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The Turbulent Oscillator: A mechanism of low-frequency variability of the wind-driven ocean gyres

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The intrinsic low-frequency variability of the midlatitude, wind-driven ocean gyres is studied using a numerical model operating at large Reynolds number. A robust mode of decadal variability is found in this model, characterised by variations in the strength and position of the eastward jet dividing the subtropical and subpolar gyres.

The central question we ask is whether this decadal mode is related to similar modes which appear at low Reynolds number? This question is answered by examining the external forcing and interior dynamics of the potential vorticity (PV) budget of the gyre. The primary forcing which governs the cycle is due to the turbulent eddy flux of PV between the gyres. Thus, the variability is a turbulent phenomenon, which is driven by the competition between the eddy rectification process and the potential vorticity anomalies induced by changes of the inter-gyre transport. For this reason, we call this mode the "Turbulent Oscillator". It can be demonstrated that the Turbulent Oscillator is a different phenomenon to low Reynolds number variability of ocean gyres.