Transport of Fukushima-derived ^{137}Cs into the South China Sea via Subtropical Mode Water intrusion through the Luzon Strait

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The Luzon Strait is an essential channel connecting the North Pacific Ocean and the South China Sea (SCS). Despite numerous studies on regional ocean circulation, the intrusion pathways and transport mechanisms of Subtropical Mode Water (STMW) into the SCS remain insufficiently understood. The Fukushima Daiichi Nuclear Power Plant accident in March 2011 released radiocesium (^{137}Cs) into the ocean, providing a unique opportunity to trace the STMW's transit from the Kuroshio Extension region to the SCS. Using a three-dimensional numerical ocean model (ROMS), this study investigates the pathway and transport timescale of ^{137}Cs associated with STMW intrusion into the SCS via the Luzon Strait. To clearly identify STMW-driven transport, atmospheric deposition of ^{137}Cs was excluded by utilizing a scenario with only oceanic discharge. Model simulations indicate an increase in ^{137}Cs concentrations within the STMW layer at the Luzon Strait approximately seven years after the Fukushima accident. Transport of ^{137}Cs through the STMW layer precedes surface circulation-derived transport into the Luzon Strait. The net flux of ^{137}Cs into the SCS exhibits a notable seasonal variation, with elevated fluxes during winter and reduced levels in summer, modulated primarily by horizontal transport and variations in the Kuroshio intrusion pattern. In particular, the leaking path of Kuroshio intrusion increases the net inflow of ^{137}Cs compared to the looping or leaping paths. Considering the role of SCS as a gateway to downstream marginal seas such as the East China Sea, Yellow Sea, and Japan/East Sea, understanding these transport mechanisms is critical for evaluating the path of ^{137}Cs and other tracers in the region.