

# Supplement of "Heuristic Estimation of Low-Level Cloud Fraction over the Globe Based on a Decoupling Parameterization"

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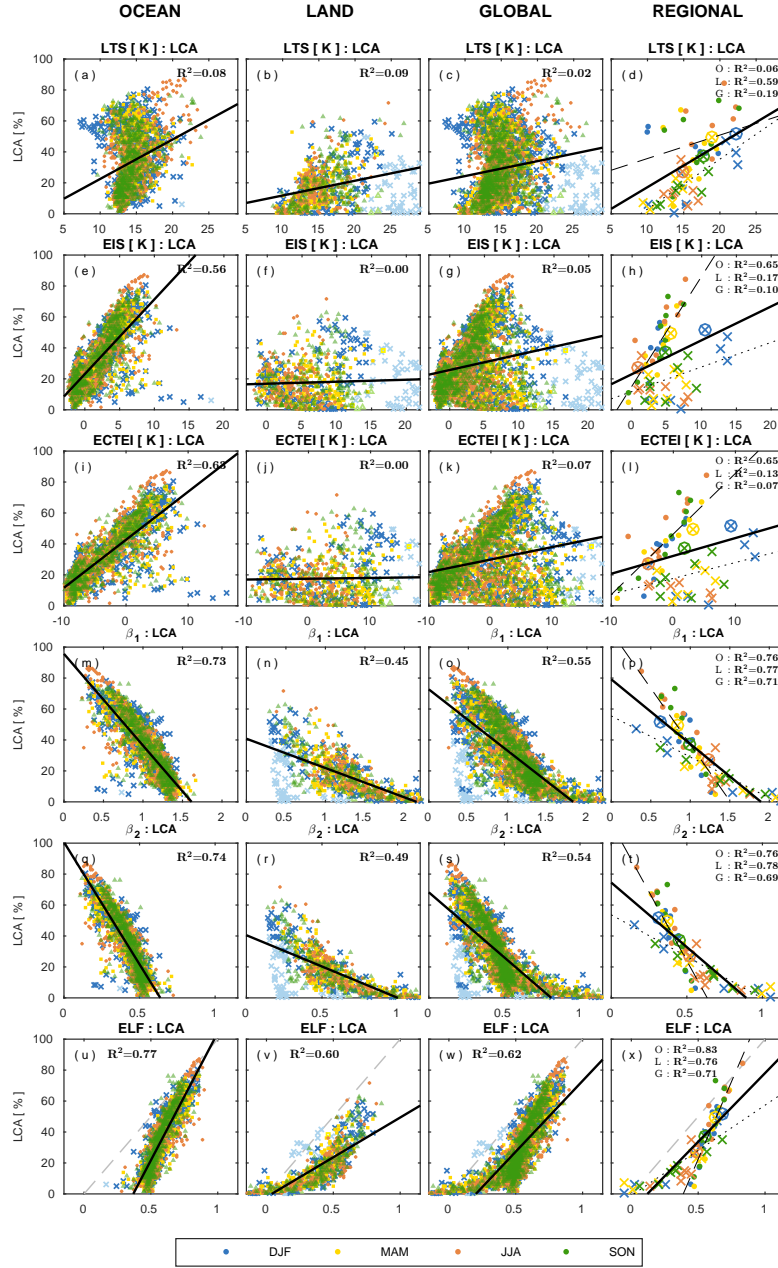
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## Supplement 1 : Analysis with Stratiform Clouds Only between 60°S and 60°N

Table S1 and Figure S1 are the same analysis as Table 3 and Figure 12, except that only stratiform LCA (the sum of stratocumulus, stratus, and fog) between 60°S and 60°N over the ice-free ocean are used instead of all LCA over the entire globe. Over the ocean, the correlations between the proxies and stratiform LCA tend to be higher than the correlations with entire LCA (Table S1). The correlations of LTS/EIS/ECTEI with LCA show relatively larger increases ( $\Delta r = 0.14 \sim 0.3$ ) than those of  $\beta_1/\beta_2/ELF$  ( $\Delta r = 0.08 \sim 0.12$ ), because LTS/EIS/ECTEI are designed to be applicable mainly over the marine stratiform cloud regions. The improved performance of EIS/ECTEI over the ocean with stratiform LCA are also evident in Figure S1 (compare with Figure 12). Note that not only EIS/ECTEI but also  $\beta_1/\beta_2/ELF$  shows improved performance. Overall, ELF shows the best performance in diagnosing stratiform LCA.

**Table S1.** Combined spatial-seasonal-interannual correlation coefficients of the seasonal stratiform LCA (defined as the fraction of stratocumulus, stratus, and fog) fitted to the individual proxy. All seasonal data (DJF, MAM, JJA, SON) in each year in each  $5^\circ$ latitude x  $10^\circ$ longitude grid box are used. All observation data (i.e.,  $0 < \alpha < 1$  and  $\alpha = 0$  and  $\alpha = 1$ ) between  $60^\circ$ S and  $60^\circ$ N are used for this table.

$r$	LCA	LTS	EIS	ECTEI	IS	DS	$\alpha$	$z_{LCL}$	$z_{inv}$	$RH_{inv}^-$	$\beta_1$	$\beta_2$	ELF
LCA	1	0.32 (0.21)	0.69 (0.26)	0.73 (0.31)	0.56 (0.30)	-0.72 (-0.42)	-0.67 (-0.35)	-0.52 (-0.51)	-0.75 (-0.61)	0.63 (0.45)	-0.78 (-0.70)	-0.78 (-0.69)	0.80 (0.73)
LTS	0.27	1	0.56 (0.70)	0.39 (0.58)	0.82 (0.57)	-0.47 (-0.54)	-0.64 (-0.67)	-0.06 (-0.08)	-0.61 (-0.70)	0.45 (0.45)	-0.56 (-0.58)	-0.44 (-0.43)	0.44 (0.23)
EIS	0.03	0.83	1	0.97 (0.98)	0.84 (0.61)	-0.98 (-0.91)	-0.98 (-0.94)	-0.22 (0.18)	-0.96 (-0.81)	0.64 (0.54)	-0.91 (-0.57)	-0.79 (-0.32)	0.73 (0.06)
ECTEI	0.01	0.76	0.99	1	0.74 (0.61)	-0.97 (-0.94)	-0.94 (-0.93)	-0.28 (0.21)	-0.94 (-0.80)	0.69 (0.60)	-0.90 (-0.54)	-0.81 (-0.30)	0.75 (0.06)
IS	-0.06	0.08	0.15	0.23	1	-0.84 (-0.78)	-0.91 (-0.82)	-0.02 (0.35)	-0.85 (-0.61)	0.59 (0.50)	-0.77 (-0.34)	-0.60 (-0.08)	0.61 (0.11)
DS	-0.05	-0.62	-0.87	-0.91	-0.52	1	0.97 (0.97)	0.22 (-0.19)	0.95 (0.85)	-0.63 (-0.59)	0.90 (0.59)	0.79 (0.33)	-0.75 (-0.19)
$\alpha$	-0.06	-0.69	-0.89	-0.92	-0.52	0.98	1	0.19 (-0.21)	0.98 (0.86)	-0.66 (-0.61)	0.92 (0.59)	0.78 (0.32)	-0.74 (-0.16)
$z_{LCL}$	-0.66	-0.33	0.01	0.09	0.55	-0.20	-0.18	1	0.40 (0.31)	-0.36 (-0.12)	0.57 (0.66)	0.76 (0.85)	-0.76 (-0.86)
$z_{inv}$	-0.51	-0.82	-0.75	-0.72	-0.06	0.70	0.73	0.55	1	-0.70 (-0.65)	0.98 (0.92)	0.90 (0.76)	-0.86 (-0.61)
$RH_{inv}^-$	0.43	0.40	0.24	0.28	0.08	-0.28	-0.30	-0.46	-0.57	1	-0.70 (-0.56)	-0.67 (-0.44)	0.66 (0.37)
$\beta_1$	-0.65	-0.70	-0.49	-0.44	0.22	0.37	0.40	0.83	0.92	-0.59	1	0.96 (0.95)	-0.93 (-0.83)
$\beta_2$	-0.68	-0.60	-0.33	-0.26	0.36	0.17	0.21	0.93	0.82	-0.56	0.98	1	-0.98 (-0.92)
ELF	0.76	0.27	-0.09	-0.13	-0.18	0.07	0.05	-0.88	-0.58	0.54	-0.80	-0.86	1



**Figure S1.** Scatter plots between stratiform LCA (defined as the fraction of stratocumulus, stratus, and fog) and six proxies (first column) ocean, (second) land, (third) globe, and (fourth) selected regions shown in Fig 7 with the least-square fitting lines and the fraction of variance ( $R^2$ ) explained by the regression lines. The grey dashed line in the panels (u)-(x) denotes LCA = ELF. All observation data (i.e.,  $0 < \alpha < 1$ ,  $\alpha = 0$ , and  $\alpha = 1$ ) between  $60^\circ\text{S}$  and  $60^\circ\text{N}$  are used for this figure. The grid data in the range of  $0 \leq \alpha < 0.01$  (i.e., very stable regime) are denoted by light colors in the first three columns.