



Natural variability of Antarctic Bottom Water in a coupled climate model

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The natural variability of Antarctic Bottom Water (AABW) is examined in a multi-millennial integration of a climate model. The fully-coupled nature of the model together with its efficient computational cost and successful reproduction of key features of AABW pathways and ventilation rates allow us to investigate large-scale AABW variability and its mechanisms on long time scales. The model AABW is predominantly sourced in the Weddell Sea. The sinking and outflow rates of the Weddell Sea bottom waters are shown to be effectively represented by the maximum rate of the Atlantic sector Antarctic overturning. The variability of the overturning is further found to be driven by surface density variability in the Weddell Sea which is in turn controlled by sea surface salinity. A mechanism driving the surface anomalies is revealed by heat and salt budget analysis. This surface variability initiates an internal negative-feedback mechanism involving Warm Deep Water inflow and sea-ice melting, giving rise to AABW overturning oscillations on interdecadal time scales. There is evidence that the Southern Annular Mode partly contributes to AABW variability in the model. Finally, the propagation of T-S anomalies in the interior is described in relation to the overturning variability.