Climate-relevant imprints and observational implications of the chaotic/intrinsic ocean variability: lessons from the OCCIPUT oceanic Ensemble.

**Take-home messages**

- In the presence of mesoscale, the ocean spontaneously generates a strong low-frequency chaotic/intrinsic variability (LFCIV). It locally competes with the atmospheric forcing in driving the interannual-to-multidecadal variability of key ocean climate indices (OHC$_{0-700}$, AMOC, MHT, etc.).
- Much weaker or absent in coarse-resolution ocean models used in most IPCC-class climate simulators, this strong LFCIV, might impact the atmosphere in coupled models with turbulent oceans.
- Over large regions, the LFCIV adds a random component to local 20/30-year trends of OHC and sea level, hindering their unambiguous attribution to [atmospheric+anthropogenic] drivers.
- Ensemble model statistics can be used to attenuate the signature of LFCIV in observational datasets (via filters or Machine Learning), and unveil the deterministic response of the real ocean to the atmosphere.

**The OCCIPUT Ensemble**: 50 turbulent ocean hindcasts

- NEMO global ocean model
- Resolution $1/4^\circ$ — 1960-2015
- 50 members with:
  - Same ERA-Interim atm. forcing
  - Slight initial perturbations

**Estimate the ocean**: 
- Atmospherically-forced variability ($\sigma_a = \text{STD of ensemble mean}$)
- Chaotic/intrinsic variability ($\sigma_c = \text{mean of ensemble STD}$)

**References**


Penduff et al., 2018: Ensembles of eddying ocean simulations for climate. CLIVAR Exchanges, Special Issue on High Resolution Ocean Climate Modelling, 55, Vol 9 No 1, July 2018.