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Observed and simulated (CMIP5 and CMIP6) early- to late-winter evolution of North Atlantic atmospheric variability and links to the ocean

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Research to date has shown strong multi-decadal variability of the North Atlantic Oscillation (NAO) in late winter, particularly in March when correlations to North Atlantic (NA) ocean variability (Atlantic multi-decadal variability (AMV)) are particularly strong. This late-winter low-frequency atmospheric variability appears too weak in the majority of climate models across a range of indices of North Atlantic large-scale atmospheric circulation. It appears that models do not successfully reproduce responses to either (or both) proximal sea-surface temperature (SST) variability at mid-latitudes or teleconnections to SST variability in the sub tropics.

Here, an in-depth analysis of the winter evolution of multiple indices of North Atlantic mid-latitude atmospheric circulation will be presented based on both re-analysis data and historical simulations of coupled climate models (CMIP5 and CMIP6). The atmospheric indices assessed will include the NAO, speed and latitude of the NA eddy driven jet and lower-tropospheric westerly wind strength in a region of maximum variability to the west of the UK. Results so far indicate that the CMIP6 models do not exhibit a clear change from CMIP5 in terms of the representation of low-frequency late-winter atmospheric variability. To diagnose in more detail possible origins of differences between observed and simulated variability, a detailed evaluation of early- to late-winter evolution in variability of the above indices will be presented, with an initial focus on observations (re-analysis and SST re-constructions) and incorporating the following questions:
- Are there significant differences in the relative strength of linkages to tropical and extra-tropical SST variability across the different atmospheric indices?
- Is the observed late-winter maximum in correlations between NA atmospheric indices and North Atlantic SSTs still apparent at sub-decadal timescales?
Initial results indicate that there are stronger tropical linkages for jet speed and that at sub-decadal timescales late winter is does not dominate in terms of correlations between atmospheric and SST variability. Updates on these early results will be presented along with implications of the results for differences between observed and simulated variability.