

LADM solves monitoring dilemma

IMPROVING Brisbane's system for monitoring air-quality was the aim of a study conducted last year by CSIRO's Environmental Consulting and Research Unit, part of the Division of Atmospheric Research. The Brisbane Wind-field Study, led by Dr Bill Physick, used LADM (see story on pages 17-18) to investigate wind patterns affecting the recirculation and build-up of ozone in a 125-square-kilometre area centred on Brisbane.

The concentration of ozone in the atmosphere is an indicator of the severity of photochemical smog, one of the major threats to air quality.

Physick says the ability of a region to absorb air pollutants without significant build-up depends on the interaction of synoptic winds and local winds generated by the topography.

Brisbane is bordered on three sides

by mountain ranges and to the east are Moreton and North and South Stradbroke Islands, less than 20 km from shore. This topography generates local air flows that have a direct impact on the dispersion of pollutants.

Ozone is an irritant formed by chemical reactions between two types of emissions: volatile organic compounds and nitrogen oxides. These are the 'precursors' of ozone. In the presence of sunlight, they convert the oxygen in the air into ozone gas.

Ozone takes three to five hours to develop and requires calm, sunny weather to peak. Because of this time lag, high ozone levels are not found close to the source of emissions, unless the air is particularly stagnant, or has been recirculated by sea or land breezes. The precursors of ozone are more likely to travel many kilometres before ozone levels peak.

High ozone levels can occur in the

centre of Brisbane or be transported up the river valleys, depending on weather conditions. The current monitoring network, located in the city itself, does not necessarily measure air quality in areas where the highest pollutant levels are occurring.

LADM was used to simulate the air flows and the resulting pollutant dispersion, for two separate days (one day in summer, one in winter) with weather conditions conducive to high ozone levels. The simulation indicated where ozone levels were likely to be highest. Based on this information, the scientists designed an expanded network to improve the monitoring of photochemical pollution (see diagram).

Expanding the monitoring network is part of an air-quality strategy being developed by Queensland's Department of Environment and Heritage and Department of Transport, and Brisbane City Council.



On a typical 'summer smog' day, the afternoon sea breeze moves smog-rich air inland along the Brisbane River Valley. The polluted air reaches Ipswich at about four o'clock and then stagnates overnight west of Ipswich or in the Boonah Valley. Some of the air, however, flows to the Beaudesert region.

Early the following morning, the stagnant air west of Ipswich and in the Boonah Valley is moved back towards Rocklea. The afternoon sea breeze then carries it south and south-west. The air which stagnated in the Beaudesert region overnight is moved further south the next day.

On a typical 'winter smog' day, breezes caused by the sinking of cool air overnight flow from the mountains and along the river valleys around Brisbane. These persist until mid-to-late morning, pushing emissions created mainly by the morning traffic peak to the north-east.

When the weak sea breeze develops, this air is moved across Deception Bay and up the river valleys at least as far as Ipswich until late afternoon, when the sea breezes wane.

These winter days are generally characterised by light wind conditions which can result in the polluted air moving back and forth across the Brisbane region for some days, with more traffic emissions added each morning and afternoon.

This recirculation and build-up of pollutants can push polluted air to the south-west (Ipswich, Boonah and Beaudesert), the north-east (Deception Bay and Brisbane River mouth) or south.

To improve surveillance of pollutants under these conditions, additional monitoring stations are being set up at six locations away from the city centre. (Source: Brisbane City Environment Management Branch.)