δ13C/Δ14C compositions of atmospheric CO2 and its applications in the quantifications of biosphere sink and anthropogenic source

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Abstract

Constant increasing of atmospheric carbon dioxide (CO2) concentration has raised many concerns over the past 60 years due to its climate regulating effect. The ubiquitous increasing trends have been observed across the globe and it is believed to be a consequence of anthropogenic combustions of fossil fuels and land use change. For the anthropogenically emitted CO2, roughly 15% is fixed by the biosphere. Precise quantification of these two important carbon fluxes would provide us a better understanding of global carbon cycle as well as predicting future climate change. In this study, we used the CO2 and the δ13C/Δ14C values measured at three different locations: Mauna Loa, Niwot Ridge and the South Pole, to explore the relative contributions of biosphere carbon sink, and the anthropogenic carbon sources to the atmosphere. Δ14C signatures showed that anthropogenically combusted fossil fuels are the primary source for the increasing atmospheric CO2 concentrations, and about a 3‰ decrease in atmospheric Δ14C equals to approximate 1.1 ppm of fossil fuel CO2 added to the atmosphere. The CO2-enhanced carbon storage (CO2-ECS) by the global biosphere was also calculated and we concluded that the biosphere is absorbing about an addition of at least 0.6 Pg CO2 yr⁻¹ due to the CO2 enrichment.