

An aerial photograph of a town, likely Toulouse, is shown from a high angle. The town is surrounded by green hills and is partially obscured by a thick layer of white clouds. Overlaid on the bottom left of the image is a white weather map showing isobars (lines of equal atmospheric pressure) and wind vectors (arrows). The isobars are labeled with values such as 1010, 1015, 1020, 1025, 1030, 1035, and 1040. The wind vectors are represented by arrows of varying lengths and directions, indicating wind speed and direction. The background of the entire slide is a dark blue gradient with a stylized sun in the top left corner.

First tests and plan for SAPHIR data assimilation at Météo France

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dépasser les frontières



METEO FRANCE
Toujours un temps d'avance

Outline of the presentation

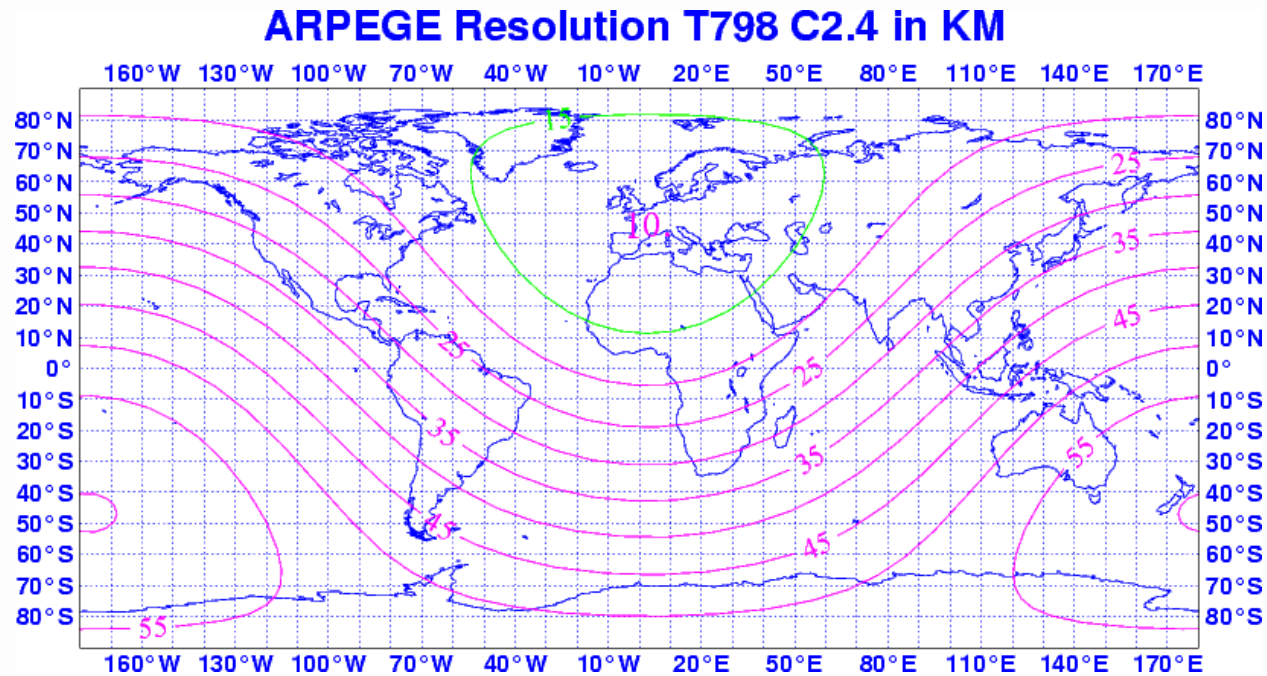
- Numerical weather prediction models and data assimilation at Météo-France (ARPEGE, ALADIN)
- Observation impact
- Real-time monitoring of observations
- Plans for the assimilation of microwave radiances from SAPHIR

PRESENTATION OF DATA ASSIMILATION SYSTEMS

Global model ARPEGE (1)

Spectral model with variable mesh : T_L798C2.4L70

Resolution from 10 km to 60 km, 70 levels from 17m to 0.05 hPa



Forecast ranges [cut-off time] :

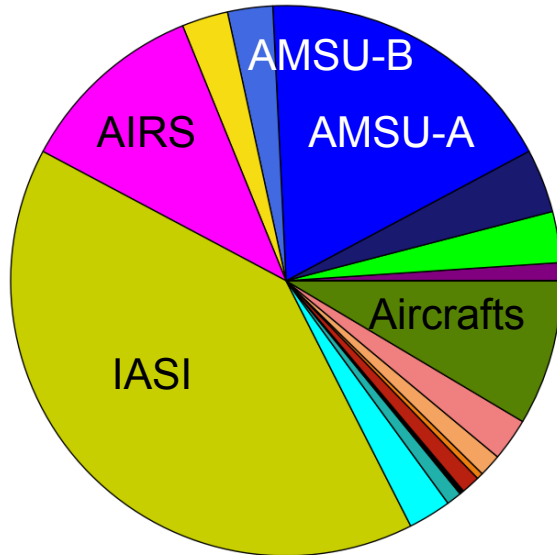
FC+102 (00 UTC) [2h15], FC+72 (06 UTC) [3h], FC+84 (12 UTC) [1h50], FC+60 (18 UTC) [3h]

Global model ARPEGE (2)

- Incremental 4D-Var data assimilation system (time window 6h) :
 - Minimization with 2 outer loops : T107C1L70 (25 iterations) + T323C1L70 (25 iterations)
 - Variances of background errors derived from a data assimilation ensemble (6 4D-Var assimilations 4D-Var at low resolution) since 2008
- Observations :
 - SYNOP, SHIP, BUOY, AIREP, AMDAR, ACARS, TEMP, PILOT
 - AMV GOES + Meteosat + MTSAT-1R, MODIS (Terra, Aqua), AVHRR/NOAA
 - HIRS, AMSU-A, AMSU-B/MHS, NOAA 15, 16, 17, 18, 19 + Aqua + MetOp-A
 - SSM/IS DMSP F16, 17, 18, AIRS/AQUA, IASI/MetOp-A, GPS-RO, GPS-ZTD
 - ASCAT surface winds over oceans
 - Clear sky radiances SEVIRI/MSG

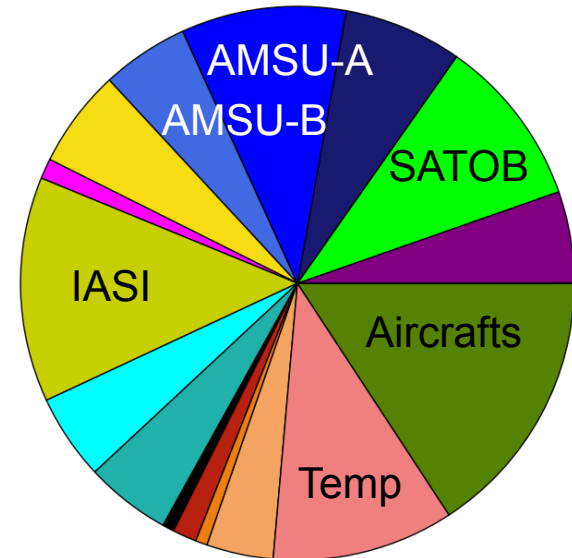
Information content of observations

Proportions des nombres d'observations utilisées par type d'obs
analyses cut-off long - ARPEGE metropole oper
observations conventionnelles et satellites
cumul du nombre d'observations utilisées sur la période 2011110300 - 2011110318 : 6984383



Fraction of observation types

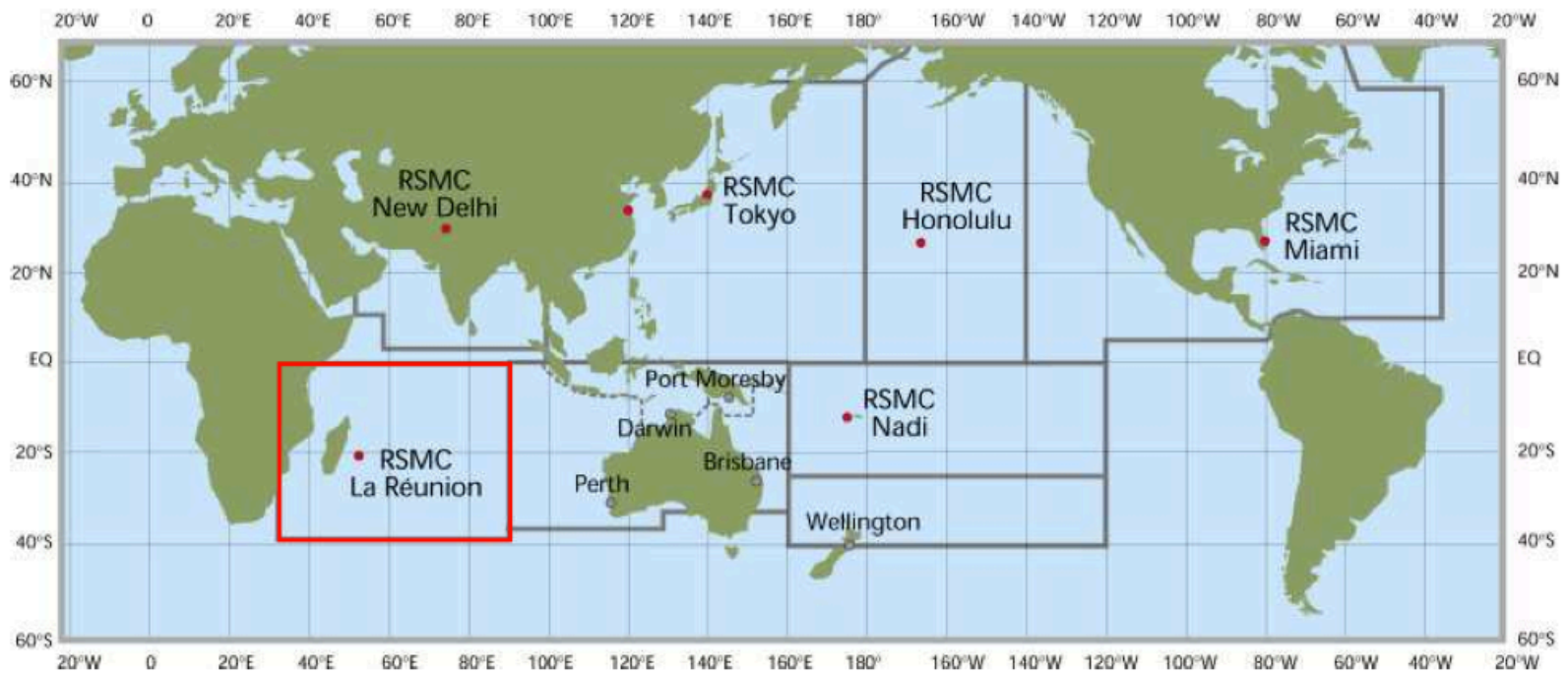
Part des DFS par type d'obs
analyses cut-off long - ARPEGE metropole oper
observations conventionnelles et satellites
cumul du DFS sur la période 2011110300 - 2011110318 : 188312



Information content (DFS)
*Capacity of an observing system
to improve the analysis*

Monitoring of tropical cyclones

Since 1993 Météo-France at La Réunion is a WMO **Regional Specialized Meteorological Centre** for providing advisories and bulletins on tropical cyclones in the Indian Ocean



Regional models ALADIN

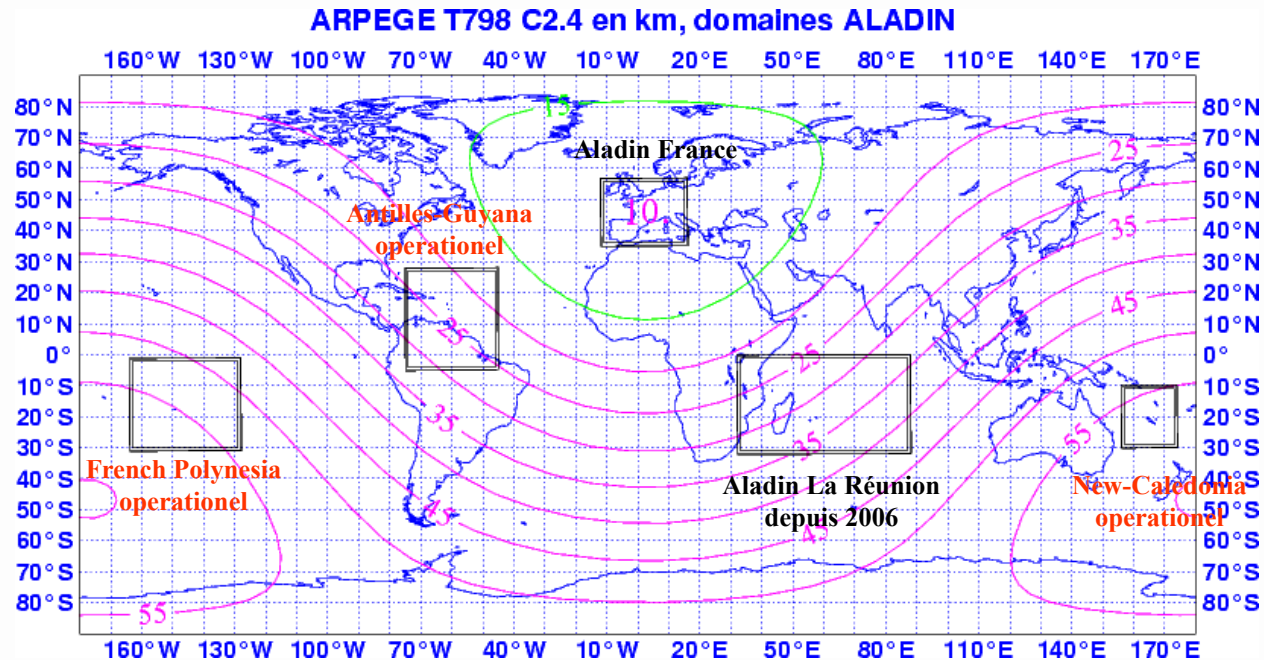
Limited area spectral models :

- 70 levels from 17mt to 0.05 hPa, horizontal resolution= 7.5 km

Data assimilation system : 3D-Var (time window 6h) :

- Same data as in ARPEGE + bogus wind for TC

Operational domains :



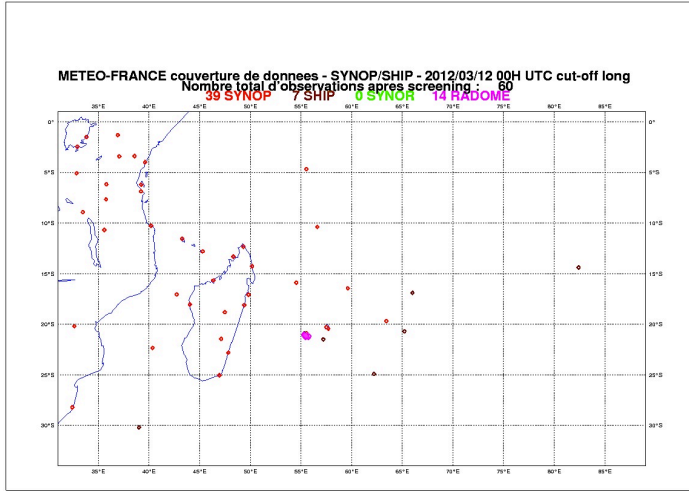
Forecast ranges :

FC+84 (00 UTC) , FC+84 (12 UTC) : La Réunion

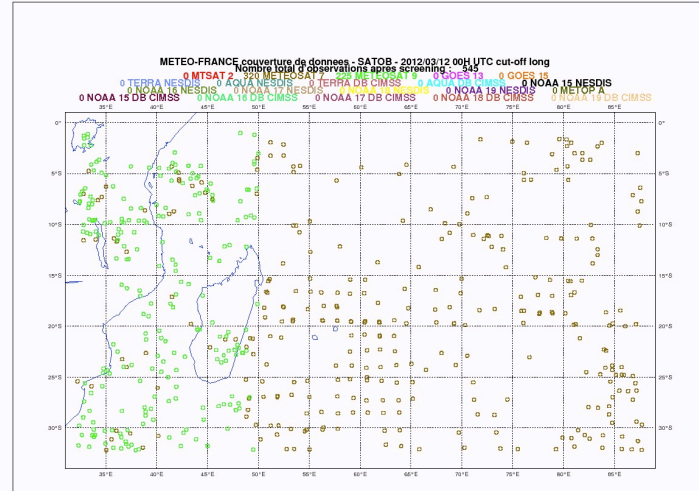
FC+54 (00 UTC) , FC+54 (12 UTC) : Others

Spatial coverage of observations

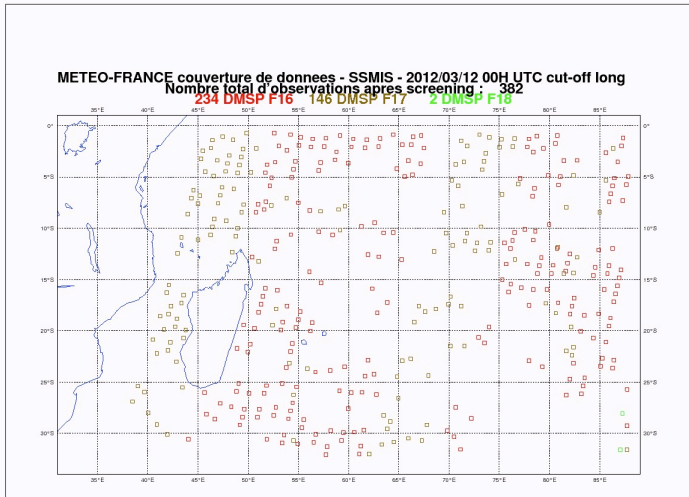
SYNOP



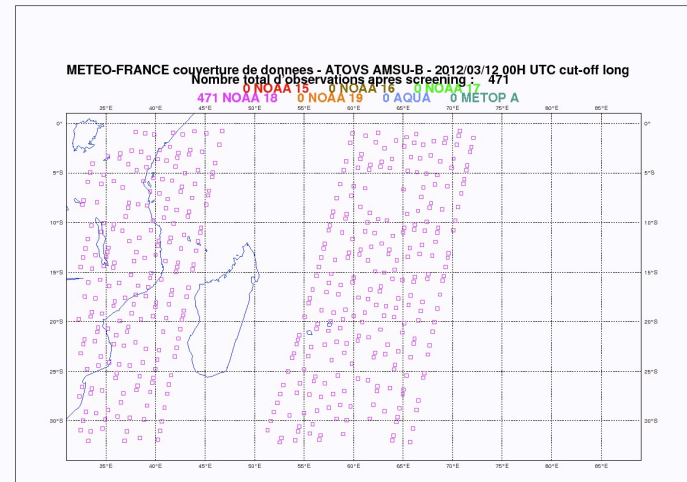
SATOB



SSM/I/S

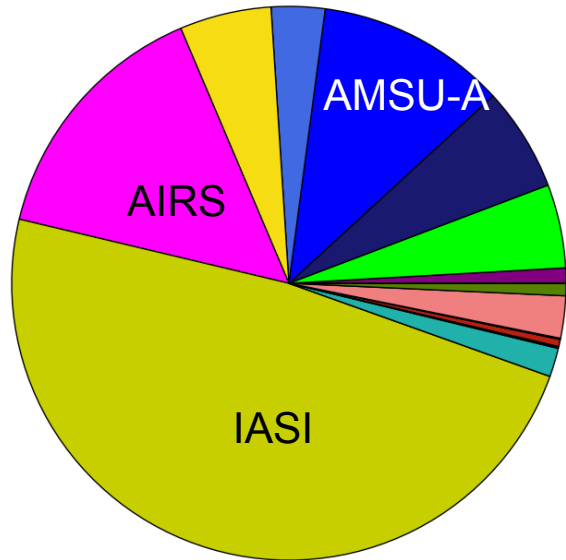


AMSU-B



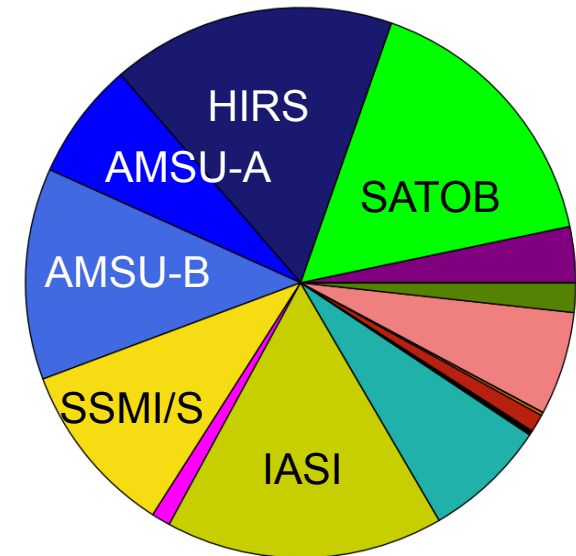
Information content of observations

Proportions des nombres d'observations utilisées par type d'obs
analyses cut-off long - ALADIN Réunion
observations conventionnelles et satellites
cumul du nombre d'observations utilisées sur la période 2011110300 - 2011110318 : 199666



Fraction of observation types

Part des DFS par type d'obs
analyses cut-off long - ALADIN Réunion
observations conventionnelles et satellites
cumul du DFS sur la période 2011110300 - 2011110318 : 19798

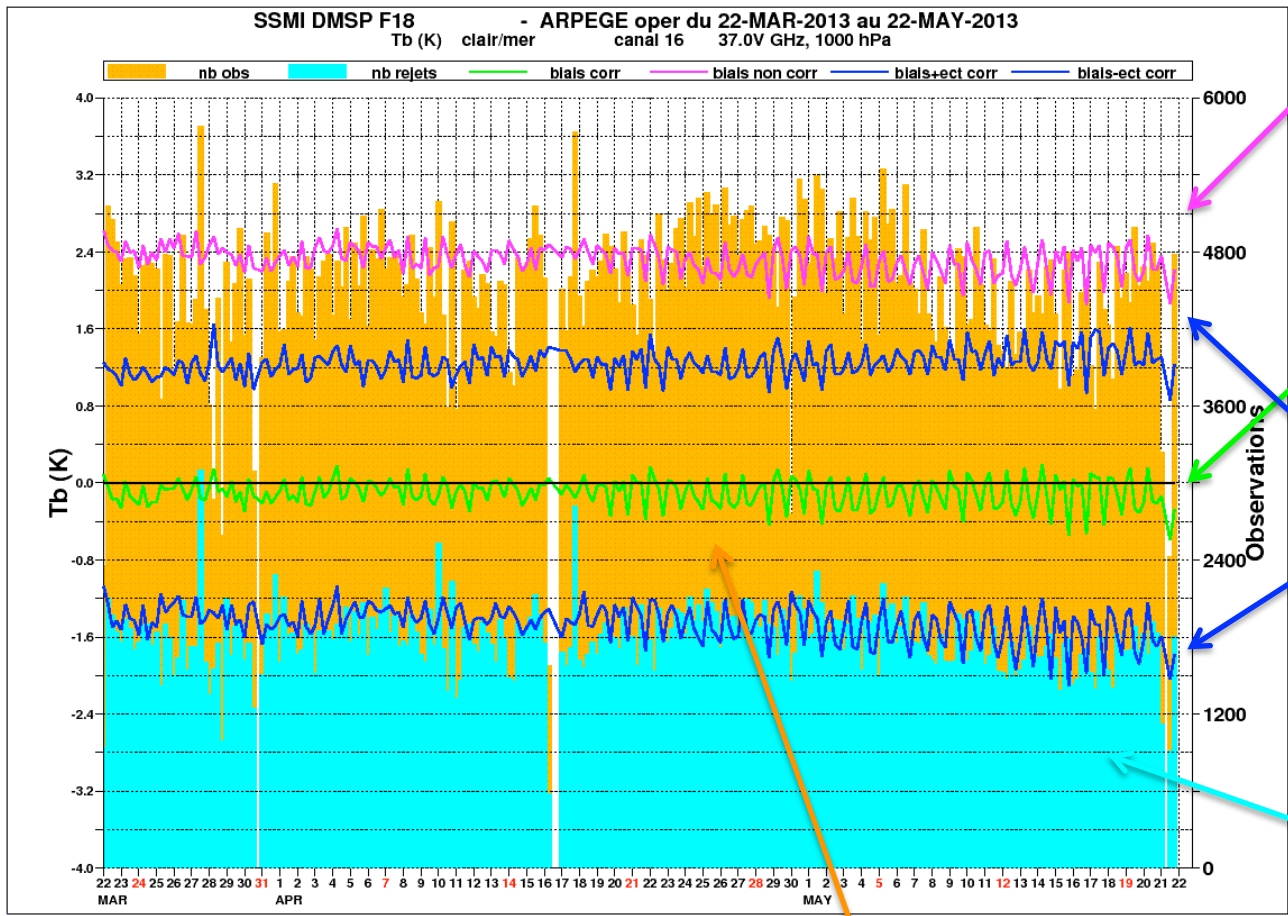


Information content (DFS)
*Capacity of an observing system
to improve the analysis*

REAL TIME MONITORING

Operational monitoring of observations

Observation - Model



Uncorrected bias

Corrected bias

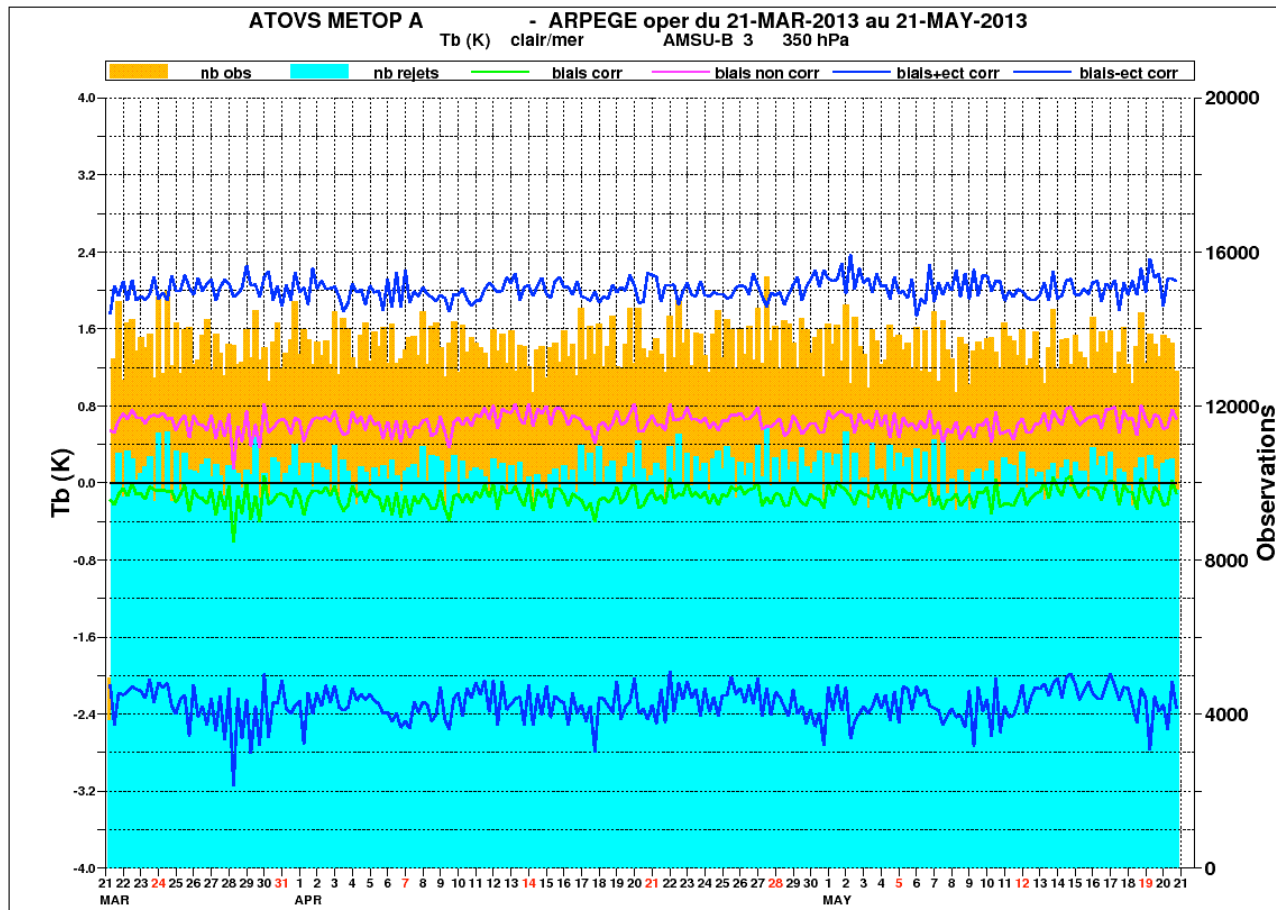
STD
Obs-model

Number of
rejected
observations

**Brightness
temperature at 22V
from SSMI/S F18**

Total number of observations

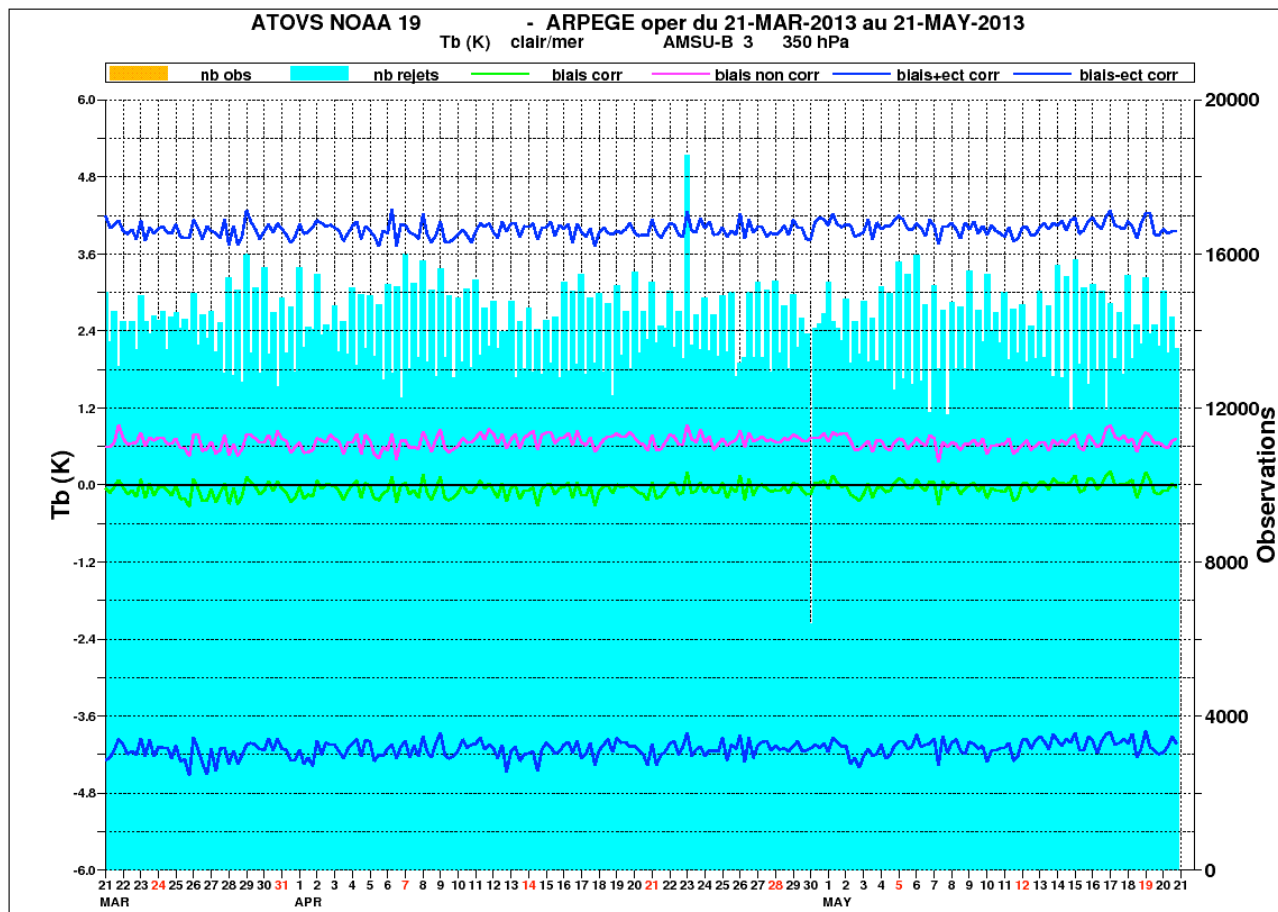
Channel 3 (183+-1GHz) from MHS/MetOp-A



Used

$$\sigma(\text{obs-mod}) = 2 \text{ K}$$

Channel 3 (183±1GHz) from MHS/NOAA-19



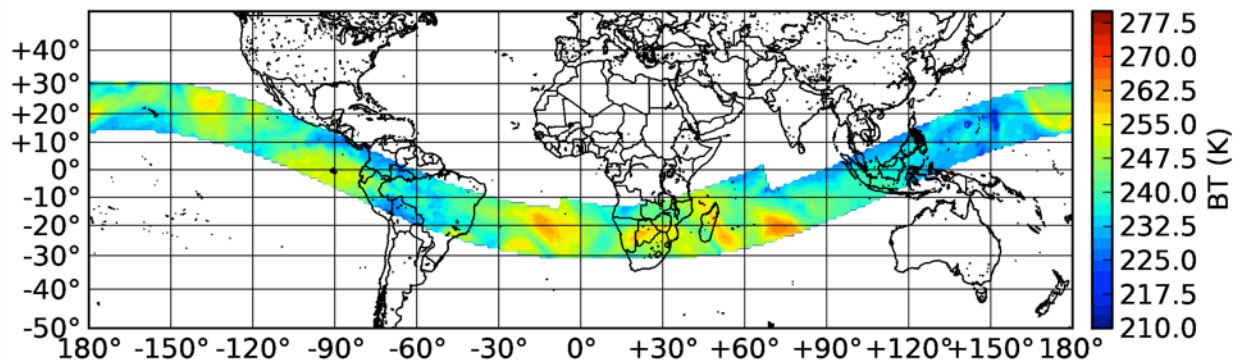
Rejected

$$\sigma(\text{obs-mod}) = 4 \text{ K}$$

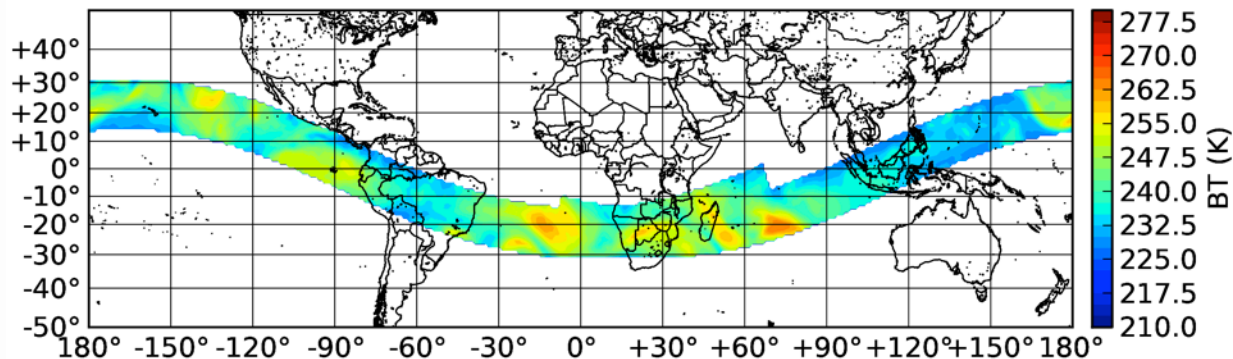
FIRST RESULTS TOWARD SAPHIR REAL-TIME MONITORING

Preliminary work on the ARPEGE/IFS code to assimilate SAPHIR done with data samples provided by Eumetsat

Observed BT
Channel1

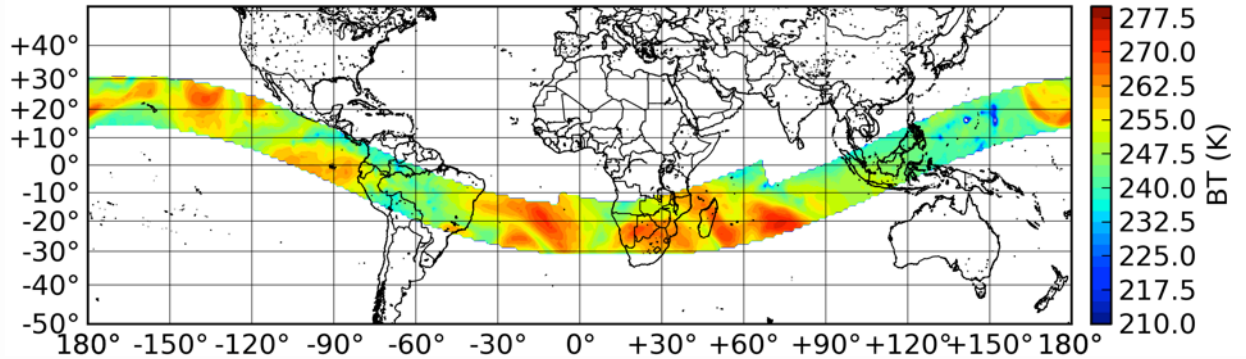


ARPEGE
Simulated BT

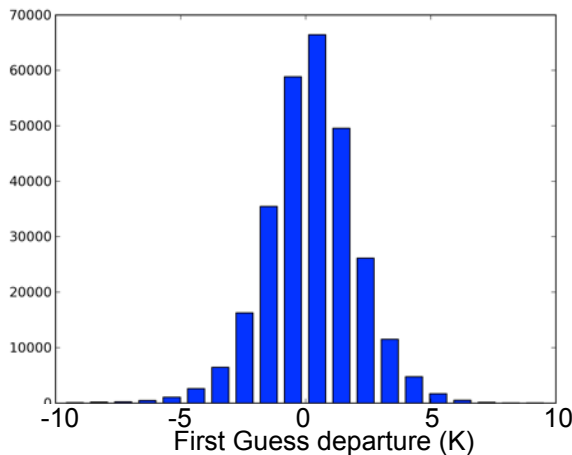
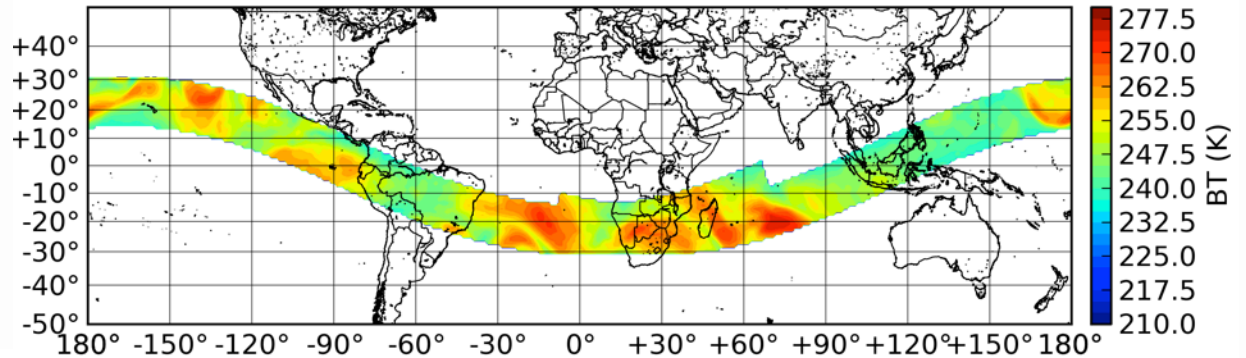


Example: SAPHIR Channel 2

Observed BT



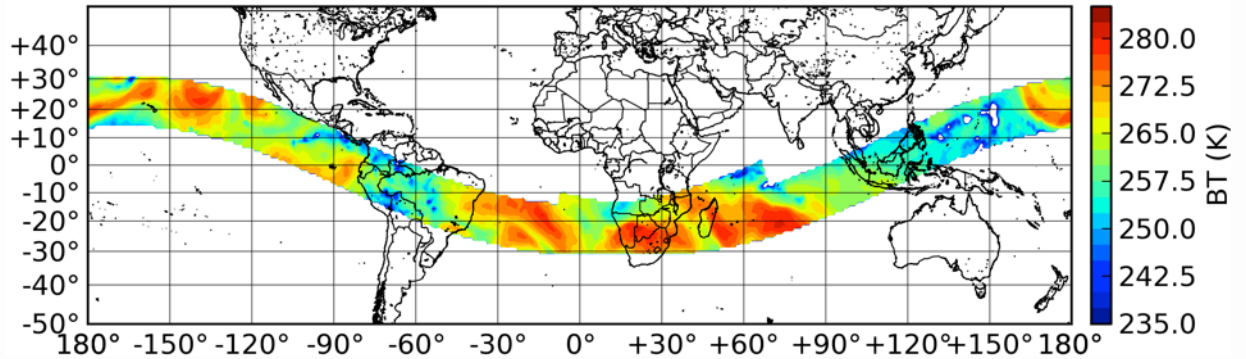
ARPEGE Simulated BT



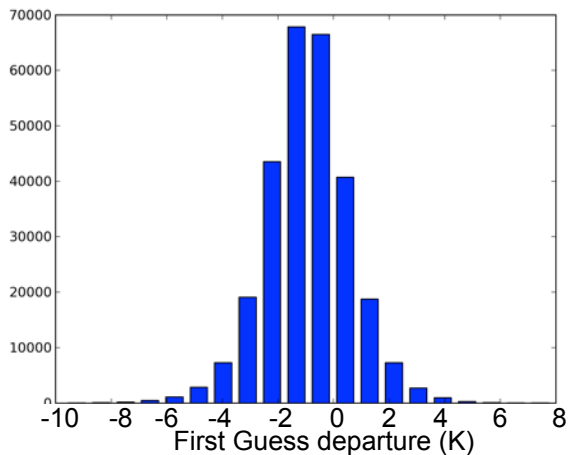
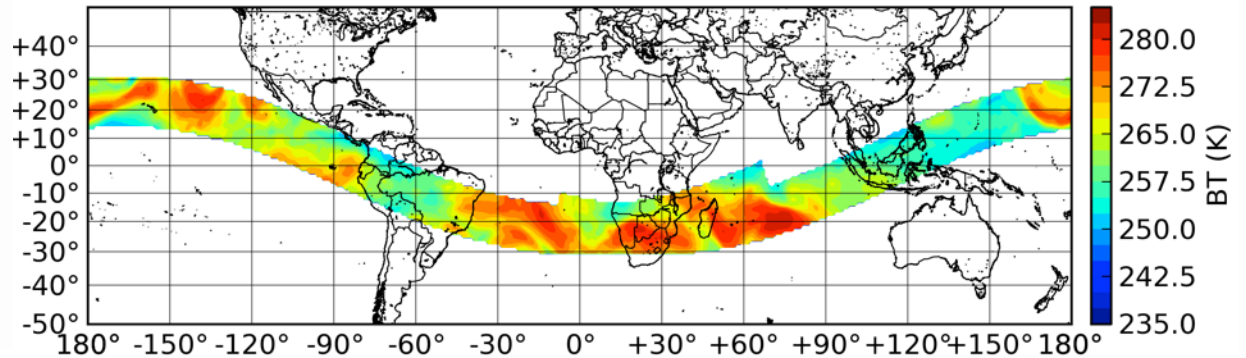
	SAPHIR			MHS (Channel 3 / 183+1 GHz) Tropics		
	Nb of obs	Bias (K)	Std Dev (K)	Nb of obs	Bias (K)	Std Dev (K)
Before Screening	315 510	-0.23	3.51	54 059	0.37 (-0.53 BC)	3.84 (3.84 BC)
After Screening	282 293	0.24	1.80	17 632	0.93 (0.015 BC)	3.37 (3.35 BC)

Example: SAPHIR Channel 3

Observed BT



ARPEGE Simulated BT



	SAPHIR			MHS (Channel 4 / 183+3 GHz) Tropics		
	Nb of obs	Bias (K)	Std Dev (K)	Nb of obs	Bias (K)	Std Dev (K)
Before Screening	315 510	-1.75	5.18	54 059	-1.06 (-0.85 BC)	4.96 (4.95 BC)
After Screening	279 587	-0.93	1.52	17 144	-0.12 (0.003 BC)	1.72 (1.71 BC)

CONCLUSIONS & PLANS

Conclusions

- Importance of microwave satellite observations in operational NWP models
- Météo-France global and regional models will be able to assimilate in near real time MEGHA-TROPIQUES data when available
- Specific interest at Météo-France for tropical regions : various regional NWP models + La Réunion island : WMO regional centre for issuing warnings for tropical cyclones in the Indian Ocean.
- Particular role of MEGHA-TROPIQUES in order to increase significantly the number of useful observations in tropical regions
- First tests reveal high consistency between SAPHIR observations and model simulated brightness temperatures

Planned activities

- Monitoring of SAPHIR radiances in the global model ARPEGE when available in near-real time on EUMETCAST (channel selection, spatial sampling, bias correction, specification of observation errors, information content)
- Assimilation of SAPHIR radiances (clear sky over land and oceans) in ARPEGE and ALADIN models
- Defining a strategy to dynamically estimate emissivities without window channel (e.g. channel 6 as pseudo window channel, Kalman filter)
- Studies towards the assimilation of SAPHIR and MADRAS over continents in rainy situations