

Understanding sea-level rise and variability during the last decades - from global to regional scales

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Global mean sea level is one of the key indicators of the state of our climate. Over the past four decades, its rate of rise has been about 1.8 mm yr⁻¹ and, since 1993, about 3.0 mm yr⁻¹. However, substantial deviations from global mean rates are observed at regional scales. These regional variations represent the integrated response of many physical mechanisms, operating at various temporal and spatial scales, in different components of the climate system (e.g., atmosphere, oceans, land water storage, cryosphere, solid Earth, etc.). Quantifying the amplitude and spatial pattern of these mechanisms and adequately representing them in climate model simulations is a major interdisciplinary challenge, but an essential step towards assessing the impacts of future sea-level rise on society. Here, we review recent progress and current limitations in the understanding of sea level variations over the past decades, associated with changes in the ocean's dynamical state due to transformation and/or redistribution of water properties (e.g., momentum and buoyancy fluxes, advection, mixing, etc.), based on observational and modeling efforts. We then discuss priorities and prospects for improving regional sea level predictions.