Supplement of

5 Building a comprehensive library of observed Lagrangian trajectories for testing modeled cloud evolution, aerosolcloud interactions, and marine cloud brightening

Ehsan Erfani¹, Robert Wood², Peter Blossey², Sarah J. Doherty², Ryan Eastman²

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¹Division of Atmospheric Sciences, Desert Research Institute, Reno, NV, USA ²Department of Atmospheric Sciences, University of Washington, Seattle, WA, USA

Correspondence to: Ehsan Erfani, (<u>Ehsan.Erfani@dri.edu</u>)

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Figure S1. Pearson correlation coefficients (R-values) between various CCFs, cloud variables, and the first three PCs based on 1663 trajectories in JJA 2018-2021 used in this study. Note that only the first (top-most) 8 variables from the left side of the x-axis are used as inputs of PCA. The use of a Δ symbol before a variable means that the difference between the value of that variable at the beginning versus the end of the trajectory is calculated. Otherwise, the along-trajectory means are calculated.

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b)		
$WS_{10m} \ (m \ s^{-1})$	1 0.08-0.05 -0.1 0.05 0.09-0.15 -0.3 0.04 0.6 -0.5 0.21 0.28 0.21 -0.06 0.07 0.02 0.22 0.38 0.25 -0.43 -0.15 0.51	.00
$q (g k g^{-1})$	0.08 1 -0.15-0.49 0.05 0.15 -0.03 -0.35 0.02 0.08 -0.01 0.06 0.17 0.07 -0.03 0.05 -0.03 -0.02 0.01 0.18 -0.72 0.29 0.03	
ω (Pa s ⁻¹)	-0.05-0.15 1 0.12 0.05 0.03 -0.09 0.35 0.14 -0.03-0.01-0.05 -0.12-0.09 0.22 0.14 0.15 -0.23 -0.26 -0.23 0.48 0 0.53	175
EIS (K)	-0.1 -0.49 <mark>0.12 1 -0.29 0.19</mark> -0.07 0.06 0.2 0.19 0 -0.08 -0.04 0.02 0.21 0.03 0.16 -0.03 -0.03 -0.11 0.48 -0.74 -0.08	
$\Delta WS_{10m}(m\ s^{-1})$	0.05 0.05 <mark>0.05 -0.29 1 -</mark> 0.04 0.05 <mark>0.16 -0.1 -0.28</mark> 0 0.02 0.01 -0.05 -0.1 <mark>0.24</mark> -0.07 -0.18 -0.08 <mark>0.16</mark> -0.03 0.6 0.33	
$\Delta q \; (g \; kg^{-1})$	0.09 0.15 0.03 0.19 0.04 1 0.05 0.39 0.08 0.2 0.08 0.02 0 0.06 0.13 0.2 0.18 0.13 0.12 0.01 0.38 0.56 0.14).50
$\Delta \omega (Pa s^{-1})$	-0.15-0.03-0.09-0.07 0.05 -0.05 1 -0.01-0.11-0.18 0.09 -0.06-0.08-0.02-0.12-0.07-0.05 0.02 -0.05 0.05 0.02 0.23 -0.69	
$\Delta EIS(K)$	-0.3 -0.35 <mark>0.35 0.06 0.16 -0.39 -0.01 1 0.12 -0.41 0.21</mark> -0.03 -0.12 -0.08 <mark>0.15 0.01 -0.07 -0.07 -0.22 -0.19</mark> 0.78 0.39 0.12	
ΔCF (%)	0.04 0.02 0.14 0.2 -0.1 0.08-0.11 0.12 1 0.18-0.03 0.42 0.47 0.38 0.58 0.19 0.12 0.11 0.05 0.2 0.1 -0.15 0.13).25
∆SST(°C)	0.6 0.08-0.03 0.19-0.28 0.2 -0.18-0.41 0.18 1 -0.35 0.09 0.22 0.18 0.17 0.03 0.12 0.34 0.43 0.15 -0.33-0.45 0.25	
ΔP_{MSL} (hPa)	-0.5 -0.01-0.01 0 0 -0.08 0.09 0.21 -0.03 -0.35 1 -0.08 -0.11 -0.09 -0 -0.05 -0.08 -0.14 -0.2 -0.13 <mark>0.22 0.15</mark> -0.27	
$\Delta \log(\text{CERES LWP})$	0.21 0.06 -0.05 -0.08 0.02 -0.02 -0.06 -0.03 0.42 0.09 -0.08 1 0.57 0.43 0.32 0.09 0.02 0.14 0.16 0.36 -0.11 0.03 0.11 - 0).00
$\Delta \log(\text{SSMI LWP})$	0.28 0.17 -0.12-0.04 0.01 0 -0.08-0.12 0.47 0.22 -0.11 0.57 1 0.51 0.28 0.09 0.03 0.2 0.31 0.46 <mark>-0.22</mark> -0.02 0.11	
$\Delta \log(AMSR LWP)$	0.21 0.07 -0.09 0.02 -0.05 -0.06 -0.02 -0.08 0.38 0.18 -0.09 0.43 0.51 1 0.18 0.05 -0.01 0.24 0.26 0.59 -0.11 -0.03 0.03	
$\Delta \log(N_d)$	-0.06-0.03 <mark>0.22 0.21</mark> -0.1 0.13 -0.12 0.15 0.58 0.17 -0 0.32 0.28 0.18 1 0.15 0.16 0.05 0.09 -0.03 0.17 -0.16 0.14	-0.25
$\Delta \log(<\!N_a\!>)$	0.07 0.05 0.14 0.03 0.24 0.2 -0.07 0.01 0.19 0.03 -0.05 0.09 0.09 0.05 0.15 1 0.11 -0.15 -0.06 0.04 -0.03 0 0.23	
$\Delta \log(N_{\partial_{700}})$	0.02-0.03 <mark>0.15 0.16</mark> -0.07 <mark>0.18</mark> -0.05-0.07 <mark>0.12 0.12 0.08 0.02 0.03 0.01 0.16 0.11 1</mark> -0.06-0.01-0.08 0.02 -0.21 0.09	
MODIS Δ CTH (km)	0.22 -0.02-0.23-0.03-0.18-0.13 0.02 -0.07 0.11 0.34 -0.14 0.14 0.2 0.24 0.05 -0.15-0.06 1 0.47 0.24 -0.1 -0.05-0.09	-0.50
CERES Δ CTH (km)	0.38 0.01 -0.26-0.03-0.08 0.12 -0.05-0.22 0.05 0.43 -0.2 0.16 0.31 0.26 0.09 -0.06-0.01 0.47 1 0.29 -0.28 -0.16 0.05	
∆log(Precip)	0.25 0.18 0.23 0.11 0.16 0.01 0.05 0.19 0.2 0.15 0.13 0.36 0.46 0.59 0.03 0.04 0.08 0.24 0.29 1 0.28 0.09 0.01	-0.75
PC1	-0.43-0.72 0.48 0.48 -0.03-0.38 0.02 0.78 0.1 -0.33 0.22 -0.11-0.22-0.11 0.17 -0.03 0.02 -0.1 -0.28-0.28 1 -0 0	0.75
PC2	-0.15 0.29 0 <mark>-0.74 0.6 -0.56 0.23 0.39</mark> -0.15 -0.45 0.15 0.03 -0.02 -0.03 -0.16 0 -0.21 -0.05 -0.16 0.09 -0 1 0	
PC3	0.51 0.03 0.53 0.08 0.33 0.14 0.65 0.12 0.13 0.25 0.27 0.11 0.11 0.03 0.14 0.23 0.09 0.09 0.05 0.01 0 0 1	-1.00
	W510m (m 5^{-1}) $q(g kg^{-1})$ $u(Pa s^{-1})$ $u(Pa s^{-1})$ $Els (K)$ $\Delta W510m (m s^{-1})$ $\Delta q (g kg^{-1})$ $\Delta a (g kg^{-1})$ $\Delta a (g kg^{-1})$ $\Delta c (K)$ $\Delta log(SSM) LWP)$ $\Delta log(N_{a,\infty})$ $\Delta log(SSM) LWP)$ $\Delta log(A)$ $\Delta log(A)$ $\Delta log(V_{a,\infty})$ $\Delta log(V_{a,\infty})$ $\Delta log(V_{a,\infty})$ $\Delta log(P_{a,\infty})$ <	

Figure S1. Continued.



Figure S2. As in Figure 4b, but each panel shows differences between the beginning and end of the trajectories for a pair of variables.



Figure S3. As in Figure 5, but for cloud optical depth (τ_c) and cloud droplet effective radius (r_e).



40 Figure S4. As in Figure S3, but for the Sandu 2010 (2018-07-04) trajectory.



45 Figure S5. As in Figure 7, but for the Sandu 2010 (2018-07-04) trajectory.



Figure S6. Variance spectrum for the LWP (solid lines) at four instantaneous times for three LES simulations (ctrl, $N_a \times 3$, $N_a \times 9$) along the Sandu 2010 (2018-07-04) trajectory. k is the wavenumber and P_{LWP} is the power spectrum for LWP calculated using Fast Fourier Transform (FFT). The LWP variance (σ_{LWP}) can be calculated as: $\sigma_{LWP} = \int_0^\infty P_{LWP} dk$. The critical wavenumber (k_c) is the wavenumber above which 2/3 of the total LWP variance is contained (dotted lines). The length scale (l) is then defined as: $l = 1/k_c$. The values of l are provided within the box in each panel (from top to bottom for ctrl, $N_a \times 3$, and $N_a \times 9$, respectively). See de Roode et al. (2004) for a detailed description of the methodology to quantify the length scale.