The MTG IRS Candidate Mission
(and Phase A Status)

Antonio Rodriquez, Rolf Stuhlmann,
Jochen Grandell, Stephen Tjemkes, Xavier Calbet

Advanced High Spectral Resolution Infrared Observations
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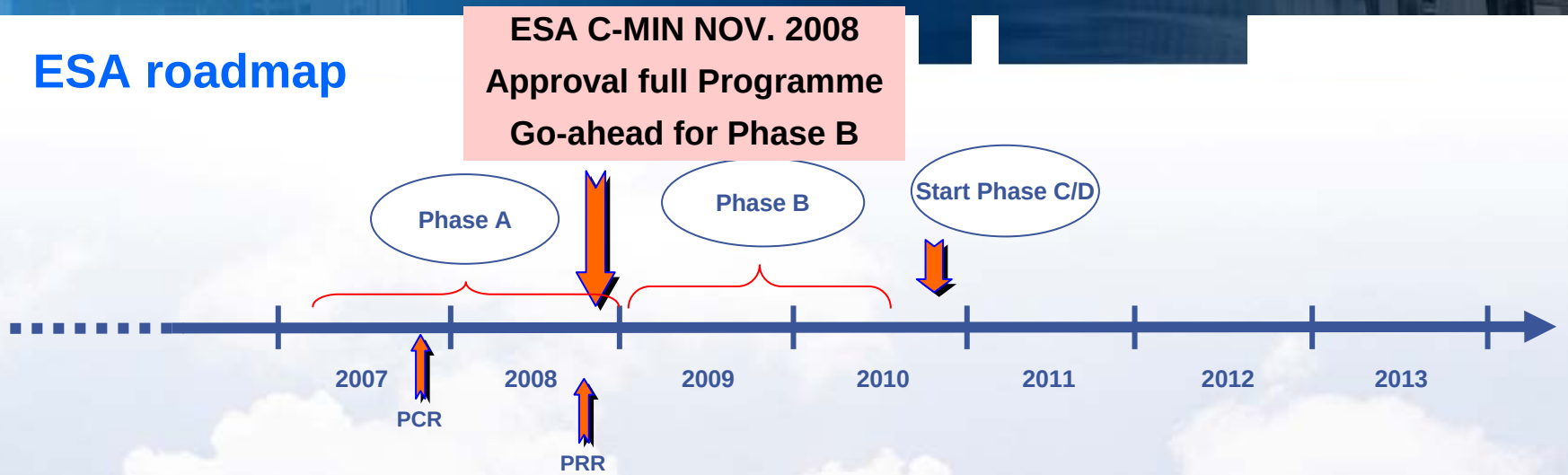
EUMETSAT
Monitoring weather and climate from space
Surveiller le temps et le climat depuis l'espace

TOPICS

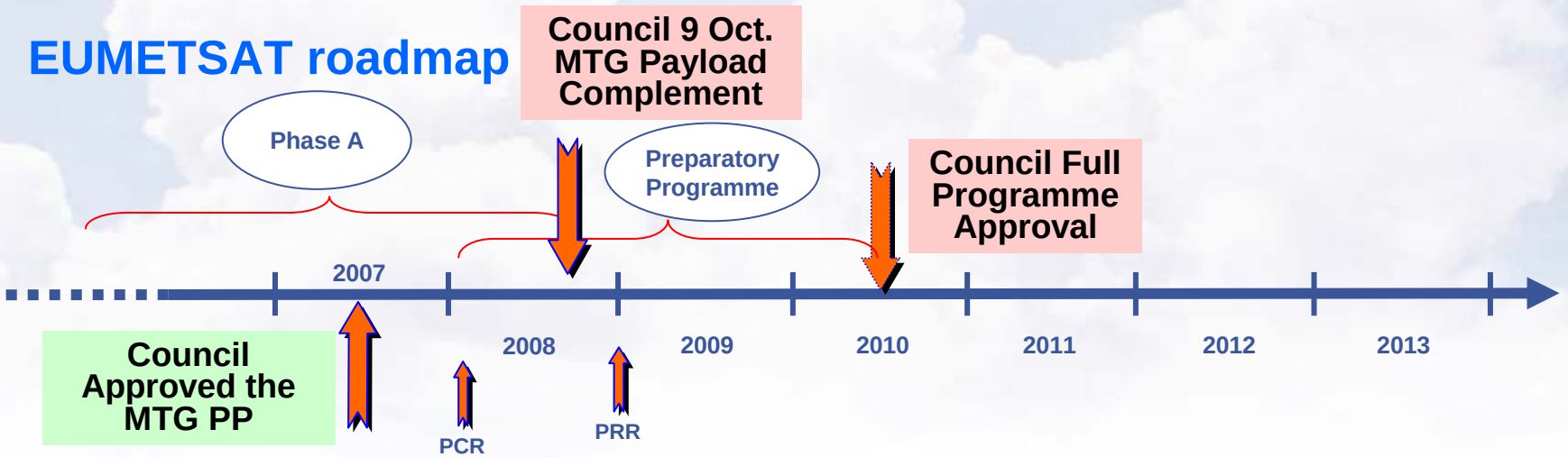
1. MTG
2. Status of Phase A
3. Development of L2 Processing chain

Overall Status

ESA roadmap



EUMETSAT roadmap

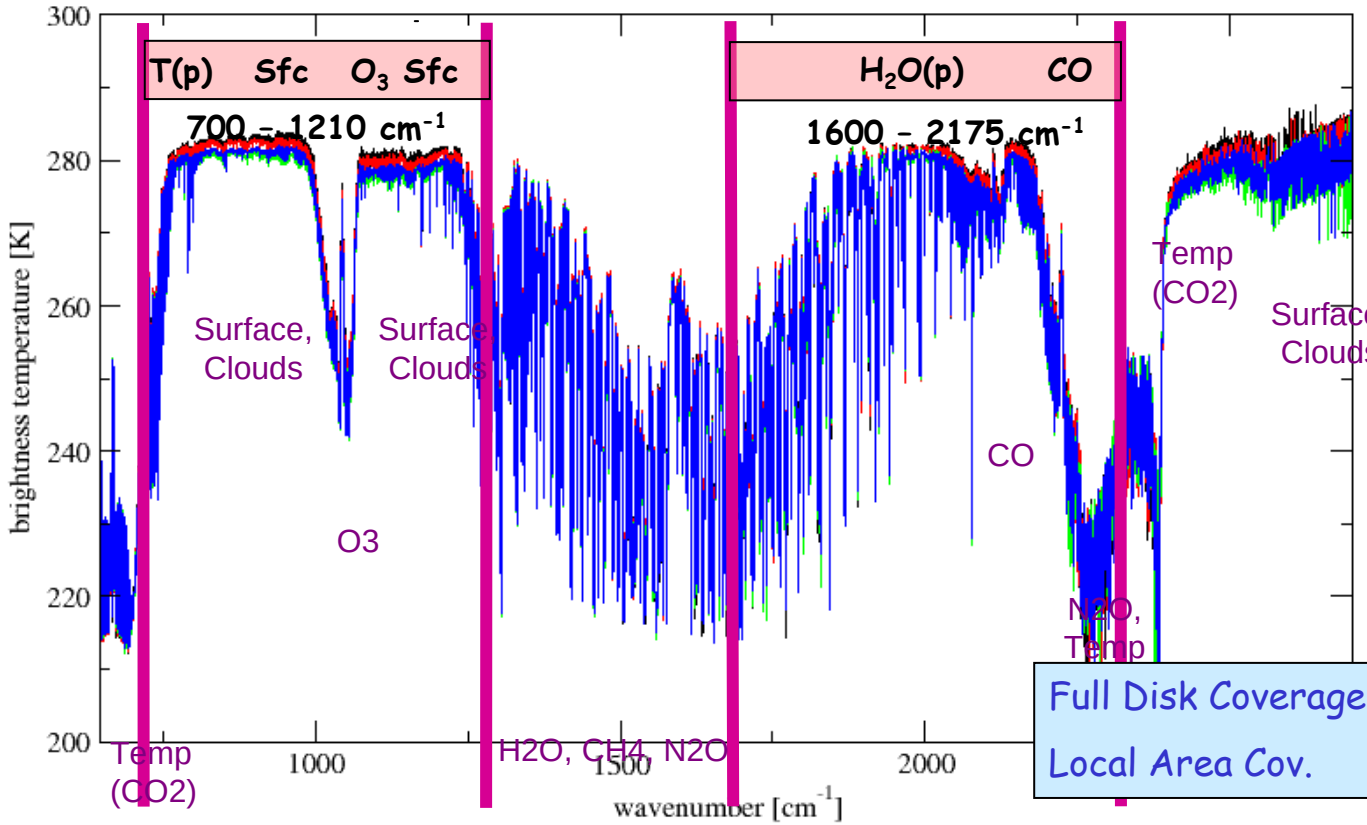


Objective of MTG-IRS

- High temporal, vertical and horizontal resolution observations of humidity and temperature profiles over Europe.
- Less frequent, high vertical and horizontal resolution observations of humidity and temperature for the full Earth disc
- Support to atmospheric chemistry application through high horizontal resolution of Ozone and Carbon Mono-oxide

First IASI Level 1C Spectra

29/11/2006, 13:42:11 UTC



MTG spectral coverage

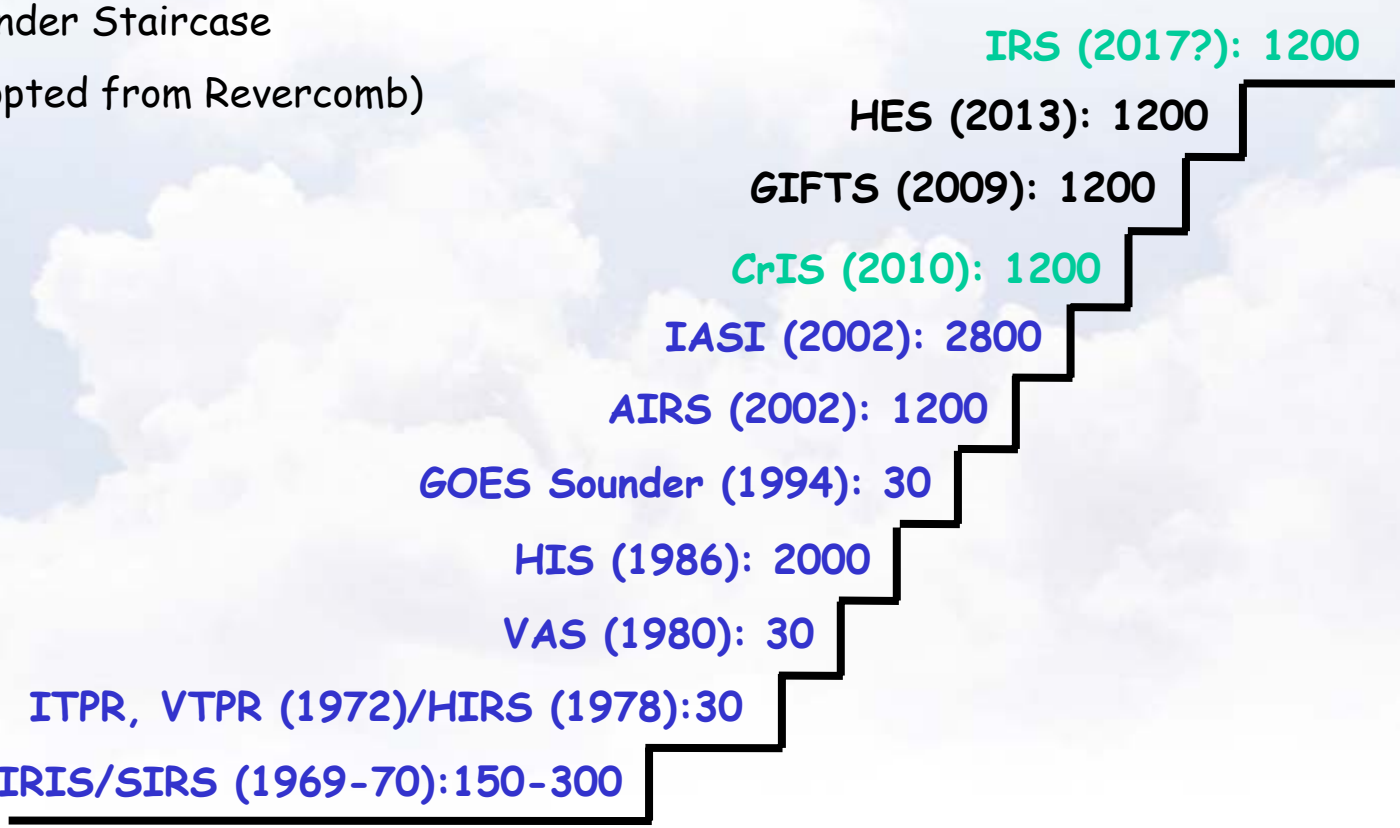
4km Spatial Sampling

	Coverage	Repeat cycle
Full Disk Coverage	Φ 18°	60 min
Local Area Cov.	1/4 of Φ 18°	15 min

Spectral Resolving Power @ 14 μm

Temperature and water vapor Sounder Staircase (adopted from Revercomb)

Now



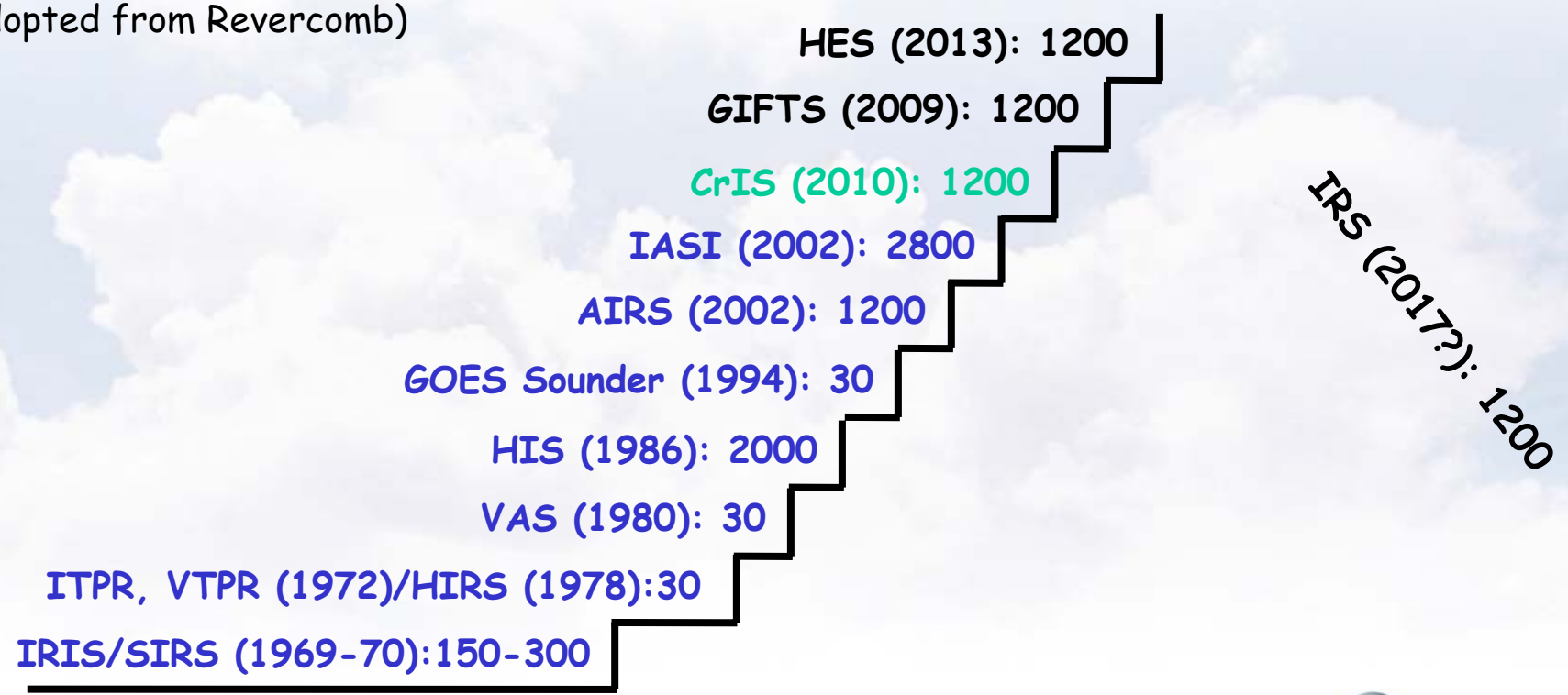
Spectral Resolving Power @ 14 μm

After 9 October 2008 ?

Temperature and water vapor

Sounder Staircase

(adopted from Revercomb)



Processing: The Challenge

Retrievals can be performed for all scenes (though the quality depends on presence of clouds)

Example iasi L2 (processing 235 channels per spectrum):

- On current system (2CPU IBM power 4 processor): 0.008333 min/spectrum
- IRS: >7 10^6 spectra / BRC
- => 60 000 min to process one BRC

Note that this is with respect to IBM power 4 Machines (several years old technology). Current state of the art machines (e.g. Power 6) are factors faster.

Still we need to explore all possibilities to keep the L2 processing affordable. So we need to look at

- Implementation:
  - Efficient codes (e.g. different RTM)
  - Parallelisation
  - ...
- Processing
  - Not all scenes => need for scenes analysis

All should be done without compromising quality.

RTM

	PCRTM	OSS	RTTOV
Community	?	+	++
Maintenance	?	+	++
Performance	?	?	?
Accuracy	?	?	?
Static Application	-	+	-

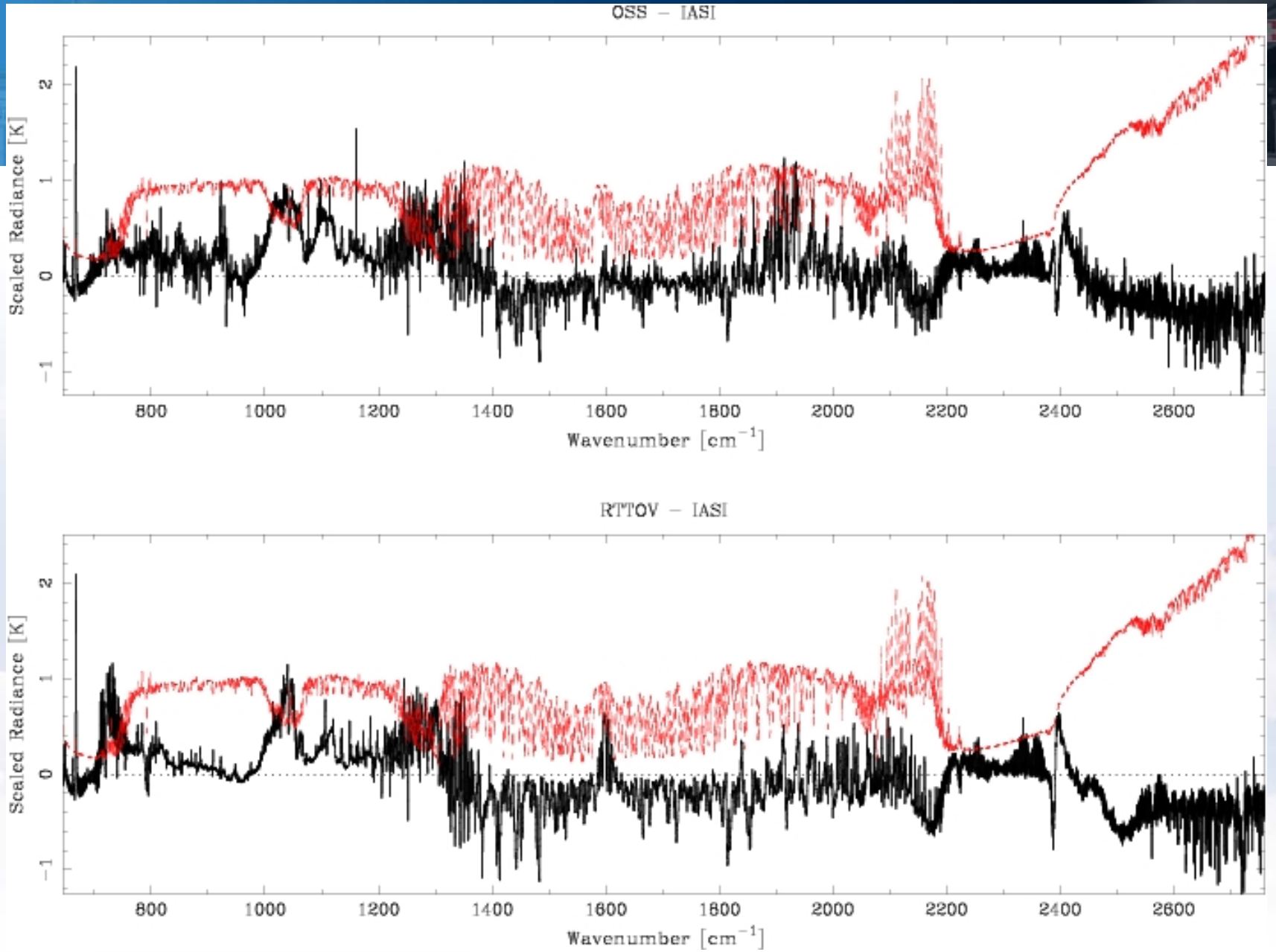
RTTOV / OSS: two different approaches

RTTOV:

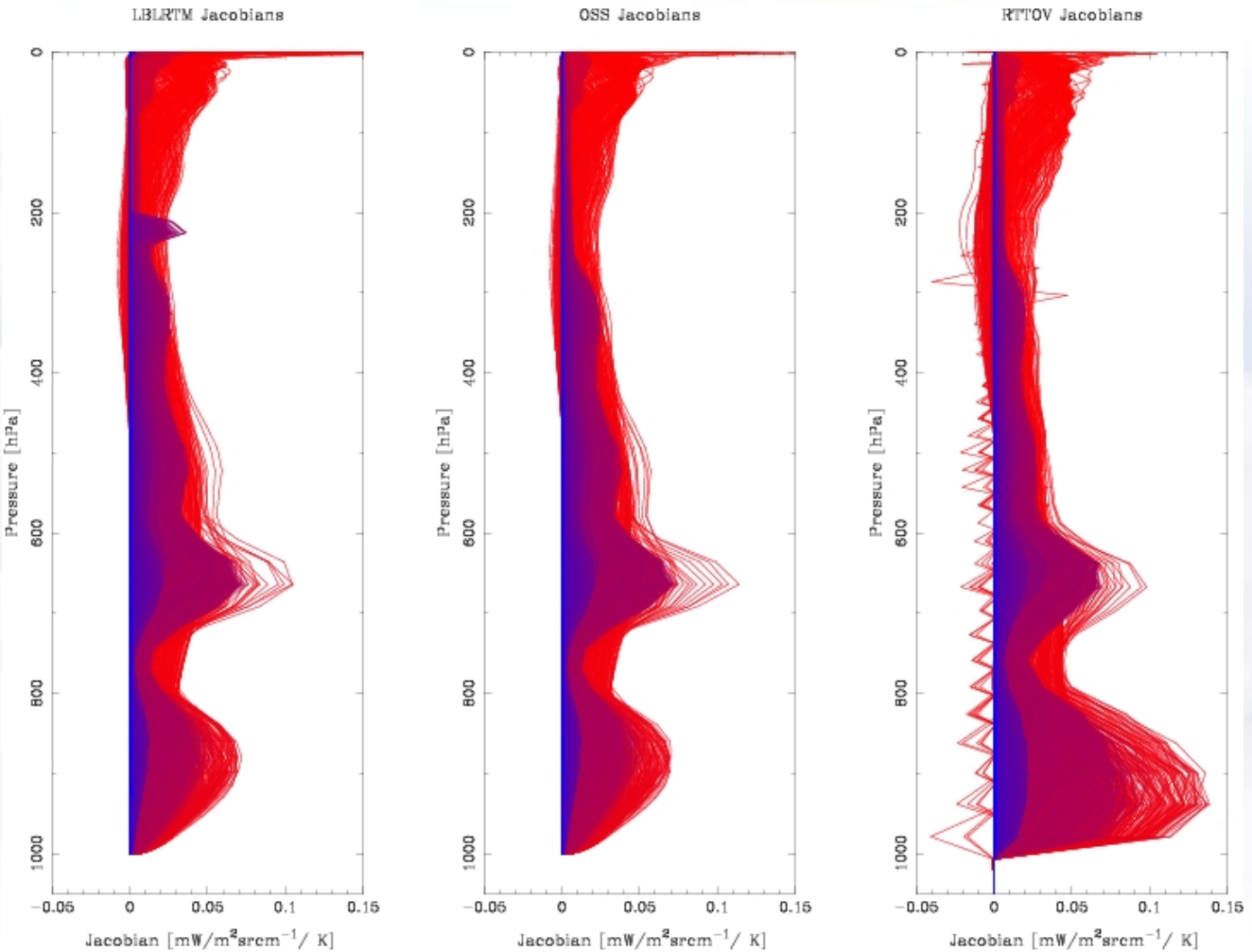
- Statistical model for mean transmission
- Multiple scattering
- Jacobians

OSS:

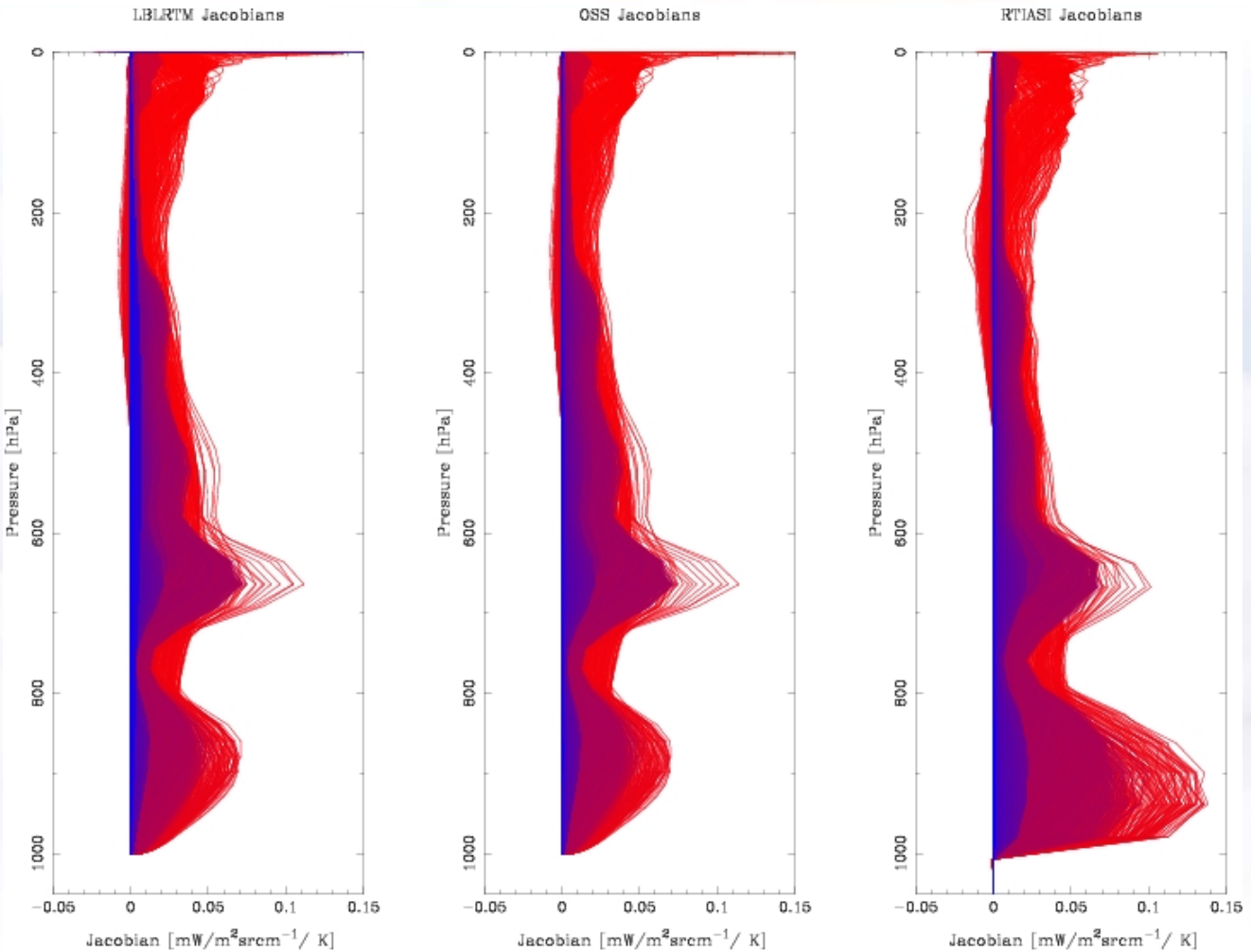
- Course resolution line-by-line
- Multiple scattering
- Jacobians
- PC scores could be implemented


OSS – IASI
Scaled Radiance [K]
2
1
0
−1
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Wavenumber [cm^{-1}]
RTTOV – IASI
Scaled Radiance [K]
2
1
0
−1
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Wavenumber [cm^{-1}]

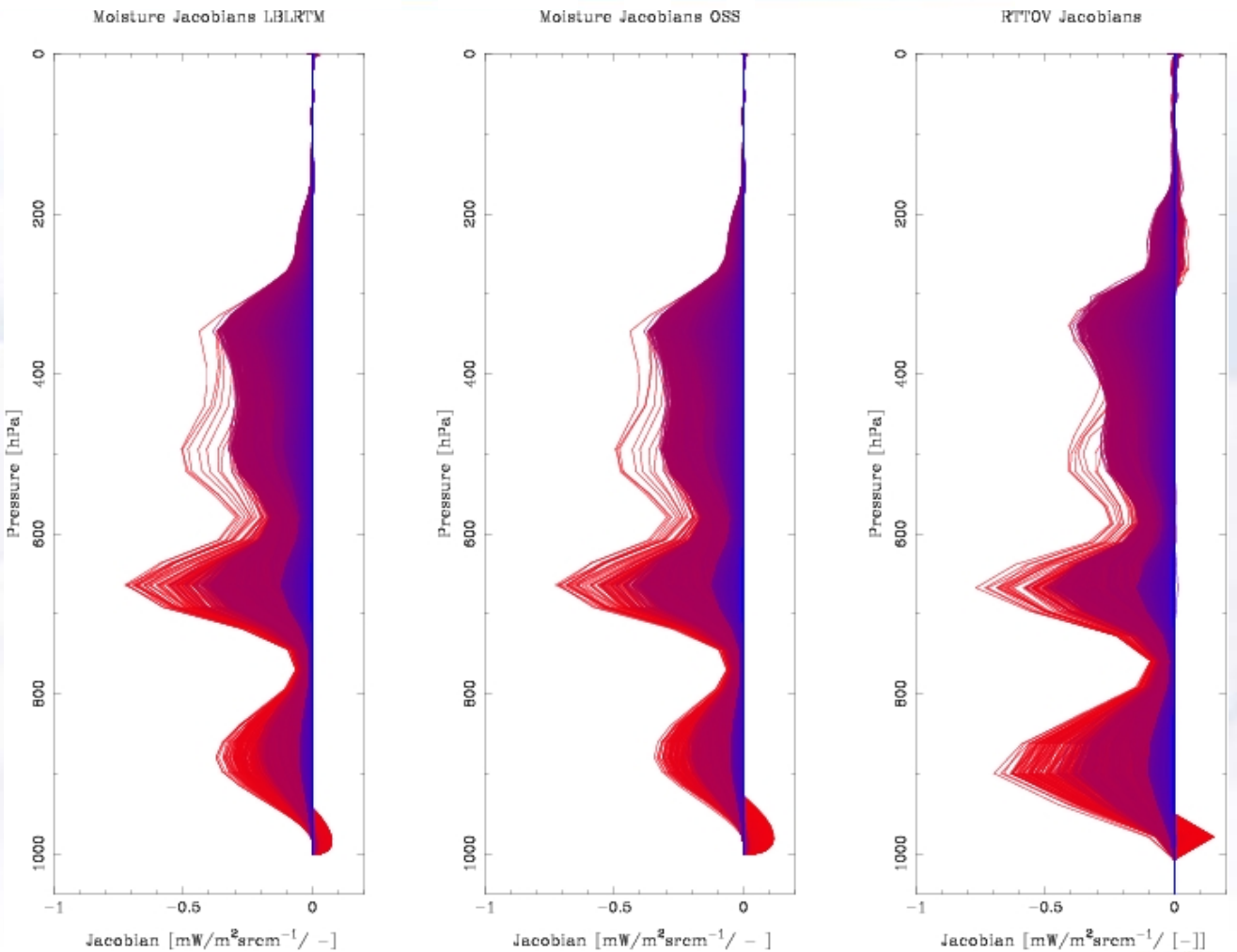
Temperature Jacobians



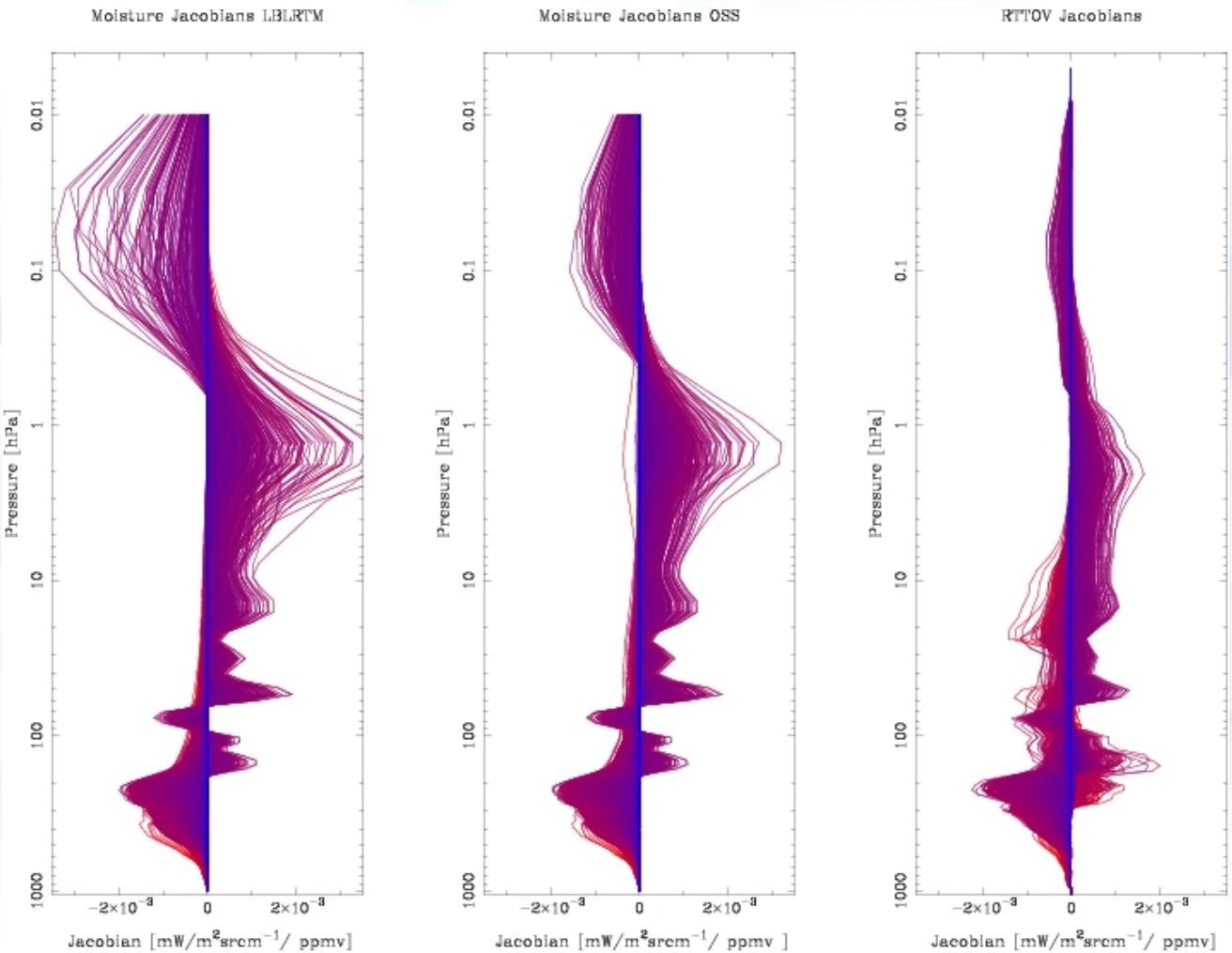
Temperature Jacobians



Moisture Jacobians



Moisture Jacobians

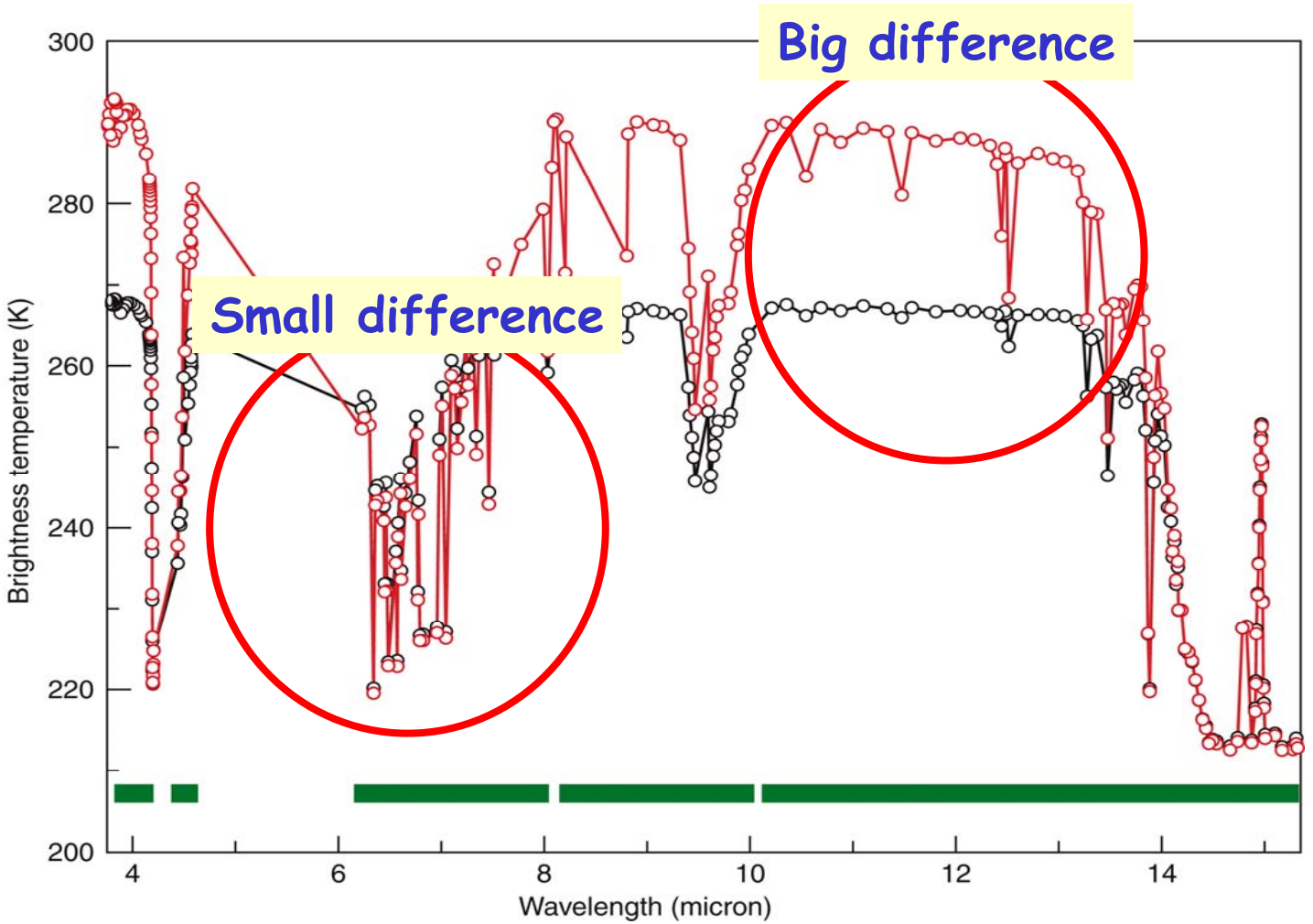


Timing Results (in sec/profile)

	Direct only	Direct + Jacobians
RTIASI	1.11	11.42
OSS	-	0.67

Averaged over 5308 profiles, on IBM power 2: xlf90 –O3 –q64

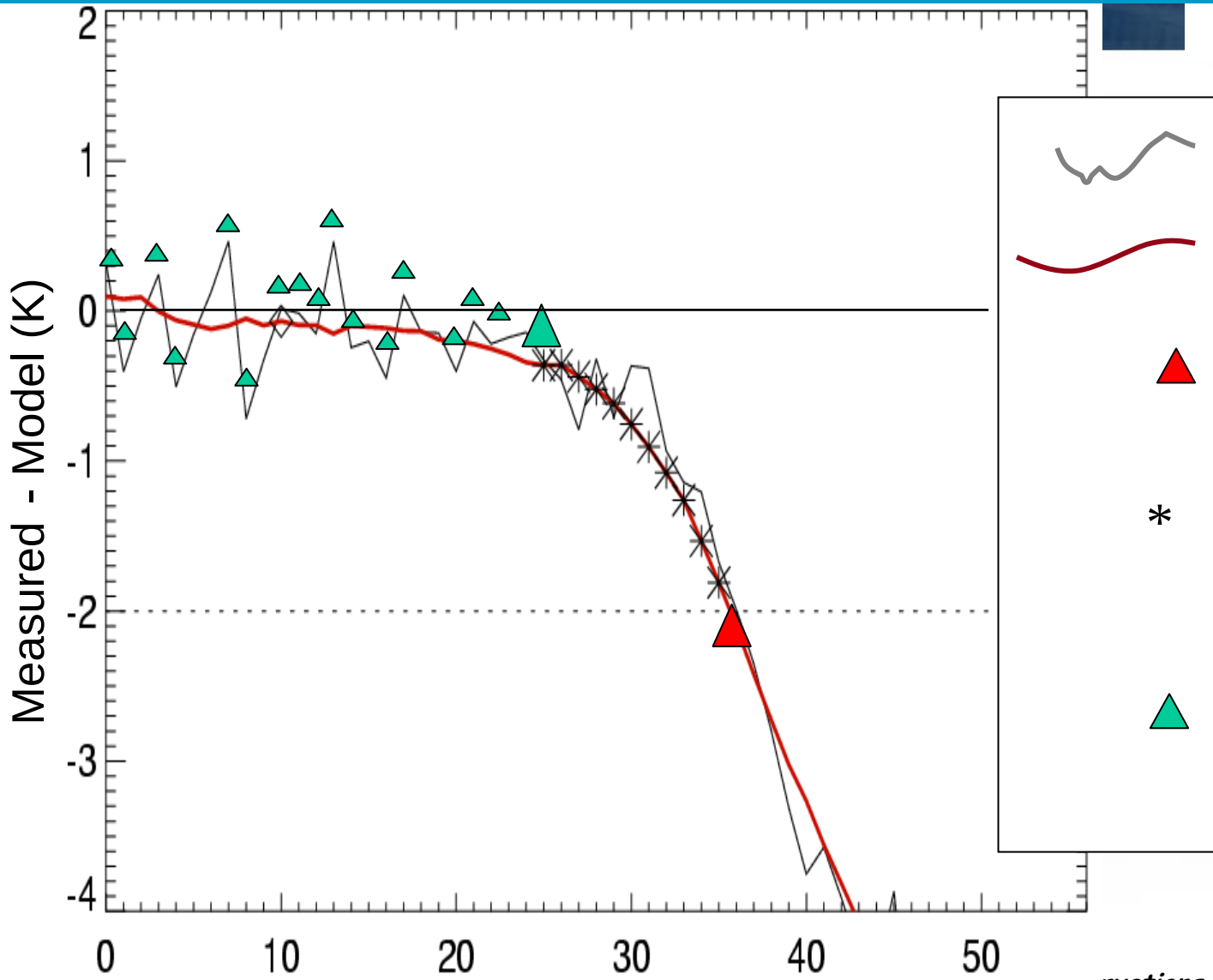
Cloudy - clear radiances (provided by phil watts)



Clear radiances
*RTTOV- 6 (Matricardi et al.)
*Ecmwf T,Q,O_3
*Model noise ($H.B.H^T + F$)

Cloudy radiances
*RTTOV-6 + (Chevallier et al.)
*Ecmwf T,Q,O_3,CLW
*Meas. Noise (O) (AIRS Flight Model)

Clear-channel id 1: Low-pass filter



δBT(j)

LP[δBT(j)] 10-20 ch

Detect 'gross' cloud signal (+ or -)

* Proceed > higher until LP gradient & signal small

Declare channels with smaller index clear

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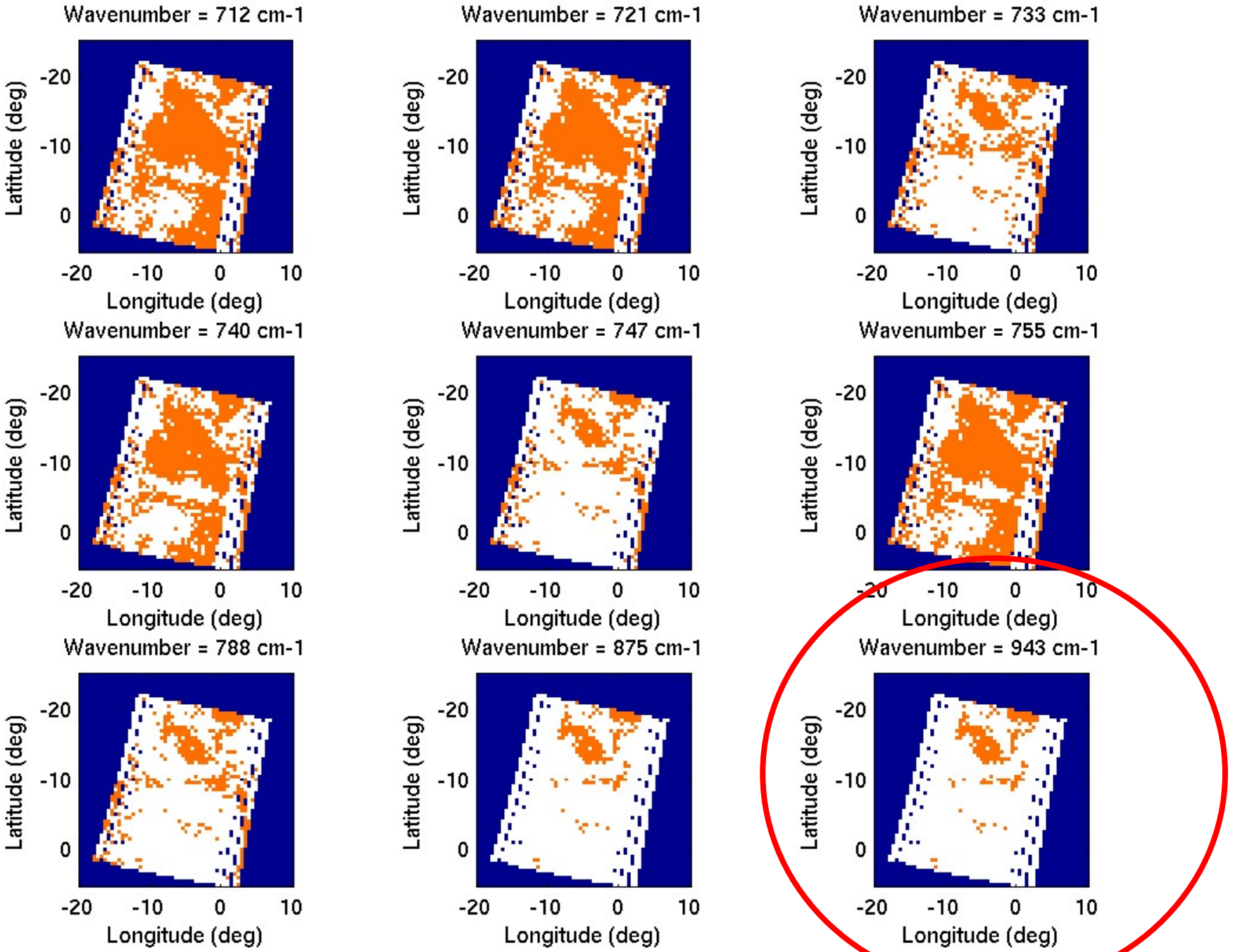
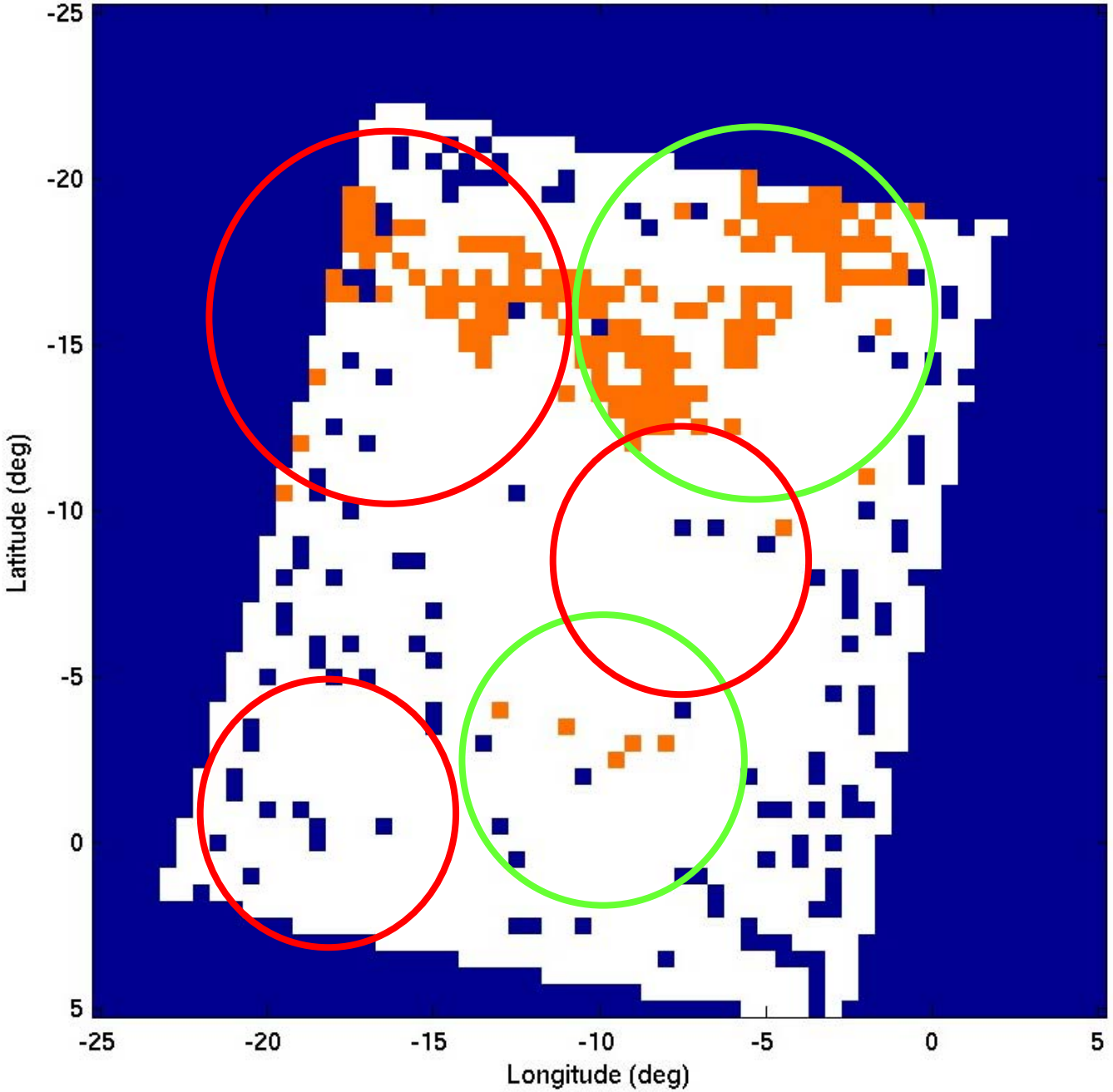

Wavenumber = 712 cm-1
Wavenumber = 721 cm-1
Wavenumber = 733 cm-1
Wavenumber = 740 cm-1
Wavenumber = 747 cm-1
Wavenumber = 755 cm-1
Wavenumber = 788 cm-1
Wavenumber = 875 cm-1
Wavenumber = 943 cm-1
Latitude (deg)
Longitude (deg)
-20
-10
0
10

IASI L2 cloud mask



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Conclusion

Successfully implemented

Not yet an extensive validation

Need to apply to MTG-proxy data

Integrate into end-to-end development chain

Replace current rtm with OSS

CO2 slicing alternative methods to be considered

Gives cloud top pressure and cloud fraction

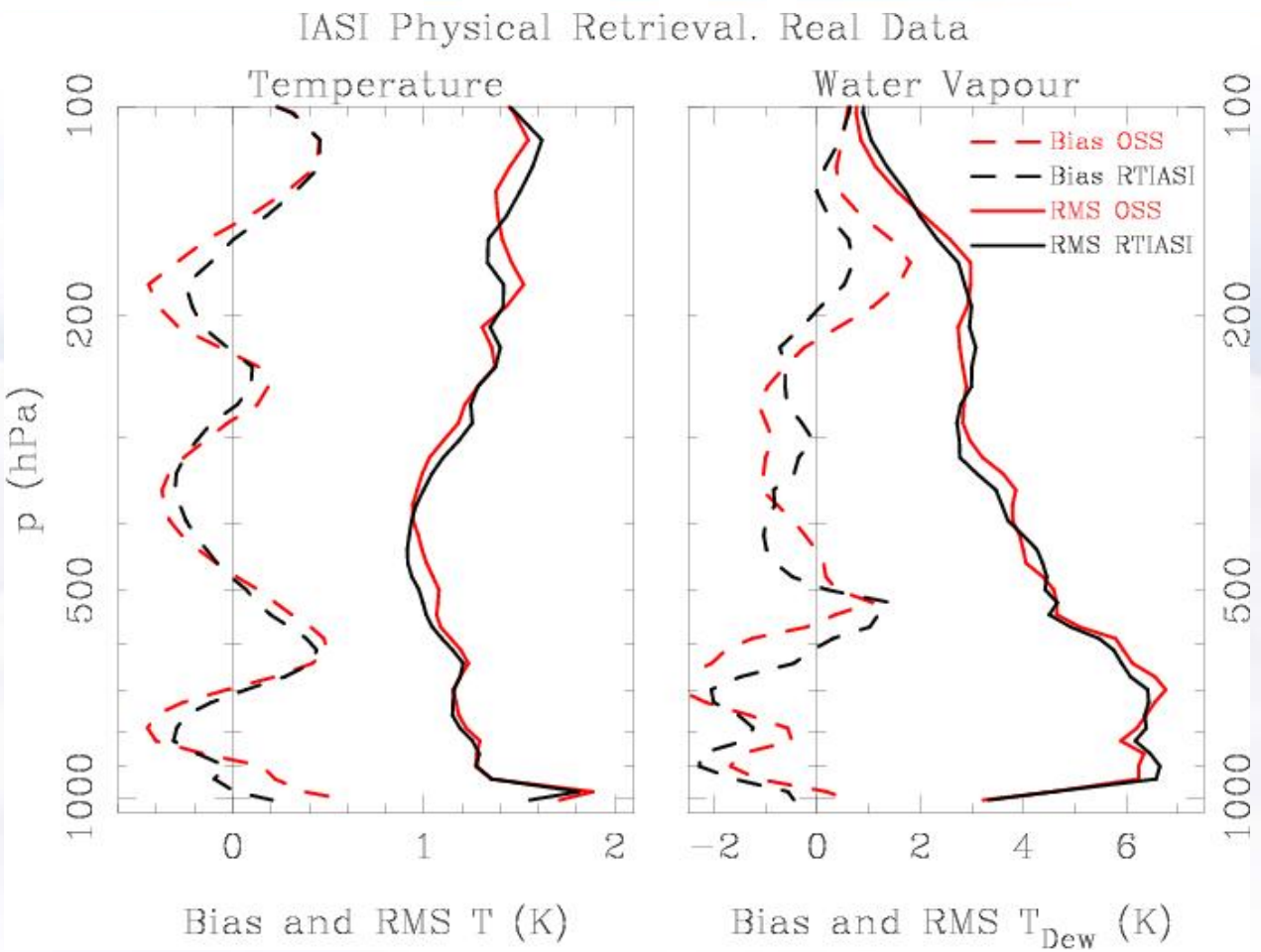
Two Retrieval Experiments

	EOF	OE
Baseline	RTIASI	RTIASI
Alternative	OSS	OSS

IRS L2 Prototype Processor

IRS L2 Prototype Processor running with:

- IASI real data
- RTM: RTIASI / OSS
- Clear sky over ocean selection scenes as for IASI (threshold test method only)
- Bias corrected
- Optimal estimation
- First guess from EOF retrieval
- Background from Chevallier
- “Optimal” measurement covariance from OBS-CALC



Timing results (in sec, for one retrieval)

	Complete non-linear retrieval	Only RTM module
Baseline	502	246
Alternative	269	10

IRS L2 Inversion: future

- Improve fast retrieval method -> Neural networks?
- Introduce more efficient matrix manipulation
- Keep on verifying with real IASI data correct… …ne classification
- Introduce realistic noise into IRS synthe… …ements
- Introduce pseudo-noise diffraction e… …synthetic measurements using proxy dat…
- Determine minimal set of ch… …nversion will be applied
- Analyse co-registr…
- Analyse correl… …rvations
- Analyse spec… …errors
- Apply to field …ments (jaivex), proxy data
- Compare to ind…endent methods

LOTS TO DO

Other components

- Surface emissivity retrieval
- Improve accuracy through exploitation of the time domain (e.g. Kalman filter)

Summary

- Important milestones of MTG development
  - Selection of payload compliment (PRR)
- Brief overview of the MTG-IRS candidate mission
- L2 end-to-end Processing

Finally Acknowledgement: MMT members

Potential of the MTG-IRS mission to resolve 3-D correlation structure of atmospheric humidity

A. Carissimo, I. De Feis[1], P. Di Girolamo, G. Grieco, G. Masiello, C. Serio, D. Summa

Department of Environmental Engineering and Physics , Potenza , Italy

[1] Institute of Applied Mathematics, IAC/CNR, Napoli, Italy

Benefit of the MTG candidate Infra-Red Sounding mission to regional forecast

An Observing System Simulation Experiment (OSSE) on regional scales

Xiang-Yu Huang, Hongli Wang, Yongsheng Chen
National Center for Atmospheric Research, Boulder, Colorado, U.S.A.

Xin Zhang
University of Hawaii, Honolulu. Hawaii, U.S.A.

The potential of MTG-IRS to detect high pollution events at urban and regional scales

Aim

The study investigates the capability of IRS onboard MTG to detect enhanced levels of carbon monoxide (CO) and ozone (O_3) at local and regional scales, in particular over Europe.

Cathy Clerbaux (CNRS/Service d'Aéronomie & ULB), Juliette Hadji-Lazaro, Anne Boynard, Solène Turquety (SA), Pierre-François Coheur, Oliver Scharf, Daniel Hurtmans (ULB).

Finally

MTG-IRS mission will deliver unprecedented information enhancing the ability to initialize NWP models by resolving mesoscale gradients of moisture, wind, and temperature between measurements either of individual radiosonde stations and/or hyperspectral soundings from a polar orbiting satellite.

Expected that 'Downstream Applications' will benefit from the new information delivered by the MTG-IRS

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Thank you