

## Hourly Observations of the Near-Surface Radon Gradient at Lucas Heights, Sydney

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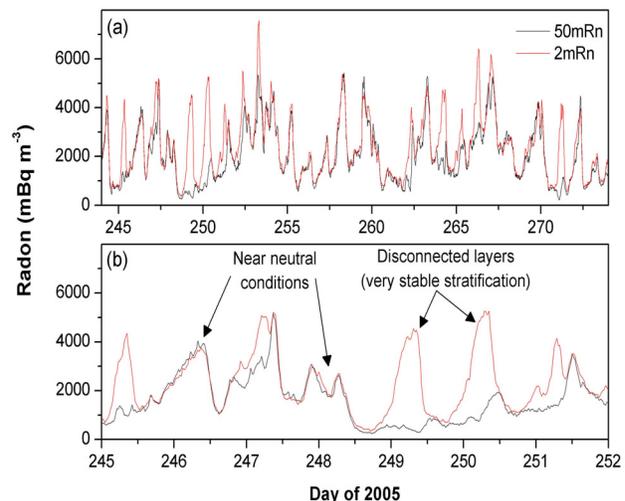
Vertical radon profiles within the lower atmosphere can be used to quantify atmospheric mixing and exchange with the surface. This in turn could lead to a significant reduction of systematic errors in the reproduction of diurnal and seasonal cycles in weather and climate prediction models on a range of scales.

We developed measurement systems for obtaining radon concentration profiles within the surface layer, atmospheric boundary layer and above. These include tower-based systems for continuous gradient measurements between 2 and 50m agl at Lucas Heights, Sydney, and between 20 and 200m agl at Cabauw, The Netherlands, as well as a sampling system enabling the measurement of radon concentrations at six heights from airborne platforms. Together with advanced meteorological and turbulence measurements, these new systems are yielding exciting insights into mixing and exchange processes in the lower atmosphere.

Here we report on the first 18 months of hourly observations of the vertical radon gradient from a 50m tower at Lucas Heights. As we are interested in high temporal resolution over the diurnal cycle, the gradient is estimated using two independent radon detectors (Fig. 1). A typical monthly time series of radon measured at 2 and 50m is shown in Fig. 2, which also includes an enlargement of a subsection of the month's data to better demonstrate the results obtained for a wide range of nocturnal atmospheric stratifications (from near neutral to highly stable).



**Figure 1a.** The radon gradient measurement in the surface layer at Lucas Heights is accomplished using by a pair of 1500L detectors.



**Figure 2a.** A typical month (September 2005) of dual-height radon measurements from the 50m tower at Lucas Heights. The frequent divergence of the signals indicates times when the depth of the nocturnal boundary layer drops below 50m agl under strongly stable conditions.

**Figure 2b.** A 7-day subset of the September radon time series contrasting differences in observations across a range of conditions from near neutral to strongly stable.