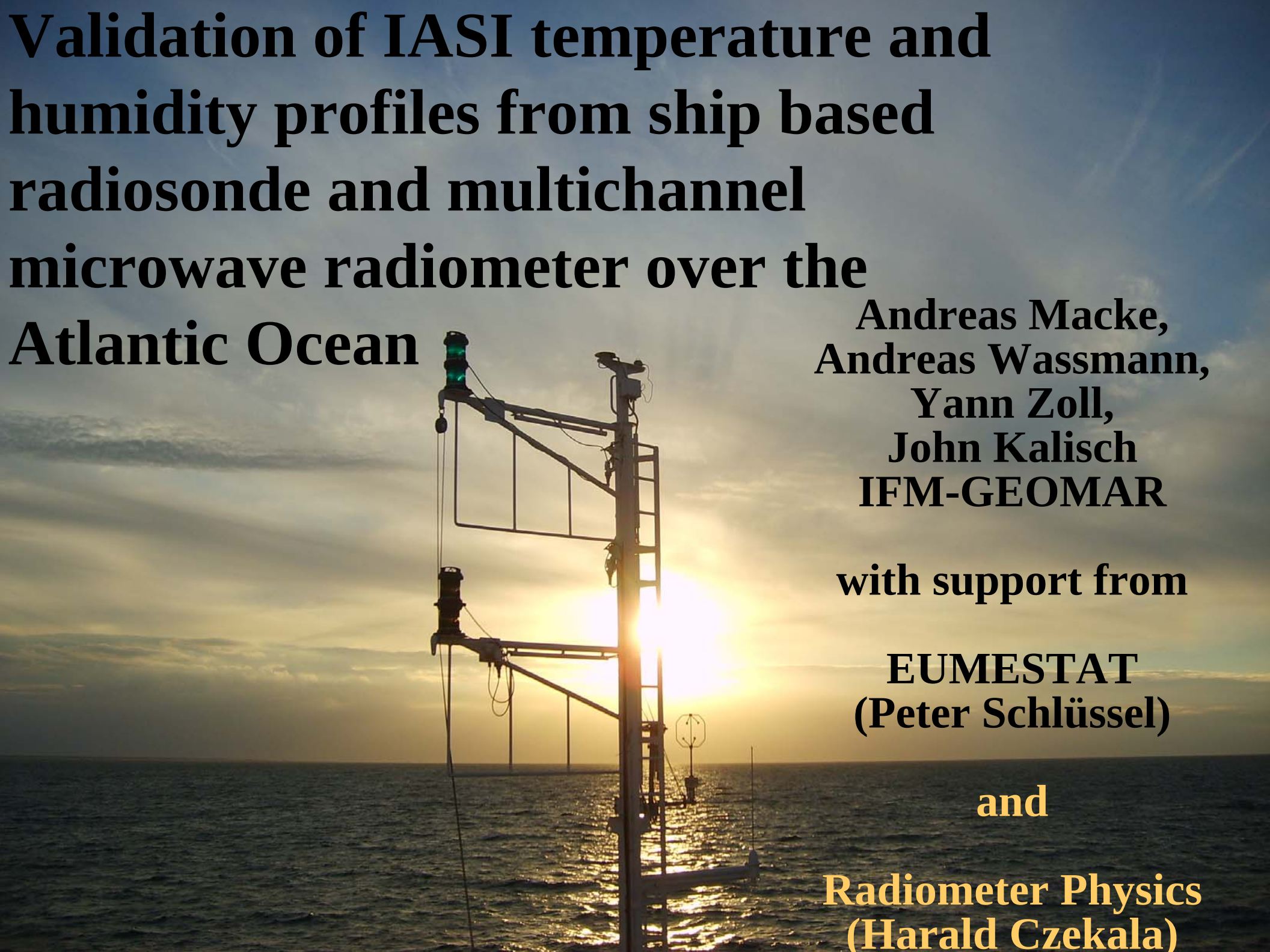
Validation of IASI temperature and humidity profiles from ship based radiosonde and multichannel microwave radiometer over the Atlantic Ocean



Andreas Macke,
Andreas Wassmann,
Yann Zoll,
John Kalisch
IFM-GEOMAR

with support from

EUMESTAT
(Peter Schlüssel)

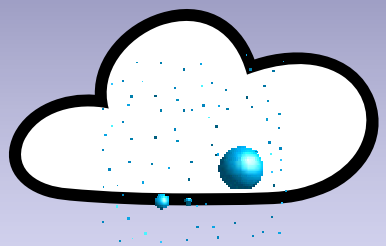
and

Radiometer Physics
(Harald Czekala)

Clouds in the Climate System
- Modeling & Observations -

Remote Sensing
Satellite

Cloud modeling



R

Radiative transfer
modeling

A

W

P

Remote Sensing
Ship

W

T = T_{dir} + T_{dif}

E LH SH

- Heating
- Photochemistry
- Photobiology

R = Reflection
A = Absorption
T = Transmission
W = Thermal Radiation

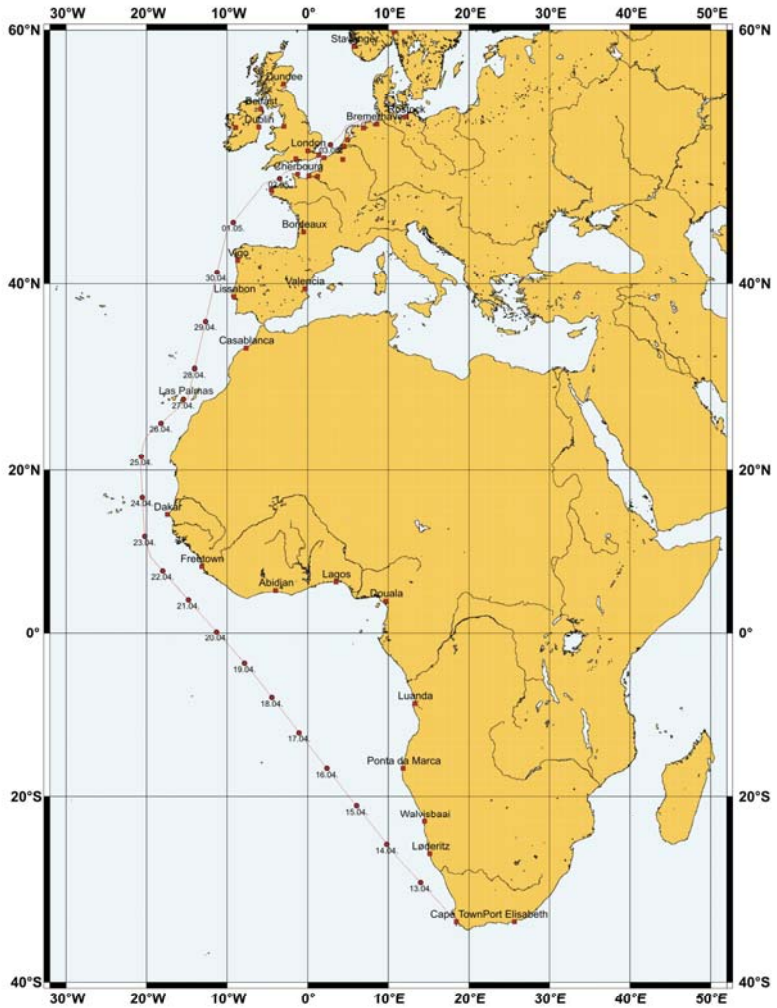
P = Precipitation
E = Evaporation
LH = latent heat flux
SH =sensible heat flux

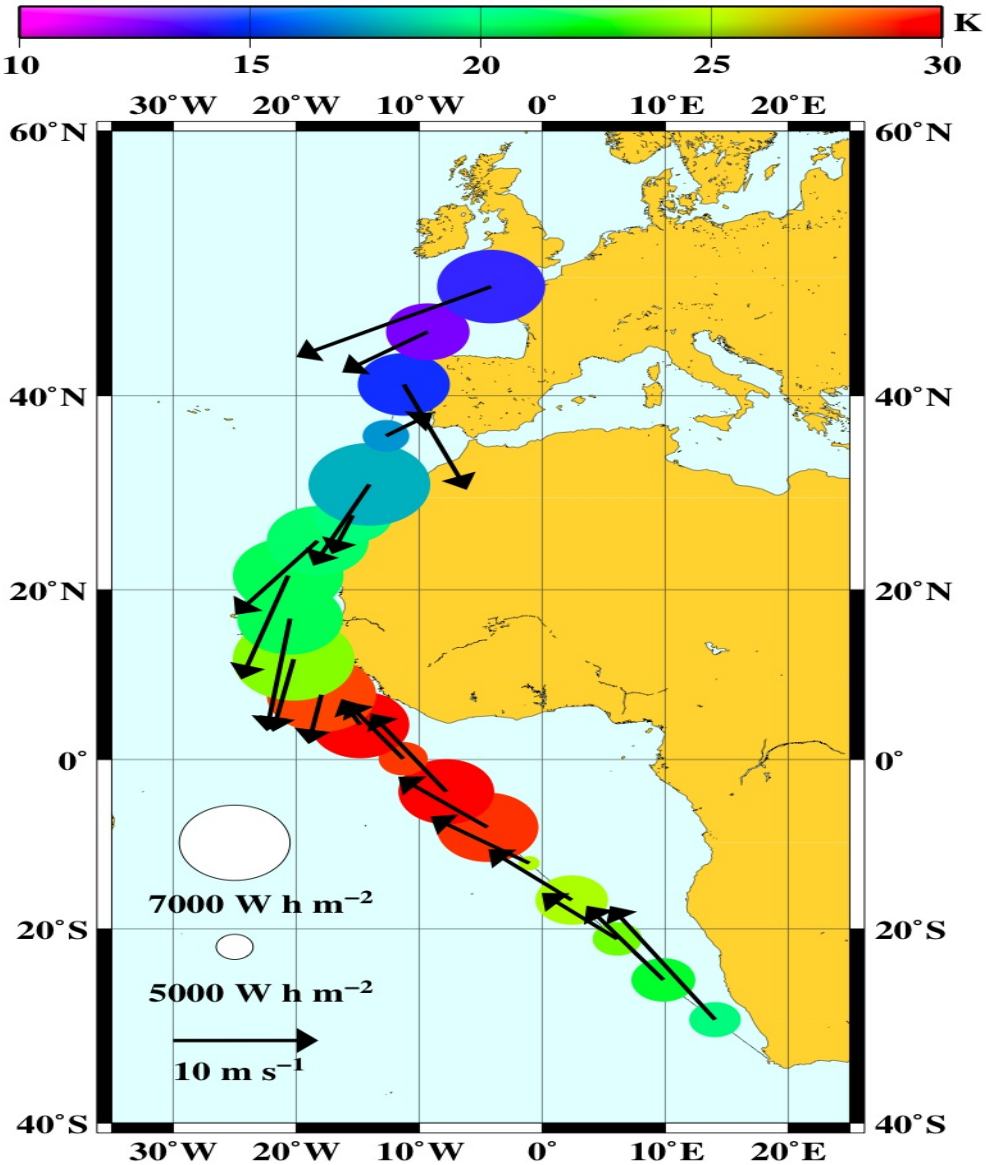
Meridional Ocean Radiation Experiment (**MORE**) Cruises

- Oct/Nov 2004: Bremerhaven – Cape Town, Vavilov
- Sept/Oct 2005: Bremerhaven – Cape Town, Vavilov
- Sep-Nov 2005: Bremerhaven – Ushuaia, Ioffe
- Ma/Apr 2006: Montevideo – Kiel, Ioffe
- Oct 2006: Bremerhaven – Montevideo/Cape Town
- **April 2007: Bremerhaven – Cape Town, Polarstern**
- **Oct/Nov 2007: Cape Town, Bremerhaven, Polarstern**

Cape Town - Las Palmas - Bremerhaven

ANT-XXIII/10





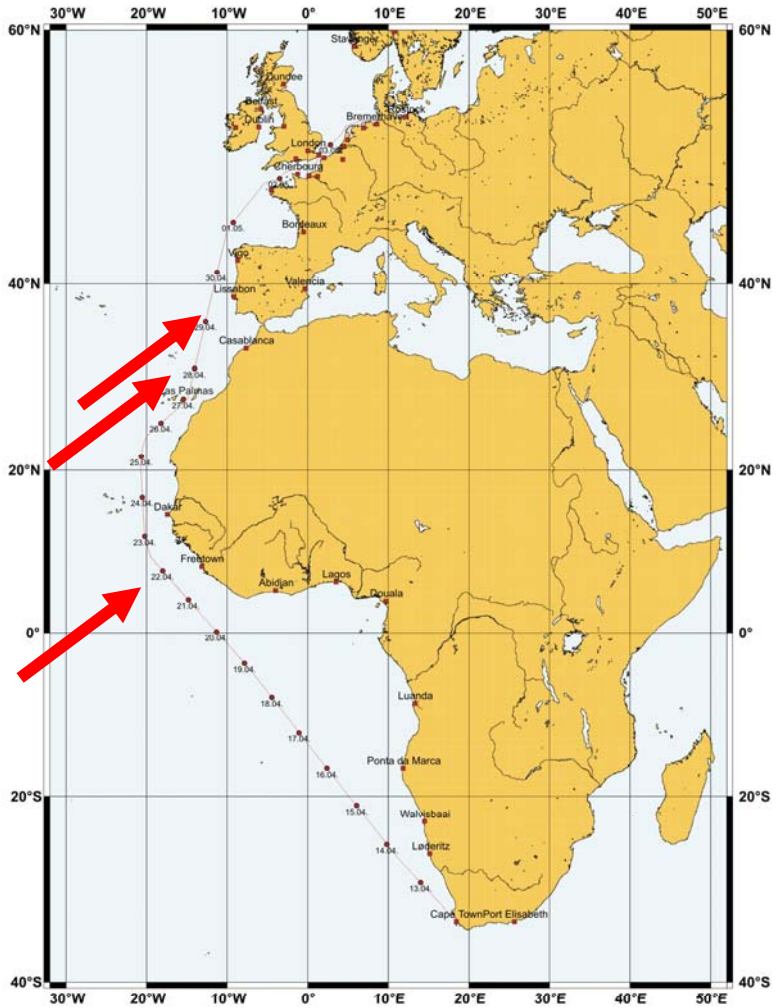
PFS "Polarstern"
ANT-XXIII/10
Cape Town - Las Palmas - Bremerhaven
April 12th till May 4th, 2007

Miles Total: 6423 nm

AWI
Alfred Wegener Institute
Polar and Marine Research
D-27515 Bremerhaven

Cape Town - Las Palmas - Bremerhaven

ANT-XXIII/10



PFS "Polarstern"
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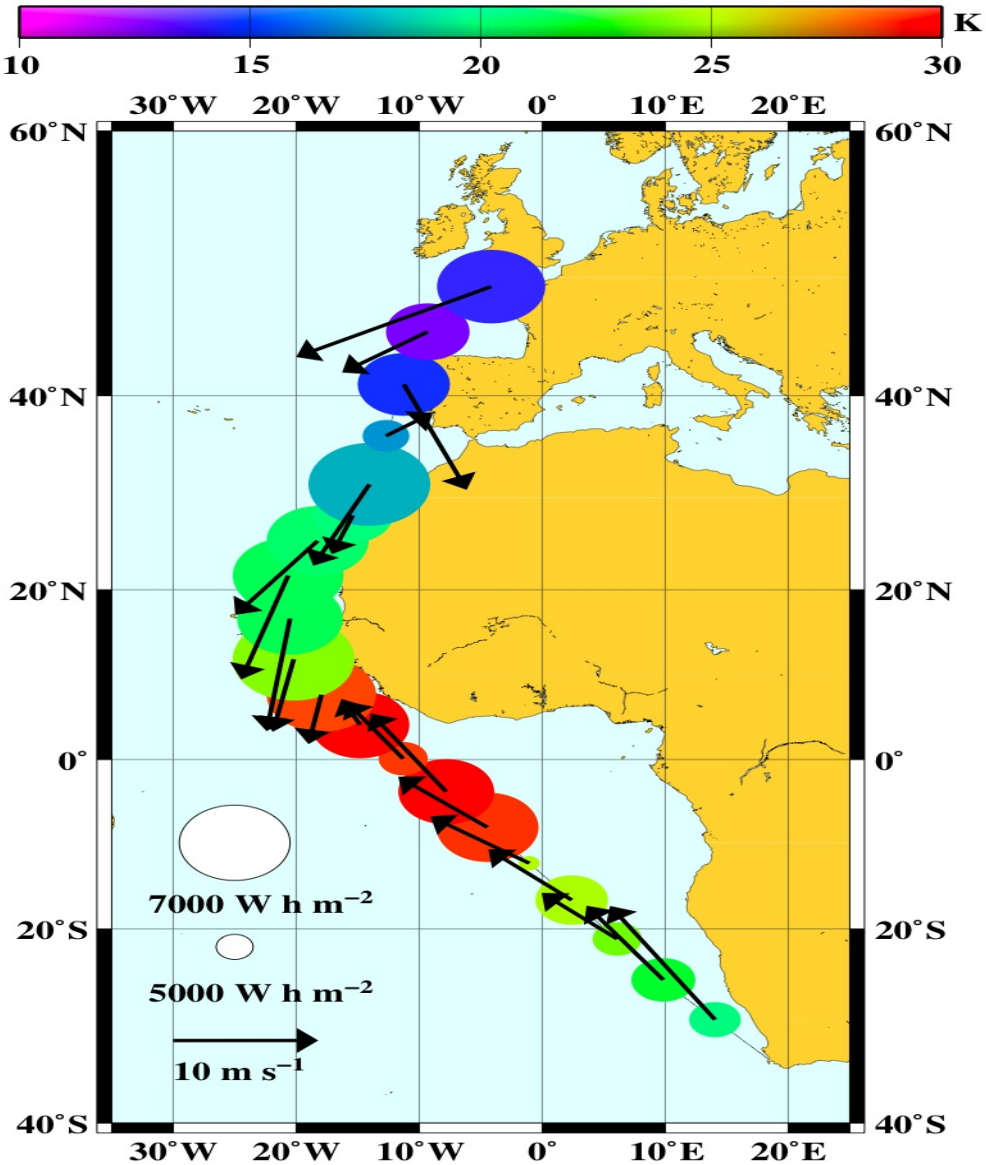
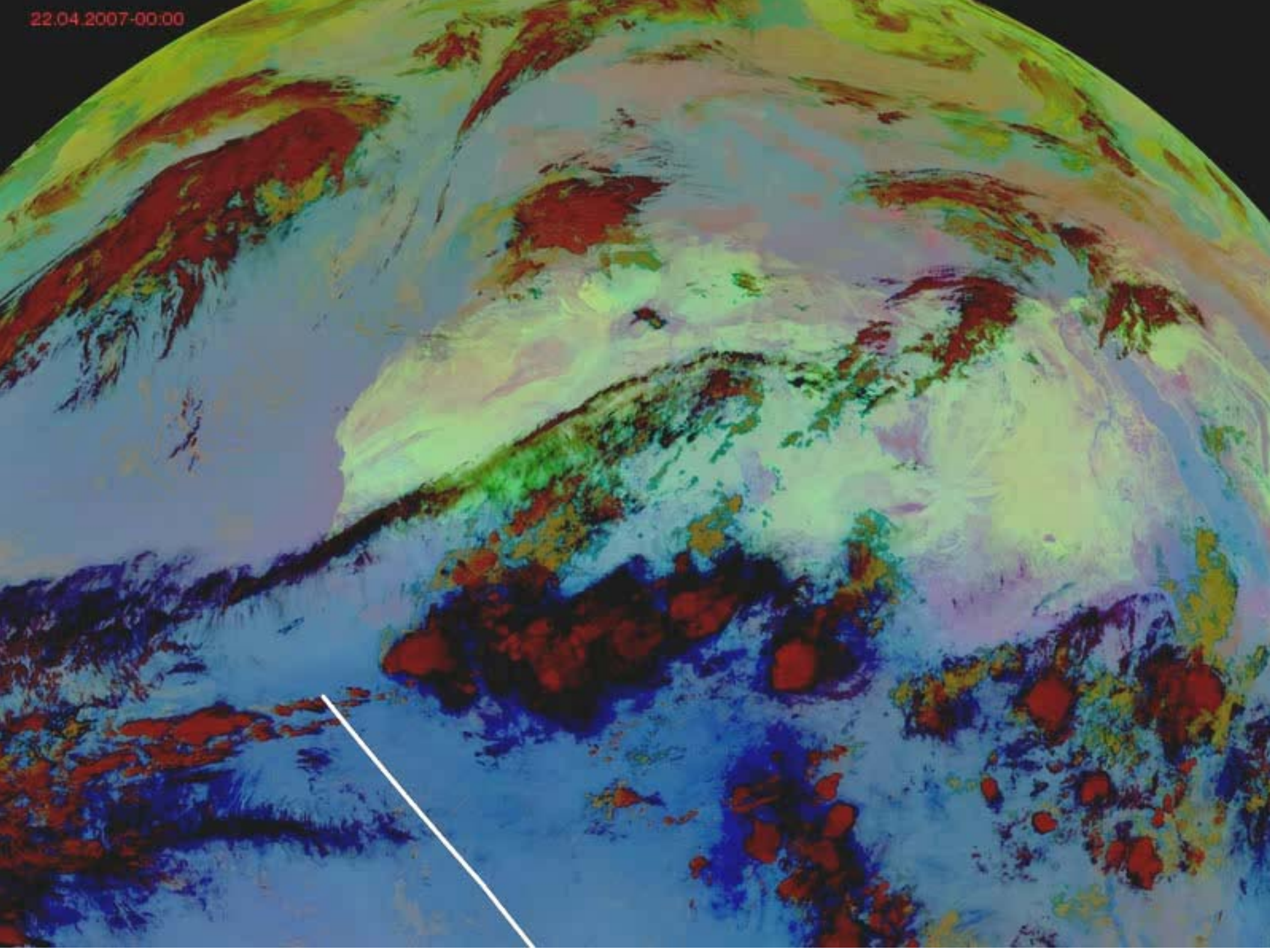
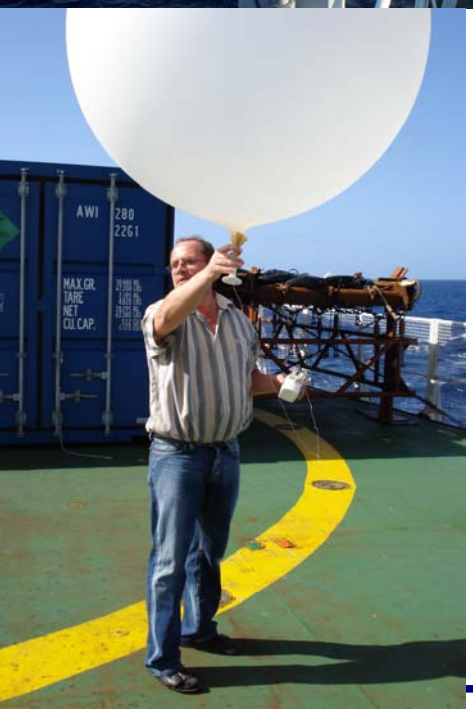
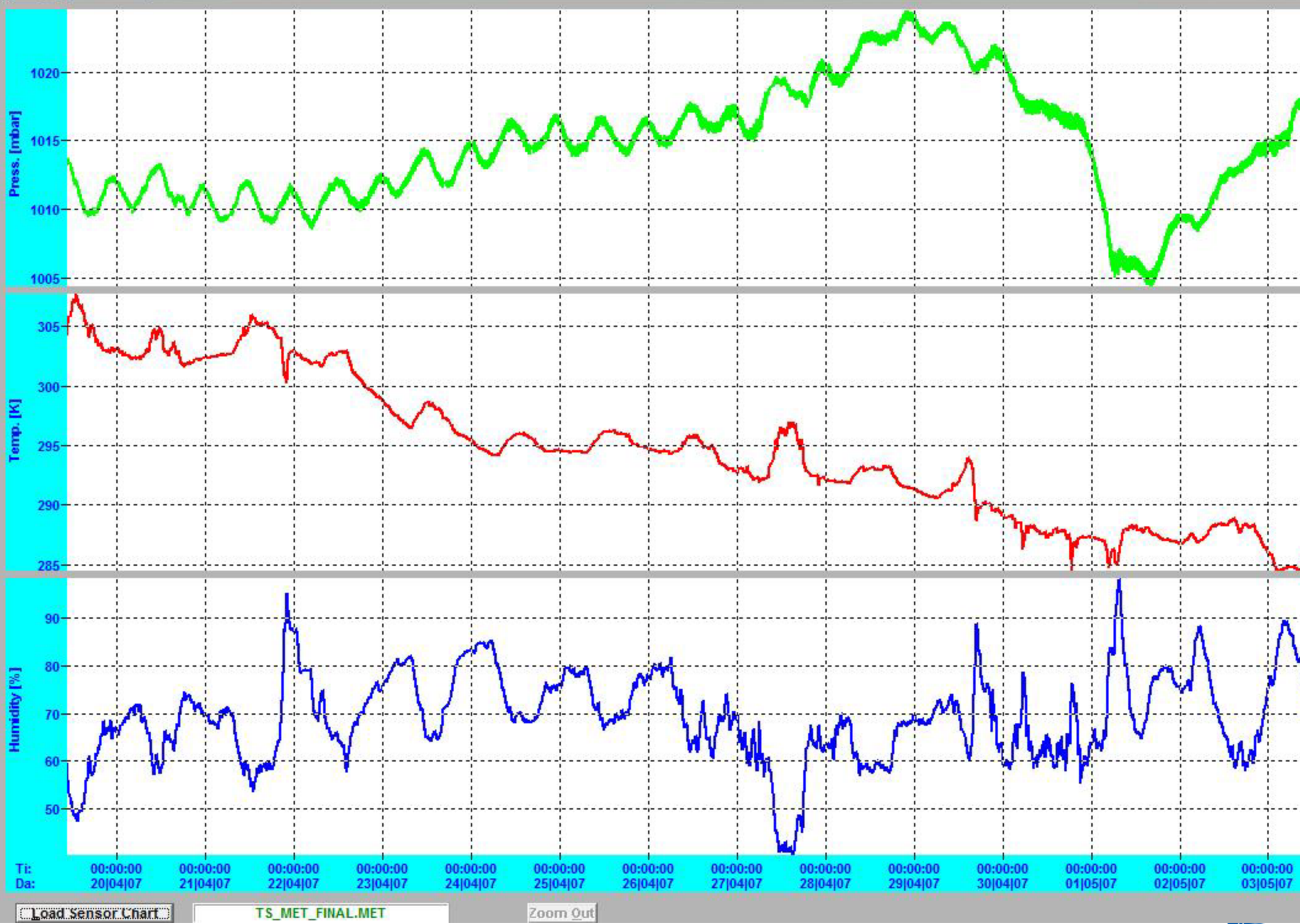



22.04.2007-00:00

Measurements devices




Press. [mbar]
1020
1015
1010
1005
Temp. [K]
305
300
295
290
285
Humidity [%]
90
80
70
60
50
Ti:
Da:
00:00:00 20|04|07
00:00:00 21|04|07
00:00:00 22|04|07
00:00:00 23|04|07
00:00:00 24|04|07
00:00:00 25|04|07
00:00:00 26|04|07
00:00:00 27|04|07
00:00:00 28|04|07
00:00:00 29|04|07
00:00:00 30|04|07
00:00:00 01|05|07
00:00:00 02|05|07
00:00:00 03|05|07
Load Sensor Chart
TS_MET_FINAL.MET
Zoom Out

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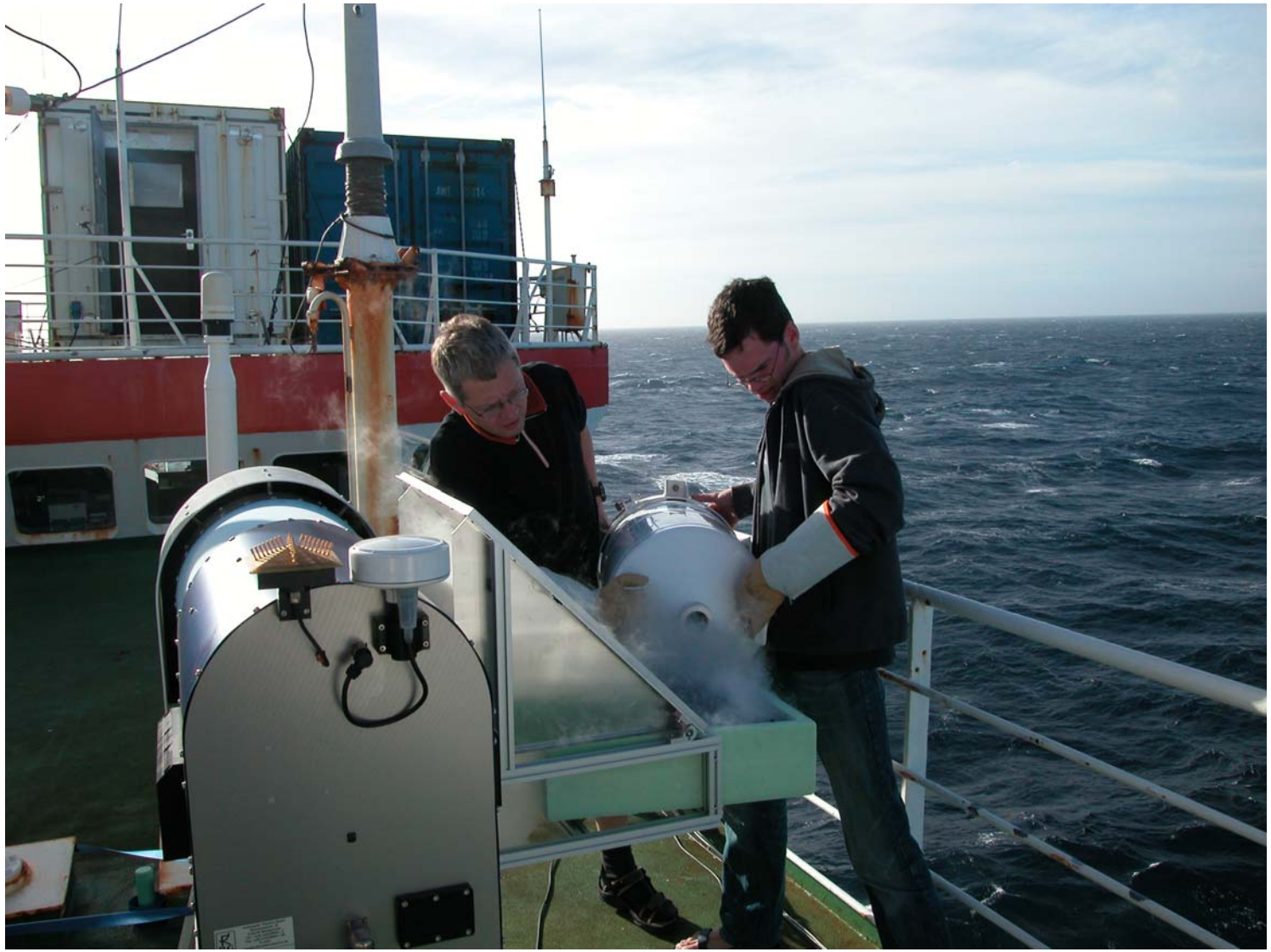
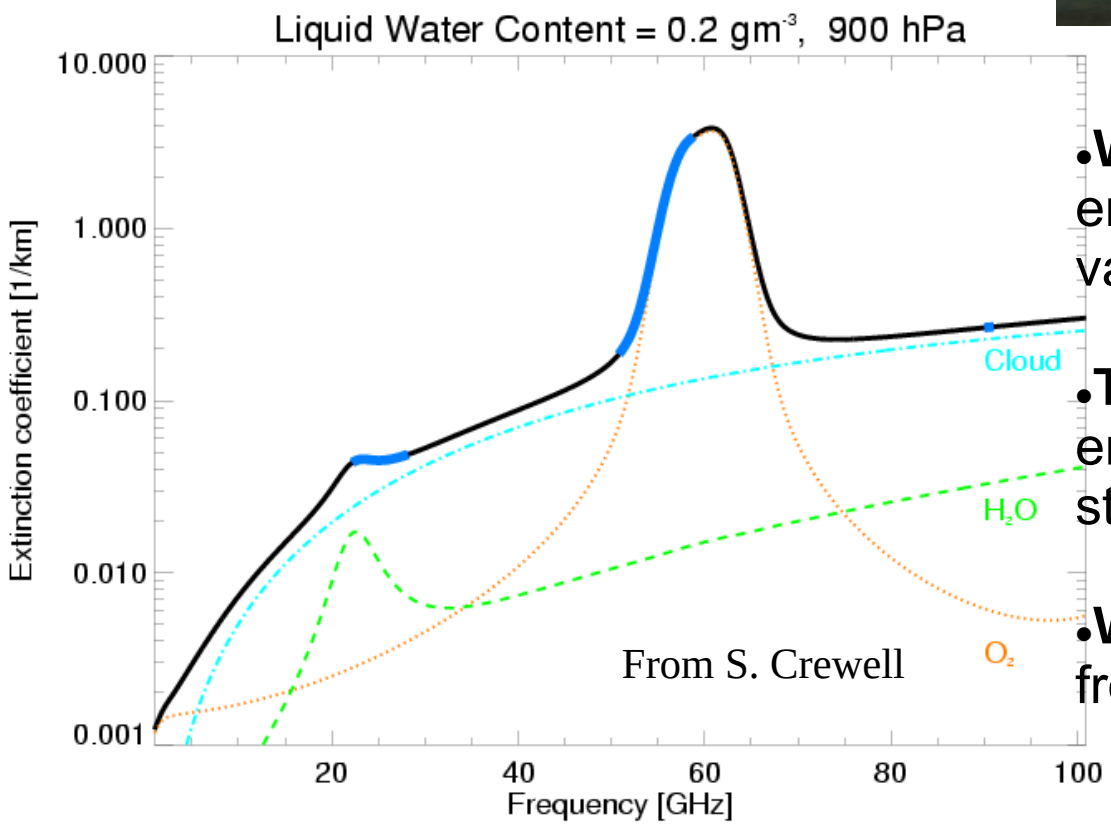
Filterbank Microwave Radiometer HATPRO for vertical profiling of humidity and temperature



RPG-HATPRO

Ground-based microwave radiometry



- **Water vapour profile** from microwave emission near pressure broadened water vapour line (22-28 GHz): weak signal
- **Temperature profile** from microwave emission near oxygen line (50-58 GHz): strong signal
- **Water vapour path** and **liquid water path** from 20/30 GHz emission

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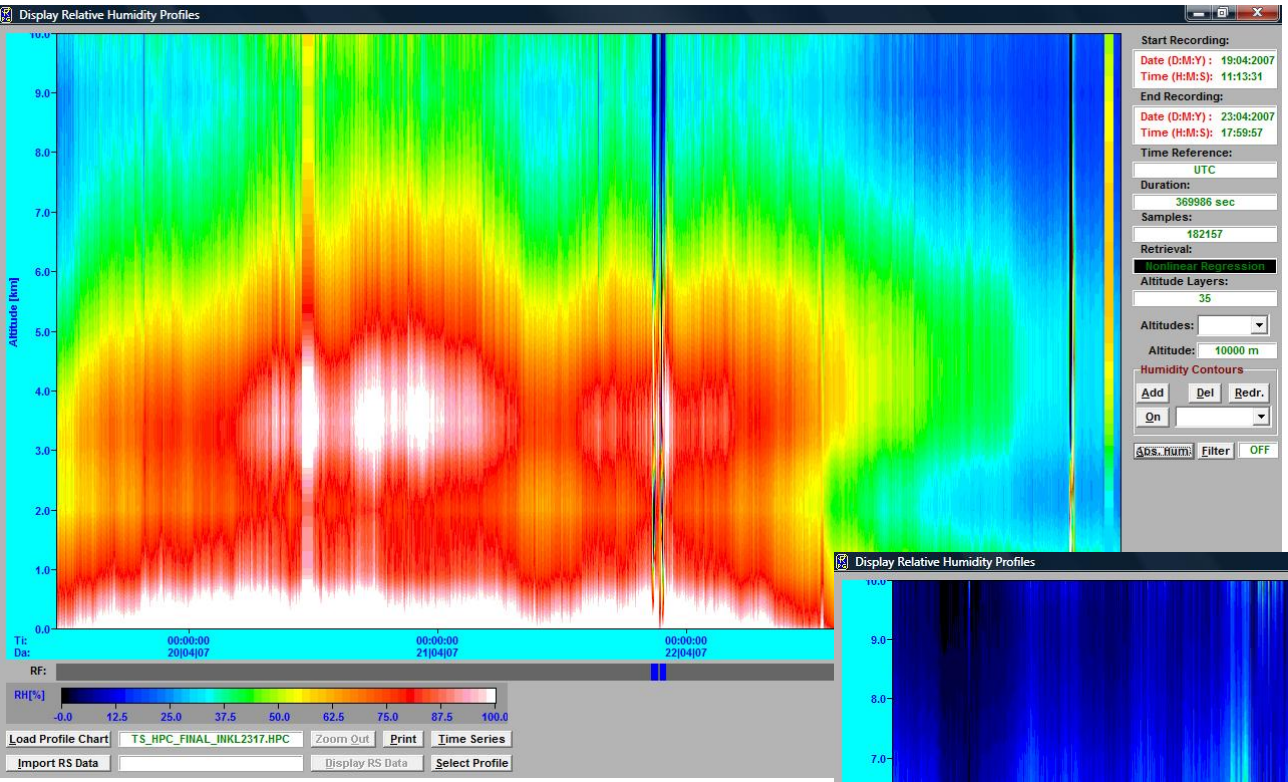
Algorithm development

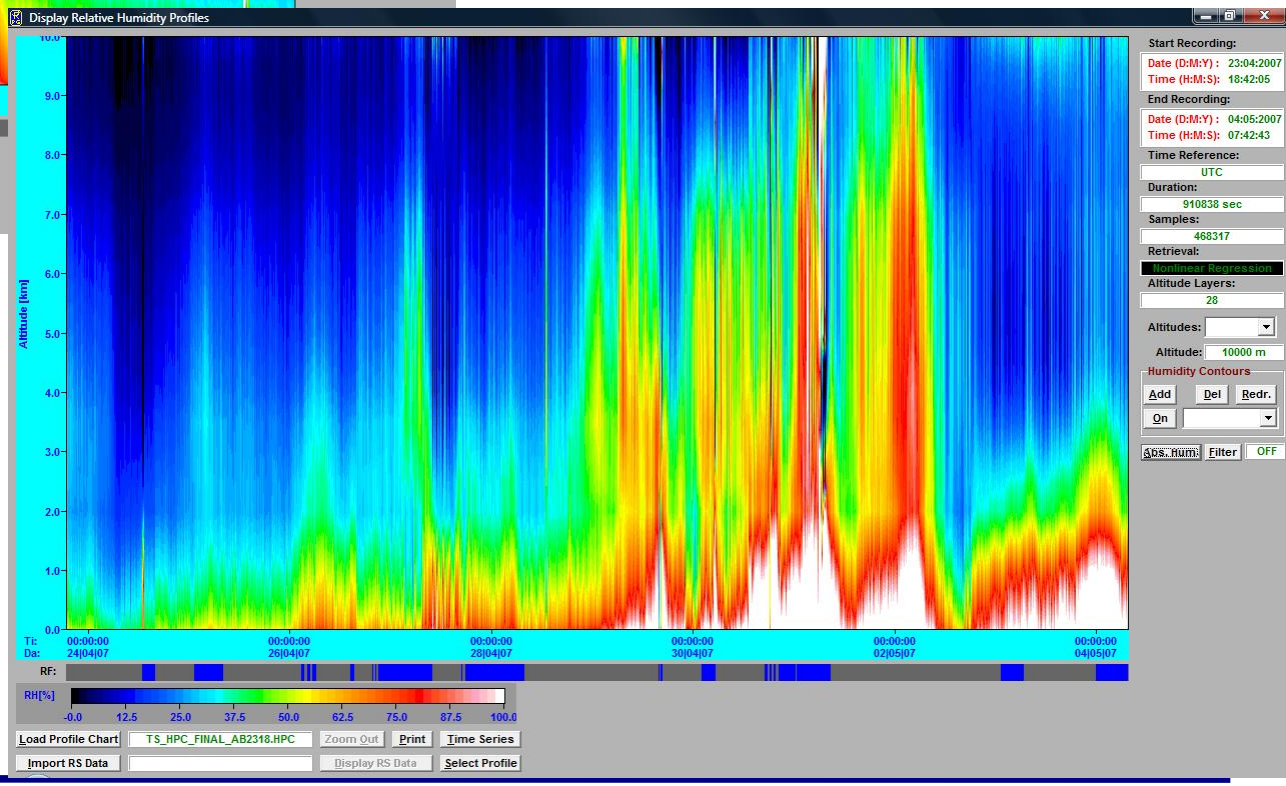
(with help from Crewell & Löhnert, University of Cologne)

- Simplified solution of radiative transfer equation (no scattering, ...)
- Radiosonde profiles as input atmospheres to match microwave radiance with atmospheric state
- Retrieval depend on radiosonde climatology
- Specific retrievals for marine tropical, subtropical, and mid-latitude conditions in preparation

Meridional cross section of humidity profiles



Thermal equator



Subtropics and mid-latitudes

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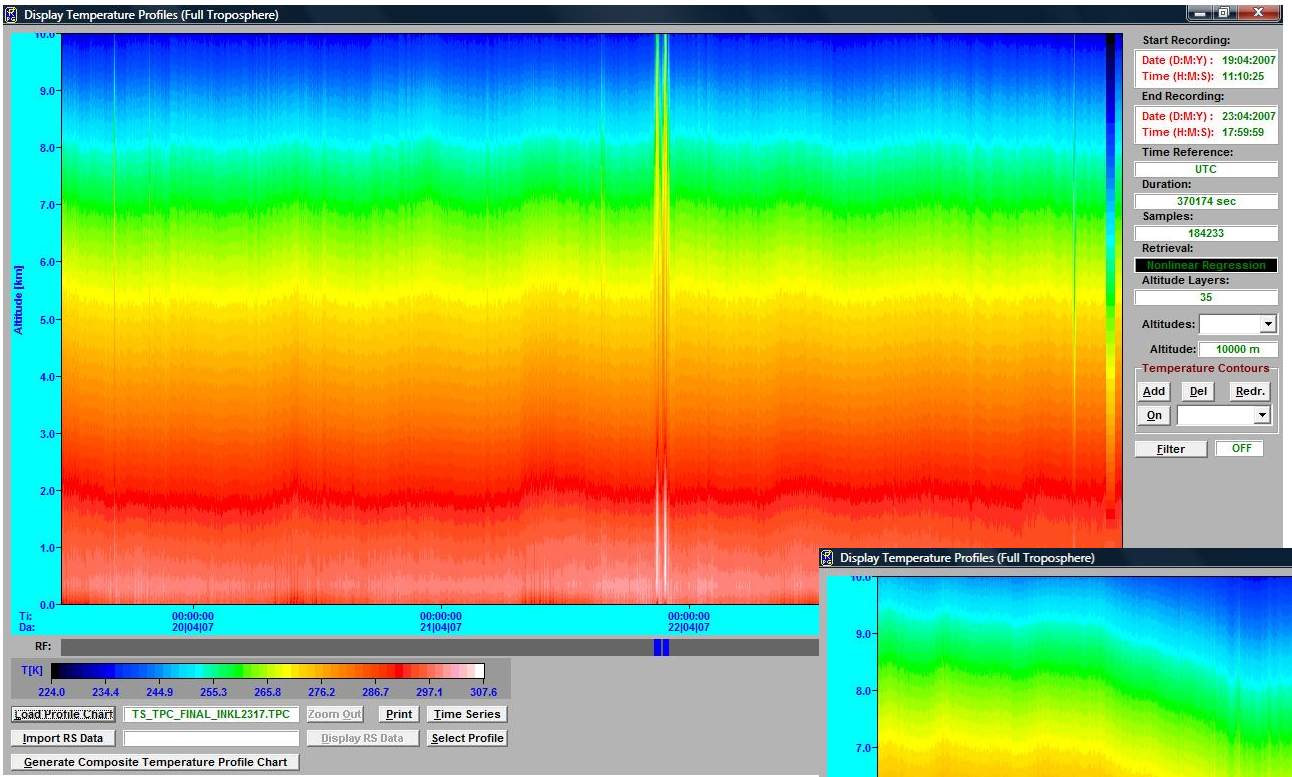
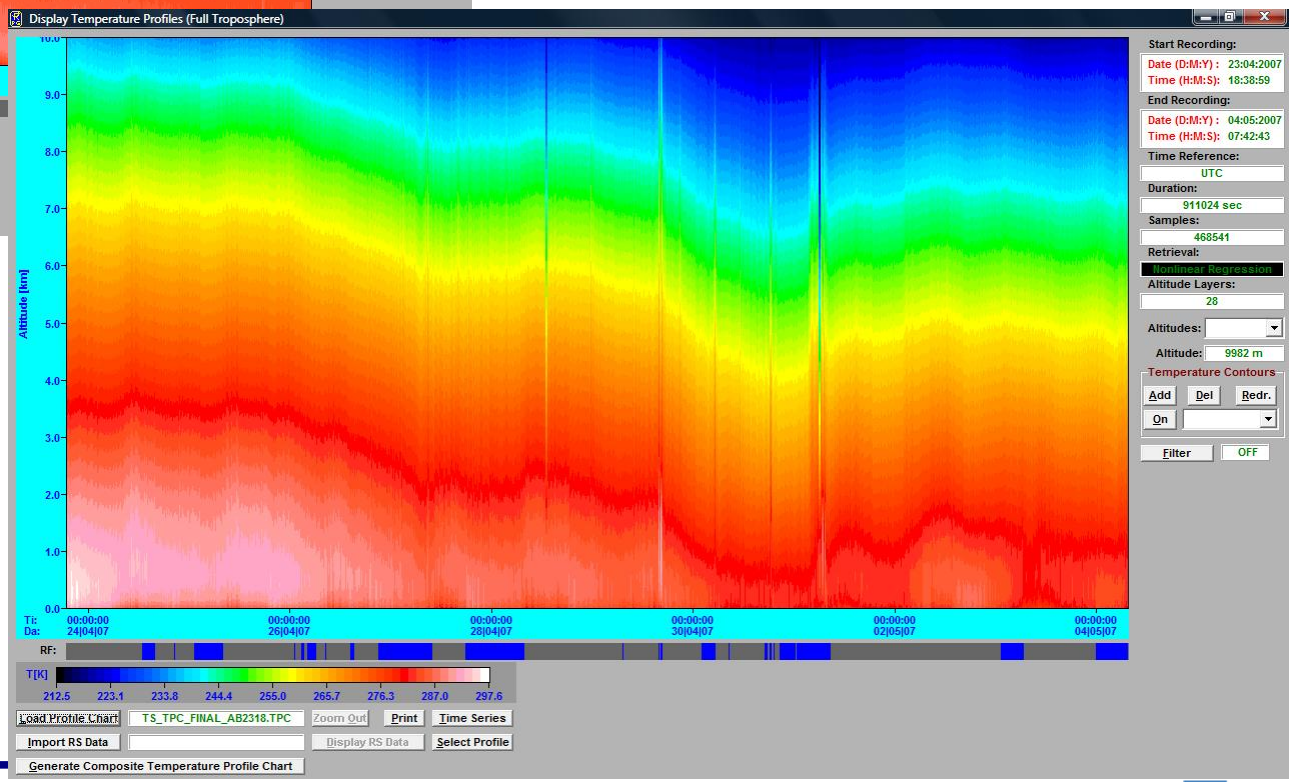
Meridional cross section of temperature profiles



Thermal equator



Suptropics and mid-latitudes

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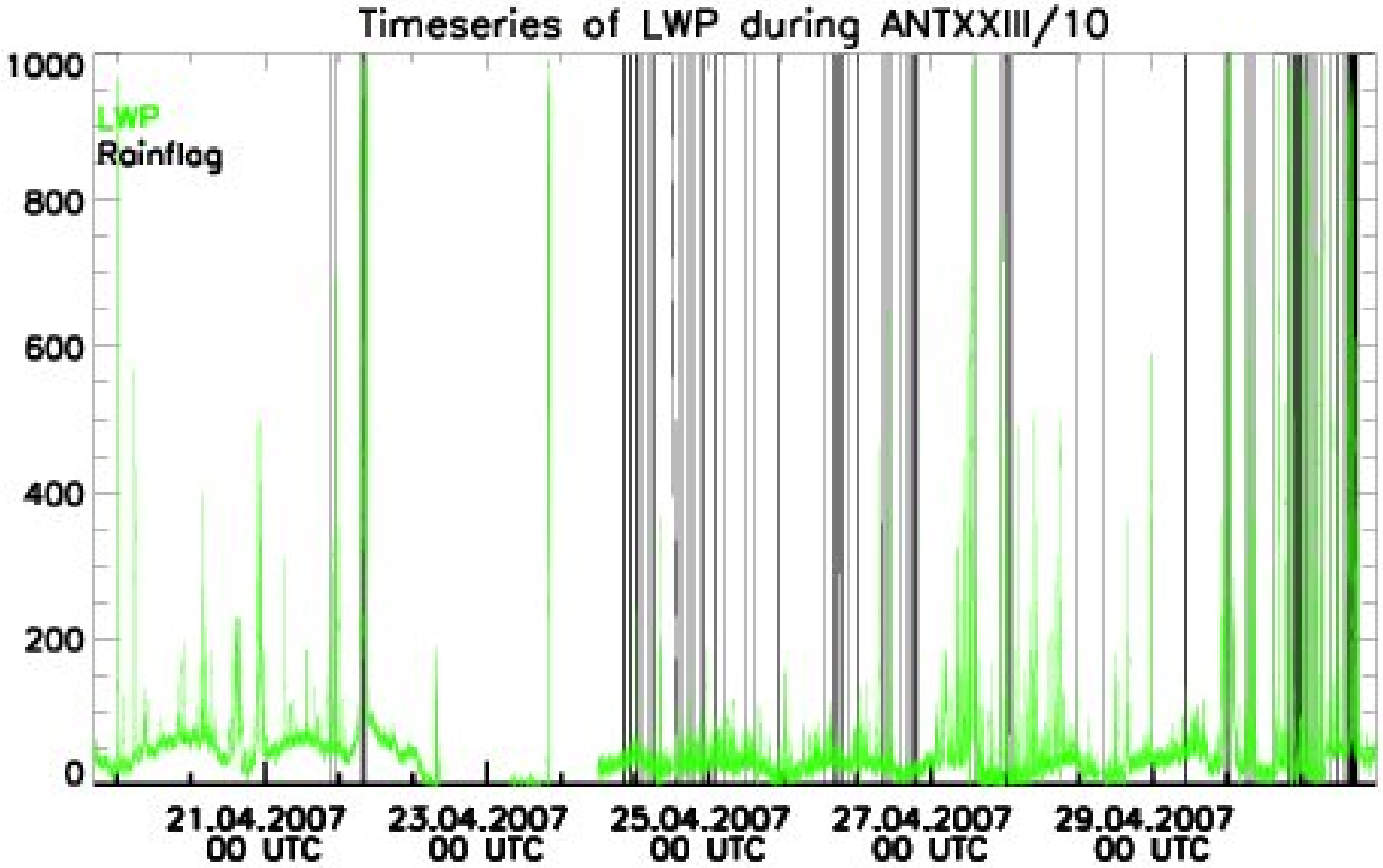
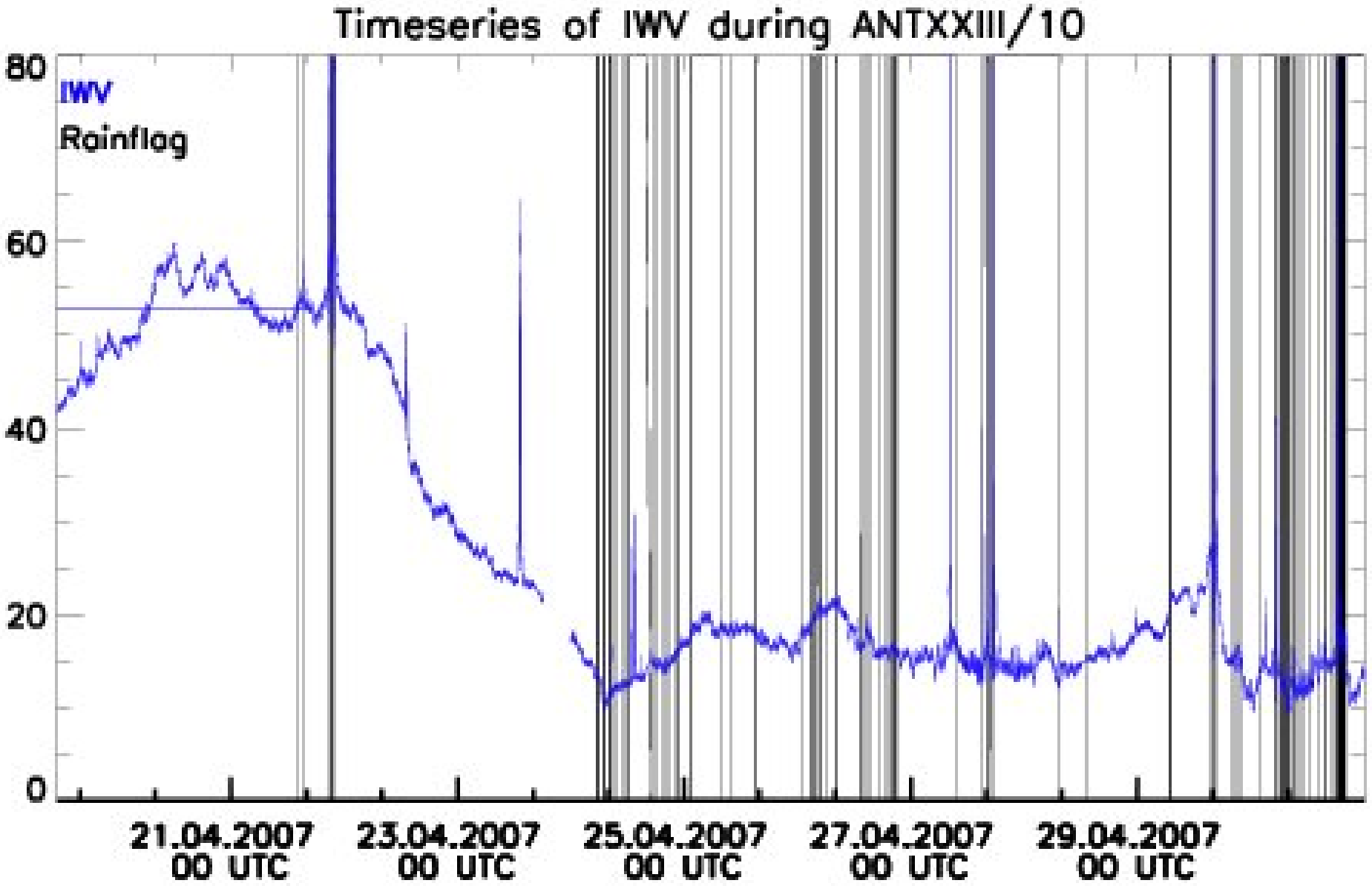
g m^{-2}

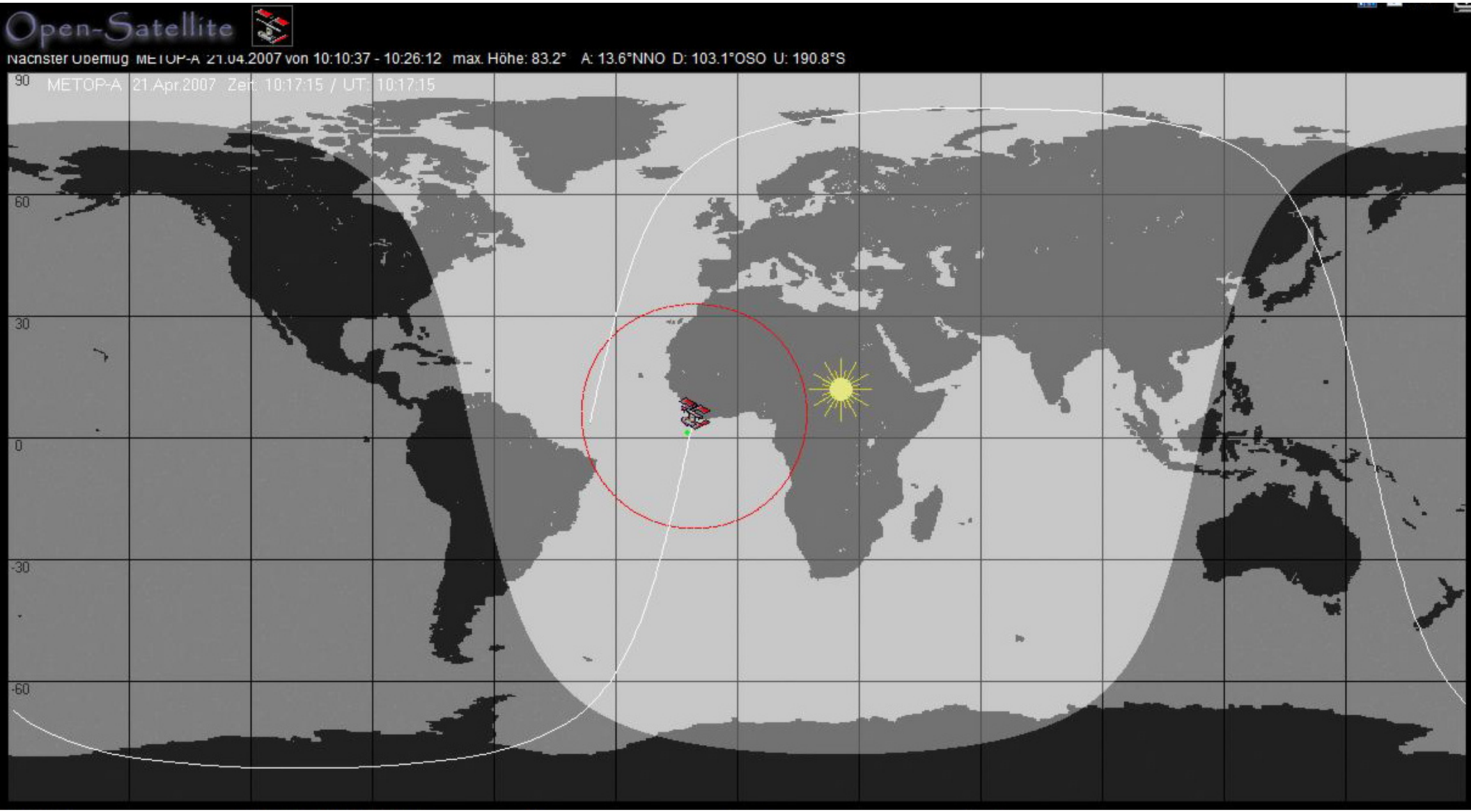


IFM-GEOMAR

kg m^{-2}



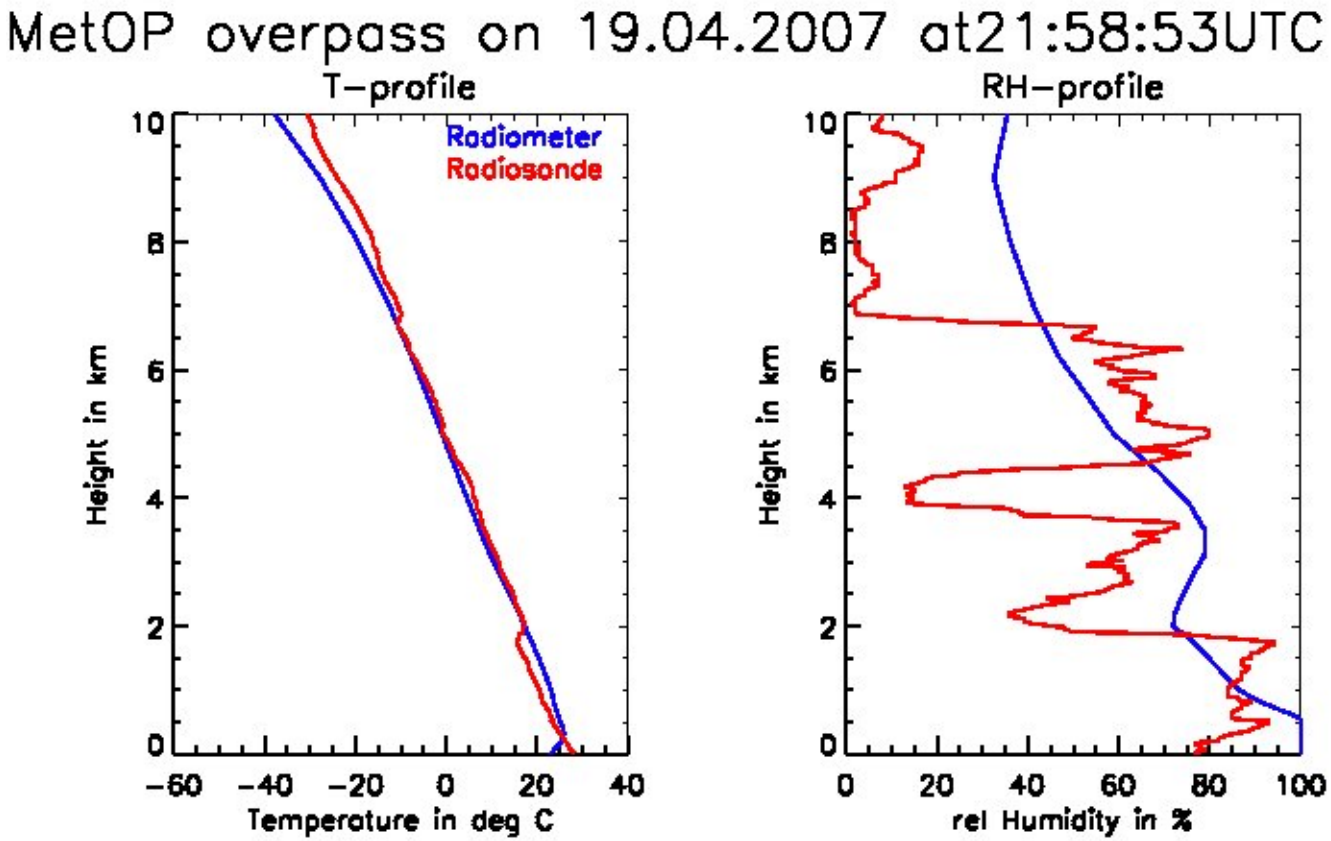
IFM-GEOMAR



MetOp-A overpasses: satellite elevation > 60 °

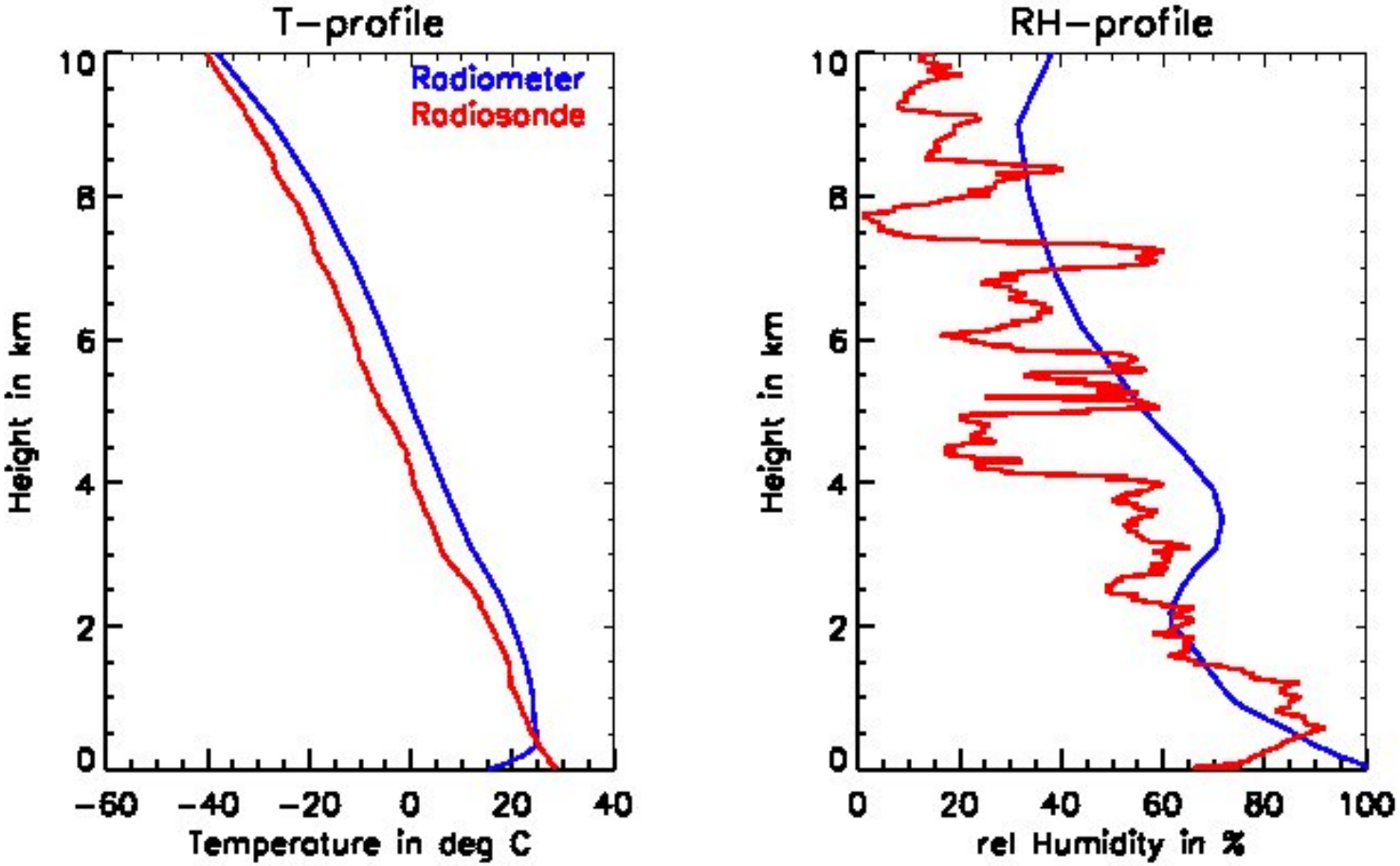
IFM-GEOMAR

Comparison of temperature (left) and humidity (right) profiles from microwave radiometer and radiosonde



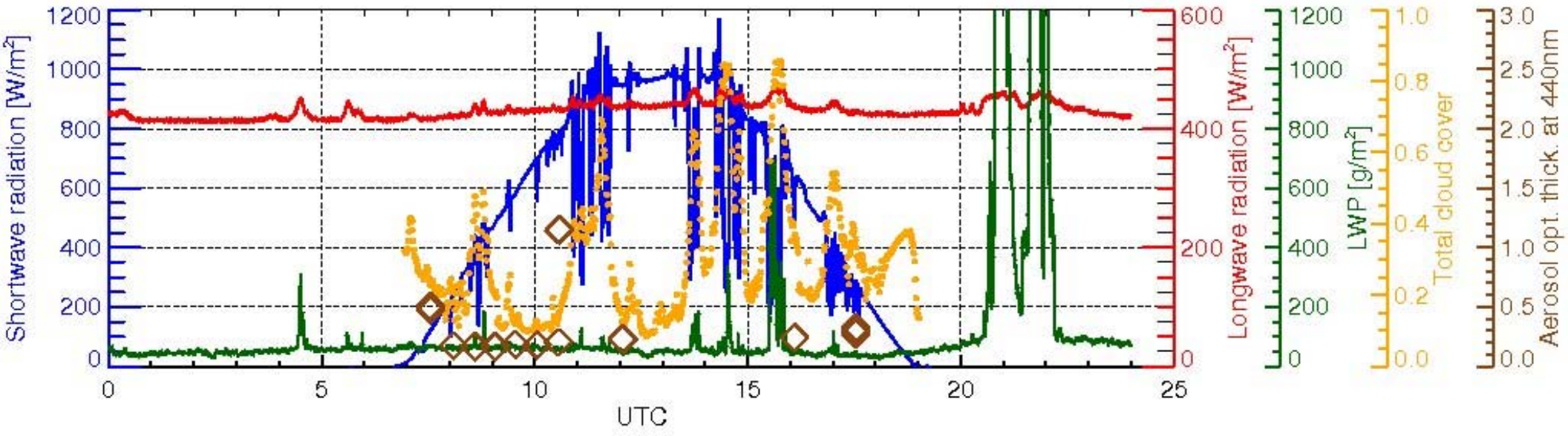
IFM-GEOMAR

MetOP overpass on 21.04.2007 at10:17:15UTC



IFM-GEOMAR

April 21, 2007: cloud & radiation data



Broadband downward solar radiative flux at the sea surface

Broadband downward thermal radiative flux at the sea surface

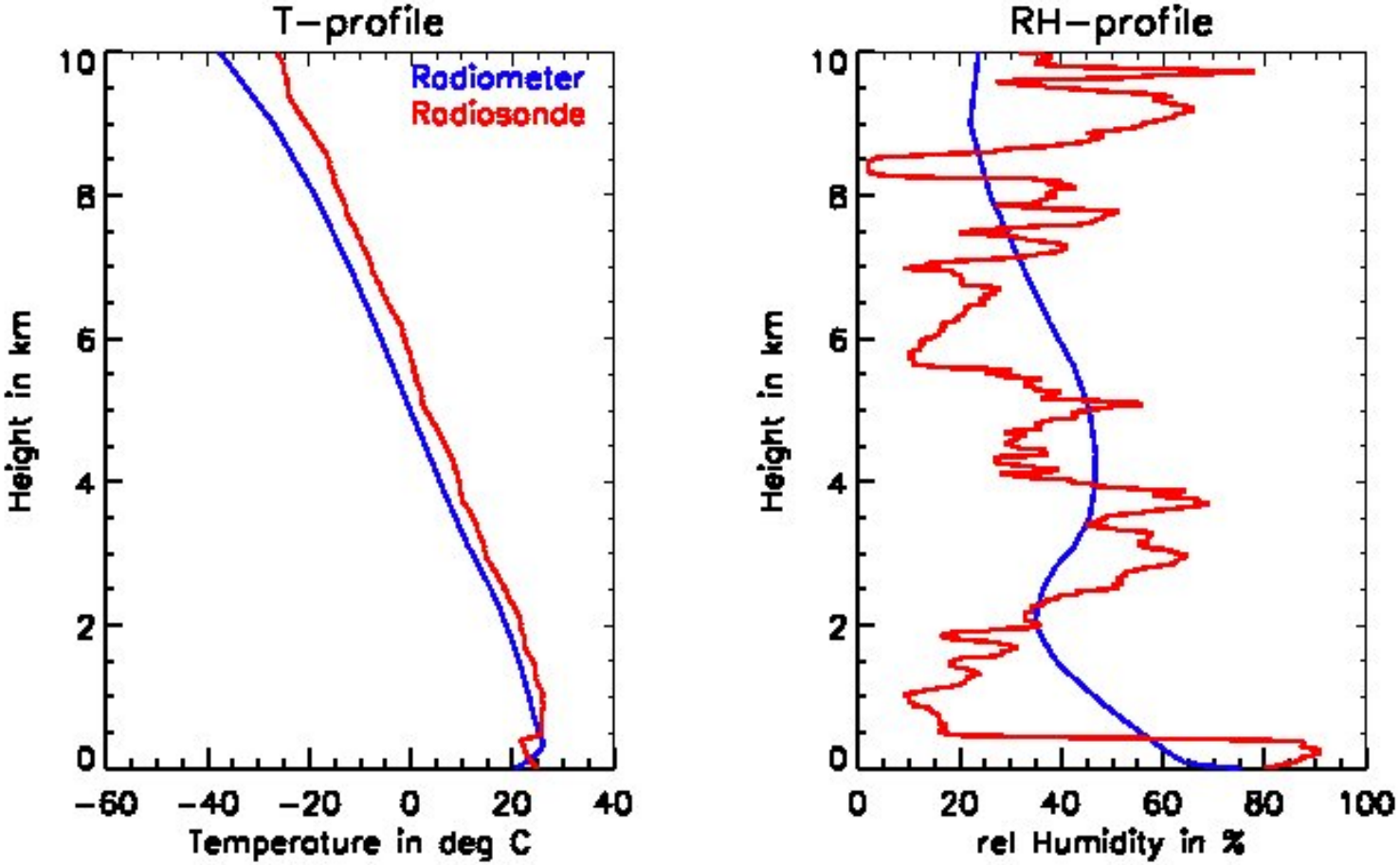
Cloud cover

Liquid water path

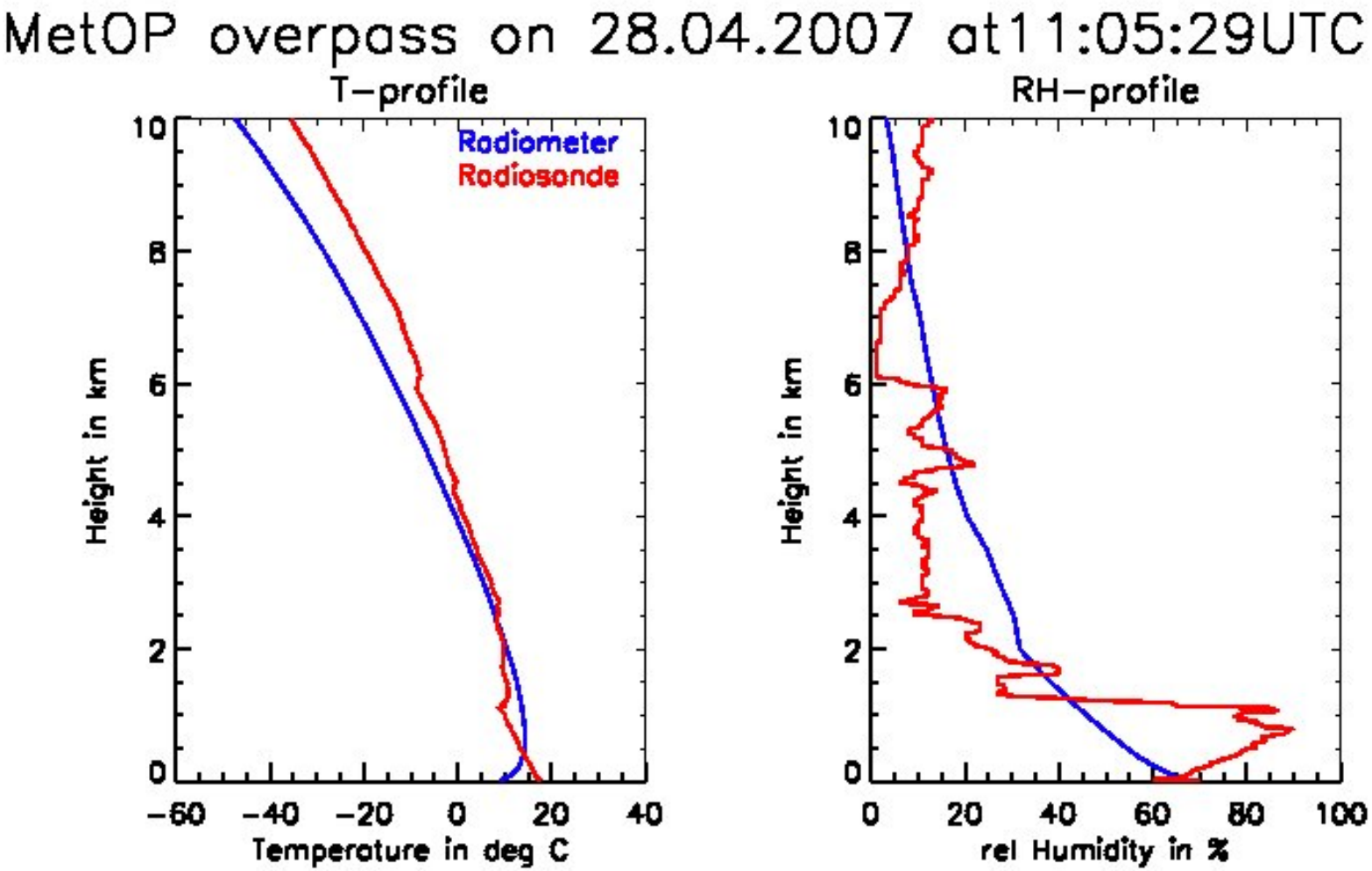
Aerosol optical thickness

IFM-GEOMAR

MetOP overpass on 22.04.2007 at22:40:41UTC

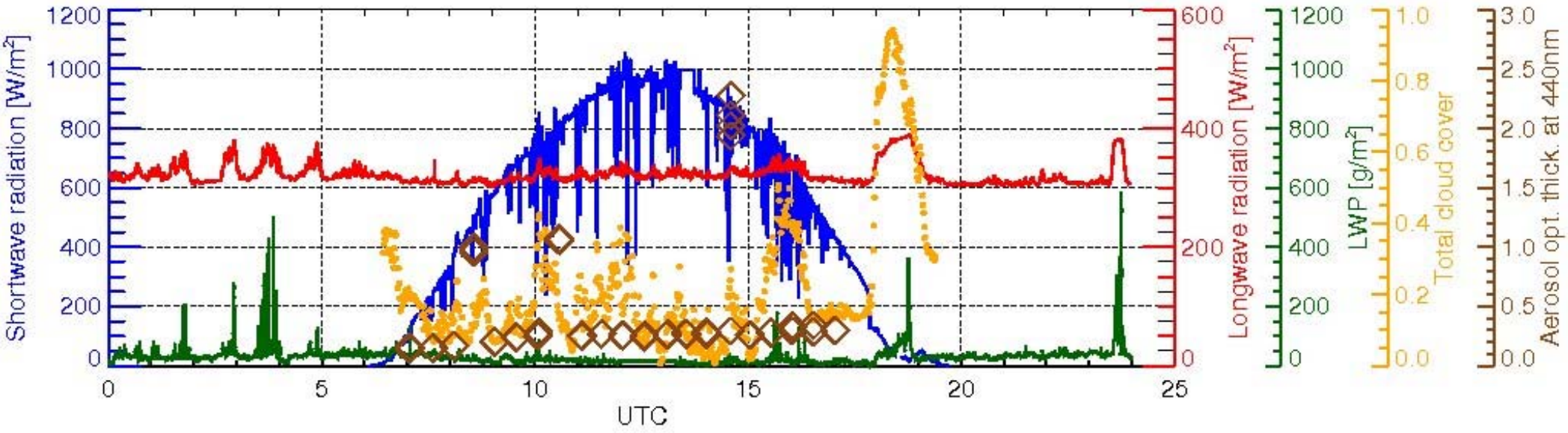


IFM-GEOMAR


MetOP overpass on 28.04.2007 at11:05:29UTC
T−profile
Radiometer
Radiosonde
Height in km
Temperature in deg C
RH−profile
Height in km
rel Humidity in %

IFM-GEOMAR

April 28, 2007: cloud & radiation data



Broadband downward solar radiative flux at the sea surface

Broadband downward thermal radiative flux at the sea surface

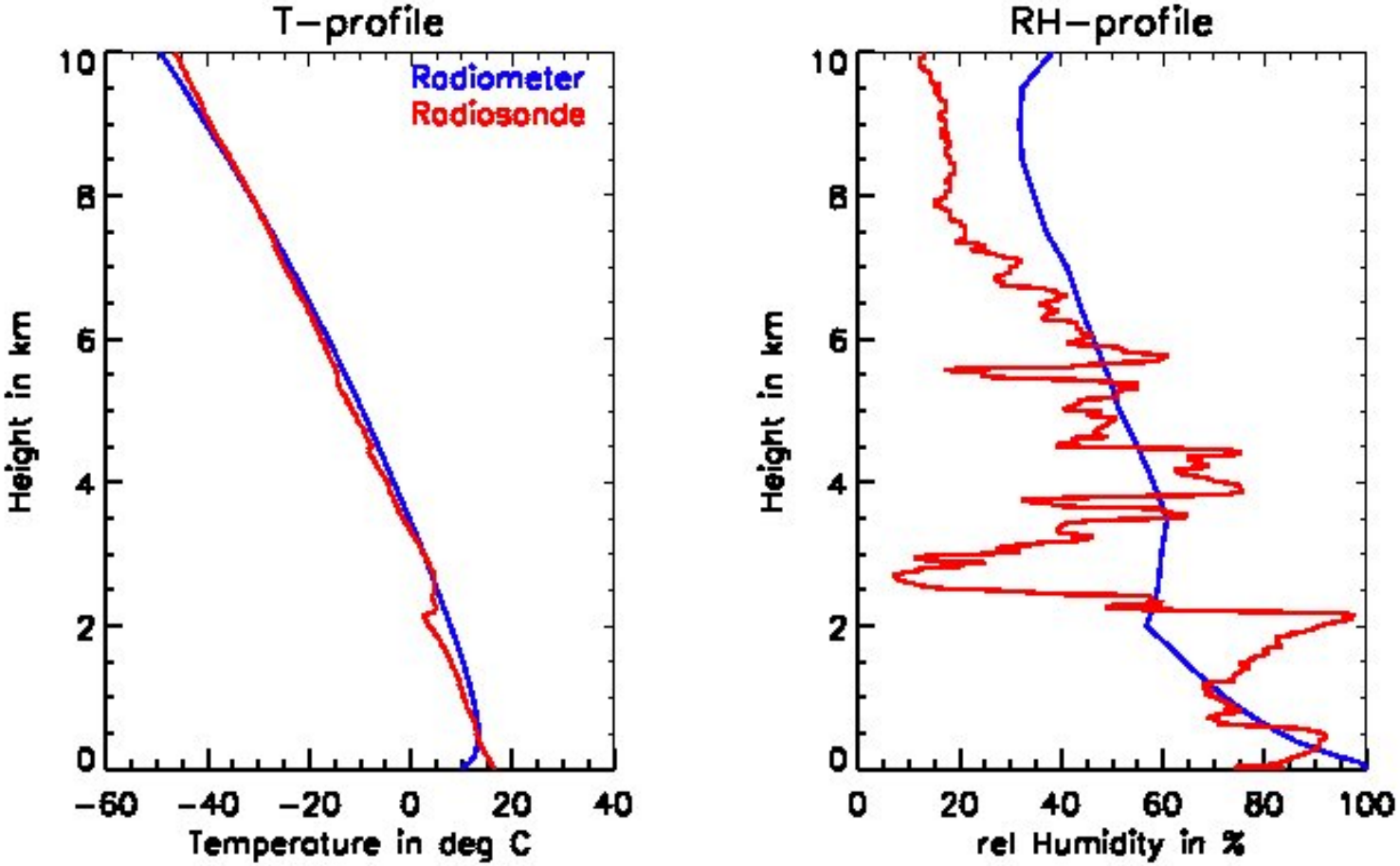
Cloud cover

Liquid water path

Aerosol optical thickness

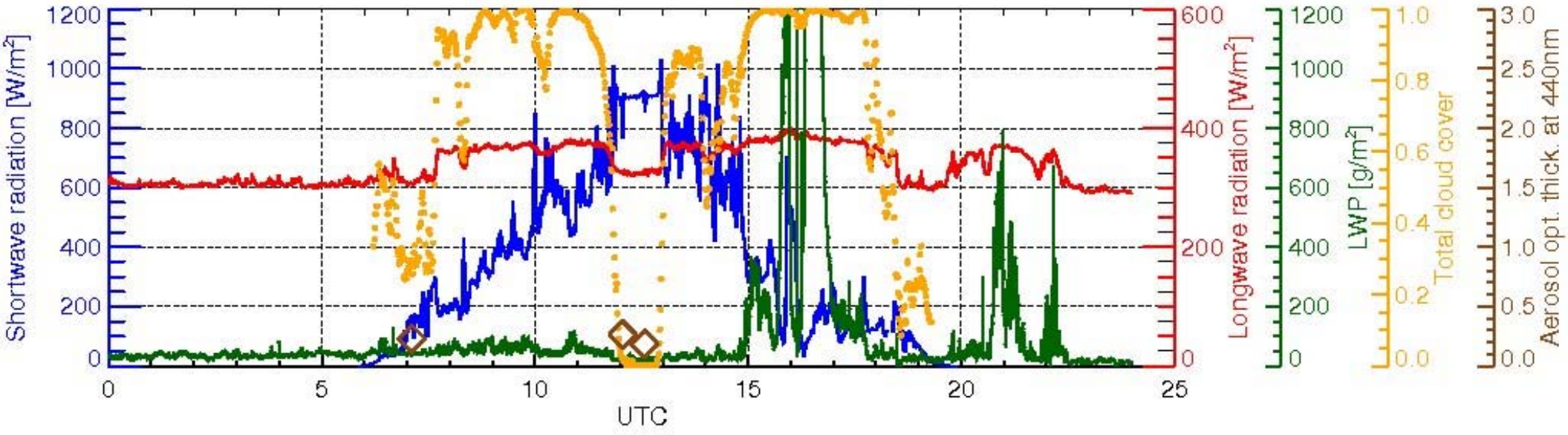
IFM-GEOMAR

MetOP overpass on 29.04.2007 at10:43:30UTC



IFM-GEOMAR

April 29, 2007: cloud & radiation data



Broadband downward solar radiative flux at the sea surface

Broadband downward thermal radiative flux at the sea surface

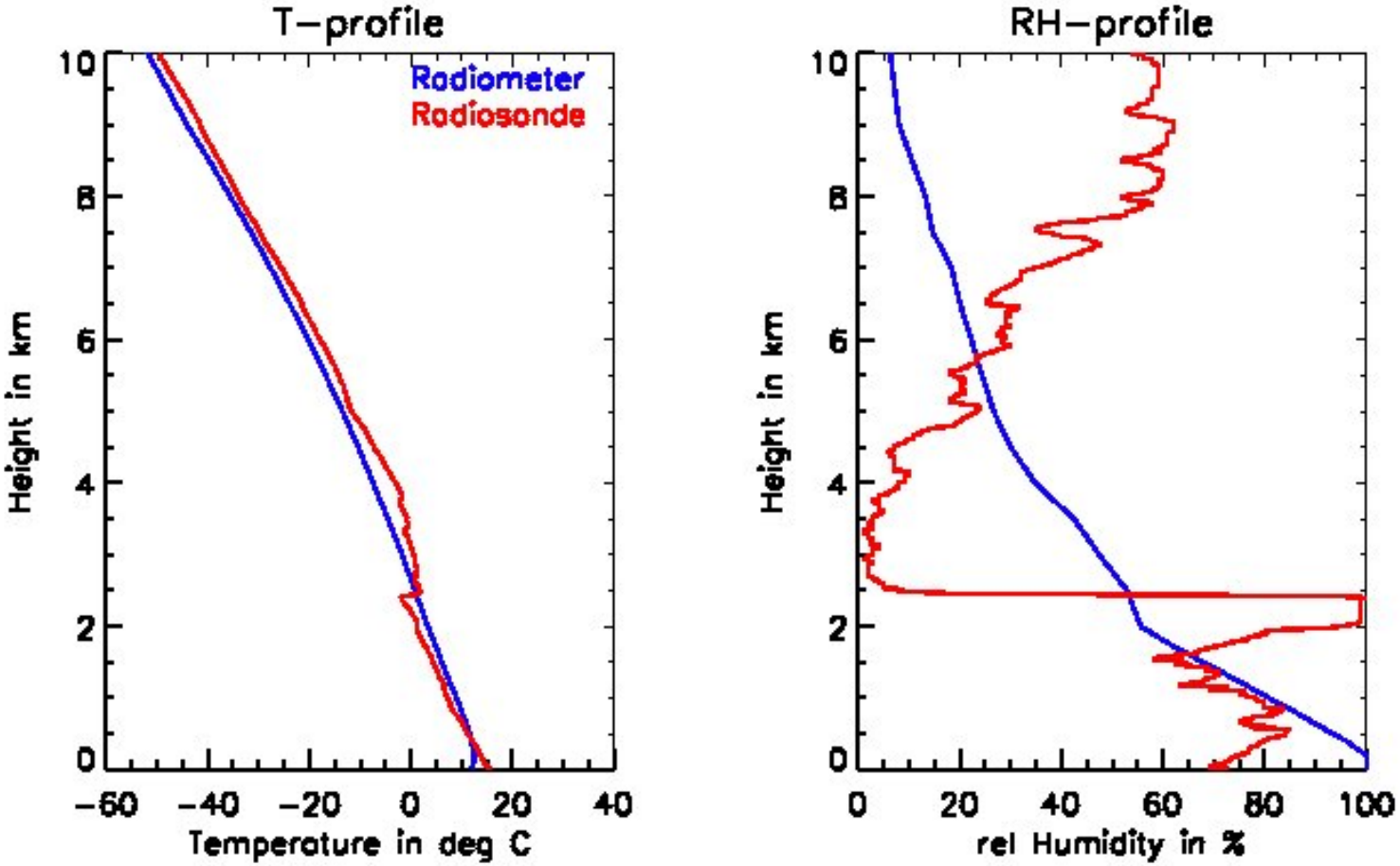
Cloud cover

Liquid water path

Aerosol optical thickness

IFM-GEOMAR

MetOP overpass on 29.04.2007 at22:03:06UTC



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All Polarstern data public available from the PANGAEA data base located at the Alfred Wegener Institute (www.awi.de)

- Outlook -

OCEANET: 2008 - 2010

Development of an autonomous observing platform for energy and trace gas exchange between ocean and atmosphere

Atmospheric measurement devices:

- Microwave radiometer
- Raman lidar
- Full sky imager
- Sun photometer
-.
-.
-.

IFM-GEOMAR

Leibniz-Institut für Meereswissenschaften
an der Universität Kiel

Atmosphere: remote sensing

Ocean:

Primary production

Atmosphere/ocean

Energy budget

GKSS FORSCHUNGSZENTRUM in der HELMHOLTZ GEMEINSCHAFT e.V.

Atmosphere/Ocean:
CO_2-budget

AWI

OCEANET Cruises (RV Polarstern)

- Apr/May 2008: Punta Arenas - Bremerhaven
- Nov 2008: Bremerhaven – Cape Town – Neymeier Station
- Apr/May 2009: Punta Arenas - Bremerhaven
- October 2009: Bremerhaven – Punta Arenas
- Spring 2010
- Fall 2010
- …