SUPPLEMENTARY MATERIAL:

The shape of the hydrograph at Rambla de la Viuda study site

We had installed water level sensors at the study site later in year 2014. Based on these we can verify that the hydrograph shape of the study site of Rambla de la Viuda is similar to Vall d'Alba observation station (see the location of the station from the Fig. 1 of the main paper document) and that the water level is much higher at the study site than the Vall d'Alba station. Thus, these measurements prove that the discharge has to be also much higher in the study area than at Vall d'Alba. In addition, based on the roughness calculations with Limerinos equations and the model calibration results, the Qx2 discharge was the correct one to be applied in the model. Based on the Limerinos equation calculations, the Qx2 was expected to work the best due to the average nature of the derived roughnesses and inclusion of bedform and bank roughness effects.

Here you can see the evolution of water levels registered at three leveloggers (L1, L2, L6) of the study site and at Vall D'Alba gauging station in late 2014 (Fig. 1). Location of these are from North to South as follows (ETRS89, Zone 30):

- Vall D'Alba: 748701E, 4453983N
- L6: 742589E, 4446617N
- L2: 743307E, 4442078N
- L1: 743728E, 4444353N

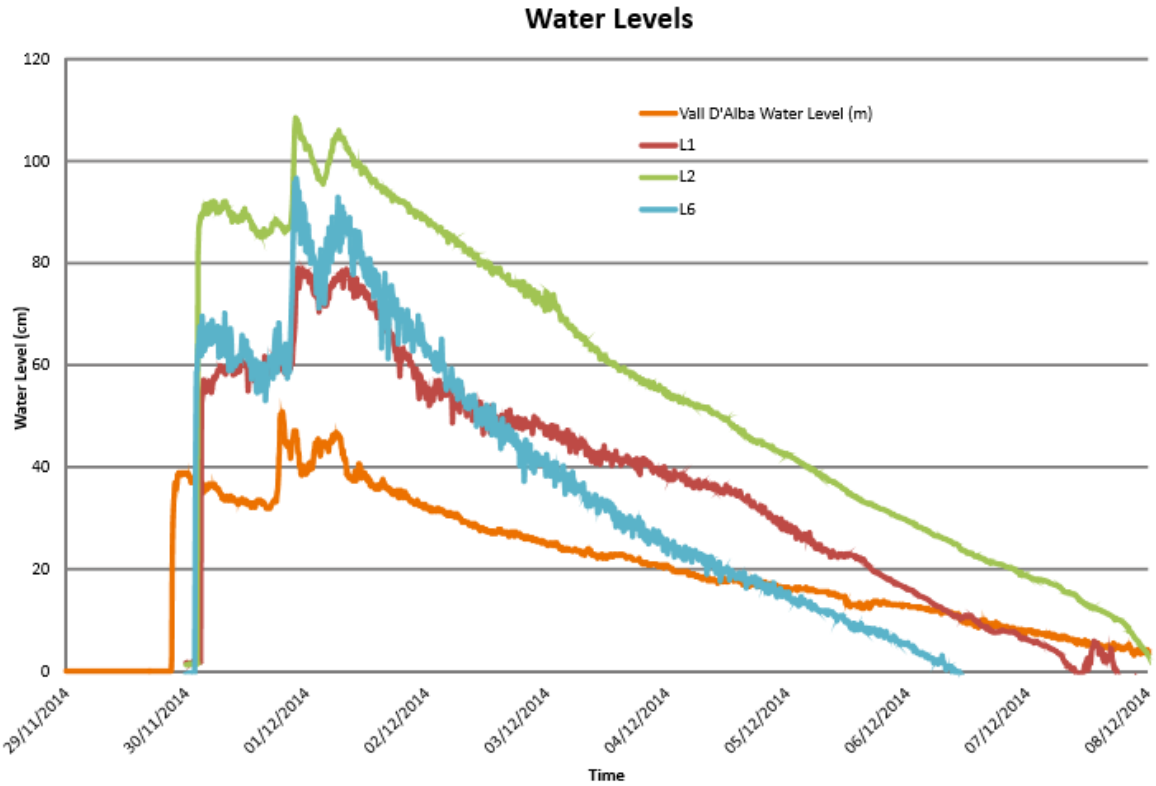

Fig. 1. The evolution of water levels registered in December 2014 at three water level sensors (Solinst leveloggers: L1, L2, L6) of the study site and at Vall D'Alba gauging station. L1 is the closest sensor to the calibration area of our study site.

The Fig. 2. shows the water level at L1, which is the levelogger located at lobes area, i.e. close to the calibration area of the morphodynamic model. Unfortunately, this is the only measurement that we have since the logger was destroyed at the following event.

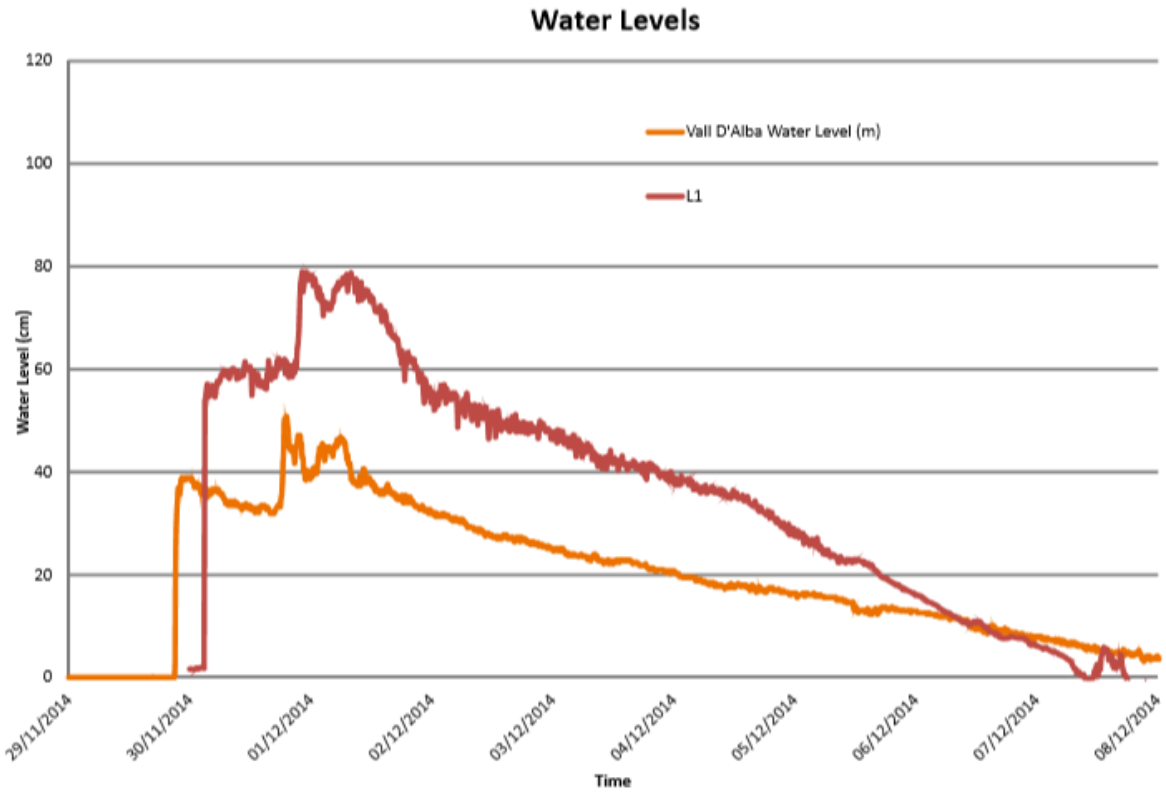

Fig. 2. The water levels of Vall d'Alba station and L1 levelogger sensor at the downstream part of the study site in December 2014.

In addition, it was possible to calculate the daily discharge curve of March 2013 event for María Cristina reservoir, which locates downstream of the study site of ours (Fig. 3 below). When comparing the March 2013 discharge peak of Qx2 discharges (Fig. 5 in the main manuscript), the resemblance to the daily discharges of María Cristina reservoir can be seen. Due to the fact that only daily data was available from Maria Christina reservoir, the curve of the reservoir is flatter than the one at the study site. Also calibration curves for the reservoir and water loss by infiltration are unclear. Despite these, we can be confident that the shape of the hydrograph at the study site was realistic and that the Qx2 discharge would be the correct discharge to apply at Rambla de la Viuda study site.

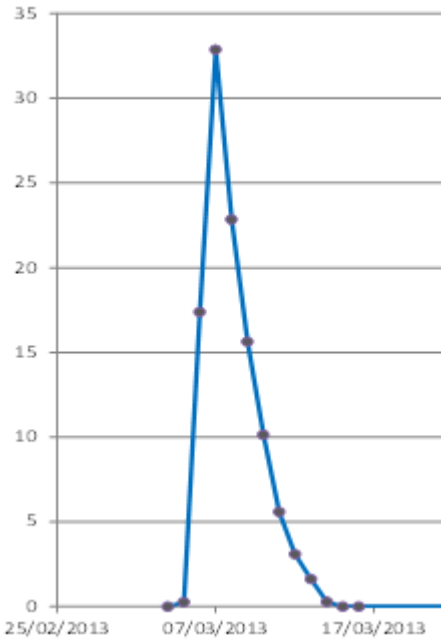

Fig. 3. Daily discharge in Maria Christina reservoir (m^3/s).