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Global ocean model resolution impacts on the first 4 moments of surface variability

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The DRAKKAR Group is developping a hierarchy of global ocean/sea-ice models and building en ensemble of 50-year simulations for climate- and process-oriented studies. These simulations mostly differ by their forcing, numerical parameters, and resolution. The four simulations considered here were driven by the same surface forcing but performed at 2°, 1°, 1/2° and 1/4° horizontal resolution.
These simulations are collocated onto AVISO sea-level anomaly (SLA) observations, then quantitatively compared to AVISO and among themselves with respect to the first four statistical moments of SLA (mean, variance, skewness, kurtosis) within three frequency ranges.
We quantify how increased model resolution progressively improves the observation-simulation agreement, not only in terms of mean flow and mesoscale activity as already known, but also in terms of e.g. spatial distribution and magnitude of large-scale interannual variabilities, distribution and statistical structure of extreme events, and dynamical links between skewness and kurtosis. This multi-simulation comparative assessment also raises open questions about the ocean dynamics and its nonlinear behavior.