Latvia – Lithuania

ICEREG

Training course on HEC-RAS model

Project Deliverable D2.1.3

2024

LIETUVOS ENERGETIKOS INSTITUTAS

Lietuvos hidrometeorologijos tarnyba

Contents

Abbreviations

EU	European Union
Floods Directive	EU Directive on the assessment and management of flood risks (Directive 2007/60/EC)
HEC-RAS	River Analysis System of the Hydrological Engineering Centre (USA)
ICEREG	“Ice-jam flood risk management in Latvian and Lithuanian regions with respect to climate change” project
LEGMC	Latvian Environment, Geology and Meteorology Centre
LEI	Lithuanian Energy Institute
RAS Mapper	Map viewer built-in HEC-RAS

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1. Introduction

The purpose of this Report is to assess the effectiveness of the training events carried out under Activity 2.1 “Ice-jam flood risk modeling and mapping” and Deliverable D.2.1.3 “Report on a Training course on HEC-RAS Model”. This training was organized for experts of the project “Ice-jam flood risk management in Latvian and Lithuanian regions with respect to climate change” (ICEREG, LL-00136) devoted to flood modelling for the ice-jam flood risk evaluation.

The Report contains information on the training provided, the participants’ reaction to the actual learning event, and information on the actual learning outcomes achieved by participating in the programme.

The main objective of the Training course on the HEC-RAS Model is capacity rising of the Lithuanian Energy Institute (Hydrology Laboratory) to assess the flood risk and address flood risk mapping in Lithuania as required by the EU Floods Directive.

The special training programme on HEC-RAS focused on the simulation of extreme flow-water levels and flood risk mapping using the model’s Geometry Editor & RAS Mapper. It was conducted by experts from the Latvian Environment, Geology and Meteorology Centre.

This course included a series of presentations and practical exercises on flood risk modelling & mapping.

2. Training objectives

For the training course on HEC-RAS, the following objectives were identified:

- HEC-RAS geometry and RAS Mapper;
- HEC-RAS Hydrological and Hydromorphological data for modelling;
- Steady flow modelling;
- Flood risk mapping.

3. Timeline, location, and institutional arrangements

The training course has been provided to Lithuanian experts within the frame of the ICEREG project (LL-00136). It was held in Kaunas on 18-19 June 2024.

This course was organized for the project partners that are responsible for ice-jam flood risk assessment and mapping in the pilot rivers. The participating institutions were as follows:

- Latvia: Latvian Environment, Geology and Meteorology Centre (LEGMC);
- Lithuania: Lithuanian Energy Institute (LEI).

4 experts from LEGMC and 7 experts from LEI took part in the training.

4. Discussions and training activities

On the first day, Tatjana Kolcova, Emils Rubins and Eduards Krizickis (Latvian Environment, Geology and Meteorology Centre) gave a series of presentations on the HEC-RAS model approach and software applications.

Tatjana Kolcova presented general information about the HEC-RAS Model and hydrological data (water flow, water level, hydraulic coefficients) required for the steady flow modelling.

Eduards Krizickis presented information on the model inflow data required for flood modelling, including data on initial and boundary conditions, as well as instream and lateral structures.

Emils Rubins presented the theory of model geometry, the RAS Mapper of the HEC-RAS, and provided practical testing and examples of this model based on geometry data of Lielupe & Islice rivers (Latvia).

On the second day, Eduards Krizickis presented and tested the calculation of Steady flow in the HEC-RAS model for flood risk modelling and mapping based on the Lielupe & Islice rivers.

4.1. Issues regarding the Steady Flow component of the HEC-RAS system

Presentations on the Steady flow calculation, input data and the data format led to active discussions and questions.

J. Kriauciuniene: How can we calibrate the HEC-RAS model?

T. Kolcova: In Latvia, we use the data from our monitoring stations for model calibration by comparing the modelling results with the statistical water level values from those stations. There are some possibilities for model calibration within the Steady flow data editor (H-Q curve, observed data). E. Krizickis added that we can also play with data by changing Manning coefficients (roughness coefficients of riverbed and riverbanks) to get better calibration results.

J. Kriauciuniene: What are the boundary conditions: water flow or water level?

E. Krizickis: the water discharge is the initial condition at the upper point of the modelled river, but the water level of defined probability is the boundary condition.

S. Nazarenko: What is the format of geometric data in the model?

E. Krizickis: In the 6th version of the HEC-RAS model, there is an integrated RAS Mapper which uses vector data in .shp format.

J. Kriauciuniene: Do I understand correctly that rivers exist as a linear unit? What about lakes and reservoirs?

T. Kolcova: Yes, the basic units of vector data are used – lines for rivers, polygons for lakes & reservoirs, and points for the junctions.

J. Kriauciuniene: Do you have any measured cross-section (XS) data for the HPP reservoir? Or is it only an object/polygon in the model?

T. Kolcova: In the 1D model for steady flow simulation, we have cross-sections along a reservoir. As for rivers, we can put the same initial data for lakes and reservoirs, for example, the storage area (water level-volume curve). It is not necessary to use cross-sections in the HPP reservoir, but it could be if you have flow through a reservoir and if you have changes in water levels along a reservoir or a lake.

S. Nazarenko: How to perform the interpolation out of the cross-section?

E. Krizickis: This function is built in HEC-RAS.

J. Kriauciuniene: Where can we find the projection file for Lithuania?

E. Rubins: If you have .shp data, you also have the projection file.

V. Akstinas: The boundary conditions will be only at the last point/cross-section of a river?

T. Kolcova: It is not a river, but it could be a river reach, or we can choose a sea level if a river flows into the sea. Another way is to choose the boundary conditions at a monitoring station site because we know the river water stage or calculated water level with a certain probability.

J. Kriauciuniene: Do we need only one boundary condition at the last cross-section?

T. Kolcova: Yes, practically, it's enough. We can add flow changes after each tributary as a 'Lateral inflow'. We don't need to have any cross-sections for each small tributary and to model flow there, but for the main reach, we need to design a new cross-section after the lateral inflow and to put additional flow data into the model.

4.2. Issues related to the practical testing of the model

After the presentations, E. Rubins and E. Krizickis tested the RAS Mapper and flood modelling using the example of the LV Lielupe and Islice rivers.

Questions and comments from the LT experts:

V. Akstinas: We do not have any monitoring stations in our pilot river stretches, but we can measure all the data needed for the modelling.

T. Kolcova: Yes, you are in a good situation, and you can get all the data in the field, excluding H & Q values with defined probabilities.

V. Akstinas: Once again, a question about model calibration. If we have Q & H data for each XS, can we input them all into the model?

E. Rubins: If you have all the data, you don't need to provide the modelling procedures. I mean, such detailed information is not necessary.

V. Akstinas: Can we get additional information about RAS Mapper and modelling by HEC-RAS?

E. Rubins: Yes, there are a lot of tutorials and literature on the homepage of the HEC-RAS producer. Tutorials of Stanford Gibson on YouTube are some of the best.

S. Nazarenko: If we put levees in any XS, do we have to make any changes in geometry?

T. Kolcova: Yes, in that case, we have to correct the XSs nearby, carry out the simulation again and check the result.

J. Kriauciuniene: It's good to have this training for understanding the data needs that is quite important for the planning of the field works.

5. Conclusions

All project experts showed interest in the topics of the training course and knowledge of the technical issue of flood modelling with the HEC-RAS model.

The practical work, half of which was carried out during the lectures and model testing, was based on Latvian data. After the data collection on the pilot rivers in Lithuania (cross-sections, water flow data), additional consultations on flood modelling might be necessary.

The training has shown that the LEI experts are able to assess the extreme water level values by ice-jam flood modelling in HEC-RAS.

Annex I

AGENDA

OF HEC-RAS MODEL TRAINING

18.06.2024

12:30 – 13:00	Registration, welcome coffee
13:00 – 13:20	Introduction to HEC-RAS model application
	Tatjana Kolcova, Project Manager
13:20 – 14:00	HEC-RAS input data
	Eduards Krizickis, Hydromorphology Expert
14:00 – 15:00	Lunch
15:00 – 15:30	HEC-RAS hydrology data
	Tatjana Kolcova, Project Manager
15:30 – 16:30	HEC-RAS geometry structure & data
	Emils Rubins, GIS Expert
16:30 – 17:00	Coffee break
17:00 – 18:30	Practical work on HEC-RAS geometry preparing and mapping using RAS Mapper
	Emils Rubins, GIS Expert and all other experts

19.06.2024

09:00 – 09:30	Registration, welcome coffee
09:30 – 12:00	Practical work on steady flow calculation & flood modelling using HEC-RAS model
	Eduards Krizickis, Hydromorphology Expert and all other experts
12:00 – 12:15	*Light lunch*
12:15 – 14.15	Discussions on HEC-RAS model application