Tongpoon Waracrut 2010: Hysteresis Loops of Relationship between Runoff Discharge and Suspended Sediment Concentration at Huai Ma Nai Sub-watershed, Phrae Province. Master of Science (Watershed and Environmental Management), Major Field: Watershed and Environmental Management, Department of Conservation. Thesis Advisor: Assistant Professor Somnimirt Pukngam, Ph.D. 89 pages.

The hysteresis loops of relationship between runoff discharge and suspended sediment concentration at Huai Ma Nai sub-watershed, Phrae province was carried out by using real time data during 2000-2008. The main objectives of this research were to determine relationship between runoff discharge and suspended sediment, hysteresis loops between runoff discharge and suspended sediment concentration of single storm and to classity of the hysteresis loops between rising limb and falling limb including study on the factor affecting to hysteresis loops both of rising and falling limb.

The result found that the relationship between monthly runoff discharge and suspended sediment was in power pattern as $SS = 0.8675R_o^{0.8184}$ when SS was suspended sediment (kg) and R_o was runoff discharge (m^3) with R^2 equal to 0.91.

The hysteresis loops of 18 total storms were classified into 4 types, i.e., 2 storms of clockwise loop occurring when rainfall amount and discharge were low to moderate, low to very high rainfall intensity, 6 storms of counter-clockwise loop when rainfall amount was moderate, very high rainfall intensity and low discharge, 7 storms of figure-eight loop when rainfall amount was low to moderate, high rainfall intensity and low discharge, and 3 storms of single line plus a loop when rainfall amount was moderate, very high rainfall intensity and low discharge.

Regarding the relationship between runoff discharge and suspended sediment concentration in each type of the hysteresis loops of rising limb and falling limb, linear and logarithm pattern, was found on the rising limb of clockwise loop, while the falling limb was in polynomial and power pattern. The rising limb of counter-clockwise loop was in exponential and logarithm pattern, falling limb was in power and polynomial pattern. The relationship of figure-eight loop was in exponential, polynomial and linear pattern both on the rising limb and falling limb. The rising limb of single line plus a loop was in the power, polynomial and exponential pattern, while falling limb was in power and exponential pattern.

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