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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Using ^{14}C, ^{13}C, ^{18}O and ^{17}O isotopic variations to provide insights into the high northern latitude surface CO inventory" *by* T. Röckmann et al.

Anonymous Referee #2

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The authors present data sets for the stable and radioisotopes of atmospheric CO from two high latitude NH stations and discuss temporal trends. The data are of very high quality and are the first multi-year, multi-isotope CO data sets at these latitudes.

The authors make a rather cursory discussion regarding ^{14}CO, which reflects the emphasis of this paper; the high quality data set. The same may be said about the Δ^{17}O data. Clearly there is much to be interpreted from these, and other similar, data sets. The remainder of the paper describes short term and seasonal variability relative to normal interseasonal variations.

In general the paper is well written, clear, concise, and scientifically sound.

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In general, I agree with the discussion on data interpretation. However there remain several unanswered questions, and it is difficult to deconvolute even the specific questions without using a model, particularly when a multi-isotope approach is used. For example, it is not clear to me as to why there exists a temporal offset between ^{13}CO and [CO] seasonal maxima and minima. In the case where d[CO]/dt<0, d(^{13}CO)/dt changes sign. Yet this is not the case for any of the other isotopes. Why does ^{18}O not show a similar pattern? Is it then that the inverse isotope effect seen for oxygen from the CO+OH reaction is completely, and exactly, offset by the simultaneous change in the aggregate source ^{18}O signature? This seems unlikely. The argument may be made that a combination of kinetic and source isotope effects is responsible, however without a model that can reproduce the in-phase seasonal extrema for the other isotopes at the same time as the out-of-phase seasonality for ^{13}CO and [CO], such an argument is not supported. Likewise, there is no observed offset in other data sets from different latitudes. Why, then, does it occur in the high latitudes? And why in both hemispheres, where the sources are very different?

This type of unanswered question is beyond the scope of this work, however, and does not take away from the quality of the paper. I recommend publication without major revisions.

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 213, 2002.