Patterns and Variability in $\Delta^{14}C$ of CO_2 in Northern Hemisphere Background Air

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The development of applications that determine fossil fuel-derived CO_2 and fossil fuel CO_2 emissions using observations of $\Delta^{14}C$ in atmospheric CO_2 has advanced rapidly in recent years. The largest uncertainties associated with this method are contributed by measurement uncertainty and the specification of the "background" level of $\Delta^{14}C$, which provides the reference to which $\Delta^{14}C$ dilution in polluted air is quantified. We will present measurements of $\Delta^{14}C$ of CO_2 in Northern Hemisphere background air from the Scripps CO_2 Program's flask sampling network that were conducted at Lawrence Livermore National Laboratory. Meridional gradients in background air are evident in comparisons of $\Delta^{14}C$ observed at Mauna Loa and Kumukahi, Hawaii (20°N), La Jolla, California (33°N) and Point Barrow, Alaska (72°N) between 2001 and 2007. La Jolla typically shows the lowest $\Delta^{14}C$. Seasonal cycles of $\Delta^{14}C$ with maxima in fall are evident, with the largest amplitudes at Point Barrow, on average. The observations also show substantial year-to-year variability. For example, very little seasonality was observed in 2002-03 at La Jolla. We will discuss the influences that are likely to contribute to the observed patterns and variability in $\Delta^{14}C$ of Northern Hemisphere background air and the implications for quantifying fossil fuel-derived CO_2 from Northern continents.

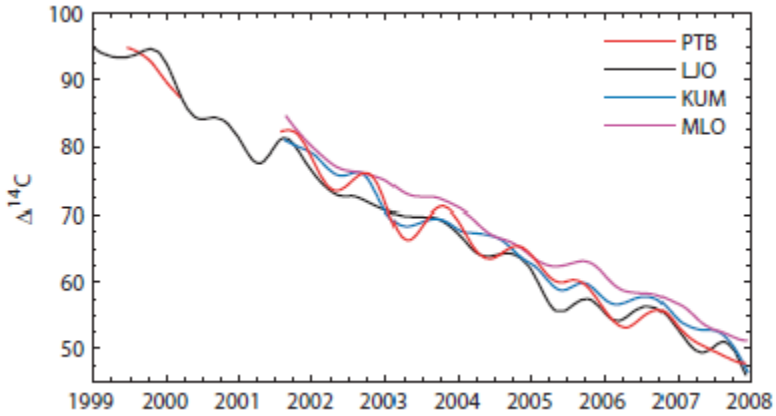

Figure 1. Measurements of $\Delta^{14}C$ in CO_2 from Northern Hemisphere flask sampling sites in the Scripps CO_2 Program. Shown are smoothed curves for Point Barrow (PTB), La Jolla (LJO), Kumukahi (KUM) and Mauna Loa (MLO).