

Predicting and Reconstructing Aerosol-Cloud-Precipitation Interactions with Physics Informed Neural Networks

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Supplementary Data

1. Training Data for Future Predictions without External Forcing:

Time (min)	Cloud Depth (m)	Cloud Droplet Concentration (cm ⁻³)
24.0	200.000	50.0000
28.8	222.809	58.4572
33.6	243.864	66.2642
38.4	263.300	73.4709
43.2	281.242	80.1236
48.0	297.805	86.2648
52.8	313.014	91.6424
57.6	326.898	95.9800
62.4	339.562	99.2913
67.2	351.110	101.602
72.0	361.634	102.951
76.8	371.219	103.384
81.6	379.931	102.964
86.4	387.825	101.761
91.2	394.953	99.8463
96.0	401.358	97.2965
100.8	407.079	94.1861
105.6	412.149	90.5892
110.4	416.598	86.5791
115.2	420.447	82.2271
120.0	423.716	77.6022
124.8	426.418	72.7707
129.6	428.561	67.7961
134.4	430.147	62.7387
139.2	431.171	57.6557
144.0	431.622	52.6015
148.8	431.480	47.6274
153.6	430.716	42.7823
158.4	429.290	38.1127
163.2	427.149	33.6634
168.0	424.224	29.4773
172.8	420.429	25.5968
177.6	415.655	22.0633
182.4	409.766	18.9187
187.2	402.596	16.2051

192.0	393.945	13.9663
196.8	383.581	12.2477
201.6	371.248	11.0969
206.4	356.702	10.5645
211.2	339.778	10.7035
216.0	320.535	11.5689
220.8	299.489	13.2157
225.6	277.893	15.6952
230.4	257.862	19.0484
235.2	242.024	23.2948
240.0	232.588	28.4164
244.8	230.416	34.3390
249.6	234.837	40.9152
254.4	244.215	47.9240
259.2	256.701	55.0944
264.0	270.732	62.1493
268.8	285.201	68.8442
273.6	299.423	74.9847
278.4	313.020	80.4252
283.2	325.805	85.0630
288.0	337.706	88.8336
292.8	348.713	91.7077
297.6	358.845	93.6857

2. Training Data for Past Reconstructions without External Forcing:

Time (min)	Cloud Depth (m)	Cloud Droplet Concentration (cm^{-3})
450.	303.107	16.3803
455.	286.269	19.2137
460.	272.187	22.8920
465.	262.627	27.3998
470.	258.625	32.6741
475.	260.144	38.5912
480.	266.258	44.9631
485.	275.628	51.5511
490.	286.937	58.0960
495.	299.136	64.3521
500.	311.496	70.1106
505.	323.560	75.2092
510.	335.068	79.5319
515.	345.885	83.0066
520.	355.953	85.6001
525.	365.255	87.3120
530.	373.801	88.1674
535.	381.608	88.2105
540.	388.702	87.4982
545.	395.108	86.0963
550.	400.852	84.0752
555.	405.956	81.5080
560.	410.440	78.4685
565.	414.323	75.0298
570.	417.618	71.2637
575.	420.335	67.2400
580.	422.478	63.0259
585.	424.048	58.6858

590.	425.038	54.2814
595.	425.437	49.8712
600.	425.224	45.5112
605.	424.372	41.2546
610.	422.842	37.1520
615.	420.587	33.2522
620.	417.547	29.6022
625.	413.647	26.2474
630.	408.801	23.2327
635.	402.907	20.6023
640.	395.854	18.4001
645.	387.528	16.6707
650.	377.827	15.4586
655.	366.696	14.8091
660.	354.170	14.7669
665.	340.461	15.3756
670.	326.043	16.6750
675.	311.739	18.6978
680.	298.702	21.4636
685.	288.238	24.9709
690.	281.456	29.1876
695.	278.931	34.0399
700.	280.555	39.4061
705.	285.673	45.1170
710.	293.360	50.9691
715.	302.683	56.7457
720.	312.859	62.2406
725.	323.310	67.2757
730.	333.643	71.7103
735.	343.611	75.4432
740.	353.071	78.4114
745.	361.943	80.5865
750.	370.190	81.9684

3. Training Data for Future Predictions with Wildfire–Induced Aerosol External Forcing:

Time (min)	Cloud Depth (m)	Cloud Droplet Concentration (cm ⁻³)
24.0	200.000	50.0000
28.8	222.809	58.5044
33.6	243.864	66.3736
38.4	263.300	73.6595
43.2	281.242	80.4099
48.0	297.805	86.6693
52.8	313.015	92.1868
57.6	326.902	96.6875
62.4	339.573	100.186
67.2	351.129	102.711
72.0	361.665	104.299
76.8	371.265	104.999
81.6	379.997	104.874
86.4	387.916	103.995
91.2	395.073	102.434
96.0	401.516	100.268
100.8	407.283	97.5702
105.6	412.410	94.4164

110.4	416.928	90.8794
115.2	420.863	87.0304
120.0	424.238	82.9382
124.8	427.071	78.6687
129.6	429.377	74.2846
134.4	431.164	69.8454
139.2	432.440	65.4072
144.0	433.206	61.0227
148.8	433.459	56.7416
153.6	433.193	52.6103
158.4	432.398	48.6723
163.2	431.060	44.9687
168.0	429.162	41.5378
172.8	426.685	38.4159
177.6	423.611	35.6374
182.4	419.924	33.2349
187.2	415.613	31.2392
192.0	410.682	29.6796
196.8	405.156	28.5837
201.6	399.087	27.9769
206.4	392.573	27.8821
211.2	385.764	28.3190
216.0	378.869	29.3022
220.8	372.159	30.8401
225.6	365.947	32.9325
230.4	360.561	35.5678
235.2	356.298	38.7209
240.0	353.379	42.3499
244.8	351.918	46.3954
249.6	351.912	50.7802
254.4	353.251	55.4115
259.2	355.754	60.1853
264.0	359.197	64.9926
268.8	363.349	69.7261
273.6	367.997	74.2866
278.4	372.954	78.5882
283.2	378.066	82.5608
288.0	383.209	86.1521
292.8	388.290	89.3272
297.6	393.239	92.0668

4. Training Data for Past Reconstructions with Wildfire-Induced Aerosol External Forcing:

Time (min)	Cloud Depth (m)	Cloud Droplet Concentration (cm^{-3})
450.	439.081	87.5942
455.	438.801	88.4380
460.	438.573	89.4127
465.	438.407	90.5077
470.	438.310	91.7114
475.	438.287	93.0112
480.	438.343	94.3937
485.	438.479	95.8453
490.	438.695	97.3522
495.	438.988	98.9005
500.	439.356	100.477

505.	439.793	102.069
510.	440.293	103.663
515.	440.852	105.250
520.	441.461	106.817
525.	442.113	108.357
530.	442.802	109.861
535.	443.520	111.322
540.	444.260	112.734
545.	445.016	114.093
550.	445.781	115.396
555.	446.551	116.639
560.	447.319	117.821
565.	448.082	118.942
570.	448.835	120.001
575.	449.574	120.999
580.	450.297	121.938
585.	451.001	122.819
590.	451.684	123.645
595.	452.344	124.418
600.	452.980	125.140
605.	453.591	125.814
610.	454.177	126.444
615.	454.737	127.032
620.	455.270	127.581
625.	455.778	128.094
630.	456.260	128.573
635.	456.718	129.022
640.	457.150	129.442
645.	457.560	129.836
650.	457.946	130.205
655.	458.311	130.552
660.	458.654	130.878
665.	458.978	131.185
670.	459.283	131.473
675.	459.569	131.744
680.	459.839	131.998
685.	460.092	132.236
690.	460.331	132.459
695.	460.555	132.666
700.	460.765	132.858
705.	460.963	133.035
710.	461.149	133.196
715.	461.323	133.341
720.	461.487	133.470
725.	461.640	133.583
730.	461.784	133.678
735.	461.919	133.756
740.	462.045	133.815
745.	462.162	133.855
750.	462.271	133.876

5. Training Data for Future Predictions with Diurnal Cycle of Cloud Depth:

Time (min)	Cloud Depth (m)	Cloud Droplet Concentration (cm^{-3})
24.0	200.000	50.0000

28.8	223.251	63.8391
33.6	244.795	76.6141
38.4	264.761	88.4070
43.2	283.272	99.2932
48.0	300.439	109.342
52.8	316.404	118.322
57.6	331.244	125.968
62.4	344.999	132.311
67.2	357.732	137.389
72.0	369.510	141.254
76.8	380.399	143.961
81.6	390.453	145.572
86.4	399.725	146.156
91.2	408.261	145.787
96.0	416.108	144.544
100.8	423.307	142.506
105.6	429.896	139.752
110.4	435.910	136.361
115.2	441.378	132.412
120.0	446.330	127.981
124.8	450.787	123.141
129.6	454.771	117.961
134.4	458.299	112.509
139.2	461.385	106.848
144.0	464.038	101.038
148.8	466.266	95.1346
153.6	468.071	89.1916
158.4	469.454	83.2582
163.2	470.410	77.3812
168.0	470.930	71.6044
172.8	471.001	65.9692
177.6	470.604	60.5149
182.4	469.717	55.2790
187.2	468.308	50.2974
192.0	466.341	45.6049
196.8	463.774	41.2357
201.6	460.557	37.2233
206.4	456.631	33.6016
211.2	451.935	30.4043
216.0	446.403	27.6663
220.8	439.972	25.4228
225.6	432.589	23.7102
230.4	424.230	22.5657
235.2	414.916	22.0270
240.0	404.753	22.1314
244.8	393.963	22.9144
249.6	382.922	24.4075
254.4	372.178	26.6347
259.2	362.414	29.6077
264.0	354.363	33.3193
268.8	348.654	37.7371
273.6	345.676	42.7951
278.4	345.503	48.3896
283.2	347.906	54.3782
288.0	352.452	60.5861
292.8	358.619	66.8185

297.6	365.894	72.8774
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6. Training Data for Past Reconstructions with Diurnal Cycle of Cloud Depth:

Time (min)	Cloud Depth (m)	Cloud Droplet Concentration (cm^{-3})
450.	429.017	22.7027
455.	419.655	21.8079
460.	409.239	21.5848
465.	397.945	22.0818
470.	386.117	23.3429
475.	374.302	25.4040
480.	363.244	28.2879
485.	353.799	31.9976
490.	346.765	36.5074
495.	342.689	41.7535
500.	341.735	47.6273
505.	343.680	53.9727
510.	348.033	60.5925
515.	354.179	67.2640
520.	361.514	73.7595
525.	369.521	79.8674
530.	377.798	85.4081
535.	386.054	90.2430
540.	394.086	94.2764
545.	401.762	97.4541
550.	408.997	99.7572
555.	415.739	101.197
560.	421.960	101.806
565.	427.644	101.636
570.	432.789	100.749
575.	437.396	99.2147
580.	441.471	97.1073
585.	445.021	94.5038
590.	448.057	91.4815
595.	450.586	88.1166
600.	452.617	84.4834
605.	454.157	80.6537
610.	455.212	76.6961
615.	455.786	72.6757
620.	455.882	68.6538
625.	455.499	64.6882
630.	454.637	60.8325
635.	453.294	57.1371
640.	451.468	53.6482
645.	449.154	50.4090
650.	446.354	47.4589
655.	443.071	44.8344
660.	439.312	42.5684
665.	435.096	40.6907
670.	430.456	39.2279
675.	425.441	38.2025
680.	420.122	37.6333
685.	414.599	37.5341
690.	408.999	37.9134
695.	403.474	38.7729

700.	398.199	40.1063
705.	393.357	41.8982
710.	389.122	44.1226
715.	385.643	46.7418
720.	383.024	49.7060
725.	381.316	52.9537
730.	380.513	56.4131
735.	380.560	60.0046
740.	381.363	63.6448
745.	382.802	67.2498
750.	384.749	70.7403