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Is there robust evidence of solar variability in palaeoclimate proxy data?

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The degree to which solar variability influences the Earth's climate is contentious. There is a large body of literature reporting that possible solar influences have been detected in palaeoclimate proxy data, often using spectral methods. However, problems including publication bias, untested methodological assumptions, and multiple testing of frequencies, make it difficult to confidently conclude that solar variability has a large influence on Earth's climate based on this literature.

We undertake meta-analyses using robust spectral methods to attempt to detect Schwabe (11 yr) and Hale (22 yr) cycles in over 2000 late-Holocene tree-ring width sequences, and Gleissberg (∼88 yr) and de Vries (∼205 yr) cycles in over 100 well-dated high-resolution mid- to late-Holocene proxy records from a variety of archives that span at least 1000 years.

Initial results indicate that many proxy records show apparently significant periodicity, but that there is little evidence that more records have periodicities near the Gleissberg and de Vries solar spectral peaks than expected by chance. We suggest that these finding indicate that either the proxy data are too noisy to reliably detect these cycles or that these cycles have limited influence on the Earth's climate relative to internal variability and volcanic forcing. Alternatively, solar forcing might be important, but only in geographically limited regions.