I am currently using Delft3D to solve problems in my research project. I need to assess how the river channel is scoured under different conditions, such as different sediment fractions on the bed. A schematic diagram of the computational domain is shown in **Fig. 1**. The curved river shape and the bed elevation are not shown here.

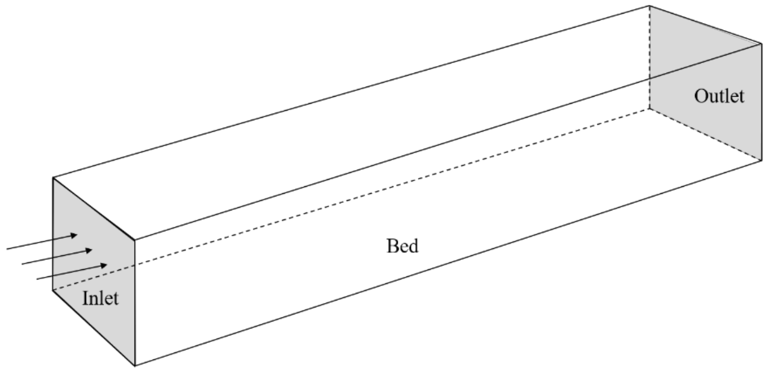

Fig. 1. schematic diagram of the computational domain.

Only Sediments Process is considered. The total computation time is 4 day, and the time step is 0.5 min.

Initial Conditions. The water level is set to be 50 m, and the concentration for all sediment fractions is zero.

Boundary conditions. There is one inlet and one outlet (**Fig. 1**). For flow conditions, a time series of total discharge condition is forced at the inlet as shown in **Fig. 2**, while a water level condition of 50 m is given at the outlet. For transport conditions, the concentration for all sediment fractions at both inlet and outlet is zero.

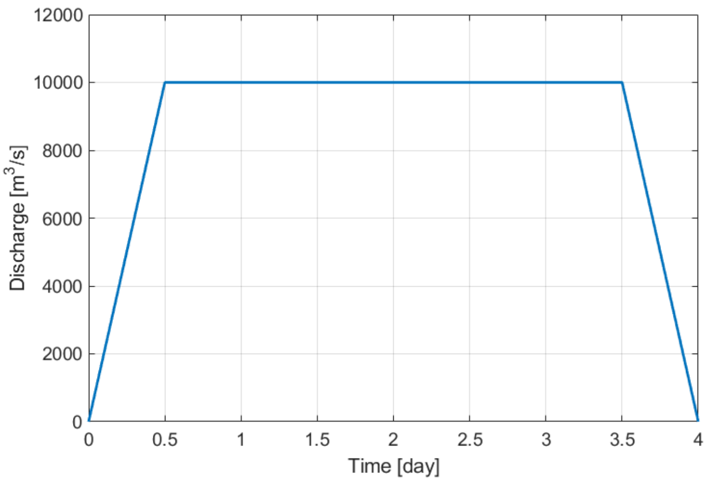

Fig. 2. Inlet flow condition.

Physical parameters. The physical parameters such as Constants, Roughness, and Viscosity are set as default. The Spin-up interval before morphological changes is zero. The only difference between the cases is the sediment parameters. All cases can be divided into two groups, i.e., group A and B (**Table 1-2**). In group A, there is only one sediment fraction, while in group B, there are two sediment fractions. For all cases, the reference density for hindered settling is 2650 kg/m^3, the specific density is also 2650 kg/m^3, while the dry bed density is 1600 kg/m^3.

Table. 1. The sediment parameters and results for cases in group A.

Case	D_{50} (mm)	Initial Thickness (m)	Total Cum. erosion/sedimentation (m^3)
A1	0.3	10	-2.55E+05
A2	1.25	10	-3.27E+04
A3	3	10	-1.22E+04
A4	5	10	-5.36E+03
A5	11	10	-5.75E+02
A6	60	10	-1.69E-02

Table. 2. The sediment parameters and results for cases in group B.

Case	D_{50} of sed1 (mm)	Initial Thickness of sed1 (m)	D_{50} of sed2 (mm)	Initial Thickness of sed2 (m)	Total Cum. erosion/sedimentation (m^3)	Cum. erosion/sedimentation of sed1 (m^3)	Cum. erosion/sedimentation of sed2 (m^3)
B1	1.25	5	0.3	5	-1.92E+05	-2.92E+03	-1.56E+05
B2	1.25	5	3	5	-2.59E+04	-1.93E+04	-4.72E+03
B3	1.25	5	5	5	-2.54E+04	-2.22E+04	-2.05E+03
B4	1.25	5	11	5	-2.87E+04	-2.77E+04	-2.44E+02
B5	1.25	5	20	5	-3.45E+04	-3.28E+04	-6.19E-04
B6	1.25	5	30	5	-4.00E+04	-3.68E+04	-5.29E-04
B7	1.25	5	40	5	-4.54E+04	-4.05E+04	-1.65E-04
B8	1.25	5	60	5	-5.56E+04	-4.70E+04	1.61E-06

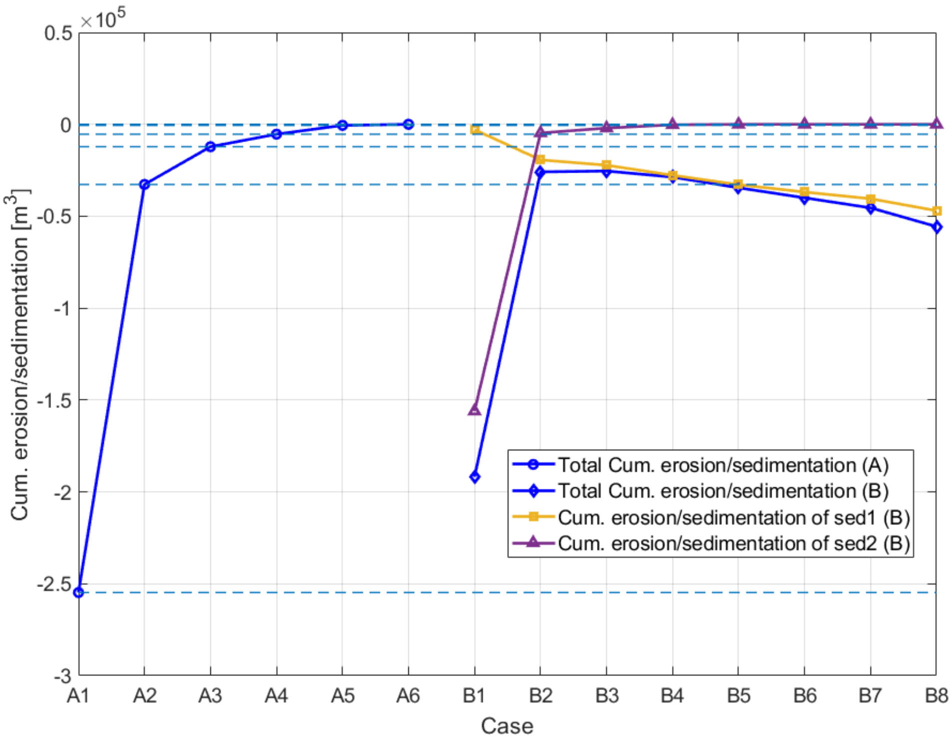

Fig. 3. Cumulative erosion and sedimentation for cases in group A and B.

I choose Van Rijn's formula (1993) to calculate the sediment transport, since it is the default option in the Delft3D and is very popular. I export the cum. erosion/sedimentation data of the final time step from QUICKPLOT and calculate the total cumulative erosion/sedimentation (CES for short) of the domain with the Integration tool in Tecplot. The results are shown in **Table 1-2** and **Fig. 3**.

As we can see, for cases A1-A6, the absolute value of CES is decreasing with the increase of sediment size (i.e., D_{50}). This is consistent with our common sense, since the coarser the sediment, the harder it is to be scoured.

Now Let's consider the cases with two sediment fractions, sed1 and sed2. The D_{50} of the two sediment fractions are D_1 and D_2 ($D_1 < D_2$), respectively. The initial thickness of both fractions is equal. Theoretically, the absolute value of CES should less than that in the case only with sed1, but larger than that in the case only with sed2. For example, the value of CES in B1 is between that of A1 and A2. However, this is not true for cases B5-B8. In B5-B8, the absolute value of CES for sed1 (D_{50} = 1.25 mm) is larger than that in A2. Since the calculation of sediment transport for non-cohesive sediment is closely related to the near-bed reference concentration, I export the near-bed reference concentration data at day 3 from QUICKPLOT and calculate the mean value in the whole domain in Tecplot, and plot the results in **Fig. 4**. It is shown that the value for cases B4-B8 is larger than that in A2. This means that for B4-B8, the near-bed reference concentration is wrongly calculated.

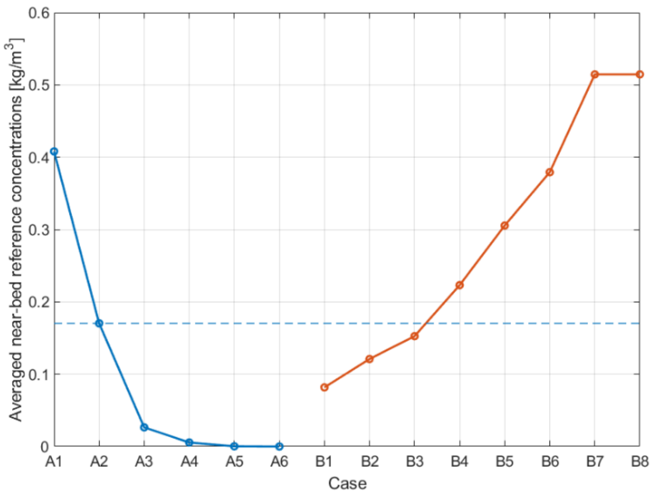

Fig. 4. Integration of near-bed reference concentration for cases in group A and B.

I could not figure out why the near-bed reference concentration is wrongly calculated, and also the CES for B4-B8 is not correct. I have read the manual carefully but this problem is not mentioned in the manual. The manual requires that the sediment diameter should be in the range 0.064 mm ~ 2 mm, but doesn't explain what would happen if the sediment diameter exceeds 2 mm. Maybe the problem is caused by too large sediment diameter is used in my case. However, in case A6, even the D_{50} is 60 mm, the result seems quite reliable. In my project, I need to use very coarse sediment to prevent scouring. So values like 60 mm for D_{50} are unavoidable. Is the problem caused by the applicability of Van Rijn's formula (1993) to coarse sediment? Could the problem be addressed if I use other formula to calculate sediment transport? Could you help me find out what's wrong with my cases? Thank you.