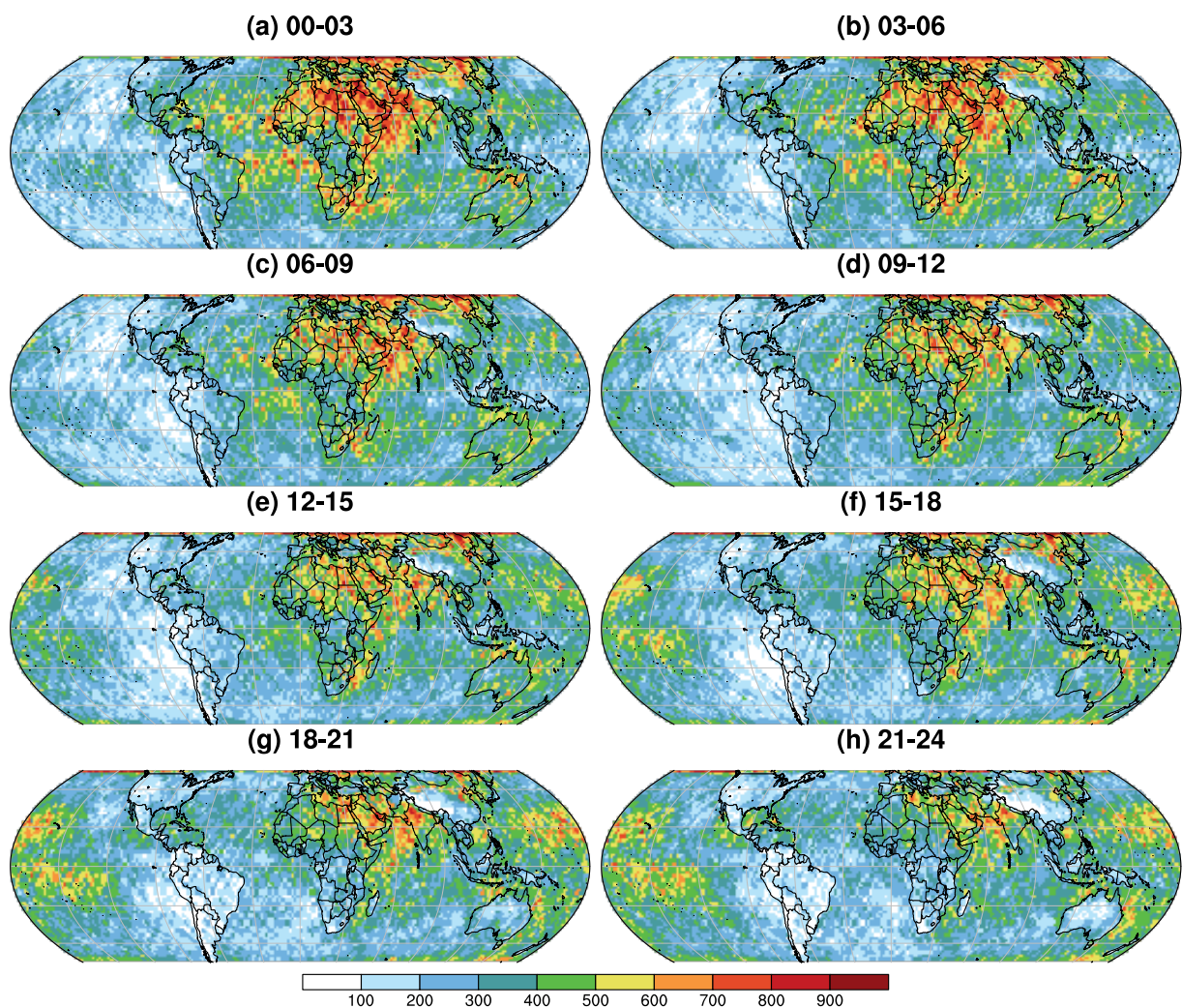
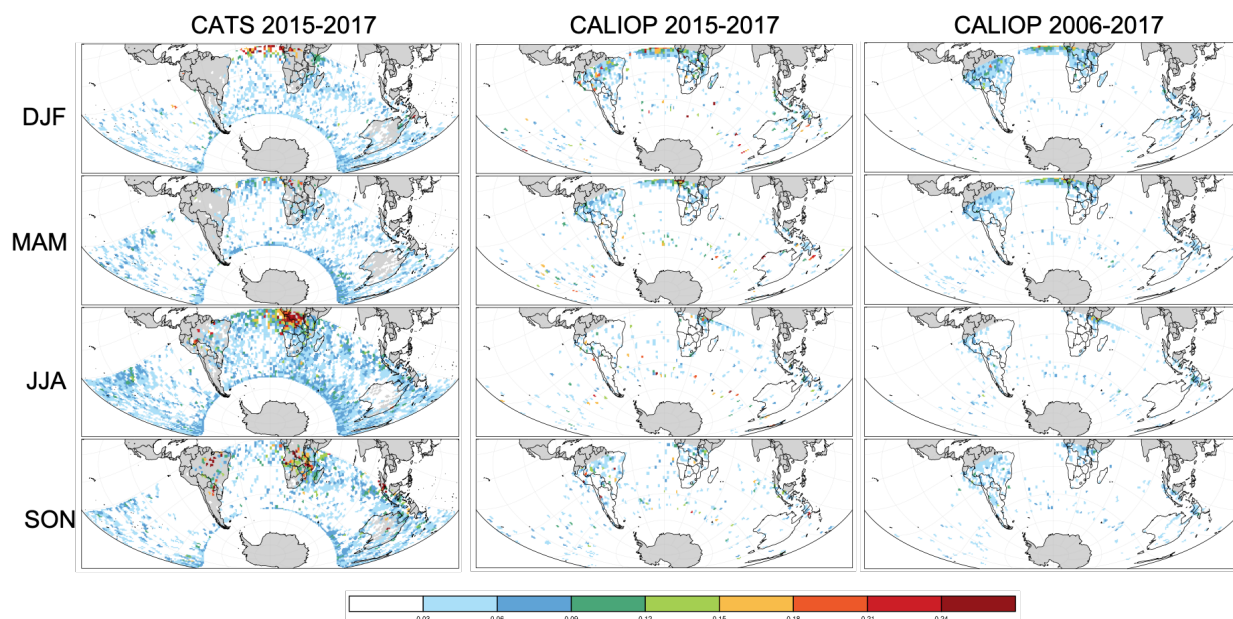
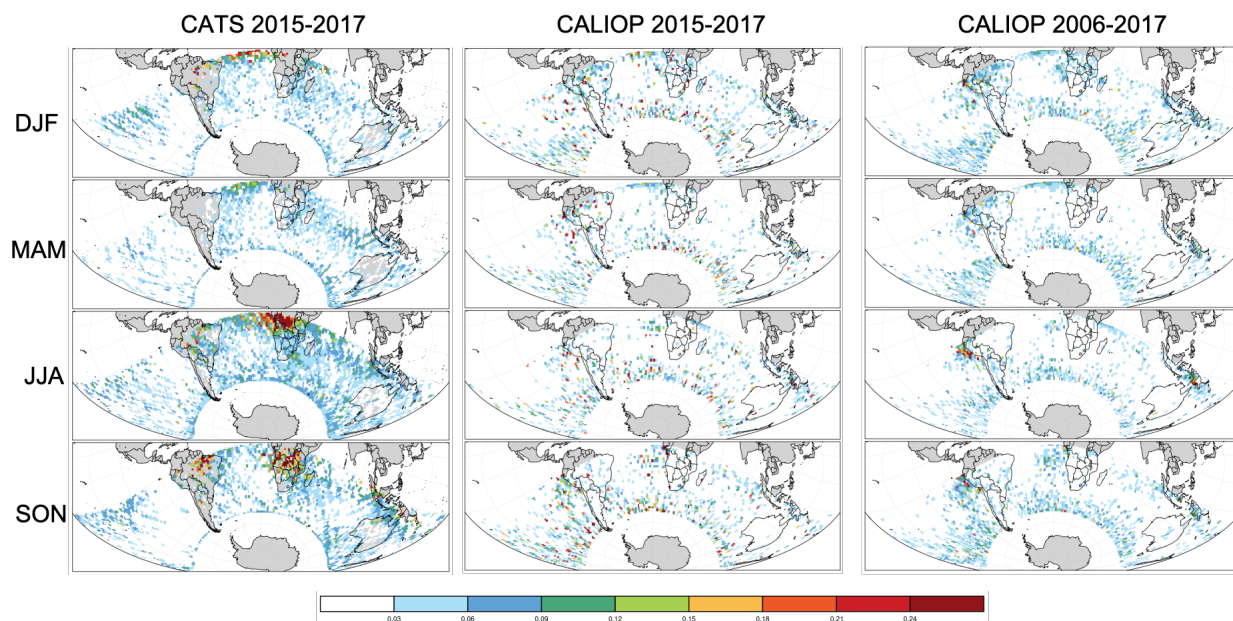
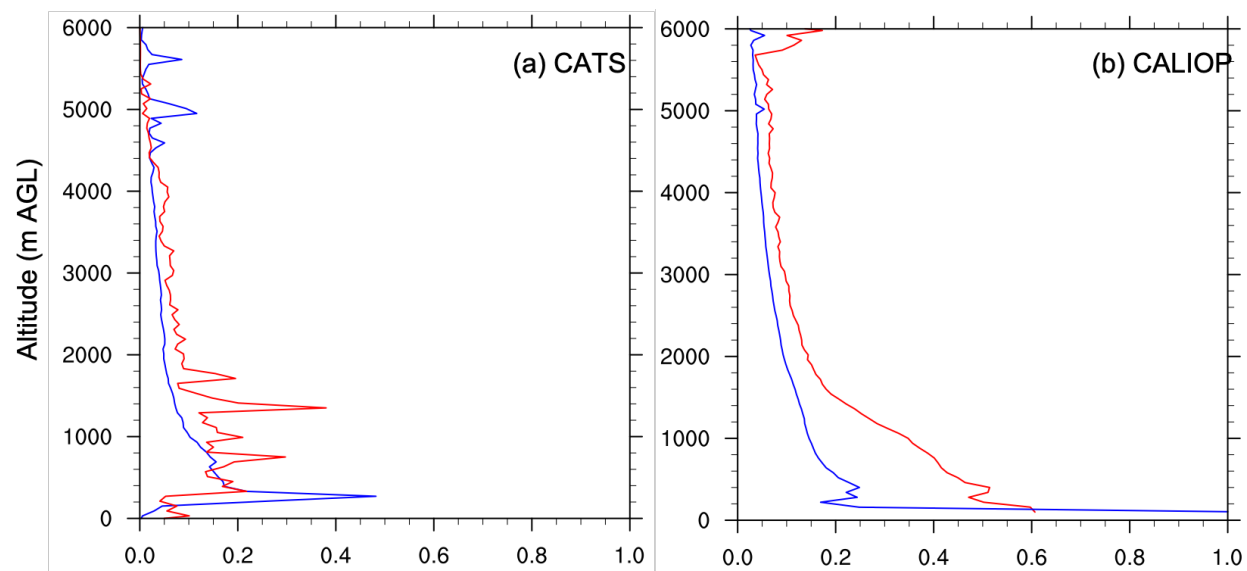
Supplemental Figure 1 CATS images of the dust plume transporting from North Africa across the Atlantic Ocean on June 17, 2015.

Supplemental Figure 2 Number of non-zero DAOD retrievals per year during 2015-2017 from CATS in each 3-hour local time window: (a) 00-03, (b) 03-06, (c) 06-09, (d) 09-12, (e) 12-15, (f) 15-18, (g) 18-21, (g) 21-24.

Supplemental Figure 3 Seasonal average, daytime DAOD over the Southern Hemisphere from CATS (noon-15:00 local time) at 1064 nm and CALIOP (13:30 local time) at 532 nm. Within equator – 52˚S, gray filling indicates sample size smaller than 20.

Supplemental Figure 3 Seasonal average, nighttime DAOD over the Southern Hemisphere from CATS (0:00-03:00 local time) at 1064 nm and CALIOP (01:30 local time) at 532 nm. Within equator – 52˚S, gray filling indicates sample size smaller than 20.

Supplemental Figure 5 Average dust extinction (km^{-1}) profiles over the Bodélé Depression during 2015-2017 from (a) CATS and (b) CALIOP during the daytime (red) and nighttime (blue) periods.