

Problems on Sediment Transport

1. Measurements on gravel bed stream were taken. The median particle size (d_{50}) of the bed is 6mm. The coefficient of gradation (σ_g) is 3. The water temperature was measured to be 15°C. The channel characteristics are as follows: $W = 100$ meter, $h = 2$ meter and $S = 0.003$.
 - a. Calculate the angle of repose.
 - b. Using the Strickler equation determine Manning “n”.
 - c. Calculate the dimensionless grain diameter.
 - d. Calculate the shear velocity
 - e. Calculate the τ_{*c} and τ_{*s} . Is the particle in motion.
 - f. Calculate the fall velocity.
 - g. Using the diagram from class determine if the mode of transport is bed load, mixed load or suspended load.
 - h. Using the Meyer-Peter Muller unit bed load equations determine the unit bed load by volume in m^2/s , the sediment discharge by mass (SI) and the monthly sediment load by weight in English tons.

2. You are given data from the Missouri River. The particle size distribution is uniform with a particle size of 0.1 mm. The slope of the river is 0.00012, flow depth 7.8 feet, river width is 800 feet and the water temperature is 70°F. Point velocity and concentration measurements are taken and summarized in table.

| Distance from bed (ft) | Velocity (ft/s) | Concentration (mg/l) |
|------------------------|-----------------|----------------------|
| 0.7 | 4.3 | 411 |
| 0.9 | 4.5 | 380 |
| 1.2 | 4.64 | 305 |
| 1.4 | 4.77 | 299 |
| 1.7 | 4.83 | 277 |
| 2.2 | 5.12 | 238 |
| 2.7 | 5.30 | 217 |
| 2.9 | 5.40 | — |
| 3.2 | 5.42 | 196 |
| 3.4 | 5.42 | — |
| 3.7 | 5.50 | 184 |
| 4.2 | 5.60 | — |
| 4.8 | 5.60 | 148 |
| 5.8 | 5.70 | 130 |
| 6.8 | 5.95 | — |

- a. Calculate the mean flow velocity.
- b. Determine Manning n.
- c. Calculate the bed shear stress.
- d. Calculate the shear velocity.
- e. Calculate the critical shear stress (τ_c).
- f. Calculate the Shields parameter.
- g. Calculate the dimensionless particle diameter.
- h. Calculate the fall velocity.
- i. Calculate the Transport parameter T.
- j. Determine the type of bedform present using the van Rijn diagram.