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Stochastic Forcing of Ocean Variability by the North Atlantic Oscillation

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The influence of the stochastic component of the North Atlantic Oscillation on the subtropical gyre circulation of the North Atlantic in an eddy permitting quasigeostrophic model is explored. Significant stochastically-induced variability in the ocean circulation occurs near the western boundary region and along the western margins of the abyssal plains associated with various processes. Variability arises from a combination of two effects depending on the variance norm chosen: growth of unstable modes of the underlying circulation, and modal interference resulting from their nonnormal nature which dominates during the first 10 days or so of perturbation growth. Near the surface, most of the variability is associated with large-scale changes in the barotropic circulation, although a significant fraction of the variability is associated with small-scale baroclinic waves. In the deep ocean, much of the stochastically-induced variability is apparently due to topographic Rossby wave activity along the continental rise and ocean ridges. Previous studies have demonstrated that rectification of topographic Rossby wave-induced circulations in the western North Atlantic may contribute to the western boundary current recirculation zones. We suggest here that a significant source of topographic Rossby wave energy may arise from stochastic forcing by large-scale atmospheric forcing, such as the North Atlantic Oscillation and other teleconnection patterns.