

Presentation type: Oral

Session: Chemistry

Organic carbon transfer across the river-sea interfaces in two contrasting Geum and Sumjin river systems in South Korea

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In this study, the surface water samples were collected across the river-sea interfaces along a salinity gradient in August and December 2016 in order to investigate spatiotemporal variations in organic carbon (OC) content and isotope in two contrasting Korean river systems (Geum and Sumjin). The Geum River flows into the Yellow Sea which has a dam at the river mouth while the Sumjin River flowing into the South Sea of Korea has an open estuary. The riverine total organic carbon (TOC, dissolved OC (DOC) and particulate OC (POC)) fluxes were much larger (4236.9 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 Sumjin River. The DOC concentrations in the Geum River were 2.0-3.8 mg/l for August and 1.3-5.3 mg/l for December, while the POC concentrations were in the range of 0.2-12.7 mg/l and 0.3-2.6 mg/l for August and December, respectively. In the Sumjin River, the DOC and POC concentrations were 1.9-2.4 mg/l and 0.8-1.0 mg/l for August and 1.1-1.5 mg/l and 0.3-0.5 for December, respectively. The DOC and POC concentrations showed decreasing trends from river to sea in the Geum River, especially in August but such trends were not observed in the Sumjin River. The proportion of POC relative to TOC in the Geum River was up to 77 % in August which was larger than that (26±13 %) in December. The Sumjin River had similar proportions of POC relative to TOC in August (24±6 %) and December (29±4 %). In the Geum River, the $\delta^{13}\text{C}_{\text{POC}}$ 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. During the sampling in August, we observed a green algae bloom before the dam in the Geum River, which caused lower $\delta^{13}\text{C}_{\text{POC}}$ values. In the Sumjin River, the $\delta^{13}\text{C}_{\text{POC}}$ 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 $\Delta^{14}\text{C}_{\text{POC}}$ values 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 the Geum River. In the Sumjin River, the $\Delta^{14}\text{C}_{\text{POC}}$ values were much lower with -186.7±2.2 ‰ in August and -214.2±38 ‰ in December. In summary, our results show that the two contrasting Geum and Sumjin river systems are differently functioning due to an algal bloom occurred in a closed estuary system, influencing OC concentrations and characteristics transferred from land to sea.

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