IASI Level 2 Product Processing

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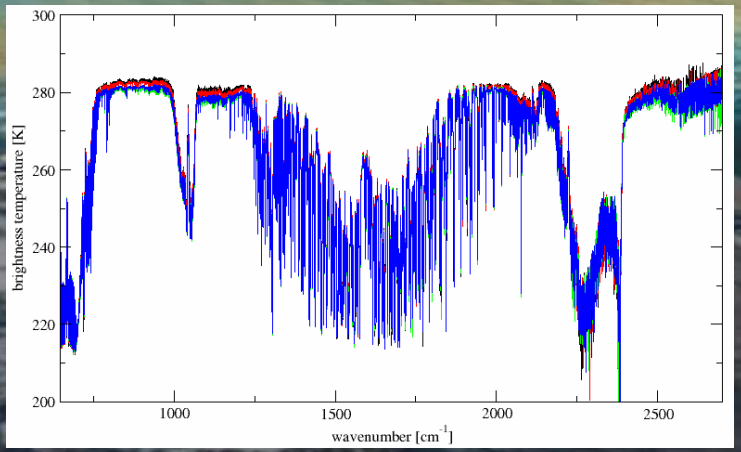
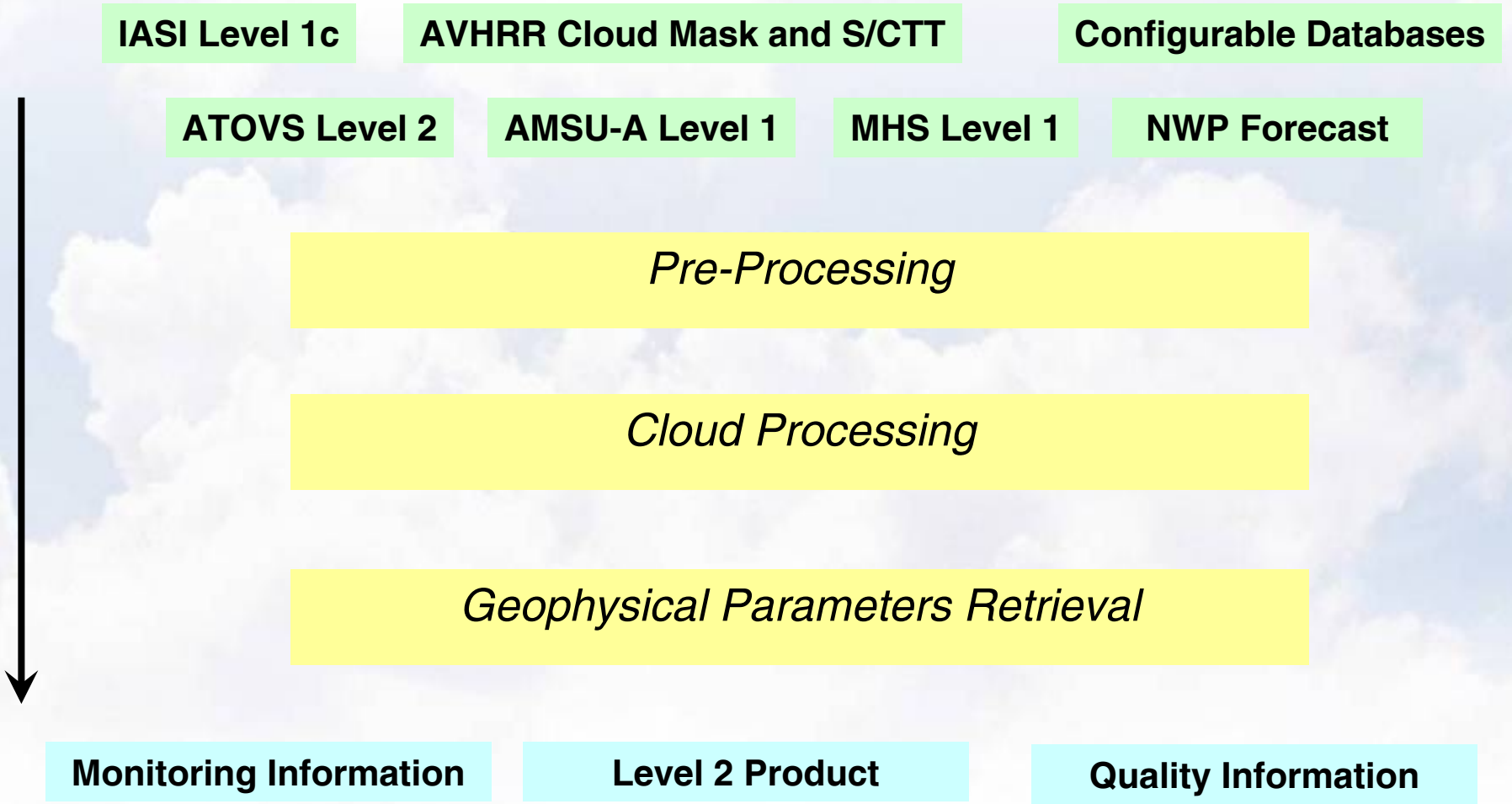
EUMETSAT

Infrared Atmospheric Sounding Interferometer (IASI)

First IASI spectra on 29 November 2006
L1 Products operational since 29 May 2007



IASI level 2 product generation



Properties of the Operational IASI L2 Processor (1/3)

- The current level 2 processing combines IASI with NWP forecast and concurrent measurements of AVHRR and AMSU-A to detect clouds and to derive cloud parameters
- IASI stand-alone processing is used for geophysical parameters retrieval
- Inclusion of NWP forecast parameters in retrieval
  - Surface pressure as reference for the profiles to be retrieved
  - Surface wind speed over sea for the calculation of surface emissivity

Properties of the Operational IASI L2 Processor (2/3)

- Processing is steered by configuration settings (80 configurable auxiliary data sets), which allows for optimisation of PPF following validation results
- Online quality control supports the choice of best processing options in case of partly unavailable IASI data or corrupt side information
- Besides error covariances a number of flags are generated steering through the processing and giving quality indicators; 40 flags are generated, which are part of the product, a sub-selection directly relevant for the user is disseminated with the product

Properties of the Operational IASI L2 Processor (3/3)

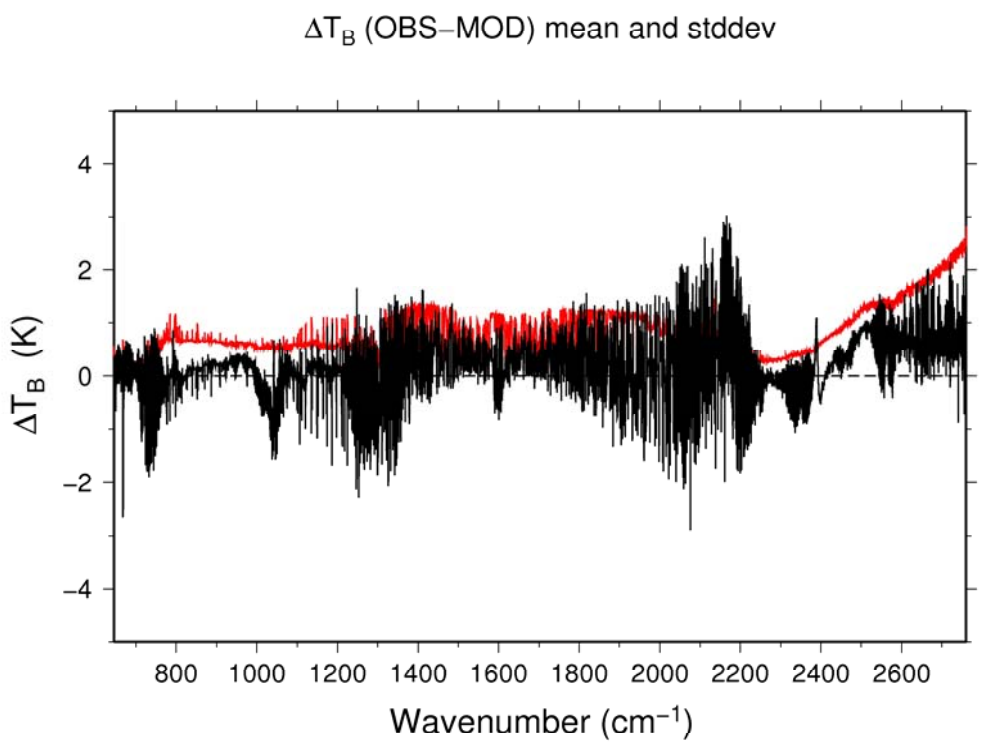
- Different retrieval methods are implemented so that the best configuration can be chosen based on validation results, so far:
  - EOF regression retrieval using all spectral samples of bands 1 and 2 for temperature and moisture retrieval, surface temperature, emissivity, and ozone columns
  - Iterative retrieval based on 235 spectral samples
- Band 3 has been removed from temperature and humidity sounding
  - Insufficient capabilities to include solar radiation (too time consuming)
  - NLTE effects not modelled
  - Suffers from high noise compared to bands 1 and 2

Geophysical parameters retrieval: state vector to be retrieved

- The state vector to be retrieved consists of the following parameters
  - Temperature profile at high vertical resolution
  - Water vapour profile at high vertical resolution
  - Ozone columns in deep layers (0-6 km, 0-12 km, 0-16 km, total column)
  - Land or sea surface temperature
  - Surface emissivity at 12 spectral positions
  - Columnar amounts of CO, N_2O, CH_4, CO_2
  - Cloud amount
  - Cloud top temperature and pressure
  - Cloud phase

- In case of clouds and elevated surface the state vector has to be modified

Correction of systematic errors

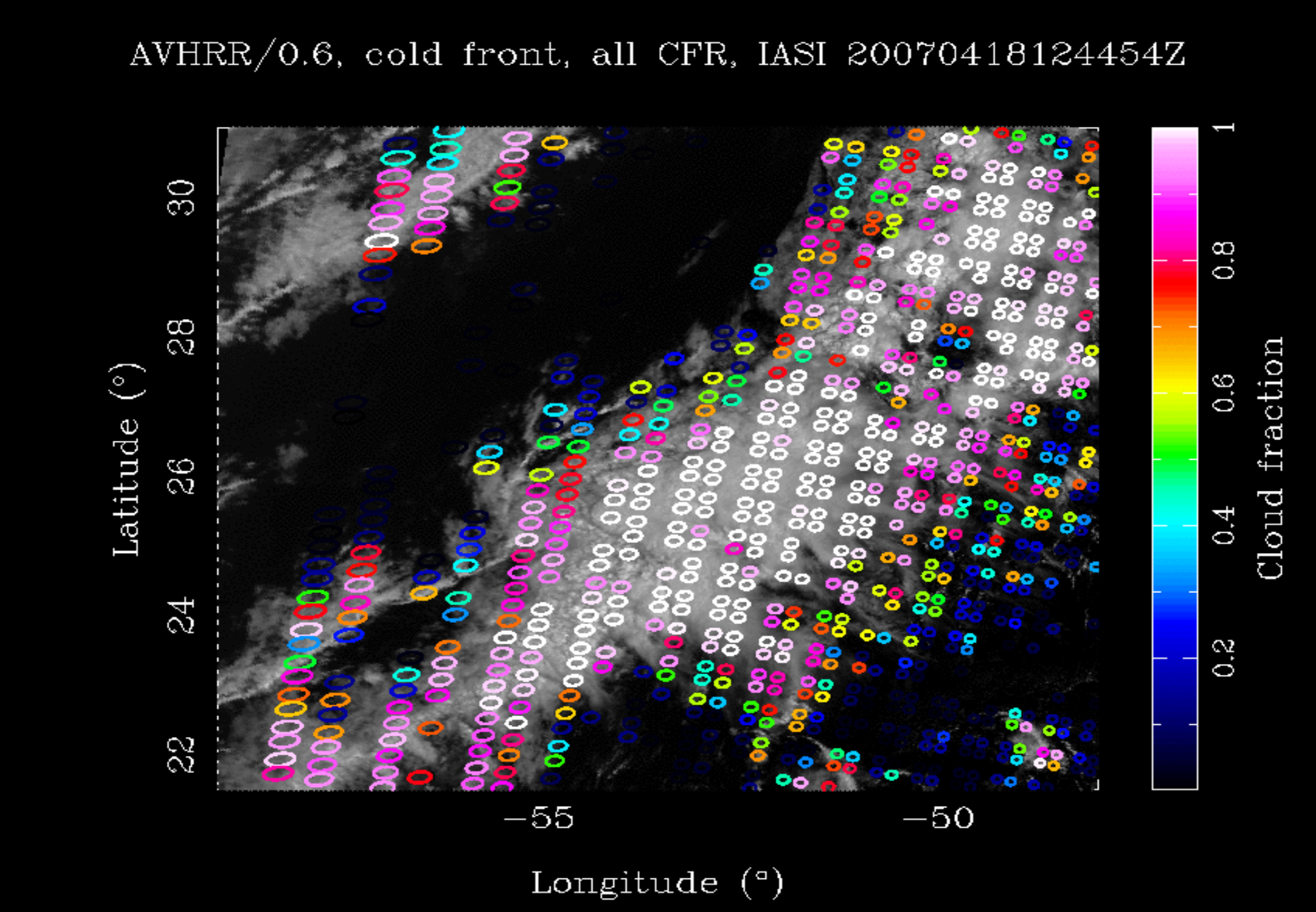


- The retrieval scheme uses radiative transfer calculations as basis
- Prerequisite for the functionality of the retrieval is a good representativity of the measurements by simulated radiances
- Systematic errors:
  - Approxmations necessary for fast calculations
  - Insufficient knowledge of spectroscopic data
  - Erroneous input data
- Systematic fit of models to IASI measurements

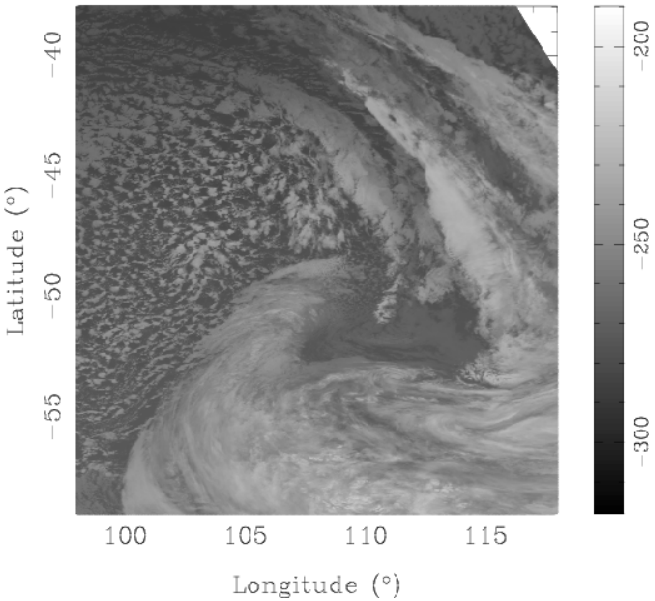
Cloud processing

- Cloud detection
  - AVHRR-based cloud detection using Scenes Analysis from AVHRR Level 1 processing
  - Combined IASI / ATOVS cloud detection
  - IASI stand-alone cloud detection

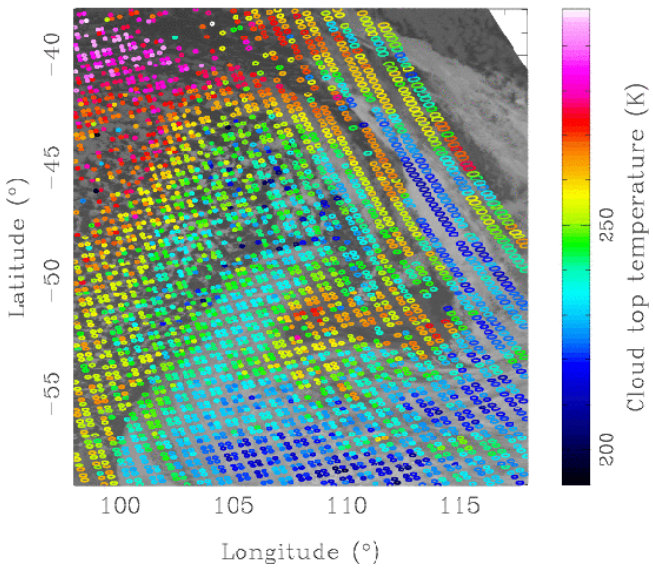
- Cloud parameters retrieval
  - Cloud fraction (CO_2-Slicing)
  - Cloud top pressure and temperature (CO_2-Slicing)
  - Cloud phase


AVHRR/0.6, cold front, all CFR, IASI 20070418124454Z
Latitude (°)
22
24
26
28
30
−55
−50
Longitude (°)
Cloud fraction
0.2
0.4
0.6
0.8
1

Cloud parameters retrieval

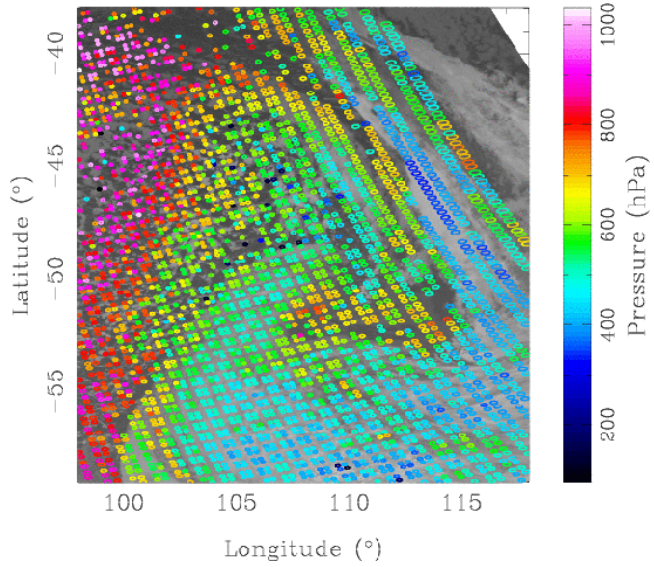


AVHRR: 10.8 µm



IASI:

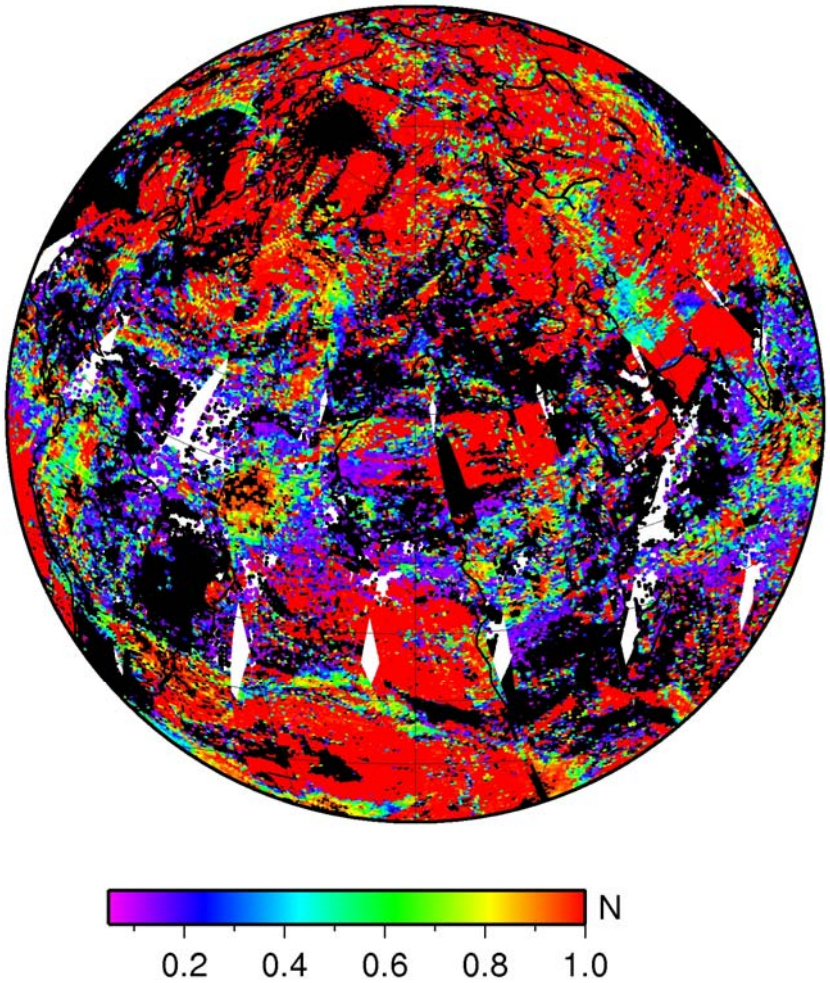
Cloud top temperature

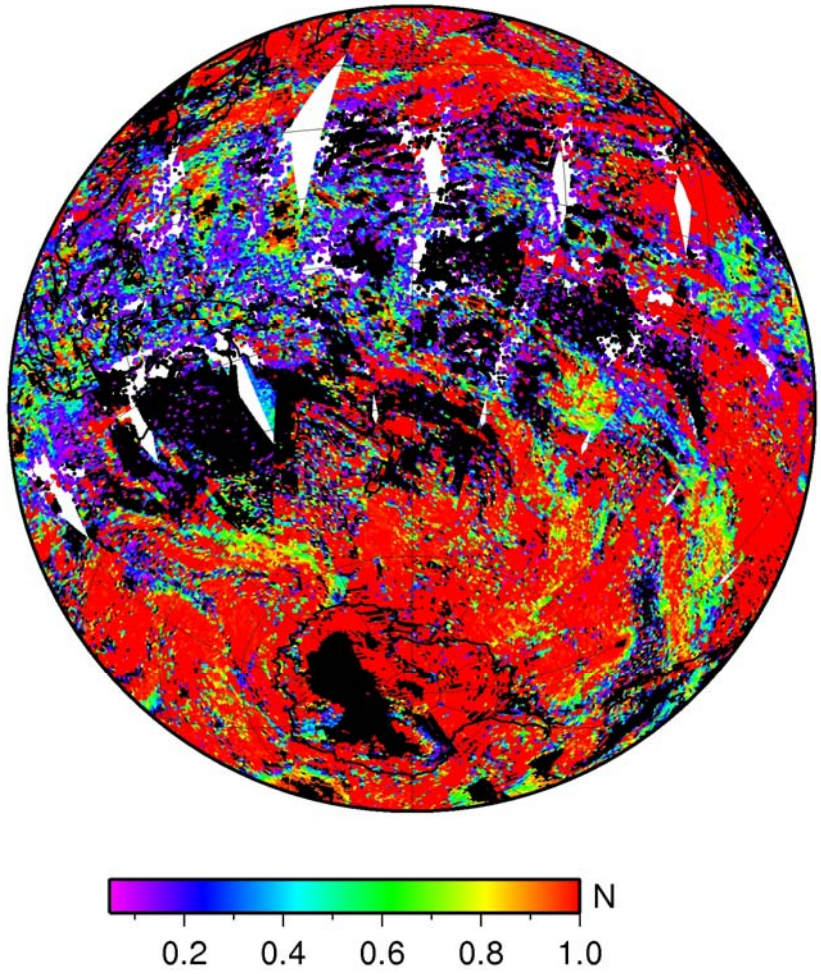


IASI:

Cloud top pressure

Cloud Cover – 16 October 2007

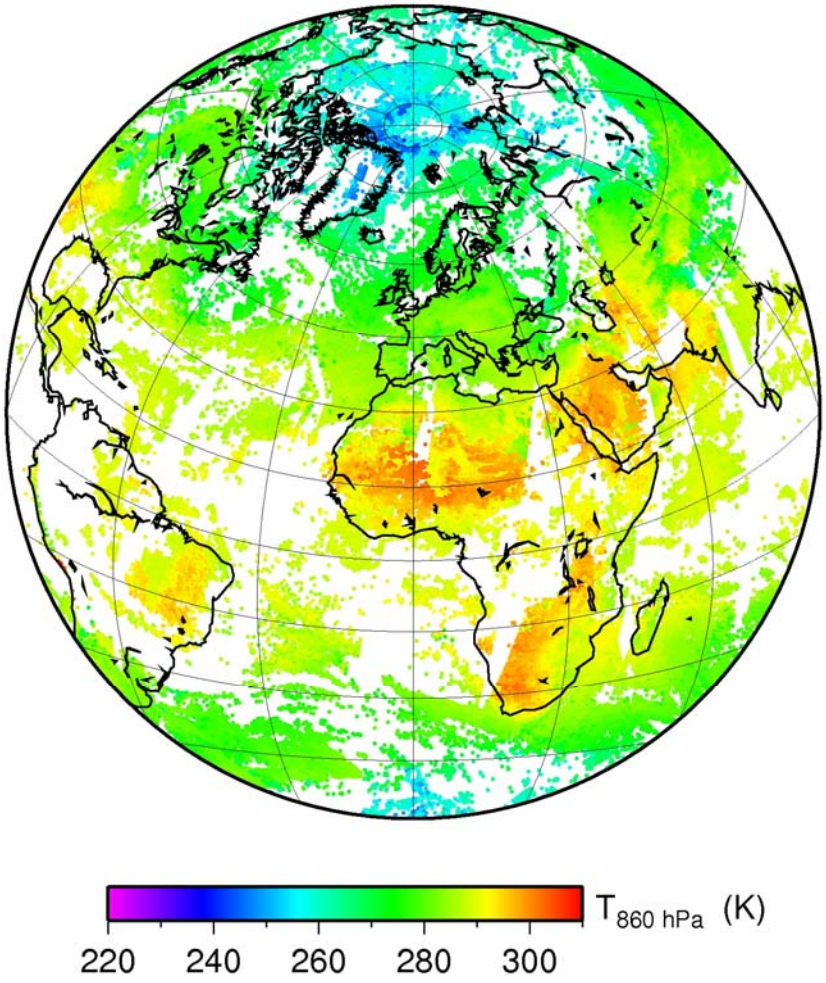


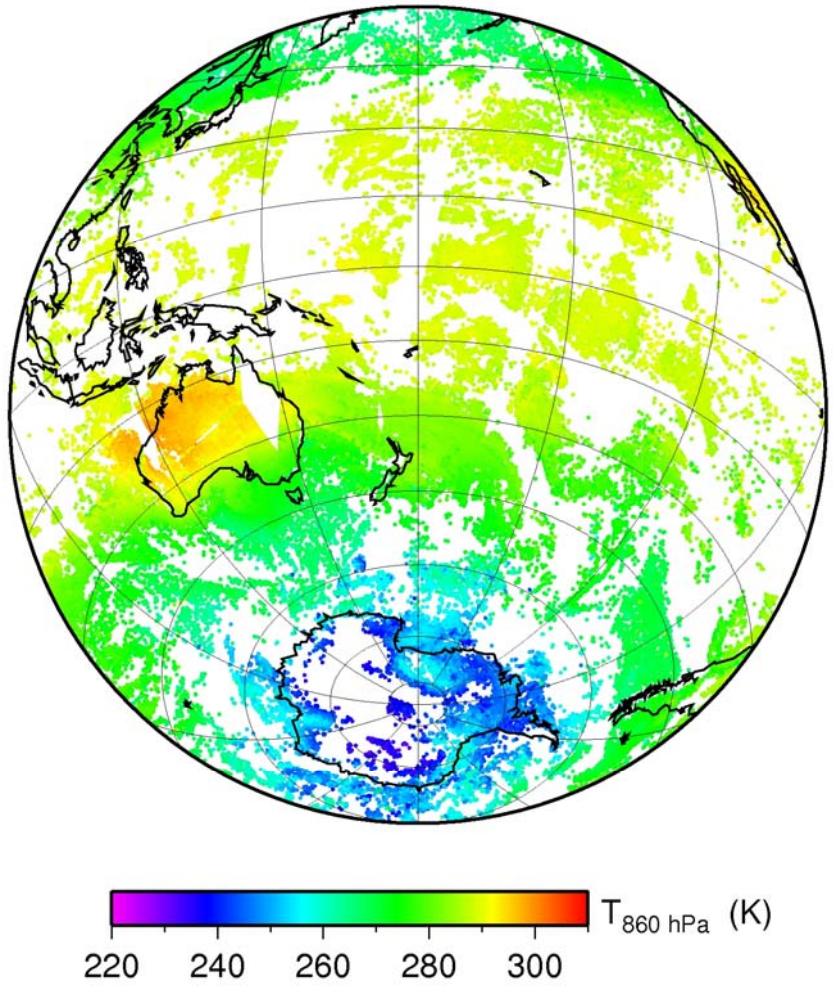


Number of soundings in global datasets

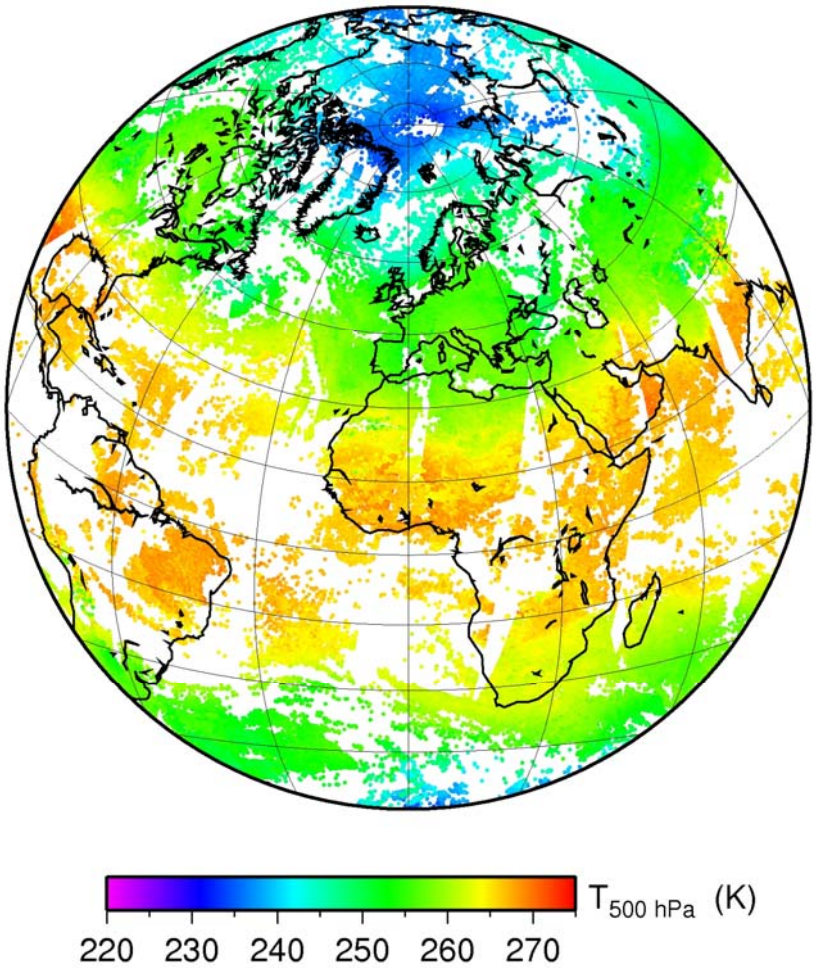
- IASI soundings are possible only in clear or nearly clear fields of view
- The fraction of clear or almost clear IASI soundings:
  - N < 2%: 15% (varies between 12 and 24% among different orbits)
- Fraction of useful soundings depending on atmospheric level
  - 860 hPa: 52%
  - 700 hPa: 54%
  - 500 hPa: 62%
  - 300 hPa: 90%
  - 200 hPa: 95%

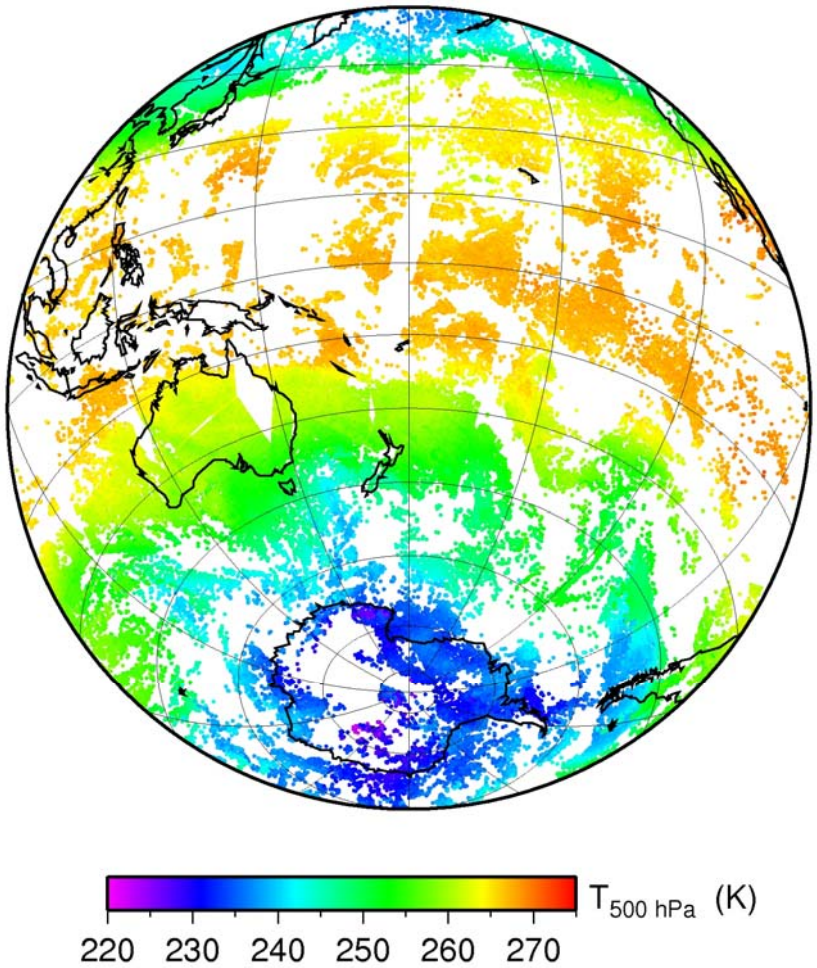
Temperature at 860 hPa: 16 October 2007



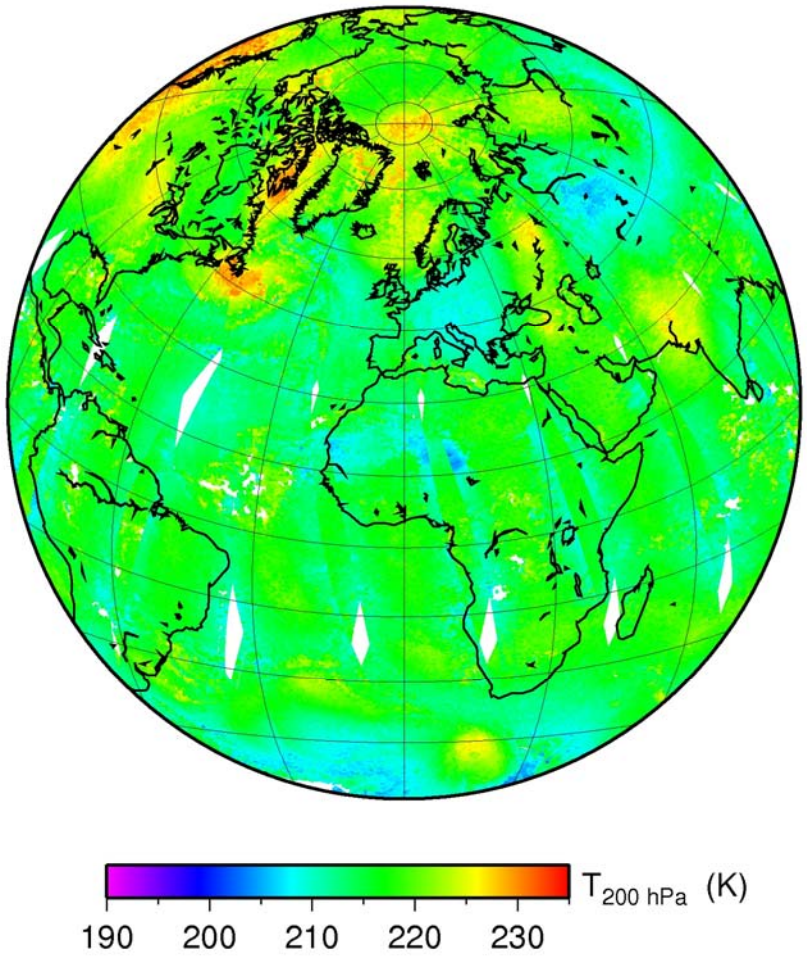


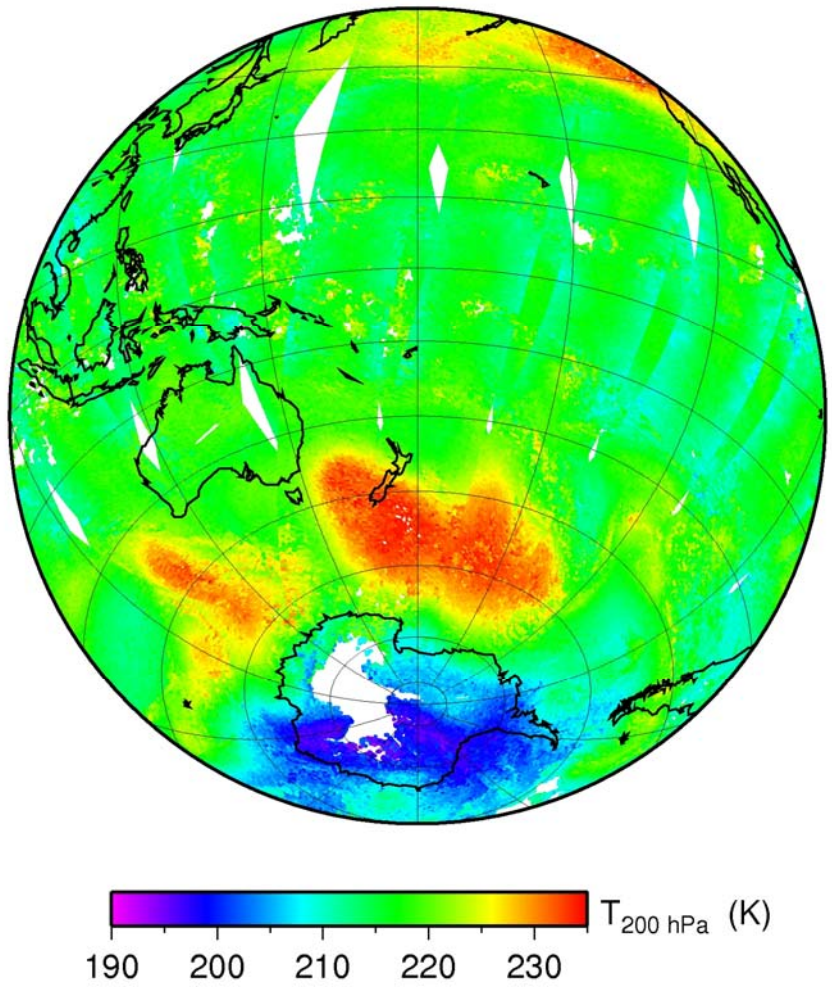
Temperature at 500 hPa: 16 October 2007



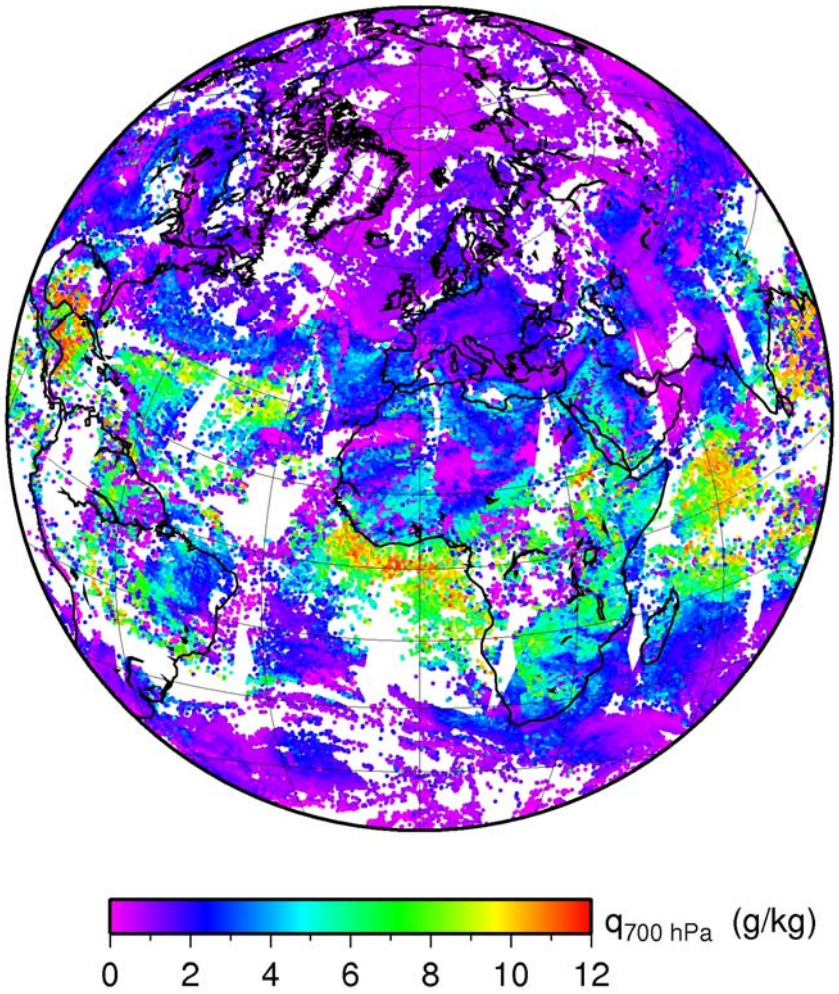


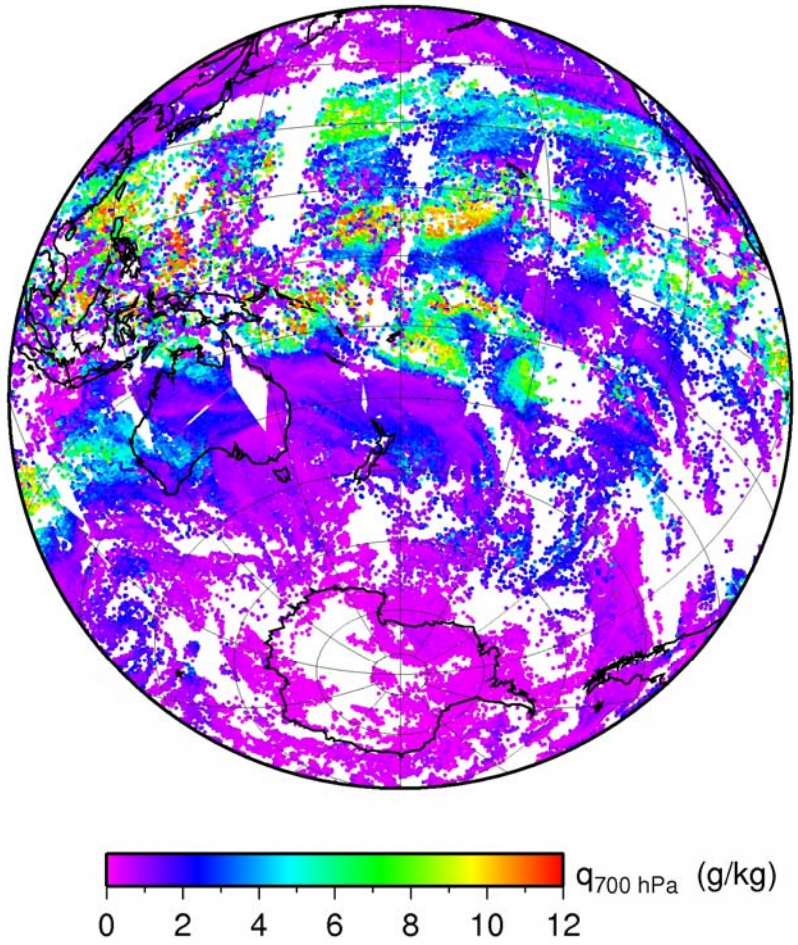
Temperature at 200 hPa: 16 October 2007



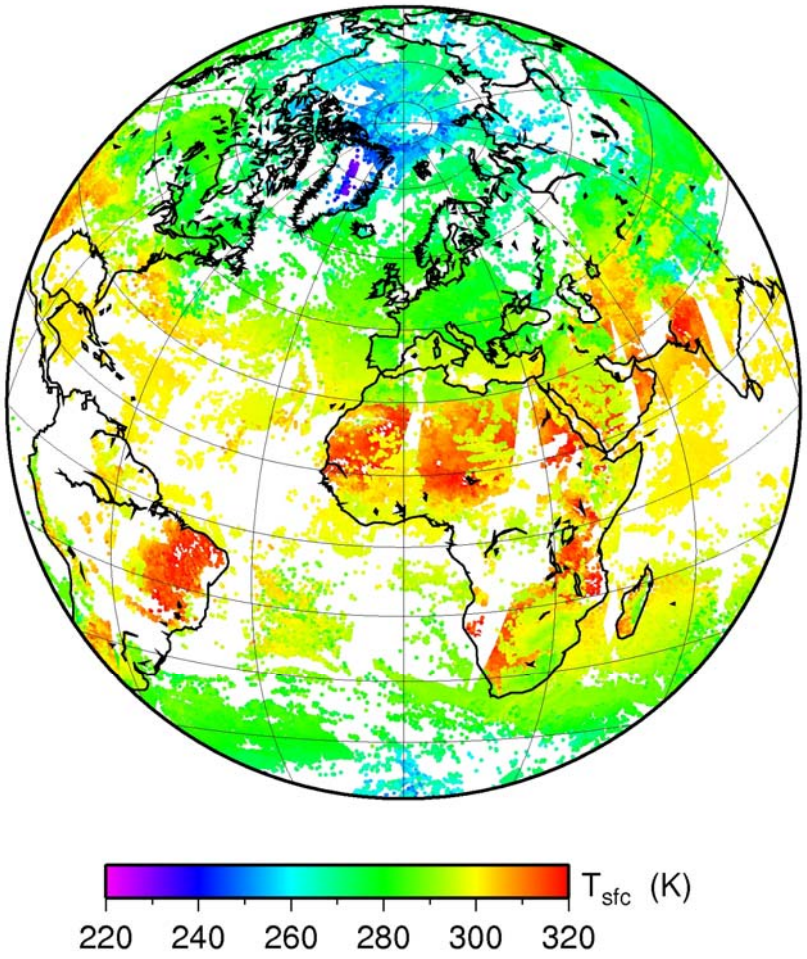


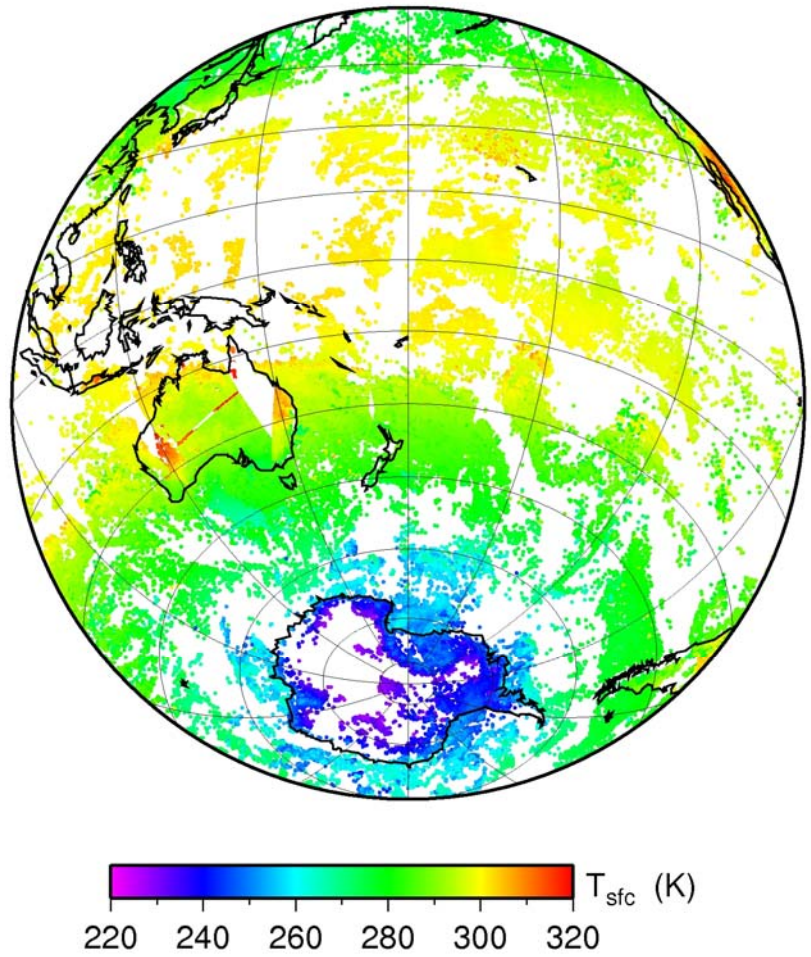
Specific humidity at 700 hPa: 16 October 2007



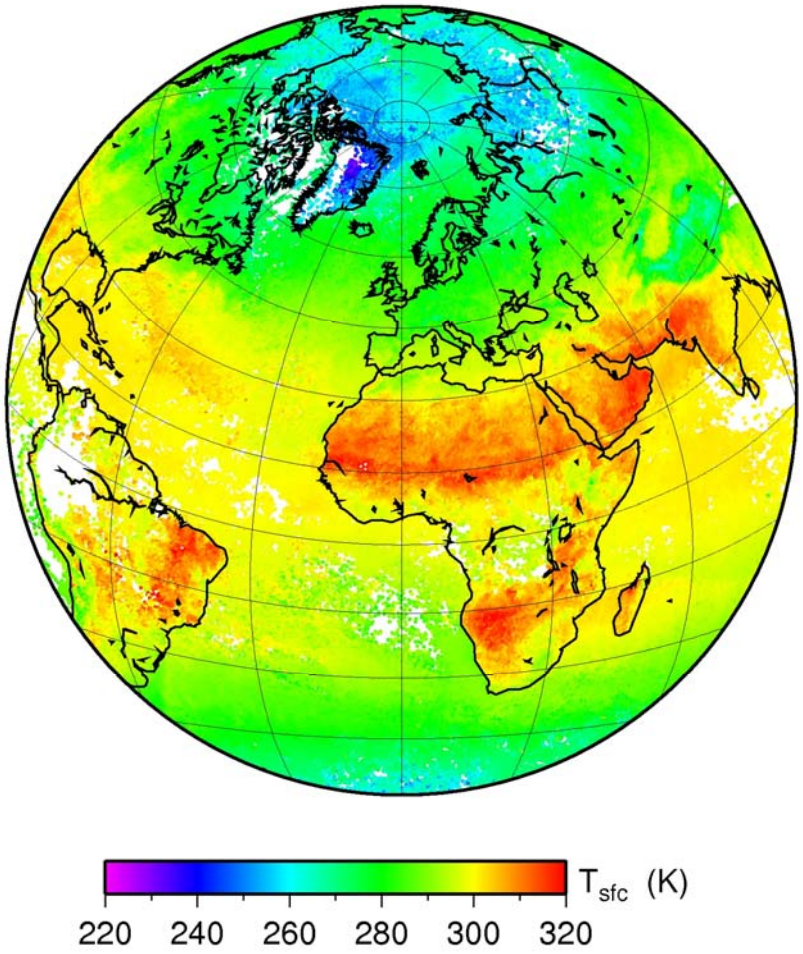


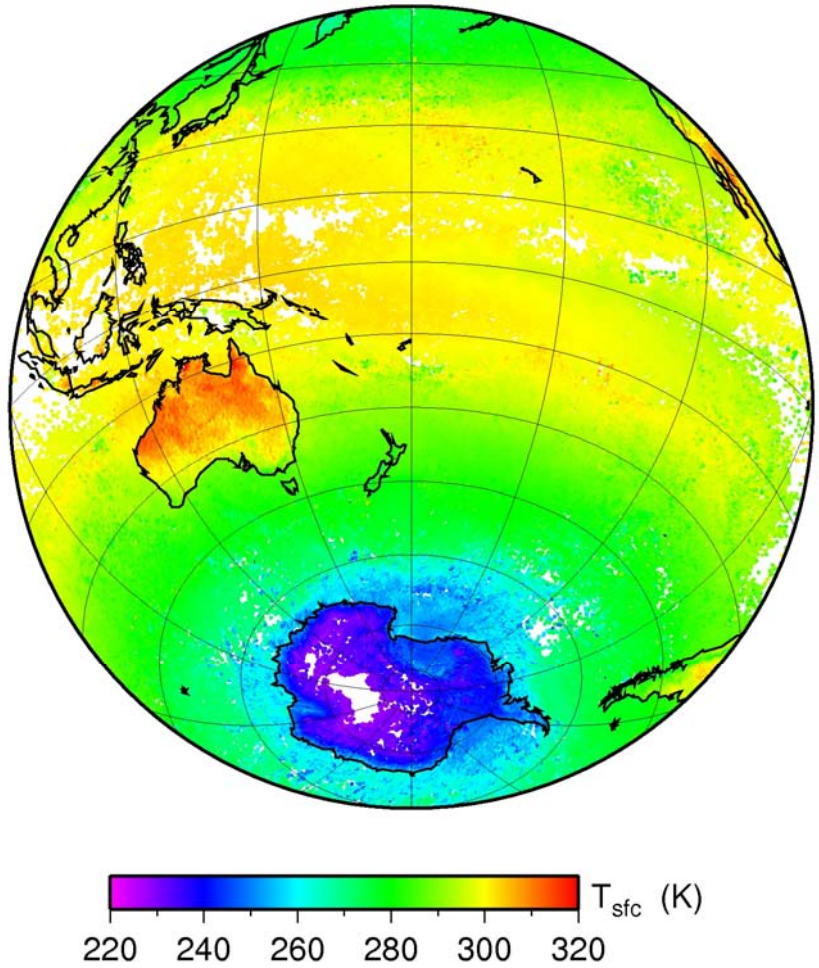
Surface skin temperature: 16 October 2007



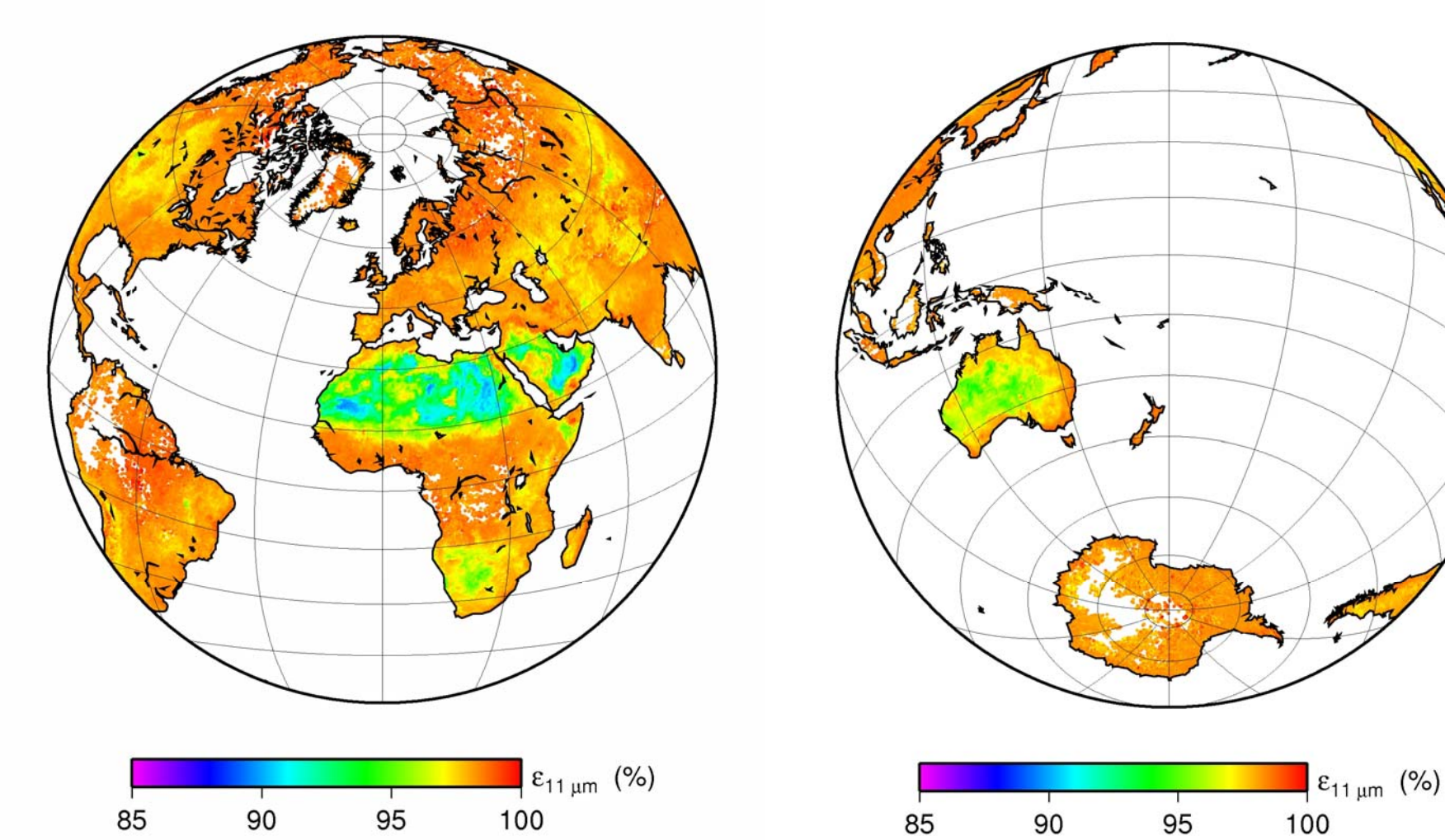


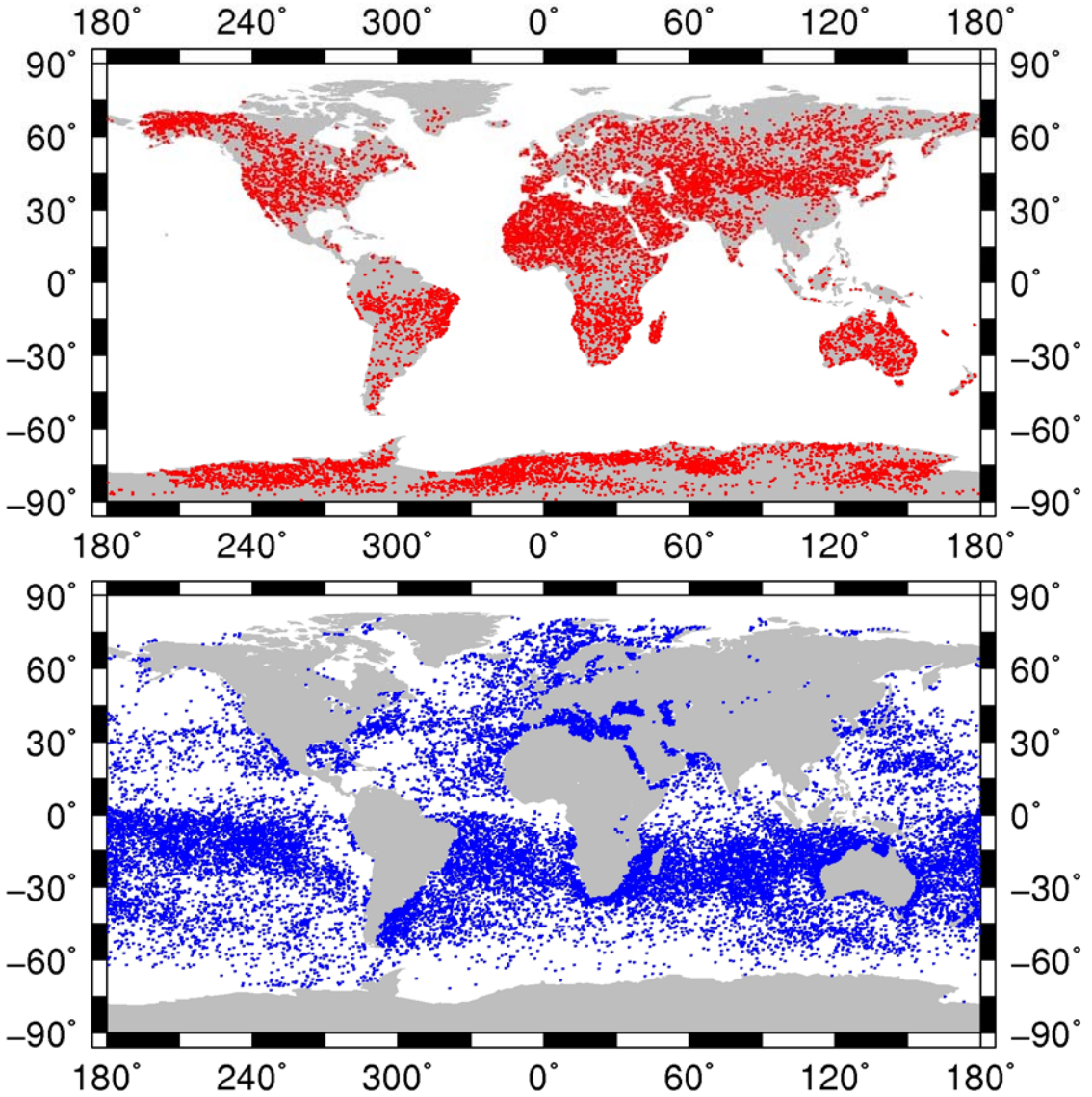
10 day average skin temperature: 16-25 October 2007





15 day average emissivity: 16-30 October 2007





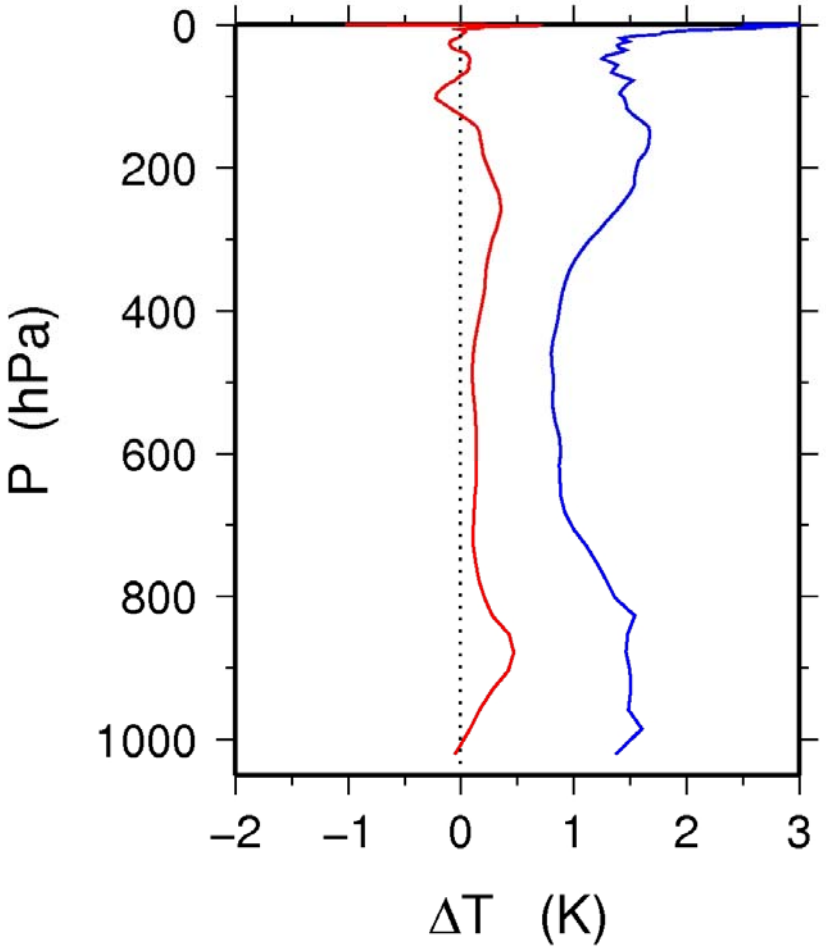
Comparison: ECMWF / IASI

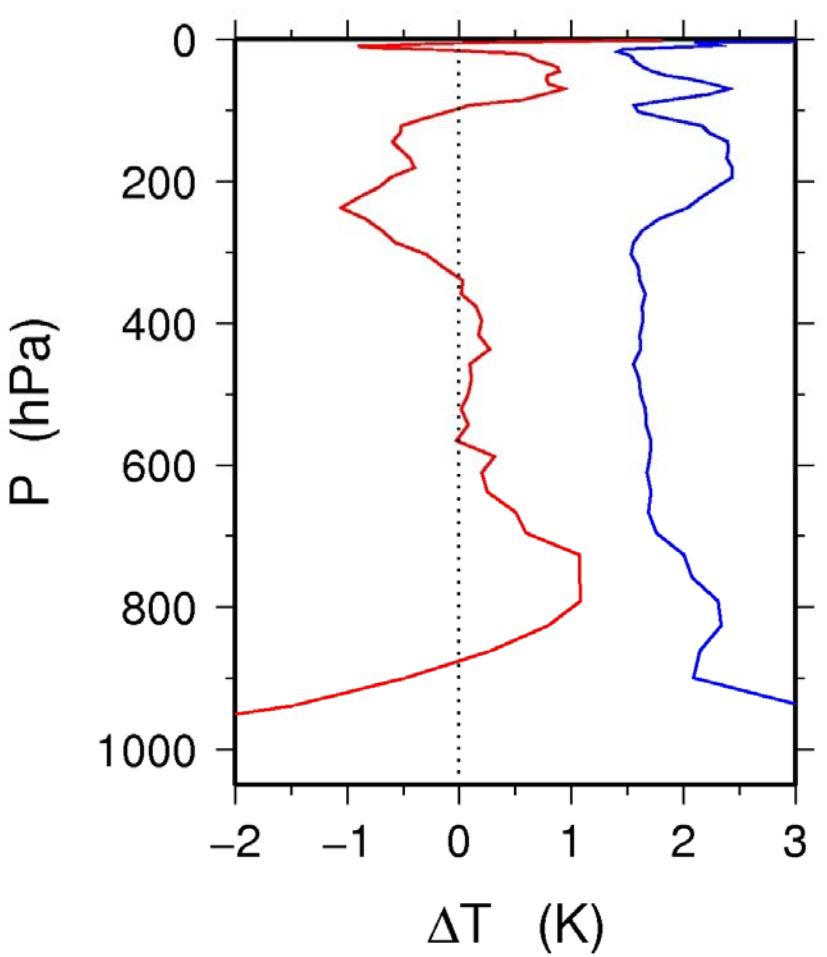
Clear situations
May – June 2007

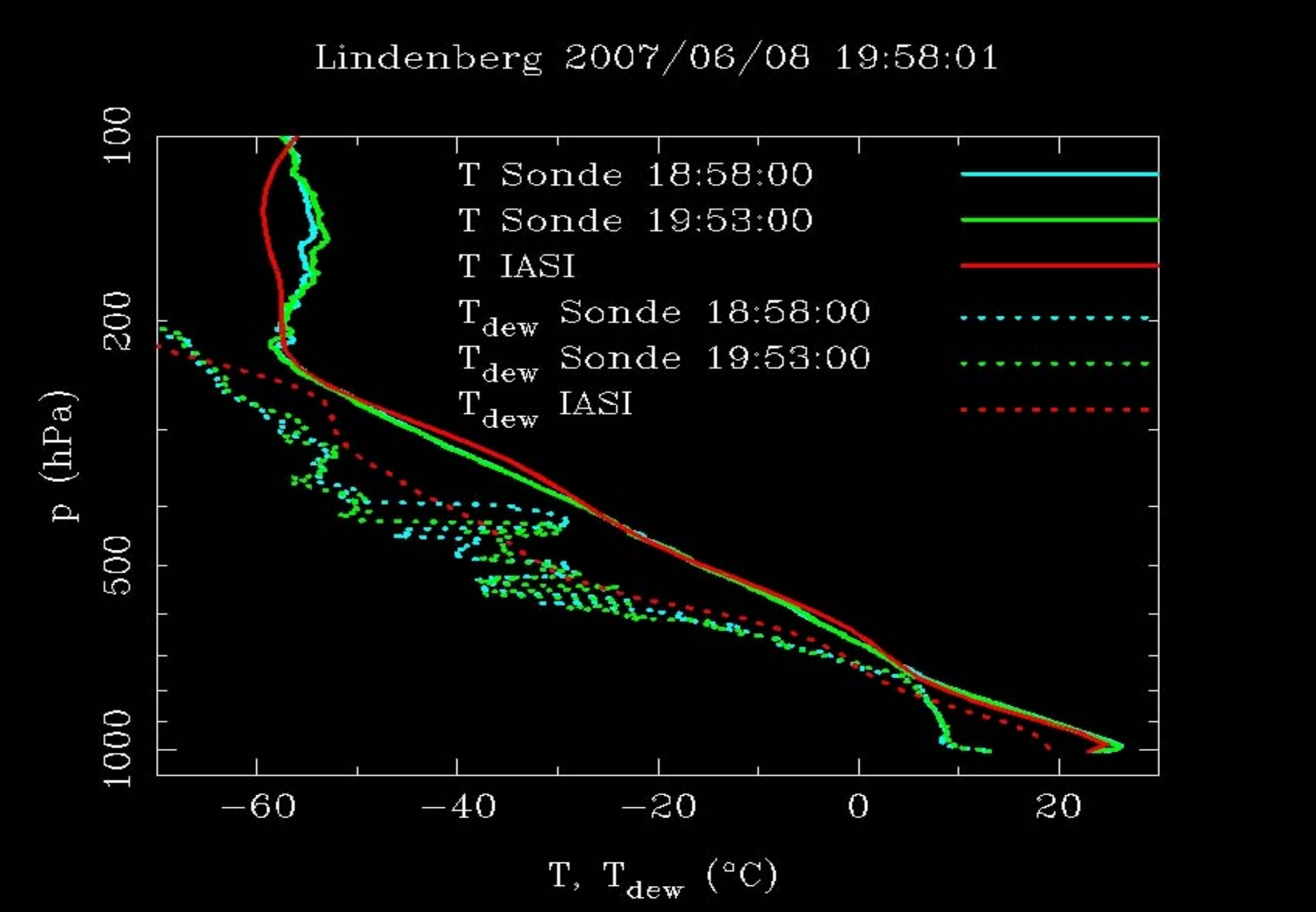
Land: 1330 match-ups

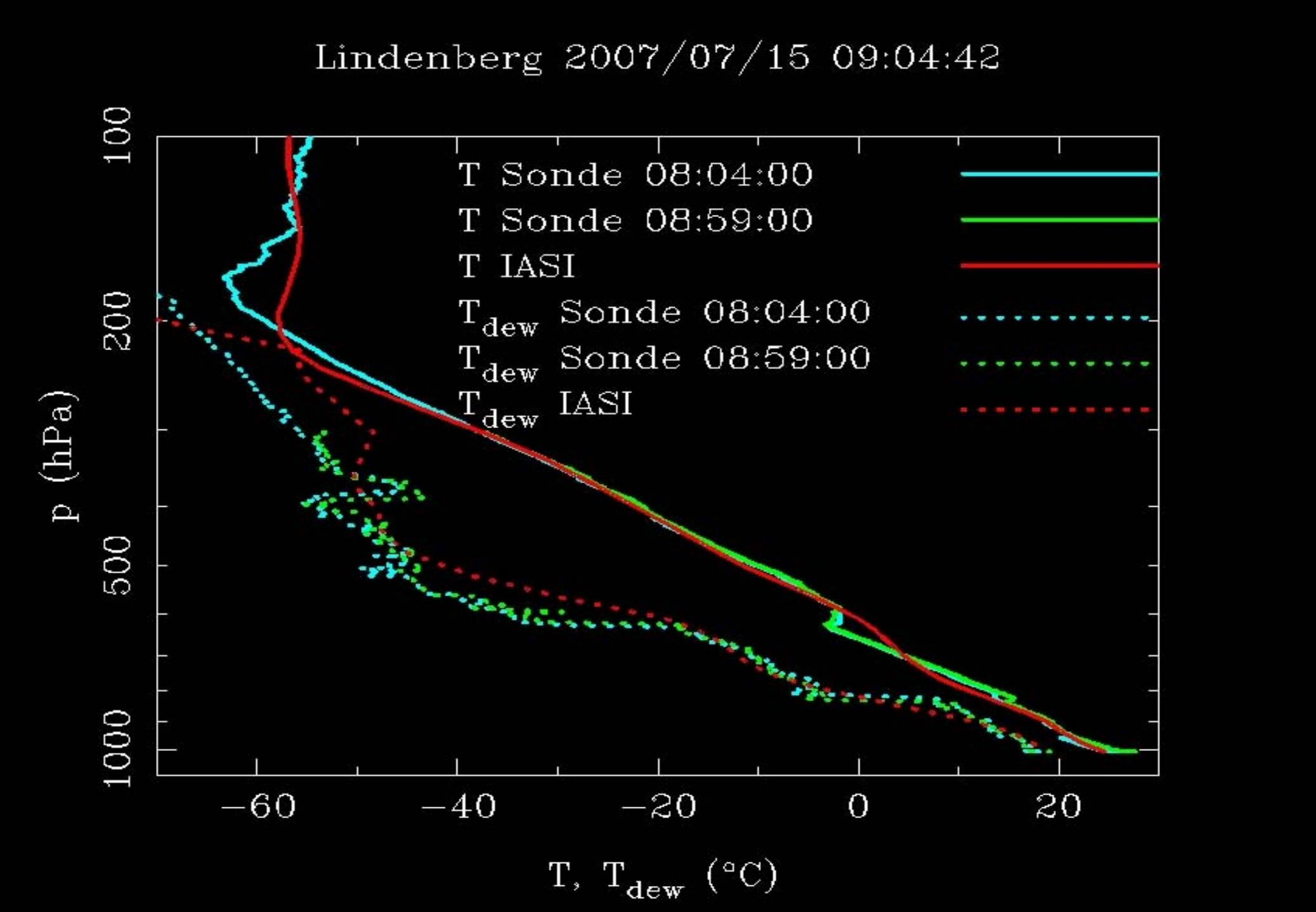
Ocean: 21810 match-ups

Comparison: ECMWF - IASI L2






Lindenberg 2007/06/08 19:58:01
T Sonde 18:58:00
T Sonde 19:53:00
T IASI
T_dew Sonde 18:58:00
T_dew Sonde 19:53:00
T_dew IASI
p (hPa)
100
200
500
1000
−60
−40
−20
0
20
T, T_dew (°C)


Lindenberg 2007/07/15 09:04:42
T Sonde 08:04:00
T Sonde 08:59:00
T IASI
T_dew Sonde 08:04:00
T_dew Sonde 08:59:00
T_dew IASI
p (hPa)
100
200
500
1000
−60
−40
−20
0
20
T, T_dew (°C)

Dissemination to users

- The product is broken down into 5 streams:
  - TWT: Atmospheric temperature profiles, atmospheric water vapour profiles, surface skin temperature
  - OZO: Atmospheric ozone
  - CLP: Cloud parameters
  - TRG: Atmospheric trace gases CO, CH_4, N_2O, CO_2
  - EMS: Land surface emissivity

- IASI level 2 products will be disseminated via EUMETCast and GTS

- The trial dissemination of level 2 products has started on 25 September 2007, including TWT and CLP

Conclusion

- The instrument is stable and provides level 1 data operationally, allowing to derive level 2 products
- Level 2 products are being validated against short-range forecast fields and against data from dedicated field campaigns
- The trial dissemination of level 2 products has started