Atmos. Chem. Phys. Discuss., 9, S788–S790, 2009
www.atmos-chem-phys-discuss.net/9/S788/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "^{36}Cl bomb peak: comparison of modeled and measured data" *by* U. Heikkilä et al.

Anonymous Referee #2

Received and published: 13 March 2009

General comments

Heikkilia et al. present a useful and interesting analysis of the global transport and deposition of nuclear-bomb produced ^{36}Cl and compare it with concentrations measured in 8 ice cores, the majority of which are from the Northern Hemisphere. It is unfortunate that Antarctica has been poorly represented in this analysis; I know of unpublished measurements that were made on a well dated ice core from the high-accumulation Law Dome site, East Antarctica, which could have been a valuable addition to this data set.

^{36}Cl is produced via the reaction ^{35}Cl(n,γ)^{36}Cl so only nuclear tests which took place in the vicinity of sea water (i.e. islands, atolls barges) were used as an input to the

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

model. The expected yields for these explosions were calculated and summed to be over 300kg, considerably greater than the 75 to 80 kg estimated by Elmore and Synal from their measurements on the Dye3 ice core. With a 300 kg ^{36}Cl input the model was found to produce much larger depositional fluxes than those measured and the modeled input of ^{36}Cl was called down by a factor of four to match measured data. Even so, the natural cosmogenic production of ^{36}Cl is much lower than bomb-produced ^{36}Cl and is not considered significant over the modeled years. This is apparent from the measured 36Cl flux for the 8 sites shown in fig.3: the bomb pulse is over 2 orders of magnitude greater than pre-bomb levels.

In calculating the ^{36}Cl yield a number of assumptions were made:

1. That 2 x 10^{26} neutrons are produced per megaton yield of TNT, that half of the neutrons enter the water and that 32% of these neutrons produce ^{36}Cl.

2. That all bomb produced ^{36}Cl reached the stratosphere.

3. Only tests with a yield > 200 kton were considered, for the reason that only these are large enough to place ^{36}Cl in the stratosphere.

The model was run under the simplifying assumption that all ^{36}Cl was particulate, rather than gaseous, and was attached to aerosols. The rapid rise of the ^{36}Cl flux peak at most sites is used as an argument that the loss of gaseous ^{36}Cl was minimal, although this might be one of the reasons why it was necessary to scale down the model ^{36}Cl input. More likely is that less ^{36}Cl was initially produced than under assumption 1, due to attenuation of the neutron flux by land mass and by differing detonation scenarios.

Specific comments

^{36}Cl concentrations are measured in ice cores, ^{36}Cl fluxes must be calculated. The authors do not explain how this was done.

2510 l 14. It is stated that the high altitude Huascaran site saw the bomb pulse earlier than the other sites, yet this is based on just one data point. Couldn't the same

ACPD
9, S788–S790, 2009

argument be used for the similarly high altitude Guliya site?

Technical comments

2503, paragraph starting l 20. Each of the three questions should begin with a capital and end with a question mark.

2504 l 8. The statement 'The ^{36}Cl concentrations in ice were all measured at the AMS facility of ETH Zurich/PSI' is not correct. For example, Elmore (1982) measured ^{36}Cl in Dye3 at Rochester; I haven't checked all the other cores.

2504 l 15. Change (ETH/PSI) to (ETH/PSI:)

2506l 26. The reference to Sachsenhauser appears as a footnote, not as a reference.

2508 l 16. Change (The approach) to (This approach)

2510 l 14. Change (latitude) to (altitude)

2510 l 20. Change (best dated one) to (best dated)

2516 l 6. Change (well visible) to (quite visible)

2519 l 1. Change (show clearly) to (clearly show)

The legibility of figures 2, 4, 5 6 would be greatly improved if coloured lines were shown, rather than just data points.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 2501, 2009.