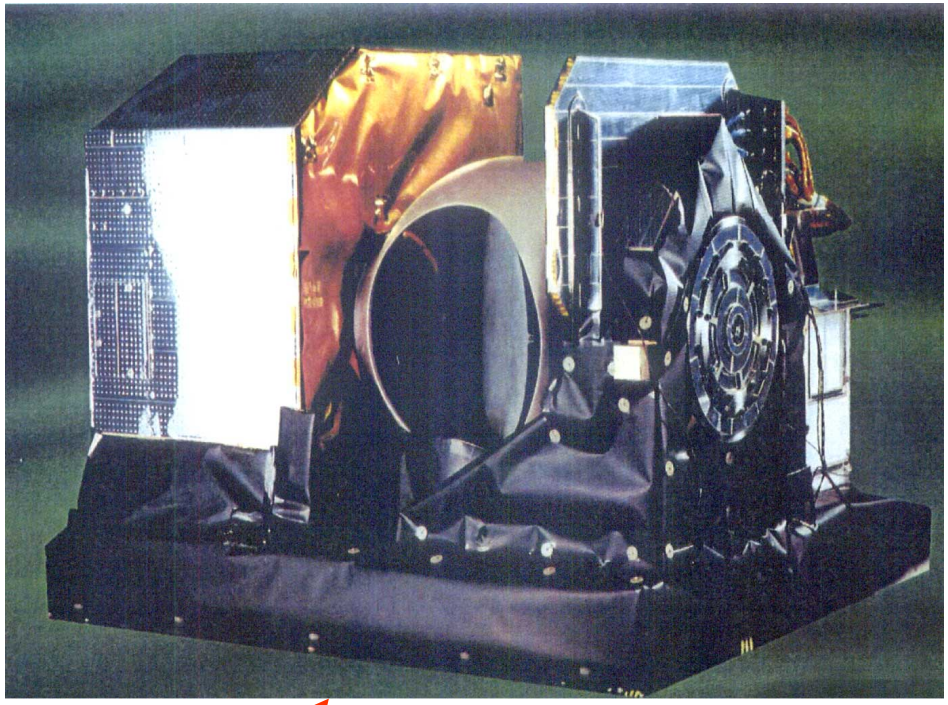
Mikrowellenradiometer AMSU-A, AMSU-B & MHS (alle Satelliten)



Pictures from eoportal.org; eumetsat.int

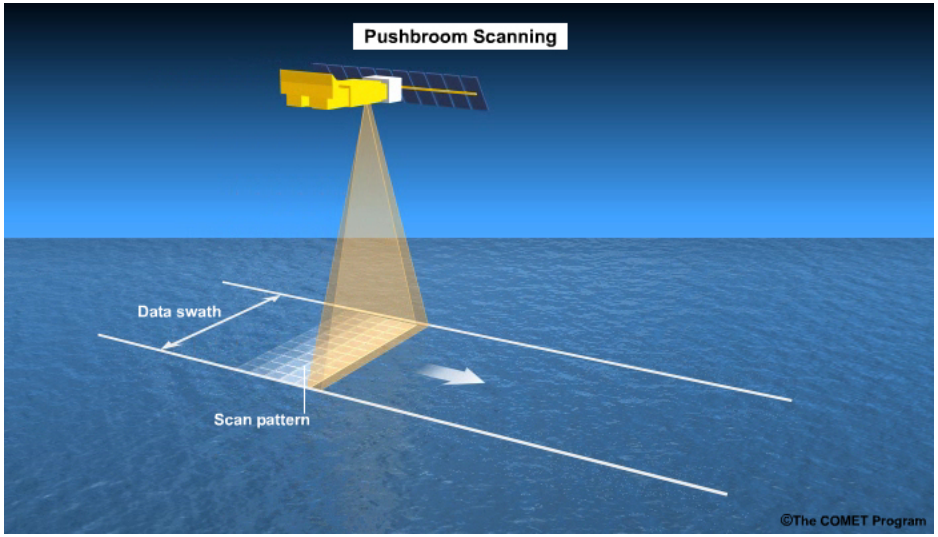
MHS instrument

Brought to you by:
Alex Bobryshev

Description (orbit, technical data, since when …

- Polar-orbiting, sun-synchronous satellites
- One satellite measures at every point on Earth two times per day, 12 hours apart;
- Passive remote sensing systems
- Data swath: 2343 km
- AMSU-A swath: 30 cells in 15 frequencies, ranging from 23.8 to 89.0 GHz. Cell size: 50 km. Operational since 1998;
- AMSU-B and MHS 90 cells in 5 frequencies, ranging from 89.0 to 183.3 GHz. Cell size 16 km. Operational since: AMSU-B 1998 MHS since 2005 (direct replacement of AMSU-B);

Measurement technique. Swath and cell



Figures from www.meted.ucar.edu

Measurement (Level 1 data)

- The AMSU level 1 product is Brightness temperature T_B
- AMSU-A – 15 channels. Main feature – O_2 line with center at 60 GHz. Purpose – All-weather temperature profiles;
- AMSU-B & MHS – 5 channels. Main feature – H_2O line with center at 183.31 GHz Purpose – all-weather humidity profiles;

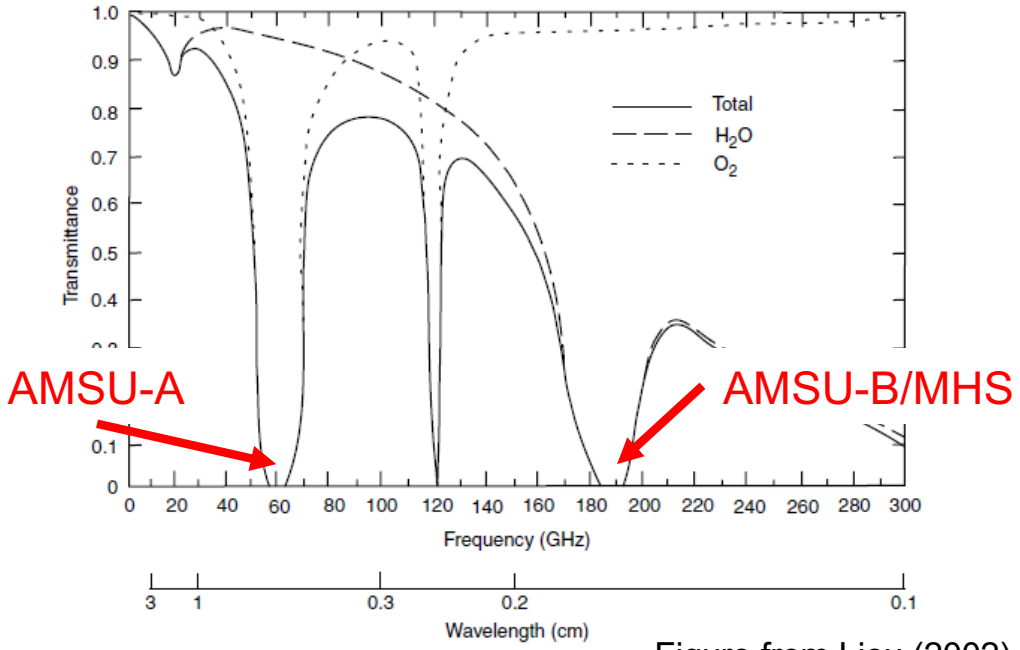
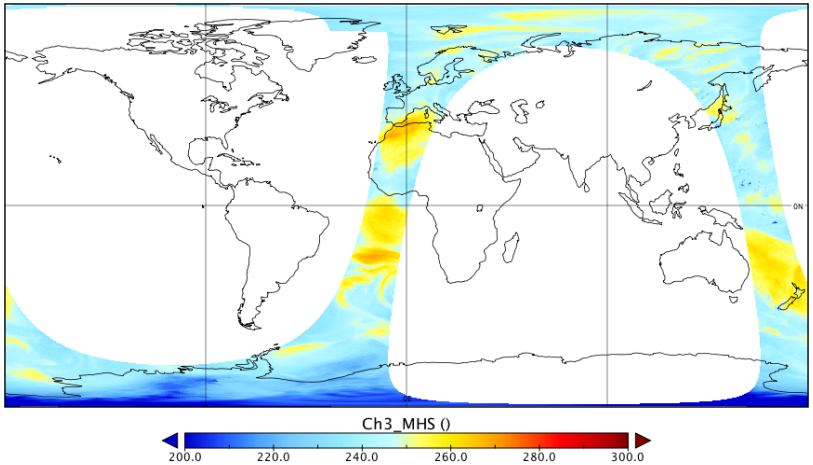
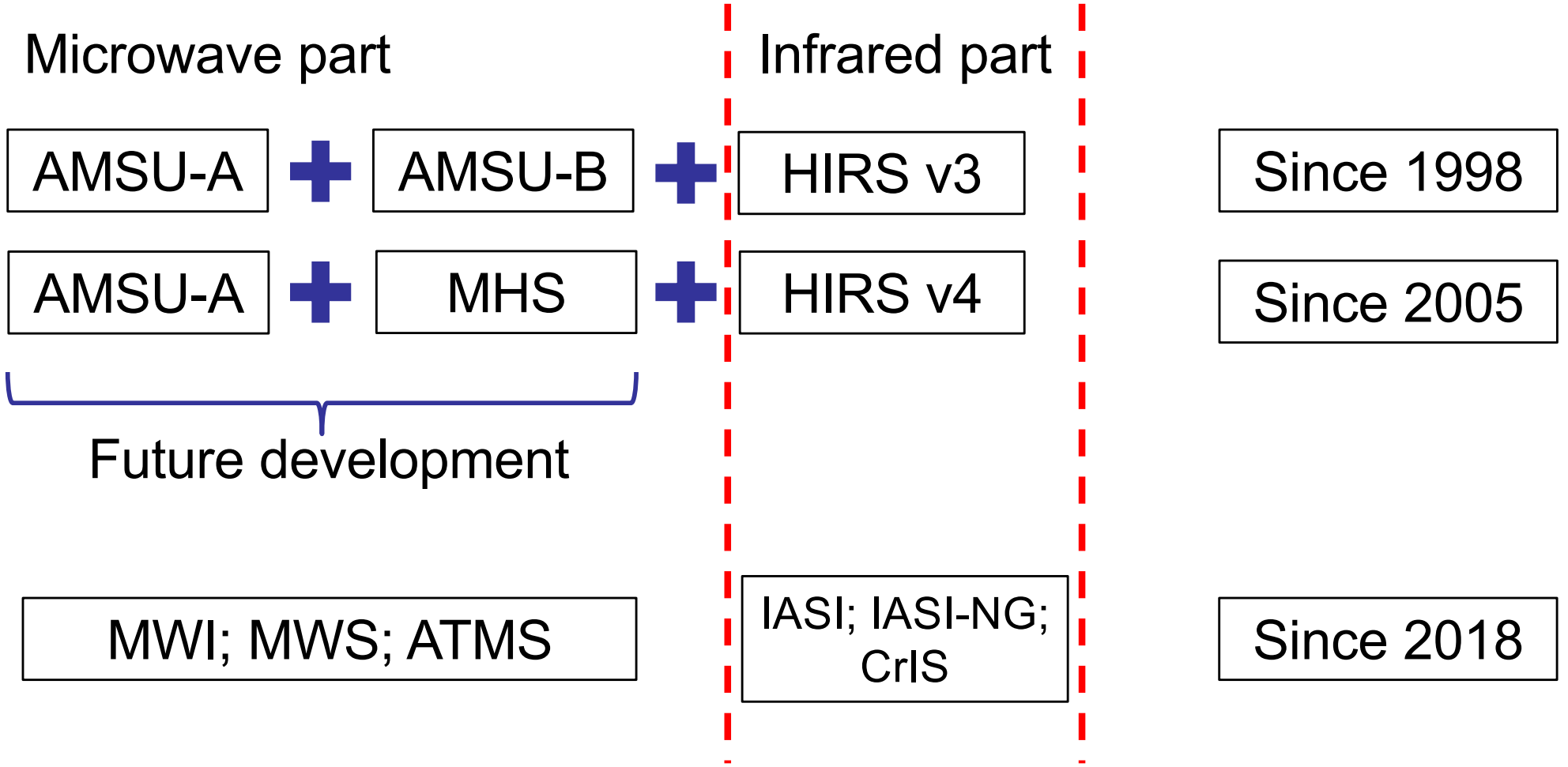


Figure from Liou (2002)



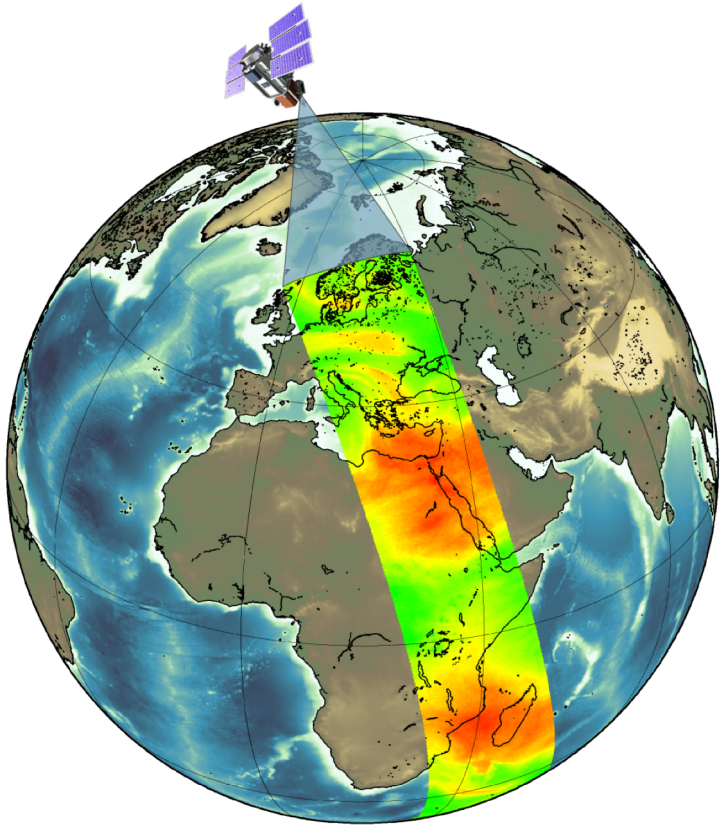
Example of MHS data

End products: All-sky retrievals of temperature and humidity profiles



AMSU-B (heutzutage MHS)

- Cross-track scanner
- 90 pixels per scan line
- Outermost pixels 49° off-nadir
- Swath with ≈ 2300 km
- Global coverage twice daily
- 16 km horizontal resolution (at nadir)



MHS (ähnlich dem alten AMSU-B)

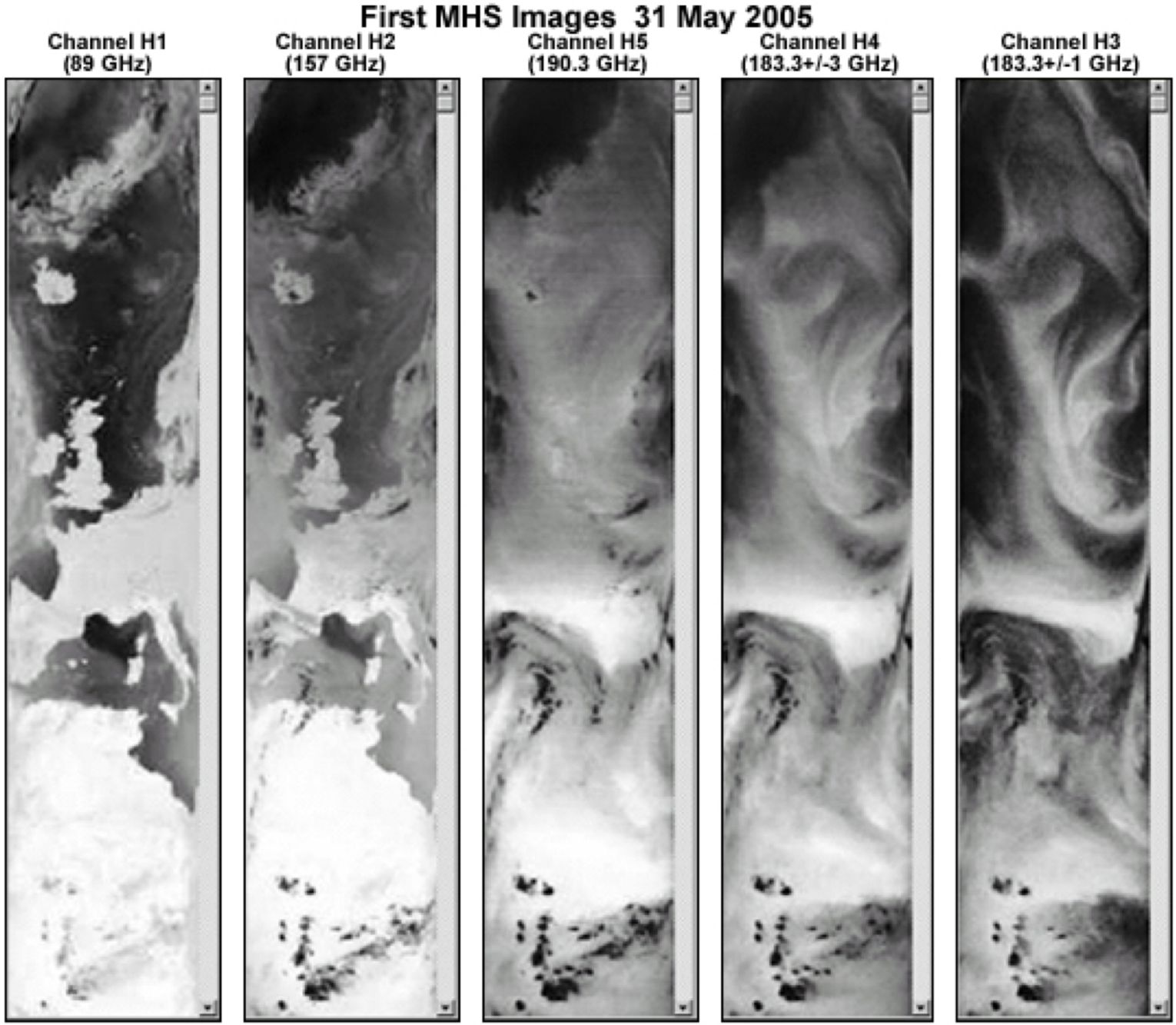
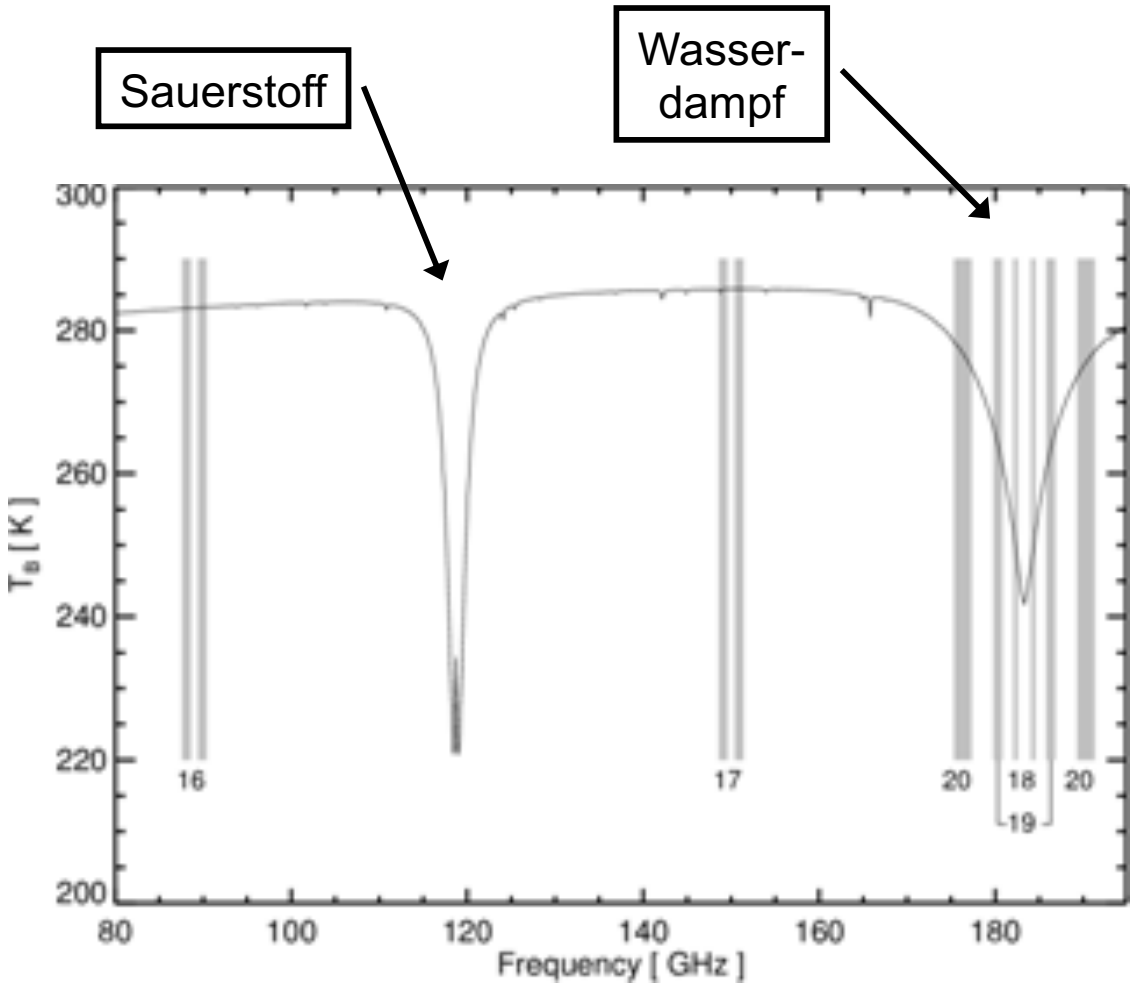


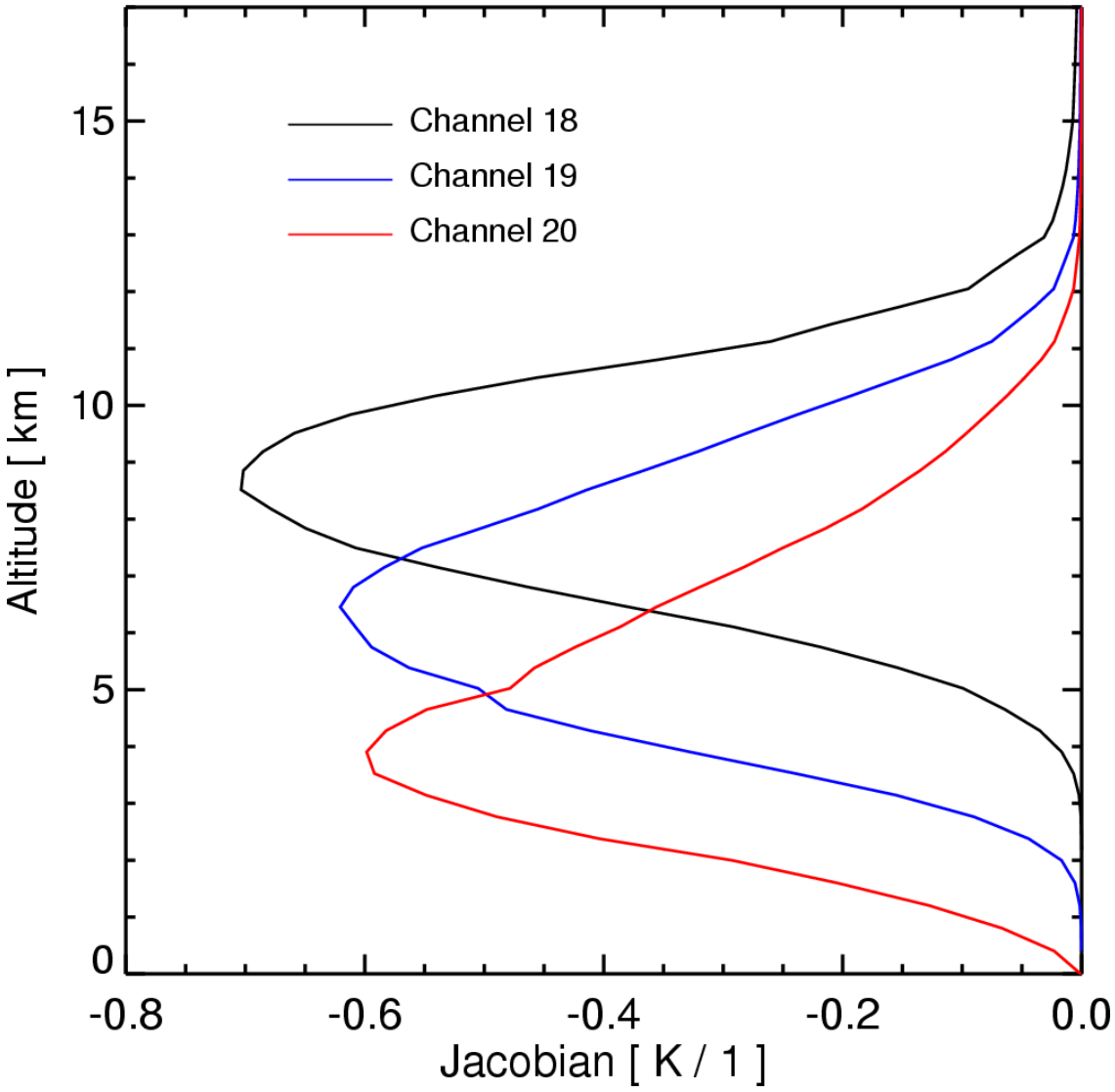
Bild: EUMETSAT (http://www.eumetsat.int/eps_webcast/eps/print.htm)

AMSU-B Helligkeitstemperatur

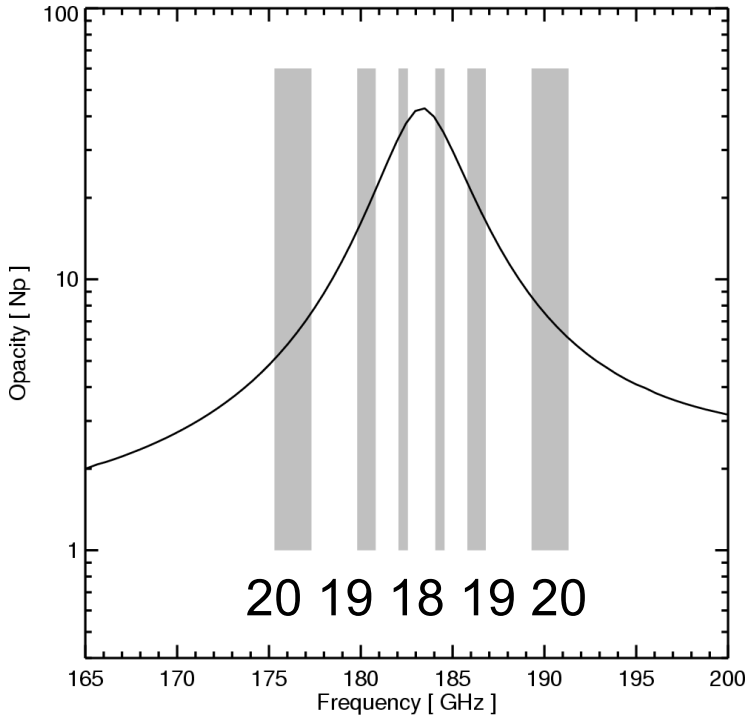


- 16+17: Oberfläche
- 18: Obere Troposphäre (p<500 hPa)
- 19: Mittlere Troposphäre
- 20: Untere Troposphäre

AMSU-B Jacobians



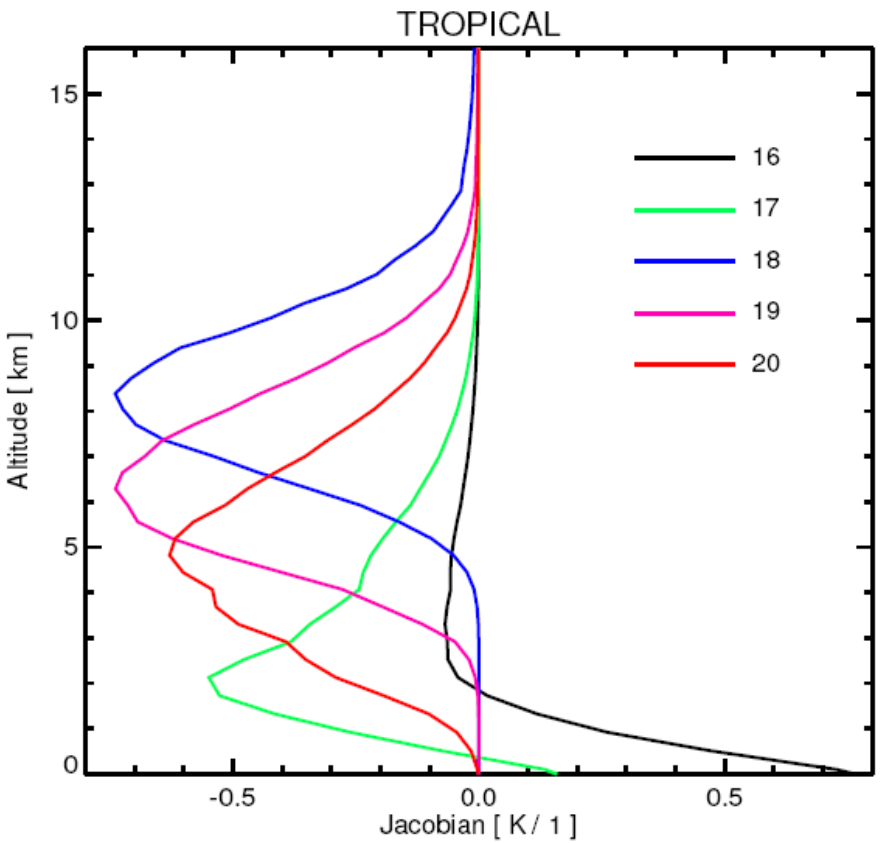
(Figure by Viju O. John)

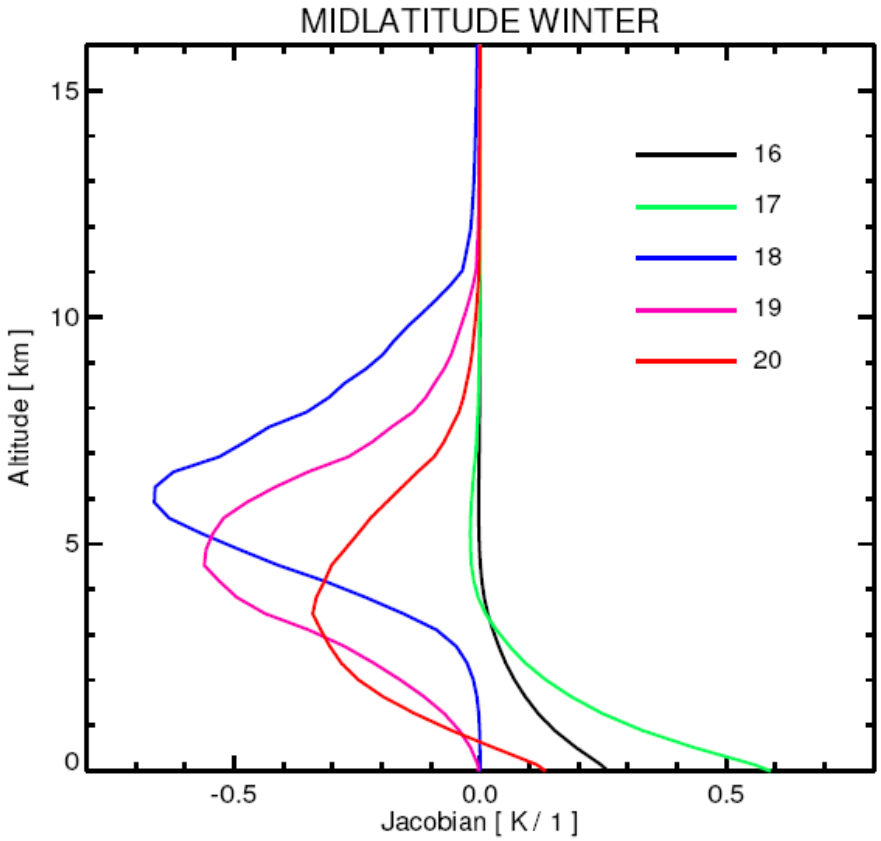


ARTS Simulation,
Atmosphere:
Midlatitude-Summer

Jacobian = Change in measurement for change in humidity

Jacobians depend on Atmospheric State

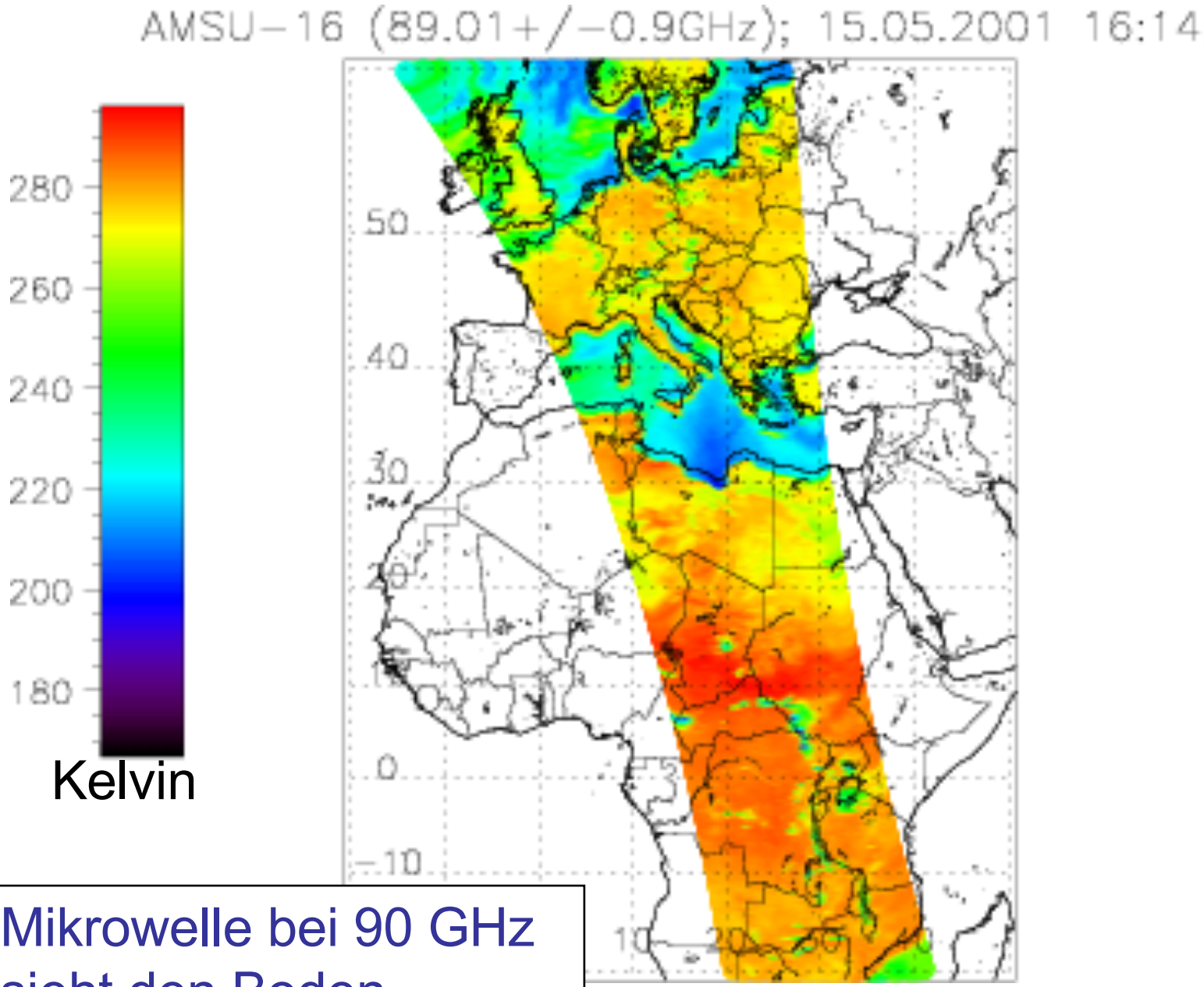


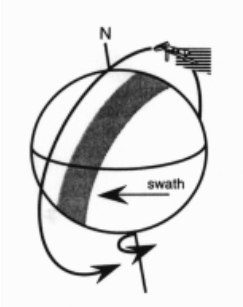


(Figures by Viju O. John)

- Bei trockener Atmosphäre sehen mehr Kanäle den Boden

AMSU 16



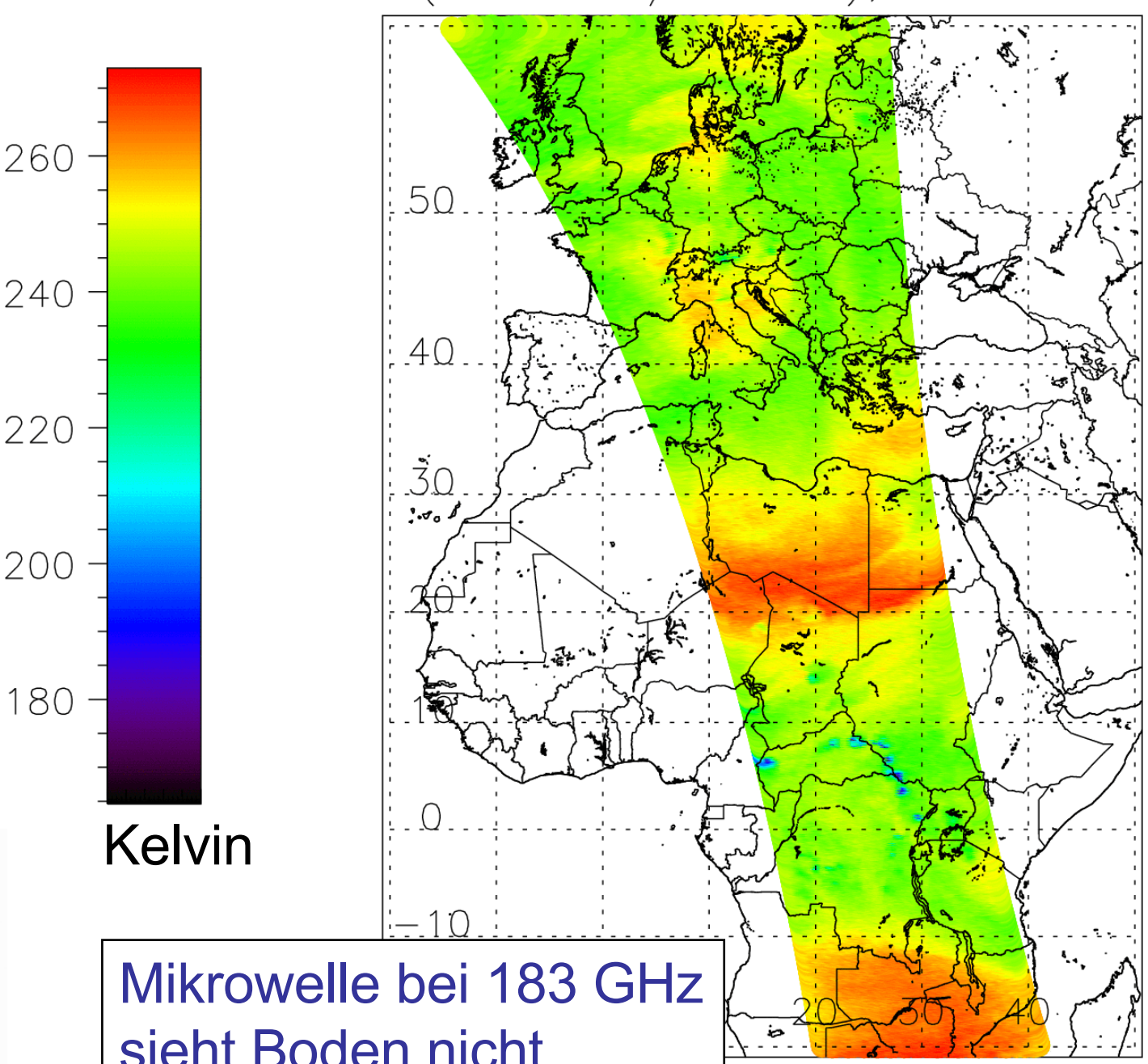


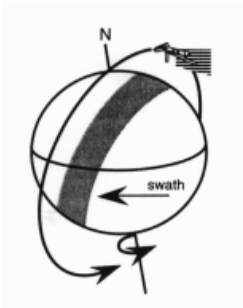
Mikrowelle bei 90 GHz sieht den Boden

Bild von Mashrab Kuvatov

AMSU

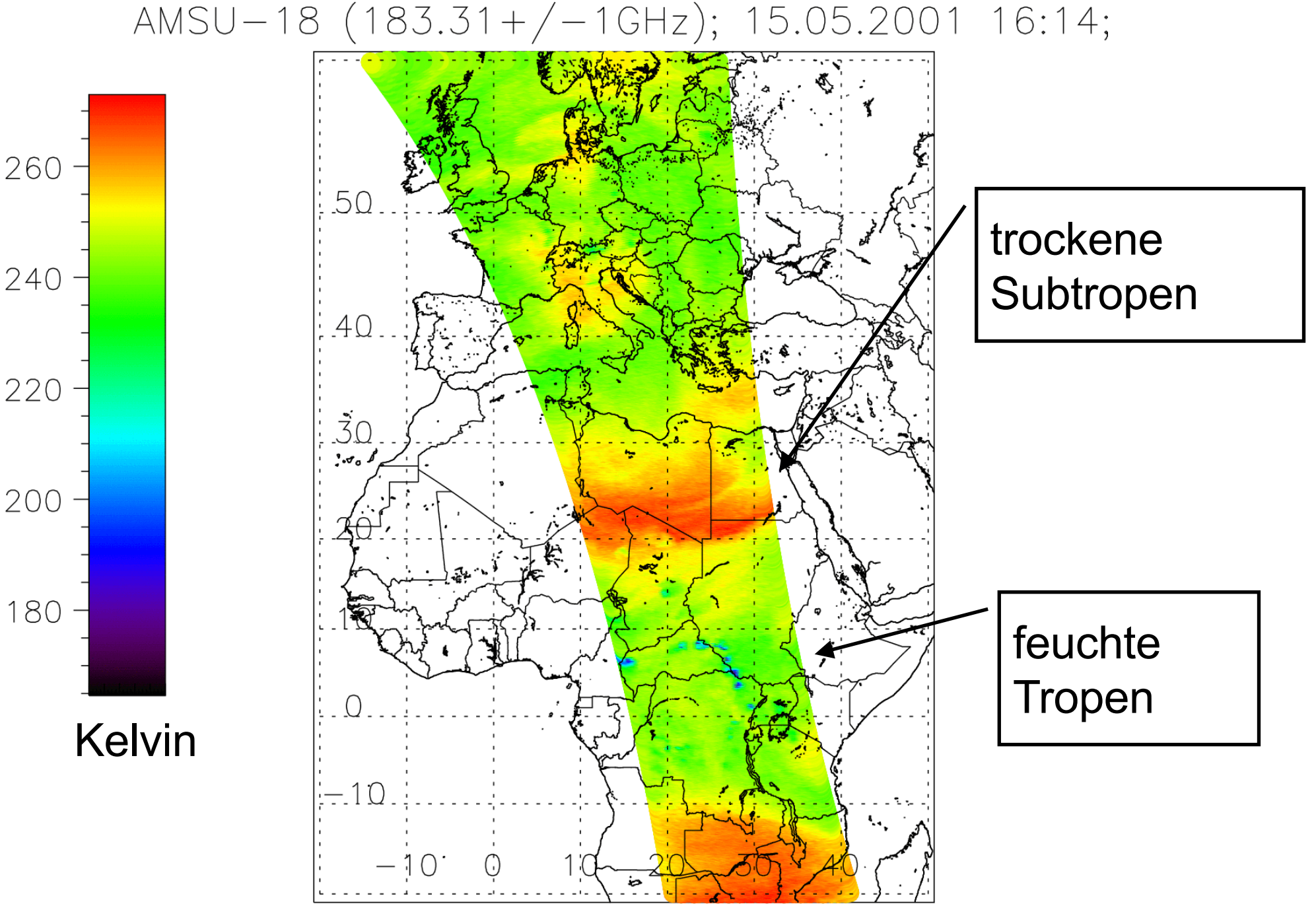
18

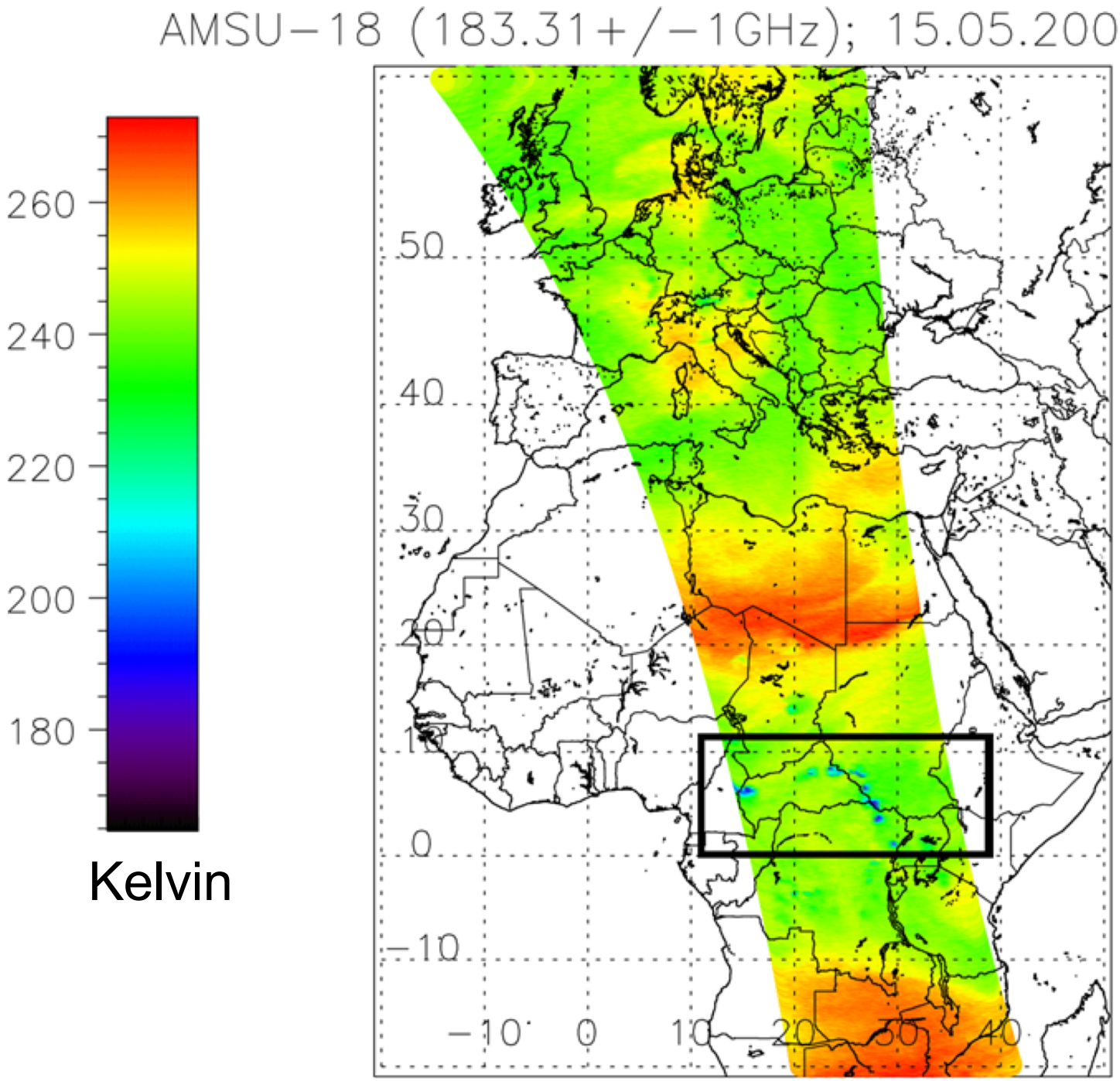




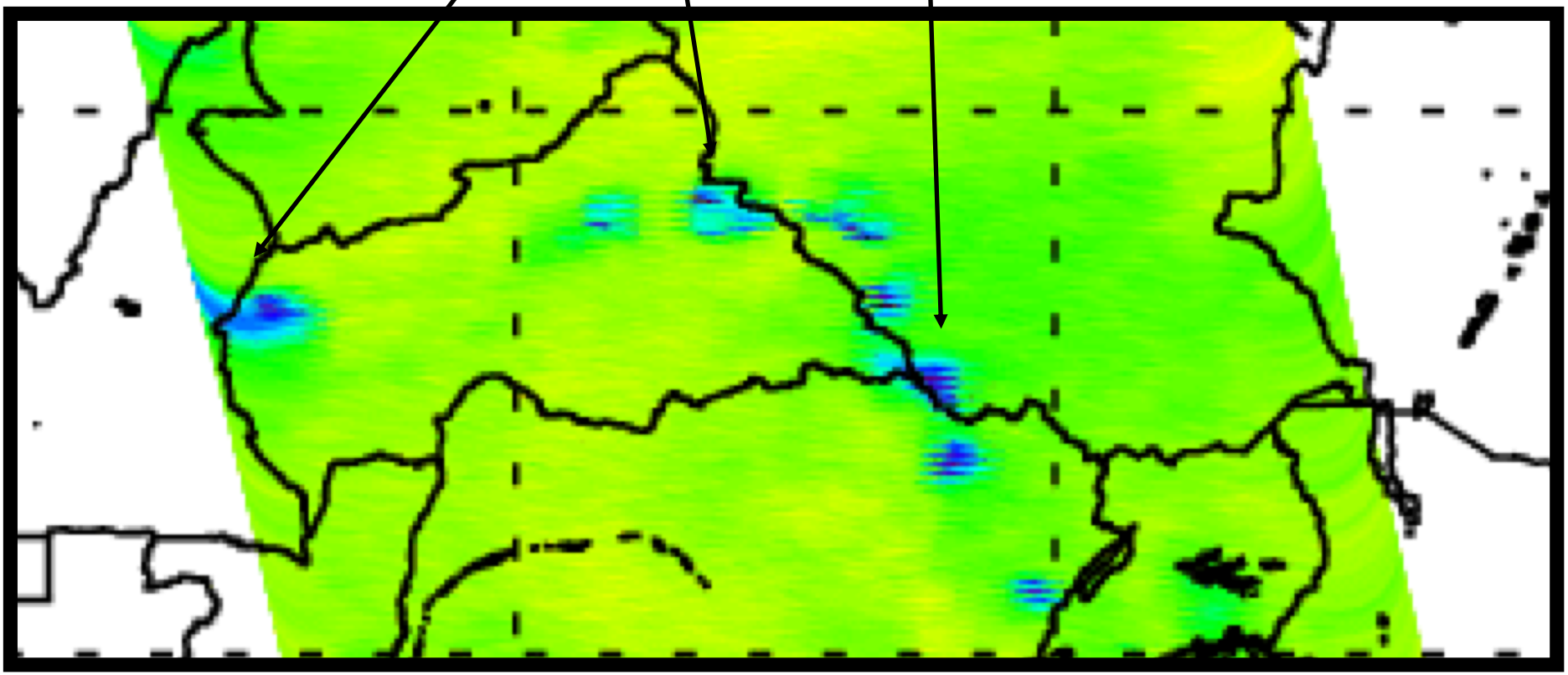
Mikrowelle bei 183 GHz sieht Boden nicht

Bild von Mashrab Kuvatov

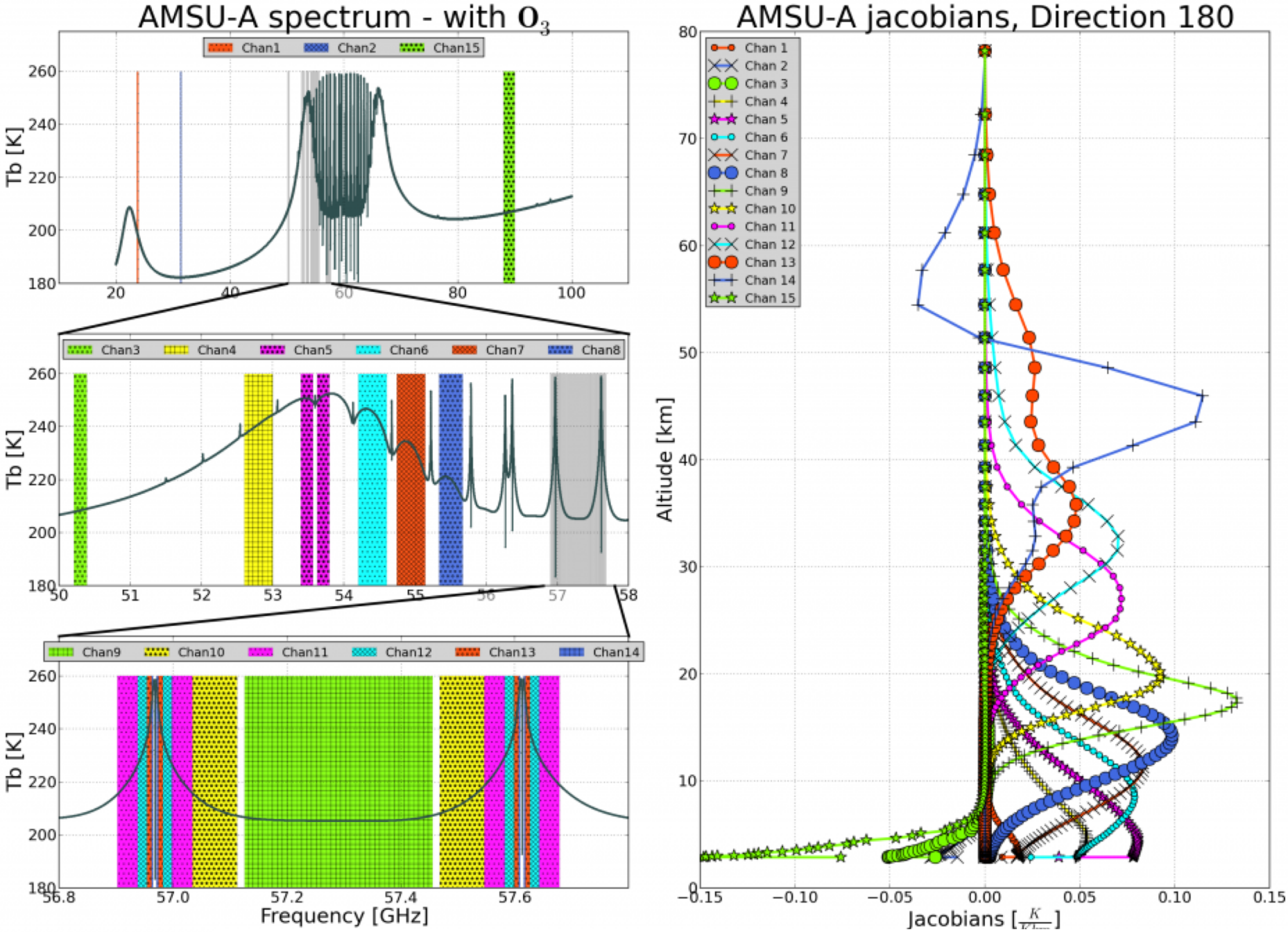

AMSU−18 (183.31+/−1GHz); 15.05.2001 16:14;
260
240
220
200
180
Kelvin
50
40
30
20
10
0
−10
−10
0
10
20
30
40
trockene Subtropen
feuchte Tropen


AMSU−18 (183.31+/−1GHz); 15.05.2001 16:14;
260
240
220
200
180
Kelvin
50
40
30
20
10
0
−10
−10
0
10
20
30
40

Eiswolken



AMSU-A



Stefan Bühler

Isoz, O., S. A. Buehler, and P. Eriksson (2015), **Intercalibration Of Microwave Temperature Sounders Using Radio Occultation Measurements**, *J. Geophys. Res.*, ***120***, doi:10.1002/2014JD022699.

Satellite of the day: Megha – Tropiques

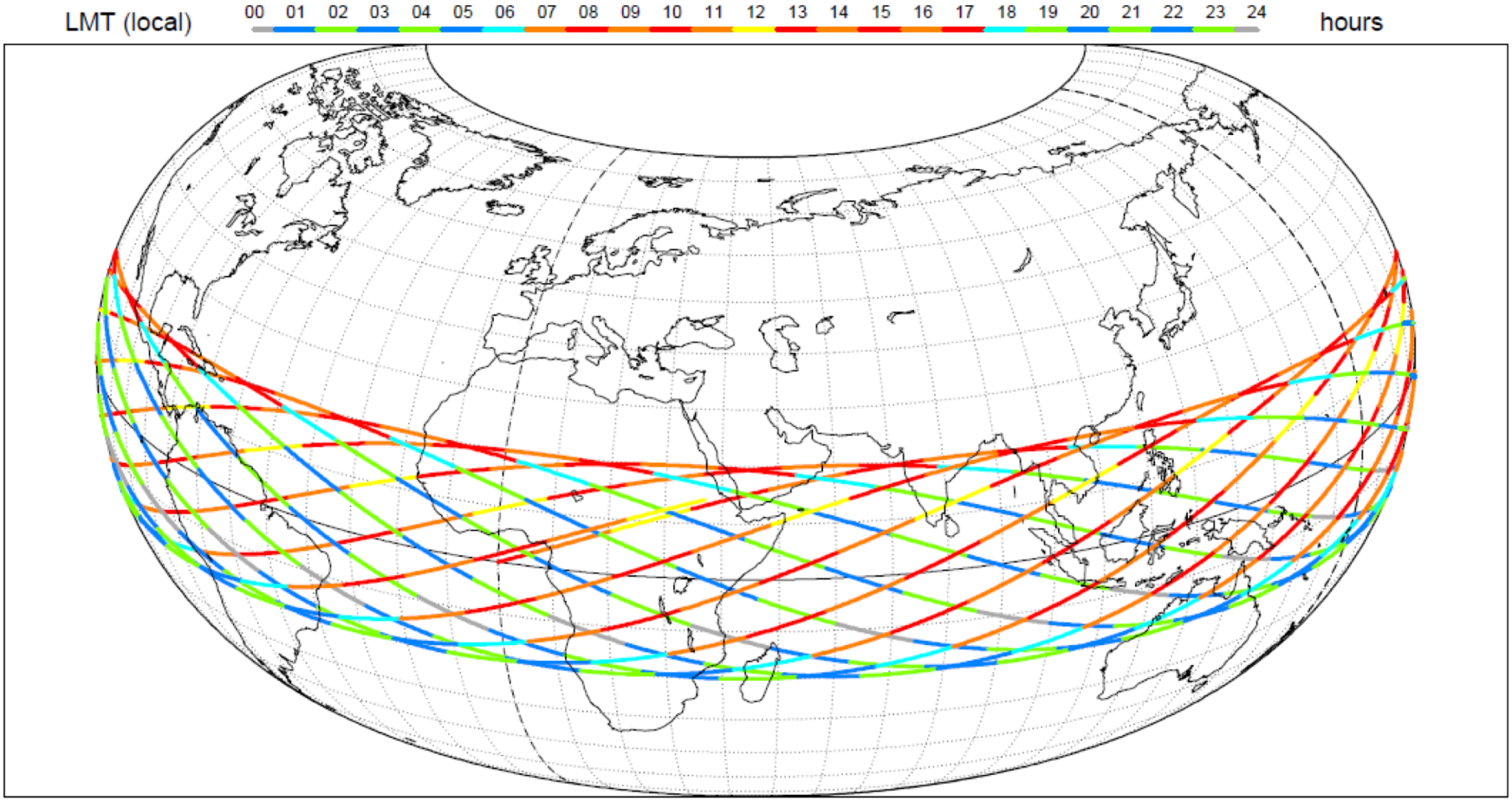
brought to you by Marc Prange

Megha – Tropiques: Mission und Umsetzung

- Im Orbit seit Oktober 2011
- Ziel der Mission: Verlässliche Statistik zu Wasser- und Energiehaushalt in den Tropen.
  - Dazu: 1. Spezieller Orbit zwischen 30° N/S
    2. Wahl der Messinstrumente an Bord
  - Drei sich ergänzende Instrumente an Bord:
    - SAPHIR: „Sounder for Atmospheric Profiling of Humidity in the Intertropical Regions“
    - MADRAS: „Microwave Analysis and Detection of Rain and Atmospheric Systems“ (Technischer Defekt seit Januar 2013)
    - ScaRaB: „Scanner for Radiation Budget“

Megha-Tropiques
Orbit - Ground track

Altitude = 865.5 km a = 7243.678 km
Inclination = 20.00 °
Recurrence = [14; -1; 7] 97 Period = 101.93 min * rev/day =14.13
>>>> Time span shown: 1440.0 min = 1.00 day Equat. orbital shift = 2892.0 km (26.0 °)



Projection: Raisz Armadillo M.C.: 0.0 ° ; 46.0 °E / 28.1 ° N; 46.0 °E Asc. node: 0.00 ° [10:00 LMT]
Property: none Aspect: Direct App. inclin. = 21.52 °
⊕ T.:(various) - Graticule: 10° {4.2} [+90.0/ +0.0/-136.0] [-] GEM-T2

Ιξιων MC ★ LMD Ατλας

Quelle: M. Capderou, Megha-Tropiques Technical Memorandum, 2009

Megha – Tropiques: Instrumente

SAPHIR

Messfrequenz [GHz]	Atmosphärische Schicht [hPa]
183,31 ± 0,2	100 – 200
183,31 ± 1,1	250 – 350
183,31 ± 2,8	400 – 600
183,31 ± 4,2	650 – 700
183,31 ± 6,8	750 – 800
183,31 ± 11	850 – 950

ScaRaB

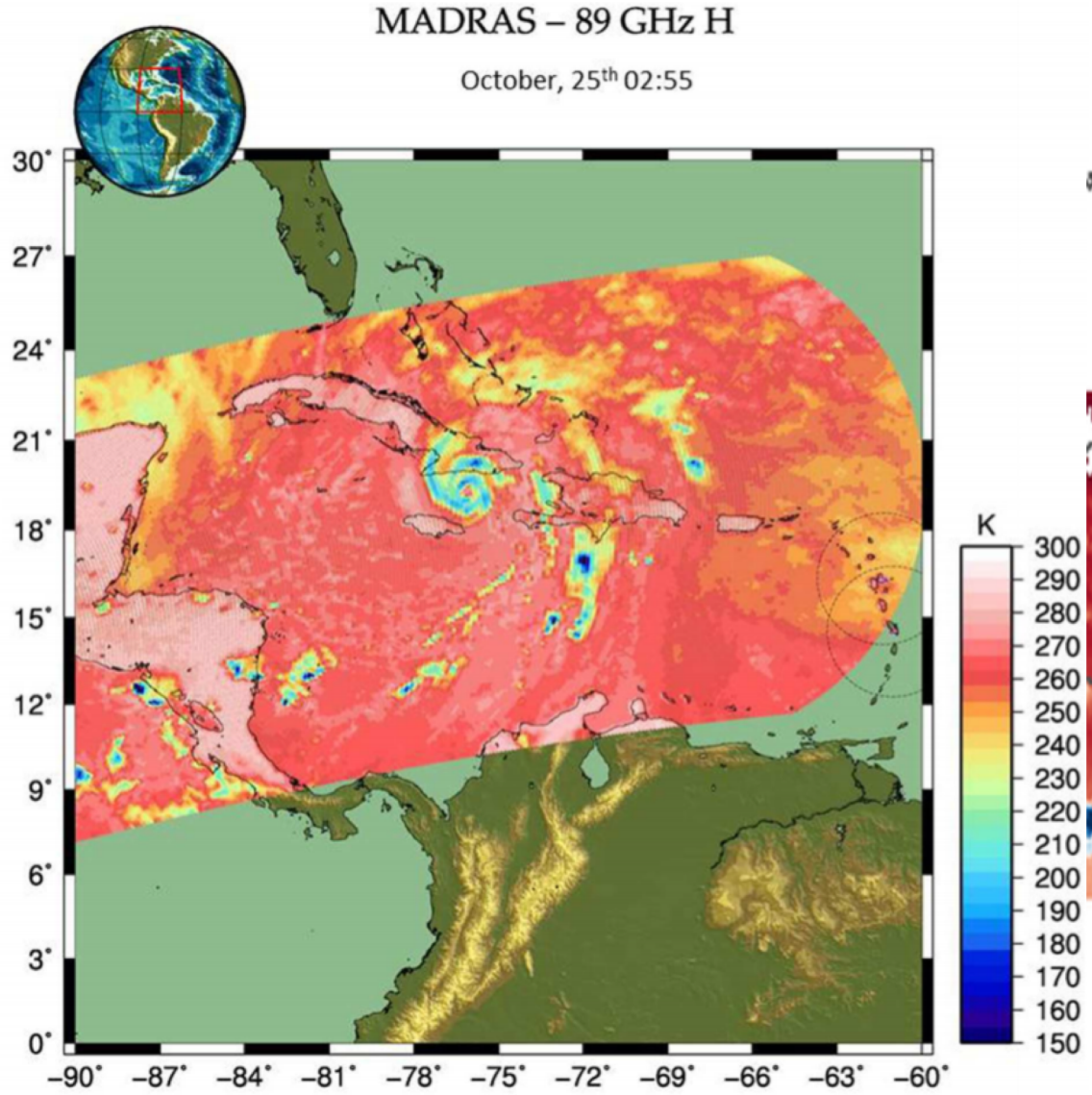
Bandweite [µm]	Messgröße
0,55 – 0,65	Sichtbar: Szenen-Identifizierung
0,2 – 4	Solarstrahlung
0,2 – 100	Solar + terrestrisch
10,5 – 12,5	Fenster Kanal

MADRAS

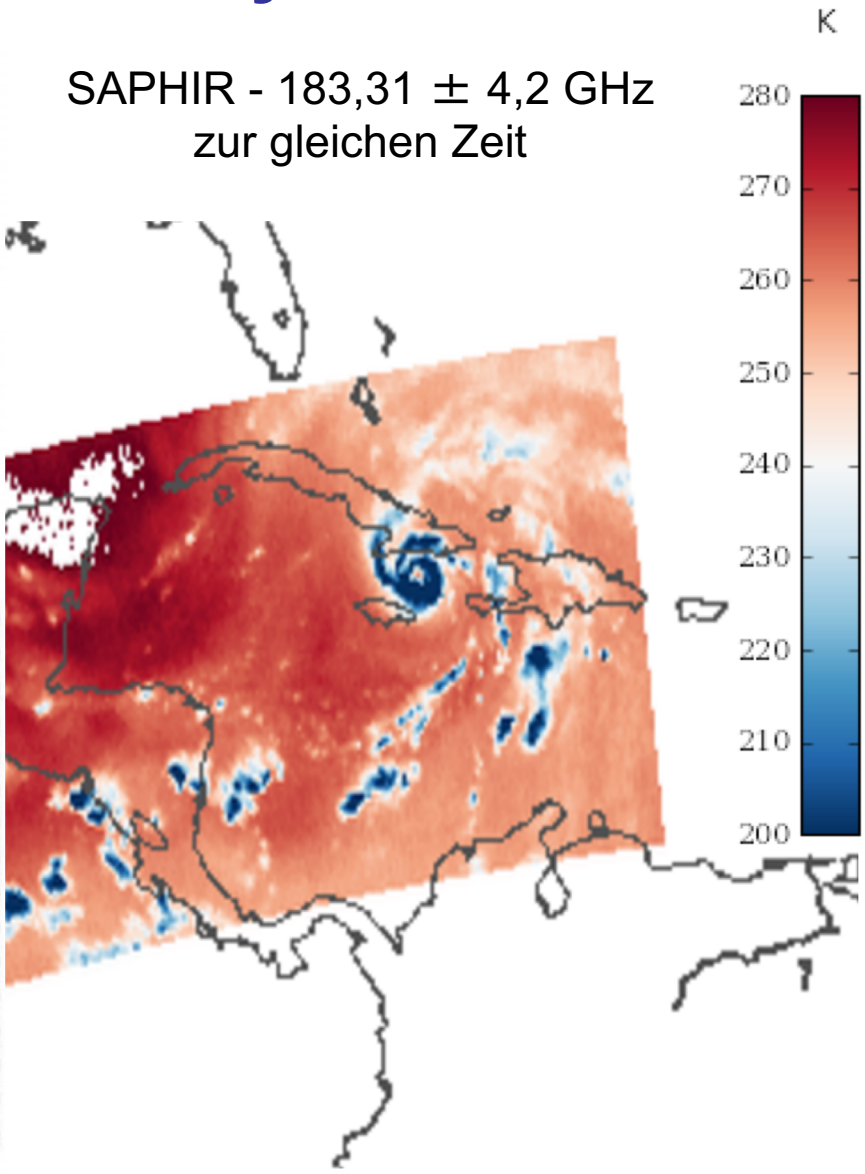
Messfrequenz [GHz]	Messgröße / Zweck
18,7 ± 0,1	Regen über Ozeanen
23,8 ± 0,2	Integrated water vapor (IWV)
36,5 ± 0,5	Flüssigkwasser in Wolken
89 ± 1,35	Cloud top ice, Identizifierung von Konvektion
157 ± 1,35	Cloud top ice bei Konvektion / Fenster Kanal

Quelle:
http://meghatropiques.ipsl.polytechnique.fr/instruments.html, 25.03.2017

Level1 – Daten (T_b): Hurricane Sandy 2012



SAPHIR - 183,31 ± 4,2 GHz
zur gleichen Zeit



Quelle: R. Roca et al., 2015: The Megha-Tropiques Mission: a review after three years in orbit

SAPHIR - L2 Produkt: Upper Tropospheric Humidity