



2nd IWHS - 2015

2nd International Workshop on Hydraulic Structures: Data Validation

Hydraulic Structures Technical Committee
of the International Association for Hydro-Environment
Engineering and Research (IAHR)

Coimbra, Portugal
May 7-9, 2015



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Welcome to IWHS 2015

Hydraulic structures located in rivers, in coastal areas and even in pipes or overland drainage systems, condition the flow behaviour, affecting turbulence as well as sediment transport, water quality, air entrainment and chemical aspects. Flow processes are inherently complex, offering challenges in their observation, understanding, and prediction. Their study in recent years has been supported by a development of monitoring equipment and instrumentation used in experimental facilities within different scales, and in prototype applications. There has also been significant progress in numerical model applications and tools to produce improved meshes and allow enhanced plots. These recent advances in both numerical and instrumentation techniques motivated the Hydraulic Structures Technical Committee (HSTC) of IAHR to organise a workshop aiming to collect several studies on different flows and different hydraulic structures focus on flow patterns and validation of data using different investigation techniques.

The Workshop, held on 7 to 9 May 2015 in Coimbra, Portugal, is the 2nd International Workshop which belongs to a wish list of workshop series organised by the Hydraulic Structures Committee of IAHR in partnership with other institutions and with 2 years' interval. This specific workshop called Data Validation aimed to contribute to a data base collection on the characterisation of different hydraulic structures that could facilitate future uses and applications, simulations and predictions and to share different experiences related to different types of hydraulic structures studies from experimental facilities, from prototypes and from numerical models and also to discuss issues related to hydraulics and fluid mechanics, modern tools and technical sustainability of engineering applications.

Rita Fernandes de Carvalho
(Chairman, LOC)

Workshop themes

In total, 20 papers from 11 countries will be presented in the fields of:

- Spillways and Weirs,
- Intakes and Gates,
- Hydraulic Jumps and Stilling Basins,
- Scour Protection Structures,
- Alteration of regimes,
- Breakwaters and Seawalls,
- Coastal Scour.

Committees

Hydraulic Structures Technical Committee (HSTC) Leadership Team (IAHR)

Robert Janssen (chair)	Bechtel Corp., Australia
Blake Tullis (vice-chair)	University of Utah, USA
Stefano Pagliara (past-chair)	University of Pisa, Italy
Michael Pfister	EPF Lausanne, Switzerland
Daniel B. Bung	FH-Aachen, Germany
Rita F. Carvalho	University of Coimbra, Portugal
Sébastien Erpicum	University of Liège, Belgium

Local Organising Committee

Rita F. Carvalho	University of Coimbra, PT
José Abreu	University of Coimbra, PT
Jorge Leandro	Univ. Coimbra, PT & Ruhr-Univ. Bochum, GER
José Dias da Silva	EDP – Energia e Produção, Porto, PT
Mário Samora	APRH – Hydroenergy S.C., Lisboa, PT
Pedro Lopes	University of Coimbra, PT
Lourenço Sassetti	LNEC, Lisboa, PT

International Scientific Committee

Stefano Pagliara	University of Pisa, Italy (Chair)
Blake Tullis	Utah State University, USA
Daniel B. Bung	FH Aachen, Germany
Fabián Bombardelli,	University of California, USA
Hubert Chanson	The Univ. of Queensland, Australia
Jorge Matos	University of Lisbon – IST, Portugal
Martí Sánchez-Juny	Univ. Poli. Catalonia, Spain
Michael Pfister	EPF Lausanne, Switzerland
Rita F. Carvalho	University of Coimbra, Portugal
Robert Boes	VAW - ETH Zürich, Switzerland
Robert Janssen	Bechtel Corporation, Australia
Rodrigo Maia	University of Porto, FEUP, Portugal
Sébastien Erpicum	University of Liège, Belgium
Teresa Viseu	LNEC, Lisbon, Portugal
Youichi Yasuda	Nihon University, Japan

Programme

Time	6 th May Pre-Workshop Seminar		Time	7 th May Workshop		Time	8 th May Workshop		Time	9 th May
09:00 - 09:30	Registration		09:00 - 09:30	Registration						
09:30 - 10:10	CFD	Rita F. Carvalho <i>“Introduction to CFD - solvers”</i>	09:30 - 10:00	Opening Session						
10:10 - 10:45		Pedro Lopes <i>“Basics of Mesh generation”</i>	10:00 - 10:45	Keynote 1 Gavin Tabor <i>“Application of OpenFOAM to Modelling Hydraulic Structures”</i>		10:00 - 10:45	Keynote 2 José Barateiro <i>“Too big or not too big... Big-data challenge in hydraulic structures applications”</i>			
10:45 - 11:15		Ricardo Martins <i>“Post-processing with ParaView”</i>	10:45 - 11:15	Invited Presentation 1 José Dias da Silva <i>“EDP’s hydroelectric activity in Portugal. New projects and the hydraulic- operational safety control of the existing dams”</i>		10:45 - 11:15	Invited Presentation 2 Alexandre Santos <i>“The use of UAV for Hydraulic Structures Observation”</i>			
11:15 - 11:30	Coffee break		11:15 - 11:40	Coffee break		11:15 - 11:40	Coffee break			
11:30 - 13:00	CFD	Raul Martín Truchado <i>Flow-3D®</i>	11:40 - 13:00	Technical Session 1 Ch2 – 4pres		11:40 - 13:00	Technical Session 4 Ch5 – 4pres			
13:00 - 14:00	Lunch		13:00 - 14:00	Lunch		13:00 - 14:00	Lunch			
14:00 - 15:30	IT	Pedro Agostinho <i>“ADV Nortek Vectrino demonstration” Qualitas Instruments</i>	14:00 - 15:20	Technical Session 2 Ch3+4 – 4pres		14:00 - 15:20	Technical Session 5 Ch7 – 4pres			
15:30 - 16:00		Lino Marques <i>“Bubble Sensor & Velocity Sensor”</i>	15:20 - 16:00	Technical Session 3 Ch8 – 2pres		15:20 - 16:00	Technical Session 6 Ch6 – 2pres			
								7:00 - 20:00		Technical Visit to Foz Tua Dam and Sabor Dam

16:00 - 16:30	Coffee break		16:00 - 16:30	Coffee break		16:00 - 16:30	Coffee break	
16:30 - 17:00	IT	Rita Carvalho “Image Processing”	16:30 - 16:45	Free presentations		16:30 - 16:45	Free presentations	
17:00		Rui Lima “Applications of Infrared Thermography”	16:45 - 17:30	Discussion TS1, TS2, TS3		16:45 - 17:30	Discussion TS4, TS5, TS6	
17:00 - 17:15	Closing Pre-Workshop		17:30 - 17:45	IAHR Young Professional Network Portugal Session		17:30 - 17:45	Closing Session	
17:15	Kayaking					18:30	Visit to Joanina Library	
19:30 - 21:00	Ice Breaker Reception		20:00	Young Professional Dinner Event		20:00	Workshop Dinner	

Kayaking

17:15 – Meeting point at Department of Civil Engineering (Main Entrance), Coimbra;

Ice Breaker Reception

19:30 - Meeting point Sereia Garden for Ice Breaker Reception, Coimbra; (Consult the Map);

Visit to Joanina Library

18:00 – Meeting Point at DEC, Polo II or 18:30 – Univ. of Coimbra, Polo I (Consult the Map)

Workshop Dinner

20:00 – Meeting point at Machado de Castro Museum (Close to University of Coimbra – Polo I).

Technical Visit Schedule:

07:00 – Meeting point at Department of Civil Engineering (Main Entrance), Coimbra;

07:10 – Stop in front of Ibis Hotel, Coimbra;

10:00 - Arrival at Foz Tua Dam with a short presentation;

11:00 – Visit to Foz Tua Dam;

13:30 – Lunch;

15:00 – Departure for Sabor Dam;

16:00 – Arrival at Sabor Dam and Visit;

17:30 – Departure to Coimbra;

20:00 – Arrival in Coimbra;

Detailed Programme

Keynote 1

Thursday, 7th May 2015

10:00 – 10:45

Gavin Tabor

University of Exeter, UK

“Application of OpenFOAM to Modelling Hydraulic Structures”



Gavin Tabor is a member of the Informatics Research Institute (IRI). He graduated from Christs College Cambridge in 1990 with a 1st in Theoretical Physics, then did a Ph.D. in Theoretical Astrophysics at the Department of Physics at Oxford. Changing both location and research area, he then worked as a RA in Prof. David Gosman's research group at Imperial College, London, for 5 years. During this time he worked on Computational Fluid Dynamics (CFD) of multiphase flows and the modeling of premixed turbulent combustion, and contributed towards the CFD code now known as OpenFOAM. He was appointed as a lecturer at Exeter in October 1999. He is a member of the Institute of Physics.

ABSTRACT: OpenFOAM is a fully-functioned Open Source Computational Continuum Mechanics (CCM) code library written in C++ and originally developed for Computational Fluid Dynamics (CFD). Technically it is a C++ class library of classes covering all aspects of CFD; mesh manipulation, tensor field algebra, calculus using the Finite Volume method and solution of implicit partial differential equations. At the top level it is designed to provide a pseudo-mathematical' syntax for modeling PDE's which can be treated as a high level programming language for writing CFD (and more generally CCM) codes. In addition the standard distributions contain pre-written codes solving most standard CFD problems (including turbulent flow, free surface and multiphase flow) and it is perfectly possible to use it as a 'black box' code with capabilities similar to or exceeding those of commercial multipurpose codes. In this Keynote presentation I will outline the capabilities and key features of OpenFOAM and present key benefits of using OpenFOAM in both academic and industrial environments. Following on from this I will present results from academic and industrial projects in the water systems area, including work on simulation of vortex flow controls, runoff from roadways into gullys, and air entrainment in stepped spillways; and look at future work at Exeter using OpenFOAM to investigate hydrodynamic scour behind bridges.

Keywords: Computational Modelling, Computational Fluid Dynamics, Open Source software

Keynote 2Friday, 8th May 2015

10:00 – 10:45

José Barateiro

LNEC & NOVA Information Management School, Portugal

“Too big or not too big... Big-data challenge in hydraulic structures applications”

Jose Barateiro is a researcher at Information Technology in Civil Engineering Unit at the Portuguese National Laboratory for Civil Engineering and an Invited Professor at Universidade Nova de Lisboa, responsible by courses on information systems, computer networks and security. His research interests focus on information systems, information management, information security and business intelligence, as well as specialized technologies applied to the civil engineering domain. From his research track, he worked in several European funded research projects and is author of more than 40 scientific publications with referee. He is also responsible by information and technology projects applied to the civil engineering industry.

ABSTRACT: As originally explained by Jim Gray, the world of science is changing to an era where data can drive research in multiple fields. In fact, the beginning of science was experimental, and then highly theoretical with Newton's, Maxwell's, etc. laws and equations. Then, many problems grew very fast, making them so complex to be analytically solved that researchers started to simulate solutions. These simulations drove the research in multiple fields during the last decades. Nowadays, gathering data that describe scientific events is much easy, allowing scientists to run their processes on top of data-intensive systems, facing new challenges related to data volume, velocity and variety (the 3 Vs of big data). In fact, data intensive processing is used to verify/validate existing knowledge, but also to produce new knowledge, represented by complex relations and data dependencies, that would be impossible to produce with traditional research paradigms. The civil engineering domain in general, and hydraulics in particular, can also take advantage of big datasets produced by monitoring sensors and simulations, being capable to generate high-quality results and running data-intensive algorithms that would fail in a traditional (non-big-data) environment. This talk will follow a top-down approach, presenting the main technical challenges and solutions in big data applications for any domain. It will clarify and distinguish the use of high performance computing (HPC), high-throughput computing (HTC) and big data. The fundamental technical concepts are then used to motivate real examples in scenarios and applications where the Portuguese National Laboratory for Civil Engineering is an important stakeholder, from both the engineering and technological perspective.

Keywords: Big Data, Science Paradigms, High Performance Computing

Invited Presentation 1Thursday, 7th May 2015

10:45 – 11:15

José Dias da Silva

EDP – Energy of Portugal, Portugal

“EDP’s hydroelectric activity in Portugal. New projects and the hydraulic-operational safety control of the existing dams”

José Dias da Silva is a Civil Engineer, graduated in 1976 by the Engineering Faculty of Porto University, Portugal. From 1976 to 1988 he worked as teacher assistant in the Hydraulics Department of the same Faculty. In 1979 he joined EDP where is, since 1989, head of Hydraulic and Water Resources Department of EDP Produção (now in Dams Engineering Division). Between 2008 and 2012 he was also technical coordinator of Fridão Hydroelectric Project. He has thirty five years of experience in the fields of hydrology and hydraulic studies, having been involved in the main hydroelectric or multipurpose projects developed by EDP since 1979. He is author or co-author of about thirty papers in the above mentioned fields.

ABSTRACT: EDP – Energias de Portugal, S.A. is a major European operator in the energy sector, one of the largest in the Iberian Peninsula, the largest Portuguese industrial group and the third worldwide largest producer of wind energy. EDP has a significant presence not only in the electricity sector - generation, distribution and trading – but also in the gas sector in the Iberian Peninsula. In 2007 the company initiated an ambitious hydroelectric construction program in Portugal comprising five repowering projects and four new schemes, which includes the construction of seven dams and eleven powerhouses and the installation of Seventeen generation units, eleven of which are reversible. In the first part of this communication, after a brief reference to the strategic importance of hydroelectricity in Portugal and the rationale for the growth program undertaken by EDP, a general description of the mentioned projects will be presented. Besides the construction of new schemes, safety of the existing dams has always been a matter of special concern for EDP. The hydroelectric power generation system of EDP, in Portugal, includes more than 50 dams in operation, which cover virtually all the structural types and a wide range of heights and reservoirs volumes, built from the end of the 1920’s to the beginning of the 2000’s. The design and construction of 43 of such dams were concluded before the publication of the new Portuguese Dam Safety Legislation (PDSL), in the beginning of the 1990’s. In order to meet the requirements of the PDSL in what concerns the hydraulic-operational safety assessment of each of these 43 existing dams, EDP defined and implemented, from the end of the 1990’s, a wide program of studies and measures. This program comprises two phases:

- The first one includes the review of the extreme flood scenarios, a suitability analysis of discharge devices and the outline of eventual corrective structural or nonstructural measures;
- The second phase, undertaken after approval of the previous one by the Portuguese Water Authority, consists in the design and/or implementation of the envisaged corrective measures.

These studies were already developed for 31 of those dams. Regarding spillways suitability, non-structural corrective measures were proposed for 16 dams and corrective structural for other 8 dams. The most relevant of these corrective structural measures refer to the Paradela, Salamonde and Caniçada dams, in each of them it was found to be necessary to construct a new spillway to complement the existing discharge capacity. In the second part of this communication, after a short reference to the main conclusions of the above mentioned hydraulic-operational safety control studies, special emphasis will be done to the main features of the complementary spillways designed and already constructed (Paradela and Salamonde) or under construction (Caniçada).

Keywords: Hydroelectric schemes, dams, spillways, hydraulic-operational safety assessment.

Invited Presentation 2Friday, 8th May 2015

10:45 – 11:15

Alexandre Santos

Consultant at Skyeye, Portugal

“The use of UAV for Hydraulic Structures Observation”

Alexandre Santos is a Consultant at Skyeye since 2013. He has a MSc in GIS and is currently enrolled in a PhD on Information Systems. He is a specialist in Web GIS, geostatistics, data mining, point cloud processing. 3D modeling and the production of ultra-high resolution orthoimagery acquired using UAV. He developed many solutions for building and infrastructure observation such as dams, bridges, breakwaters. He also focused on building high resolution 3D models for hydrologic models and costal erosion modeling.

ABSTRACT: UAV can fly over infrastructures in hard to reach areas and acquire information using multiple sensors. The most common is a photo camera which can be used for video footage and orthoimagery production. These images can produce very accurate 3D point cloud models (using Ground Control Points obtained by GPS and RTK) much like a LIDAR system. Water discharge infrastructure in dams requires a close inspection to ensure that discharge is not producing excessive erosion in the concrete and river margins. UAV provide a good solution for these close inspections in hard to reach locations. In addition thermal and infrared imagery can provide additional information on water seepage in infrastructure like dams and river levees.

Keywords: Ortho imagery. Very high resolution imagery. 3D Modeling.

Technical Sessions**Technical Session 1 - Spillways and Weirs**Thursday, 7th May 2015 - 11:40 – 13:00

Chair: Jorge Matos

11:40 – 12:00

Pressure and velocity on an ogee spillway crest operating at high head ratio: experimental measurements and validation.*Y. Peltier, B. Dewals, P. Archambeau, M. Pirotton & S. Erpicum*

12:00 – 12:20

Caniçada dam complementary spillway. Design, hydraulic model and ongoing works.*A. Muralha, L. Couto, T. Alvarez, R. Sardinha, M. Oliveira & J. Dias da Silva*

12:20 – 12:40

Interpretation of near bed RMS velocity & shear stress in the approach flow of Piano Key Weir (PKW).*H. Tiwari & N. Sharma*

12:40 – 13:00

Measuring void fraction of a stepped spillway with non-intrusive methods using different image resolutions.*P. Bühler, J. Leandro, D. B. Bung, P. Lopes & R.F. Carvalho***Technical Session 2 - Intakes and Gates & Hydraulic Jumps and Stilling Basins**Thursday, 7th May 2015 - 14:00 – 15:20

Chair: Sébastien Erpicum

14:00 – 14:20

Cavitation around the butterfly valves of the new lock of Lanaye (Belgium): estimation and Remedy.*C. Savary, R. Durvaux, F. Grimée & Z. Li*

14:20 – 14:40

Assessment of a numerical method to forecast vortices with a scaled model.*G. Guyot, B. Huber & A. Pittion-Rossillon*

14:40 – 15:00

Length of submerged jump and B-jump.*M. Ishikawa, M. Takahashi, Y. Yasuda, & I. Ohtsu*

15:00 – 15:20

Roller lengths, sequent depths, surface profiles for predesign of dissipation basins.*H.E. Schulz, A.L.A. Simões & J.D. Nóbrega*

Technical Session 3 - Coastal ScourThursday, 7th May 2015 - 15:20 – 16:00

Chair: Rita Carvalho

15:20 – 15:40

Flume measurements of the wake of two model horizontal-axis tidal stream turbines.*S.M. Simmons, S.J. McLelland, D.R. Parsons & B.J. Murphy L.B. Jordan & L. Vybulkova*

15:40 – 16:00

Application of a new approach for modeling of coastal erosion in Arctic areas.*A. Reda, W. Sulisz, D. Majewski, M. Paprota, & M. Szmytkiewicz***Technical Session 4 - Scour Protection Structures**Friday, 8th May 2015 - 11:40 – 13:00

Chair: Pedro Lopes

11:40 – 12:00

Time of scour at elliptical guide banks.*B. Gjunsburgs & O. Lauva*

12:00 – 12:20

Comparative research of interlocked-carpet block ramp (ICBR) made of natural stone with rapid hydraulic structure (RHS) of Peterka type.*A. Radecki-Pawlik & K. Plesinski*

12:20 – 12:40

Effect of un-steady flow conditions on scour features at stepped gabion weirs.*S. Pagliara & M. Palermo*

12:40 – 13:00

Adaptive wavelet-based finite volume shallow water solver.*D. A. Haleem, G. Kesserwani & D. Caviedes-Voullième***Technical Session 5 - Breakwaters and Seawalls**Friday, 8th May 2015 - 14:00 – 15:20

Chair: Stefano Pagliara

14:00 – 14:20

Modelling of an extreme wave attack on a seawall.*M. Paprota, R. Staroszczyk & W. Sulisz*

14:20 – 14:40

Rubble-mound breakwater armour units displacement analysis by means of digital images processing methods in scale models.*J.M. Courela, R.F. Carvalho, R. Lemos, J. Fortes & J. Leandro*

14:40 – 15:00

Development of an integrated tool for numerical modelling of OWC-WECs in vertical Breakwaters.

M.T. Reis, E. Didier, J. Dias, A. Mendonça, J.M.P. Conde, M.G. Neves, C.J.E.M. Fortes & P.R.F. Teixeira

15:00 – 15:20

Influence of coastal structures in velocity fields and wave height.

R.F. Carvalho, C.J.E.M. Fortes, M. Castro

Technical Session 6 - Alteration of regimes

Friday, 8th May 2015 - 15:20 – 16:00

Chair: Ricardo Martins

15:20 – 15:40

Alternation of channel river pattern reach and its hydraulic and hydrodynamics consequences – the Flinta river example.

T. Kaluza, A. Radecki-Pawlik, K. Plesinski, N. Walczak & K. Szoszkiewicz

15:40 – 16:00

Alteration of the river regime downstream small hydropower schemes. Exploratory analysis of the effects on the vegetation of the river corridor.

M. Mendonça, M.M. Portela & F.C. Aguiar

NOTE: The workshop will be transmitted online using the following channel:

<http://ustre.am/1nY69>

General Information

Round table discussions

The round tables aim to provide a forum for deeper discussions on the presentations as well as on possible future solutions for hydraulic engineering challenges in general. The discussions are moderated by the session chairs. All authors who present a paper are kindly asked to join the round table related to their Technical Session TS1 to TS6. All other participants are also kindly invited to attend the round tables.

Coffee and lunch break

Catering will be offered during the coffee and lunch breaks, coffee breaks in the 4th floor of DEC. Lunches will be in Casa da Pedra next to DEC.



NOTE: Please don't forget to wear your name badge.

Wireless LAN

All the university campus is covered by eduroam network.

Public transports

To/From Coimbra:

Airports: Lisbon or Oporto International Airport have regular plane trips for every European and Main World Capital.

Taxi or Metro: The Porto and Lisbon metro have stations at the airport with trains into the city, to the Train Station (“Oriente”) and Coach Station (“Sete Rios”).

- Lisbon: Metro red line from Airport to “Oriente” Train Station (taxi is also a good choice to go from airport to “Oriente”); and also from the Airport to Coach Station of “Sete Rios” (Red line until “S. Sebastião” and then Blue Line until “Sete Rios”);
- Porto: line E -purple which runs straight from the Airport to “Campanhã” train Station (this is by far the cheapest and quickest way to get to the city and to the railway station). “Garagem Atlântico” Bus Terminal Station is a difficult 7 or 8 minutes walk up a very steep hill from the nearest train and metro stations at “São Bento” (Line D - Yellow). Alternatively you can use “Bolhão” metro station and walk along “Santa Catarina” Street, 8 min, to the bus terminal.)

Train/Coach: Every half an hour/hour there are connections between Lisbon and Coimbra (2h) and Porto and Coimbra (1 hour)

For train travels consult: <https://www.cp.pt/passageiros/en/>

For Coach travels consult: <http://www.rede-expressos.pt/default.aspx>

In Coimbra:Buses:

The bus company in operation in Coimbra is called SMTUC (Yellow/white buses). Both bus lines 34 and 38 attend the workshop location: Line 34 connects the University of Coimbra Polo I, city centre and Coimbra Stadium (“SOLUM”) to Polo II - UC. Line 38 covers the Polo II - UC, “Portagem” (Coimbra-A train station) and the Workshop Hotel (Ibis Hotel). Please consult the “City Map” for better understanding.

Each travel will cost you 1.60€ when purchased to the bus driver. Once need more than one ticket during you stay in Coimbra, we recommend buy a package of Pre-ordered tickets.

For SMTUC Bus travels consult: <http://www.smtuc.pt/>

You can download the SMTUC app on GooglePlay: <http://www.smtuc.pt/mobile/>

Taxis:

Getting to DEC University of Coimbra at Polo II - The Polo II of the University of Coimbra, where the Department of Civil Engineering is located, is on the right bank side of Mondego river in a zone called “Pinhal de Marrocos”.

The central Taxis number is: +351 239 499 090

For more Taxi informations go to: <http://www.politaxis.pt/>

You can download the politaxis app on AppStore or GooglePlay:

<http://www.politaxis.pt/app.html>

Contact

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