

Sediment in Lake Soyang as an Integrating Archive of Catchment Processes

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Background

- Precipitation in South Korea is concentrated in the summer monsoon season (July and August), when rainfall of 100 mm/day occurs in a number of episodic heavy events.
- More than half of nutrient input from agricultural land use occurs during the summer monsoon season.
- POC (Particulate Organic Carbon) loading from the rivers may be dramatically increased, because the suspended load increases with the increased flow in the rivers.
- Lake Soyang is thermally stratified during the summer (monsoon) season.
- Phosphate concentration in the hypolimnion is 100 times higher than in the epilimnion during anoxic condition in Lake Soyang (Kim et al., 1995).
- Since 1989, blue green algae which fix nitrogen bloom in summer. The bloom occurs with decreased N:P ratio in the reservoir due to the large phosphorus input from the watershed into Lake Soyang (Heo et al., 1991).
- Major sources of organic matter appear to be in situ phytoplankton production during the dry season and the terrestrial influx during the monsoon season into Lake Soyang (Hong et al., 1989).

Research concept

Upstream catchment processes that depend on land use and climate change will impact water quality and quantity of the lake, especially during the monsoon season.

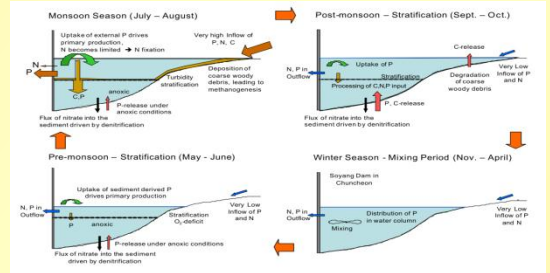


Figure 2. Hypothesized controls on the Soyang Lake water quality over an annual cycle.

Hypothesis

- Lake Soyang water quality is controlled by material release from the sediment such as phosphate, and methane is produced under anoxic conditions after the monsoon season. Phosphorus is distributed throughout the water body during the mixing period.
- External influences are largely due to the inflow of large amounts of P, N and C from the watershed, which directly impacts the phytoplankton species and density change as well as variation in the sediment composition during the monsoon season.

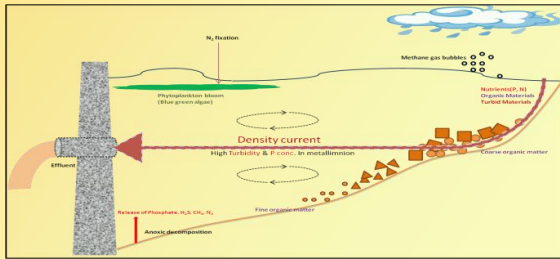


Fig.1. Internal processes in Lake Soyang

Materials and Methods

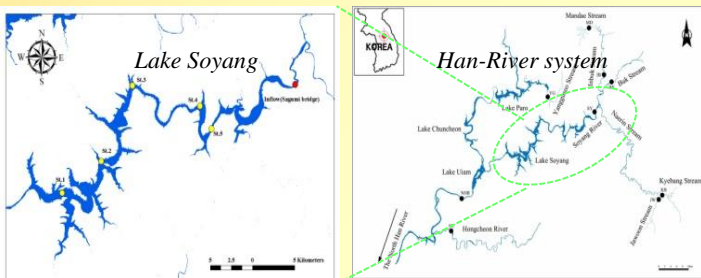


Fig.3. Maps of Lake Soyang and the Han-River system.

Preliminary Results

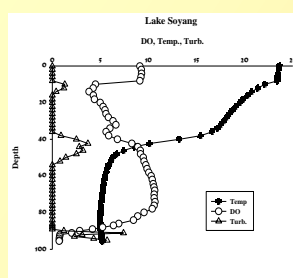


Fig.5. Vertical profiles of DO, Temp. and Turbidity in Lake Soyang during the stratification period in autumn.

- In autumn, oxygen is extremely depleted by decomposition of organic matter under stratification of the hypolimnion of Lake Soyang
- A turbid layer which reflects input from the upstream watershed was observed at a depth of 40 m in Lake Soyang



Fig.4. Sampling during 2012 field work

Future Work

- Analyses of the chemical composition of sediments and pore water are progressing at this moment.
- In the field work this year, I could observe gas bubbles which seem to be methane gas at the upper end (inlet) of the lake. I will check methane flux at station 1. I will make some devices which can collect gas in water bubbles for investigation of Methane flux.
- I would like to compare the sediment chemical composition results with other lakes which are smaller than Lake Soyang and constructed for agriculture.
- I have a plan for incubation experiment to observe ongoing process in sediment. I will take some sediment samples for incubation measurements.

References

G.H. Hong, S.L. Cho and S.Q. Park (1989) Nutrients and Particulate Organic Matters in Lake Soyang during the Thermally Stratified Period. J. KSWPRC 35-46
 W.M., Heo, B. Kim and K.S. Cho (1991) The Bluegreen Algal Blooms in Lake Soyang and Change N/P Ratio with Eutrophication. KOREAN JOURNAL OF LIMNOLOGY 24(4)
 B.Kim, W.M. Heo, G.S. Hwang, D.S. Kim and K.S. Choi (1995) The Distribution of Phosphorus Fractions in Lake Soyang. KOREAN JOURNAL OF LIMNOLOGY 2 (28) : 151-157

Linkage to Other Studies

Measurement of chemical composition in Soyang Lake and watershed

Input parameters for SWAT & CAEDYM model