Excess $^{234}$Th and $^{210}$Pb seabed inventories were measured in cores collected from the Amazon continental shelf to examine particle scavenging and seabed dynamics. Typical excess $^{210}$Pb inventories range from 100 to 300 dpm cm$^{-2}$, and the total excess $^{210}$Pb inventory for the Amazon shelf was determined to be $2.7 \times 10^{17}$ dpm. The $^{210}$Pb measurements indicate that particle-reactive species are scavenged not only from the Amazon River but also from the lateral advection of offshore water. In order to sustain the $^{210}$Pb inventories, the volume of water supplied by the lateral advection from offshore must be approximately five to ten times the water discharge of the Amazon River. This lateral advection supplies about 67% of the total excess $^{210}$Pb to the Amazon continental shelf with relatively small contributions from riverine input (31%), atmospheric fallout (2.3%), and in-situ production (0.1%). The $^{234}$Th inventories were measured on four cruises, which occurred during periods of differing river discharge, wind stress, and flow rates of the North Brazil Current. The $^{234}$Th excess seabed inventories show large spatial and seasonal variability, with a range from 0 to 22 dpm cm$^{-2}$. Ratios of predicted $^{234}$Th inventories over observed $^{234}$Th inventories indicate that a large portion of the inventories on the inner and mid shelf occur in the fluid mud layer or the suspended sediments. The $^{234}$Th excess seabed inventories are controlled by resuspension, cycling the inventories between the water column and the seabed. $^{210}$Pb and $^{234}$Th excess seabed inventories are compared directly using corrections for the different time scales and offshore concentrations. This approach indicates that for most of the shelf, the inventories of the shorter-term tracer ($^{234}$Th) are less than predicted by the inventories of the longer-term tracer ($^{210}$Pb). There are two explanations for this trend. The first is that a larger portion of the $^{234}$Th inventory occurs in the fluid muds or the water column relative to $^{210}$Pb. The second is that the supply of offshore water, scavenging efficiency, and/or deposition have been lower over the two year study period relative to the last one hundred years.