Abstract

Over the past few decades, the radioisotope pair of $^{238}U/^{234}Th$ has been widely and increasingly used to describe particle dynamics and particle export fluxes in a variety of aquatic systems. The present paper is one of five review articles dedicated to ^{234}Th. It is focused on the models associated with ^{234}Th whereas the companion papers (same issue) are focused on present and future methodologies and techniques (Rutgers van der Loeff et al.), $C/^{234}Th$ ratios (Buesseler et al.), ^{234}Th speciation (Santschi et al.) and present and future applications of ^{234}Th (Waples et al.). In this paper, we review current ^{234}Th scavenging models and discuss the relative importance of the non steady state and physical terms associated with the most commonly used model to estimate ^{234}Th flux. Based on this discussion we recommend that for future work the use of models should be accompanied by a discussion of the effect that model and data uncertainty have on the model results. We also suggest that future field work incorporate repeat occupations of sample sites on time scales of 1-4 weeks in order to evaluate steady state versus non steady state estimates of ^{234}Th export, especially during high flux events (> ca. 800 dpm m^{-2} d^{-1}). Finally, knowledge of the physical oceanography of the study area is essential, particularly in ocean margins and in areas of established upwelling (e.g. Equatorial Pacific). These suggestions will greatly enhance the application of ^{234}Th as a tracer of particle dynamics and flux in more complicated regimes.