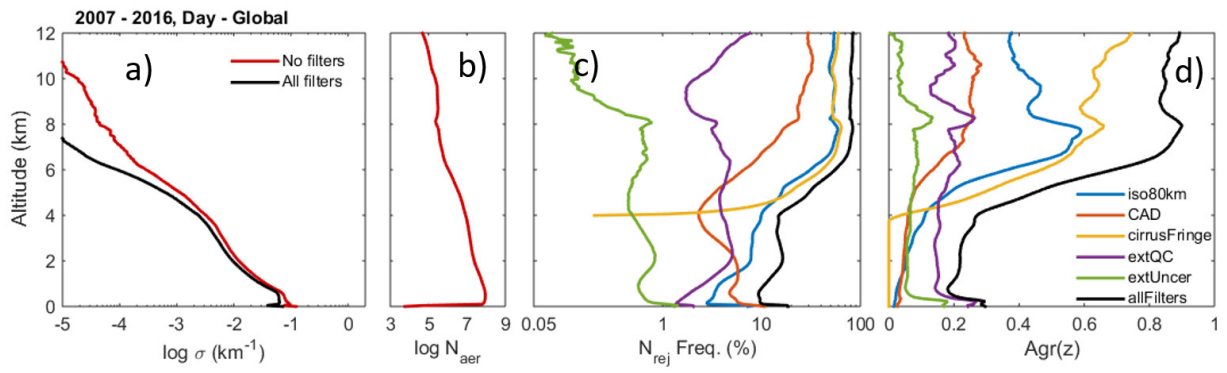
Figure S3. Frequency of aerosol samples rejected by the indicated filter out of all aerosol detected for 2007–2016 at day, all-sky.



**Figure S4.** Zonal frequency of aerosol samples rejected by the indicated filter out of all aerosol detected for 2007–2016 at day, all-sky.



**Figure S5.** Frequency of aerosol samples rejected by the extinction QC filter out of all aerosol detected for (a) JJA and (b) DJF, 2007–2016 at night, cloud-free.



**Figure S6.** (a) Mean extinction with and without quality filters, (b) number of unfiltered aerosol samples, (c) frequency of aerosol samples rejected, and (d) filter aggressiveness (Eq. (A1)) smoothed vertically over 600 meters for 2007–2016 at day, all-sky.

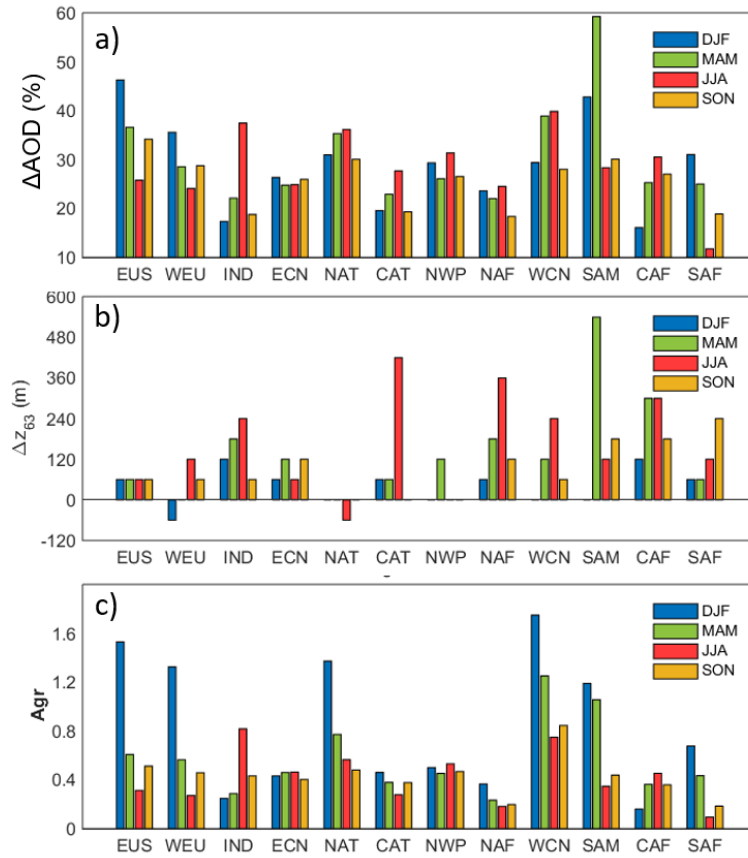


Figure S7. Regional changes in AOD and with no filters compared with all filters: (a) percent reduction in AOD with numbers above the bars indicating mean filtered AOD, (b) difference in 63% extinction scale heights (all filters – no filters), and (c) filter aggressiveness (Eq. (A3)) for 2007–2016 at night, all-sky. Samples at altitudes  $\leq 0.039$  km are excluded due to low sample counts.

**Table S1. Global metrics comparing changes in mean AOD and  $\bar{\sigma}$  with no filters against all filters and with each filter applied independently for global ocean and global land for 2007–2016 at night, all-sky: AOD with all filters,  $\Delta$ AOD = percent change in AOD,  $\Delta z_{63}$  = difference in 63% extinction scale heights (all filters – no filters), *Agr* = aerosol sample-weighted mean of filter extinction impact profile (Eq. (A3)). Samples at altitudes  $\leq 0.039$  km are excluded due to low sample counts.**

	<b>DJF</b>				<b>JJA</b>			
	AOD	$\Delta$ AOD (%)	$\Delta z_{63}$ (m)	<i>Agr</i>	AOD	$\Delta$ AOD (%)	$\Delta z_{63}$ (m)	<i>Agr</i>
EUS	0.09	-46	60	1.53	0.15	-26	60	0.31
WEU	0.13	-36	-60	1.32	0.17	-24	120	0.27
IND	0.34	-17	120	0.25	0.46	-37	240	0.82
ECN	0.50	-26	60	0.43	0.42	-25	60	0.46
NAT	0.11	-31	0	1.37	0.06	-36	-60	0.56
CAT	0.17	-20	60	0.46	0.25	-28	420	0.28
NWP	0.14	-29	0	0.50	0.11	-31	0	0.53
NAF	0.21	-24	60	0.37	0.45	-24	360	0.18
WCN	0.55	-29	0	1.75	0.48	-40	240	0.75
SAM	0.15	-43	0	1.19	0.16	-28	120	0.35
CAF	0.42	-16	120	0.16	0.31	-31	300	0.45
SAF	0.17	-31	60	0.68	0.34	-12	120	0.09
	<b>MAM</b>				<b>SON</b>			
	AOD	$\Delta$ AOD (%)	$\Delta z_{63}$ (m)	<i>Agr</i>	AOD	$\Delta$ AOD (%)	$\Delta z_{63}$ (m)	<i>Agr</i>
EUS	0.11	-37	60	0.61	0.09	-34	60	0.51
WEU	0.15	-29	0	0.56	0.14	-29	60	0.46
IND	0.42	-22	180	0.29	0.33	-19	60	0.43
ECN	0.45	-25	120	0.46	0.44	-26	120	0.40
NAT	0.08	-35	0	0.77	0.07	-30	0	0.48
CAT	0.21	-23	60	0.38	0.14	-19	0	0.38
NWP	0.15	-26	120	0.45	0.11	-27	0	0.47
NAF	0.34	-22	180	0.23	0.25	-18	120	0.20
WCN	0.43	-39	120	1.25	0.44	-28	60	0.84
SAM	0.09	-59	540	1.06	0.30	-30	180	0.44
CAF	0.35	-25	300	0.36	0.24	-27	180	0.36
SAF	0.15	-25	60	0.43	0.34	-19	240	0.18
	<b>2007 – 2016</b>							
	AOD	$\Delta$ AOD (%)	$\Delta z_{63}$ (m)	<i>Agr</i>				
EUS	0.11	-34	60	0.51				
WEU	0.15	-28	60	0.44				
IND	0.38	-24	120	0.42				
ECN	0.44	-25	120	0.44				
NAT	0.08	-33	-60	0.60				
CAT	0.19	-23	60	0.35				
NWP	0.12	-28	60	0.48				
NAF	0.30	-23	180	0.22				
WCN	0.46	-34	60	1.01				
SAM	0.18	-38	240	0.62				
CAF	0.34	-23	180	0.31				
SAF	0.27	-18	120	0.23				