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Sensitivity of transatlantic dust transport to chemical aging and related atmospheric processes

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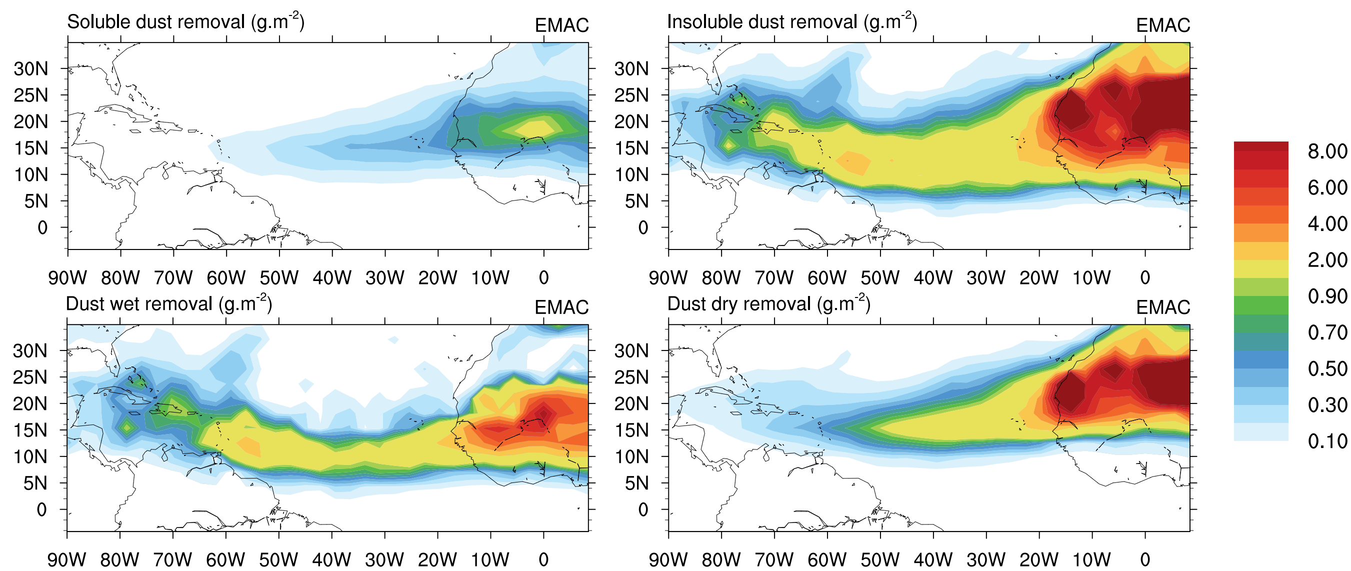

Figure S1: Monthly average (July 2009) dust removal during the transatlantic dust transport for (upper panel) total removal for soluble and insoluble modes (lower panel) wet removal and dry removal from left to right. The upper panel shows that mainly the removal of the dust are in the insoluble mode especially over Sahara where the acids concentration is very low which is needed to coat the dust particles. The figure shows that the wet removal is significant in the DIR zone while the dry removal dominates the DTA zone.

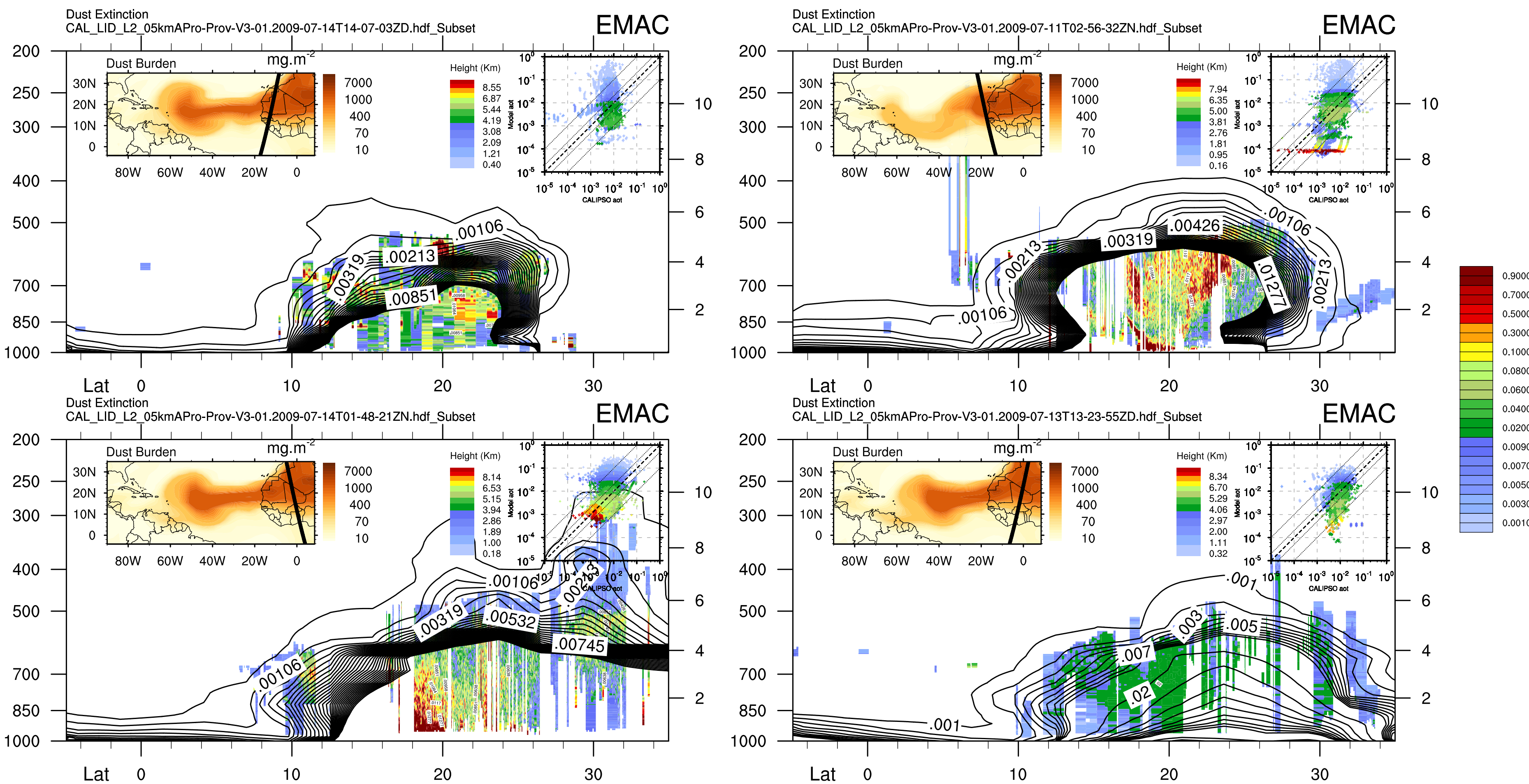

Figure S2a: Available CALIPSO tracks for the 2nd dust outbreak over the Atlantic Ocean complementing Fig. 7. The time of the CALIPSO overpasses is shown in the upper left corners (11-17th July 2009).

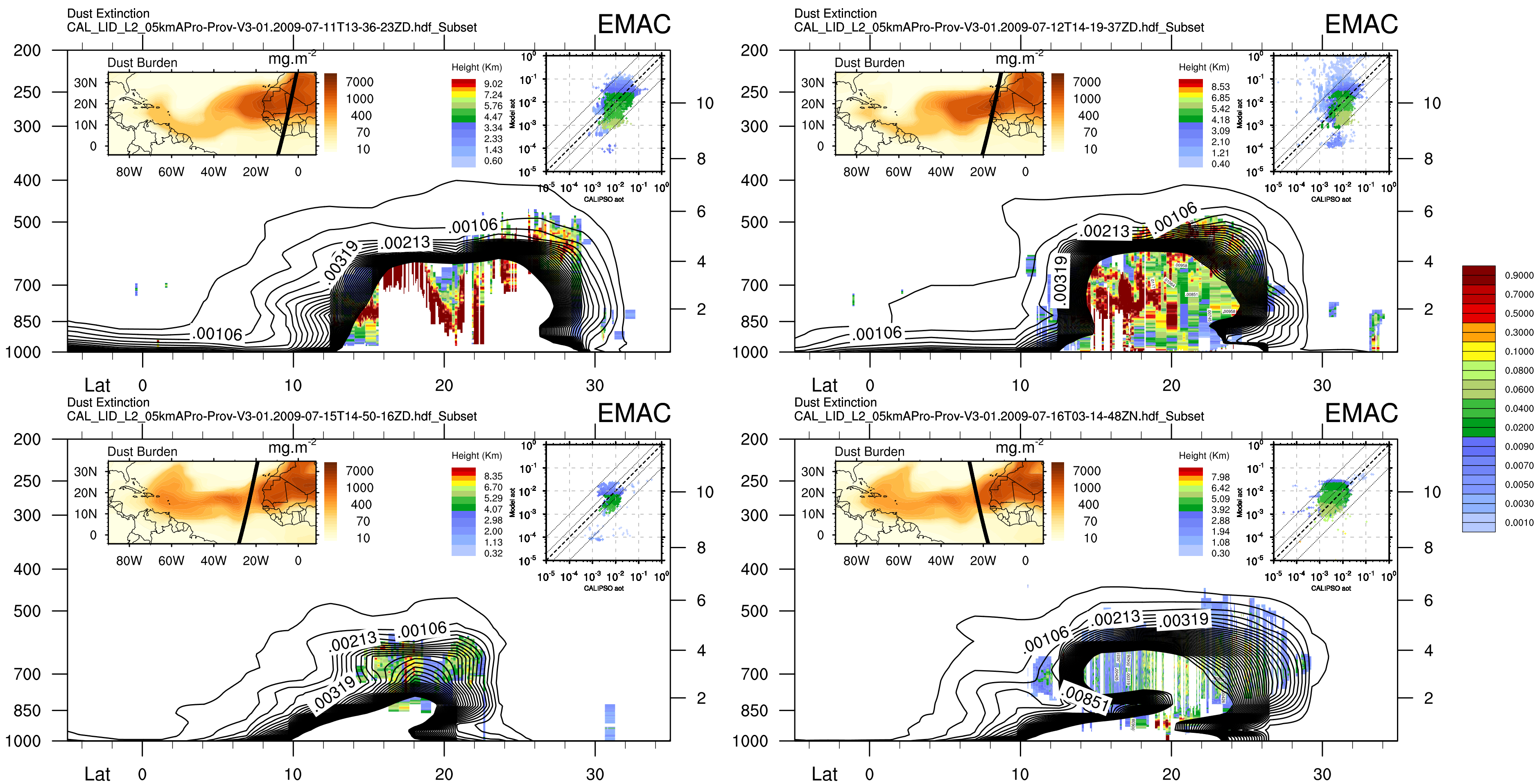

Figure S2b: Continued for Fig. S2a.

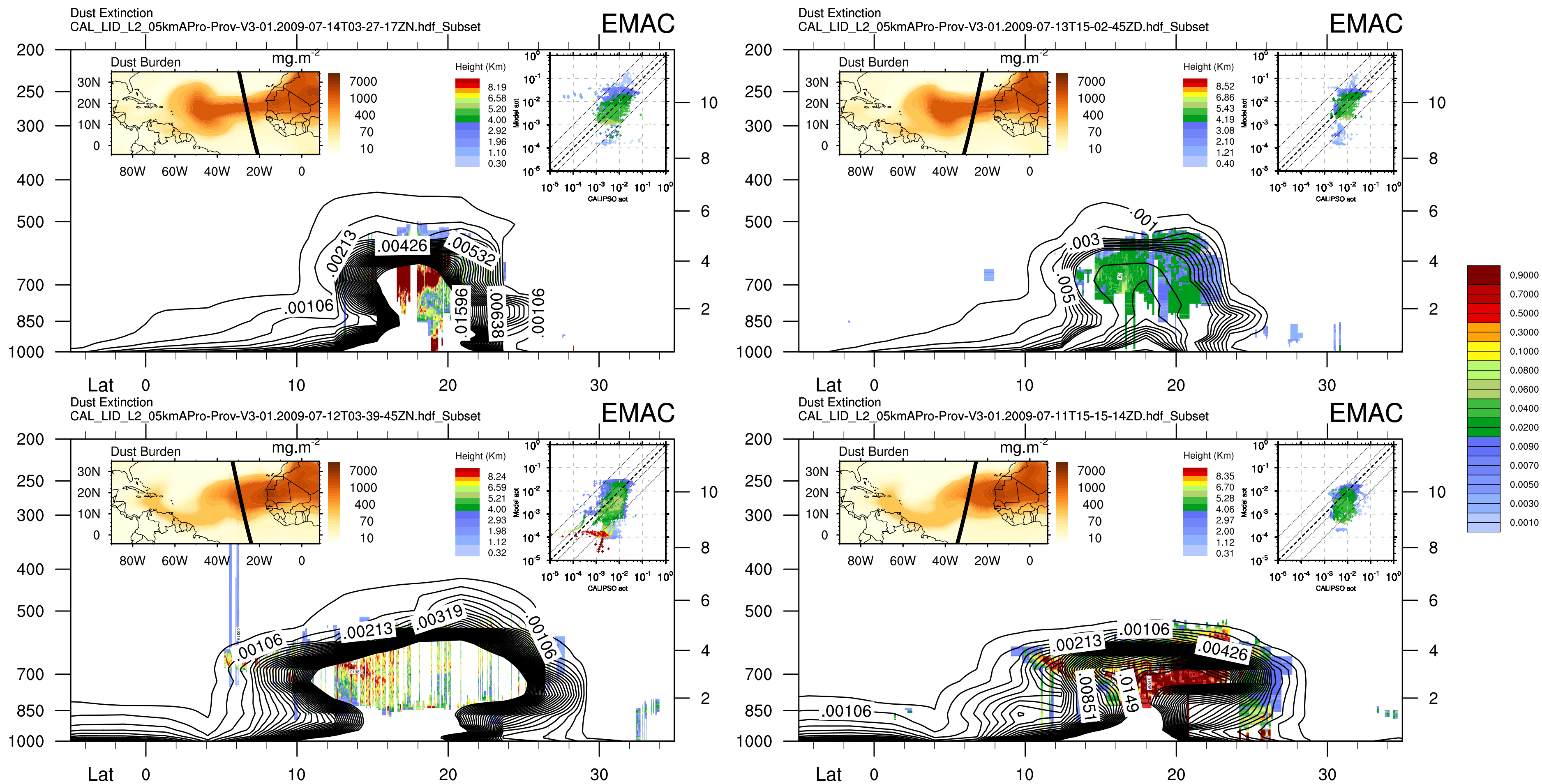

Figure S2c: Continued for Fig. S2a.

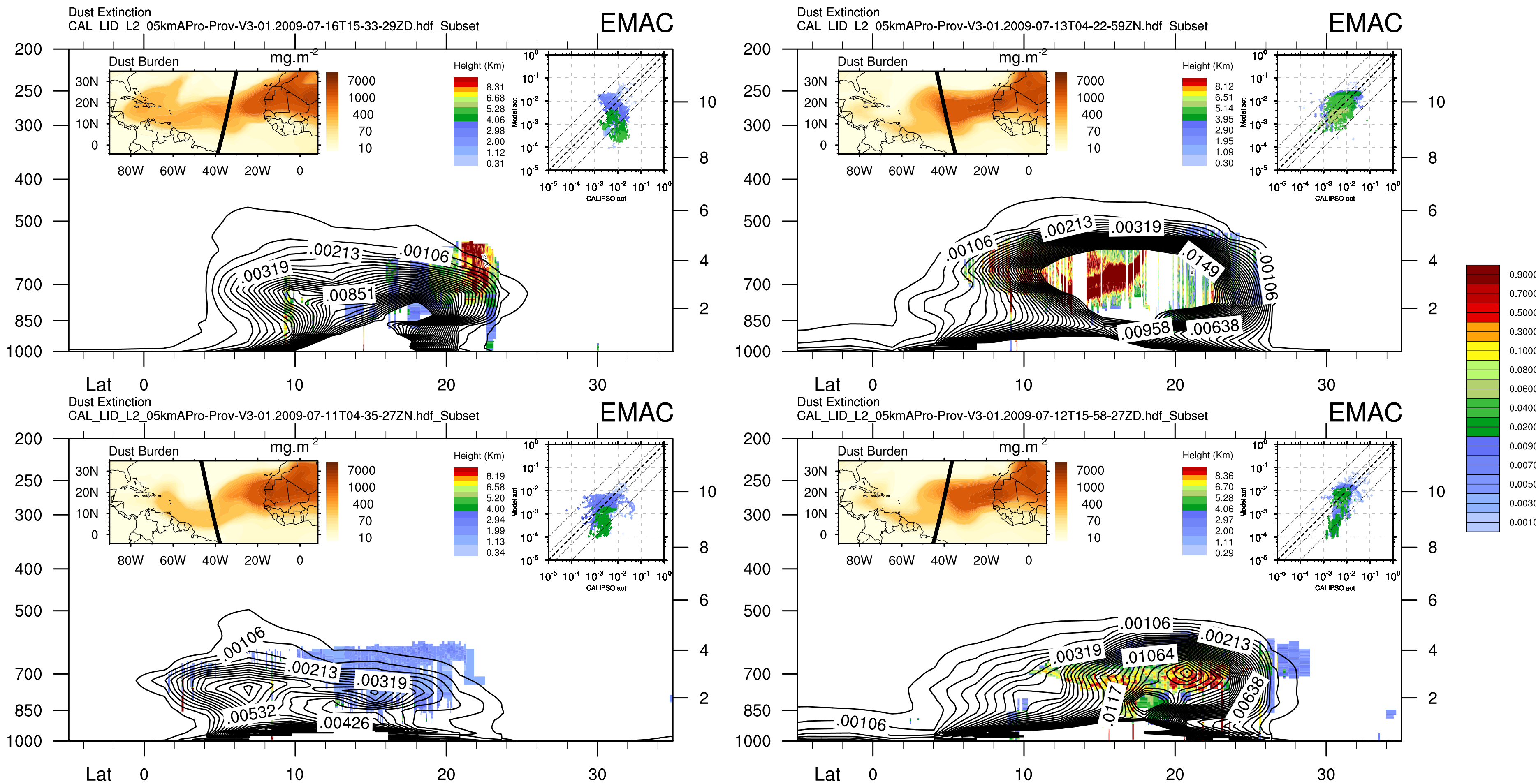

Figure S2d: Continued for Fig. S2a.

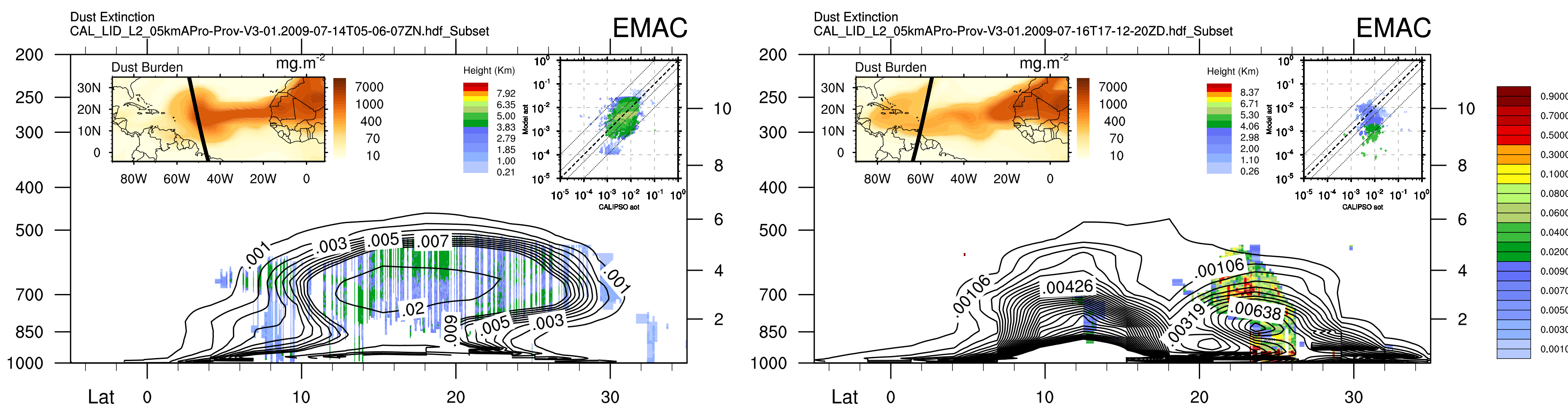

Figure S2e: Continued for Fig. S2a.

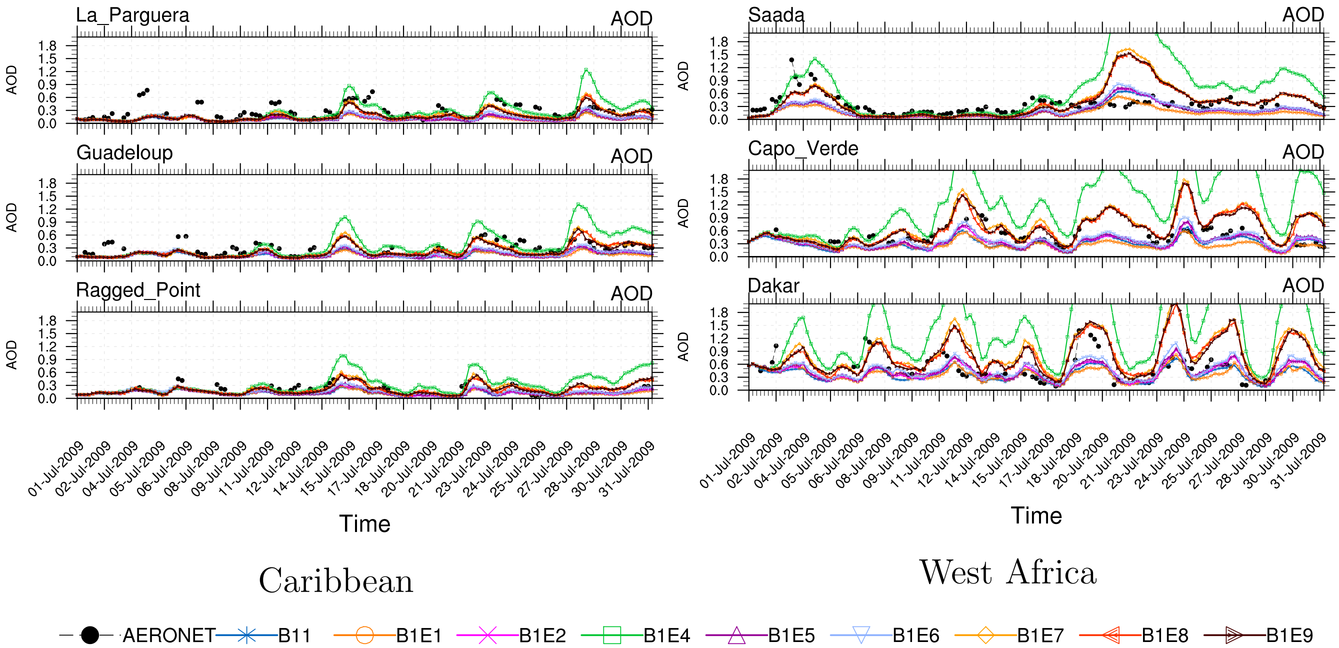

Figure S3: Complementing Fig. 8: EMAC and AERONET AOD for the western Africa (right) and Caribbean (right) sites based on different dust emissions (Table 3).

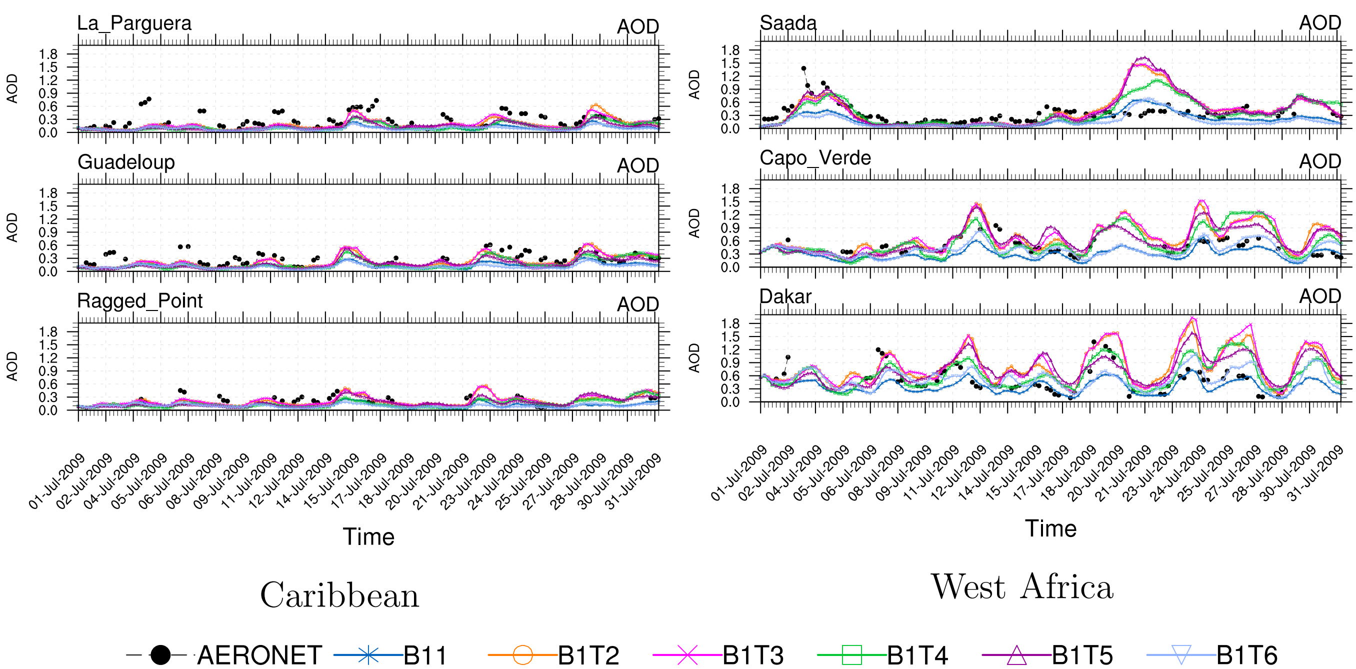

Figure S4: Complementing Fig. 9: EMAC and AERONET AOD for the western Africa (right) and Caribbean (right) sites based on different convection schemes (Table 3).

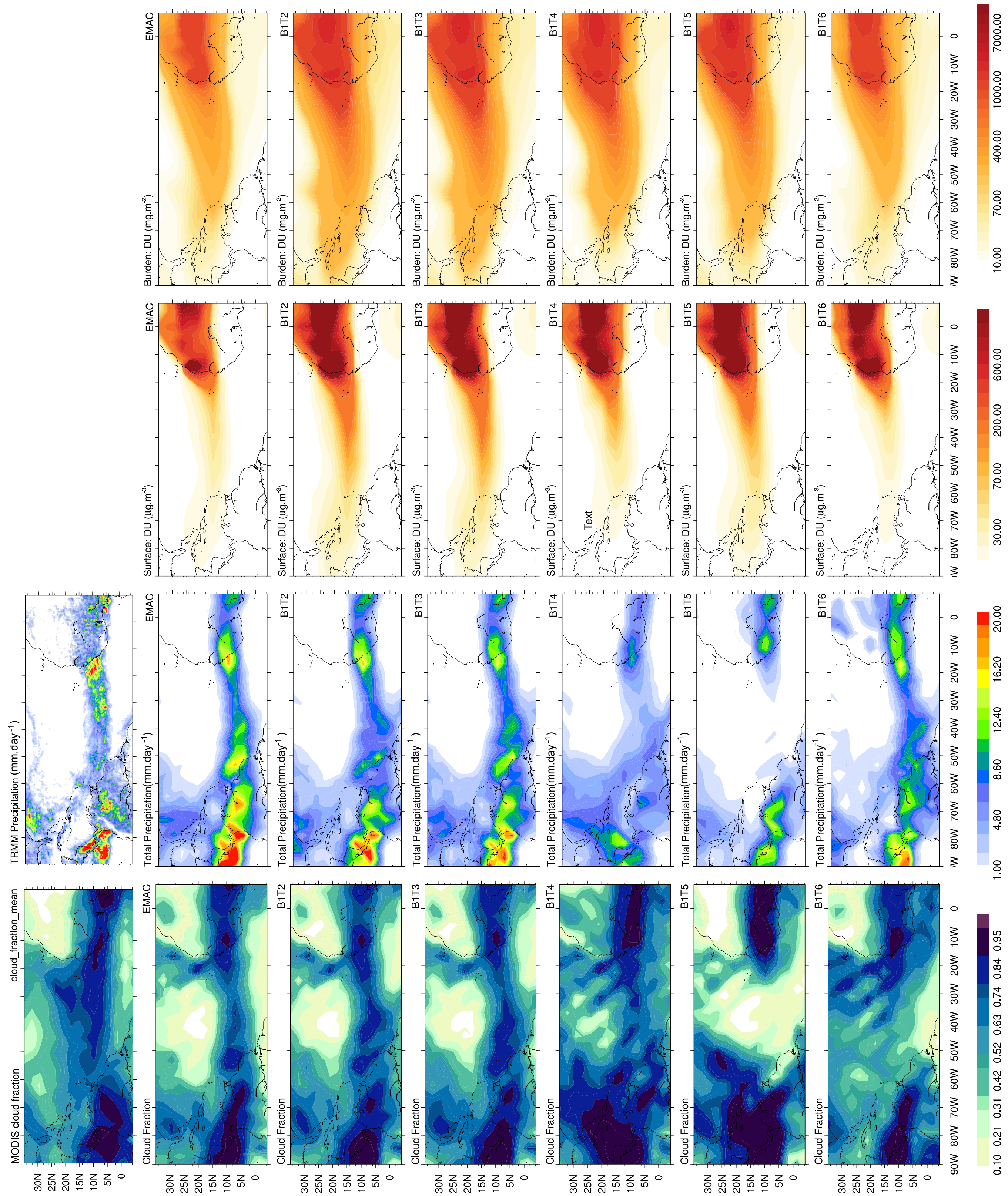

Figure S5: Complementing Fig. 10: (Top) MODIS cloud fraction and TRMM precipitation (monthly mean); (below) EMAC results (from left to right) cloud fraction, precipitation, surface dust concentration, and dust burden for different convection schemes (2nd–7th row). The model precipitation and cloud cover agrees for our EMAC set-up best with TRMM and MODIS observations with the ECMWF and TIEDTKE convection schemes.

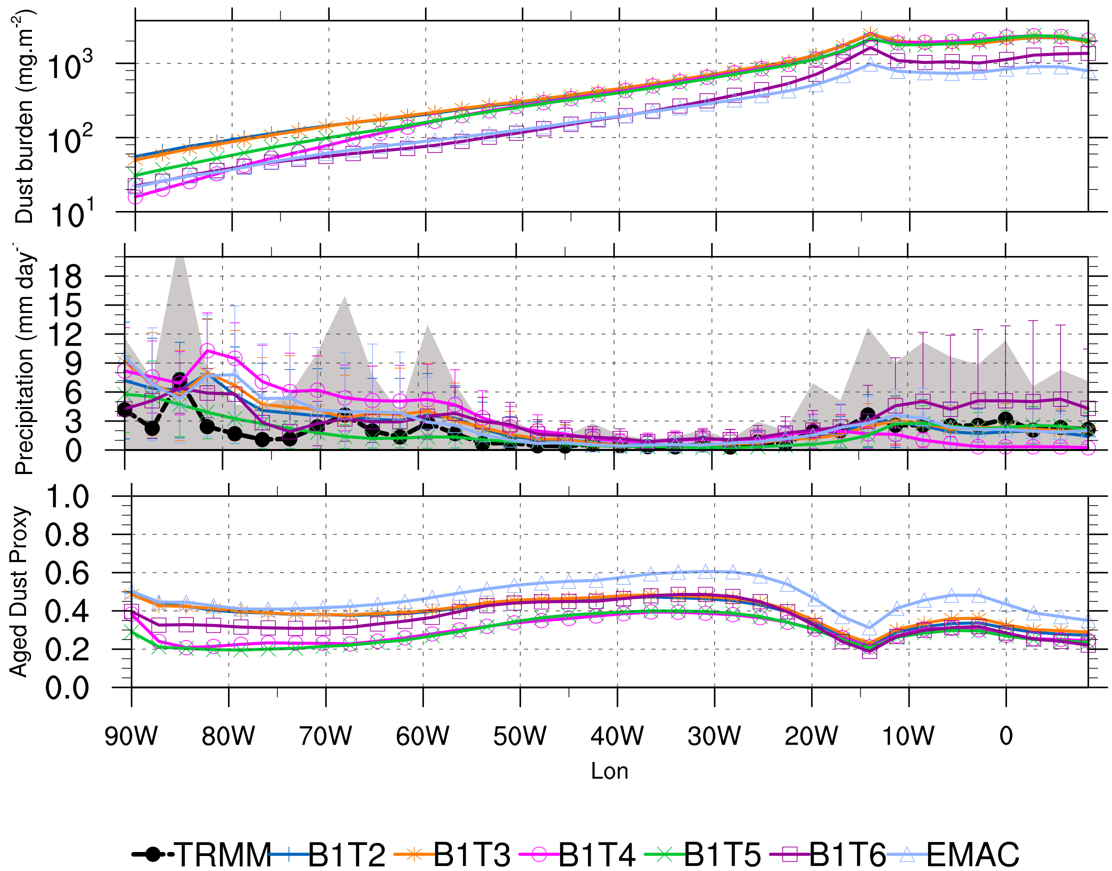

Figure S6: Complementing Fig. 11: Comparison of observed and calculated meridional means over the DIZ region (10^o–25^o N) for: (Top) dust burden, (middle) precipitation, (bottom) aged dust proxy (ADP) for July 2009 (monthly mean). The ADP represents a ratio between aged and non-aged dust particles (cs/ci). The shaded area represents one standard deviation of the TRMM-precipitation and the error bars shows one standard deviation of the model.

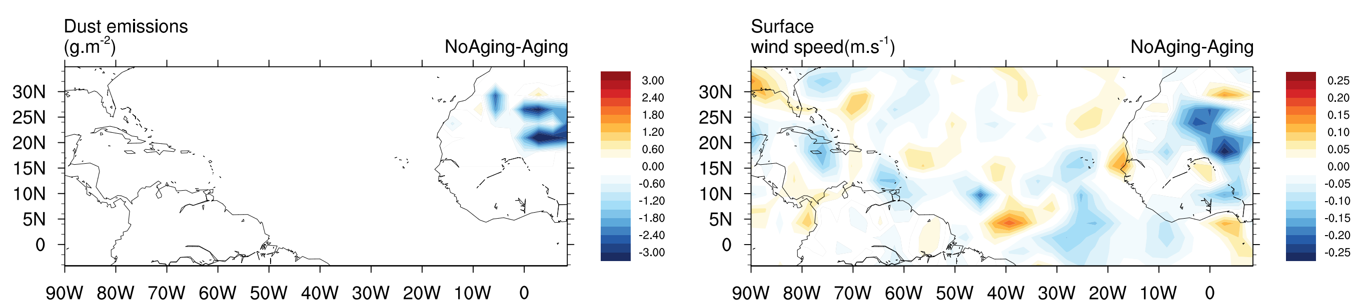

Figure S7: Monthly mean of difference in (left) dust emissions and (right) surface wind speed between "Aging" – "NoAging case" showing the increased surface wind speed for the aging case due to the radiative feedback resulting in increase in dust emission flux.

Table 1a: AOD Evaluation metrics for the sensitivity simulations (July 2009) over West Africa; dust emissions flux, convection parameterizations and dust Aging. "EMAC" is the reference simulation. Definition of the statistical parameters are shown in App. A in the main text.

	EMAC	Dust emissions								Convection					NoAging
		B1E1	B1E2	B1E3	B1E4	B1E5	B1E6	B1E7	B1E8	B1T2	B1T3	B1T4	B1T5	B1T6	
$Mean_m$	0.18± 0.33	0.18± 0.30	0.21± 0.32	0.57± 0.46	0.21± 0.33	0.22± 0.33	0.36± 0.40	0.34± 0.39	0.34± 0.39	0.36± 0.39	0.35± 0.39	0.36± 0.38	0.37± 0.39	0.21± 0.36	0.25± 0.33
$Mean_o$	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38
r_m	0.18± 0.33	0.18± 0.30	0.21± 0.32	0.57± 0.46	0.21± 0.33	0.22± 0.33	0.36± 0.40	0.34± 0.39	0.34± 0.39	0.36± 0.39	0.35± 0.39	0.36± 0.38	0.37± 0.39	0.21± 0.36	0.25± 0.33
r_o	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38	0.24± 0.38
RMSE	0.36	0.38	0.33	0.42	0.33	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.32	0.35	0.31
R	0.73	0.73	0.73	0.73	0.74	0.73	0.73	0.74	0.74	0.74	0.73	0.73	0.74	0.71	0.69
MBE	-0.24	-0.27	-0.19	0.22	-0.19	-0.17	0.03	0.02	0.01	0.03	0.03	0.04	0.04	-0.2	-0.1
GFE	-0.26	-0.26	-0.26	-0.04	-0.26	0.53	-0.42	-0.41	-0.52	-0.29	-1.03	-1.72	-0.31	-0.27	-0.24
SS1	0.84	0.82	0.84	0.84	0.85	0.85	0.87	0.87	0.87	0.87	0.86	0.87	0.87	0.85	0.83
PF2	0.5	0.5	0.57	0.55	0.56	0.59	0.65	0.64	0.66	0.67	0.66	0.65	0.64	0.53	0.59
PF10	1	1	1	0.98	1	1	1	1	1	1	1	1	1	1	1
NP	639														

Table 1b: AOD Evaluation metrics for the sensitivity simulations (July 2009) over the Caribbean; dust emissions flux, convection parameterizations and dust Aging. "EMAC" is the reference simulation. Definition of the statistical parameters are shown in App. A in the main text.

	EMAC	Dust emissions								Convection					NoAging
		B1E1	B1E2	B1E3	B1E4	B1E5	B1E6	B1E7	B1E8	B1T2	B1T3	B1T4	B1T5	B1T6	
$Mean_m$	0.07± 0.31	0.10± 0.21	0.10± 0.22	0.18± 0.34	0.11± 0.23	0.11± 0.23	0.14± 0.28	0.14± 0.27	0.14± 0.27	0.14± 0.25	0.14± 0.27	0.11± 0.26	0.12± 0.25	0.08± 0.22	0.13± 0.21
$Mean_o$	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24
r_m	0.07± 0.31	0.10± 0.21	0.10± 0.22	0.18± 0.34	0.11± 0.23	0.11± 0.23	0.14± 0.28	0.14± 0.27	0.14± 0.27	0.14± 0.25	0.14± 0.27	0.11± 0.26	0.12± 0.25	0.08± 0.22	0.13± 0.21
r_o	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24	0.25± 0.24
RMSE	0.44	0.42	0.4	0.33	0.4	0.38	0.31	0.33	0.33	0.31	0.32	0.42	0.41	0.54	0.32
R	0.53	0.49	0.52	0.43	0.51	0.51	0.48	0.48	0.49	0.49	0.5	0.49	0.4	0.54	0.52
MBE	-0.39	-0.37	-0.34	-0.05	-0.33	-0.31	-0.18	-0.2	-0.21	-0.19	-0.2	-0.34	-0.31	-0.5	-0.24
GFE	-0.27	-0.26	-0.25	-0.26	-0.25	-0.24	-0.19	-0.2	-0.2	-0.2	-0.2	-0.25	-0.24	-0.32	-0.2
SS1	0.71	0.73	0.76	0.63	0.75	0.75	0.72	0.72	0.73	0.74	0.74	0.73	0.69	0.77	0.75
PF2	0.33	0.39	0.43	0.67	0.46	0.49	0.69	0.66	0.66	0.69	0.67	0.42	0.51	0.18	0.63
PF10	0.99	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NP	180														