Geophysical Research Abstracts
Vol. 16, EGU2014-11280, 2014
EGU General Assembly 2014

Timing of Heinrich Events and its Relation to the Synchronization of Polar Climates

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Heinrich events were prominent features of climate variability in the Northern Hemisphere during the last glacial period. In this study, we investigated the timing of Heinrich events and IRD (ice-rafted detritus) events in the context of the climate evolution at the poles. To be able to compare proxy records from both poles, age models of four southern and three northern isotope proxy records (from either Greenland or Antarctica) span the length of the last glacial period have been remapped to a unified age model via a Monte Carlo based matching approach. All of the matched records, before further analysis, have been reconstructed using selected IMFs (intrinsic mode functions) to prevent the influence of short period weather signals and long period astronomical forcing from being seen in the results. The polar temperature gradient and energy in the system created by the oscillating climates records at the two poles have been estimated and investigated based on the reconstructed data. The energy of the polar climate system is estimated by constructing an analytic signal out of isotope records from both the northern and southern poles, which is justified by the established pi/2 relationship between polar climates. The resulting maximum values in the polar temperature gradient and energy estimation strongly correlated with the timings of Heinrich events and IRD events in other records. These results demonstrated that pi/2 synchronization is not only a way of summarizing and simplifying the polar climate relationship, but also has the potential to be used to investigate other climate events that may have a global origin. The clear match between the timing of Heinrich events and IRDs and the timing of peaks from both temperature gradient and energy estimation suggests that, though mainly seen in the Northern Hemisphere, the initiation and persistence of Heinrich events and smaller scale IRDs may have a global origin, one that involves the interplay of climates between the two poles.