Organic carbon transfer across the open and closed estuary systems: a case study of Geum and Seomjin River systems, South Korea

Sujin Kang[1,*], Jung-Hyun Kim[2,*], Daun Kim[1], Hyeongseok Song[3,4], Jong-Sik Ryu[3,4], Kyung-Hoon Shin[1,*]

[1] DEPARTMENT OF MARINE SCIENCES AND CONVERGENT TECHNOLOGY, HANYANG UNIVERSITY, Ansan, Republic of Korea

[2] KOREA POLAR RESEARCH INSTITUTE (KOPRI), Incheon, Republic of Korea

[3] DIVISION OF EARTH AND ENVIRONMENTAL SCIENCES, KOREA BASIC SCIENCE INSTITUTE, Chungbuk, Republic of Korea

[4] GRADUATE SCHOOL OF ANALYTICAL SCIENCE AND TECHNOLOGY, CHUNGNAM NATIONAL UNIVERSITY, Daejeon, Republic of Korea

In this study, we investigated spatiotemporal variations in organic carbon (OC) concentration and isotope to understand river damming impact on the transport of riverine carbon. We collected surface water samples in two contrasting Korean river systems (Geum and Seomjin) across the river-sea interfaces along a salinity gradient in August and December 2016, and analysed OC concentrations and their isotopes. The Geum River flows into the Yellow Sea which has a dam at the river mouth, while the Seomjin River flowing into the South Sea of Korea has an open estuary. The fluxes of riverine total organic carbon (TOC; sum of dissolved OC (DOC) and particulate OC (POC)) were much larger (4237.0 and 963.1 g/s in August and December, respectively) in the Geum River than those (51.5 and 38.5 g/s in August and December, respectively) in the Seomjin River. In the Geum River, DOC concentrations were 2.0-3.8 mg/l in August and 1.3-5.3 mg/l in December, while POC concentrations were in the range of 0.2-12.7 mg/l and 0.3-2.6 mg/l in August and December, respectively. In the Seomjin River, DOC and POC concentrations were 1.9-2.4 mg/l and 0.8-1.0 mg/l in August and 1.1-1.5 mg/l and 0.3-0.5 in December, respectively. Both DOC and POC concentrations showed decreasing trends from river to sea in the Geum River, especially in August but none in the Seomjin River. In the Geum River, $\delta^{13}C_{POC}$ values were -21.1±2.5 ‰ before the dam and -22.4±1.5 ‰ after the dam in August, while they were -30.61±2.7 ‰ before the dam and -27.17±2.4 ‰ after the dam in December. We observed a heavy algal bloom before the dam during the sampling in August, which resulted in higher $\delta^{13}C_{POC}$ values in the Geum River. In the Seomjin River, $\delta^{13}C_{POC}$ values were -29.1 to -21.1 ‰ in August and -29.0 to -26.6 ‰ in December, showing an increasing trend from river to sea. The $\Delta^{14}C_{POC}$ values in the Geum River were -51.1 ‰ before the dam and -98.2 ‰ after the dam in August and -87.0 ‰ before the dam and -221.8 ‰ after the dam in

December. In the Seomjin River, the $\Delta^{14}C_{POC}$ values were much lower with -186.7±2.2 ‰ in August and -214.2±38 ‰ in December. Accordingly, our results show that the two contrasting river systems are differently functioning due to an algal bloom occurred in the closed Geum estuary system, and therefore influencing OC concentrations and characteristics transferred from land to sea.