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Projections of atmospheric radiocarbon content to 2100

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The radiocarbon content of atmospheric CO_2 has undergone dramatic changes over the past century. Radiocarbon in CO_2 has been diluted by the combustion of ^{14}C-free fossil fuels since the industrial revolution, causing a slow decline in the relative abundance of ^{14}C to total carbon ($\Delta^{14}C$) in the early 1900s. This decline was interrupted by nuclear weapons testing in the 1950s and 60s, which nearly doubled the atmospheric inventory of ^{14}C. Following the extraordinary rise in radiocarbon content, a quasi-exponential decrease was observed as excess radiocarbon was assimilated by carbon reservoirs in the ocean and on land. Recently, fossil fuel emissions have once again become the dominant influence on the long-term trend in $\Delta^{14}C$ of CO_2. This presentation will investigate the trajectory of atmospheric $\Delta^{14}C$ to 2100 in relation to the Representative Concentration Pathways (RCPs) using a simple carbon cycle model. In all scenarios, $\Delta^{14}C$ of CO_2 is projected to drop below the zero per mil level in the next decade. Simulated atmospheric $\Delta^{14}C$ is lower than -200 per mil in 2100 in the scenario with the largest growth in fossil fuel emissions, while the most ambitious emission reductions are projected to sustain $\Delta^{14}C$ near zero per mil. The presentation will discuss the implications of these changes in atmospheric composition on isotopic disequilibria and net fluxes of radiocarbon between different reservoirs, including the sensitivity of atmospheric $\Delta^{14}C$ to fossil fuel emissions on global and regional scales.