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Response of the North Atlantic storm track to climate change shaped by ocean–atmosphere coupling

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A poleward shift of the mid-latitude storm tracks in response to anthropogenic greenhouse-gas forcing has been diagnosed in climate model simulations. Explanations of this effect have focused on atmospheric dynamics. However, in contrast to storm tracks in other regions, the North Atlantic storm track responds by strengthening and extending farther east, in particular on its southern flank. These adjustments are associated with an intensification and extension of the eddy-driven jet towards western Europe and are expected to have considerable societal impacts related to a rise in storminess in Europe. Here, we apply a regression analysis to an ensemble of coupled climate model simulations to show that the coupling between ocean and atmosphere shapes the distinct storm-track response to greenhouse-gas forcing in the North Atlantic region. In the ensemble of simulations we analyse, at least half of the differences between the storm-track responses of different models are associated with uncertainties in ocean circulation changes. We compare the fully coupled simulations with both the associated slab model simulations and an ocean-forced experiment with one climate model to establish causality. We conclude that uncertainties in the response of the North Atlantic storm track to anthropogenic emissions could be reduced through tighter constraints on the future ocean circulation.