Measurements During The South American Biomass Burning Analysis (SAMBBA) Field Experiment

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Biomass burning represents one of the largest sources of particulate matter in the atmosphere and can significantly perturb local air quality, meteorology and the earth's radiative balance (Bond et al., in press). Due to the relatively short atmospheric lifetimes, these effects are most acutely felt on regional scales and can have a significant effect on quality of life and the hydrological cycle. However, many of its predicted effects are very poorly constrained. The lifetime and properties of these aerosols are strongly dependent on their composition and injection height, which are turn are highly dependent on the burn conditions.

The South American Biomass Burning Analysis (SAMBBA) field campaign took place in Brazil in September and October 2012, towards the end of the dry season when biomass burning is typically at its peak. This was a collaborative project between a number of UK and Brazilian institutes and featured a comprehensive suite of state-of-the-art instruments on board the UK Facility for Airborne Atmospheric Measurements (FAAM) BAe-146 large research aircraft, based in Porto Velho, in the state of Rondonia. Aerosol instrumentation included an Aerodyne Aerosol Mass Spectrometer (AMS), Single Particle Soot Photometer (SP2), Scanning Mobility Particle Sizer (SMPS), Particle Soot Absorption Photometer (PSAP), Cloud Condensation Nuclei Counter (CCN), Passive Cavity Aerosol Spectrometer Probe (PCASP) and Nephelometers. In conjunction with other measurements, such as inorganic gases, VOCs, optical spectrometers, lidar and dropsondes, a comprehensive characterisation of the composition and dynamics of smoke plumes could be obtained, which can in turn be used to inform and validate models that attempt to simulate the emissions and impacts of these fires based on satellite data.

During the campaign, 19 sorties were performed and a number of different fires were characterised, along with regional hazes, background aerosols (in both the boundary layer and free troposphere) and 'clean' areas dominated by biogenic emissions. Very different aerosol compositions were found depending on the exact burn conditions. As an example, flight B737 sampled a large forest fire in a remote area of Rondonia, which was principally smouldering in nature, whereas B742 sampled fires in an agricultural area of Tocantins, which were principally flaming. The B742 case showed a larger mass concentration of black carbon (up to 50 µg m^{-3} instead of 5 µg m^{-3}), whereas organic matter concentrations were similar (up to 5 mg m^{-3}). Relationships were also found between different fractional mass spectral markers commonly used in the AMS, specifically *f*44 (oxygenated organics) and *f*60 (anhydrous sugars such as levoglucosan). The relationship between these markers changed between the two cases, although these were both within the range of previously published works (figure 1).

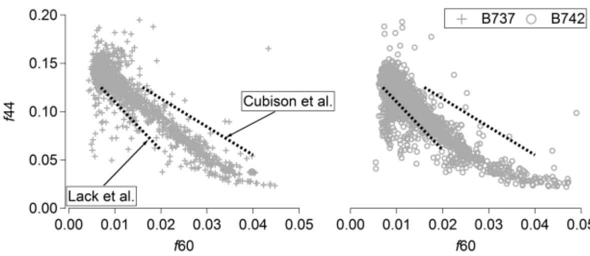

Figure 1: Relationship between *f*44 and *f*60 for a smouldering wildfire (B737) and flaming agricultural fires (B742). The dotted lines correspond to the relationships reported by Lack et al. (2012) and Cubison et al. (2011)

Further results from this campaign will be presented and discussed, quantifying the properties of aerosols under the various conditions. As well as differences in the plume characteristics with burn type, also of interest are the transformations during plume age. The intended applications of these data (e.g. to modelling activities) will also be discussed.

Bond et al.: *J. Geophys. Res. –Atmos.*, doi: 10.1002/jgrd.50171, in press.

Cubison et al.: *Atmos. Chem. Phys.*, 11, 12049-12064, doi:10.5194/acp-11-12049-2011, 2011.

Lack et al.: *Atmos. Chem. Phys.*, 13, 2415-2422, doi:10.5194/acp-13-2415-2013, 2013.