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Tests of oceanic stochastic parameterisation in a seasonal forecast system.

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Over seasonal time scales, our aim is to compare the relative impact of ocean initial condition and model uncertainty, upon the ocean forecast skill and reliability. Over seasonal timescales we compare four oceanic stochastic parameterisation schemes applied in a 1x1 degree ocean model (NEMO) with a fully coupled T159 atmosphere (ECMWF IFS). The relative impacts upon the ocean of the resulting eddy induced activity, wind forcing and typical initial condition perturbations are quantified. Following the historical success of stochastic parameterisation in the atmosphere, two of the parameterisations tested were multiplicitave in nature: A stochastic variation of the Gent-McWilliams scheme and a stochastic diffusion scheme. We also consider a surface flux parameterisation (similar to that introduced by Williams, 2012), and stochastic perturbation of the equation of state (similar to that introduced by Brankart, 2013).

The amplitude of the stochastic term in the Williams (2012) scheme was set to the physically reasonable amplitude considered in that paper. The amplitude of the stochastic term in each of the other schemes was increased to the limits of model stability. As expected, variability was increased. Up to 1 month after initialisation, ensemble spread induced by stochastic parameterisation is greater than that induced by the atmosphere, whilst being smaller than the initial condition perturbations currently used at ECMWF. After 1 month, the wind forcing becomes the dominant source of model ocean variability, even at depth.