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Selective Loss of Recent Carbon in Marginal Seas Caused by Sediment Mixing

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Continental margins store large amounts of terrestrial and marine carbon in sediments. The sediment mixed layer (SML) may control carbon sequestration, but drivers of SML development and its impact on carbon sequestration remain poorly constrained. Here, we combine machine learning with comprehensive observations to resolve current SML conditions and predict changes to sediment carbon storage under climate change. Thick SML corresponded to lower sediment organic carbon and highest ancient carbon. Sediment mixing selectively enhanced the decomposition of recently-deposited labily carbon, increasing the proportion of old carbon. Increasing river discharge by 2100 will thicken the SML and drive a loss of 45 Tg of carbon from marginal sea sediments. Sediment mixing and related oxygenation is a key process driving marine carbon sequestration and should be considered in the formulation of carbon capture strategies in marginal seas.