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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 #1

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1 General remarks

Heikkilä et al. use a global circulation model to simulate the emission, atmospheric fate and deposition of 36Cl from nuclear bomb tests. A 20-year simulation is compared to records from ice cores at various locations world-wide. As the source strength is largely unknown, the modelled fluxes are scaled by a factor of 4 to match the observed deposition fluxes.

This is an interesting paper and an unusual, but very successful application of an aerosol-climate model. The paper is generally well written, and the figures are very clear. I recommend it for publication in ACP, but ask the authors to address the below points.

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Interactive Discussion
Discussion Paper

I am missing some information about the model setup. In particular: Was the meteorology nudged to reanalysis data? Is the sea surface temperature climatological or does it follow the observed sea surface temperature? This is crucial for the year-to-year variability of precipitation. Is the variation of the precipitation rates in Figure 5 in agreement with observations?

Did you use historic or climatological aerosol emissions? This might be important for explosive volcanic eruptions, which significantly influence the stratospheric aerosol load - and therefore also the surface area which the 36Cl can attach to.

2 Specific comments

- I suggest to mention the natural sources of 36Cl in the introduction.
- "between 1960 and 1964" (p2505 l17): According to Table 1, there were significant tests in 1962. Can this explain why Synal et al. obtain a longer residence time?
- accumulation rate at Guliya: First it is refered to as "quite low" and a few sentences later as "relatively high".
- "reach the natural level": I would say that none of the locations, and in particular not Berkner Island, is back to pre-1952 levels in 1975.
- How exactly do you calculate the slope and residence time? Can you give a formula? The units are confusing. The slope of the graphs would usually have the units [atoms/m2]. I guess residence time is the time until which the curve has dropped to 1/e?

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- Table 2: integrated mass = extrapolated to the whole globe (as I understand from the text). Please add this to the caption. Are the model values presented here already scaled?
- "The integration was performed coarsely" (p2509 l10) - what does that mean?
- deposition flux at Dye3: That the global bomb input estimated here agrees well with the previous Dye3 estimates of 80 kg, is only because it has been scaled to those 80kg, isn't it? The agreement is less good for the actual Dye3 values calculated here (55/70 kg). Or do you mean 55/70≈80?
- "The slope is a measure of the form of the bomb produced input function" - and (of course) of the sinks. (p2510 l6)
- Are the simulated precipitation rates taken at the model surface layer (although the model orography is usually much lower), or at the pressure level corresponding to the station height? Please specify.
- "..., but might reflect the enormous seasonability" - this should be easy to check (and if you already have checked it, omit the "might"). (p2514 l3)
- The statements about the importance of sublimation of gasous Cl from the Berkner Island core are somewhat contradictory.

3 Technical comments

- The author has a tendency to write long sentences without any punctuation. Breaking up sentences into two shorter sentences and the addition of a large number of commas would greatly enhance readability. I am not a native speaker myself, but I think commas/full stops would be correct in the following positions:

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- Because the 36Cl showed a steep leading edge of the bomb peak in all data sets, we assume ... (p2509 l17)
- No direct observations from this region exist, meaning that ... (p2513 l22)
- ... caused by new tests, which are ... (p2519 l20)
- The modeled stratospheric residence times ... are 1.3-1.7 years, which are ... (p2519 l24)
- any many more.

Please check with somebody who is literate in English grammar.

- What is AMS (p2504 l8)?
- Define “W.E.” at the first occurrence (p2504 l26).
- Fig. 2, 4, 5: It is not clear whether the tick marks identify the beginning of a year or the middle of a year. The (simulation) data points, which are annual mean values, are plotted in the middle of 2 tickmarks in Figures 2 and 4, but directly at the tickmarks in Figure 5. It would be good to have this consistent, as the reader might want to compare the year-to-year variations from Figures 4 and 5.
- It would be reader-friendly if the lines in Figures 2,4,5 could be colorcoded (in addition to the symbols).
- or → nor (from the two Alpine glaciers) (p2513 l2)
- exists → exist (p2513 l21)
- pattern → patterns, slope → slopes and is → are. Or insert “a” after reveal. (p2519 l17)
- next sentence: insert “of” after because.

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Interactive Comment

- I suggest that the animations are placed on the ACP website. For me, the link in the document did not work because the underscores were not recognized - I had to enter the link manually.

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