Usage of IASI at global NWP centres and intercomparison of IASI impact assessment

Vincent GUIDARD  
vincent.guidard@meteo.fr

S. Heilliette  
R. Eresma, M. Matricardi  
F. Smith  
A. Collard  
B. Ruston  
+ others

CNRM, Météo-France & CNRS

Environment Canada  
ECMWF  
MetOffice (at that time)  
NOAA/NCEP  
NRL

ITSC-21, Darmstadt, Germany
IASI, a key player in global NWP models

Example at MF: monthly usage of observations in global model
Channels used in global NWP models
Which channels were assimilated in 2015?

Over sea

Over land

No surface-sensitive channel over land
IASI data coverage

Example at MF:
Average number of channels assimilated per pixel over 3 months
time window D-1@21UTC – D@03UTC
Experimental design

- **3-month assimilation experiments** in global NWP models from 1 August 2015 to 31 October 2015
  - **Control**
    - Also called IASI hereafter, should corresponds to operational version
  - **Denial**
    - Also called noIASI hereafter
    - Control minus IASI data
Difference of +24h forecasts – T at 10 hPa

Average difference of +24h forecasts (over 3 months)
IASI minus noIASI (MF)
Difference of +24h forecasts – T at 100 hPa

Average difference of +24h forecasts (over 3 months) IASI minus noIASI (MF)
Difference of +24h forecasts – T at 500 hPa

Average difference of +24h forecasts (over 3 months)
IASI minus noIASI (MF)
Difference of +24h forecasts – T at 850 hPa

Average difference of +24h forecasts (over 3 months)
IASI minus noIASI (MF)
Setup

- **3-month assimilation experiments** in global NWP models from 1 August 2015 to 31 October 2015
  - **Control**
    - Also called **IASI** hereafter, should correspond to operational version
  - **Denial**
    - Also called **noIASI** hereafter
    - Control minus IASI data

- **Verification**
  - Stdev IASI = Standard deviation of (control forecast minus control analysis)
  - Stdev noIASI = Standard deviation of (denial forecast minus control analysis)
  - Relative reduction of standard deviation wrt to control analysis =
    \[ \frac{\text{Stdev noIASI} - \text{Stdev IASI}}{\text{Stdev noIASI}} \]
    positive value = IASI improves forecast
Relative reduction of standard deviation wrt control analysis – Z @ 500 hPa NH
Relative reduction of standard deviation wrt control analysis – Z @ 500 hPa NH
standard deviation wrt control analysis – Z @ 500 hPa NH
Relative reduction of standard deviation wrt control analysis – Z @ 500 hPa SH

![Graph showing relative reduction of standard deviation](image-url)
Relative reduction of stdev T @ 150 – D+1
Relative reduction of stdev T @ 150 – D+1

- MF means MF vs MF
  - Stdev IASI = Standard deviation of (MF control forecast minus MF control analysis)
  - Stdev noIASI = Standard deviation of (MF denial forecast minus MF control analysis)
  - Relative reduction of standard deviation wrt to MF (own) control analysis = \( \frac{\text{Stdev noIASI} - \text{Stdev IASI}}{\text{Stdev noIASI}} \)

- Should evaluate the impact of the verifying analysis!
  MF vs ECMWF
  - Stdev IASI = Standard deviation of (MF control forecast minus ECMWF control analysis)
  - Stdev noIASI = Standard deviation of (MF denial forecast minus ECMWF control analysis)
  - Relative reduction of standard deviation wrt to ECMWF control analysis = \( \frac{\text{Stdev noIASI} - \text{Stdev IASI}}{\text{Stdev noIASI}} \)
Relative reduction of stdev T @ 150 – D+1
Relative reduction of stdev T @ 150 – D+2

MF vs ECMWF

ECMWF

MF

MO
Relative reduction of stdev T @ 150 – D+3
Relative reduction of stdev T @ 150 – D+4
Relative reduction of standard deviation wrt to control analysis – Z – D+1 – zonal average

MF

ECMWF

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Relative reduction of standard deviation wrt to control analysis – Z – D+2 – zonal average

MF  ECMWF
Relative reduction of standard deviation wrt to control analysis – Z – D+3 – zonal average

MF

ECMWF
Relative reduction of standard deviation wrt to control analysis – Z – D+4 – zonal average

MF

ECMWF

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<table>
<thead>
<tr>
<th>100 hPa</th>
<th>250 hPa</th>
<th>500 hPa</th>
<th>850 hPa</th>
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<tr>
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<tr>
<th>No data</th>
<th>Positive impact – statistically significant</th>
<th>Positive impact – not statistically significant</th>
<th>Neutral impact</th>
<th>Negative impact – not statistically significant</th>
<th>Negative impact – statistically significant</th>
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Summary

- **3-month assimilation experiments** in global NWP models from 1 August 2015 to 31 October 2015
  - Many NWP centres participated
  - Lots of statistics still to compile

- IASI definitely has a positive impact on top of the whole observing systems used at NWP centres
  but result presentation is not straightforward
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  showing kitten pictures would be easier...
Summary

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- An article to be submitted Q2 2018