Water Quality of the Shinotsu Canal in the Lower District of Ishikari River Basin

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1. Introduction

Shinotsu district of Ishikari river basin is covered by paddy field, upland field, meadow, forest, and others. Cultivation is the main land-use activity in this district. Suspended sediment transport processes play an important role in the down stream environment, because fine grained sediments are important carriers of various nutrients and pollutants. Nagasawa et al. (1992) showed the mechanism of suspended sediment transport and the relationship between the behavior of suspended sediment and land use in agricultural watersheds. River water quality is generally linked with land-use in the catchment that can affect the quantity and quality of runoff during and after precipitation. Tachibana et al. (2001) reported that non-point pollution greatly influence the water quality of the Ishikari river. However, some natural and agro-environmental disasters associated with water use and quality, land use, management as well as agro-ecosystem studies on the Ishikari river still remain as major problem to be solved. Therefore, the purpose of this study are - to assess the influences to water qualities of the Ishikari river by land and water use of Shinotsu district; to determine the periodic fluctuation of suspended sedimentation rate and nitrogen content of the Shinotsu canal falls to the Ishikari river.

2. Methodology

The investigation was carried out in Shinotsu area of lower reach of Ishikari River basin, Hokkaido (Fig.1). The study was investigated from May 2006 to March 2007. Water samples were collected from the Shinotsu canal at 11 points (Fig.1) by hand. Precipitation and snow depth data were collected from AMeDAS. Suspended solids (SS) and total nitrogen (T-N) were analyzed according to JIS. SS and T-N were determined gravimetrically through suction filtration method using glass fiber filters (1 μm) and UV spectrophotometric method, respectively. Arc-View software was used for scaling the catchment area. Fig. 2a shows the catchment area.

3. Results and discussion

3.1. Periodic variations of SS and T-N concentrations

Point 1 (P1) represents the quality of Ishikari river water and P2~P11 indicate these of Shinotsu canal water. Fig. 2b shows the temporal variations in SS concentration at 11 points. SS shows high values in paddling period and low values in snow covered period with the maximum of 124 mg/L at P10 and minimum of 1 mg/L at P1. Lowest value of T-N (0.76 mg/L) found at P1 in snow covered period where, P11 indicates the maximum value (3.11 mg/L) (Fig. 2c). T-N gradually increases from P1 to P11 except P5.

3.2. Comparative study of P1 and P11

The highest SS was observed in 13th October '06 (Fig. 3b) because of previous two days 22 mm precipitation (Fig. 3a) effect especially when land was crop less. Maximum and minimum T-N was 4 and 0.58 mg/L (Fig. 3c) for P11 and P1, respectively. Interestingly, T-N gradually reaches its highest value in snow melting period where as, SS shows the opposite trend. This is because of SS is derived from surface

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runoff, land cover with snow but surplus N fertilizer was discharged into canal through drainage water. Higher N application results in greater surplus N in agricultural fields, are not absorbed by crops and discharged into drainage water.

4. Conclusions

The concentrations of SS and T-N in P11 are larger than P1. Periodic average value of SS and T-N was highest in paddling and snow melting period, respectively. Maximum SS was 127 mg/L at P11 in mid-October after precipitation. 4 mg/L was the maximum value for T-N in P10 found in February due to surplus N discharge. P10 possess 2nd largest catchment area that has a downstream water flow impact on P11. Besides this, P11 always shows larger values compared to P1. Since, P11 shows the highest values in almost every period so, there must have impact of water use and land management of catchment areas on drainage water which affects the water quality of Shinotsu canal and finally the Ishikari river.

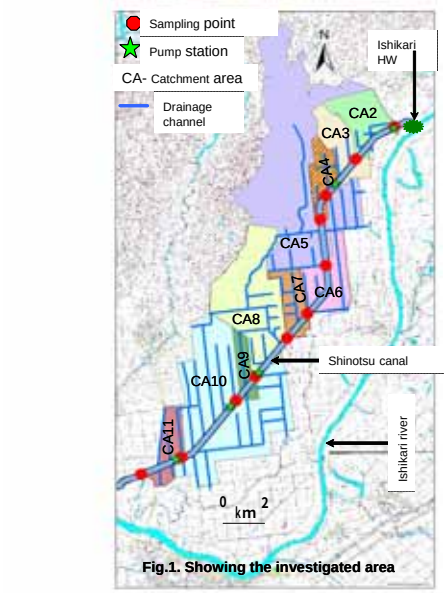

Fig.1. Showing the investigated area

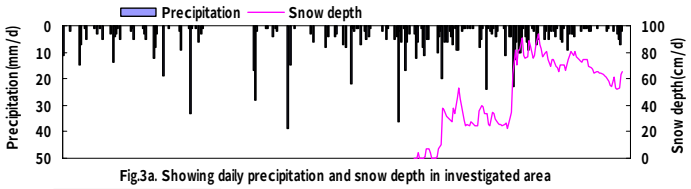

Fig.3a. Showing daily precipitation and snow depth in investigated area

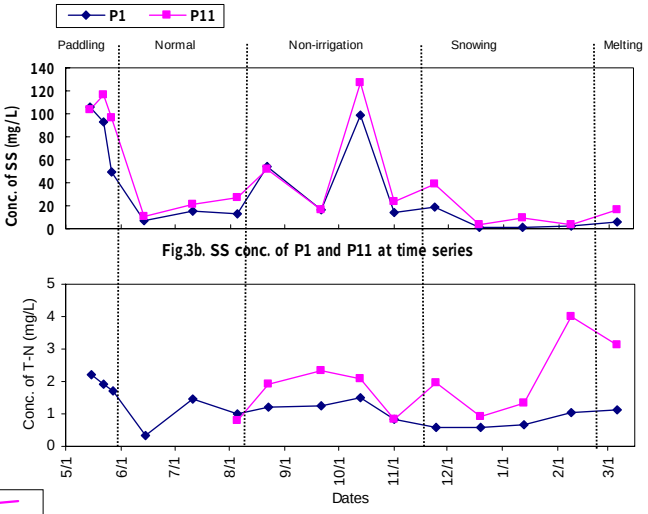

Fig.3b. SS conc. of P1 and P11 at time series

Fig.3c. T-N conc. of P1 and P11 at time series (2006-2007)

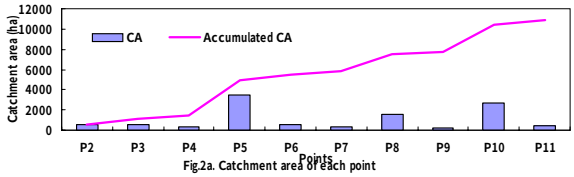

Fig.2a. Catchment area of each point

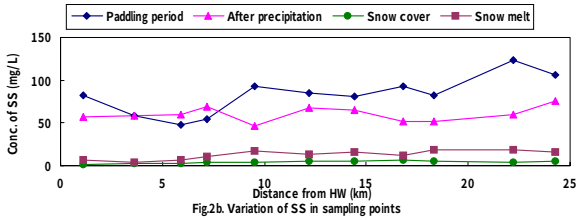

Fig.2b. Variation of SS in sampling points

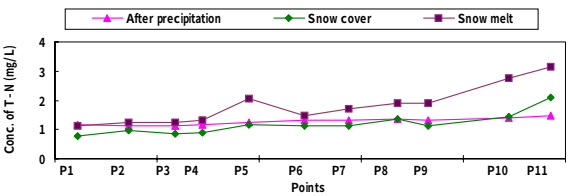

Fig. 2c. Variation of T-N in sampling points

References

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