Comments by P.Reimer

Original comments are given in normal fonts, the reply is set in bold. New revised text in red.

The use of both the Southern and Northern Hemisphere tree-ring curves to provide the atmospheric 14C record is a good idea although does not make as much of a difference in the modelled production as I might have expected. Perhaps the authors could comment on this.

Differences in the radiocarbon production, Q, are generally small when comparing results from the standard simulations to those from a simulation where the Northern Hemisphere data are prescribed globally. However, there is a notable and important exception. The difference between the two simulations increases over the industrial period. As the mid-20th century 14C production is used to normalize the solar modulation to instrumental observations, reconstructed solar modulation is remarkably different for the two cases.
The text on page 1188, line 4 ff is slightly adjusted to better make the link to the following sections. It reads now:

"In a further sensitivity run, the influence of the interhemispheric 14C gradient on Q is explored (Fig. 8e; dashed line). In simulation INT09 the Northern Hemisphere dataset IntCal09 is applied globally and all other forcings are as in BIO. Differences in Q between CIRC/BIO and INT09 are generally smaller than 20 mol/yr, but grow to 50 mol/y from 1900 to 1950 AD. The reason are the different slopes in the last decades of the Northern and Southern Hemisphere record. This mid-20th century difference has important consequences for the reconstruction of solar modulation as described in section 3.3. This sensitivity experiment demonstrates that spatial gradients in atmospheric D14C and in resulting radiocarbon fluxes should be taken into account, at least for the industrial period."

The last paragraph of section 3.3 reads:

"The relatively higher modern values inferred by Solanki et al. (2004) are eventually related to their application of a Northern Hemisphere 14C dataset (IntCal98) only. Thus, these authors neglected the influence of interhemispheric differences in 14C. We calculated Phi from results of our sensitivity simulation INT09, where the IntCal09 Northern Hemisphere data are applied globally. Due to the lower Q in the normalization period from 1937 to 1950 AD (see Fig. 8, dashed line), the Phi-record during the Holocene is shifted downward by approximately 150 MeV for INT09 compared to CIRC/BIO; the same normalization of Phi to the Forbush data is applied. Then, the solar activity for recent decades appears unusually high compared to Holocene values in the INT09 case."

I would point out that the Marmod09 production should not really be considered after AD 1850 or 1900 as this model purposely doesn't include a fossil fuel correction. It is used to

provide a reconstruction of the surface age of the ocean for the Holocene for calibration of marine samples from that time period.
Text on page 1189, line 13 is changed to read:

" In the industrial period, the Marmod09 production rate displays a drop in Q by almost a factor of two. This reconstruction is intended to provide the surface age of the ocean for the Holocene for calibration of marine samples from that time period. Data after 1850 AD are not to be considered as the authors purposely do not include a fossil fuel correction. Similarly, Usoskin and Kromer (2005) do not provide data after 1900 AD. "

References:

Solanki, S., Usoskin, I., Kromer, B., Schussler, M., and Beer, J.: Unusual activity of the Sun during recent decades compared to the previous 11,000 years, Nature, 431, 1084–1087, 2004.

Usoskin, I. G. and Kromer, B.: Reconstruction of the C-14 production rate from measured relative abundance, Radiocarbon, 47, 31–37, 2005.