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Pan-regional characterization of the variability in the Indonesian Seas

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The Indonesian Seas feature a wide-spectrum of variations in hydrography and circulation. This study applies a simple frequency-based time series decomposition method on the 20-year model outputs without data-assimilation, and demonstrates the spatial distribution of the variations in intra-seasonal, semi-annual, annual, and inter-annual bands, respectively. The four bands of variations are further used in K-mean clustering to investigate the inherent dynamical similarities/dissimilarities for a pan-regional characterization. The clusters based on the variations of the sea-level/thermocline emphasize the competing impacts of the annual and inter-annual variations in the Indonesian Seas, which lays on a "cross-road" of the inter-annual variation dominated NE-SW oriented deep-ocean regime and the annual variation dominated NW-SE oriented marginal sea regime. The annual variation is primarily driven by the regional monsoon wind. Moreover, profiles of annual current variations show a significant difference between the main and east branch of the Indonesian Throughflow (ITF), where annual variations play a major role above (below) the thermocline in the main (east) branch. In general, the ITF variability is mainly influenced by the remotely generated inter-annual variability, regional annual forcings by monsoon, and local flow instability and fluctuations, with the semi-annual variation being minor but non-trivial.