



Response of the North Atlantic subpolar gyre to persistent North Atlantic Oscillation like forcing

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The response of the North Atlantic subpolar gyre (SPG) to a persistent positive phase of the North Atlantic Oscillation (NAO) is investigated using an ocean general circulation model (OGCM) forced with idealized ERA40 reanalysis fields. The integration is analyzed with reference to an integration forced with idealized fields representing a neutral state of the NAO. The results suggest that the well-known cooling of the SPG region and subsequent strengthening of the SPG are, after about ten years of positive NAO forcing, replaced by a counter-intuitive warming in the SPG region and a subsequent weakening of the SPG. These changes are caused by the advection of warm water from the subtropical gyre (STG) region, driven by a spin-up of the Atlantic meridional overturning circulation (AMOC) and the effect of an anomalous wind stress curl in the northeastern North Atlantic. After about ten years of positive NAO forcing, and without an expected feedback response from the atmospheric forcing, the advection of warm water from the STG counteracts the local buoyancy forcing in the SPG region. The strength of the initial spin-up of the SPG depends on the initial conditions of the idealized experiments, notably the strength of the AMOC and the sign of the NAO, giving rise to a possible predictability of the SPG strength on inter-annual and possibly longer time scales.