Training courses on Calibration of turbidity measurement by ADCP and Physical model with moveable bed

1. Task 1.3: Training course on calibration of turbidity measurement by ADCP

PJ: 4 PDF-documents + 11 scientific papers

The training course took place at SIWRR (Ho Chi Minh, Vietnam) from 23rd to 28th September 2016. During these five days training, the both theoretical and practical aspects has been dealt with great success.

Acoustic ADCP measurement was taught for velocity and concentration measurements during three days. General theory and equations are presented in order to point out the main parameters for an accurate measurement. The teaching of theory also focused on research questions about the inversion's principle of acoustic backscattering, for extended grading curve in particular. This sequence ended by recommending three methods to calibrate turbidity measurement by ADCP. Among those methods, one protocol was selected after discussions on available time and materials. This choice was used during the field experiments: test results were analysed further.

Day 4 was dedicated to practical aspects in field conditions (Fig. 1 and 2). A pilot site in the Mekong Delta was previously selected by the Vietnamese partners.

Figure 1: Field experiment set-up: 600 kHz ADCP (RDI) with batteries, sampling bottles

Figure 2: Acoustic turbidity training at field (27th sept 2016)

During the investigation, a boat was fully equipped to perform acoustic measurements for the velocimetry and turbidity. Water discharge was measured by navigating across the river section while acquiring acoustic data. Some of discharge measurements were interrupted due to the traffic of commercial vessel passing though the pilot site. These operations were therefore repeated several times to obtain accurate measurement.

Suspended Sediment Concentration (SSC) was measured by using two independent means in order to calibrate concentration and acoustic turbidity. For this measurements, the boat was maintained at different fixed position along the transect. At a given point, the sampling bottle technique was used to collect suspension at three depths (3, 6 and 12m). And vertical profile of acoustic backscattered signal was measurement quasi-simultaneously for same point. During the field experiment, the maximum of sampling bottle (nearly 40) was used for redundancy and to cover a wide range of concentration.

Back to the SIWRR institute, samples of suspension in bottle were immediately analysed for concentration in order to provide quickly data for the day 5. During this last day, results from bottle were considered to establish calibration law between acoustic turbidity and solid concentration. In order to extract acoustic backscattered signal to compare with concentration, or to facilitate further study, a Matlab code and an Excel sheet were prototyped to correlate both measurement.

As conclusion, the task 1.3 of WP 1 was successfully achieved, from theoretical aspects in classroom to practical training at field. The selected protocol to calibrate acoustic turbidity and concentration is relevant for the SIWRR as no extra-material as required. Supplement tools to facilitate data analysis were proposed and illustrated on field measurements. By multiplying application cases, collecting and analysing more data, the SIWRR team will become an experienced team for this technique.

2. Task 6.3: Training course on Physical model with moveable bed

PJ: 4 PDF-documents + 2 PPT-extra material

The training course took place at SIWRR (Ho Chi Minh City, Vietnam) from 29 September to 4 October 2016. During these five days training, the general principle in physical scaling with applications in Hydraulic and Sediment has been taught during 3 days in classroom. Day 4 was dedicated to a visit of SIWRR new hydraulic facilities which includes wave flume and basin. The last day focused on discussions and recommendations to organise and design the tests for the AFD-SIWRR project LMDCZ.

Theoretical aspects provided during the first 3 days consisted in dimensional analysis of a physical problem, with a focus on the theorem by Vaschy-Buckingham in particular. Different examples were used to apply the theorem or illustrate the 3 main similitudes (geometrical, kinematic and dynamic) used in mechanic. Consequence, compatibility between different (Froude, Reynolds, Strouhal, Euler) similitude were also discussed. Non-dimensional numbers used in coastal engineering were introduced as for example the Irribaren number (surf- and breaking point), the Dean or Sunamura parameters (beach morphology), the brownian particle number (transition between cohesive sediment and non-cohesive one). Most of scaling considerations for sediment concerned non-cohesive (or sand) because there are the most established. In particular classification of sediment transport by using Shields and Rouse number was proposed and discussed with a dimensional particle radius and settling velocity. Existing experiments on beach erosion by using lightweight sediment were presented with application to study submerged structure to damp wave energy.

Practical aspects of the training have been provided during the day 4 (visit) and the day 5 (visit's feedback). General aspect of wavemaker, wave gauge and process were presented. In particular, signal process and electronic were taught in order to present a rigorous method of calibration. Extra- material was prepared to explain the different parts (electrical supply, signal conditioner, filter, multiplexer) of acquisition chain.

The last day was devoted to answer questions or recommend future designs to study in the framework of the AFD-SIWRR project LMDZC. Model structures such as armoured layer, rubble mount, submerged breakwater, groynes were discussed and a preliminary working plan elaborated. By using the material of this training and performing physical tests, the SIWRR will successfully perform good investigation and become a national reference for these studies.