

Runoff characteristics in accordance with the strength of first-flush in agricultural area

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Nonpoint source (NPS) pollutants are generally delivered from land to water bodies during rainfall. In agricultural areas, excessive nutrients and particulates are intensively released by various phenomena such as rainfall, snow-melting, and human activity. These can directly or indirectly cause eutrophication to river, lakes, estuaries, and coastal oceans (Dunne et al, 2005; Withers et al, 2000). The characteristics of NPS pollutant transport and mitigation should be analyzed and generalized to reduce the negative impact of NPS pollutants on fresh water system

To do this, Field experiments were conducted in agricultural area, which has homogeneous land use. First flush, as critical phenomena in the stormwater runoff, can indicate the characteristics of the storm event. The calculation method for the strength of first-flush was proposed by Rossi (2005) and can be estimated by a relation

$$F(x) = x^\beta$$

where $F(x)$ is the fraction of the total mass during a storm event, x is the fraction of the total amount of water during the storm event, and β is the adjustment coefficient.

The relation between first-flush and β can be explained as 1) $\beta < 1.0$ means that first-flush occur, 2) $\beta = 1.0$ means that NPS pollutant loads and runoff are proportional during a storm event, and 3) $\beta > 1.0$ means that NPS pollutant loads arrive predominantly towards the end of the event (Rossi, 2005).

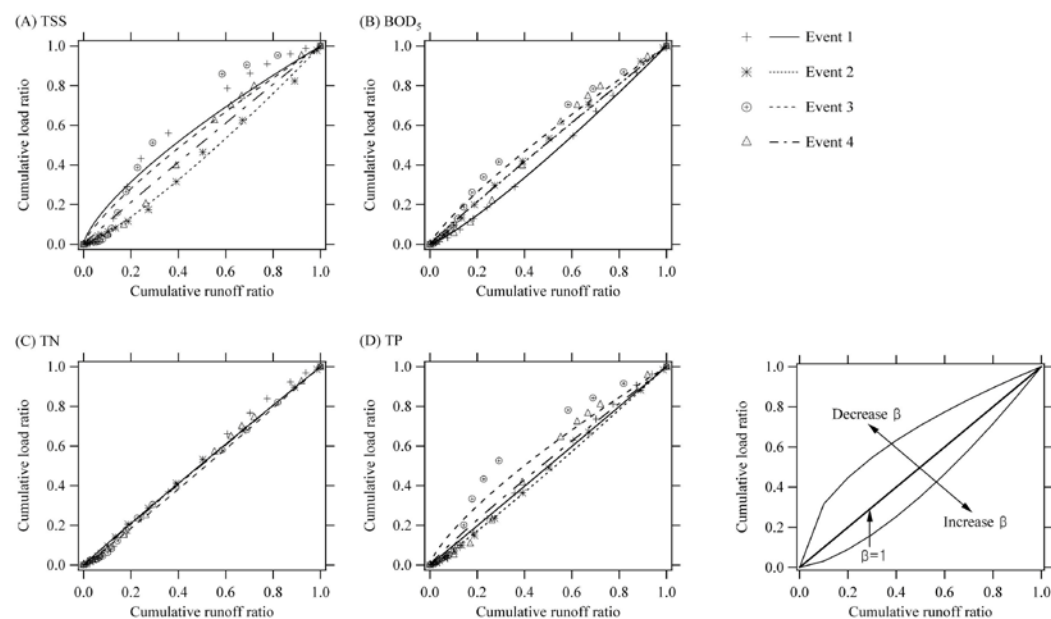


Figure 1.1 Cumulative load curves proposed by Rossi (2005) with four runoff conditions in agricultural area.

Figure 1.1 is a figure for addressing the strength of first-flush in four storm events. The β coefficients showed that TN was almost proportional to the storm volume because mean β value was 1.00. The strength of first-flush for agricultural area was elucidated in order of TSS>TP>BOD>TN

Table 1.1 NPS pollutants concentrations, EMCs of runoff conditions in agricultural area.

	TSS				BOD			
	Max (mg/L)	Min (mg/L)	EMCs (mg/L)	B	Max (mg/L)	Min (mg/L)	EMCs (mg/L)	β
Event 1	102.00	4.00	28.52	0.72	8.04	0.72	5.51	1.19
Event 2	143.00	17.00	64.52	1.23	12.54	4.52	9.33	0.96
Event 3	430.00	26.00	126.26	0.79	9.06	2.5	3.94	0.83
Event 4	64.00	13.00	40.61	0.96	10.16	3.16	7.33	0.95
Mean	184.75	15.00	64.98	0.93	9.95	2.73	6.53	0.98
	TN				TP			
	Max (mg/L)	Min (mg/L)	EMCs (mg/L)	B	Max (mg/L)	Min (mg/L)	EMCs (mg/L)	β
Event 1	21.64	3.25	17.78	0.97	0.39	0.06	0.29	1.01
Event 2	6.8	2.64	4.69	0.98	0.36	0.12	0.28	1.09
Event 3	7.15	2.12	4.27	1.05	2.5	0.2	0.48	0.75
Event 4	6.98	1.31	5.29	0.98	0.64	0.18	0.42	0.92
Mean	10.64	2.33	8.01	1.00	0.97	0.14	0.37	0.94

The factors affecting the strength of first-flush are meteorological conditions including rainfall intensity and rainfall depth, land use conditions, and soil moisture conditions. Each event has different characteristics about the factors, which means if we have enough β coefficient, it can be possible to make a group for similar discharge patterns.

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