

# SOP-0 (DABEX)

## Biomass Burning aerosol: measurements of composition using an Aerosol Mass Spectrometer

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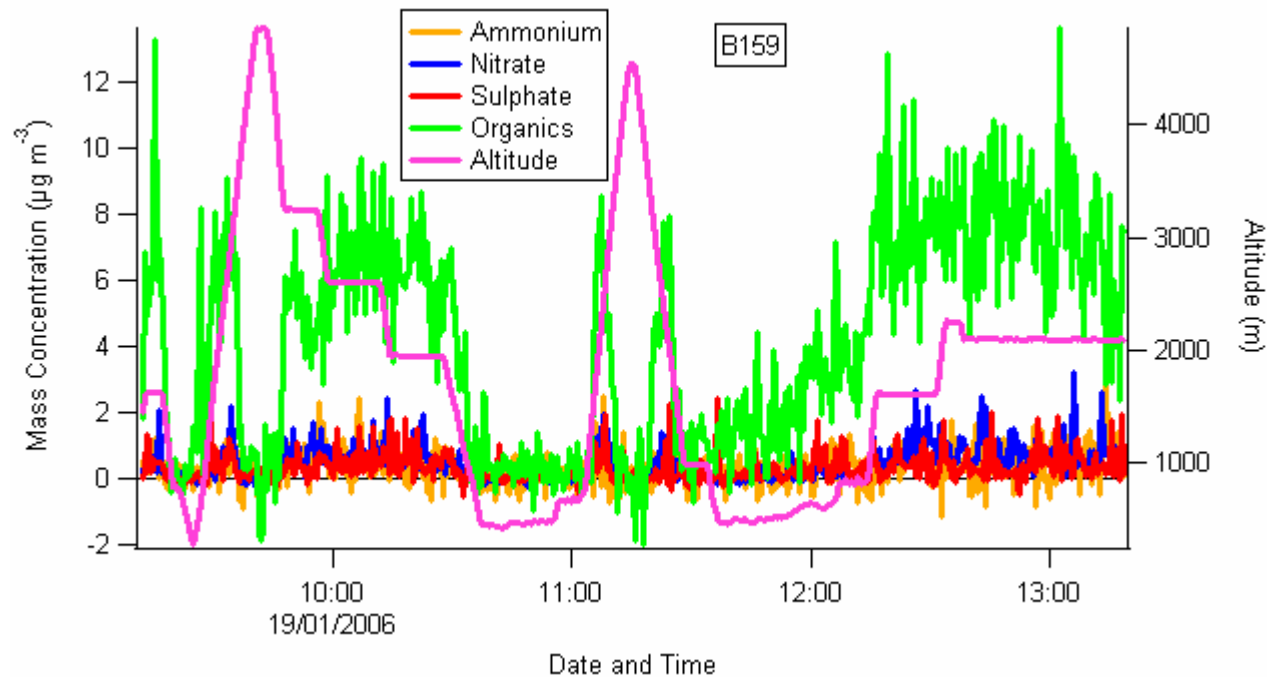
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# Outline

- What AMS data have we got?
- Aerosol size distributions
- Profiles
- Spectral fingerprints and ageing
- Correlations
- The way forward

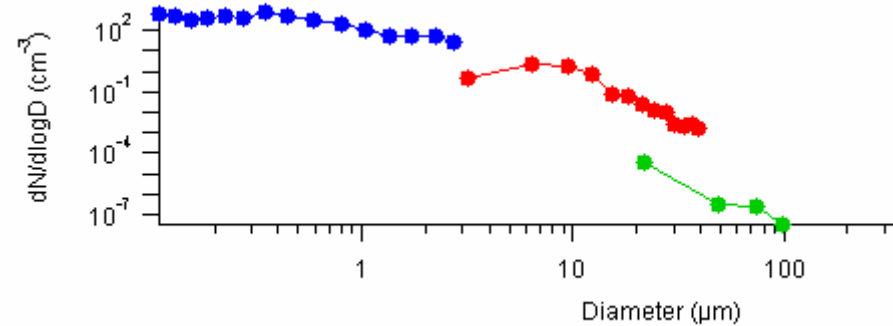
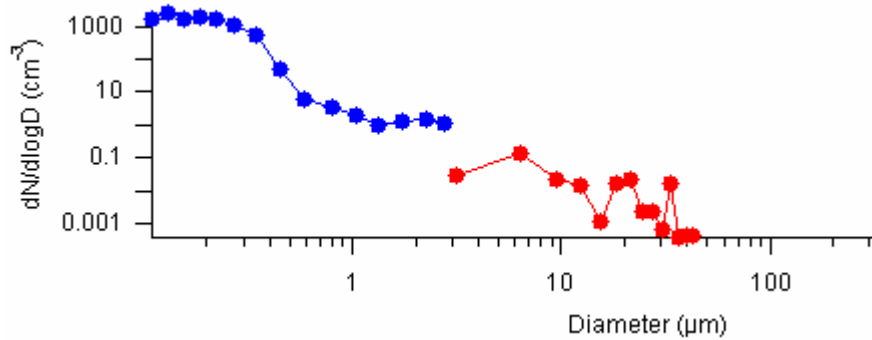
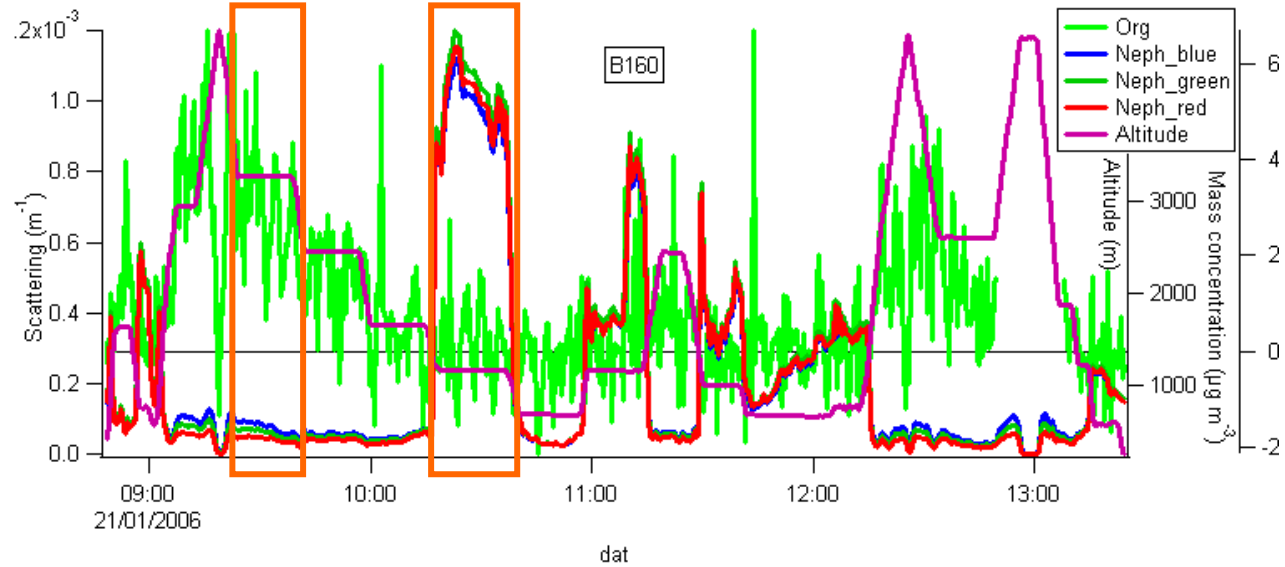
# AMS data

- Very successful – useable data from all (DABEX & DODO) flights except second half of B156



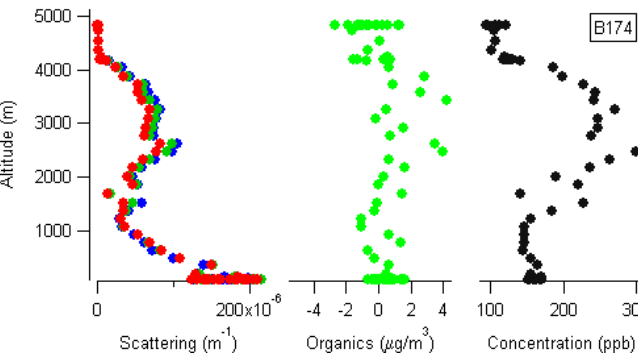
- Background signal very clean – few sources of pollution.
- Only substantial signal was for biomass burning (org)

# Size distributions

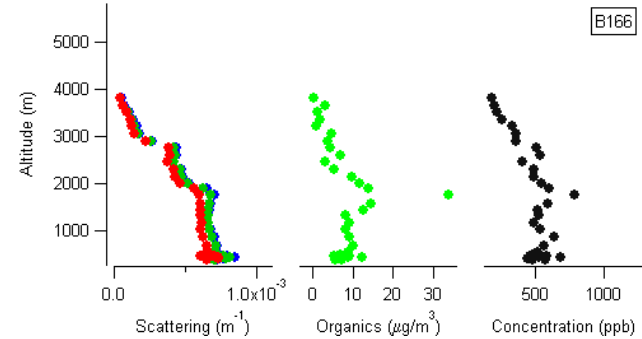
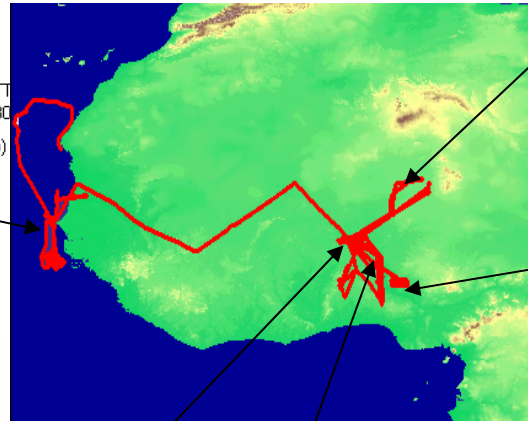
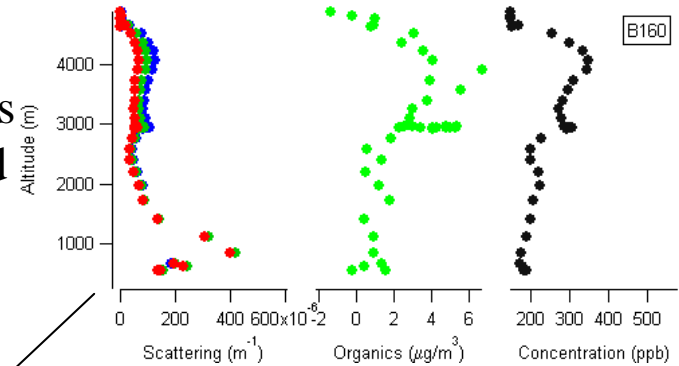


# Some typical profiles

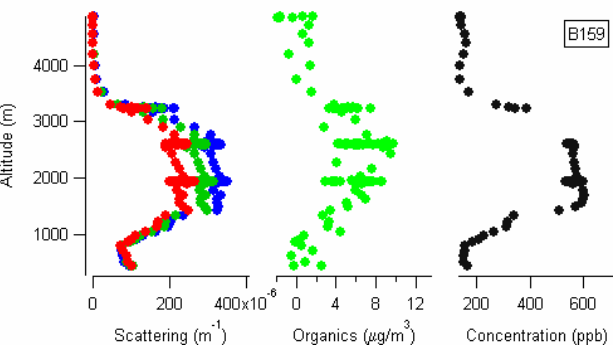
B174 Off coast of Senegal, biomass at similar altitude, above the dust



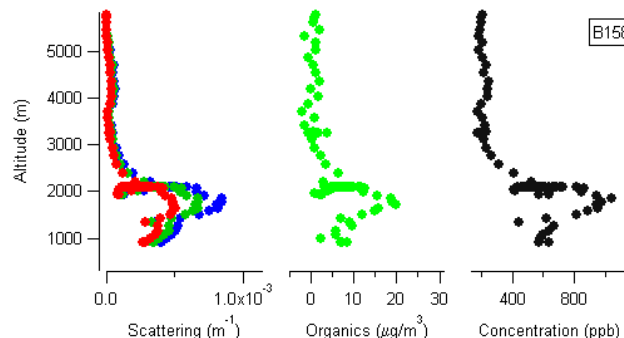
B160 Dust dominates at low level, elevated biomass layers



B166 Far SE in burning region, biomass burning dominates at all altitudes

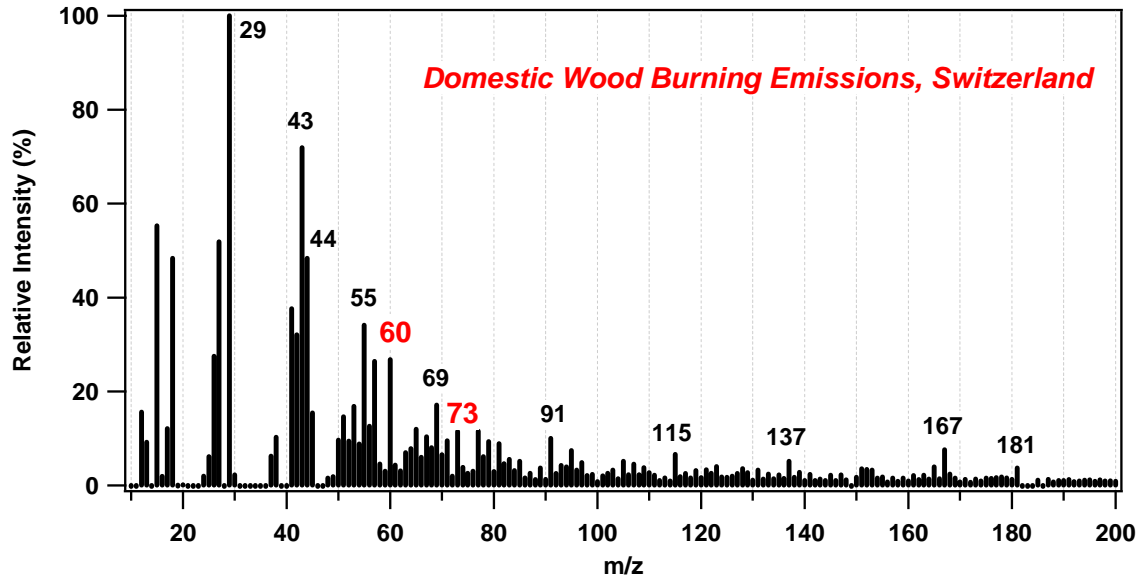


B159 Over Niamey, often dust at low level, with biomass burning at higher altitude (>2000m)



B158 heading SE out of Niamey, biomass layers at similar altitude

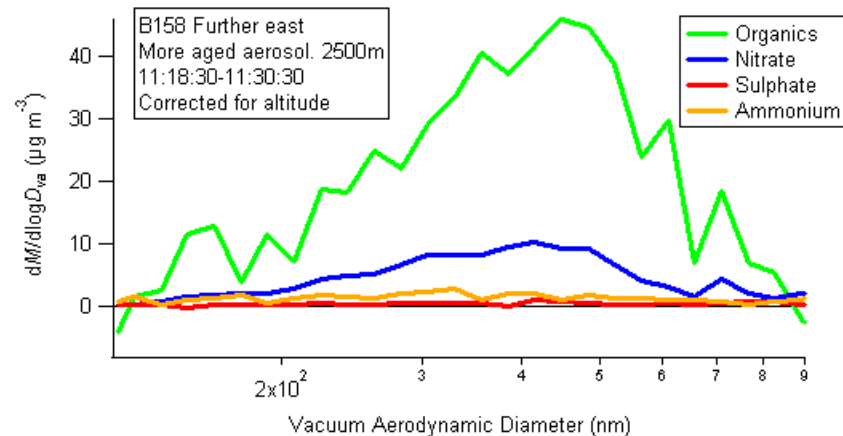
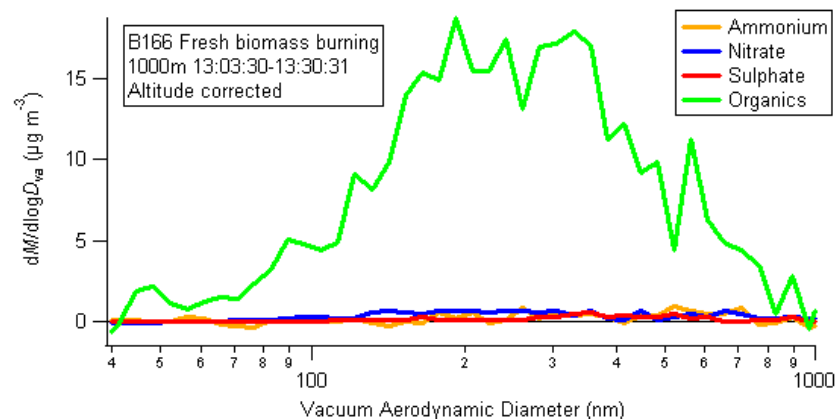
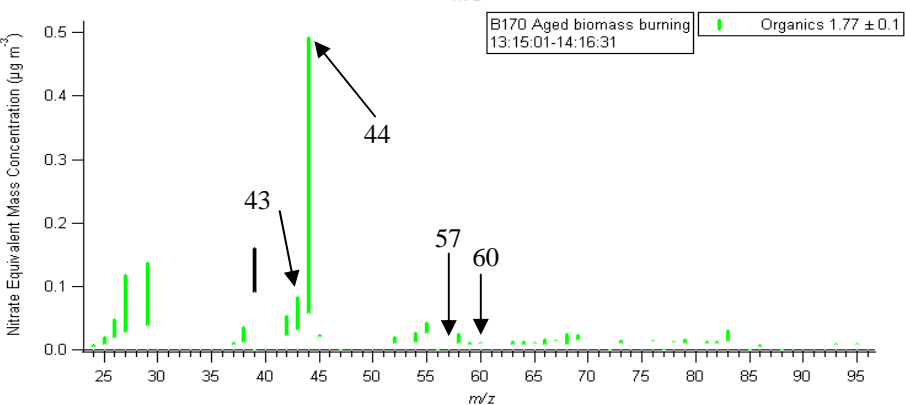
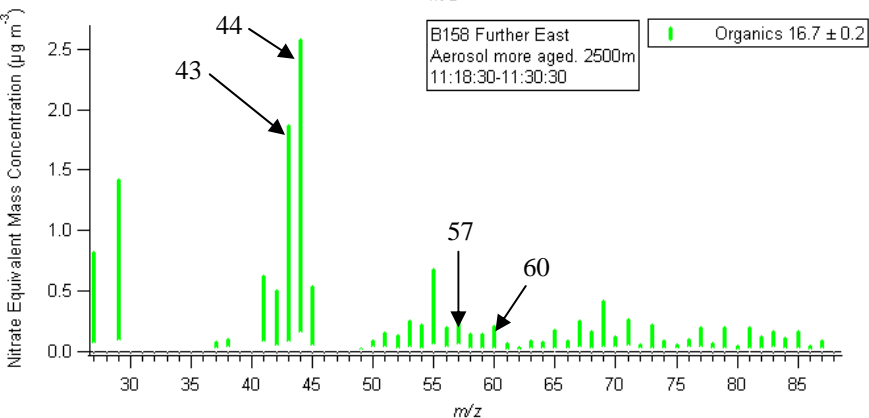
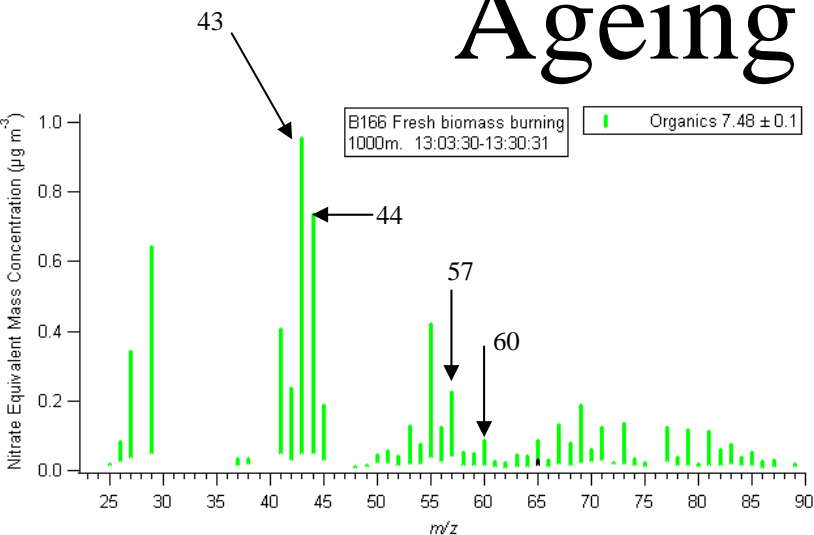
# Mass spectra – characteristic fragments



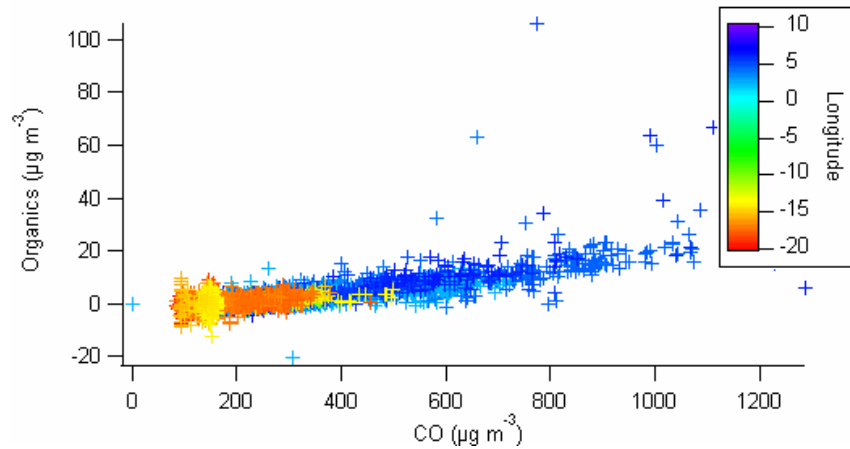
Rami Alfarra, PSI

- $m/z$ 43 Both saturated ( $C_3H_7^+$ ) and oxidised compounds (aldehydes and ketones  $CH_2CHO^+$   $CH_3CO^+$ )
- $m/z$ 44  $CO_2^+$  Oxidised compounds
- $m/z$ 57  $C_4H_9^+$  Saturated hydrocarbons (fresh) aerosol
- $m/z$ 60 Levoglucosan marker

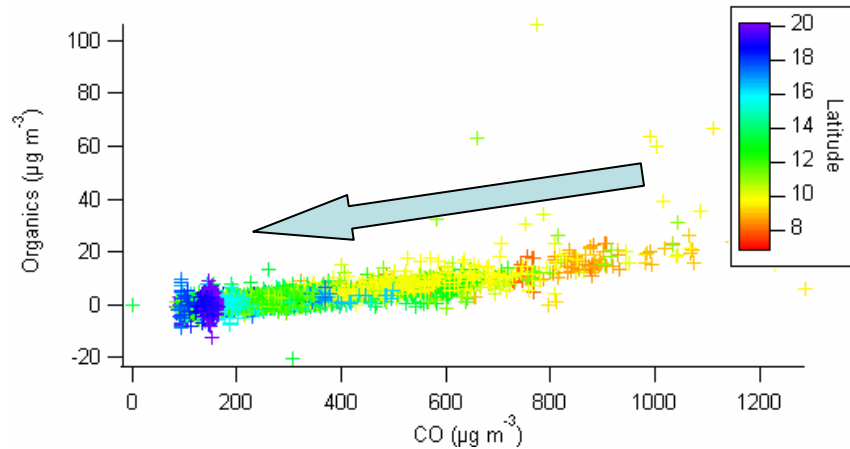
# Ageing of the aerosol



# CO/ Organics correlation

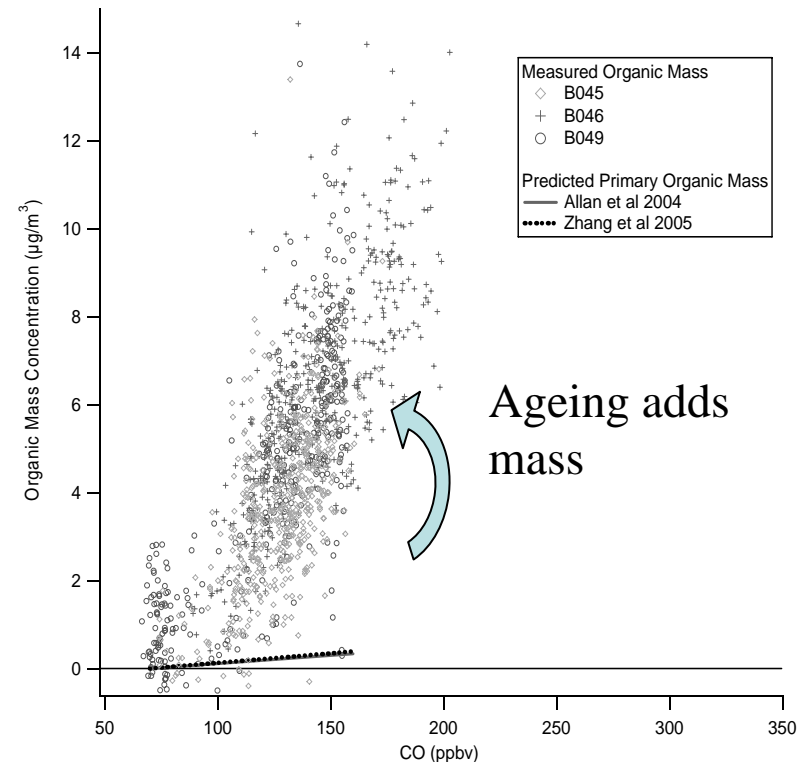


B169 is the only flight that doesn't fit the plot – air mass came from the north instead, so not the same source region.



Ageing moves along the curve

## Measurements of UK pollution



# Why this robust relationship?

1. All the secondary aerosol is produced very close to source i.e. very quick processing
2. There is very limited secondary production i.e. little precursor VOC is converted to secondary aerosol mass due to limited photochemistry
3. The primary organic mass is far greater than the secondary, rendering the secondary contribution insignificant

Regardless of which of the three is the case, all of the above scenarios mean that the regional relationship between organic mass and CO is robust.

# Using Andreae and Merlet emission ratios:

	<b>Sub Tropical</b>	<b>Tropical</b>	<b>AMMA SOP0</b>
<b>CO</b>	65	104	
<b>OC</b>	3.4	5.2	
<b>OC:OM</b>	1.2	1.2	
<b>TO</b>	4.08	6.24	
<b>TO:CO</b>	<b>0.0628</b>	<b>0.06</b>	<b>0.042*</b>

SOP0 derived ratio is lower than Andreae and Merlet, but using different methods

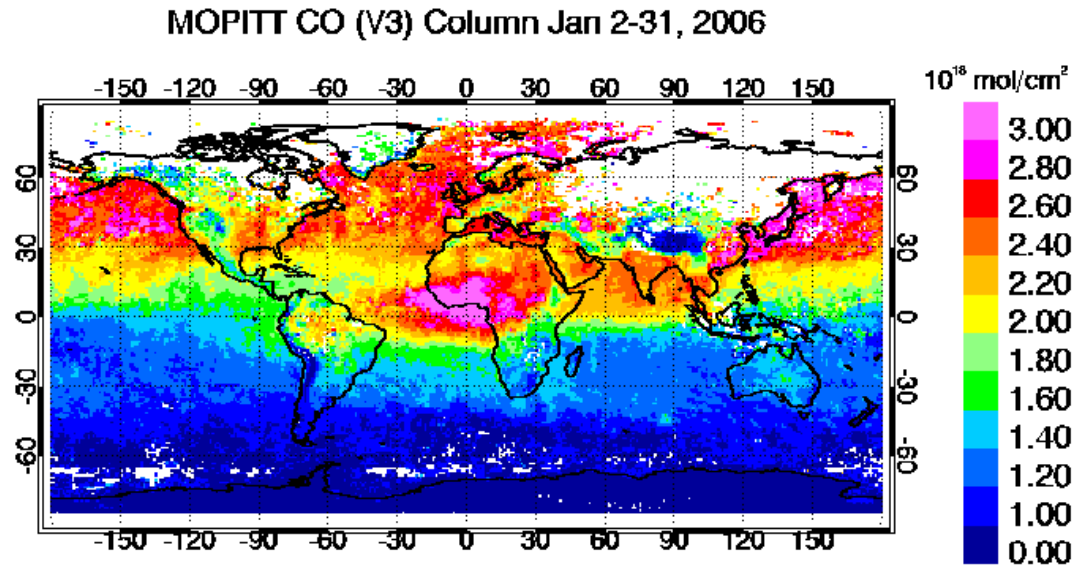
\*Using a collection efficiency of 0.5

CE assumed = 1 in data shown. True value 0.5 -0.7 (based on laboratory wood burning and ambient measurements - Rami Alfarra, PSI)

# Summary

- CO:OM ratio constant over whole region
- Primary and near-source secondary dominates the mass
- Use hydrocarbon data to assess quantity of precursor available for SOA and to predict the level of photochemistry
- Aerosol does undergo chemical processing removing primary species (e.g. levoglucosan) and leading to highly oxygenated aerosol dominated by organic acids
- Calculated emission ratios compare well with those of Andreae and Merlet using regional data from a range of burn types compared to their single-source estimates
- Need to examine whether OM:CO ratios can be extended to scattering and black carbon

# What next?



Gridded at 1x1deg from MOP02-20060131-L2V5.9.4.val.hdf (apriori fraction < 50%)

- MOPITT – biomass burning maps for modelling