A Study of East Asian Land Fetch at MLO Using Hourly Radon Observations and Trajectory Analysis (2001-2003)

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Radon-derived fetch regions of tropospheric air masses arriving at MLO in winter and spring that have experienced the greatest and least terrestrial influence are presented and discussed. Results are based on an analysis of hourly atmospheric radon concentrations sampled at MLO between 2001-2003 in conjunction with 7-day back trajectory analysis performed with the NOAA-ARL Hysplit-4 package. Diurnal composite radon concentrations at MLO were used to define a nocturnal sampling window (2200-0700 local time) for air masses representative of the free troposphere. The seasonal distribution of hourly radon concentration was calculated for each year. Air masses with radon concentrations above (below) the seasonal 90th (10th) percentile radon concentration were considered to be the most (least) terrestrially influenced. Trajectories within the nocturnal window corresponding to radon concentrations greater than/ less than the 90th/10th percentiles, respectively, were then calculated. These groups of hourly back trajectories were further sub-sampled at 3-hourly intervals for display and analysis.

The resulting trajectories (e.g., Figure 1) demonstrate that radon is a very good indicator of recent land contact. It was found that air masses strongly influenced by the Asian continent often traversed the continent in an east-west orientation within a relatively narrow latitude range. Based on this observation, the strongly influenced air masses arriving at MLO were then regrouped according to the latitude band within which they crossed the East Asian coastline (e.g., 20-30°N, 30-40°N or 40-50°N). However, there were insufficient trajectories originating from the 40-50°N band for further analysis. Radon concentrations of the corresponding air masses were found to vary both with latitude and season, with the highest concentrations always observed in spring, and from the 30-40°N latitude band. The fact that the observed atmospheric radon gradient opposes the expected source gradient (which, in the region, decreases with increasing latitude) suggests that mechanisms that lift boundary layer air to the free troposphere (e.g., frontal activity and convection) are either stronger or more efficient over the continent between 30-40°N than 20-30°N.

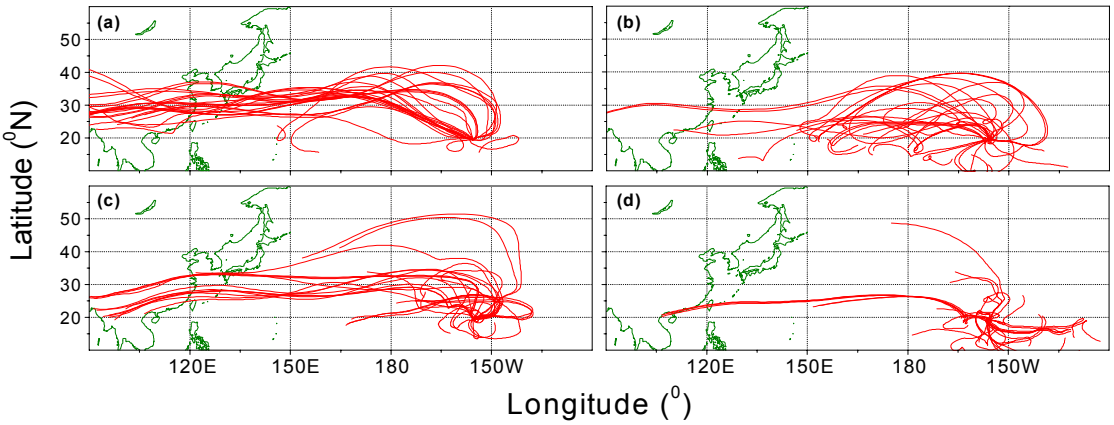

Figure 1. Seven-day back trajectories from MLO in 2003 of air masses with radon concentrations (a) above the winter 90th percentile value, (b) below the winter 10th percentile value, (c) above the spring 90th percentile value, and (d) below the spring 10th percentile value.