

November 24-27, 2009  
Viterbo, Italy



## 1st Annual 2D Flood Modelling Workshop

by FLO-2D in collaboration with



**Hydraulics Applied Research & Engineering Consulting**

## Training Class Focus: River and Coastal Flooding

hosted by



Tuscia University of Viterbo



GIS Terrain Analysis Research Group

<http://www.gistar.org>

**Course objective:** This training course is for professionals, scientists, managers and students wishing to learn the bidimensional flood modelling software FLO-2D (<http://www.flo-2d.com/>). FLO-2D, approved by FEMA for both riverine studies and unconfined alluvial fans, is used in Italy and worldwide to simulate river overbank flooding, unconfined alluvial fan floods, urban flooding, watershed rainfall/runoff, coastal flooding, tsunamis/storm surges, and mud and debris flows. The course will also introduce the RiverFLO-2D finite modeling system for detailed analysis of river hydrodynamics, sediment transport and bed evolution. This 4-day training class, designed for both entry-level and more advanced users, will teach participants from the basics to the most advanced features of the last version of FLO-2D. A brief theoretical introduction and getting-started lessons on the FLO-2D GIS interface (day 1), followed by detailed presentations of the various model components and new features of the 2009 version also presenting recent case studies of Italian flood map updating projects (day 2 and 3), will guide participants to day 4 where they will practice applying the model on their own and discussing about results of their custom-made projects.

### Instructors

**Jimmy O'Brien**  
FLO-2D, USA

**Reinaldo Garcia**  
FLO-2D, USA

**Fernando Nardi**  
HAREC Srl, Italy  
Tuscia University GISTAR

**Giovanni Cuomo**  
HAREC Srl, Italy

### Invited speakers

Salvatore Grimaldi (Associate Professor, GISTAR, GEMINI Department, Tuscia University)  
Andrea Petroselli (Assistant Professor, GISTAR, GEMINI Department, Tuscia University)

**Course organization**  
HAREC Srl  
<http://www.harec.net>

**Contact info**  
[info@harec.net](mailto:info@harec.net)  
tel.: +39.06.4550 5971 fax: +39.06.97257990

### **About FLO-2D**

FLO-2D Software, Inc. is a private corporation with headquarters in the USA offering a number of advanced modeling tools used worldwide for flooding, hydrology, river hydraulics, sediment and pollutant transport, estuary dynamics and coastal flooding. FLO-2D models are backed by technical support, international training courses as well as consulting. FLO-2D Software is affiliated with Riada Engineering to provide flood modeling and consulting services.

FLO-2D model developers Jim O'Brien and Reinaldo Garcia will participate as course instructors.

More info at <http://www.flo-2d.com/>

### **About HAREC**

HAREC (Hydraulics Applied Research & Engineering Consulting) is an Italian private civil engineering consulting firm specializing in the research, development and application of advanced hydraulic modelling solutions for fluvial, maritime, coastal and environmental engineering design and management projects. The HAREC staff includes professionals and researchers specializing in hydrology, hydraulics, coastal and offshore engineering, fluvial and coastal geomorphology, seismic and geotechnical engineering, statistics, computer science. HAREC is partnering with FLO-2D for: FLO-2D software reselling and technical assistance in Europe / Short course organization and teaching / Programming of FLO-2D new features and model components / Developing and programming of an integrated modelling framework including both FLO-2D and HAREC ocean modelling algorithms for coastal flooding risk assessment and mapping.

HAREC team members Fernando Nardi (bidimensional hydraulic modelling and GIS expert programmer and FLO-2D Freqplot interface developer) and Giovanni Cuomo (coastal flooding expert and software developer) will participate as course instructors.

More info at <http://www.harec.net/>

### **About GISTAR**

GISTAR (Geographic Information System Terrain Analysis Research) is a research group involved in the investigation, developing and application of GIS-based terrain analysis tools for hydrologic and geomorphic models. Since 2004 GISTAR group members and partners have organized workshops and conference special sessions at the national and international level promoting, teaching and distributing state of the art GIS-based terrain analysis tools for hydrogeomorphic applications.

Prof. Grimaldi and Petroselli, from the GISTAR group, will participate to this short course as invited lecturers.

More info at <http://www.gistar.org/>

### Venue and Location

Università degli Studi della Tuscia di Viterbo.  
Facoltà di Agraria, Dipartimento GEMINI - Via  
S.Camillo de Lellis, s.n.c., Viterbo (Italy).  
Detailed instructions for reaching the classroom  
will be posted at  
<http://www.harec.net/courses/flo-2d2009.html>

### Accommodation

The Best Western Hotel\*\*\*\* of Viterbo  
(<http://www.hotelviterbo.com>) is offering  
special rates for course participants. Please  
visit <http://www.harec.net/courses/flo-2d2009.html>  
for further information and  
contact info.

### Course Language

Lectures and labs will be taught in ENGLISH.  
Real time language interpretation and  
translation will be provided by HAREC Italian  
instructors for participants with limited English  
comprehension skills. Course material  
(presentations, hands-on, lab exercises etc) will  
be provided both in English and Italian.

### Course Tuition

The course fee is € 1000,00 (one thousand  
Euro) [+20% VAT (I.V.A.) to be added for Italian  
participants]. **Students** (PhD, graduate and  
undergraduate) will receive a **30% discount** on  
the full fee. The fee also includes:

- 30 days evaluation copy of FLO-2D v2009
- free update to FLO-2D v2009 for v2007 users
- CD with course material (presentation and  
hand-outs) in both English and Italian
- language assistance for participants with  
limited English comprehension skills
- PC, laptops and any other software needed for  
performing the labs
- special discount for existing (v2006 or earlier)  
and new users as here below specified.

### FLO-2D Software discounts

FLO-2D model discounts of 50% for new users  
(or users from v2006 and earlier) purchasing  
the v2009 or the new components (e.g.  
FreqPlot, DIFIRM, etc). RiverFLO-2D models will  
be discounted of 25%.

### Registration deadline

Please apply by **October 30th**.

Early application discount: 10% off for those  
applying by October 1st (for non-students only).

### Maximum capacity (30 participants)

Please consider that your application can be  
rejected when the course maximum capacity is  
reached.

### Payments methods

Money transfer to HAREC bank account.  
Intesa San Paolo Bank, Via Gregorio VII, 380,  
00165 Rome, Italy.

From Italy:

IBAN: IT81B0306903217100000002282

Total due: € 1000,00 + IVA 20%

For international participants:

BIC: BCITITMM

Bank account # 100000002282

Total due: € 1000,00

### How to register

Please download and fill the application form at  
<http://www.harec.net/courses/flo-2d2009.html>  
and send it, attaching a receipt of the money  
transfer, by email to [info@harec.net](mailto:info@harec.net) or by fax to  
+39.06.97257990. Italian public employees  
that won't be able to have the money transfer  
processed in time may contact the organization  
committee to arrange for accepting a different  
proof of payment.

### Cancellation Policy

Full refunds will be given for cancellations made  
by October 30th. Cancellations made after this  
time will attract a 50% penalty. Cancellations  
made less than 48 hours prior to course  
starting date will not be refunded at all.

### Course cancellation

A minimum number of participants is required  
for the course to be confirmed. If the minimum  
number is not reached the course is cancelled  
and 100% of the tuition will be refunded.

## Course AGENDA

*Primarily 'hands-on' computer session times are highlighted in blue.*

*Most presentations have some 'hands-on' activities.*

*Invited lectures are highlighted in green.*

### Day 1: Tuesday, November 24, 2009 Introductory Sessions and Urban Flooding

- 9:00 – 9:15** Intro by Prof. Salvatore Grimaldi (Head of GEMINI Department from Tuscia University). Check-in and introductions by instructors and participants.
- 9:15 – 10:30** FLO-2D model overview, new features in FLO-2D Version 2009 and grid size selection. (Instructor: Jim O'Brien)
- 10:30 – 11:00** Introduction to the Grid Developer System GDS. (Instructor: Reinaldo Garcia)
- 11:00 – 11:15** Break
- 11:15 – 12:00** Hands on session 1: Using the GDS to import and edit terrain elevation data, filter elevation point data, establish a grid system, work with aerial images, setup hydrographs and run the FLO-2D model. (Instructors: Reinaldo Garcia, Fernando Nardi)
- 12:00 – 13:00** Discussion of routing algorithms and stability criteria. (Instructor: Jim O'Brien)
- 13:00 – 14:00** Lunch
- 14:00 – 14:45** Flood hydrology, rainfall and inflow hydrographs. Volume conservation. Unconfined hillslope and river flooding. (Instructor: Jim O'Brien)
- 14:45 – 15:00** Introduction to lab session 2.
- 15:00 – 16:00** Hands on session 2: Work with floodplain attributes. Edit model components and layer attributes including Manning's n-values from shape files. (Instructors: Jim O'Brien, Fernando Nardi)
- 16:00 – 16:15** Break
- 16:15 – 18:00** Hands on session 3: Urban flood details. Set up streets buildings, levees, and infiltration parameters. (Instructors: Jim O'Brien, Fernando Nardi)

**Day 2: Wednesday, November 25, 2009**  
**River flooding: Channel and Floodplain Flow Exchange – Levees**

- 9:00 – 10:00** Channel flood routing overview. Channel/floodplain exchange – return flow. (Instructor: Jim O'Brien)
- 10:00 – 11:00** Overview of GDS tools river channel tools. Introduction to lab session 4. (Instructor: Reinaldo Garcia)
- 11:00 – 11:15** Break
- 11:15 – 13:00** Hands on session 4: Starting the channel from scratch using the GDS. Editing and interpolating the channel cross section data using PROFILES. (Instructors: Reinaldo Garcia, Fernando Nardi)
- 13:00 – 14:00** Lunch
- 14:00 – 15:00** Channel routing problems: What to look for? NOFLOCs, channel profiles, n-values, surging. Using hydraulic structures in the urban environment: weirs, bridges and culverts for rivers and floodplains. Outflow control. (Instructor: Jim O'Brien)
- 15:00 – 16:00** Modeling levees and levee breach, safe storage and levee fragility curves. (Instructor: Jim O'Brien)
- 16:00 – 16:15** Break
- 16:15 – 17:00** Hands on session 5: Import a HEC-RAS project and channel segments in FLO-2D. Reviewing the channel output files and results with the HYDROG and PROFILES programs. Editing the bank elements. (Instructors: Jim O'Brien, Fernando Nardi)
- 17:00 – 18:30** Modeling detailed river flows in 2-D using RiverFLO-2D finite element modeling system. (Instructor: Reinaldo Garcia)
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**Wednesday evening**  
**FLO-2D community**  
**social event**

**Day 3 part 1: Thursday, November 26, 2009  
Updating river flood maps in Italy using FLO-2D**

- 9:00 – 9:45** Map modernization using 2D flood modelling in Italy (Instructor: Fernando Nardi)
- 9:45 – 10:15** Hydrologic data (rainfall and discharge) frequency analysis using FreqPlot. Probability distribution plots. Introduction to lab session 7. (Instructor: Fernando Nardi).
- 10:15 – 10:30** Hands on session 7: FreqPlot: Computing return period rainfall and flood discharge. Selecting the best fitting distribution curve using FreqPlot. (Instructor: Fernando Nardi).
- 10:30 – 10:45** Break
- 10:45 – 11:45** Characterizing the design hydrograph for 2D flood modeling in ungauged basins implementing advanced GIS-based terrain analysis tools (Invited speakers): Prof. Salvatore Grimaldi / Prof. Andrea Petroselli
- 11:45– 12:15** Application of FLO-2D for updating flood maps in Italy: case studies (Instructor: Fernando Nardi)
- 12:15 – 13:00** Hands on session 6: MAPPER I: Graphical display of flow depths and velocities. Generate shaded contour maps. Import aerial photos, customize layers, create shape files, view flood animations, generate profile cuts, and flow depth and velocity vs. time plots. (Instructors: Reinaldo Garcia, Fernando Nardi)

**Day 3 part 2: Thursday, November 26, 2009  
Coastal flooding**

- 14:00 – 14:45** Introduction to coastal flooding: Storm surges and tsunamis. (Instructors: Giovanni Cuomo, Jim O'Brien)
- 15:30 – 16:15** HAREC numerical models for tsunami generation and propagation. (Instructor: Giovanni Cuomo)
- 16:15 – 16:30** Break
- 16:30 – 17:15** Toward an integrated coastal-inland flood modelling framework: integrating FLO-2D with HAREC ocean wave and tsunami modelling software. (Instructors: Giovanni Cuomo, Jim O'Brien)
- 17:15 – 18:00** Hands on session 8: Storm surge modelling in urban areas using FLO-2D. (Instructors: Jim O'Brien, Giovanni Cuomo, Fernando Nardi)

**Day 4: Friday, November 27, 2009  
Project Review and Flood Hazard Mapping**

- 9:00 – 10:15** Troubleshooting. Is the flood simulation running ok? Solving common problems with flood routing. Volume conservation, numerical surging, sticky grid elements, underestimated n-values. (Instructors: Jim O'Brien)
- 10:15 – 11:00** Hands on session 9: MAPPER II – Hazard mapping and damage assessment in the urban environment. (Instructors: Reinaldo Garcia, Fernando Nardi)
- 11:00– 11:15** Break
- 11:15 – 13:00** Hands on session 10a: Project Workshop: Complete project from start to finish.
- 13:00 – 14:00** Lunch
- 14:00– 16:00** Hands on session 10b. Project Workshop: Complete project from start to finish.
- 16:15 – 17:15** Project Review and discussion of results. Troubleshooting, issues and performances. Presentation of custom projects.
- 17:15 – 18:00** Project Review and Project Conceptualization. What is important and what is not? Component details – what to look for. Final Question & Answer session.