Hemispherical scale climate variability during the last glacial period

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The last glacial period is characterized by dramatic and rapid shifts in climate. The warm excursions known as Dansgaard-Oeschger (D-O) events, the best expression of these changes, have been documented well in Greenland ice cores, and variability in a number of continental marine climate proxies. Advances in U-series chronology of speleothems have now made it possible to put precise timing on these events and explore time-scale of hemispherical and inter-hemispherical climate variability. We previously showed (Asmerom *et al*., 2010, Nature Geoscience 3, 114 - 117) that $\delta^{18}O$ variability in Fort Stanton, New Mexico, USA speleothems, reflects, in part, changes in the ratio of winter to summer precipitation forced by meridional shifts in the polar jet stream. Our new $\delta^{18}O$ time series from a fast-growing, precisely dated stalagmite (FS-AH1) has mean 2σ uncertainties of about 70 years from 47 to 11 ka. Our FS-AH1 $\delta^{18}O$ time-series has an excellent untuned match with the NGRIP $\delta^{18}O$ time series (GICC5 time scale), both with respect to the long-term secular trend and timing and duration of DO and HS ($r=0.66$, $p<0.001$). Comparison of our time series with the Hulu $\delta^{18}O$ shows that the timing of the DO and other rapid climate transitions are coherent within error across the Northern Hemisphere. In contrast, there is marked difference between the secular variation in our record, the ice core temperature proxies from both hemispheres on one hand, reflecting summer insolation variation of both hemispheres and the Hulu record on the other hand, reflecting a strong precessional imprint on the East Asian monsoon. The inter-hemispherical coherency of climate variability, in particular associated with DO warming, is modulated through the Atlantic Meridional Overturning Circulation, led by changes in the Southern Hemisphere.