

# Recent improvement in data assimilation at Meteo-France: emphasis on AMMA region

M.NURET, F.Z. HDIDOU\* and J.P.  
LAFORE

Meteo-France & Maroc-Meteo(\*)

# OPERATIONAL NWP at MF

## The ARPEGE global model

### Global spectral model

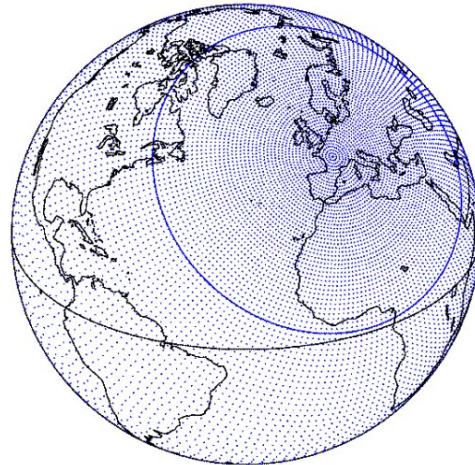
**T<sub>L</sub>358 C2.4, 41 levels**

Associated grid: 23 km (France)  
→ 133 km (antipodes)

Representation on the globe with stretching and turning of the pole over the interest zone

Collaboration with ECMWF

Grid for the ARPEGE model



## The ARPEGE-Tropiques model

### • Uniform resolution

- horizontal grid without stretching (T<sub>L</sub>359 grid)
- vertical levels unchanged (41 levels)

### • Run once a day

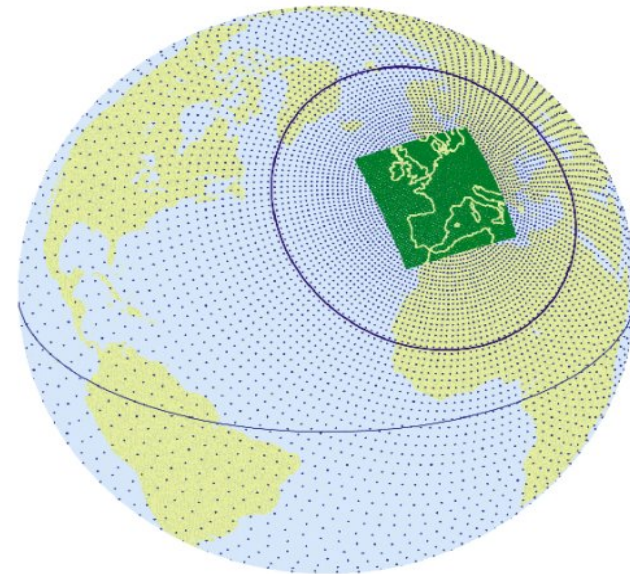
from 00 UTC up to 72h range

Evaluation - See Poster: A first evaluation of models involved in the AMMA « dry-run » forecasting exercise in Summer 2005 monsoon (P. Chapelet, N. Asencio, M. Nuret and J.P. Lafore)

# OPERATIONAL NWP at MF

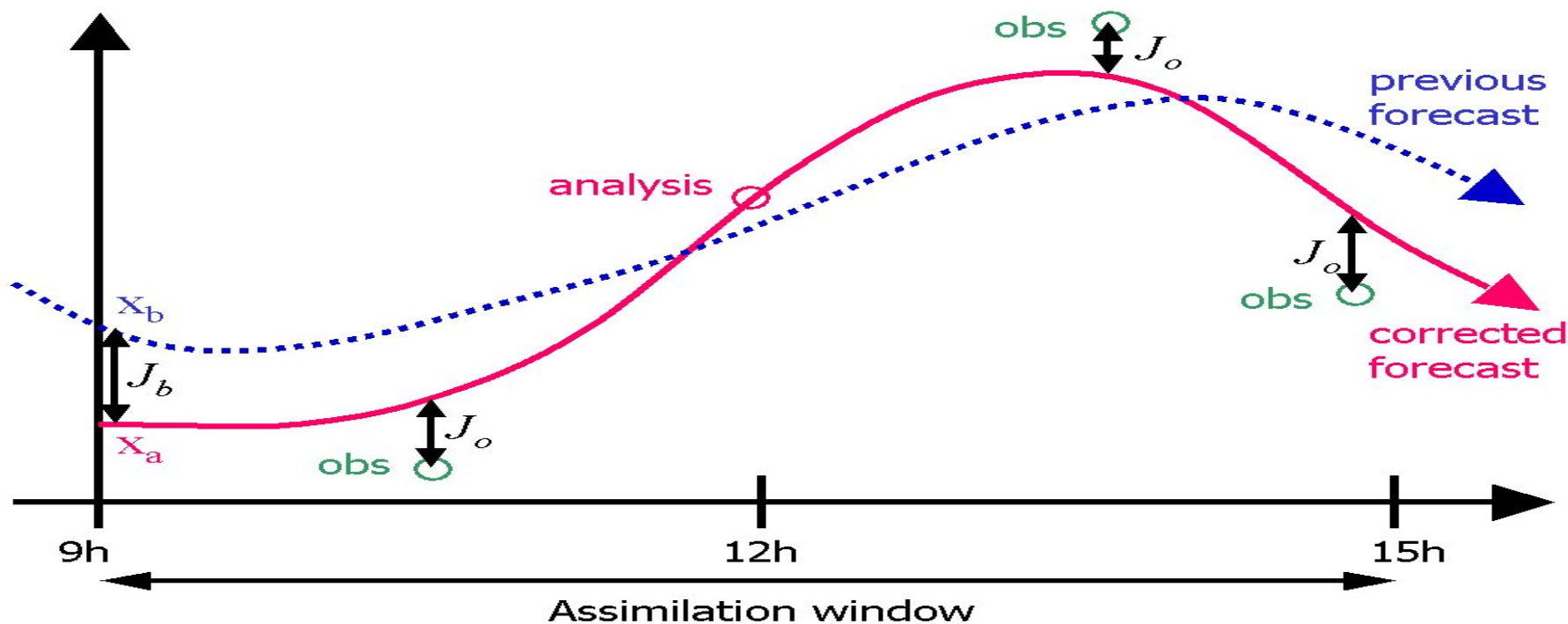
## The Aladin-France limited area model

- ◆ *A spectral model*
- ◆ *Domain*: a square 2740 km in side, centered on the point of maximal resolution of Arpège
- ◆ *Vertical levels*: same as Arpège (41)
- ◆ *Horizontal resolution* (9 km)  
~ 2.5 × max resolution in Arpège
- ◆ *Coupling*: applied every three hours to the global model Arpège



# OPERATIONAL NWP at MF

## Principles of 4D-VAR assimilation



- ARPEGE, ARPEGE Tropiques: 4d-var
- ALADIN: 3d-var (since July 2005 – before ARPEGE analysis)

# ALADIN-AMMA

- **Domain** ~ 4000kmx2000km
- **Jb** = f (model, domain)  
computed with lagged-NMC  
method (Montmerle et al.,  
2005)
- **SEVIRI (MSG-1) radiances**  
flux at full resolution for  
operational use

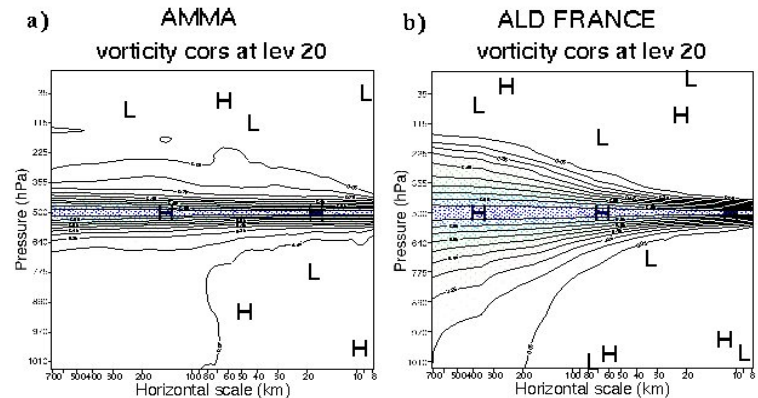
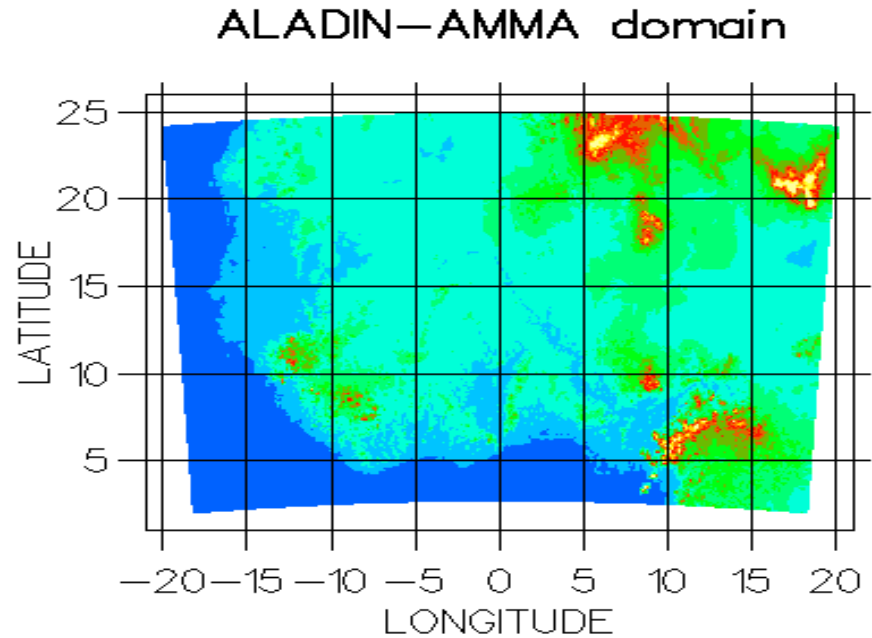
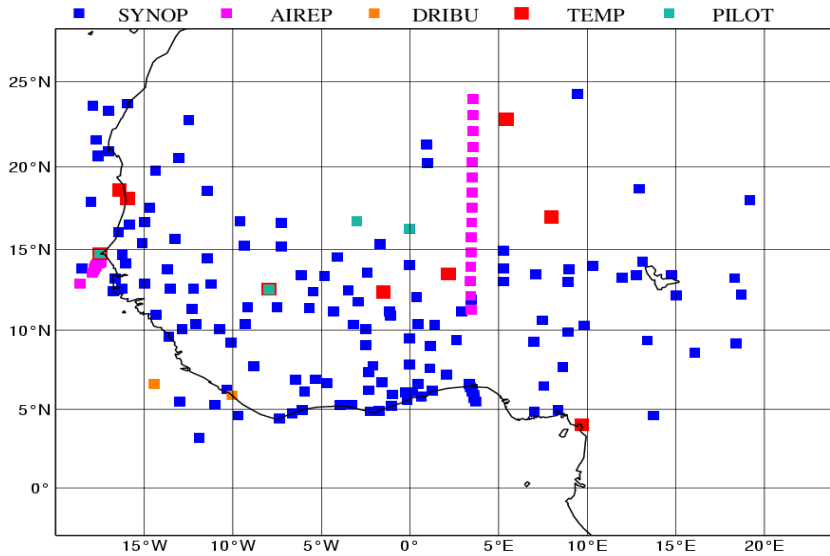


Figure 3. Vertical correlations of the vorticity forecast errors between the 500 hPa model level and other levels as a function of horizontal scale and of height (a) over Africa and (b) over Western Europe. Isolines are plotted every 10 %, H and L denote local maxima and minima respectively.

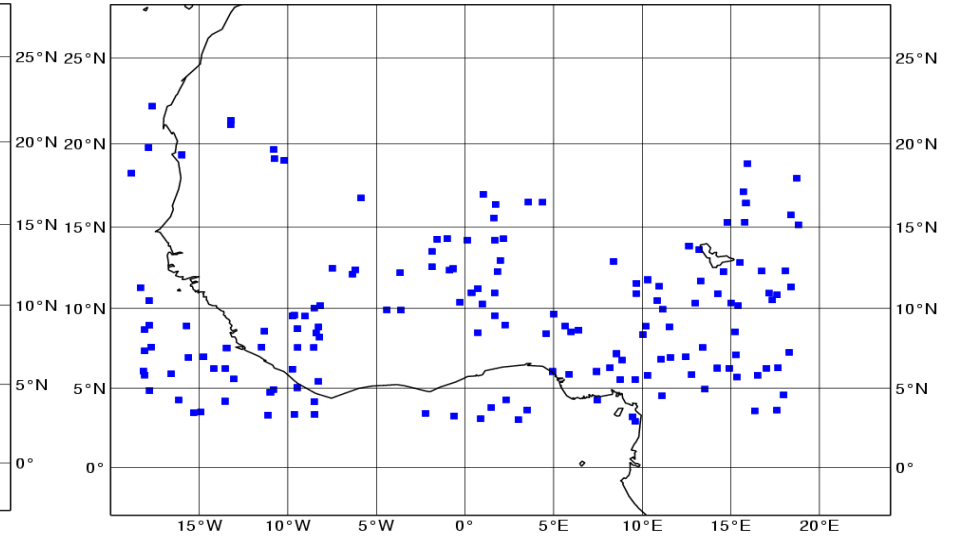
From Montmerle et al., 2005.

# ALADIN-AMMA: conventional data

**CONV 20050822-12UTC**



**SATOB 20050822-12UTC**



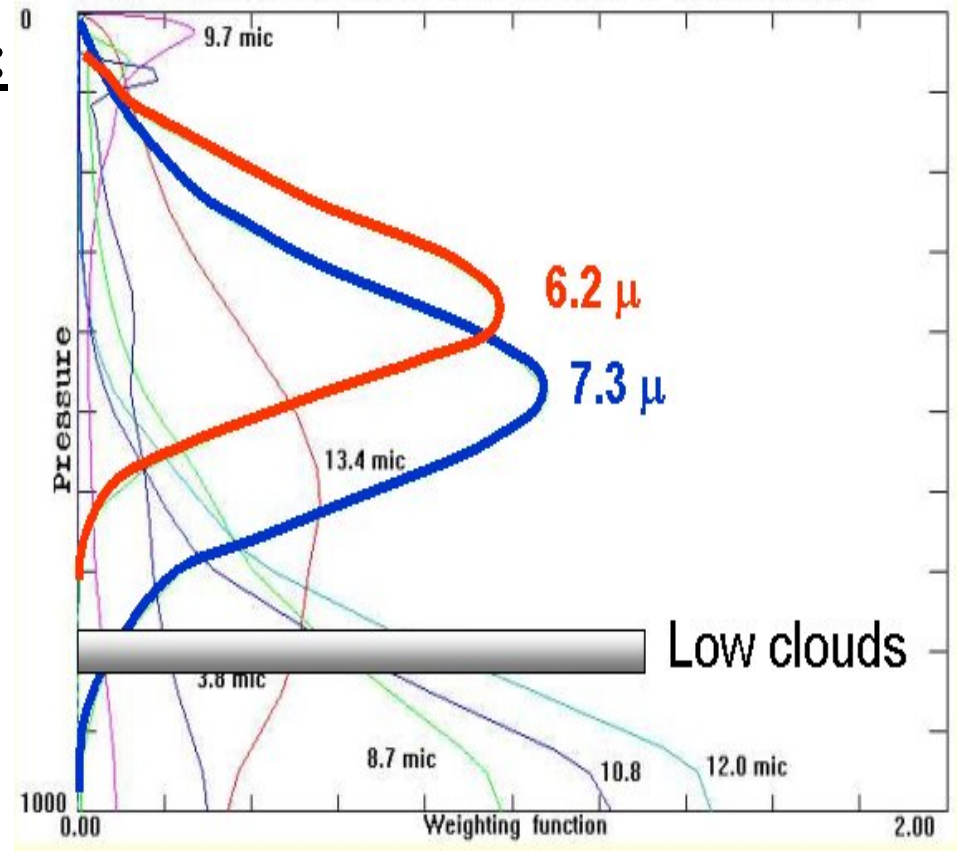
# ALADIN-AMMA: satellite data

## Use of SEVIRI (MSG-1)

### Radiances in 3d-var ALADIN:

- **WV(2)**: over sea/land – clear (low clouds accepted for 6.2  $\mu$  Channel)
- **IR (3)** : over sea – clear (8.7 $\mu$  + 10.8  $\mu$  + 12.1  $\mu$ )

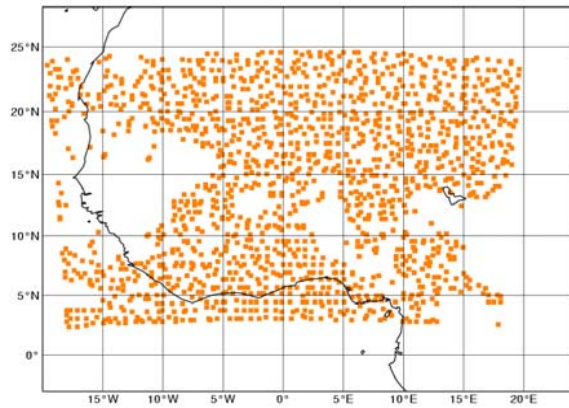
Screening -Thinning: 1 pixel in a 70x70km square.



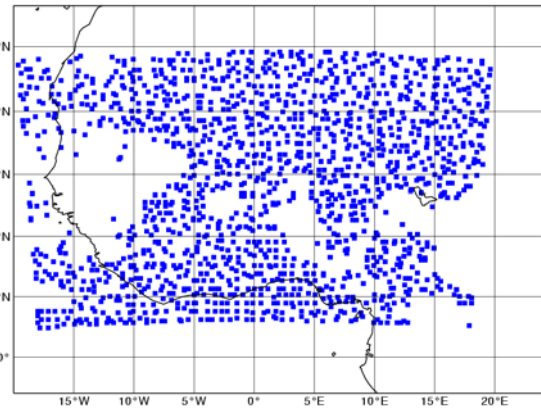
AMMA region: 70% of the data (mainly WV channels)

# ALADIN-AMMA: satellite data

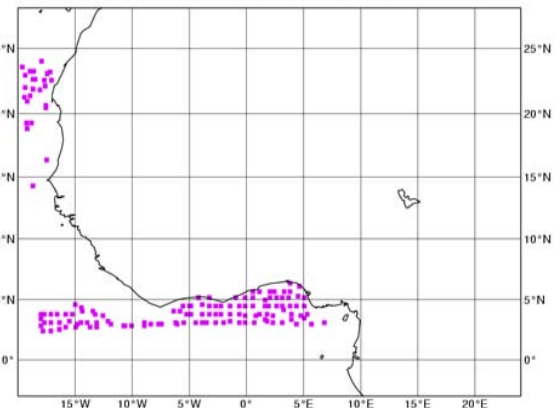
METEOSAT-8 WV7.3 20050822-12UTC



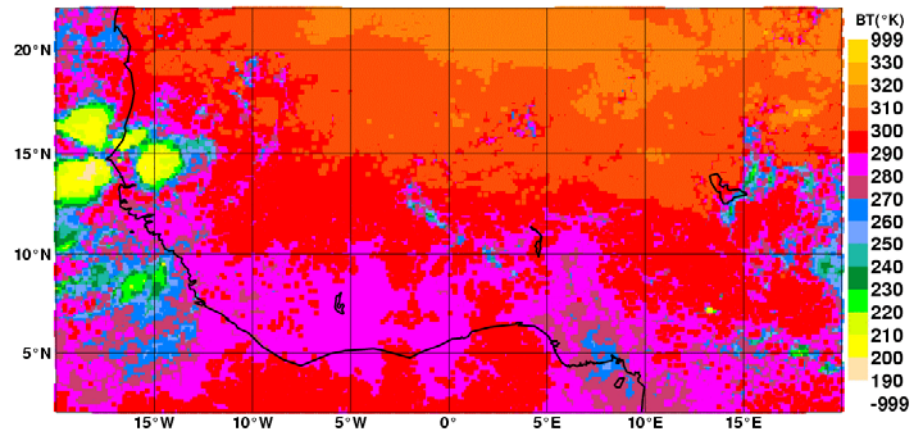
METEOSAT-8 WV6.2 20050822-12UTC



METEOSAT-8 IR8.7 20050822-12UTC

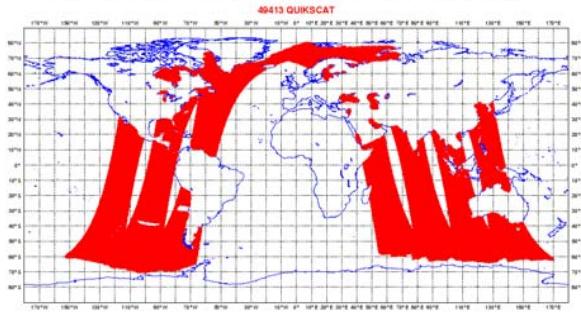


METEOSAT-8 IR8.7 20050822 12UTC

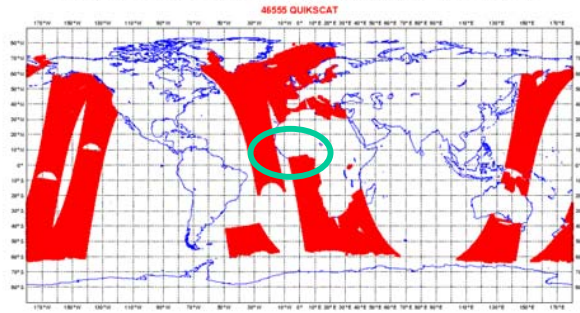


# ALADIN-AMMA: satellite data

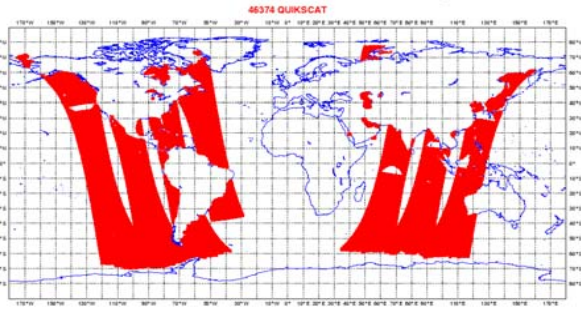
METEO-FRANCE couverture de donnees - DIFFUSIOMETRE  
2005/11/22 00H UTC cut-off long  
Nombre total d'observations avant screening : 49413



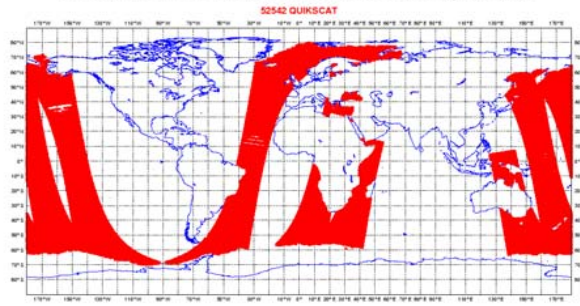
METEO-FRANCE couverture de donnees - DIFFUSIOMETRE  
2005/11/22 06H UTC cut-off long  
Nombre total d'observations avant screening : 46555



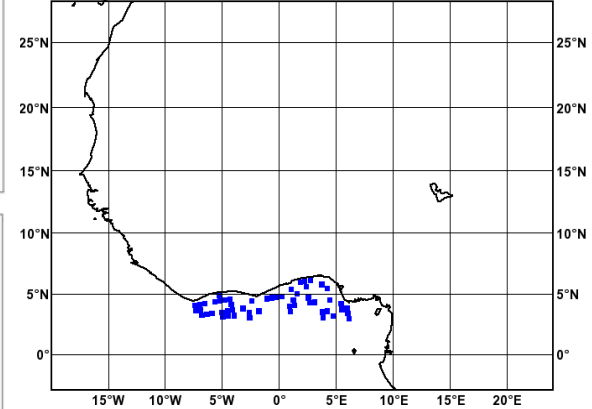
METEO-FRANCE couverture de donnees - DIFFUSIOMETRE  
2005/11/22 12H UTC cut-off long  
Nombre total d'observations avant screening : 46374



METEO-FRANCE couverture de donnees - DIFFUSIOMETRE  
2005/11/22 18H UTC cut-off long  
Nombre total d'observations avant screening : 52542



QSCT 20050821-06UTC

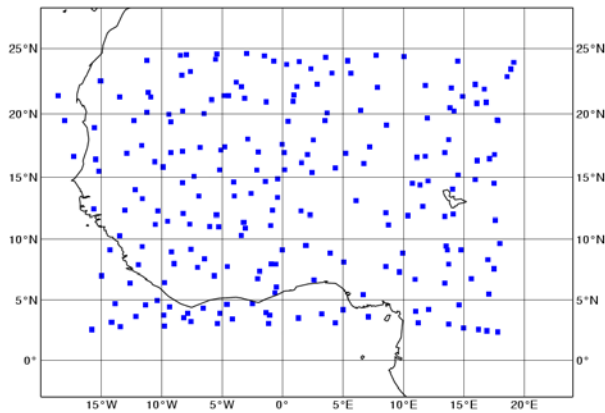


# ALADIN-AMMA: satellite data

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KARBOU *et al.*

**HIRS 20050822-12UTC**



**AMSU 20050822-12UTC**

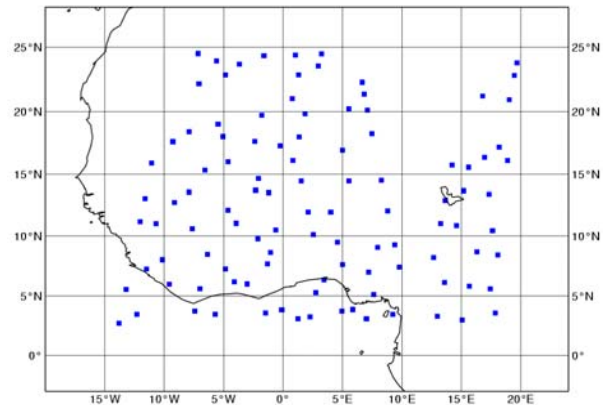


TABLE 1. AMSU-A AND -B CHARACTERISTICS AND CONDITIONS FOR USE

Channel	Frequency (GHz)	Noise equivalent (K)	Conditions
=====			
AMSU-A			
=====			
1	23.8	0.20	not used
2	31.4	0.27	not used
3	50.3	0.22	not used
4	52.8	0.15	not used
5	53.596±0.115	0.15	not used
6	54.4	0.13	used if (clair sky, sea ice)
7	54.9	0.14	not used if (cloudy,  lat  ≤ 30°)
8	55.5	0.14	not used if (cloudy,  lat  ≤ 30°)
9	ν=57.290	0.20	used
10	ν±0.217	0.22	used
11	ν±0.322±0.048	0.24	used
12	ν±0.322±0.022	0.35	used
13	ν±0.322±0.010	0.47	not used
14	ν±0.322±0.0045	0.78	not used
15	89	0.11	not used
=====			
AMSU-B			
=====			
1	89	0.37	not used
2	150	0.84	not used
3	183±1	0.60	used if (sea, clear sky)
4	183±3	1.06	used if (sea, land and orog ≥ 1000m, clear sky)
5	183±7	0.70	used if (sea, land and orog ≥ 1500m, clear sky)

# ALADIN-AMMA: experimental design

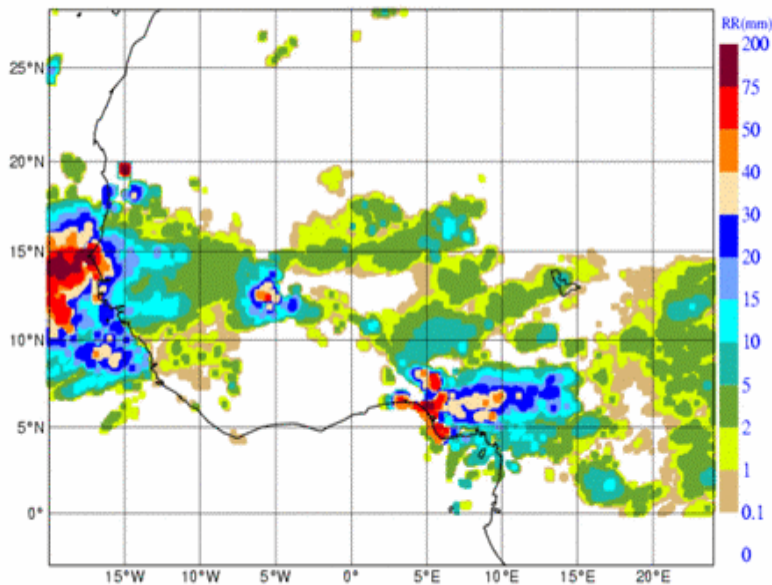
	INITIAL CONDITIONS
ADAP	Interpolation of 4d-var ARPEGE analysis (conv. +satellite+Quikscatt)
MSG1	3d-var ALADIN analysis (conv. + satellite (incl. MSG1))
QSCT	3d-var ALADIN analysis (conv+satellite (incl. MSG1) +Quikscatt)

MSG1= current operational ALADIN suite at MF

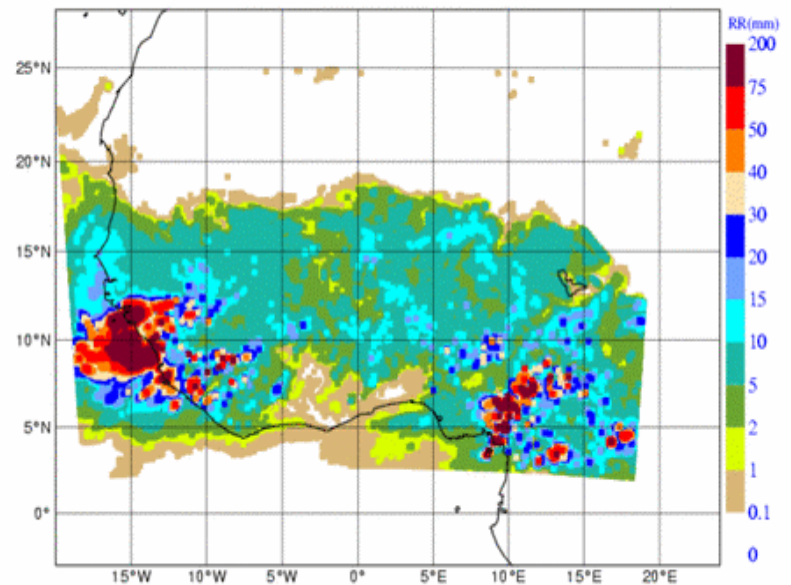
# ALADIN-AMMA: results

**FOCUS** on cumulated rainfall from 06-UTC(J) to 06UTC(J+1): P30-P6

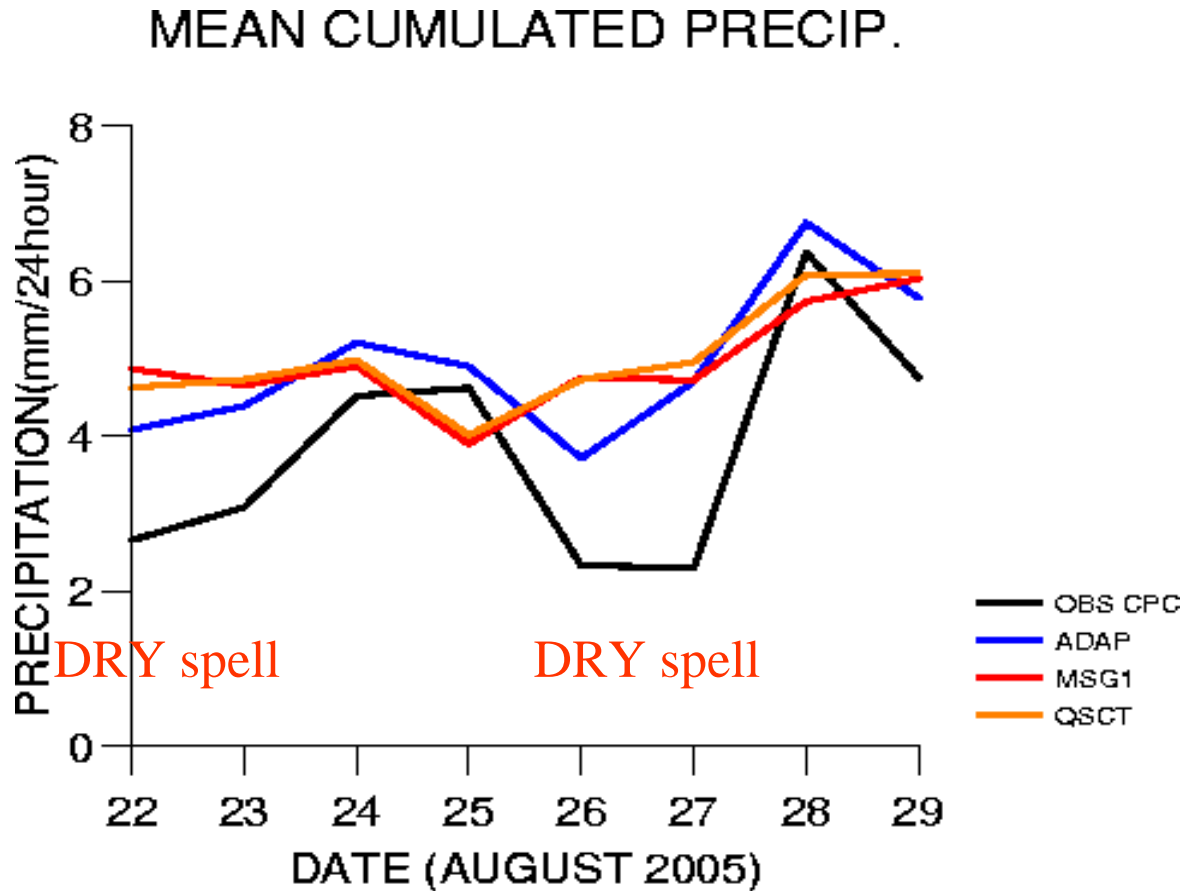
OBS 20050822



ALA\_QSCT 20050822 (06-30)



# ALADIN-AMMA: results



# QPF VALIDATION

- Comparison of 24 hour rainfall amounts (06UTC(J) – 06UTC(J+1)) for the « dry-run » period
- « Truth » = NOAA-CPC estimation (resolution 10km, daily)
- Methodology: interpolation of the « observation » at model gridpoint + objective scores (correlation, ETS)

# QPF VALIDATION

- **R~0.35** for all runs i.e ADAP, MSG1 or QSCT.
- **Bias** in almost all simulations (except when weak rain observed) ~ +40%

MSG1 slightly better than ADAP  
 QSCT the best

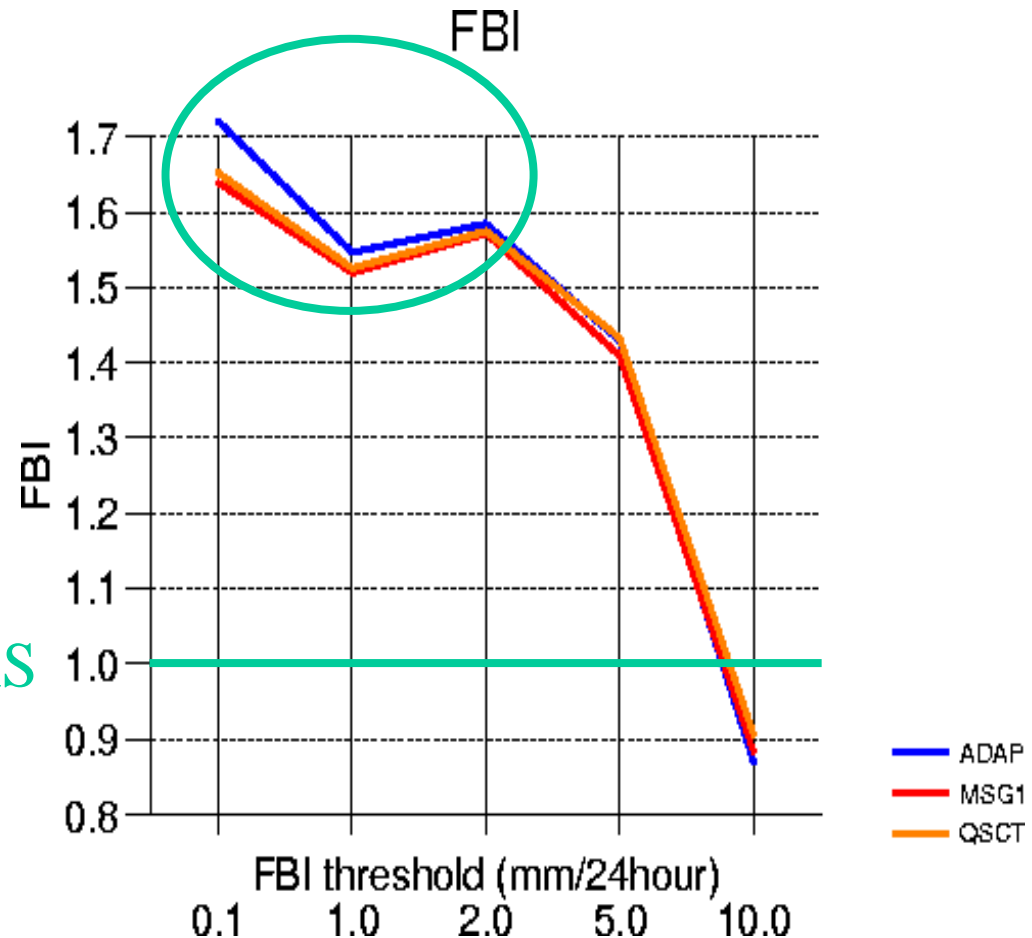
"06-30"	ADAP	MSG1	QSCT
<b>22/08/2005</b> (2.44mm/24h)	0.26 54%	0.30 83%	0.33 74%
<b>23/08/2005</b> (2.87mm/24h)	0.36 42%	0.34 51%	0.38 53%
<b>24/08/2005</b> (4.14mm/24h)	0.32 15%	0.28 8%	0.27 10%
<b>25/08/2005</b> (3.92mm/24h)	0.41 6%	0.42 -16%	0.34 -13%
<b>26/08/2005</b> (1.99mm/24h)	0.41 59%	0.42 104%	0.45 103%
<b>27/08/2005</b> (2.55mm/24h)	0.48 104%	0.35 105%	0.32 116%
<b>28/08/2005</b> (6.37mm/24h)	0.38 6%	0.40 -10%	0.42 -5%
<b>29/08/2005</b> (4.75mm/24h)	0.16 22%	0.19 27%	0.22 28%
<b>SUMMARY</b>	2	1	5
	2	6	0
	4	1	3

# QPF VALIDATION

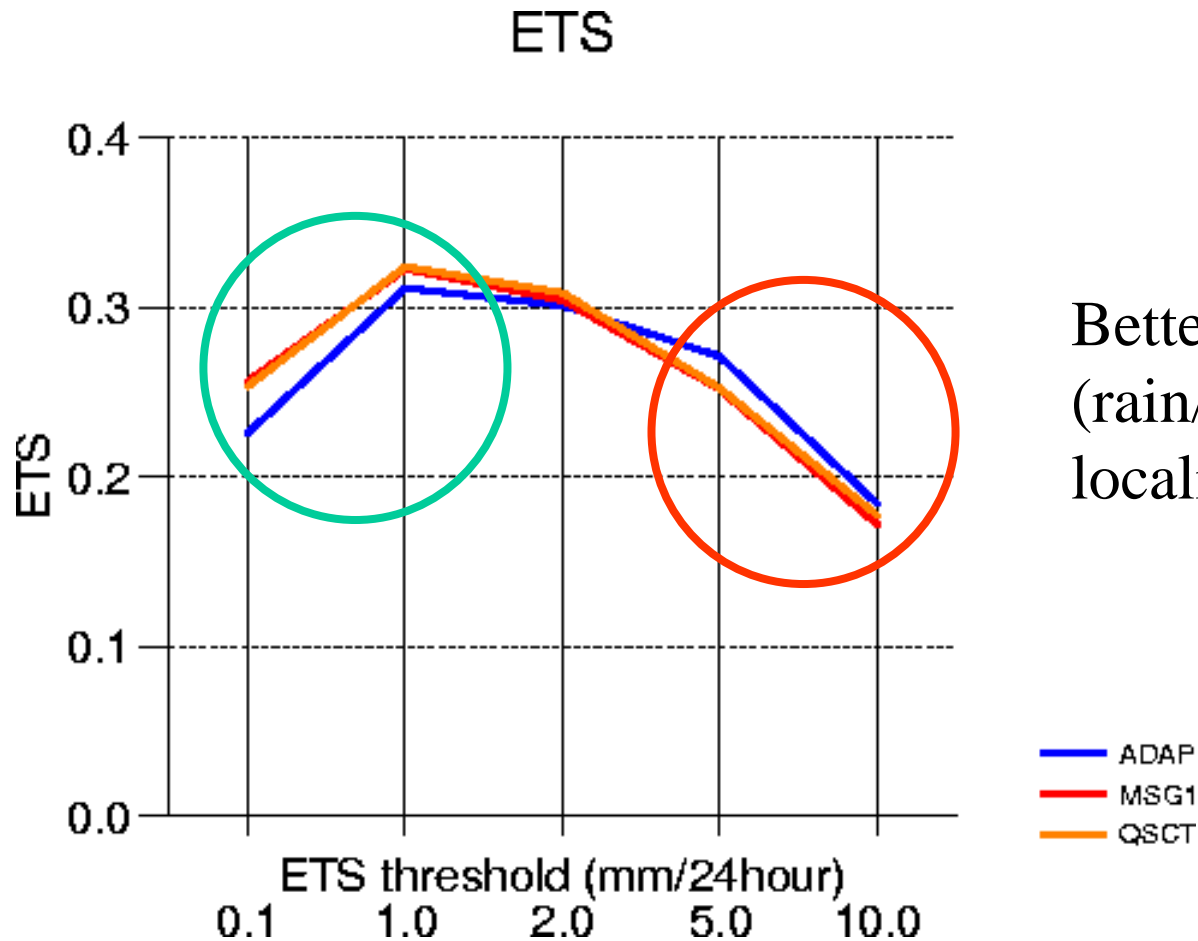
- Frequency bias:

$$\text{FBI} = \frac{\text{NB forecast} > T}{\text{NB observation} > T}$$

NULL BIAS



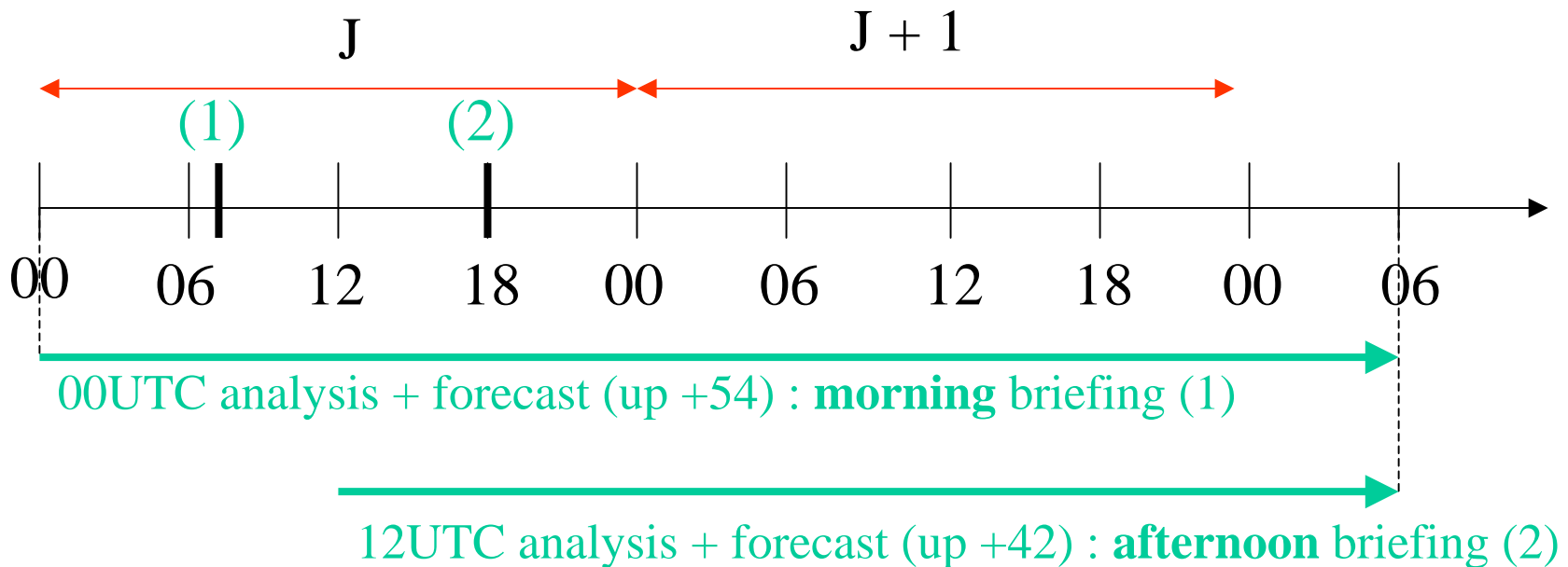
# QPF VALIDATION



Better discrimination  
(rain/no rain), *but* worse  
localisation for maxima.

# ALADIN-AMMA 2006

- Numerical support for AMMA Operational Center (AOC - Niamey) during the field campaign (2006 monsoon)
- Run from 00UTC and 12UTC analysis



# CONCLUSION

- **Weak positive** impact of **SEVIRI data**
- **Positive** impact of **Quikscatt data**
- **Bias** problem
- **Poor skill** in predicting **dry spells** (suppressed convection)

## Future work (ongoing):

- **Model:** Bias problem mainly linked to physical package (convection scheme, soil coupling...)
  - Current work to identify the contribution of the physical package
  - Improvements expected
- **Data assimilation:**
  - Use of AMSU data over land (F.Karbou)
  - Tuning of the assimilation of SEVIRI data (MSG1)