First steps toward an improvement of open ocean WTC using HRMR high-frequency channels

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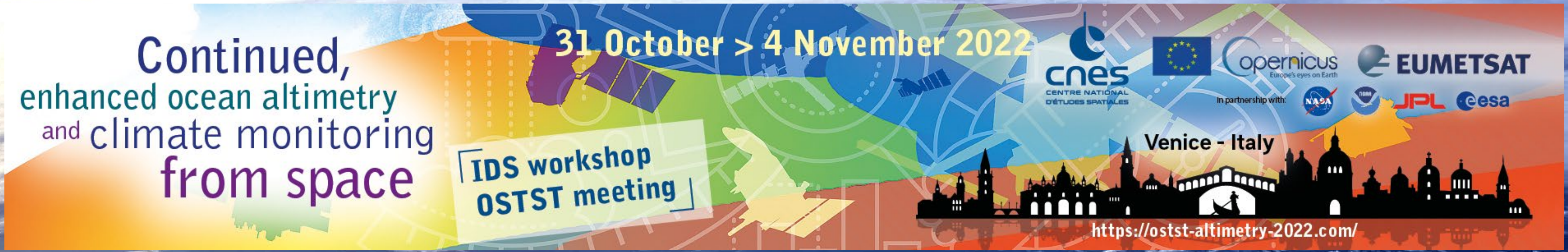
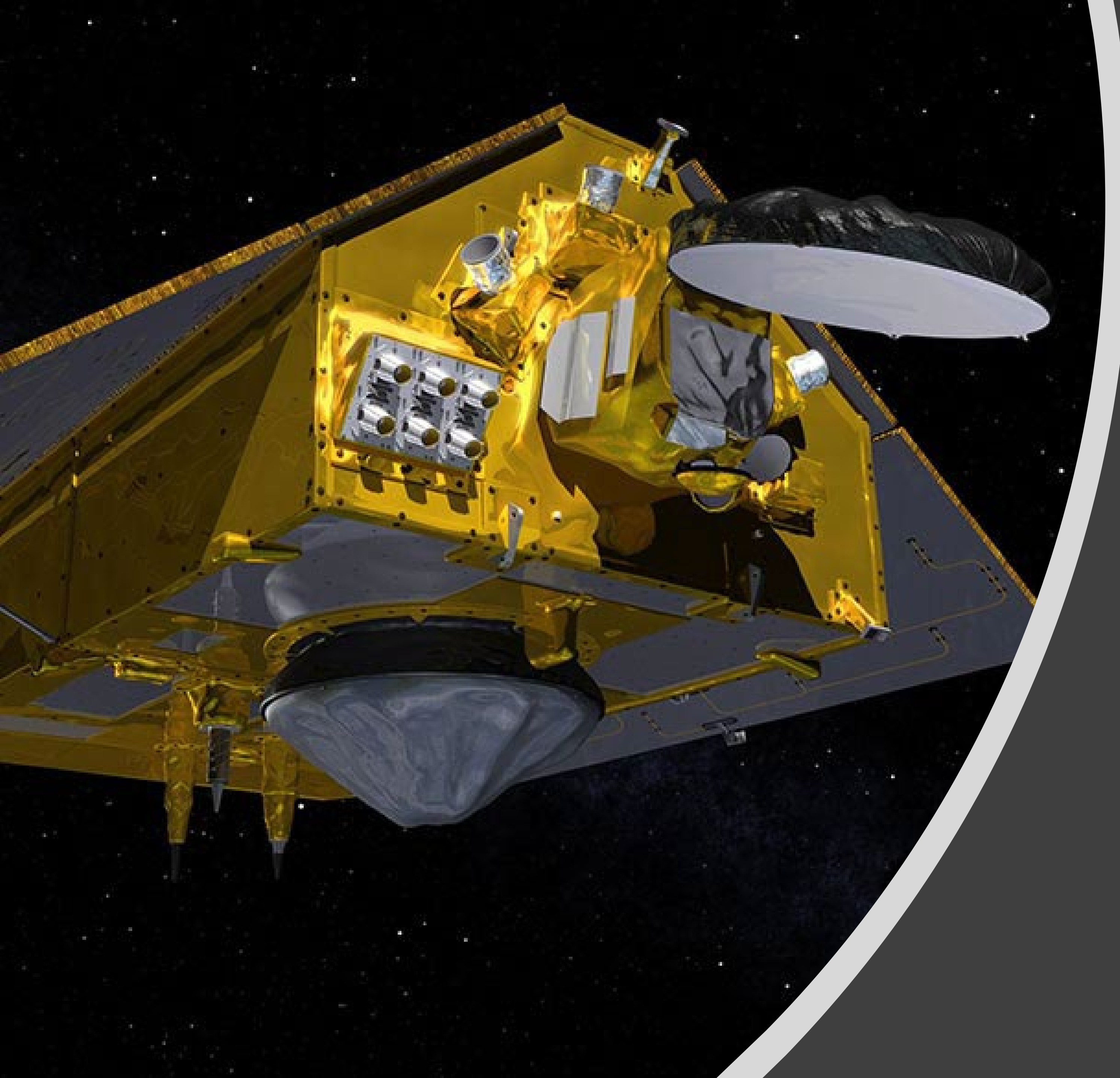
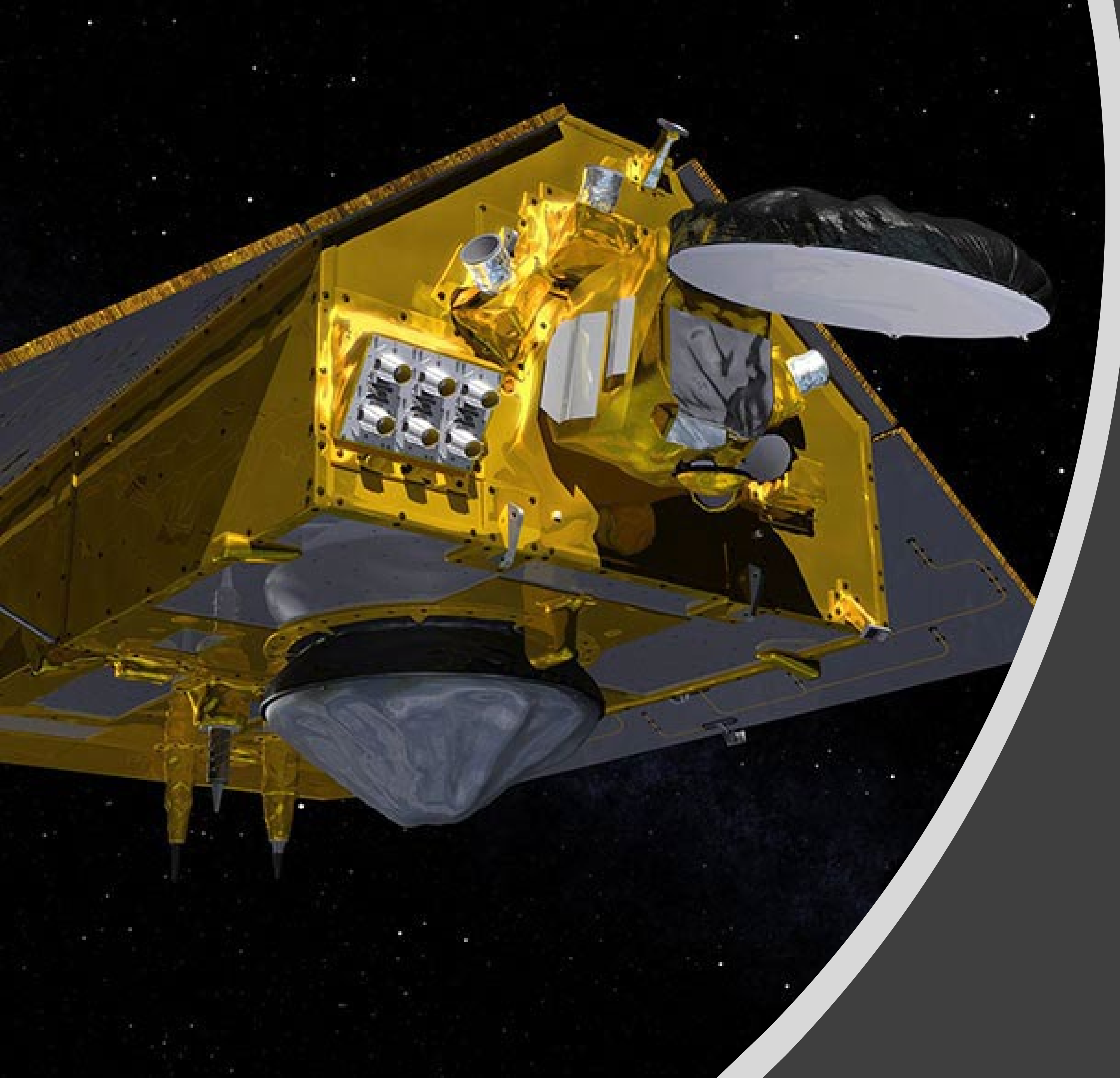




MWR for WTC retrieval

- historical AMR-C
low-frequency channels
18.7/23.8/34 GHz
~25 km

- brand new HRMR
high-frequency channels
90/130/166 GHz
~3-5 km

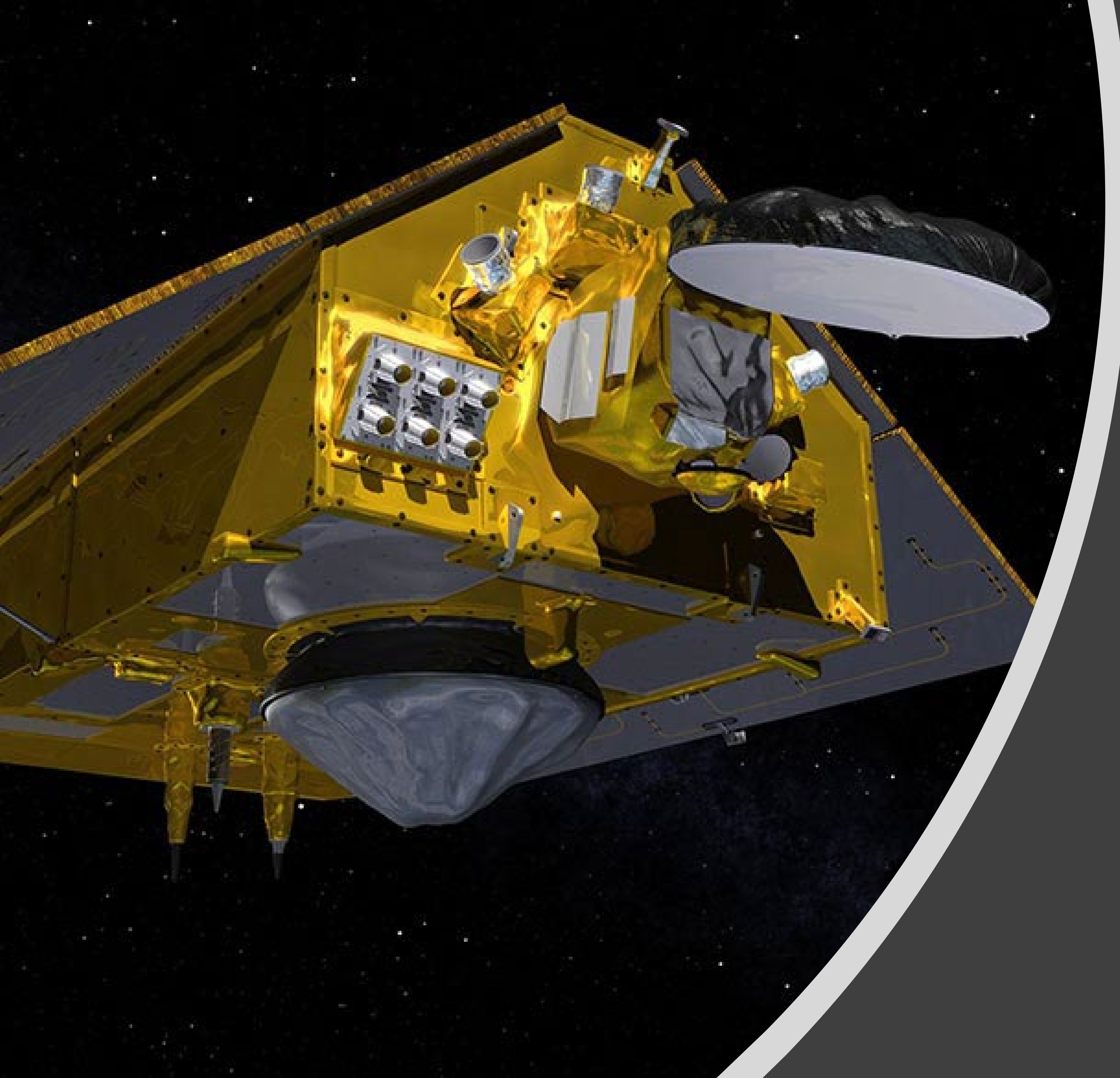


Higher frequencies =

- better spatial resolution

- less sensitive to the surface

- more sensitive to precipitation

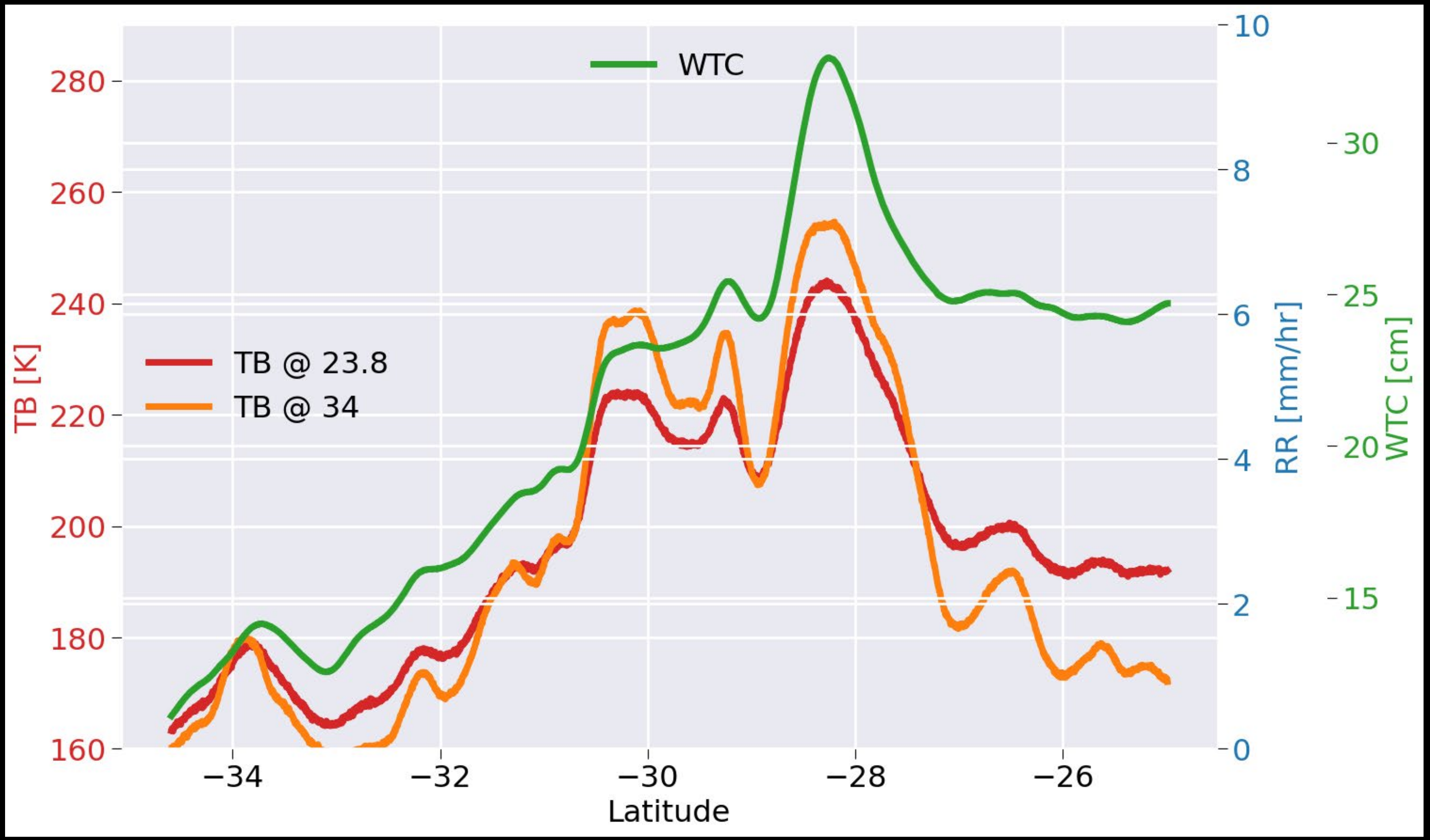


HF are a direct (from observations) solution to two areas of research for the improvement of the WTC

- coastal areas
(see S. Brown slides)

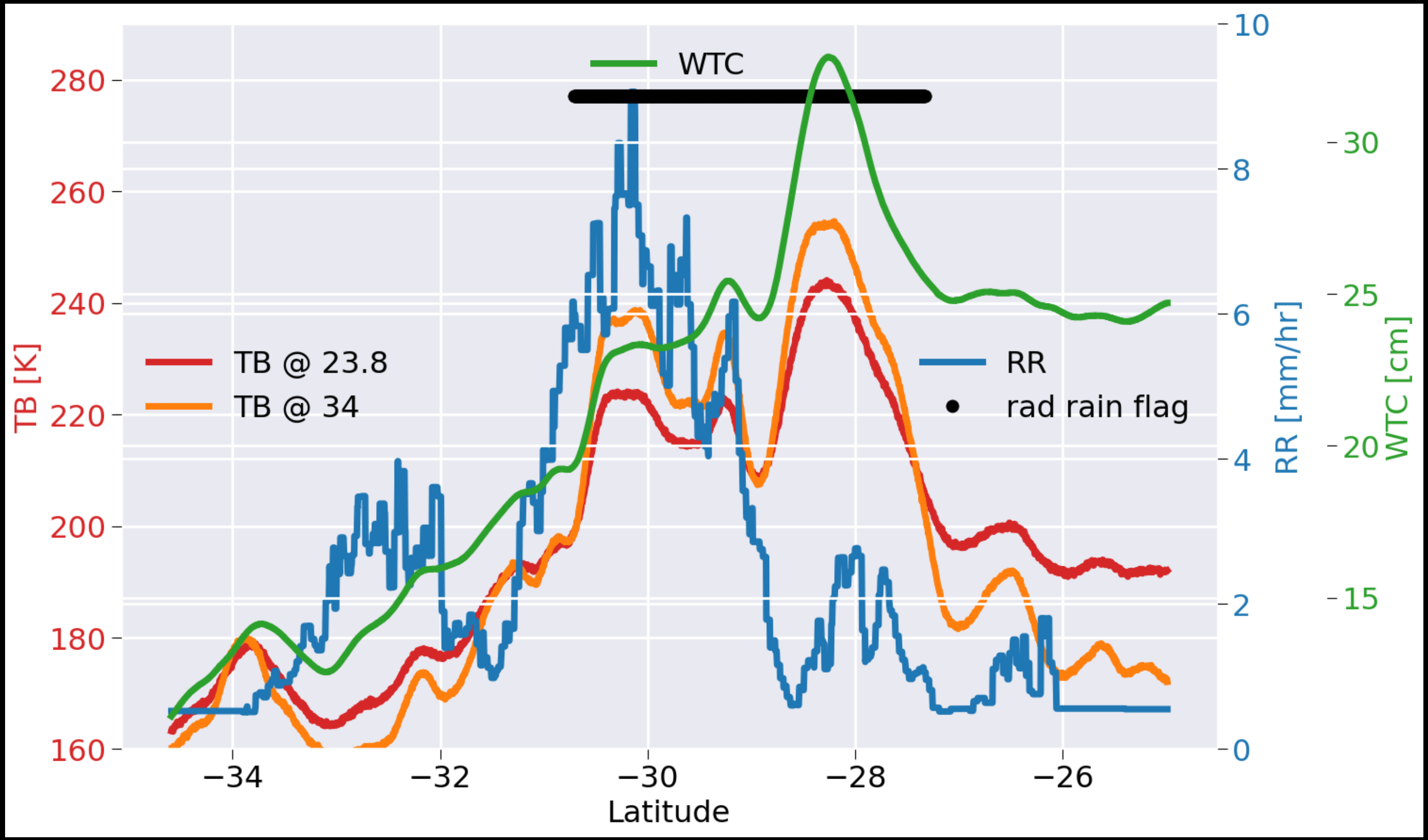
- cloudy / precipitation conditions

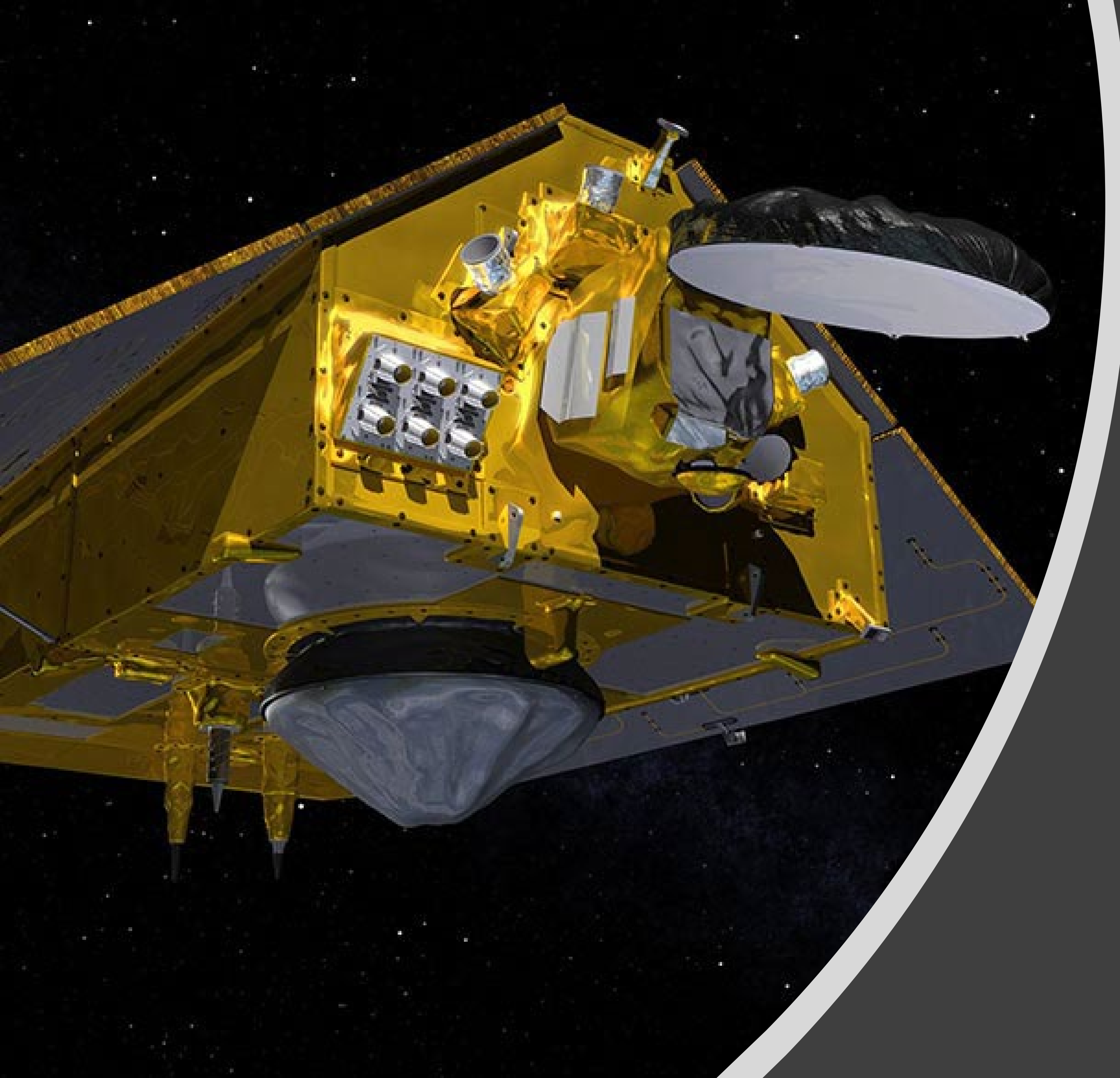
The variations of the WTC are highly correlated to the variations of the TB …



… which are (also) correlated to the precipitations

Is it possible
to take advantage of the HF channels
(resolution + physic)
in order to improve the WTC under such conditions ?

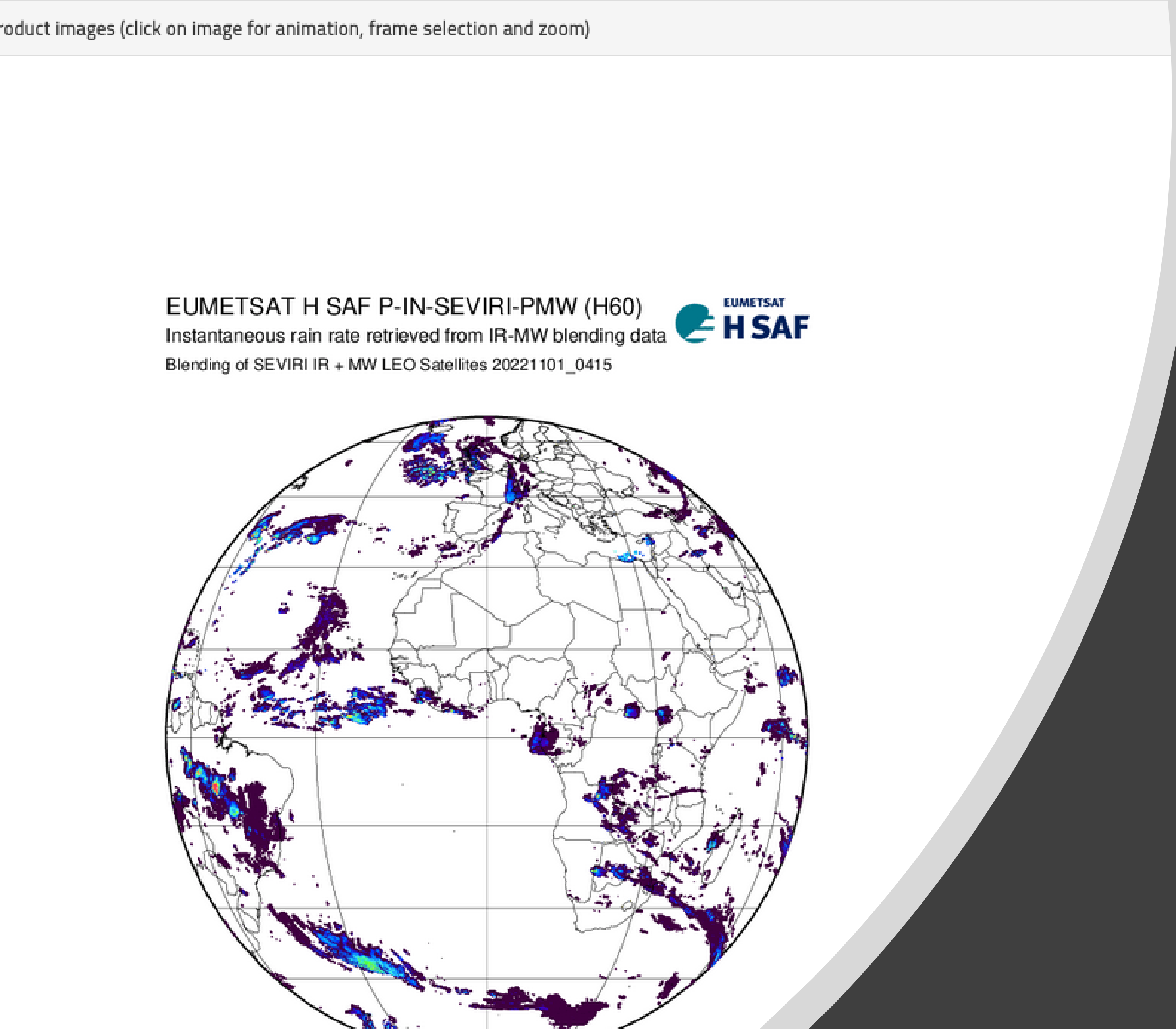




Dataset:

- AMR Level 2 NTC F07 (from Eumetsat https://archive.eumetsat.int/usc/UserServicesClient.html) (also special delivery from R. Scharroo)

- Hydro-SAF H60 NRT product https://hsaf.meteoam.it/

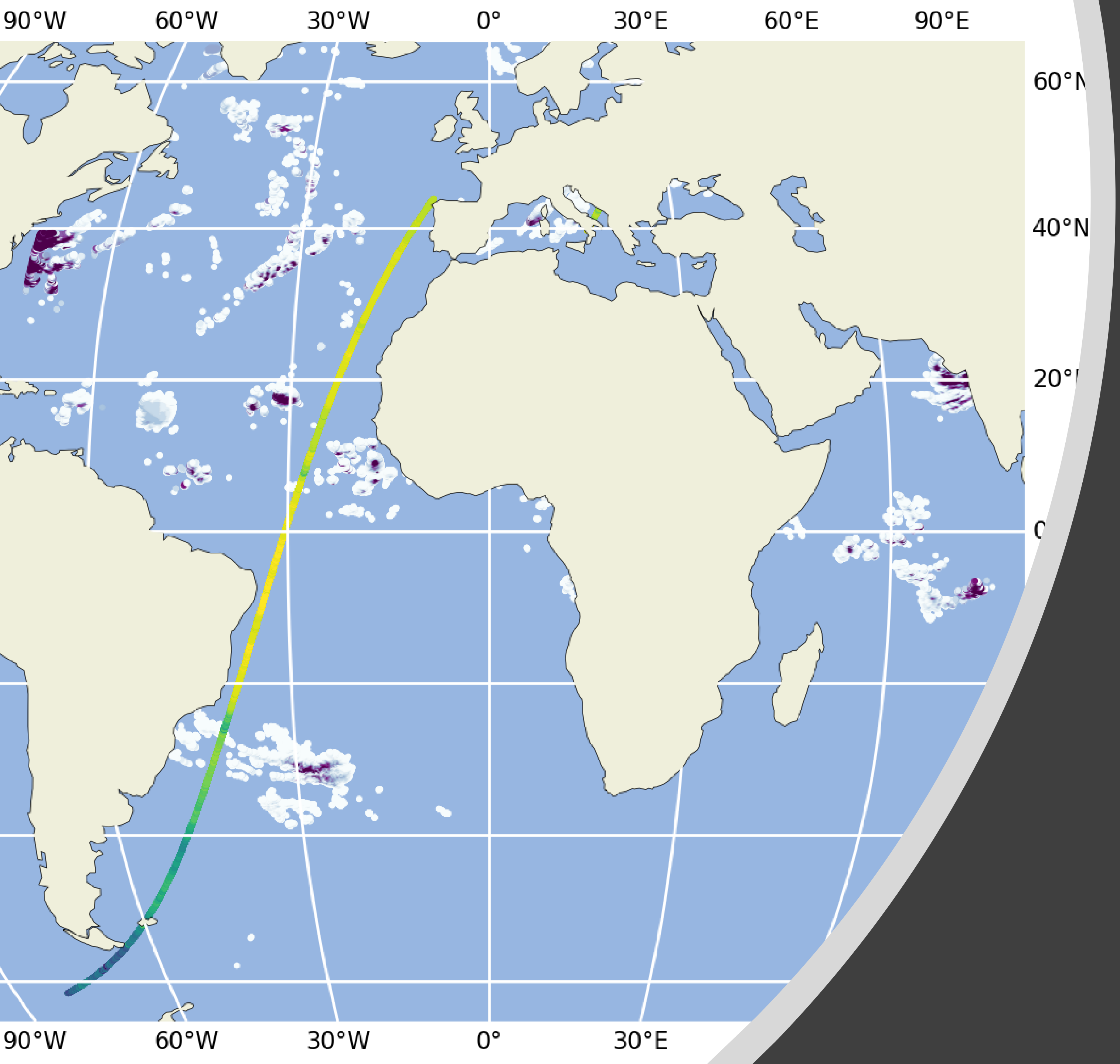


Geostationay Seviri IR + MW blending

few km of spatial resolution

1 RR product every 15min

“closest” time wrt HRMR



2022-09-15

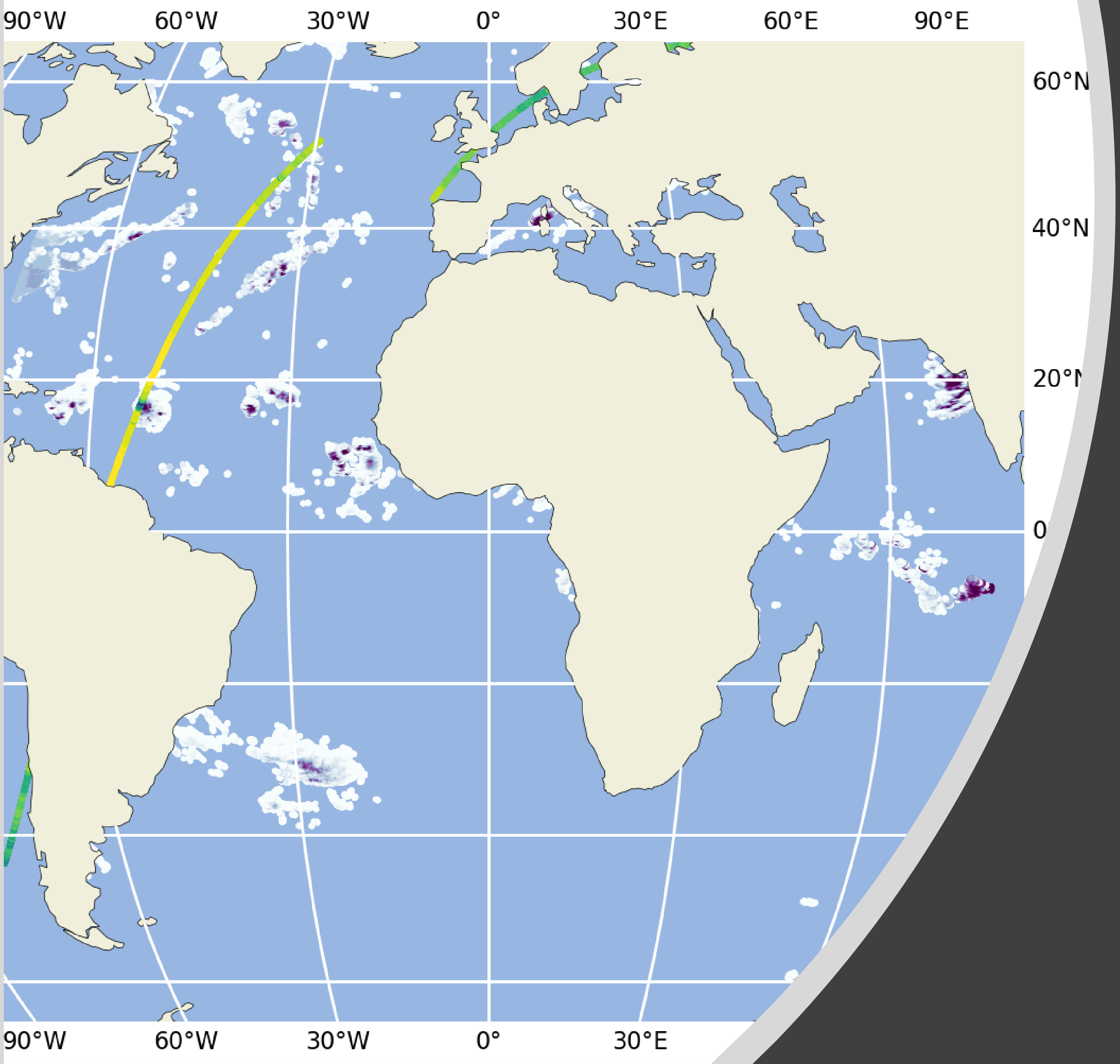
cycle 68

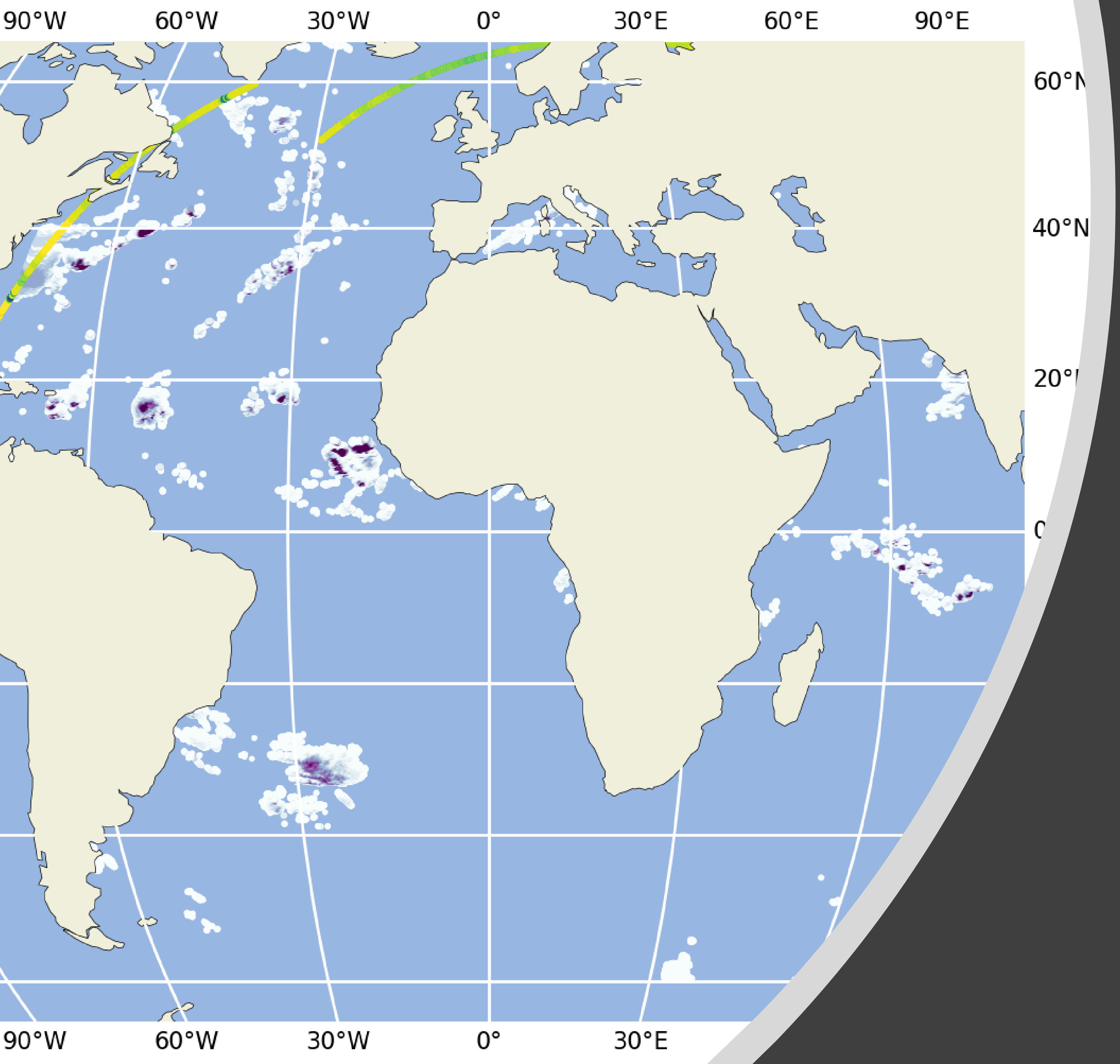
Passes 59 to 75

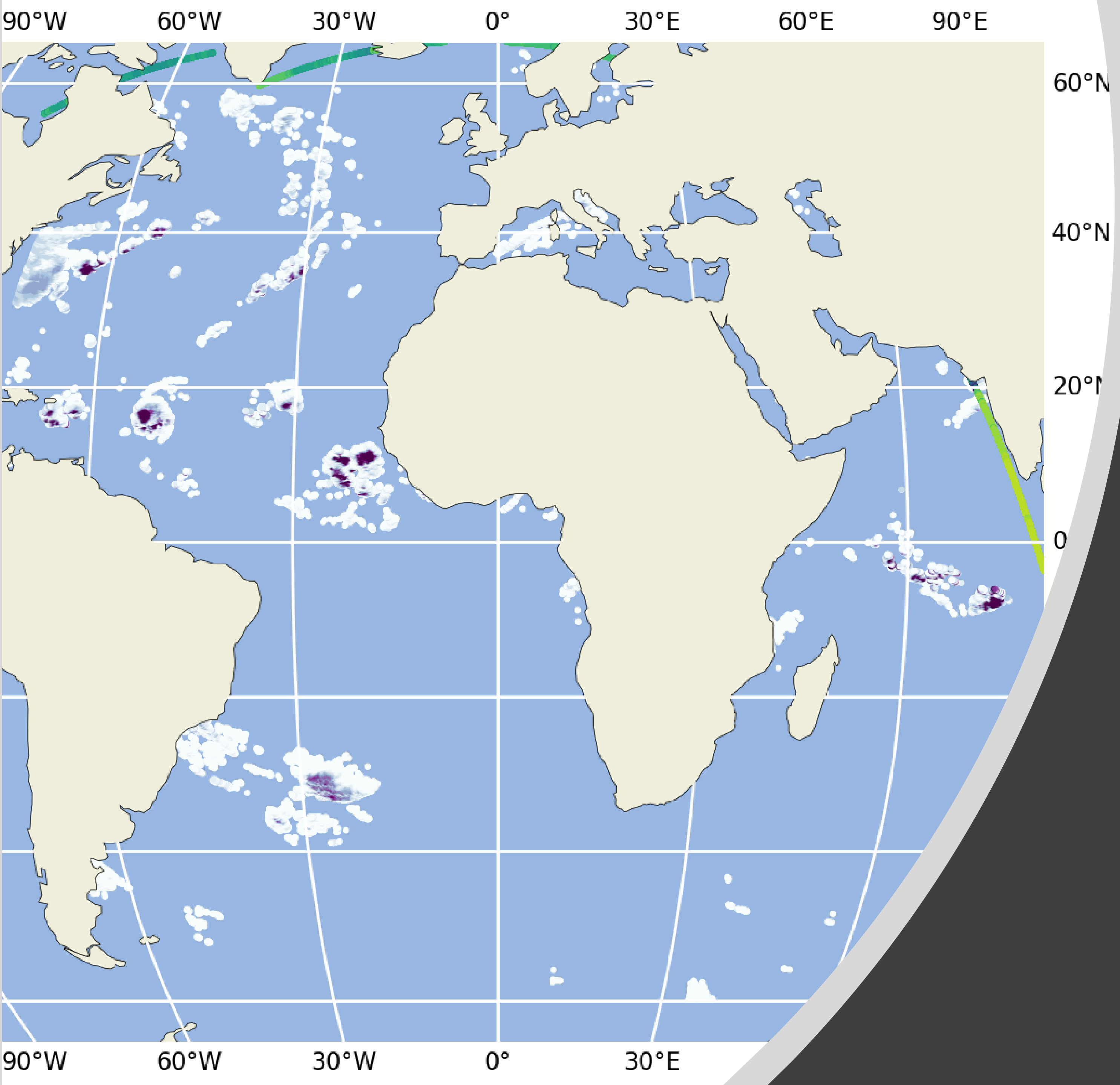
07:30 to 23:30

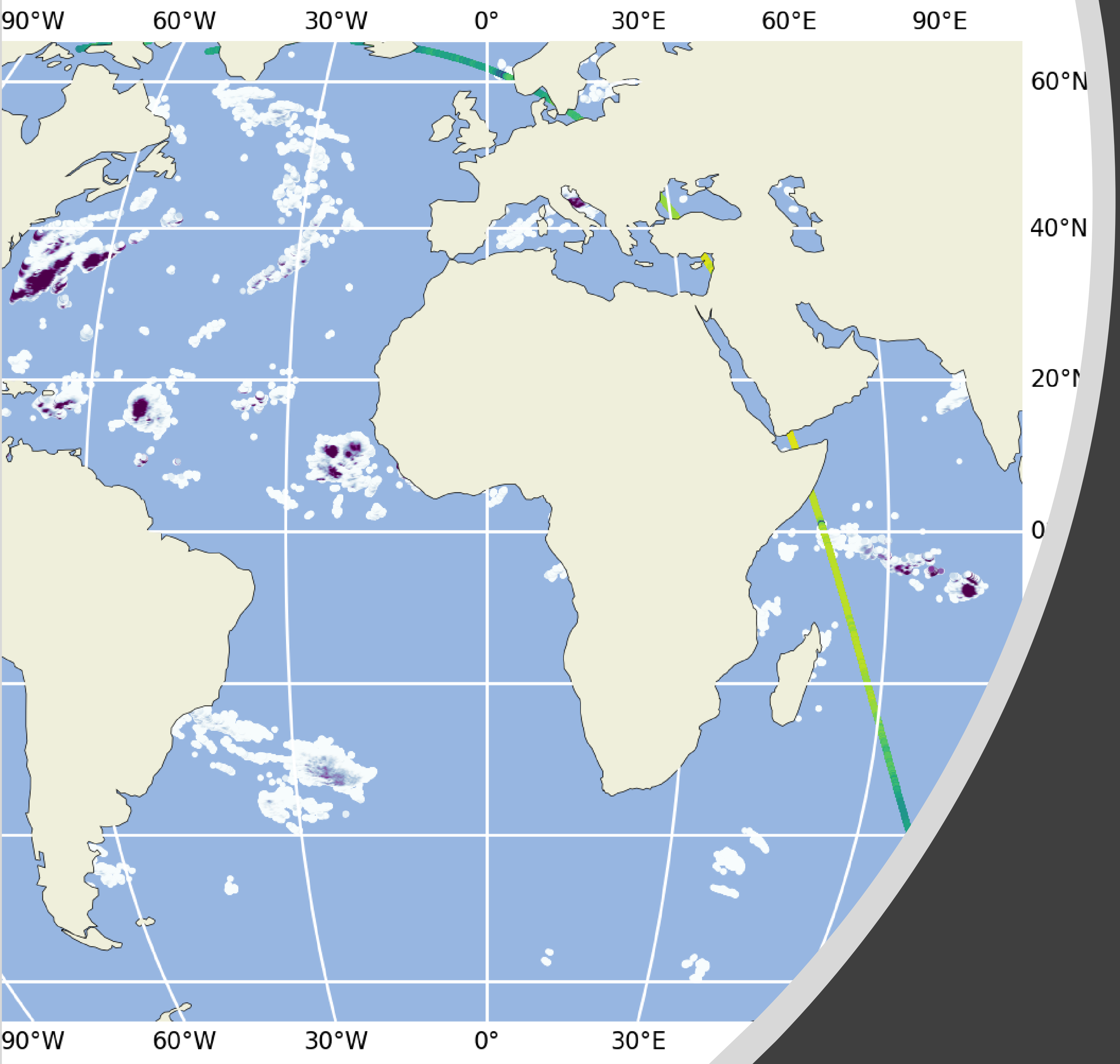
TB @166 GHz [K]

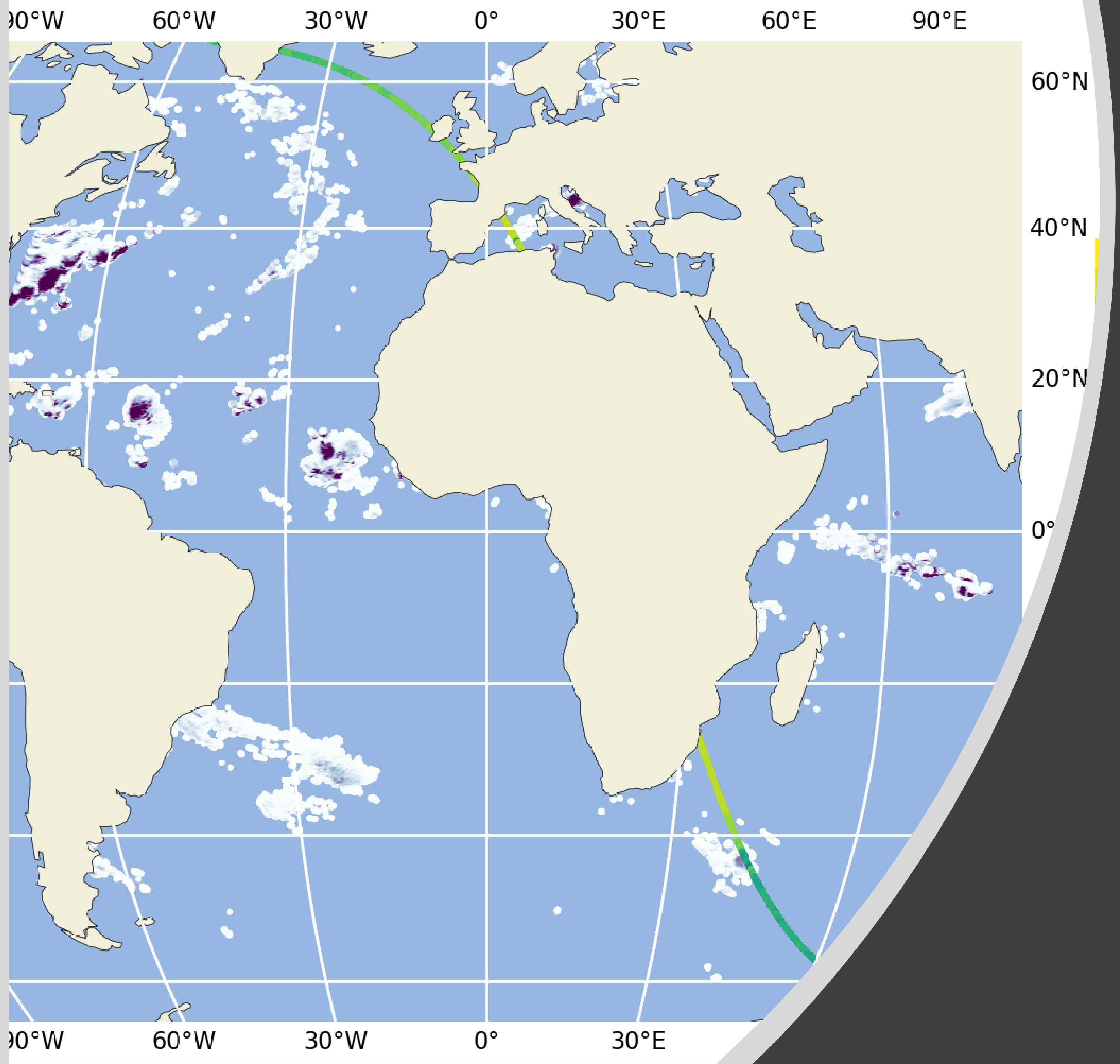
RR [0,10] mm/hr


90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
20°N
0
90°W
60°W
30°W
0°
30°E

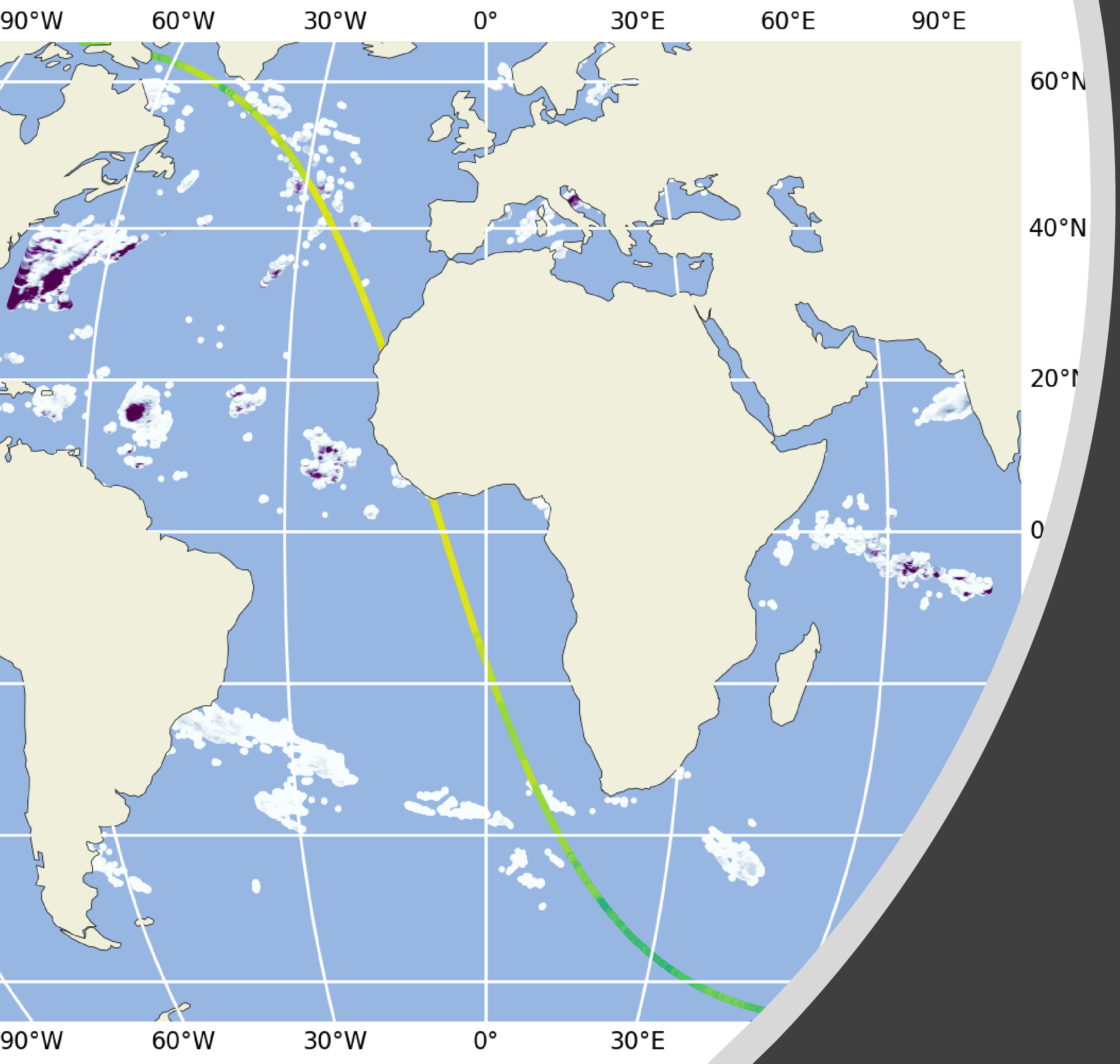

90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
90°W
60°W
30°W
0°
30°E


90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
20°N
0
90°W
60°W
30°W
0°
30°E

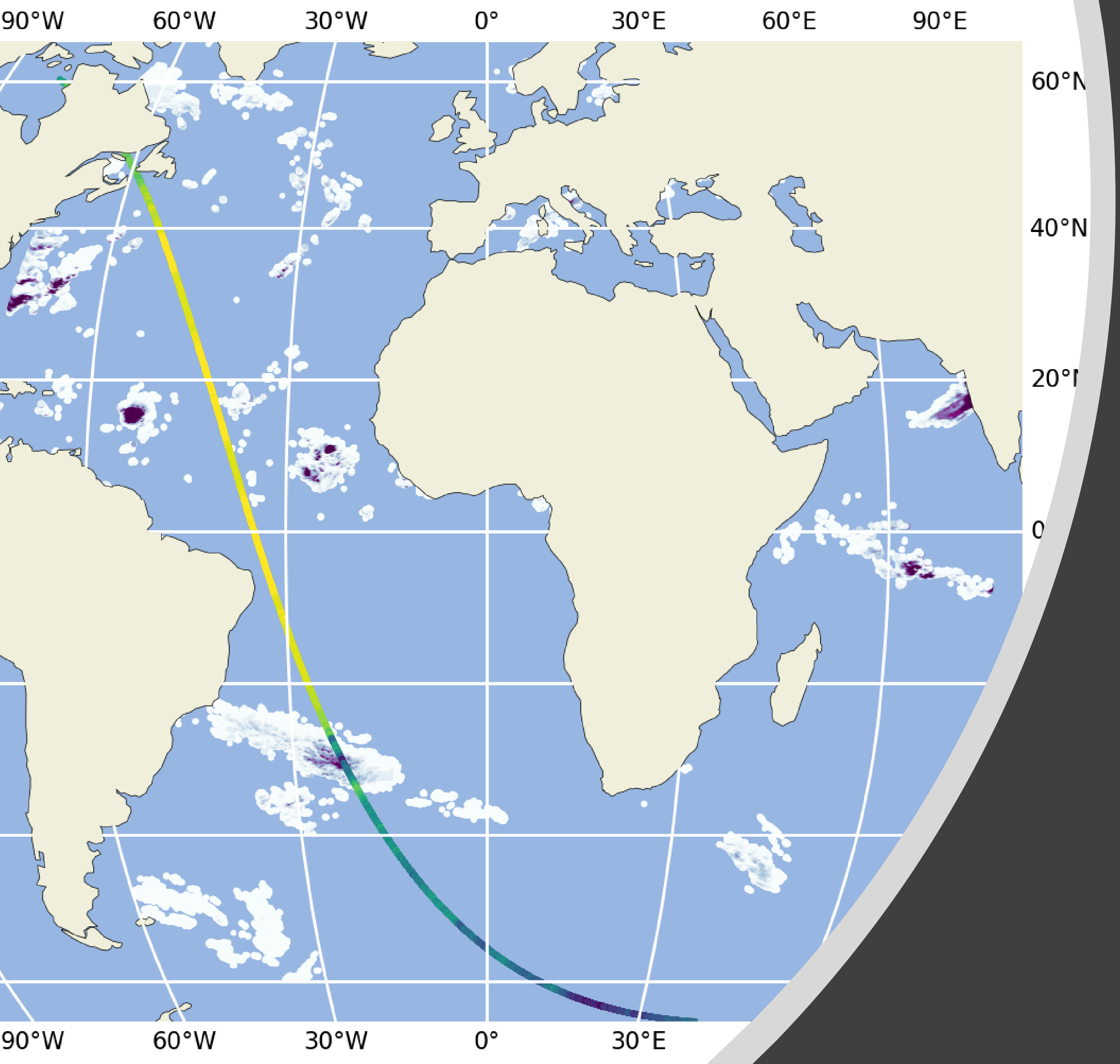

90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
20°N
0
90°W
60°W
30°W
0°
30°E

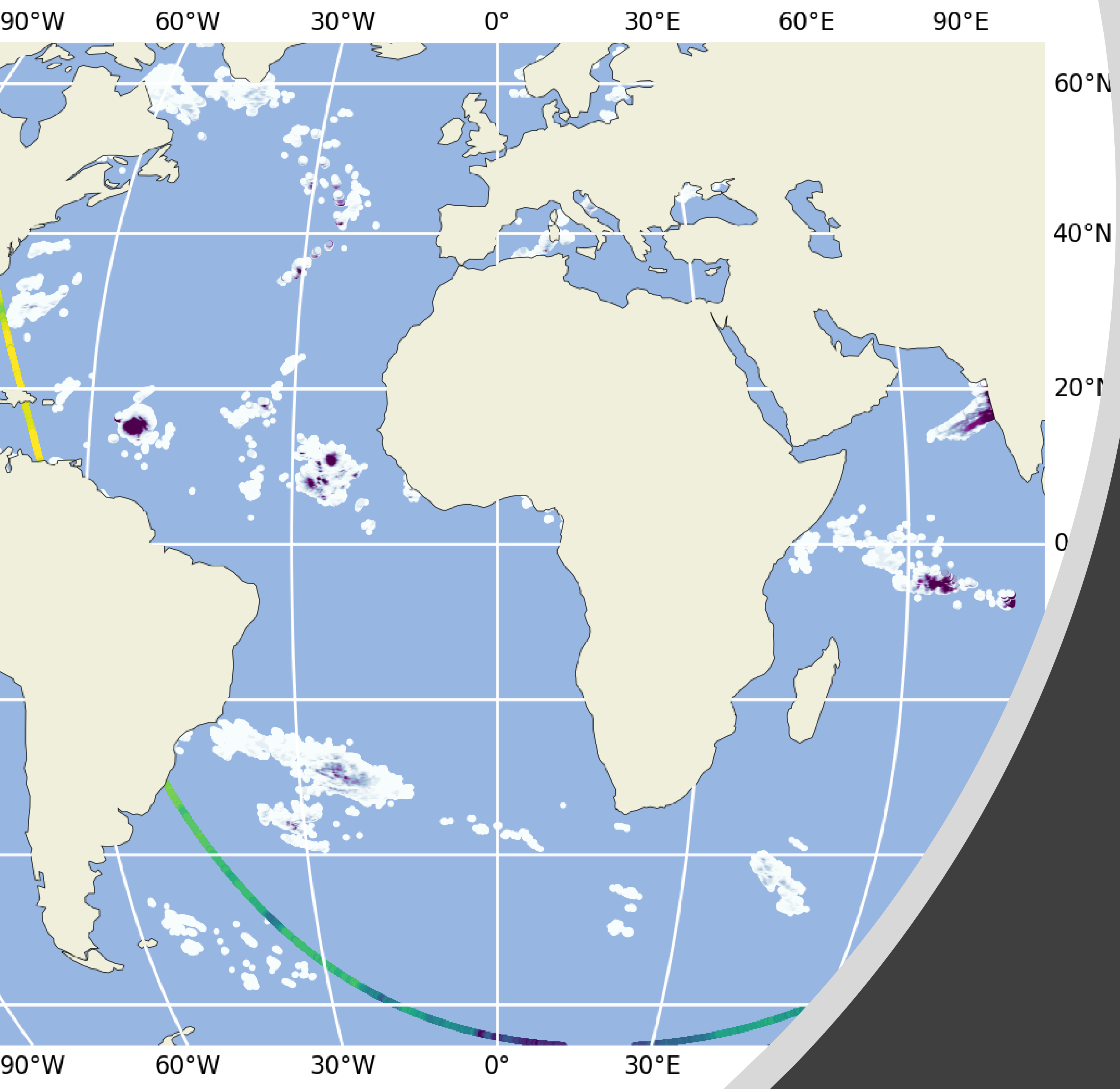


90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
20°N
0°
90°W
60°W
30°W
0°
30°E



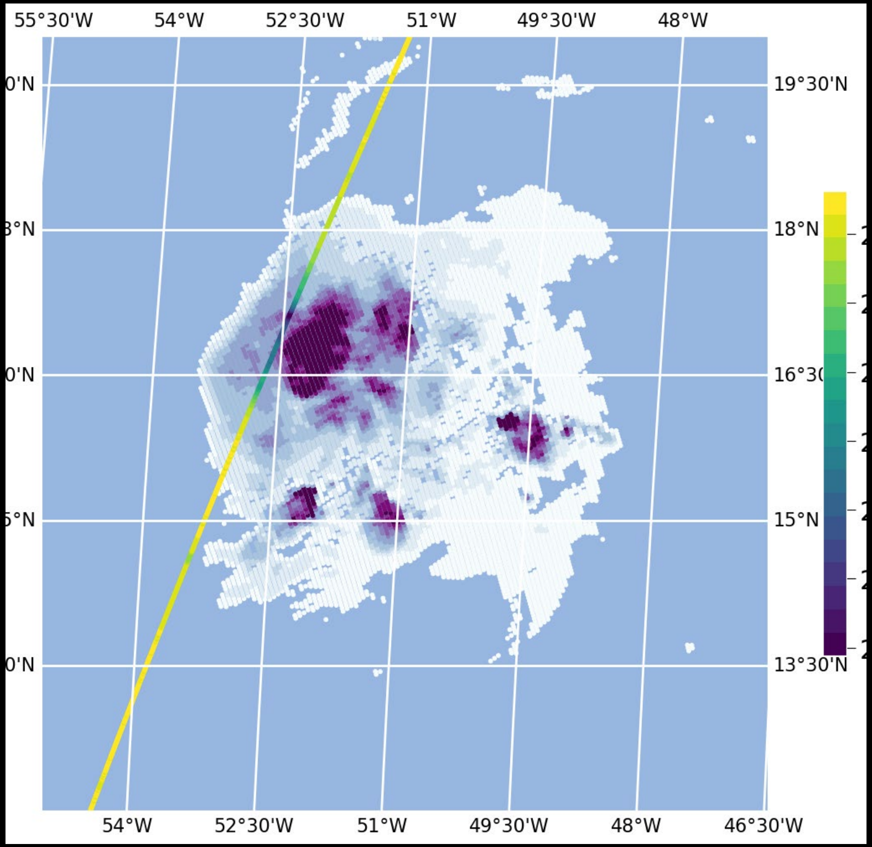
90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N

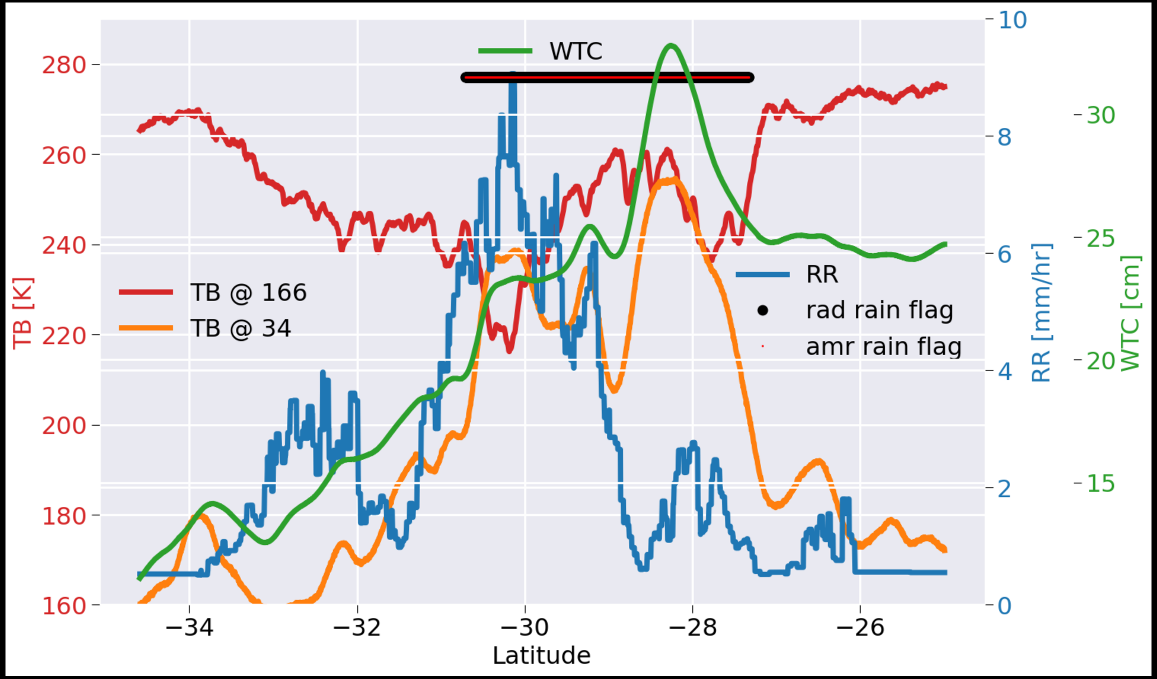

90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
20°N
90°W
60°W
30°W
0°
30°E



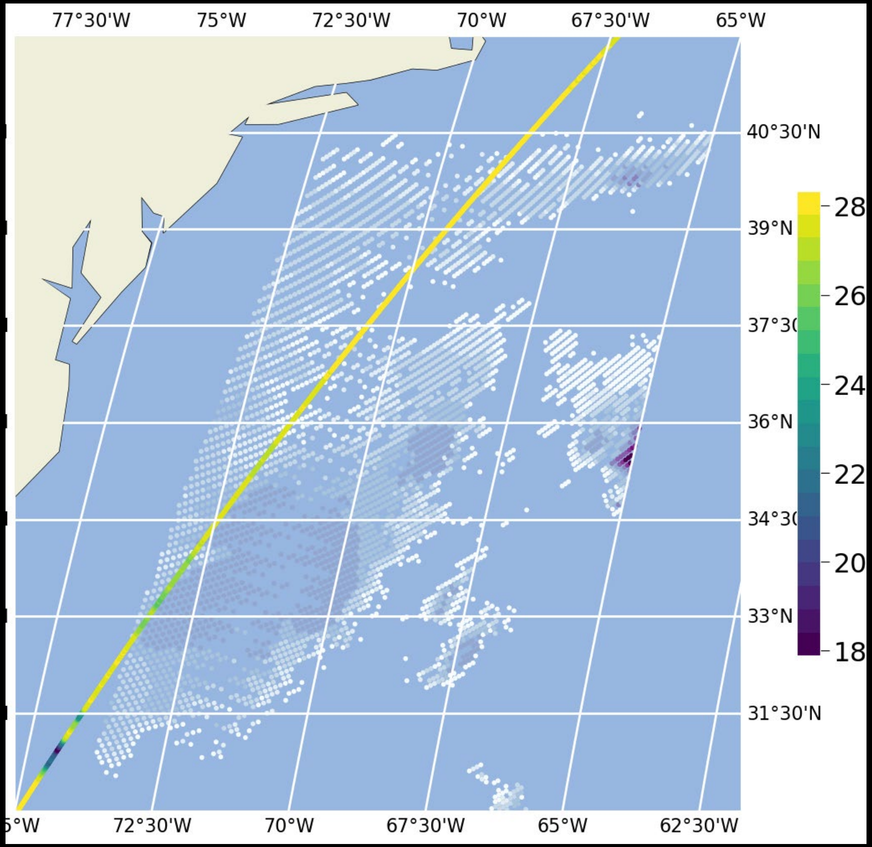
90°W
60°W
30°W
0°
30°E
60°E
90°E
60°N
40°N
20°N
0

Pass 61

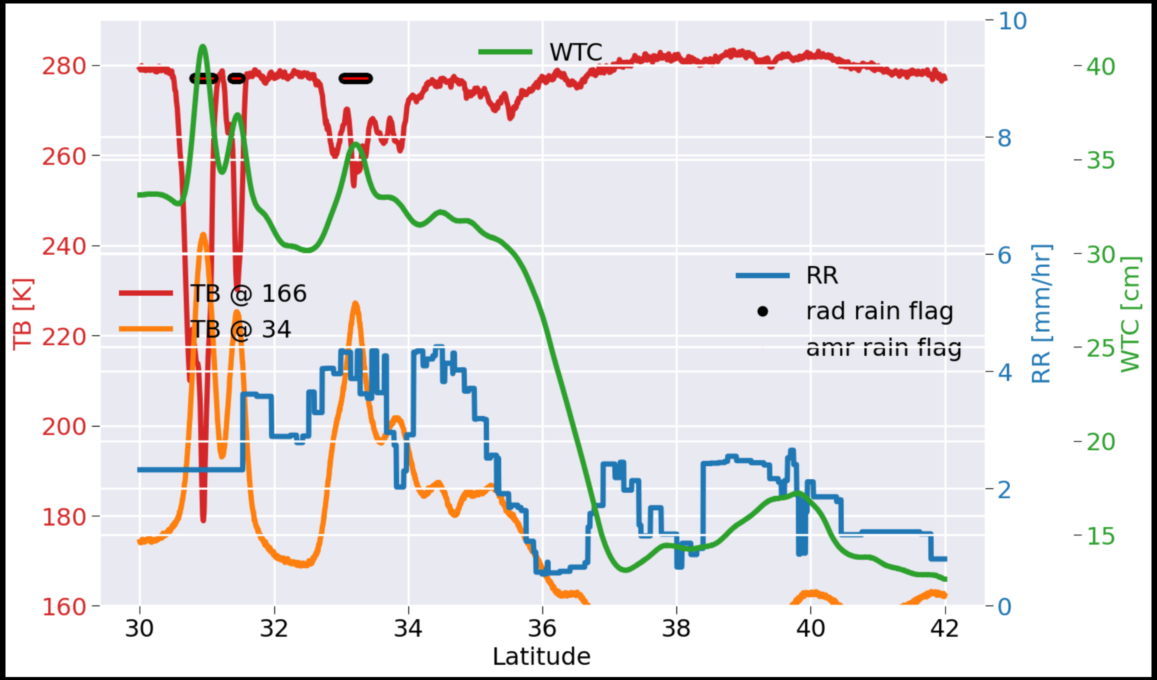

55°30'W
54°W
52°30'W
51°W
49°30'W
48°W
19°30'N
18°N
16°30
15°N
13°30'N
54°W
52°30'W
51°W
49°30'W
48°W
46°30'W


WTC
TB @ 166
TB @ 34
RR
rad rain flag
amr rain flag
TB [K]
RR [mm/hr]
WTC [cm]
Latitude
280
260
240
220
200
180
160
−34
−32
−30
−28
−26
10
8
6
4
2
0
30
25
20
15

Pass 63

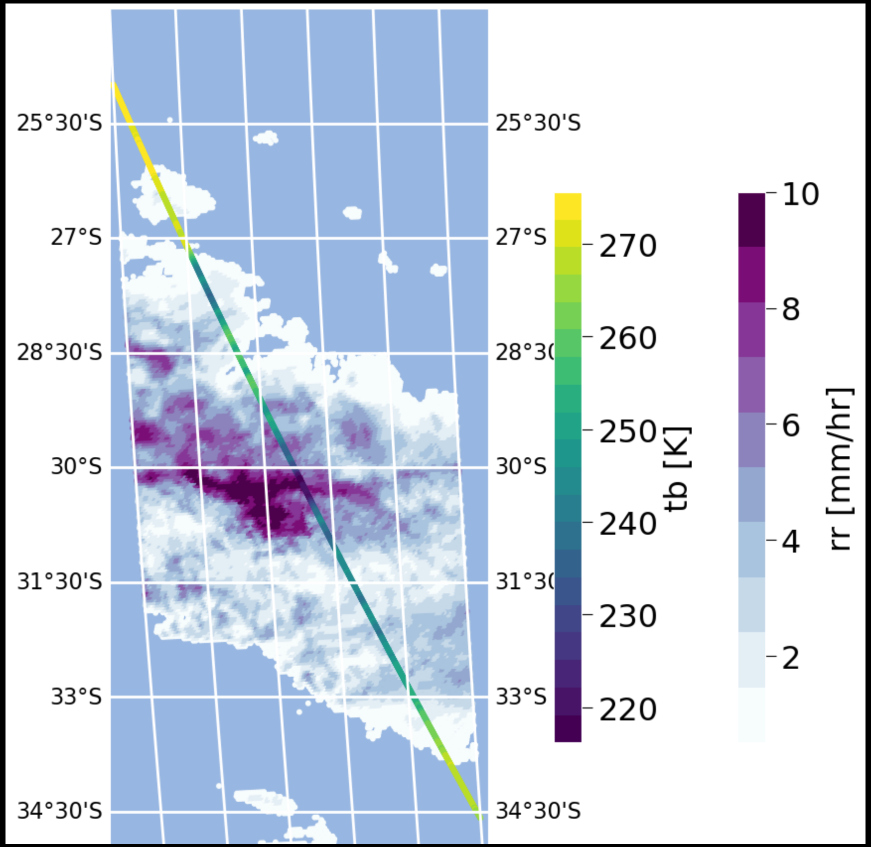


77°30'W
75°W
72°30'W
70°W
67°30'W
65°W
40°30'N
39°N
37°30
36°N
34°30
33°N
31°30'N
72°30'W
70°W
67°30'W
65°W
62°30'W
28
26
24
22
20
18

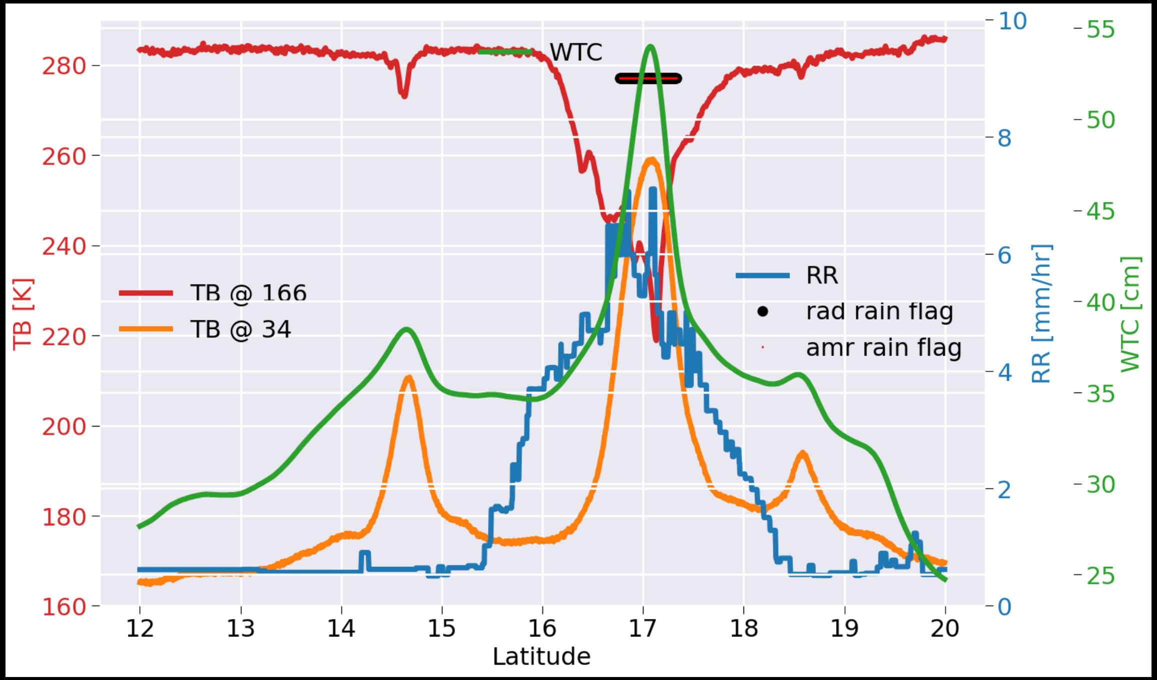


WTC
TB @ 166
TB @ 34
RR
rad rain flag
amr rain flag
TB [K]
RR [mm/hr]
WTC [cm]
Latitude
280
260
240
220
200
180
160
30
32
34
36
38
40
42
10
8
6
4
2
0
40
35
30
25
20
15

Pass 73



25°30'S
27°S
28°30'S
30°S
31°30'S
33°S
34°30'S
270
260
250
240
230
220
tb [K]
10
8
6
4
2
rr [mm/hr]



WTC
TB @ 166
TB @ 34
RR
rad rain flag
amr rain flag
TB [K]
RR [mm/hr]
WTC [cm]
Latitude
280
260
240
220
200
180
160
12
13
14
15
16
17
18
19
20
10
8
6
4
2
0
55
50
45
40
35
30
25

The scattering effect leads to lower TB

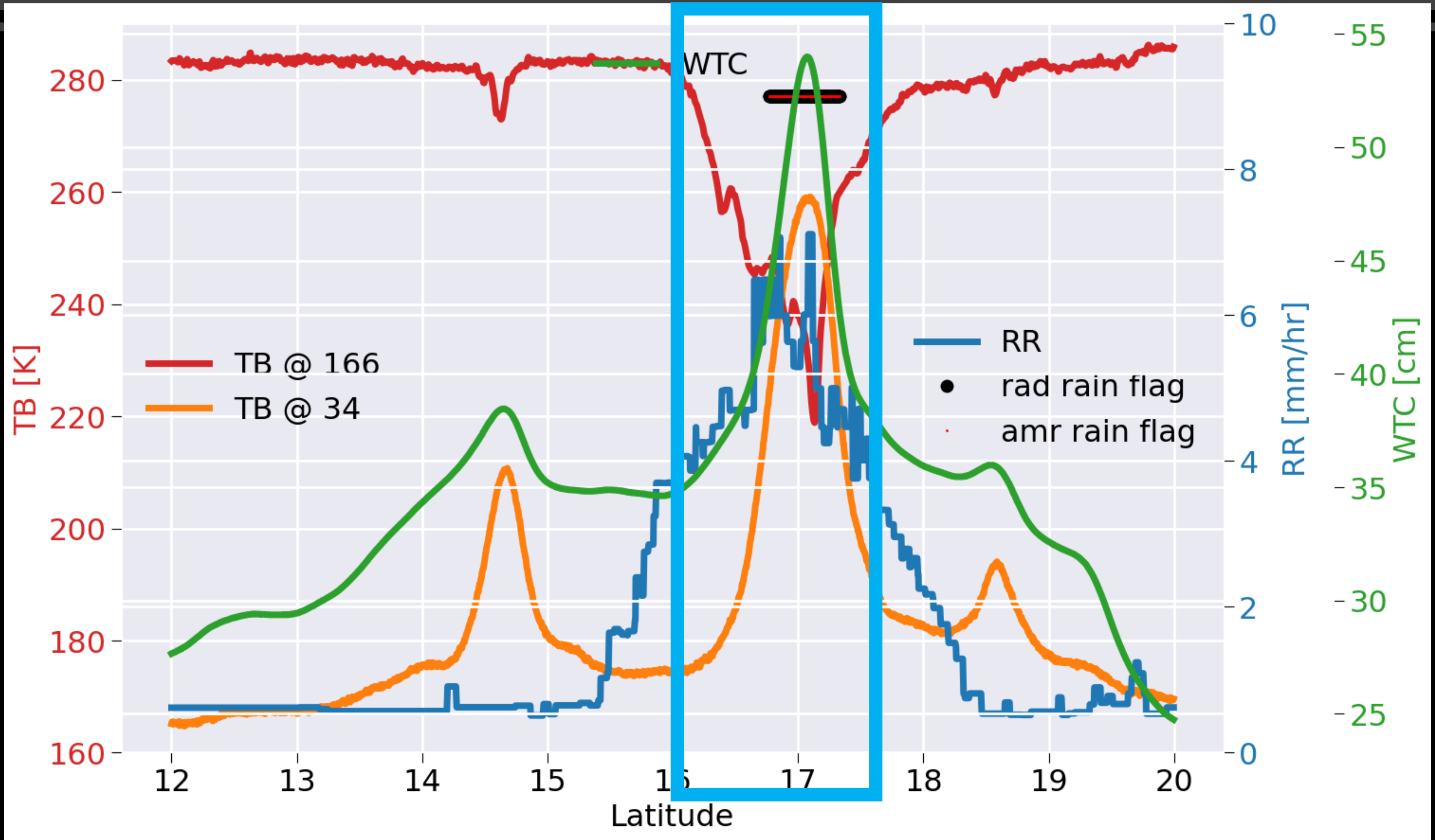
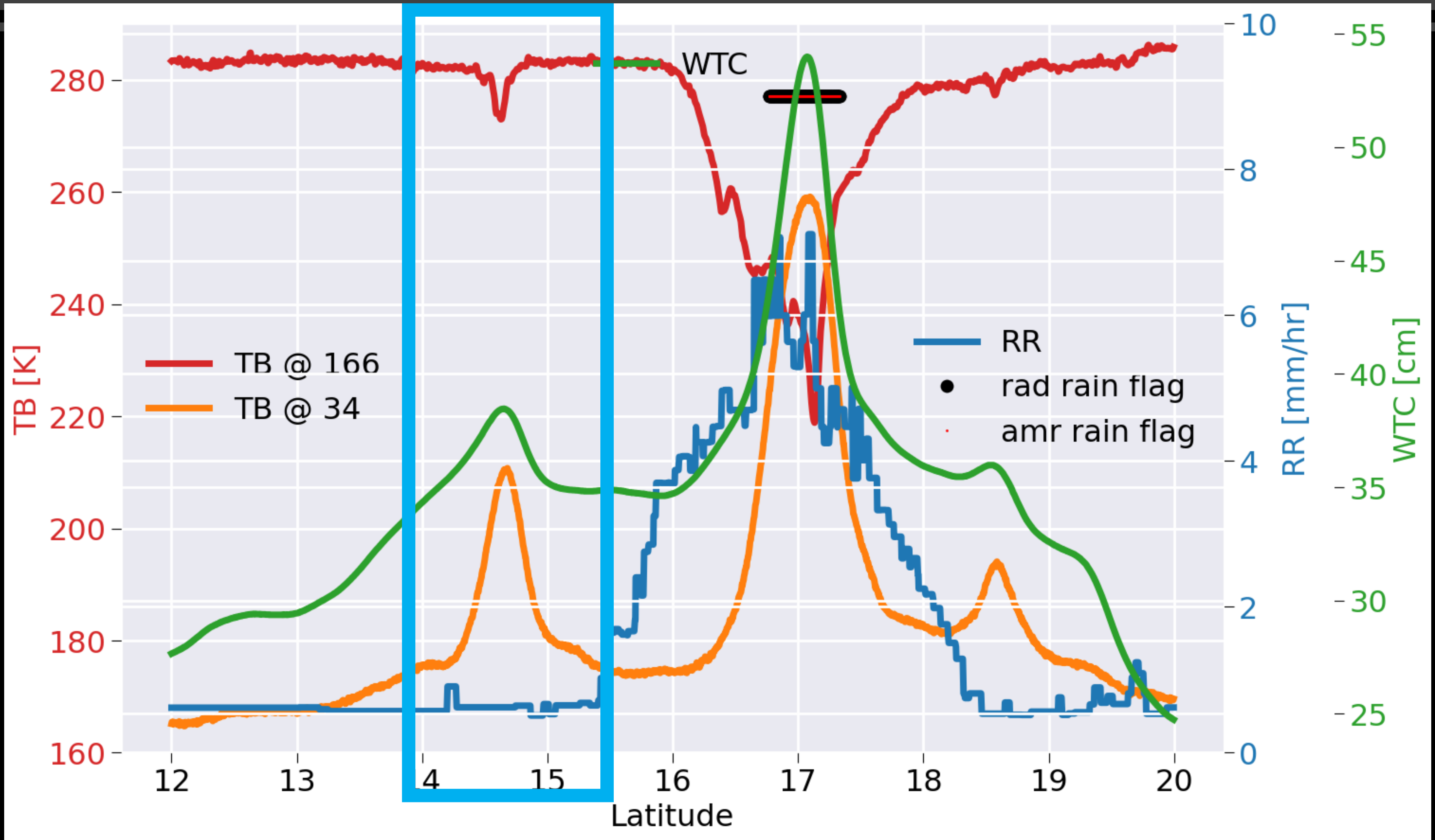
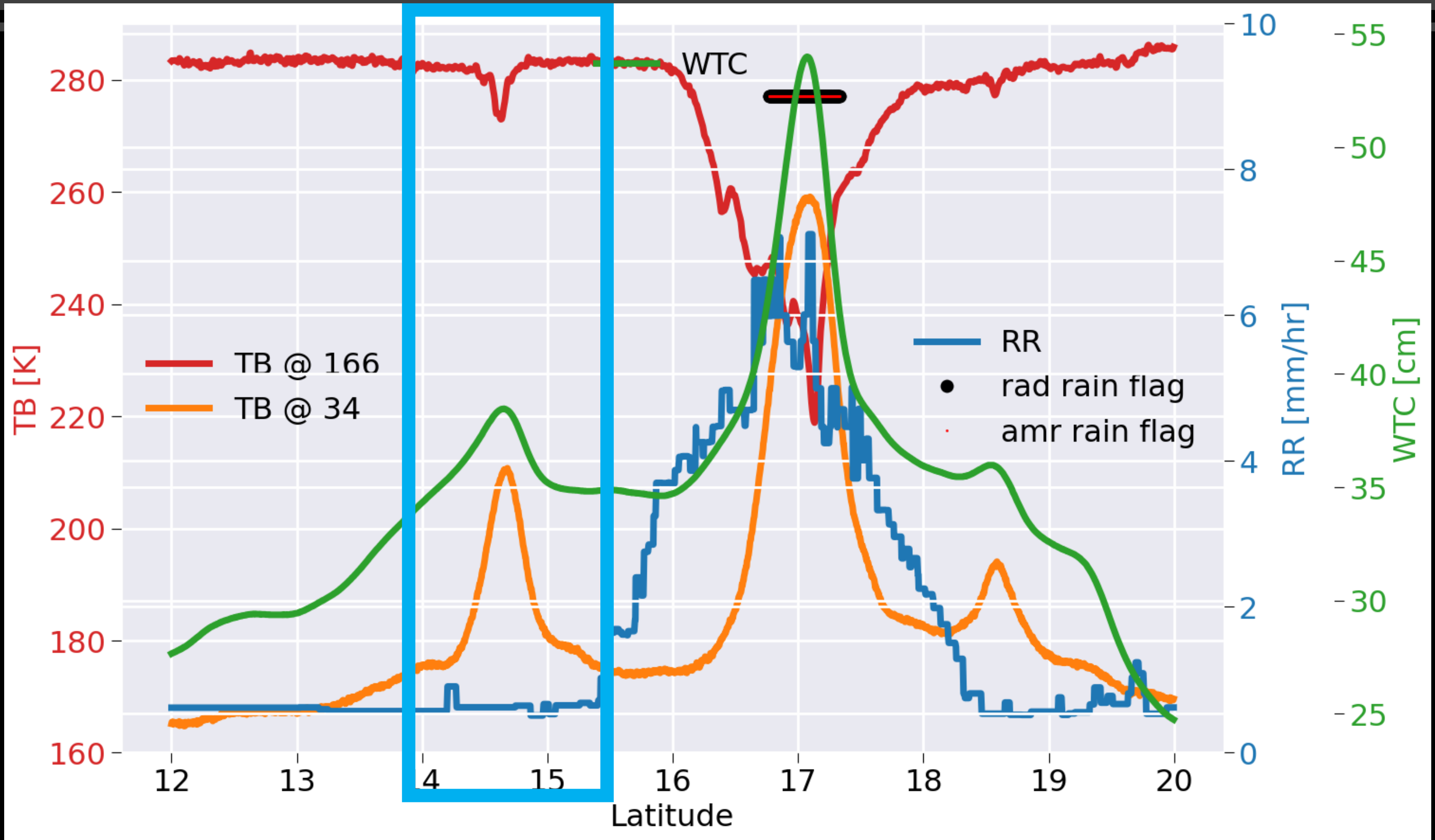


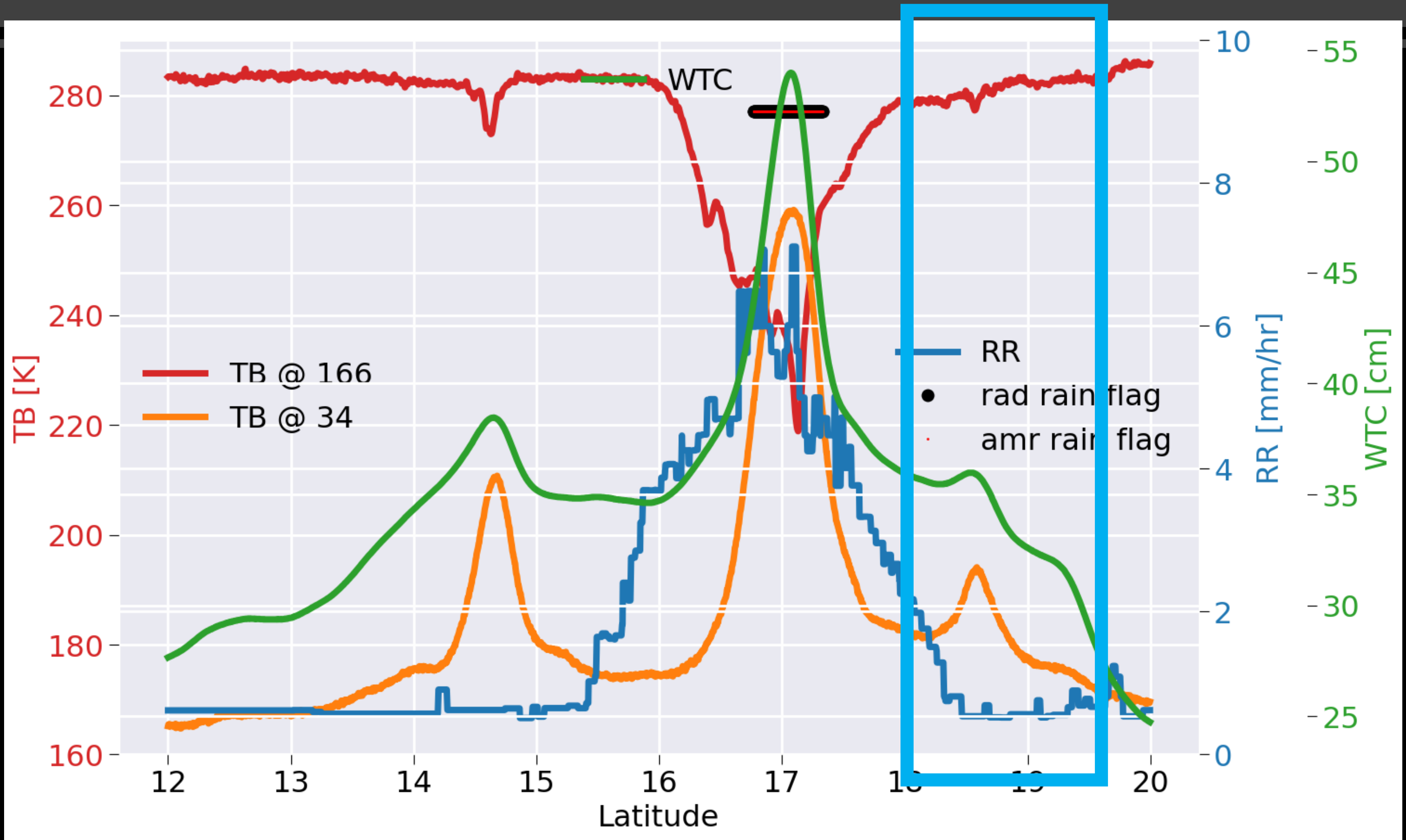
Illustration of the spatial resolution



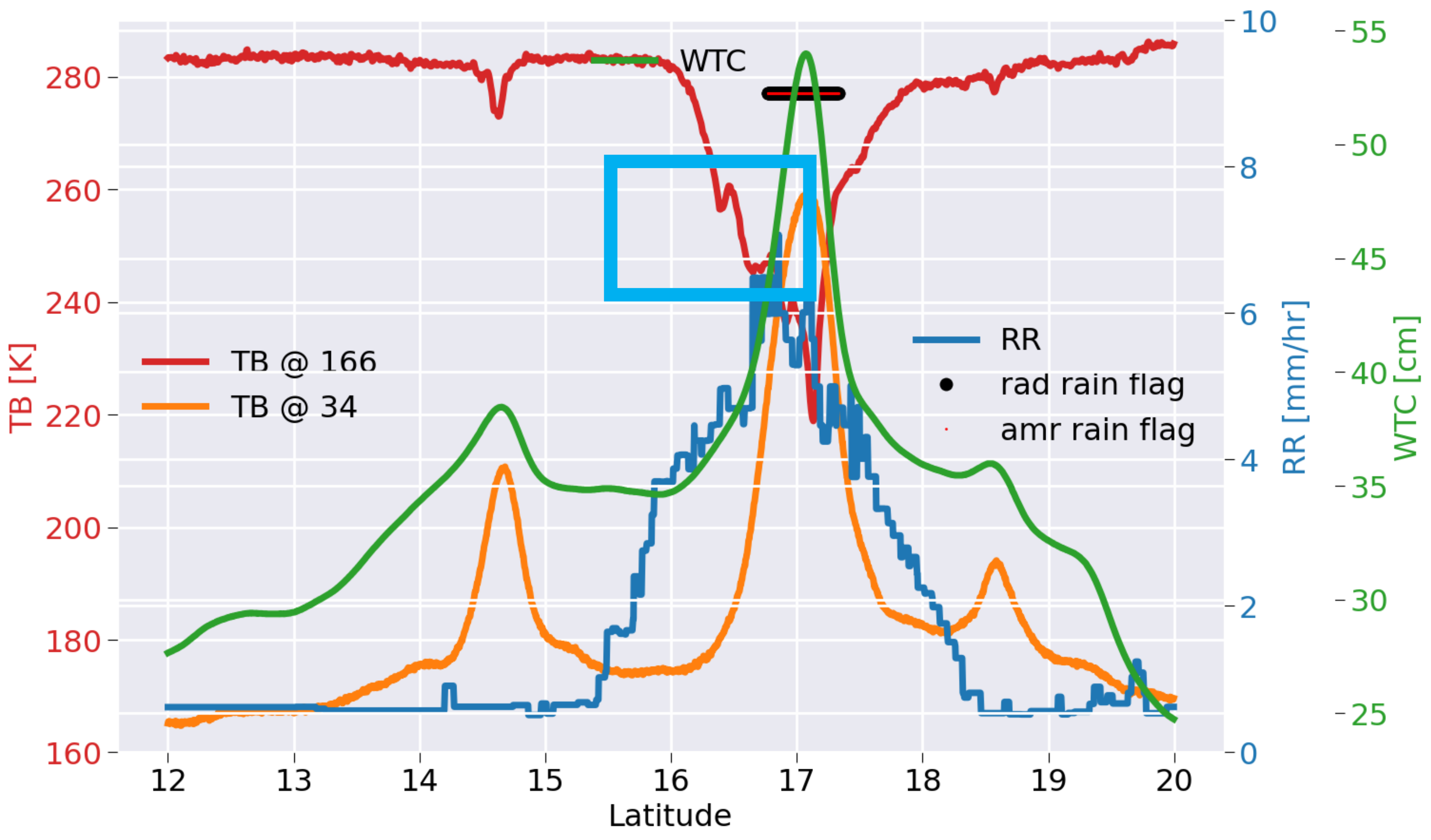
Unseen precipitation or small island ?



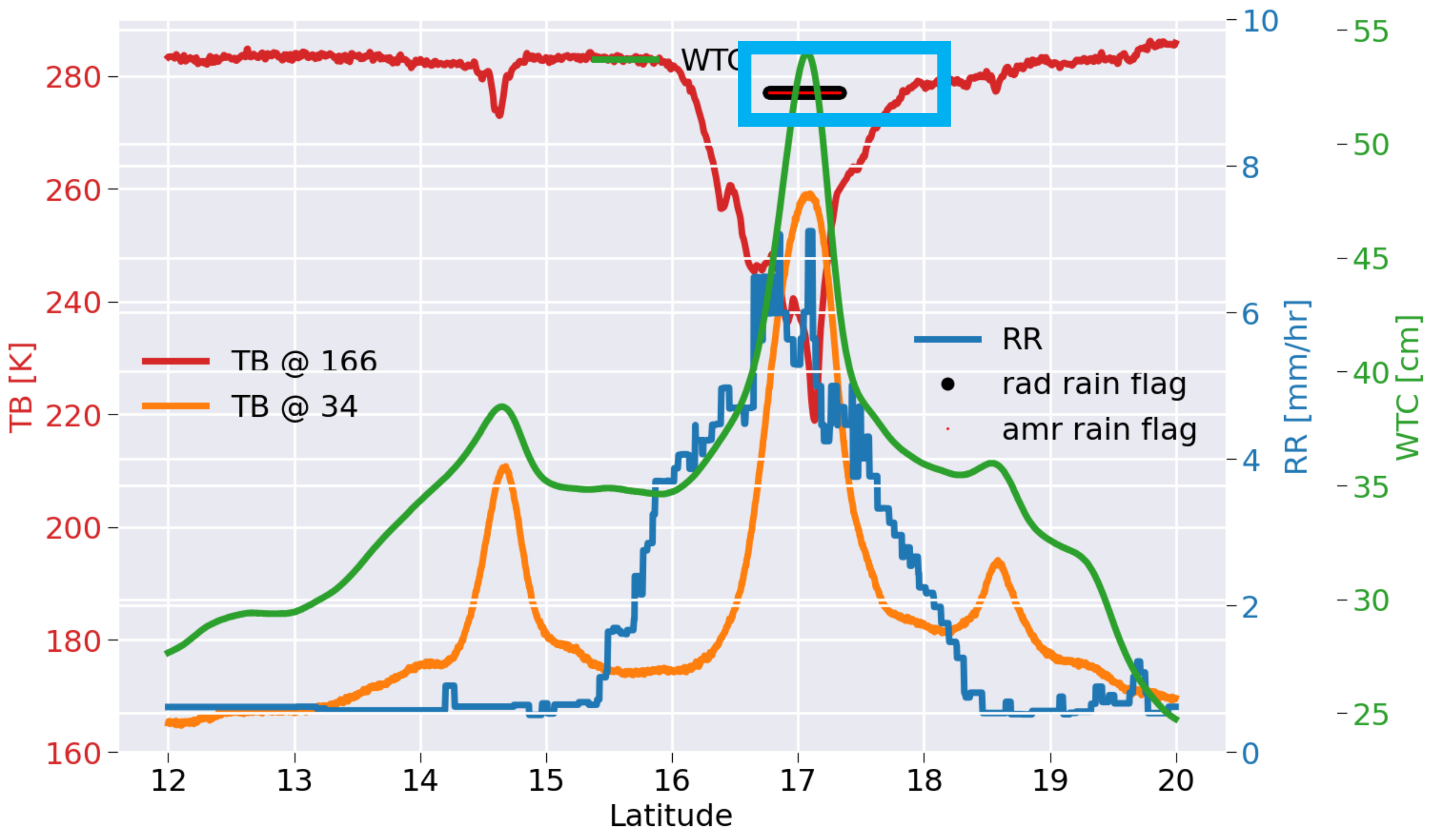
Water vapour or rain cell ?



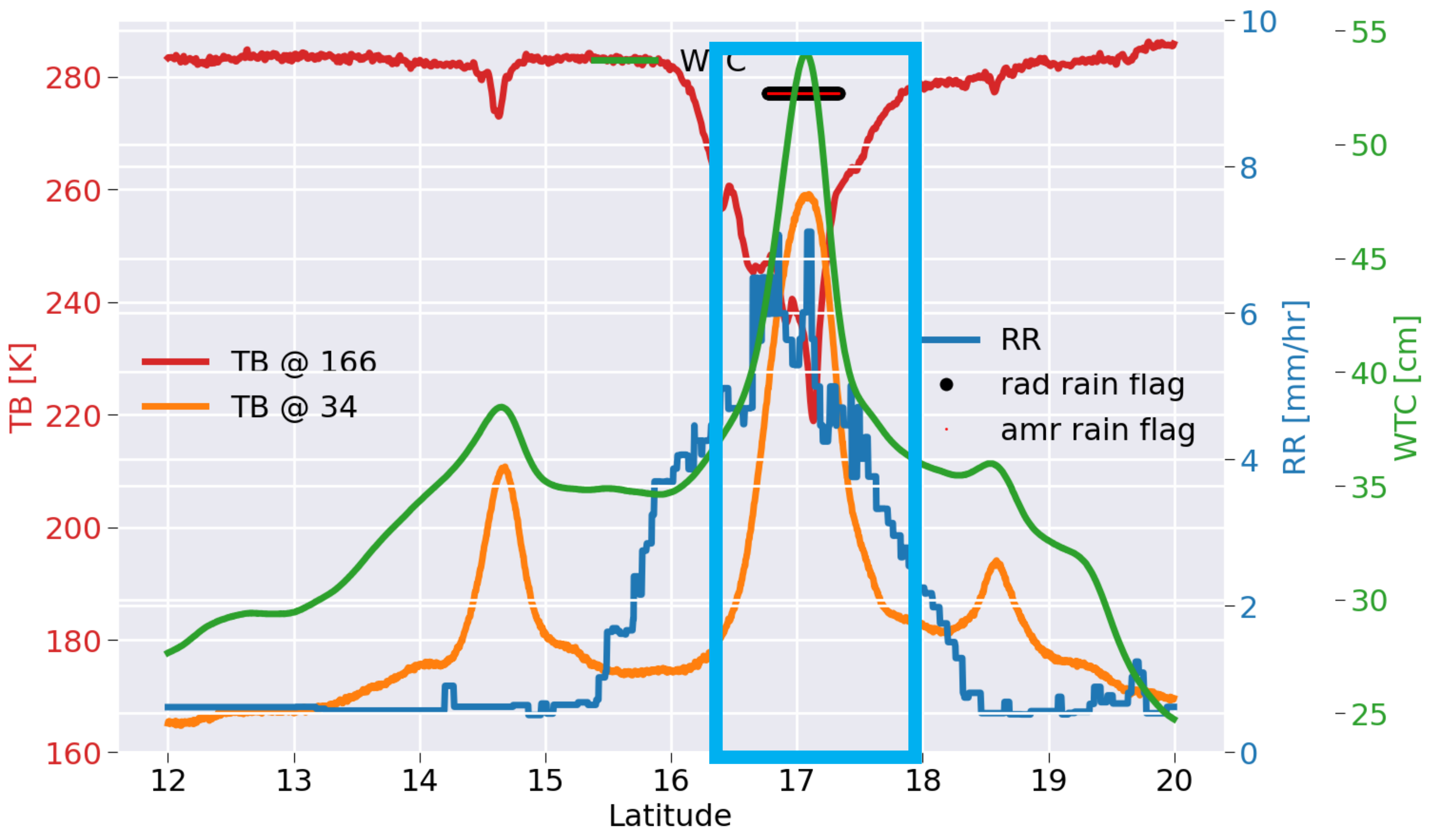
Small details

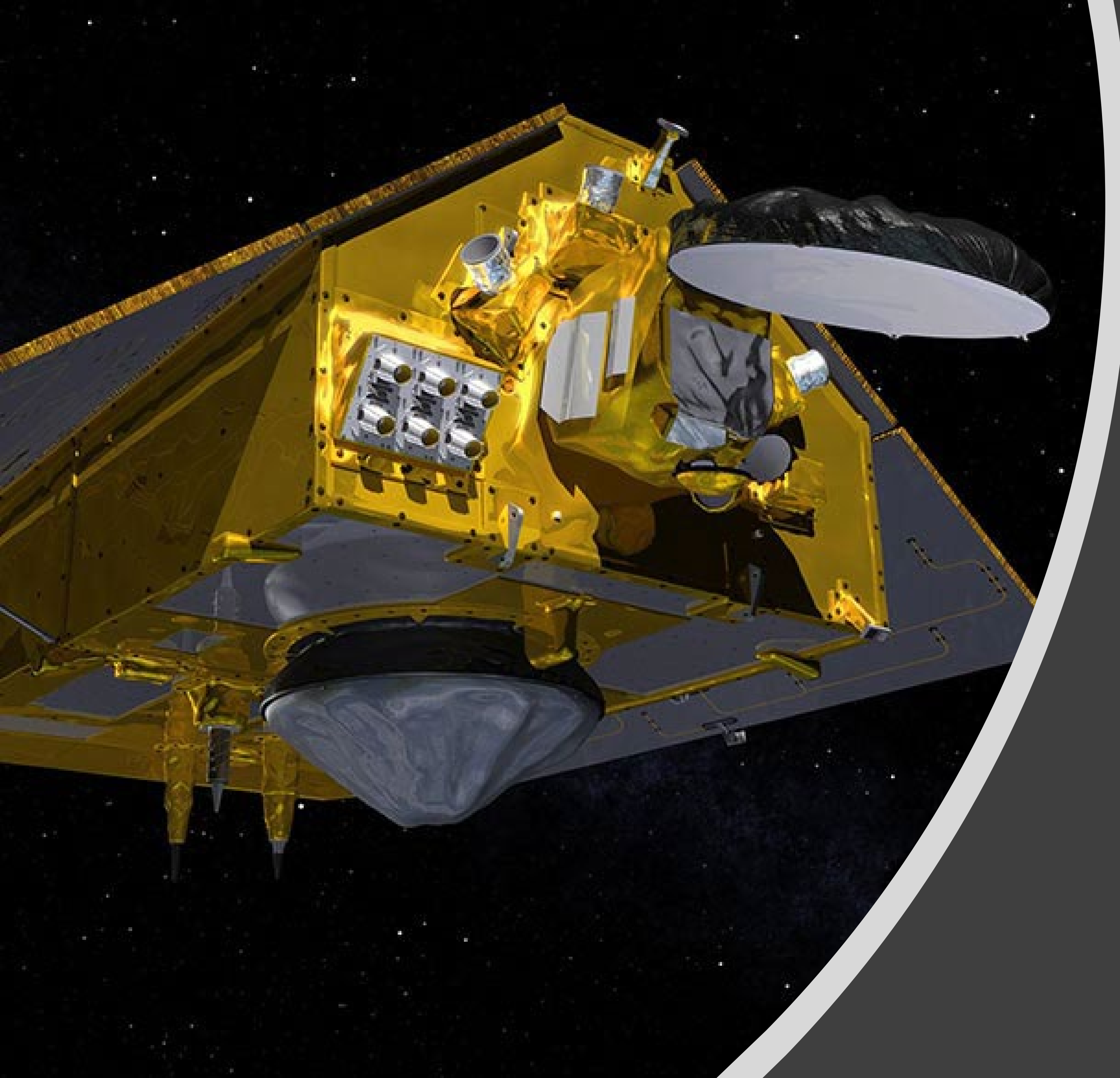


Potential tuning on rad rain flag



Is there independent information that could be used to provide a better WTC ?





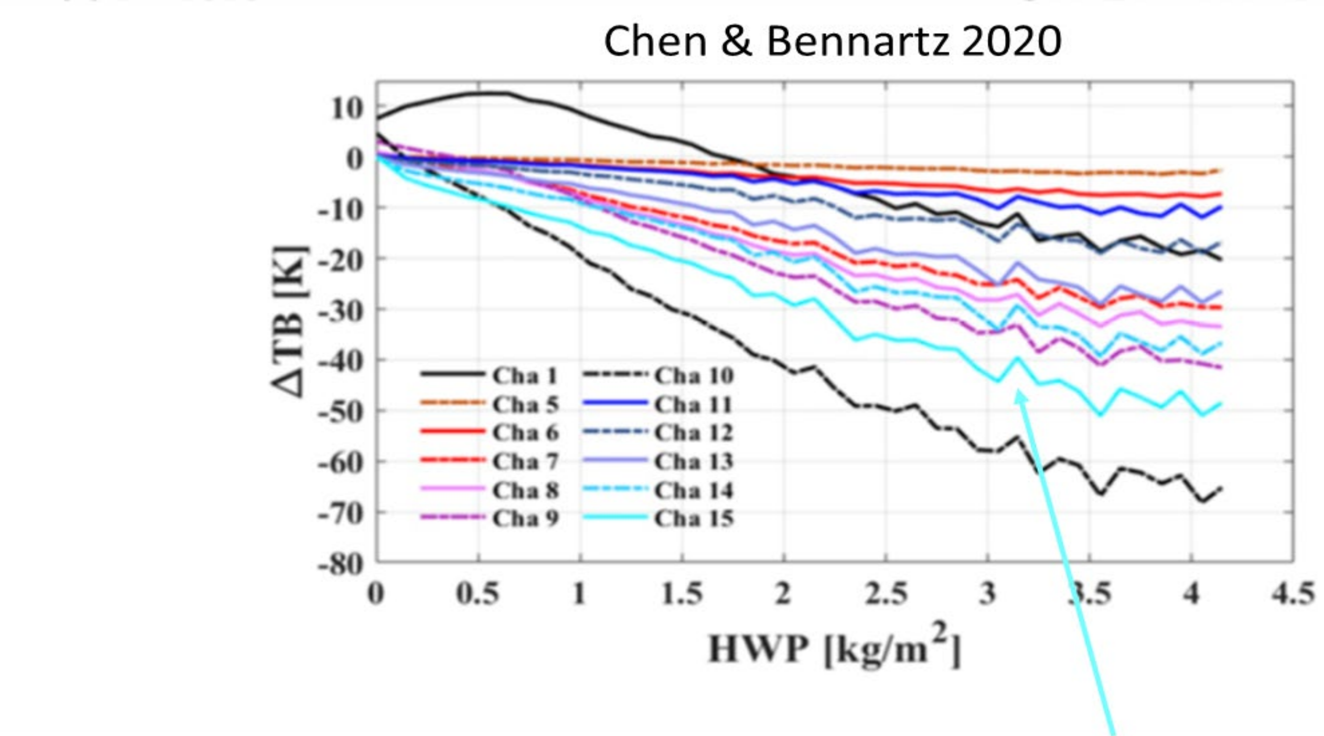
Toward an empirical approach that would include HRMR HF:

- simulation
- calibration
- learning

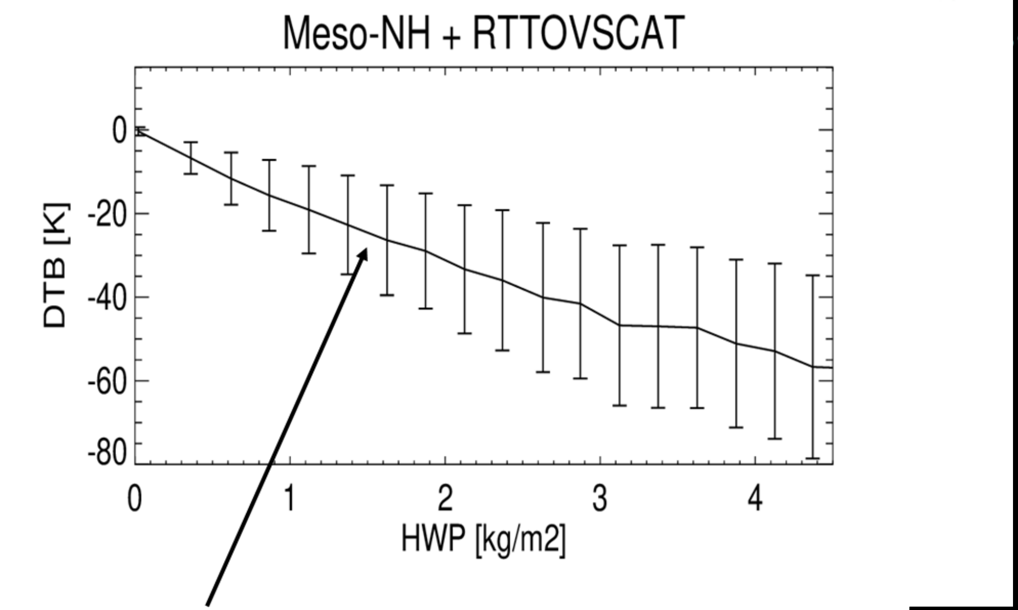
Simulations

RTTOV provides simulations (bottom) very close to observations (top) including the depression on the TB due to the scattering effect

(CNES study)



olid light blue



e right with **black** curve on the left

Calibration

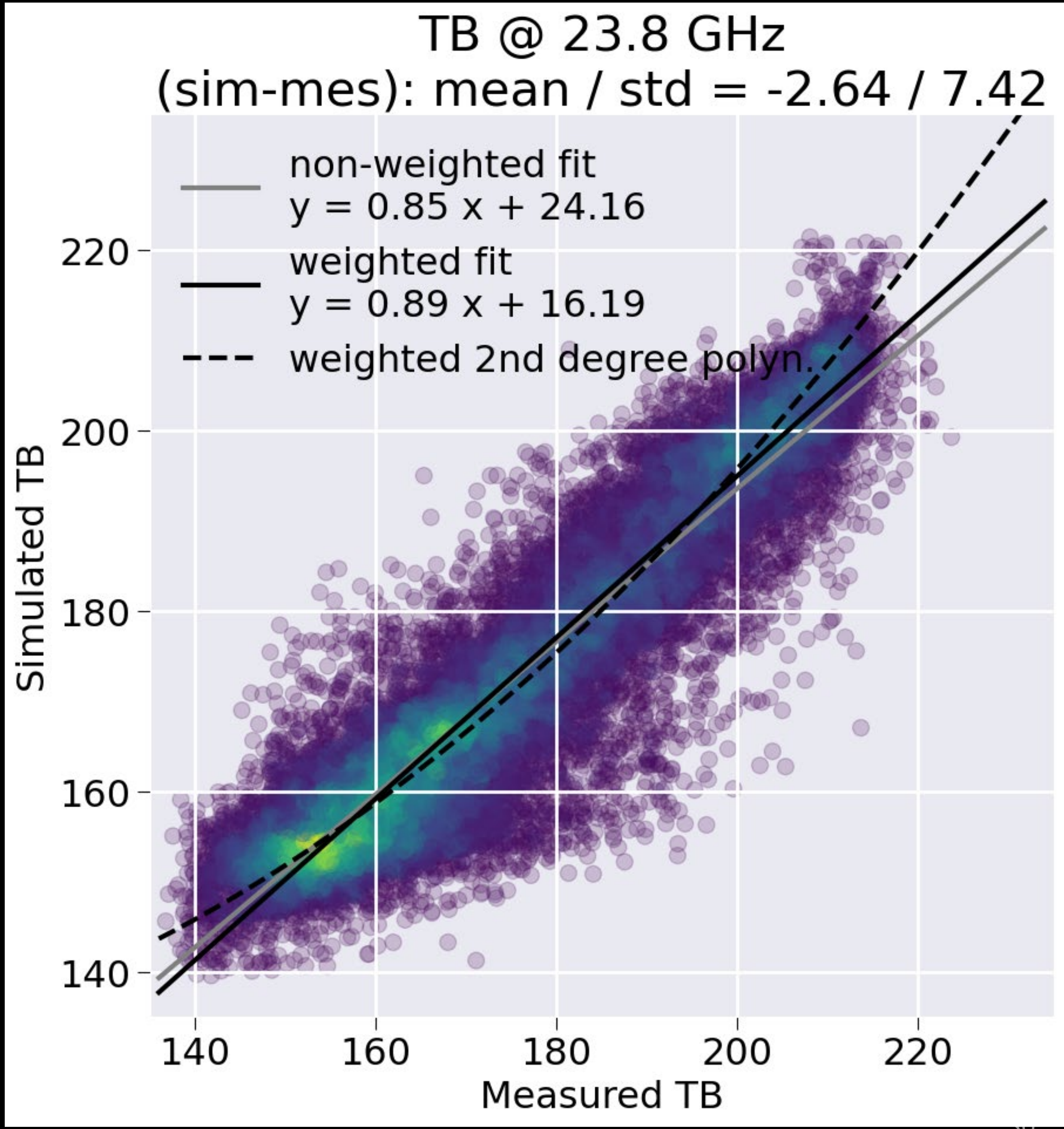
Comparison of

simulated TB based on ERA5 simulations

with

observations

nothing to report



Calibration

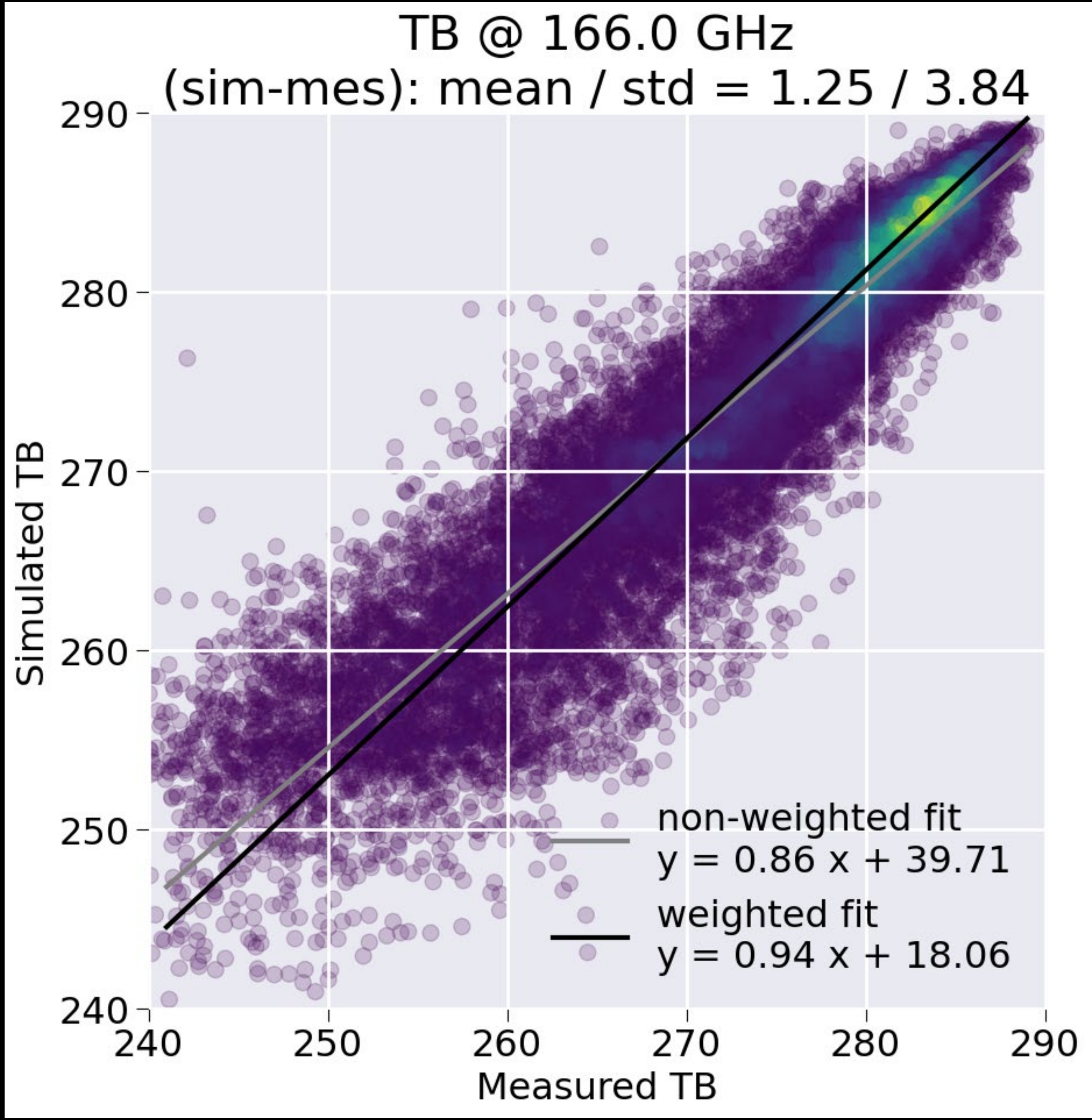
Comparison of

simulated TB based on ERA5 simulations

with

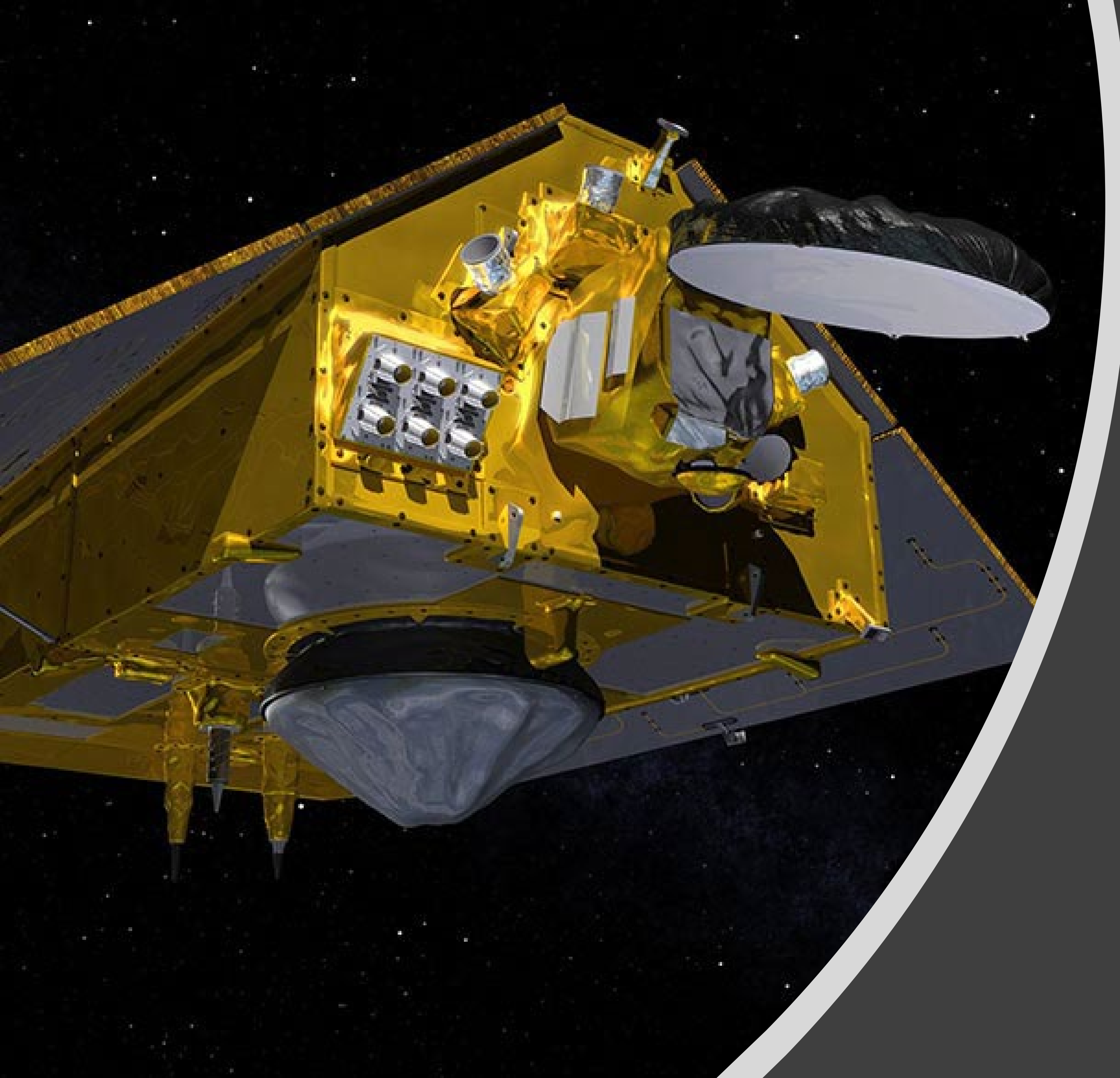
observations

nothing to report



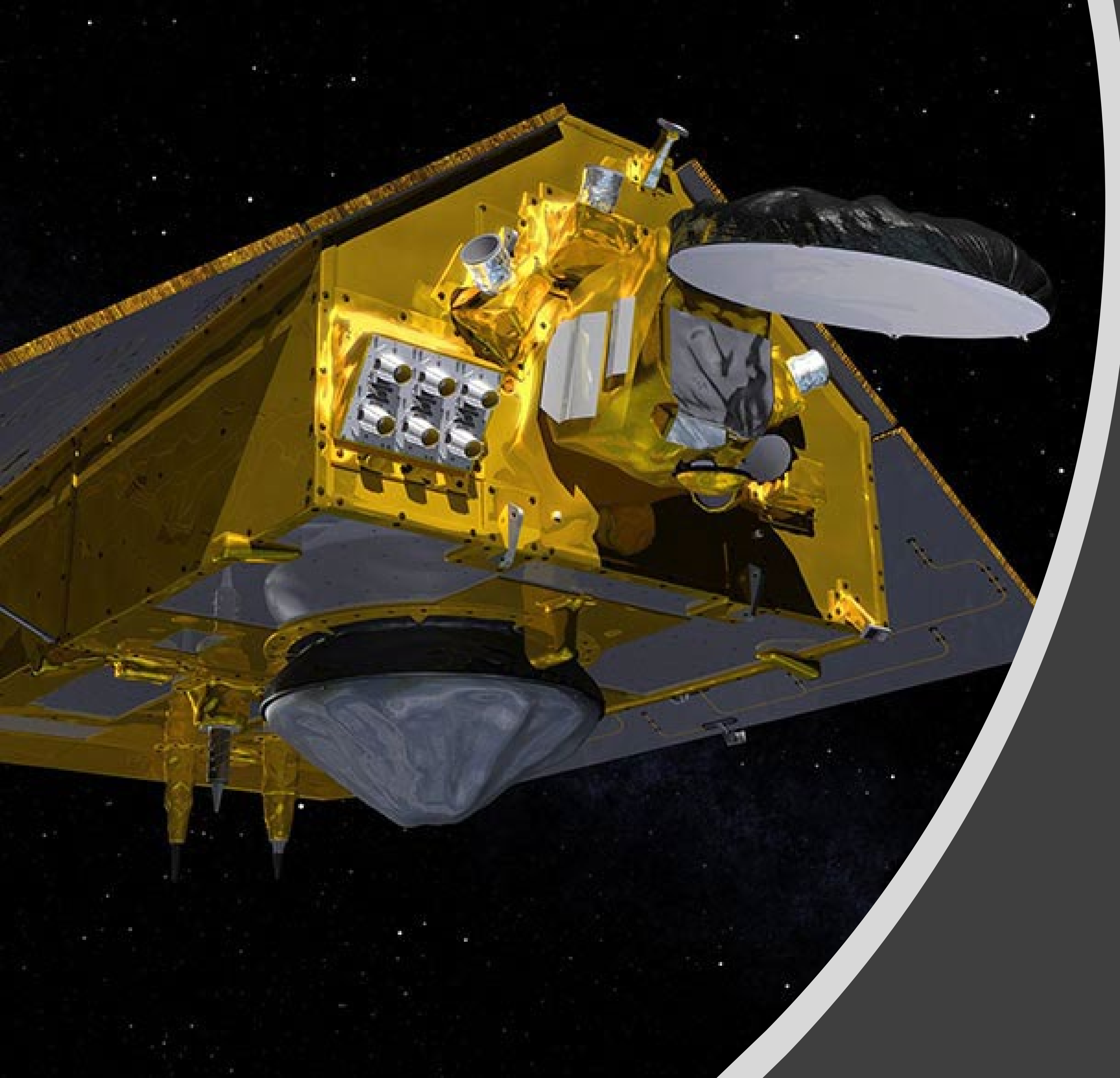
Learning

work in progress



Conclusion

- very first illustration of collocated HF TB in the context of an altimetry mission !

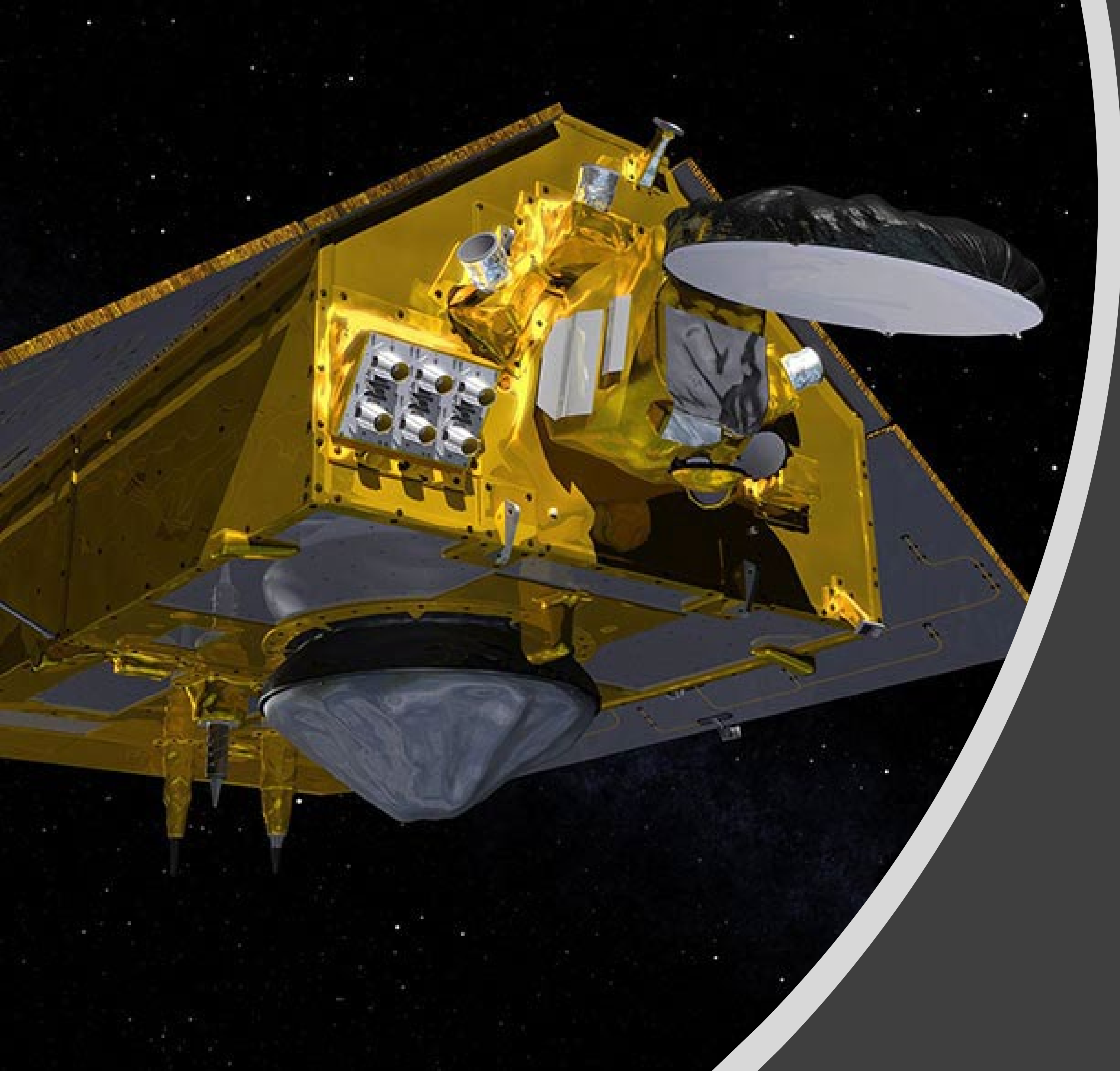


Conclusion

- Using collocated precipitation allows to better understand

- impact on WTC
- behaviour of LF wrt HF

- critical for the design of future L2 retrieval



Conclusion

- still a lot of work to do

but the combination of AMR-C and HRMR measurements is a unique opportunity to demonstrate the benefit of HF observations for future missions