4. In-forest wind

Meteorologists generally describe the surface wind in statistical terms (i.e., average wind speed and direction), and use values that are averaged over defined intervals, e.g. 10 to 20 minutes, in order to overcome the inherent variations caused by the lulls and gusts embedded in the wind. In the past, experimental fire spread measurement has been taken over periods of 1 to 5 minutes in an attempt to correlate fire spread with wind speed, slope and fuel characteristics. Wind measurement at short intervals is satisfactory when the fire is small and the anemometer is close to the fire. When the front of the fire is more distant from the anemometer, it has been assumed that the wind speed at the anemometer can still be correlated with the spread of the fire provided a time-lag is incorporated to allow for the time wind takes to travel from the anemometer to the fire front. Measurements in open woodland and open grasslands found that gusts travelled at around the mean wind speed for a distance of 500 m downwind of the anemometer (Cheney and Gould 1995). Similar measurements have not been done in dry eucalypt forest.

Measurement of wind speed at the fire front is difficult and is not attempted for two main reasons: firstly, measurements of wind speed will be influenced by the presence of the fire, and secondly, it is impractical to maintain an anemometer in the same position relative to the moving fire front. Thus, in order to determine a satisfactory system for measuring the wind in the forest that is driving the fire spread, it is necessary to:

- describe the wind variation within the forest;
- determine the optimum number of anemometers; and
- determine the minimum period over which optimally representative wind measurements should be taken.

In conjunction with Project Vesta, a study into the structure of the wind beneath the forest canopy was carried out. The aim of this study was to provide the best possible measure of wind, and to clearly define associated error ranges, for use in the development of empirical models of fire spread. This study was the most comprehensive measurement of wind associated with bushfire research yet to be undertaken. Measurements of wind under the canopy were made using multiple anemometers in a variety of configurations.

Gust formation

The wind that affects the spread and behaviour of a forest fire is the result of a complex interaction between the atmosphere, the earth and the vegetation on the earth's surface. Heating of the earth's surface by the sun results in convective bubbles of air rising and mixing with the lower layers of the geostrophic wind (i.e., the wind above the earth's surface induced by the rotation of the planet). The height at which this mixing occurs defines the planetary boundary layer (PBL). During the night this layer is quite thin but during the day when convective heating occurs, the PBL increases in height and is about 1.5 km thick during a typical summer day.