The Early Anthropogenic Hypothesis

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1 Emissions data for the anthropegenic carbon source

Our findings so far have indicated a light carbon source in the "Remaining Sinks/Sources" box starting about 8,000 years ago. In 2001, paleoclimatologist William Ruddiman proposed that the Anthropocene, the era in Earths geological history in which humans have affected the climate, began at the same time our light carbon source appears. Kaplan et al published a paper in 2010 quantifying these effects using two computer simulations. Two data sets - KK10 and HYDE 3.1 - drove simulations of Anthropogenic Land Cover Change (ALCC) over the last 8,000 years. The ALCC data can then be a measure of carbon emissions from human sources over this time period, both as annual emissions rates and cumulative emissions. This set of raw data is not particularly easy to work with, so for our purposes we will be using spline fits of the KK10 and HYDE annual emissions rates.

2 Isotopic concentration of source

We will again use δ^{13}C to find the ^{12}C and ^{13}C of the anthropogenic soure over time. A commonly used δ^{13}C value for anthropogenic emissions is -25‰, and we will use this value as accurate data for isotopic concentrations of these emissions is not available. Following the process outlined in Section 4.2, we will have ^{12}C(t) and ^{13}C(t) for both the KK10 and HYDE simulations.

3 Incorporation into the model

So far our model includes data from the atmosphere and from North American peatlands. Now that we have data on anthropogenic emissions, we can move forward similarly to adding the peatland source. Incorporating the emissions data will allow us to see what the composition of the Remaining Sinks/Sources box must be. As this is the case in which we have a carbon source (instead of a carbon sink) we will take the rate of the atmosphere plus the rate from the peatlands and subtract the rate of emissions.

We can see from the figure showing the δ^{13} over time for the new "Remaining Sinks/Sources" box that from about -7500 to -6500 years ago we have a δ^{13} value between 0‰ and -10‰, and the figure displaying the ^{12}C and ^{13}C tells us this carbon is a source. We can also see that between -6500 and -3000 years ago there is again a carbon source, and this source has δ^{13} around -15‰. For the last 3000 years we see the "Remaining Sinks/Sources" box become a sink instead of a source. D13 figure indicates that this sink has δ^{13} value -25‰ to -30‰. Over the last 3000 years then humans have produced an excess of carbon that overtook the role of the peatlands leading to very light carbon needing a sink in order to balance the atmosphere against these anthropogenic effects. The large spikes between these periods again coincides to the rate of carbon in the "Remaining Sinks/Sources" flips from positive to negative or vice versa.