Auxiliary Material for

Multi-centennial Agulhas leakage variability and links to North Atlantic climate during the past 80,000 years

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Paleoceanography

**Introduction**

The Auxiliary Material consists of six supplementary figures. Supplementary Figures (1-6) are referenced in the main body of the manuscript.

**Supplementary Figure S1**. Agulhas Bank (ABS, MD02-2594, *G. ruber*) and Chatham Rise (MD97-2120, *G. bulloides*) [*Pahnke et al.*, 2003; *Pahnke and Zahn*, 2005] SST (a) and planktic δ18O (b). Green markers are MD97-2120 radiocarbon ages and black markers are MD97-2120SST tie points to Vostock deuterium record. Chatham Rise record is from the south Pacific and 5º farther south than MD02-2594.

**Supplementary Figure S2**. The MD02-2594 SST record on the timescale of *Martínez-Méndez et al.* [2010] (red) compared to the same record as transferred to the EDC3 timescale (blue).

**Supplementary Figure S3.** Testing MD02-2594 on the GICC05 timescale. (a) MD02-2594 *G. bulloides* δ18O on the time scale published by *Martínez-Méndez et al*. [2010] (red) compared with MD02-2594 *G. bulloides* δ18O on the GICC05 timescale (blue). (b) Age difference (∆ age, black line) along MD02-2594 between the timescales of GICC05 and MM2010 used in (a). Black squares with error bars are 14C age markers along MD02-2594, black squares without error bars are tie points with the EDML time scale [*Martínez-Méndez et al.*, 2010]. Blue line is NGRIP maximum counting error for GICC05 from 0-60 kya.

**Supplementary Figure S4.** Comparison of δ18O from *G. ruber* (MD02-2594, smoothed to 1000-year windows) and modeled δ18Osw derived from sea level [*Arz et al.*, 2007; *Grant et al.*, 2012]. Similar inflection points (marked by arrows) support the age model for core MD02-2594 based on updated calibrations [*Reimer et al.*, 2013] for empirical radiocarbon dating.

**Supplementary Figure S5.** Removal of glacial-interglacial and decadal variability from EDC δD temperature is achieved by (a) first smoothing the EDC temperature record (gray) to 1000-year windows (blue) and 7500-year windows (orange) [data from *Jouzel et al.*, 2007]. To smooth the record, it was resampled at a high, even spacing (every 10 years) and then averaged within the respective time windows. (b) The difference between the two curves (black curve, Residual T) is the resulting millennial-scale record without decadal or glacial-interglacial variability. As an exercise, we performed the same analysis of EDC δD using the AICC 2012 age model (gray line) [*Veres et al.*, 2013]. (c) Original MD02-2594 SST (red) and the resulting adjusted SST when the millennial-scale contribution from Antarctica is resampled at the sampling resolution of MD02-2594 and subtracted (dark red). The adjusted timeseries using the gray curve from the alternative ice core AICC 2012 age model above (pink). (d) Original ∆δ18Osw (green) compared to Δδ18Osw calculated from the residual SST on the EDC ice core age model (dark green) and alternative AICC 2012 age model (blue).

**Supplementary Figure S6.** Comparison of δ18Osw changes upstream in the Agulhas Current (CD154 17-17K, orange) [*Simon et al.*, 2013] with Agulhas Bank δ18Osw (MD02-2594, green).

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