Seasonal variations of organic carbon fluxes and sources in Geum and Sumjin rivers in South Korea

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Introduction:

As a pathway of terrigenous carbon to the adjacent seas, the river-sea interface is a key place for better understanding regional as well as global carbon cycles. Dam constructions exert strong impacts on riverine carbon fluxes and sources. The water flow of the Geum River is controlled by a dam in its estuary while the Sumjin River has an open estuary. In this study, we analyzed concentrations and stable carbon isotopes of particulate organic carbon (POC) and concentrations of dissolved organic carbon (DOC) to investigate variations in fluxes and sources of riverine OC in two contrasting Korean river systems (Geum and Sumjin).

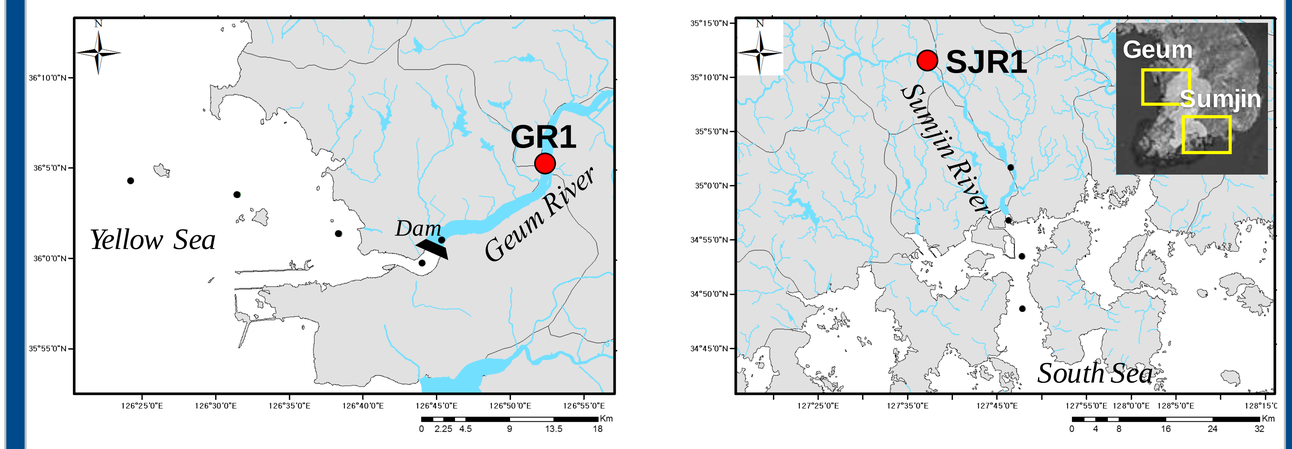

Fig. 1. Map showing the location of the study site in (a) the Geum River and (b) the Sumjin River. We selected the lowest point of each river where it is not affected by sea water.

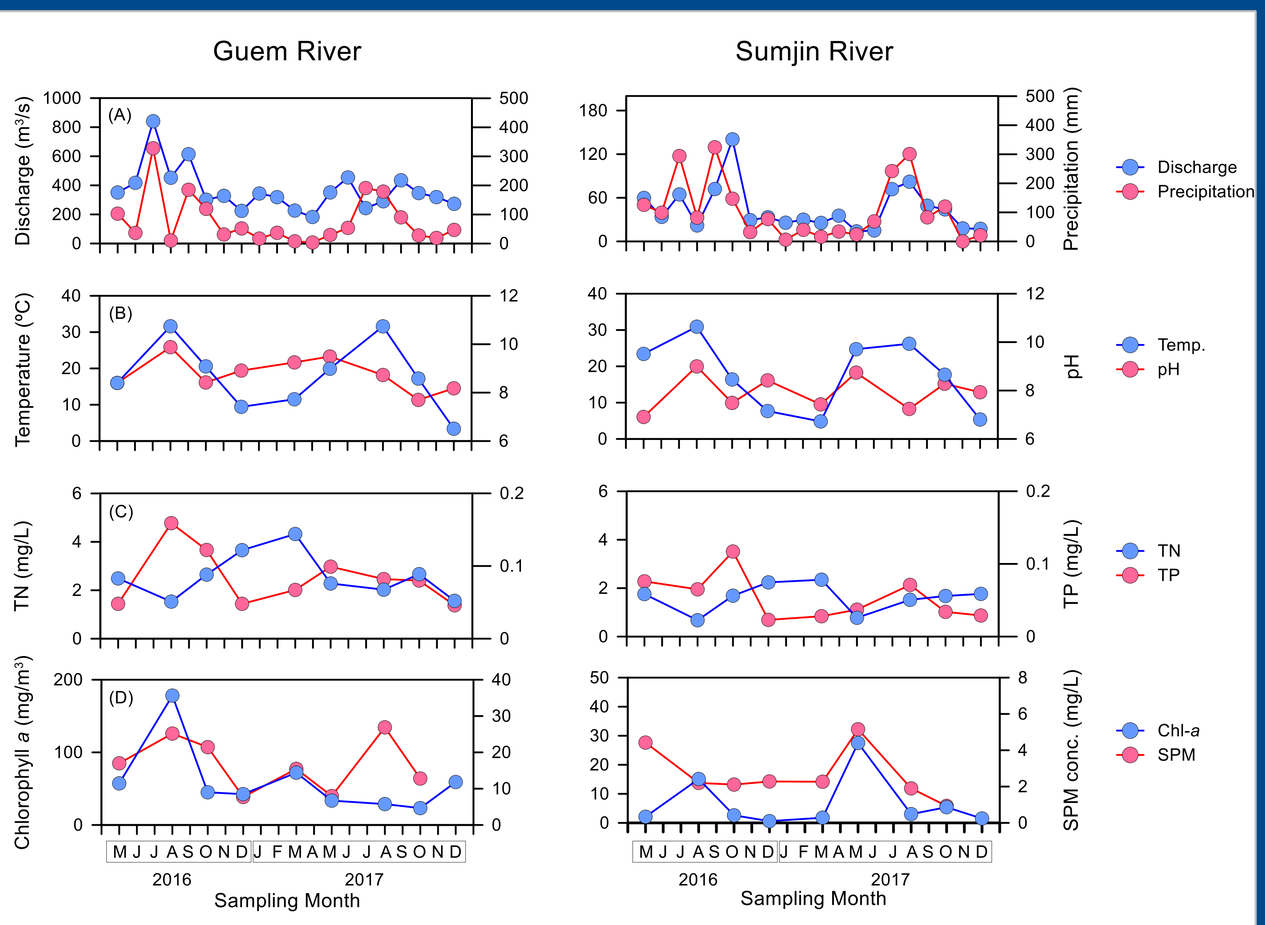

Fig. 2. Variation in hydrological and water parameters in each river. Water discharges, precipitations, and concentrations of total nitrogen (TN), total phosphorus (TP) and *Chlorophyll a* were obtained from the Water resources management information system (WAMIS) in South Korea.

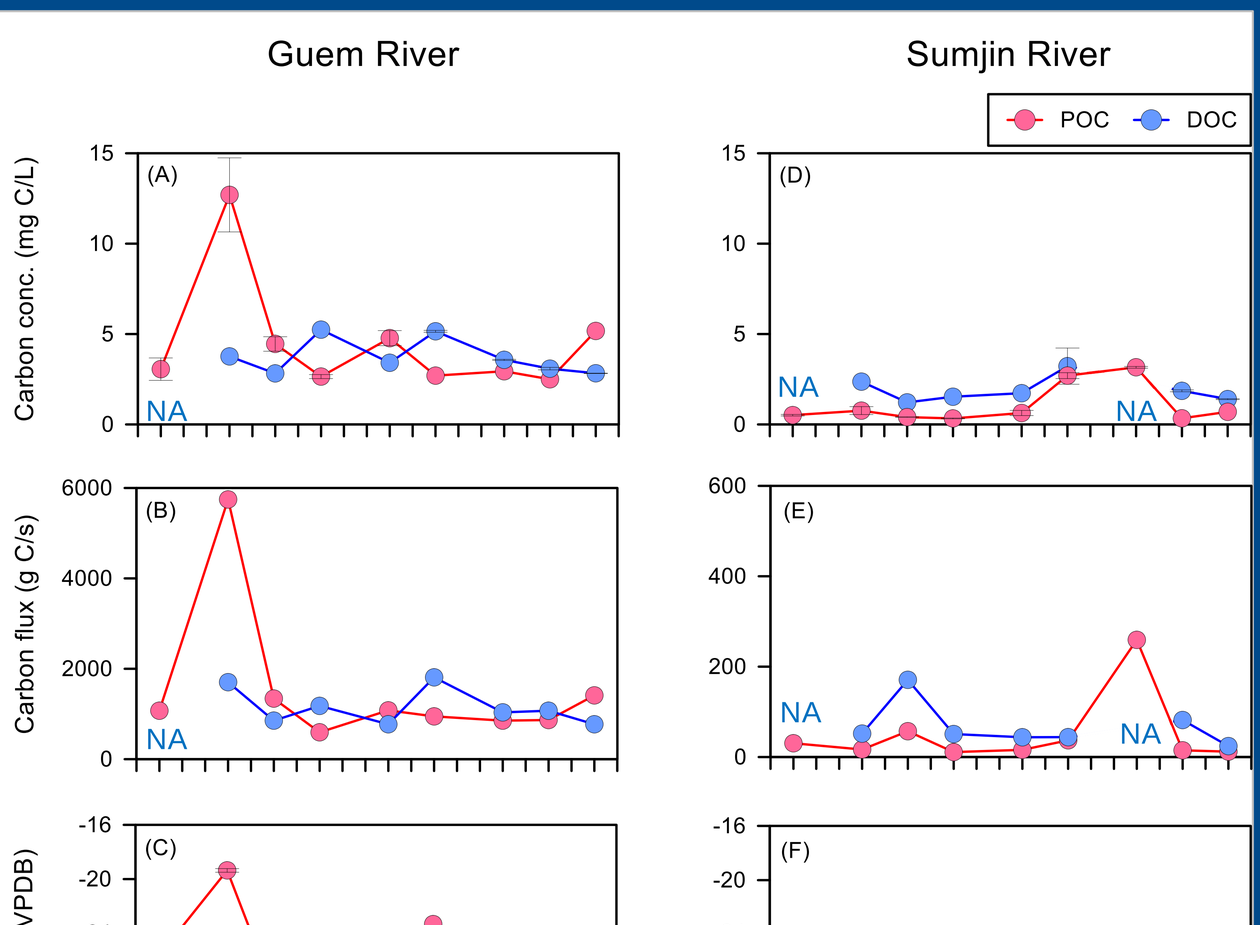

Fig. 3. Variation in the concentration and flux of the DOC, POC and stable isotope ratio of the particulate organic carbon ($\delta^{13}C_{POC}$) in Geum and Sumjin River. (NA: Not analyzed)

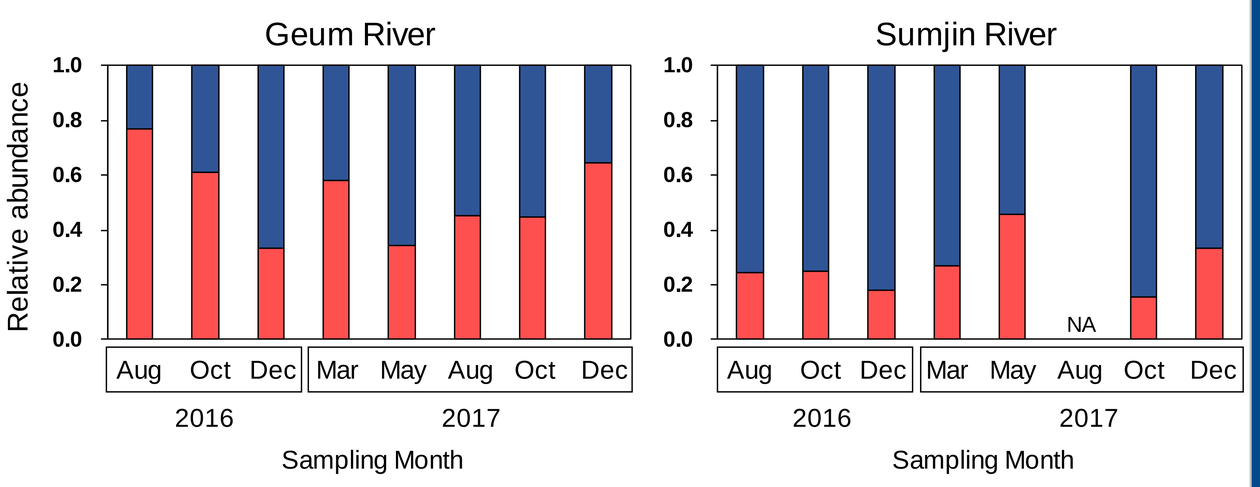

Fig. 4. Relative abundances of DOC (blue) and POC (red) to total organic carbon (TOC) in Geum and Sumjin rivers. NA: Not analyzed.

Our results suggest that the OC fluxes were in general controlled by the water discharges in both rivers and the major source of POC was derived from surrounding lands. However, in the Geum River, the major source of POC was changed in August 2016 due to a heavy algal bloom. Accordingly, our study shows that the damming affects the fluxes and the compositions of riverine OC by lowering the water flow rate, increasing residence time, and thus promoting primary productivity in the reservoirs.

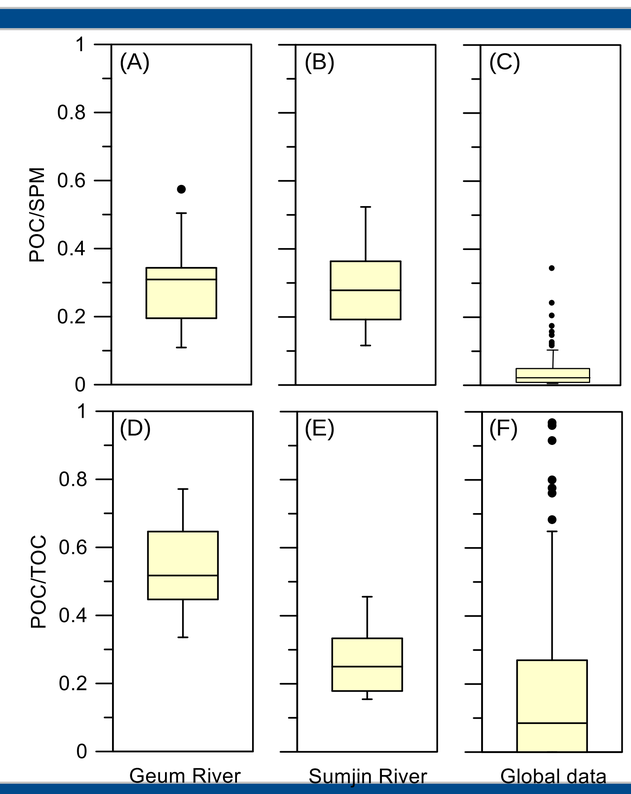

Fig. 5. Comparison of the Geum and Sumjin rivers (this study) with major watersheds worldwide (Alvarez-Cobelas et al., 2012; Zhang et al., 2010). Boxplots represent proportions of POC to suspended particulate matter (SPM) and POC to TOC.

Acknowledgement: This study was supported by the National research foundation of Korea (NRF-2016R1A2B3015388, NRF- 2017H1A2A1043821).
We thank to colleagues of Hanyang Univ. ISOE and KBSI for their sampling support.

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