Geophysical Research Abstracts
Vol. 13, EGU2011-14103, 2011
EGU General Assembly 2011

Millennial length summer sunshine reconstructions from stable carbon isotope ratios in tree rings from across Fennoscandia.

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Cloud cover is one of the most important factors controlling the radiation balance of the Earth. The response of cloud cover to increasing global temperatures represents the largest uncertainty in model estimates of future climate because the cloud response is not well-constrained. Here we a regional reconstruction of summer sunshine over the past millennium, based on the stable carbon isotope ratios of pine treerings from Fennoscandia. Comparison with the regional temperature evolution reveals the Little Ice Age to have been sunny in its coldest periods. A negative short-wave cloud feedback is indicated at high latitude. A millennial climate simulation indicates that regionally low temperatures during the LIA were mostly maintained by a weaker greenhouse effect due to lower humidity. Simulations of future climate that display a negative short-wave cloud feedback for high-latitudes are consistent with our proxy interpretation.