Impacts of reducing scattering and absorbing aerosols on the temporal extent and intensity of South and East Asian summer monsoon

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Supplementary Material

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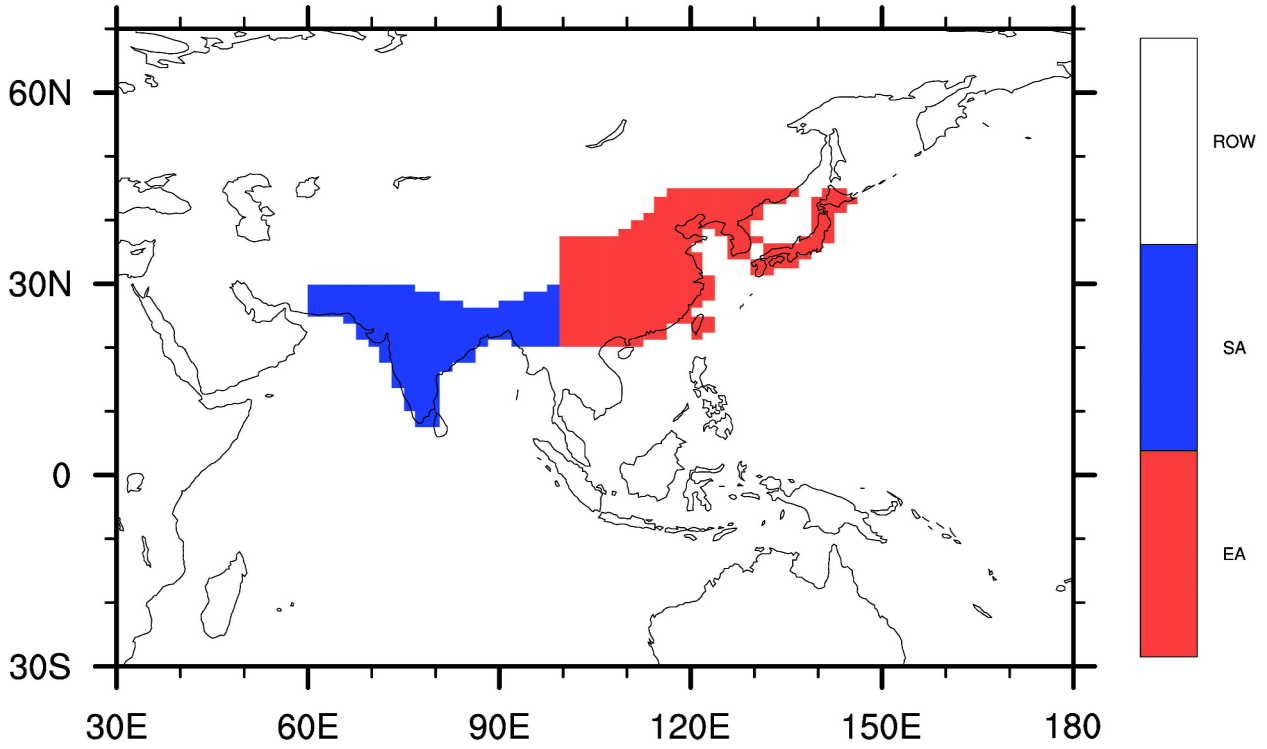


Figure S1. The division of the South Asia (SA), East Asia (EA) and rest of the world (ROW) refers to the sixth IPCC assessment report.

Table S1. The mean values and the 25th-75th percentile ranges of the monsoon onset date (unit: pentad or day), withdrawal date (unit: pentad or day) and duration (unit: pentad or day) over South and East Asia in different simulations obtained based on different definitions.

		W2009[a]			N2016[b]		
		Onset (pentad)	Withdrawal (pentad)	Duration (pentad)	Onset (day)	Withdrawal (day)	Duration (day)
SASM	CTRL	30.8 (30,32)*	51.2 (50,52)	21.4 (19,23)	160.7 (149,169.5)	279 (268,290.5)	119.4 (110.5,134)
	AER-75%	30.7 (30,32)	51.2 (50,52)	21.5 (20,23)	158 (148,168)	279 (266,286)	122 (105,138)
	SCT-75%	30.7 (29,32)	51.5 (50.5,52.5)	21.8 (20,23)	158.4 (153,164))	288.2 (281,296.5)	130.8 (119,144.5)
	ABS-75%	32 (30.5,33.5)	50.4 (49.5,51.5)	19.4 (17,20.5)	160.6 (153.5,167.5)	275.8 (263,285.5)	116.2 (100.5,133.5)
		W2016[c]			G1983[d]		
		Onset (pentad)	Withdrawal (pentad)	Duration (pentad)	Onset (pentad)	Withdrawal (pentad)	Duration (pentad)
EASM	CTRL	15.8 (14,18)	49.3 (47.5,51)	34.5 (33,37)	16.7 (15,19)	53.2 (52,54)	37.8 (36,40)
	AER-75%	15.9 (14,19)	48.9 (48,50)	34.0 (31,37)	17.1 (16,18)	52.6 (52,54)	36.4 (35,38)
	SCT-75%	15.8 (14,18)	50.1 (48,51.5))	35.4 (31.5,39.5)	16 (14.5,17)	53.7 (52.5,54))	38.8 (36,41)
	ABS-75%	15.2 (14,16)	48.8 (47.5,50)	34.6 (32,36.5)	16.8 (16,18)	52.7 (51,54)	36.9 (34.5,39)

*mean value with a 25th-75th percentile range. [a] Definition from Wang et al. (2009) to obtain South Asian summer monsoon (SASM) onset and withdrawal dates, hereafter referred to as W2009. [b] Definition from Noska and Misra (2016) to obtain the SASM onset and withdrawal dates, hereafter referred to as N2016.[c] Definition from Wang, D. et al (2016) to obtain East Asian summer monsoon (EASM) onset and withdrawal dates, hereafter referred to as W2016.[d] Definition from Guo (1983) to obtain the EASM onset and withdrawal dates, hereafter referred to as G1983.

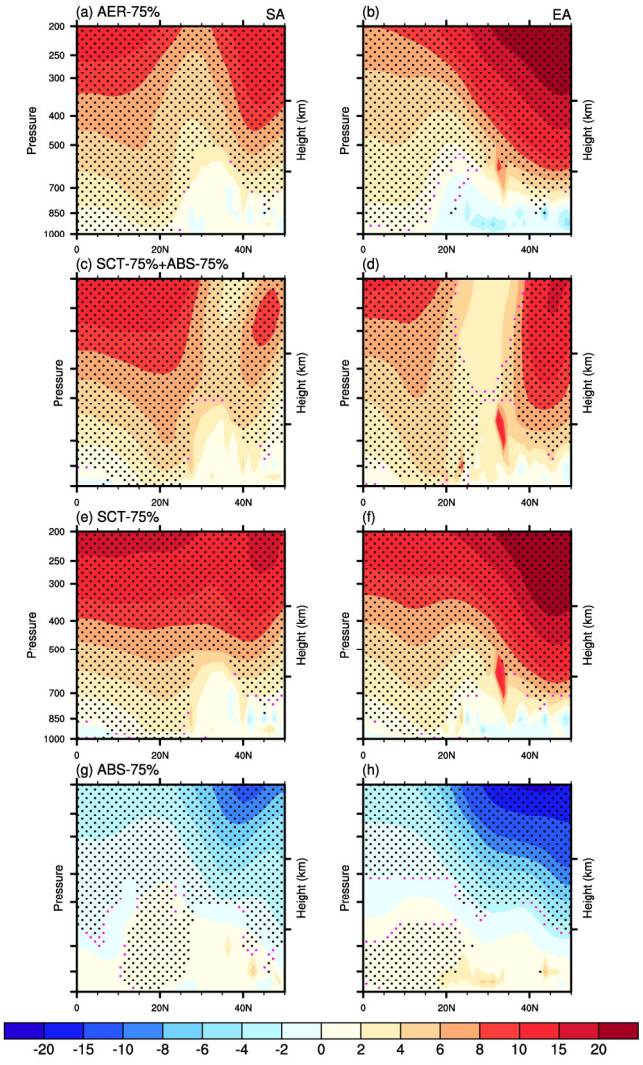
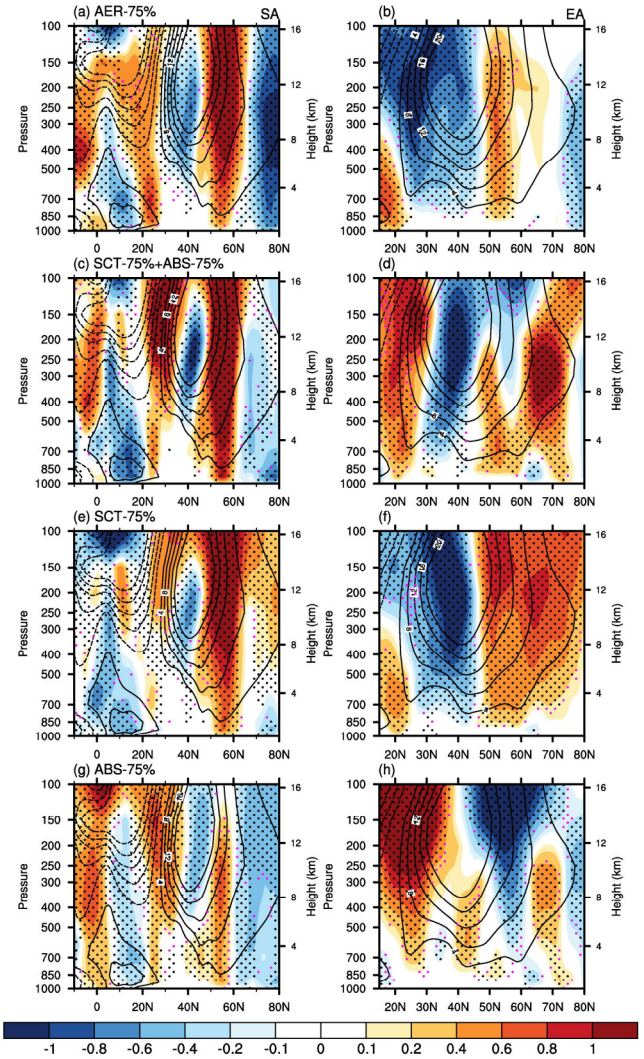


Figure S2. Zonal-mean geopotential height (unit: m) responses to the reductions in total aerosols (a and b), scattering (SCT) aerosols (e and f), and absorbing (ABS) aerosols (g and h) during monsoon season over South Asia (70-90°E; a, c, e and g) and East Asia (100-120°E; b, d, f, h). Monsoon season is analyzed and based on the definitions from N2016 over South Asia and G1983 over East Asia. Panels (c) and (d) are the sum of the impacts of the reductions in the SCT and ABS. Black and pink dotted regions denote where the geopotential height change is statistically significant at the 95% and 90% confidence level, respectively, according to a t-test.



40 **Figure S3. Same as Figure S2, but for the zonal-mean zonal wind (shading; unit: m s^{-1}; red and blue denote westerly and easterly wind, respectively) responses during monsoon season. Black lines represent the climatological zonal wind from control simulations (unit: m s^{-1}; solid and dash lines denote westerly and easterly wind, respectively).**

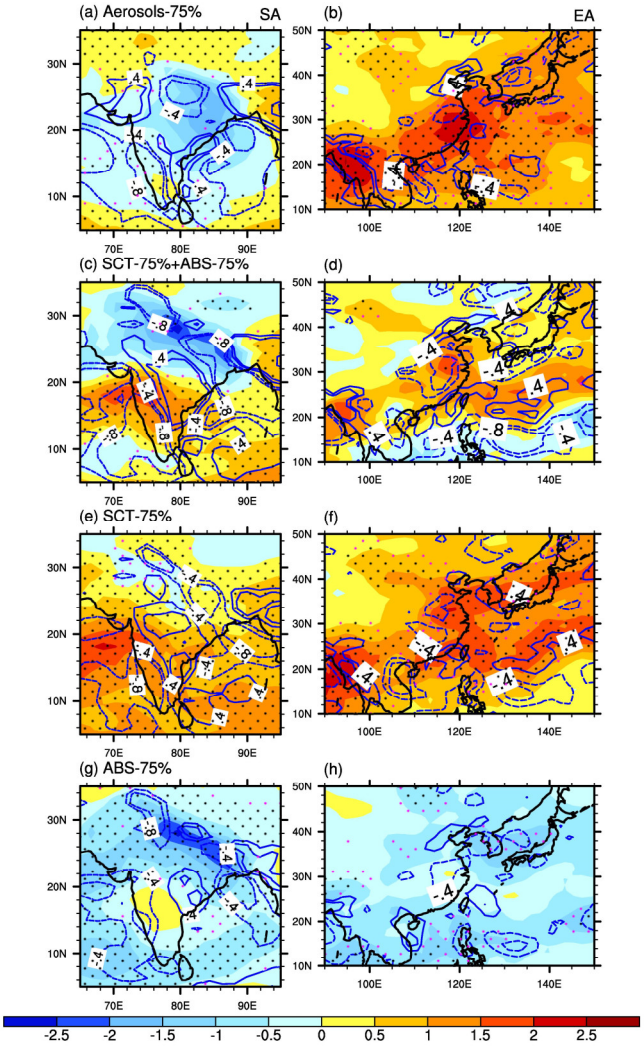


Figure S4. Spatial distributions of the total column moisture flux (shading; unit: kg m^{-2} s^{-1}; red denote moisture convergence and blue denote divergence) and 850-hPa vertical velocity (contours; unit: -100×Pa s^{-1}) responses to the reductions in total aerosols (a and b), SCT aerosols (e and f) and ABS aerosols (g and h) during monsoon season over South Asia (a, c, e and g) and East Asia (b, d, f and h). Monsoon season is analyzed and based on the definitions from N2016 over South Asia and G1983 over East Asia. Panels (c) and (d) is the sum of the impacts of the reductions in the SCT and ABS. Black and pink dotted regions denote where the total column moisture flux change is statistically significant at the 95% and 90% confidence level, respectively, according to a t-test.