1. Is this non-vegetated river?

Reply: No, there is vegetation both inside the river main channel and in the floodplains. As we said in the first review, a much larger number of parameters would have been required in order to provide a detailed reconstruction of the flow variables, but the goal of the proposed application is simply to prove that even the use of a single parameter (Manning coefficient) allows the computation, by means of the proposed formulas and of the indirect measurement strategy, of the actual river discharge.

2. Question (5) is all about flow development along the very short model length. Are the flow parameters (velocity, TKE, bed shear stress...) reached fully development state within the modeled length? The authors need to provide evidence of longitudinal profile of flow parameters (Longitudinal velocity, TKE, bed shear stress...) along the reach. Otherwise, they need to use fully developed condition at inlet boundary (see Rameshwaran et al. 2013 section 5)

Reply: We agree with the reviewer that the use of zero gradient boundary conditions at the outlet plane would be more appropriate for our simulations. On the other hand, the CFX code does not allow to prescribe this condition at the outlet plane. In the computations we followed the reviewer strategy only in the first part, because we adjusted the velocity distribution in the inlet plane according to the result of a previous steady-state simulation. In the outlet plane we set the hydrostatic pressure distribution, and assigned zero non-orthogonal components to the velocity.
In the first revised version we have shown that the sensitivity of the discharge, computed in the middle section, is anyway very low, such doubling the length of the modeled channel would provide an increment of less than 0.2% of the computed discharge.
In the revised paper we added the following comment about the chosen boundary conditions:
"A more appropriate boundary condition at the outlet section, not available in the CFX code, would have been given by zero velocity and turbulence gradients (Rameshwaran et al. 2013)".
In order to test the achievement of the fully developed state within the first half of the modeled length the authors plotted the vertical profiles of the streamwise velocity components for ten verticals, equally spaced along the longitudinal axis of the main channel. See in Fig. 1 the plot of five of them and their location. The streamwise velocity evolves longitudinally and becomes almost completely self similar starting from the vertical line in the middle section (p5 velocity profile). This means that the boundary layer, and so the flow, is fully developed since the middle section. We expanded the computational domain further on only to show the secondary currents computed in the middle section.
In the revised paper we added the plot and the following comments:

“To compute the uniform flow discharge, for a given outlet section, CFX code is run iteratively, each time with a different average longitudinal velocity in the inlet section, until the same water depth as in the outlet section is attained in the inlet section for steady state conditions. Using the velocity distribution computed in the middle section along the steady state computation as upstream boundary condition, transient analysis is carried on until pressure and velocity oscillations become periodic.”
“In order to test the achievement of the fully developed state within the first half of the modeled length the authors also plotted the vertical profiles of the streamwise velocity components for ten verticals, equally spaced along the longitudinal axis of the main channel. See in Fig. 15 the plot of five of them and their location. The streamwise velocity evolves longitudinally and becomes almost completely self similar starting from the vertical line in the middle section.”

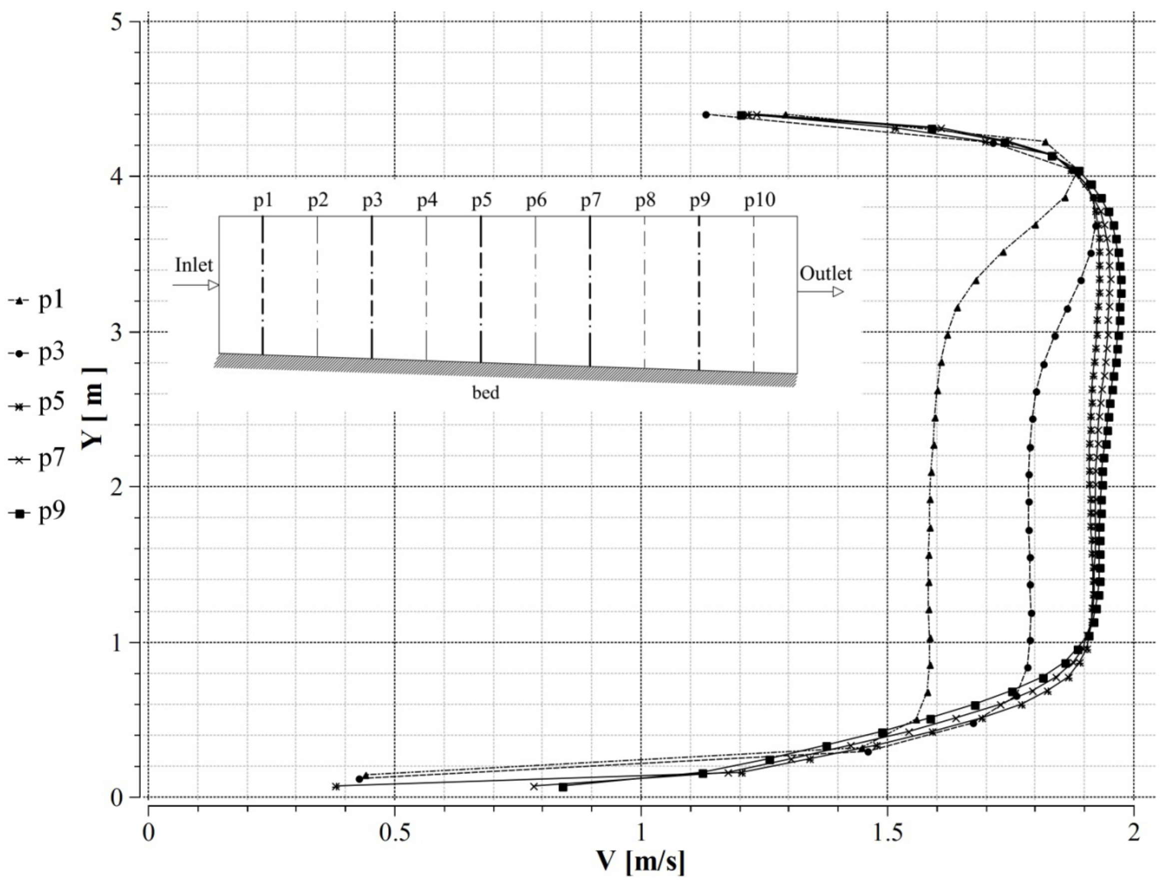

Fig. 1. Streamwise vertical profile along the longitudinal axis of the mean channel.

References

Rameshwaran, Ponnambalam; Naden, Pamela; Wilson, Catherine A.M.E.; Malki, Rami; Shukla, Deepak R.; Shiono, Koji. 2013 Inter-comparison and validation of computational fluid dynamics codes in two-stage meandering channel flows. Applied Mathematical Modelling, 37 (20-21). 8652-8672. 10.1016/j.apm.2013.07.016

3. Question (6 & 7) and answer (6 & 7): The equation can be simplified ignoring some small terms as (correct me if I am wrong): u/u*=(1/k)ln(y/0.15d50)+C where d50=0.73 m and y=0.07 - What is your y+? Using above k=0.41: u/u*= -1.091291+C The above equation is meaningless unless C is positive and greater than 1.091291. What is C? (Refer to Introduction section in Rameshwaran et al. 2011 and other papers in my earlier comments). The first term is negative in the equation because the y is too small and d50 too big. It is therefore not numerically valid to use wall function approach to model flow over gravel beds with d50 = 0.73 m (see papers in my earlier comments).

Reply: In the previous review the authors reported the logarithmic wall law used in CFX solver as it has been shown in the study of Shen and Diplas (2010):

$$\frac{u}{u^*} = \frac{1}{\boldsymbol{k}}\ln\left(\frac{c_\mu^{\frac{1}{4}} y k^{\frac{1}{2}}}{\nu}\right) - \frac{1}{\boldsymbol{k}} ln\left(1 + \frac{0.15 d_{50} c_\mu^{\frac{1}{4}} k^{\frac{1}{2}}}{\nu}\right) + C \quad (1).$$

In the ANSYS CFX theory guide the log-law is expressed as follow:

$$\frac{u}{u^*} = \frac{1}{\boldsymbol{k}}\ln(y^+) + B - \Delta B \quad (2)$$

where $\boldsymbol{k}$ = 0.41 is the Von Karman constant; $\Delta B = \frac{1}{\boldsymbol{k}} ln(1 + 0.3 {h_s}^+)$ is the function of the dimensionless roughness height ${h_s}^+$ defined as : ${h_s}^+ = \frac{h_s u^*}{\nu}$, B is a log constant equal to 5.2, $u^* = c_\mu^{\frac{1}{4}} k^{\frac{1}{2}}$and y$^+$ is the dimensionless distance from the boundary wall, defined as$\frac{y\, u^*}{\nu}$.

With appropriate substitutions we get from Eq. (2):

$$\frac{u}{u^*} = \frac{1}{\boldsymbol{k}} ln\left(\frac{c_\mu^{\frac{1}{4}} k^{\frac{1}{2}}\, y}{\nu}\right) + B - \frac{1}{\boldsymbol{k}} ln\left(1 + 0.3\frac{h_s\, c_\mu^{\frac{1}{4}} k^{\frac{1}{2}}}{\nu}\right) \quad (3).$$

Because$h_s = 0.5 * d_{50}$ Eq.(3) becomes:

$$\frac{u}{u^*} = \frac{1}{\boldsymbol{k}}\ln\left(\frac{c_\mu^{\frac{1}{4}} k^{\frac{1}{2}}\, y}{\nu}\right) + B - \frac{1}{\boldsymbol{k}} ln\left(1 + \frac{0.15 d_{50} c_\mu^{\frac{1}{4}} k^{\frac{1}{2}}}{\nu}\right) \quad (4).$$

Because Eq.(4) is equal to the Eq. (1), as observed in the previous reply, coefficient *C*is equal to *B* (equal to 5.2) and the ratio u/u* is positive.