Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

Fog discussion meeting

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Fog (Tosca Kettler)

Too large fog extent

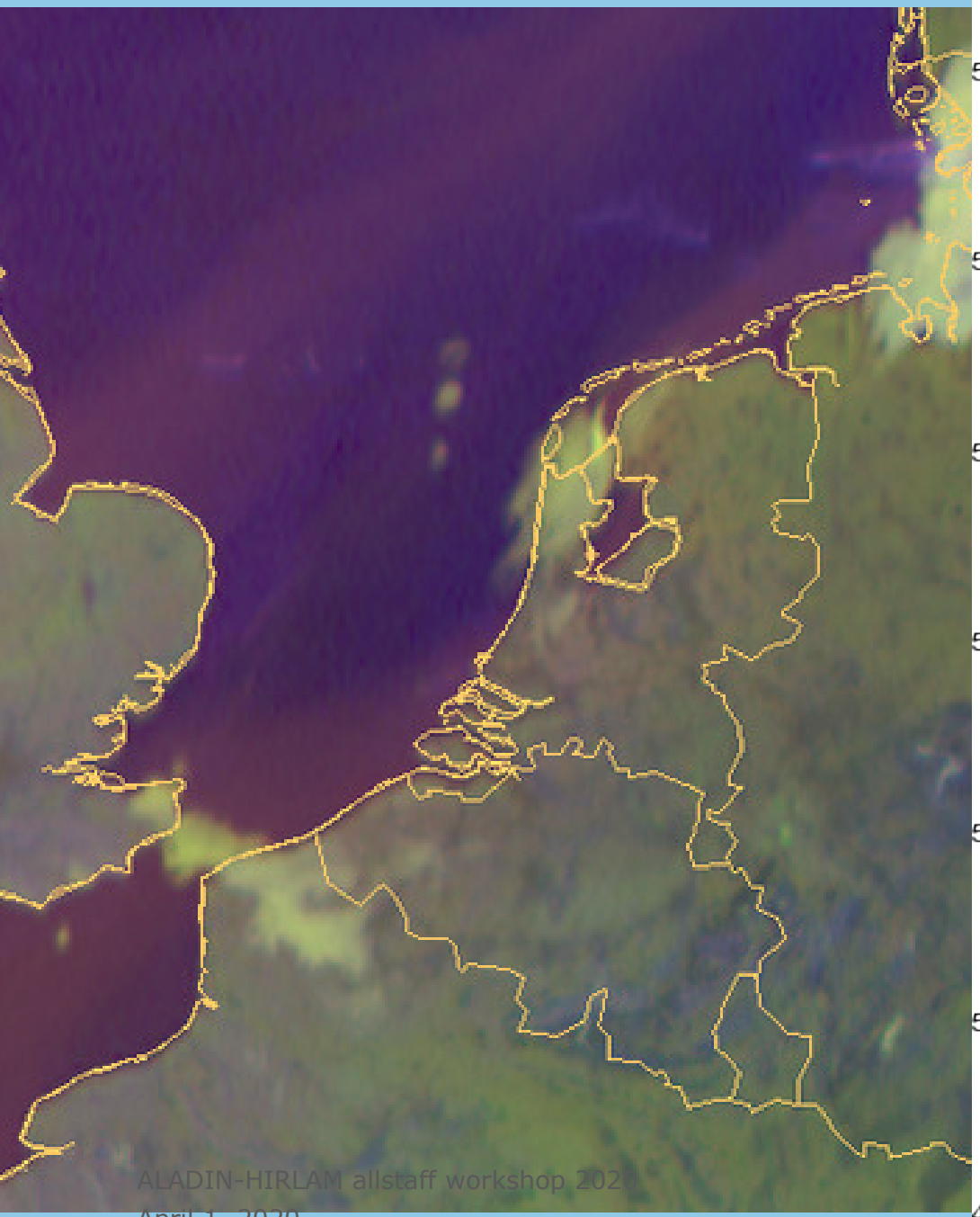
Too dense fog

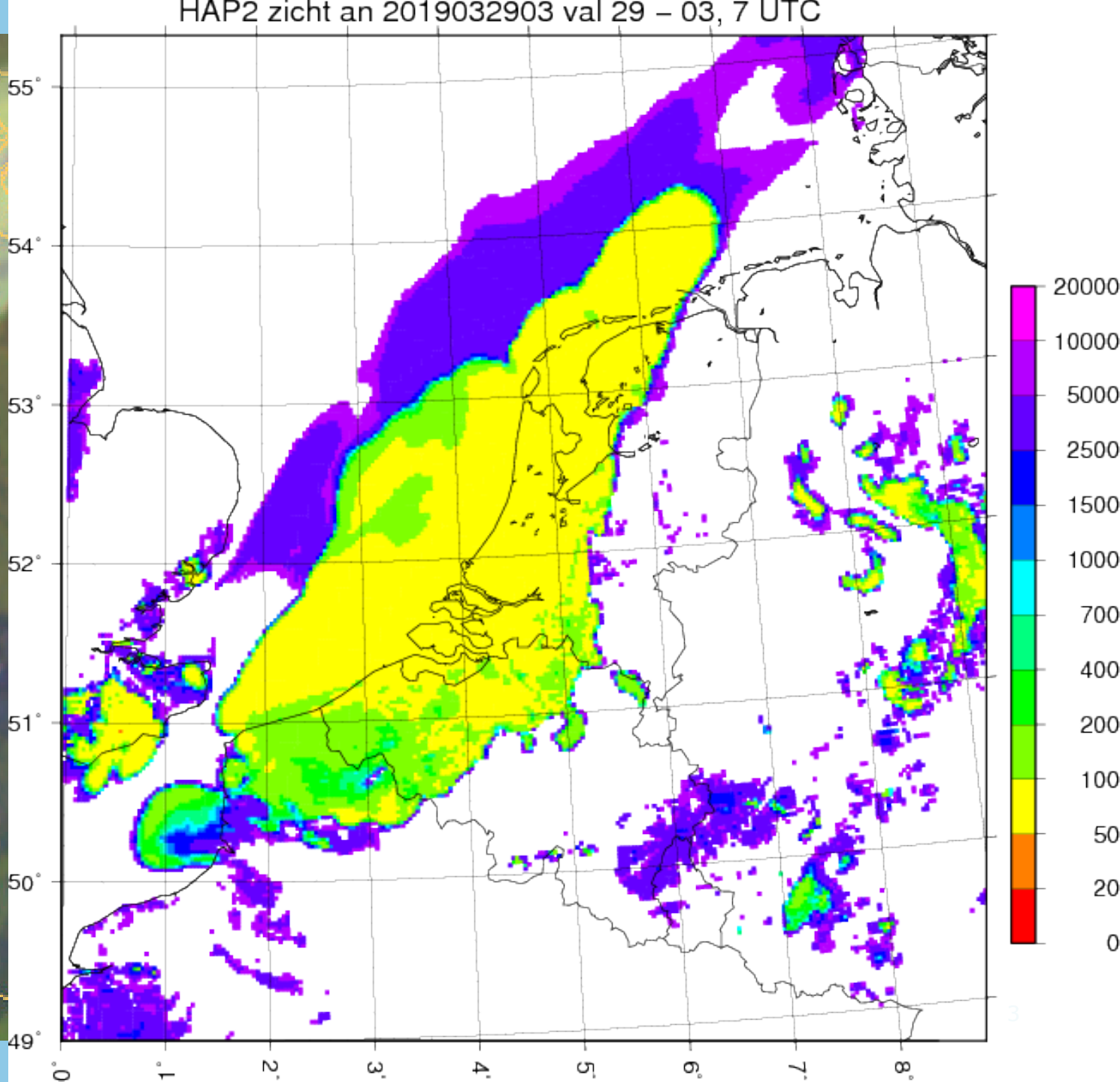
Fog cools too much over sea

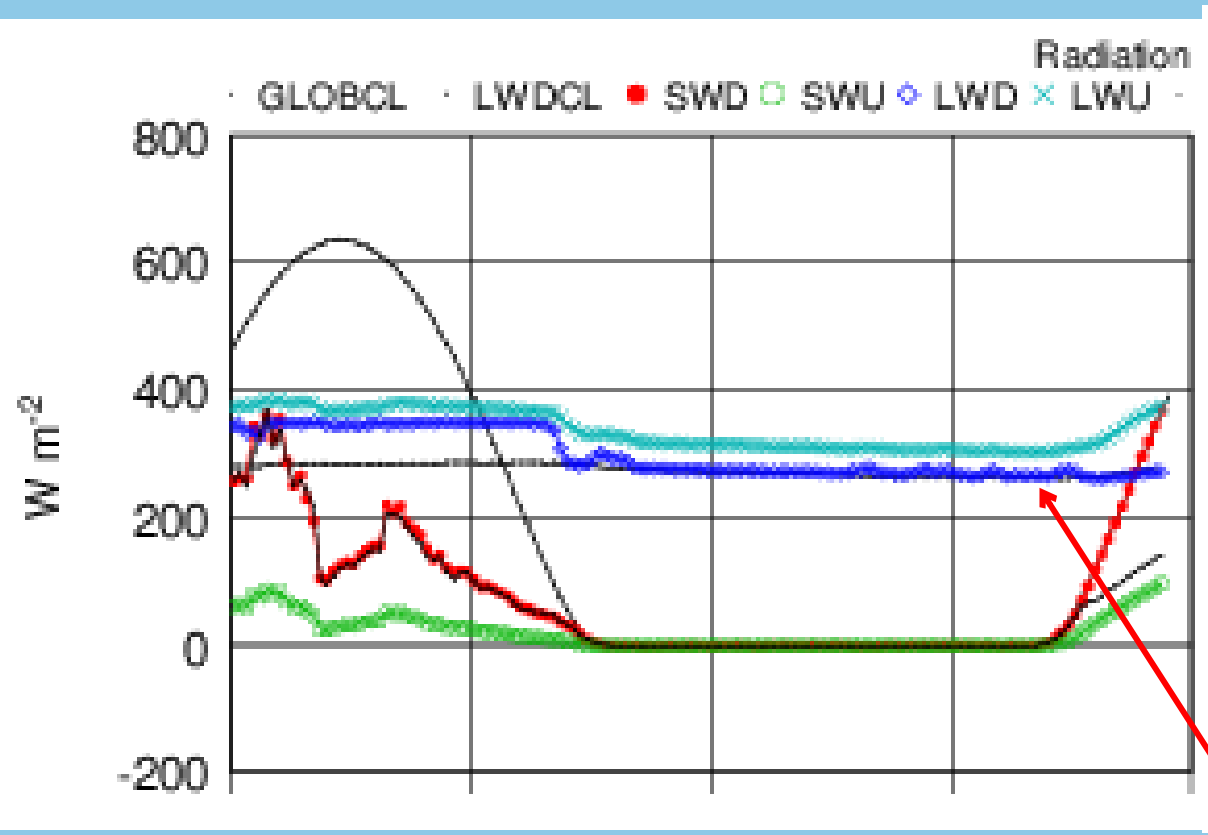
Too much cloud water in fog (Paris fog campaign: mostly less than 0.06 g/kg*, at start of fog, HARMONIE-AROME up to 0.45 g/kg)

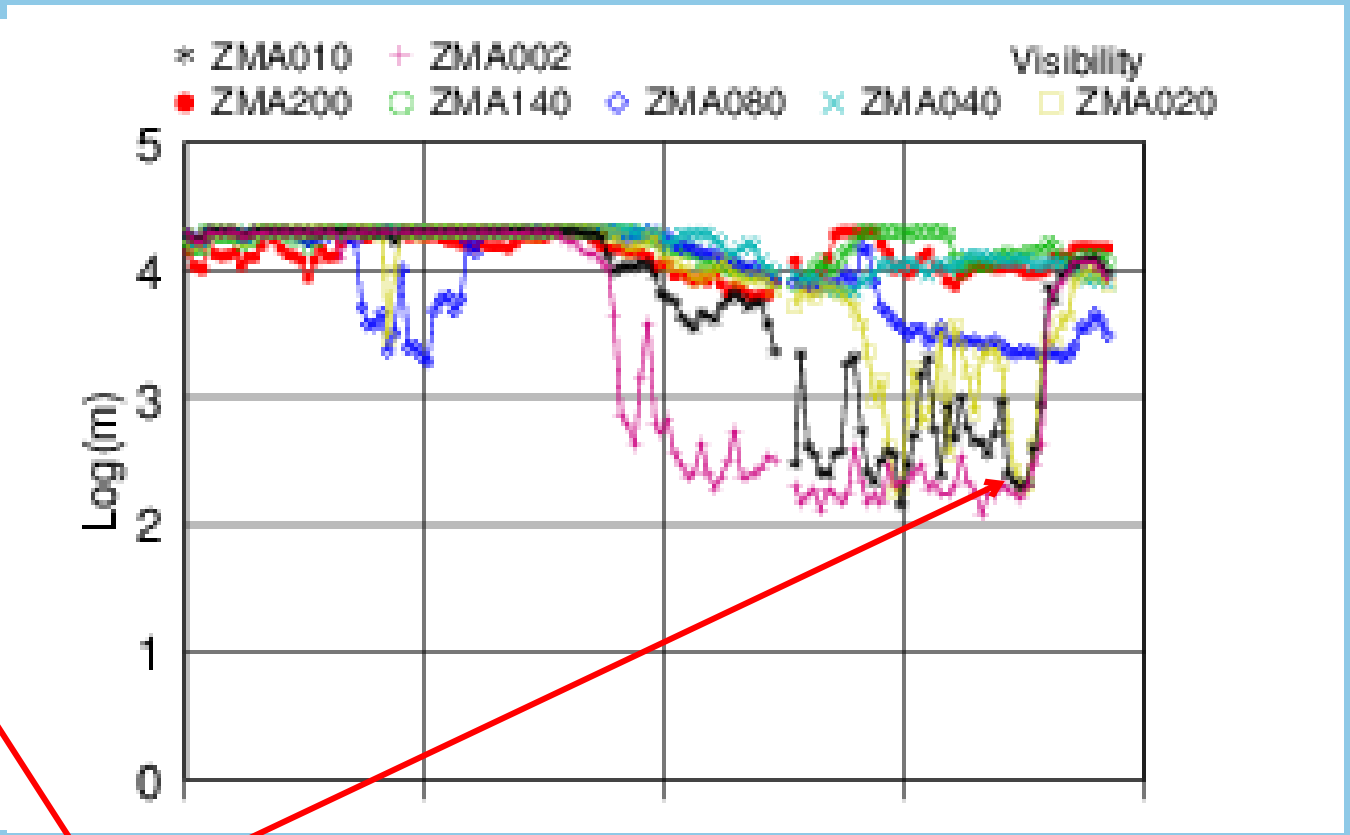
Study of 3D case 28/29-03-2019, setup of 1D case in MUSC

*:*M. Mazoyer et al.: Experimental study of the aerosol impact on fog microphysics, Atmos Chem Phys, 2019*



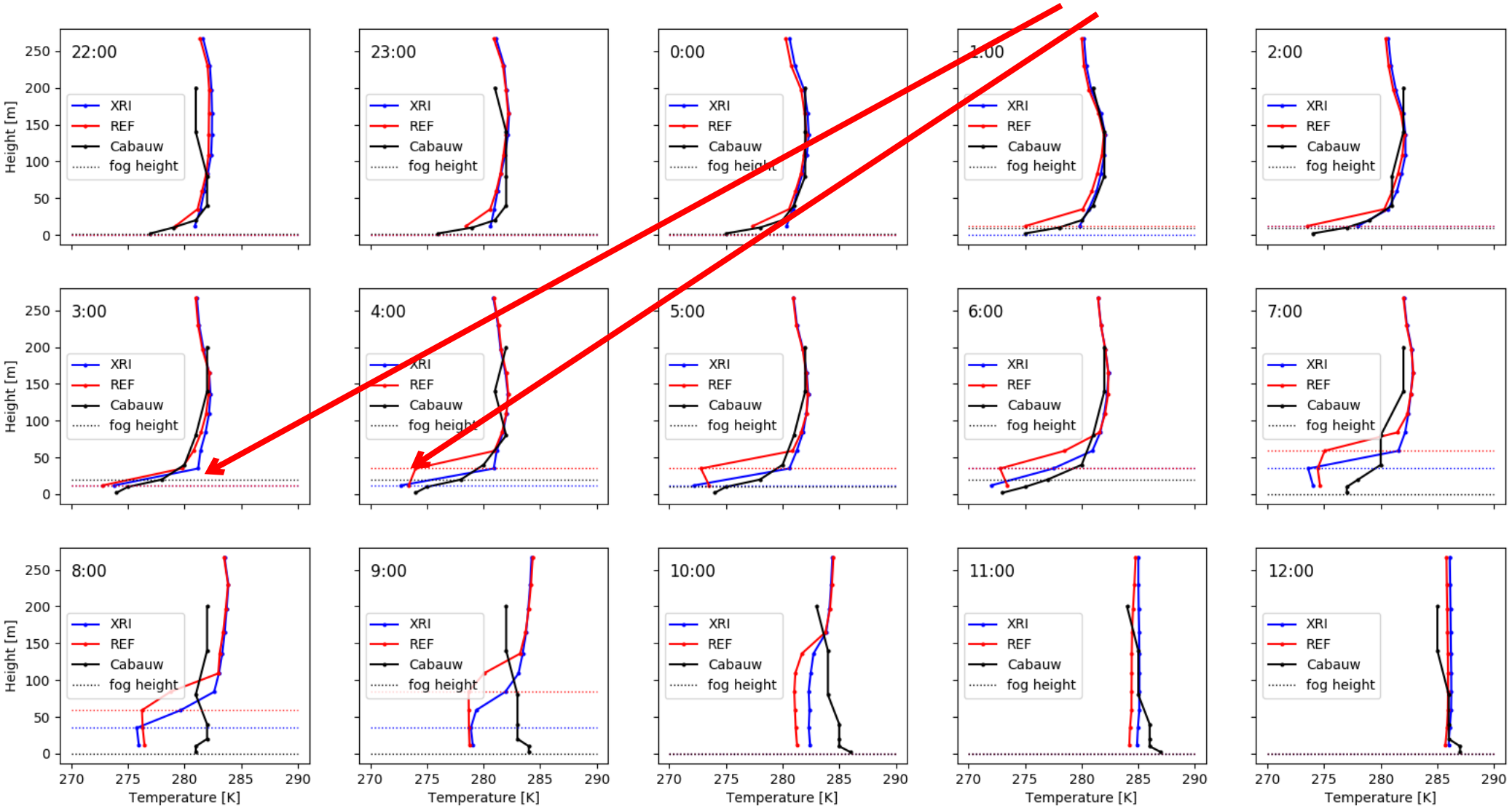

HAP2 zicht an 2019032903 val 29 – 03, 7 UTC
55°
54°
53°
52°
51°
50°
49°
0°
1°
2°
3°
4°
5°
6°
7°
8°
20000
10000
5000
2500
1500
1000
700
400
200
100
50
20
0

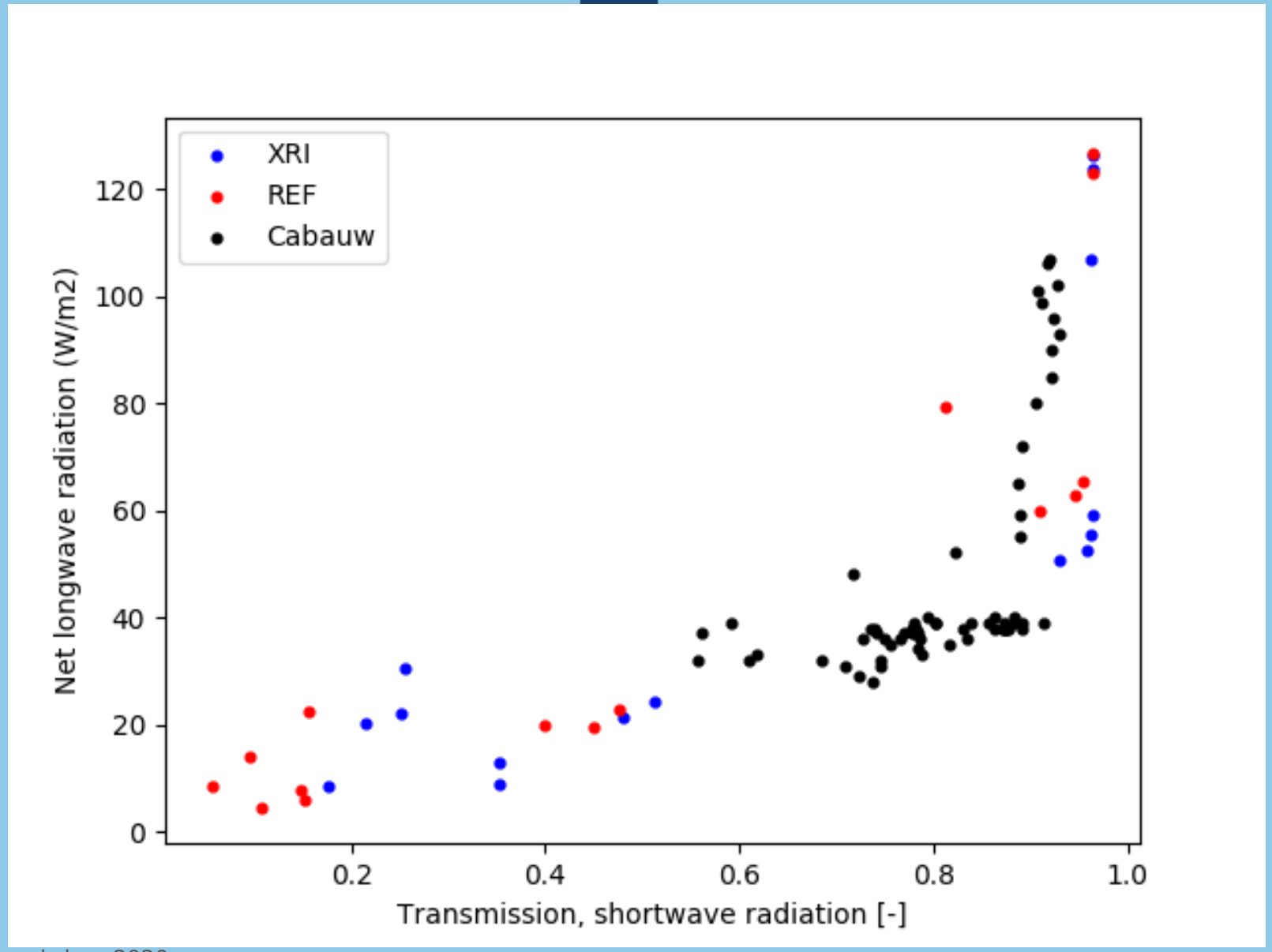




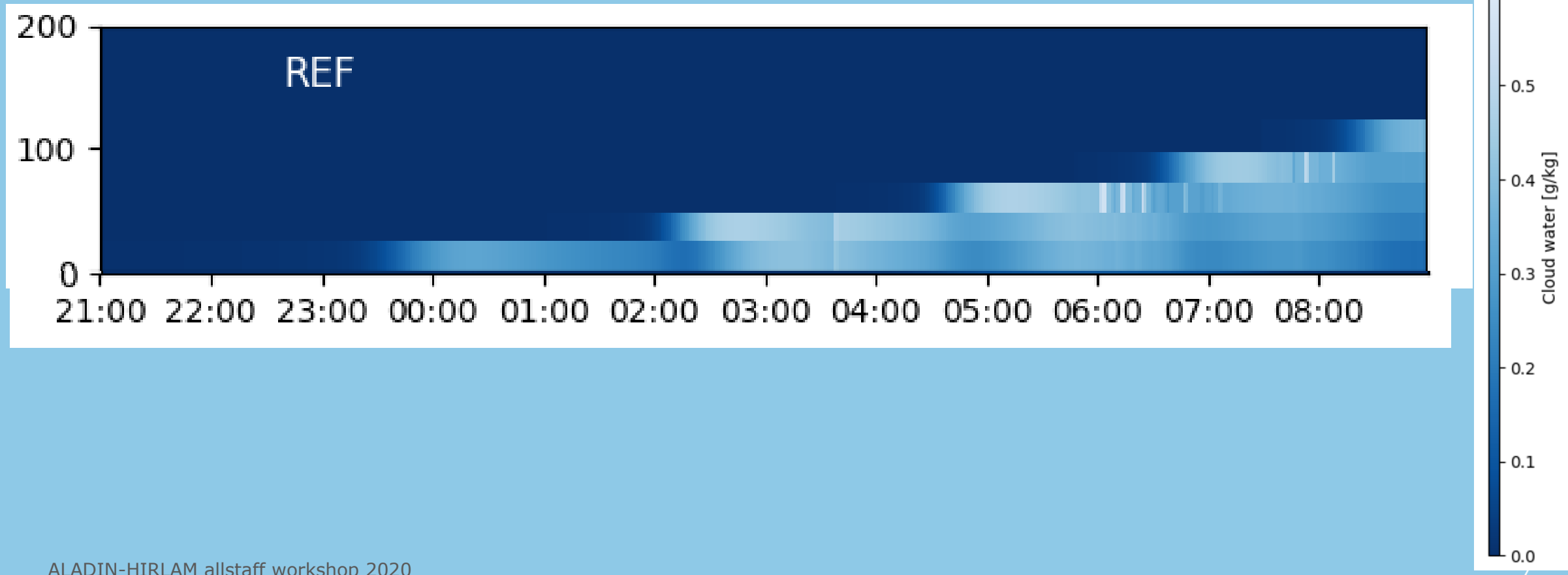
Fog depth 10-20 m, no impact on downwelling longwave radiation

Fog layer of 25m already starts to cool from the top, 5K in one hour




XRI
REF
Cabauw
Net longwave radiation (W/m2)
0
20
40
60
80
100
120
0.2
0.4
0.6
0.8
1.0
Transmission, shortwave radiation [-]

MUSC with 30 second time step OK
Starting from profile from HARMONIE-AROME 43h2.1



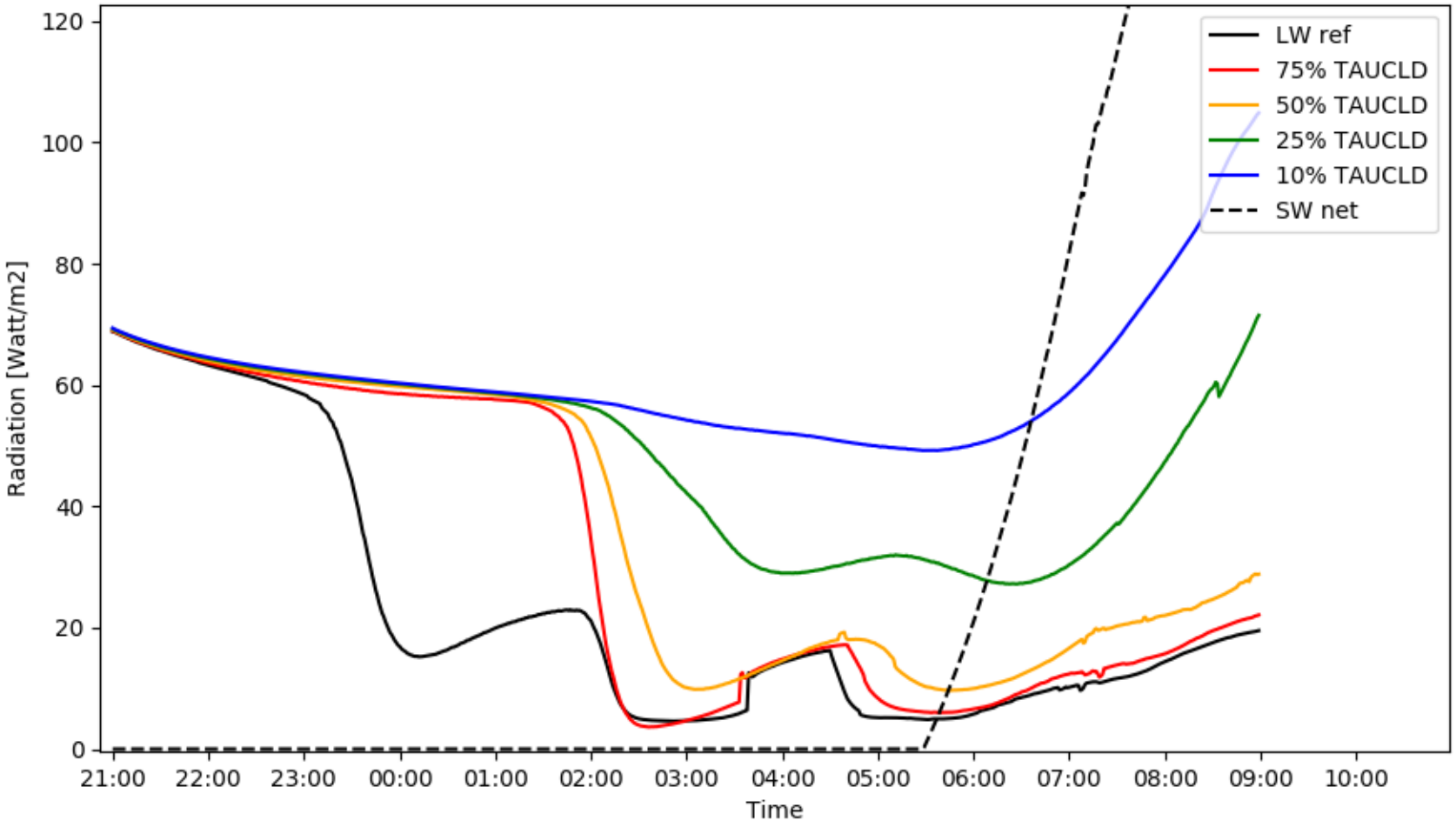
First results MUSC

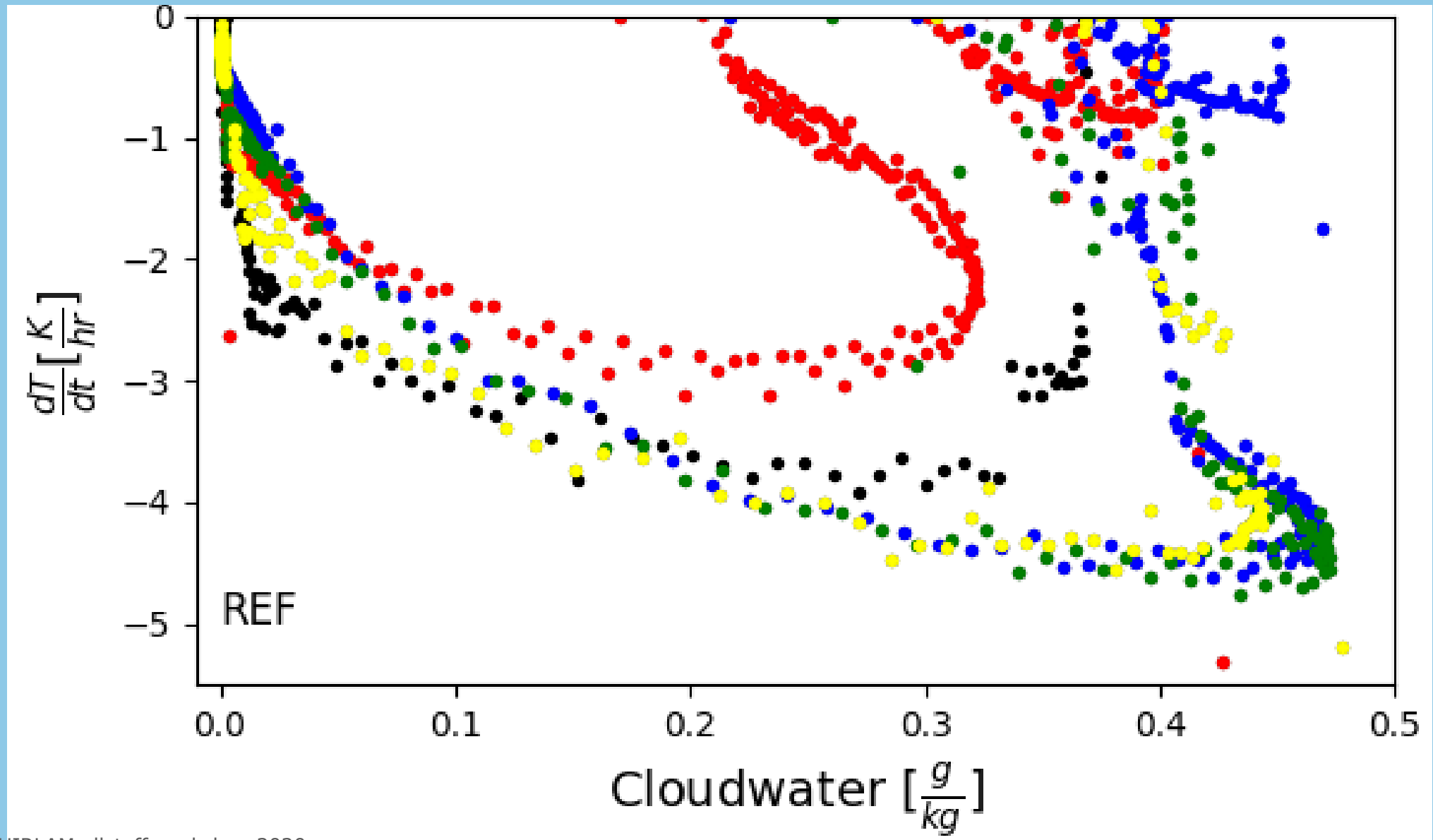
Fog cools very quickly, up to 5 K/hr

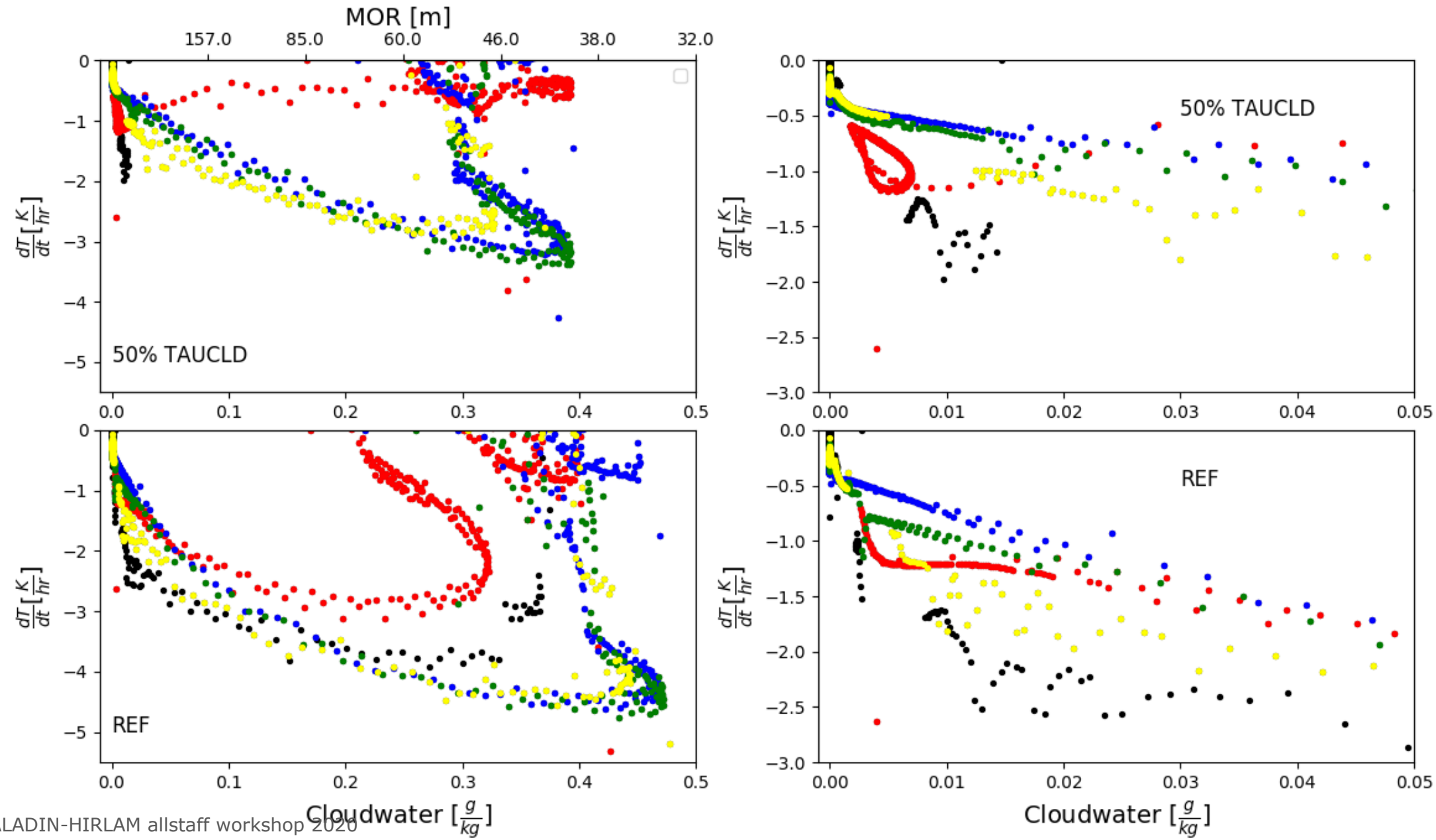
90 layers does not solve problem in this case

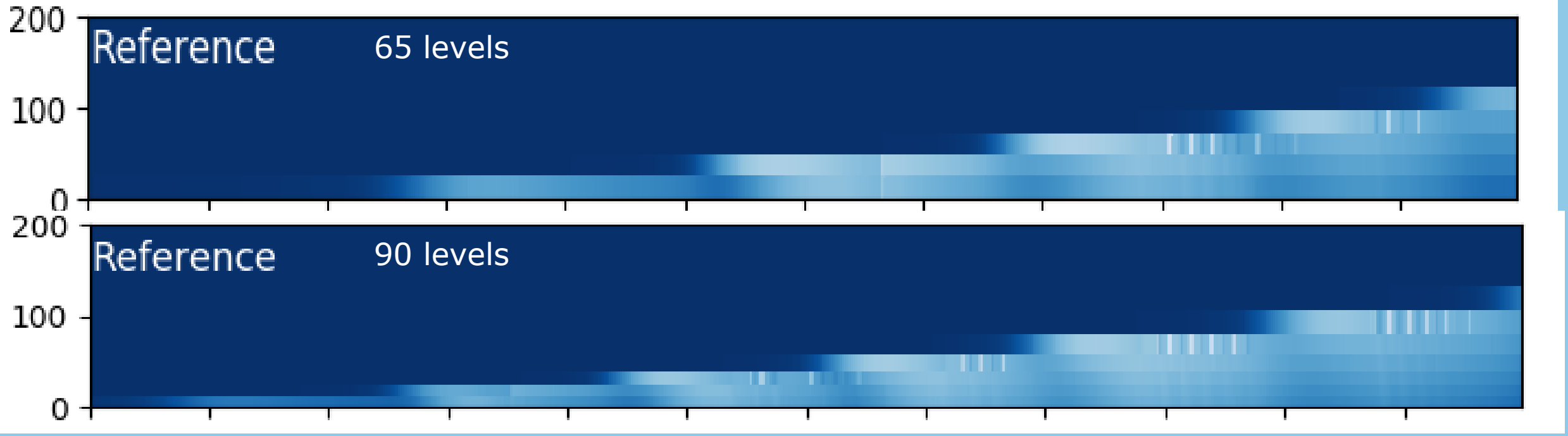
CY43 has later development and smaller horizontal extent of fog, evaporation?

Chicken and egg question, cloud water causing too strong impact of longwave radiative cooling or longwave radiation causing too strong cooling leading to too much cloud water? Or both?

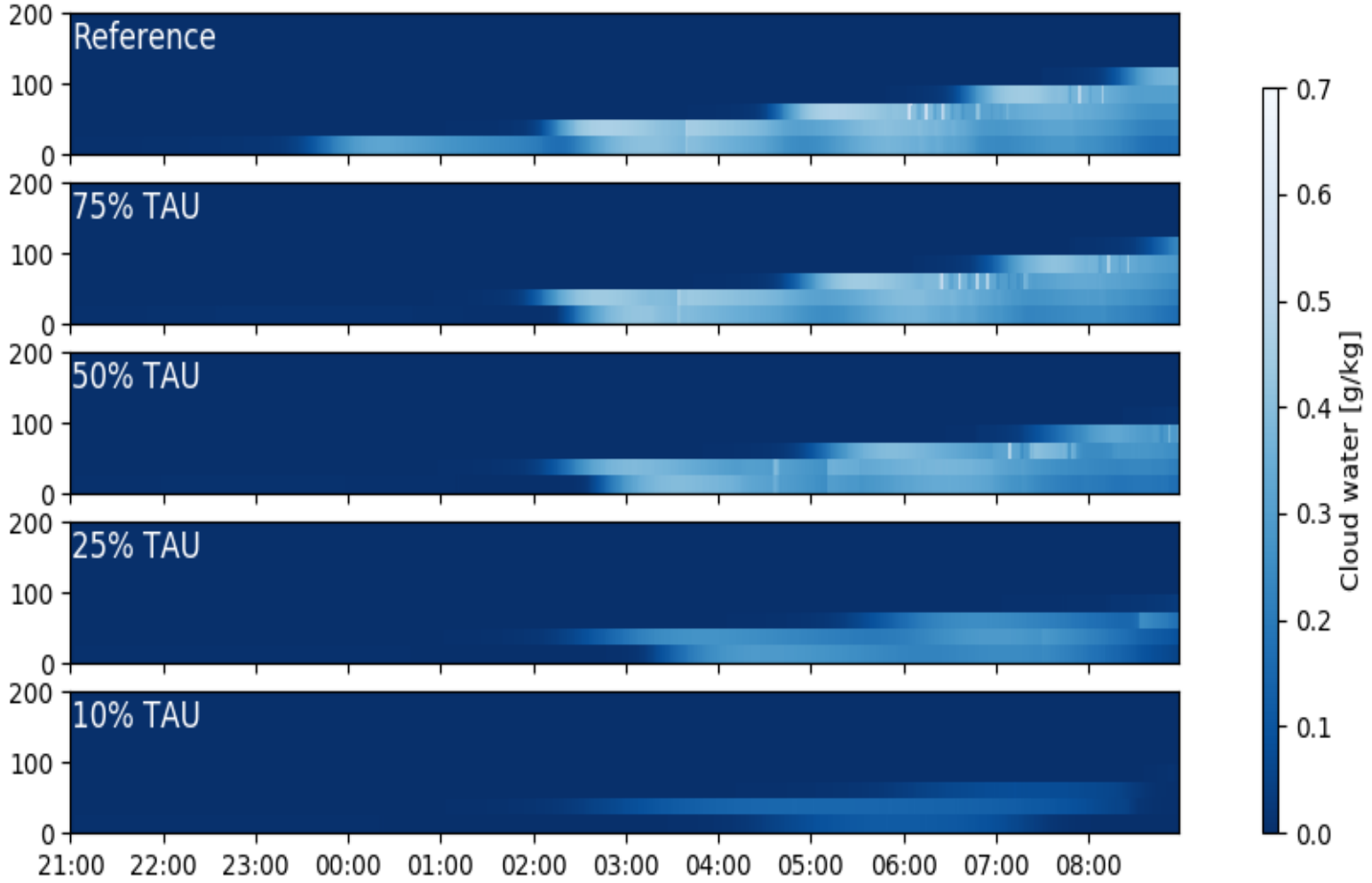

LW ref
75% TAUCLD
50% TAUCLD
25% TAUCLD
10% TAUCLD
SW net
Radiation [Watt/m2]
Time
120
100
80
60
40
20
0
21:00
22:00
23:00
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00


0
−1
−2
−3
−4
−5
$\frac{dT}{dt}[\frac{K}{hr}]$
REF
0.0
0.1
0.2
0.3
0.4
0.5
Cloudwater $[\frac{g}{kg}]$

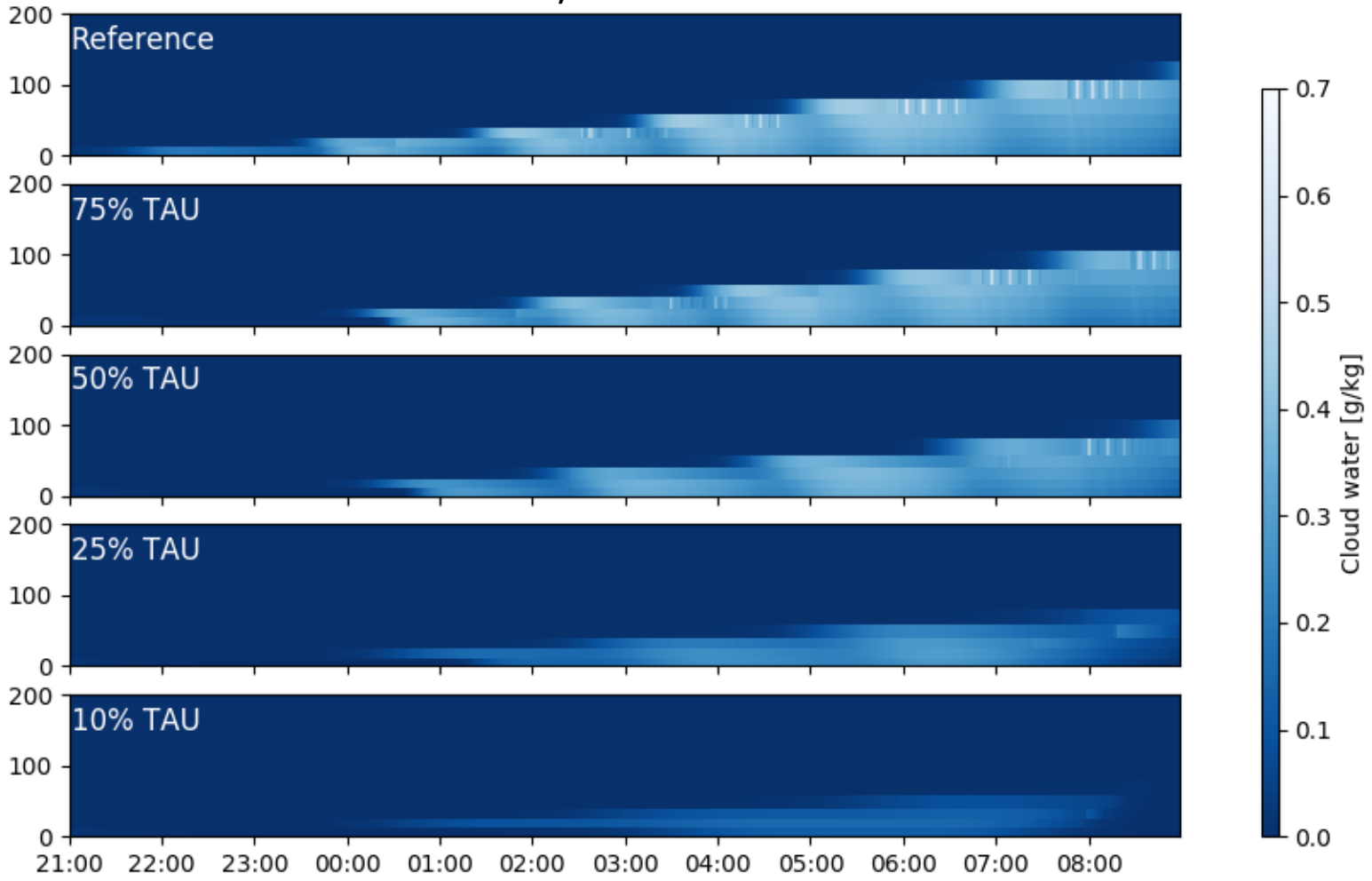

MOR [m]
157.0
85.0
60.0
46.0
38.0
32.0
50% TAUCLD
REF
50% TAUCLD
REF
$\frac{dT}{dt}[\frac{K}{hr}]$
Cloudwater $[\frac{g}{kg}]$

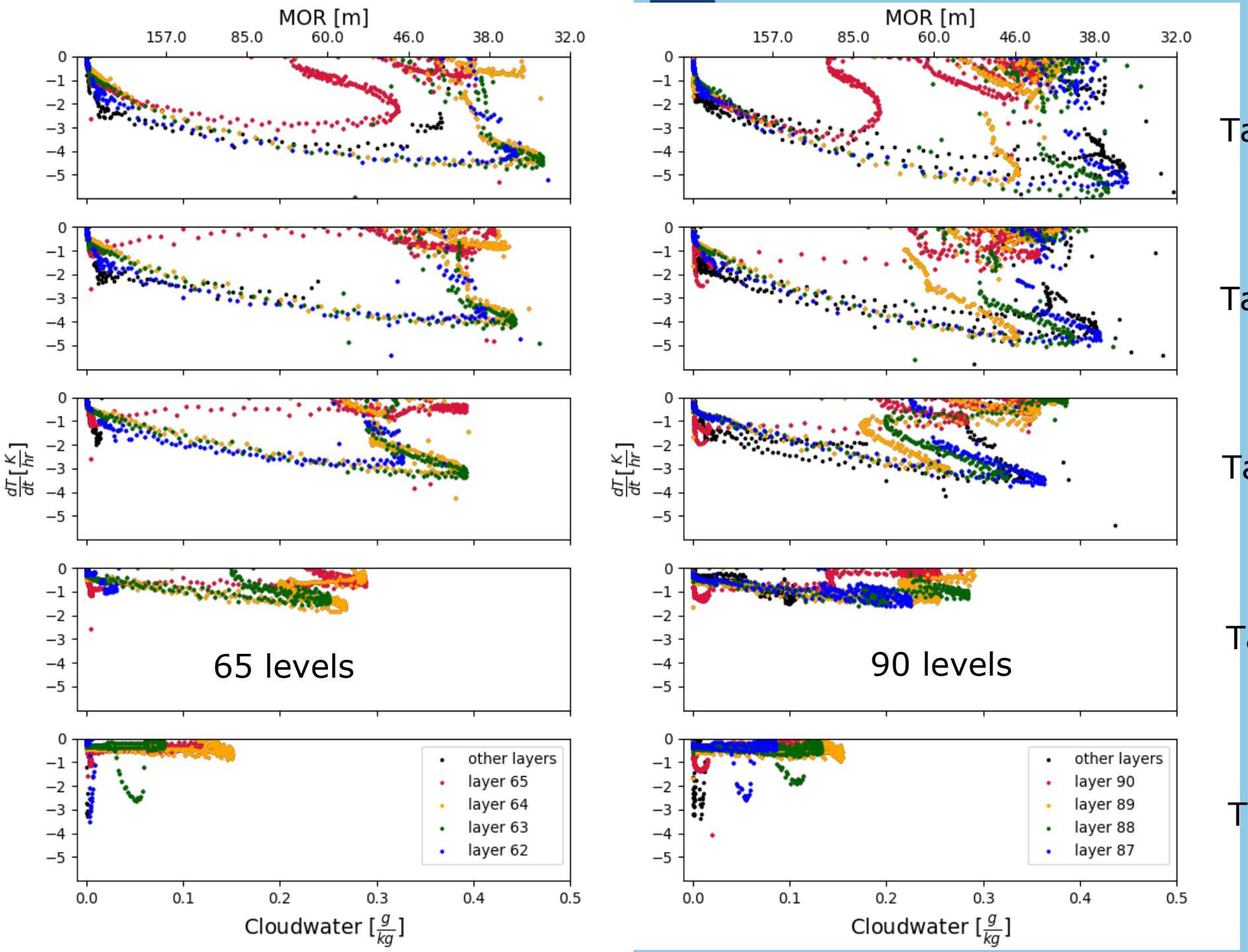

200
100
0
Reference
65 levels
200
100
0
Reference
90 levels

65 levels, Cloud water



90 levels, Cloud water





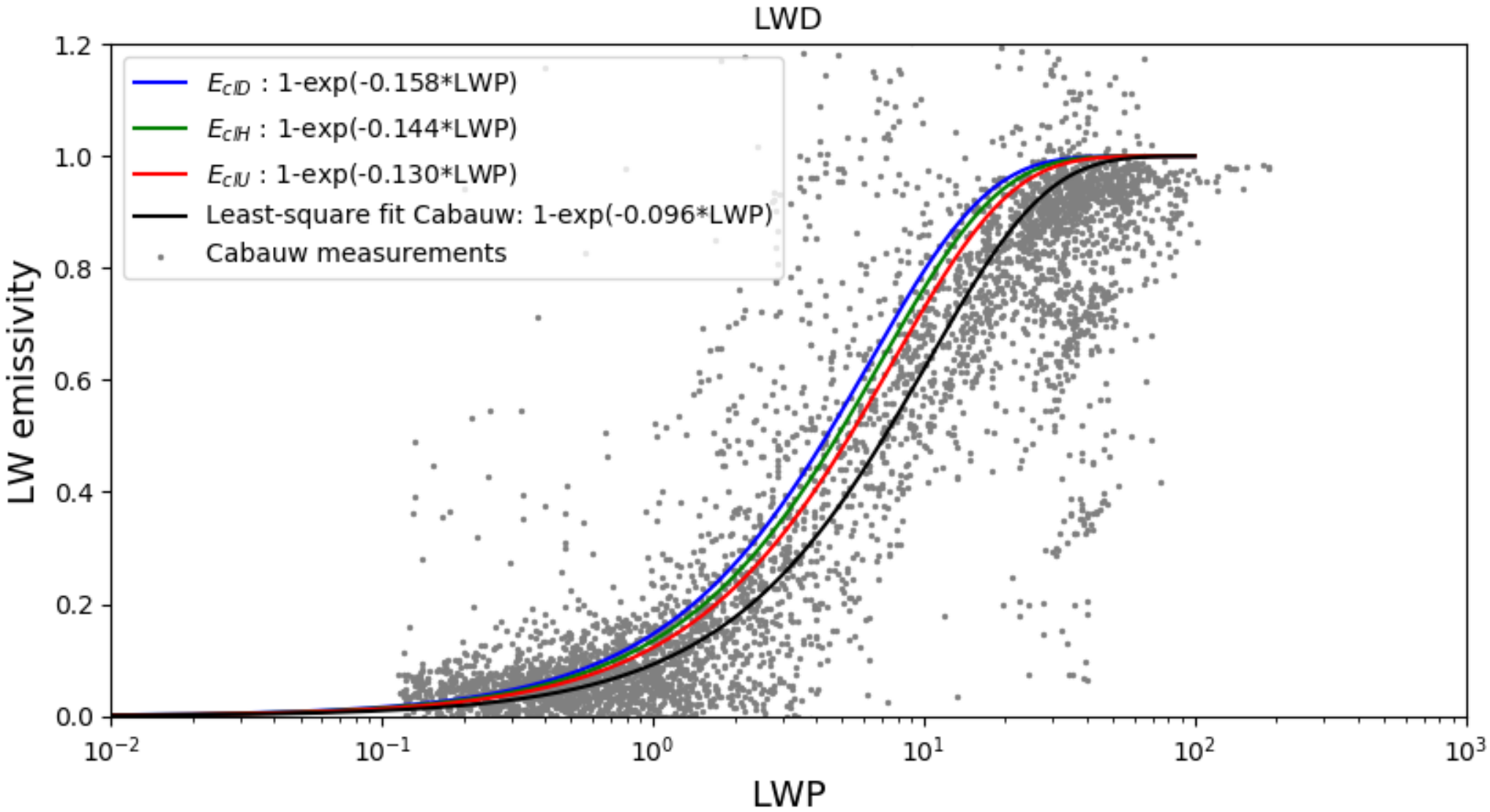
Taucld * 100%

Taucld * 75%

Taucld * 50%

Taucld * 25%

Taucld * 10%


LWD
E_{cID} : 1-exp(-0.158*LWP)
E_{cIH} : 1-exp(-0.144*LWP)
E_{cIU} : 1-exp(-0.130*LWP)
Least-square fit Cabauw: 1-exp(-0.096*LWP)
Cabauw measurements
LW emissivity
LWP
1.2
1.0
0.8
0.6
0.4
0.2
0.0
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}