

EUMETSAT IASI L2 products, from Global to Local services

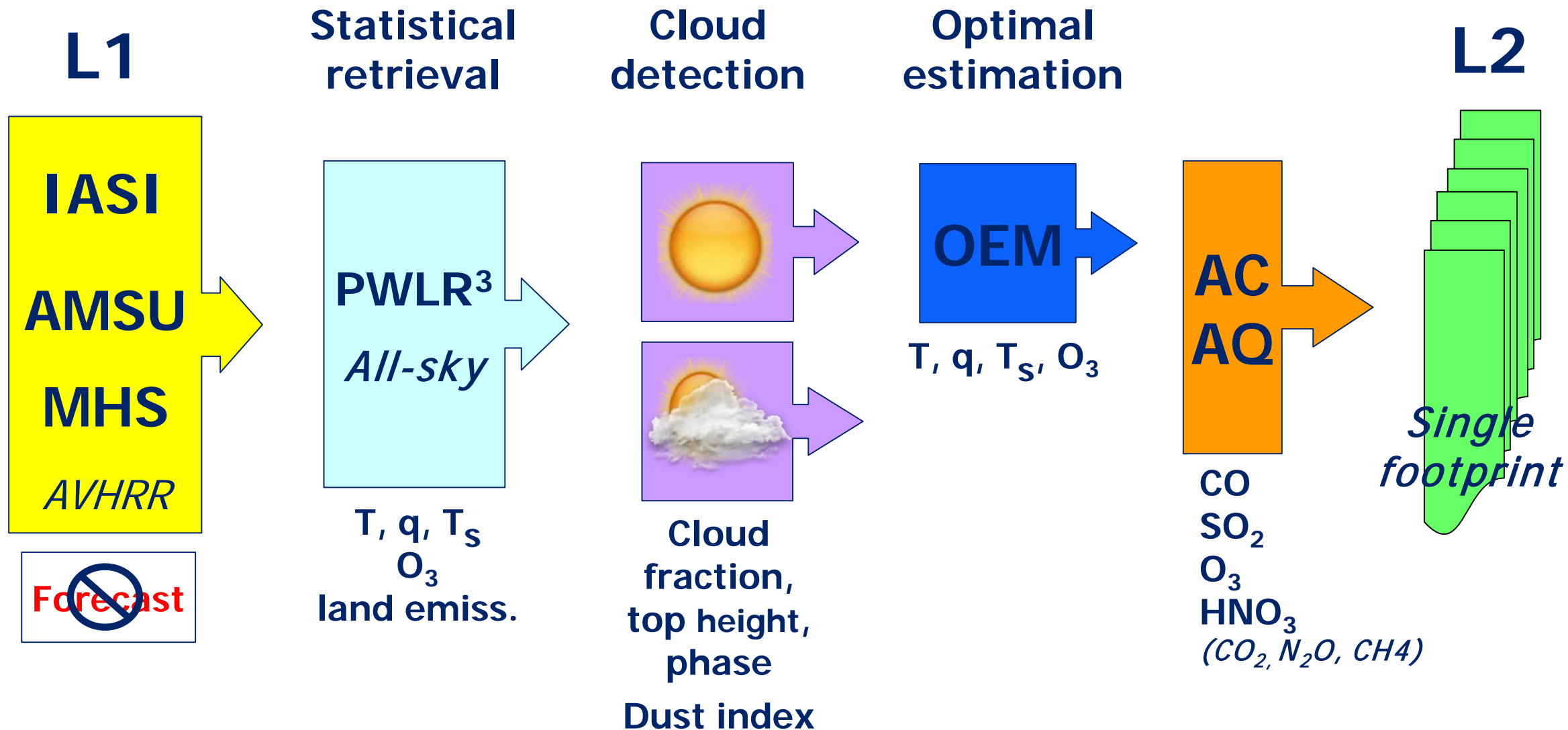
*T. August, T. Hultberg,
M. Crapeau, A. Burini, D. Klaes,
EUMETSAT
C. Clerbaux (LATMOS), P. Coheur (ULB)*



Outline

- IASI L2 v6: (very) quick processor overview
- Recent and on-going updates
 - v6.3 operational June'17
 - ✓ New AC products
 - v6.4 under deployment
 - ➔ Algorithm updates
 - ➔ Sounding performances
- Regional service

IASI L2 v6 processor main steps

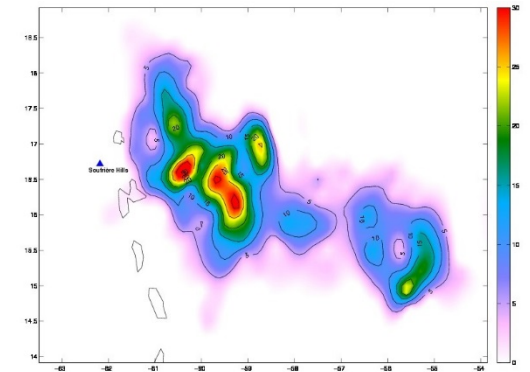


New atmospheric composition products

EUMETSAT AC SAF IASI CO product
 FORLI library (ULB/LATMOS)
 Operational since March 2017
 NRT profiles + averaging kernels

EUMETSAT AC SAF IASI SO₂ product

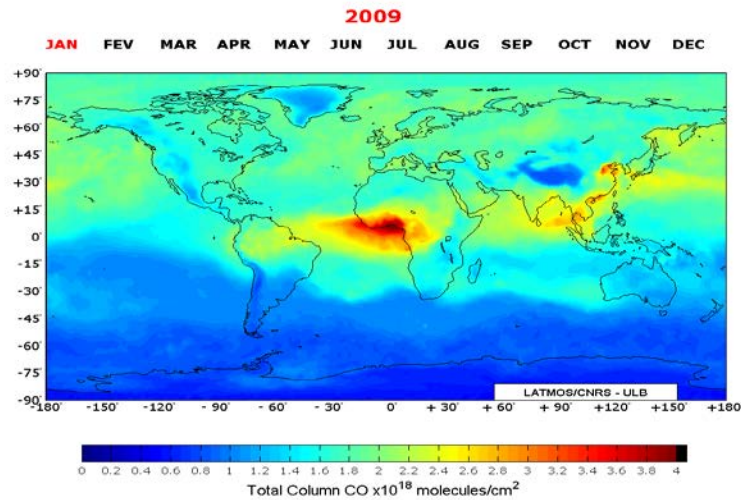
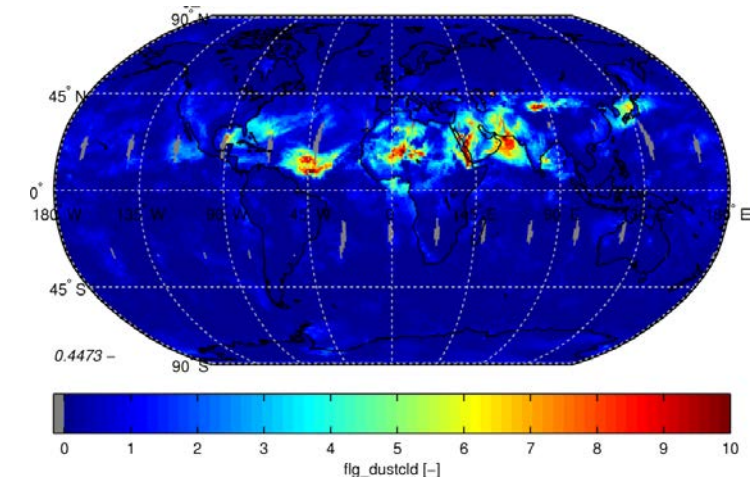
BRESCIA library (ULB/LATMOS)
 Pre-Operational since June 2017 (v6.3)
 NRT SO₂ detection & columns



Credits: L. Clarisse (ULB)

IASI Dust index

After Clarisse et al. (ACP 2013)
 Unitless dust load indicator
 Released in June 2017 (v6.3)



CO₂ content in optimal estimation, impact on temperature

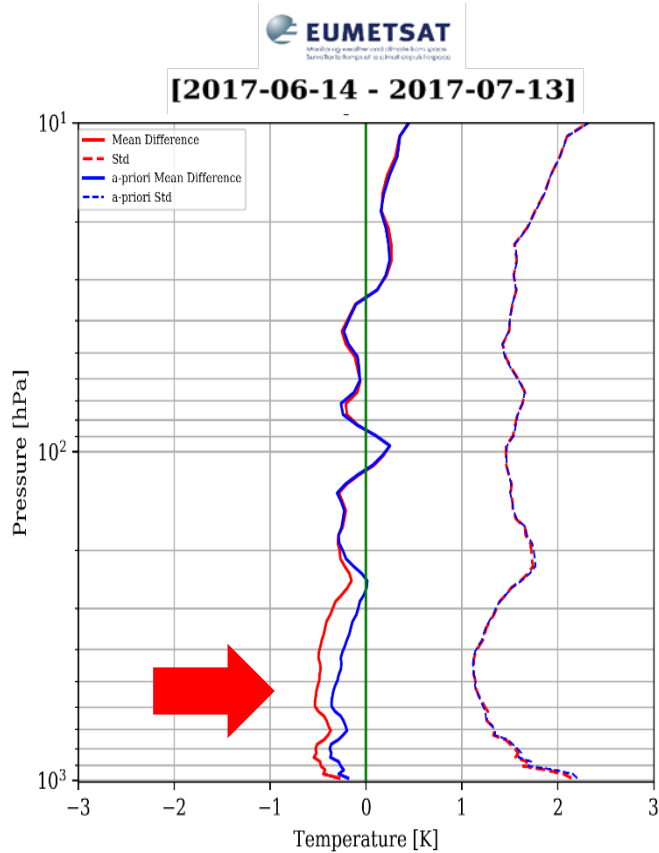
Current OEM (clear-sky) settings

Forward model: RTTOV 10.2
Dynamic (retrieved): T , q , T_s , O_3

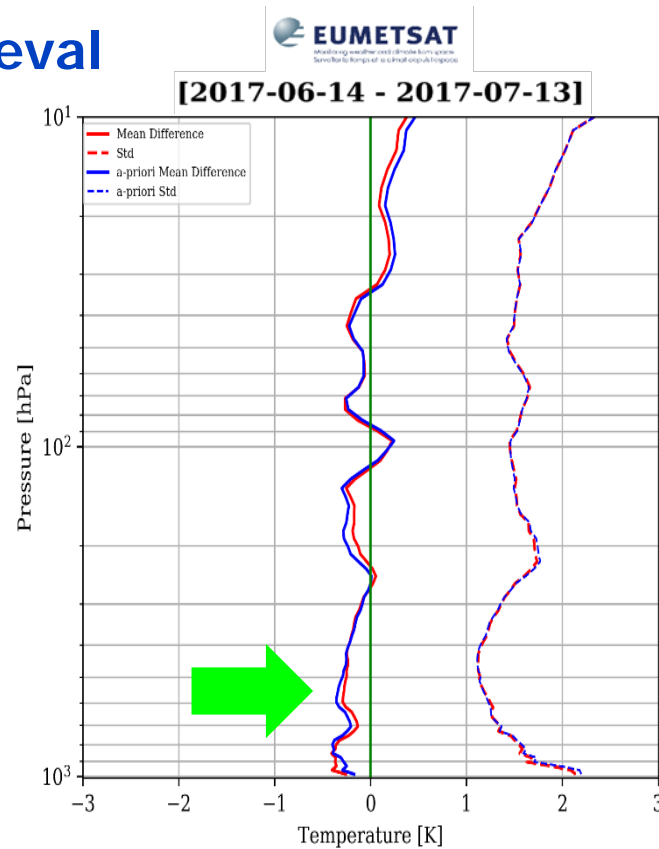
Fixed input: surface emissivity (PWLR³)
Static configuration: CO₂, CH₄...

- First retrieval
- OEM

*IASI L2 T
vs
sondes*



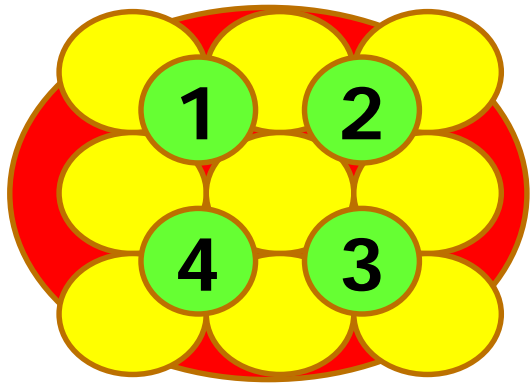
v6.3 – CO₂ 380 ppmv



v6.4 (early '18) – CO₂ 400 ppmv

... plans for v6.5
RTTOV 12
variable CO₂

PWLR³ – 3D retrieval, exploiting geophysical horizontal correlation

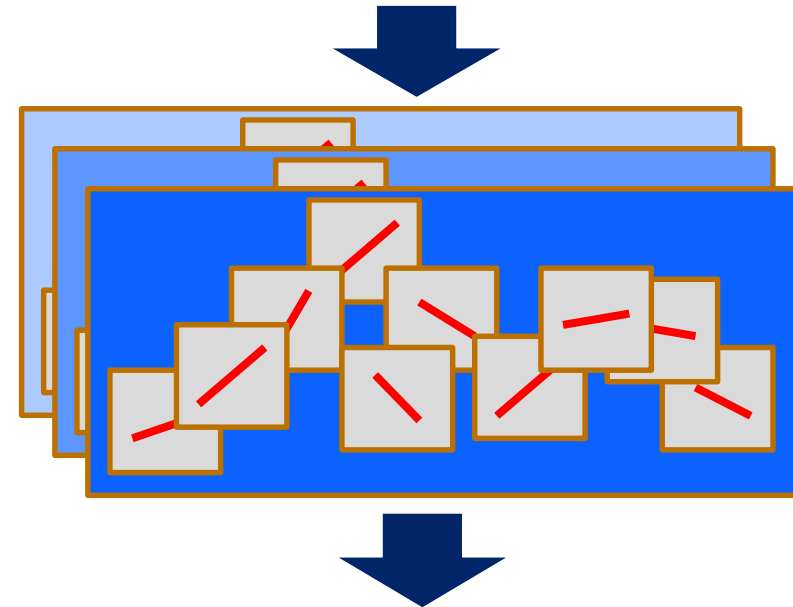


PWLR³ 'All-sky'

Input vector with adjacent measurements (PCS) + viewing angle...



- K-mean clustering based on observations
- Supervised machine learning with real obs. matched with ECMWF re-analysis + CAMEL
- ~100 millions teaching pairs
- Ensemble retrieval to reduce random noise
- Quality indicators (uncertainty estimates)



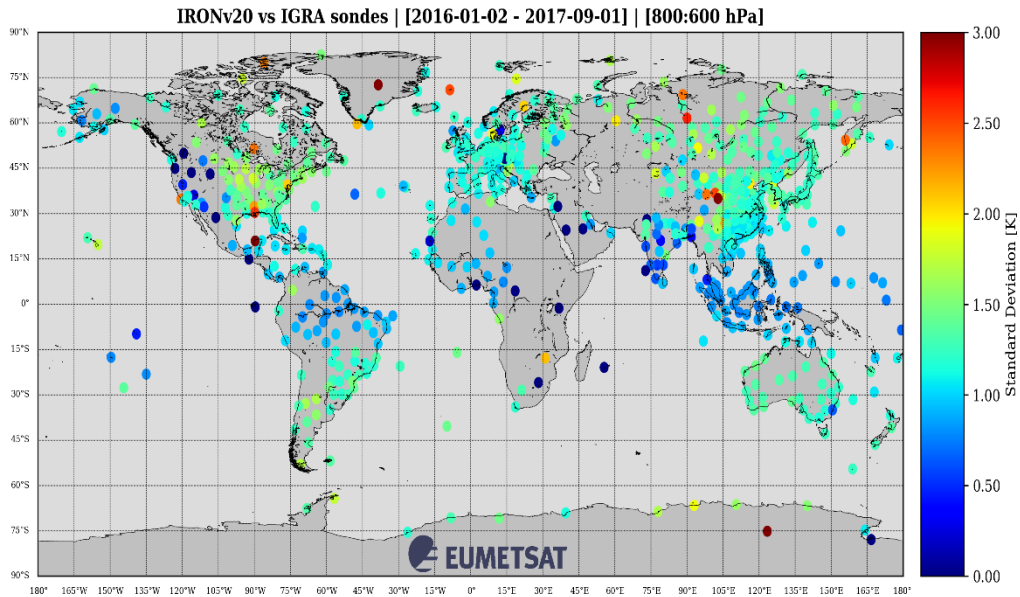
Update in v6.4:
IR-only fallback
Better clustering
New training set

T, q, Ts, O₃, surface emissivity, cloud
for every pixel separately

Assessment vs sondes

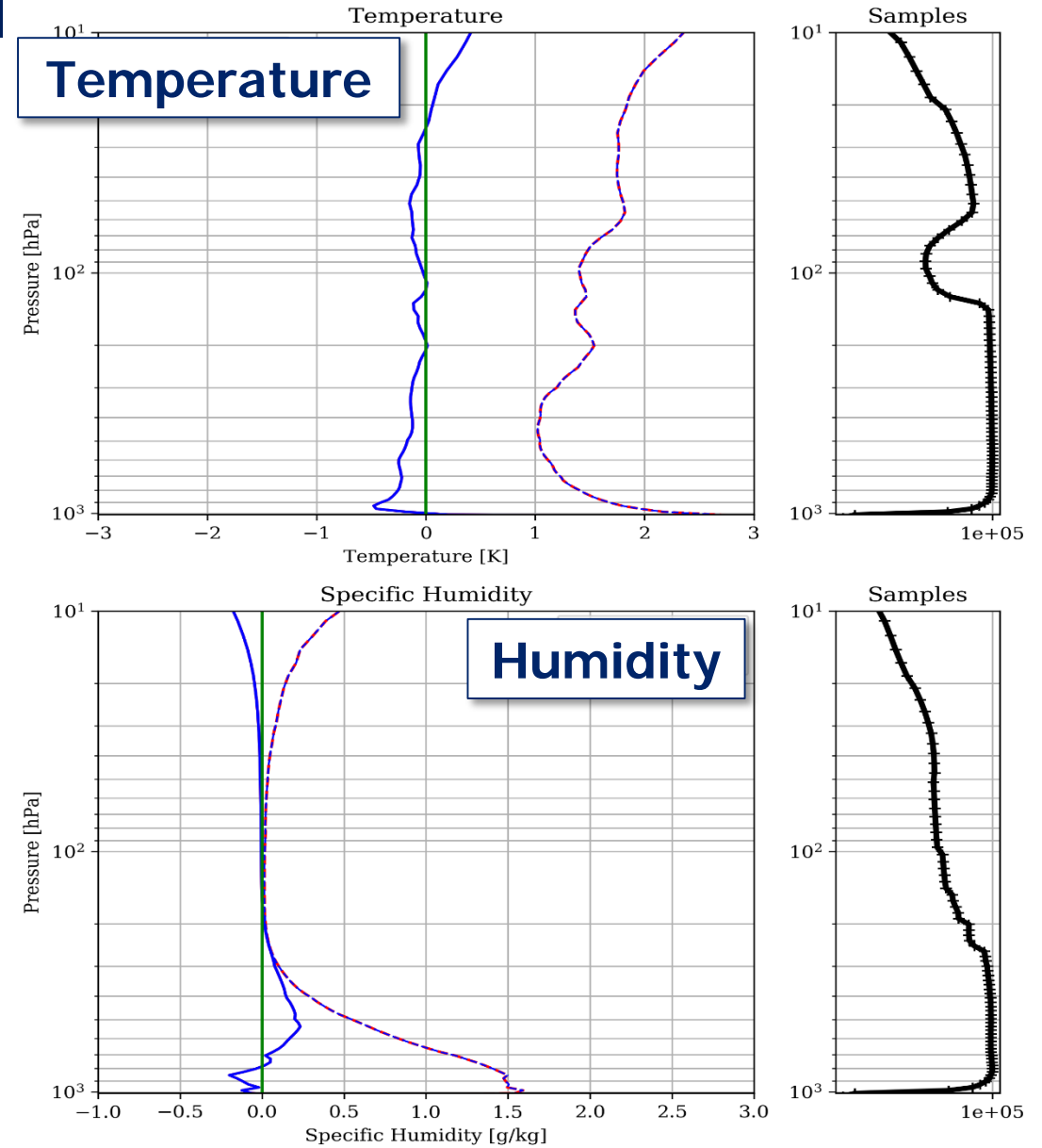
IASI L2 IR-only PWLR³

20 months: January 2016 – August 2017
vs radio-sondes ($\pm 3h$; $< 50km$)



Yield ~50%,
includes cloudy pixels

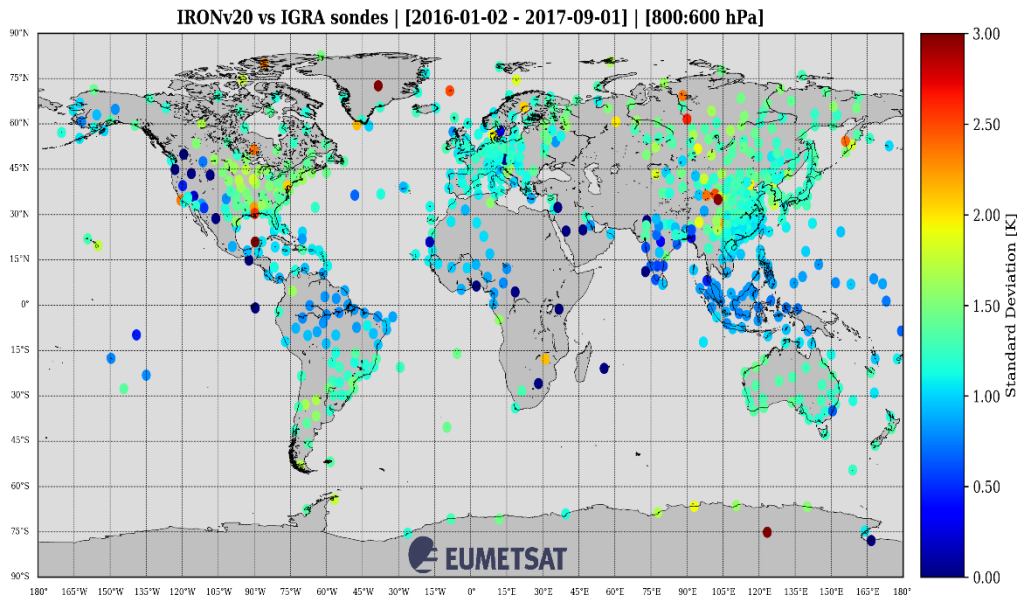
IRONv20 vs IGRA sondes | [2016-01-02 - 2017-09-01]



Assessment vs sondes

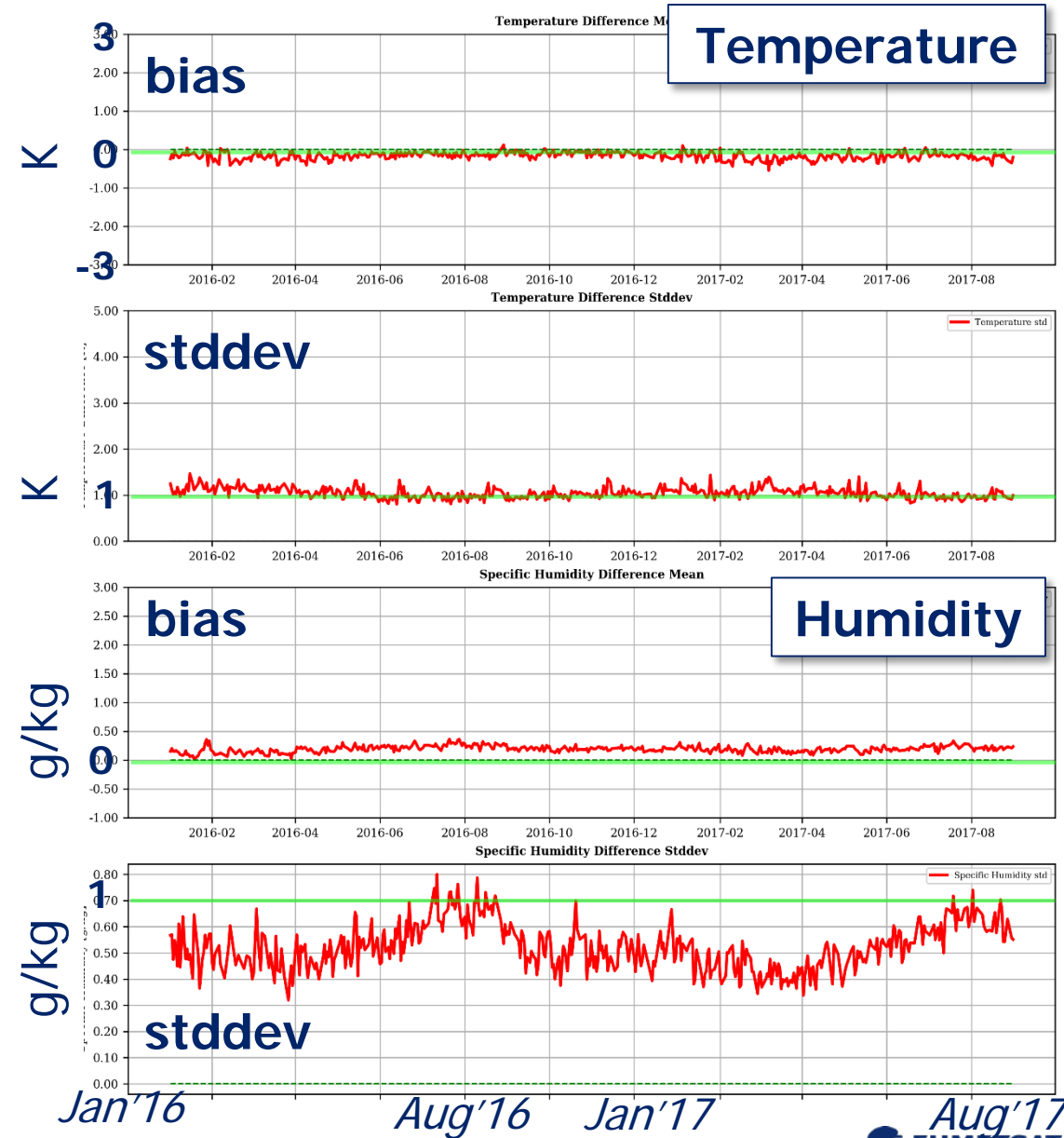
IASI L2 IR-only PWLR³

20 months: January 2016 – August 2017
vs radio-sondes ($\pm 3h$; $< 50km$)



Yield ~ 50%,
includes cloudy pixels

IRONv20 vs IGRA sondes [500.0 hPa] | [2016-01-02 - 2017-09-01]



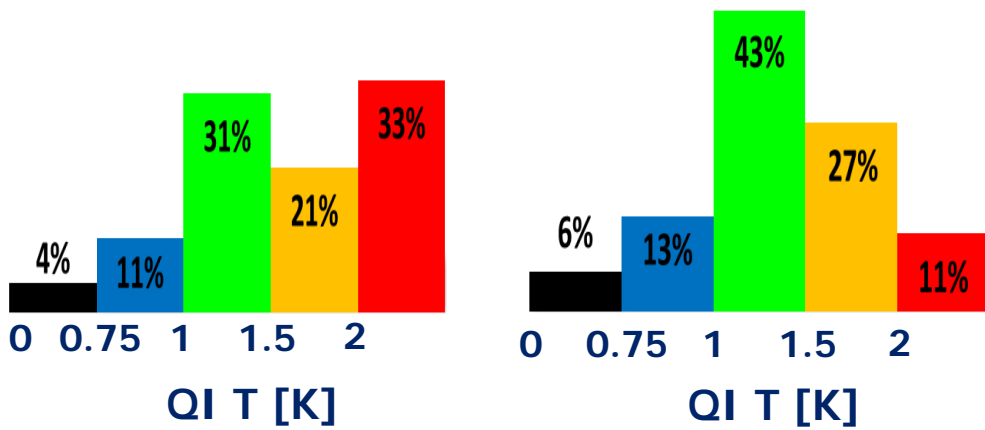
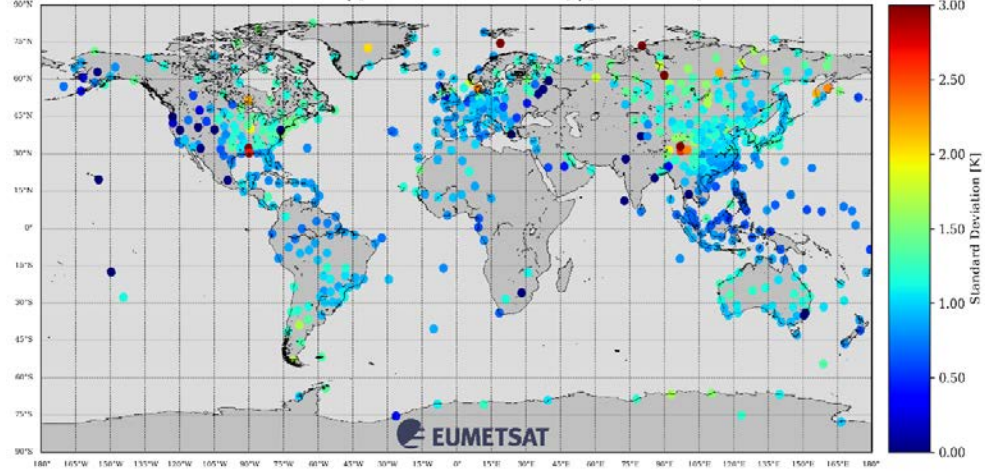
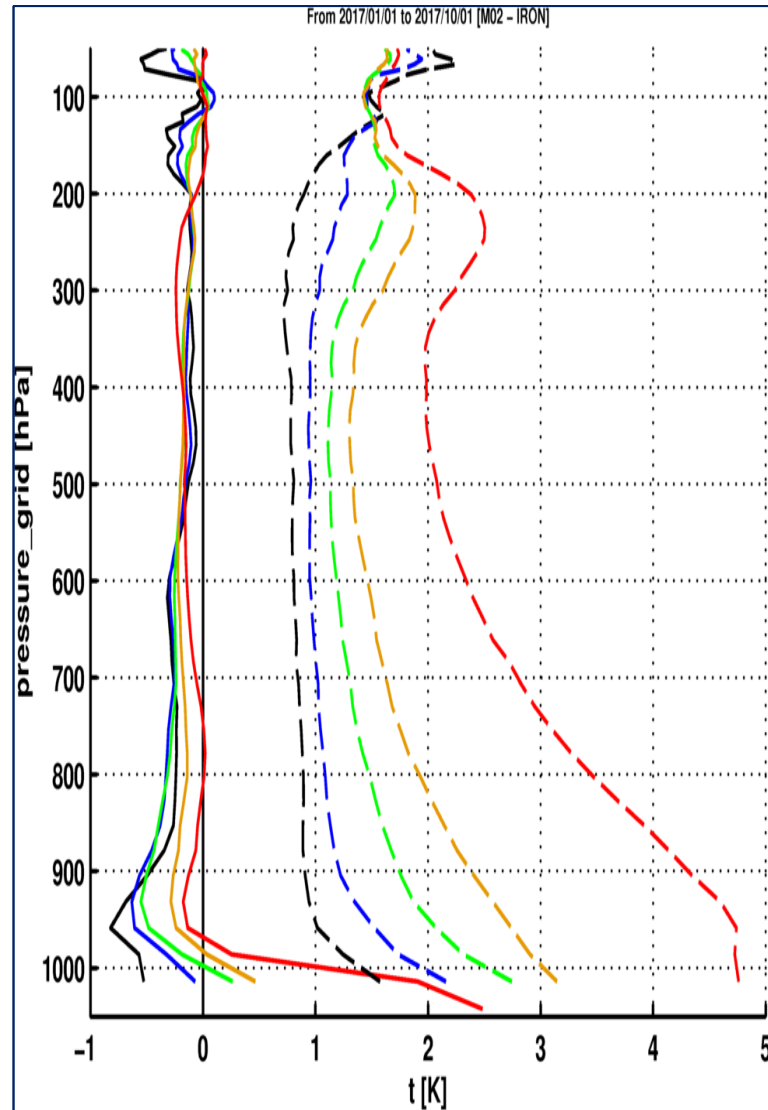
Quality indicator significance vs sondes [IGRA]

IR-only

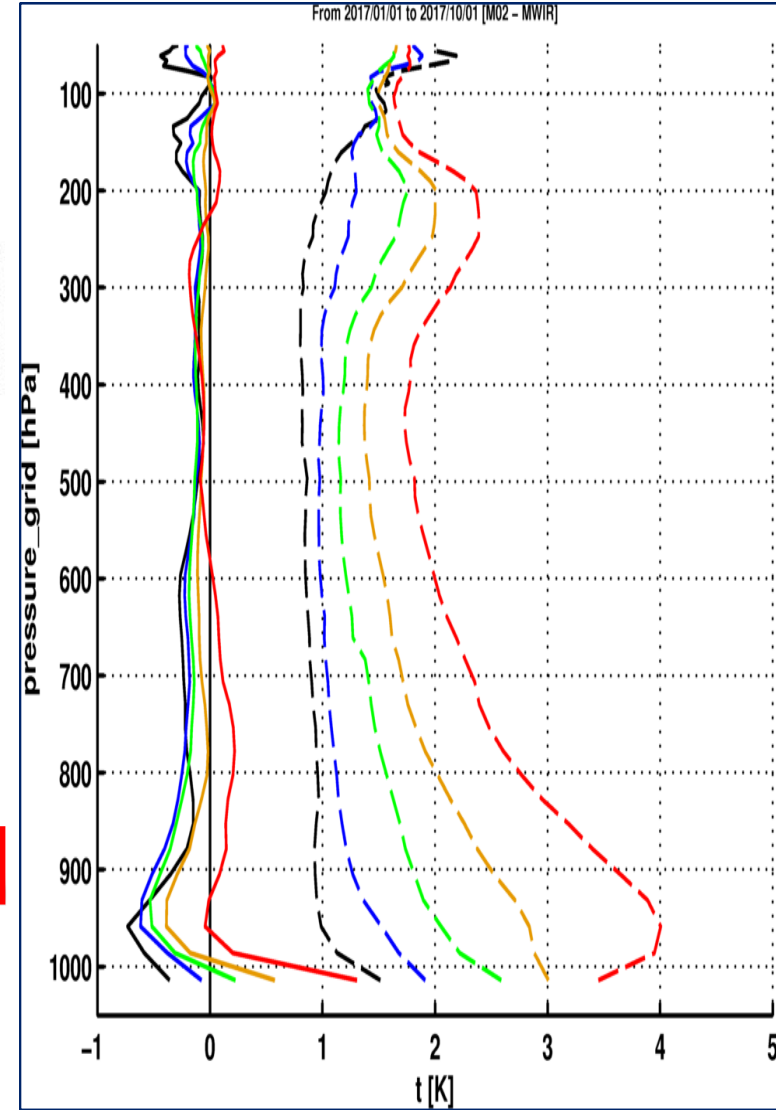
Jan. – Oct. 2017
 < 50km ; < 3h

MW+IR

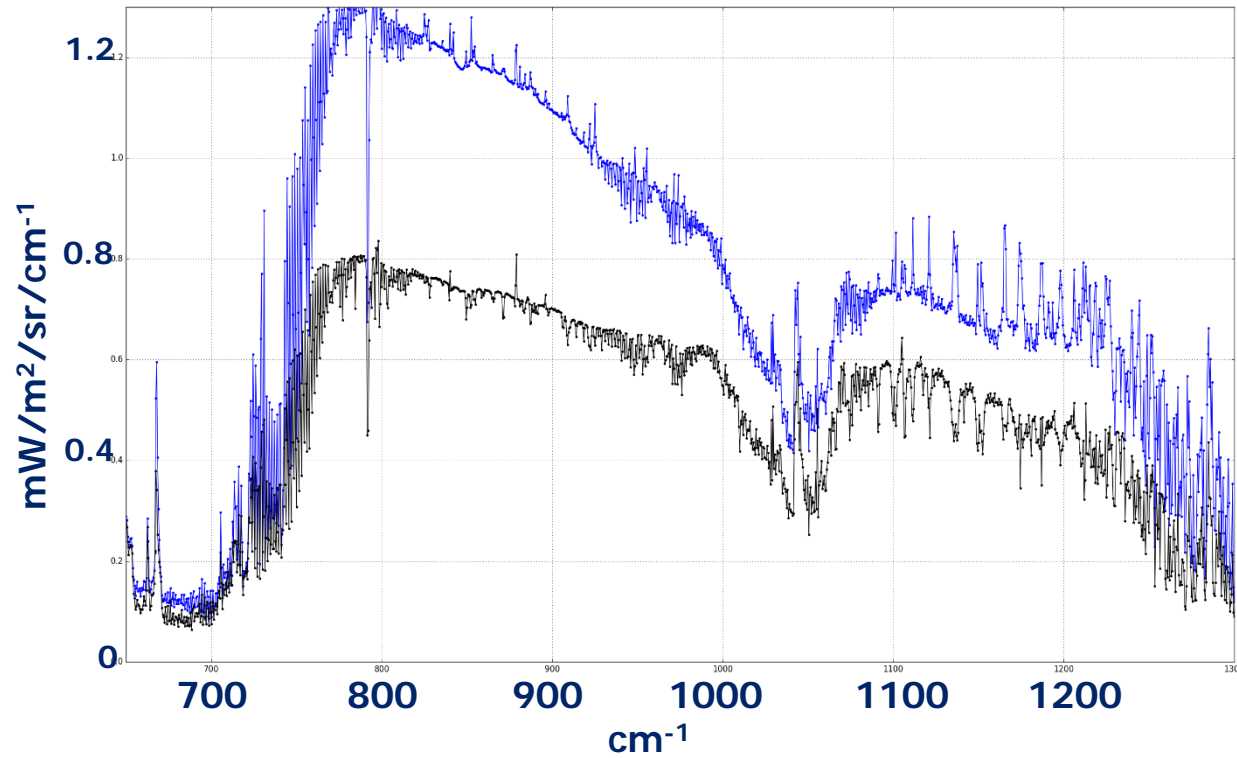
Match-up QC still needed



PWLR³ tropospheric error estimate



Assessment in radiance space - Ocean

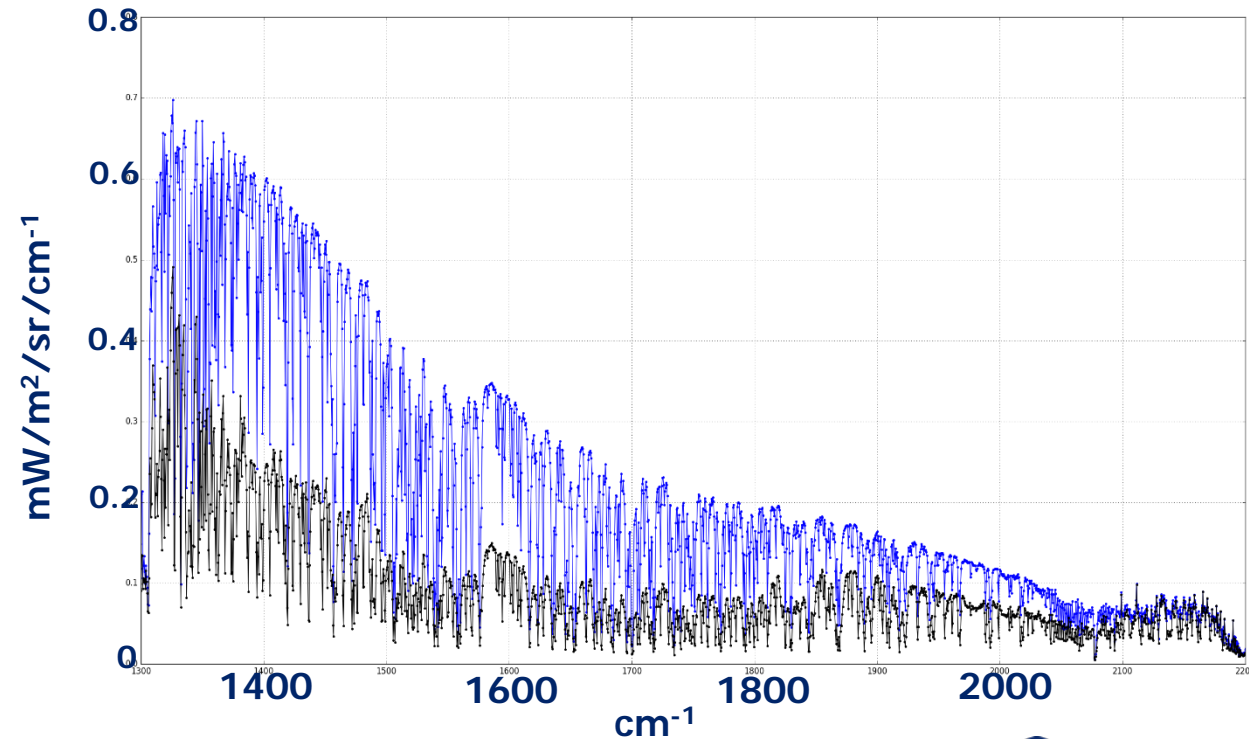


OBS – CALC(ECMWF FCT)
OBS – CALC(PWLR³ v6.4)

01/11/2017

Maritime scenes ; |lat| < 60°

Clear-sky QC from IASI L2



Assessment in radiance space - Land

01/11/2017

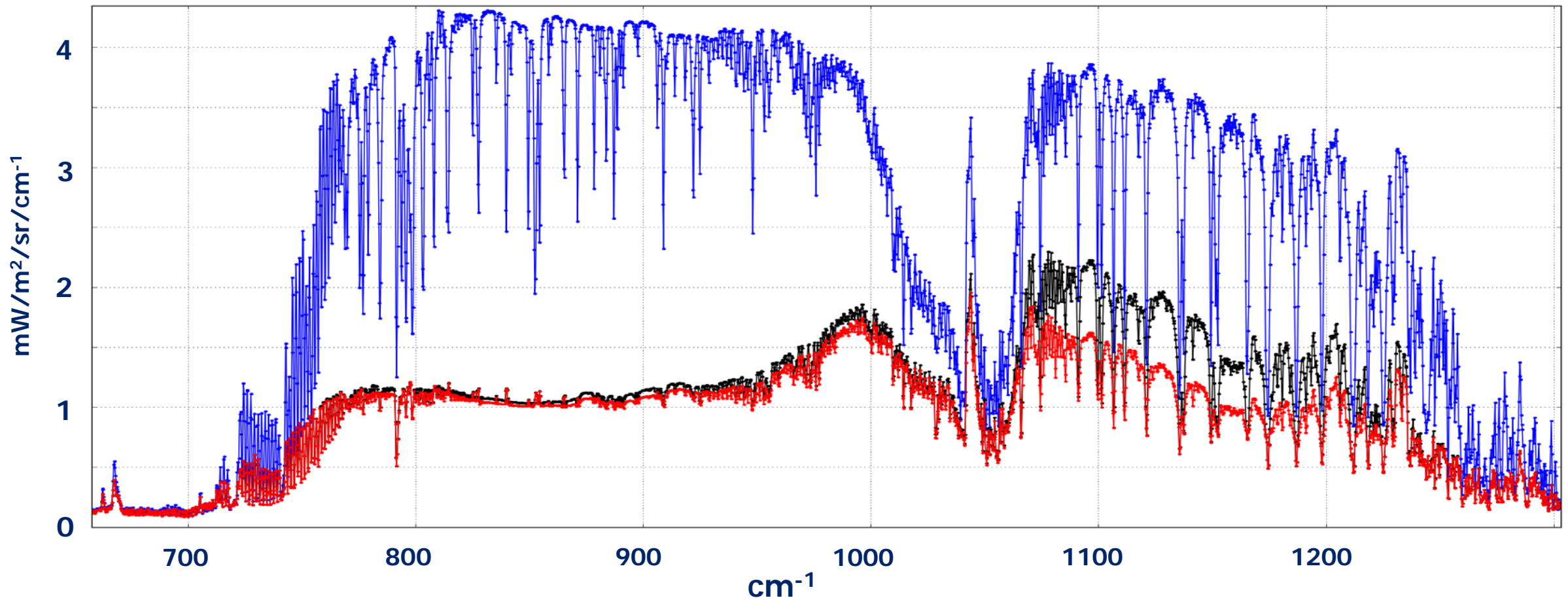
Continental scenes ; $|\text{lat}| < 60^\circ$

Clear-sky QC from IASI L2

OBS – CALC(ECMWF FCT + CAMEL)

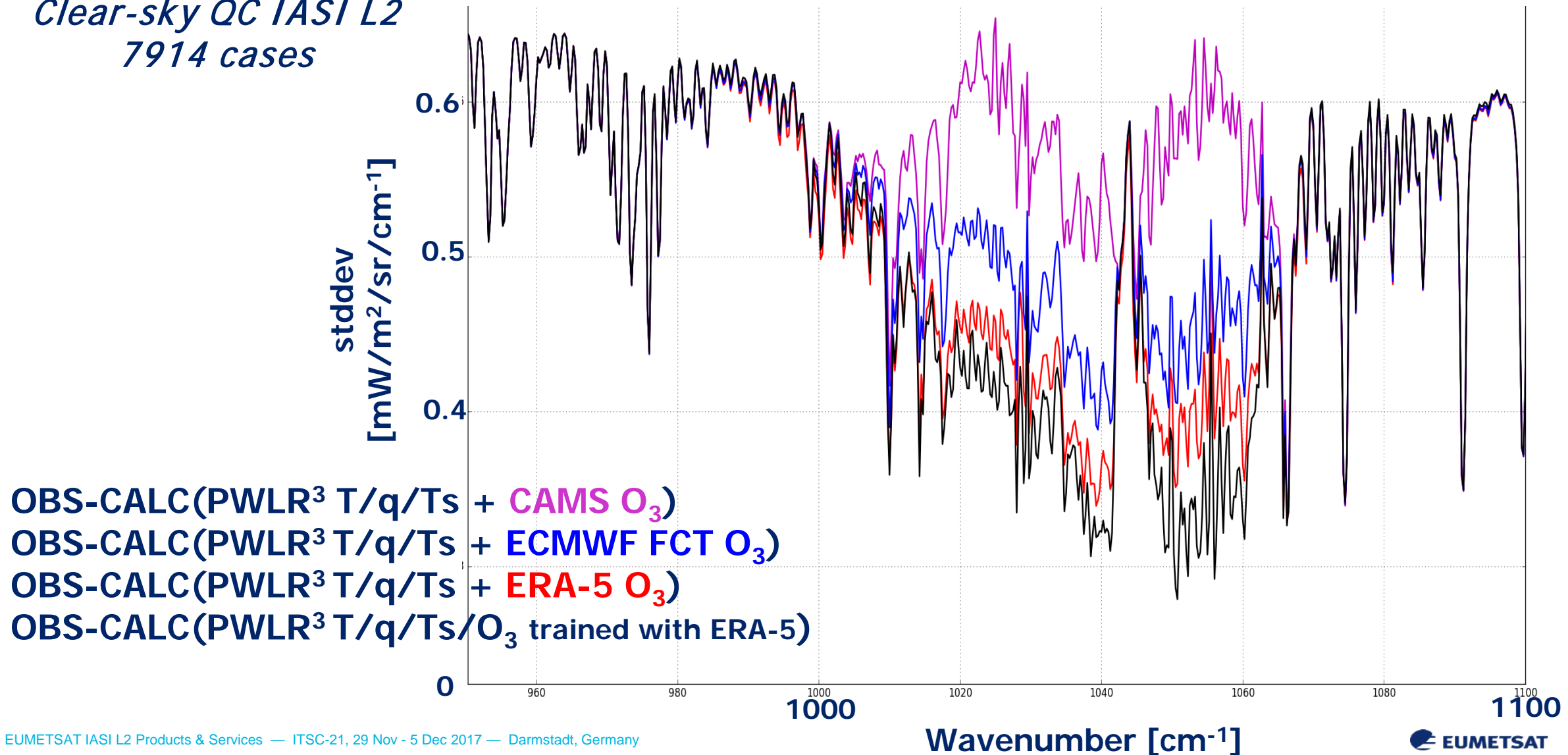
OBS – CALC(PWLR³ v6.4 + CAMEL)

OBS – CALC(PWLR³ v6.4) *trained with CAMEL*

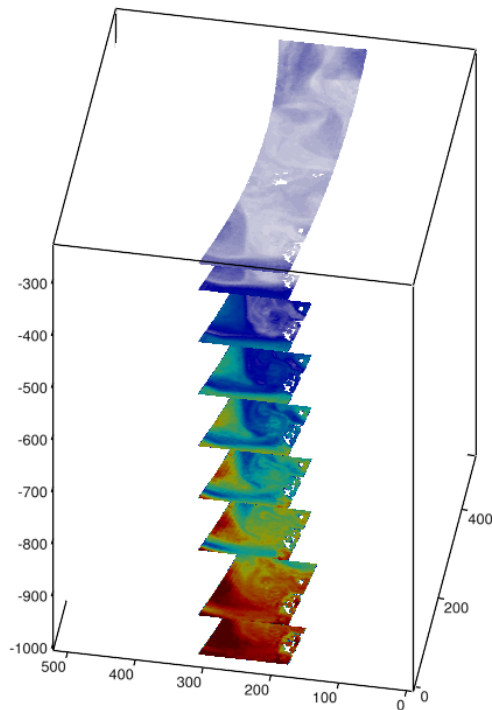


Assessment in radiance space - Ozone

20161201, Sea, $|latitude| < 60^\circ$
Clear-sky QC IASI L2
7914 cases



3D-wind products from hyperspectral sounding profiles



- **Data sources:**

- Operational IASI sounding L2 products (EUMETSAT)
 - Metop-A and Metop-B to maximize overlaps

- **Parameters:**

- Temperature, Humidity and Ozone
 - at standard pressure levels, Polar stereographic interpolation

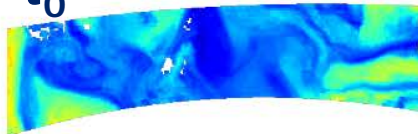
- **Method:**

- 3D optical flow

Humidity at 500 hPa for successive overpasses

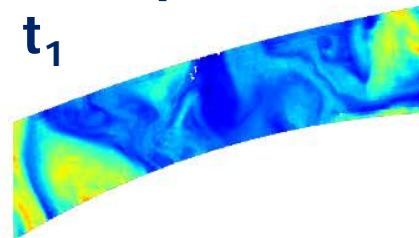
Metop-B

t_0



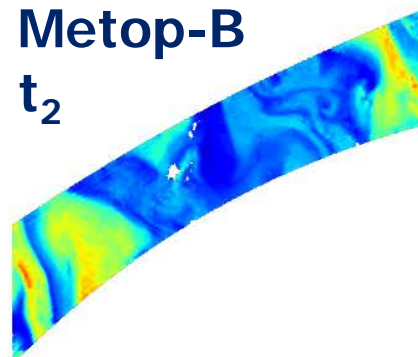
Metop-A

t_1



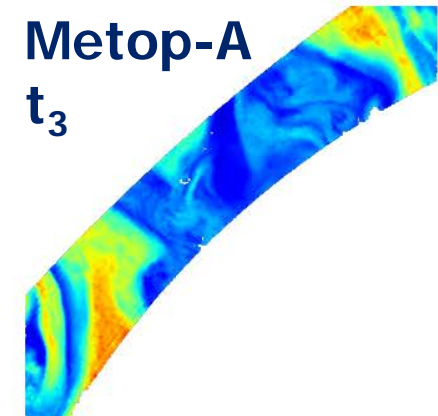
Metop-B

t_2



Metop-A

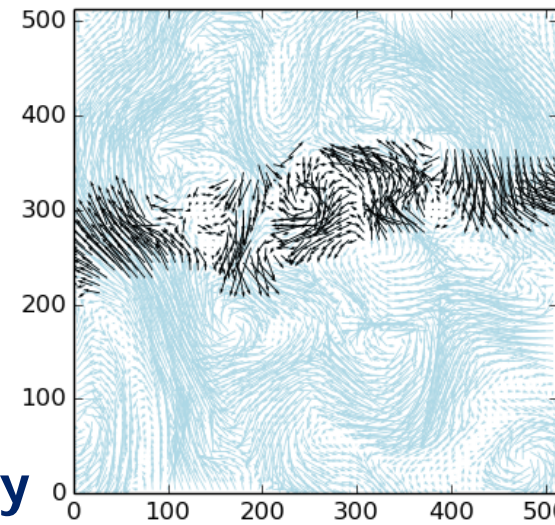
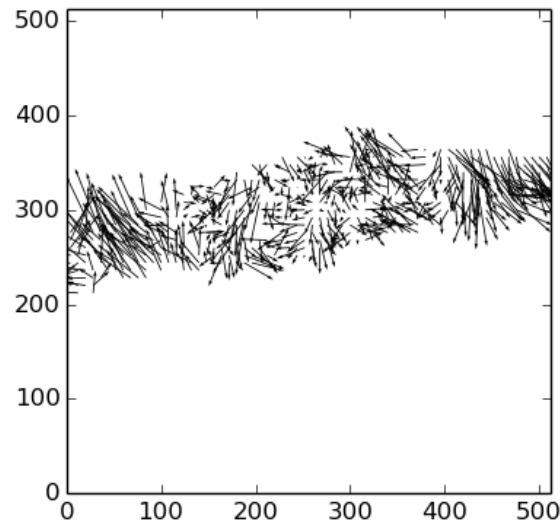
t_3



Credits: O. Hautecoeur & R. Borde, EUMETSAT Users Conference 2017

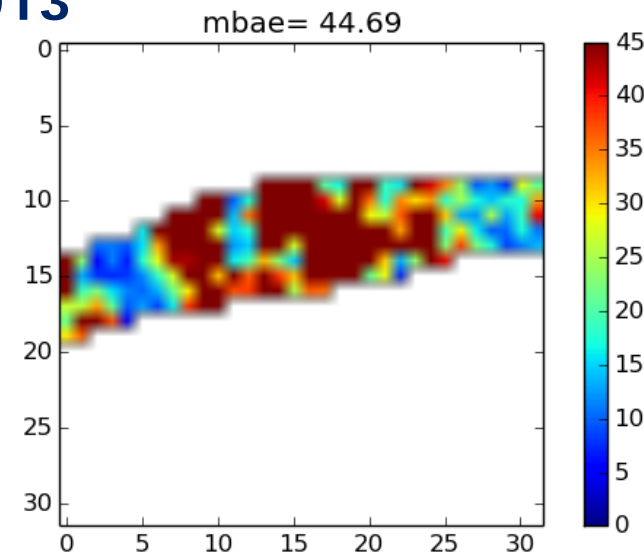
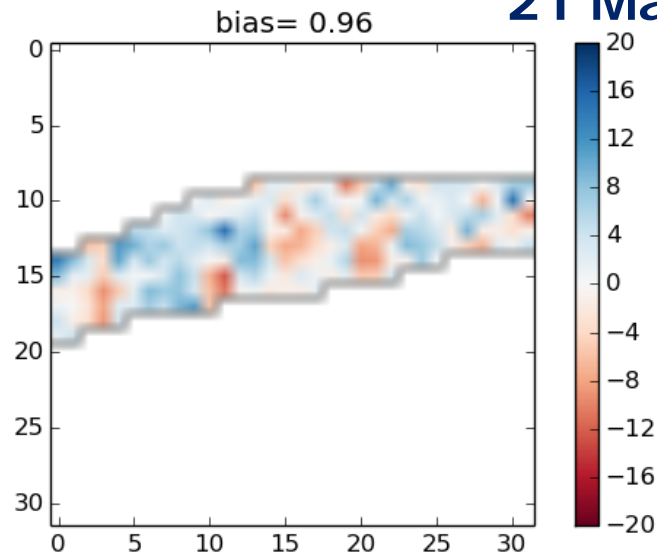
3D-wind products from hyperspectral sounding profiles

Wind fields
at 700 hPa
derived from
IASI



Forecast
wind
field

Case study
21 March 2013



Credits: O. Hautecoeur & R. Borde, EUMETSAT Users Conference 2017

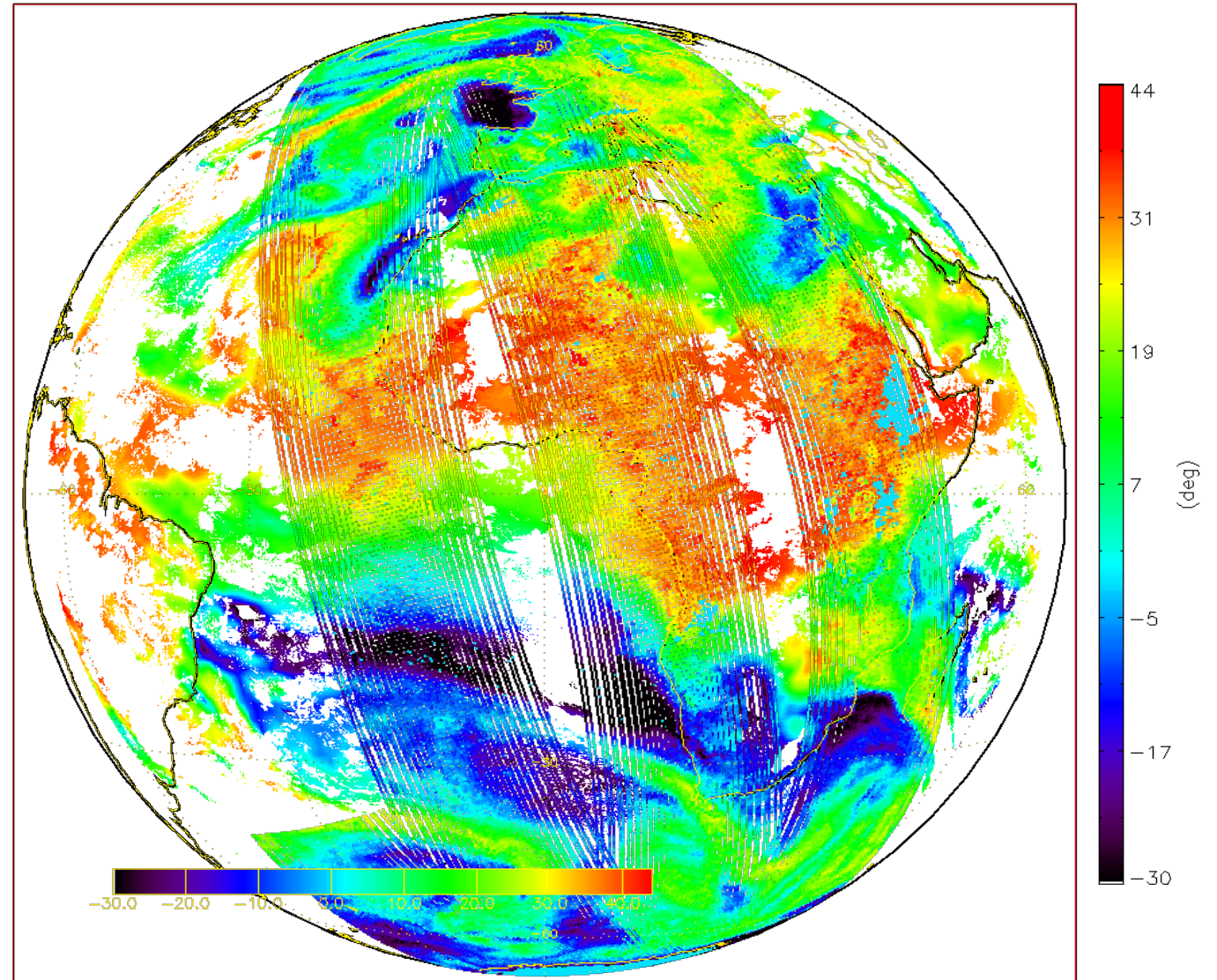
Studying instability from hyperspectral sounding profiles

**MSG GII products
(Glob Instability Indices)**

**+
IASI v6**

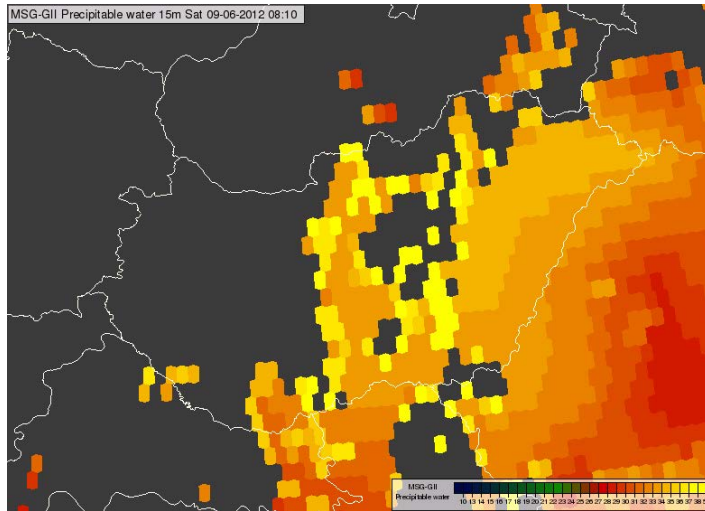
IASI L2 v6 shows
consistent with the GII and
complementary.

It provides information in the
cloudy areas and at
high latitudes.

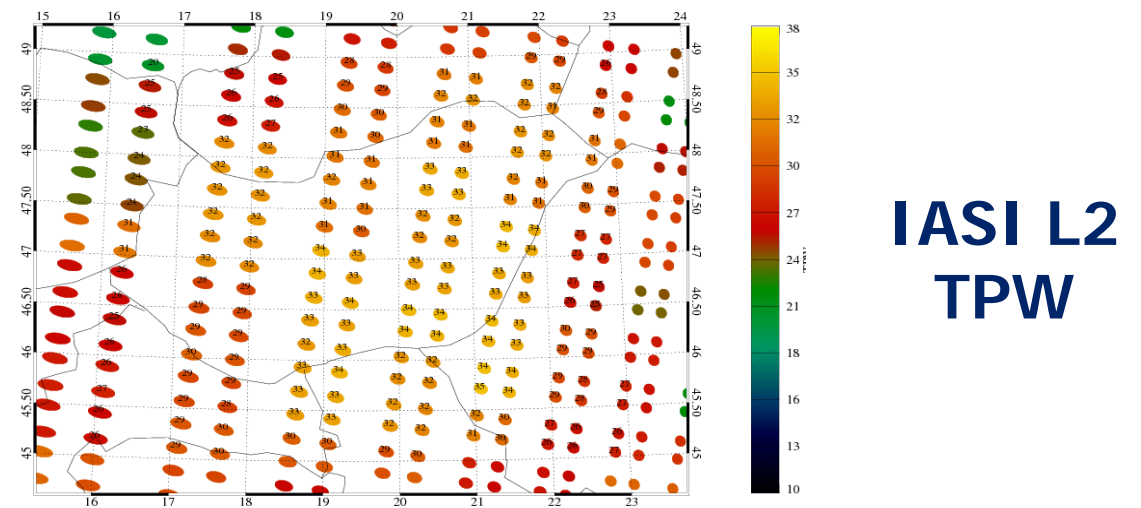
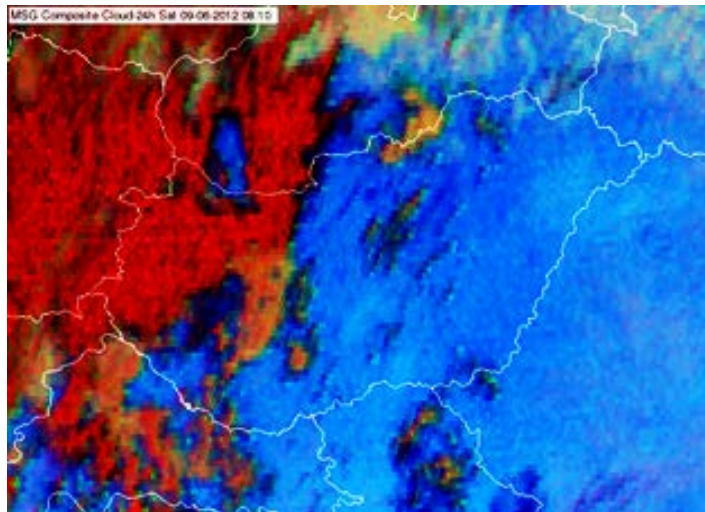


SEVIRI GII vs IASI L2 consistency assessment

SEVIRI
TPW



SEVIRI
RGB
clouds



Systematic quantitative comparisons GII vs IASI L2

Coverage: full MSG disk

Period: April – October 2016

Products: MSG GII vs Metop-A + Metop-B

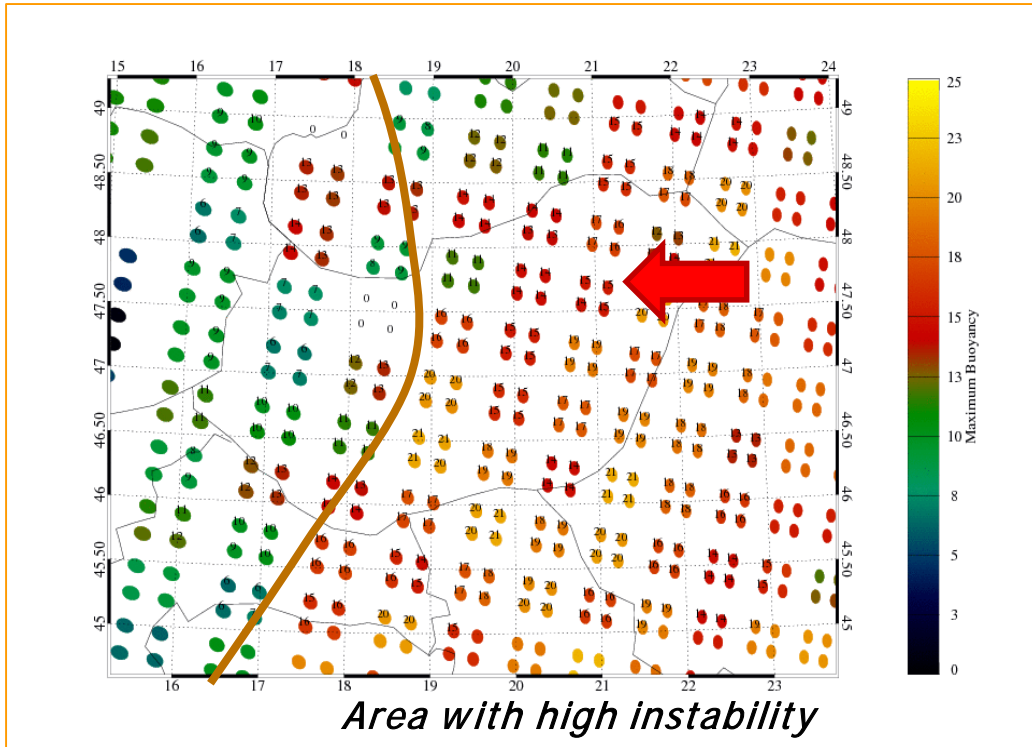
- **Overall high correlation btw GII and IASI L2 indicators**
- **Independent info from Metop, also available in clouds**
- **Combine ground-based observation with satellite profiles?**

Study by Hungarian Met Services

Credits: A. Simon, Z. Kocsis, M. Putsay

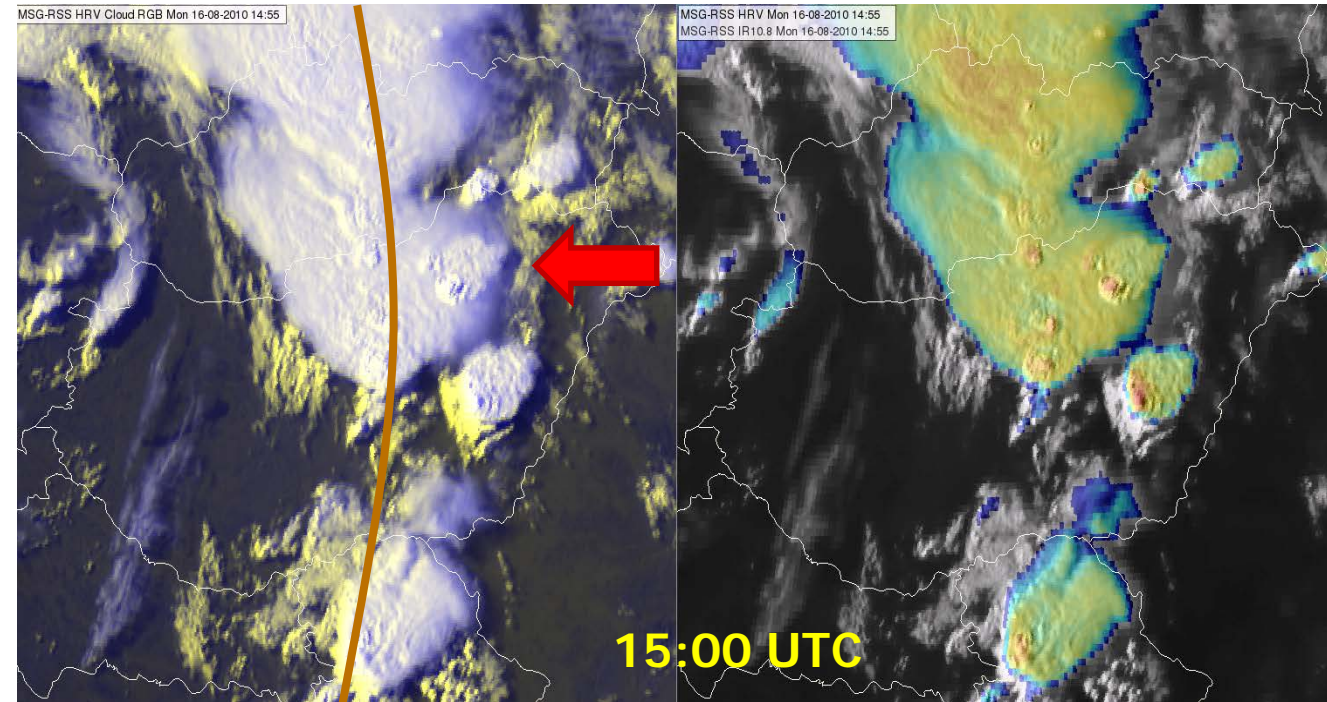
Studying instability from hyperspectral sounding profiles

Tornadic storm, 16 August 2010



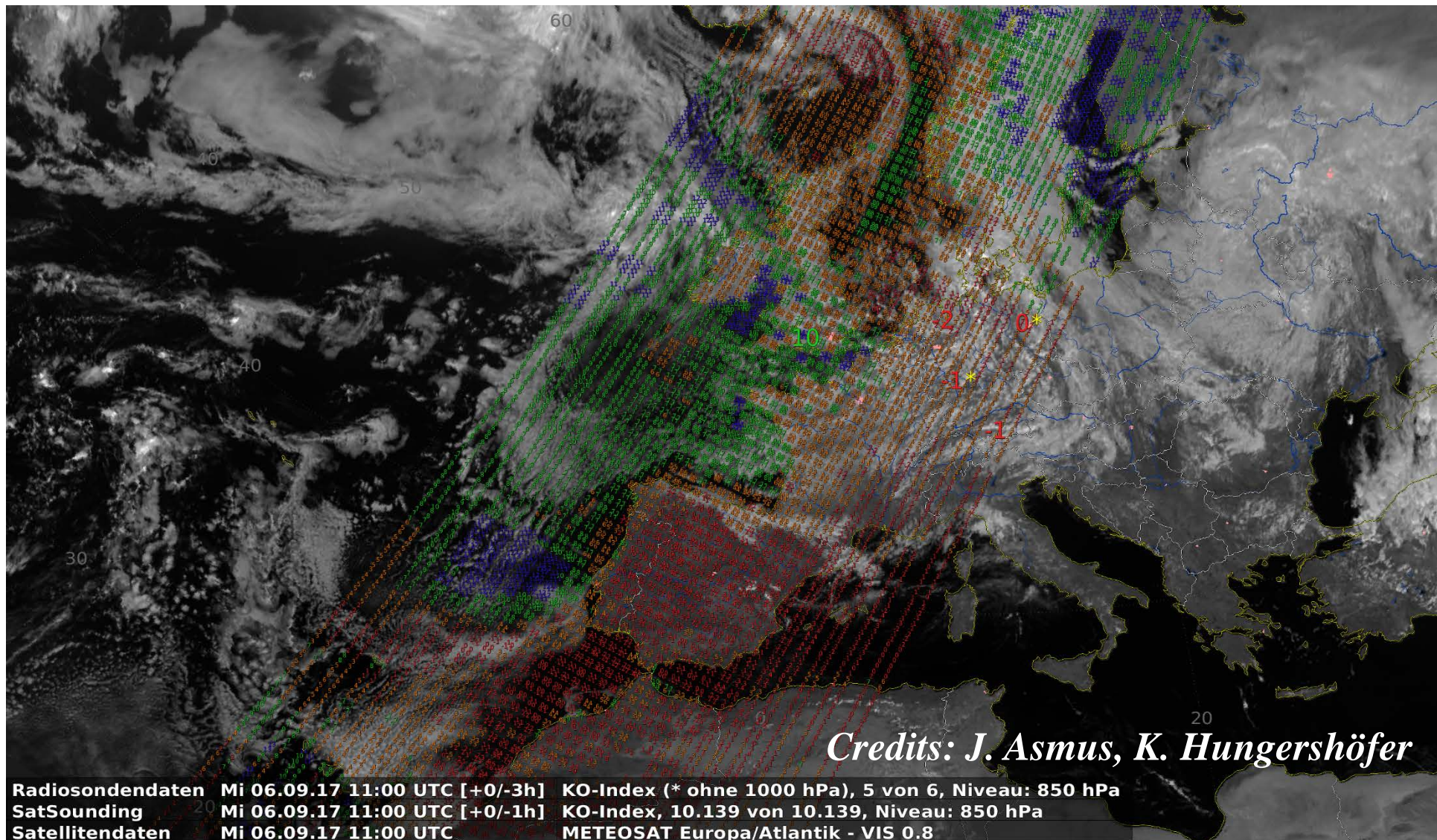
IASI L2 – Maximum Buoyancy (0823 UTC)

Cold front



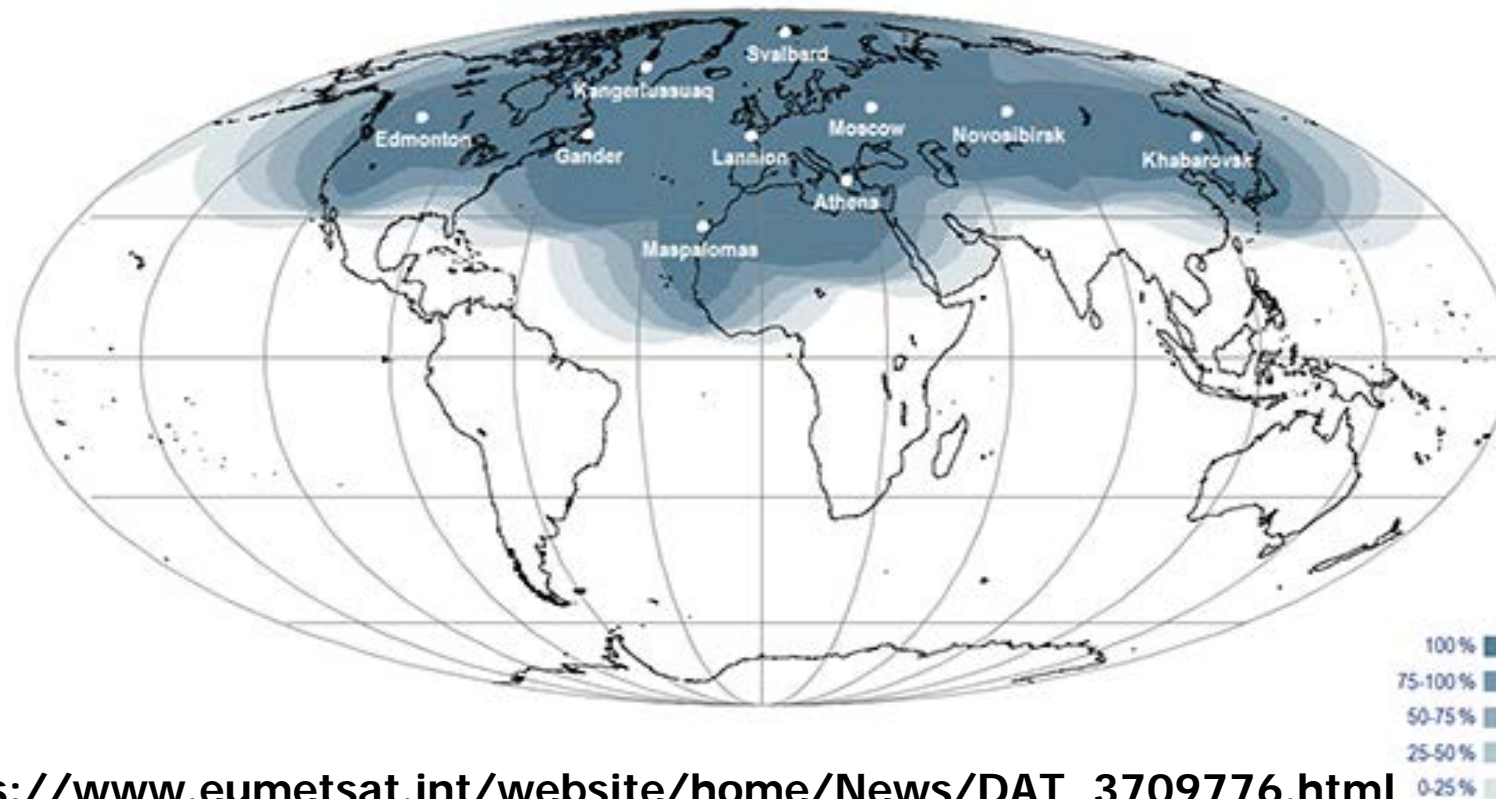
*Study by Hungarian Met Services
Credits: A. Simon, Z. Kocsis, M. Putsay*

KO index from IASI L2 monitored at DWD with NinJo



EARS-IASI L2 – A new regional service

- PWLR³ ‘all-sky’ retrieval from the global IASI L2 processor.
- NRT dissemination on **EUMETCAST**, in **HDF5** files.
- **Products available < 30’ from sensing**
- **Pilot phase started 23/11/2017** (in Demo since 11/2016)

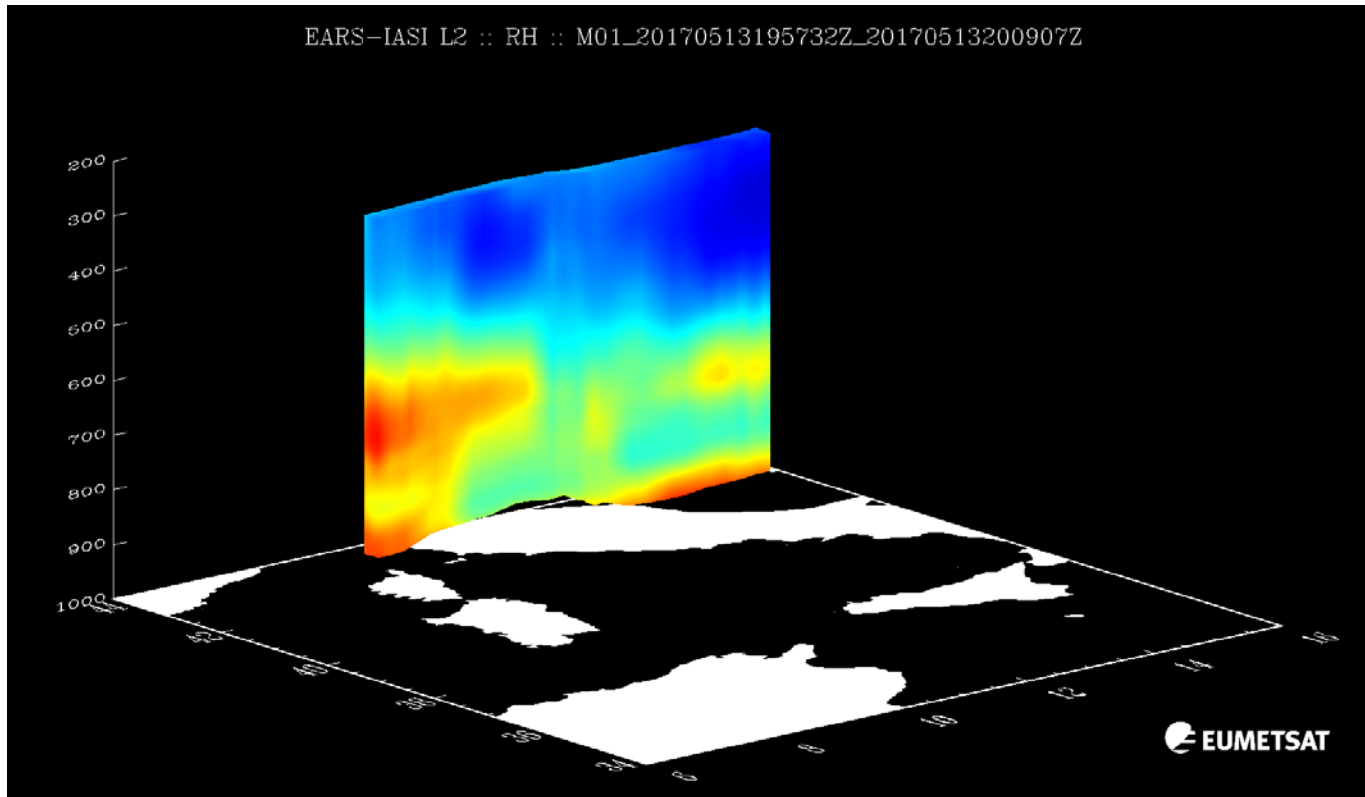


https://www.eumetsat.int/website/home/News/DAT_3709776.html

Summary

- IASI L2 v6.4 under deployment
 - Updated CO₂ content in OEM → reduced T bias ; Preparing for variable CO₂
 - Robust fall-back IR-only statistical retrieval (PWLR³)
 - Further improved MW+IR 'all-sky' sounding T/q/O₃ + T_s / land emissivity
 - T/q profiles and quality indicators validation with sondes
- Exploring new applications
 - 3D-winds products
 - Studying support to regional
- Regional service
 - EARS-IASI L2: all-sky PWLR³ (*IASI + MW*)
 - Products available < **30' from sensing**, on EUMETCast

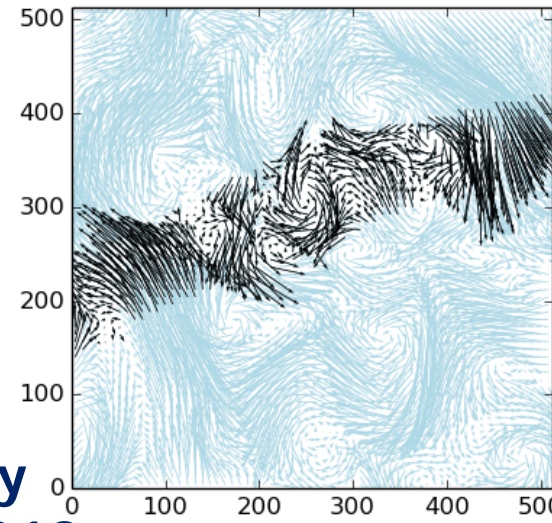
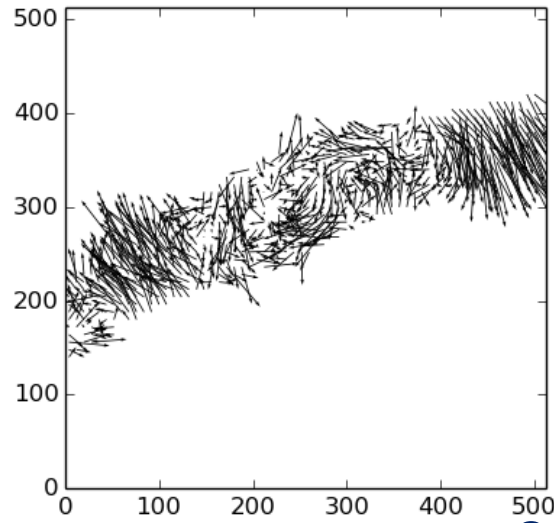
Questions ?



Spare slides

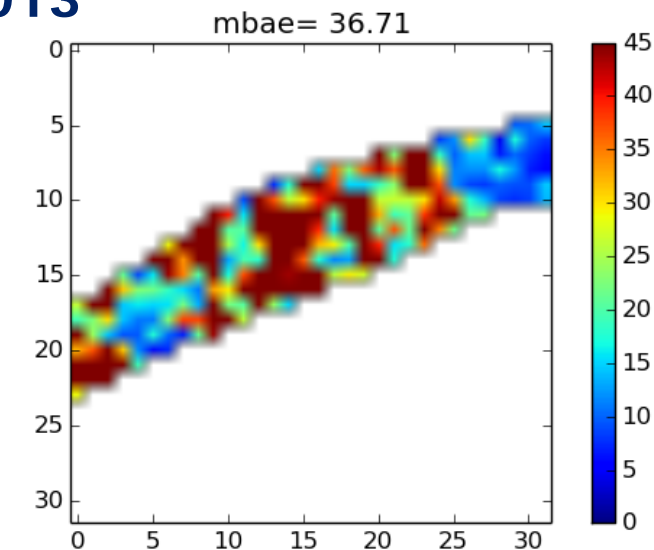
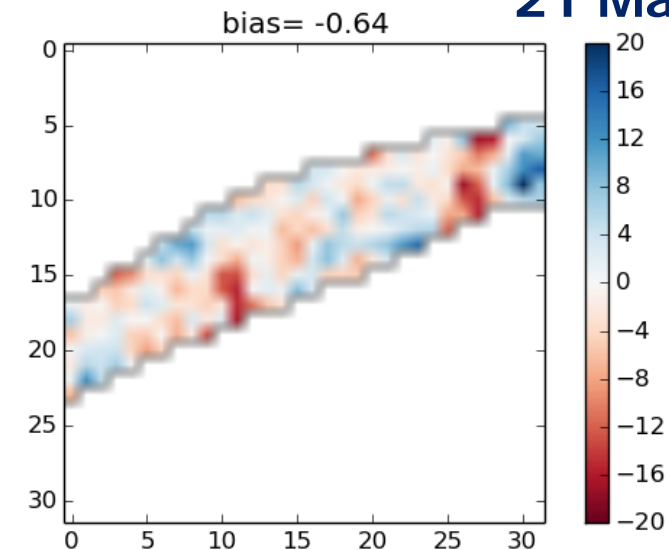
3D-wind products from hyperspectral sounding profiles

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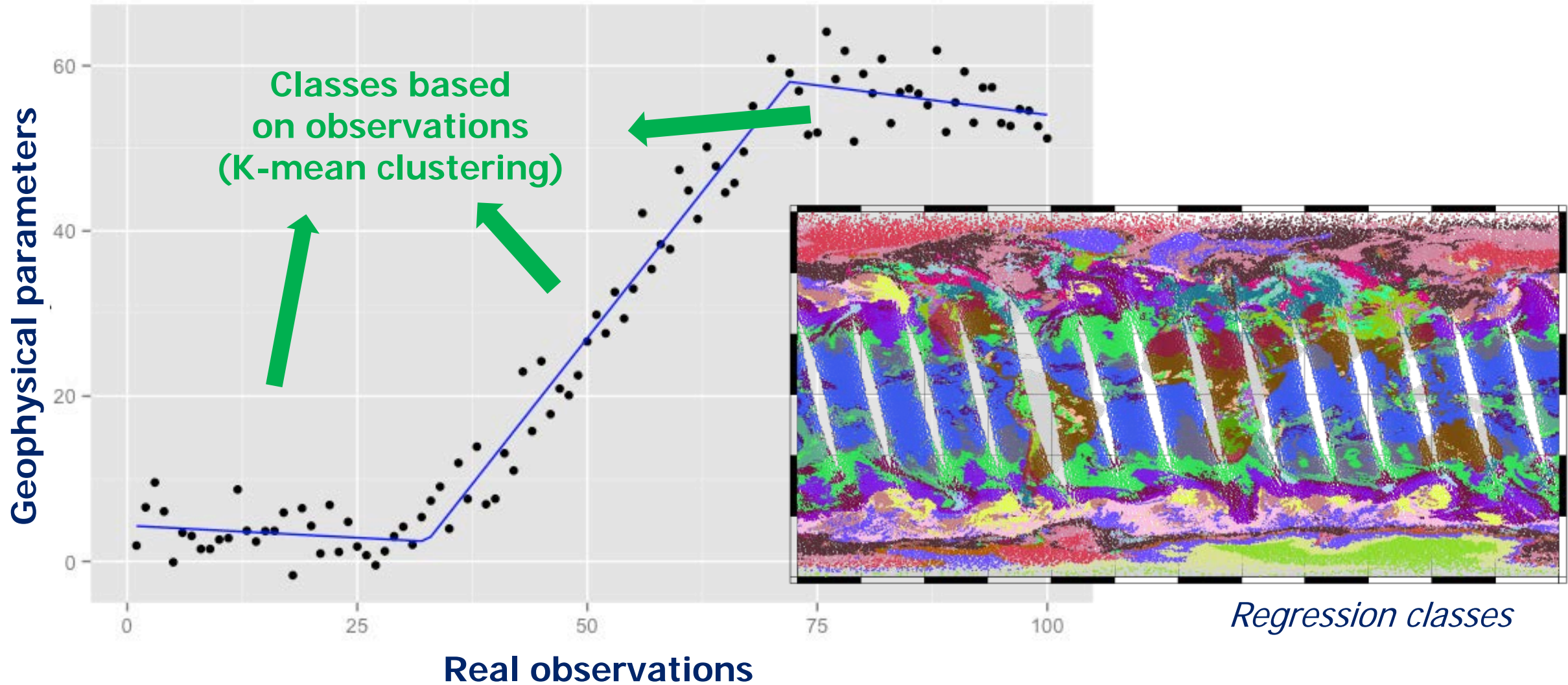
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Case study
21 March 2013



Credits: O. Hautecoeur & R. Borde, EUMETSAT Users Conference 2017

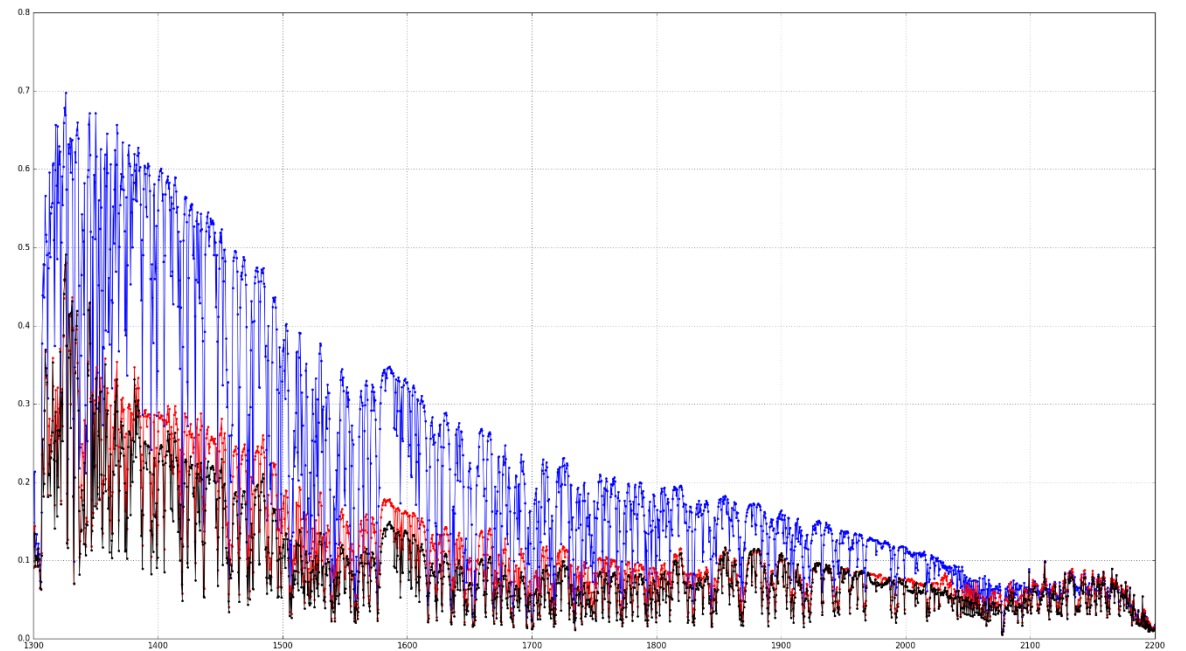
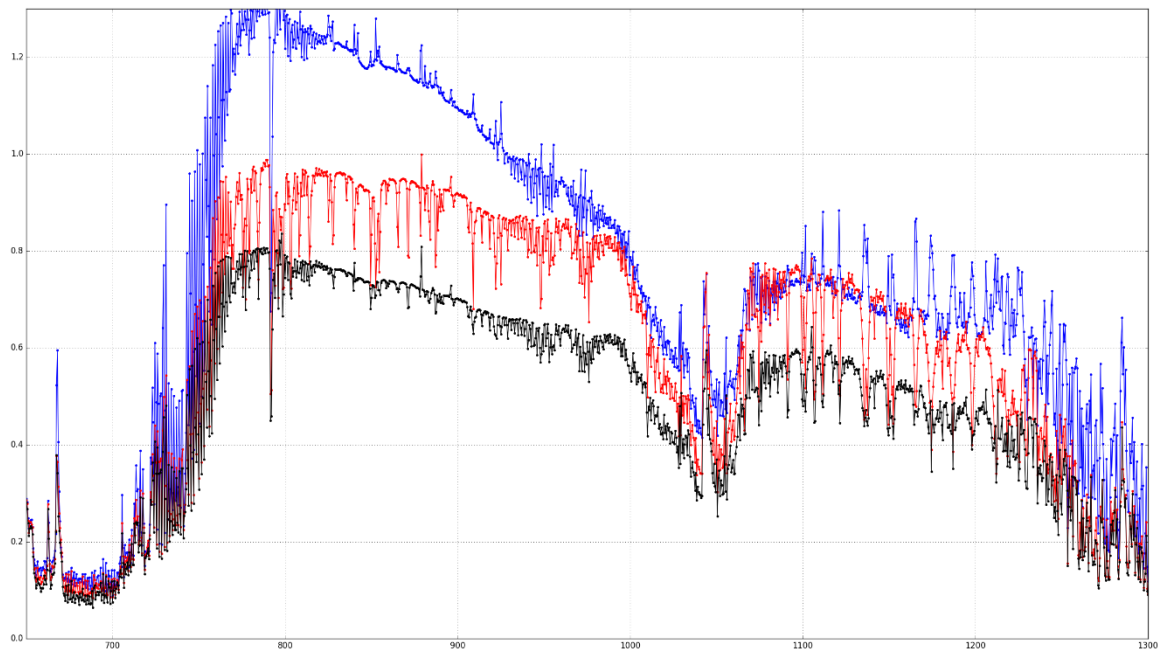
The Piece-Wise Linear Regression



OBS – CALC(ECMWF FCT)

OBS – CALC(PWLR³ v6.3)

OBS – CALC(PWLR³ v6.4)



OBS – CALC(PWLR³ v6.4 + LSE CAMEL)

OBS – CALC(PWLR³ v6.4 incl. LSE)

