Savannah Early Dry Season Fire Experiment: Project Overview

Marc Mallet[1], Maximilien Desservettaz[3], Dean Howard[4], Zoran Ristovski[1], Melita Keywood[2], Clare Paton-Walsh[3], Grant Edwards[4], Joel Alroe[1], Brad Atkinson[8], Scott Chambers[5], Min Cheng[2], Luke Cravigan[1], Rob Gillett[2], David Griffith[3], James Harnwell[2], Rohan Jayaratne[1], Graham Kettlewell[3], Sarah Lawson[2], Andelija Milic[1], Branka Miljevic[1], Paul Selleck[2], Marcel Vanderschoot[2], Xianyu Wang[9], Jason Ward[2], Sylvester Werczynski[5], Alastair Williams[5], Leah Williams[6], Steve Wilson[3] and Holly Winton[7]

[1]Department of Chemistry, Physics and Mechanical Engineering, Queensland University of Technology, Queensland, Brisbane, 4000, Australia
[2]CSIRO Oceans and Atmosphere Flagship, Aspendale, Victoria, 3195, Australia
[3]School of Chemistry, University of Wollongong, Wollongong, New South Wales, 2552, Australia
[4]Department of Environment Sciences, Macquarie University, Sydney, New South Wales, 2109, Australia
[5]Institute for Environmental Research, ANSTO, Sydney, New South Wales, 2232, Australia
[6]Aerodyne Research, Inc., Billerica, Massachusetts, 01821, USA
[7]Department of Physics, Curtin University, Perth, Western Australia, 6102, Australia
[8]Bureau of Meteorology, Darwin, Northern Territory, 0810, Australia
[9]National Research Centre for Environmental Toxicology, Brisbane, Queensland, 4108, Australia

Keywords: biomass burning, aerosol aging, field campaign
Presenting author email: marc.mallet@hdr.qut.edu.au

The Savannah Early Dry Season Fire Experiment (SEDS-FE) was carried out during June 2014 at the Australian Tropical Atmospheric Research Station (ATAR) at Gunn Point (12°14'56.8"S, 131°02'40.7"E), in the Northern Territory, Australia. This region consists of Eucalypt forest trees and both native and exotic shrubs and grasses (Bowman 1986). Fires during the dry season in this region are common. In addition, the introduction of exotic grasses has been shown to disrupt natural feedback processes and increase fire frequency. This is a growing concern in the Northern Territory with the recent expansion of high-biomass exotic grasses (Bowman *et al*., 2014). It is therefore important to investigate the magnitude and aging of the emissions of these fires so that their influence on a micro and macro scale can be determined.

Instruments were housed in two air-conditioned laboratories and scientists from eight institutions took part in the experiment. Parameters measured included biomass burning aerosols, volatile organic compounds, greenhouse gases, radon, mercury, and trace metals. Measurements of biomass burning aerosol focused on the understanding of general physical and chemical aerosol properties, aerosol aging, ocean micronutrients, nucleation, and cloud nuclei activity. Aerosol measurements were carried out at 40% RH and instruments used for aerosol measurements included; a cToF-AMS, ACSM, VH-TDMA, SMPSs, CCNC, NAIS, as well as several filter samplers with PM2, PM10 and non-restricted inlets. In addition, gaseous measurements were performed using an in-situ FTIR trace gas and isotope analyser, a MAX-DOAS, PTR-MS, ozone and NO_x monitors.

Over the course of the month-long campaign, numerous burning events were observed at the Gunn Point Research Station. Particle size distributions were mostly unimodal, with the mode fluctuating between 60nm and 140nm. Particle number concentrations reached up to 4 x 10^5 cm^{-3}. CO concentrations followed a similar trend to particle number and reached up to 18000 ppm for close-by fires.

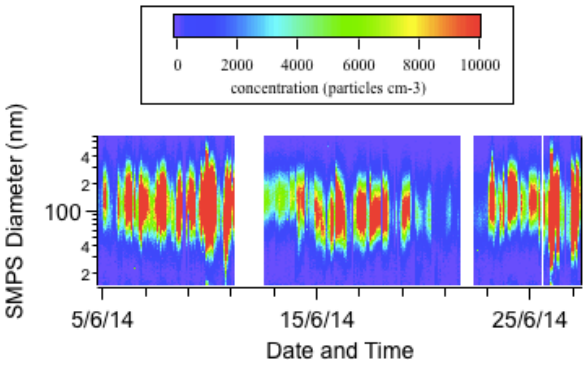

Figure 1. Particle size distribution and total particle number concentrations for the campaign.

The outcomes of this campaign will be numerous. Excluding filter measurements, the time resolution for the majority of the data is 5 minutes. Relationships between the aerosol physical and chemical properties, gas concentrations and meteorological data for the entire month will provide fundamental knowledge relating to biomass burning in this region and how the emissions influence the atmospheric composition in the region.

The CSIRO Oceans and Atmosphere Flagship funded the majority of this work with contributions from each of the involved institutes. ATARS is owned and operated by CSIRO and the Bureau of Meteorology and is a Regional Station in the Global Atmospheric Watch Program.

Bowman, D. M. J. S. (1986), *Vegetatio*, *65*(2), 105-113.
Bowman, D. M., MacDermott, H. J., Nichols, S. C., & Murphy, B. P. (2014), *Ecology and evolution*, *4*(21), 4185-4194.