Total $^{210}$Pb and $^7$Be fallout rates were measured on the coastal region of Niteroi, Brazil. The monthly depositional flux of $^{210}$Pb and $^7$Be varied by a factor of 26, from 1.7 to 43.3 mBq cm$^{-2}$ year$^{-1}$ and ~27, from 7.5 to 203.5 mBq cm$^{-2}$ year$^{-1}$, respectively. The relatively large oscillations in the depositional flux of $^{210}$Pb at this study site were likely due to variations in air mass sources, while the $^7$Be fluctuations may be driven by a combination of weather conditions. Local geology could support the periodic high fluxes of $^{210}$Pb from continental air masses, as shifting oceanic wind sources were affirmed by the uncorrelated $^{210}$Pb and $^7$Be fallout activities and $^7$Be/$^{210}$Pb ratios. The $^{210}$Pb atmospheric deposition was found to be in agreement with local sediment inventories, an important consideration in geochemical studies that estimate sedimentation processes.