

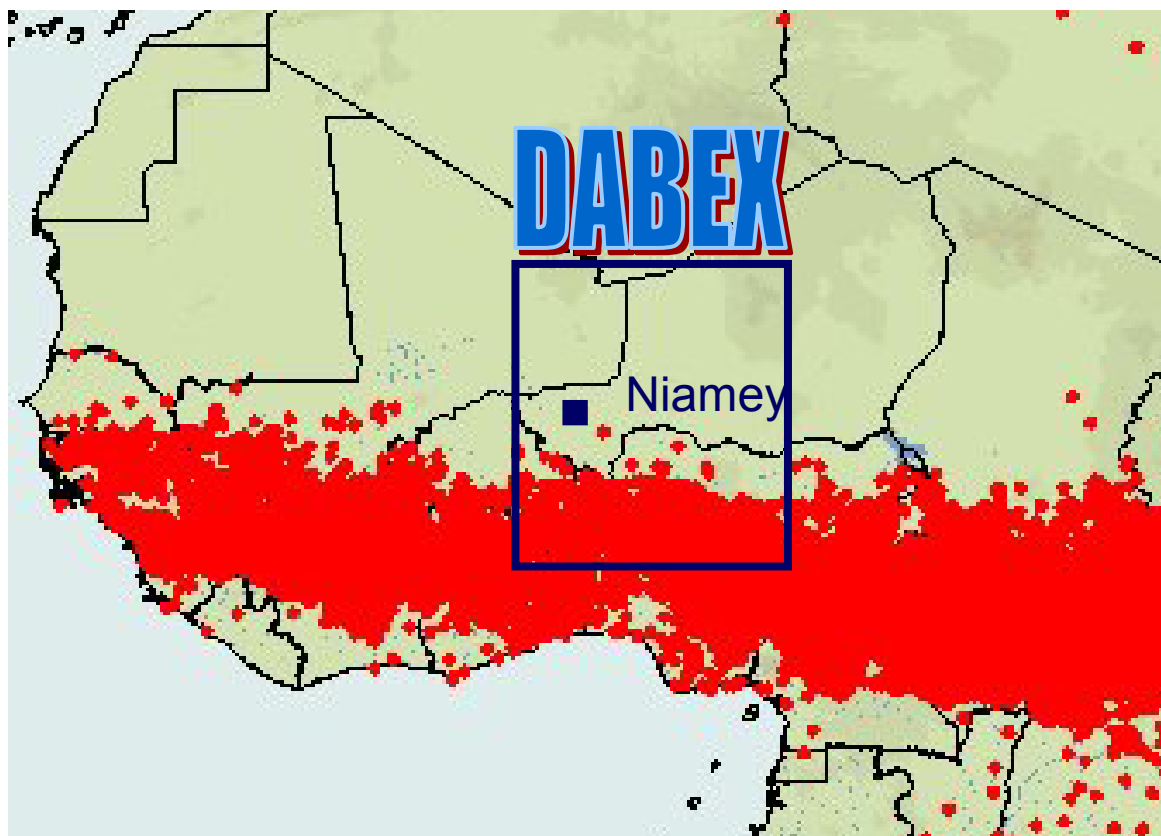


Overview of DABEX (Dust and biomass experiment)

Jim Haywood, Simon Osborne & Ben Johnson

AMMA SOP0 Meeting, Toulouse, 6-10th November 2006

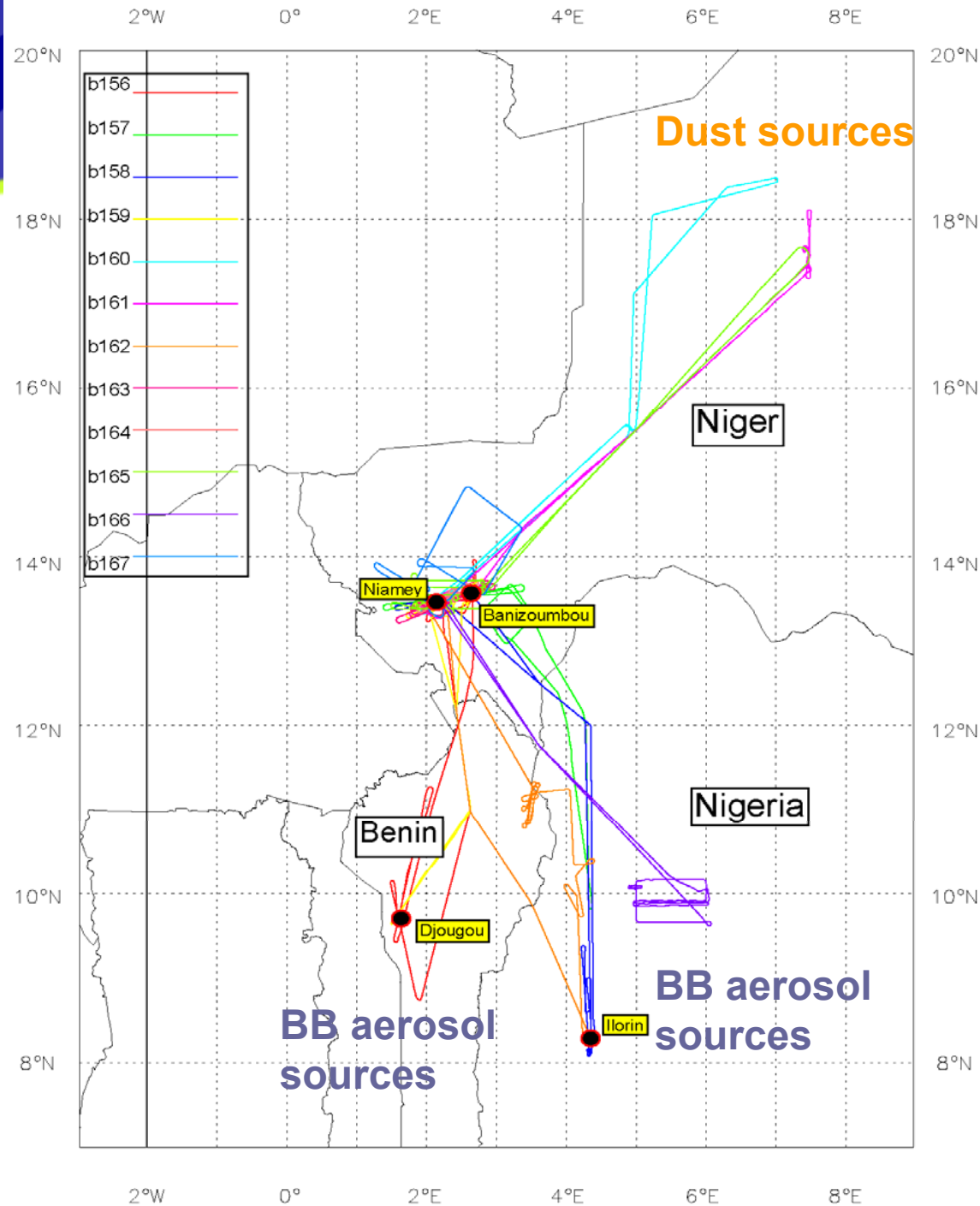
MODIS fire counts 15-19th Jan 06



DABEX overview

- 3 Flights to the NE for dust
- 6 Flights to the south for biomass
- 3 Flights near Niamey
- Flying over Aeronet sites

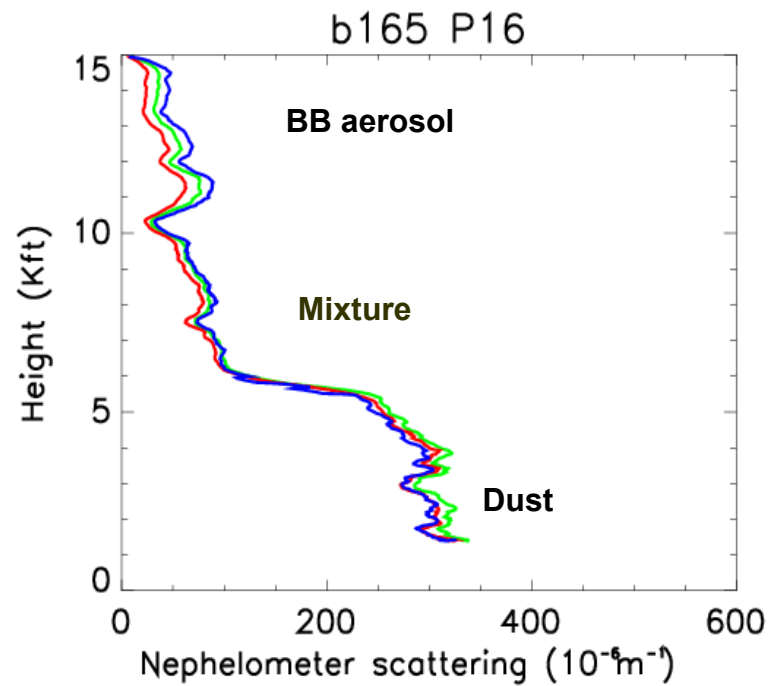
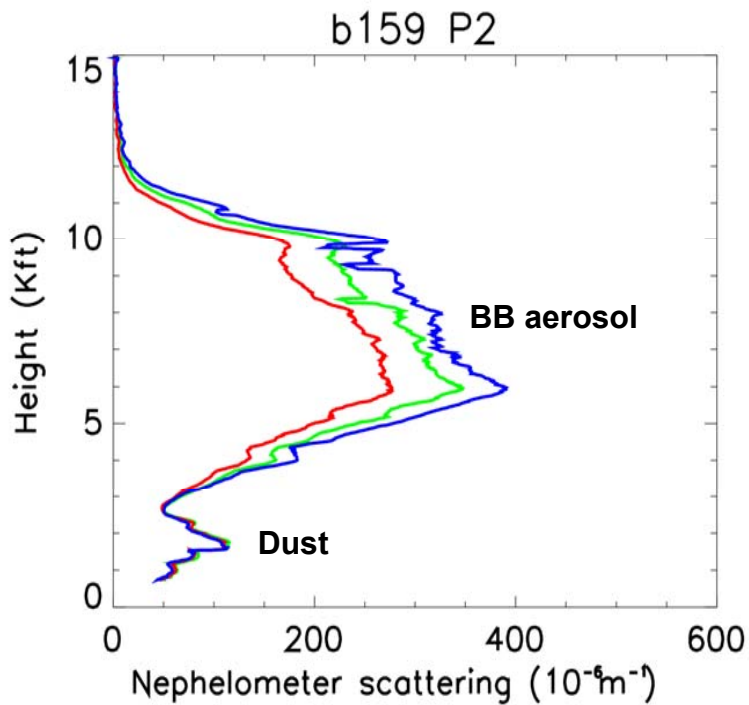
BB = "Biomass-burning"



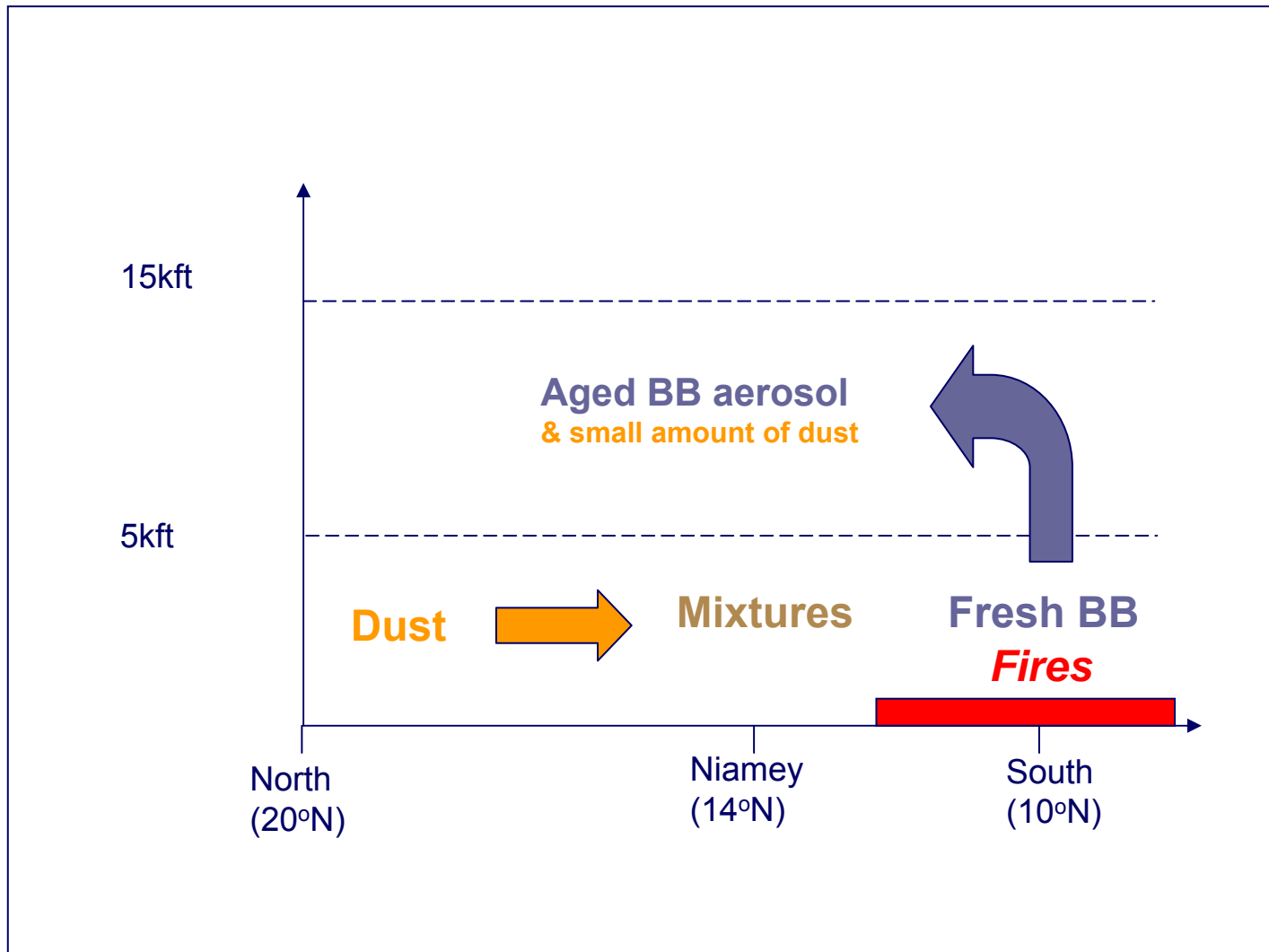
Vertical distribution

Nephelometer
wavelengths

- 0.45 μm
- 0.55 μm
- 0.70 μm



Schematic of aerosol transport





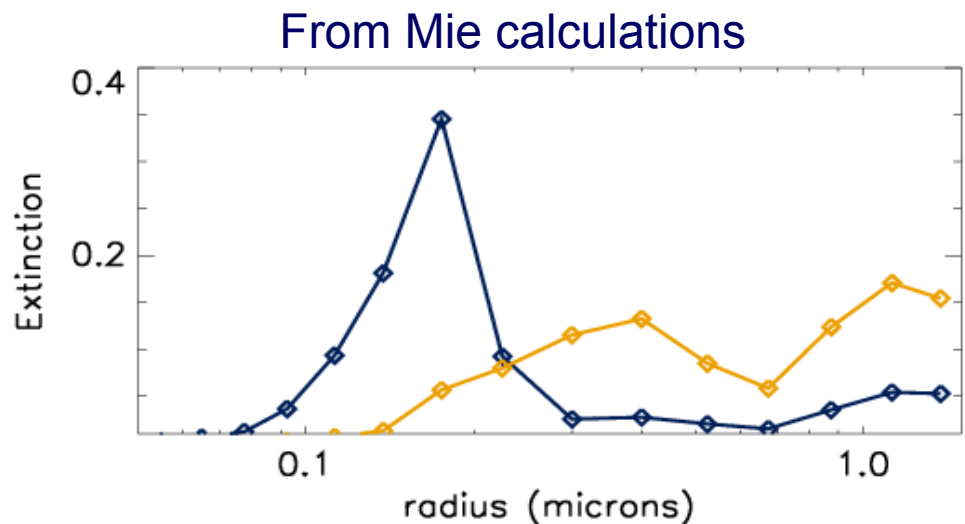
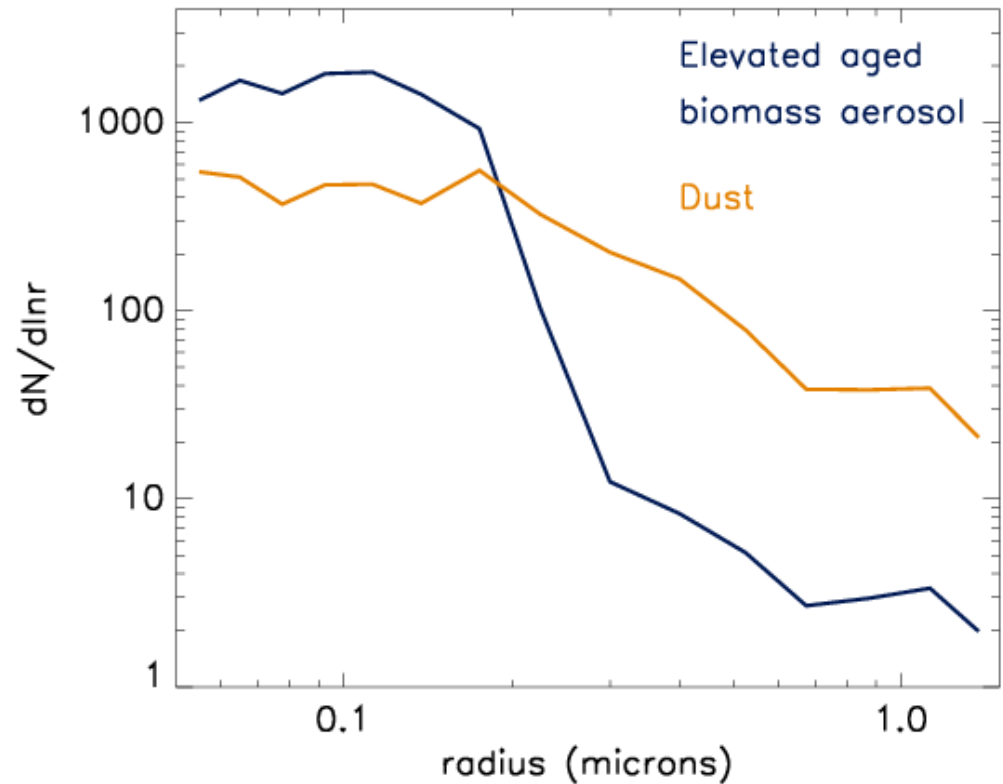
Physical and optical properties of dust and biomass-burning (BB) aerosols

Ben Johnson

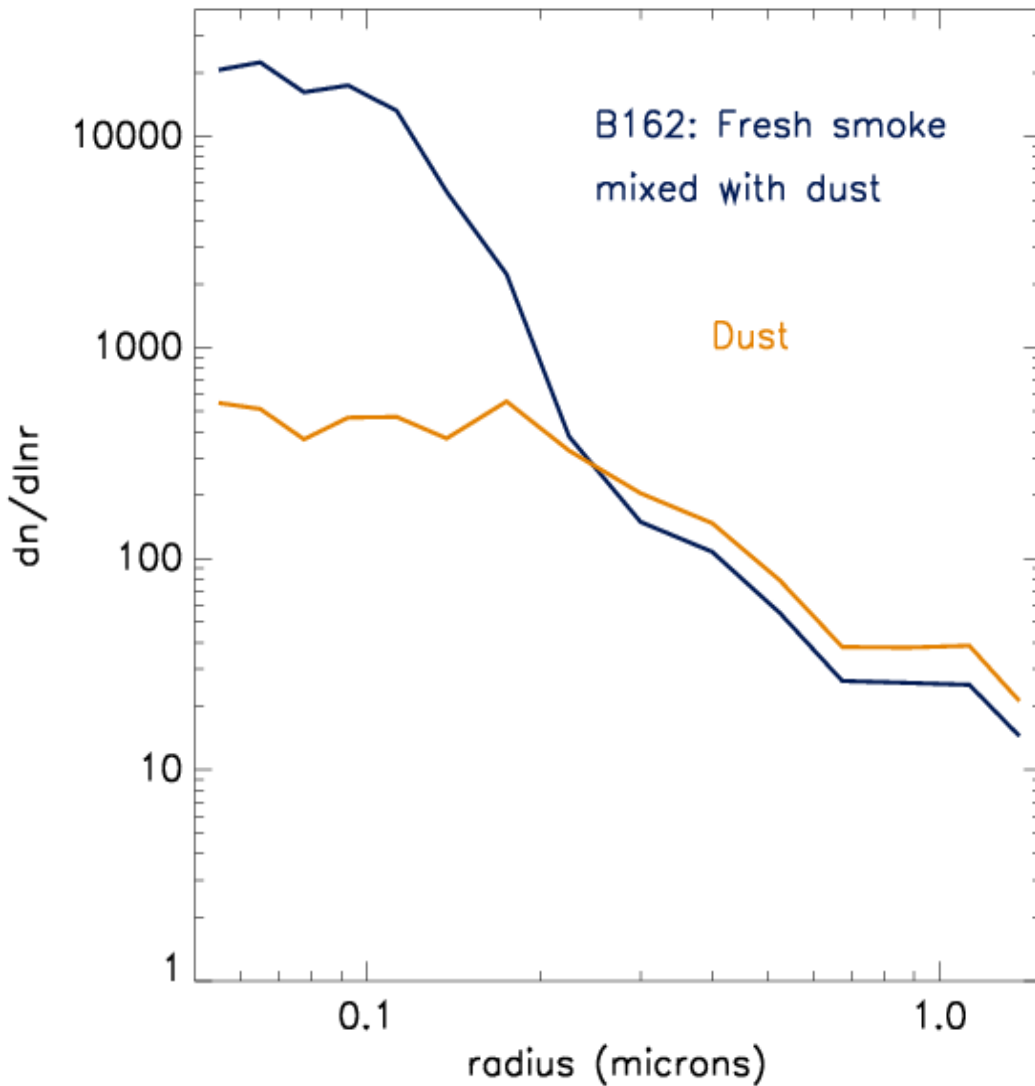
AMMA SOP0 Meeting, Toulouse, 6-10th November 2006

PCASP size distribution (0.05 – 1.5 μm):

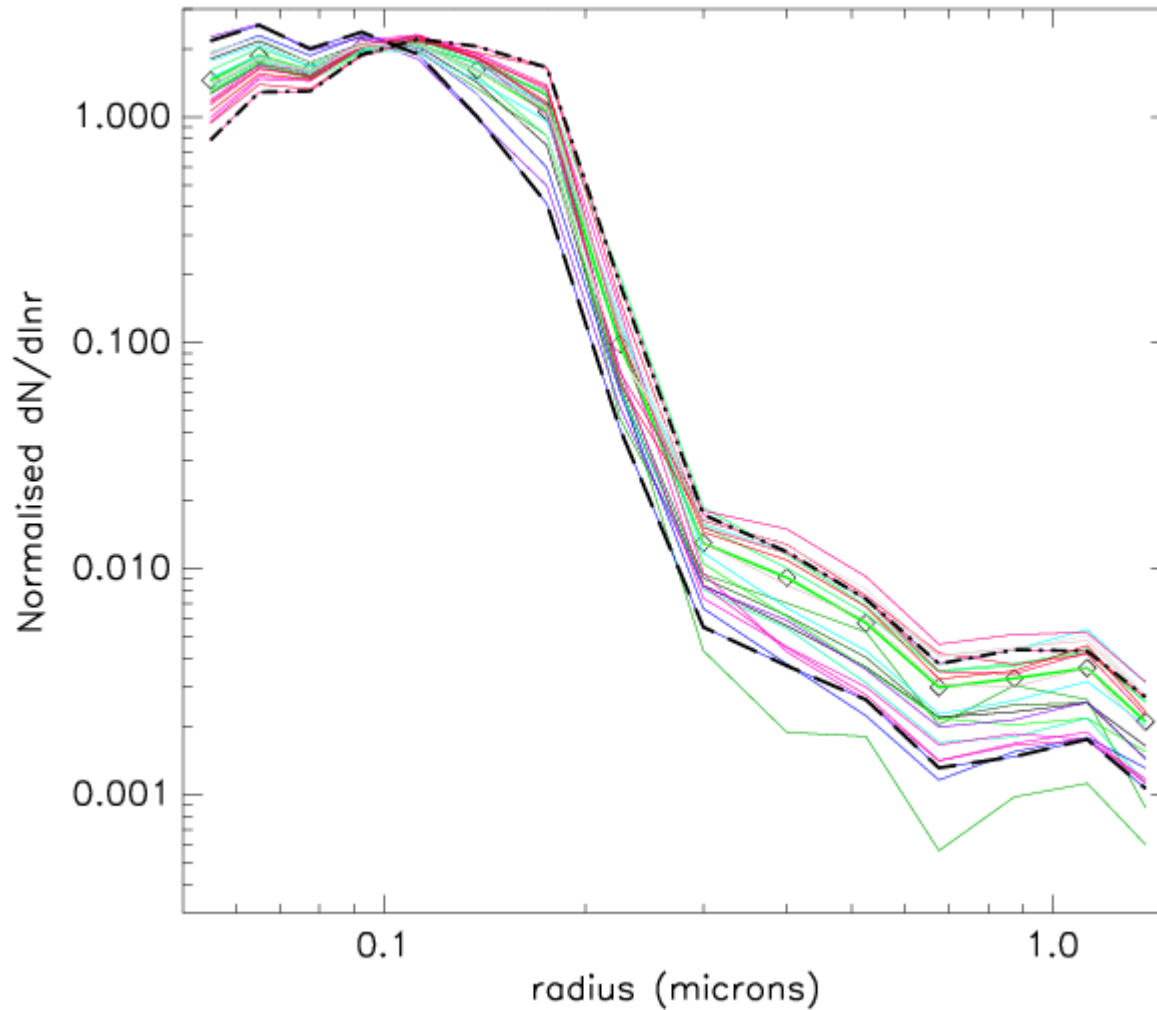
- **BB aerosol dominated by fine particles**
- **Dust dominated by coarse particles**



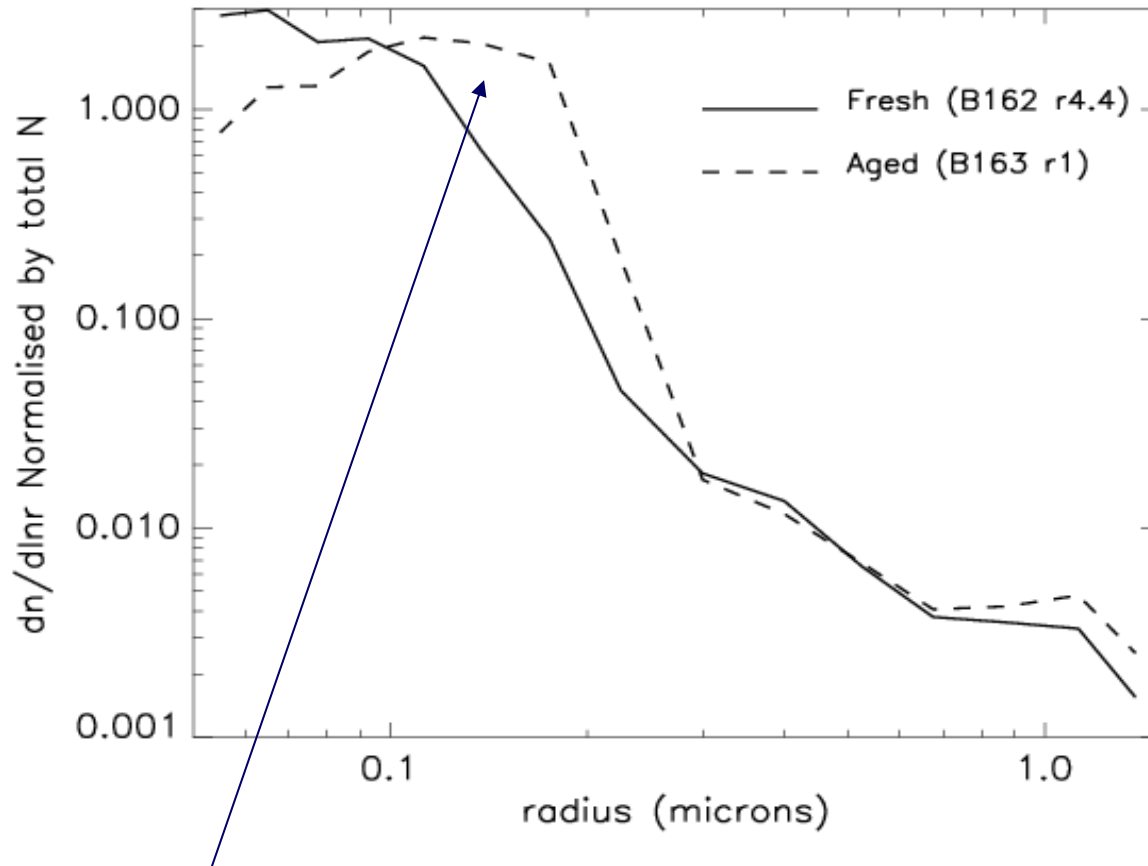
Mixing of fresh smoke and dust



Variability of size distribution: Elevated aged BB aerosol



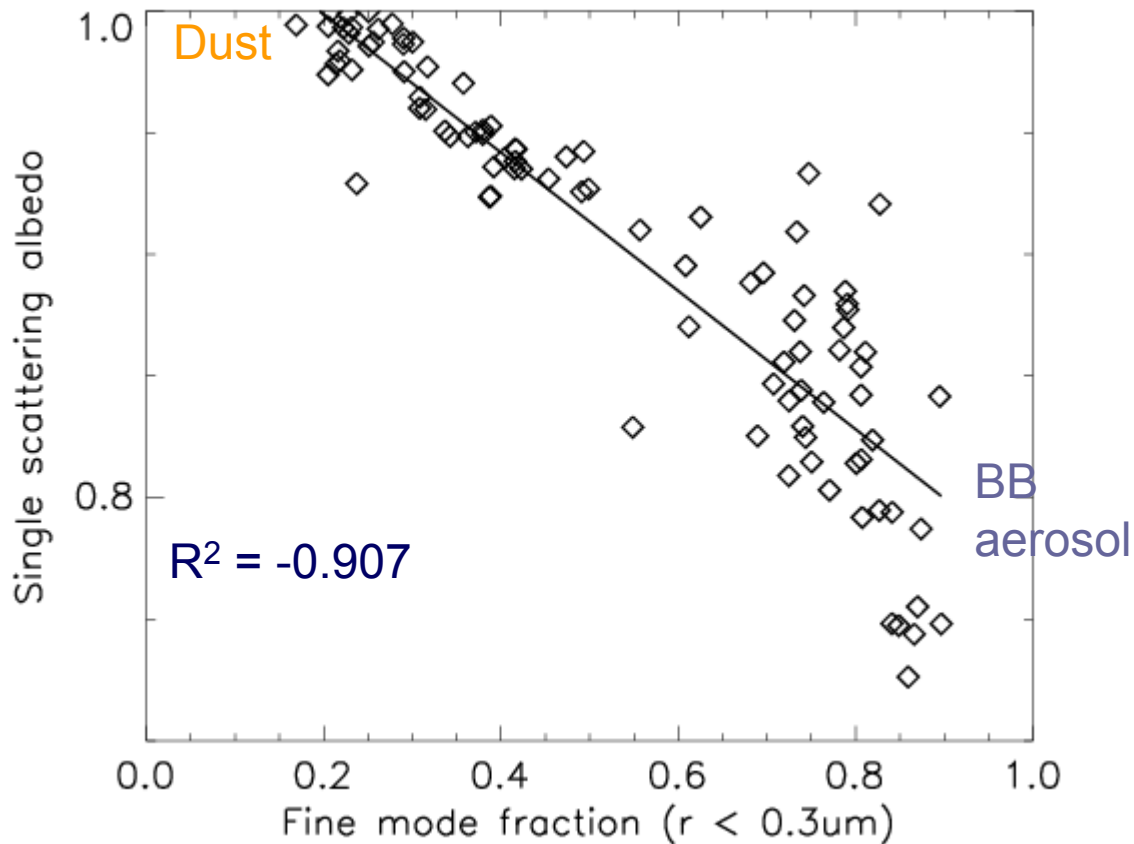
“Aging” of BB aerosol



- Growth of particles via coagulation and condensation of VOCs
- Collaboration with Uni. Leeds UKCA group to model this process

Single scattering albedo (ω)

All SLR data from DABEX



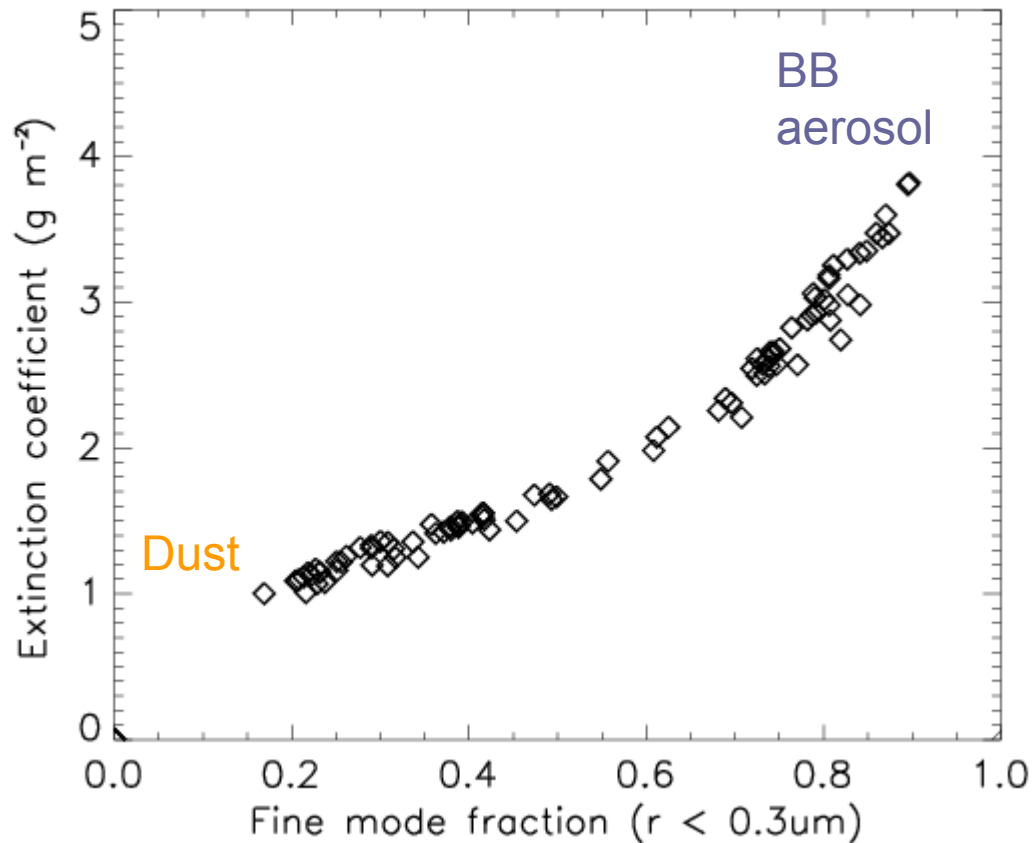
Huge range of values

Dust virtually non-absorbing ($\omega \sim 1$)!

BB aerosol highly absorbing ($\omega = 0.75 - 0.9$)

Extinction coefficient (K_{ext})

All SLR data from DABEX



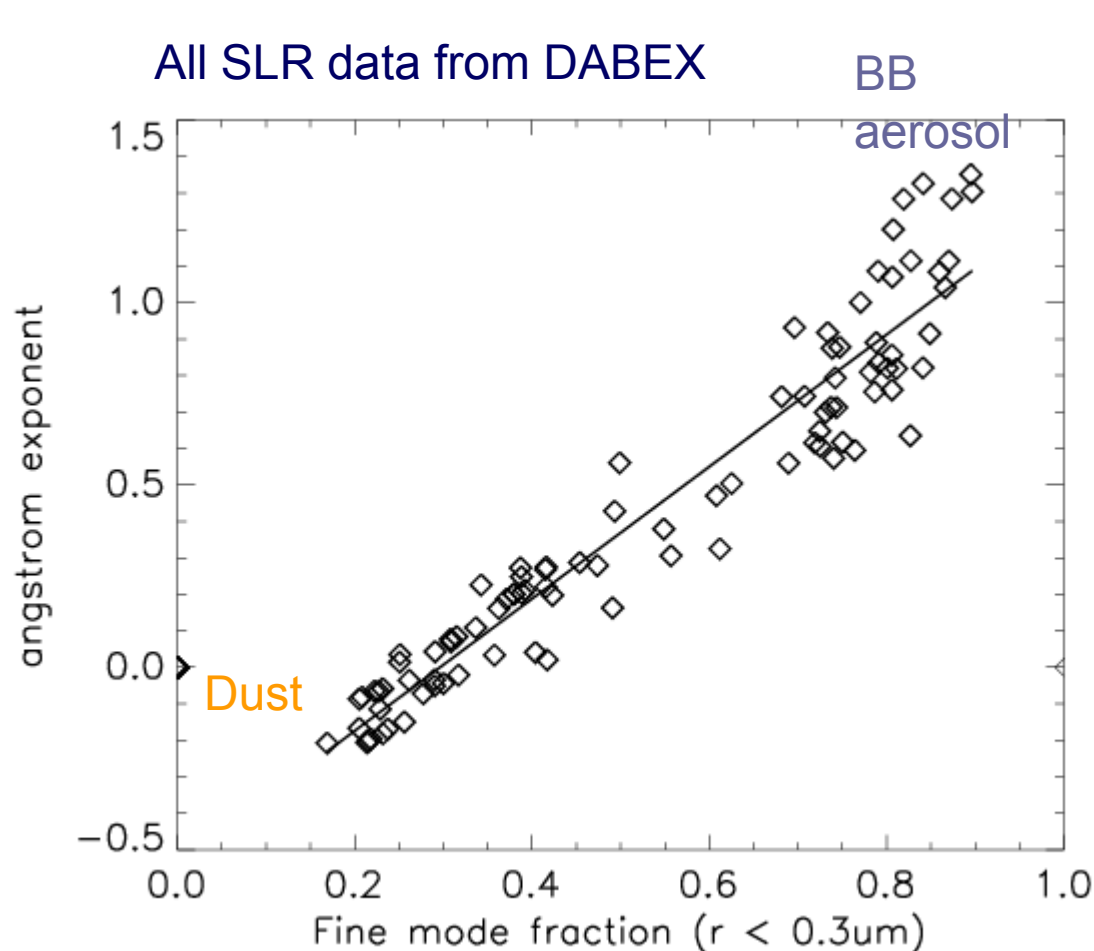
$$K_{ext} = K_{sca} + K_{abs}$$

$$K_{ext} = \frac{3Q_{ext}}{4\rho r}$$

$$K_{ext} \sim 1 \text{ m}^2/\text{g} \text{ for dust}$$

$$K_{ext} \sim 4 \text{ m}^2/\text{g} \text{ for BB aerosol}$$

Angstrom exponent (\AA) measured from the 3-wavelength nephelometer



$$\tau_{\lambda} = \tau_{\lambda_0} \left(\frac{\lambda}{\lambda_0} \right)^{-A}$$

Positive angstrom exponent indicates that radiation is scattered preferentially at shorter wavelengths

$\text{\AA} \sim 0$ for dust

$\text{\AA} \sim 0.7 - 1.4$ for BB aerosol
(SAFARI: $\text{\AA} \sim 2$,
Mie calcs for pure BB: $\text{\AA} \sim 2.3$)

Mean optical properties (@ 550nm) from DABEX and past campaigns



Data source	Observed ω	Mie-calculated K_{ext} ($\text{m}^2 \text{g}^{-1}$)	Mie-calculated asymmetry parameter
Fresh BB DABEX B162	0.7-0.85 +/- 0.05	3.7	0.50
Fresh BB SAFARI A790	0.84-0.88 +/- 0.04	3.9	0.52
Aged BB mixed with dust DABEX	0.73-0.90 +/- 0.05	2.5	0.62
Aged BB SAFARI A790	0.88-0.91 +/-0.03	5.0	0.59
DUST DABEX B160 & B161	0.99-1.0 +/- 0.02	1.1	0.69
DUST SHADE A797 (Sept 2000)	0.92-0.98 +/- 0.02	0.42	0.74

$$n_{\text{dust}} = 1.53 + 0.0003i, \rho_{\text{dust}} = 2.65 \text{ g cm}^{-3}, n_{\text{BB}} = 1.54 + 0.035i, \rho_{\text{BB}} = 1.35 \text{ g cm}^{-3}, r < 1.5\mu\text{m}$$

- Biomass-burning aerosol had very high SW absorption (x2 SAFARI), whereas dust was virtually non-absorbing.
- Huge variation in size distributions and optical parameters, mainly due to variable proportions of dust and biomass aerosol.
- We invite collaboration especially for case studies of **B159** (19th Jan) & **B160** (20th Jan) (e.g. chemical analysis)

The end



Thank you for your attention!