

## **Material transport between the marginal seas and western North Pacific using Neodymium and Radiocesium isotopes**

JING ZHANG<sup>1</sup>, JUSTIN SI-TENG ZHU<sup>2</sup>, SHOTA KAMBAYASHI<sup>3</sup>, TAKESHI MATSUNO<sup>4</sup> AND EISUKE TSUTSUMI<sup>5</sup>

<sup>1</sup> Graduate School of Sci. and Eng., University of Toyama, 3190 Gofuku, Toyama, 930-8555, Japan, jzhang@sci.u-toyama.ac.jp

<sup>2</sup> University of Toyama, m1848501@ems.u-toyama.ac.jp

<sup>3</sup> CAREM, National Institute of Quantum and Radiation Science and Technology, c/o FMU, Fukushima, 960-1295, Japan, kambayashi.shota@qst.go.jp

<sup>4</sup> RIAM (Research Institute for Applied Mechanics), Kyushu University, 6-1 Kasugakohen, Kasuga, Fukuoka, 816-8580, Japan, matsuno@riam.kyushu-u.ac.jp

<sup>5</sup> RIAM, Kyushu University, tsutsumi@riam.kyushu-u.ac.jp

Marginal seas in the western North Pacific are continually exchanging energy and materials between land and open ocean. While a large amount of nutrient material is transported between the East China Sea (ECS) shelf and the Kuroshio, it is difficult to identify the various sources solely by estimating the potential temperature and salinity. Here, chemical tracers, i.e., rare earth elements, Nd and Cs and isotopes ( $\epsilon\text{Nd}$ ,  $^{137}\text{Cs}$ ) are suitable conservative water mass indicators, helping to unravel the complex water mass structures present. Four water masses are in play, Mixed Shelf Water (MSW), Kuroshio Surface Water (KSW), Kuroshio Tropical Water (KTW), and Kuroshio intermediate Water (KIW). KIW and KTW account for  $39\pm 14\%$  and  $49\pm 18\%$ , respectively, of the central ECS shelf bottom water. Approximately 10% of the CDW (Changjiang Diluted Water), 28% of the YSW (Yellow Sea Water), and 62% of the Kuroshio Water enter the Sea of Japan while approximately 6% of the MSW discharges into the adjacent Northwestern Pacific.  $^{137}\text{Cs}$  originating from the Fukushima Dai-ichi Nuclear Power Plant (FNPP1) accident shows a maximum in the Luzon Strait area, ECS and Tsushima Strait, being observed in the same water mass recognized as Subtropical Mode Water (STMW; temperature  $15\text{-}17^\circ\text{C}$ , salinity  $34.60\text{-}34.75$ , density  $25.2\text{-}25.7$ ). This same water mass is KIW, at 400 m depth in Luzon Strait and up to 150 m depth in the Tokara and Tsushima Straits, and is rich in nutrients. As a result, KIW (STMW) transports about 34% of the nutrients flowing into the Sea of Japan through the western channel of Tsushima Strait, and 11% of the total flowing through the full width of the Tsushima Strait.