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A cosmogenic radionuclide perspective on Holocene geomagnetic field changes in comparison to new geomagnetic field reconstructions

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The solar and geomagnetic shielding modulates the spectrum of galactic cosmic rays reaching Earth. In the Earth's atmosphere galactic cosmic rays produce cosmogenic radionuclides that, therefore, provide the possibility to reconstruct the geomagnetic field intensity back into the past. Cosmogenic radionuclide records offer a complementary view on the history of the geomagnetic field since the cosmic ray shielding is mainly sensitive to the dipolar component of the Earth magnetic field. In addition, cosmogenic radionuclides records for the Holocene have a very high temporal resolution potentially allowing us to investigate rapid changes in the Earth's magnetic field. However, the solar influence and the geochemical behavior of cosmogenic radionuclides have to be accounted for when interpreting such records in terms of geomagnetic field changes. The solar component is usually expected to act on shorter time scales and, therefore, assumed to be of minor importance for the longer-term variations in cosmogenic radionuclide records. The geochemical component can be investigated by joint analysis of 10Be and 14C records that have a completely different geochemical behavior. The reliability of these approaches and the impact on the radionuclide-based geomagnetic field reconstructions will be discussed. In addition, we will compare cosmogenic radionuclide-based reconstructions to the output of state-of-the-art reconstructions of the geomagnetic dipole field based on lake sediments and archaeomagnetic data. The dipole moment in these models remains poorly constrained, but in combination with radionuclides, they allow us to put realistic bounds on the amplitude of Holocene dipole variations. We will show the agreements and disagreements and will discuss possible reasons for the observed differences.