



# Aerosol direct radiative forcing on Djougou (Benin) during the AMMA dry season experiment



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# What do we measure during SOP 0 / aerosol microphysical properties



- aerosol number size distribution (0.05 – 0.5  $\mu\text{m}$ ) from SMPS
- aerosol number size distribution (0.5 – 10  $\mu\text{m}$ ) from GRIMM
- total particle number concentration



**derived properties**

aerosol radiative properties (SSA &  $g$  at  $\neq \lambda$ )  
from the Mie theory

- aerosol mass size distribution for major ions, BC and OC  
from impactor Dekati (13 stages)

# What do we measure during SOP\_0 / aerosol radiative properties



- light absorption coefficient ( $\sigma_{abs}$ ) from MAGEE aethalometer (at  $7\lambda$ ) at the surface

**derived properties**

aerosol single scattering albedo (at 520nm) at the surface



- light scattering coefficient ( $\sigma_{scat}$ ) from ECOTECH nephelometer (at 520nm) at the surface



PHOTON / LOA

- aerosol optical depth (440, 670, 870 and 1020nm)
- aerosol volume size distribution ( $0.05 < r < 10 \mu\text{m}$ ) for the total atmospheric column (Dubovik et al., 2002)
- aerosol single scattering albedo and asymmetry parameter (at  $4 \lambda$ ) for the total atmospheric column (Dubovik et al., 2002)

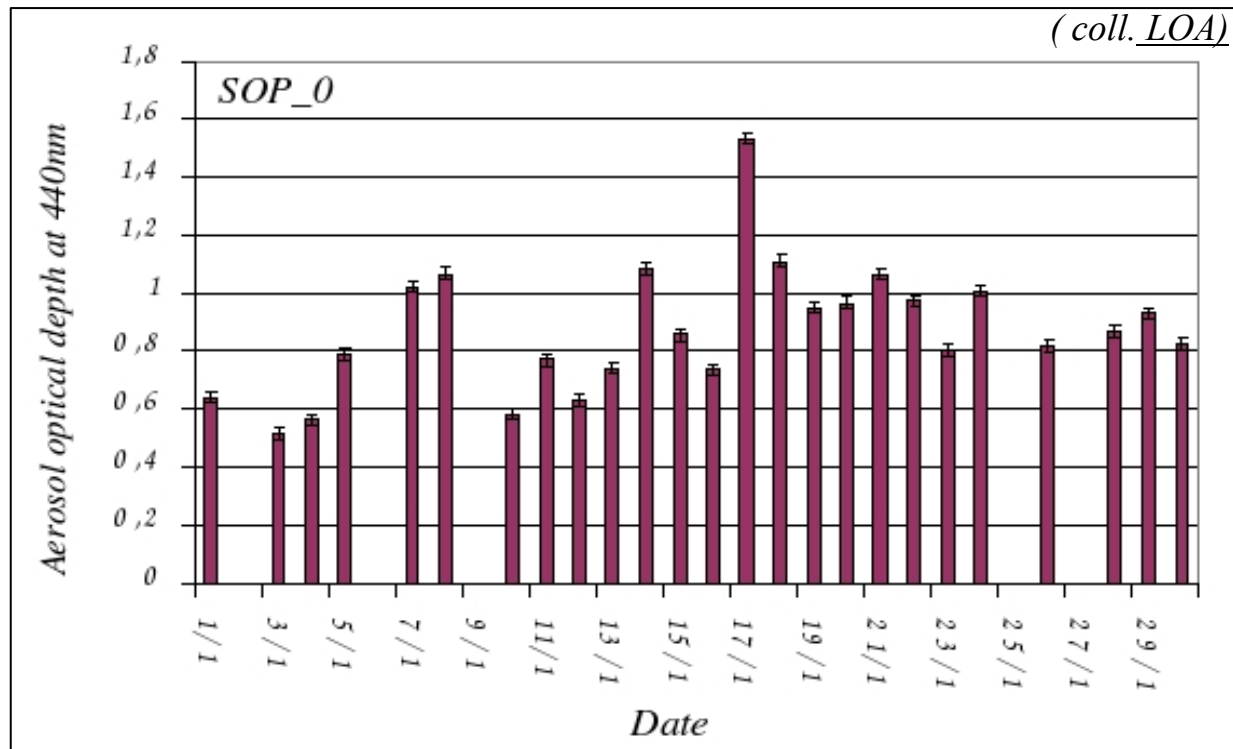
**derived properties**

vertical profiles of aerosol extinction coefficients (coll. SA)



- vertical profiles of aerosol backscattering coefficients (coll. SA)

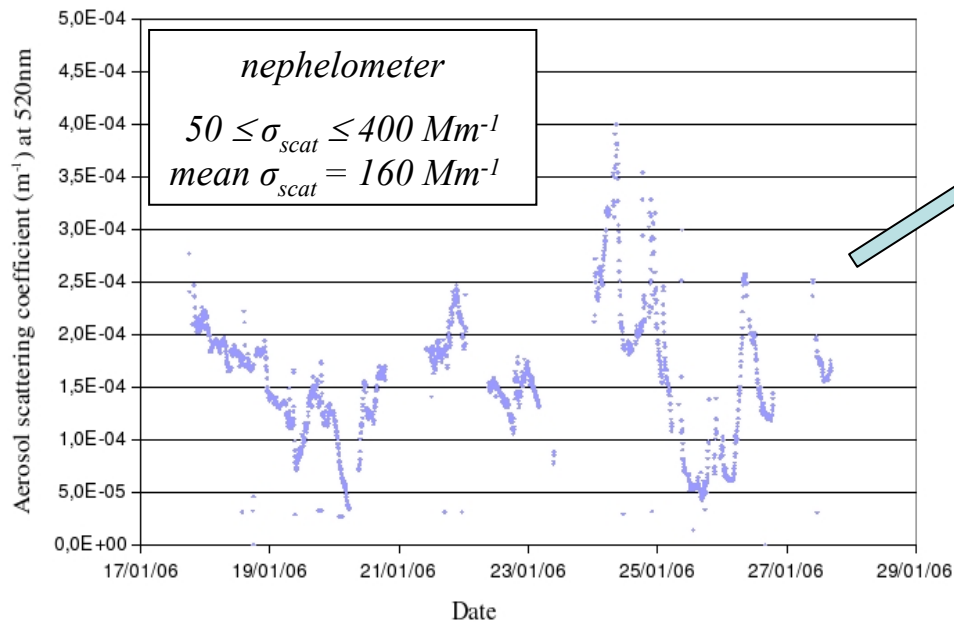
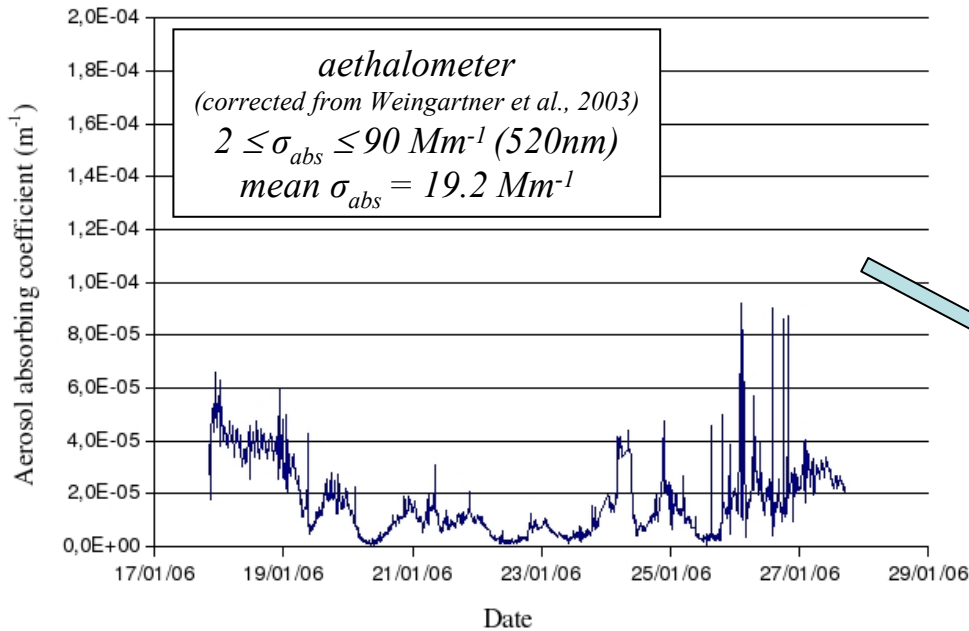
## Aerosol optical depth on Djougou



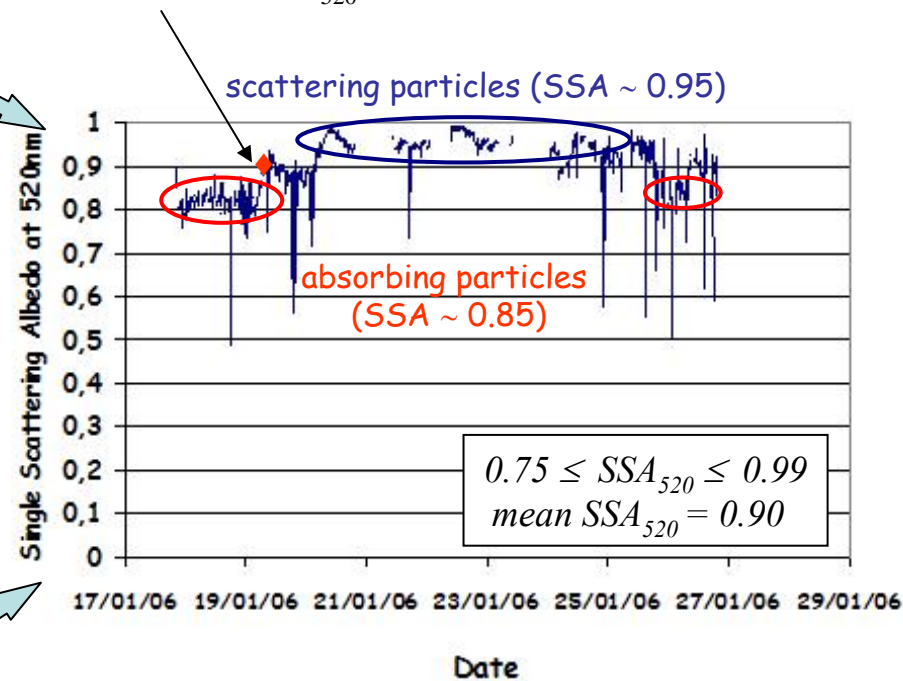
➤ the region was rather turbid →  $AOD_{440} \geq 0.5$  for major days

➤ mean  $AOD_{440}$  during January 2006 is equals to  $0.90 \pm 0.01$

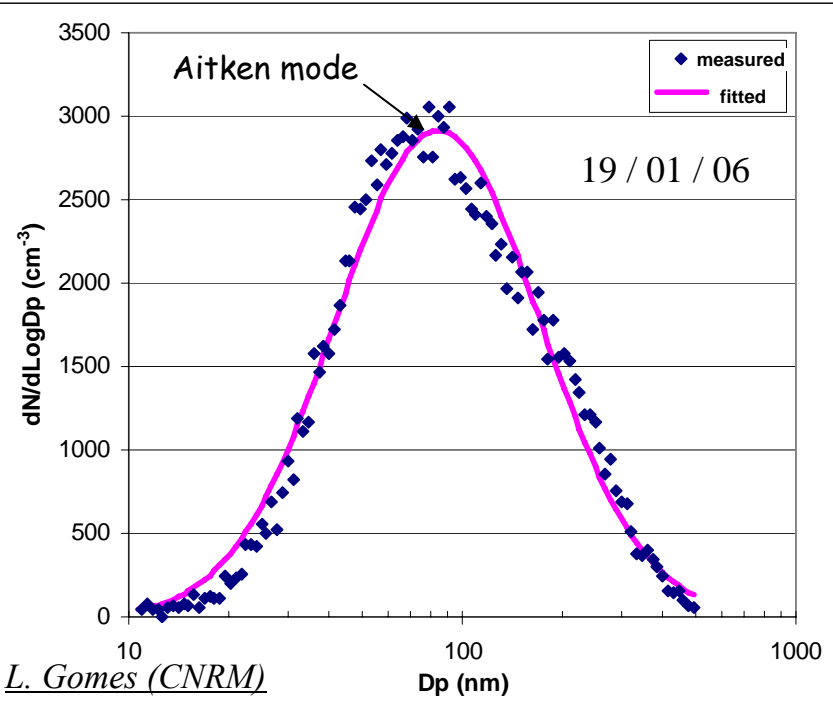
# Aerosol single scattering albedo on Djougou



- very good comparisons with aircraft measurements over Djougou (alt.  $\sim 500\text{m}$ )
- BAe-146  $\rightarrow \text{SSA}_{520} \sim 0.90$  (S. Osborne, Met Office)



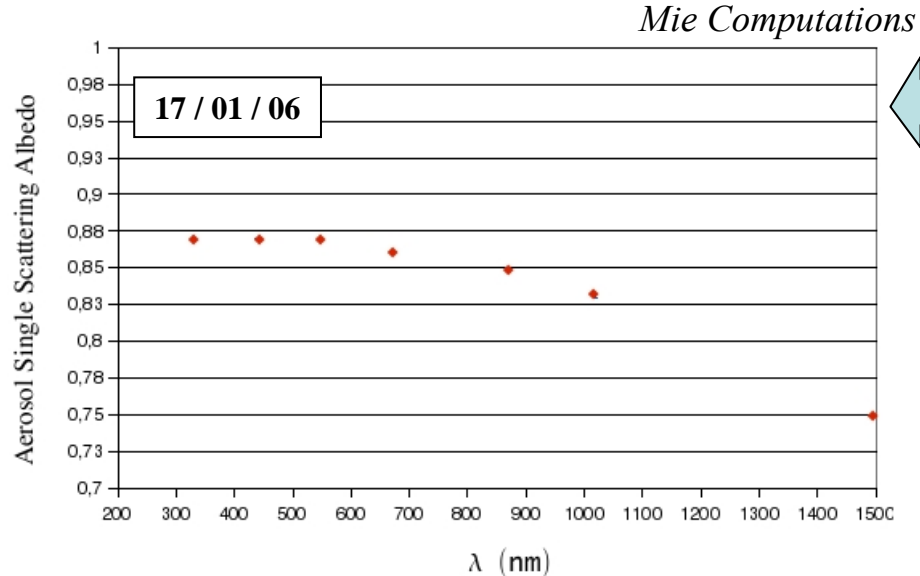
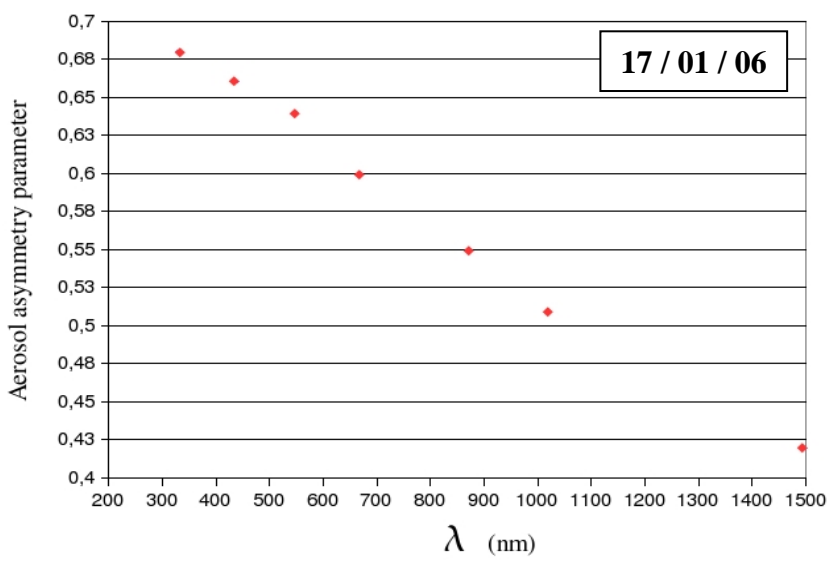
# Aerosol number size distributions on Djougou



- aerosol number size distributions are monomodal at the surface → Aitken mode.
- very good comparisons with aircraft BAe-146 measurements (*S. Osborne*)

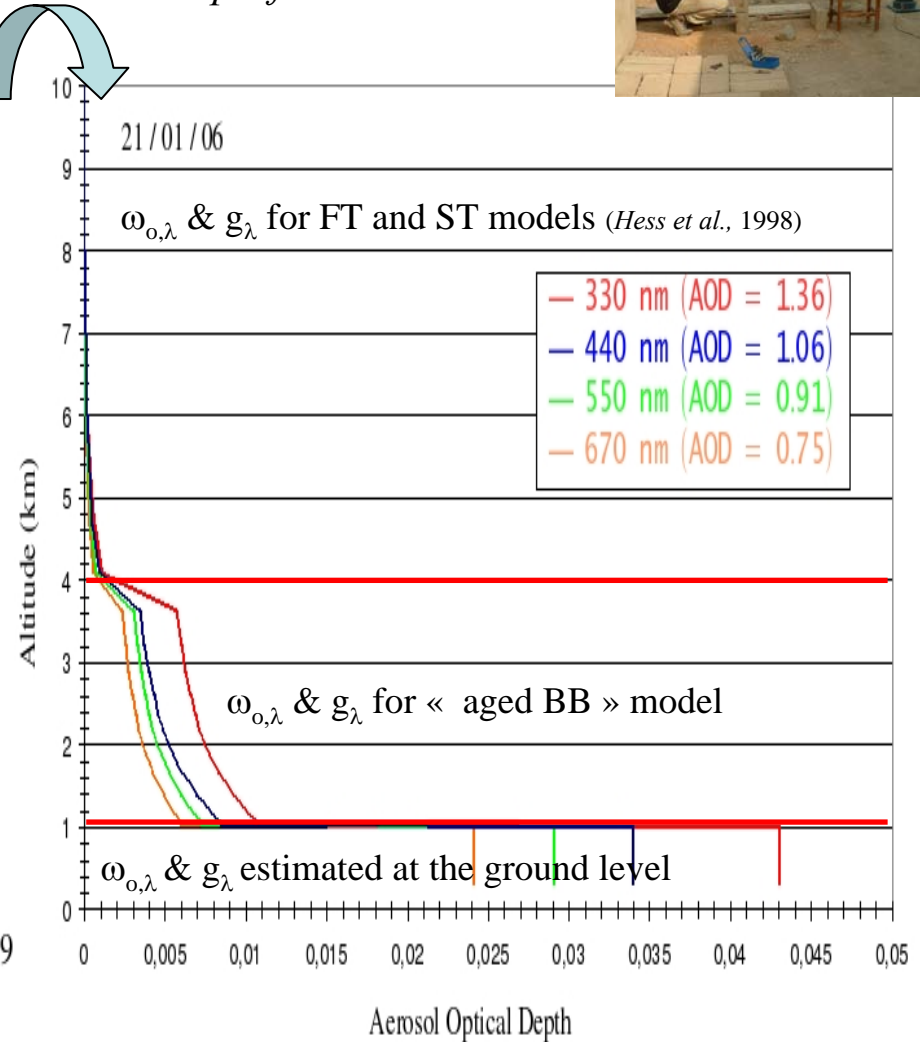
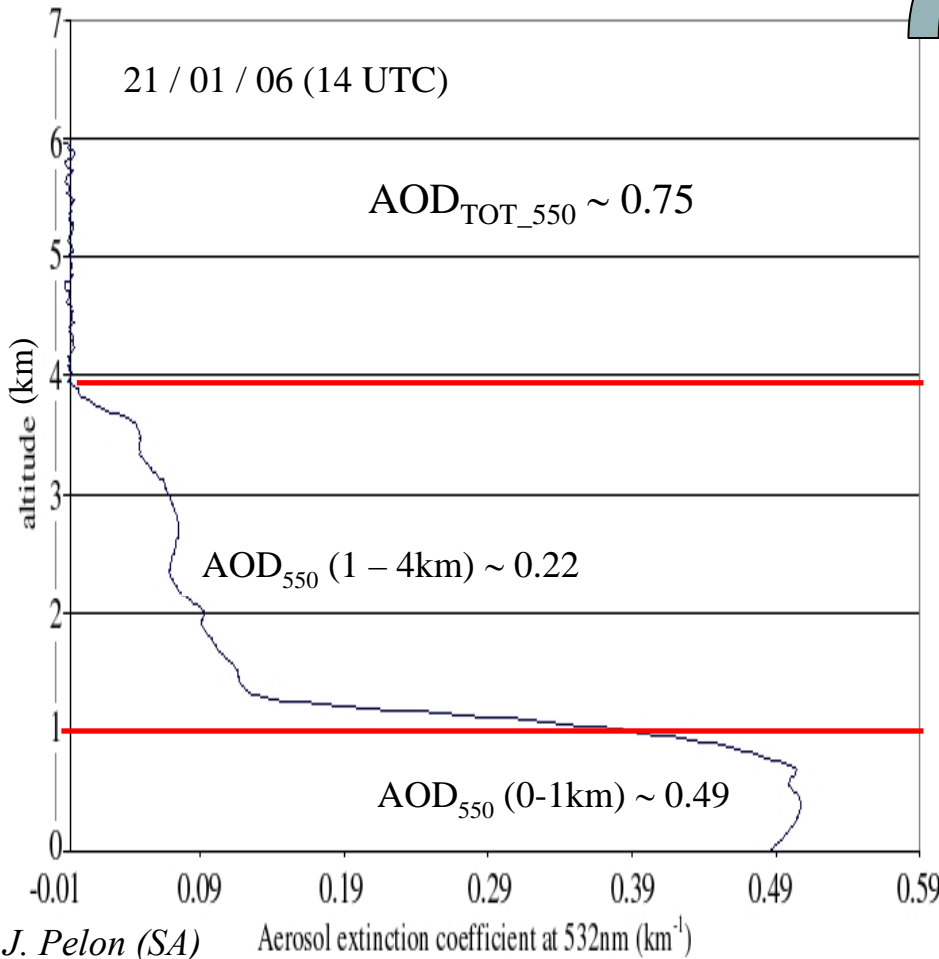
adjusted with optical measurements

	Number conc. (#.cm-3)	GMD (nm)	GSD	RI <sub>550</sub>
17 / 01	5604	115.11	1.83	1.54-i0.025
18 / 01	6391	112.13	1.81	1.54-i0.035
19 / 01	5089	85.94	1.95	1.54-i0.018
21 / 01	8486	99.39	1.86	1.54-i0.014
22 / 01	3927	74.71	1.95	1.54-i0.005
23 / 01	6085	87.99	1.85	1.54-i0.008
24 / 01	7120	100.17	1.86	1.54-i0.013
<b>mean</b>	<b>6100</b>	<b>96.49</b>	<b>1.87</b>	<b>1.54-i0.017</b>



# Aerosol vertical profiles over Djougou

used to improve aerosol vertical profiles in RTM !



➤ thermodynamic parameters profiles ( $T^\circ$  and RH) (coll. B. Pospichal & S. Crewell)

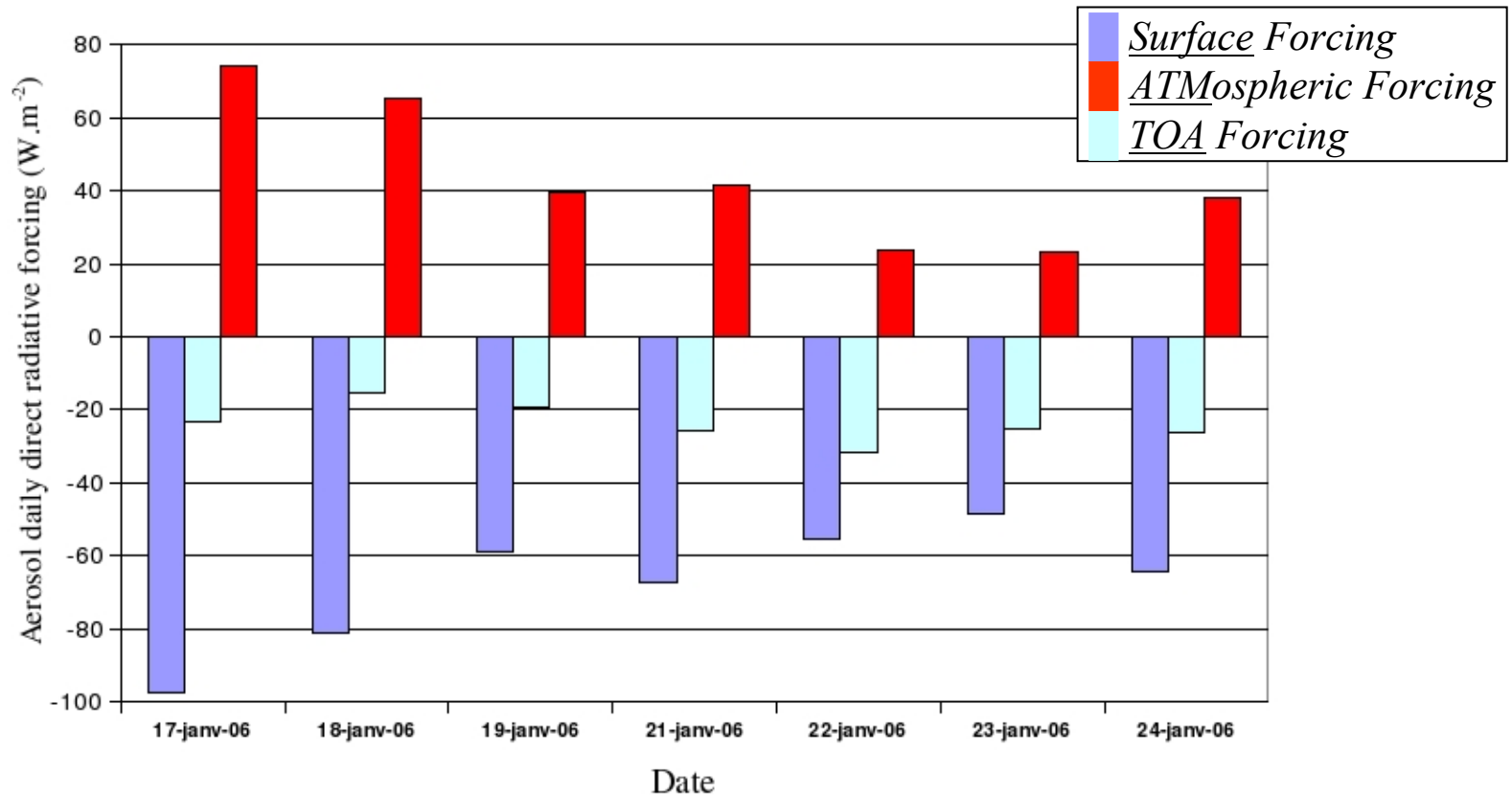
➤ surface albedo → Modis sensor (<http://deleenn.gsfc.nasa.gov>) (coll. J.C. Roger) →  $R_s \sim 0.20$  at 555nm

# Aerosol local direct radiative forcing on Djougou

- significant aerosol atmospheric forcing !
- $+ 20 \text{ W.m}^{-2} \leq \Delta F_{\text{ATM}} \leq + 70 \text{ W.m}^{-2}$  !



what is the possible impact on the atmospheric dynamic and on the cloud formation ?



- significant aerosol surface forcing !
- $- 45 \text{ W.m}^{-2} \leq \Delta F_{\text{BOA}} \leq - 100 \text{ W.m}^{-2} \rightarrow 17^{\text{th}} \text{ Jan. due to SSA} \sim 0.85 \text{ \& AOD} \sim 1.5$  !



what is the possible impact on the surface energy budget, such as latent or sensible heat fluxes ?