

Modulation of Greenland temperature through changes in solar activity

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During the past decades, Greenland climate has undergone rapid warming and ice sheet ablation in coastal region with a nearly 1 mm/y sea level contribution. For sea level projection, it is critical to understand the mechanisms of Greenland temperature variability. Greenland temperature is known to be affected by the North Atlantic Oscillation (NAO), and it is also highly correlated with North Atlantic average temperature. Using the Greenland temperature reconstructed from argon and nitrogen isotopes in occluded air in GISP2 ice core (Kobashi et al., 2011), we found Greenland temperature deviated negatively (positively) from North Hemispheric (NH) temperature trend during stronger (weaker) solar activity over the past 800 years (Kobashi et al., 2013b). We also confirmed this effects continued over the past 4000 years (Kobashi et al., 2013a). Climate modeling suggests that the deviation was caused by solar induced atmospheric circulation changes (like NAO). The model also suggests that Atlantic meridional circulation weakens during the stronger sun by similar processes as enhanced greenhouse effect (Kobashi et al., 2013b). From the past relation between Greenland temperature anomaly and solar variability, it can be speculated that future grand solar minimum may induce additional 2 ° C warming in Greenland with increased melting of the ice-sheet.

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