Evaluating the Influence of Terrestrial Emissions on Offshore Air Composition Using Radon-222 Observations at Cape Grim, Tasmania

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Within 12 to 24 hours of a local wind direction change to the oceanic sector at Cape Grim, radon concentrations come close to equilibrium with their oceanic source (Fig. 1). The corresponding air parcels have been conditioned over a large fetch of the Southern Ocean and, based on observed radon concentrations, show minimal influence from distant land masses (Fig. 2). A significant number of similarly conditioned air parcels come to Cape Grim in non-oceanic sectors, and, on the way, mix with air that has recently been perturbed by Australian mainland and or Tasmanian emissions (Fig. 3). In the absence of in situ oceanic transects, analyzing the radon content of these events is a convenient means to gauge the impact of terrestrial influence on otherwise clean air masses. The enhanced radon signal is strongest over areas in the Bass Strait (Figure 4). A comparable impact on off-shore air masses to that observed using radon is to be expected for other atmospheric species with terrestrial source and life times similar to radon.

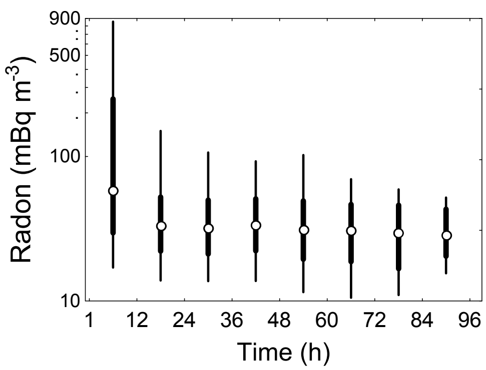

Figure 1. Radon medians, quartiles, 10^{th} and 90^{th} percentiles as a function of time after change to the oceanic sector.

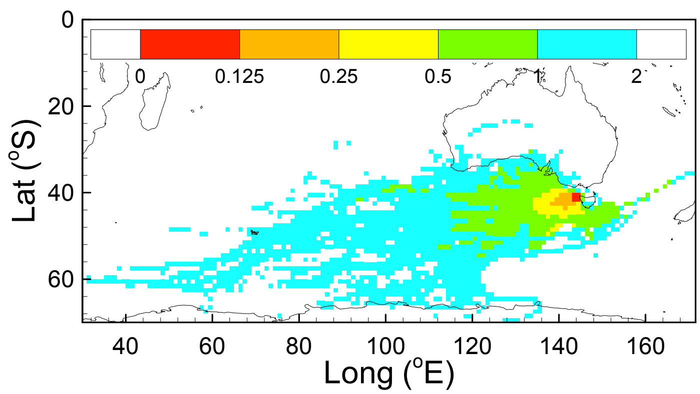

Figure 2. Mean time required for the least perturbed air Parcel to reach Cape Grim (in units of Rn $\tau_{1/2}$ =3.84 days).

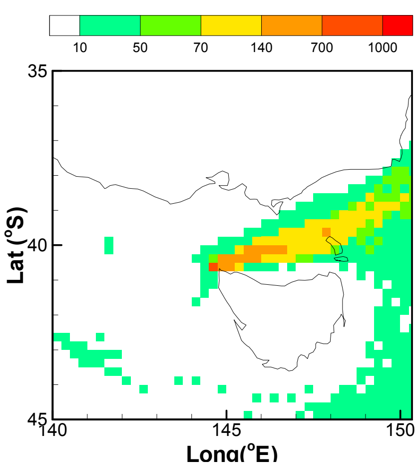

Figure 3. Density of back trajectories for oceanic air parcels arriving at Cape Grim in 90-100° wind direction bin.

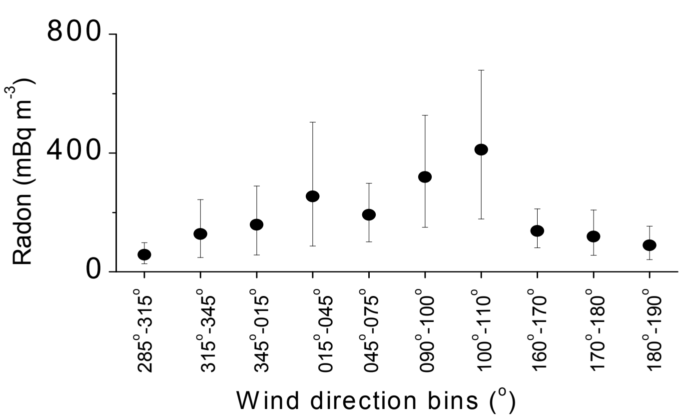

Figure 4. Radon medians, 10^{th} and 90^{th} percentiles for perturbed air in local wind direction bins for non-oceanic sectors.