Eddy-driven Low-Frequency Variability: Physics, and Observability through Altimetry

Future climate simulators will include eddying rather than laminar oceans. When eddies are present, global ocean/sea-ice simulations forced by repeated annual cycles show that an intermittent, intrinsic low-frequency (LF: interannual-to-multidecadal) oceanic variability emerges spontaneously, with a stochastic character, and a strong (large-scale) imprint on SLA, SST and MOC. This intrinsic variability questions the determinism of ocean LF variability, and suggests that in coupled mode its SST signature might inject low-frequency eddy-driven « noise » into the atmosphere/climate. Here we use a gridded altimeter product, idealized quasi-geostrophic (QG) turbulent simulations, and realistic high-resolution global ocean simulations to study the spontaneous tendency of mesoscale (high frequency/wavenumber) kinetic energy to non-linearly cascade towards larger time & space scales.

**Signal: NEMO 1/4°: Intrinsic Part (R in %) of Large-Scale Interannual Variance (scales>1000km)**

**QG Simulations: Inverse Cascades of Mesoscale Kinetic Energy Toward Larger Scales & Periods**

Doubly Periodic 2-layer QG model (Flierl, 1978). Constant forcing:

**HyCOM 1/12°: Temporal Inverse Cascade**

(left: regions of investigation overlaid on AVISO SLA snapshot)

**Gridded SLA: Temporal Inverse Cascade?**

**References**