Leveraging multiple forms of observational data to improve and validate the quantitative smoke and air quality forecasting system AQFx.

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In the state of Victoria, Australia, planned burning is a common fire management tool to reduce fuel load and thereby minimise the impact of major bushfires on communities. Planned burns are typically undertaken during calm and stable conditions when the burn extent and duration can be carefully controlled. However, the atmospheric ventilation can be poor in such conditions, leading to a build-up of smoke that impacts air quality and human health. To optimise opportunities to achieve planned burning, while minimising the impact of smoke on the community, a multi-tiered quantitative smoke and air quality forecasting system, AQFx, has been developed.

The AQFx system integrates fire spread, smoke emissions and chemical transport models to predict smoke plume dispersion and downwind concentrations. A key to improved forecasting of smoke exposure are reliable observational data- both for blending/assimilation with model forecasts, as well as for validating the processes controlling smoke emissions, transport and chemistry.

In this presentation, we will report on two observation-based strategies which are being leveraged by AQFx.

1. During the development of AQFx, ground-based field measurements were conducted to characterise gases and particles emitted during the period of rapid and intense flaming combustion of fine fuels and during the slow and prolonged smouldering combustion of heavy fuels. The latter form the weakly lofted plume that remains close to the ground and which is often the source of significant and enduring local pollution.
2. The use of multiple forms of near real time smoke intelligence including remote sensing, air quality monitoring station data, and low cost sensor network data to support decision making using operational AQFx forecasts. In this presentation we will focus on the use of a low cost sensor network which is being developed via a STEM project targeted to Grade 6-8 students in regional Victoria. Students build and deploy their own smoke observation gadget (SMOG), a unit that comprises of a dust sensor and a digital temperature and humidity sensor, interfaced via a printed circuit board to a Raspberry Pi to monitor fine particles in the air.