Auxiliary Materials for

Evaluation of Factors Controlling Global Secondary Organic Aerosol Production from Cloud Processes

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Table S1. Correlation matrix between the six factors

	LWC	TC_{loss}	Temp	OH	O_3	VOC/NO_x
LWC	1	0.07	0.18	0.05	-0.1	-0.04
TC_{loss}		1	0.17	0.08	-0.03	0.07
Temp			1	0.66	-0.22	-0.13
OH				1	-0.08	-0.1
O_3					1	0.08
VOC/NO_x						1

Table S2. Major difference between this work and Ervens et al., 2008

	This work	***Ervens et al.*, 2008**
Model	GCM coupled with detailed gas and cloud chemistry	Cloud parcel model with detailed gas and cloud chemistry
SOA_{cld} precursors	isoprene, toluene, α-pinene	isoprene
Multiphase chemistry	*Jacob,1986; Liang and Jacobson, 1999; Lim et al.*, 2005; *Tan et al.*, 2010; *Emmons et al*., 2010; *Liu et al.*, 2012	*Ervens et al., 2004a*; *Lim et al.*, 2005; *Altieri et al.*, 2006; *Carlton et al.*, 2006,2007
Transport	Coupled chemistry-climate GCM simulated continuously for one year	Offline 45 1-h trajectories describing passages of an air parcel through stratocumulus clouds, derived from three-dimensional Eulerian large-eddy-simulations. Repeat 5 times from 10 am.
Methods	Statistical analysis on the spatiotemporal association of different factors with respect to in-cloud SOA formation	Sensitivity of in-cloud SOA production against initial chemical composition in a closed system.
Parameterization	$P_{SOAcld} = \alpha \cdot LWC \cdot TC_{loss}^{\gamma} + \beta$	$P_{SOAcld} = (a \cdot LWC + b \cdot \tau + c) \cdot TC_{initial}$
Major findings	1. LWC linearly determines the spatiotemporal variability of P_{SOAcld}. 2. The spatiotemporal association between TC_{loss} and P_{SOAcld} is non-linear. 3. VOC/NO_x is not spatiotemporally correlated ($r < 0.1$) well with P_{SOAcld}.	1. Initial VOC/NO_x ratio and τ are the most important factors. 2. In-cloud SOA yield is less affected by LWC.

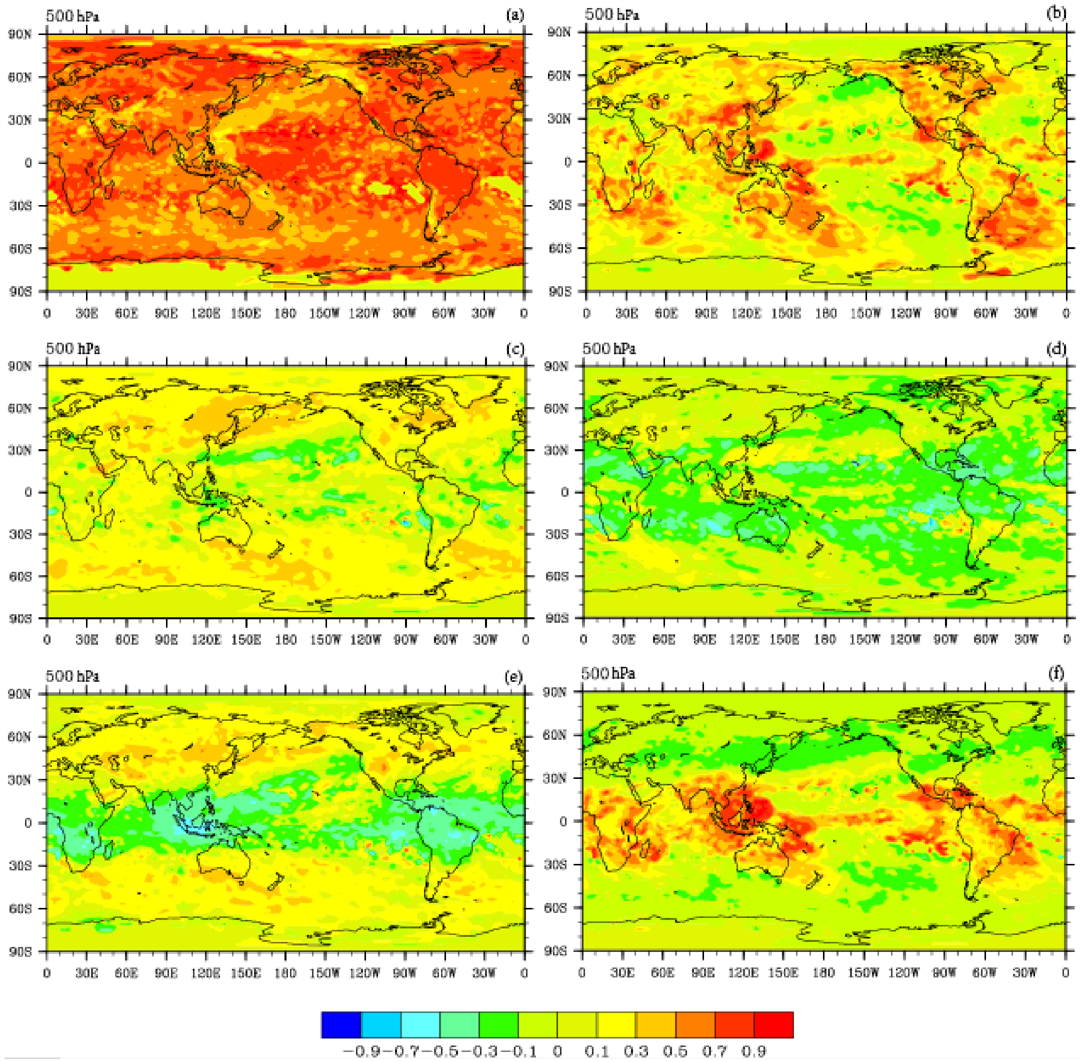

Figure S1. Distribution of the correlation (r) between SOA_{cld} production and (a) LWC, (b) TC_{loss} , (c) temperature, (d) O_3, (e) OH, (f) VOC/NO_x at 500hPa.

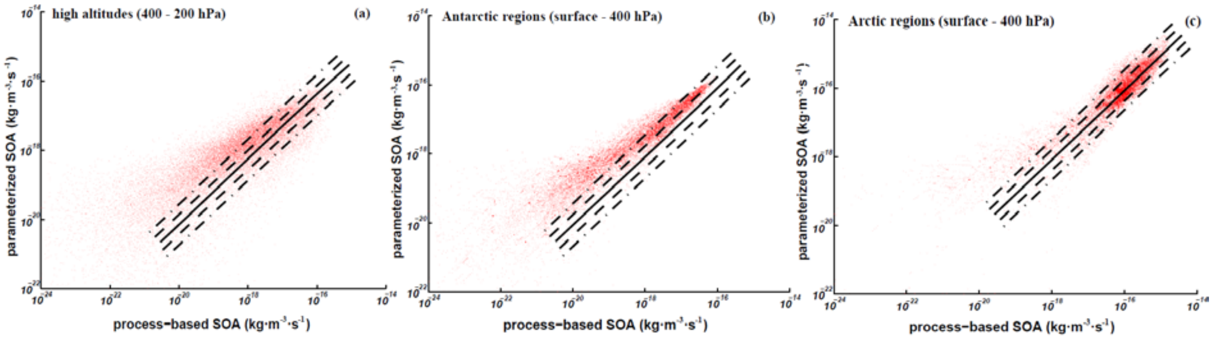

Figure S2. Same as Figure 3 in the main text, but only for (a) high altitudes (above 400 hPa), (b) the Antarctic region, and (c) the Arctic region.

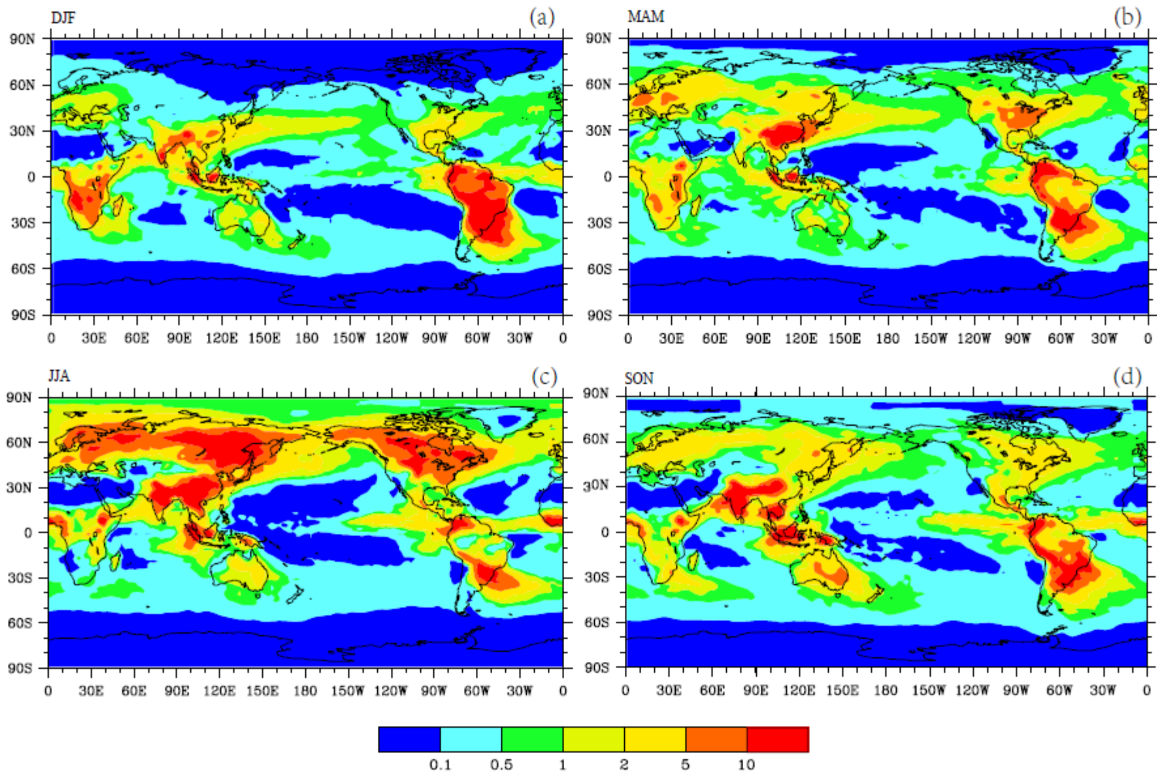

Figure S3. Process-based seasonal averaged column production of SOA_{cld} in DJF, MAM, JJA, and SON (unit: $ng \cdot m^{-2} \cdot s^{-1}$).

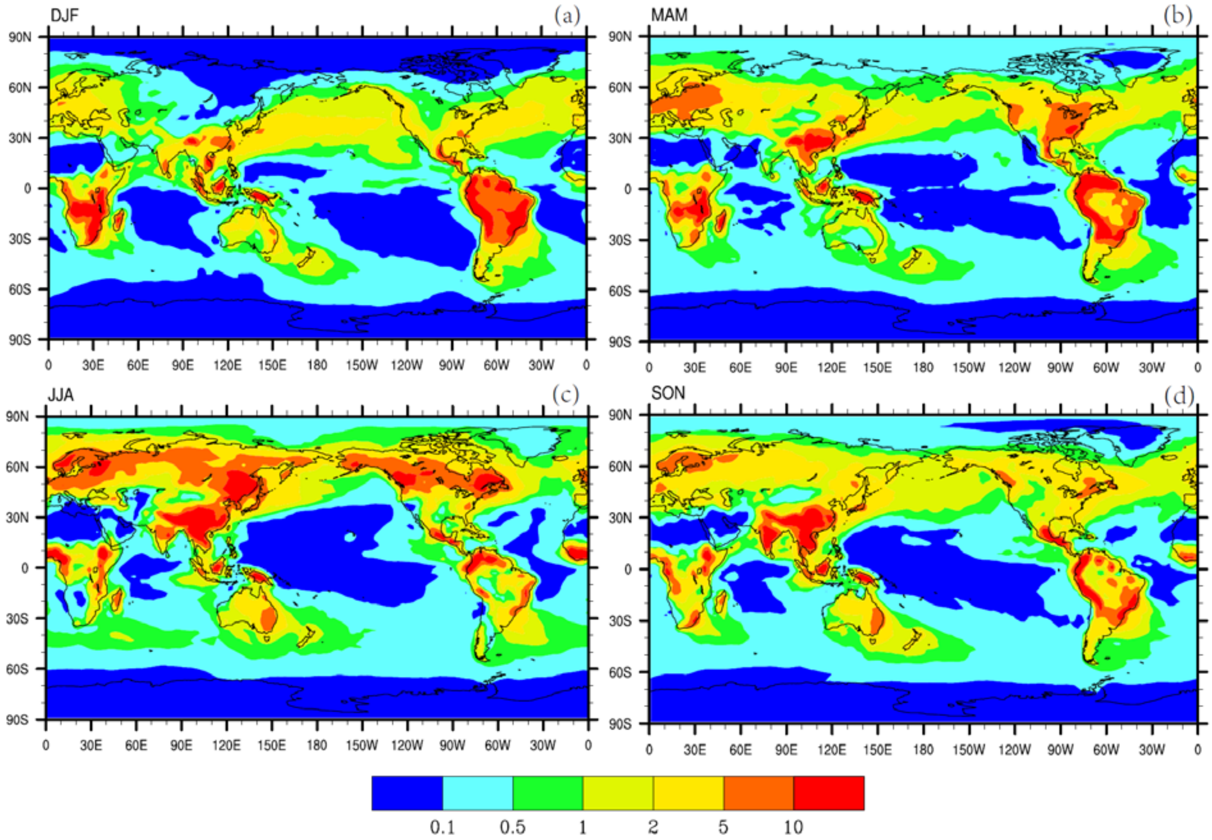

Figure S4. Parameterized seasonal averaged column production of SOA_{cld} in DJF, MAM, JJA, and SON (unit: $ng \cdot m^{-2} \cdot s^{-1}$).

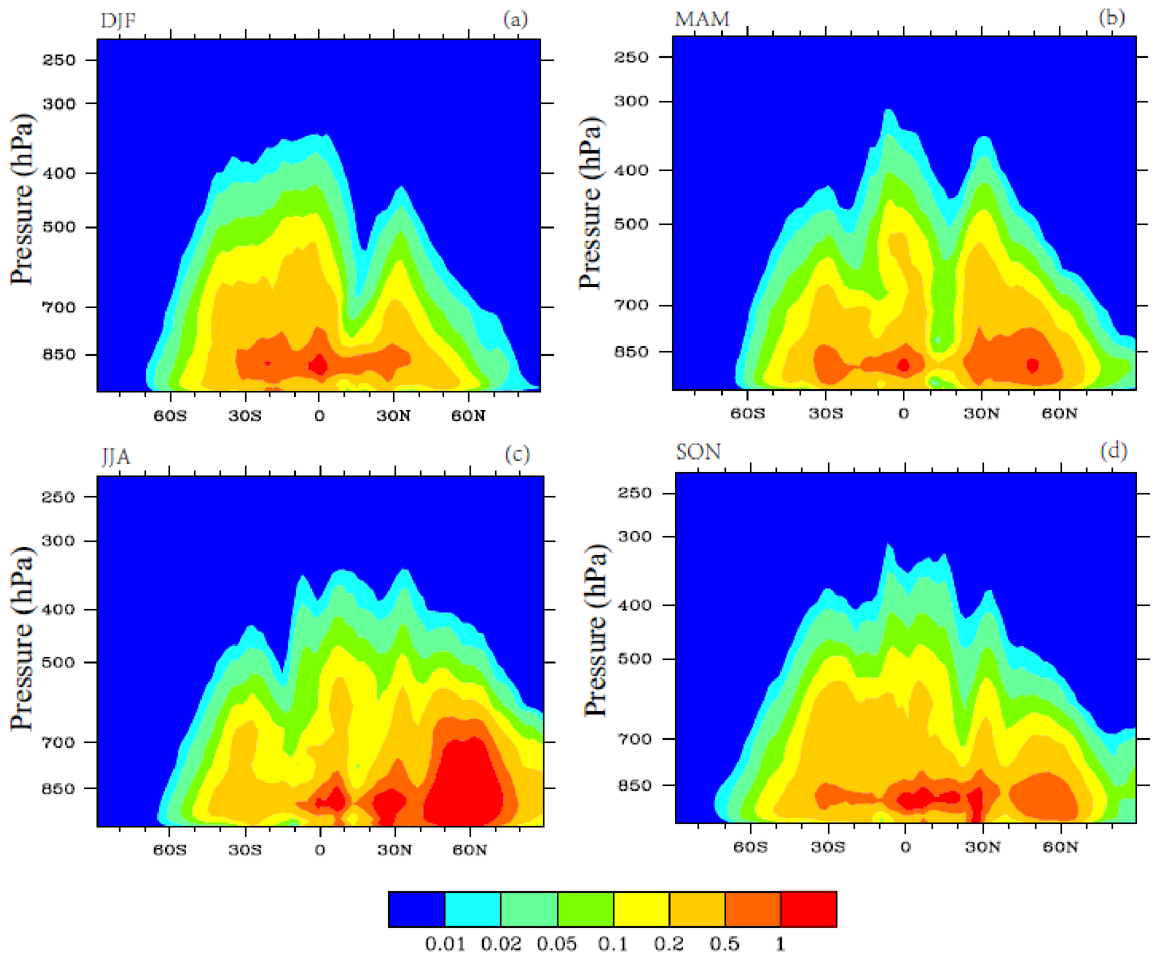

Figure S5**.** Process-based seasonal averaged zonal mean production of SOA_{cld} in DJF, MAM, JJA, and SON (unit: $pg \cdot m^{-3} \cdot s^{-1}$).

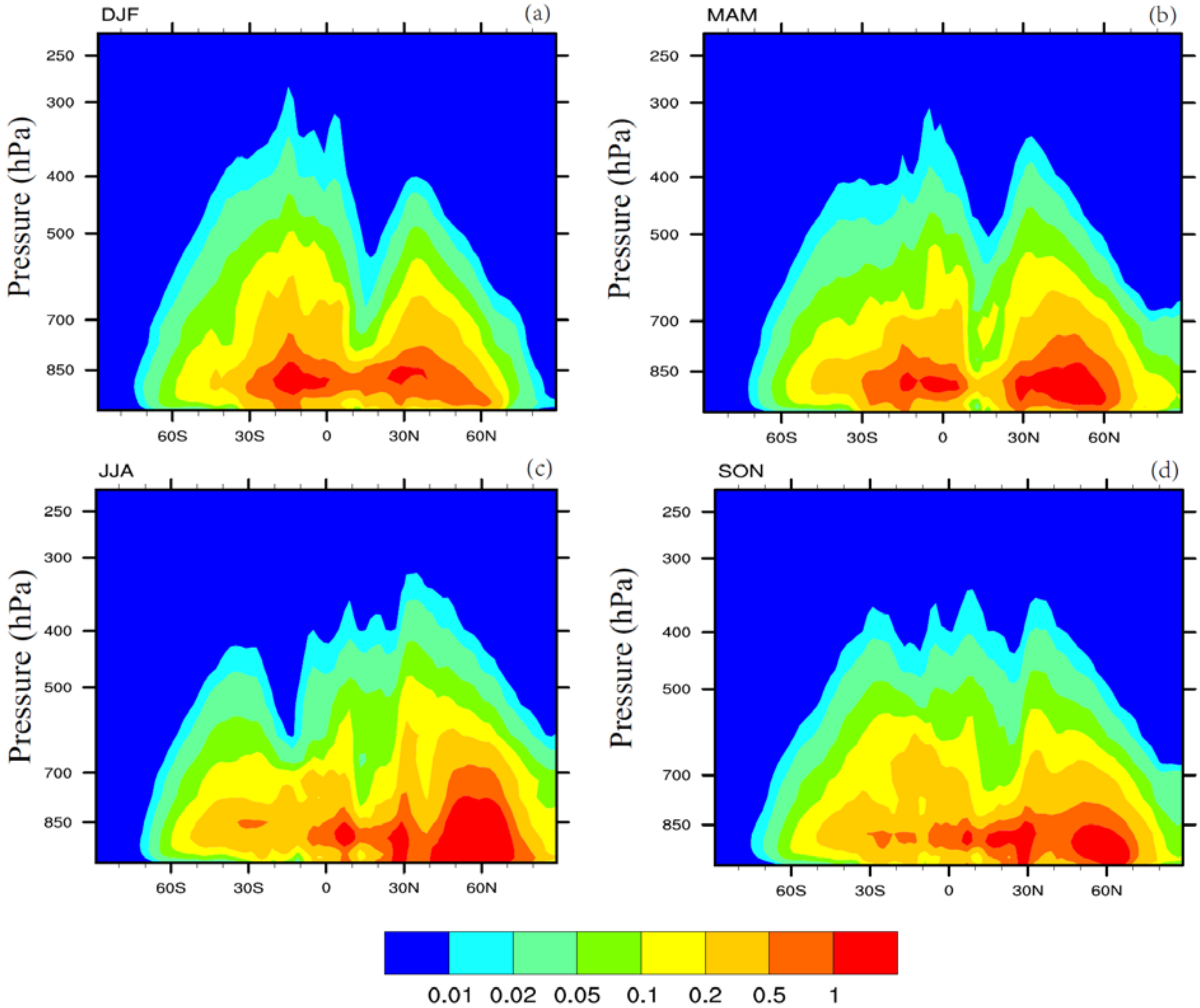

Figure S6. Parameterized seasonal averaged zonal mean production of SOA_{cld} in DJF, MAM, JJA, and SON (unit: $pg{\cdot}m^{-3}{\cdot}s^{-1}$).