TT8 - Wet season SOP

Status of SOP planning : Seignosse, September 2005

… including outcomes of Leeds meeting (July 05) and ISSC – Paris – (August 2005)

- *A quick guided tour of TT8*
- *A diplomatic mission SOP ➔ EOP*

Organisation of TT8

Coordinators:
Cyrille Flamant, Doug Parker

Core group:
Crewell, Diedhiou, Flamant, Formenti, Hoeller, Kalthoff, Mari, Parker, Protat, Reeves, Thorncroft

Members: 133	**Europe: 80**	**Africa: 47**	**USA:6**
France: 41	UK: 22	Germany: 12	Italy: 2
Mali: 3	Senegal: 13	Niger: 11	Benin: 3

Representation:
- All of WP4.2 (management) in the EU project
- Instruments (a representative (PI) for each aircraft, and each ground instrument)
- Science areas (selected EU work packages)
- National and international groups
- AMMA-weather
- NASA funded N-POL activities
- PIs of PIAF proposals
- International Agencies
- Representatives of linked TTs and STs

Deployment periods in SOP1 and SOP2

Week	29/5	5/6	12/6	19/6	26/6	3/7	10/7	17/7	24/7	31/7	7/8	14/8	21/8	28/8	4/9	11/9
SOP #	**SOP1**					**SOP2**										
Dates	**1 June – 30 June**					**1 July – 15 Sept**										
Aircraft	**SOP 1-a**				**SOP 2-a1**			**SOP 2-a2**						**SOP 2-a3**		
Dates	**1 – 15 June**				**1 – 15 July**			**17 July – 25 August**						**1 – 15 Sept**		
BAe146								17 July – 21 August						22 – 28/8		
ATR	1 – 15 June				1 – 15 July				25 July – 25 August							
F-F20	1 – 15 June				1 – 15 July				25 July – 25 August					1 – 15 Sept		
D-F20					1 – 15 July					1 – 20 August						
Geoph.										1 – 20 August						

TT8 objectives and strategy

The overall strategy for the SOP observations is a multidisciplinary, multi-instrument approach.

Research aircraft = high temporal and spatial resolution + Lagrangian view

Ground-based = continuity in time + Eulerian view.

There are two important modes of instrument operation:

1. **Intensive observing periods (IOPs) of 1-4 days** will be used to focus attention on specific events. Prescribed IOP patterns are numbered I1, I2, … In

2. **Intensive monitoring** will be conducted throughout the SOP period using **ground-based instruments.**

Ground-based deployment strategy

There are two characteristic modes of operation for ground-based instruments:

1. ***Continuous monitoring*.**

This mode is typical of instruments measuring vertical profiles or scalar parameters, such as sodars, wind profilers, automatic weather stations, surface energy balance stations.

2. ***Responsive mode*.**

Instrument operation depends critically on the prevailing conditions, and on the particular scientific objectives in question.

This mode is characteristic of radar, balloon-borne soundings, and tethered balloon systems. The instruments will be linked to the IOP patterns (I1, I2, …).

EOP – SOP instruments (EOP with an SOP mode of working)

Instrument	Code	Lead	PI	Location	Deployment	Mode
Radiosounding Network			TT1		EOP-SOP	**R**
Ozone soundings	AS.RSO3_Od_E	LA	Thouret	Cotonou	June-August	**M**
X-Band polarised Radar	AS_RADX_O	IRD	Gosset	Djougou	EOP	**R**

SOP – responsive instruments

Instrument	Code	Lead instit'n	PI	Location	Deployment
Radiosounding Dano	AS.Rs_D	FZK	Kalthoff	Dano	1 June - end July
Driftsondes	AS.Drift_T1_E	CNES/NCAR	Drobinski/ Parsons	N'Djamena	15 Aug.-30 Sep.
Constant volume balloons	AS.BVC_T2_E	CNES	Drobinski	Cotonou/Djo?	15 June - 15 July
Oceanic soundings	OS.RS_SAG_E	CNRM	Caniaux	Atalante/EGGE	
C-Band Radar Ronsard	AS.Ronsard_O_E	CNRS	Scialom	Djougou	15 Jun-15 Sep
Tethered balloon		U Leeds	Parker	Niamey	15 July - 21 Aug

Radiosondes

2 modes of operation:

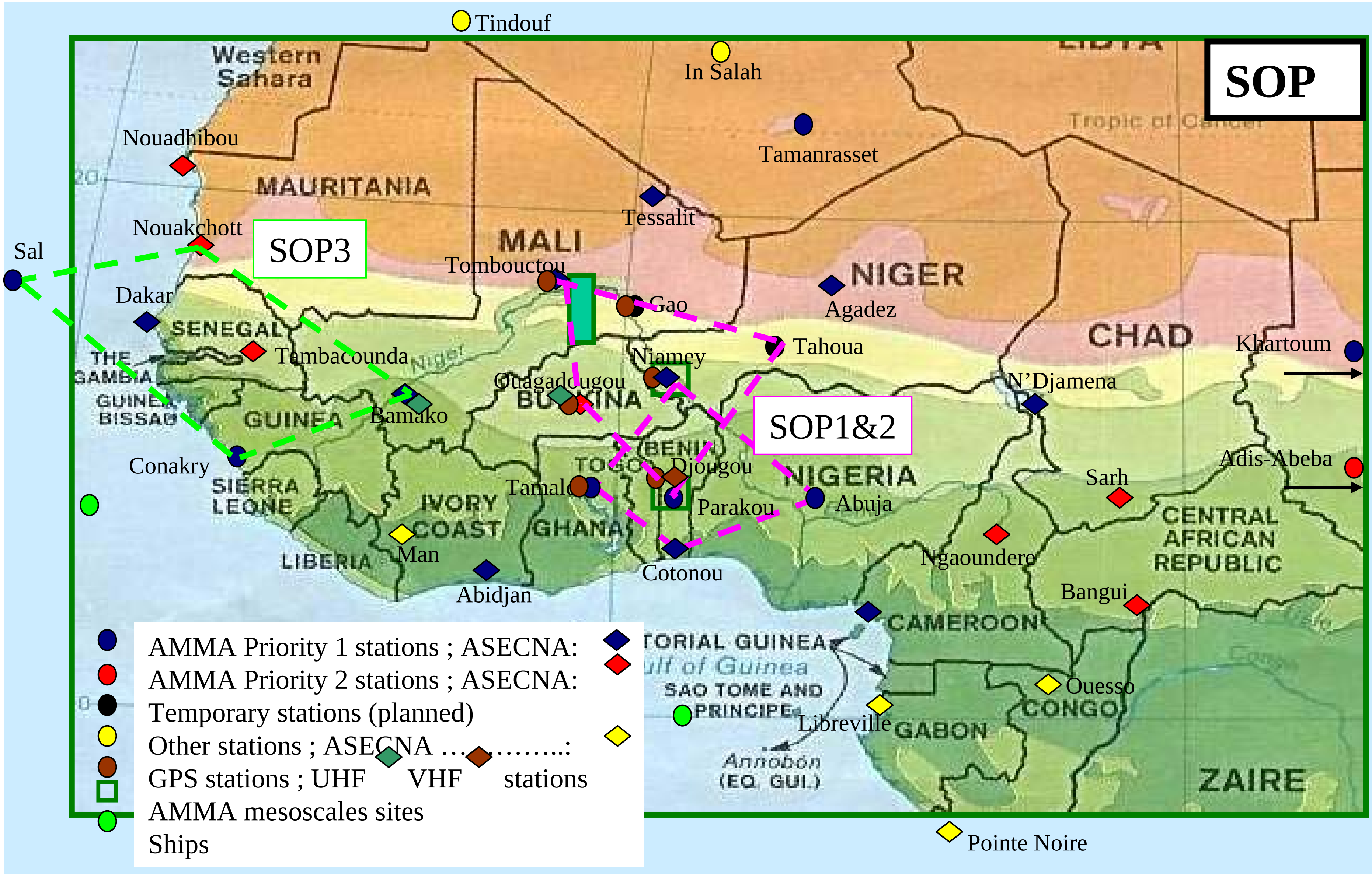
- **regular monitoring** on a fixed array and
- **'responsive' operations**, associated with IOPs

Currently the radiosonde programme includes provision for 4 soundings per day from the following stations:

- *Southern quadrilateral:* Cotonou, Tamale, Parakou, Abuja, Niamey
- *Northern stations and monsoon flux array:* Tamanrasset, Agadez

Do we need an ‘Outer Sounding Array’?

Northern Quadrilateral – need to evaluate consequences – deploy EAMAC station

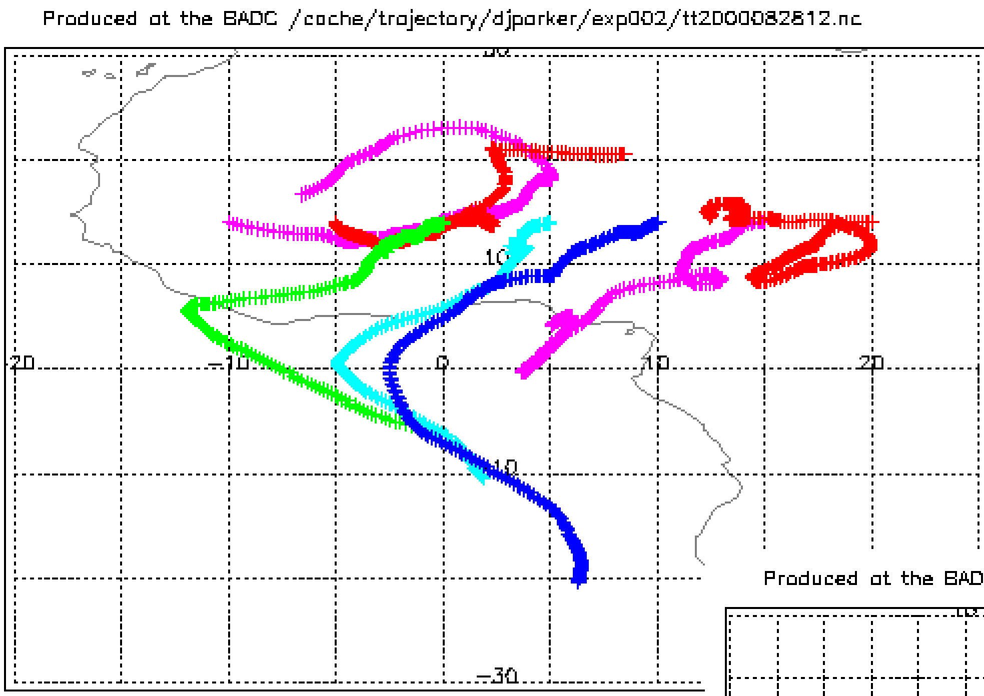


Unresolved issues:

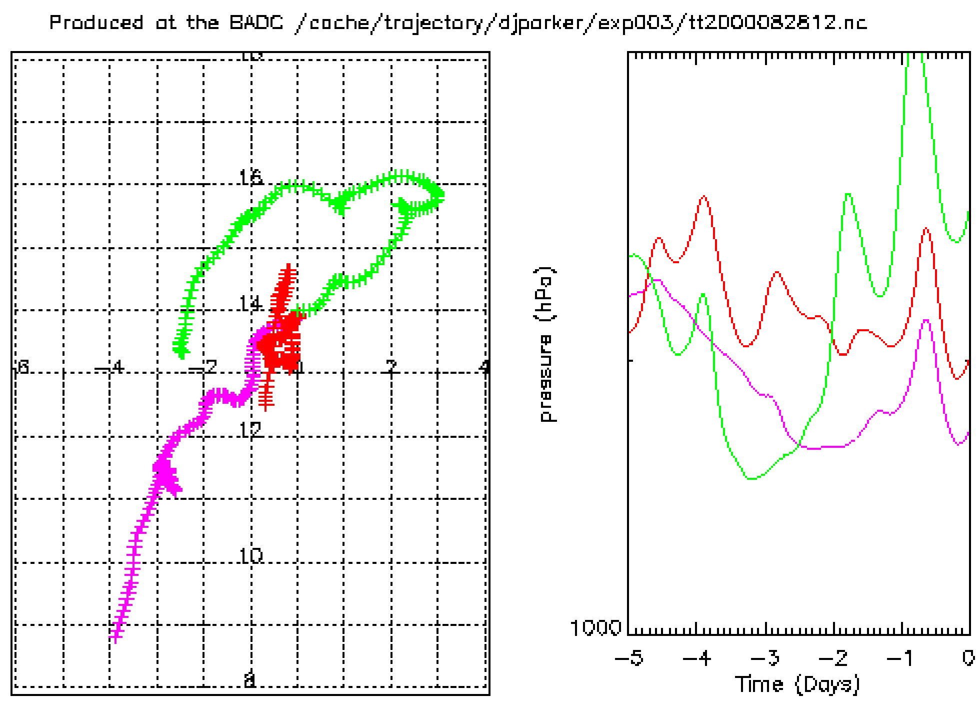
- balance between **responsive** and **routine** soundings at each station
- Communications – shipping and ‘responsiveness’
- determination of ‘sounding capacity’ of each station (up to 8 soundings per day have been proposed, but this may not be feasible at a number of stations, due to the time needed to generate gas).

Constant level balloons

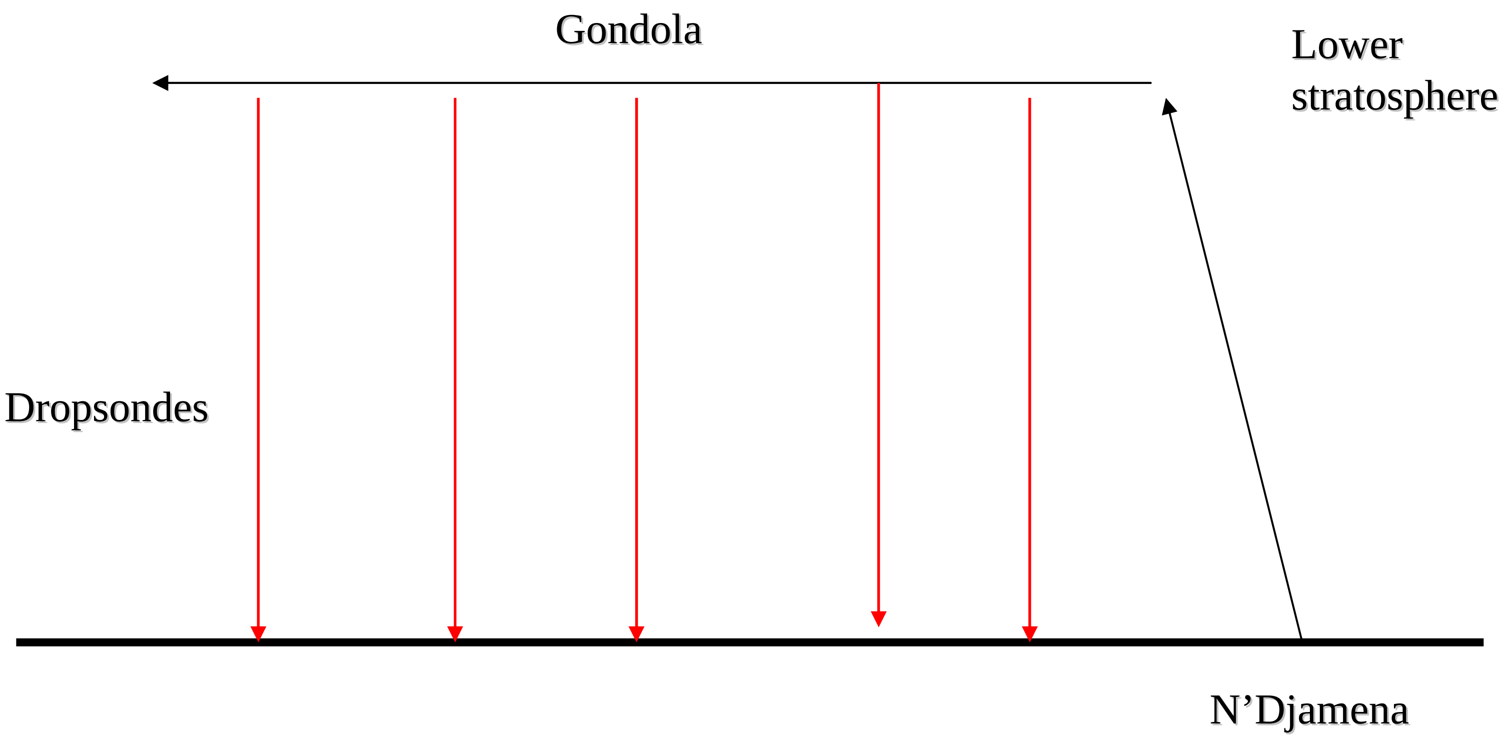
- The balloons fly at constant density, and are expected to follow the monsoon winds towards the north-east (from Cotonou)
- The number of balloons is about 20.
- The sampling strategy will consist to sample the period uniformly (about one launching every other day)
- Enhanced launching (maximum 2-3 balloons) during IOPs.



All terminate at 925 hPa

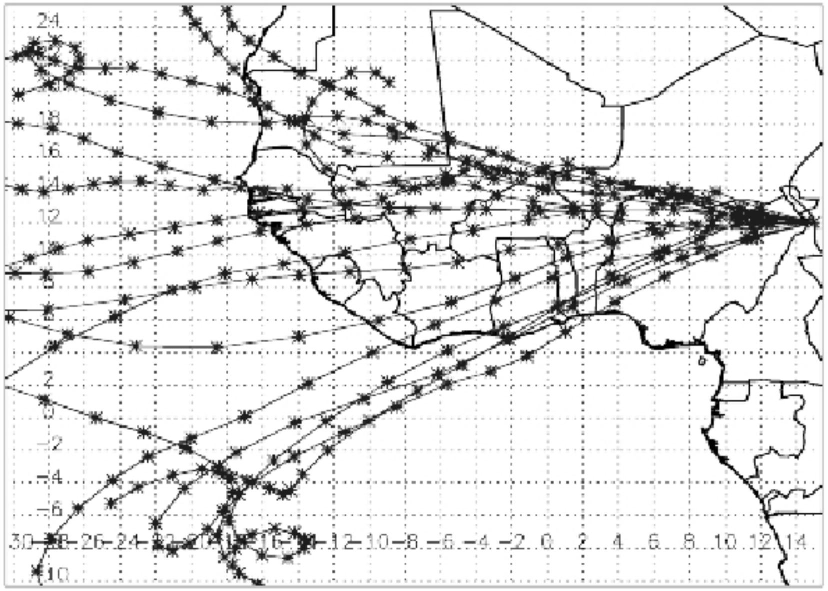


Driftsondes



Driftsondes (NCAR-CNES)

PI : D Parsons



Driftsondes

- Launched to the east of the main AMMA study areas, and will drift towards the west in the lower stratosphere. The gondolas release dropsondes, either at regular times or on demand.
- The number of gondolas is 8 (but probably 10), each gondola carrying 40 dropsondes (there again we should be able to go to 50).
- For the moment, we plan to drop
  - on synoptic times twice daily plus
  - drops on demand based on targeting needs for hurricanes, developing tropical cyclones and AMMA convective systems.
  - If we assumed 15 days of twice daily giving us 30 sondes, we would have 10/20 left for ‘responsive’ launches.

SCOUT / CNES balloons

- Sophisticated TTL chemistry instrumentation
- Nocturnal flights – ascent to TTL and slowly descend over ~12 hours
- 2 balloons funded by AMMA-UK to be released in association with MCS studies
- Motivation to link with Geophysica

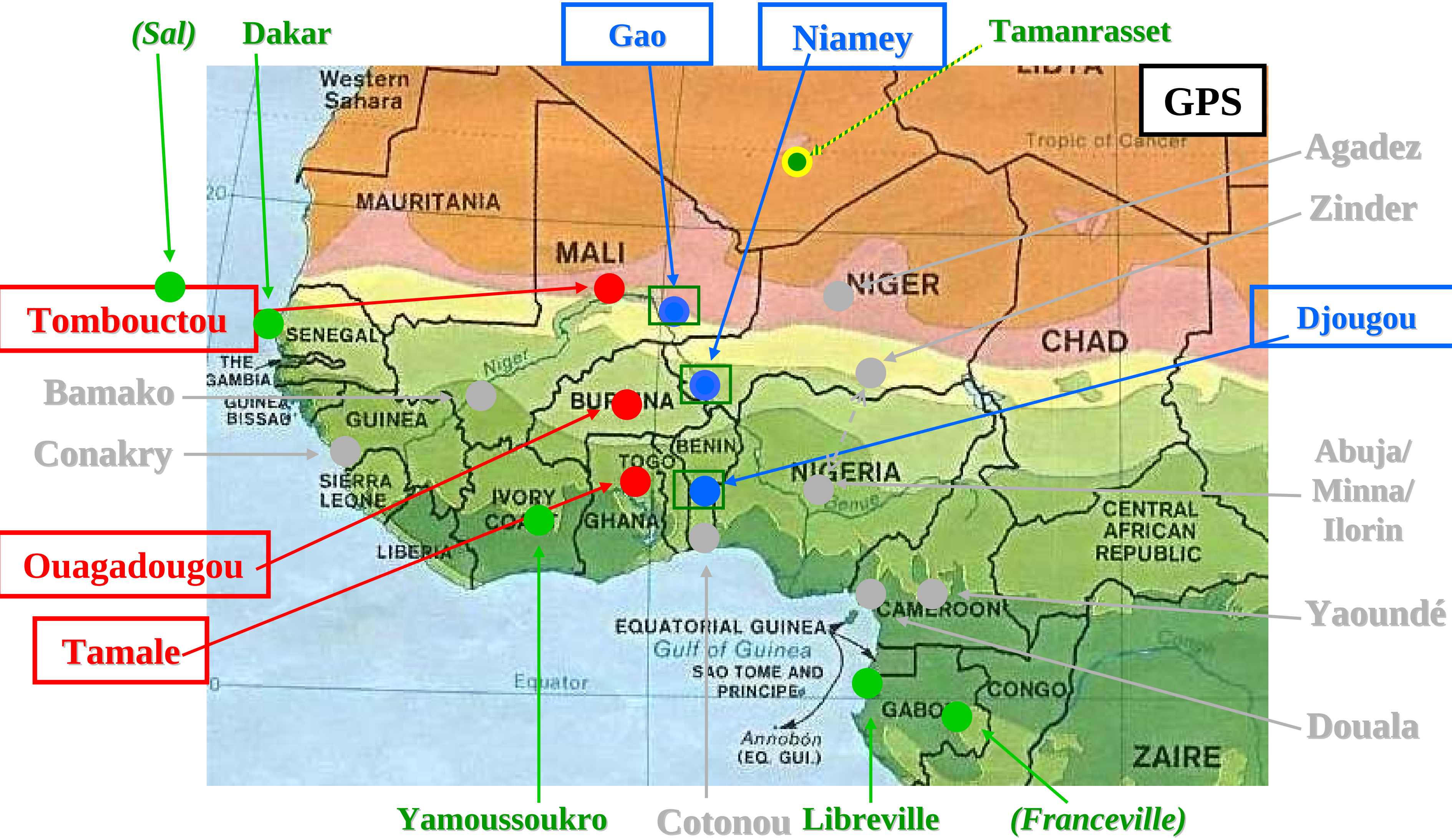
Radars

- Radars embedded in the northern and southern radiosonde quadrilaterals
- Ronsard S-band for Djougou (plus X-band EOP radar (X-port))
- MIT C-band radar for Niamey is under discussion for funding by NASA

Radars

- The radar will be used to target MCS events, non-organised rainfall (congestus and other types of cumulonimbus) and also has clear-air capabilities.
- surveillance PPI mode (3 to 4 successive elevations at relatively low elevation angles from 0.5° to 8°, with the 200 km range).
- volumetric scanning mode details are still under discussion
- We need to plan the further integration in IOP patterns.

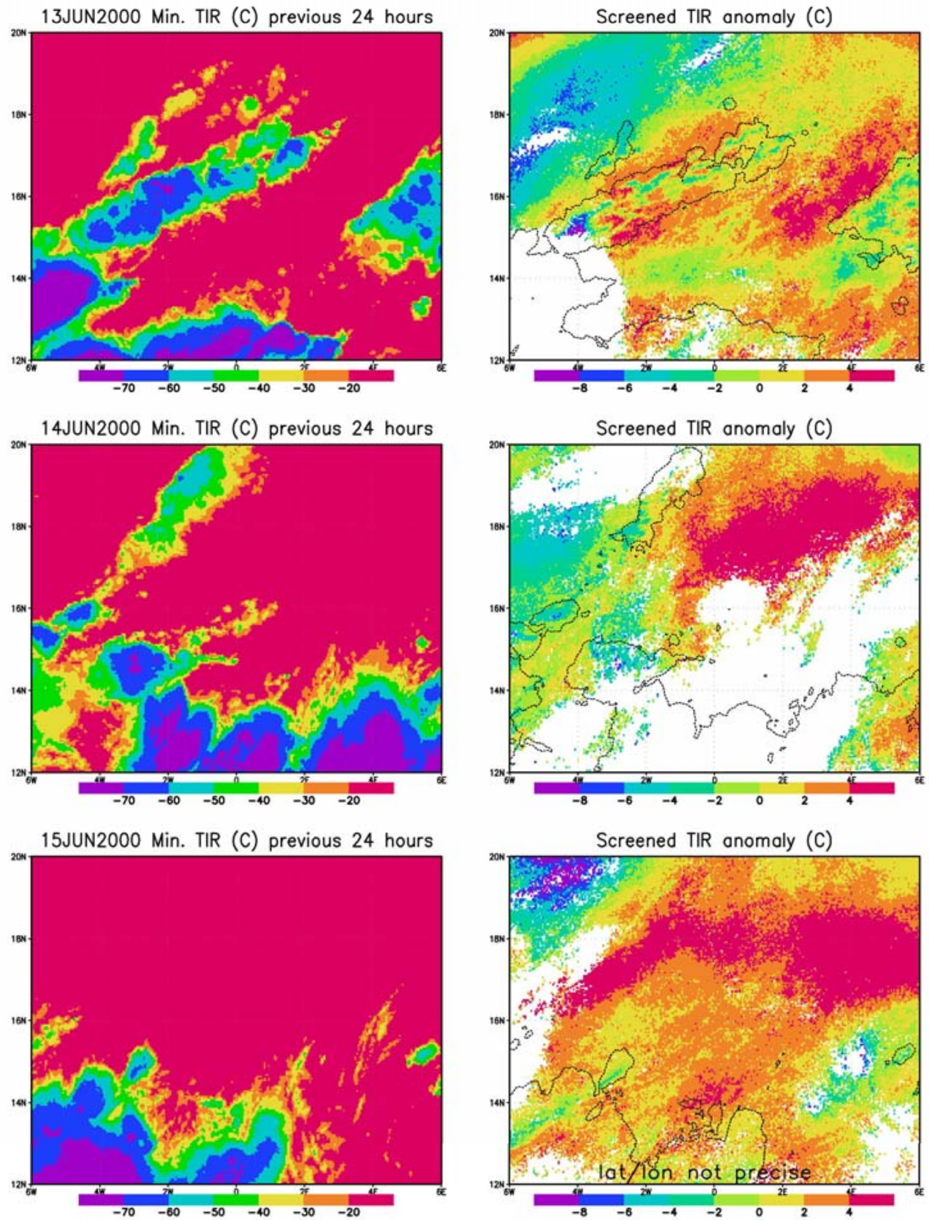
● =IGS ● =EOP ● =SOP ● = other possibilities



Sodar network and tethered balloon(s) (for Niamey)

- local circulations due to surface heterogeneity (vegetation and soil moisture)
- the diurnal cycle of the low level monsoon flow
- low level wind structure of MCS events at 10-30 minute resolution
- Tethersonde – fluxes up to 1.6 km?

Quick Look at Meteosat Data from June 2000 (Chris Taylor, CEH)

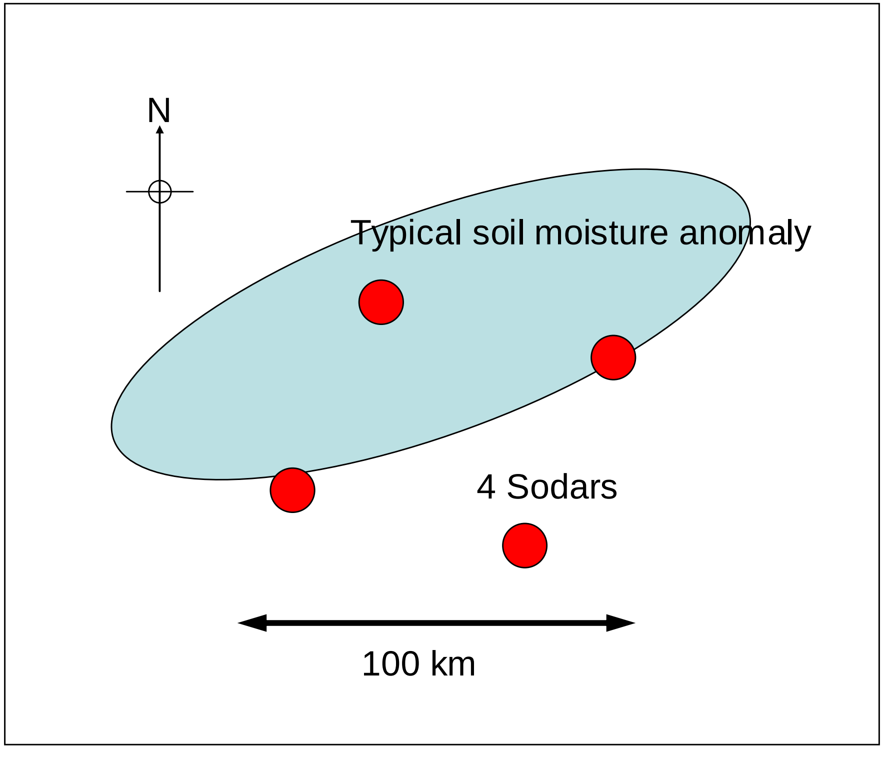


Background:
One of the objectives of these flights is to provide measurements of atmospheric response to surface heterogeneity, notably from recent rainfall. The following figures provide an indication of what surface moisture heterogeneity might be sampled at this time of year from flights in this region.

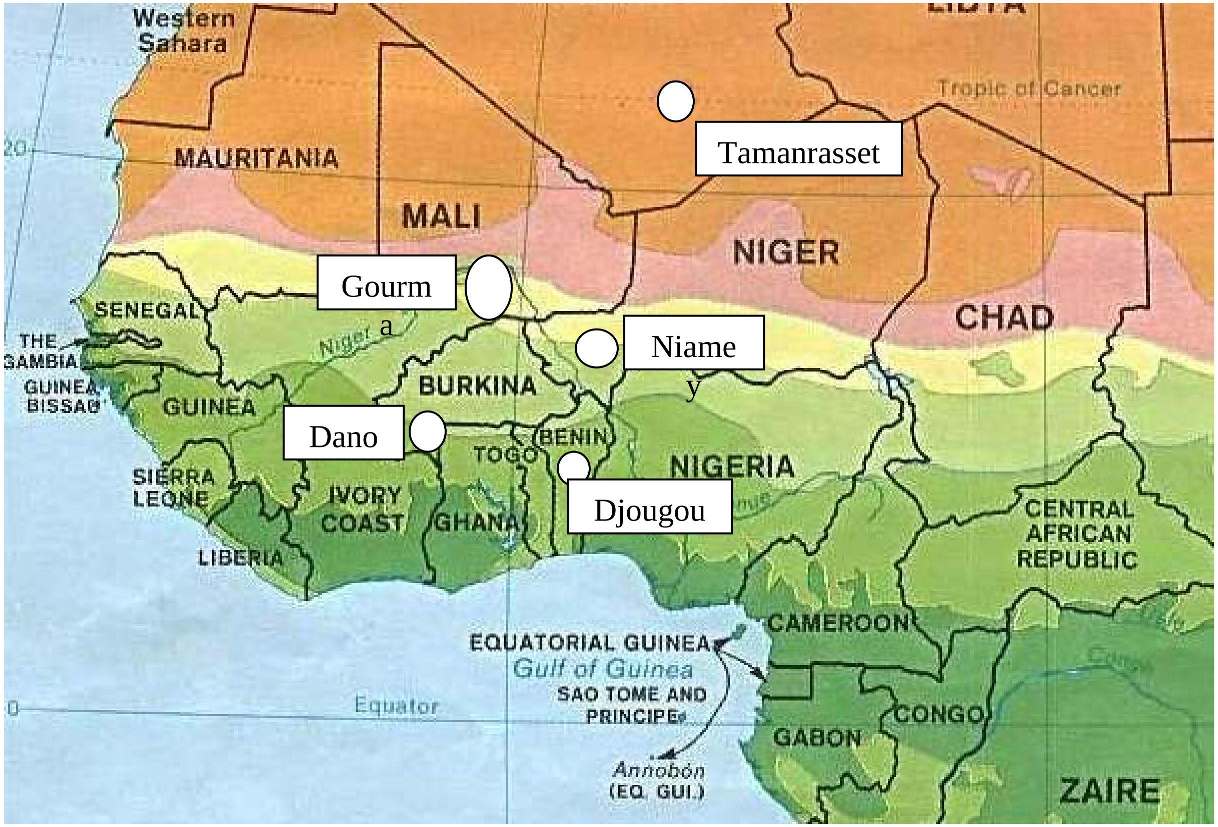
Data used:
- Meteosat 7 ~4.5km pixel resolution TIR and VIS, June 6 – September 30 2000 (only June 7-15 shown)
- Raw TIR data to locate cold cloud in previous 24 hours
- Daytime cloud-screened TIR to locate surface temperature anomalies (often associated with surface soil moisture from recent rain)

Interpretation of figures:
Antecedent cold cloud maps (left hand side) provide an indication of where convective systems have passed, but cannot accurately locate where surface rainfall occurred, or indeed whether it rained at all.
In sparsely-vegetated regions on the other hand, recent rainfall produces a strong decrease in surface temperature.
In cloud-free zones, interpretation of maps of brightness temperature anomalies (compared to a longer-term mean diurnal cycle calculated, in this case, over 15 days) can provide accurate locations of storm tracks. The surface is likely to be wet if it:
- Has low brightness temperature
- Is coincident with cold cloud feature in recent 24-48 hours
- Has a well-defined patch edge
- Has geometry associated with "typical" storms e.g. oriented NE-SW

Flight planning during the SOP
CEH hope to set up an operational system for the SOP based on near-real-time satellite data which can assist flight planning during the morning of the flights. This will be based on cloud-screened Meteosat Second Generation data, and other sensors if available. Using this technique, we hope to be able to accurately locate wet/dry surface patches from recent rainfall, and hence provide suitable cases of heterogeneity for the aircraft to sample. We anticipate improvements in the cloud-screening using MSG which will hopefully make the Niamey region less obscure (the current algorithm is very conservative).


N
Typical soil moisture anomaly
4 Sodars
100 km

SOP additional instruments according to mesoscale site



Niamey site: SOP instruments

Instrument	**Code**	**Lead inst it'n**	**PI**	**Deployment**	**Mode**
Wet and dry deposition fluxes, etc.	AS.Dust.ST_flux	UP12	Rajot	all SOPs	M
Aerosol characteristion		UP12	Desboeufs	SOP 1-2	M
Sodar network	AE.SODAR_	U Leeds / FZK	Kalthoff / Parker	1 June - 21 Aug	M
Tethered balloon		U Leeds	Parker	15 July - 21 Aug	R
ARM Mobile facility			**Tony Slingo**	**Jan-Dec 2006**	**M**

Djougou site: SOP instruments

Instrument	Code	Lead instit'n	PI	Deployment	Mode
Microwave Radiometer	AE.PROF_T	U Bonn	Crewell	Jan-Dec 2006	M
Lidar Ceilometer CT25K	AE.CT25K	U Bonn	Crewell	Jan-Dec 2006	M
Micro Rain Radar	AE_RADK_T	U Bonn	Crewell	Jan-Dez 2006	M
C-Band Radar Ronsard	AS.Ronsard_O_E	CNRS	Scialom	15 Jun-15 Sep	R
Bistat. Radar (Wind field)	AS_BIST.RADAR_O	DLR	Hagen	15 Jun-15 Sep	M
Lightning detection network		DLR	Höller	SOP1-2	M
Chemical instrumentation	AS.DUST_Od	UPS	Pont	SOP2-a1	M

Djougou Super Site during wet SOPs

WHEN ?

- From 06/01 to 06/15
- From 07/01 to 07/15
- From 08/01 to 08/15

WHO ? (expected from API 2006 fundings)

4 french scientists + 1 african scientist per period

WHY ?

Major goals:

- On field, study of the variability of the hygroscopicity and associated chemical and optical properties of the aerosol mixing over the wet season
- Chemical, Micro-Physical and optical (CMPO) closures with aircraft measurements for 3D aerosol mixing characterisation

Why this timetable ?:

- Two first periods of 15 days: CMPO characterisation of the aerosol mixing before/during/after NOx peak emissions from soils
- 3 Periods of **ONLY** 15 days: limited number of persons in the experimental group

Dano site

Instrument	**Code**	**Lead**	**PI**	**Deployment**	**Mode**
Flux station	AS.Flux_D	FZK	Kalthoff	1 June - end July	M
Radiosounding Dano	AS.Rs_D	FZK	Kalthoff	1 June - end July	R

Airborne Operations during AMMA Wet Season

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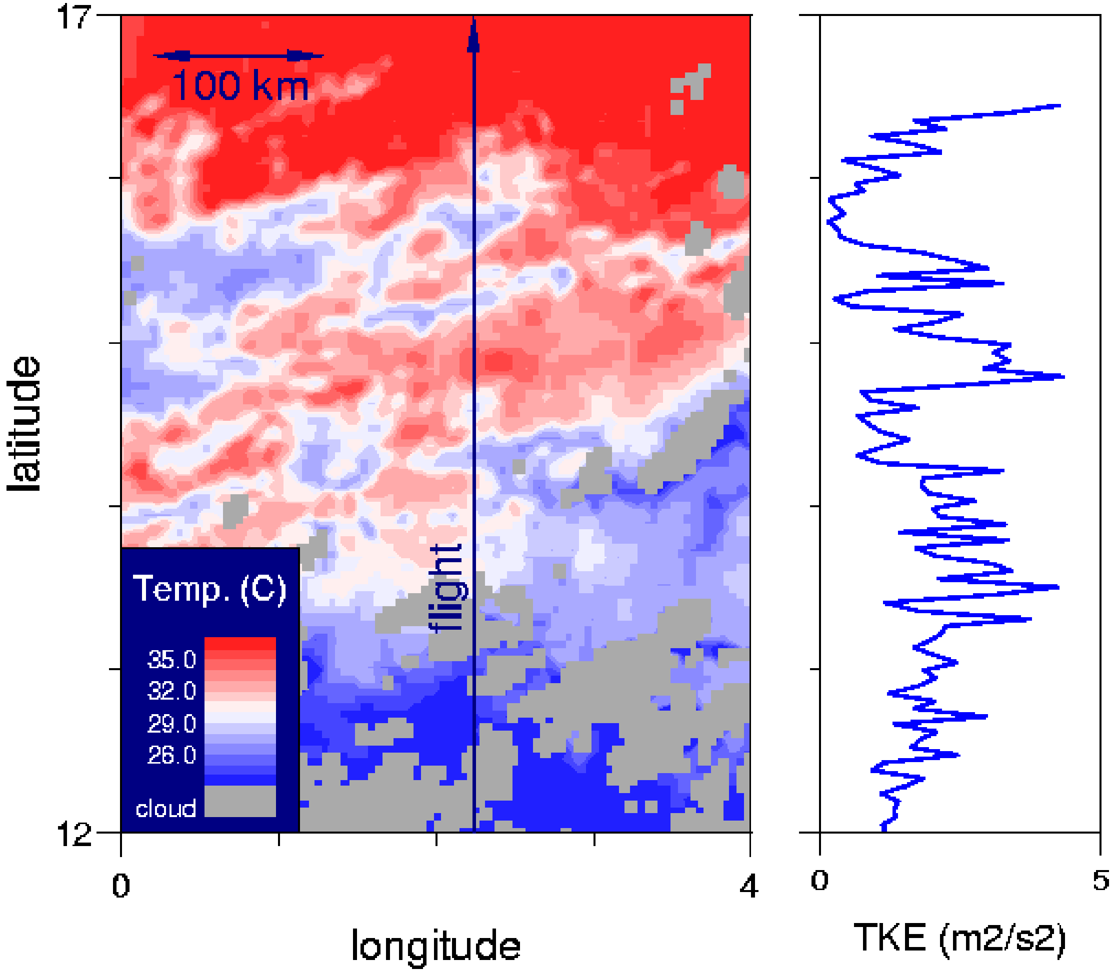
SOP #	**SOP1**				**SOP2**											
Dates	**1 June – 30 June**				**1 July – 15 Sept**											
Aircraft	**SOP 1-a**				**SOP 2-a1**			**SOP 2-a2**						**SOP 2-a3**		
Dates	**1 – 15 June**				**1 – 15 July**			**17 July – 25 August**						**1 – 15 Sept**		
BAe146								17 July – 21 August						22 – 28/8		
ATR	1 – 15 June				1 – 15 July				25 July – 25 August							
F-F20	1 – 15 June				1 – 15 July				25 July – 25 August					1 – 15 Sept		
D-F20					1 – 15 July					1 – 20 August						
Geoph.										1 – 20 August						

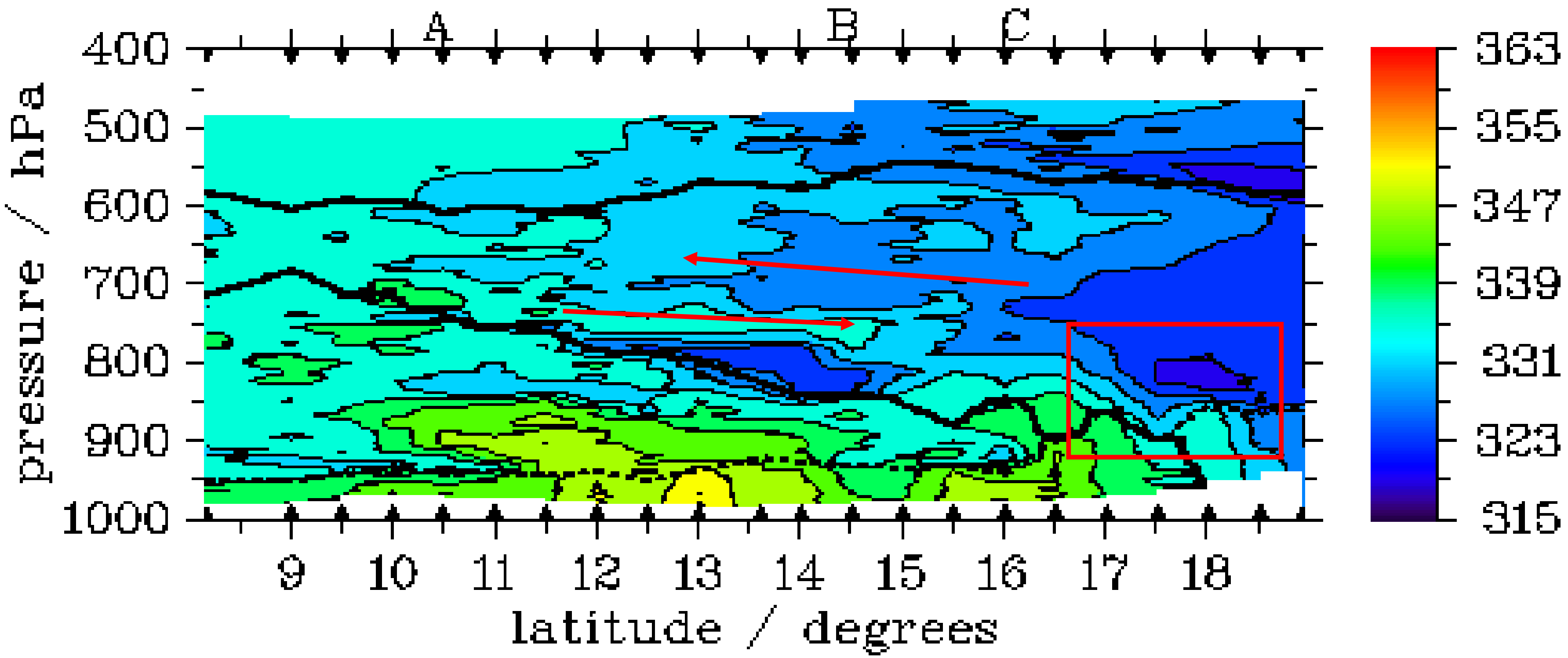
IOP patterns

- As proposed prior to Leeds, and modified since.
- Some patterns may be modified according to SOP / instrument fit etc.
- Possibility to merge and refine IOP patterns?
  - Biarritz and beyond.

I1.x Surface-atmosphere IOPs

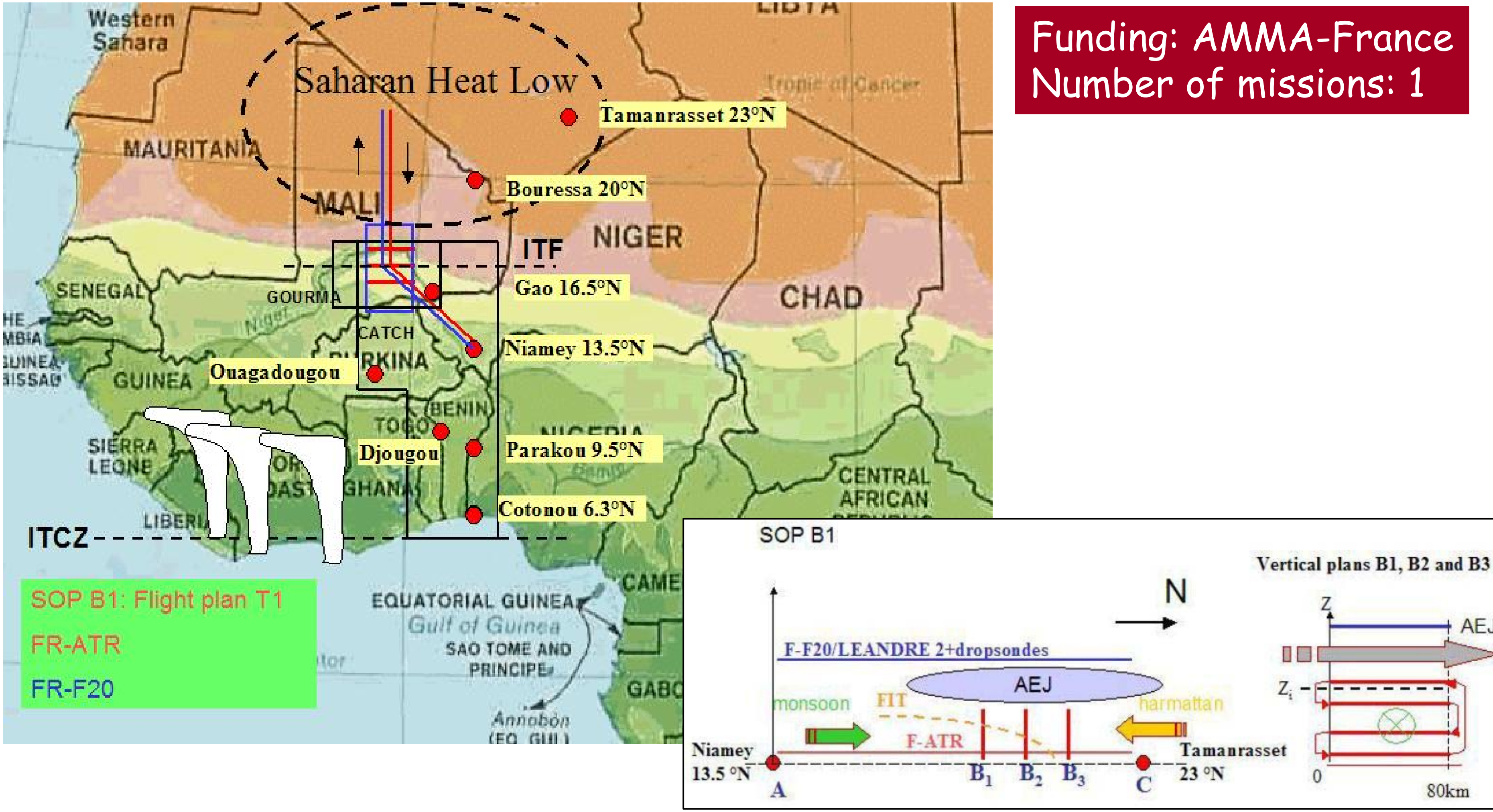


I1.x Surface-atmosphere IOPs



I1.1: Inter-tropical front and heat low surveys (SOP1-a)

Funding: AMMA-France
Number of missions: 1



WP 2.1 recommendations/concerns:

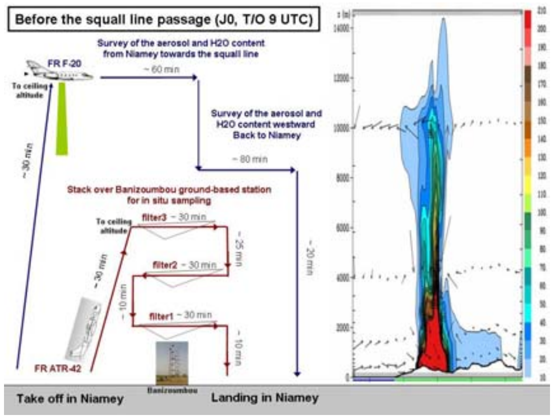
- Need for a climatology of the position of the IFT
- Take into consideration moisture and vegetations patterns
- Look at historical cases to better anticipate environmental conditions

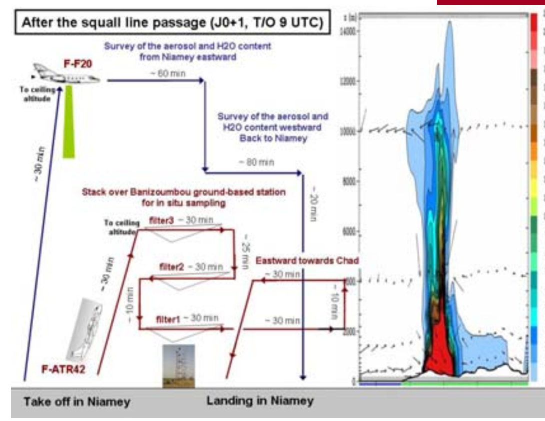
I1.2: Aerosol emissions, PBL evolution and rain efficiency related to squall line passage early in the season

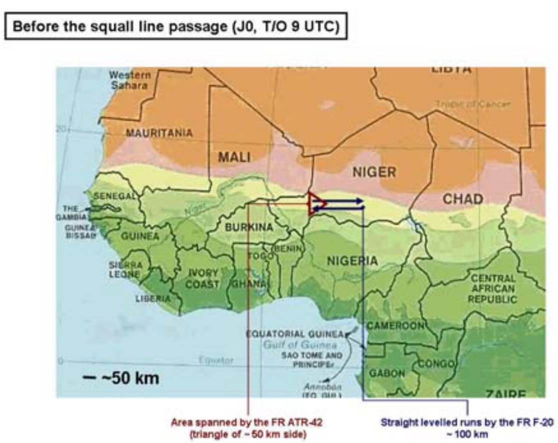
Funding: AMMA-France
Number of missions: 2 (+1)

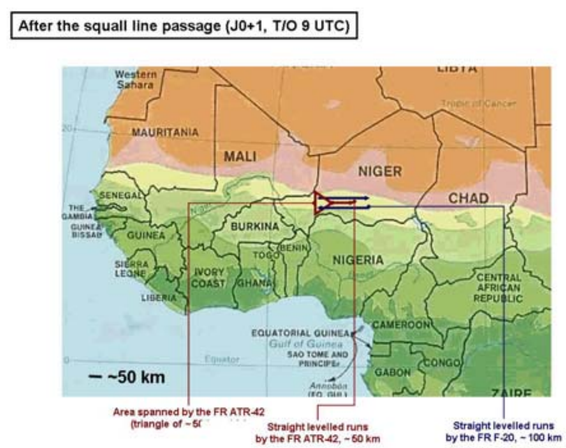
Before

After



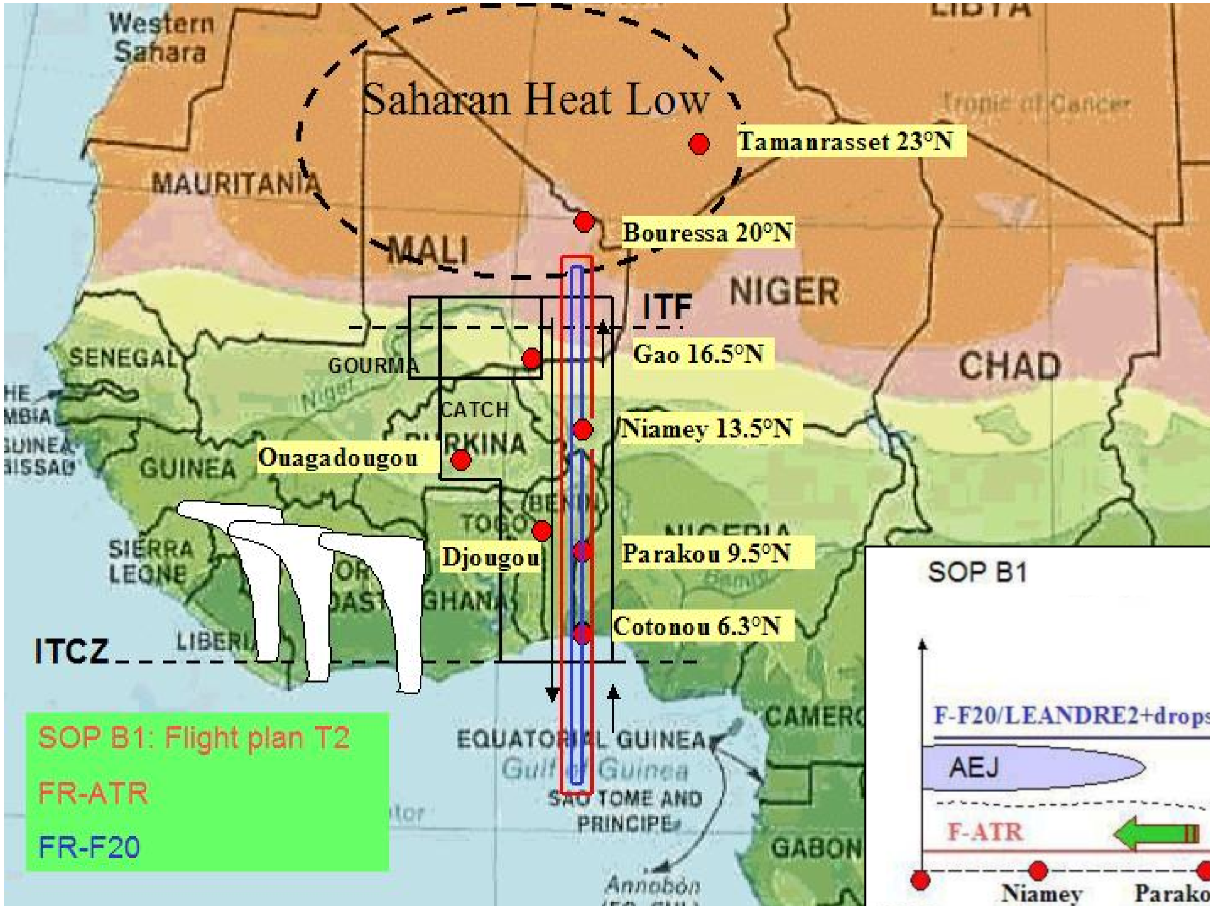


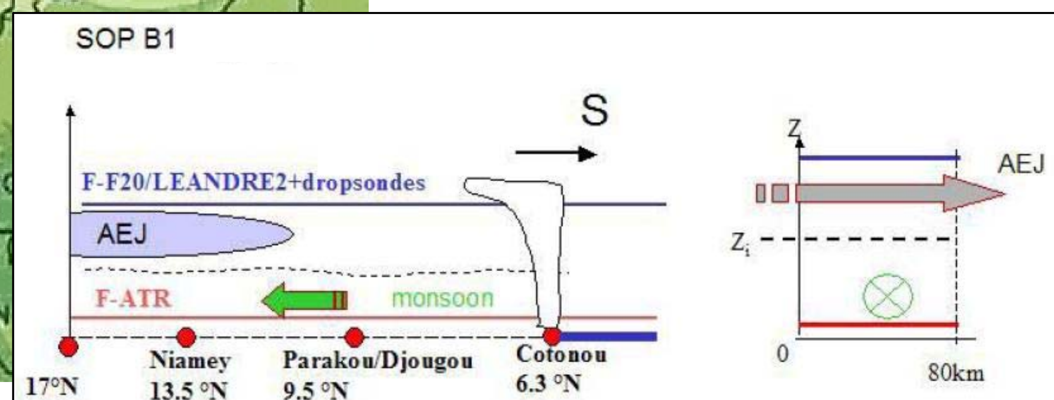




I1.3: North-South 'land-ocean-atmosphere interactions' surveys (SOP1-a)

Funding: AMMA-France
Number of missions: 1

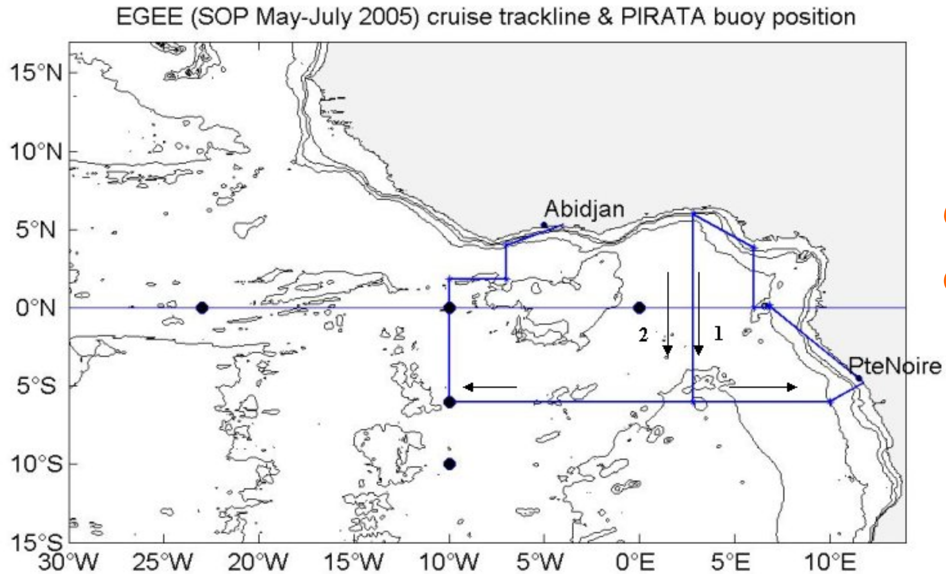




WP 2.1 recommendations/concerns:

- This transect must also be performed after the onset (SOP2-a1)!!

EGEE Experiment



Ship trajectory planned during EGEE-SOP1 (May-July 2006) with positions of PIRATA ATLAS buoys

Climate variability due to the presence of the ITCZ and the « cold tongue »

ROLE OF SEA SURFACE FLUXES AND AIR-SEA INTERACTIONS

The primary objective is to provide a closed surface heat and salinity budget for the GG, covering the monsoon onset, at a fine spatial and temporal resolution

Benin radial to be sampled twice:

- 26 and 30 May 2006
- 17 and 21 June 2006

(1) In-situ measurement: anchored buoy (Pirata), São Tomé met. Station; ship measurements with an instrumented mast for classical met observables;

(2) Turbulence measurements for the bulk algorithm (SEAFLUX database)

(3) Radio-soundings along the ship trajectory to document the atmosphere (AMMA link) and for operational NWP assimilation ;

(4) Marisonde drifters to document SST/ MLD

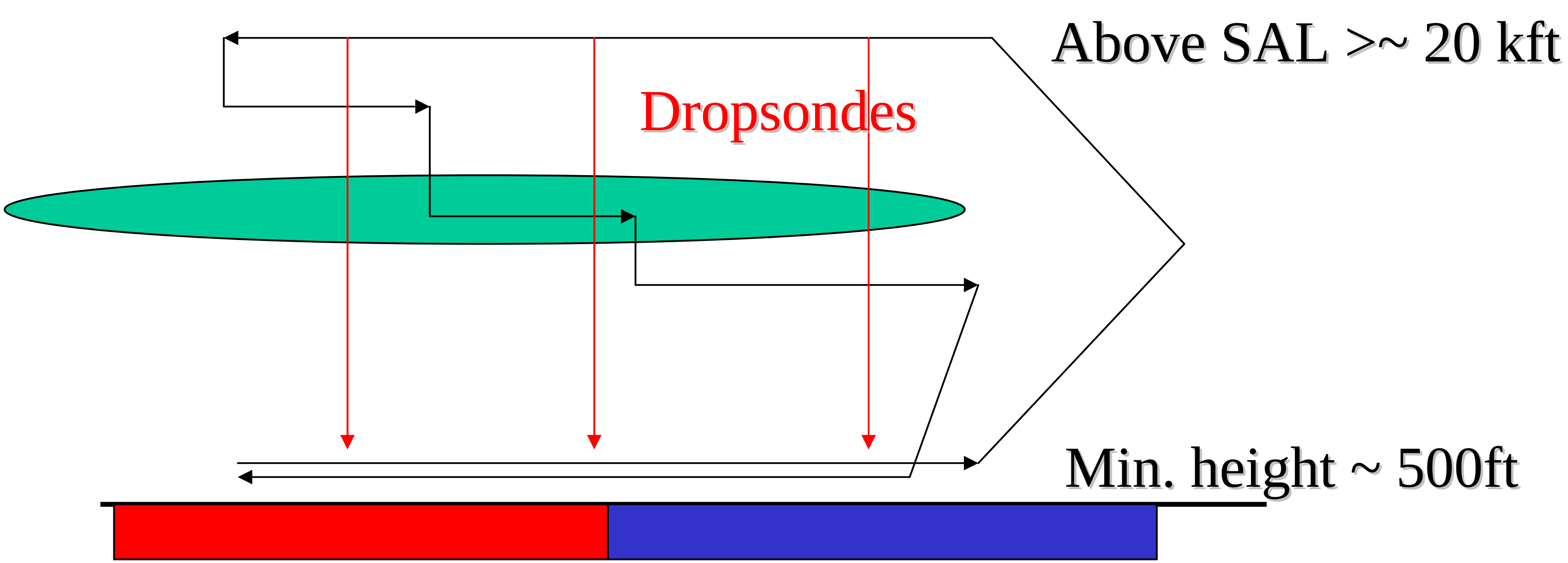
(5) Specific sensors for rain: SSS and rain impact (CETP); for skin SST…

I1.4: North-South 'land-ocean-atmosphere interactions' surveys

Funding: AMMA-UK
Number of missions: 12

- Nocturnal flights possible (T/O 0400 UTC)
- J0 Morning ➔ J0 afternoon ➔ J+1 afternoon

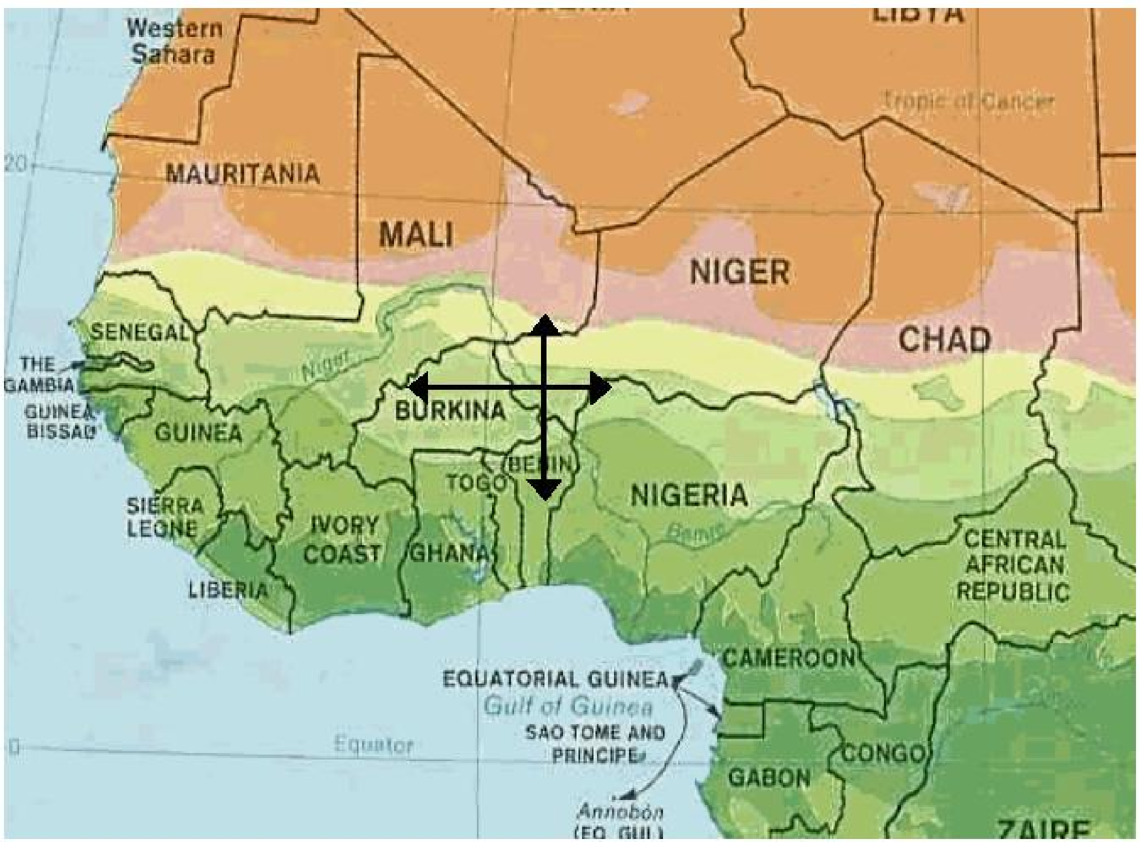
J-1	J0		J+1		J+2	
Daytime precipitation	Am	pm	am	pm	am	pm
	0600	1200		1200		1200
	1000	1600		1600		1600



I1.5: Vegetation emission surveys

Objective: Characterise the emissions from different vegetation types

- Long straight and level runs, mostly in the CBL (as low as possible ~ 500ft).
- East-West legs will collect data along a particular climatic zone, as well as studying synoptic-scale variability in the land surface state.
- North-south legs will also be made across contrasting vegetation.



Funding: AMMA-UK
Number of missions: 5

UK/BAe146 only

I1.6: Urban surveys

Objective: short surveys of large urban regions (Niamey; Lagos or Dakar)

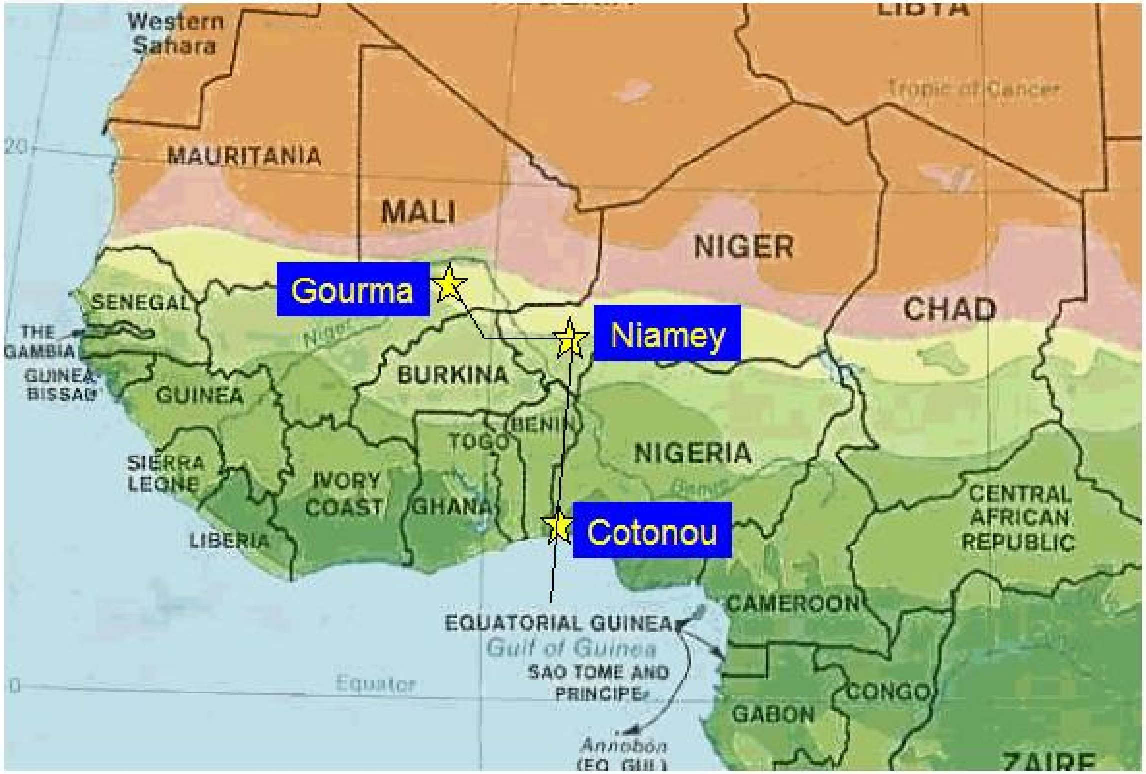
Funding: AMMA-UK
Number of missions: 2

UK/BAe146 only

I1.7: Aerosols mixing and hygroscopicity

Objective: provide the basic scientific understanding of how do mixing and in-cloud processes change the surface, hygroscopic, and therefore optical properties of dust and biomass aerosols?

Characterization the north-south gradient of hygroscopic particles (soluble and/or insoluble) near and within **shallow to moderately deep clouds.**



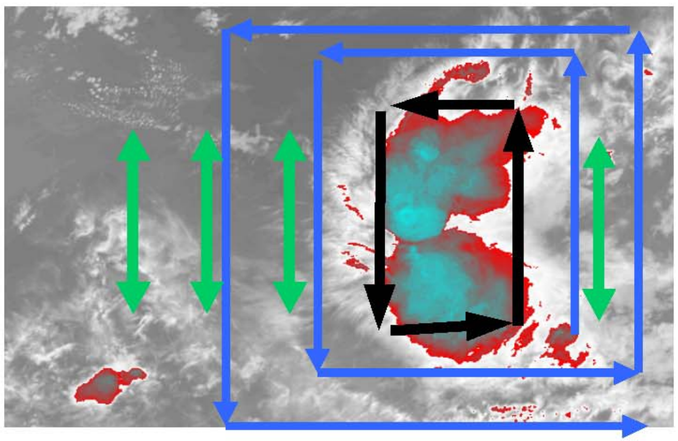
Funding: AMMA-France
Number of missions: 4

F/ATR only

Aerosol direct, indirect and semi-direct effects on WAM

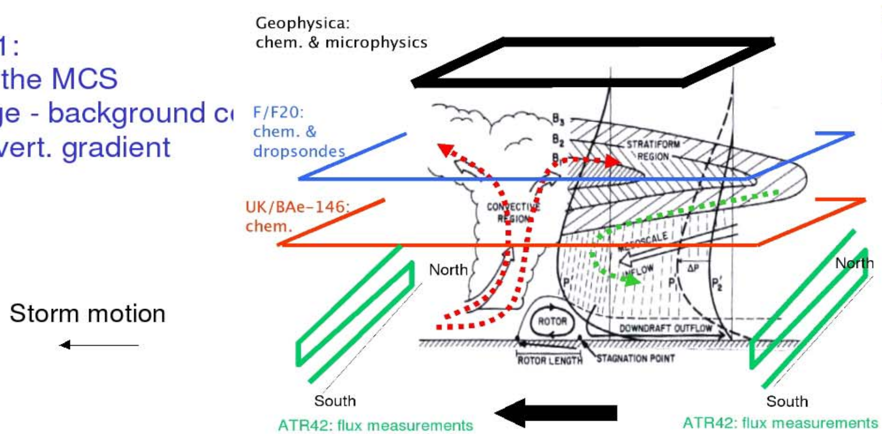
I2: Dynamics and chemistry of MCSs

Funding: AMMA-France
AMMA-EU
AMMA-UK
EEIG, SCOUT ?
Number of missions: 3

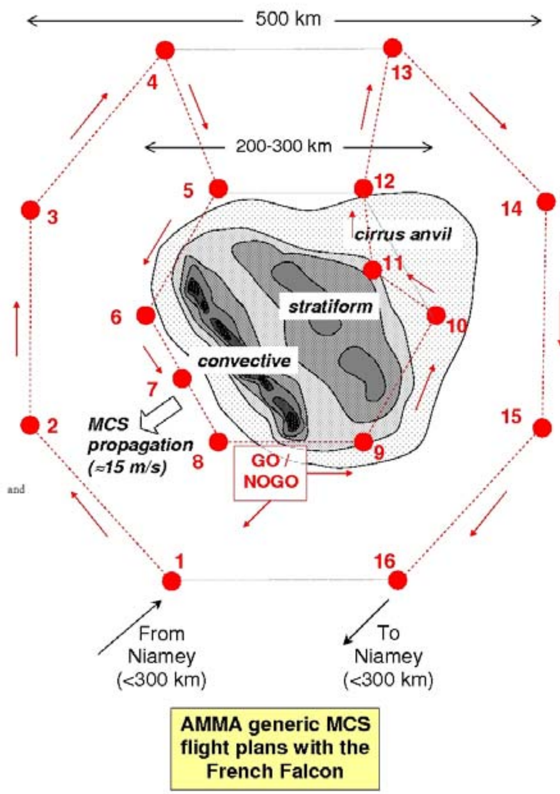


Flight plan
(Small MCS, < 1

STEP 1:
before the MCS passage - background c
Lat. & vert. gradient

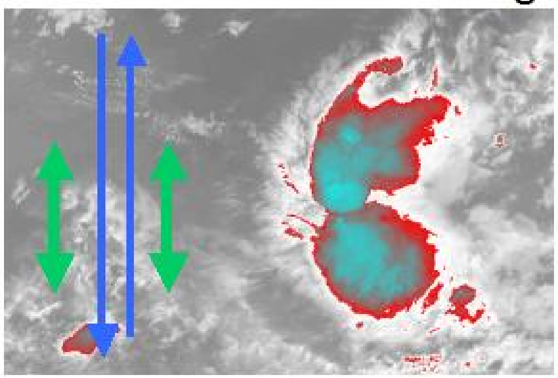


STEP 2:
After the MCS passage - pertu
Lat. & vert. grac

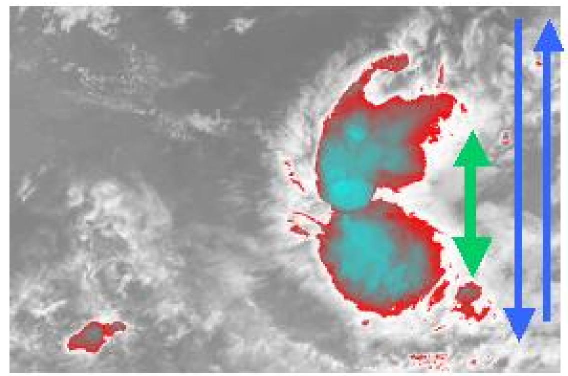


I2: Dynamics and chemistry of MCSs surveys

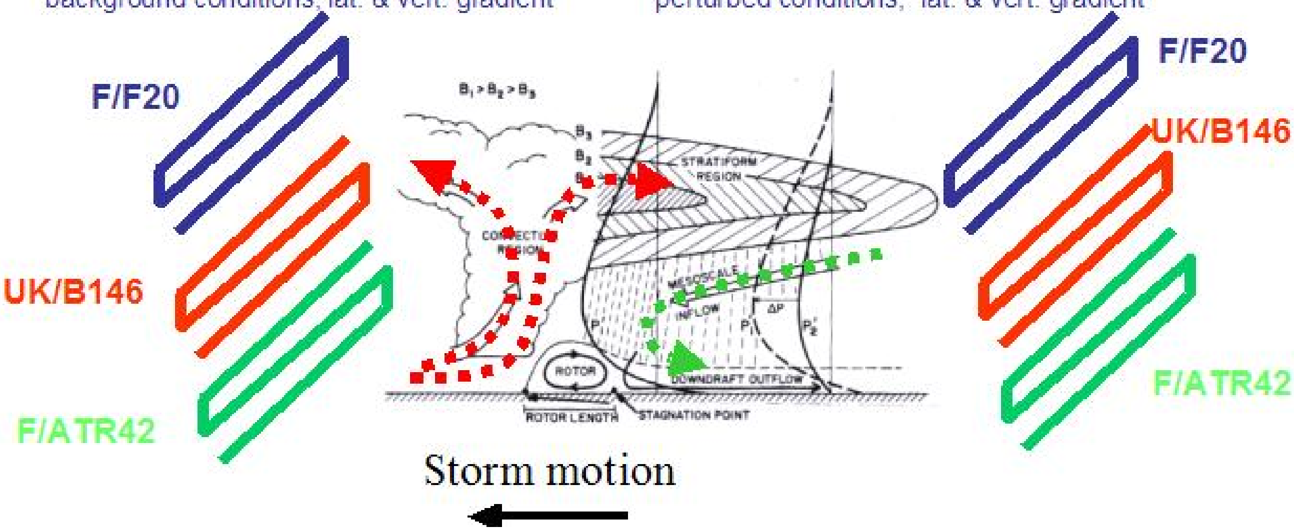
Large MCSs



STEP 1: before the MCS passage -
background conditions, lat. & vert. gradient

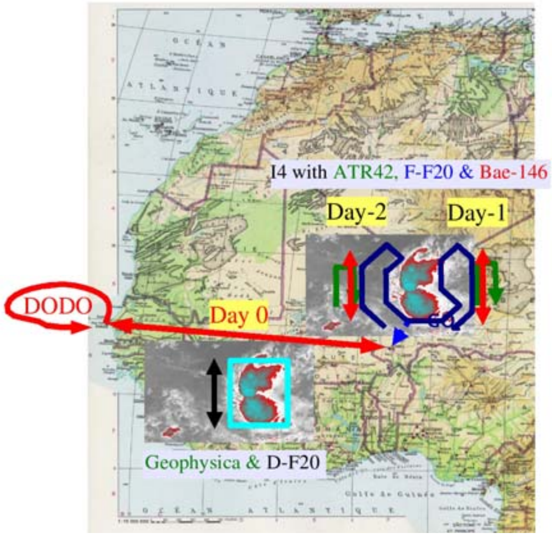


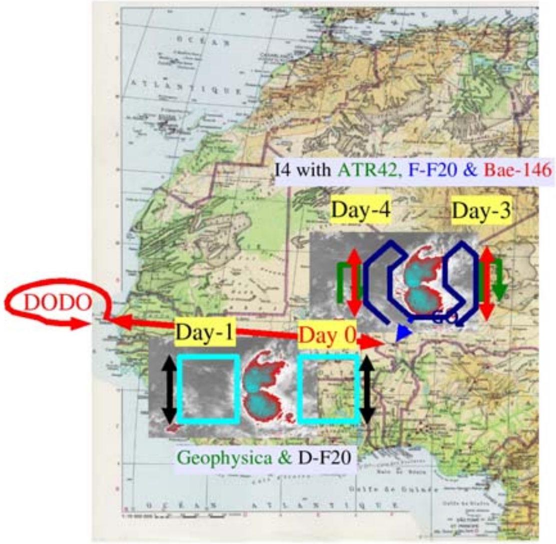
STEP 2: After the MCS passage –
perturbed conditions, lat. & vert. gradient



I3: Long range transport surveys

Funding: AMMA-France
AMMA-EU
AMMA-UK
EEIG, SCOUT ?
Number of missions: 3

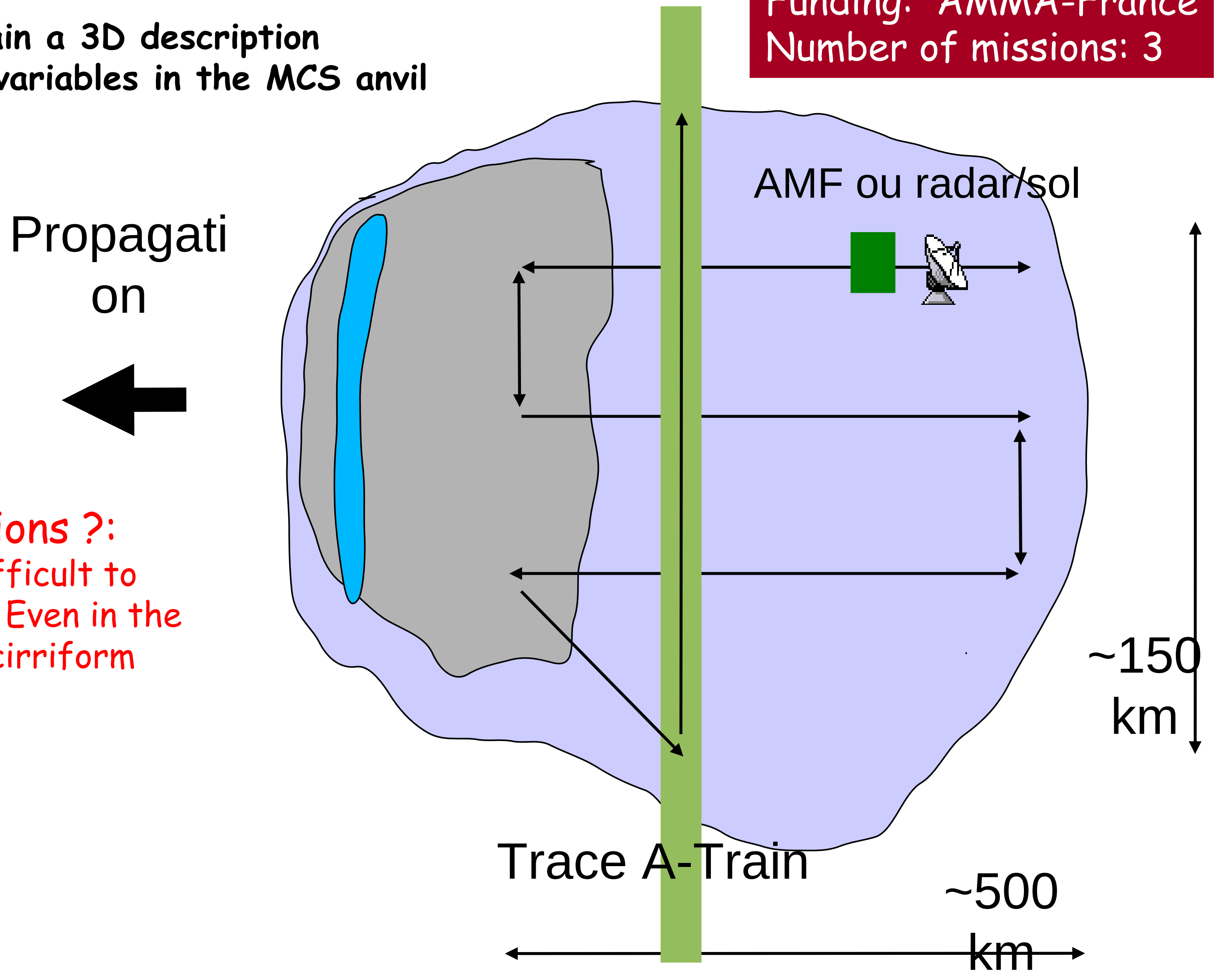




I4.1: microphysical variability of MCS anvils

Funding: AMMA-France
Number of missions: 3

Objective: obtain a 3D description of all relevant variables in the MCS anvil



FP modifications ?:

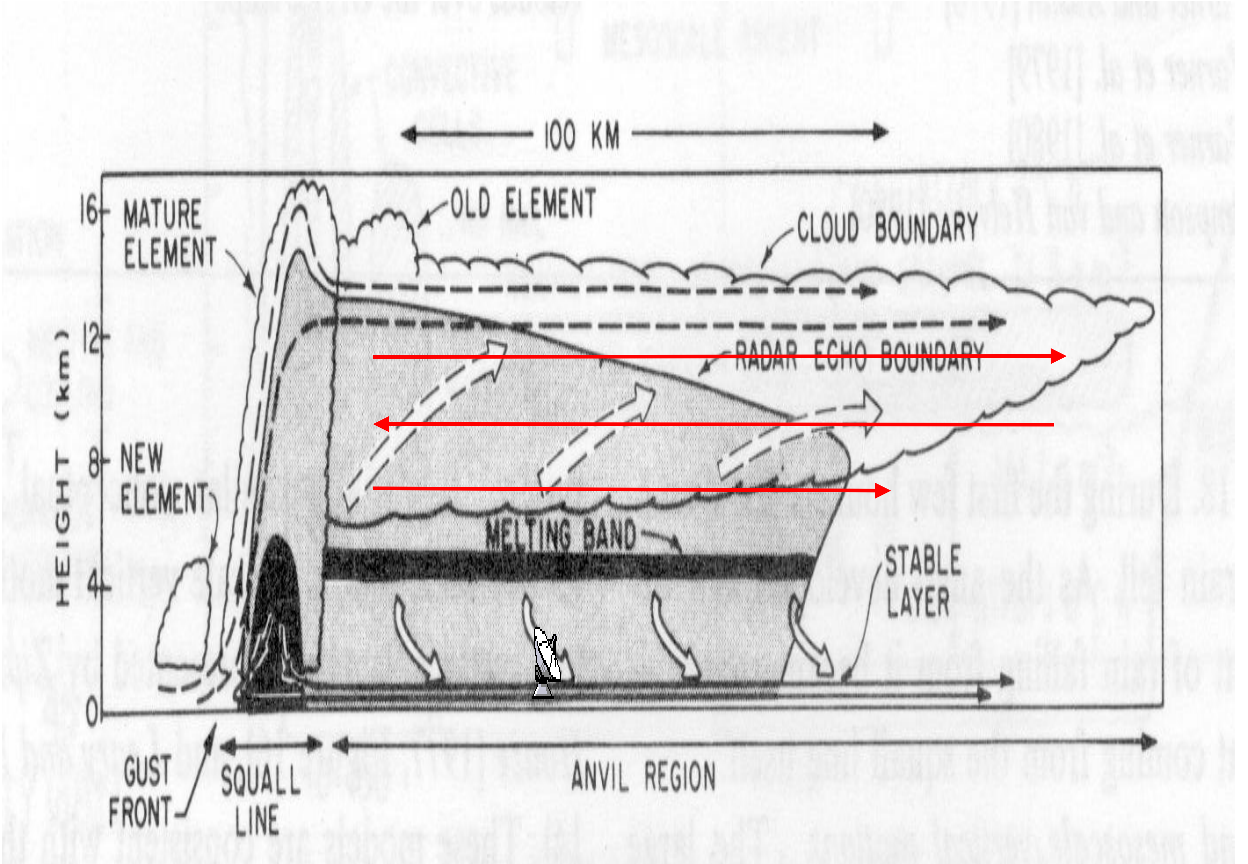
- It might be difficult to enter the cloud. Even in the stratiform and cirriform region.

I4.2: microphysical variability of MCS anvils

Objective: document the vertical layering of microphysical properties

FP modifications ?:

- It might be difficult to enter the cloud. Even in the stratiform and cirriform region.



Funding: AMMA-France
Number of missions: 3

WP 2.1 recommendations/concerns:

- Coordination with the A-Train
- Also document widespread residual clouds that can persist a long time
- Non-MCS stratus?

I5: Intensive regional observations (THORPEX-style)

- Radiosondes
- Targetted dropsondes
- Driftsondes??
- Other responsive instruments
- Data assimilation
- Responsive to conditions, or pre-programmed?

For discussion!

- Merging of IOP patterns / cooperation
- Optimisation of the links to ground facilities
  - Responsive instruments
  - Spatial extension for point data (shall we over-fly the Gourma site?)
- Satellite validation etc.

Aircraft commitments by IOP pattern

ATR42													
Flight plan	**I1.1**	**I1.2**		**I1.3**	**I1.4**	**I1.5**	**I1.6**	**I1.7**		**I2.1 and I2.2**	**I3**	**I4.1**	**I4.2**
								I1.7.1	I1.7.2				
Description of FP	ITF and Heat Low	Aerosol emissions/ squall passage		N/S Land/Atmos/Ocean interact	Land/Atmos interact	Veget. emission	Urban Survey	Aerosol mixing. Hygroscopicity		Dyn and Chem of MCS	Long range transport	Mesoscale structure	Vertical structure
		Before squall line	After squall line					Niamey-cotonou +guinee gulf	Niamey-Hombori				
FH/flight	5.5	2.5	3.3	5.5						5.5			
nb of flights	8	2	2	4				3	1	12			
Total FH	44	5	6.6	22				0	0	66	0		
Typical time of flights	10:30 - 16:00 LT												
Total													143.6

Proposal for daily decision-making schedule

Day	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
J-2							Forecast briefing					PI Group		2y AOC		TT8 meeting	
J-1							Forecast briefing	IOP Planning Group		NOTAM?		PI Group		2y AOC	NOTAM?	TT8 meeting	
J0	Range of morning take off times						Forecast briefing		Range of afternoon take off times							TT8 meeting	

IOP pattern	I1.1: ITF and Heat Low Surveys	I1.2: Dry Squall Line Passage	I1.3: N-S Land-Ocean-Atmosphere Interactions	I1.4: Land-atmosphere	I1.5: Vegetation Emission Surveys	I1.6: Urban Surveys
Key Phenomena/ Lead time	24 hours	24 hours or less	1-4 days	1-4 days	24 hours	12 hours
Intraseasonal regime	Flights before and after monsoon onset	Pre-onset	Monsoon onset.	Presence of wet or dry period; likelihood of subsequent rain	Presence of wet or dry period	N/A
Heat Low	Intensity of heat low?	N/A	Intensity of heat low?		N/A	N/A
ITCZ/ITF	Location of ITF affects flight patterns	N/A	N/A	May influence latitude of flights	May influence latitude of flights	N/A
Jets (AEJ, TEJ, STJ)	N/A	N/A	N/A	May influence latitude of flights	Affect latitude of flights	N/A
AEWs and vortices	Consider AEW activity and phase.	N/A	Consider AEW activity and phase.	May influence location of flights	Location and intensity of trough/ridge patterns and vortices	N/A
Dry intrusions	N/A	N/A	N/A	N/A	May be relevant to AEW patterns	N/A
MCSs and convection	Avoid Cb	Dry squall events.	Seek land surface responses to Cb. Avoid Cb during flights.	Seek land surface responses to Cb. Avoid Cb during flights	Avoid Cb	Avoid Cb
Non-precipitating convection	N/A		N/A		Northward extent may affect latitude of flights	N/A
Land surface	Flights before and after monsoon onset		N/A	Soil moisture will guide flight planning	Strong E-W soil moisture variability	N/A

Forecast criteria (a selection of Ix.y, for illustration)

3.1.1 How do we choose IOPs?

- Analysis and forecast criteria
- AMMA objectives
- Conduct of previous and current IOPs

3.1.2 Who has authority to nominate activities with each platform and instrument?

Collectively, the PIs will form a **'PI Group'**, which will make decisions regarding IOP plans for the next 48 hours. The membership of this **PI Group** is not yet finalised, and will depend on the availability of personnel.

3.1.3 Who has final decision regarding IOPs?

A small **IOP Planning Group** will work on detailed flight plans (the following day), and will, where necessary, choose between IOP options, and abort when necessary.

Needs from AOC

- Aircraft – dealt with by ST2-aircraft (Said)
  - Met forecasting – 24h or once daily?
  - Internet and phones
  - Rooms, vehicles
- Ground-based
  - Additional vehicles
  - Accommodation
  - Personnel
  - Power, space, maintenance, …
  - Time

Operational communications

- Radars with AOC
- Lidars with AOC
- Aircraft in-flight and post-flight
- Transmission to GTS: radiosondes and dropsondes

Partnership

All partners will be included in the daily operational discussions, as members of TT8.

Efforts will be made by operators of the larger aircraft (BAe146, ATR42 …) to obtain permission for scientific partners to fly on IOP missions.

We will make every effort to take account of the unfunded projects identified in the PIAF in our operational objectives.

TT8 presentation: Summary

- Do the monitoring strategies meet your needs?
- Are the IOP patterns comprehensive? Can they be optimised?
- TONIGHT’S MEETING – identify additional needs for mesoscale sites.

Djougou Super Site during wet SOPs

Transport: No transport plan as every useful involved instruments will stay in Djougou between SOP0 and WET SOPs

Instruments on field: (**To complete measurements supplied by AE.VAN_0D, AE.RADX_0, AE_Dsd_Or, CL.Depot_RW**)

- 3 *'13-stairs' impactors (ELPI dedicated to Carbon Fraction, one dedicated to mineral fraction, one to traces elements)
- Microlidar CAML
- Continuous Chromatography (AIRMO**VOC**)
- Nephelometer with air-dryer (on line with the EOP nephelometer)
- D-SMPS (thermo air drier + DMA + CPC)
- SMPS (DMA + CPC)
- Cloud Condensation Nuclei Counter

Decision-making (not yet finalised)

- ***Day J-2*** – identification of possible IOPs, based on available instruments and overall strategy
- ***Day J-1*** – use of forecasts for identification or realistic IOP possibilities. Submission of a set of provisional flight plans, perhaps with a contingency option. The exact time at which these need to be submitted is yet to be resolved. NOTAM.
- ***Day J0*** – development of detailed flight plans, to be submitted at least 2 hours before take-off.

	IOP pattern	I1.1: ITF and Heat Low Surveys	I1.2: Dry Squall Line Passage	I1.3: N-S Land-Ocean-Atmosphere Interactions	I1.4: Land-atmosphere	I1.5: Vegetation Emission Surveys		I1.6: Urban Surveys	I1.7: Aerosol Mixing and Hygroscopicity	I2: Dynamics and Chemistry of MCSs	I3: Long Range Transport	I4.1: MCSs Mesoscale Structure	I4.2: MCSs Vertical Structure
Aircraft	BAe146				NERC	EU	NERC	NERC ?		NERC	EU		
	ATR	API	API	API					API	API	API		
	F-F20	API	API	API						API	API	API	API
	D-F20	EU								EU	EU		
	Geophysica									?			
Coordination	Hombori	Yes	Possible	Possible		Possible		No	Yes	Possible	Yes	Possible	Possible
	Niamey	Yes	Yes	Yes		Possible		Possible	Yes	Possible	Yes	Yes	Yes
	Oueme	No	No	Yes		Possible		No	Yes	Possible	Yes	Possible	Possible
	Ships	No	No	Yes		No		No	Possible	??	Yes	No	No
	Radiosondes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes
	SCOUT	No	No	No		Possible		??	No	SOP-C	Possible	No	No

	IOP pattern	I1.1: ITF and Heat Low Surveys	I1.2: Dry Squall Line Passage	I1.3: N-S Land-Ocean-Atmosphere Interactions	I1.4: Land-atmosphere	I1.5: Vegetation Emission Surveys
AMMA-EU	1.1.1					
	1.1.2					
	1.1.3					
	1.3.1					
	1.3.2					
	1.3.3					

Stakeholders …