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Meridional coherence of the North Atlantic meridional overturning circulation

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The North Atlantic Meridional Overturning Circulation (MOC) is associated with deep water formation at high latitudes, and climatically-important ocean-atmosphere heat fluxes, hence the current substantial effort to monitor the MOC. While it is expected that, on sufficiently long time scales, variations in the MOC would be coherent across latitudes south of the deep water formation region, it is not clear whether coherence should be expected at shorter timescales. In this paper, we investigate the coherence of MOC variations in a range of ocean models. We find that, across a range of model physics, resolution, and forcing scenarios, there is a change in the character of the overturning north and south of about 40^oN. To the north the variability has a strong decadal component, while to the south higher frequencies dominate. This acts to significantly reduce the meridional coherence of the MOC, even on interannual timescales. A physical interpretation in terms of an underlying meridionally coherent mode, strongest at high latitudes, but swamped by higher frequency, more localised processes south of 40^oN is provided.