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Solar and atmospheric signals in 10Be depositions in Greenland and Antarctica over the last 100 years

Content

Cosmogenic radionuclides (e.g., 10Be) from ice cores are powerful tools for solar reconstructions back in time. However, superimposed on the solar signal, there are additional factors that can complicate the interpretation of the 10Be data. These include weather/climate and volcanic influences, ice cores timescale uncertainties, and possibly data quality issues. Comparing 10Be records from different polar sites can improve our understanding of these "noise signals". Here we present a new 10Be record over the last 100 years from a firn core from the EGRIP (East GReenland Ice-core Project) drill site. The new EGRIP 10Be record shows a similar decreasing trend (about 2.65%/decade) as NGRIP and NEEM records over the last 100 years adding support to the solar activity reconstruction from these records. By comparing all available 10Be records from polar ice cores (seven records from Greenland and five from Antarctica) with 20th-century reanalysis data and indexes of major atmospheric circulation patterns, we find no or only weak influences of large-scale circulation patterns on the 10Be deposition in polar regions. Finally, we investigate how the stacking of the bipolar 10Be records can strengthen the solar signal inferred from the 10Be data. This approach is not straightforward as large uncertainties in some records (e.g., time scale uncertainties) can lead to a weaker solar signal in the composite record. A careful evaluation, selection and possible correction of the records before stacking is recommended for reliable solar activity reconstructions.

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