Complex Terrain and Ecological Heterogeneity (TERRECO): Evaluating Ecosystem Services in Mountainous Landscapes

Identification of source areas and the role of the hyporheic exchange for nitrate and DOC export from a catchment under monsoonal climate conditions

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Introduction: In this study we aim to investigate the effect of how landuse and changes in landuse affect the nitrate and DOC export from catchments under monsoonal climate conditions. We focus our studies on a subcatchment of the Haean Catchment, which is located in the north east of South Korea. The Haean Catchment is representative for the mountainous areas of the Korean peninsula and is a subcatchment of the Lake Soyang watershed. Since Lake Soyang serves as a major drinking water supply for the Seoul metropolitan area, a better understanding of source areas and transport pathways of nutrients from different compartments of the catchment into the receiving waters is an important prerequisite to sustain the supply of clean water.

Hypothesis

1. River-aquifer exchange can significantly affect nutrient retention and transformation.
2. The export of NO_3 and DOC from the catchment is highly variable in time driven by the hydrologic dynamics (e.g. monsoon and pre- and post-monsoon).

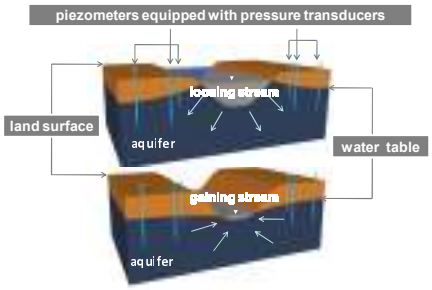

Figure 1: *Piezometer setup and the interaction hypothesized between surface water and groundwater, **A)** during monsoon, **B)** under dry conditions.*

Aims and Methods

A.) Discharge measurements
a) setting a weir, **b)** current meter measurements

B.) Groundwater/surface water-interactions
a) piezometer transects **b)** using stable (^{16}O;^{18}O) isotopes for identifying the origin of the water, **c)** using heat as natural tracer (temperature time series from the river and piezometers)

C.) Identifying source areas of nitrate and DOC
a) network of surface water sampling points which reflect the dominant landuse types **b)** groundwater sampling.

First Impressions, Installations and Progress

A.) Discharge measurements:

a.) Weir construction: The sharp crested v-notch weir in combination with continuous measured water levels upstream the weir offers continuous discharge data at site S1.

b.) Stage-discharge relationship: Water level monitoring via pressure transducers in combination with current meter measurements at different water levels offer continuous discharge data at site S3, S4 and S5.

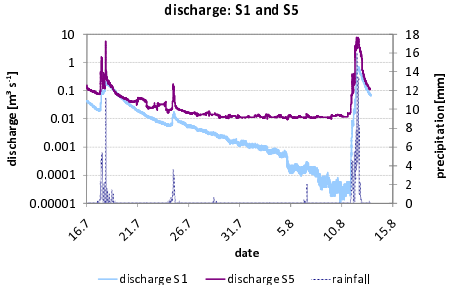

Figure 2*: First discharge data at site S1 (weir) and S5 (subcatchment outlet).*

Figure 3*: S1 weir: a) during low flow conditions, b) during high flow conditions.*

B.) Groundwater and surface water-interactions

a.) Piezometer transect: All piezometers were equipped with pressure transducer in order to gain information about the groundwater level fluctuation as well as the hydraulic potentials.

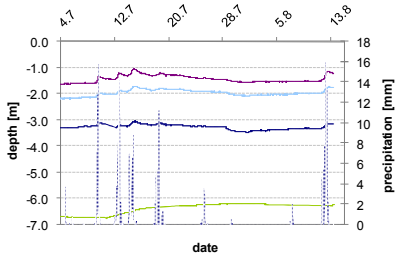

Figure 4*: S4a piezometer transect: Groundwater level fluctuations and rainfall over time.*

Table 1*: Piezometer description*

W1	close to a rice field, depth: 9.25 m, 1.0 m Screen
W2	0.5 m beside W3, depth: 7.81 m, 0.5 m Screen
W3	directly at the river, depth: 2.64 m, 0.5 m Screen
W4	close to a winery, depth: 16.10 m, 1.0 m Screen

C.) Identifying source areas of nitrate and DOC

a.) Surface water sampling: The sample locations, site S1; S2; S3; S4 and S5 are given in Figure 5. Site S1 can be seen as a reference location, since it is located in a natural system. The other sites are already influenced by the intensive agriculturally-used areas.

b.) Groundwater sampling: Since, there was no opportunity to obtain groundwater samples out of already existing wells, the wells (site S4a) of the piezometer transect were sampled.

Study Site

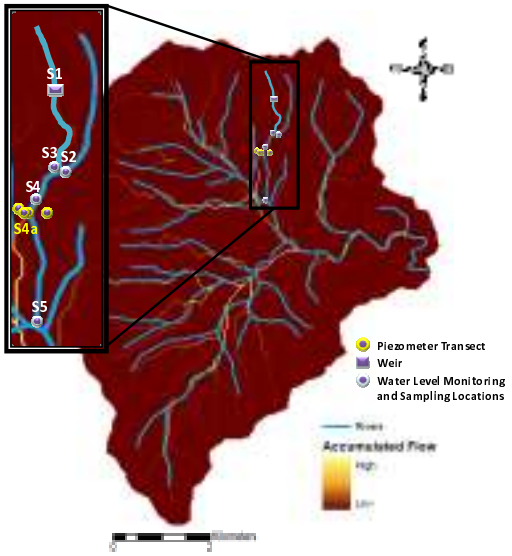

Figure 5: *Map of the Haean Catchment as well as the selected subcatchment (zoom in) including the different sites. S1: naturally vegetated forest area, S2;S3;S4;S4a: intensive agricultural used areas (rice, radish, potato), S5: subcatchment outlet, riverbed in parts concreted.*

Impressions and Outlook

A.) Discharge measurements: One of the most challenging objective within this project is to obtain continuous discharge data. The reason for this big challenge can be seen in the very large range in discharges (see Figure 2) as well as in the very high sediment freight due to the monsoonal storm events.

B.) Groundwater and surface water-interactions: As given in Figure 4 the wells W1, W2 and W3 react very fast to the storm events. Well W4 doesn't show these clear reactions. Since, the levels in the wells react incredibly fast, further analyses are needed in order to make precise conclusions.

C.) Identifying source areas of nitrate and DOC: At this point in time, we cannot give any impressions about the nitrate and DOC concentrations, since the data are not yet analyzed.

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