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Stratosphere-troposphere coupling: Evidence for stratospheric impacts onoOcean circulation

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Previous research has found significant dynamical linkages between stratosphere and troposphere on intra-seasonal time scales. However, whether stratospheric variability influences the ocean has not been addressed before, despite the fact that the low-frequency nature of stratospheric events might be effective in driving and enhancing intrinsic oceanic variability. Being able to detect such an influence would have important implications for climate predictability on both decadal and climate time scales. In order to investigate whether the stratosphere impacts the ocean, we study a 4000 year long control integrations with the coupled GFDL model CM2.1, focusing on the North Atlantic sector where strong variability in association with the Atlantic Meridional Overturning Circulation (AMOC) exists. From these simulations we find clear evidence for an impact of long-lived stratospheric circulation anomalies on the AMOC. This impact is mediated through the North Atlantic Oscillation and its associated heat flux anomalies at the air-sea interface. The resulting sea surface temperature anomalies modulate the deep convective part of the AMOC and lead to signals which, over the course of several years, propagate towards the bottom of the ocean. We further find that these events drive intrinsic low-frequency variability in the AMOC that persist for many decades. Our findings support the increasing body of evidence that resolving the climate prediction problem requires understanding the nature of stratospheric variability on all time scales.