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Sea-level expression of intrinsic and forced interannual variabilities: a global OGCM study.

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This study evaluates in a realistic context the local contributions of direct atmospheric forcing and intrinsic oceanic processes on interannual sea-level anomalies (SLA). A 1/4° global ocean/sea-ice general circulation model, driven over 47 years by the full range of atmospheric timescales, is first shown to reproduce most observed features of the high- and low-frequency SLA variability from 1993 to 2004. Comparing this simulation with a second one driven only by the climatological annual cycle reveals that the intrinsic part of the total interannual SLA variance exceeds 40% over half of the open ocean area, and exceeds 80% over one fifth of it. This intrinsic contribution is particularly strong in eddy-active regions (more than 70-80% in the Southern Ocean and western boundary current extensions) as predicted by idealized studies, as well as within the 20-30° latitude bands. The atmosphere directly forces most of the interannual SLA variance at low latitudes and in most mid-latitude eastern basins, in particular north of about 40°N in the Pacific. The interannual SLA variance is almost entirely due to intrinsic processes south of the Antarctic Circumpolar Current in the Indian sector, while half of this variance is forced by the atmosphere north of it. The same simulations were performed and analyzed at 2° resolution as well: switching to this laminar regime yields a comparable forced variability (large-scale distribution and magnitude), but almost suppresses the intrinsic variability. This probably explains why laminar ocean models largely underestimate the interannual SLA variance.