**Hydrodynamic Modeling with HydroHP – Problems**

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*Question 1 (10)*: Design a trapezoidal channel with, n = 0.025 sm^(-1/3), S0 = 0.1% such that the maximum flood depth at the outlet is approximately 5 m +- 0.3 m. You need to specify the bottom width and the lateral slopes. The inflow hydrograph is simulated by a Nash function (see the class material) with Qp = 150 m3/s, Qb = 2 m3/s, Tp = 1h, and Beta = 8.

*Question 2 (10)*: For the input hydrograph of the problem 2, design the channel for steady state considering the peak flow hydrograph and using Manning’s equation (kinematic wave approach). Compare and discuss results with the results of previous question.

*Hint: Apply Manning’s equation using the bottom slope and solve iteratively in excel via trial or error or with the solver (GRG non-linear, preferably).*

*Question 3 (15)*: Evaluate the sensitivity of Manning’s roughness coefficient in the channel by simulating the channel for -30%, -20%, -10%, 10%, 20%, and 30% variations from the base n of 0.025 sm^(-1/3) (e.g., n\* = n (1-30%), … n\* = n (1+30%)). Plot a chart with the percentage variation of n in the x axis and percentage variation of maximum water surface depth at the outlet. What is more sensitive, the Manning’s coefficient or the slope, for this case? Discuss your results

*Question 4 (15)*: Evaluate the sensitivity of the bottom slope for the same intervals of Question 3. Plot results for each case.

*Question 5 (50)*: Collect a bathymetry of a river of your interest (you need the cross-section). Estimate the time of concentration of the upstream catchment. Calculate the average slope of the catchment by means of a digital elevation model (see Copernicus DEM for instance). Estimate the average CN of the catchment. Using the SCS-CN method, estimate the inflow hydrograph for a return period of 100-years using a rainfall distribution method of your interest. Propagate the floodwave hydrograph of this river for a 50-km reach (assuming the same cross-section), discretized into 500-m sub-reaches. (make sure your catchment is smaller than 100-150 km2). Present the hydrographs and stages at 10, 20, 30, 40, and 50 km.