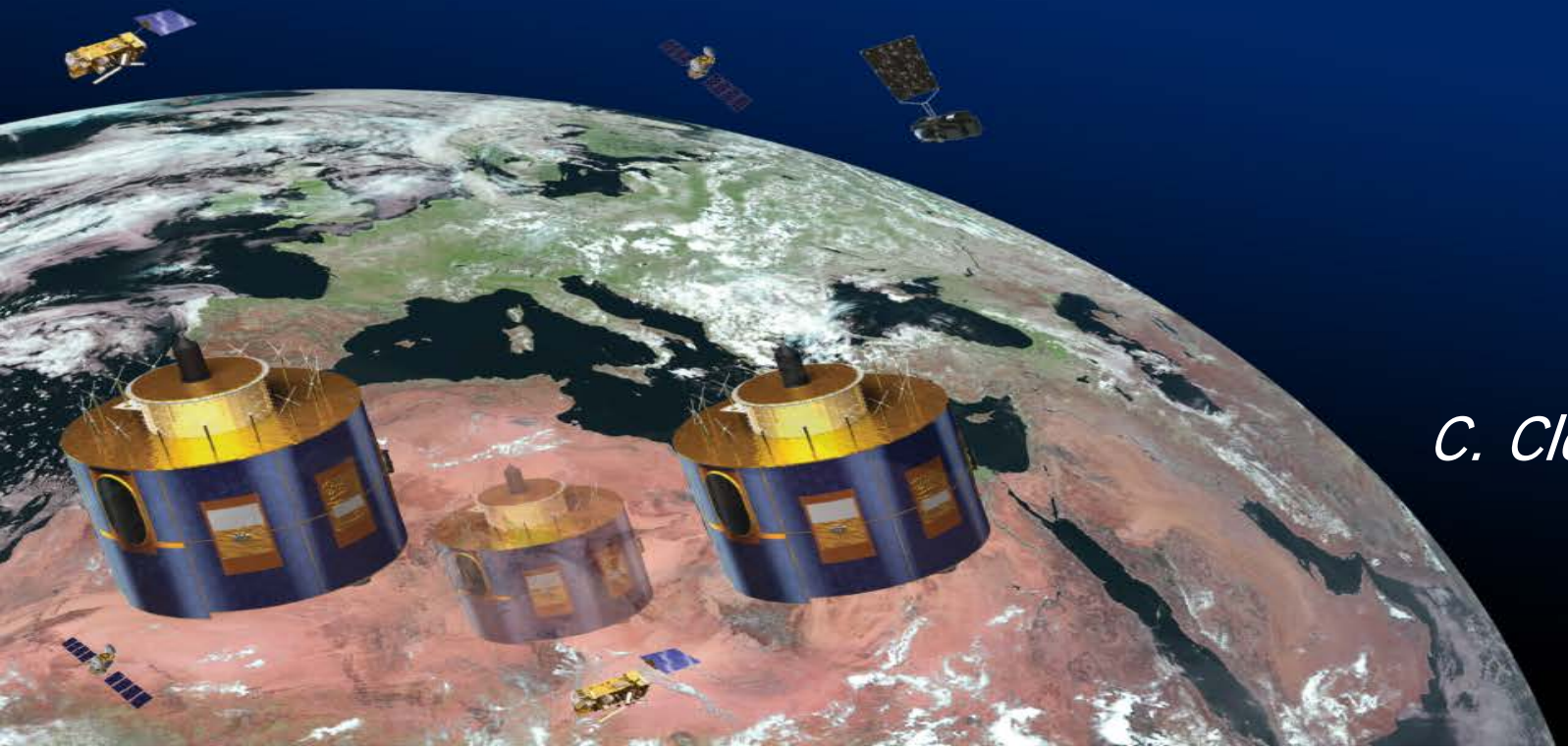
EUMETSAT IASI L2 products, from Global to Local services



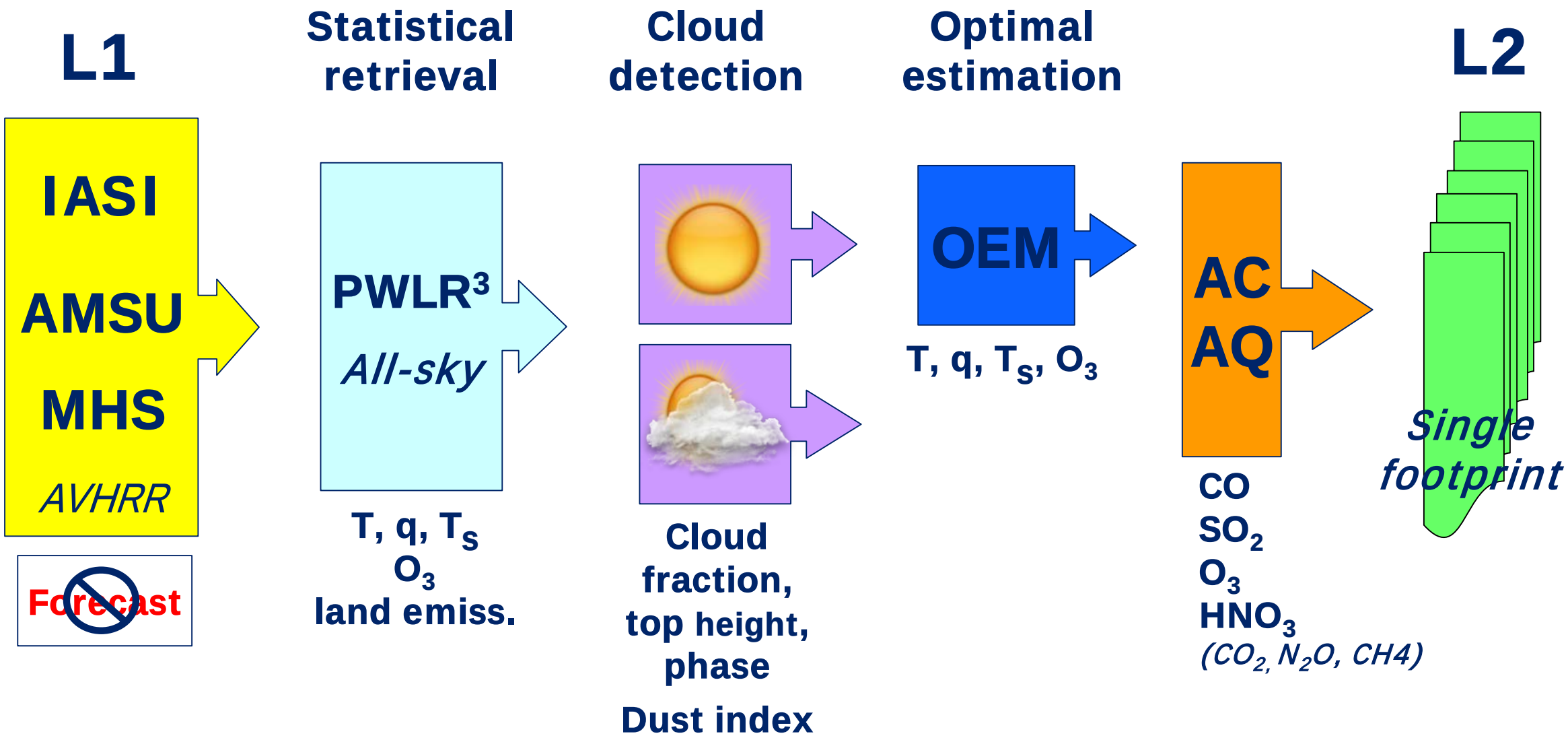
T. August, T. Hultberg, M. Crapeau, A. Burini, D. Klaes, EUMETSAT

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

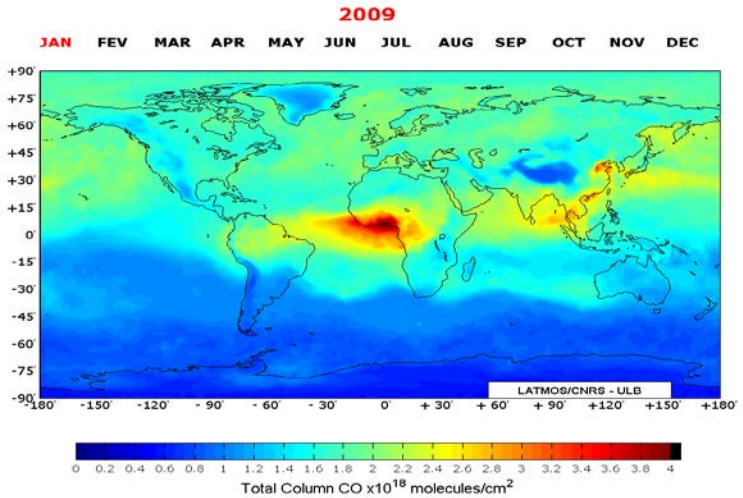
IASI L2 v6 processor main steps



New atmospheric composition products

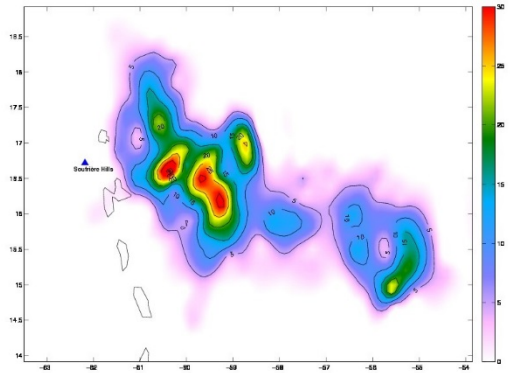
EUMETSAT AC SAF IASI CO product

FORLI library (ULB/LATMOS)
Operational since March 2017
NRT profiles + averaging kernels



EUMETSAT AC SAF IASI SO_2 product

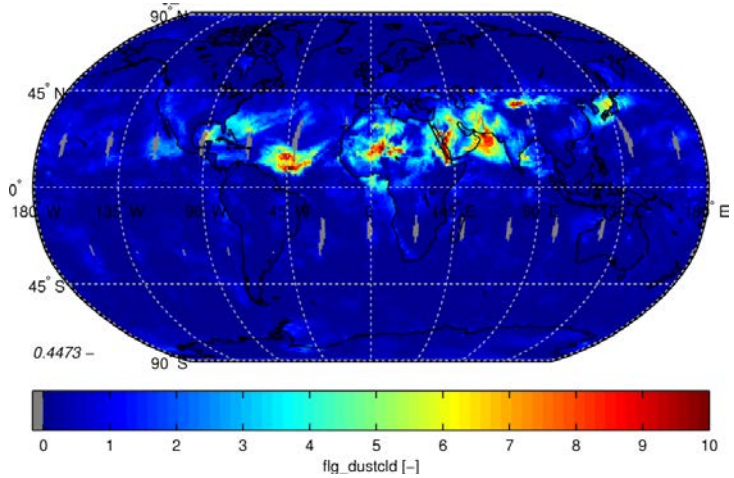
BRESCIA library (ULB/LATMOS)
Pre-Operational since June 2017 (v6.3)
NRT SO_2 detection & columns



Credits: L. Clarisse (ULB)

IASI Dust index

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

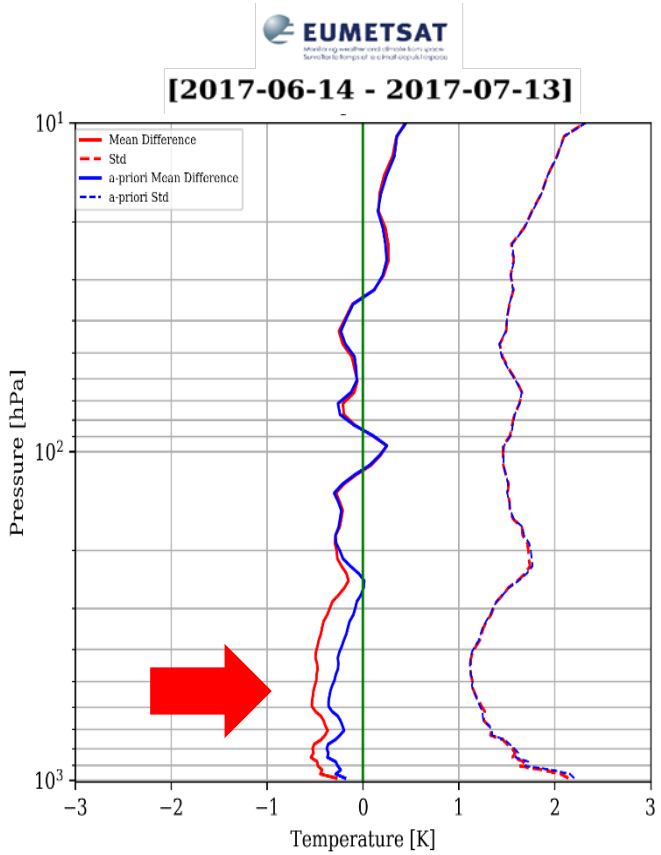


CO_2 content in optimal estimation, impact on temperature

Current OEM (clear-sky) settings

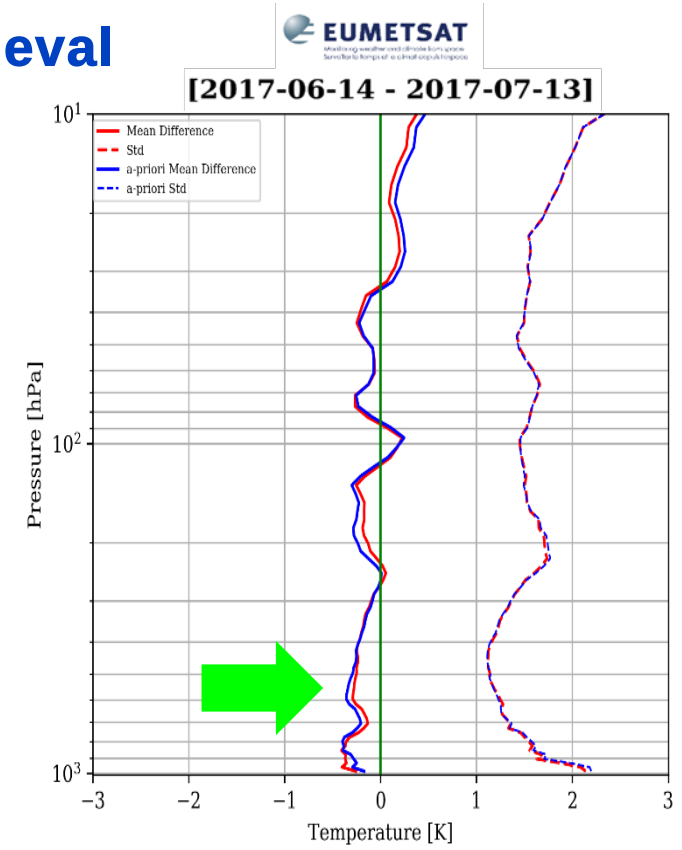
Forward model: RTTOV 10.2
Dynamic (retrieved): T, q, T_s, O_3

Fixed input: surface emissivity (PWLR[3])
Static configuration: CO_2 , CH_4 …



- First retrieval
- OEM

IASI L2 T vs sondes



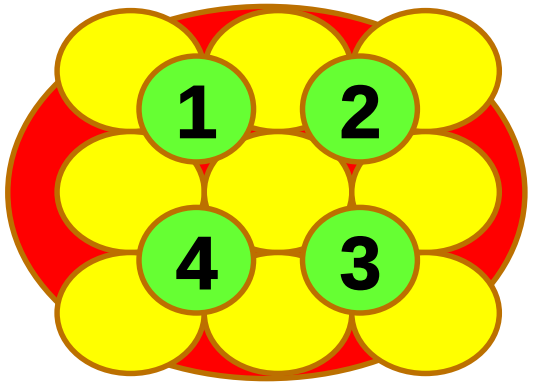
…

plans for v6.5
RTTOV 12
variable CO_2

v6.3 – CO_2 380 ppmv

v6.4 (early'18) – CO_2 400 ppmv

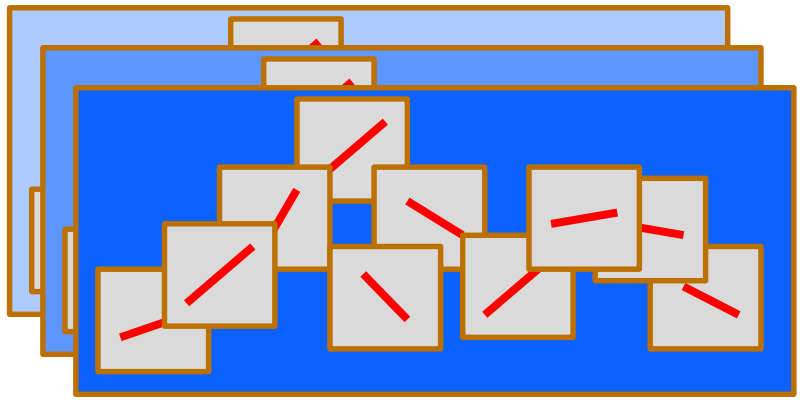
PWLR^3 – 3D retrieval, exploiting geophysical horizontal correlation



PWLR^3 '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)



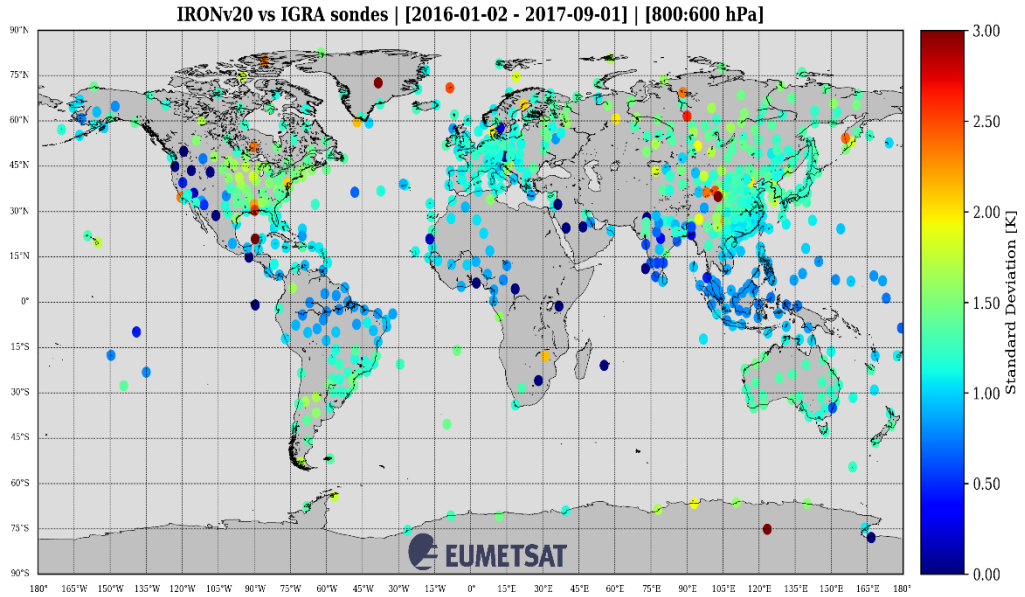
Update in v6.4:
IR-only fallback
Better clustering
New training set

T, q, Ts, O_3, surface emissivity, cloud
for every pixel separately

Assessment *vs* sondes

IASI L2 IR-only PWLR³

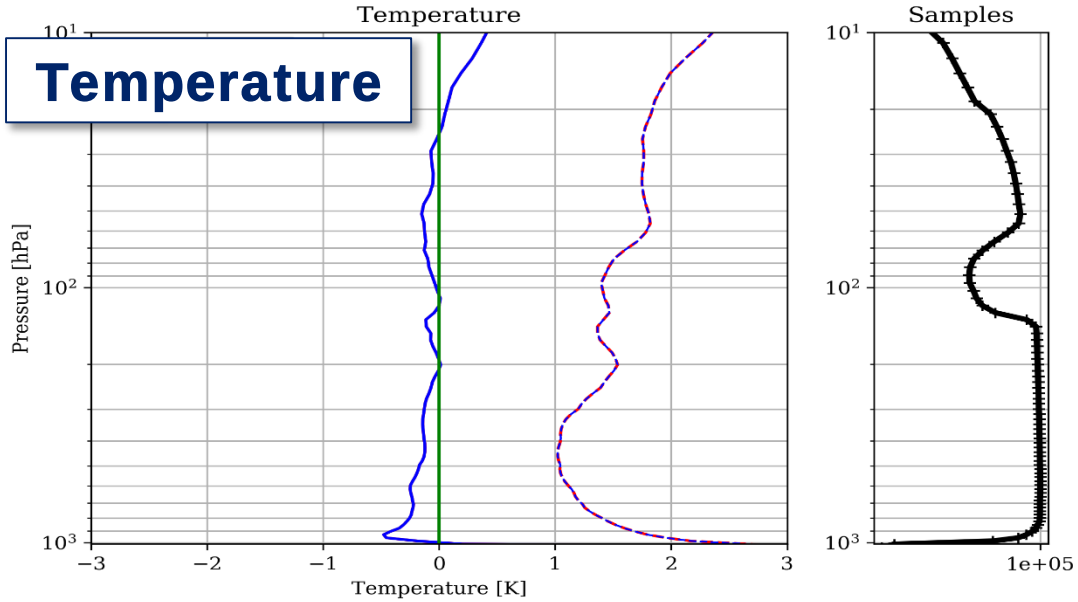
20 months: January 2016 – August 2017
vs radio-sondes (±3h ; <50km)



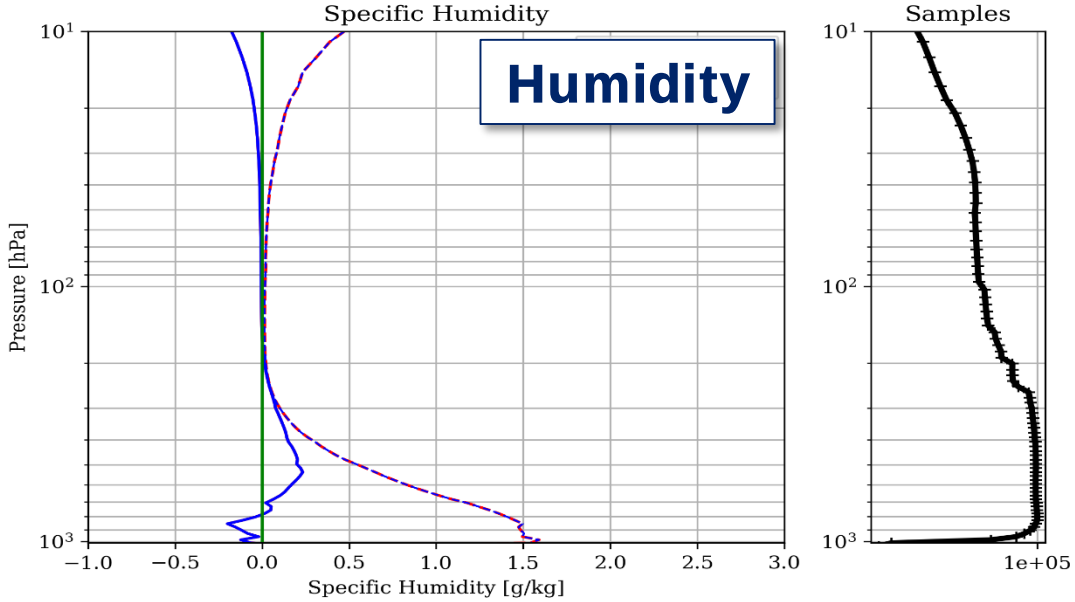
Yield ~50%,
includes cloudy pixels

EUMETSAT

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



Temperature



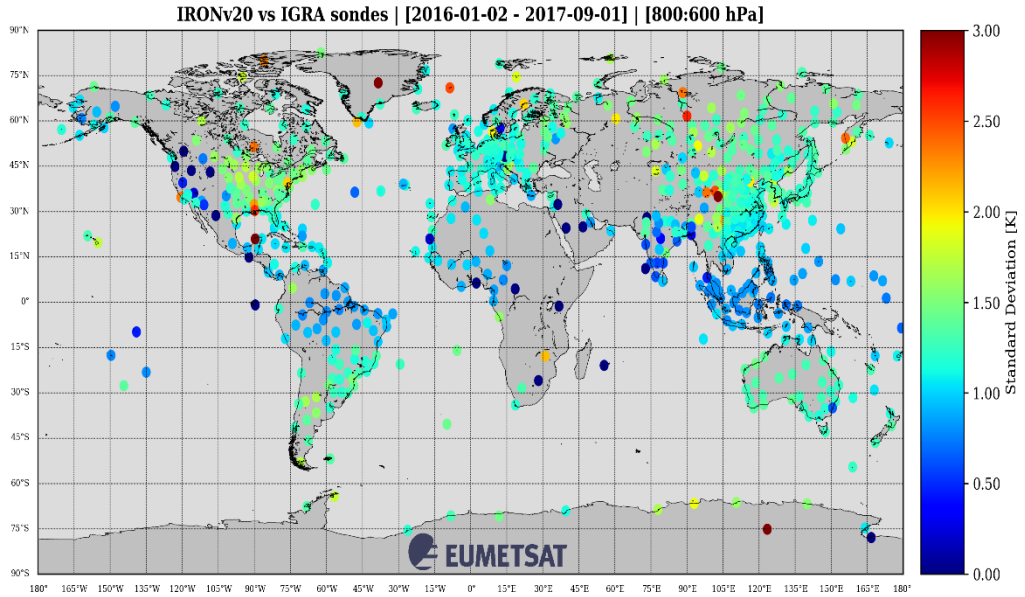
Humidity

EUMETSAT

Assessment *vs* sondes

IASI L2 IR-only PWLR³

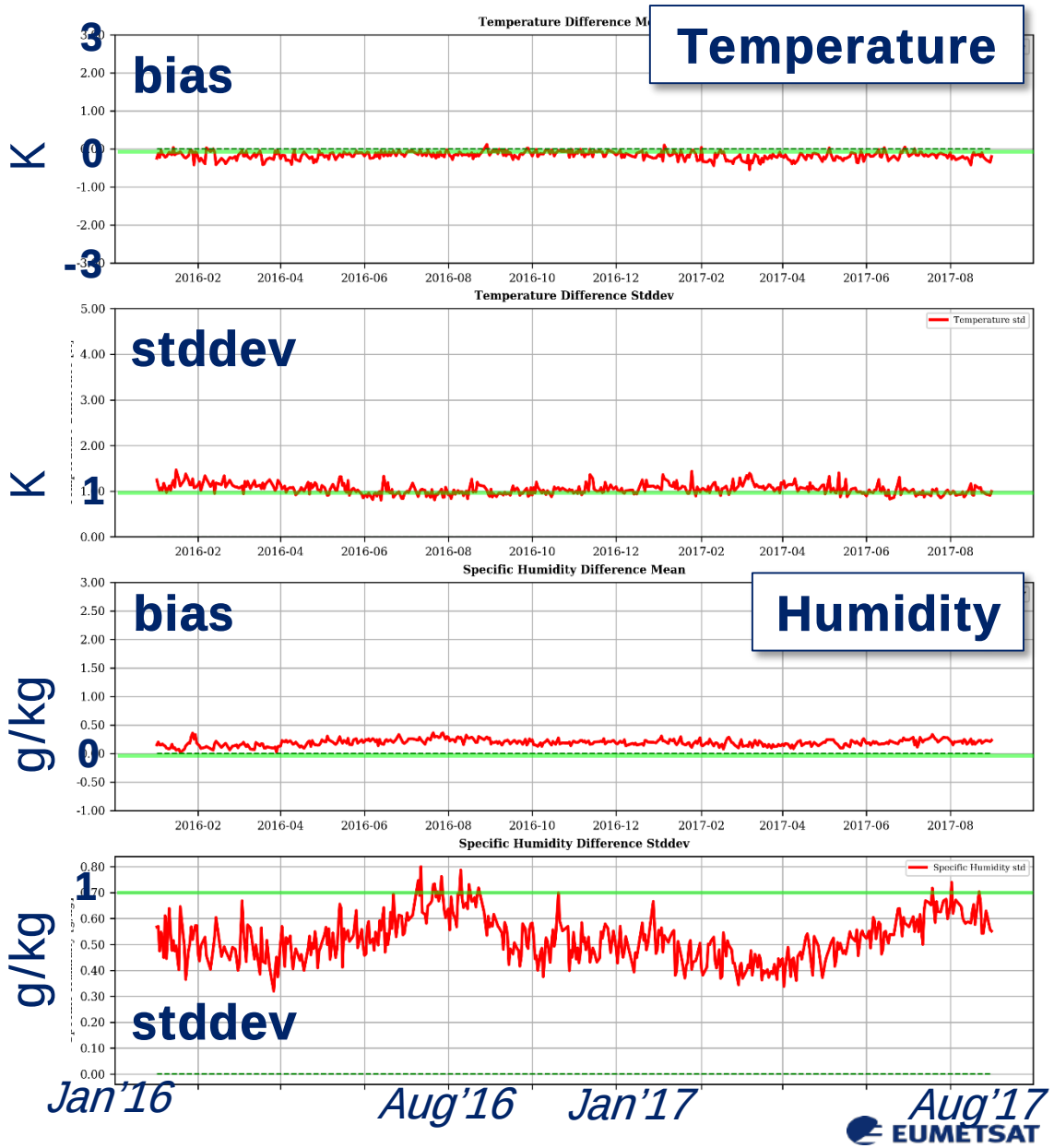
20 months: January 2016 – August 2017
vs **radio-sondes (±3h ; <50km)**



Yield ~50%,
includes cloudy pixels

EUMETSAT
Monitoring weather and climate from space
Surveiller le temps et le climat depuis l'espace

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



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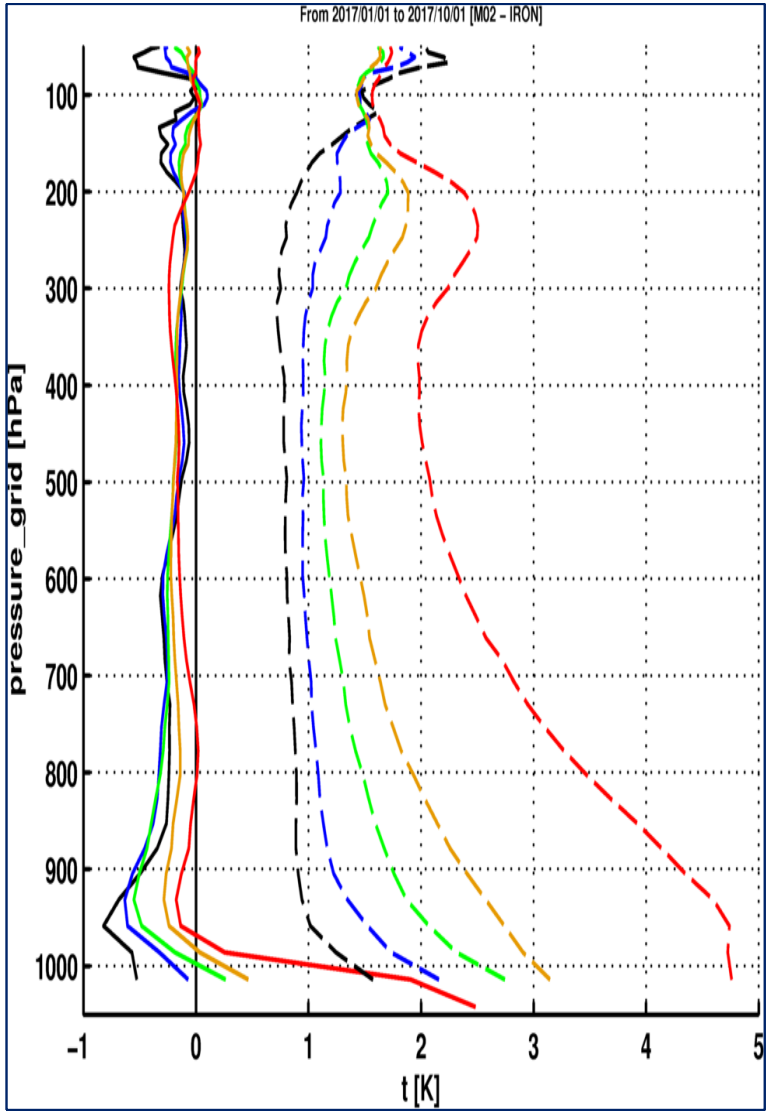
Quality indicator significance *vs* sondes [IGRA]

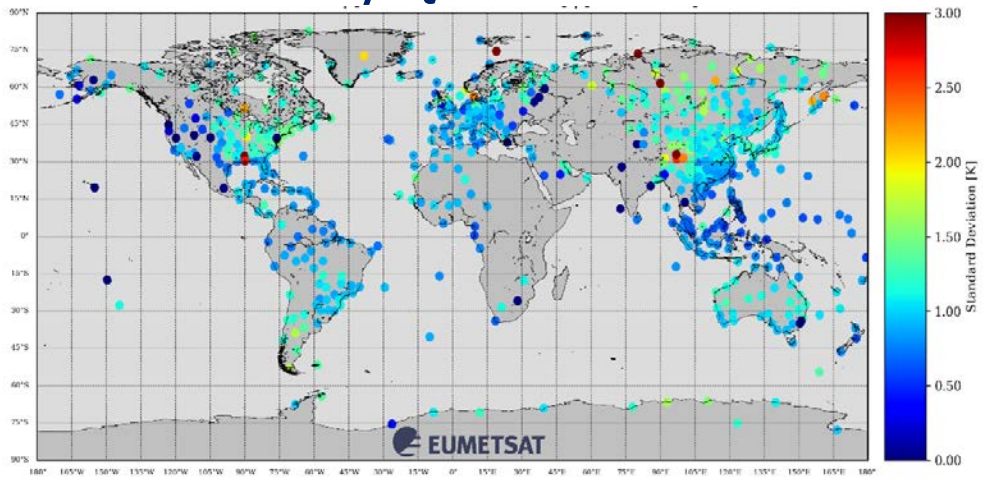
IR-only

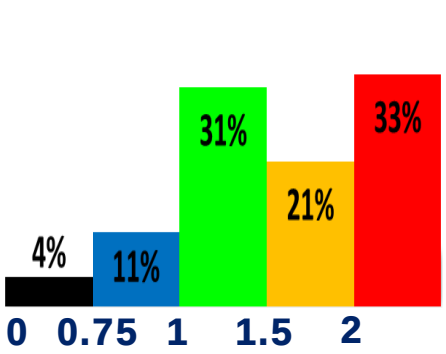


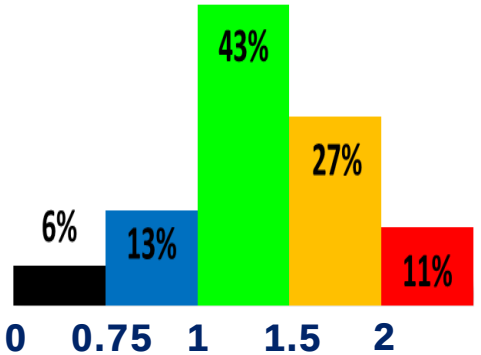
Jan. – Oct. 2017

< 50km ; < 3h

Match-up QC still needed

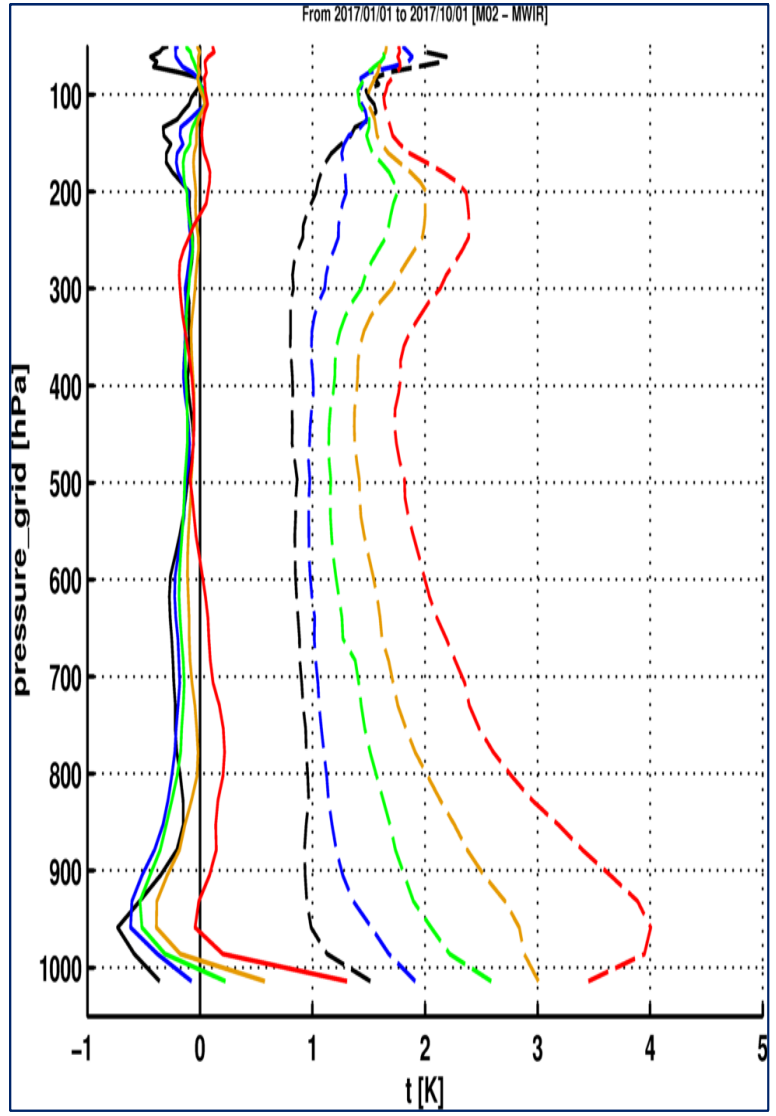






PWLR³ tropospheric error estimate

MW+IR



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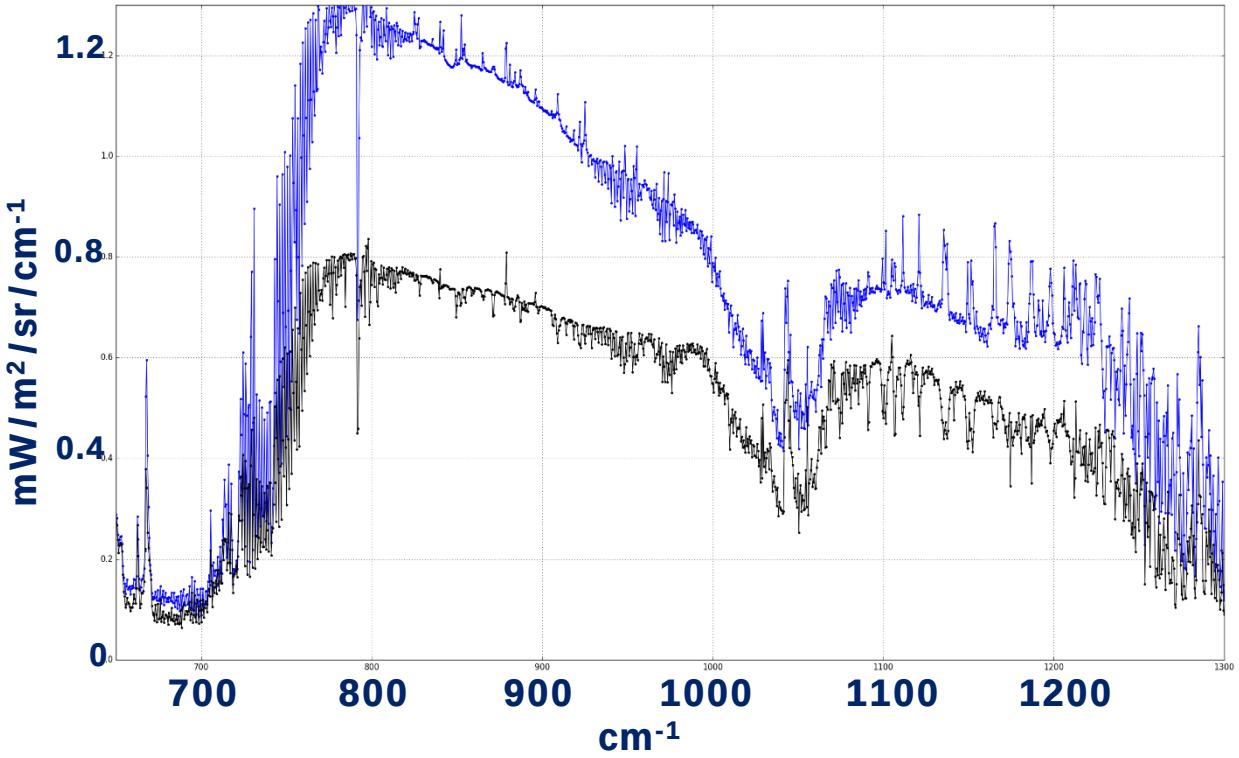
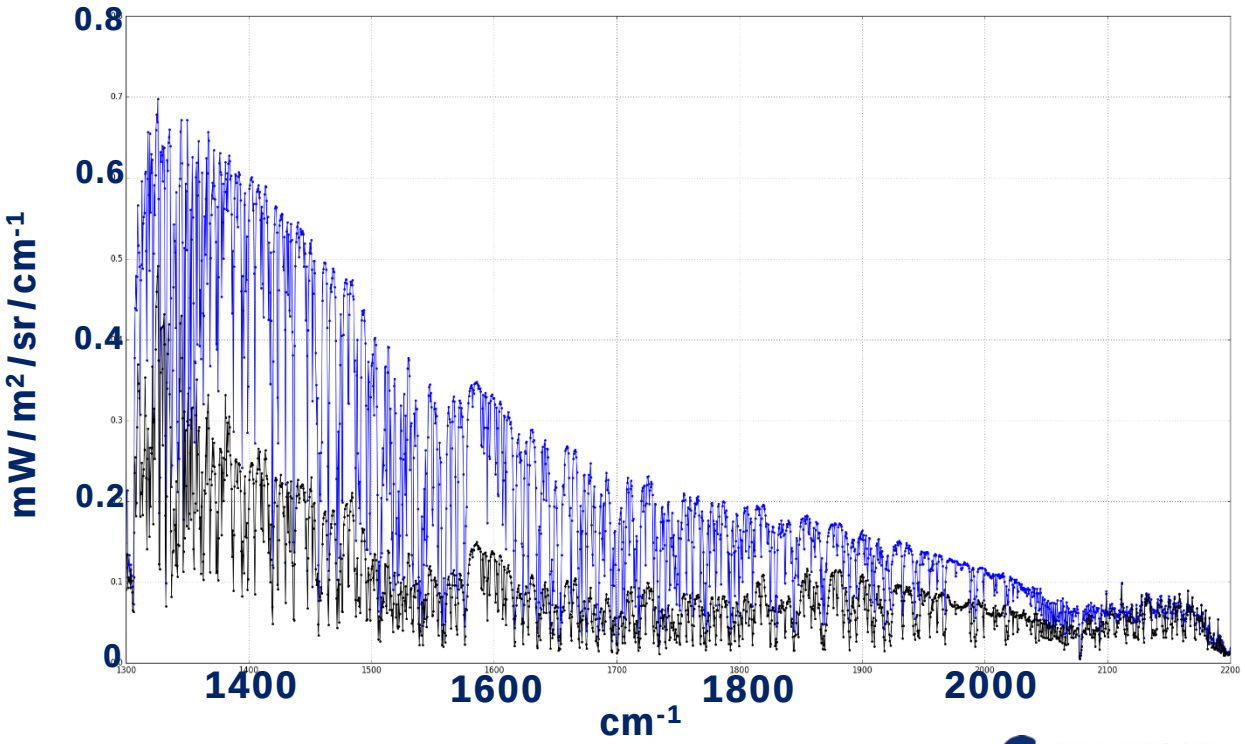
Assessment in radiance space - Ocean



OBS – CALC(ECMWF FCT)

OBS – CALC(PWLR³ v6.4)



01/11/2017

Maritime scenes ;|lat| < 60°

Clear-sky QC from IASI L2

EUMETSAT

Assessment in radiance space - Land

01/11/2017

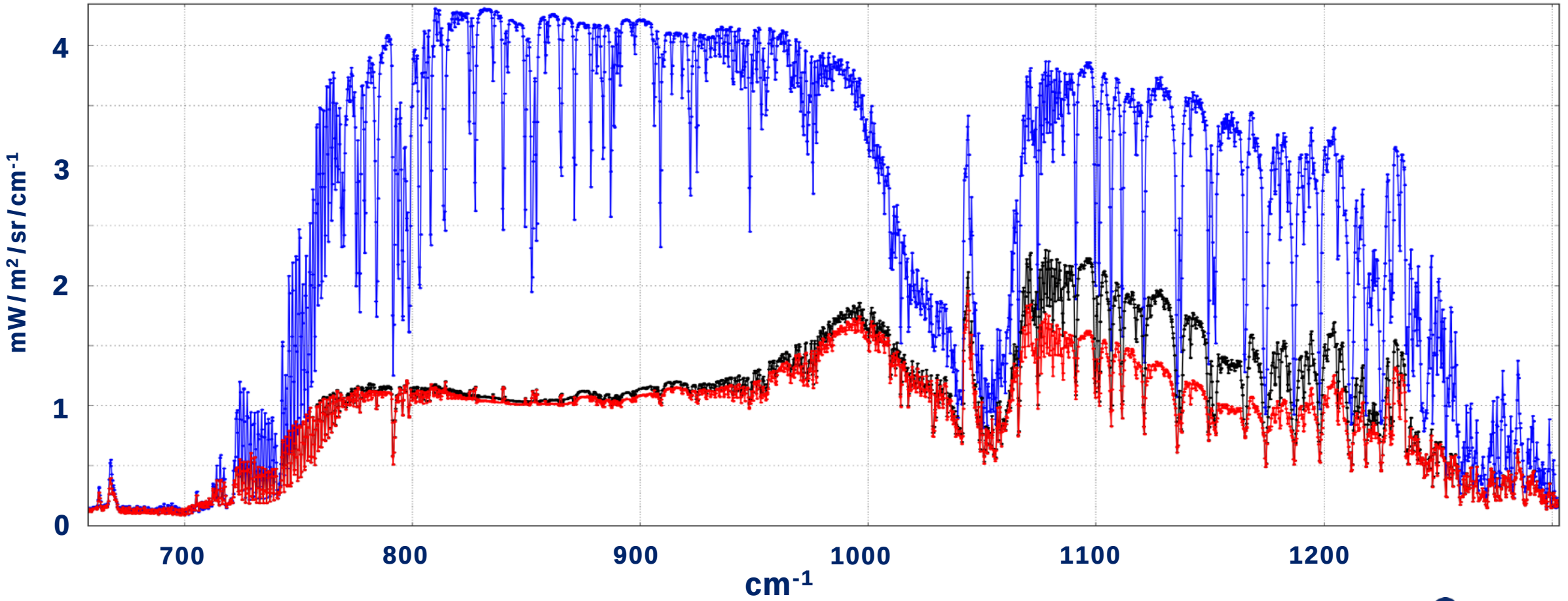
Continental scenes ; |lat| < 60°

Clear-sky QC from IASI L2

OBS – CALC(ECMWF FCT + CAMEL)

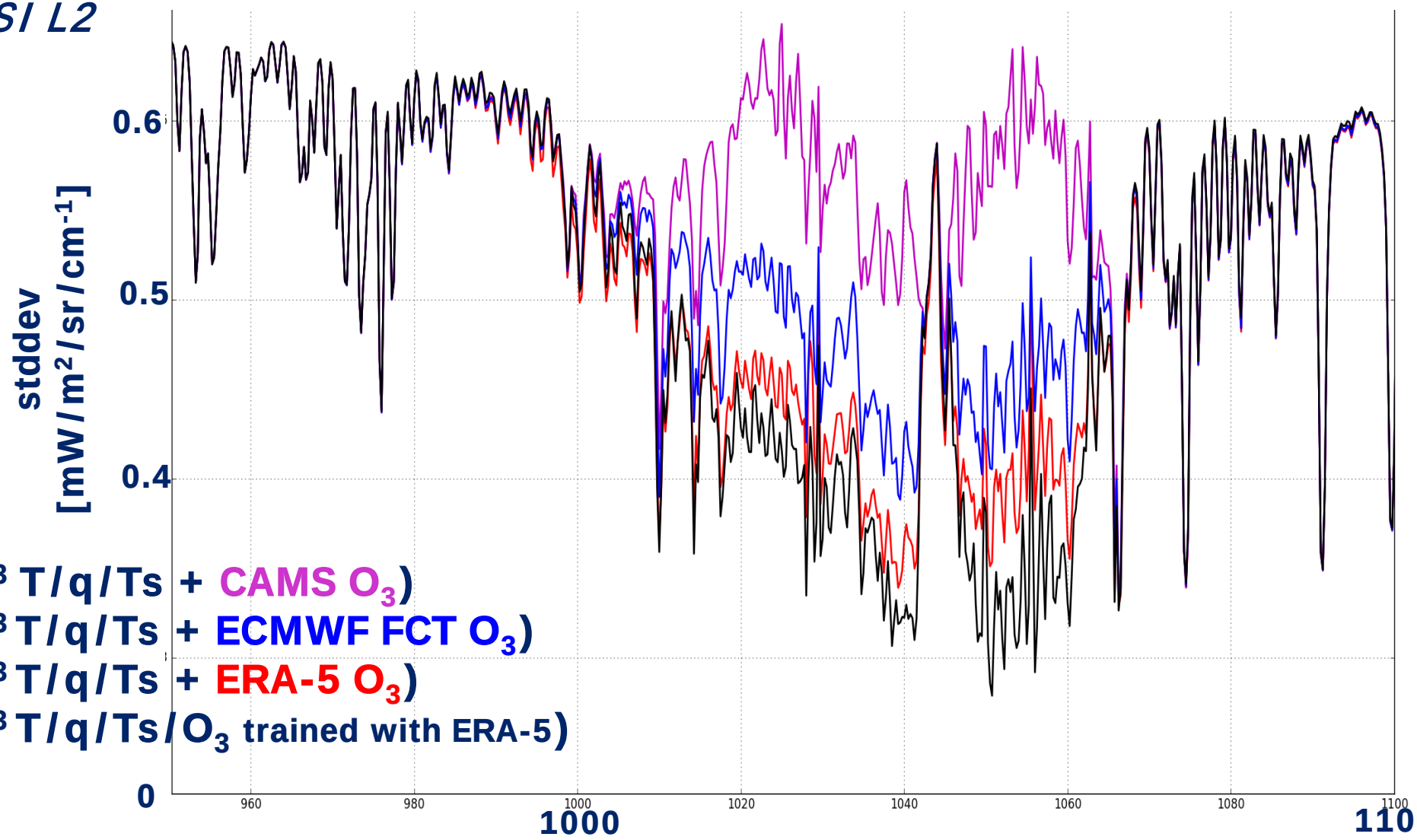
OBS – CALC(PWLR^3 v6.4 + CAMEL)

OBS – CALC(PWLR^3 v6.4) *trained with CAMEL*



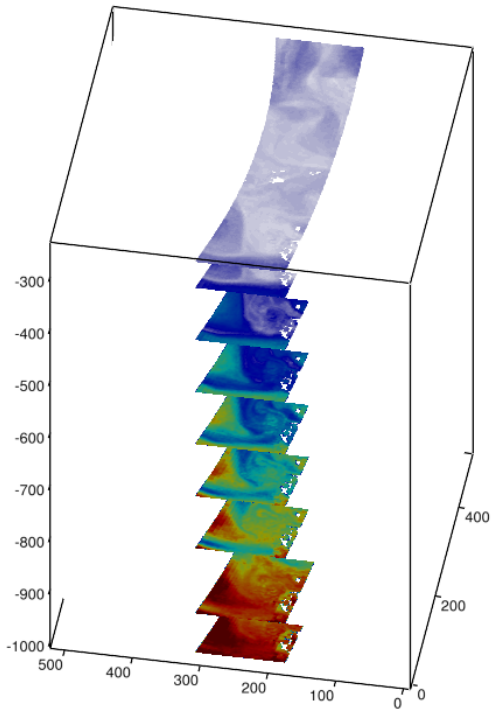
Assessment in radiance space - Ozone

20161201, Sea, |latitude| < 60°
Clear-sky QC IASI L2
7914 cases



EUMETSAT

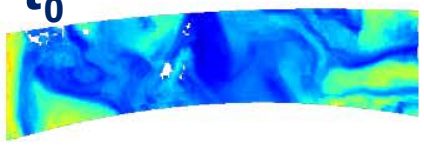
3D-wind products from hyperspectral sounding profiles



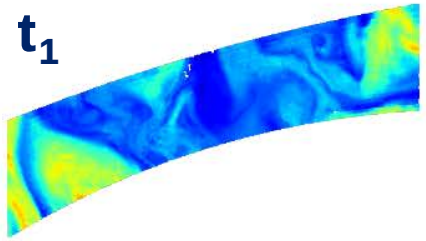
- **Data sources:**
  - Operational IASI sounding L2 products (EUMETSAT)
  - Metop-A and Metop-B to maximize overlaps
- **Parameters:**
  - Temperature, Humidity and Ozone
  - at standard pressure levels, Polar stereographic interpolation
- **Method:**
  - 3D optical flow

Humidity at 500 hPa for successive overpasses

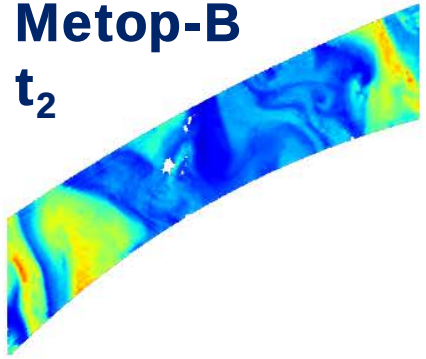
Metop-B t_0



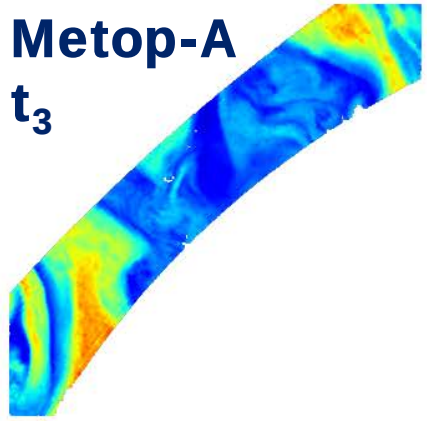
Metop-A t_1



Metop-B t_2



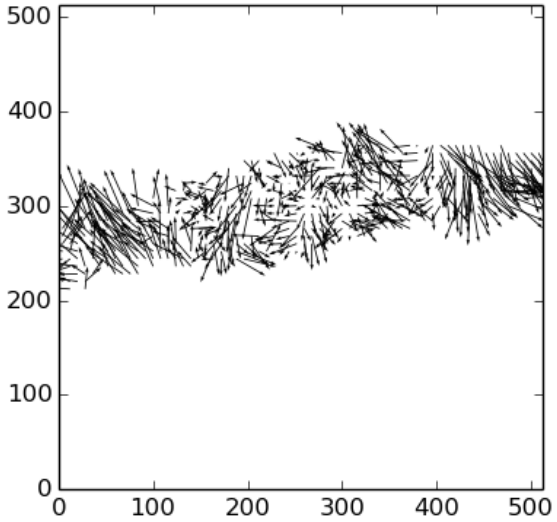
Metop-A t_3

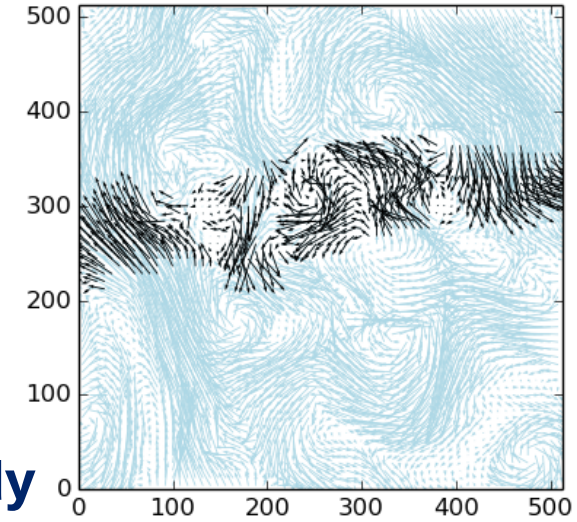


Credits: O. Hautecoeur & R. Borde, EUMETSAT Users Conference 2017

3D-wind products from hyperspectral sounding profiles

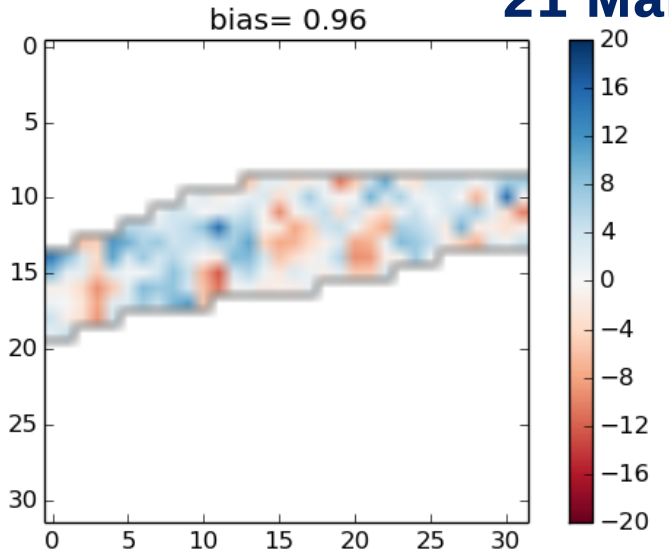
Wind fields at 700 hPa derived from IASI

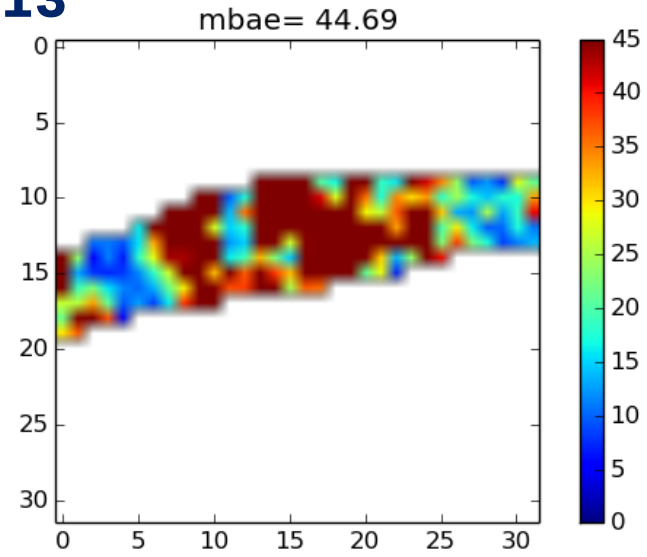




Forecast wind field

Case study 21 March 2013





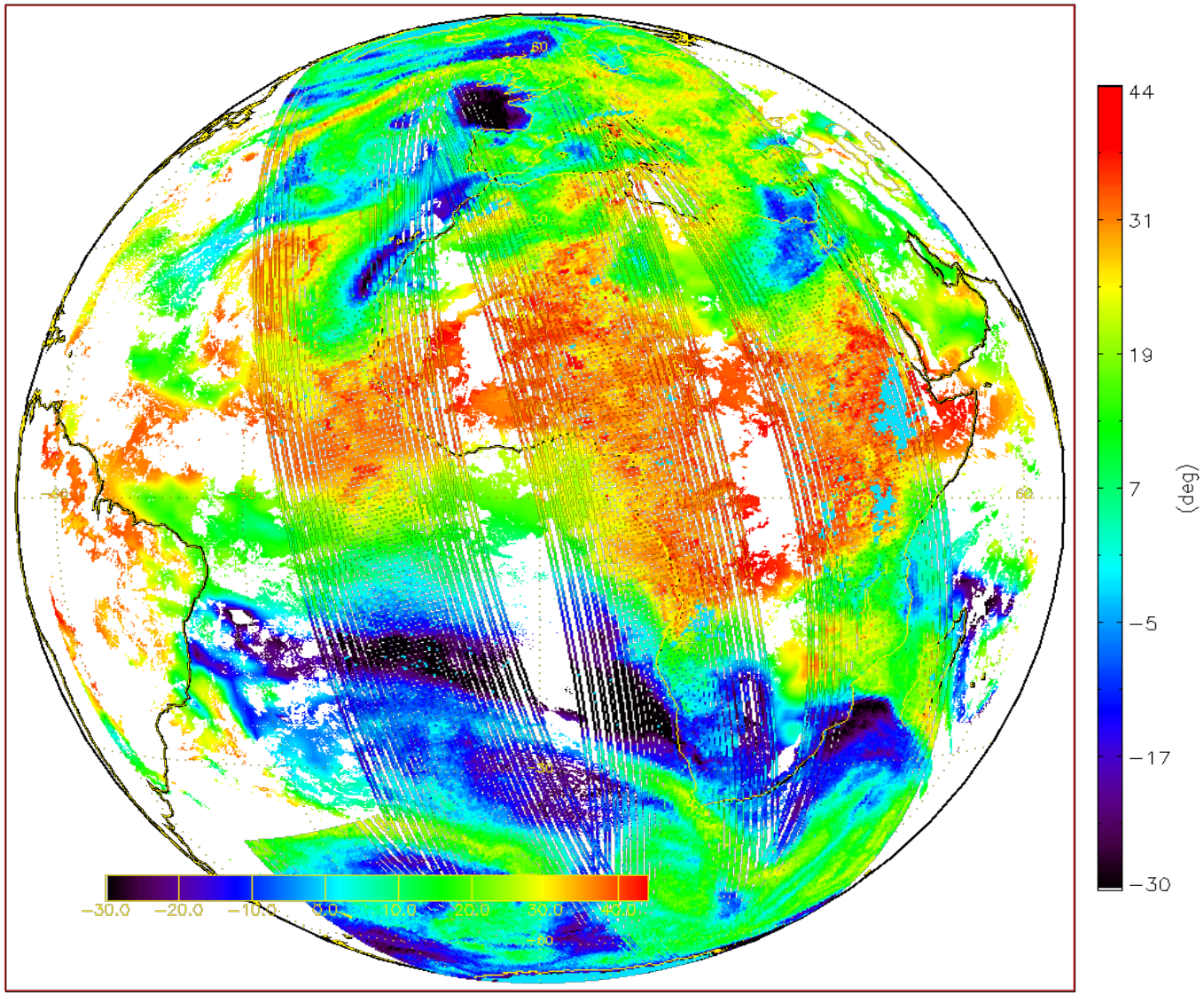
Credits: O. Hautecoeur & R. Borde, EUMETSAT Users Conference 2017

Studying instability from hyperspectral sounding profiles

MSG GII products (Glob Instability Indices) + IASI v6

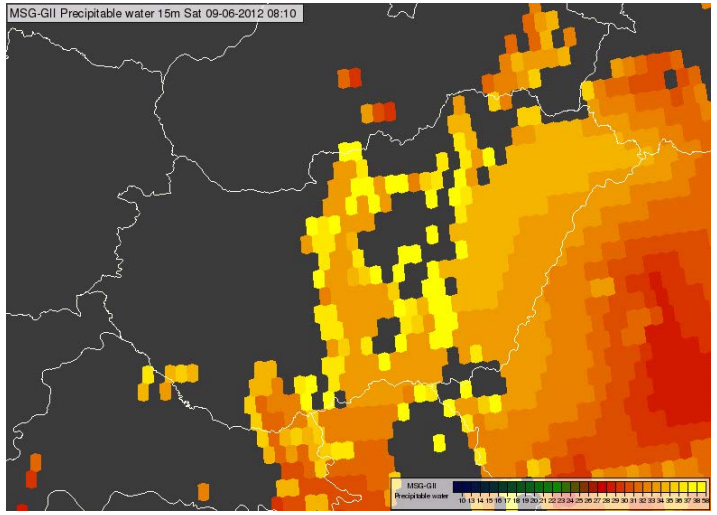
IASI L2 v6 shows **consistent** with the GII and **complementary**.

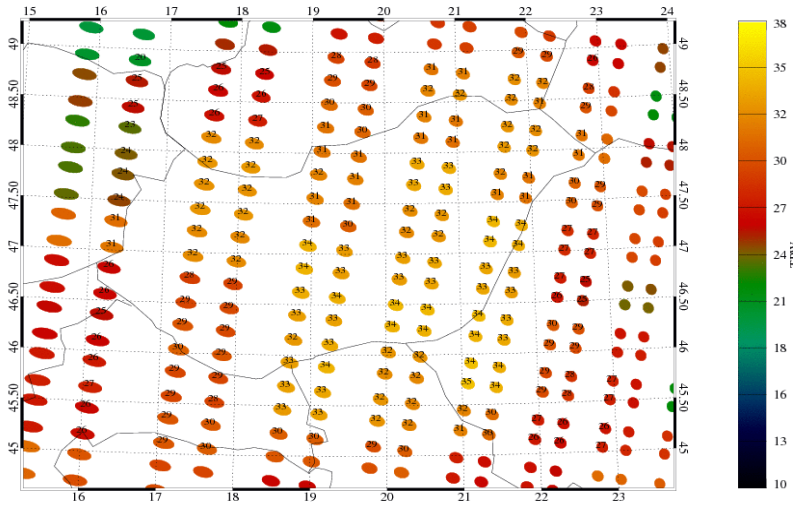
It provides information in the **cloudy areas** and at **high latitudes**.



SEVIRI GII *vs* IASI L2 consistency assessment

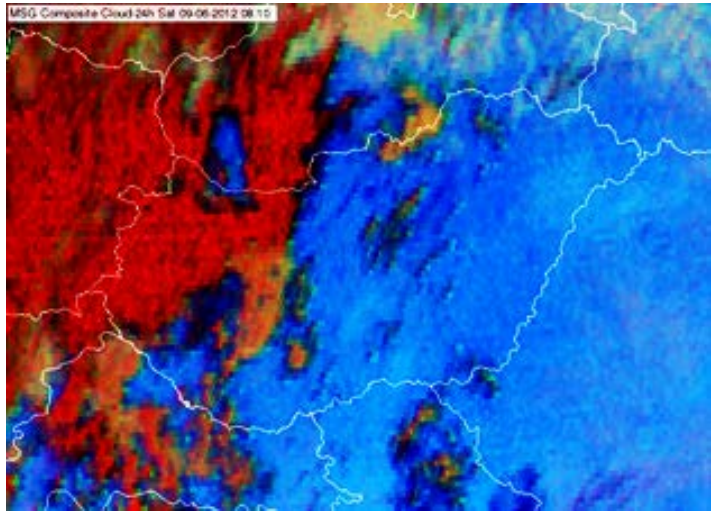
SEVIRI TPW





IASI L2 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

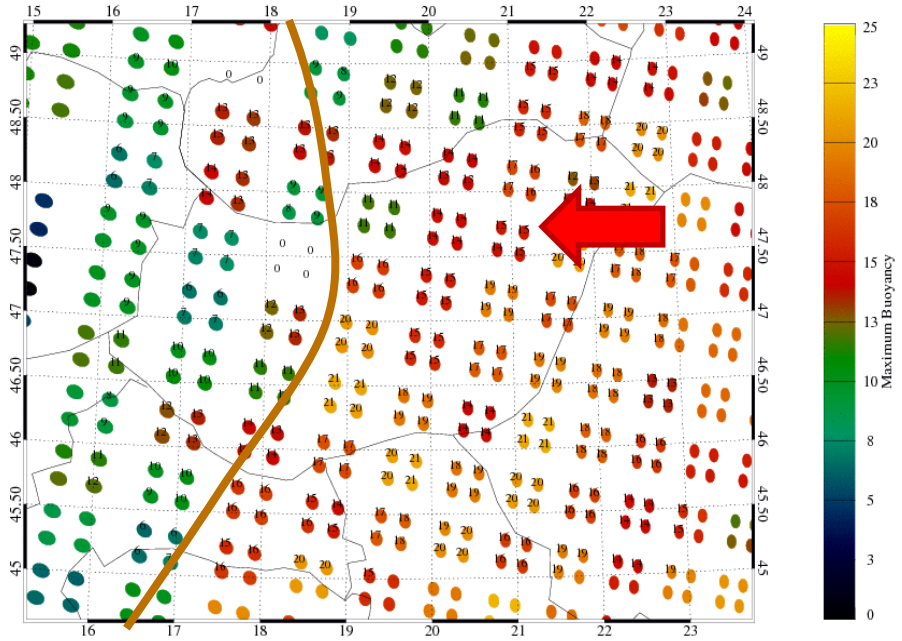
- **Overall high correlation btw GII and IASI L2 indicators**
- **Independent info from Metop, also available in clouds**
- **Combine ground-based observation with satellite profiles?**

Study by Hungarian Met Services

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

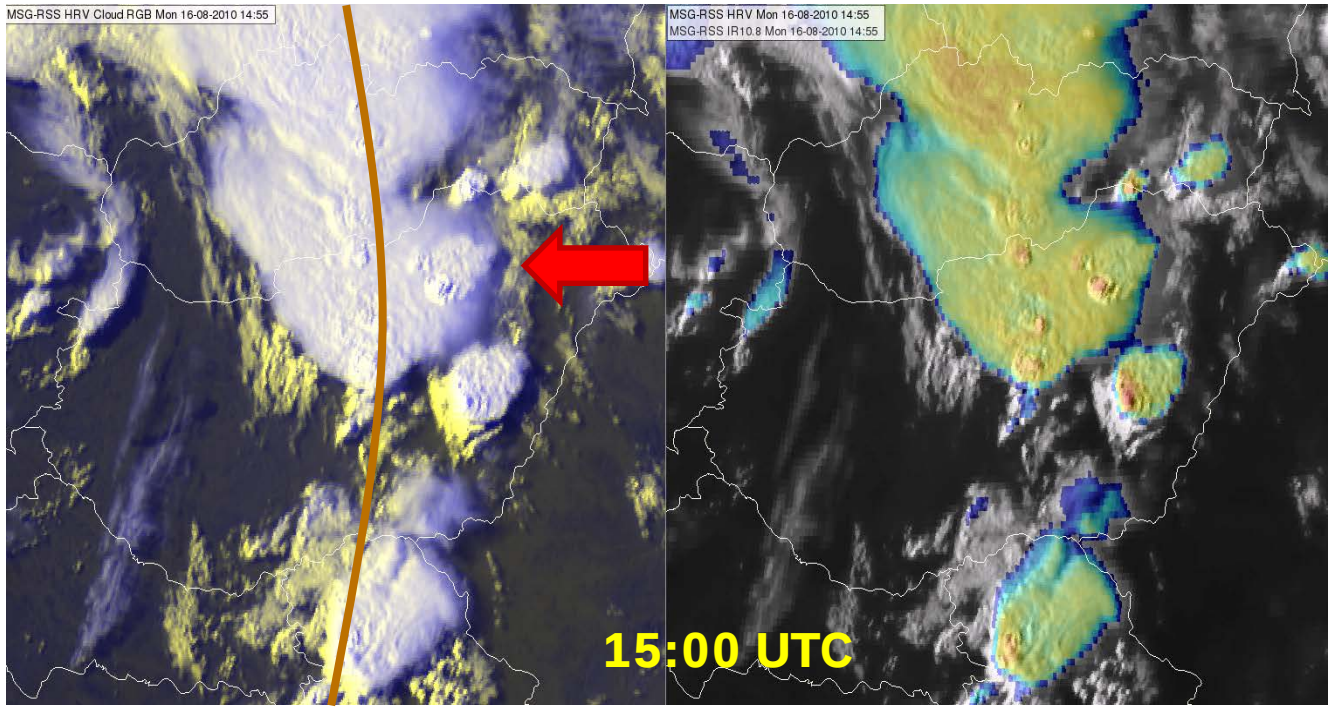
Studying instability from hyperspectral sounding profiles

Tornadic storm, 16 August 2010



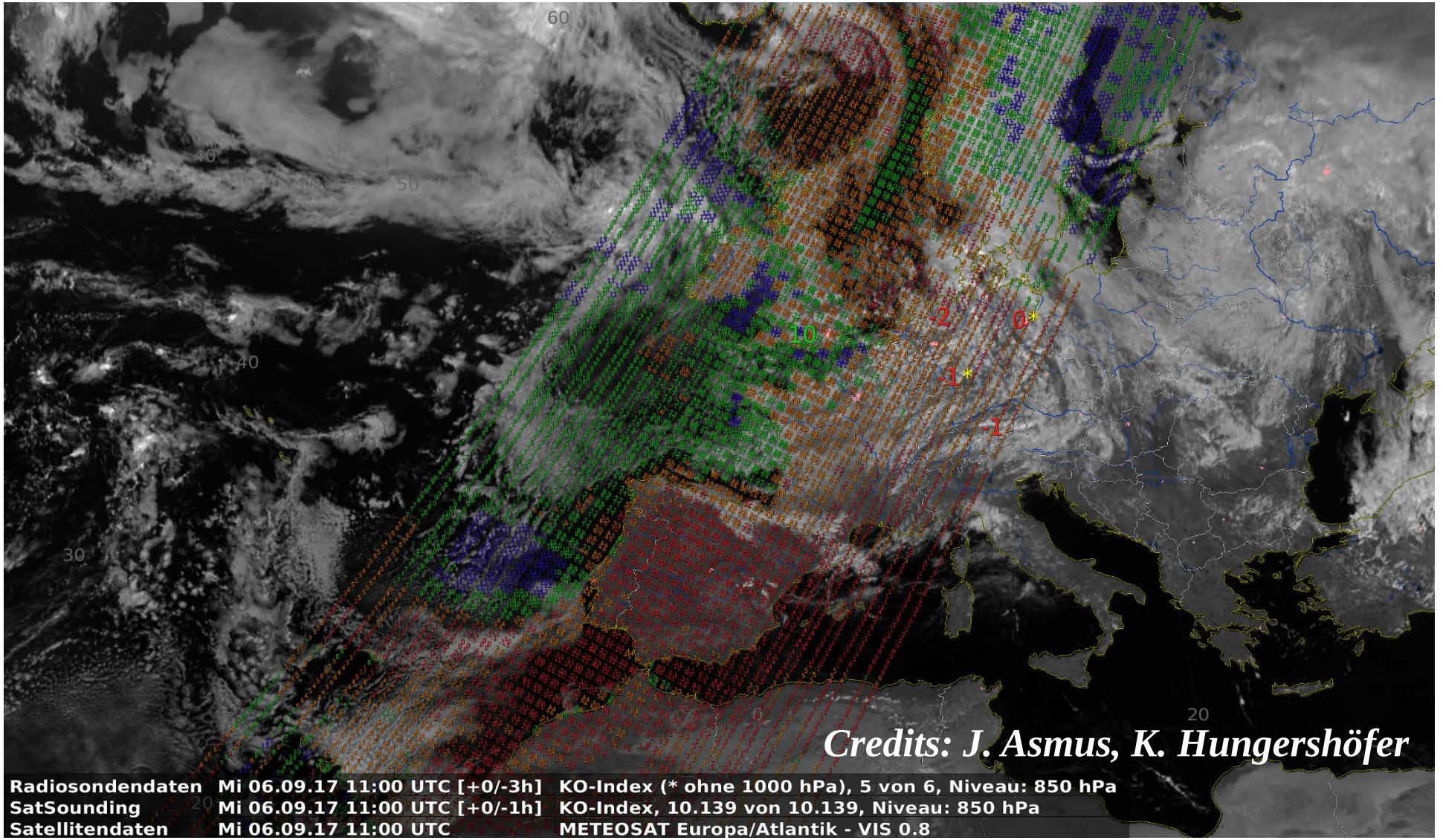
IASI L2 – Maximum Buoyancy (0823 UTC)

Cold front



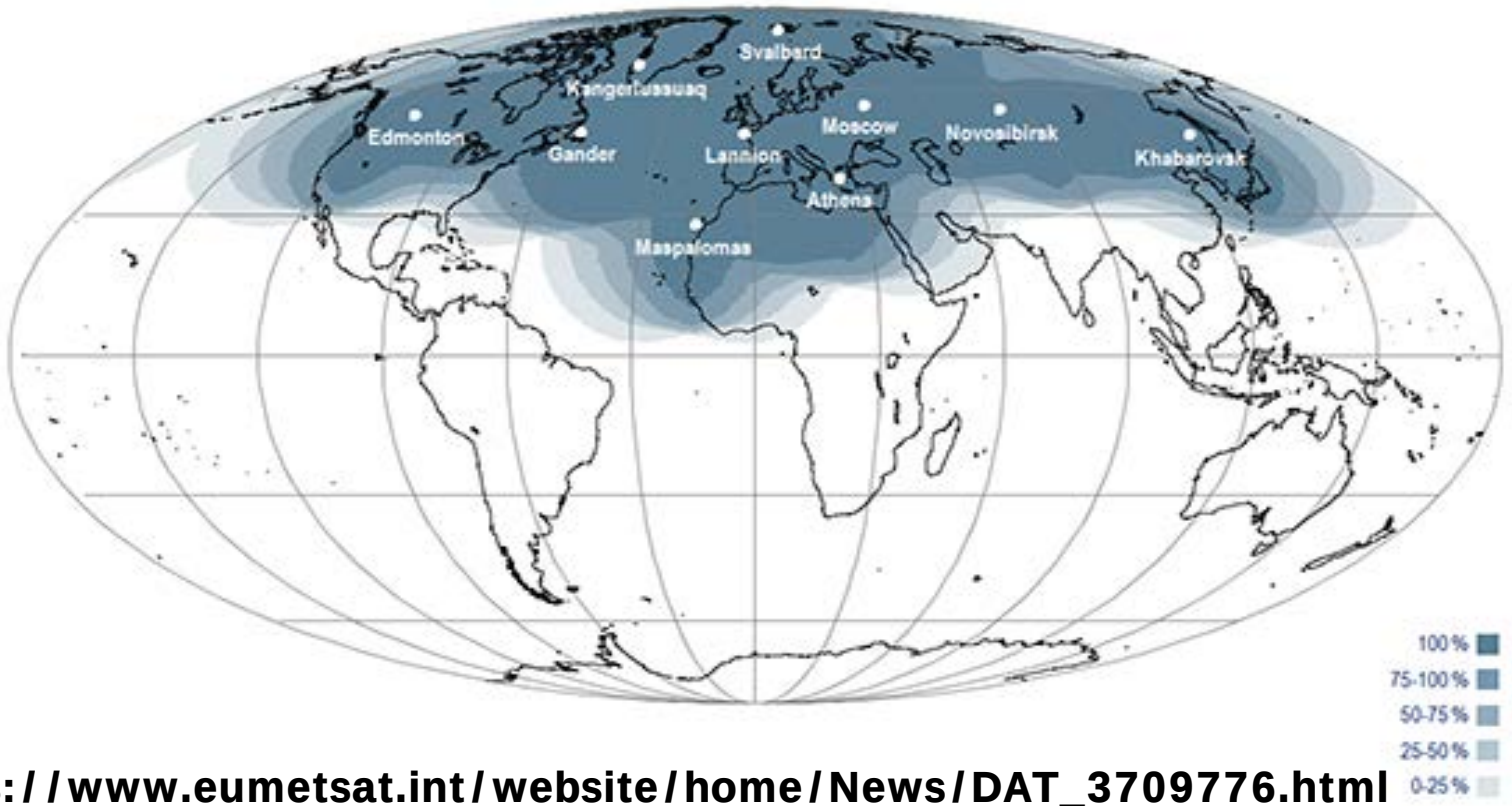
Study by Hungarian Met Services
Credits: A. Simon, Z. Kocsis , M. Putsay

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)

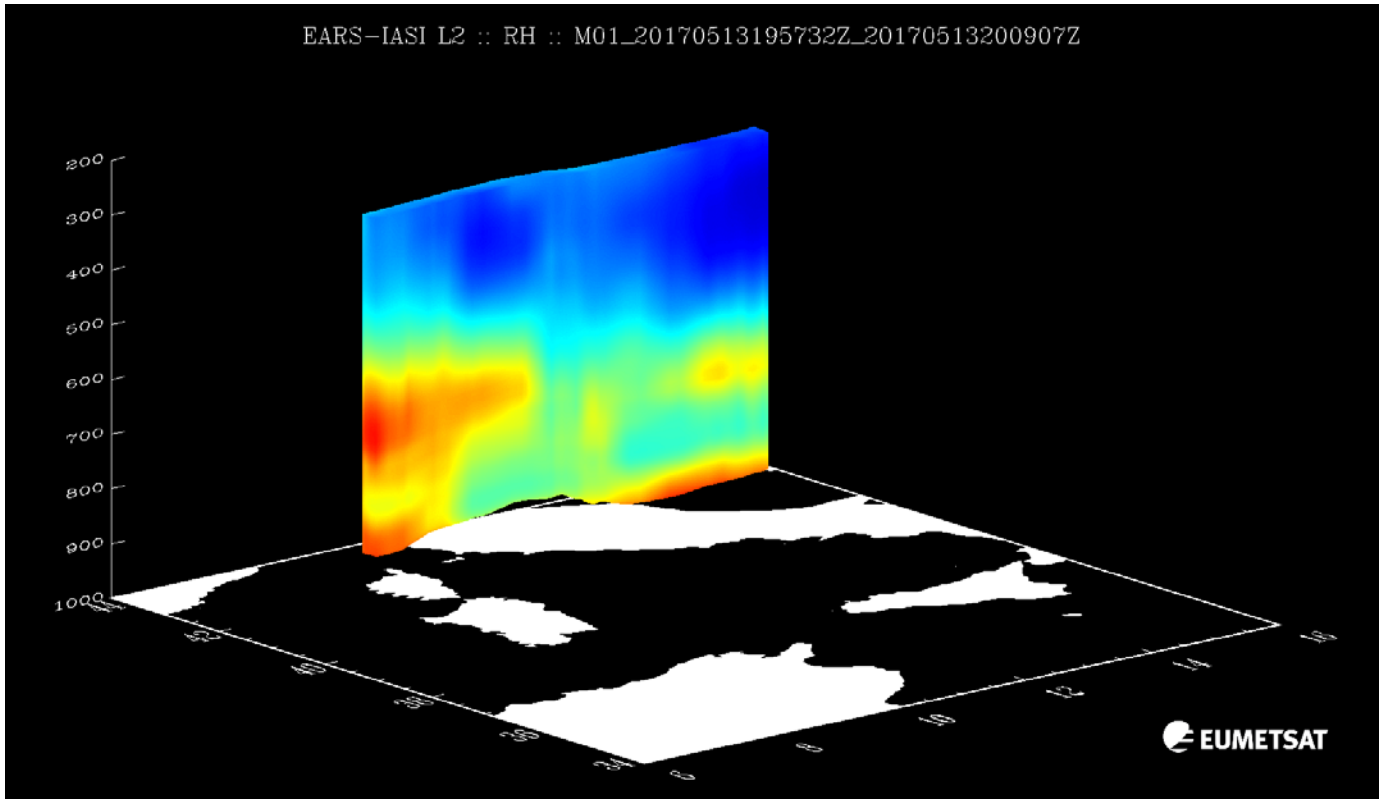


https://www.eumetsat.int/website/home/News/DAT_3709776.html

Summary

- IASI L2 v6.4 under deployment
  - Updated CO_2 content in OEM ➔ reduced T bias ; Preparing for variable CO_2
  - Robust fall-back IR-only statistical retrieval ($PWLR^3$)
  - Further improved MW+IR 'all-sky' sounding $T/q/O_3$ + 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 $PWLR^3$ *(IASI + MW)*
  - Products available < **30' from sensing**, on EUMETCast

Questions ?

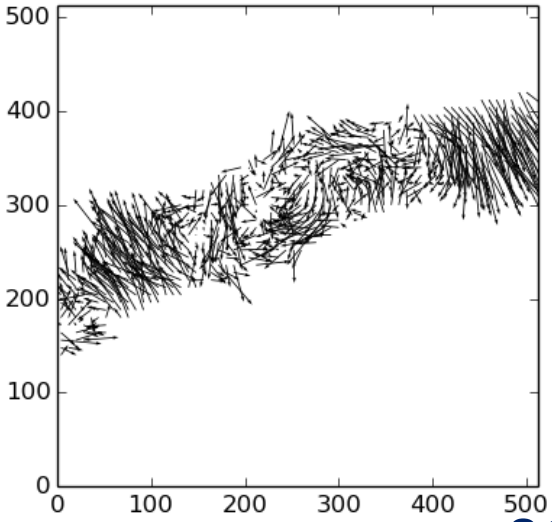

EARS-IASI L2 :: RH :: M01_20170513195732Z_20170513200907Z
200
300
400
500
600
700
800
900
1000
EUMETSAT

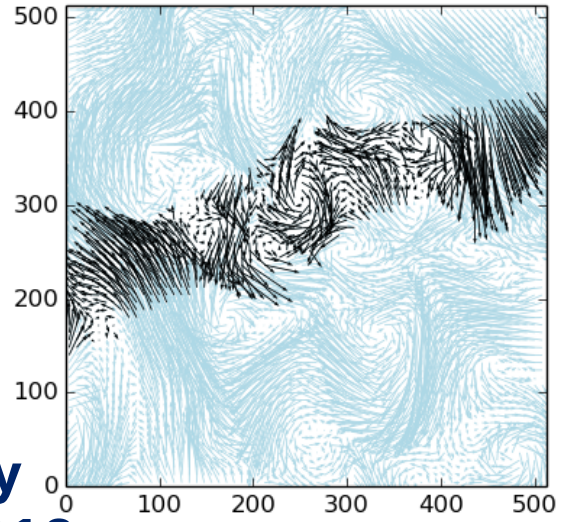

Vielen Dank
für Ihre
Aufmerksamkeit!

Spare slides

3D-wind products from hyperspectral sounding profiles

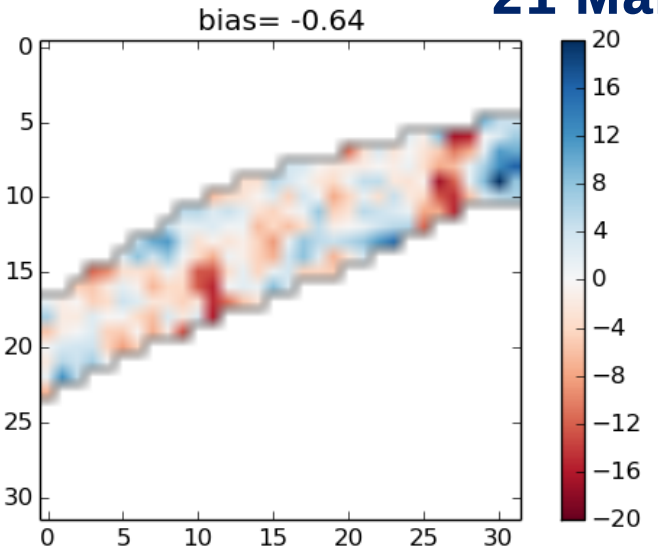
Wind fields at 500 hPa derived from IASI

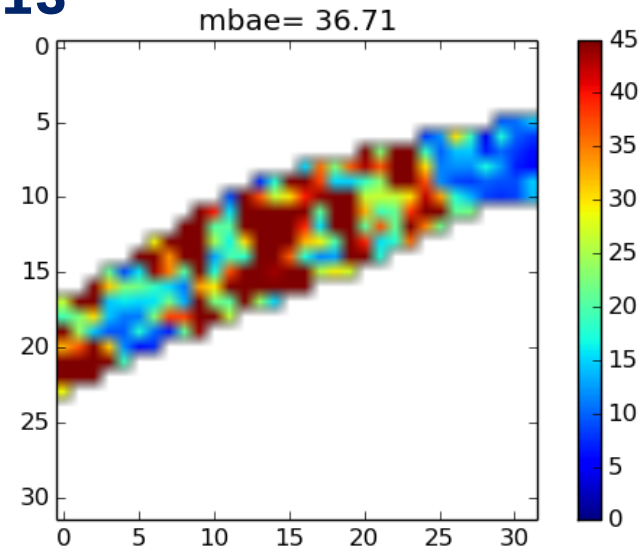




Forecast wind field

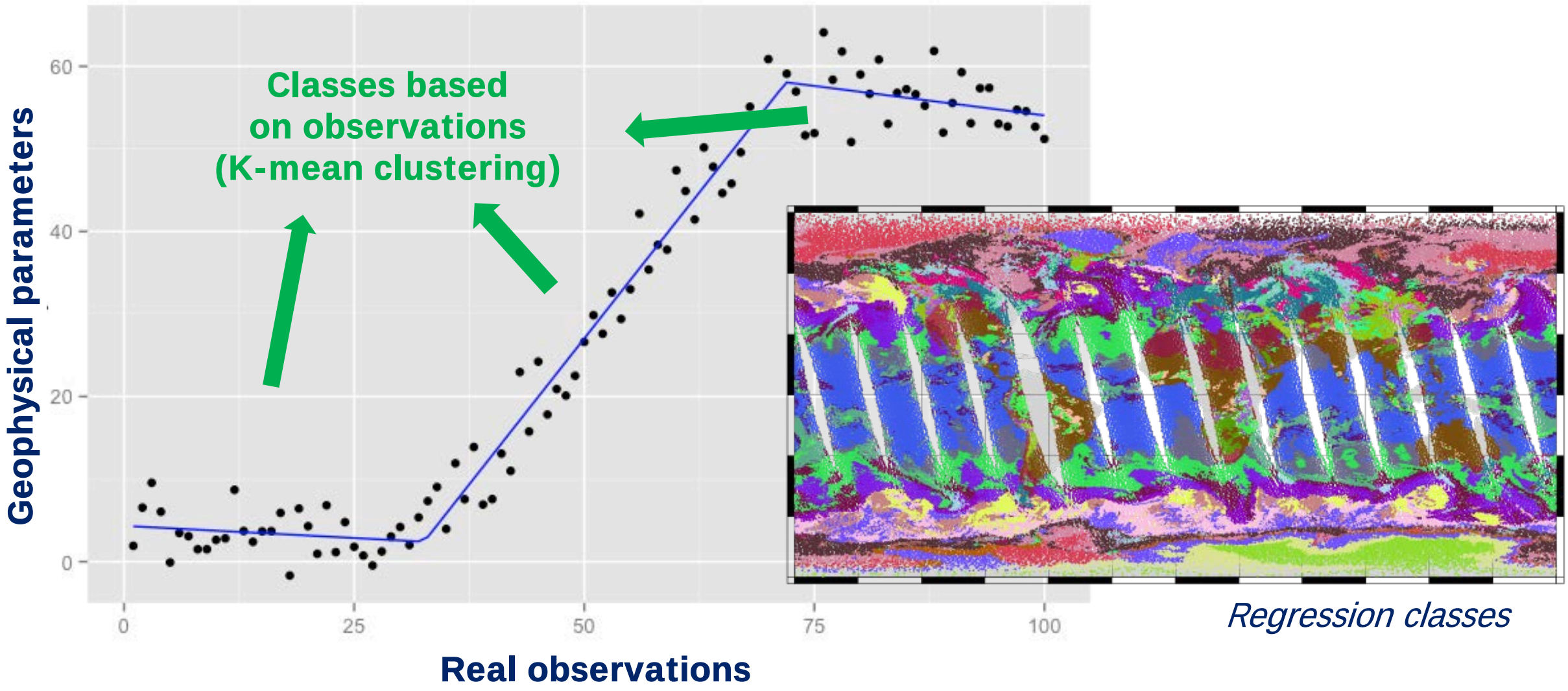
Case study 21 March 2013





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

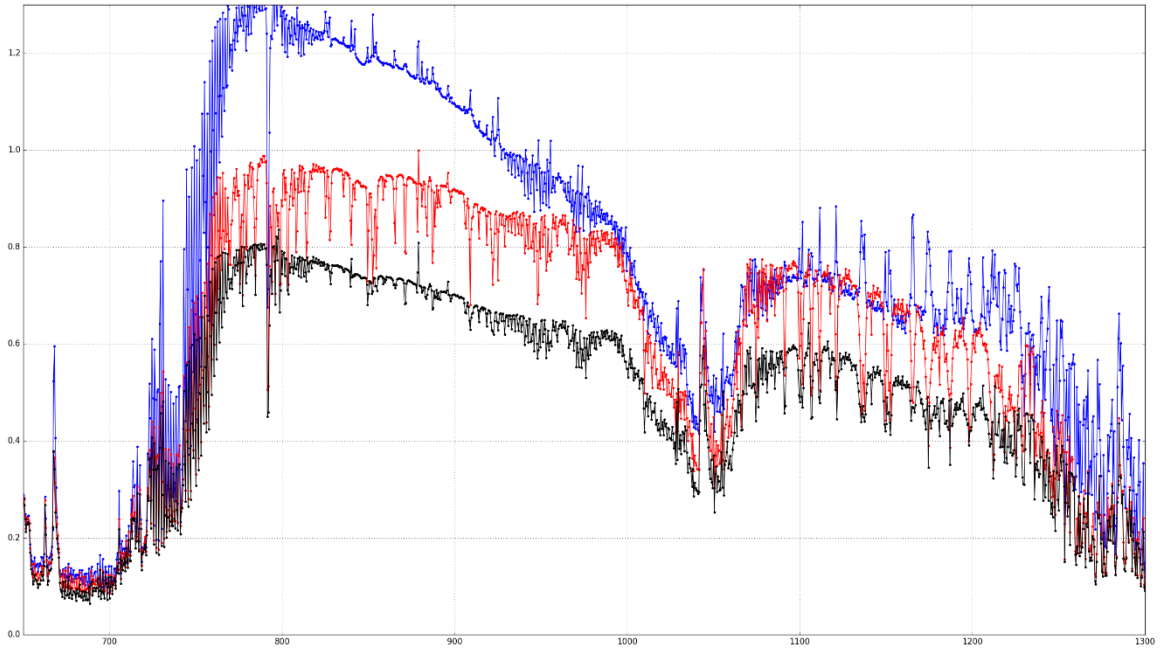
The Piece-Wise Linear Regression

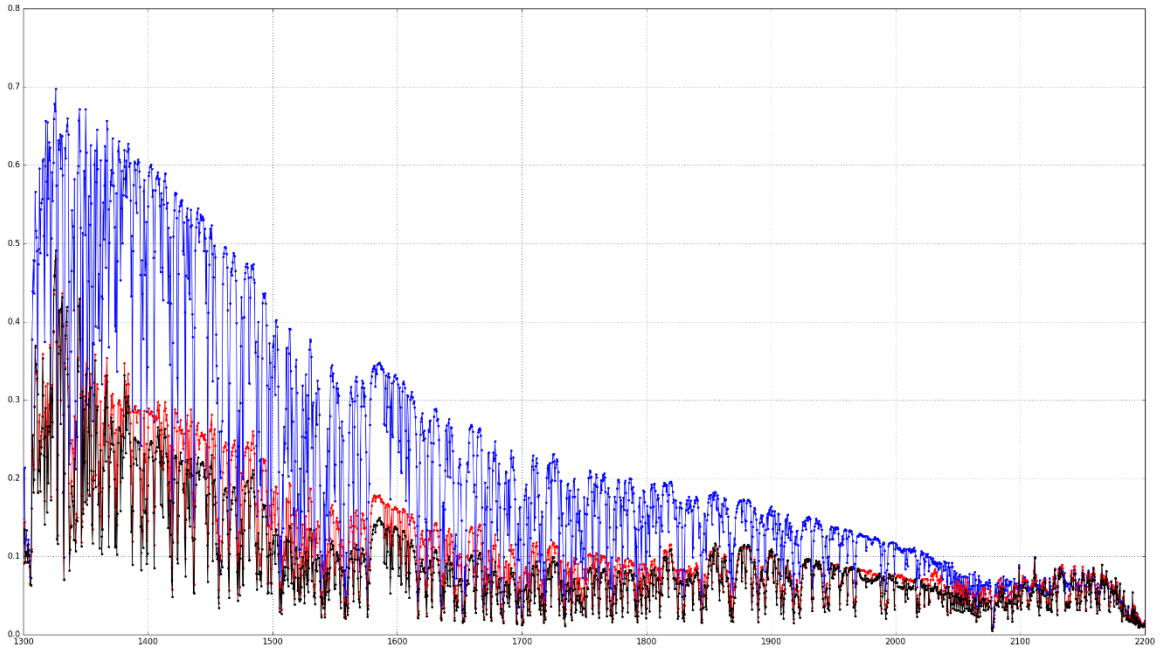


OBS – CALC(ECMWF FCT)

OBS – CALC(PWLR^3 v6.3)

OBS – CALC(PWLR^3 v6.4)





OBS – CALC(PWLR³ v6.4 + LSE CAMEL)

OBS – CALC(PWLR³ v6.4 incl. LSE)