



Supplement of

Labrador Sea subsurface density as a precursor of multidecadal variability in the North Atlantic: a multi-model study

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Supplementary Figure 1: a-c Fourier spectra of the AMOC45 indices (with/without the Ekman component) in GC2, HiGEM and the CMIP5 ensemble, respectively. In *a,b* the red-noise spectra corresponding to a 1^{st} order autoregressive process fit to the AMOC indices are provided as reference (the dark lines correspond to the index without the Ekman component, and the light lines to the one with Ekman). **e-f** The same as in panels *a-c* but for the AMOC26 indices.



Supplementary Figure 2: a Lead-lag correlations across the picontrol ensemble between PC1-LSD and the maximum AMOC streamfunction at 45° N after the Ekman transport is removed (AMOC45). Correlations are based on 10-year running trends. For positive lags, PC1-LSD leads. Significance is assessed as in Figure 2d and indicated with a circle. **b** The same as in *a* but for the full AMOC45 index (i.e. with the Ekman transport included). **c-d** The same as in *a*-*b* but with respect to the AMOC26 indices.



Supplementary Figure 3: a Lead-lag correlations across the picontrol ensemble between PC1-LSD and the maximum AMOC streamfunction at 45° N after the Ekman transport is removed (AMOC45). Correlations are based on 10-year running trends. For positive lags, PC1-LSD leads. Significance is assessed as in Figure 2d and indicated with a circle. **b** The same as in *a* but for dLSD index. **c-h** The same as in *a-b* but with respect to the AMOC26 (without the Ekman component), the SPGSI and ESPNA-T700 indices, respectively.



Supplementary Figure 4: a Scatterplot of the maximum cross-correlations value in Figure 4b between PC1-LSD and AMOC26 (without the Ekman component) against the climatological mean of the Labrador Sea Density stratification index (computed as the difference of the vertical means in the levels 0-50 m minus the vertical means in the levels 400-500 m; see Fig. 1). The maximum correlations are based on 10-year running trends. The correlation coefficient between the two metrics is shown in the top-left corner. The presence of an asterisk indicates that the correlation is significant at the 95% confidence level. Colors indicate the lag at which the maximum correlation between PC1-LSD and AMOC26 is obtained. The grey vertical lines depict the mean stratification value in the DePreSys3 assimilation run for the reference period 1960-2013. **b-c** The same as in *a* but for stratification indices defined between the levels 0-100 m vs 500-1000 m (the same index shown in Figure 9c) and 0-200 m vs 1000-2000 m, respectively.