



New continental African supersite for atmospheric observations

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Megacities pose an increasing source of pollution due to migration to urban areas. This development is pronounced in developing countries, where economical possibilities for regional area planning are limited. Due to uncontrolled migration, new population often settles in informal settlements around the actual city areas. This is also the case in South Africa, where the Gauteng Metropolitan conurbation (Johannesburg, and Pretoria greater metropolitan areas) continuously grows and has became the most important economical area in Africa.

Observations

In our presentation, we introduce a new comprehensive measurement station 100 km West of Johannesburg on grazed savannah-grassland area with a few local pollution sources, but strongly impacted by the plumes from Gauteng (and Mpumalanga industrial Highveld) area with more than 10 million people. In addition to pollution plumes, the site experiences frequent injections of clean air from cleaner sparsely populated sector to the West-South-West.

The station is build in and around a mobile measurement trailer utilized in South Africa since 2006 (Laakso et al., 2008; Vakkari et al., 2010; Petäjä et al., 2011), which was placed on its permanent location in May 2010. The technical lay-out of the site provides possibility for more temporary installations of additional instruments for short measurement campaigns.

The continuous observations at the site are the following:

Trace gases: SO₂, CO, NO_x, O₃ and anthropogenic and biogenic VOC's (2010-2011).

Aerosol particles: air ion size distributions 0.4-40 nm, aerosol particle size distribution 10-840 nm, PM₁₀, black carbon, 3-λ aerosol scattering, aerosol chemical composition by online Aerosol mass spectrometer (2010-2011), and specific aerosol composition (2010-2011)

Solar radiation: direct and reflected PPFD (Photosynthetic Photon Flux Density) and global radiation, and net radiation

Meteorology: precipitation, wind speed and direction, temperature at different heights and relative humidity.

Ecosystem: sensible and latent heat fluxes, CO₂ flux, and soil temperature and moisture at different depths.

Results

The first year of measurements has revealed the advantages of the measurement location for the studies of the environmental impacts from Gauteng 'mega-city' area. During the prevailing easterly and northerly winds, concentration of particulates and trace gases reach very high values, capable of affecting radiative balance and causing damages on the regional ecosystem, whereas during the westerly winds, all concentrations are low. During the dry season (May-September), the site was frequently hit by plumes of regional and local wild fires. The ecosystem measurements clearly showed the onset of photosynthesis and pulsed nature of the respiration following the precipitation events.

The current focus of the studies is on ageing of the plume during the day time with high oxidizing capacity and night-time with low O₃ and OH concentrations. Another research focus is on the validation of regional water balance models, which almost completely lack continuous boundary layer measurements of water exchange.

References

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