

AMMA Task Team 2b :

**EOP/LOP Aerosols Monitoring
and Radiation**

First document : 01 July 2005

Updated document : 16 September 2005

COMPOSITION of TT2b

Coordinators: **Béatrice Marticorena (F)** , **Francesco Cairo (I)**

Core group:

C. Liousse (F), J.L Rajot (F), P. Gouloub (F), V. Yoboué (I. C.).

Representation:

Representatives of the TT3, 4 and 5 : **F. Lavenu (F).**

TT2a: **C. Lloyd (UK)**

TT7: **Ellie Highwood (UK)**

TT8: **P. Formenti (F)**

Other members :

UK related proposals : **Hugh Coe ; Martin Todd, Richard Washington**

ARM station : **Tony Slingo;**

SOLAS observatory : **Allistair Lewis; Konrad Müller, Martin Heimann.**

Ron Brown Cruises : **Erica Keys**

Modelling groups : **Gé Verver, B. Vogel**

Satellite groups : **I. Chiapello, J.F Léon**

AERONET : **B. Chatenet**

IDAF : **C. Galy-Lacaux + local scientist**

Local institutions: **to be defined**

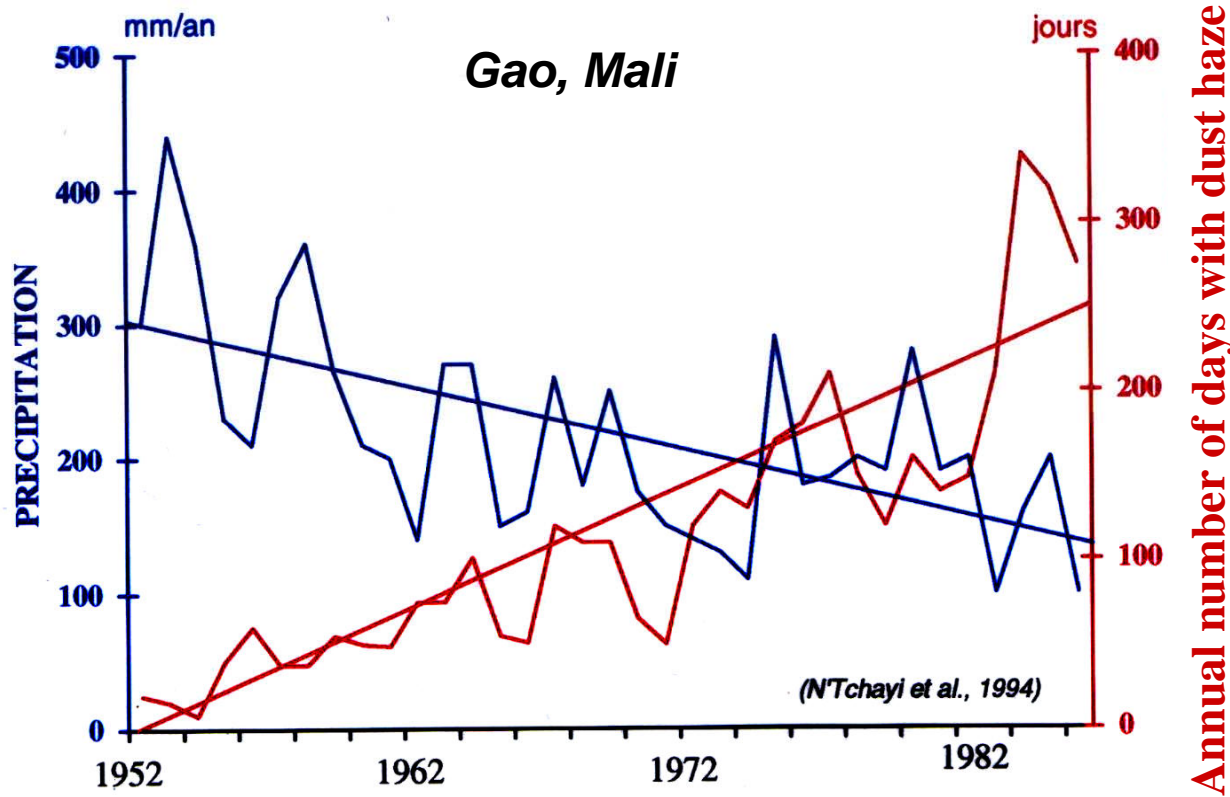
GENERAL OBJECTIVE

⇒ Coordinate the deployment and activities of the different LOP/EOP measurements dedicated to the monitoring of tropospheric aerosols :

- **atmospheric content**
- **chemical composition**
- **optical properties**

Largely based on existing network !!

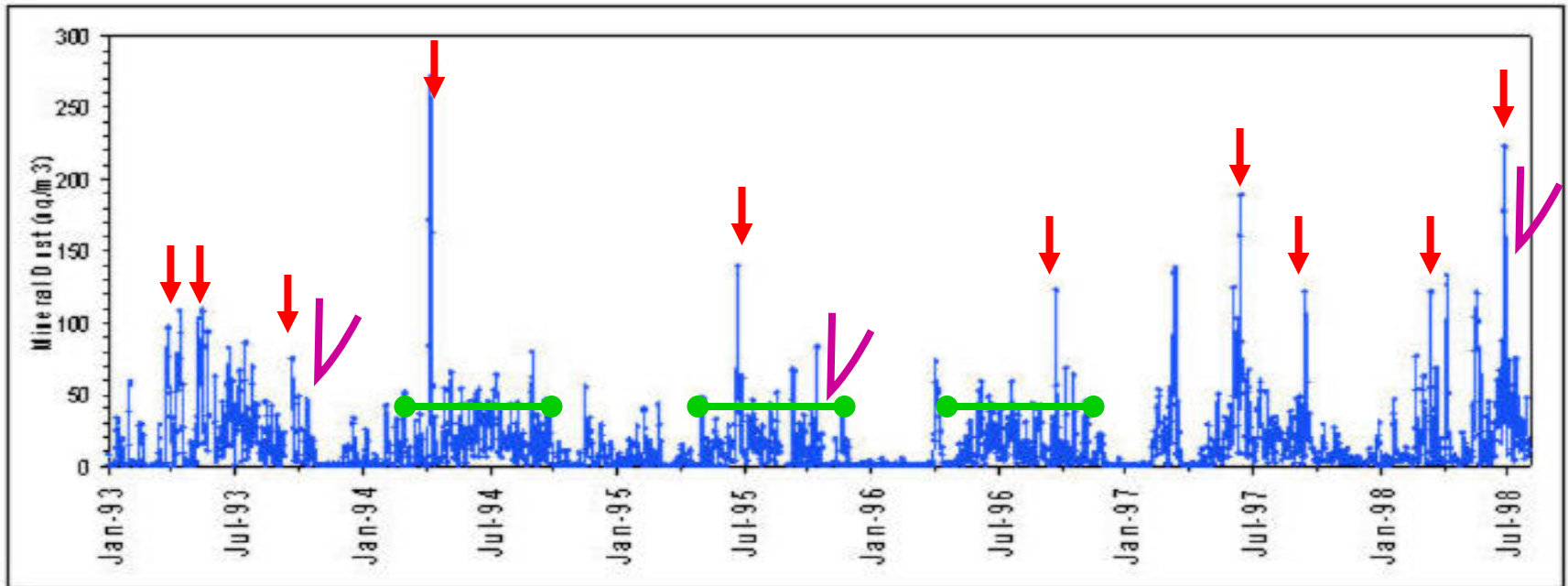
WHY DO WE NEED AROSOLS MONITORING OVER WESTERN AFRICA ?



⇒ Long term variations have been observed and are related to climatic condition

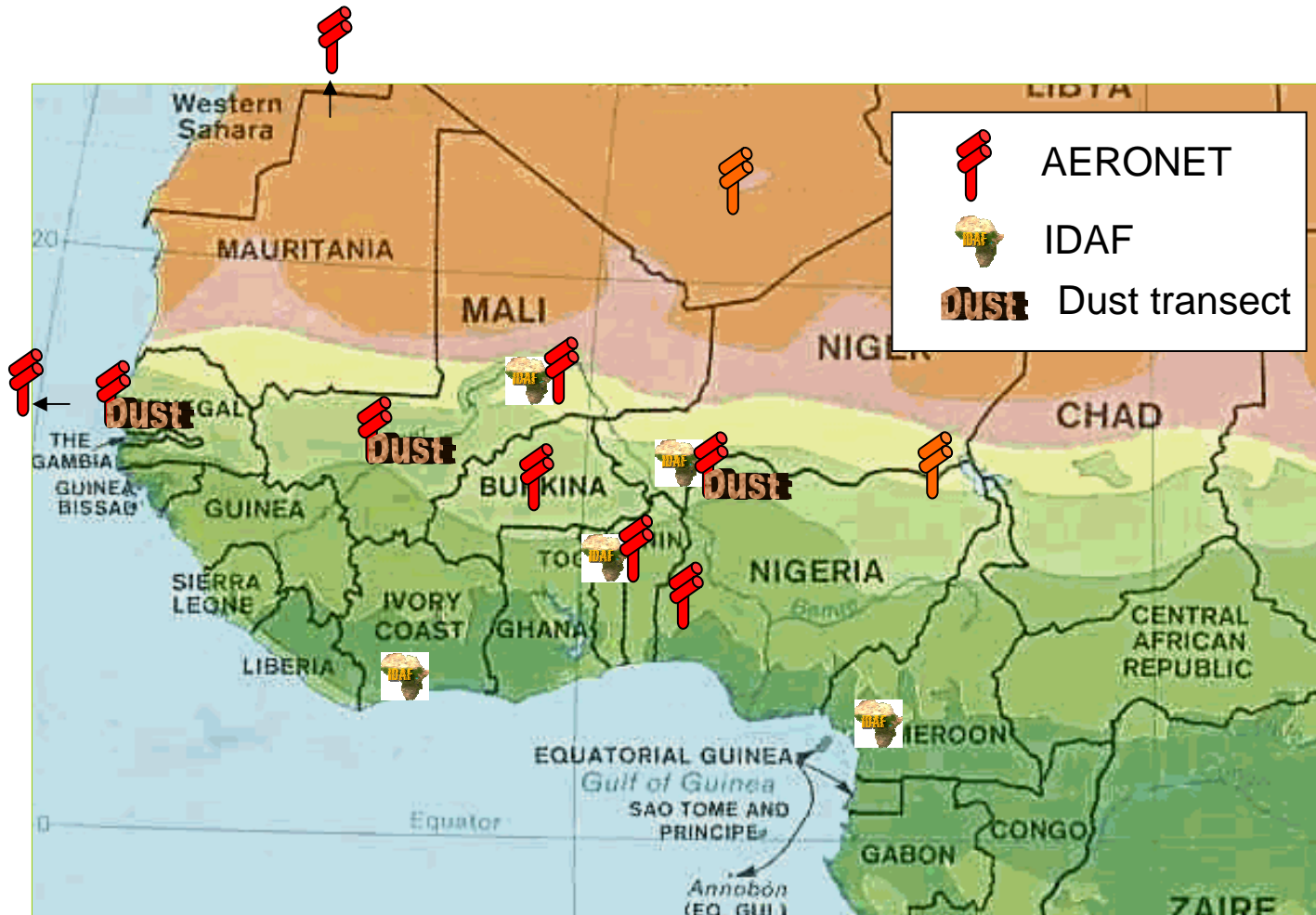
WHY IS AEROSOL MONITORING REQUIRED ?

Mineral dust concentrations measured in Barbados ($\mu\text{g}\cdot\text{m}^{-3}$)
(J, Propero, RSMAS, Univ. Miami, USA)



- **Daily** : dust pulses, several orders of magnitude
- **Seasonal** : pronounced seasonal cycle, maximum in summer
- **Interannual** : strong variability of the maximum and the mean

TT2b ground stations



AERONET/PHOTONS Network

Sun Photometer (CIMEL)

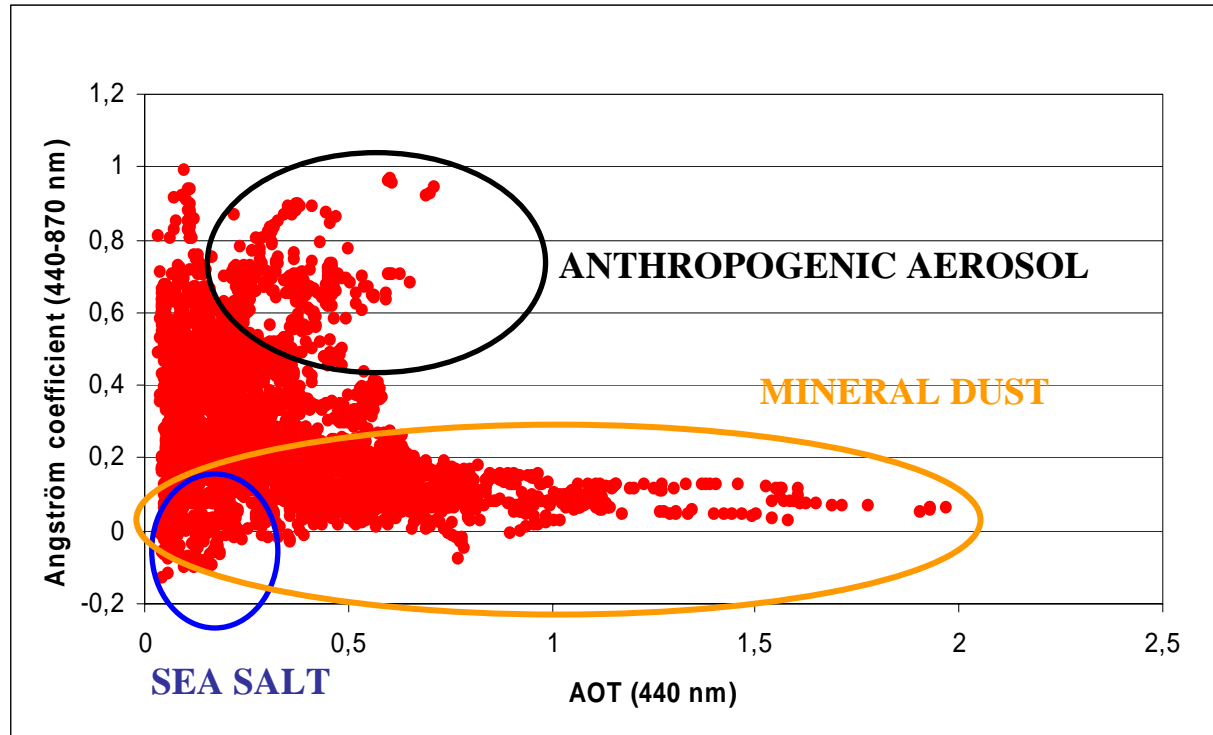
λ : 870, 670, 440 nm



AERONET/PHOTONS	
Measurement	Geophysical Parameter
Sun radiation extinction at several wavelengths	-Aerosol Optical Thickness -Angström coefficient
Angular distribution of sky radiance	-Size distribution -Single scattering albedo

AERONET/PHOTONS Network

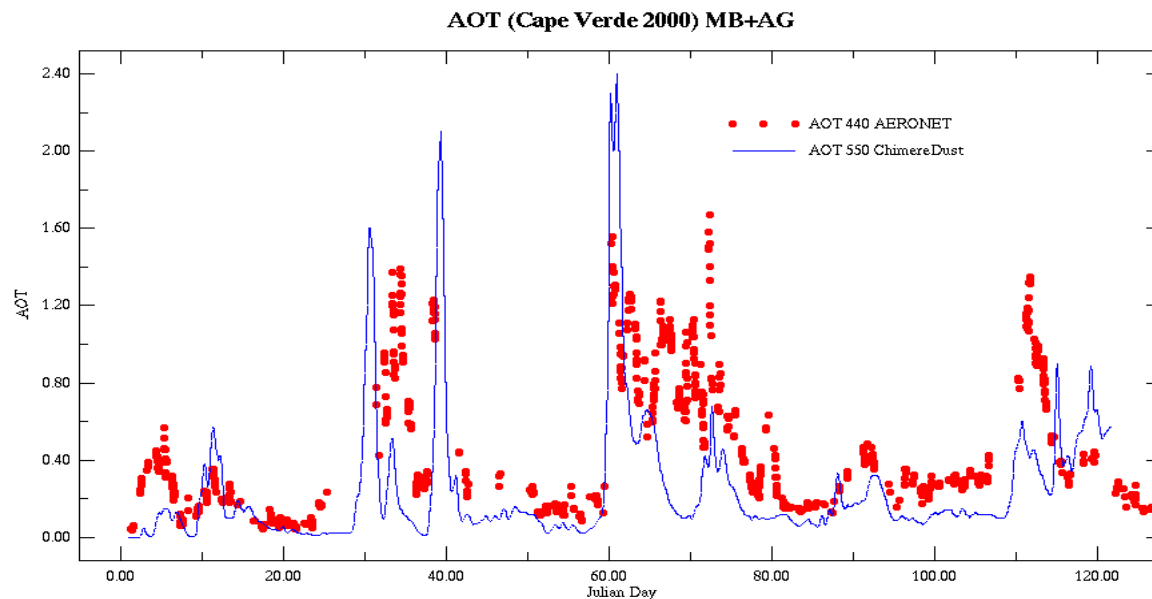
- High temporal resolution / long term variation (up to 10 years) of the integrated aerosol content
- Aerosol types identification



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AERONET/PHOTONS Network

- « Real-time » transmission of the data : a help for the forecast during SOPs
- Widely and commonly used for satellite products validation and model comparison



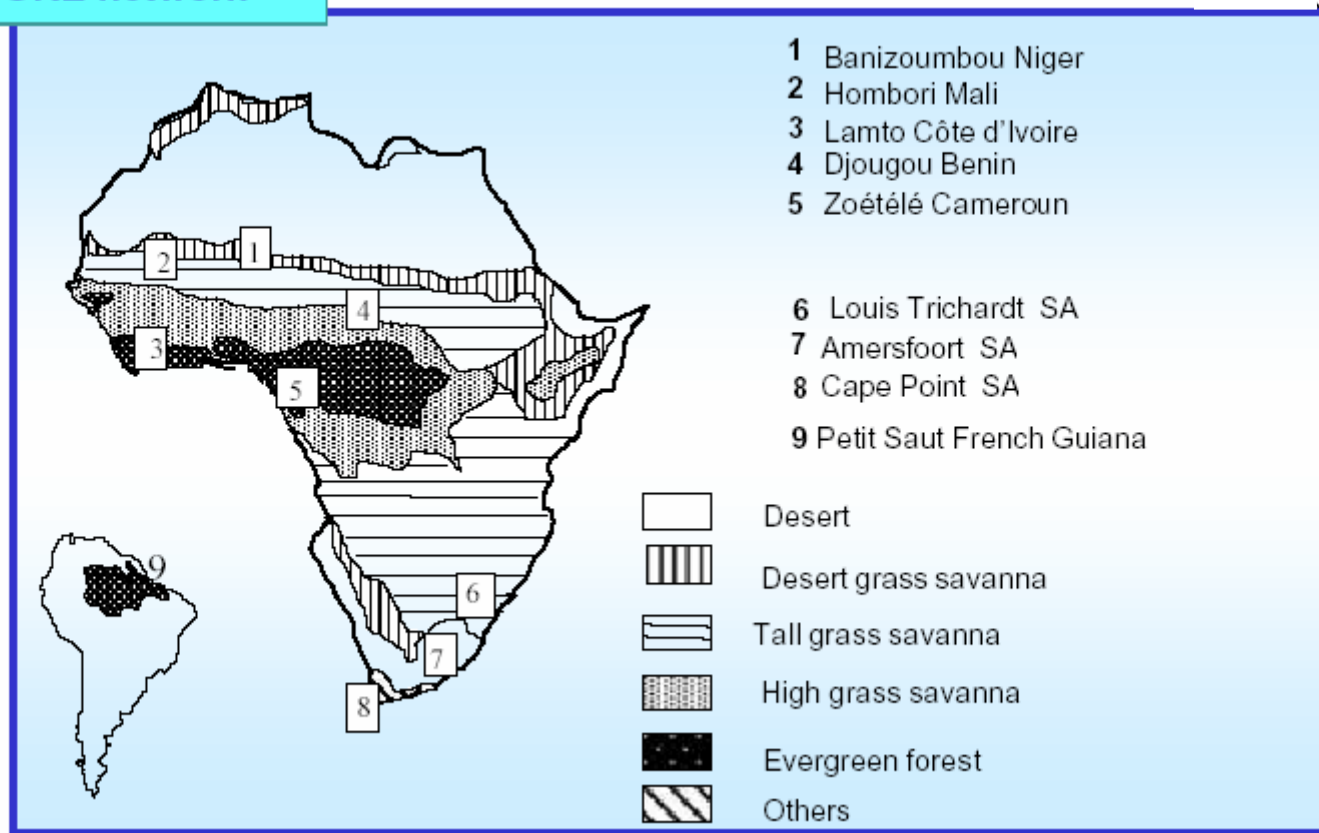
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IDAF (IGAC/DEBITS/Africa)

IGAC : International Global Atmospheric Chemistry

DEBITS: Deposition of Important Biogeochemically Trace Species

IDAF ORE network



IDAF (IGAC/DEBITS/Africa)

IDAF	
Measurement	Geophysical Parameter
Aerosol sampling/chemical analyses (weekly integrated)	<ul style="list-style-type: none">-Atmospheric mass concentration at the ground level for PM2.5 and PM10- Chemical composition (mineral and organic soluble fraction, carbonaceous fraction, trace metal)-Particulate carbon (concentration, Black carbon and organic carbon)
Rain collector	<ul style="list-style-type: none">-Wet deposition-Rain chemical ionic composition, pH, conductivity
Gas phase sampling/analysis	<ul style="list-style-type: none">-Atmospheric concentration (SO₂, NO₂, NH₃, HNO₃, O₃)

IDAF (IGAC/DEBITS/Africa)

Additional instrumentation for aerosol optical properties

DJOUGOU IDAF station	
Measurement	Geophysical Parameter
Aerosol physical and optical properties	-Particle number concentration, size distribution, absorption and extinction coefficient
Meteorological parameters	-To be described
Gas phase sampling/analysis	-Atmospheric concentration (NO_x , CO, CO_2)

Sahelian Dust transect

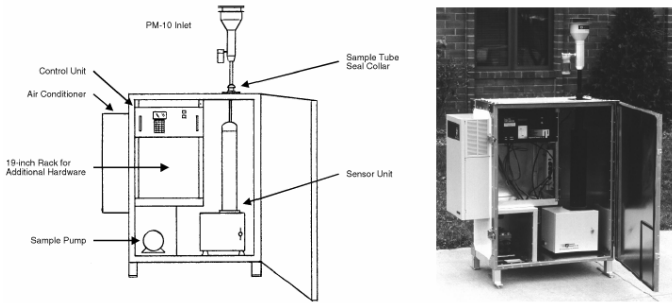
to assess the mineral dust budget (emission-transport and deposition)
from the local to the regional scale

Sahelian Dust Transect	
Instrument-Measurement	Geophysical Parameter
Aerosol sampling	-Atmospheric mass concentration for PM10
Rain collector	-Wet deposition
Passive collector	-Dry deposition (mass and size distribution)
Microlidar (MPL)	-Aerosol vertical distribution

Sahelian Dust transect

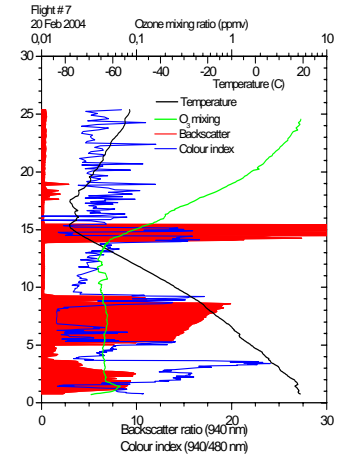
Mass concentration PM10

⇒ TEOM

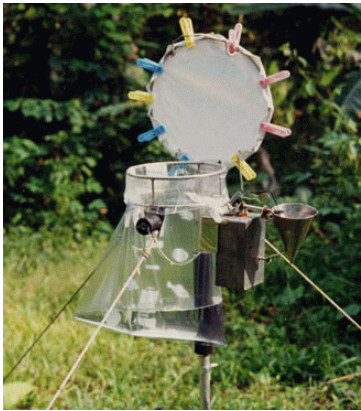


Vertical distribution

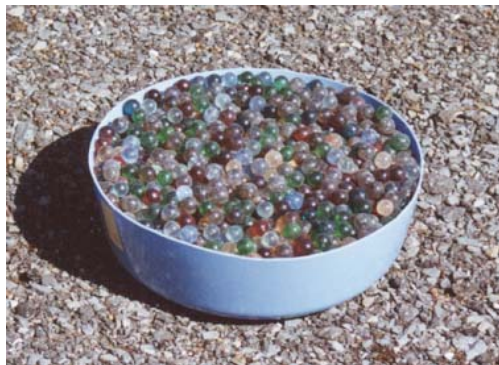
⇒ microlidar



Wet deposition



Dry/total deposition



AOT

+ Size distribution

⇒ AERONET Sunphotometer

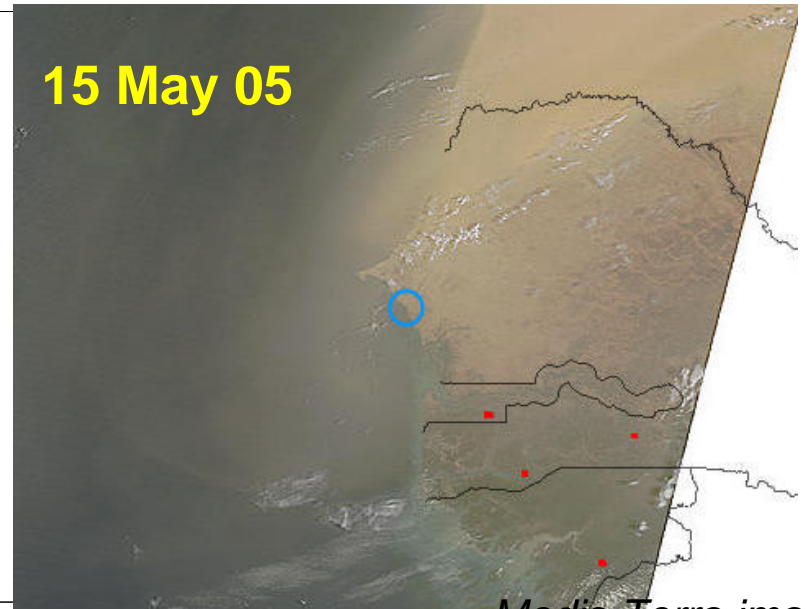
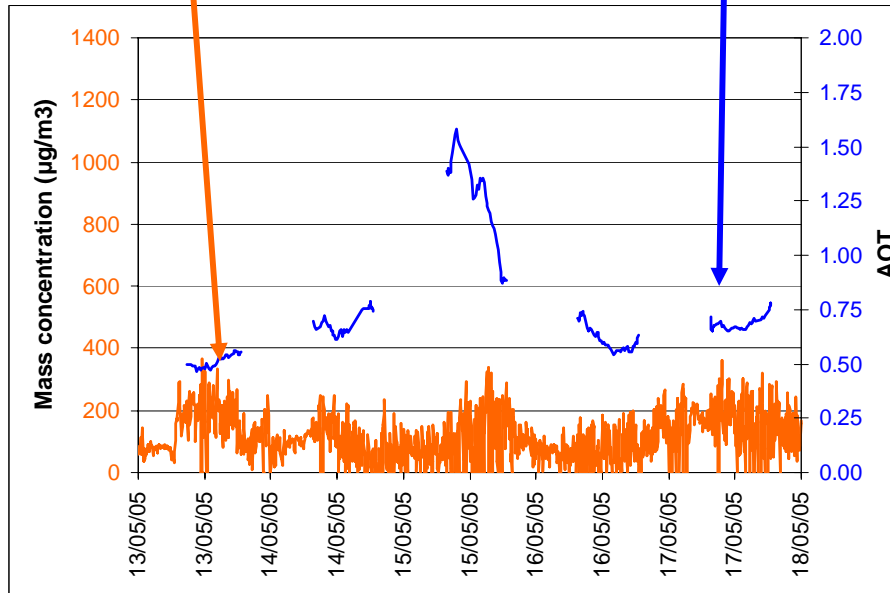
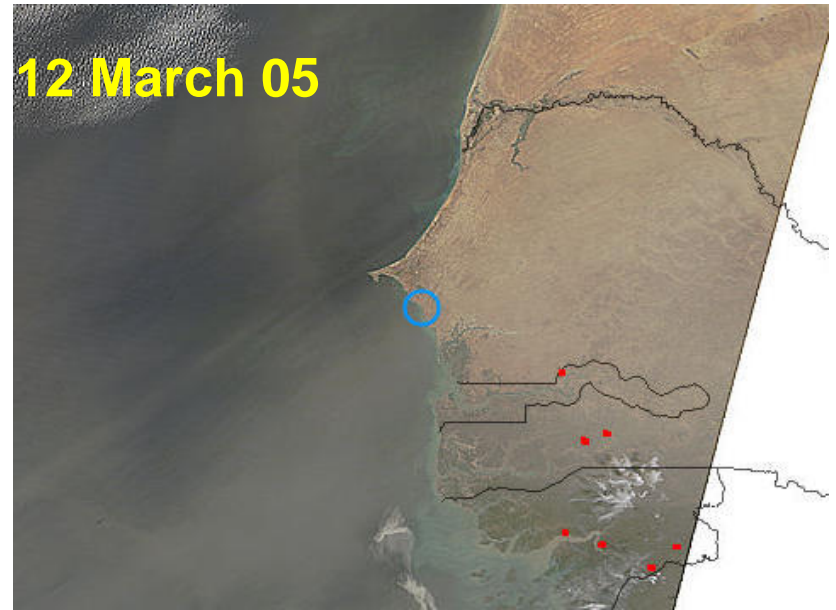
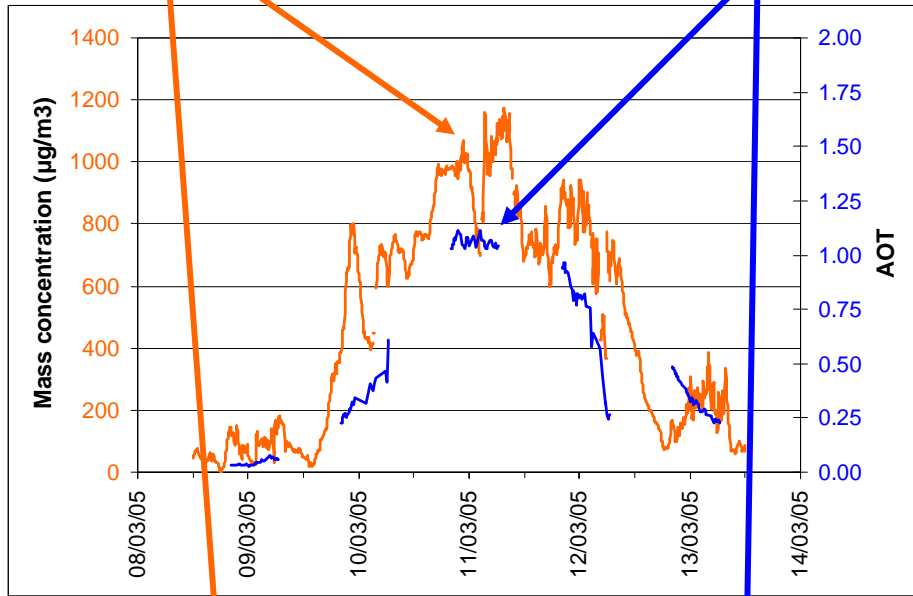


Sahelian Dust transect

Aeolian erosion monitoring on an agricultural field

Sahelian Dust Transect	
Instrument-Measurement	Geophysical Parameter
Micro-mast equipped with sand catchers	-Vertical profile of eroded mass
Saltiphone	-Erosion threshold; erosion periods
Vegetation cover	-Surface cover rate, mean height

PM10 concentration Aerosol Optical Thickness



Modis-Terra images

Related SOP TTs : TT7 and TT8

⇒ The AEROSOL super-sites (M'Bour, Banizoumbou, Djougou) and the ARM field station (Banizoumbou) are located in TT2b stations

Direct radiative impact (M'Bour, Banizoumbou, Djougou, Tamanrasset)

- Chemical and mineralogical composition : total and size resolved
- Optical properties : surface and vertical distribution
- Number concentration and size distribution

Mineral dust budget (Banizoumbou)

- Dust emission fluxes (mass and number) : total and size resolved
- Time resolved chemical composition and solubility of aerosol in rain samples

Related EOP TTs

⇒ The heat fluxes (TT2a) and radiation fluxes stations are located in TT2b stations

= Complementarity of the measurements

= Optimization of logistic aspects

⇒ Scientific complementarity

-How does aerosol variability affect the radiation fluxes ?

-Dynamic parameters measured in banizoumbou for erosion monitoring.

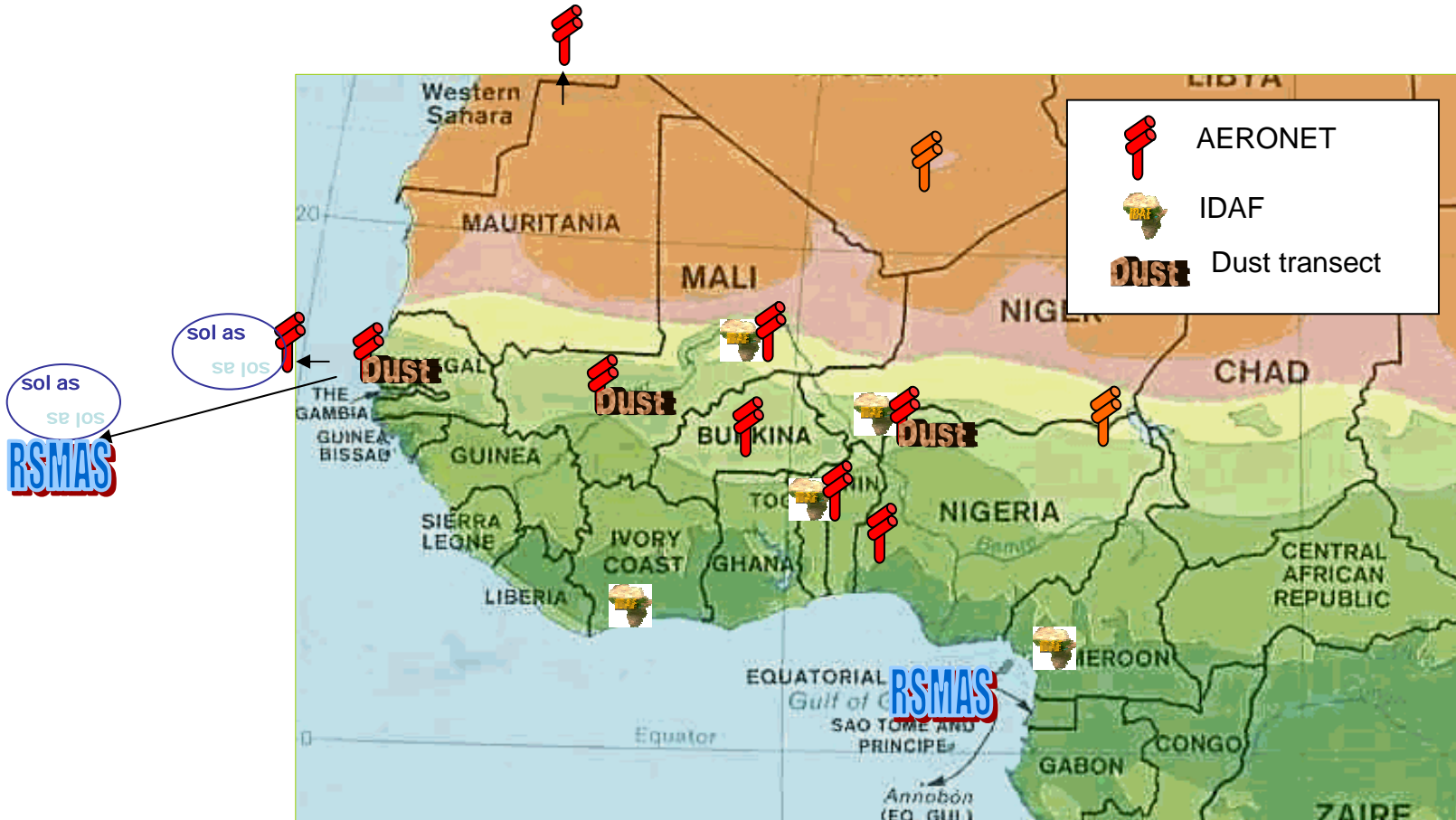
Related Proposals

⇒ SOLAS observatory in [Cap Verde Island](#)
(UK/German) and complementary observations on
[Barbados](#) (RSMAS, Miami, US)
Aerosol and gas phase concentration and chemical composition

= eastward extension ; oceanic conditions

⇒ RSMAS Proposal : 2 years aerosol and radiation
monitoring in the [Gulf of Guinea](#)
= similar scientific issues
= Biomass burning and oceanic conditions

TT2b + related stations



Partnership

⇒ Most of the TT2b stations are maintained through **collaboration with local institutions**

- *4 local representation of IRD*

- *8 local universities, research or meteorological institutes*

⇒ **Local people involved in the measurements are formed** by European scientists either on the sites or in the European laboratories

⇒ African partners involved in the deployment of these stations have proposed **scientific project in the PIAF**.

Scientific cooperation still needs to be encouraged

Deployment

Because of external (national) support and practical considerations (logistics, politics) the deployment is already defined ...

AERONET : operational

IDAF : operational

Sahelian Dust transect :

partially operational ⇒ 2006

SOLAS Observatory and US station : ⇒ 2006