

Appendix A: Aircraft payloads

F/F20 payload

Table A1 – Measurements common to all SOPs

General Eastern dew point sensor 1011B	Dew point	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
INS, GPS	Position, winds, u,v,w	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
5-port turbulence probe	Turbulence	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Rosemount	Temperature T	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Aerodata humidity sensor	Relative Humidity	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
UV-O3 and IR-CO instrument	O3 and CO in situ	SAFIRE	Stephane Letourneur letourneur@dt.insu.cnrs.fr

Table A2 – Measurements required for the SOP2-a1

AVAPS dropsondes	Vertical profiles of dynamical variables	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Pygreometers and Pyranometers (Up/down)	Upwelling/Downwelling, Vis/IR Broadband radiation	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Multichannel thermal infrared radiometer (CLIMAT)	Brightness temperature	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Differential absorption lidar LEANDRE 2	2D water vapor field (below the a/c)	IPSL	C. Flamant cyf@aero.jussieu.fr

Table A3 – Measurements required for the SOP2-a2

Pygreometers and Pyranometers (Up/down)	Upwelling/Downwelling, Vis/IR Broadband radiation	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Photometer	NO2 photolysis j(NO2)	SAFIRE	Mar Pontaud Marc.pontaud@meteo.fr
AVAPS dropsondes	Vertical profiles of dynamical variables	SAFIRE	Mar Pontaud Marc.pontaud@meteo.fr
Nitrogen oxides analyser	NO, NO2 and NOy in situ	LISA	P. Perros perros@lisa.univ-paris12.fr
Mircroadsorbent tubes and ground analysis with CG--MS	COV	LISA	P. Perros perros@lisa-univ-paris12.fr
Oxygenated VOC sampling and ground analysis CG--MS	Oxygenated COV	LISA	P. Perros perros@lisa.univ-paris12.fr
HCHO	Formaldehyde	LISA	P. Perros perros@lisa.univ-paris12.fr
H2O2	Hydrogen peroide	LISA	P. Perros perros@lisa.univ-paris12.fr

Table A4 – Measurements required for the SOP2-a3

RALI	Cloud optical properties dynamics and microphysics	INSU IPSL	N. Grand grand@dt.insu.cnrs.fr
Size particle/rain drop distribution	2 DC - 2 DP – FSSP	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
AVAPS dropsondes	Vertical profiles of dynamical variables	SAFIRE	Mar Pontaud Marc.pontaud@meteo.fr

F/ATR-42 payload

Table A5 – Measurements common to all SOPs

Rosemount, Thales Avionic	Static and dynamic pressure	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Rosemount PRT	Temperature T	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Buck Research dew point sensor	Dew point	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
AIR Lyman Alpha	Water Vapour H ₂ O	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
INS, GPS	Position, winds, u,v,w	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
5-port turbulence nose	Turbulence	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
radioaltimetre Thales Avionic	Height above ground	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
IR-CO instrument	CO in situ	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
UV-O3 instrument	O3 in situ	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Externally sampling PCASP	Size distribution (0.1 to 3 µm)	SAFIRE	M. Pontaud Marc.pootaud@meteo.fr
Pyrgreometers and Pyranometers	Upwelling/Downwelling, Vis/IR Broadband radiation	SAFIRE	M. Pontaud Marc.pontaud@meteo.fr

Table A6 – Measurements required for the SOP2-a1

Chimiluminescence NO _x instrument (METAIR)	NO, NO ₂ in situ	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Photometer	NO ₂ photolysis $j(\text{NO}_2)$	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Size particle / rain drop distribution	FSSP	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
AVIRAD particle inlet	Coarse particle inlet (AVIRAD) ^o	LISA/LSCE	formenti@lisa.univ-paris12.fr
Optical sizer GRIMM	Size distribution (0.3-20 μm)	LISA	formenti@lisa.univ-paris12.fr
7- λ aethalometer	Particle soot, black carbon	LISA	formenti@lisa.univ-paris12.fr
3- λ Nephelometer	Spectral Scattering and backscattering coefficients	LISA	formenti@lisa.univ-paris12.fr
filters for individual particle analysis	Particle shape and composition	LISA	formenti@lisa.univ-paris12.fr
4-stage impactors	Aerosol composition and mass distribution	LISA	formenti@lisa.univ-paris12.fr
Particle inlet	Aerosol Particle inlet ("Veine communautaire")	CNRM	L. Gomes Laurent.gomes@meteo.fr
filters for sub and supermicron particle collection	Ions, trace, BC/OC	LA	V. Pont ponv@aero.obs-mip.fr
Ultrafine CPC	Particle number concentration > 3nm	CNRM	L. Gomes Laurent.gomes@meteo.fr
CCN counter	CCN	CNRM	L. Gomes Laurent.gomes@meteo.fr
Multi-channel CPCs	Size distribution > 10nm	CNRM	L. Gomes Laurent.gomes@meteo.fr
DMPS	Size distribution of Aitken and accumulation mode particles (20-1000 nm)	LaMP	P. Lal P.Laj@opgc.univ-bpclermont.fr
PCASPX	Size distribution 0.3-10 μm	LaMP	P. Lal P.Laj@opgc.univ-bpclermont.fr
Thermodenuder	Volatility analysis of particles	LaMP	P. Lal P.Laj@opgc.univ-bpclermont.fr
X-Probe	Aerosol and droplet size distribution (0.5-50 μm)	CNRM	L. Gomes Laurent.gomes@meteo.fr
Fast FSSP	Cloud droplet spectrum	CNRM	L. Gomes Laurent.gomes@meteo.fr

Table A7 – Measurements required for the SOP2-a2

Gerber Probe, King Probe	Liquid water content	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Chimiluminescence NOx instrument (METAIR)	NO, NO2 in situ	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Photometer	NO ₂ photolysis $j(\text{NO}_2)$	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Size particle / rain drop distribution	FSSP	SAFIRE	M. Pontaud marc.pontaud@meteo.fr
Spectres dimensionnels		LaMP	Alfons Schwarzenboeck a.schwarzenboeck@opgc.univ-bpclermont.fr
Particle inlet	Aerosol Particle inlet ("Veine communautaire")	CNRM	L. Gomes Laurent.gomes@meteo.fr
filters for sub and supermicron particle collection	Ions, trace, BC/OC	LA	V. Pont ponv@aero.obs-mip.fr
Ultrafine CPC	Particle number concentration > 3nm	CNRM	L. Gomes Laurent.gomes@meteo.fr
CCN counter	CCN	CNRM	L. Gomes Laurent.gomes@meteo.fr
Multi-channel CPCs	Size distribution > 10nm	CNRM	L. Gomes Laurent.gomes@meteo.fr
DMPS	Size distribution of Aitken and accumulation mode particles (20-1000 nm)	LaMP	P. Lal P.Laj@opgc.univ-bpclermont.fr
PCASPX	Size distribution 0.3-10 μm	LaMP	P. Lal P.Laj@opgc.univ-bpclermont.fr
Thermodenuder	Volatility analysis of particles	LaMP	P. Lal P.Laj@opgc.univ-bpclermont.fr
X-Probe	Aerosol and droplet size distribution (0.5-50 μm)	CNRM	L. Gomes Laurent.gomes@meteo.fr
Fast FSSP	Cloud droplet spectrum	CNRM	L. Gomes Laurent.gomes@meteo.fr
Microadsorbent tubes and ground analysis with GC-MS	COV	LISA	P. Perros Perros@lisa.univ-paris12.fr
Oxygenated VOC sampling and ground analysis with GC-MS	Oxygenated COV	LISA	P. Perros Perros@lisa.univ-paris12.fr
PAN-GC	Peroxyacetylnitrate	LISA	P. Perros Perros@lisa.univ-paris12.fr
HNO ₃	Nitric acid	LISA	P. Perros perrons@lisa.univ-paris12.fr

D/F20 payload

Table A8 – Measurements required for SOP 2a1

Rosemount temp probes	Temperature	DLR-FB	Andreas Giez Andreas.giez@dlr.de
INS, GPS	Position, wind	DLR-FB	Andreas Giez
Lyman-alpha	Relative humidity	DLR-FB	Andreas Giez
WIND lidar	Vertical profiles of the wind vector below the a/c along the flight track	DLR-IPA	Oliver Reitebuch Oliver.reitebuch@dlr.de

Table A9 – Measurements required for SOP 2a2

UV photometer	O3	DLR-IPA	Hans Schlager Hans.schlager@dlr.de
VUV fluorescence	CO	DLR-IPA	Hans Schlager
IR	CO2	DLR-IPA	Hans Schlager
CL	NO	DLR-IPA	Hans Schlager
CL + Au converter	NOy	DLR-IPA	Hans Schlager
Filtarradiometer	j(NO2)	DLR-IPA	Hans Schlager
IT-CIMS	HNO3	MPI-K / DLR-IPA	Frank Arnold / Hans Schlager
IT-CIMS	SO2	MPI-K / DLR-IPA	Frank Arnold / Hans Schlager
PERCA	RO2	Uni Bremen	Lola Hernandez lola@iup.physik.uni-bremen.de
CPSA (Multi-channel condensation particle counter)	Nucleation mode aerosol size distribution	DLR-IPA	Andreas Minikin andreas.minikin@dlr.de
Airborne-DMA	Aitken mode aerosol size distribution	DLR-IPA	Andreas Minikin
PCASP-100X	Accumulation mode aerosol size distribution	DLR-IPA	Andreas Minikin
FSSP-300, FSSP-100	Coarse mode aerosol and cloud element size distribution	DLR-IPA	Andreas Minikin
Thermodenuder + condensation particle counters	Aitken mode aerosol : volatile and non-volatile particle fractions	DLR-IPA	Andreas Minikin
PSAP absorption photometer	Aerosol absorption coefficient	DLR-IPA	Andreas Minikin
Impactor sampler	Single particle analysis	DLR-IPA	Andreas Minikin
Rosemount temp probes	Temperature	DLR-FB	Andreas Giez Andreas.giez@dlr.de
INS, GPS	Position, wind	DLR-FB	Andreas Giez
Lyman-alpha	Relative humidity	DLR-FB	Andreas Giez

UK/BAe146 payload

Table A10 – Measurements required for SOP 2a2

Rosemount Thermometers	Non-deiced/deiced temperatures	FAAM	Stephen Devereau stde@faam.ac.uk
General eastern	Dew point	FAAM	Stephen Devereau stde@faam.ac.uk
FWVS Lyman- α fluorescence	Water vapour	UKMO	Jim Haywood jim.haywood@metoffice.gov.uk
INS, GPS, wind vanes	Position, winds, u,v,w	FAAM	Stephen Devereau stde@faam.ac.uk
Cruciform GPS	Position	UFAM/C amb	Stephen Devereau stde@faam.ac.uk
Video cameras	Forward, rearward, upward, downward	FAAM	Stephen Devereau stde@faam.ac.uk
Radar altimeter	Altitude	FAAM	Stephen Devereau stde@faam.ac.uk
Radar	Rainfall	UFAM/C amb	Stephen Devereau stde@faam.ac.uk
5-port turbulence probe	Turbulence	UFAM/C amb	Stephen Devereau stde@faam.ac.uk
Heimann IR thermometer	SST	FAAM	Stephen Devereau stde@faam.ac.uk
SWS	Short wave radiation	UKMO	Jim Haywood jim.haywood@metoffice.gov.uk
AVAPS dropsondes	Vertical profiles of dynamical variables	FAAM	Stephen Devereau stde@faam.ac.uk
Pyreometers and Pyranometers	Broadband radiation	FAAM	Stephen Devereau stde@faam.ac.uk
Photometer	NO ₂ photolysis j(NO ₂)	Leicester	Paul Monks psm7@le.ac.uk
Fixed bandwidth radiometry, UV	O ₃ photolysis j(O ¹ D)	Leicester	Paul Monks psm7@le.ac.uk
VUV fluorescence	Ozone in situ	FAAM	Stephen Devereau stde@faam.ac.uk
VUV fluorescence	Carbon monoxide CO	FAAM	Stephen Devereau stde@faam.ac.uk
PTR-MS	Real-time Oxygenates	UEA	David Oram d.e.oram@uea.ac.uk
Whole air samples (WAS) and ground analysis with dual channel GC	>100 VOCs inc NMHCs, alcohols, ketones, aldehydes, ethers	York	Ally Lewis acl5@york.ac.uk
WAS and ground analysis with 2DGC	Semivolatle VOCs	York	Ally Lewis acl5@york.ac.uk
Microadsorbent tubes and ground analysis with GC- TOF-MS	VOCs	York	Ally Lewis acl5@york.ac.uk
WAS and ground analysis with GC-MS	>40 halocarbons	UEA	David Oram d.e.oram@uea.ac.uk
Gold convertor + chemiluminescence	NO _y , NO, NO ₂ , HNO ₃	UEA	David Stewart d.stewart@uea.ac.uk
TECO	NO _x	FAAM	Stephen Devereau stde@faam.ac.uk

Gas chromatography (GC)	Peroxyacetylnitrate	UFAM/York	Jim Hopkins jh61@york.ac.uk
Fluorometric	Speciated peroxides (inorg/organic)	UEA	Brian Bandy b.bandy@uea.ac.uk
Fluorometric	Formaldehyde	UEA	Graham Mills g.mills@uea.ac.uk
Chemical amplifier – PERCA	Peroxy radicals (RO ₂ + HO ₂)	Leicester/UEA	Paul Monks psm7@le.ac.uk
FAGE (laser induced fluorescence at low pressure)	OH, HO ₂	Leeds/UFAM	Dwayne Heard d.e.heard@leeds.ac.uk
Aerosol mass spectrometer AMS	Aerosol size and composition	UNIMAN/UFAM	Hugh Coe hugh.coe@manchester.ac.uk
TSI condensation particle counters	Particle number concentration > 3nm	FAAM/UNIMAN	Hugh Coe hugh.coe@manchester.ac.uk
internally and externally sampling (OPCs) PCASP	Size distribution (0.2-30 um)	FAAM	Stephen Devereau stde@faam.ac.uk
internally and externally sampling (OPCs) GRIMM	Size distribution (0.2-30 um)	UNIMAN	Hugh Coe hugh.coe@manchester.ac.uk
filters for sub and supermicron particle collection and ionic analysis	Ions	FAAM/UNIMAN	Hugh Coe hugh.coe@manchester.ac.uk
Fast FSSP	Drop size spectrum	FAAM	Stephen Devereau stde@faam.ac.uk
CCN spectrometer	CCN	UKMO	Jim Haywood jim.haywood@metoffice.gov.uk
PSAP	Particle soot, black carbon	FAAM	Stephen Devereau stde@faam.ac.uk
Nephelometer (TSI),	Scattering	FAAM	Stephen Devereau stde@faam.ac.uk
SID1	Particle sizes, non-sphericity	Herts/UKMO	Jim Haywood jim.haywood@metoffice.gov.uk

Geophysica/M55 payload

Table A11 – Measurements required for SOP 2a2

FOZAN Dye chemiluminescence + ECC	O ₃	CNR	Fabrizio Ravegnani
FOX UV absorption	O ₃	DLR	Hans Schlager
FISH Lyman- α photo-fragment fluorescence	H ₂ O (total)	FZJ	Cornelius Schiller
FLASH Lyman- α	H ₂ O (gas phase)	CAO	Vladimir Yushkov
ACH mirror hygrometer with digital feedback	H ₂ O frost-point -> H ₂ O (gas phase)	CAO	Vladimir Yushkov
SIOUX Chemiluminescence, + Au-converter + Subisokinetic inlet	NO NO _y Particle NO _y	DLR	Hans Schlager
HALOX Chemical-conversion resonance fluorescence + thermal dissociation	ClO BrO, ClONO ₂	FZJ	Fred Stroh
HAGAR GC/ECD GC/ECD GC/ECD GC/ECD IR absorption	N ₂ O, CFC 12, CFC11 Halon 1211 SF ₆ CH ₄ CO CO ₂	Uni Frankfurt	C. Michael Volk
ALTO TDL	N ₂ O, CH ₄ CO	INOA	Piero Mazzinghi
CO-TDL		INOA	Piero Mazzinghi
COPAS 4 channels 2-channel CN counter, one inlet heated	Condensation nuclei (CN-total , CN-non-volatile)	Uni Mainz	Stephan Borrmann
FSSP3000 or FSSP100 Laser-particle spectrometer	Size speciated aerosols (0.4-40 μ m)	Uni Mainz	Stephan Borrmann
Particle Imager		Uni Mainz	Stephan Borrmann
MAS Multi-wavelength Scattering	Aerosol optical properties	CNR	Francesco Cairo
MAL 1 & 2 Microjoule-lidar	Remote Aerosol Profile (2km from aircraft altitude)	Obs. Neuchatel	Valentin Mitev
WAS Whole air sampler	Trace gas isotopes Water vapour isotopes	MPI-Heidelberg	Thomas Röckmann
TDC Rosemount probe	Temperature	CAO	G. Shur
PT100, 5-hole probe	horizontal wind	CAO	G. Shur
MTP Microwave passive sensor	vertical profile of temperature and potential temperature	JPL	MJ Mahoney
SMOKE	Vertical velocity Diffusivity	AWI	Markus Rex

Appendix B: Surface-based instrumentation

An updated list of the SOP instruments as well as instrument forms are available at:
http://www.lthe.hmg.inpg.fr/AMMA_International/instruments/List_SOPInstruments_Total.html

Table B1: Ground-based instrumentation

Instrument	Period	Code	Instit'n	PI	Location	Deployment Period	Mode	Sampling
SOP southern quad	EOP-SOP	AS.RS_1	U Koeln	Fink	5 P1 RS stations	EOP	R	
SOP northern quad	EOP-SOP	AS.RS_2	U Leeds	Parker	4 P1_EOP RS & 2 P1_SOP RS stations	EOP	R	
SOP western quad	EOP-SOP	AS.RS_3	IPS	Janicot	4 P1 RS & 1 P2 RS stations	EOP	R	
Flux station Dano	SOP	AS.Flux_D	FZK	Kalthoff	Dano	1 June - end July	M	30 min
Radiosounding Dano	SOP	AS.Rs_D	FZK	Kalthoff	Dano	1 June - end July	R	3-6 hrs
Lidar Ceilometer CT25K	SOP	AE.CT25K_Od	U Bonn	Crewell	Djougou	January-December	M	15 sec
Micro Rain Radar	SOP	AE_RADK_Od	U Bonn	Crewell	Djougou	January-December	M	10 sec
Bistat. Radar receiver	SOP	AS_BISTAT_Od	DLR	Hagen	Djougou	15 Jun-15 Sep	M	Continuous
Lightning detection network	SOP	AS.Lightning_Od	DLR	Höller	Djougou	SOP1 & 2	M	Continuous
Sodar network	SOP	AS.SODAR_N	U Leeds/FZK	Kalthoff / Parker	Niamey	1 June - 21 Aug	M	
Tethered balloon	SOP	AS.Tethersonde_N	U Leeds	Parker	Niamey	15 July - 21 Aug	R	to be arranged
Microwave Radiometer	SOP	AS.PROF_O	U Bonn	Crewell	Djougou	January-December	M	1 min
COV measurements	SOP	AS.TMS_O	U. York	Lewis	Djougou	SOP 2a2	M	30 min
GPS humidity	SOP	AS.GPS_1	CNRS	Bock	Tamale, Ouaga, Tombouctou	May-September	M	30 min
C-Band Radar Ronsard	SOP	AS.Ronsard_O	CNRS	Scialom	Djougou	15 Jun-15 Sep	R	
Oceanic soundings	SOP	OS.RS_SAG	CNRM	Caniaux	Atalante/EGGE	25 May – 7 July	R	
Oceanic instrumented mast (mean variables)	SOP	OS.Mat_SAG	CNRM	Caniaux	Atalante/EGGE	25 May – 7 July	M	
Oceanic instrumented mast (turbulence)	SOP	OS.Flux_SAG	CNRM	Caniaux	Atalante/EGGE	25 May – 7 July	M	
Marisonde buoys	SOP	OS.Mari_SAG	CNRM	Rolland	Gulf of Guinea	June 1	M	10 min

Expendable probes	SOP	OS.XBT_GG	LEGOS	Bourles	Gulf of Guinea	25 May – 7 July	M	
XCTDs and XTBs	SOP	OS.ITAF_Sn	LEGOS	Bourles	Tropical Atlantic	July-September	M	
Constant volume balloon	SOP	AS.BVC_T2	CNES	Drobinski	Cotonou	15 June - 15 July	R	
Driftsondes	SOP	AS.Drift_T1	CNES/NCAR	Drobinski / Parsons	Diffa or Zinder	15 Aug.-30 Sep.	R	
Wet and dry deposition fluxes, etc..	SOP	AS.Dust.ST_flux	UP12	Desboeuf	Niamey	June-August	M	continuous
Chemical instrumentation	SOP	AS.Dust_Od	UPS	Pont	Djougou	SOP 2a1	M	
Ozone soundings	EOP-SOP	AS.RSO3_Od	LA	Thouret	Cotonou	June-August	M	
Lidar	SOP	AS.TRESS_Tam	IPSL	Flamant	Tamanrasset	June – September	M	
Lidar	SOP	AS.lidar_Mbour	LOA	Tanré	M'Bour	June –August	M	
Aerosol characterisation	SOP	AS.Aeros_MBour	LOA	Chiapello	M'Bour	SOP 2	M	
Soil moisture radar	SOP	AS.RAD4.3_Bani	LTHE	Cohard	Banizoumbou	June-September	M	
UHF radar	SOP	AS.UHF_O	LA	Campistron	Djougou			
X-Band pol. Radar	EOP-SOP	AS.RADX_O	IRD	Gosset	Djougou	EOP	R	
Surface station	SOP	AS.met_S	U Reading	Slingo	Banizoumbou	January-December	M	1 min
IR and VIS radiative fluxes	SOP	AS.skyrad_S	U Reading	Slingo	Banizoumbou	January-December	M	1 min
Radiosounding	SOP	AS.sonde_S	U Reading	Slingo	Niamey	January-December	M	4 per day
VHF wind profiler & 915 nm Doppler radar	SOP	AS.rwp_S	U Reading	Slingo	Niamey	January-December	M	6 min
W-Band cloud radar	SOP	AS.wacr_S	U Reading	Slingo	Niamey	January-December	M	2 sec
Microwave radiometer	SOP	AS_mwr_S	U Reading	Slingo	Niamey	January-December	M	25 sec
Lidar ceilometer CT25K	SOP	AS.vceil_S	U Reading	Slingo	Niamey	January-December	M	15 sec
Lidar	SOP	AS.mpl_S	U Reading	Slingo	Niamey	January-December	M	1 min
Sky imager	SOP	AS.tsi_S	U Reading	Slingo	Niamey	January-December	M	30 sec
Downwelling radiance at 869 nm	SOP	AS.nfov_S	U Reading	Slingo	Niamey	January-December	M	1 sec

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Digital camera	SOP	AS.twrcam_S	U Reading	Slingo	Niamey	January-December	M	1 hour
MIT C-band Doppler radar polarized	SOP	AS.MITRadC_N	U Reading	Slingo	Niamey	January-December	M	

Appendix C: Scientific stakeholders for the IOPs

Table C1: Scientific stakeholders for different IOP patterns

	IOP pattern	I1.1	I1.2	I1.3	I1.4	I1.5	I1.6	I1.7	I2	I3	I4.1	I4.2	I5.1	I5.2	
AMMA-EU	1.1.1														I1.1: IFT and heat low surveys I1.2: Squall-line related aerosol emissions I1.3: North-south land-ocean-atmosphere interactions I1.4: land-ocean-atmosphere interactions I1.5: Vegetation emission surveys I1.6: Urban surveys I1.7: Aerosol mixing and hygroscopicity I2: Dynamics an chemistry of MCSs I3: Lang-range transport I4.1: Horizontal variability of MCS anvils I4.2: Vertical microphysical properties of MCS anvils I5.1 Intensive regional observations: Monsoon onset I5.2: Intensive regional observations: Monsoon peak
	1.1.2														
	1.1.3														
	1.3.1														
	1.3.2														
	1.3.3														
	2.1.1														
	2.1.2														
	2.1.3														
	2.4.1														
	2.4.2														
	2.4.3														
2.4.4															
AMMA-UK	1.3														
	1.4														
	2.1														
	2.2														
	3.1														
	3.2														
	3.3														
	3.4														
	3.5														
	4.1														
	4.2														
	4.3														
4.4															
5.1															
AMMA-France	1.1.1														
	1.1.2														
	1.1.3														
	1.3.1														
	1.3.2														
	1.3.3														
	2.1.1														
	2.1.2														
	2.1.3														
	2.1.4														
	2.1.5														
	2.1.6														
	2.4.1														
	2.4.2														
	2.4.3														
	2.4.4														

Table C2: Scientific stakeholders for different SOP ground-based instruments

Instrument	Code	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4
SOP Southern, Northern & Western quadrilaterals	AS.RS_1 AS.RS_2 AS.RS_3	X	X			X		X	X					X		X	X
Flux station Dano	AS.Flux_D			X		X								X			X
Radiosounding Dano	AS.Rs_D	X	X			X		X	X					X		X	X
Lidar Ceilometer CT25K	AE.CT25K			X		X			X								X
Micro Rain Radar	AE_RADK_T		X			X								X		X	X
Bistat. Radar (Wind field)	AS_BISTAT_Od		X			X			X					X			X
Lightning detection network	AS.Lightning_Od					X			X					X			X
Sodar network	AS.SODAR_N					X								X			X
Tethered balloon	AS.Tethersonde_N					X											X
Microwave Radiometer	AS.PROF_O		X	X		X								X		X	X
COV measurements	AS.TMS_O			X				X	X					X			X
GPS humidity	AS.GPS_1		X			X								X		X	X
C-Band Radar Ronsard	AS.Ronsard_O		X			X			X					X		X	X
Oceanic soundings	OS.RS_SAG	X		X		X	X										X
Oceanic instrumented mast (mean variables)	OS.Mat_SAG			X		X	X							X		X	X
Oceanic instrumented mast (turbulence)	OS.Flux_SAG			X		X	X							X		X	X
Marisonde buoys	OS.Mari_SAG	X					X							X			X
Expendables probes	OS.XTB_GG	X					X							X			X
XCTDs and XTBs	OS.ITAF_Sn	X					X							X			X
Constant volume balloon	AS.BVC_T2	X	X	X		X								X			X

Driftsondes	AS.Drift_T1	X	X			X											X
Wet and dry deposition fluxes, etc..	AS.Dust.ST_flux	X						X					X		X		X
Chemical instrumentation	AS.DUST_Od							X									X
Ozone soundings	AS.RSO3_Od							X									X
Lidar	AS.TRESS_Tam	X		X		X		X					X				X
Lidar	AS.lidar_Mbour	X		X				X									X
Aerosol characterisation		X						X					X		X		X
Soil moisture radar	AS.RAD4.3_Bani	X	X	X		X							X		X		X
UHF radar	AS.UHF_O	X				X							X				X
X-Band pol. Radar	AS_RADX_O		X			X		X					X		X		X
MIT C-band Doppler radar polarized	AS.MITRadC_N		X			X		X					X		X		X
ARM Mobile Facility	AS.met_S AS.skyrad_S AS.sonde_S AS.rwp_S AS.wacr_S AS.mwr_S AS.vceil_S AS.mpl_S AS.tsi_S AS.nfov_S AS.twrcam_S	X	X			X		X					X		X		X

Appendix D: Provisional planning of PIs during SOP 1 & 2

		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	18/9
BAe146	Coe																	
	Evans																	
	Highwood																	
	Lewis																	
	Matthews																	
	McQuaid																	
	Messenger																	
	Methven																	
	Monks																	
	Murphy																	
	Oram																	
	Parker																	
	Reeves																	
	Stewart																	
Taylor																		
ATR42	Said																	
	Lothon																	
	Formenti																	
	Durand																	
	Lohou																	
	Gomes																	
	Schwarz.																	
Jambert																		
F-F20	Flamant																	
	Cammas																	
	Chong																	
	Roux																	
	Perros																	
	Borbon																	
	Bouniol																	
Pelon																		
D-F20	Reitebugh																	
	Dabas																	
	Schlager																	
	Minikin																	
M55	Cairo																	
	Law																	
	Schlager																	

Table D1: Aircraft PIs planning during SOP 1 and 2 (provisional)

			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	18/9		
Tamanrasset	TReSS	Cuesta																			
		Edouart																			
		Marnas																			
		Lapouge																			
		Gibert																			
Niamey/ Banizoumbou	Dust station	Chatenet																			
		Marticorena																			
		Caquineau																			
	MIT C-band radar	Williams																			
	Tethersonde	Brooks																			
		Hobby																			
		Lavender																			
		Bain																			
	Soil moisture Radar	Cohard																			
	ARM Mobile Facility																				
GPS	Bock																				
Djougou	RONSARD	Scialom																			
		Protat																			
	X-PORT	Gosset																			
		Cazenave																			
	Bisatic radar	Hagen																			
		RONSARD PI																			
	Lightning Network	Hoeller																			
		Houngninou																			
	Dust Incl. LIDAR	Galy-Lacaux																			
		Delon																			
		Lewis																			
	Ceilometer Radiometer	Crewell																			
Pospichal																					

	Rain radar																		
	UHF radar	NO Pls ONSITE																	
Dano	Radiosonde	Kalthoff																	
		Kohler																	
	Flux	Kalthoff																	
		Kohler																	
R/V Atalante	Radiosonde	Caniaux																	
		Eymard																	
	Mast	Caniaux																	
		Eymard																	
	Air-sea int. Buoys	Caniaux																	
		Eymard																	
	SVP, ARGO, PIRATA buoys	Bourles																	
		Bourles																	
Hydrology/ Salinity	Gouriou																		
	Thouret																		
Cotonou	Ozone Sounding																		
	PCVB	Basdevant																	
Diffa / Zinder	Dust station Incl. LIDAR	NO Pls ONSITE																	
	Driftsondes	Drobinski																	
Redelsperger																			

Table D2: Ground-based instruments Pls planning during SOP 1 and 2 (provisional)

		01-Jun		15-Jun		01-Jul		15-Jul	17-Jul	25-Jul		22-Aug	25-Aug	01-Sep	15-Sep		
		start SOP 1a arrival F20 & ATR		end SOP 1a departure F20 & ATR		start SOP 2a1 arrival F20 & ATR & DLR F20		end SOP 2a1 departure F20 & DLR F20	start SOP 2a2 arrival BAe146		arrival F20 & ATR SAFIRE		departure F20 & ATR	end SOP 2a2 departure BAe146	start SOP 2a3 arrival F20	end SOP 2a3 departure F20	
No SOP aircraft activity		SOP 1a 1-15 June			SOP 2a1 1-15 July			SOP 2a2 17 July - 25 August					SOP 2a3 1-15 Sept				
No SOP ground-based activity		SOP 1g 15-30 June															
Week	22/05/06 – 28/06/06	29/05/06 – 04/06/06	05/06/06 – 11/06/06	12/06/06 – 18/06/06	19/06/06 – 25/06/06	26/06/06 – 02/07/06	03/07/06 – 09/07/06	10/07/06 – 16/07/06	17/07/06 – 23/07/06	24/07/06 – 30/07/06	31/07/06 – 06/08/06	07/08/06 – 13/08/06	14/08/06 – 20/08/06	21/08/06 – 27/08/06	28/08/06 – 03/09/06	04/09/06 – 10/09/06	11/09/06 – 17/09/06
AOC Niamey																	
Science coordination																	
ISSC-EC																	
T. Lebel		1/6/06		15/6/06		1/7/06		15/7/06							1/9/06		15/9/06
J.L. Redelsperger				16/6/06		30/6/06						1/8/06		13/8/06			
A. Diedhiou				16/6/06		30/6/06					25/7/06	31/7/06					
C. Thorncroft									17/7/06		31/7/06						
J. Polcher												08-13/08/06		14/8/06	25/8/06		
D. Parker									17/7/06	25/7/06							
C. Flamant		1/6/06		15/6/06		1/7/06		15/7/06									

Table D3 – Roster for Scientific Coordinators and Deputies

	01-Jun		15-Jun		01-Jul		15-Jul		17-Jul		25-Jul		22-Aug		25-Aug		01-Sep		15-Sep	
	start SOP 1a arrival F20 & ATR		end SOP 1a departure F20 & ATR		start SOP 2a1 arrival F20 & ATR & DLR F20		end SOP 2a1 departure F20 & ATR & DLR F20		start SOP 2a2 arrival BAe14		arrival F20 & ATR SAFIRE		departure F20 & ATR		end SOP 2a2 departure BAe146		start SOP 2a3 arrival F20		end SOP 2a3 departure F20	
No SOP aircraft activity	SOP 1a 1-15 June				SOP 2a1 1-15 July				SOP 2a2 17 July - 25 August								SOP 2a3 1-15 Sept			
No SOP ground-based activity	SOP 1g 15-30 June																			
Week	22/05/06 – 28/06/06	29/05/06 – 04/06/06	05/06/06 – 11/06/06	12/06/06 – 18/06/06	19/06/06 – 25/06/06	26/06/06 – 02/07/06	03/07/06 – 09/07/06	10/07/06 – 16/07/06	17/07/06 – 23/07/06	24/07/06 – 30/07/06	31/07/06 – 06/08/06	07/08/06 – 13/08/06	14/08/06 – 20/08/06	21/08/06 – 27/08/06	28/08/06 – 03/09/06	04/09/06 – 10/09/06	11/09/06 – 17/09/06			
Forecast Group																				
J.-P. Lafore	19/5/06		2/6/06		13/6/06				21/7/06		11/8/06									
Vidal	19/5/06								11/7/06		28/7/06									
Chapelon	19/5/06		6/6/06																	
Forecast Support Group																				
F. Couvreur (CNRM)	2/6/06						30/6/06													
N. Asencio (CNRM)					27/6/06				25/7/06											
J. Yu (IPSL)											4/8/06		25/8/06		25/8/06		15/9/06			
M. Nuret (CNRM)																				
IPSL, CNRM & LA "non instrument-PIs" Scientists																				
Could act as Scientific Secretary or deputy																				
Could act as Facility Supervisor																				
F. Aires (IPSL)	30/5/06		16/6/06																	
M.-P. Lefèvre (IPSL)	26/5/06		13/6/06																	
B. Sultan (IPSL)					30/6/06		21/7/06													
S. Janicot (IPSL)					27/6/06		18/7/06													
C. Mari (LA)					30/6/06		7/7/06													
A. Deme (IPSL)									18/7/06		8/8/06									
F. Guichard (CNRM)									20/7/06		5/8/06									
P. Peyrillé (CNRM)									28/7/06		11/8/06									
J.-Y. Grandpeix (IPSL)											8/8/06		29/8/06							
G. Gastineau (IPSL)											11/8/06		1/9/06							
F. Cheruy (IPSL)													29/8/06		15/9/06					

Table D4: Commitment of scientists to other 'Named responsibilities' at Niamey AOC for the SOP periods.

	01-Jun	15-Jun	01-Jul	15-Jul	17-Jul	25-Jul	22-Aug	25-Aug	01-Sep	15-Sep							
	start SOP 1a arrival F20 & ATR	end SOP 1a departure F20 & ATR	start SOP 2a1 arrival F20 & ATR & DLR F20	end SOP 2a1 departure F20 & ATR & DLR F20	start SOP 2a2 arrival BAe14	arrival F20 & ATR SAFIRE	departure F20 & ATR	end SOP 2a2 departure BAe146	start SOP 2a3 arrival F20	end SOP 2a3 departure F20							
No SOP aircraft activity	SOP 1a 1-15 June		SOP 2a1 1-15 July		SOP 2a2 17 July - 25 August				SOP 2a3 1-15 Sept								
No SOP ground-based activity	SOP 1g 15-30 June																
Week	22/05/06 – 28/06/06	29/05/06 – 04/06/06	05/06/06 – 11/06/06	12/06/06 – 18/06/06	19/06/06 – 25/06/06	26/06/06 – 02/07/06	03/07/06 – 09/07/06	10/07/06 – 16/07/06	17/07/06 – 23/07/06	24/07/06 – 30/07/06	31/07/06 – 06/08/06	07/08/06 – 13/08/06	14/08/06 – 20/08/06	21/08/06 – 27/08/06	28/08/06 – 03/09/06	04/09/06 – 10/09/06	11/09/06 – 17/09/06
									arrival DLR F20 & Geophysica		departure DLR F20 & Geophysica						
AOC Ouaga									arrival DLR F20 & Geophysica		departure DLR F20 & Geophysica						
I. Bouara									28/7/06		18/8/06						
B. Cadet									28/7/06		18/8/06						
MSC specialist (CNRM?)																	
J. Polcher																	
AOC Djougou									20/7/06		20/8/06						
C. Rio									20/7/06		20/8/06						

Table D5: Commitment of scientists to 'Named responsibilities' at Ouagadougou AOC for the SOP periods.

Appendix E: Objectives of (inter)national AMMA groups

1. AMMA-EU sub-workpackages with specific interest in this SOP

WP1.1 WAM and the global climate

1.1.1 Interannual variability and trends of the WAM

1.1.1.a: study of the ocean-atmosphere couplings and their impacts on WAM dynamics

1.1.1.b: analysis of the African ITCZ

1.1.2 WAM impacts on atmospheric composition and global climate (impact of WAM emissions on global oxidant and aerosol budgets, the oxidising capacity and global radiative forcing)

WP1.2 Water cycle

WP1.3 Land surface-atmosphere feedbacks

1.3.1 Land surface processes and atmospheric forcings

1.3.2 Atmospheric responses to land surface processes

1.3.3 Coupling studies

WP1.4 Scale interactions

WP2.1 Atmospheric dynamics and convection

2.1.1 Regional to synoptic scale

2.1.2 Synoptic to mesoscale

2.1.3 Mesoscale to cloud scale

WP2.4 Aerosols and chemical processes in the atmosphere

2.4.1 Aerosol radiative properties and hygroscopicity

2.4.2 Gas and particle phase chemistry

2.4.3 Surface processes

2.4.4 Effect of convection of chemical and aerosol budgets

2. AMMA-UK Objectives relevant to TT8 / SOP-Monsoon

Objectives of relevance to TT8 are:

WP1.3 To implement a high resolution land surface-only version of the Met Office Unified Model (UM) over the tropical North African region, forced by observations, to generate daily analyses of land surface properties and fluxes. The use of MSG data to nudge soil moisture towards observed cloud-screened brightness temperature patterns will produce analyses of greatly improved quality, reducing the sensitivity of the output to poorly observed precipitation data. This technique can be applied where cloud cover permits - from experience at least one in three days in the southern Sahel and more often further north. Coupled with radiation estimates from MSG, this will provide the dominant atmospheric forcing at scales down to 2.5 km. Vegetation and topography data exists at even high resolution, thus permitting the production of high resolution soil moisture and leaf area data.

WP1.4 To provide daily surface fields of soil moisture, soil temperature and leaf area for initialisation and validation of Unified Model simulations from micro to synoptic

scales, exploring soil-canopy-atmosphere interactions. This work package will also make use of ground data from the CATCH, IMPETUS and other networks provided by the international AMMA consortium, ECMWF atmospheric analyses, rainfall analyses from GPCP, and satellite datasets (MSG and MODIS).

WP2.1 To make sub-canopy observations alongside the flux station array, and thereby to quantify the microclimates of the region, in relation to spatial patterns inferred by satellite and aircraft data.

WP2.2 To use mesoscale model simulations (on spatial resolutions of 1km or smaller) to attempt to simulate the control of the microclimate by spatial inhomogeneities of surface properties (as provided by WP1). This modelling will be in the form of case studies and idealised simulations.

WP3.1 To develop validated model case studies of the diurnal cycle of convection in the continental WAM, and over anomalies of soil moisture.

WP3.2 To use case studies to quantify the response of the WAM dynamics to MCSs.

WP3.3 To quantify the transport properties of dry and moist convective circulations, on the mesoscale and the continental scale, through model case studies and through use of chemical tracers that act as markers of source regions and of air mass ages. Within this, to model mixing in the monsoon layer and its implication for the monsoon fluxes.

WP3.4 To develop synoptic cases studies of AEW structure both north and south of the AEJ, and explore the interaction of these AEWs with soil moisture patterns.

WP3.5 To describe the evolution of the SAL on synoptic and diurnal timescales.

WP4.1 To make, for the first time, comprehensive observations of the atmospheric composition within the WAM, and thereby to characterise the composition (trace gases and particles) of the different zones within the WAM system.

WP4.2 Relate the composition observed in the boundary layer to land surface and vegetation characteristics, as derived from satellite and ground-based observations, and make a first attempt to derive airborne vertical fluxes of biogenic VOCs within the WAM region.

WP4.3 Use the improved understanding of the dynamics to evaluate the role of the monsoon circulation in transporting chemical constituents within the WAM region (e.g. boundary layer to mid-troposphere).

WP4.4 Use the observational dataset to provide improved constraints on our understanding of how natural emissions (VOC and NO_x) impact the chemistry (e.g. O₃ and HO_x budgets, secondary organic aerosol) of the WAM region, and the production of constituents that may be transported both into the TTL and over regional and continental scales. This objective will relate the chemical control of the particulate material to its ability to act as cloud condensation nuclei and to affect the radiative properties of the particulates.

WP5.1 To use observations of the convective outflows in the TTL region to analyse the chemical and dynamical processes occurring in such outflows.

3. AMMA-France Objectives for TT8 / SOP Monsoon

The management structure for AMMA-France is identical to that of the AMMA-EU programme (section 1.1 above).

1. SOP-Monsoon-related Objectives from the PIAF

The following projects have been proposed as part of the PIAF (African involvement plan – <http://www.ird.ne/ammanet/>).

The full project descriptions can be found by contacting the proposers of each project, or by consulting members of the African coordination committee (CSAM – see <http://www.ird.ne/ammanet/>).

Name	Affiliation country	Research area	Project proposal
EL MAJDOUB Ali	ACMAD	Prévision Numérique	Evaluation de l'impact de AMMA sur la PNT, cas du modèle Aladin NORAF
FOAMOUHOUE Kamga	ACMAD	Recherches Développement des Applications	Validation des modèles climatiques pour l'exploitation et formation
MUMBA Zilore	ACMAD	Météorologie	Inter-Annual and Intra-seasonal Variability of the West African Monsoon System
B, TRAORE Seydou	AGRHYMET	Agrométéorologie, unité Méthodes et applications	Analyse de la variabilité des rendements agricoles en Afrique de l'Ouest en fonction des facteurs climatiques liés à la mousson
ABOU Amani	AGRHYMET	Hydrologie	1. Evaluation régionale de l'impact du changement climatique sur les ressources en eau en Afrique de l'Ouest; 2. Amélioration de la prévision saisonnière des écoulements en Afrique de l'Ouest
ABOU Amani	AGRHYMET	Hydrologie	Evaluation des techniques de downscaling en Afrique de l'Ouest
ONIBON Hubert	Bénin	Modélisation stochastique	Analyse des problèmes d'échelles liés à l'étude d'impact de la variabilité climatique sur les ressources en eau
AKPO Aristide	Bénin	Aérosols, convection, Physique de l'Atmosphère	Impacts des aérosols désertiques sur la Mousson Africaine
DIDE Francis	Bénin	Météorologie	Dynamique de la Mousson - Spécialités de la région du Golfe du Bénin à la Donga

YACOUBA Hamma	Burkina Faso	Erosion, physique du sol	Impact du changement climatique sur les processus de dégradation de l'environnement au Burkina Faso: Application à l'identification des zones à risque majeur d'érosion et de perte de fertilité dans le bassin supérieur du Nakambé
LENOUO André	Cameroun	Physique de l'Atmosphère	Impact de la stabilité et de l'humidité sur les Ondes d'Est Africaines
MONKAM David	Cameroun	Physique de l'atmosphère	Monsoon rainfall behaviour in recent times and impact assessment of El NIÑO and LA NIÑA episodes on local/regional scale in the Northern Africa
CORTE-REAL Joao	Portugal (Cap Vert)	Atmospheric Sciences	African Easterly Waves and its interactions with the West African Monsoon System
SILVA Ana Maria	Portugal (Cap Vert)	Atmospheric Physics	The Health effects of aerosols at Cabo Verde
JEANNE Isabelle	CERMES	Conception analyses SIG Télédétection Terrain	Méningites et climat. Paludisme et climat : CLIMPAL-Niger
ASSAMOI Paul	Côte d'Ivoire	Dynamique de l'Atmosphère	Interconnexion des Phénomènes Océaniques et Continentaux dans la Circulation de la Mousson Ouest-Africaine
KOUADIO Georges	Côte d'Ivoire	Dynamique de l'Atmosphère, Mesure des flux et paramétrisation	Quantification et modélisation des émissions d'oxydes d'azote par les agrosystèmes fertilisés et impact sur la chimie de l'air en Afrique de l'Ouest
KOUAME Brou	Côte d'Ivoire	Agriculture	Analyses fréquentielles de la pluviométrie : détermination des calendriers culturels de plantes annuelles
MAHAN N'DJEANGNONM OU Claude	Côte d'Ivoire	Océanographie, upwelling Côtier	Upwelling Ivoirien-Ghanéen : fluctuations halieutiques et variabilité climatique
N'GORAN Yao	Côte d'Ivoire	Rayonnement, Gisement	Etude et exploitation du gisement solaire Ouest Africain à partir de l'imagerie satellitaire(GISOA-SAT)
YAPI Ahoua	Côte d'Ivoire	Santé, Coordination	Impact de la variabilité climatique sur l'étiologie de la maladie asthmatique

YAPI Grégoire	YAPI	Côte d'Ivoire	Climat, santé	Impact de la variabilité climatique sur la transmission du paludisme et des bilharzioses en zone forestière et pré-forestière de Côte d'Ivoire
YOBOUE Véronique		Côte d'Ivoire	Bilan de l'azote	Etude de la pollution atmosphérique dans les capitales africaines en Afrique de l'Ouest et chimie des précipitations en zone de savane humide
ADAMOU Garba		EAMAC	Dynamique des systèmes convectifs	Etude de la dynamique des systèmes convectifs et leurs impacts sur les changements climatiques au Sahel
KONATE Daouda		EAMAC	Météorologie	Etude de l'interconnexion entre l'occurrence et l'intensité des pluies de mousson et les systèmes de temps dans la méditerranée
DIAKITE Cheick Hamala		Mali	Géographie	1. Relations entre Méningite et climat pour la mise en place d'un système d'alerte précoce : le cas du Mali. 2. L'eau, Système de prévision de l'inondation du Delta Central du Niger et développement régional
FOFANA Almoustapha		Mali	Hydrologie, hydrochimie	Etude hydrologique et hydrochimique des mares du Gourma
MARIKO Adama		Mali	Hydrologie, Télédétection	Analyse d'impacts et stratégies d'adaptation au changement climatique en zone soudano-sahélienne : cas du Delta intérieur du Niger au Mali
KAMAYE Maâzou		Niger	Dynamique de l'Atmosphère, Aérosols	Etude statistique de la Variabilité du flux de Mousson et régimes de précipitation en Afrique de l'Ouest
SEYDOU SANDA Ibrah		Niger	Aérosols-convection, Variabilité atmosphérique	Aérosols et convection
Zibo Garba		Niger	Aérosols, Ensablement, Paléoclimatique, SIG Télédétection	Mise en place d'un observatoire "proximal" en bordure du Sahara pour la surveillance et l'analyse des processus éoliens et de leurs impacts (Nguigmi, Mainé-Soroa et Gouré au Niger Oriental, Bassin du Lac Tchad)

AMMA-Niger	Niger	Atmospheric dynamics and Convection	Improved understanding of convective initiation over the Air mountain. Improved understanding of the processes leading to MCS breakup in the region of Dosso and Dogondoutchi, east of Niamey
Prof OMOTOSO Bayo, OYEBANDE Lekan	Nigeria	Meteorology	Modelling of mesoscale convective systems over West Africa
CAMARA Moctar	Sénégal	Physique de l'Atmosphère	Perturbations atmosphériques en Afrique de l'Ouest et activité cyclonique sur l'Atlantique
DIOP Mariane Kane	Sénégal	Dynamique des systèmes convectifs	Dynamique des systèmes convectifs de méso-échelle (MCS)
DIOP Mbaye	Sénégal	Agro-climatologie	Impact de la mousson africaine sur les cultures au Sénégal
GAYE Amadou Thierno	Sénégal	Aérosols-Pollution	Aérosols-chimie-processus radiatifs-pollution
KEBE Cheikh Mohamed Fadel	Sénégal	Estimation des pluies, Télédétection	Estimation des pluies par radar et satellite
LECLERC Grégoire	Sénégal	Pastoralisme	Impact de la mousson sur le pastoralisme
NDIAYE Aminata	Sénégal	Climat-Socio Economie	Evaluation socio-économique des impacts de la mousson
NDIONE Jacques André	Sénégal	Environnement-Santé	Impacts de la mousson sur la santé
SAMBOU Soussou	Sénégal	Hydrologie et Hydrogéologie	Processus hydrologiques liés à la mousson
SOW Bamol Ali	Sénégal	Océanographie physique	Réponse de l'océan au forçage de petite échelle dans le système d'upwelling sénégalais
WATT Mamadou	Sénégal	Amélioration du réseau	Réseau d'observation du Sénégal
Dr BLIVI Adoté	Togo	Dynamique des Surfaces	Evolution Climato-Hydrologique Récente et Conséquence sur l'Environnement/l'Exemple du Bassin Versant du Fleuve Mono (Togo-Bénin)

Appendix F: Integration of in-situ measurements from low-level flights with ground-based measurements over the meso-sites

1. Problems with intercomparing ground- and aircraft-derived fluxes

Over the heterogeneous terrain of the area, fluxes are highly variable in space. A ground-based measurement is only really relevant to its 'local' domain (perhaps the area of a few tens or hundreds of metres over which the vegetation is homogeneous?). An aircraft-based measurement, which requires averaging over flight legs of perhaps 30-50 km, naturally averages out much of this 'local' variability, although it should capture mesoscale structure. Also, the aircraft have a minimum altitude of 500 ft (~ 170 m), somewhat outside the 'constant flux layer' (about 50m). For these reasons, we do not expect that exact matching of aircraft-derived and ground-based measurements will be useful.

2. Different capabilities of each kind of measurement.

A 'surface flux' is a complex, derived quantity. Despite the difficulties and ambiguities in evaluating this from measurements, the fluxes are extremely important for modelling, and therefore for prediction. The aircraft and ground-derived fluxes are 2 ways of exploring the same quantity. The ground-based measurements give a long and consistent time-series, from which we can learn about seasonal and more rapid variability, response to rainfall, response to vegetation (from a network of sites) and so on. The aircraft data, in contrast, give a nearly instantaneous view of the fluxes, with the important advantage that they can sample spatial variability over the heterogeneous surface (albeit at mesoscale resolution). So the aircraft should at least attempt to measure the surface fraction that is seen by the surface station, and then a larger area to document the corresponding area averaged flux.

It is possible that the heterogeneity of the vegetation over the Gourma site is lower than over the other sites, so this would be the best chance of directly comparing aircraft- and ground-derived fluxes.

There is a motivation to combine ground- and aircraft-derived fluxes over the mesoscale sites, in that these may be combined to give a spatial and temporal view of fluxes. For example, over the Gourma site, we may fly aircraft following a rain event, and evaluate the spatial patterns in fluxes in response to this event. The ground-based data will then provide a ground-truth evaluation of the temporal response of the fluxes to this rain event, and a number of other rain events.

Aircraft transit times to the Gourma site from Niamey make it more expensive to operate there. However, during the wet season we can't see the Niamey region very often with visible/thermal satellite data, in which case high resolution mapping of rainfall relies on other sources (for which Niamey is well-equipped, but which may not get assimilated into surface analyses. For these reasons, flights over the Gourma region measuring surface fluxes from the lowest possible altitude are desirable.

3. Other data for intercomparison

From the JET2000 project we learned a lot about spatial heterogeneity and surface-atmosphere coupling by evaluation of lower-order diagnostics, which do not require

the same, long averaging times as aircraft fluxes. For instance, TKE, and simply water vapour, showed significant response to the local surface during the day (Taylor *et al*, 2003, *QJRMS*). These lower-order diagnostics may provide a greater incentive to over-fly the ground sites. **Mid afternoon** is a good time to use the aircraft to sample for lower order diagnostics, especially with an aircraft which cannot fly very low.

4. Chemical fluxes

We will attempt to evaluate fluxes of trace gases from some of the flights, but it is accepted that the errors in these estimates are likely to be large. In this case, overflying surface sites may provide some useful limits on the error bars.

Regarding these chemical fluxes, there are different scientific issues related to the Djougou, Niamey and Gourma sites, with the southern region interesting for biogenic emissions from vegetation, and the northern, especially Gourma, sites interesting for emissions from bare soil.

5. Summary

In summary, we can regard the attempt to evaluate fluxes with flights over the mesoscale sites as important, but only when aimed at **phenomena** which are relevant to spatial heterogeneity (e.g. recent rainfall, soil type, vegetation type, topography ...). It should be accepted that overflying the surface flux sites is unlikely to yield interesting comparisons except (a) over the Gourma where the surface may be more homogeneous, or (b) in regard to fluxes of trace gases, for which the aircraft-derived error-bars may be very large.

6. Existing plans

IOP patterns I1.1 (Gourma), I1.3 (Djougou), I1.4 (various), I1.5 (various), all propose to overfly the mesoscale sites, with the capacity to make measurements of use in flux calculation. I2 (MCS sampling) and I3 (long-range transport) also could involve low level flights for the purposes of flux evaluation.

We hope to deploy a tethered balloon near Banizoumbou, with the capacity to evaluate fluxes up to 1km in altitude. We can discuss whether particular flight legs and / or balloon operations need to be recommended.

Appendix G: Tables of personnel with particular responsibilities

3.3.1 SOP 1a

			Expertise				
			Atmospheric dynamics	Chemistry	Aerosols	Surface-atmosphere interactions	Water cycle
Aircraft	F/F20	Flamant (Leandre 2)	X		X	X	
		Cammass (dropsondes)	X				
	F/ATR	Formenti (AVIRAD)	X		X		
		Said (Turbulence)	X			X	
		Gomes (HYGRO+)			X		

Table G1: List of aircraft PIs for SOP 1a.

		Site coordinator	Instrument PIs
Site	Tamanrasset	Cuesta/Edouart	Cuesta/Edouart (TReSS)
	Niamey/ Banizoumbou		? (MIT C-band radar)
			Marticorena (aerosol station)
			? (sodar)
			? (soil moisture radar)
	Djougou (Kolokondé, Kopargo, Nangatchori)		? (ARM Mobile Facility)
			? (RONSARD)
			? (X-PORT)
			Hagen (bistatic radar receiver)
			Hougninou & Hoeller (lightning)
			Galy-Lacaux (aerosol station)
			? (Micro-rain radar, ceilometer, radiometer)
	Dano		? (UHF)
			? (lidar)
	Dano		Kalthoff (radiosonde, flux)
	R/V Atalante		? (buoys)
? (soundings)			
? (instrumented mast)			
Cotonou		? (constant level balloons)	
		? (Ozone soundings)	
M'Bour		? (lidar)	
		? (aerosol station)	

Table G2: List of ground-based PIs for SOP 1a.

3.3.2 SOP 2a1

			Expertise				
			Atmospheric dynamics	Chemistry	Aerosols	Surface-atmosphere interactions	Water cycle
Aircraft	F/F20	Flamant (Leandre 2)	X		X	X	
		Chong (dropsondes)	X				
	F/ATR	Formenti (AVIRAD)	X		X		
		Said/Lothon (Turbulence)	X			X	
		Gomes (HYGRO+)			X		
	D/F20	Reitebuch/Dabas (WIND)	X				

Table G3: List of aircraft PIs for SOP 2a1.

		Site coordinator	Instrument PIs
Site	Tamanrasset	Cuesta	Cuesta (TReSS)
	Niamey/ Banizoumbou		? (MIT C-band radar)
			Caquineau (aerosol station)
			? (sodar)
			? (soil moisture radar)
			? (ARM Mobile Facility)
	Djougou (Kolokondé, Kopargo, Nangatchori)		? (RONSARD)
			? (X-PORT)
			RONSARD PI & Hagen (bistatic radar receiver)
			Hougninou & Hoeller (lightning)
			Delon (aerosol station)
			? (Micro-rain radar, ceilometer, radiometer)
			? (UHF)
			? (lidar)
	R/V Atalante		? (chemistry)
			? (buoys)
			? (soundings)
Cotonou		? (instrumented mast)	
		Basdevant (constant level balloons)	
		? (Ozone soundings)	
M'Bour		? (lidar)	
		? (aerosol station)	
Diffa or Zinder		? (driftsondes)	

Table G4: List of ground-based PIs for SOP 2a1.

3.3.2 SOP 2a2

			Expertise				
			Atmospheric dynamics	Chemistry	Aerosols	Surface-atmosphere interactions	Water cycle
Aircraft	F/F20	Perros/Borbon(chemistry)		X			
		Roux (dropsondes)	X			X	X
	F/ATR	Jambert (chemistry)		X			
		Durand/Said (Turbulence)	X			X	
		Gomes/Schwarzenboeck (HYGRO & CVI)			X		
	D/F20	Schlager (chemistry)	X	X			
		Minikin (aerosol)			X		
	M55	Schlager (chemistry)	X	X			
		Law (chemistry)	X	X			
		Cairo (aerosol)			X		
	UK/ Bae146	Coe		X	X		
		Evans		X			
		Lewis		X	X		
		Matthews	X				
		McQuaid		X	X		
		Messenger	X			X	
		Methven	X	X	X		
		Monks		X			
		Murphy		X			
		Oram		X			
Parker		X			X		
Reeves			X	X			
Stewart			X				
Taylor	X			X			

Table G5: List of aircraft PIs for SOP 2a2.

		Site coordinator	Instrument PIs
Site	Tamanrasset	Marnas/Lapouge/Gibert	Marnas/Lapouge/Gibert (TReSS)
	Niamey/ Banizoumbou		? (MIT C-band radar)
			? (aerosol station)
			Brooks (sodar & tethered balloon)
			? (soil moisture radar)
			? (ARM Mobile Facility)
	Djougou (Kolokondé, Kopargo, Nangatchori)		? (RONSARD)
			? (X-PORT)
			RONSARD PI & Hagen (bistatic radar receiver)
			Hoeller & Hougninou (lightning)
			Pont/Lewis (aerosol station)
			? (Micro-rain radar, ceilometer, radiometer)
			? (UHF)
			? (lidar)
		? (chemistry)	

	Dano		Kohler (radiosonde, flux)
	Cotonou		Basdevant (constant level balloons)
			? (Ozone soundings)
	M'Bour		? (lidar)
			? (aerosol station)
Diffa or Zinder		? (driftsondes)	

Table G6: List of ground-based PIs for SOP 2a2.

3.3.2 SOP 2a3

			Expertise				
			Atmospheric dynamics	Chemistry	Aerosols	Surface-atmosphere interactions	Water cycle
Aircraft	F/F20	Bouniol (RALI)	X				X
		Pelon (LNG)	X		X		
		Duroure (PMS probes)	X		X		X
		? (dropsondes)	X				X

Table 3.8: List of aircraft PIs for SOP 2a3.

		Site coordinator	Instrument PIs
Site	Tamanrasset	Cuesta	Cuesta (TReSS)
	Niamey/ Banizoumbou		? (MIT C-band radar)
			? (aerosol station)
			? (soil moisture radar)
			? (ARM Mobile Facility)
	Djougou (Kolokondé, Kopargo, Nangatchori)		? (RONSARD)
			? (X-PORT)
			Hagen (bistatic radar receiver)
			Hougninou & Hoeller (lightning)
			? (Micro-rain radar, ceilometer, radiometer)
			? (UHF)
			? (lidar)
	? (Ozone soundings)		
	M'Bour		? (lidar)
			? (aerosol station)

Table 3.9: List of ground-based PIs for SOP 2a3.

Appendix H: SCOUT-03 balloon flights in AMMA

Type of Flights **Type 1: Water vapour (in situ)** μ SDLA (H₂O, CH₄), LABS (BKS, depolar), μ Dirac (tracers, VSLS)
 12 SF balloon, ascent in the afternoon to 25 km, slow nighttime descent 2m/s down to 13.5 km + large parachute
3 Flights: nighttime, 2 MCS, 1 non convective as reference **Type 2: Ice and aerosols (in situ)** OPC (size distribution), LABS (BKS, depolar), μ Dirac (tracers)
 5 SF balloon, launch at anytime, ascent to 23 km, slow descent 2 m/s down to 13.5 km,
2 Flights: anytime, next to MCS **Type 3: Anvils and Cirrus (remote)** μ lidar (cirrus, anvil), IR Radiometer (brightness temp), SAOZ (H₂O, cirrus, O₃, NO₂ et sunset), AIRS (electric field, lightning and blue-jet flashes)
 3 SF balloon, ascent in the afternoon to 22-24 km, overnight flight as long as possible
3 Flights: nighttime MCS **Type 4: Chemistry** SAOZ-N (O₃, NO₂), SAOZ-UV (BrO), μ Dirac (Tracers and VSLS organic), NILUCUBE (Photolysis rates)
 10 ZL balloon, afternoon launch, ascent to 30 km, end after sunset
2 Flights: daytime, MCS outflow **Type 5: Chemistry and transport (in situ)** Minisampler: tracers, age of air, H₂O isotopes, organic compounds
 Post flight analysis of samplings in the laboratory in Europe
 12 SF balloon, ascent to 25 km, descent
1 Flight: anytime
Instrument under devt, to be confirmed
UWyo (NSF funded flight, operated by UWyo + help CNES)
 Double OPC + ozone sonde
 4000 m³ Raven balloon, ascent / descent 33 km
1 Flight: anytime

Campaign planning	17-24 July: installation
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24-29 July: Ice and aerosol 1, Water vapour 1, UWyo
31-July-5 Aug: Chemistry 1, Anvil and cirrus 1
7-12 Aug: Water vapour 2, Ice and aerosol 2
14-19 Aug: Anvil and cirrus 2, Chemistry 2, Chemistry/transport TBC)
21-26 Aug: Water vapour 3, Anvil and cirrus 3