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Project Name: WALOWA

Notes as bullet points on data validation on Layer Thickness and Velocity

By L. Cappietti

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- 1) The present notes are intended to complement the set of general notes already reported into the two following reports (part of which have had already being corrected in the basis of the findings pointed out during the present data validation work, e.g.: errors in calibration coefficients of the WLDM sensors, errors in sensors alignments, ... ) :
  - Data storage report WaLoWa.pdf
  - ANNEX A - Test logbook.xlsxThe understanding of the present notes needs of the reading and comprehension of these two mentioned general documents. The structure of the present document is intentionally let as short bullet points waiting for the users' interactions thus postponing its finalization in due course after having received their feedbacks;
- 2) The validated set of data related to each test are saved to an asci file named: *<Testname>\_Thickness\_Velocity.txt*;
- 3) Summary notes on the quality of measurements carried out by each sensor, during each specific test, are reported into the document
  - *Postprocessing\_Layer\_Thickness\_Velocity.xlsx*
- 4) Measurements carried out by the following sub-set of the WALOWA set of sensors have been validated and saved into the data file (see point 3):
  - resistive gauges positioned along the flume: WHM02, WHM 13 and WHM14;
  - ultrasonic distance sensors on the promenade: USD1, USD2, USD3 and USD4;
  - bi-directional electromagnetic current meter positioned on the promenade: EMS-X and EMX-Y
  - resistive gauges positioned on the promenade: WLDM1, WLDM2, WLDM3 and WLDM4;
  - paddle wheel velocity meter positioned on the promenade: PW1, P2, P3 and P4;
- 5) this data validation work has been conducted by using the raw data, i.e. data file with file name extension *.raw*; it has been decided to used the raw data instead of the calibrated data, i.e. data file with file name extension *.asc* because such data are partially incorrect due to wrong setting of the calibration parameters during the test at Deltares. So, during the present work, the calibration parameters have been carefully reviewed and used to re-calibrate the original raw data;

**LABIMA - LABORATORY OF MARITIME ENGINEERING**

[www.labima.unifi.it](http://www.labima.unifi.it)

Director: Dr.-Ing. Lorenzo Cappietti, PhD, Professor of Maritime Engineering

Via Santa Marta, 3 – 50139 Firenze

Tel. +39 055 4796316 | Fax. +39 055 4796321 | e-mail: [lorenzo.cappietti@unifi.it](mailto:lorenzo.cappietti@unifi.it)

P.IVA | Cod. Fis. 01279680480



- 6) the time series measurements at each sensor (see point 4) have been processed as follow (the tasks are listed in the order of conduction of each task):
  - data calibration
  - low-pass filter (4<sup>th</sup> order butter filter has been used with cut-off frequency of 1Hz)
  - move mean filter (by using a 100 samples-wide window)
  - resampling from 1000HZ to 100 Hz
  - zeroed to the measured value collected during the still water condition.
- 7) Moreover, the EMS has needed the two following post-processing:
  - measurements during the passage of water layers less thick than 5cm (as measured by the WLDM2 sensor) have been posed equal to zero since the EMS volume of measure was 3cm above the bottom of the promenade and for correct measurements such volume must be fully surrounded by the water stream.
  - due to specific algorithm running inside the EMS electronics, the output measurements have a 0.3125 time delay, as declared by the EMS producer. The raw data has been corrected thus the validated data is synchronized with all the other sensors' output saved in the `<Testname>_Thickness_Velocity.txt` file;
- 8) The above list of tasks has been optimized in order to achieve the main valuable objective of validate the EMS measurements. The raw measurements by this sensor show very fast and strong vibrations that were probability due to the vibration of the support structure where the EMS were mounted.  
After this validation, the velocities measured by the EMS-Y match quite well the velocities measured by the PaddleWheel2 (i.e. those located much closer to the EMS);
- 9) the validated data related to each test have been saved into the ASCII file named `<Testname>_Thickness_Velocity.txt` (see point 2). Each column is related to the sensors as mentioned into the header section of the file. The sampling frequency is 100 Hz and the system of units is SI (i.e. the distances are measured in meters and the velocities are measured in m/s).
- 10) Generally:
  - the velocities at peaks as measured by the EMS-Y are a bit lower than the velocities measured by the PW;
  - the layer thickness at peaks as measured by the WLDM sensors are a bit lower than the layer thickness measured by the USD sensors;