IASI data assimilation within RC LACE

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based on the results from LACE stay in Budapest, 3/10/11-17/11/11

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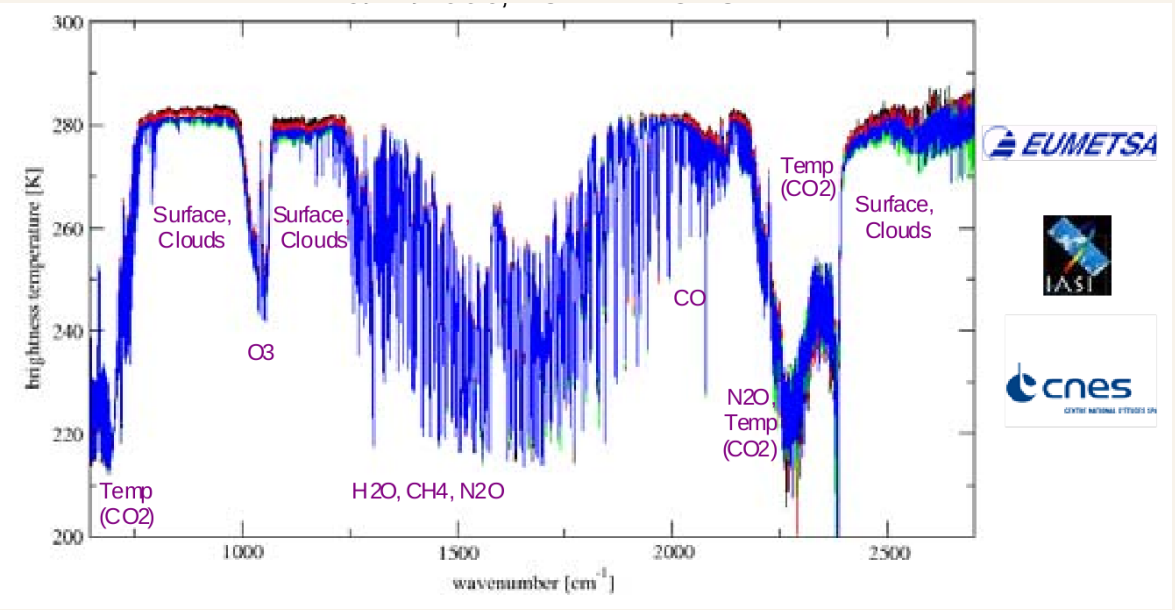
Outline of the talk

- IASI instrument
- IASI data
- Practical DA aspects
- The first results

IASI instrument

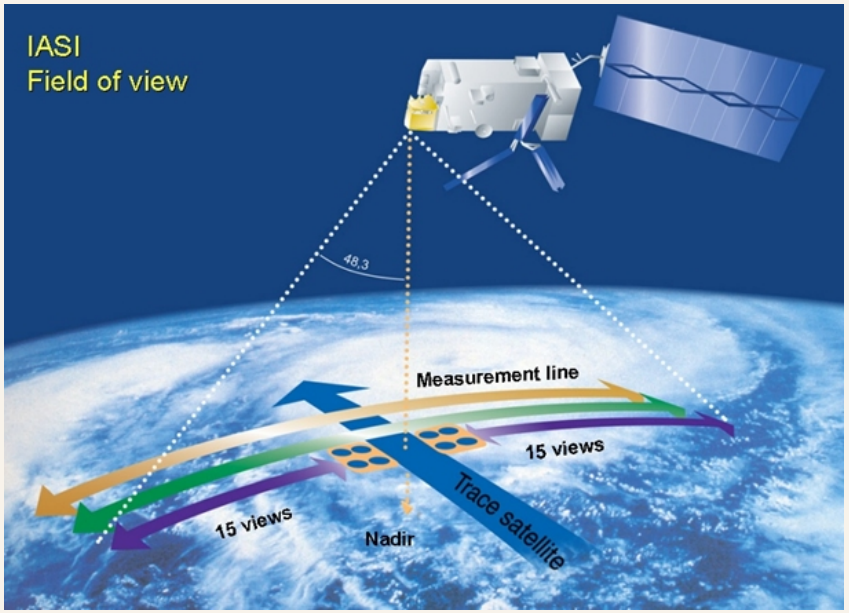
- Infrared Atmospheric Sounding Interferometer (IASI), is a key payload element of the Metop series of European meteorological polar satellites.
- was developed by CNES in the framework of a cooperation agreement with EUMETSAT and the instrument has been designed for operational meteorological soundings with a very high level of accuracy
- allow retrieval of temperature and humidity profiles at a 1 km vertical resolution with an accuracy of respectively 1K and 10 %. Trace gases column amount (CO, CH4, N2O) are retrieved with an accuracy greater than 10 % and 5 % for Ozone



typical atmospheric spectrum measured

IASI instrument

- instrument observes the Earth until an angle of 48.3 degrees on either side of the satellite track
- for each view, the instrument analyses an atmospheric cell of about 3.3 degrees x 3.3 degrees, or 50 km x 50 km at nadir. Each cell is analysed simultaneously by a 2 x 2 array of detectors.
- pixel diameter of 12 kilometres



IASI field of view (FOV)

IASI instrument

- 8461 channels
- instrument covers the spectral range from the edge of the thermal infrared at 3.62 m (2760 cm^{-1}) up to 15.5 m (645 cm^{-1})
- following primary regions contain most of information

650 to 770 cm^{-1}	Temperature sounding (CO2 band)
770 to 980 cm^{-1}	Surface and cloud properties
1000 to 1070 cm^{-1}	O3 sounding
1080 to 1150 cm^{-1}	Surface and cloud properties
1210 to 1650 cm^{-1}	Water vapour sounding; N2O, CH4 and SO2
2100 to 2150 cm^{-1}	CO column amount
2150 to 2250 cm^{-1}	Temperature sounding; N2O column amount
2350 to 2420 cm^{-1}	Temperature sounding
2420 to 2700 cm^{-1}	Surface and cloud properties
2700 to 2760 cm^{-1}	CH4 column amount

For more details please check www.eumetsat.int or included references

IASI data

Following aspects will NOT be detailed in this talk:

- a subset of IASI channels selection such that the total loss of information is a minimum
- the set is available through EUMETCAST (from Sept 2011 in OPLACE)

  - more details of this selection can be found in Collard (2007) and Collard and McNally (2009)
- IASI data assimilation in NWP centers

  - channel selection

  - cloud detection scheme of McNally and Watts (2003)

  - ...

  - see Hilton et al (2010), Collard and McNally (2009), Guidard et al (2010) or Randriamampianina et al (2011)
-

but some practical aspect of IASI data usage in ALADIN LAM application of the subsert of 366 IASI channnels available in OPLACE.

- data processing (reading, blacklisting)
- observation monitoring

Practical aspects - BATOR

- change of the default number of the channels

```
diff inter.1/odb/pandor/module/bator_init_mod.F90 local/odb/pandor/module/bator_in
345c345
<     TS_IASI(xx)%t_select  =  SATOBSSEL(0,0,-9,-9,.TRUE.,314,-9,.TRUE.)
---
>     TS_IASI(xx)%t_select  =  SATOBSSEL(0,0,-9,-9,.TRUE.,366,-9,.TRUE.)
```

- fix to allow skip scan lines before Struct%SclStart given via namelist

```
  odb/pandor/module/bator_decodbufr_mod.F90 ../inter.1/odb/pandor/module/bator_dec
618,621d617
< ! atro skip scanlines before Struct%SclStart set via namelist
<  if ( Scanline < Struct%SclStart ) then
<   SelSclAndFov = .FALSE.
<  else
634d629
<  endif
```

Practical aspects - BATOR namelist

- option 1 - default setting (no specification except the number of channels, which differs from Meteo France default due to different data source)
- option 2

```
&NADIRS
TS_IASI(4)%t_select%SclStart=1,
TS_IASI(4)%t_select%SclJump=0,
TS_IASI(4)%t_select%FovInterlace=.true.,
TS_IASI(4)%t_select%TabFov(1:30)=1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,6
                                 77,81,85,89,93,97,101,105,109,113,117,
TS_IASI(4)%t_select%NbChannels=366,
/
```

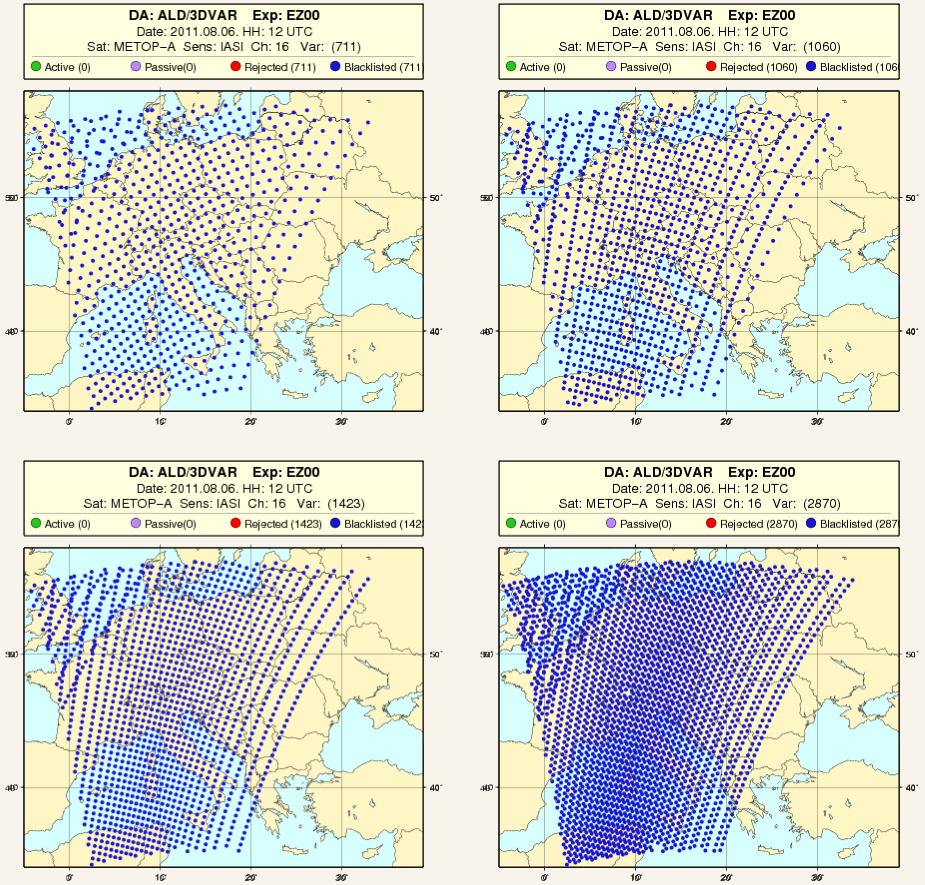
- option 3 - selection used in tests at HMS

```
&NADIRS
TS_IASI(4)%t_select%SclStart=1,
TS_IASI(4)%t_select%SclJump=0,
TS_IASI(4)%t_select%FovInterlace=.false.,
TS_IASI(4)%t_select%TabFov(1:30)=1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,6
                                 77,81,85,89,93,97,101,105,109,113,117,
TS_IASI(4)%t_select%NbChannels=366,
/
```

- option 4 - Meteo France AROME setting for 366 channels

```
&NADIRS
TS_IASI(4)%T_SELECT%TABFOV=1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37,39,
                           47,49,51,53,55,57,59,61,63,65,67,69,71,73, ...
TS_IASI(4)%T_SELECT%TABFOVINTERLACE=1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,
                           41,43,45,47,49,51,53,55,57,59,61,63,65,67,69,71,73, ...
TS_IASI(4)%t_select%NbChannels=366,
/
```

Practical aspects - BATOR namelist



IASI data selection for option 1 (top-left), option 2 (top-right), option 3 (bottom-left) and option 4 (bottom-right)

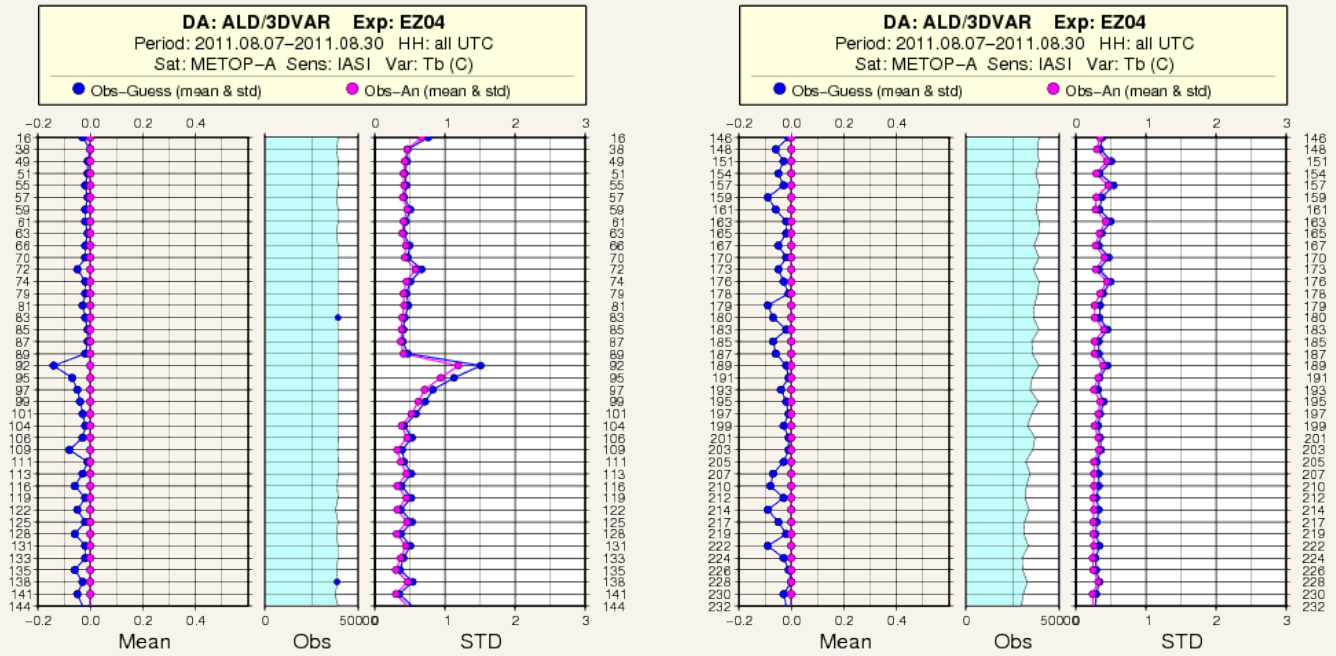
Practical aspects

Blacklisting

- mf_blacklist.b
- LISTE_LOC

Observation monitoring

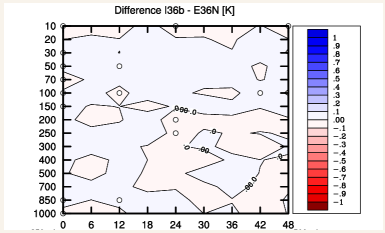
- IASI data extension for LACE observation monitoring is available



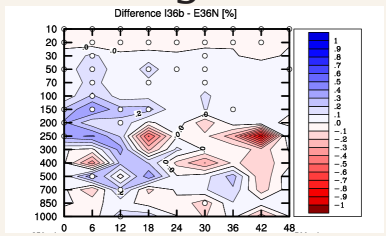
The first results

- assimilation of IASI data was tested technically with the ALADIN 3D VAR data assimilation system installed at HMS
- an impact study with IASI data was performed, no particular strategy for channel selection was considered and as starting point Randriamampianina et al (2011) channel selection was used
- it is an encouraging starting point of potential development on the field of IASI data assimilation in LACE and further elaboration of full potential of the IASI data usage is essential

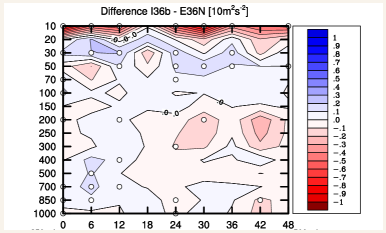
RMSE differences, scores against observation



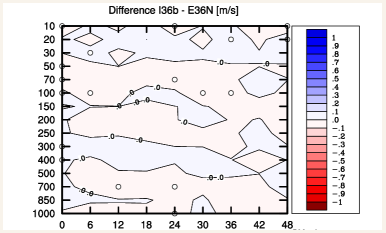
T [K]



RH [%]



ϕ [$10m^2/s^{-2}$]



$wind$ [m/s]

red areas denote a positive impact of IASI data, white circles significance 95% two-side confidence interval

... to be continued .. in Patrik's talk ;-)

The End

Thank You for Your attention.

References

- **EUMETSAT** *http://www.eumetsat.int/Home/Main/News/Features/716376?l=en*
- **Guidard V., Brusseau P, Fouriee N, Rabier F, 2010: Impact of IASI assimilation in convective scale model AROME,** *2nd International IASI Conference, Annecy, France. 25-29 January 201* **http://smsc.cnes.fr/IASI/PDF/conf2/session3/Guidard.pdf**
- **F. Hilton, A. Collard, V. Guidard, R. Randriamampianina and M. Schwaerz 2010: Assimilation of IASI Radiances at European NWP Centers,** *Proceedings of ECMWF/EUMETSAT NWP-SAF Workshop on the assimilation of IASI in NWP, 6-8 May 2009* **http://www.ecmwf.int/publications/library/do/references/list/17**
- **Randriamampianina R., T. Iversen and A. Storto, 2011: Exploring the assimilation of IASI radiances in forecasting polar lows** *Q.J.R. Meteorol. Soc.*: **DOI: 10.1002/qj.838**
- **AD. Collard, 2007: Selection of IASI channels for use in numerical weather prediction** *Q.J.R. Meteorol. Soc.* **133:1977-1991**
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- **Storto A and Randriamampianina R, 2009: The relative impact of meteorological observations in the Norwegian regional model as determined using an energy norm-based approach** *Atmos. Sci. Lett.* **11:51-58**