



## Stratosphere-Ocean Coupling

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It is well recognized that the stratosphere is connected to tropospheric weather and climate. In particular, extreme stratospheric circulation events and their feedback on the troposphere are known to play an important role. However, what is not known to date is whether the state of the stratosphere also matters for the ocean and its circulation. Previous research suggests co-variability of decadal stratospheric flow variations and conditions in the North Atlantic Ocean, but such findings are based on short simulations with only one climate model. In this study we demonstrate from past observations that the stratosphere and the Atlantic thermohaline circulation underwent low-frequency variations that were similar to each other. Using a long simulation with the GFDL climate model CM2.1 we show that this similarity is consistent with our hypothesis that variations in the sequence of stratospheric circulation anomalies, combined with the persistence of individual anomalies, lead to a significant impact of the stratosphere on the North Atlantic Ocean. The latest CMIP5 simulations solidify our results and also demonstrate that the surface response over the Atlantic to stratospheric events is stronger in models with a well-resolved stratosphere than in models with a relatively simple stratosphere. In summary, our work identifies a previously unknown source for decadal climate variability and suggests that simulations of deep layers of the atmosphere and the ocean are needed for realistic predictions of climate.