Modeling detailed sedimentary 210Pb and fallout 239,240Pu profiles to allow episodic events: An application in Chesapeake Bay

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ABSTRACT: Dependable sediment chronologies are essential to the interpretation of the sedimentary record of past environmental change. In the present article, we use high-resolution chemical and radiochemical data as the basis for a numerical simulation of sediment accumulation, bioturbation, and episodic deposition or erosion in a dynamic estuary. We simulate episodic events by employing a time dependent sedimentation rate that we solve by finding a set of model parameters that describes depth profiles of both excess ^{210}Pb and fallout ^{239,240}Pu. We apply the model to depth distributions of these tracer nuclides in cores from upper-, mid- and lower-Bay sites in Chesapeake Bay. At the upper-Bay site, combining chemical and radiochemical data permits us to recognize and to quantify the sediment deposition due to tropical storm Agnes (1972). At the lower-Bay site, we demonstrate nonsteady sedimentation and propose plausible scenarios to account for it. Given adequate data, our model can provide information that is not available from steady-state models.