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Bimodality, regime shifts, and decadal variability in the QBO and the NH stratospheric winter vortex as seen in model ensembles.

Bo Christiansen
Danish Meteorological Institute, Climate Research Division, Copenhagen, Denmark (boc@dmi.dk, +45 39 15 74 60)

The stratospheric Northern Hemisphere (NH) winter mean vortex alternates between a strong and a weak state which is manifested in a statistically significant bimodal distribution. In the end of the 1970s a regime change took place increasing the probability of the strong phase relative to the weak phase (Christiansen 2003). Christiansen (2010) found a strong coincidence between strong (weak) vortex winters and the westerly (easterly) QBO phase. This work also demonstrated that the change of the vortex in the late 1970s can be related to a change in the QBO. However, this change in the QBO can be random process simply related to the annual sampling of the QBO.

In this paper we investigate the connection between the decadal variability of the vortex and the QBO in historical CMIP5 and CCMVal2 experiments. The CMIP5 archive contains both models with and without a spontaneously generated QBO. Additionally, the CCMVal2 archive includes models with prescribed QBOs.

Preliminary results indicate that models with prescribed or spontaneously generated QBOs do show realistic bimodal behaviour of the QBO. While the strength of the variability of the vortex in the models is realistic there is in general little bimodality. We also find that the connection between QBO and the NH vortex is weaker in the models than in the reanalysis.

References:
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