IASI in global and mesoscale operational NWP systems

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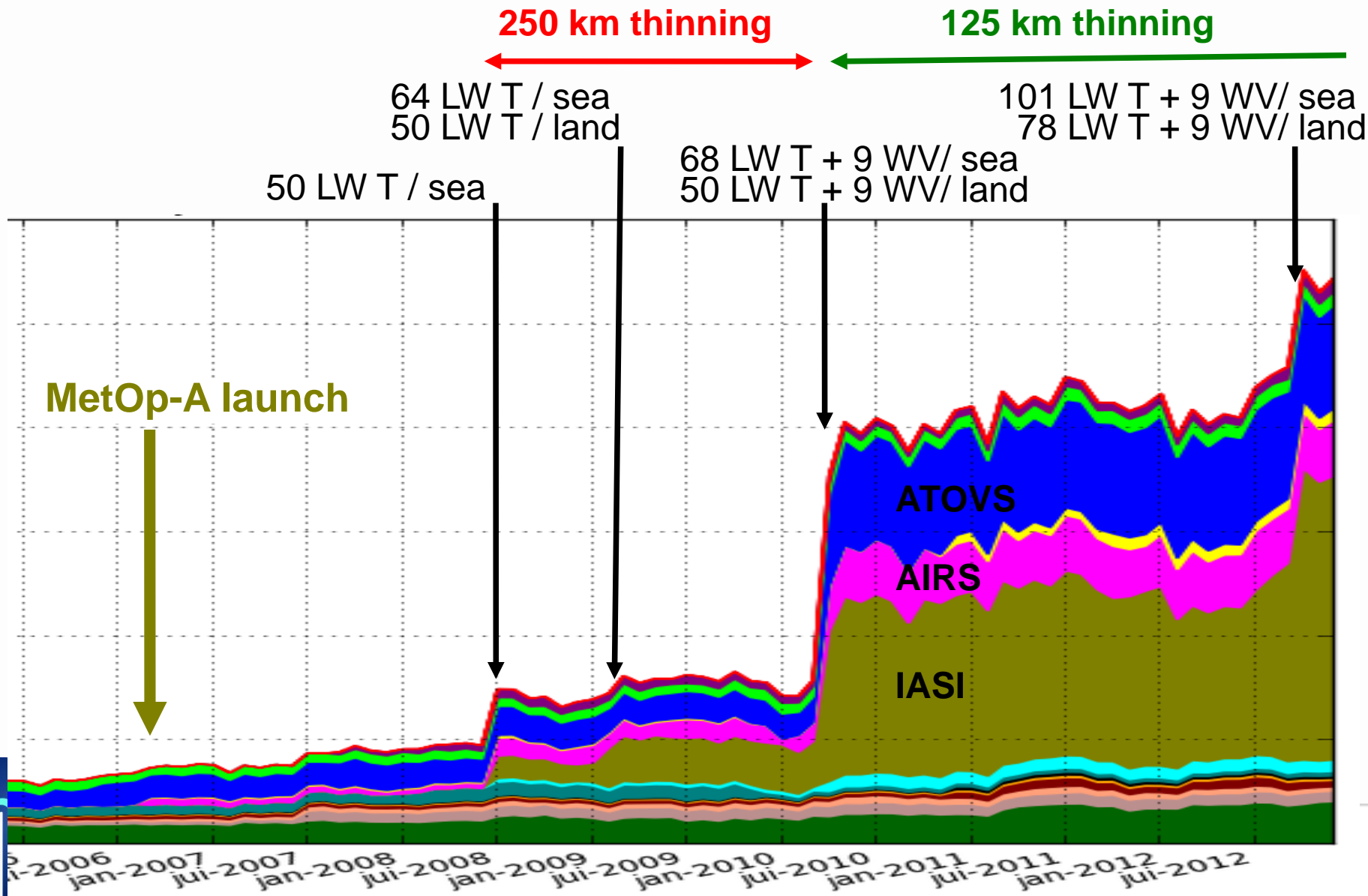
CNRS

METEO FRANCE
Toujours un temps d'avance

Content

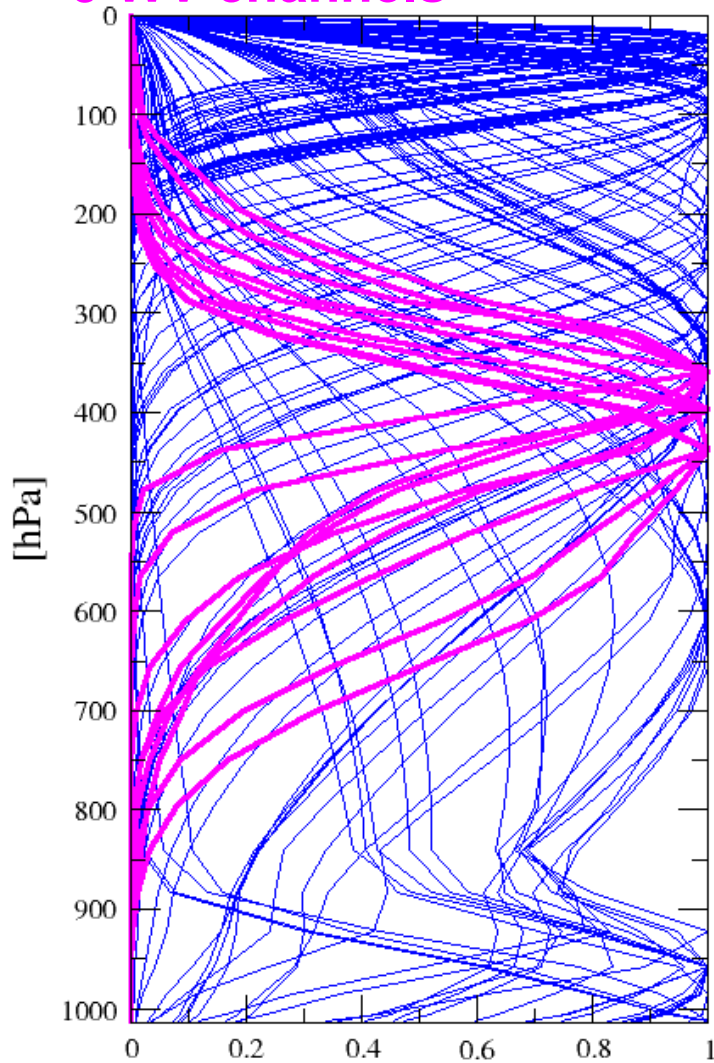Operational global models

Operational regional models

Next steps

# Evolution of data usage in Météo-France global model

250 km thinning

125 km thinning

64 LW T / sea
50 LW T / land

101 LW T + 9 WV/ sea
78 LW T + 9 WV/ land

50 LW T / sea

68 LW T + 9 WV/ sea
50 LW T + 9 WV/ land

MetOp-A launch

ATOVS

AIRS

IASI

jui-2006 jan-2007 jui-2007 jan-2008 jui-2008 jan-2009 jui-2009 jan-2010 jui-2010 jan-2011 jui-2011 jan-2012 jui-2012

Channel selection in operations at Météo-France

Over sea
101 LW T channels +
9 WV channels

Over land
78 LW T channels +
9 WV channels
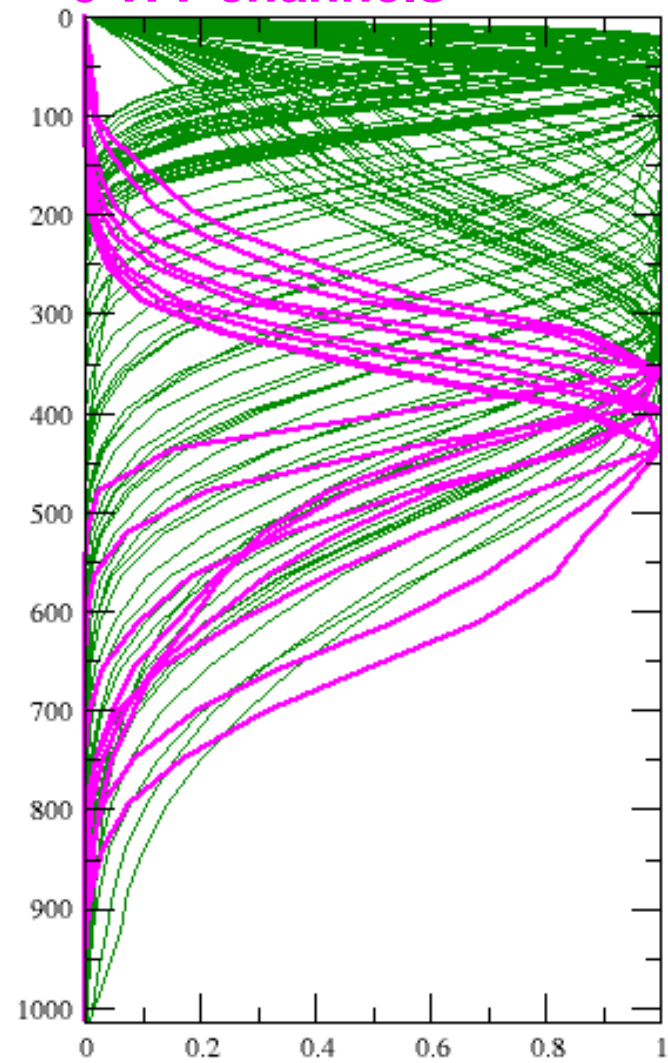
Channel selection in operations at NWP centres

	Sea	Land	Sea Ice
Météo-France	Up to 101 T Up to 4 Window Up to 9 WV	Up to 78 T Up to 9 WV	Up to 78 T Up to 9 WV
Met Office	Up to 87 T Up to 21 Window Up to 30 WV * NB a few more channels are used in OPS	Up to 87 T Up to 14 Window Up to 30 WV * NB a few more channels are used in OPS	
ECMWF	Up to 153 T Up to 12 Window Up to 16 Ozone Up to 10 WV ** NB does not include PC assimilation!!		Up to 153 T Up to 12 Window
NRL	Up to 51 T	Up to 51 T	Up to 51 T

Pixel selection in operations at NWP centres

	Global model
Météo-France	1 pixel in 8 (always detector 1) then 125 km thinning
Met Office	1 pixel in 4 (most homogeneous) then 120km extratropics 154km tropics
ECMWF	1 pixel in 4 (warmest, but never detector 4) then 120 km thinning
NRL	135 km thinning

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Bias Correction

Met Office: static Harris & Kelly method with predictors

- constant offset
- scan angle
- 850-300 hPa and 200-50 hPa thickness
- Still some residual biases but believe they are mostly model bias

ECMWF & Météo-France: VAR-BC with predictors

- global offset
- 1000-300 hPa, 200-50 hPa, 10-1 hPa and 50-5 hPa thicknesses;
- nadir view angle **1, **2, **3
- No thickness predictors for LW window channels to restrict aliasing of residual cloud into erroneous bias corrections

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Cloud detection in operations at NWP centres

	Method
Météo-France	McNally & Watts (2003) to select channels unaffected by cloud with cross-band cloud detection for WV channels. Plus assimilation of some channels in fully overcast scenes over sea only.
Met Office	Pavelin et al (2008) 1D-Var cloud parameter retrieval to select channels weakly affected by cloud
ECMWF	McNally & Watts (2003) to select channels unaffected by cloud with cross-band cloud detection for WV channels. Night time scenes use cross-band method with Short-wave channels used to determine cloud height. Plus assimilation of all channels in fully overcast scenes over sea only. * NB does not include PC assimilation!!
NRL	McNally & Watts (2003) to select channels unaffected by cloud

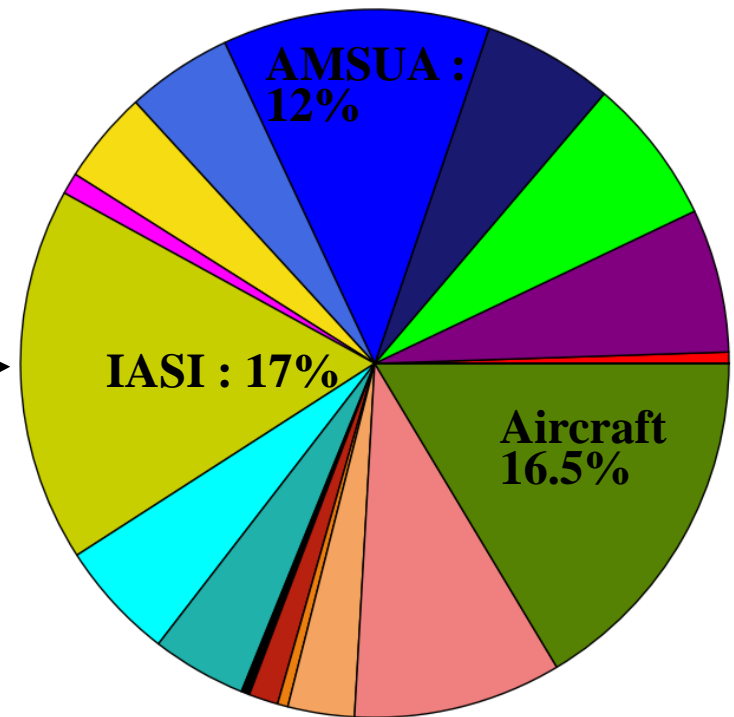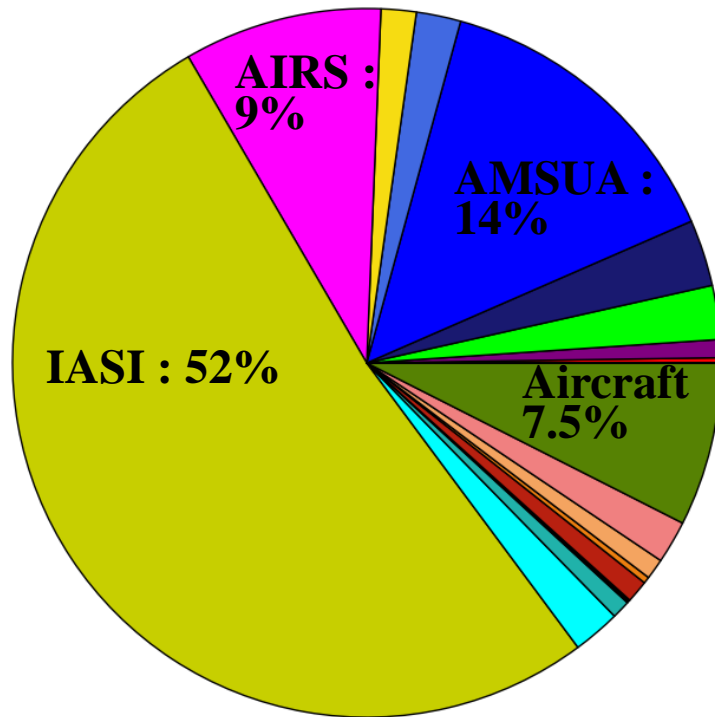# Typical daily data coverage in MF global model

Colors indicate the number of channels assimilated in each pixel
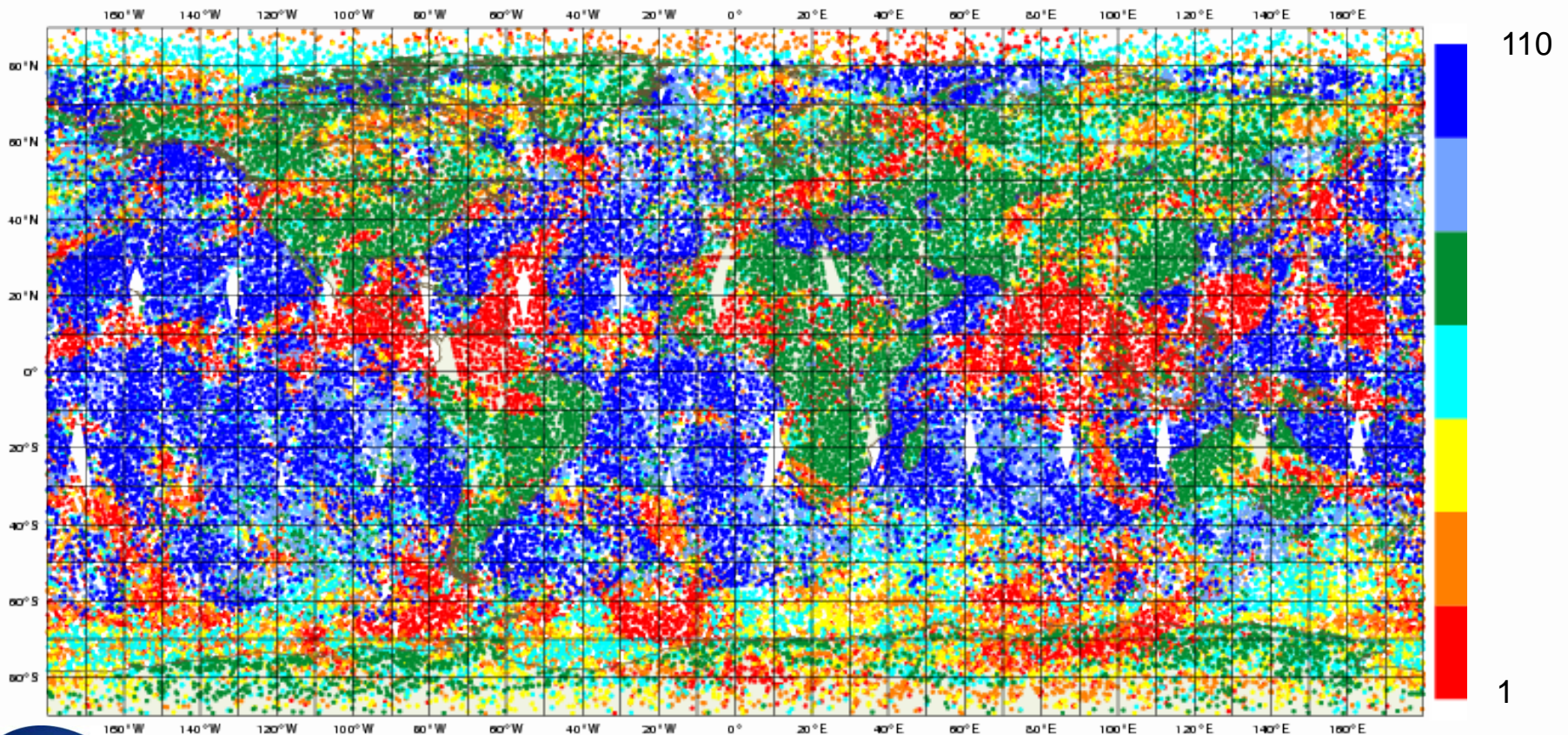
Data usage

DFS

GPS ground	0.24%	AIRS	9.04%	PILOT/PRF	0.94%
GPS sat	0.82%	IASI	51.77%	TEMP	1.95%
SATOB	2.46%	SEVIRI	2.16%	AIRCRAFTS	7.46%
ATOVS HIRS	3.03%	SCATT	0.84%	RADAR Vr	0.00%
ATOVS AMSU-A	14.18%	BUOY	0.16%	RADAR Hur	0.00%
ATOVS AMSU-B	2.03%	SYNOP/SYNOR/RADOME	1.02%	BOGUS	0.00%
SSMIS	1.60%	SHIP	0.30%		

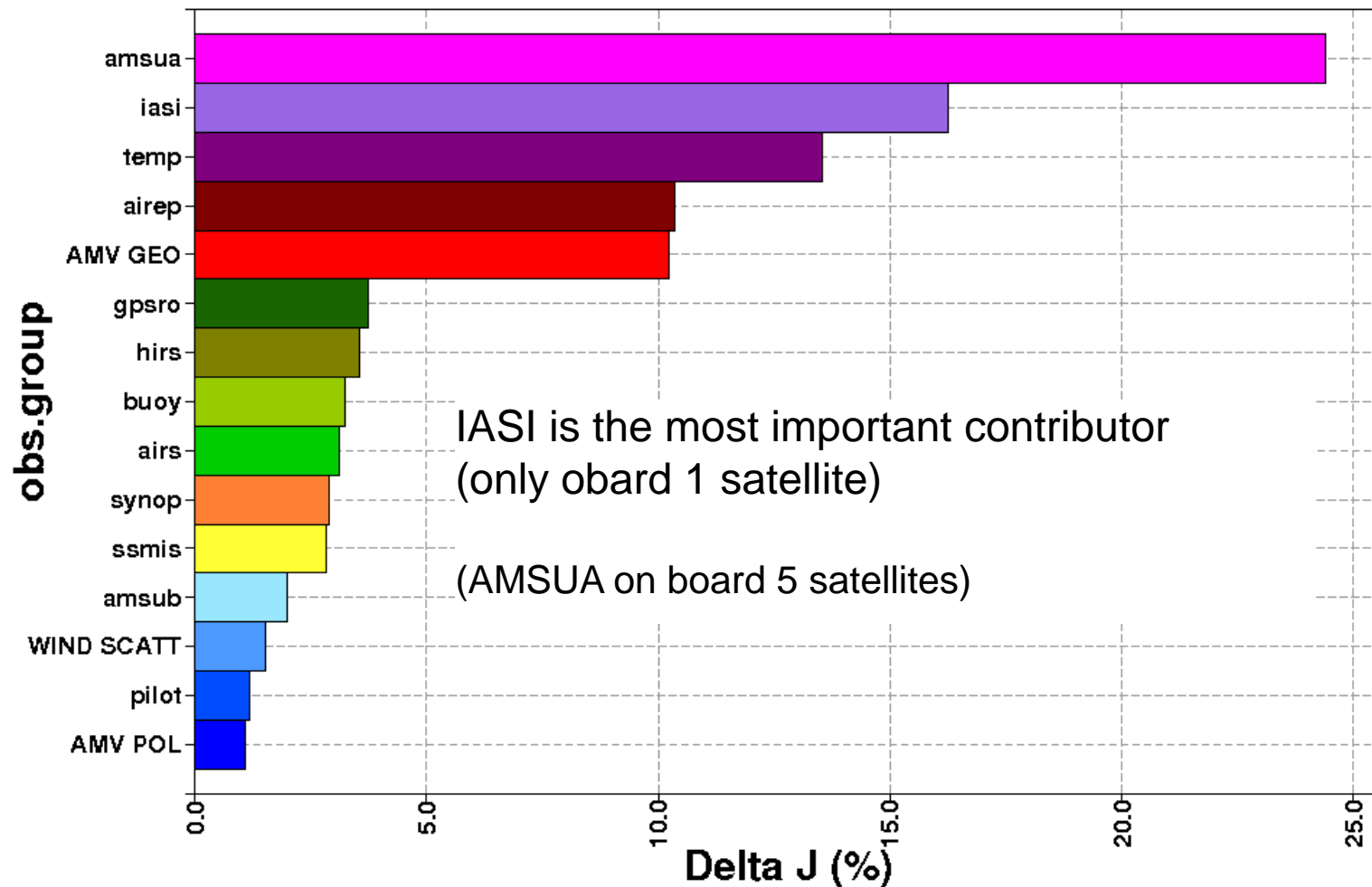|					
GPS ground	0.52%	AIRS	0.97%	PILOT/PRF	3.04%
GPS sat	6.56%	IASI	17.10%	TEMP	9.50%
SATOB	6.71%	SEVIRI	5.44%	AIRCRAFTS	16.40%
ATOVS HIRS	5.99%	SCATT	4.31%	RADAR Vr	0.00%
ATOVS AMSU-A	12.19%	BUOY	0.39%	RADAR Hur	0.00%
ATOVS AMSU-B	4.84%	SYNOP/SYNOR/RADOME	1.34%	BOGUS	0.00%
SSMIS	4.23%	SHIP	0.47%		

Over Europe,
wrt radiosoundings

Gain at D+3 :
4 hours
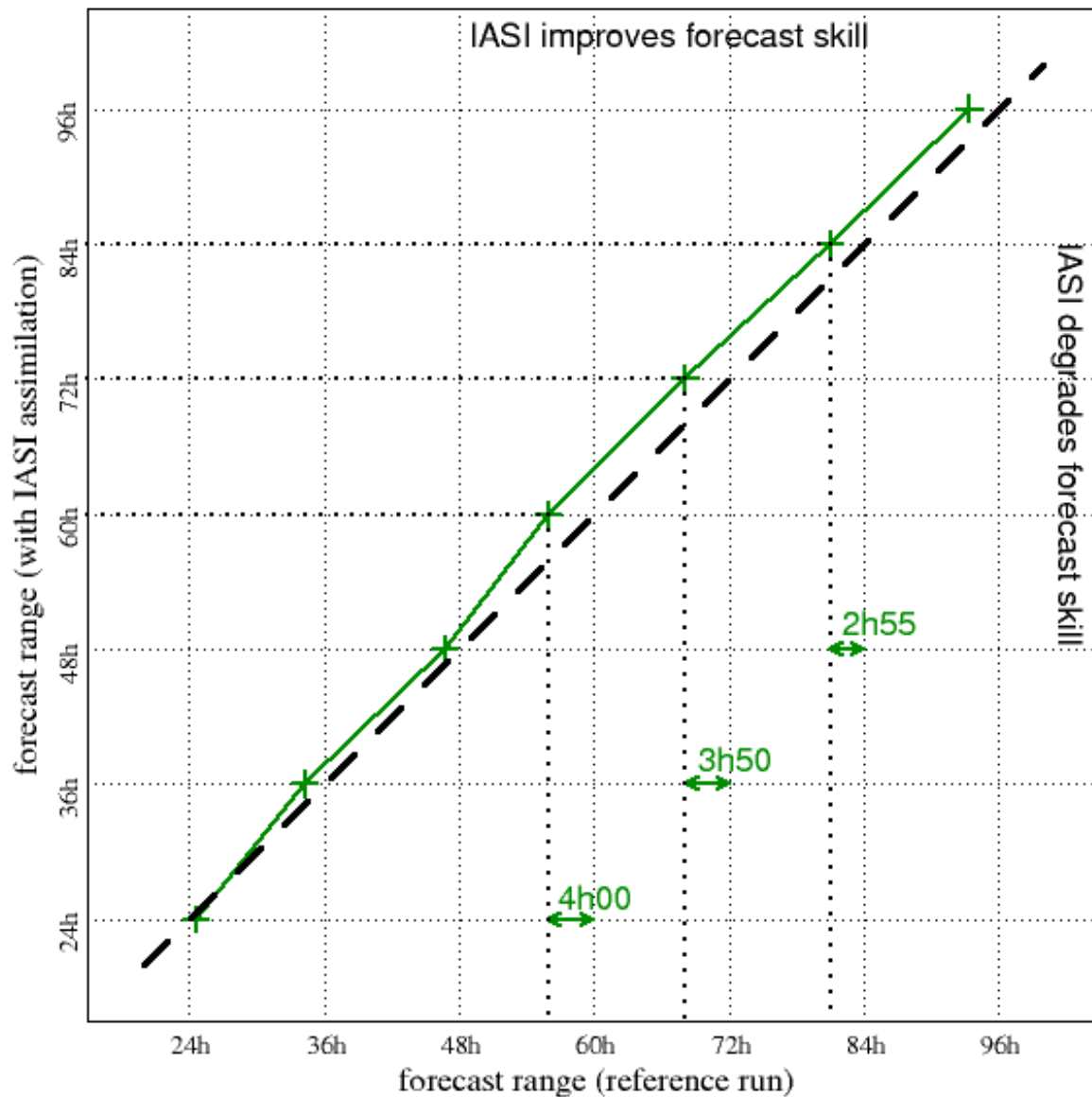
Impact in MF global model
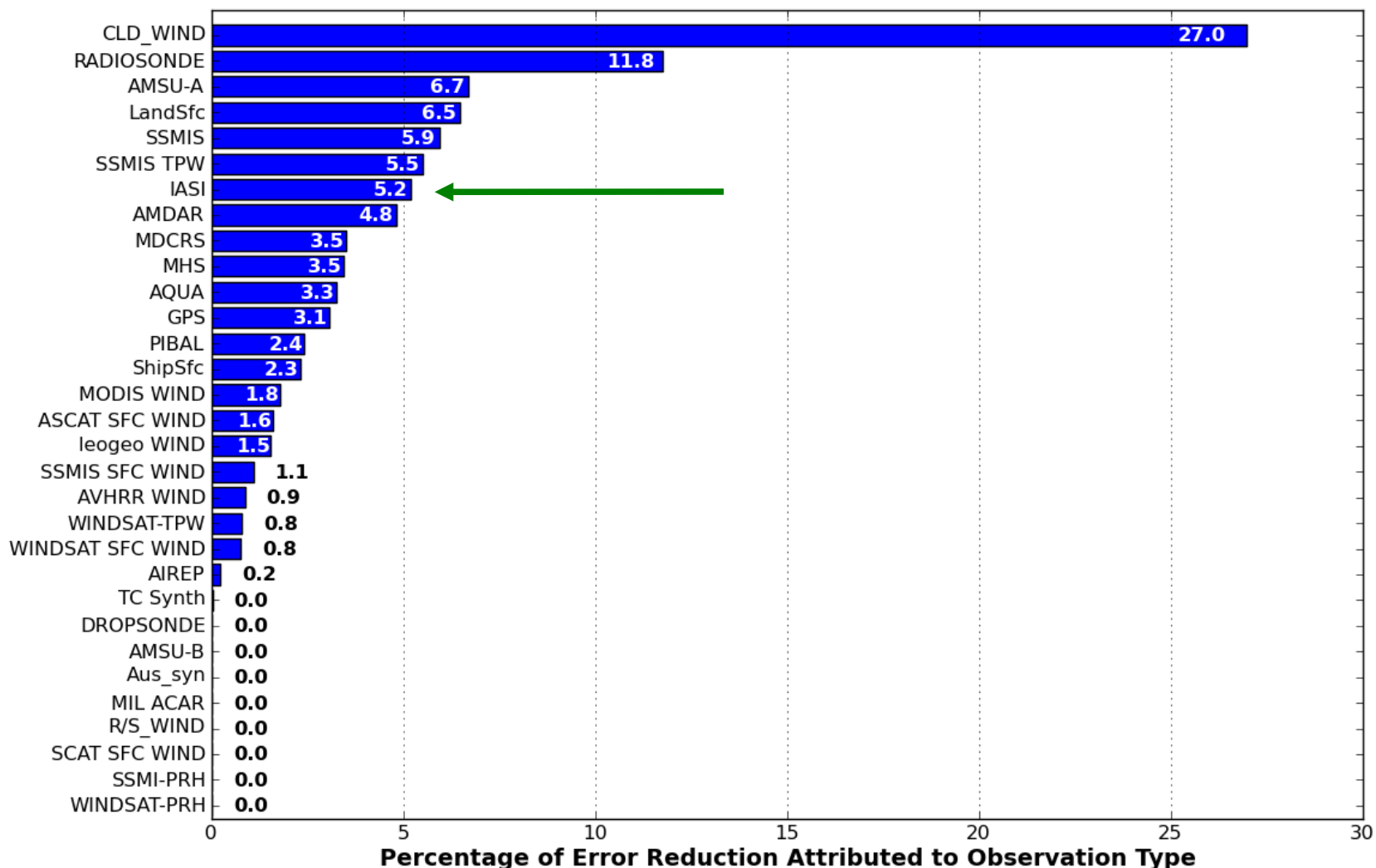
Contribution to the reduction of forecast error
Courtesy N. Saint-Ramond

IASI is the most important contributor
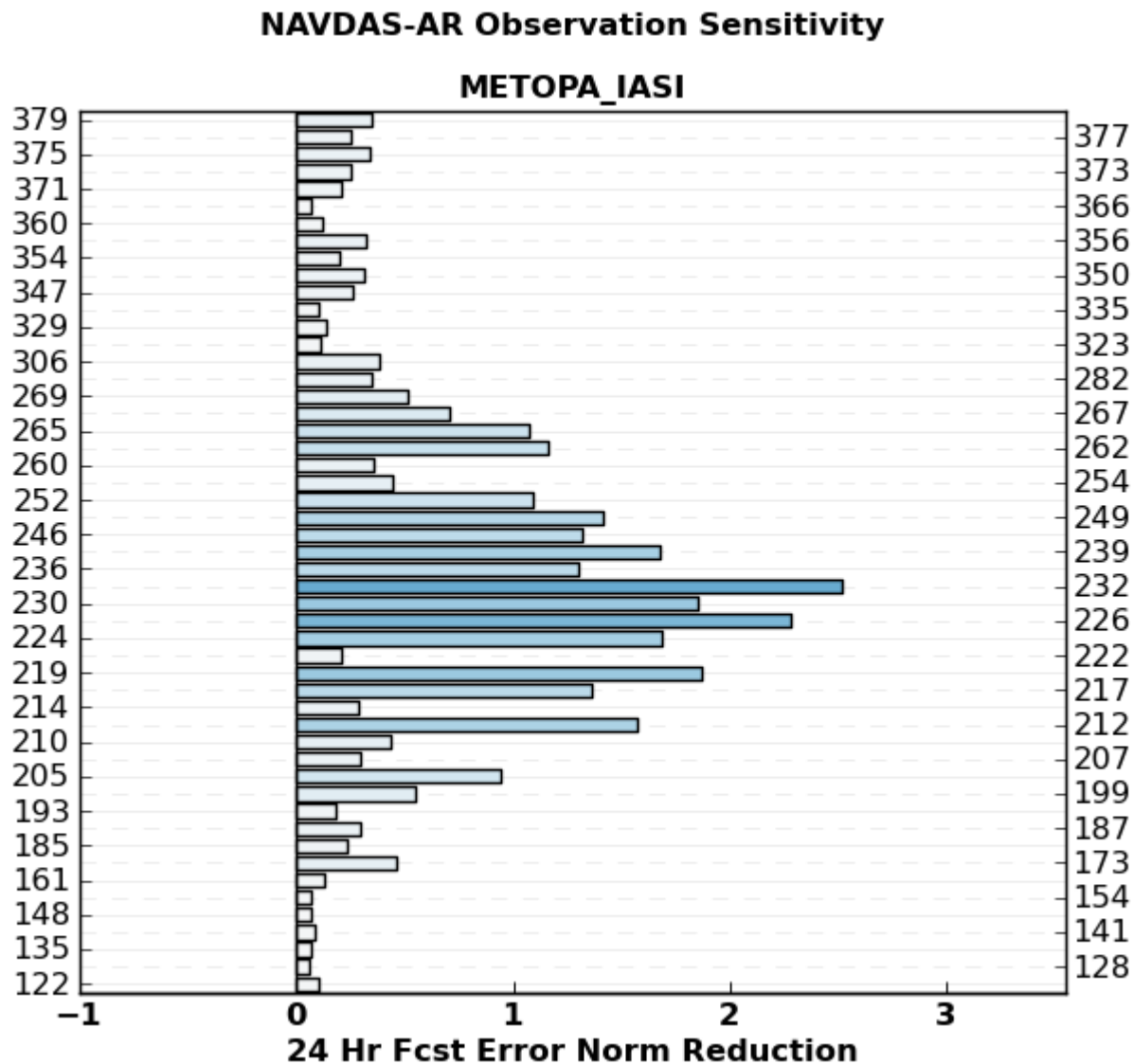(only obard 1 satellite)

(AMSUA on board 5 satellites)

Contribution to the reduction of forecast error

NAVGEM Observation Sensitivity

Contribution to the reduction of forecast error

NAVDAS-AR Observation Sensitivity

METOPA_IASI

Observation impact in Met Office global NWP

space-based = 64%; surface-based = 36%

Relative Contribution of Observations to NWP forecast

Chart showing Relative Observation Impact[%] by Observation Types:

- METOP: 24.3
- NOAA: 20.4
- OTHER LEO: 7.9
- GEO: 5.9
- AIRCRAFT: 9.9
- SONDE: 13.2
- SFC LAND: 15.3
- SFC SEA: 3.1
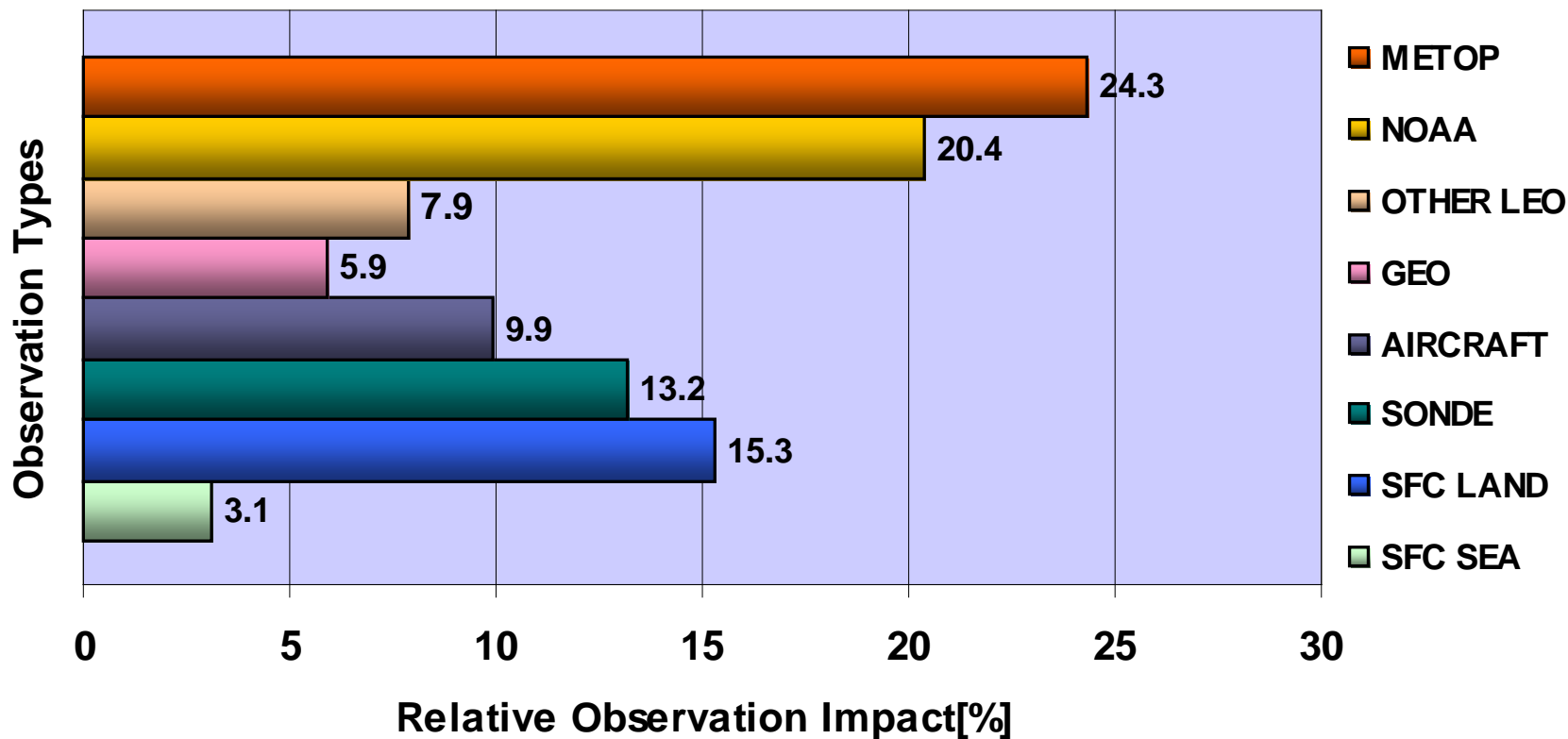
Observation impact in Met Office global NWP
Satellite observation impact per platform

Relative Contribution of Satellite to NWP forecast (per Platform)
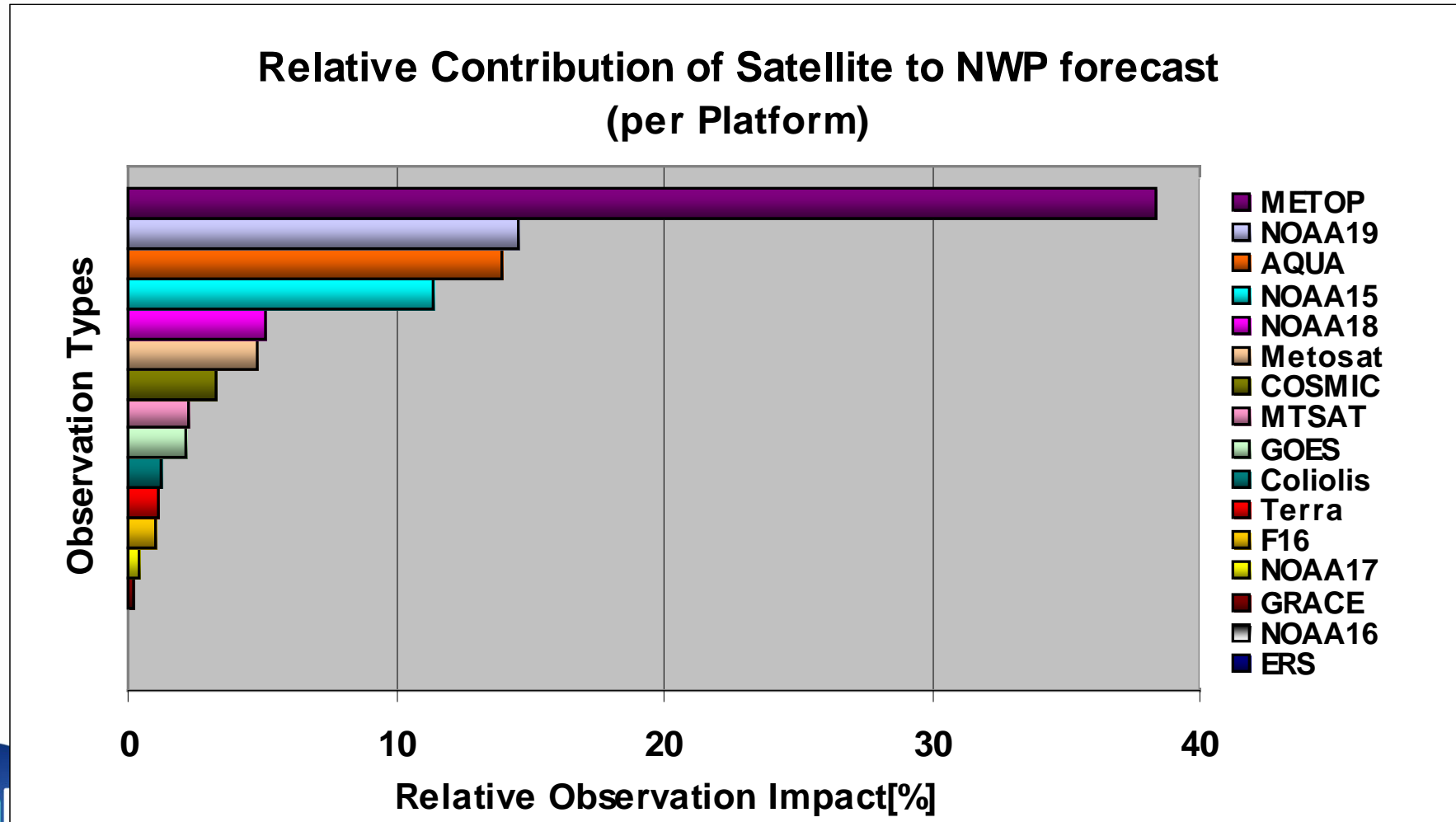
Regional models at Météo-France

Typical coverage in **AROME France**

Assimilation time around 09 UTC

(number of active channels)
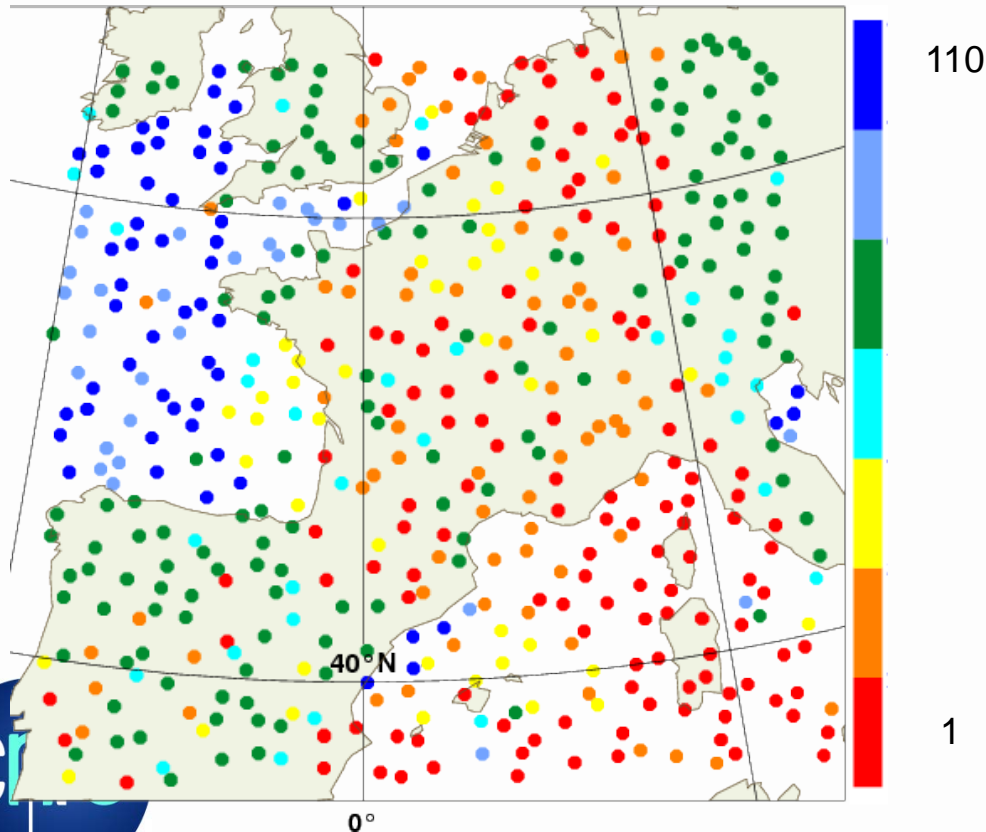
Channel selection = global model
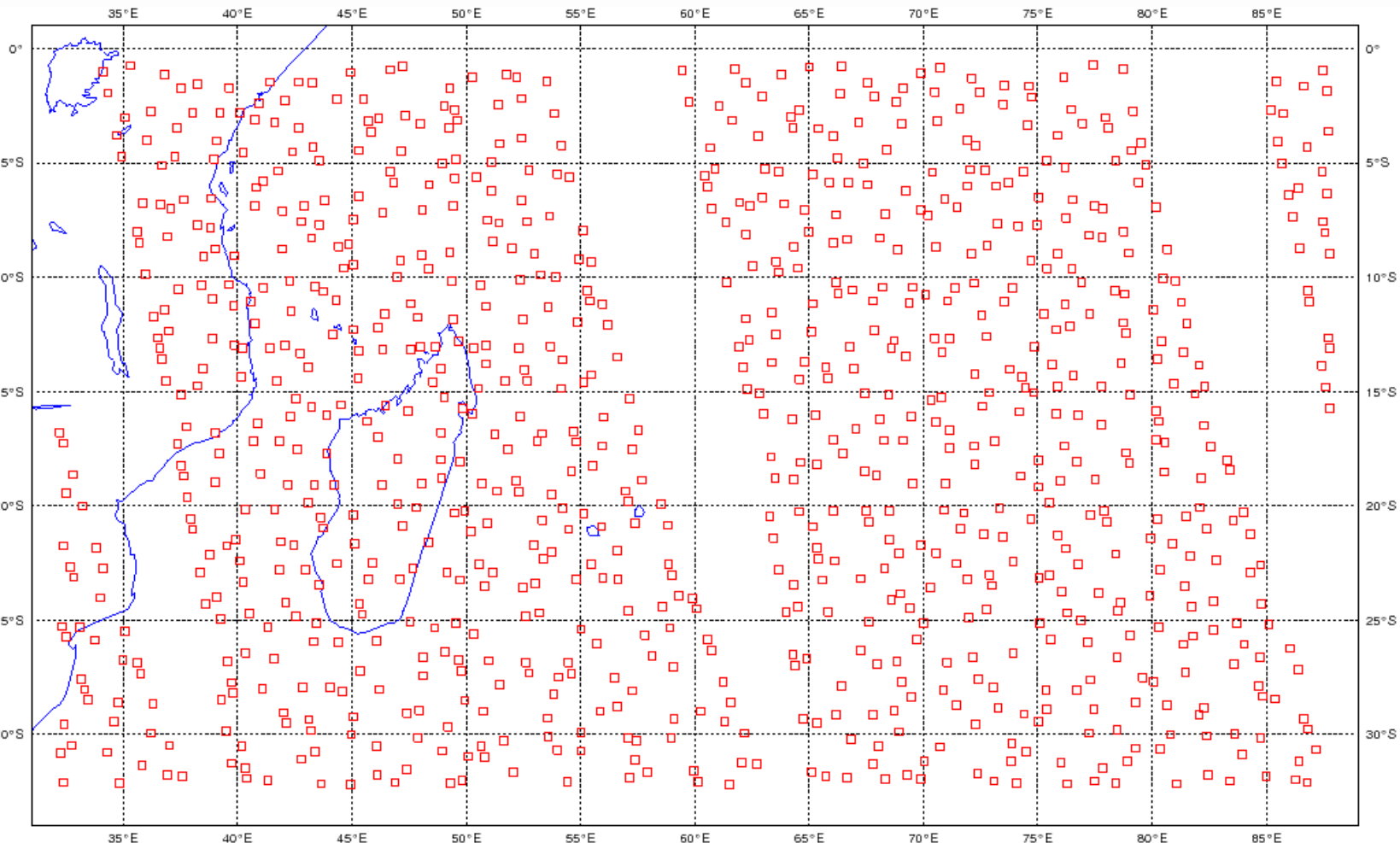
Bias correction = taken from global model

Pixel selection =
2 pixels in 4 (detectors 1 and 3) then
80 km thinning

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Regional models at Météo-France

Typical coverage in **ALADIN Reunion**   Same setting as AROME France
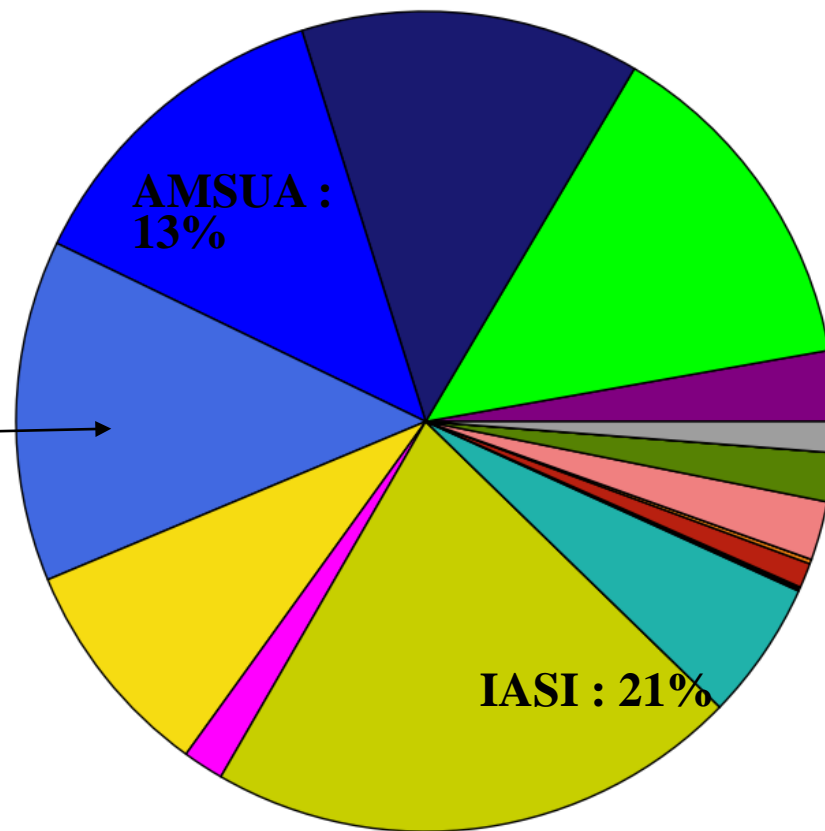
Assimilation time around 18 UTC

Data usage and influence during assimilation at MF

Data usage in ALADIN Réunion   DFS

Next steps and challenges

Using more of the spectrum

- F. Smith's talk – PC-compressed and reconstructed radiances

- N. Fourrié's talk – using more WV information

- M. Matricardi's talk – assimilation of principal components

- P. Weston's talk – observation error correlations

Using cloudy information

- R. Eresmaa's talk – using the AVHRR

- P. Martinet's talk – channel selection for cloud affected radiances

Next steps and challenges

Assimilation over land

- Land surface temperature and emissivity
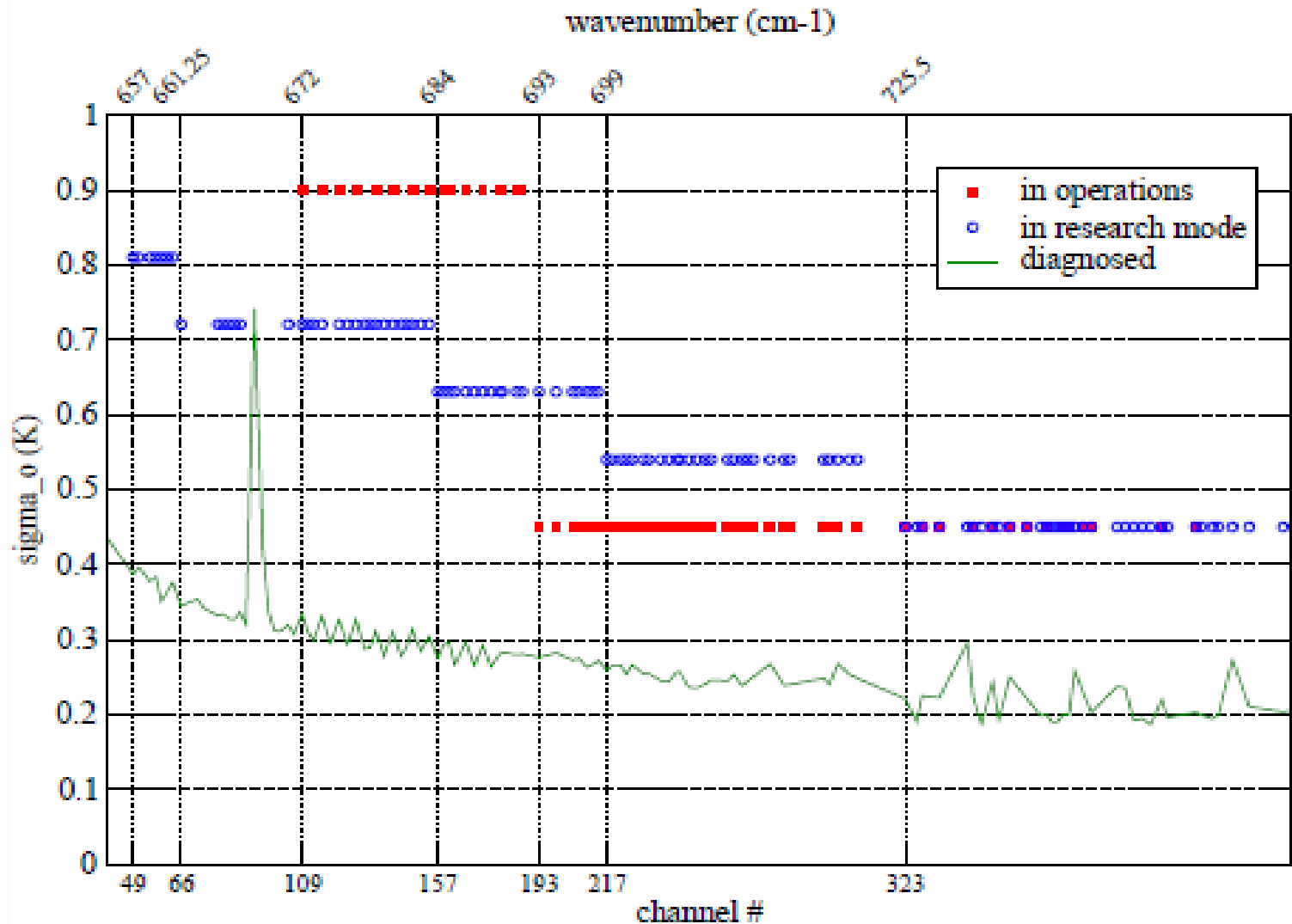- → Dedicated session on surface parameters

Regional models

- Very few models assimilate IASI
- Numerous European and American regional models going towards assimilating IASI soon
- Taking into account the discrepancy between model resolution and IASI pixel size
- What about using the subpixel information ?

Merci de votre attention

Observation errors

ECMWF : 0.4 K, 1.0 K and 2.0 K on tropospheric-sounding, stratospheric-sounding, and window channels