Supplement of Atmos. Chem. Phys., 25, 10907–10929, 2025
https://doi.org/10.5194/acp-25-10907-2025-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Microphysical fingerprints in anvil cloud albedo

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1 Introduction

This supplementary information includes figures for evaluation of additional dates and longwave/infrared evaluation of cloud morphology between satellite and model, analysis of LW effects from microphysical experiments, and individual profiles plots for crystal and snow hydrometeor species separately. It includes a table of model level hybrid heights, and a table showing conditional regressions of high cloud radiative properties and environmental factors.

Table 1. Model level hybrid heights. The true height of hybrid model levels varies with the the terrain height.

Level	Height (m)	Level	Height (m)	Level	Height (m)
1	5	25	2245	49	8383
2	22	26	2422	50	8759
3	45	27	2605	51	9161
4	75	28	2795	52	9595
5	112	29	2992	53	10068
6	155	30	3195	54	10588
7	205	31	3405	55	11167
8	262	32	3622	56	11815
9	325	33	3845	57	12546
10	395	34	4075	58	13376
11	472	35	4312	59	14321
12	555	36	4555	60	15403
13	645	37	4805	61	16642
14	742	38	5062	62	18064
15	845	39	5325	63	19696
16	955	40	5595	64	21569
17	1072	41	5872	65	23716
18	1195	42	6155	66	26175
19	1325	43	6445	67	28985
20	1462	44	6742	68	32193
21	1605	45	7048	69	35845
22	1755	46	7362	70	40000
23	1912	47	7688		
24	2075	48	8027		

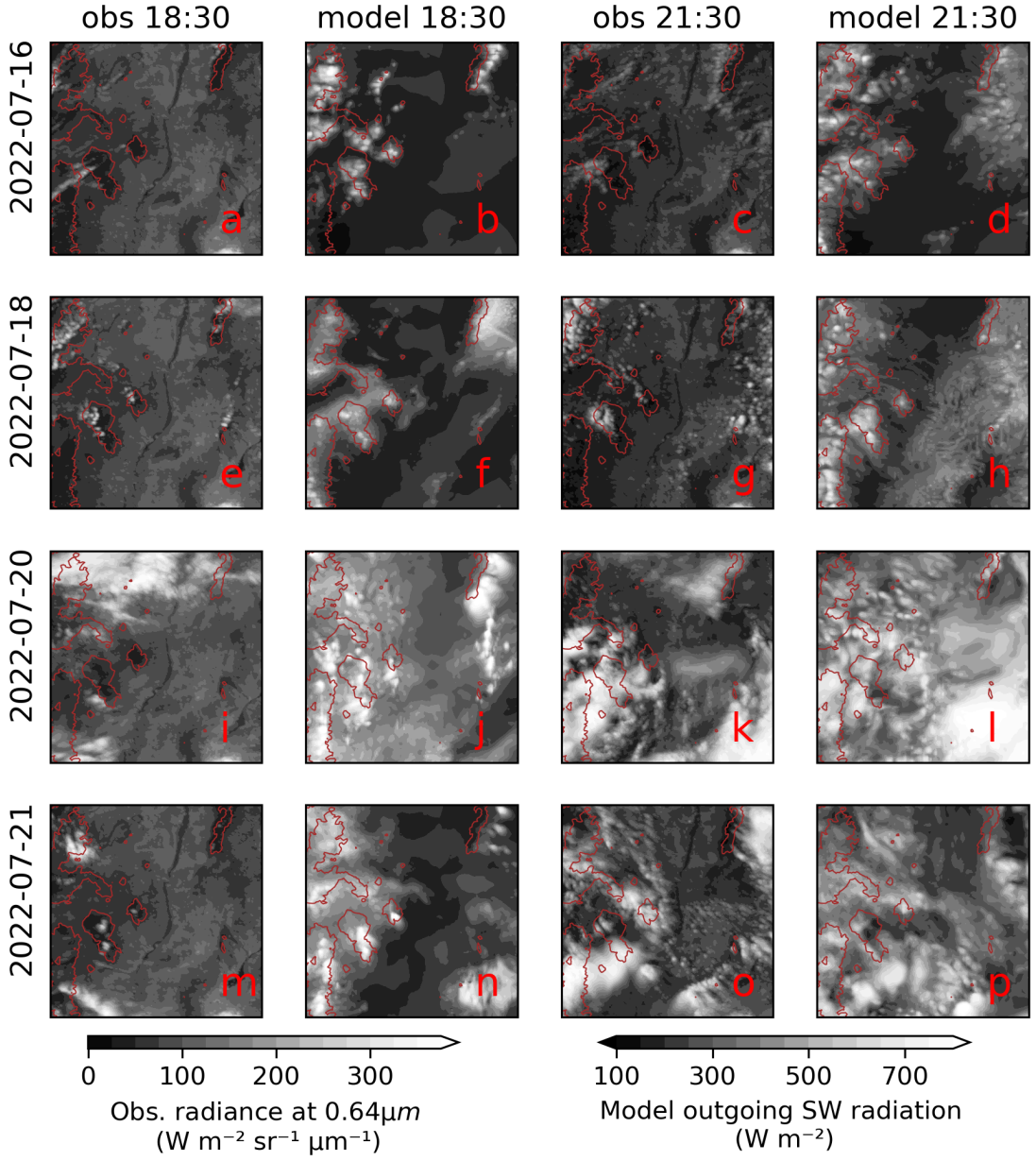

Figure 1. Equivalent plots to Figure 3, for cases: 16/jul/2022, 18/jul/2022, 20/jul/2022, 21/jul/2022.

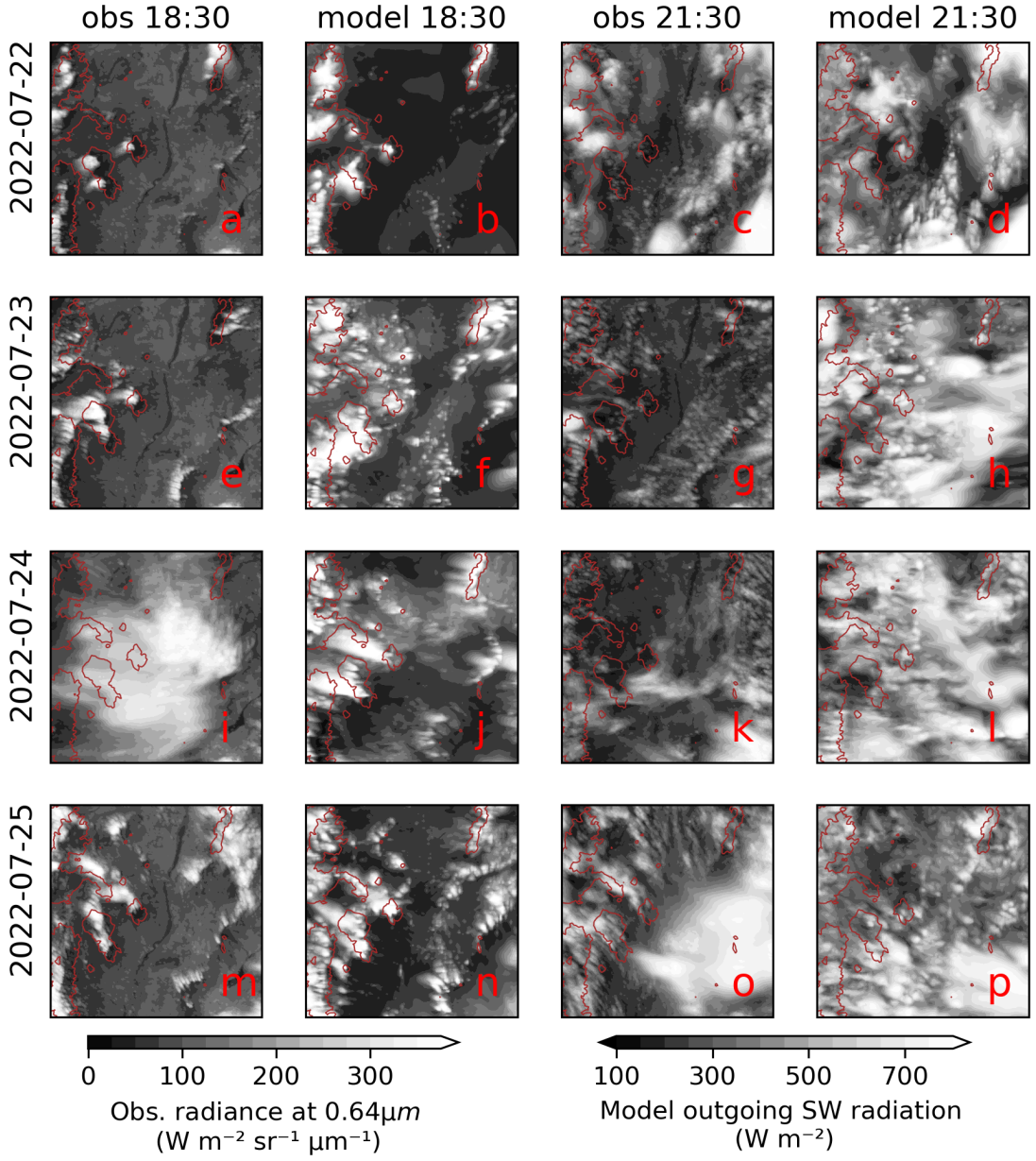

Figure 2. Equivalent plots to Figure 3, for cases: 22/jul/2022 t0 25/jul/2022

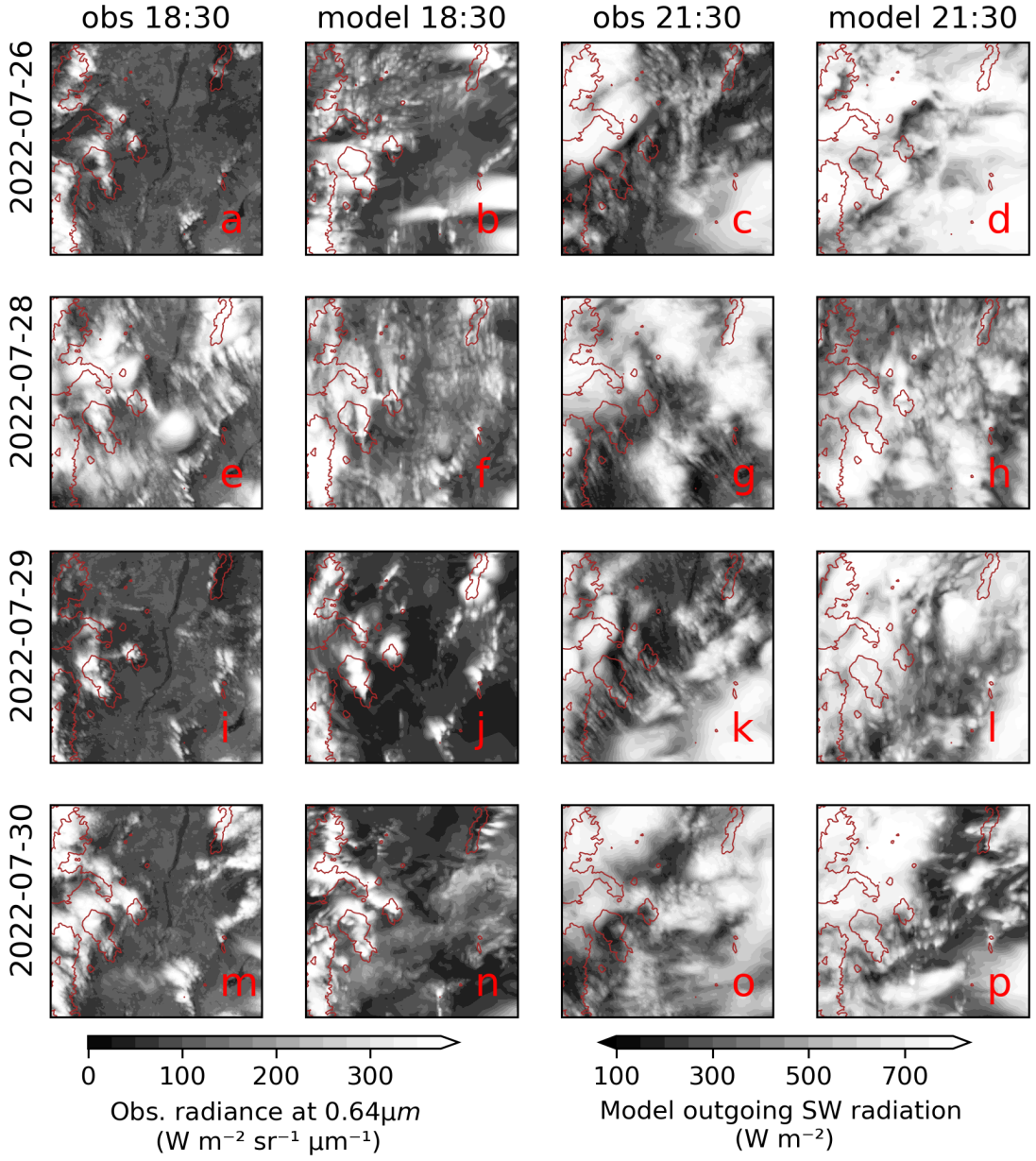

Figure 3. Equivalent plots to Figure 3, for cases: 26/jul/2022, 28/jul/2022, 29/jul/2022, 30/jul/2022.

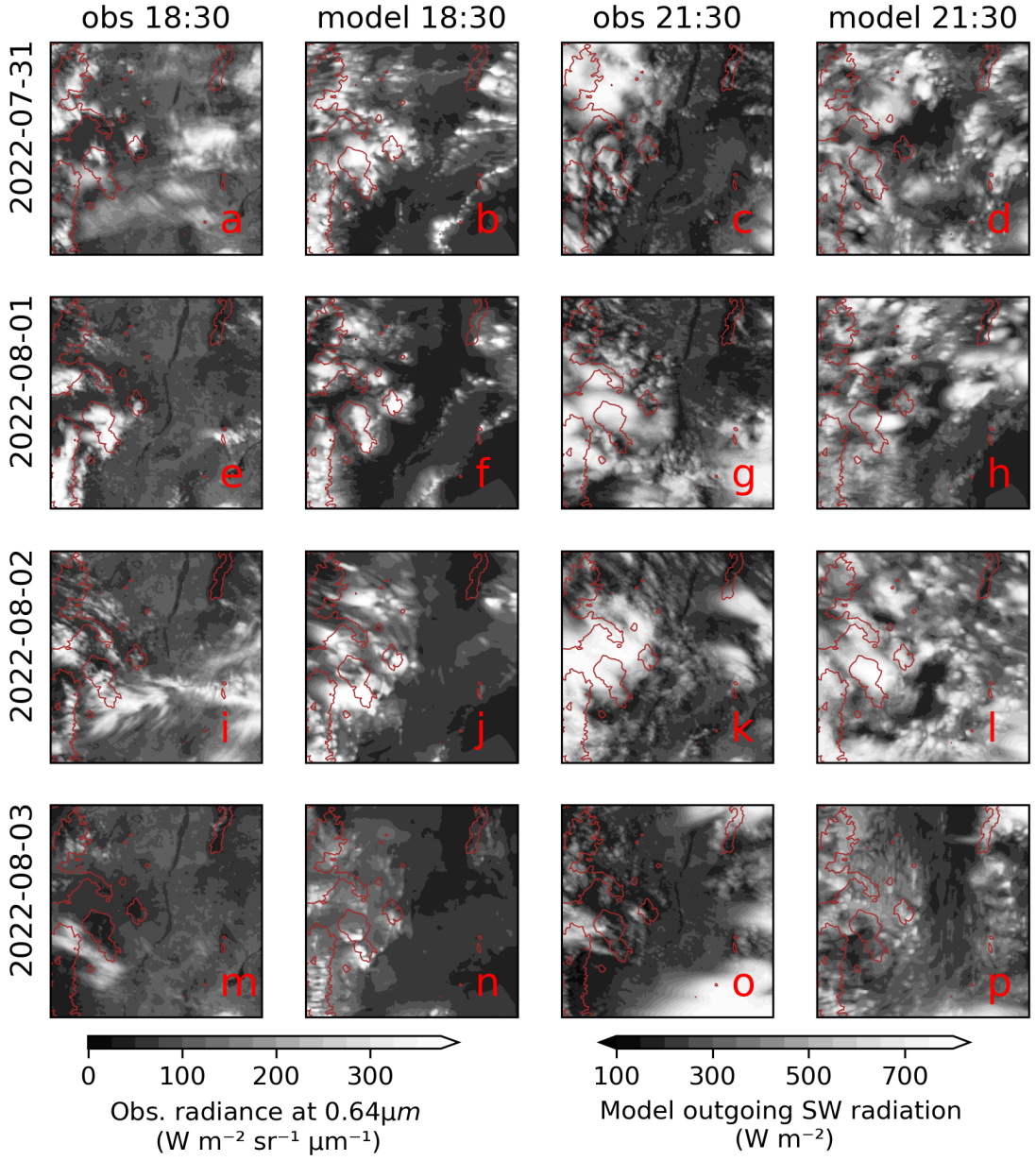

Figure 4. Equivalent plots to Figure 3, for cases: 31/jul/2022 to 3/aug/2022.

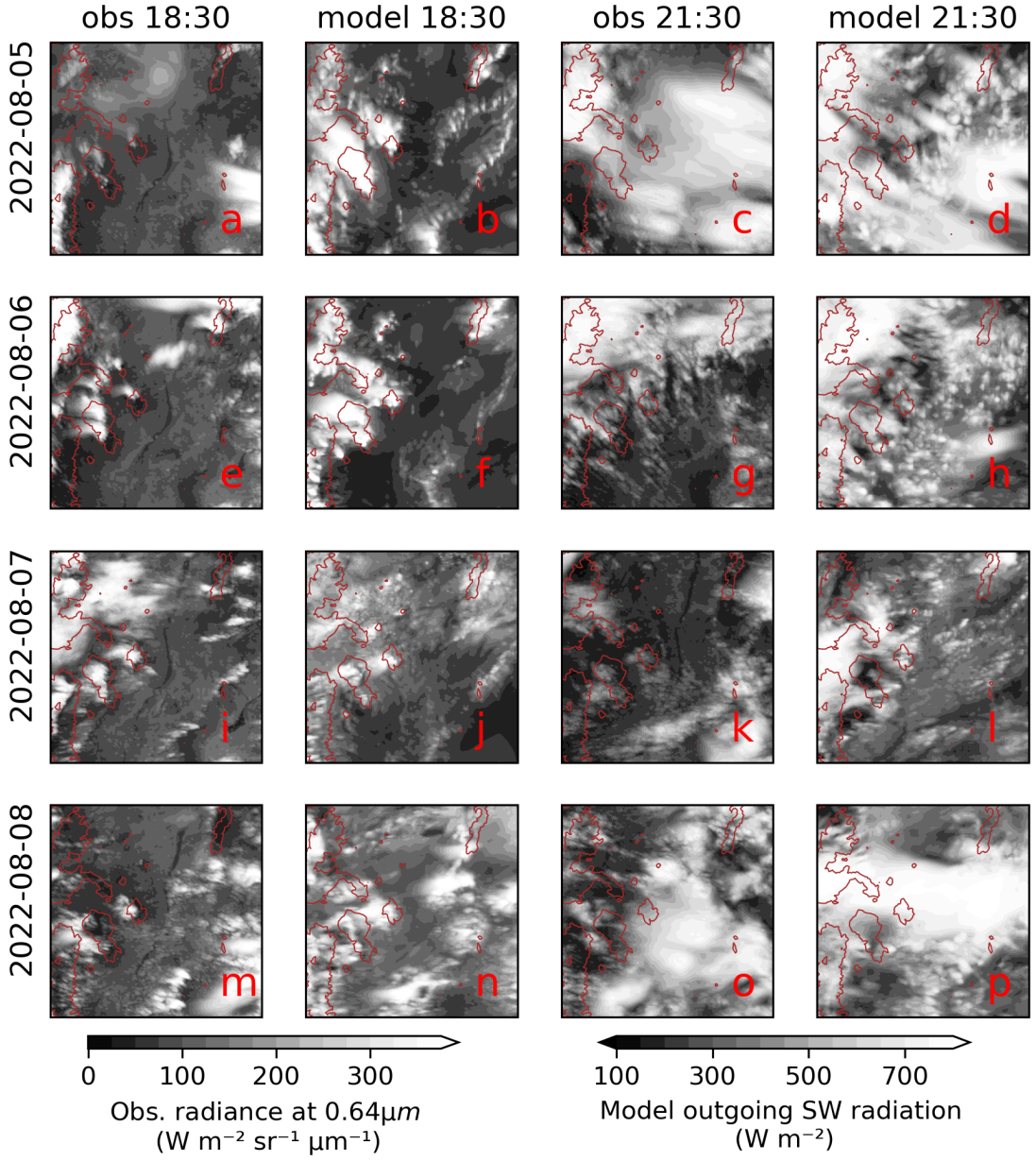

Figure 5. Equivalent plots to Figure 3, for cases: 5/aug/2022 to 8/aug/2022.

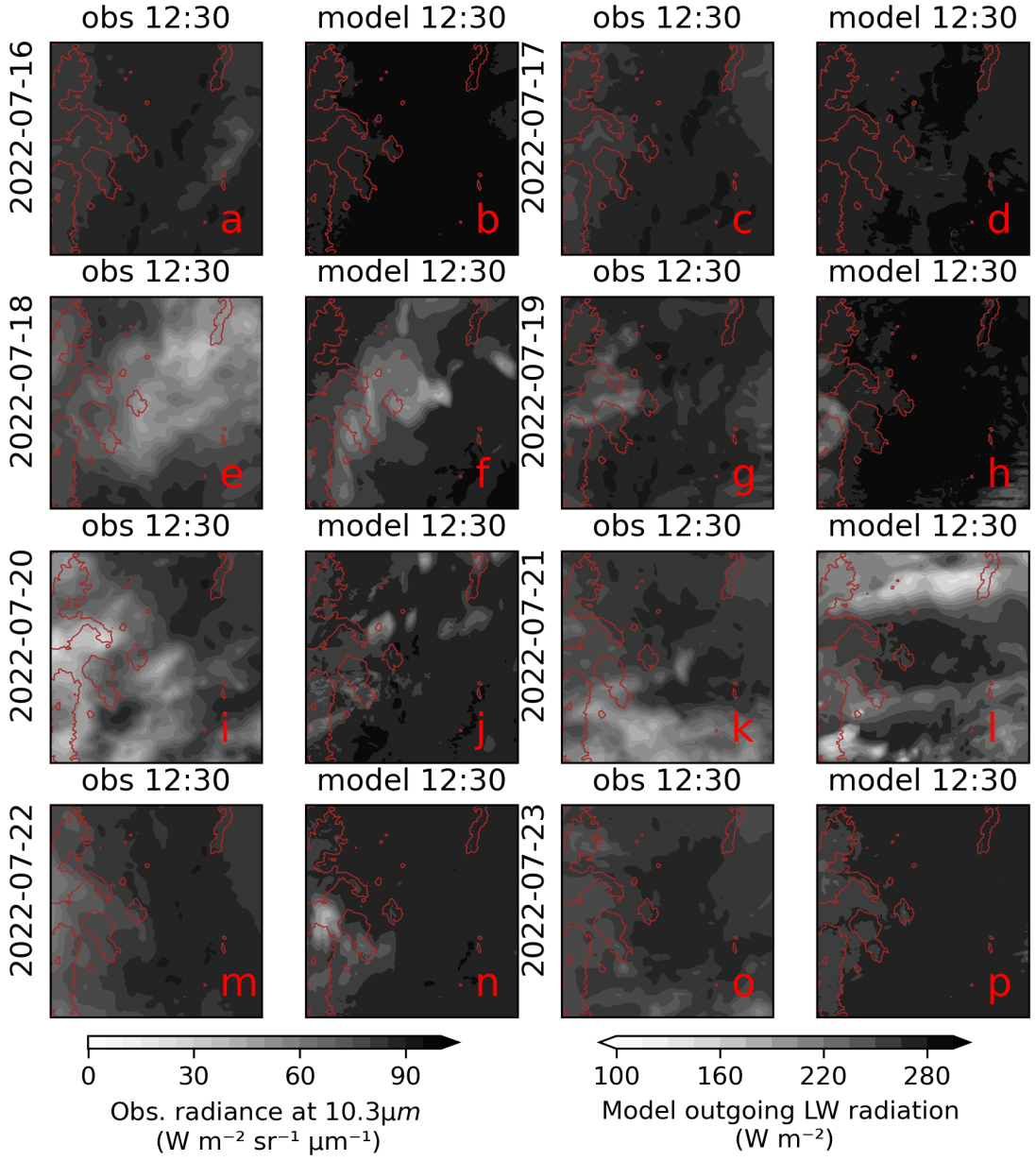

Figure 6. Equivalent plots to Figure 3 but using GOES channel 13 infrared radiance for obs, model outgoing LW radiation, and GOES channel 13 which measures infrared radiance. Only a single time, 12:30 UTC, is shown, allowing for two dates to be shown per row of subplots. This figure includes cases: 16/jul/2022 - 23/jul/2022.

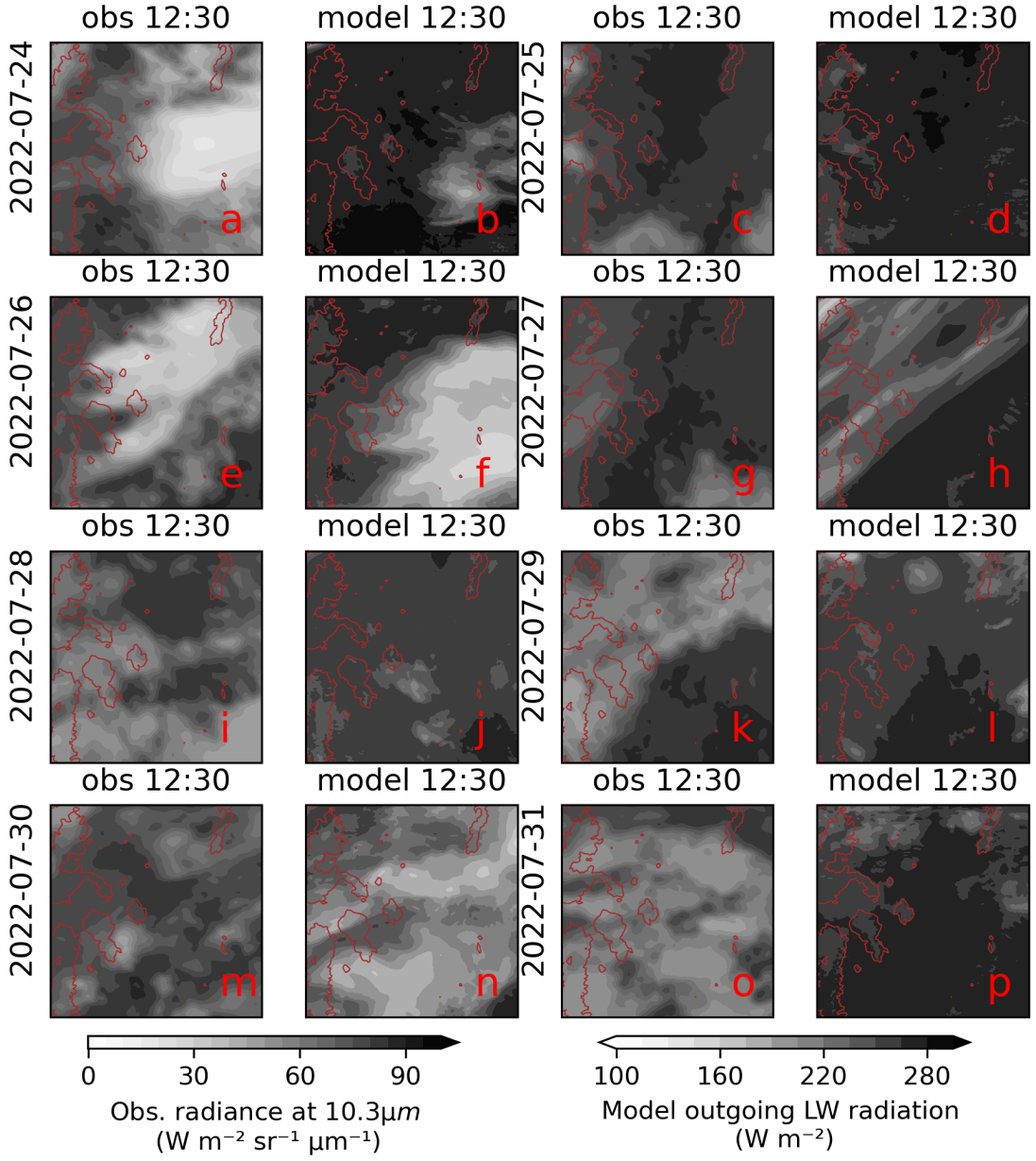

Figure 7. Equivalent plots to Figure 3 but using GOES channel 13 infrared radiance for obs, model outgoing LW radiation, and GOES channel 13 which measures infrared radiance. Only a single time, 12:30 UTC, is shown, allowing for two dates to be shown per row of subplots. This figure includes cases: 24/jul/2022 - 31/jul/2022.

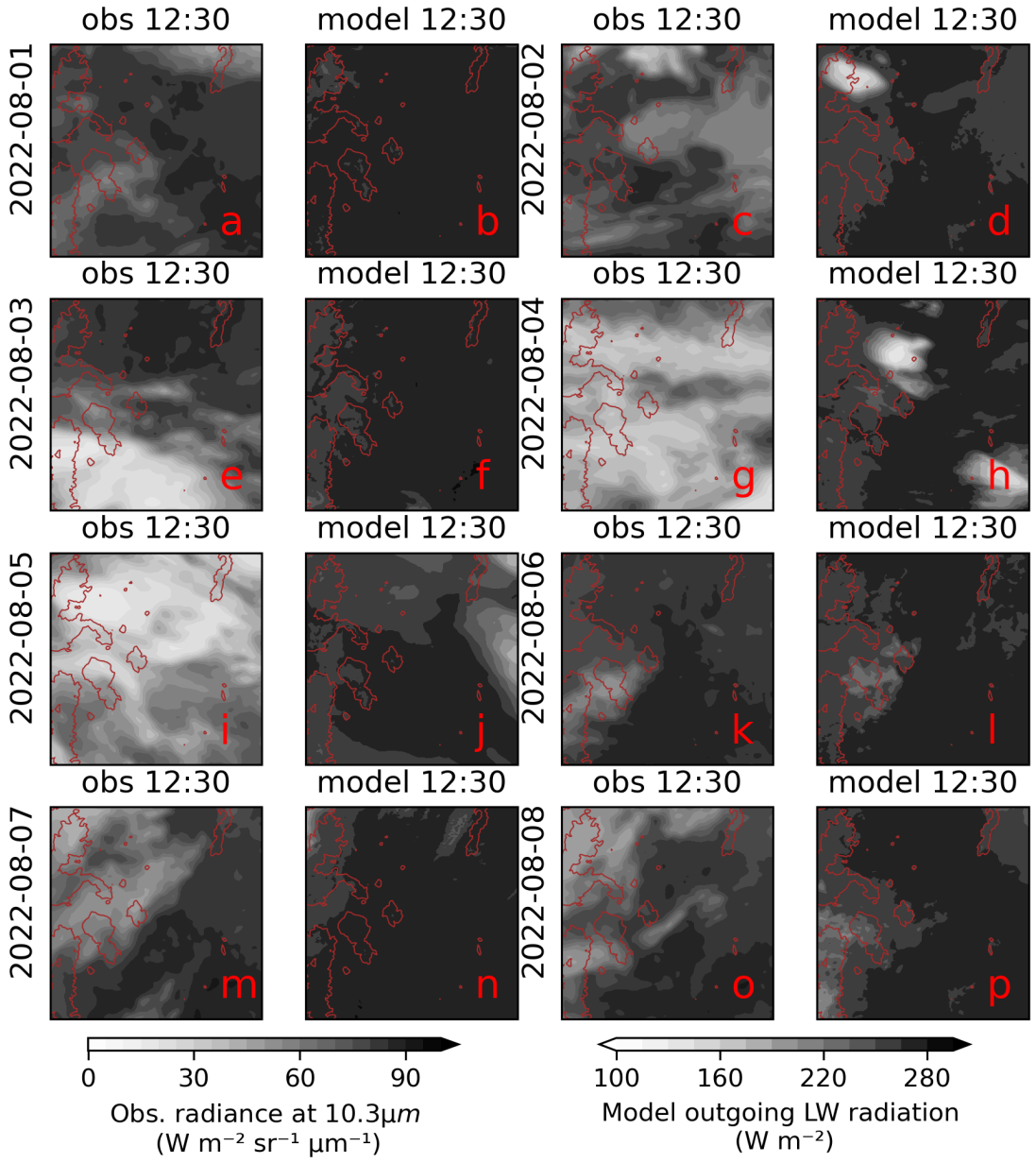

Figure 8. Equivalent plots to Figure 3 but using GOES channel 13 infrared radiance for obs, and model outgoing LW radiation, and GOES channel 13 which measures infrared radiance. Only a single time, 12:30 UTC, is shown, allowing for two dates to be shown per row of subplots. This figure includes cases: 01/aug/2022 - 08/aug/2022.

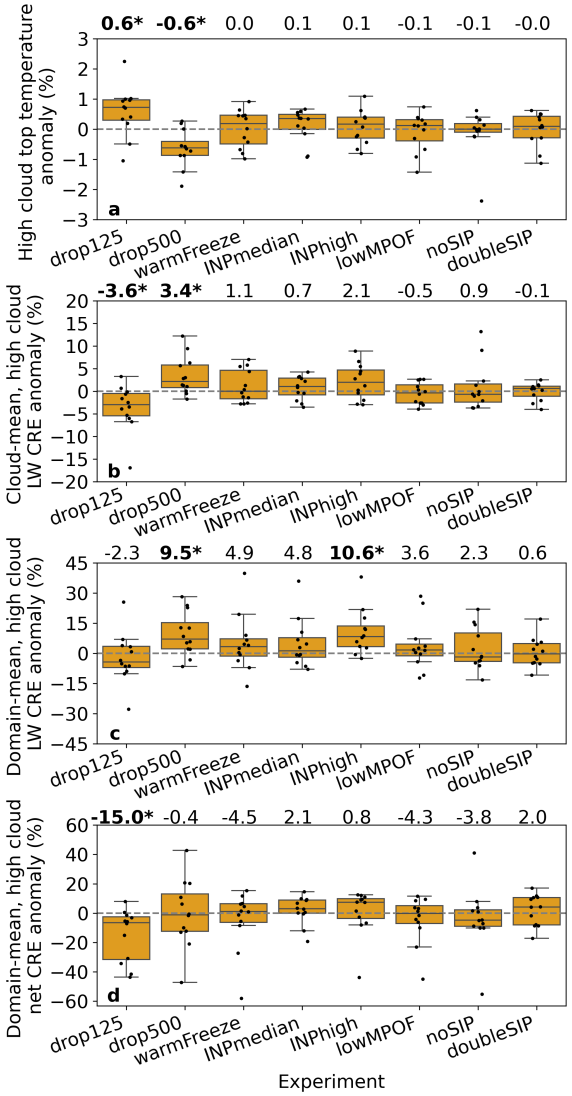

Figure 9. Equivalent to Figure 6 but showing percentage anomaly of high cloud top temperature, high cloud mean LW CRE, domain-mean high cloud LW CRE, and domain-mean high cloud net CRE. Mean and standard deviation of the control experiment absolute values across cases for each of panels a-d are 220 $\pm$ 3.9 K, 77 $\pm$ 6.6 W m^{-2}, 29 $\pm$ 11 W m^{-2} and -23 $\pm$ 11 W m^{-2} respectively.

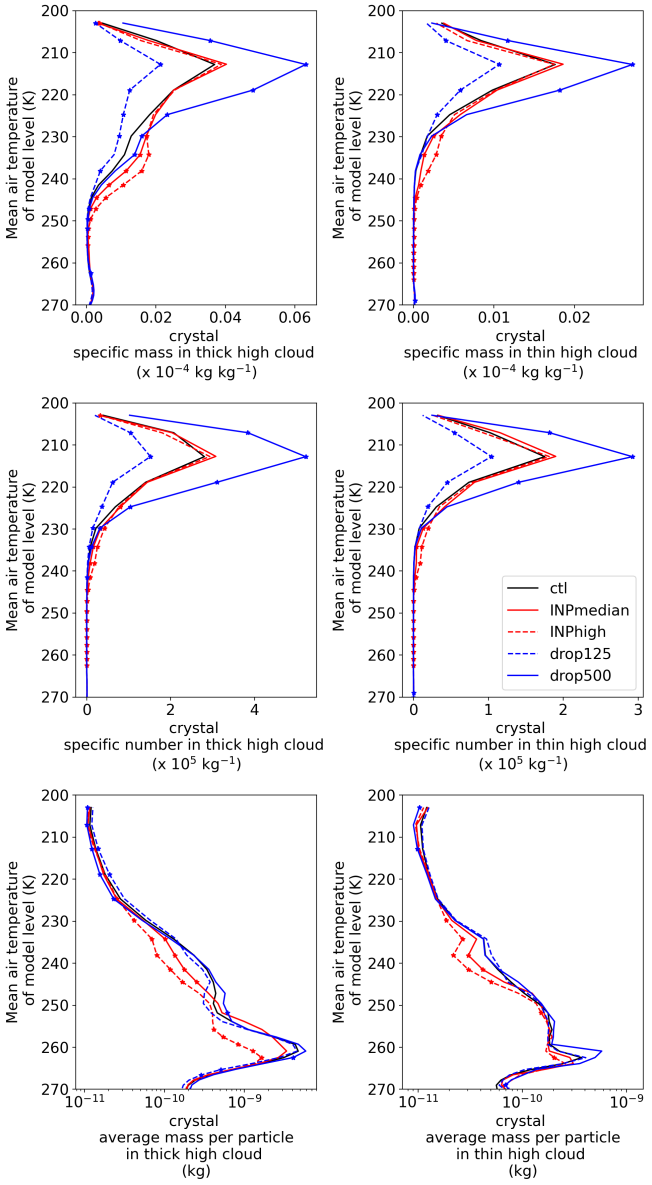

Figure 10. Equivalent plots to Figure 8 but for crystal hydrometeors only.

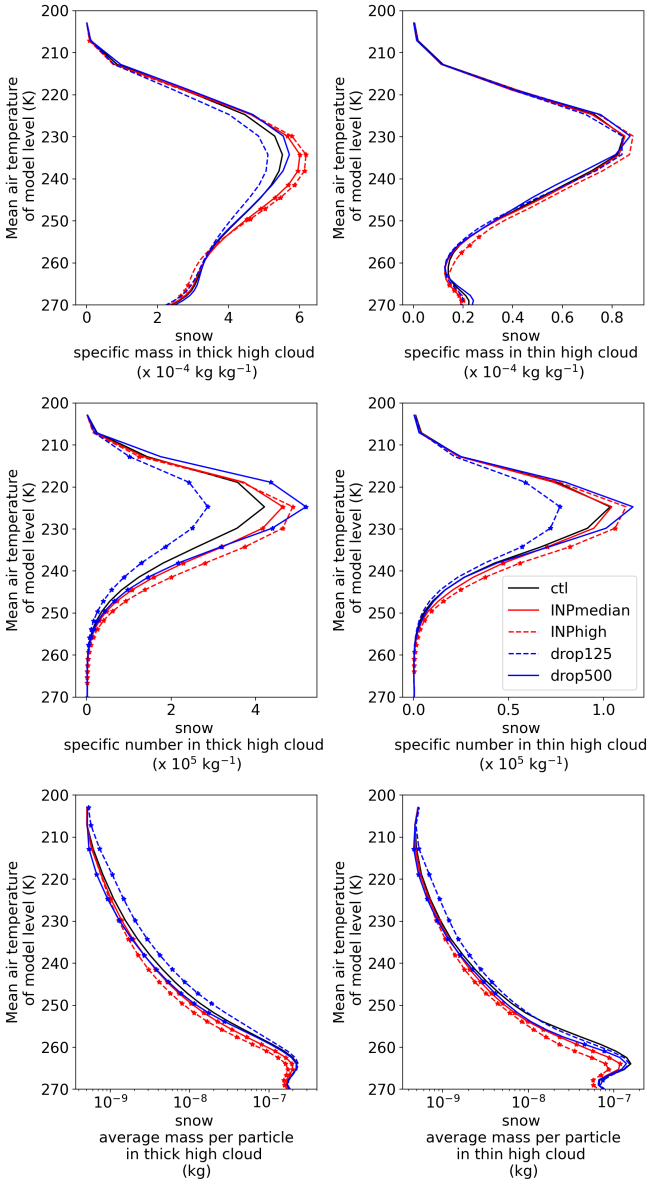

Figure 11. Equivalent plots to Figure 8 but for snow hydrometeors only.

Table 2. Equivalent to Table 2, but applying a condition of high cloud fraction greater than or equal to 5% before calculating the regression statistics.

	Albedo		**Cloud area**		**Approx. daily SW CRE**	
Feature(s)	model	obs	model	obs	model	obs
R700	**0.45** * (+)	0.58 * (+)	0.02	0.22 * (+)	0.16 * (-)	**0.42** * (-)
CAPE	0.17 * (+)	0.69 * (+)	-0.06	0.05	-0.03	0.24 * (-)
V200	-0.05	-0.05	0.06	-0.05	0.10	-0.05
SUT	0.12	0.31 ** (+)	0.02	-0.05	0.18 ** (-)	0.02
R700, CAPE	0.42 *	0.73 *	0.00	0.19	0.18	0.39 *
R700, V200	0.42 *	0.56 *	**0.11**	0.18	**0.34** *	0.40 *
R700, SUT	0.45 *	0.62 *	-0.01	**0.26** *	0.23 *	0.40 *
CAPE, SUT	0.40 *	0.70 *	-0.04	0.03	0.20	0.19
R700, CAPE, V200	0.39 *	0.72 *	0.07	0.14	0.33 *	0.37 *
R700, CAPE, SUT	0.42 *	**0.74** *	-0.06	0.22	0.18	0.37 *
R700, CAPE, V200, SUT	0.39 *	0.73 *	0.01	0.17	0.31	0.34 *