Geophysical Research Abstracts, Vol. 9, 06925, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06925

The role of Southern Ocean dynamics in abrupt climate change revealed by decadally resolved records of sub Antarctic surface and intermediate water property changes 20-70 ka

H. F. Kleiven (1), U. S. Ninnemann (1,2) A-E. Førde (2)

(1) Bjerknes Centre of Climate Research, University of Bergen, 5007 Bergen, Norway (kikki@uib.no / Phone: 4755583535), (2) Department of Earth Sciences, University of Bergen, 5007 Bergen, Norway

Here we report decadally resolved planktonic and benthic foraminiferal isotopic records spanning MIS 3 (20-70 ka) from an exceptionally high sedimentation rate (1.5m/kyr) core from the Chilean slope: Ocean Drilling Program (ODP) Site 1233 (41˚00'S, 74˚27'W, 838m) located beneath the northernmost reaches of Southern Westerlies at a water depth intersecting AAIW. Site 1233 provides an essential marine counterpart to the recent high resolution EPICA ice core from Dronning Maud Land—monitoring changes in circumpolar ocean circulation and water masses. The benthic foraminiferal carbon and oxygen isotopic records monitor the physical and chemical properties of Antarctic Intermediate Water (AAIW) close to its source in the SE Pacific, while the planktonic isotopic records monitor the near surface water properties and the large scale atmospheric (Westerlies) and oceanic (ACC) systems influencing them. Taken together, these records provide the first ever simultaneous decadal scale description of SE Pacific surface and intermediate water properties spanning MIS 3. Our surface water reconstructions suggest that sea surface temperatures varied by up to 4-5 degrees C on multi-centennial to millennial timescales throughout MIS 3. In addition, our bottom water proxy suggests that these surface water warmings were accompanied by concomitant changes in intermediate waters approximately 50% as large as those seen in the surface waters. As in the records of air temperature from Antarctica, warm events appear relatively symmetric—there is no systematic difference in the rate of warming versus cooling. The bulk of both warming and cooling is

often accomplished in as little as a few decades but can take up to centuries.

The extremely rapid rate at which these surface and intermediate ocean changes are accomplished is indicative of their origin. Such abrupt and concurrent shifts in extratropical surface and intermediate ocean properties are most likely driven by changes in the major dynamical systems of Southern Hemisphere ocean and atmospheric circulation which govern their properties today (the Westerlies and the ACC). The similarity in timing and rate of these changes on the fringes of the Southern Ocean relative to those recorded closer to the pole in the new ice core records suggests that such changes are broadly felt and involve the major circumpolar dynamical systems. We discuss what implications such abrupt, synoptic scale changes in Antarctic climate and dynamics have on the origin and propagation of abrupt climate change.