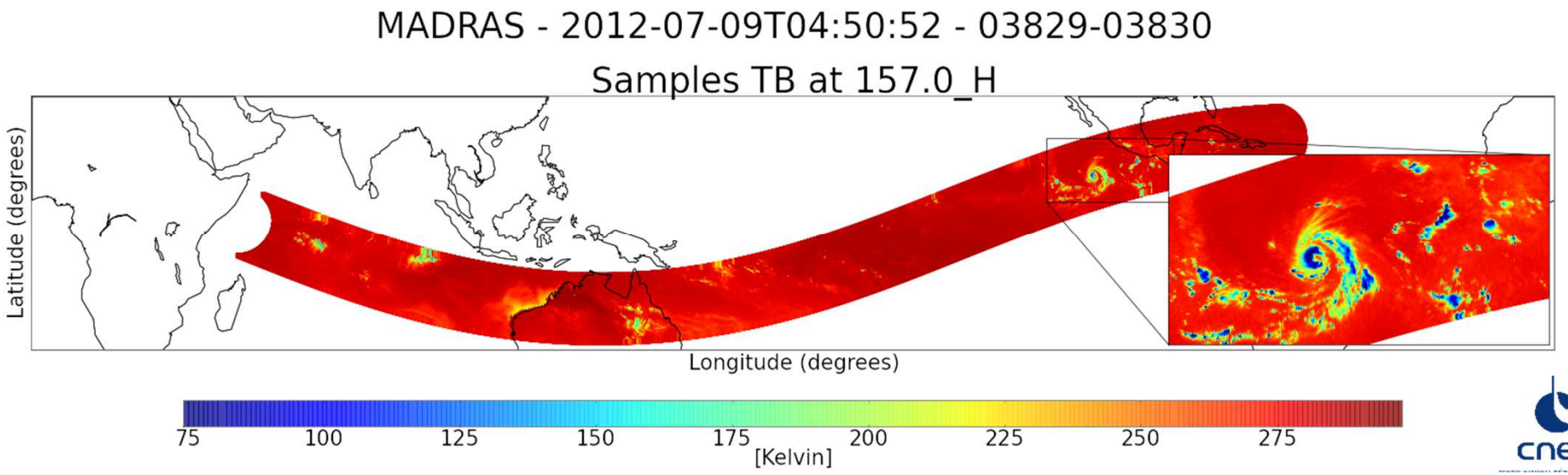
The Megha-Tropiques mission

Rainfall activities Status



Rémy Roca and the MT Mission group

The Megha-Tropiques mission

Overview

Indo-french mission realized by

The Indian Space Research Organisation (ISRO) and the

Centre National d'Etudes Spatiales (CNES)

Megha means cloud in sanskrit and tropiques means tropics in french

Dedicated to the

Water and energy cycle in the Tropics

Low inclination on the equator (20°);

865 km height Launched on October 12th, 2011

High repetitivity of the measurements

The Megha-Tropiques mission
Scientific objectives

- Atmospheric energy budget in the intertropical zone and at system scale (radiation, latent heat, …)

- Life cycle of Mesoscale Convective Complexes in the Tropics (over Oceans and Continents)

- Monitoring and assimilation for Cyclones forecasting. NRT Activities

Note that SAPHIR L1A v1.05 are now reaching EUMETSAT for further RT dissemination via EUMETCAST (2nd semester 2013). POC at EUMETSAT: Simon Elliot.

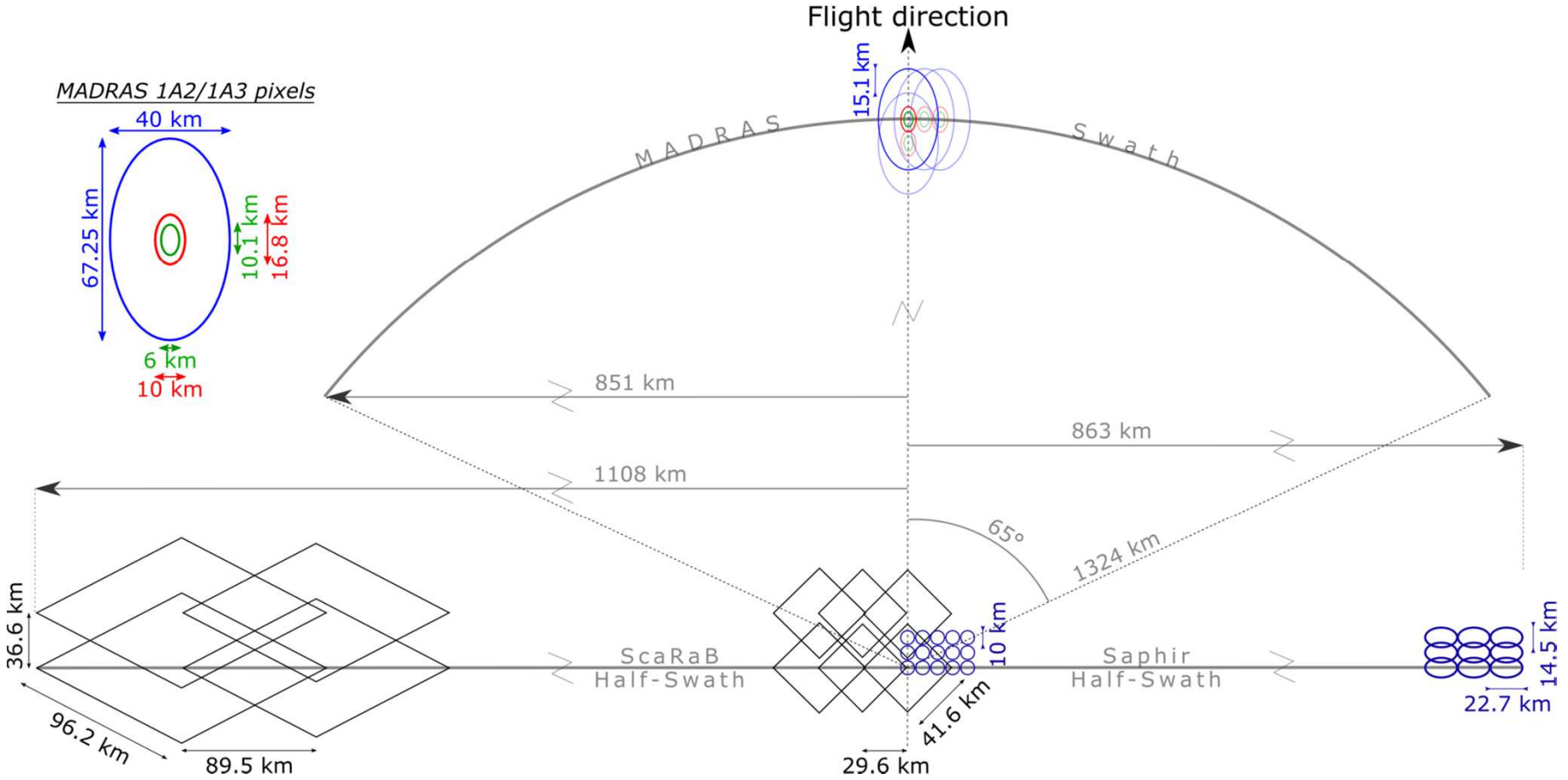
- Hydrometeorology, flood analysis/forecasting

More on the science activities at:
http://megha-tropiques.ipsl.polytechnique.fr

Payloads
MADRAS and SAPHIR

•**MADRAS** : microwave imager for precipitation : channels at 18, 23, 37, 89 and 157 GHz, H and V polarisations. (conical swath, <10 km to 40 km)

•**SAPHIR** : 183GHz 6 channels sounder (Xtrack, 10km at nadir)



Payloads and performance

MADRAS

Observation :Random phenomena

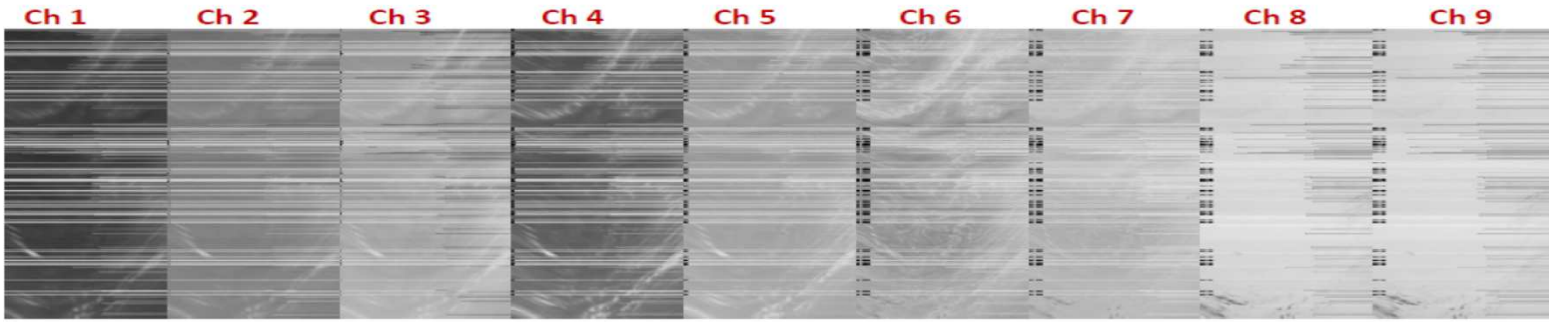
Earth data contain some incorrect random data followed by fixed filled

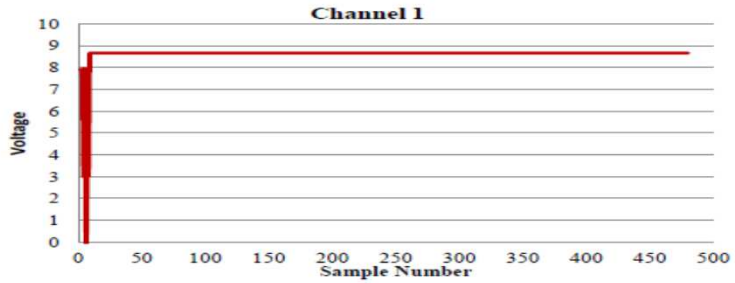
➔Data of the scan are lost

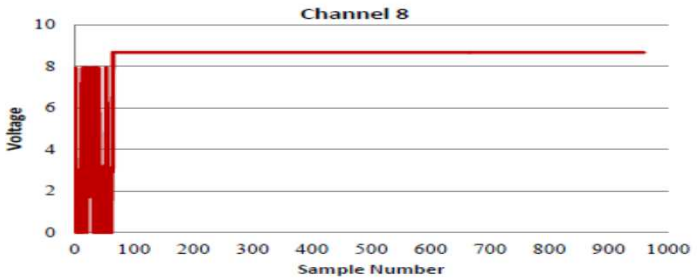
This may affect calibration zones

Cause : Electrical interference

Glitch on the synchronization DATA WINDOW signal defining acquisition windows



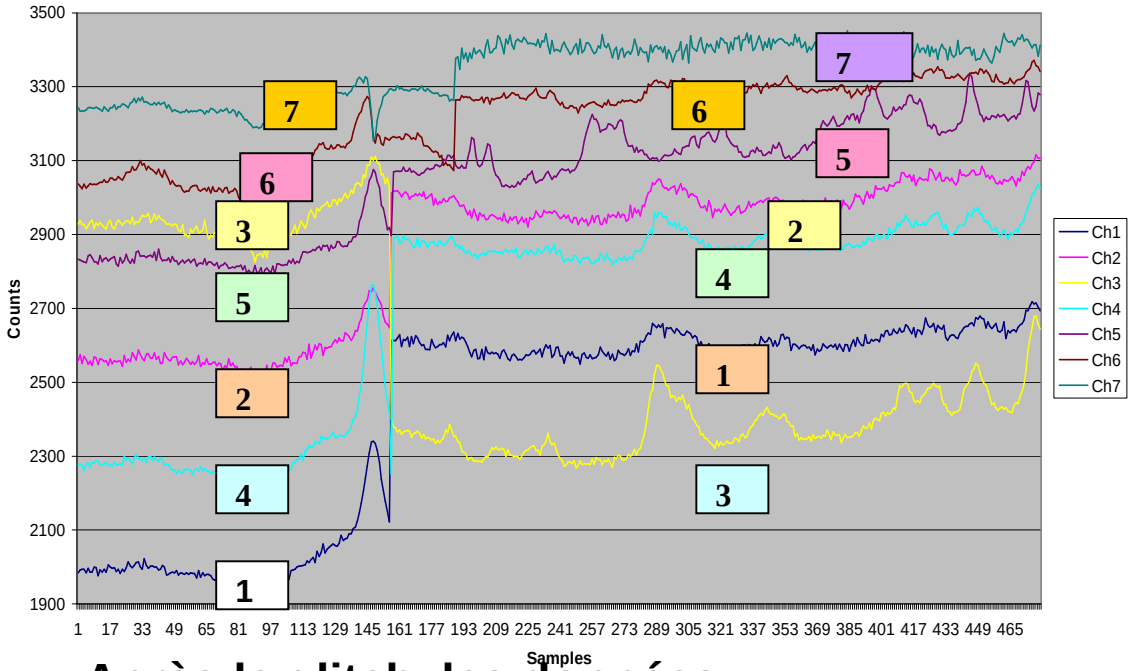




Courtesy N. Karouche, CNES

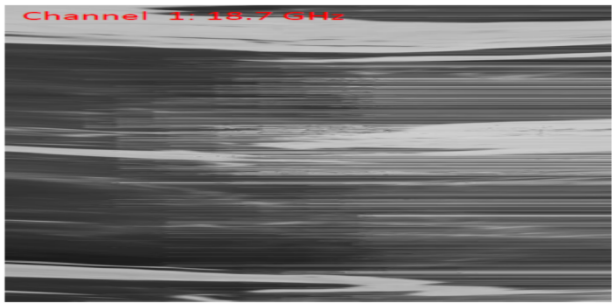
Payloads and performance

MADRAS



Observation : mixup of channel data

Cause : Electrical interference ➔Glitch on signal circulating along the data

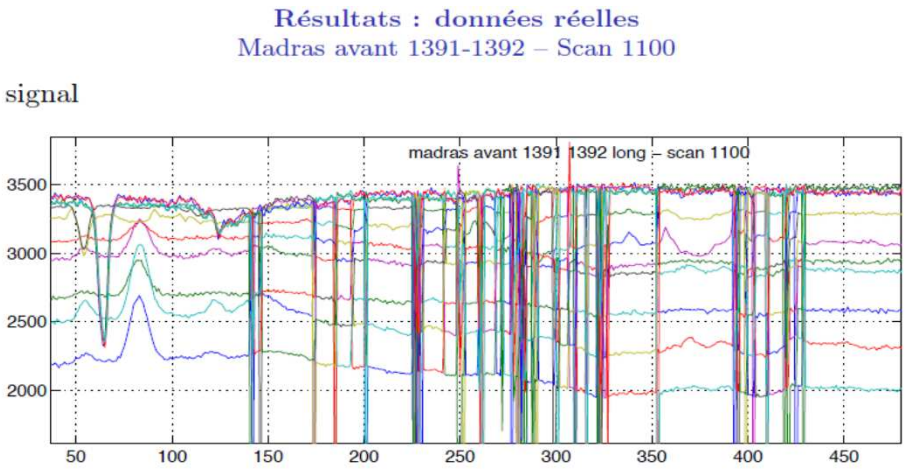


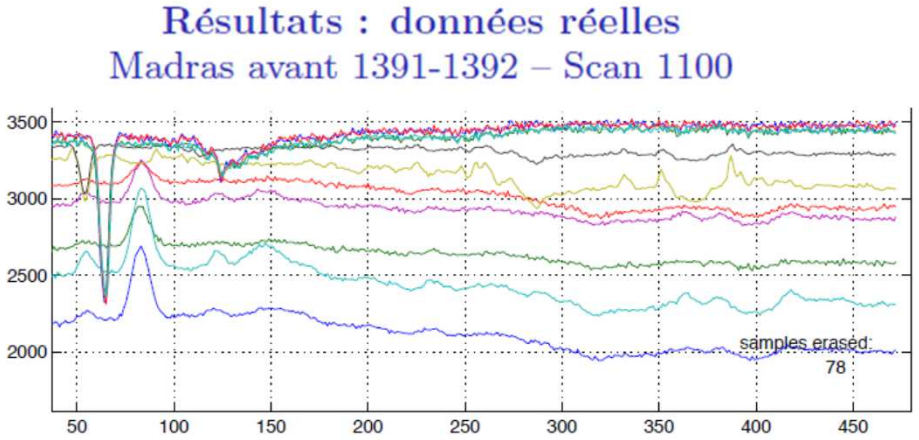
Après le glitch, les données :

- **canal 3 contiennent celles du 4**
- **canal 1 contiennent celles du 2**
- **canal 4 contiennent celles du 5**
- **canal 2 contiennent celles du 3**
- **canal 5 contiennent celles du 6**
- **canal 6 contiennent celles du 7**
- **Canal 7 contiennent celles du 8**
- **Canal 8 contiennent celles du 9,9**
- **Canal 9 contiennent celles du 1,8**

Courtesy N. Karouche, CNES

Payloads and performance
MADRAS: correction example





Courtesy: N. Karouche, CNES

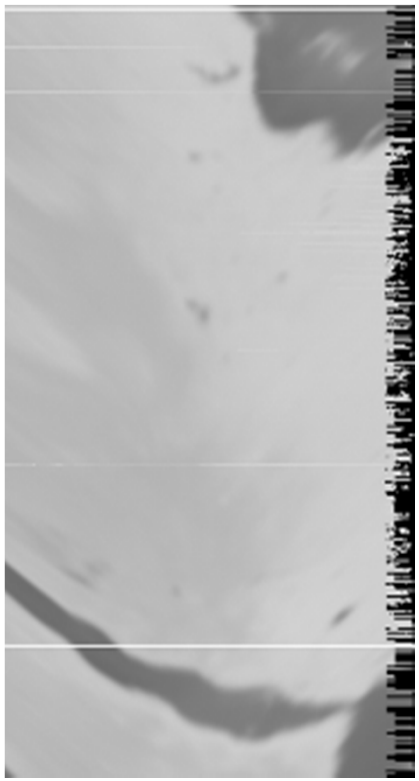
Method for anomaly correction

- only erroneous scans processed for corrections
- No interpolation
- Lost data are declared Invalid
- Difficulties encountered in case of multiple jumps
- Specific processing for calibration zone
- No recovery in case of saturation of data
- Performances for Anomaly 1 :

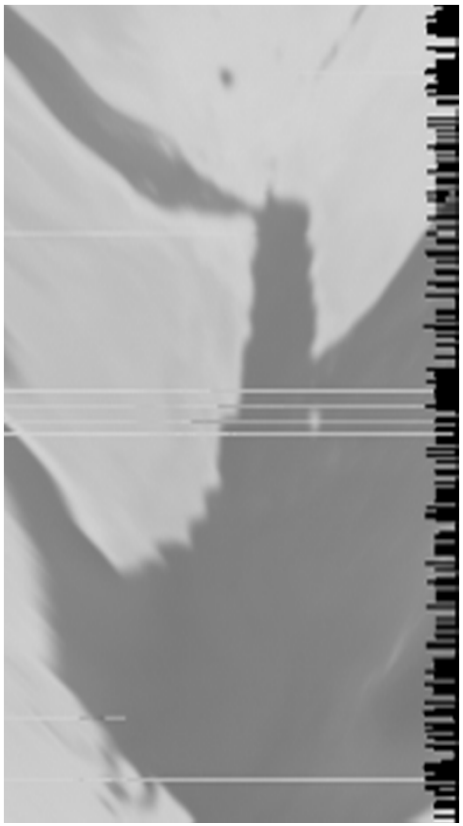
Superior to 90%

- Further improvement under analysis

Payloads and performance
MADRAS: correction example



Zoom orbite1331



Zoom orbite1331

Courtesy: N. Karouche, CNES

Payloads and performance
MADRAS in summary

•**MADRAS : microwave imager for precipitation : channels at 18, 23, 37, 89 and 157 GHz, H and V polarisations. (conical swath, <10 km to 40 km)**

Source: N. Karouche, CNES

- ❑ **No anomaly in MARFEQ microwave assemblies➔ intrinsic performances maintained since launch**
- ❑ **The glitch issue is patched (v1.05)**
- ❑ **Since January 29th 2013, no more data acquisition : serious anomaly under investigation by the space agencies**

MADRAS is still in commissioning phase restricted to the 2009 IAO PIs

http://smsc.cnes.fr/MEGHAT/index.htm

The Megha-Tropiques mission
Status of the L1 data

L1 Product	Collection/Version	Period
MADRAS L1A/L1A2 (segment wise)	C0/V1.02	2011-10-13 -> 2011-12-11
	C1/V1.05	june 2012
SAPHIR L1A/L1A2 (segment wise)	C0/V1.02,V1.03,V104	2011-10-13 -> 2013-01-24
	C1/V1.05	june 2012; 2013-01-24-> on going
SAPHIR L1A (orbit wise)	**C1/V1.05**	2013-01-24-> on going

More information S. Cloché (sbcipsl@ipsl.jussieu.fr)

Collection 1/V1.05 :

-For MADRAS: anomaly Correction Algorithm implementation + additional Flags
Gain /offset management Correction of errors in Radiometric processing SW
New file naming convention + in General attribute name of L0 file added

-For SAPHIR: Based on latest calibration results, correction of Pixel location
Change on some thresholds for count validity
New file naming convention + in General attribute name of L0 file added

Collection 0/V1.02,1.03,1.04 : preliminary radiometric and geometric calibrations

The Megha-Tropiques mission
The products (1/3)

Rainfall and water vapor

Megha-Tropiques Level-2 "Day 1" (i.e. at launch) science products

Retrieved parameter	Product Name	Sensor	Spatial Resolution	No. of Overpasses	Science Team Release	Public Release
Level-2 Precipitation (Instantaneous)				PI: N. Viltard (IPSL/LATMOS)		
Surface Rainfall Convective Rainfall Retrieval error Liquid Cloud content profile Liquid precipitation content profile Ice Cloud content profile Ice Precipitation content profile	L2-RAIN	MADRAS	20 km	1-6 times/day 28°S/28°N	2013	2013
Level-2 Water Vapor - Non precipitating conditions (Instantaneous)				PI: H. Brogniez (IPSL/LATMOS)		
Relative humidity profile Total Column water vapor	L2-RH	SAPHIR-MADRAS	10 km at nadir	1-6 times/day 28°S/28°N	2013	2013
Upper Tropospheric Humidity	L2-UTH	SAPHIR	10 km at nadir	1-6 times/day 28°S/28°N	2013	2013

The Megha-Tropiques mission
The products (2/3)

Radiation and clouds

Level-2 Radiative Budget (Instantaneous)				PI: O. Chomette (IPSL/LMD)		
LW, SW TOA outgoing fluxes Unfiltered Radiance Albedo	L2-FLUX	ScaRaB	40 km at nadir	1-7 times/day 30°S/30°N	2013	2013
LW, SW TOA outgoing fluxes Albedo	L2B-FLUX	ScaRaB	1 deg.	1-7 times/day 30°S/30°N	2013	2013
Level-2 Geostationary Cloud Products (Based on SAFNWC algorithms)				PI: G. Sèze (IPSL/LMD)		
Cloud mask	GEOCLD_CMa	MSG,MTSAT, GOES	3 or 4 km	every 15 or 30 min	2013	2013
Cloud type classification	GEOCLD_CT	MSG,MTSAT, GOES	3 or 4 km	every 15 or 30 min	2013	2013
Cloud top characterization	GEOCLD_CTTH	MSG,MTSAT, GOES	3 or 4 km	every 15 or 30 min	2013	2013

The Megha-Tropiques mission
The products (3/3)

Megha-Tropiques Level-4 science products						
Retrieved parameter	**Product Name**	**Sensor**	**Spatial Resolution**	**Composite Period**	**Science Team Release**	**Public Release**
Level-4 Surface accumulated rainfall					PI: R. Roca (OMP/LEGOS)	
Surface rainfall Estimated error	L4-TAPEER	MADRAS,SSMI,SSMIS,TMI MFG,MSG,MTSAT,GOES	1 deg	daily	2013	2013
Level-4 MCS composite - Composite life cycle of MCS					PI: R. Roca (OMP/LEGOS)	
Rainfall	L4-MCS-RAIN	MADRAS MFG,MSG,MTSAT,GOES	5 tropical regions	Seasonal	2013	2013
Radiation	L4-MCS-FLUX	ScaRaB MFG,MSG,MTSAT,GOES	5 tropical regions	Seasonal	2013	2013

The information on the readiness and distribution of all the french MT products
And the Level 1 data set

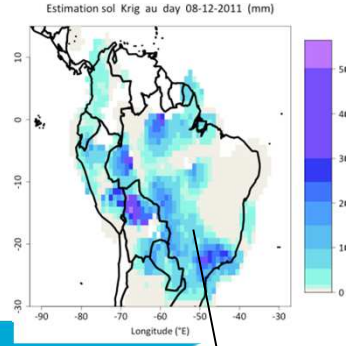
http://www.icare.univ-lille1.fr/mt

A tropical validation plan (1/3)

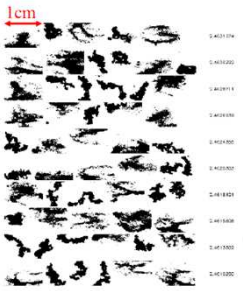
A multi continental plan for validation

ISRO-CNES

megha-tropiques



MT algo val 1 8/2010



AMERIQUE

AFRIQUE

AS

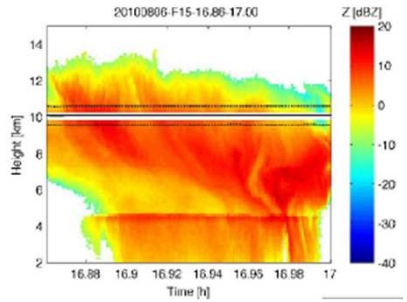
Brazil
& CHUVA

Burkina Faso
Super site

Kabinhi

CINDY-
DYNAMO

Darwin

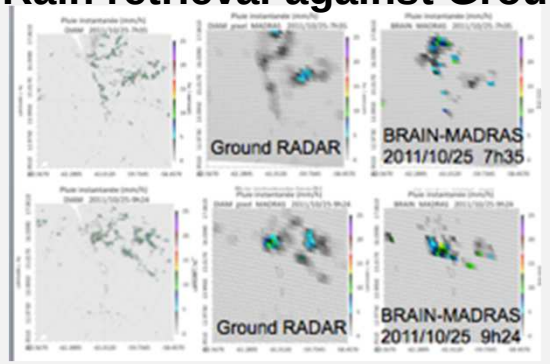


+ Meteo-France weather radar

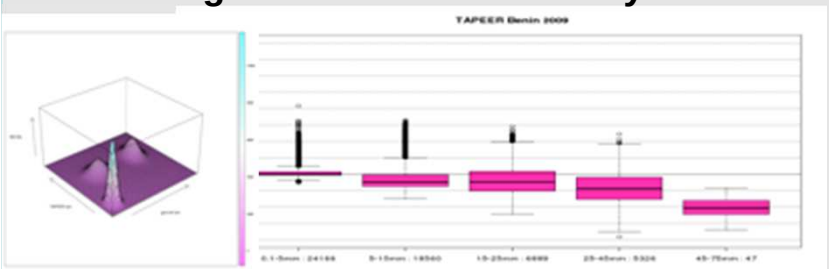
A tropical validation plan (2/3)

Quick overview on rainfall

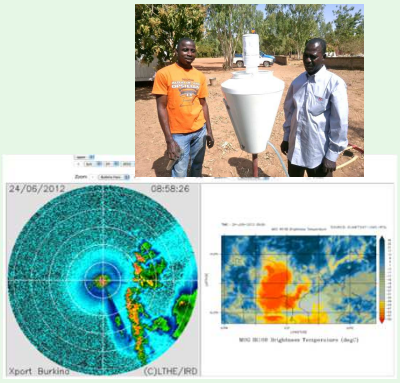
Rain retrieval against Ground radar



Accounting for Grd Ref uncertainty



The Ouagadougou Validation Super Site !



- ✓ **Inter tropical GV data set since launch collected**
- ➢ **Waiting for MADRAS derived products**

- ✓ **Preliminary GV on partial data set for OND 2011**
  - **TAPEER over South american gages network**
  - **BRAIN over Tropical operationnal Radar (Meteo-France ; Darwin) ;**

- ✓ **Integration of uncertainties in the validation diagnostic**

- ✓ **Active radar based super site in Ouagadougou**

Excellent field campaign in 2012 – a very rainy season with strong events / floods.

84 cases - 50 days with MT overpass

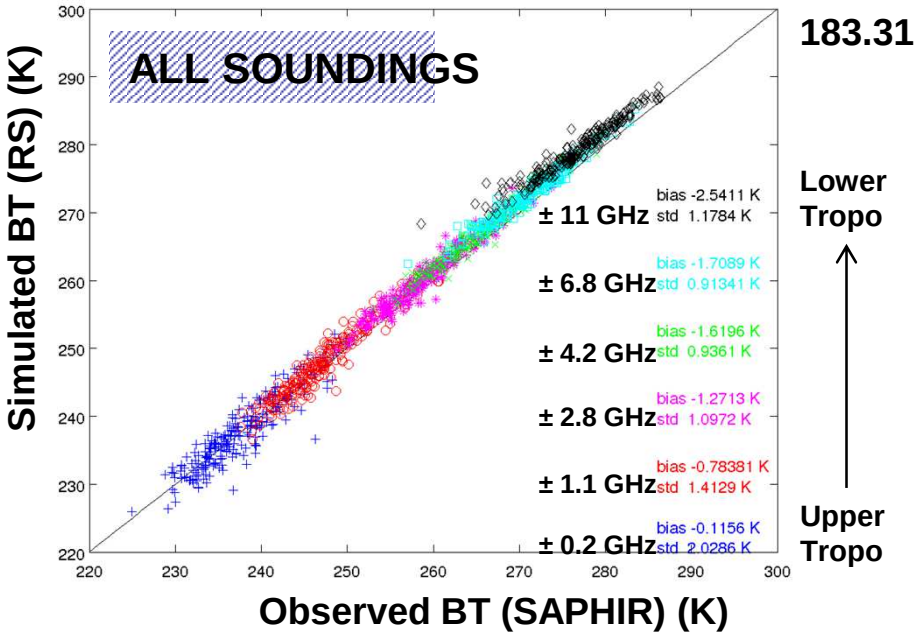
One more radar campaign in summer 2013

A tropical validation plan (3/3)

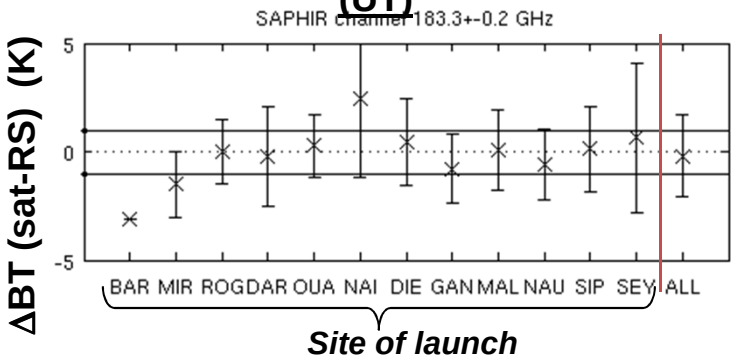
Some preliminary results for SAPHIR

Courtesy of Gaëlle Clain & Hélène Brogniez (LATMOS)

CINDY-DYNAMO campaign measurements (> 5000 RS92 soundings)
Data thanks to : R. Johnson, P. Ciesielski (CSU) & K. Yoneyama (JAMSTEC) & C/D team
Ouagadougou/Burkina Faso (summer 2012 : 64 RS92)



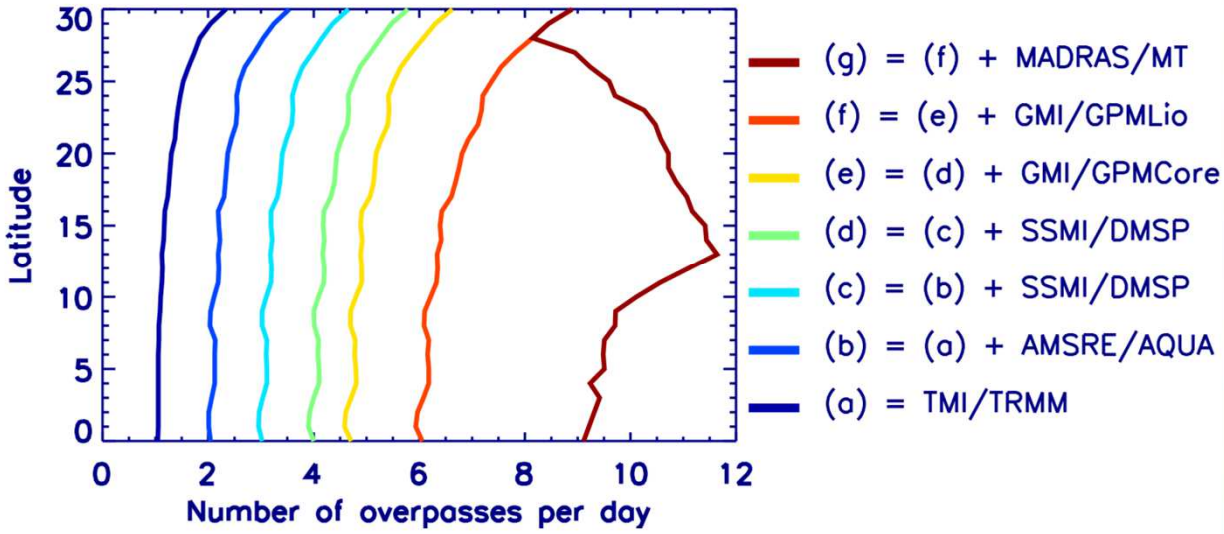
Summary according to site for 1 channel (UT)



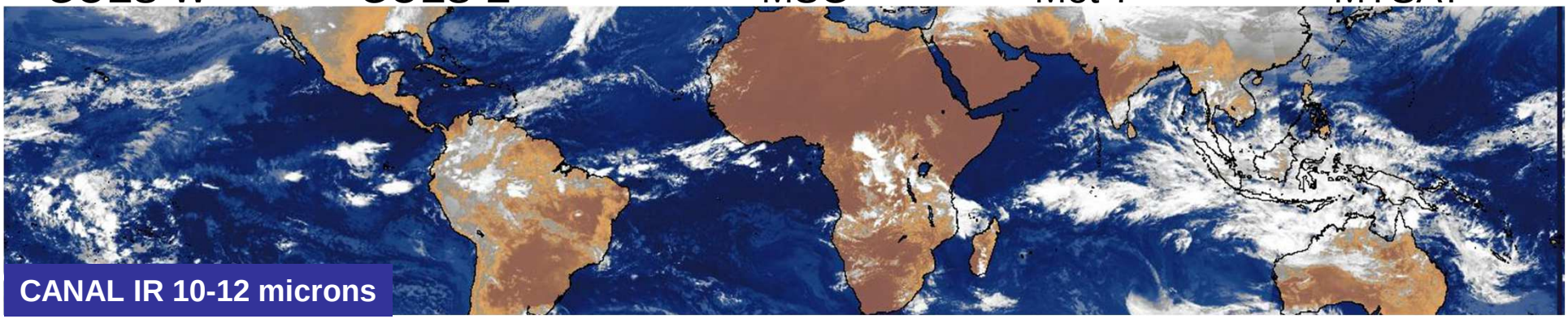
The products that are anticipated

And that will benefit from the GPM efforts

The TAPEER retrieval for accumulated estimates of surface rainfall (Tropical Amount of Precipitation with Estimate of ERors



GOES-W GOES-E MSG Met-7 MTSAT

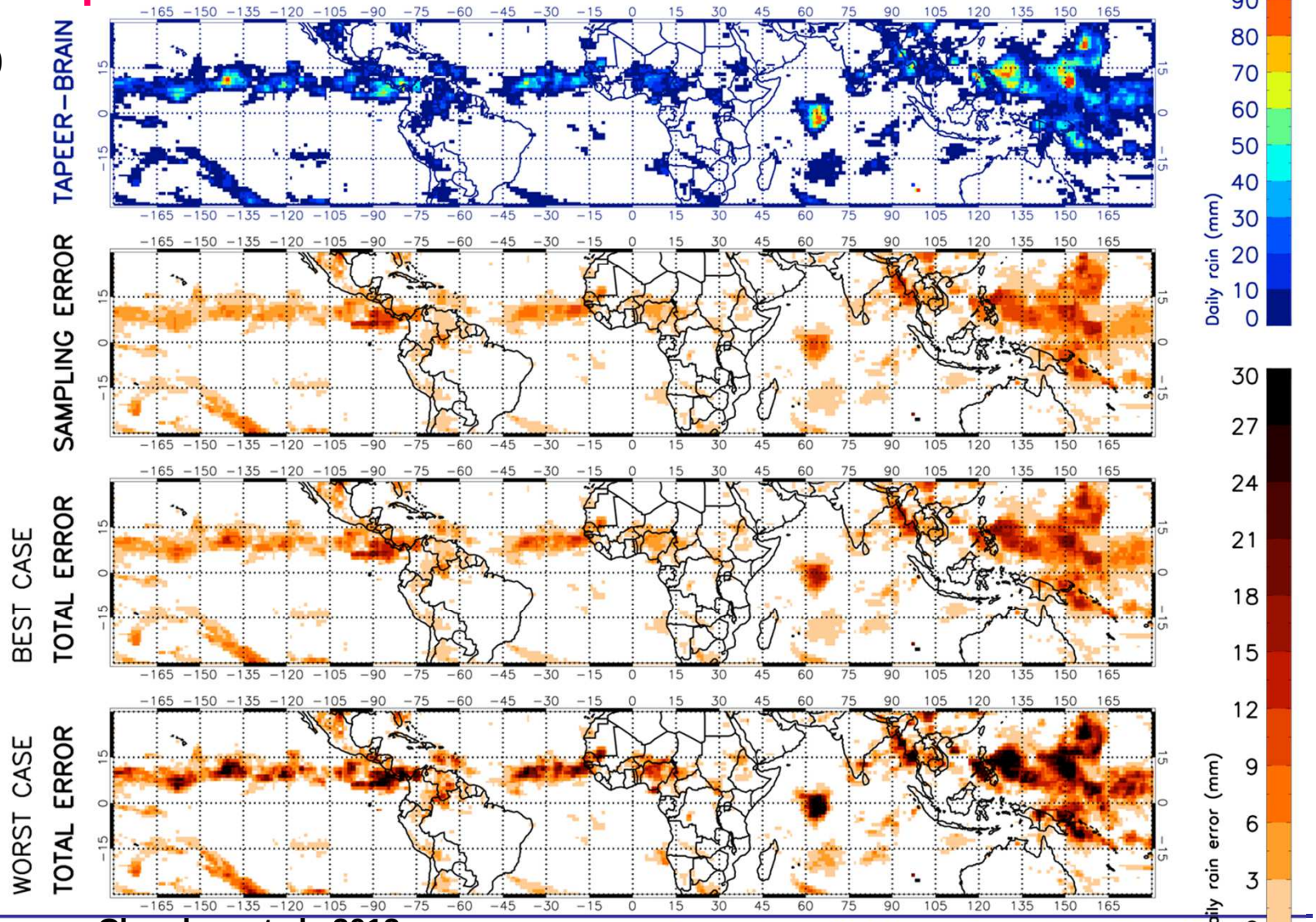


CANAL IR 10-12 microns

Tropical Amount of Precipitation with Estimation of ERrors

Ingesting multi plateform BRAIN instantaneous rain

30 July 2009



20% bias on BRAIN Intermediate instantaneous rainrates

60%

Chambon et al., 2012

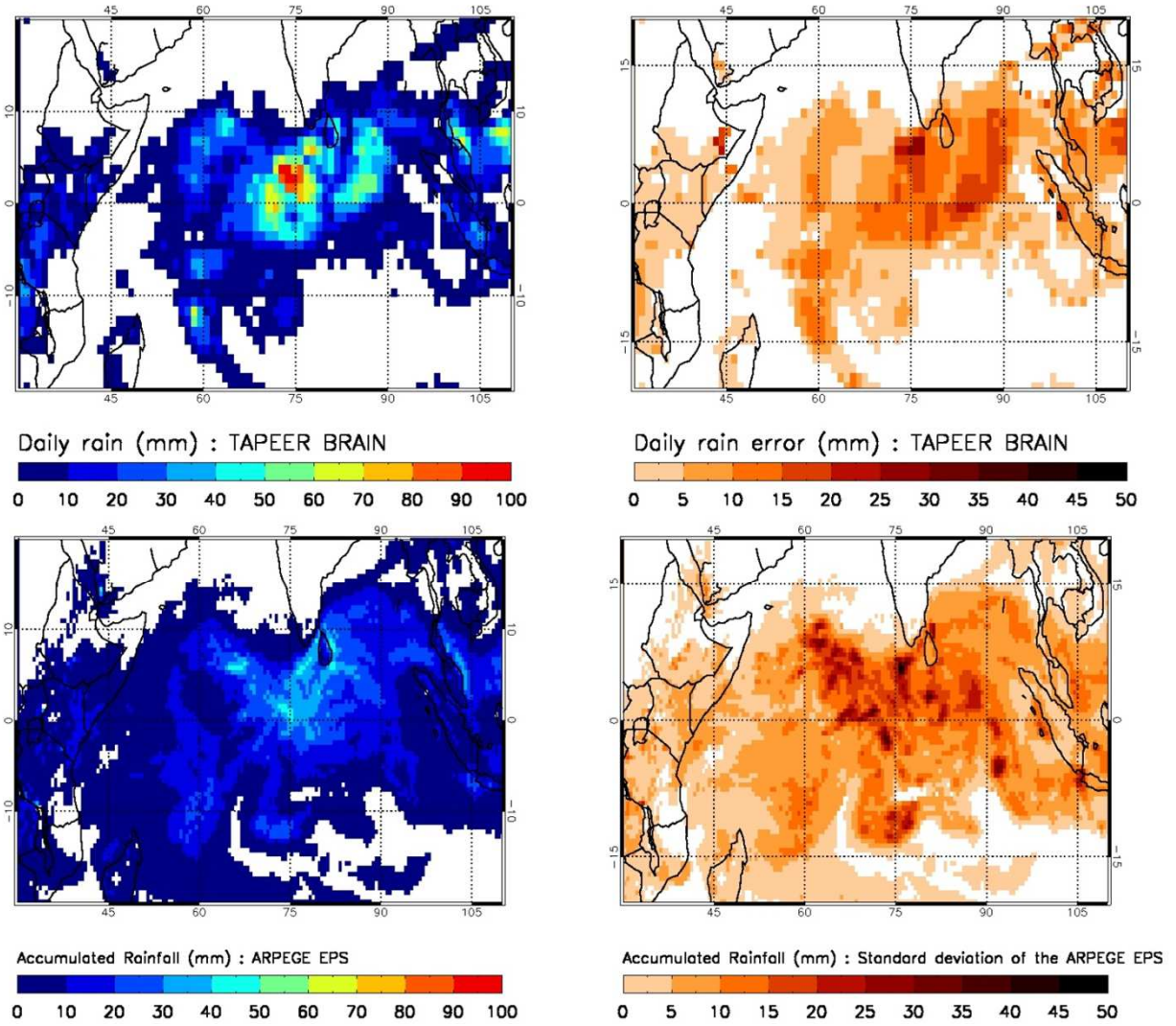
Preliminary studies using the errors

Validation of Meteo-France Ensemble Prediction System

CINDY DYNAMO campaign

TAPEER (no Madras)

From 2011/11/23 06h, to 2011/11/24 06h



The Megha-Tropiques mission

The french science team

First colloquium in June 2008 à La Rochelle
Second colloquium in March 2012 à Bordeaux
Arounnd 60 participants during 3 days
A community:

-pan-national CNRM, GET, IPSL, ICARE, LA, LAMP, LATMOS,LEGOS, LTHE, LOA, LOCEAN, LMD

-multi-institutionnal: INSU, IRD,CNES Météo-France Universités

-tropical: West Africa, Brazill, India, Indian Océan

Tropical meteorology
(Recherche et Prévisions)

TAPEER, PWAT, Profiles RH, campagnes

Hydrologie and Surface

TAPEER, TAPEER-H, campagnes

MCS life cycle process

BRAIN, TOOCAN, SCARAB, Profiles RH, campagnes

Microphysics and microwave radiative transfert model

(Assimilation, validation modèles, amélioration retrievals)

http://meghatropiques.ipsl.polytechnique.fr

Conclusions and rendez vous

A longer than expected commissioning phase

Any time

Further release of the L1 data

First release of the scientific products too

May 2013

22 and 23 X-cal meeting in Toulouse hosted by CNES/CNRS

July 2013

Saphir RT stream via EUMETCAST and EUMETSAT

September 2013

25-27 Megha-Tropiques Ground Validation science workshop in Toulouse

Direct product validation; Indirect validation (via soil moisture); Hydrological budget based validation; algorithm validation (microphysics, pol radar) ~30 people More information: **marielle.gosset@ird.fr**

March 2014

First international scientific conference to be held in India