

# The Infrared Atmospheric Sounding Interferometer (IASI) and its implications on HPC?

Lars Fiedler

EUMETSAT

Am Kavalleriesand 31

64295 Darmstadt

Germany



# The Infrared Atmospheric Sounding Interferometer (IASI)

EUMETSAT will provide the IASI high resolution sounder data operationally from 2006 onwards with a duration of 14 years:  
Will the large information content of the IASI spectra have an implication on HPC ?

Starting the discussion with introducing:

- Mission objectives
- The METOP satellite
- The IASI instrument
- The processing chains (L0, L1 and L2)
- Product format and content

## The IASI Mission objectives

IASI measures the spectrum of IR radiation emitted by the Earth system from a low altitude sun-synchronous orbit.

The primary objective is to provide information on:

- Atmospheric temperature profiles in the troposphere and lower stratosphere
- Profiles of water vapour in the troposphere
- Total amount of ozone and information about its vertical distribution
- Fractional cloud cover and cloud top temperature/pressure

# METOP

AVHRR-3

GRAS

GOME-2

HIRS-4  
Metop 1/2 only

ASCAT

IASI

AMSU-A1

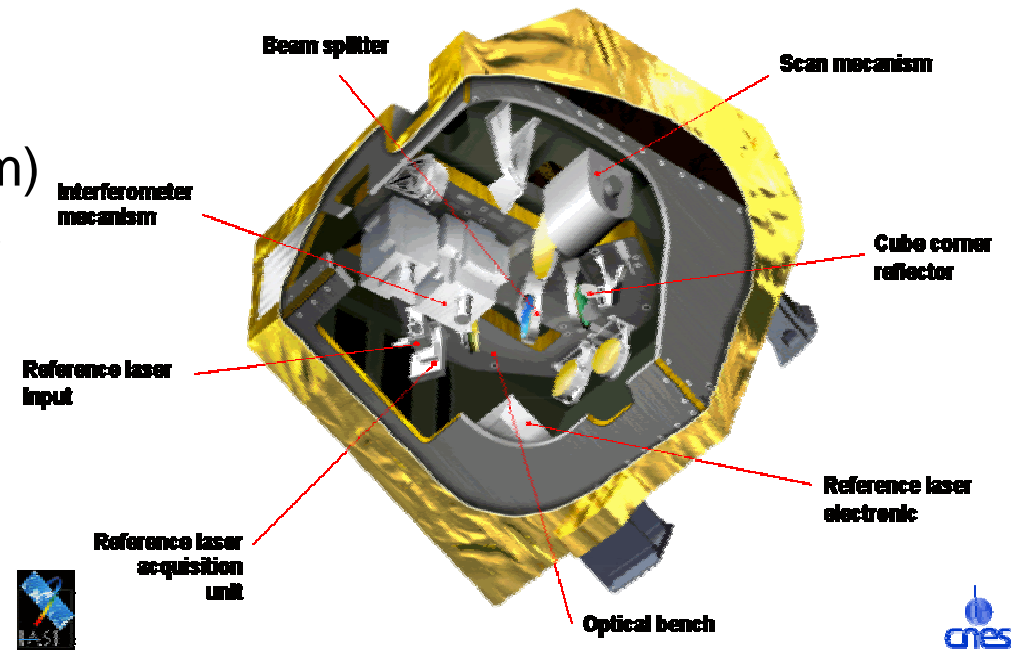
MHS

AMSU-A2

- equator local crossing at 9:30
- sun-synchronous orbit
- height about 820 km

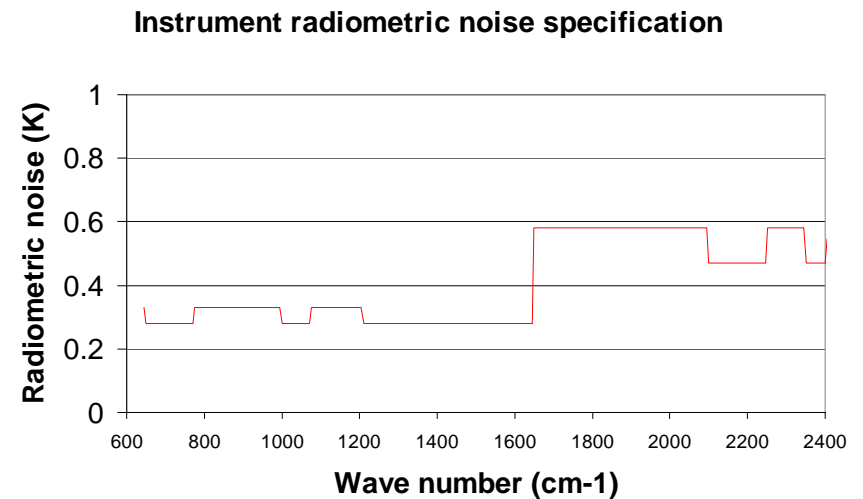
# IASI instrument

- Fourier transform spectrometer with OPD of 2 cm
- Covering the infrared between 645 and 2760  $\text{cm}^{-1}$  (3.62-15.5 $\mu\text{m}$ ) with 3 different bands/detectors
- Spectral resolution 0.5  $\text{cm}^{-1}$  (FWMH)
- sampling at 0.25  $\text{cm}^{-1}$
- 8461 channels
- Integrated Imaging Subsystem with 3.3333° by 3.3333° field of view raster by 64 x 64 pixels



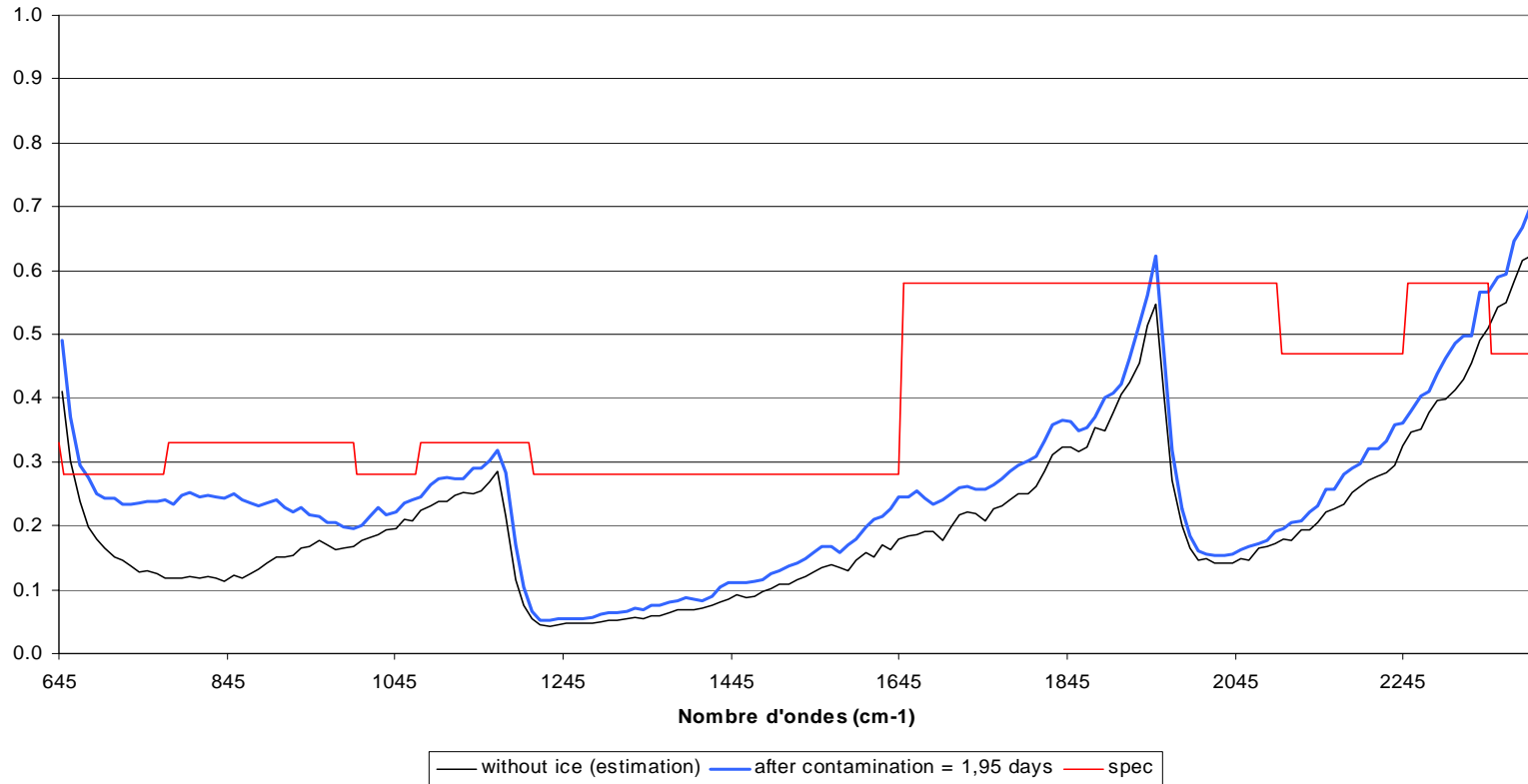
# Radiometric accuracy

- IASI radiometric noise  
NEDT @280K  
0.28 K at 650 cm<sup>-1</sup>  
0.47 K at 2400 cm<sup>-1</sup>
- Dynamic range 180 K to 350 K
- Radiometric calibration better than:
  - 0.5 K absolute
  - 0.2 K relativein each channel.
- Imager radiometric noise @280K  
0.57 K
- Dynamic range 200 to 300 K

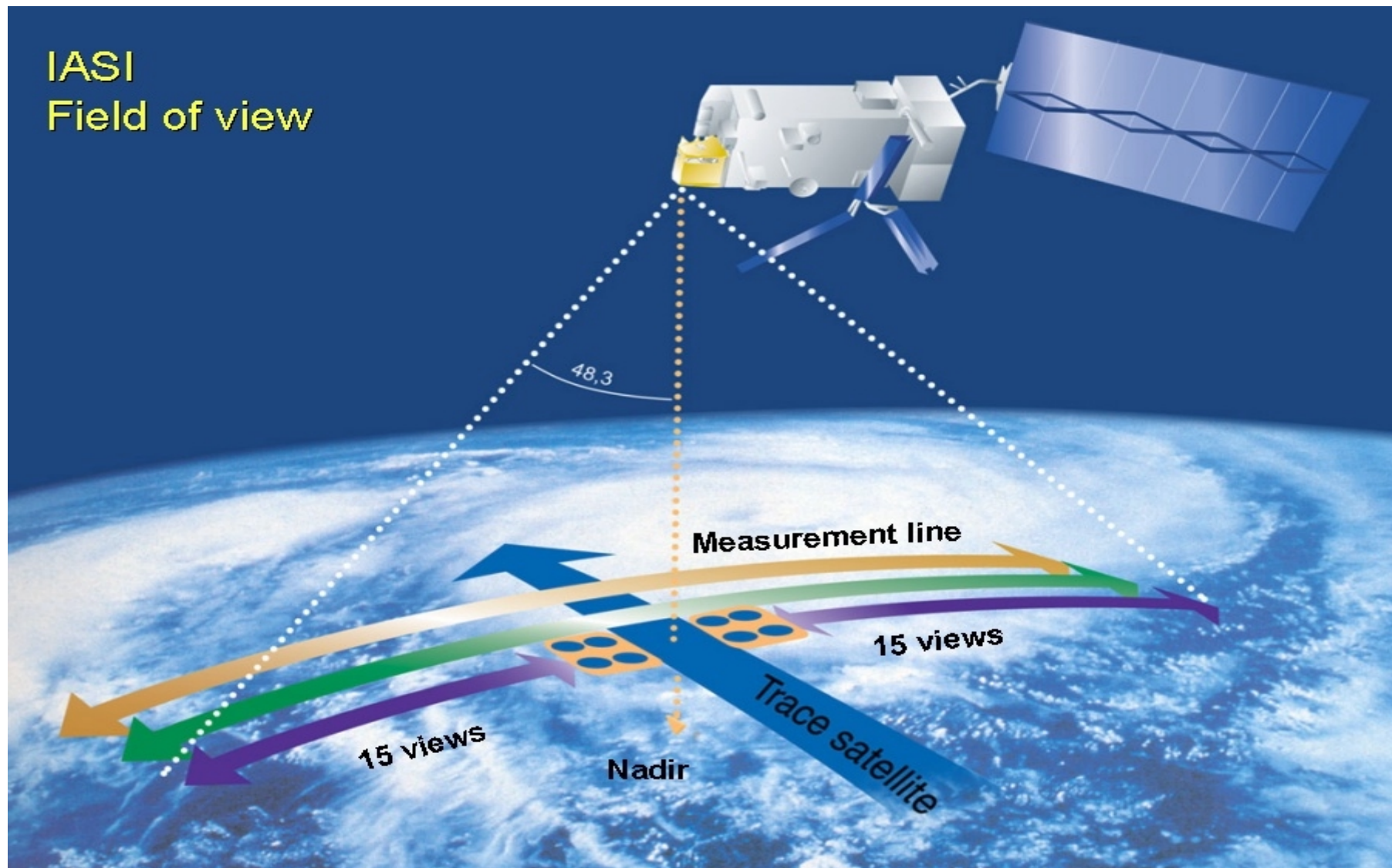


# Radiometric accuracy of PFM

Instrument radiometric performance in NeDT (IPR-2) measured during optical vacuum test

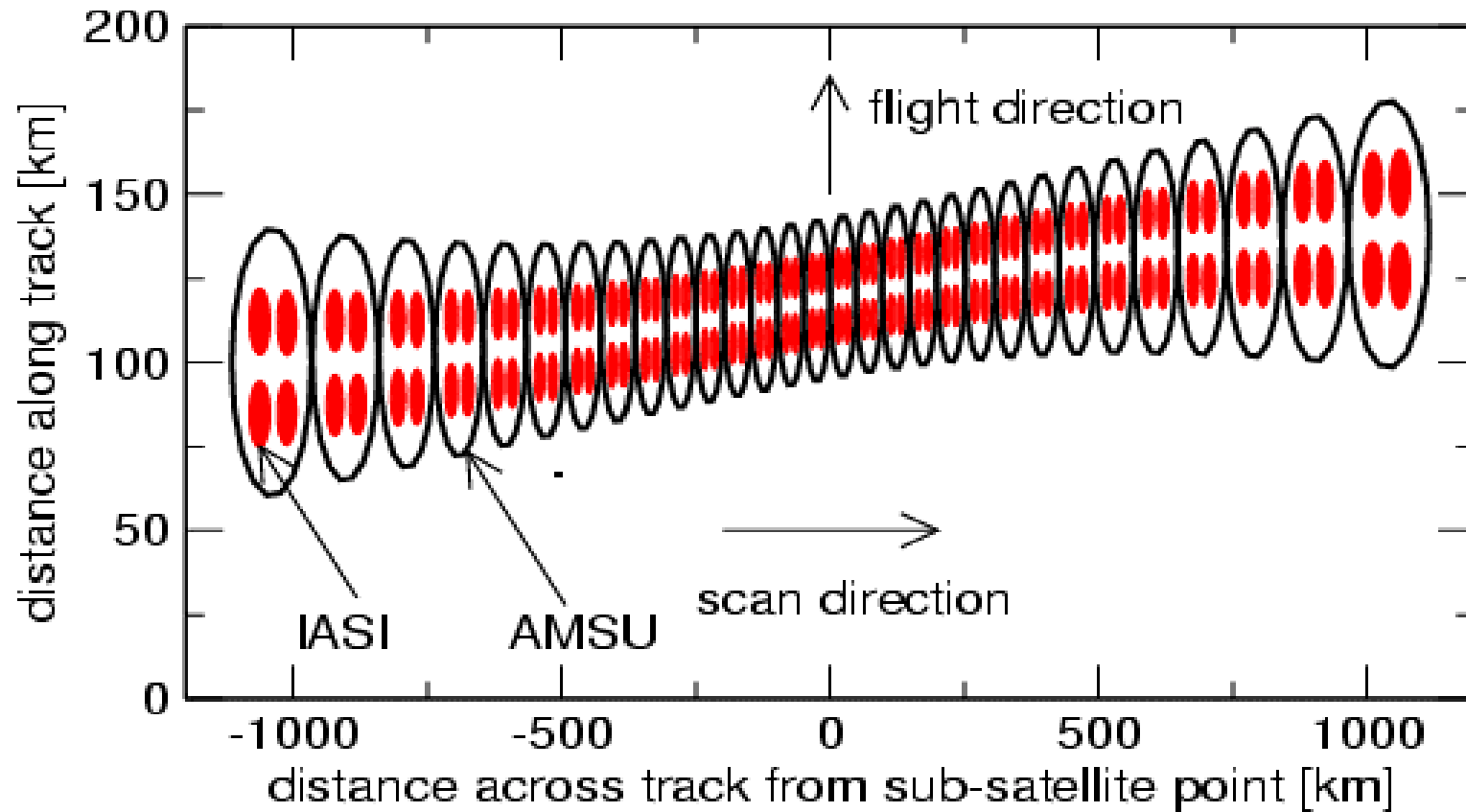


# IASI Field of view

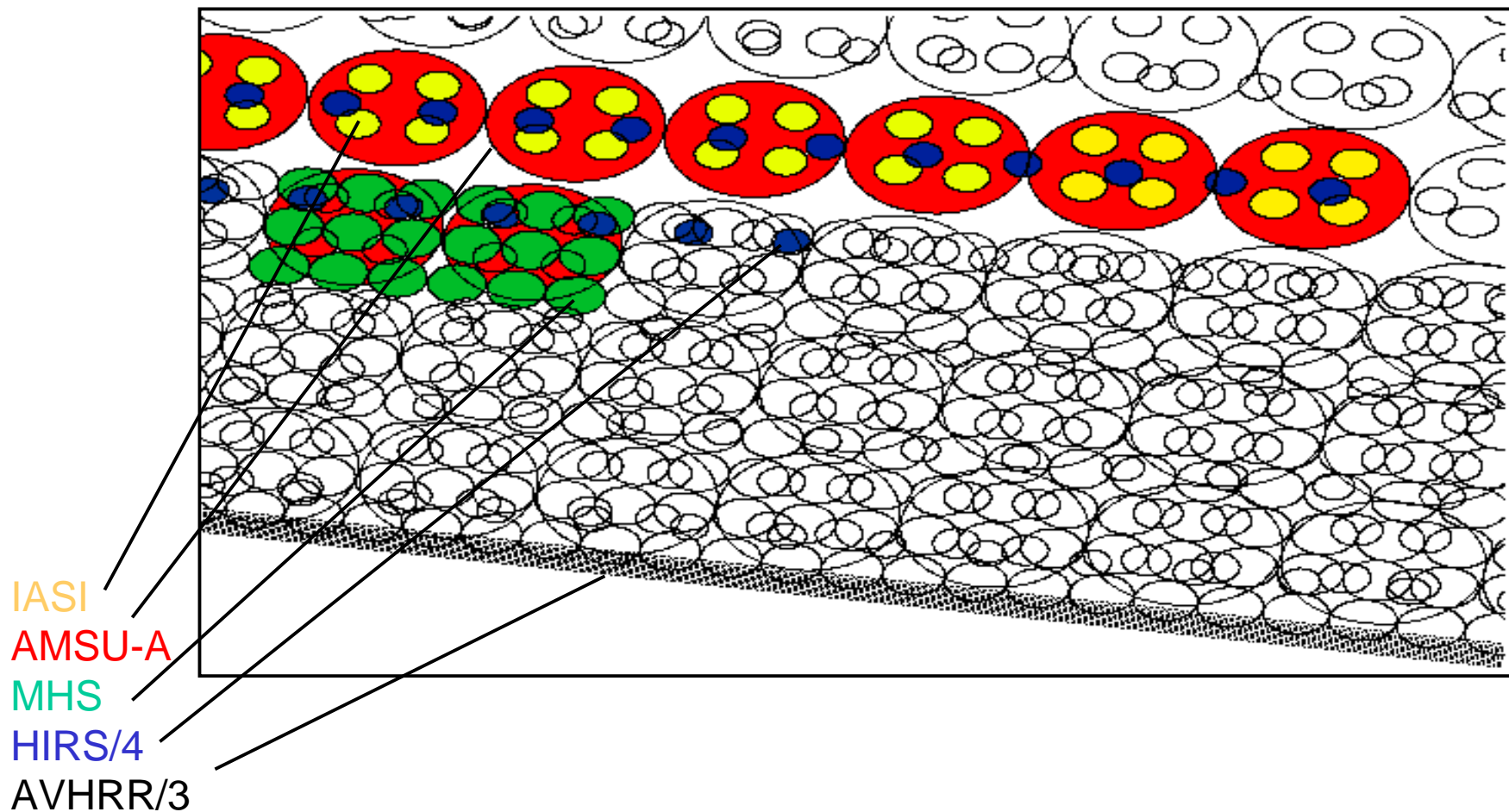


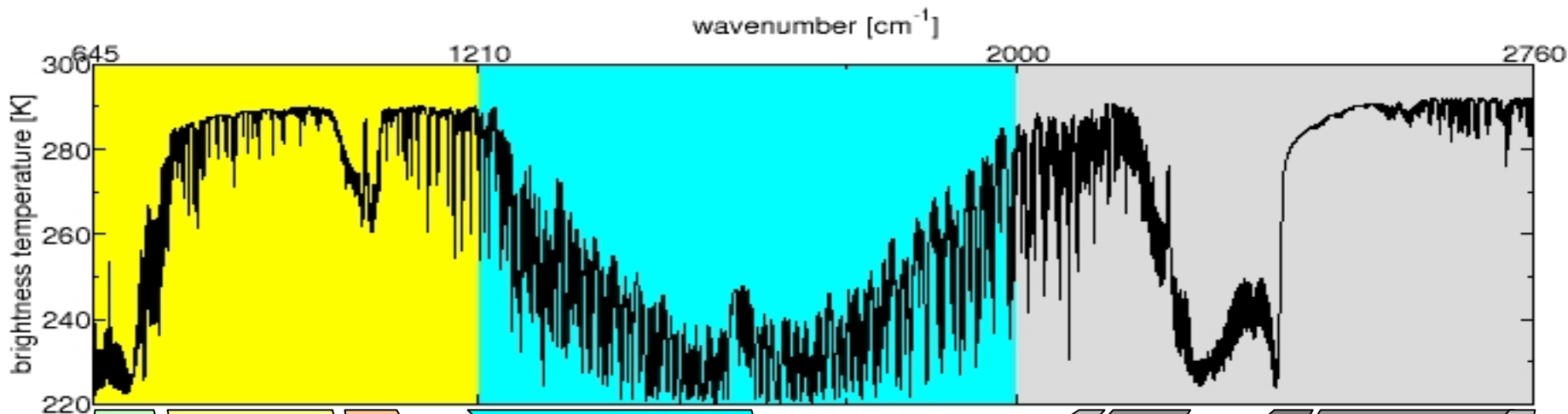


# IASI field of view



# Collocation of IASI, ATOVS and AVHRR

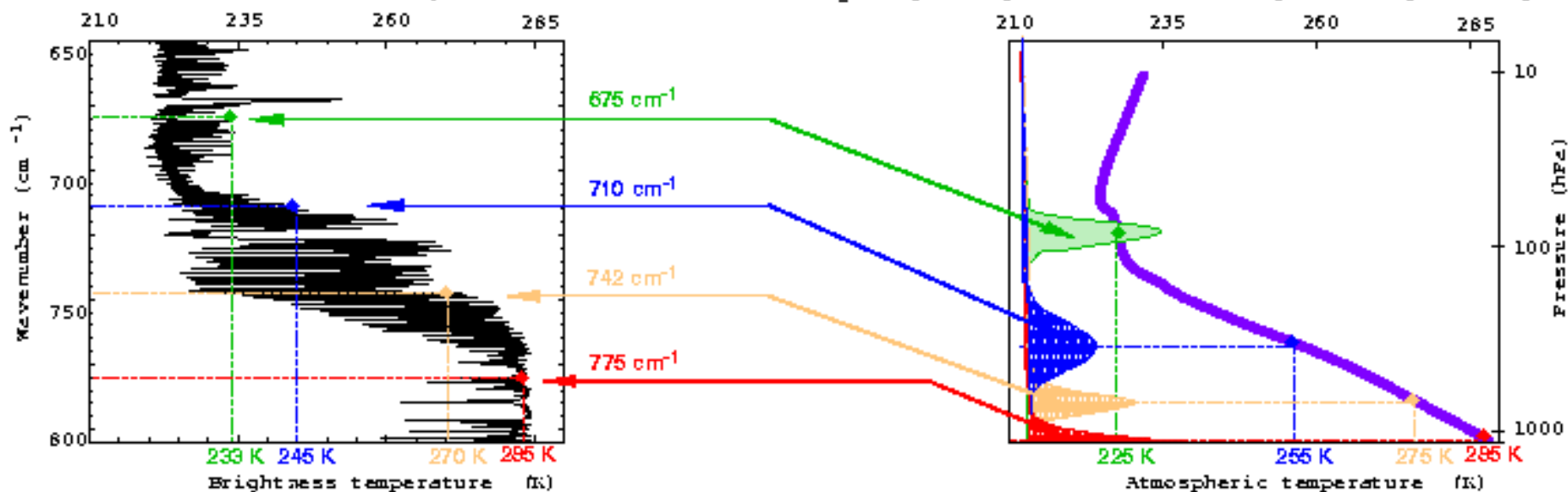




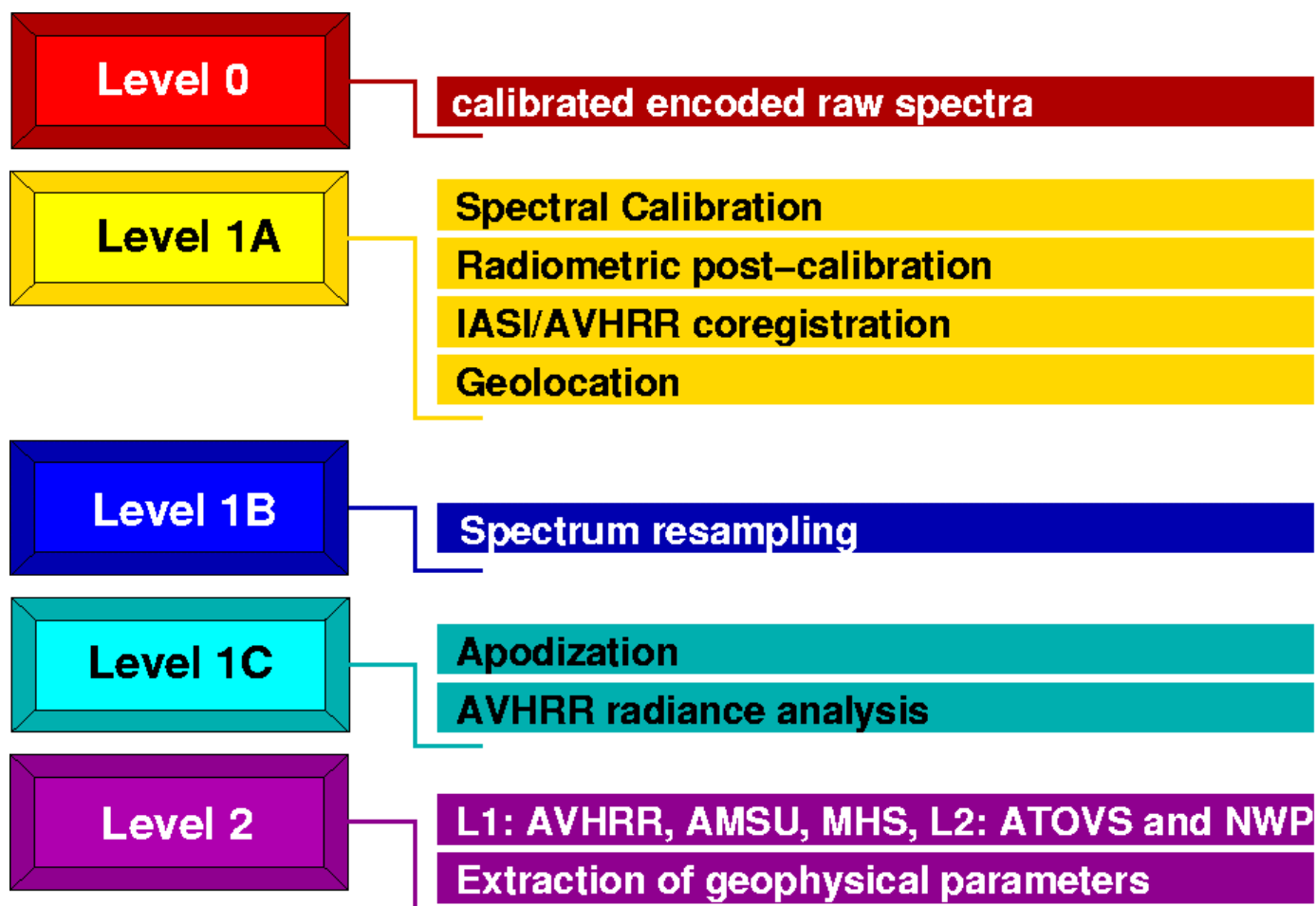
650-770	790-980	1000-1070	1080-1150	1210-1650	2100-2150	2150-2250	2350-2420	2420-2700	2700-2760
CO <sub>2</sub>	Atm. window	O <sub>3</sub>	Atm. window	H <sub>2</sub> O	CO	N <sub>2</sub> O & CO <sub>2</sub>	CO <sub>2</sub>	Atm. window	CH <sub>4</sub>
Temp. profile	Surface & cloud properties	O <sub>3</sub> sounding	Surface, cloud properties	Humidity profile, CH <sub>4</sub> , N <sub>2</sub> O column amount	CO column amount	Temp. profile, N <sub>2</sub> O column amount	Temp. profile	Surface & cloud properties	CH <sub>4</sub> column amount

# Temperature sounding

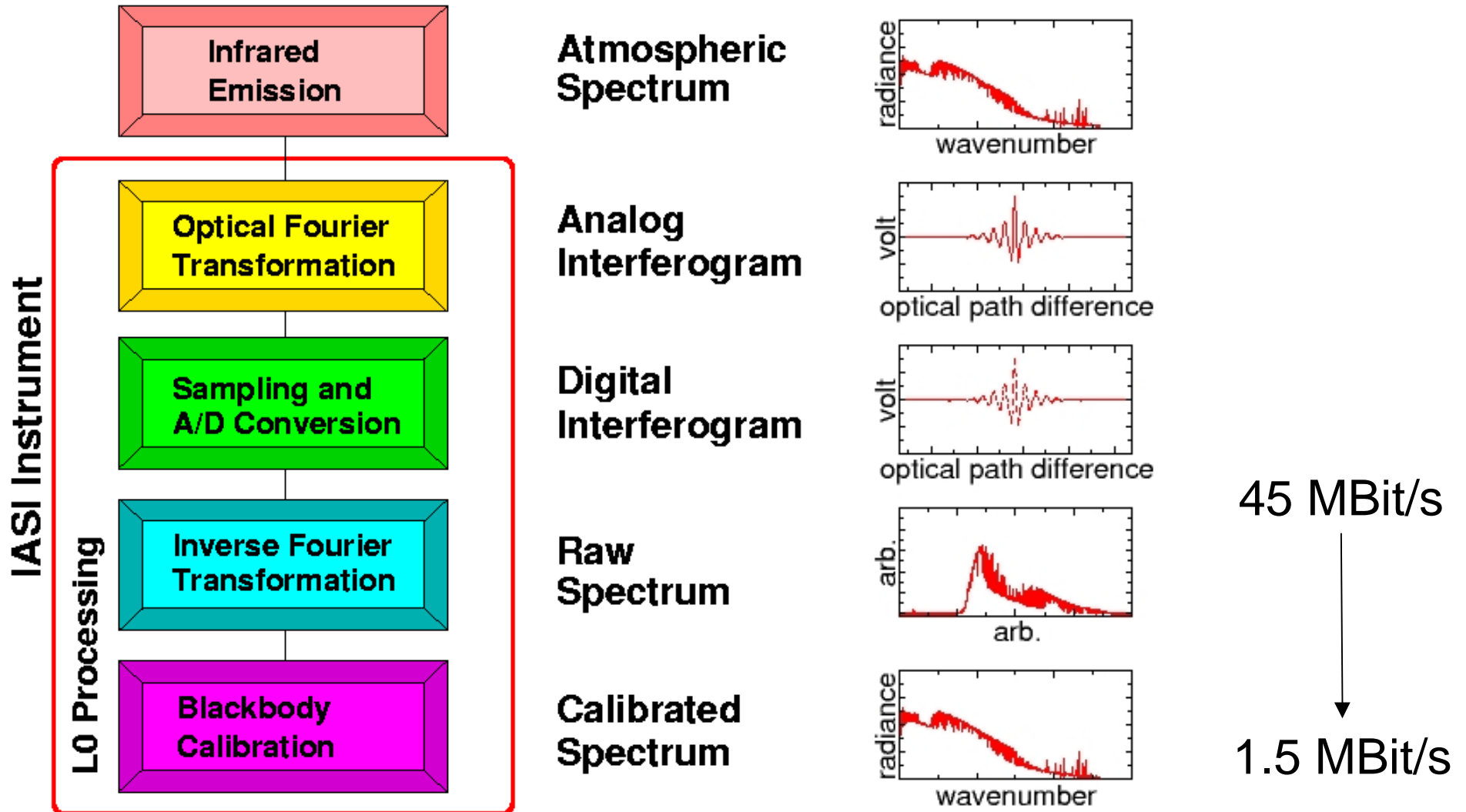
Fig. 3: Correlation between the CO<sub>2</sub> absorption spectrum and the atmospheric temperature profile



# Summary of processing levels



# L0 (on-board) Processing



# IASI L1 processing constraints

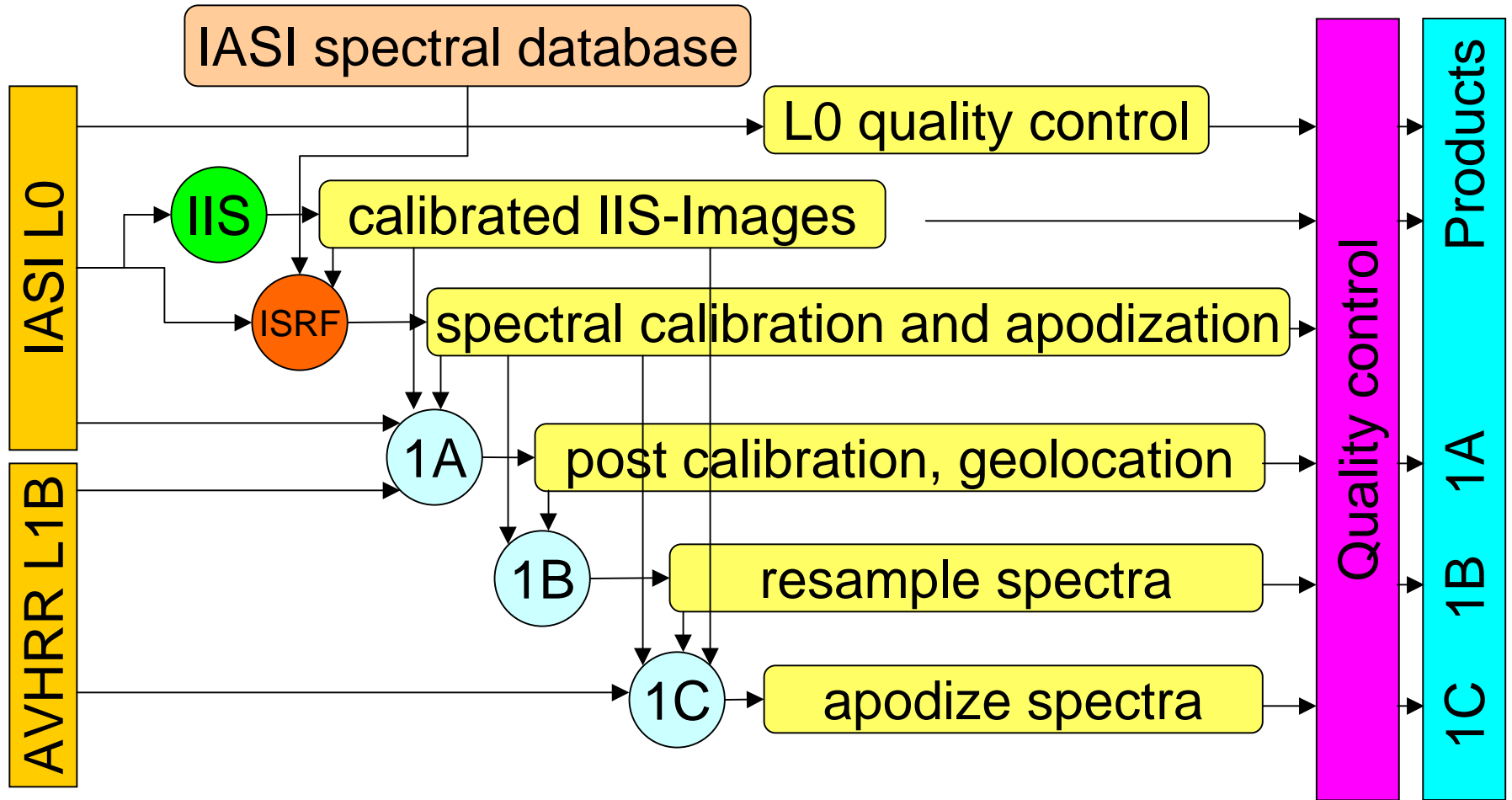
## NRT

- processing of L1C products in near-real time
- dissemination of L1C via EUMETcast and NRT-terminals
- processing and dissemination within 2h 15min

## Format

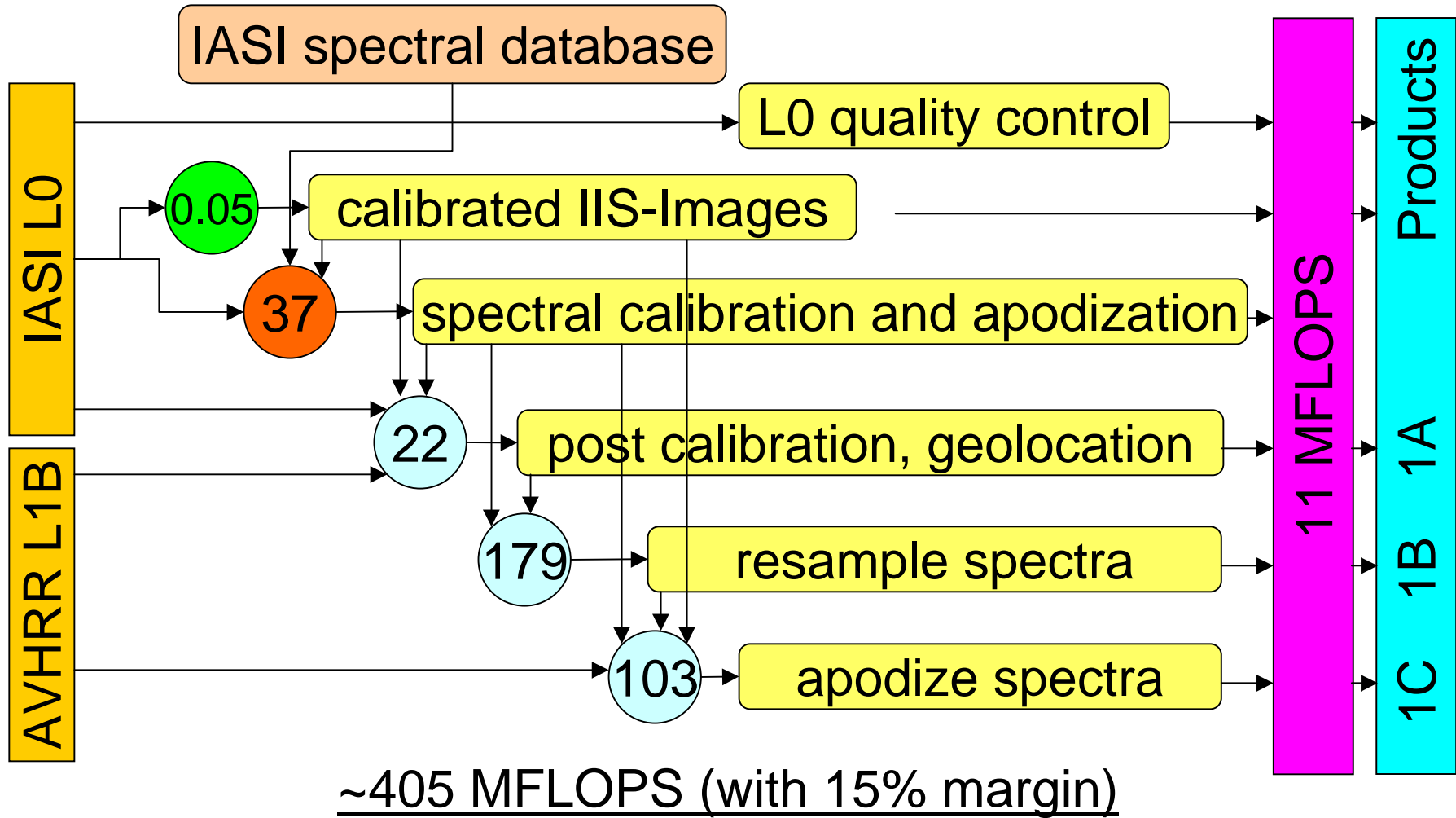
- format for L1C dissemination is native EPS format (NRT-T)
- for EUMETCast the usage of BUFR (WMO) format is foreseen
- benefit is compression of about 50%

# IASI L1 processing





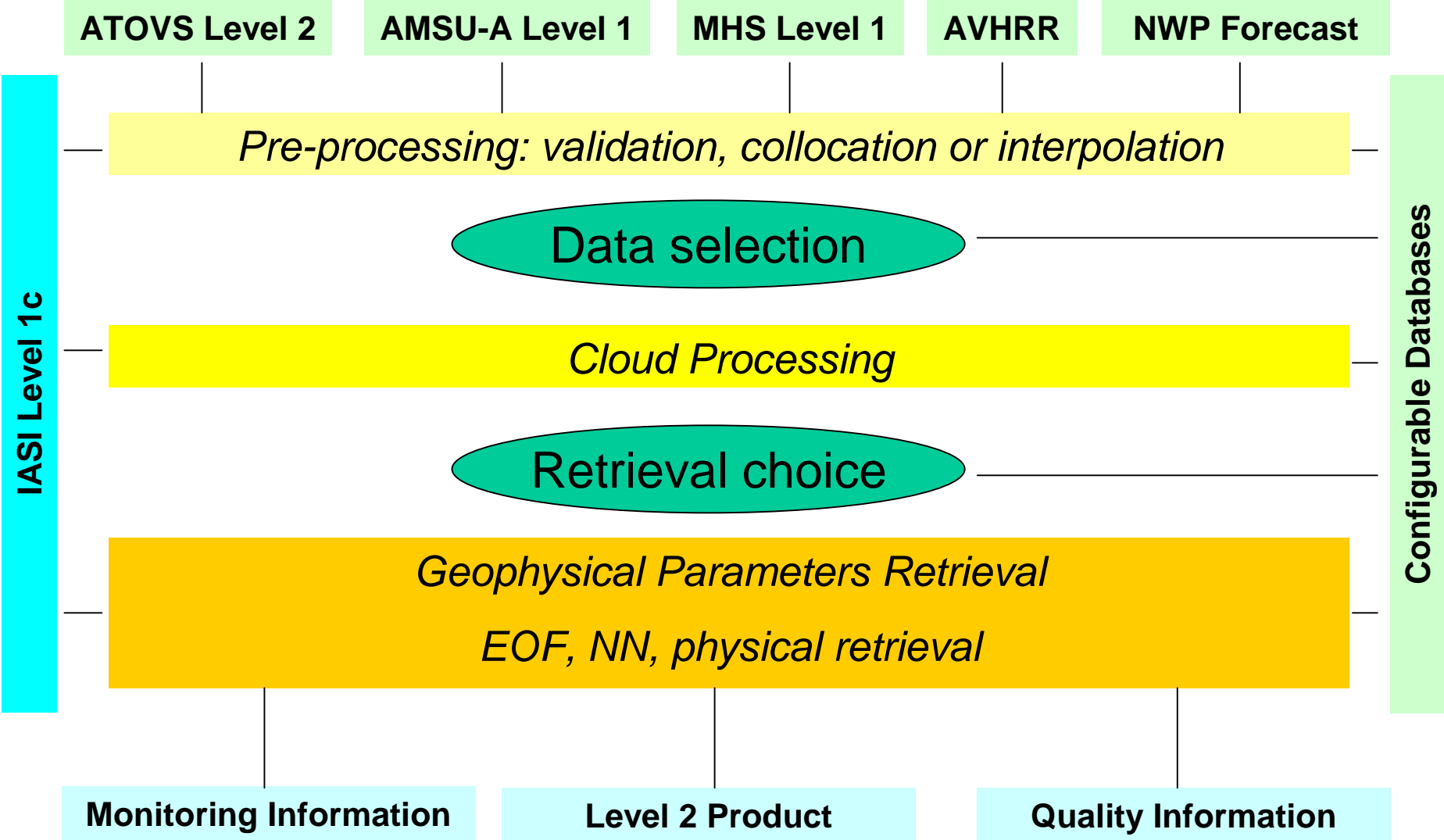
# IASI L1 processing



# IASI L1C product content

- Calibrated apodized radiance spectra
- Geolocation and time stamp
- Calibrated IIS images
- AVHRR radiance analysis
- Product Quality information
- Processing information

# IASI Level 2 Product Generation






## L2 product content

Atmospheric Temperature	90 Levels
Atmospheric Water Vapour	90 Levels
Atmospheric Ozone	10 Layers
Integrated Ozone	1
Surface Temperature	2
Integrated N2O	1
Integrated CO	1
Integrated CH4	1
Integrated CO2	1
Surface Emissivity	20
Fractional Cloud Cover	3
Cloud Top Temperature	3
Cloud Top Pressure	3
Cloud Phase	Liquid, ice, mixed

# IASI L2 prototype processing

- IASI L2 prototype runs on IBM p655, 8 CPUs with 1.5 GHz, 16 GB memory
- IASI L2 prototype is currently not running in near real time
- NRT L2 prototype processing costs are in the order of GFLOPS
- physical retrieval is the expensive part
- and especially the forward model and jacobians calculations

# Processing summary

Data rates	Processor	Product Size
45 MBit/S ↓	 <b>Level 0</b>	1.2 GByte/Orbit 16 GByte/Day
1.5 MBit/S ↓	 <b>Level 1</b>	405 MFLOPS 2.1 GByte/Orbit 30 GByte/Day
30 MBit/S	 <b>Level 2</b>	~ GFLOPS 2.6 GByte/Orbit 37 GByte/Day

# IASI implications on HPC?

