# A New Exchange Flow Formulation for the LOICZ Model and the Relative Contribution of Advection and Diffusion to Transport Time Scales

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The LOICZ biogeochemical model is widely used worldwide to estimate the residence time of water in estuaries and the role of the coastal ocean in processing carbon, nitrogen, and phosphorus as materials move between land and sea. It is shown using data from four estuaries that the model under-estimates the residence times by a factor of 3-4 for these estuaries. A new exchange flow formulation is proposed for vertically well-mixed estuaries as well as a simple analytical method to quantify the relative contribution of advection and diffusion to estuarine transport time scales.

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