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Factors controlling long-term variability of alkalinity in the marginal seas of western Pacific Ocean

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The Yellow Sea is a dynamic marginal sea in the northwestern Pacific, influenced by strong riverine inputs, complex water mass interactions, high biological productivity, and shallow bathymetry. These factors shape the regional carbonate system through a combination of conservative physical mixing and internal biogeochemical processes. However, basin-scale evaluations of long-term carbonate variability remain limited. In this study, we compile and integrate more than 14,000 carbonate chemistry observations (2005–2025) from a unified Korean long-term monitoring program (> 9,800 samples) and multiple Chinese research surveys (> 4,500 samples). Using this combined dataset, we examine spatial and temporal variability in total alkalinity (TA), dissolved inorganic carbon (DIC), and derived parameters including pH, pCO_2, Revelle factor, and calcium carbonate saturation states. This integrated dataset provides a basin-wide perspective on carbonate system variability in the Yellow Sea and offers a basis for evaluating how physical mixing and biogeochemical processes jointly regulate regional carbon dynamics under ongoing anthrpogenic change.