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Quantifying risk of a noise-induced AMOC collapse from northern and tropical Atlantic Ocean variability

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The Atlantic Meridional Overturning Circulation (AMOC) exerts a major influence on global climate. There is much debate about whether the current strong AMOC may collapse as a result of anthropogenic forcing and/or natural variability. Here, we ask whether internal decadal variability could affect the likelihood of AMOC collapse. We examine natural variability of basin-scale salinities and temperatures in four CMIP6 pre-industrial runs. We fit the CMIP6 variability to several empirical, linear noise models, and to a nonlinear, process-based AMOC model. The variability is weak and its processes inconsistent among the CMIP6 models considered. Based on the CMIP6 variability levels we find that noise-induced AMOC collapse is unlikely in the pre-industrial climate, but plausible if external forcing has shifted the AMOC closer to a threshold, which can be identified for the non-linear model using bifurcation analysis. However the CMIP6 models may systematically underestimate current Atlantic Ocean variability, and we find that substantially stronger variability would increase the likelihood of noise-induced collapse.