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Intrinsic variability in the global eddying ocean: an OGCM-based analysis of spatiotemporal scales

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Ocean general circulation models (OGCMs) spontaneously generate low-frequency intrinsic variability when their resolution allows the production of mesoscale eddies (e.g. 1/4° and finer). Global variance analysis (Penduff et al., 2011) and regional EOF analysis (Taguchi et al., 2010) on Sea Surface Height have shown that this intrinsic contribution to the total variability is particularly strong in eddy-active regions, and may largely dominate the atmospherically-forced component.

In this presentation, we investigate the spatiotemporal scales of this oceanic intrinsic variability from a 327-year seasonally-forced global 1/4° OGCM simulation (no interannual forcing), and its 50-year counterpart driven by the full range of atmospheric timescales (with interannual forcing). Both model outputs are low-passed filtered temporally to extract interannual-to-decadal scales. We then compare the spatial scales and magnitudes of the full and intrinsic low-frequency variabilities. Results are presented for variables (e.g. Sea-Surface Temperature, Mixed Layer Depth, Heat fluxes) that are significantly impacted by intrinsic variability, and that are likely to be involved in the processes which couple the ocean, the atmosphere, and the biogeochemical systems.

We argue that such OGCM-based investigations extend and fruitfully complement more idealized dynamical system studies, which have shown the intrinsic and chaotic nature of transitions between circulation patterns (e.g. Pierini and Dijkstra, 2009).