

Summary Report - Air quality modelling of smoke exposure from the Hazelwood mine fire

On 9 February 2014, a disused section of the Hazelwood open-cut brown coal mine in the Latrobe Valley caught fire resulting in the nearby town of Morwell being covered in plumes of smoke and ash over a period of six weeks. Although the plumes travelled large distances, the Latrobe Valley experienced the largest smoke levels due to the fire.

To complement air quality measures that were made during the mine fire, but were not made in Morwell when the fire first started, the air quality team at CSIRO has conducted an air quality modelling study of the mine fire. To assess the air quality impacts on nearby communities, concentrations of two major pollutants from the fire were estimated, namely particles smaller than 2.5 thousandths of a millimetre (PM_{2.5}) and carbon monoxide (CO). The team used weather information such as wind direction, wind speed and temperature, combined with an estimate of how much coal was burned each day during the fire using fire activity maps provided by the Country Fire Authority. Air quality measurements made by the Environmental Protection Authority (EPA) Victoria near the fire location were used to calculate the amount of PM_{2.5} and CO released per unit mass of burning coal. All this information was put into computer models to predict the levels of PM_{2.5} and CO in the Latrobe Valley for the duration of the fire.

Two types of air quality models were used: The first model used a very high area resolution (100 to 300 m, which is about street level size) to estimate the air quality impacts in the vicinity of the fire, such as within the towns of Morwell and Traralgon. The second, larger-scale model used a much lower area resolution (3 km, which is about small town sized) and covered the whole of eastern Victoria, estimating air quality impacts for towns located hundreds of kilometers from the mine fire.

The high-resolution modelling showed that the hourly averaged concentration of PM_{2.5} in southern Morwell reached as high as 3700 micrograms (millionths of a gram) per cubic metre of air during the early period of the fire (see Figure 1). The concentrations of PM_{2.5} returned to usual levels of about 6 micrograms per cubic metre in the Latrobe Valley by March 12th. Modelled peak hourly concentrations of CO reached 60 parts in one million, with usual levels being about 0.07 parts in one million. The modelled concentrations were compared with measured data and found to be similar (Figure 1). Note that no measurements were made during the first few days of the fire, when some of the largest concentrations were predicted by the model.

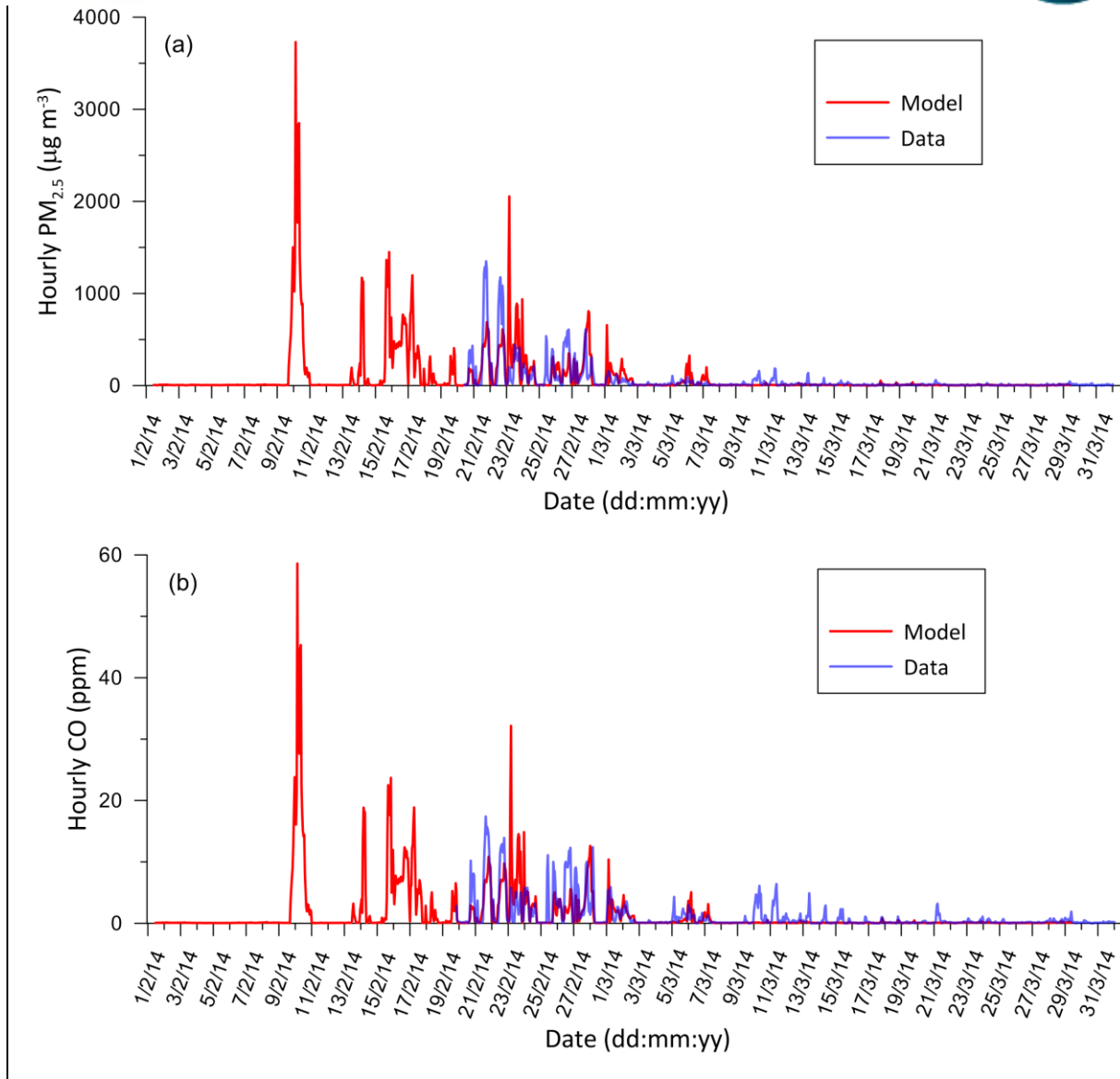


Figure 1 Hourly-averaged observed and modelled concentrations of (a) PM_{2.5} and (b) CO at southern Morwell. Output from the fine-scale modelling used. No observations (or data) were available for the early period of the fire.

In Australia, the outdoor air quality standards (National Environment Protection Measures) for PM_{2.5} particles are 25 micrograms per cubic metre as a 24-hour average and, for CO, nine parts in one million as an eight hour average. The modelling showed that Morwell residents were exposed to the greatest number of exceedances of the PM_{2.5} standard, with 23 days at southern Morwell and 12 days at eastern Morwell when PM_{2.5} was above the standard during the 45 days the fire burned. There were five days above the PM_{2.5} standard at Traralgon. The standard for CO was exceeded seven times at southern Morwell.

Elsewhere in the Latrobe Valley, PM_{2.5} concentrations decreased rapidly as the smoke plumes dispersed in the atmosphere. The large-scale modelling showed that there were three days above the 24 hour PM_{2.5} air quality standard at Churchill and two days above the standard at Moe (Figure 2 shows a distribution of the modelled number of exceedances). There were no exceedances of the CO outdoor air quality standard outside of Morwell.

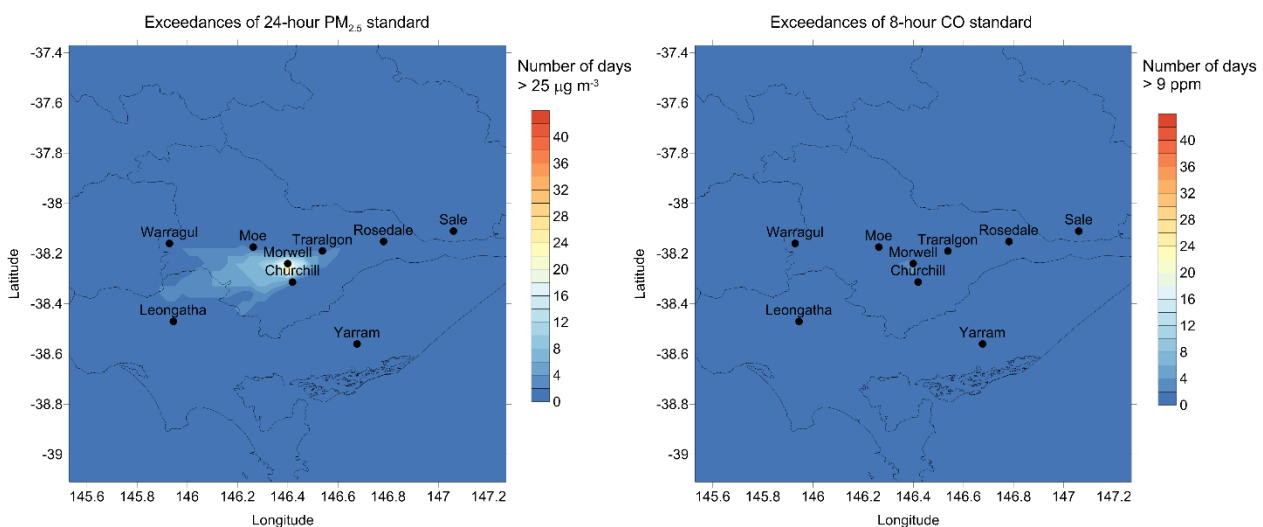


Figure 2 Distribution of the number of days (out of a possible 45) when the outdoor air quality standards (National Environment Protection Measures) for PM_{2.5} (left) and CO (right) were exceeded, based on the larger-scale modelling.

The lower resolution Victoria wide model predicted low concentrations of PM_{2.5} and CO for the population at Sale. Residents in Sale have been chosen as the control population for the Hazelwood Health Study Adult Survey. The peak hourly averaged PM_{2.5} concentration predicted at Sale was 17 micrograms per cubic metre on 10th February, whilst peak CO was 0.46 parts in one million on 22nd February. No exceedances of either air quality standard were predicted by the model for Sale during the mine fire.