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UV solar forcing change as a control on Atlantic multi-decadal variability using a high resolution ocean-atmosphere coupled climate model

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Multi-decadal variability in the North Atlantic Ocean is poorly understood due to the limited timespan of ocean observations. Past climate reconstructions and long observational datasets indicate that multi-decadal North Atlantic variability is a feature of the pre-industrial as well as modern Atlantic, and is of similar magnitude to recent anthropogenically-forced change. The likely drivers of multi-decadal variability include solar forcing changes, volcanic and anthropogenic aerosol forcings, cryosphere-ocean interaction, atmospheric forcings, internal ocean variability or some combination of these factors. Here we consider solar forcing and in particular changes in the UV part of the spectrum, which recent studies have indicated may have a pronounced impact on regional climate. Changes in the amount of UV radiation reaching Earth have been shown in climate models to alter the stratospheric equator to pole temperature gradient, ultimately resulting in surface pressure changes over the North Atlantic, with coupled processes producing an ocean manifestation in following years. We build on prior work by performing step changes in the UV forcing which could have occurred during the Maunder Minimum, the lowest period of sunspot activity in the recent past. We do this in a state of the art coupled climate model with a quarter degree ocean resolution, allowing us to study the impacts on ocean circulation. It is widely considered that ocean dynamics are better represented in eddy-permitting ocean models of such resolution than in the previous generation coarser resolution ($\sim$ 1 degree) models. To test our hypothesis that changes in solar UV are responsible for a significant component of multi-decadal Atlantic variability, we compare the model results with annually resolved and absolutely dated temperature and salinity reconstructions from marine variability at several sites bordering the North Atlantic Ocean.