



## DR. IGNACIO ESCUDER BUENO

### Founding partner

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Ignacio Escuder Bueno has his **doctorate's degree in Civil Engineering (PhD, CE)** from Polytechnic University of Valencia (UPV, Spain) and a **Master's of Science in Civil Engineering (MSc)** from the University of Wisconsin-Milwaukee (UWM). **Since 1996 he is Professional Engineer (PE) as member** of the Spanish Institution of Civil Engineers (CICCP).

He is **full professor in Hydraulic works at UPV and founding partner of iPresas** (a technology-based SPIN-OFF company from UPV founded in 2011). He has been **a visiting professor** at the University of Maryland (USA, 2014), at Utah State University (USA, 2006) and teaching assistant at University of Wisconsin-Milwaukee (USA, 1995-1996).

**Since 1996 he works as a consultant and has carried out work on an international scale related to dam safety studies, behavior modeling or risk analysis of hundreds of dams** (hydroelectric, supply, irrigation, etc.) among which we can mention the large dams of the Lower Caroní in Venezuela, the Drini river in Albania, the Cerros Colorados system in Argentina, the large hydropower dams of Porce in Colombia, or the Chira-Soria complex in Gran Canaria (Spain).

**Since 2015, he supports the Inter-American Development Bank (IDB) in the implementation of its disaster risk management and climate change adaptation policy for civil infrastructure projects.** He regularly works as a consultant for the design of natural risk governance strategies, critical infrastructure and dam safety for private operators, government agencies and other multilateral organizations such as the **World Bank (WB)** or the **Andean Development Corporation (CAF-Development Bank of Latin America)**.

**Since 2016 he is member of the Independent Expert Panel of reviewers for the dam safety program of the US Army Corps of Engineers (USACE).** He has been Team Leader of the World Bank DRIP project (Dam Rehabilitation and Improvement Project; WB) for the **Central Water Commission (CWC) of the Government of India** (2018 and 2020) and member of the External Panel of reviewers of the Condor Cliff dam project in Argentina (2019-2021).

**Since 2021, he coordinates the implementation of risk governance and climate change adaptation of federal-owned dams in Spain** for the General Directorate of Water of the Ministry for Ecological Transition and Demographic Challenge (MITERD) and he has been an advisor in different projects for the implementation of risk analysis in dam safety management (for the Argentine Regulatory Agency for Dam Safety (ORSEP) and for Tenaga Nasional Berhad (TNB) in Malaysia, among others).

**He is author or co-author of more than 150 publications**, and he has lectured in over 30 conferences hosted in several countries. Among others, he has been coordinator of the **SPANCOLD Technical Guide N.8., T.1 "Risk analysis applied to the safety management of dams and reservoirs (2012)"**, co-author of the **ICOLD Bulletin 155 "Guidelines for use of numerical models in dam Engineering"** (2011) and has led the team that developed the **Guide for the evaluation and management of risks associated with dams of the CWC of India** (2019). He is **co-developer of the iPresas software** for dam safety risk analysis and management.

**He has been Principal Investigator of multiple research projects** on dam safety and flood risk management and has also been an **organizer of international forums and conferences** on the subject-matter (for example, the International Week on Risk Analysis, Dam Safety, Dam Security and Critical Infrastructure held in Valencia 2005, 2008 and 2011 or the International Symposium on Dam Safety held in Gran Canaria in 2021).

After completing his Master's Thesis titled "Review of dam safety protocols" in 1996 at UWM, he studied the impact of the North American dam safety program during the 80s and 90s. In the late 90s he dedicated himself to the in-depth study of the behavior and safety of these infrastructures.

In 2001 he presented his doctoral thesis "Evaluation of stress-strain behavior of flood embankments by numerical simulations formulated in finite difference method and calibrated with instrumentation outcomes", whose main contributions were made in FLAC (ITASCA software).

At the same time, using FLAC code, he developed a dynamic calculation of routines in the time domain of application to liquefiable materials, which were applied to the evaluation of the new Tous Dam in Spain.

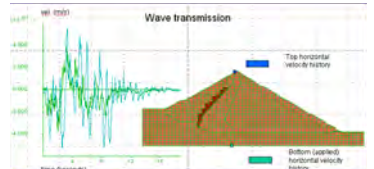
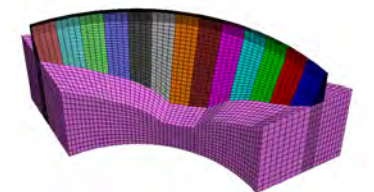
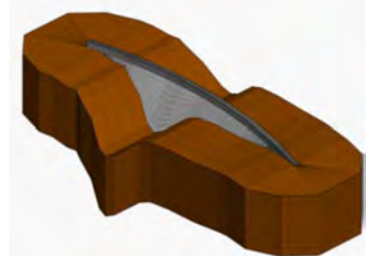
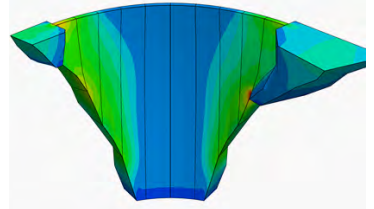
In the first decade of the 21st century, he worked extensively in the general assessment for the safety and behavior of around 30 large dams (Turia river basin, Guadiana, Guadalquivir, Duero and Ebro rivers in Spain, fundamentally), including the numerical modeling of its structural behavior and the statistical modeling of surveillance records. In some cases, he also developed hydraulic models to support the development of Operating Rules and Emergency Action Plans.

In addition, he participated in the design and calculation of the Terrateig dam, as well as the impervious screen of the Escalona dam and the stabilization of the Arenós reservoir slope (Júcar Hydrographic Confederation).

Starting in 2005, he began to develop methodologies and practical applications of risk analysis to relevant dams such as Macagua (EDELCA, Venezuela), WolfCreek (USACE, USA), Hällby (E.ON, Sweden) and to the group of 27 large dams owned by the Duero River Basin Authority (Spain), consolidating this activity from 2011 to today with more than 40 complete practical cases of application of quantitative risk analysis to large dams in countries spanning over three continents (Albania, Argentina, Spain, India and Uruguay fundamentally).

In the last decade he has been responsible for the elaboration of complete numerical models for evaluating the behavior of dams (e.g. the Soria dam, a 120-meter-high double-courvature arch dam in the Canary Islands), as well as the implementation of integral programs of safety assessment and risk management in dams (e.g. for ORSEP in Argentina and the "Junta de Extremadura" in Spain), and integral flood risk management systems (e.g. for the city of Tegucigalpa, Honduras).

**In summary, for more than 25 years he has done extensive professional work and research activity in the field of behavior assessment and dam safety. He has also contributed in all aspects of risk governance of these and other hydraulic infrastructures, including design of policies, processes and capacity building for private operators, government agencies and multilateral organizations.**



# MAIN PROJECTS



### LEGEND

- Projects related to risk analysis
- Projects related to dam safety, modelling, design and governance
- Research projects (main researcher)

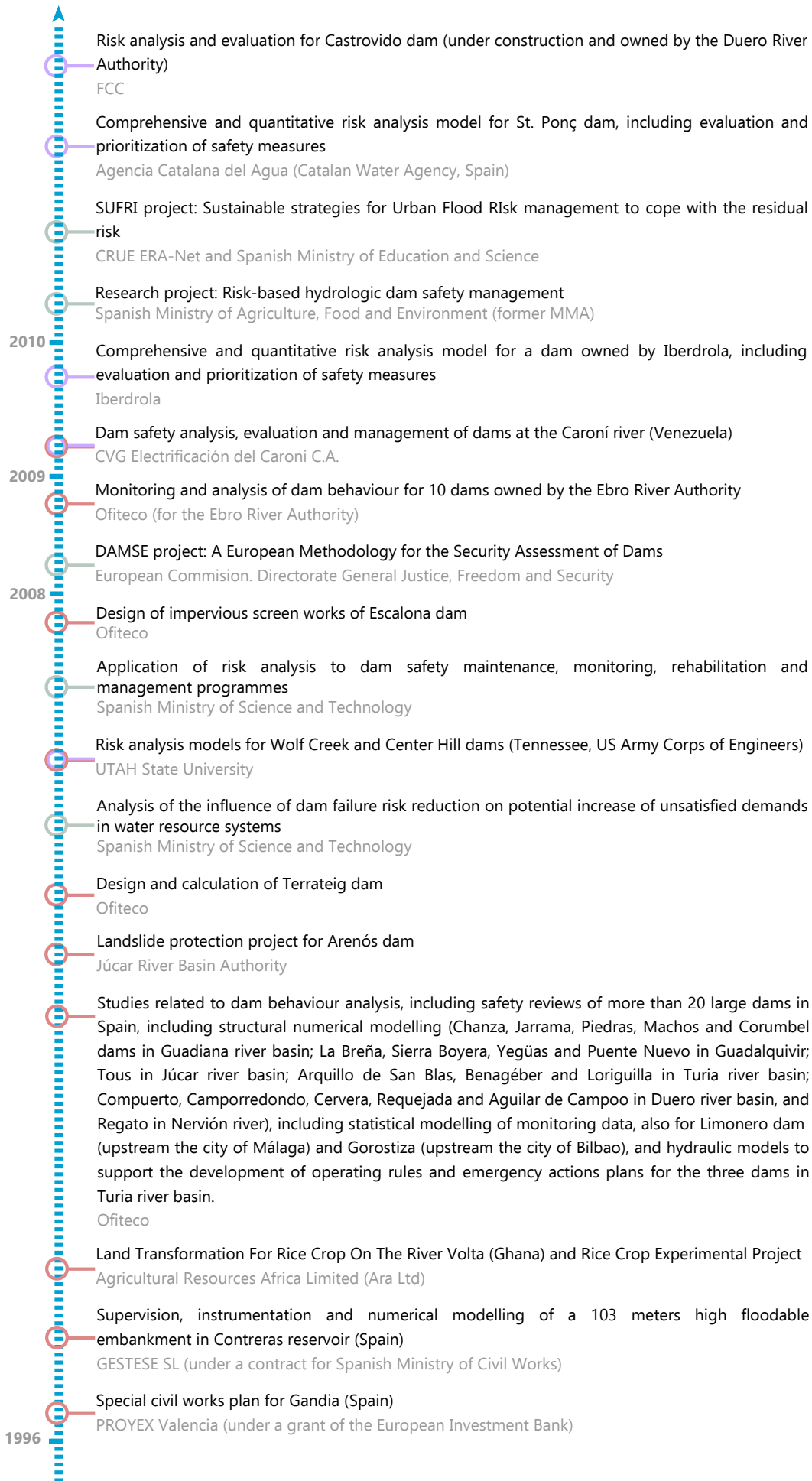


- 2020
  - Risk analysis of Rio Hondo, Escaba and Batiruaana Dams (Argentina)  
Dam Safety Regulatory Agency of Argentina (ORSEP)
  - Review and update of the designs for flood control at Walter Thilo Deininger park (El Salvador)  
Inter-American Development Bank (IDB)
  - Technical inspection and development of risk-based screening tool for dams in Bolivia  
Inter-American Development Bank (IDB)
  - Panel of experts for the review of the works of hydroelectric project of Condor Cliff (Argentina)  
China Gezhouba Group Company Limited - Electroingenieria S.A. – Hidrocuyo S.A.
  - Intermediate safety review of dams of Porce II, Porce III, Santa Rita and Playas (Colombia)  
EPM (Medellin Public Company)
  - Analysis of risk reduction measures for Valencian ports against climate change  
AVI (Valencian Agency for Innovation) in collaboration with UPV
  - Support to develop a dam safety program for EPSAS (Bolivia)  
EPSAS (urban water supply company for La Paz)
  - Technical support to implement risk analysis in Salto Grande dam (Uruguay – Argentina)  
Inter-American Development Bank (IDB) in collaboration with ORSEP and CHSG
- 2019
  - Dam break analysis and monitoring system review for Mtkvari HPP (Georgia)  
Mtkvari HPP
  - Comprehensive safety review of hydropower dams of ISAGEN (Colombia)  
ISAGEN
  - Risk-informed quality control of flood protection measures under the programme "Argentina: resilient to natural risks"  
Inter-American Development Bank (IDB)
  - Development on Guidelines for Assessing and Managing Risks Associated with Dams  
EGIS EAU (under a contract for CWC, Ministry of Water Resources of India)
  - Failure modes identification and risk analysis of road RN5 (Haiti) considering climate change  
Inter-American Development Bank (IDB)
- 2018
  - Technical assistance for numerical modelling of Chira and Soria dams  
Insular Water Council of Gran Canaria (Spain)
  - Review and strengthening of the risk analysis methodology for addressing natural hazards and climate change in IDB projects  
Inter-American Development Bank (IDB)
  - Risk-informed dam safety management of Pretura del Molino, Carrascalejo and las Majadillas dams  
Regional Government of Extremadura (Spain)
  - Project DAMSAFE: Enhancing Dam Safety and Water Management in Karnataka (India)  
Netherlands Enterprise Agency (project led by Deltares)
  - Support to dam safety and risk management in Brazil  
Gas Natural Fenosa (under a contract for the Brazilian Ministry of National Integration)
  - Technical assistance to introduce risk analysis techniques as a tool to support dam safety management in Argentina  
Dam Safety Regulatory Agency of Argentina (ORSEP)
- 2017
  - Risk analysis of San Marcos dam  
Regional Government of Extremadura (Spain)
  - Independent External Expert for reviewing US Army Corps of Engineers Dam safety Program  
Schnabel (under a contract for US Army Corps of Engineers)











- Quality control from a risk analysis perspective of the flood risk control measures at the Choluteca river in Tegucigalpa (Honduras)  
Inter-American Development Bank (IDB)
- Risk analysis of Paso Severino dam (owned by OSE). "Water for Uruguay" Programme. Pillar 3: Regulatory framework for Dam Safety in Uruguay  
World Bank
- Pilot project to define procedures for quantitative estimation of spillway gate functionality and evaluate its impact on dam safety risk management  
Gas Natural Fenosa (Spain)
- Local action plan against Flood Risk for the city of Oliva (Valencia)  
Oliva City Council
- Coordinator of activities for developing a Pre-Investment Guide for the Hydropower Sector including disaster risk criteria in Bolivia  
Inter-American Development Bank (IDB)
- 2016
- Risk analysis of Jaime Ozores dam  
Regional Government of Extremadura (Spain)
- Risk analysis consultancy services for the portfolio of dams owned by Grupo Gas Natural Fenosa  
Gas Natural Fenosa (Spain)
- Impact evaluation of "Project on concrete rehabilitation Phase IV. La Minilla dam" on sliding stability through advanced numerical modelling.  
EMASESA
- Local action plan against Flood Risk for the city of Benaguasil (Valencia)  
Benaguasil City Council
- Risk analysis study for supporting safety management in "El Vado" dam  
Canal de Isabel II (Spain)
- Recommendations to improve the regulatory and institutional framework, and the development of dam safety management tools. Water Management and Infrastructure Development in Chile  
World Bank
- 2015
- Risk analysis of Membrío dam  
Regional Government of Extremadura (Spain)
- INICIA project: Methodology for evaluating investments in water cycle infrastructures based on risk and energy efficiency indicators  
Spanish Ministry of Economy and Competitiveness (MINECO)
- Risk analysis for Fierze, Komani and Vau I Dejes dams (Albania), including quantitative risk modelling and prioritization of risk reduction actions  
Gas Natural Fenosa (under a contract for KESH, Albanian Power Company)
- 2014
- Risk analysis of "El Horcajo" dam  
Regional Government of Extremadura (Spain)
- E2STORMED project: Improvement of energy efficiency in the water cycle by the use of innovative storm water management in smart Mediterranean cities ([www.e2stormed.eu](http://www.e2stormed.eu))  
MED Programme European Union
- 2013
- Comprehensive and quantitative risk analysis for Hällby dam: A case study in Sweden  
ELFORSK (Sweden)
- IPRESARA project: Incorporating manmade threats into dam safety risk management  
Spanish Ministry of Science and Innovation (MICINN)
- Numerical modelling of La Aceña dam behaviour  
Canal de Isabel II (Spain)
- 2012
- Protection plan for a water treatment plant in Spain  
Aguas de Valencia (Spain)
- Risk analysis of a portfolio of 27 dams owned by the Duero River Authority in Spain, including evaluation and prioritization of investments for risk reduction  
Ofiteco (under a contract for the Duero River Authority in Spain)
- 2011



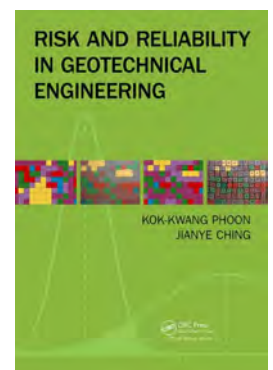
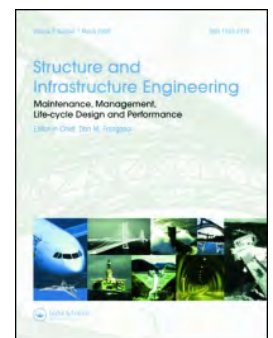
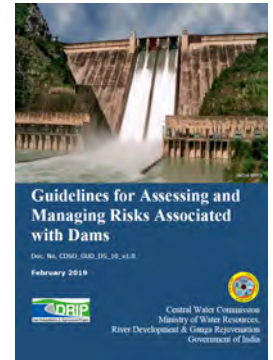


## RESEARCH AND PROFESSIONAL SKILLS

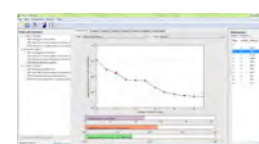
 Dam safety management	● ● ● ● ●	 Numerical modelling	● ● ● ● ●
 Risk analysis	● ● ● ● ●	 Software development	● ● ● ● ●
 Critical infrastructure governance	● ● ● ● ●	 Hydraulic modelling	● ● ● ● ●
 Urban flood risk analysis	● ● ● ● ●	 Green infrastructures	● ● ● ● ●

## SELECTED PUBLICATIONS

- J. Fluixá-Sanmartín, I. Escuder-Bueno, A. Morales-Torres, and J.T. Castillo-Rodríguez, Accounting for Climate Change Uncertainty in Long-Term Dam Risk Management. *Journal of Water Resources Planning and Management*, 147(4), 04021012. 2021.
- Participation in the development of Guidelines for Classifying the Hazard Potential of Dams. Central Water Commission. Ministry of Water Resources, Government of India. 2020.
- Fluixá-Sanmartín, J., Escuder-Bueno, I., Morales-Torres, A. and Castillo-Rodríguez, J.T. Comprehensive decision-making approach for managing time dependent dam risks. *Reliability Engineering and System Safety* 203 (November). Elsevier. 2020. <https://www.sciencedirect.com/science/article/pii/S0951832020306013>
- Coordinator of Guidelines for assessing and managing risks associated with dams. Central Water Commission. Ministry of Water Resources, Government of India. 2019.
- Morales-Torres, A., Escuder-Bueno, I., Serrano-Lombillo, A. and Castillo-Rodríguez, J.T. Dealing with Epistemic Uncertainty in Risk-Informed Decision Making for Dam Safety Management. *Reliability Engineering and System Safety* 191 (November). Elsevier. 2019. <https://doi.org/10.1016/j.ress.2019.106562>.
- Fluixá-Sanmartín, J., Morales-Torres, A., Escuder-Bueno, I. and Paredes-Arquiola, J. Quantification of Climate Change Impact on Dam Failure Risk under Hydrological Scenarios: A Case Study from a Spanish Dam. *Natural Hazards and Earth System Sciences* 19 (10):2117–39. 2019. <https://doi.org/10.5194/nhess-19-2117-2019>.
- Fluixá-Sanmartín, J., Altarejos-García, L., Morales-Torres, A. and Escuder-Bueno, I.: Review article: Climate change impacts on dam safety, *Nat. Hazards Earth Syst. Sci.*, 18, 2471-2488, DOI: 10.5194/NHESS-18-2471-2018, 2018.
- Fluixá-Sanmartín, J., Altarejos-García, L., Morales-Torres, A. and Escuder-Bueno, I.: Empirical Tool for the Assessment of Annual Overtopping Probabilities of Dams, *American Society of Civil Engineers*, DOI: 10.1061/(ASCE)WR.1943-5452.0001017, 2018.
- A combined risk analysis approach for complex dam–levee systems. Castillo-Rodríguez, J.T., Needham, J., Morales-Torres, A. & Escuder-Bueno, I. *Structure and Infrastructure Engineering*. 2017.
- Overcoming failure root causes in infrastructure risk governance implementation: large dams case. Halpin, E. & Escuder-Bueno, I. *Journal of Risk Research*. 2016.
- Computational Aspects of Dam Risk Analysis: Findings and Challenges. Escuder-Bueno, I., Mazzà, G., Morales-Torres, A., & Castillo-Rodríguez, J. T. *Engineering* 2 (3), 319–324. 2016..
- A new risk reduction indicator for dam safety management combining efficiency and equity principles. Serrano-Lombillo, A., Morales-Torres, A., Escuder-Bueno, I., & Altarejos-García, L. *Structure and Infrastructure Engineering*. 2016.
- Decision Support Tool for energy-efficient, sustainable and integrated urban stormwater management. Morales-Torres, A., Escuder-Bueno, I., Andrés-Doménech, I. & Perales-Momparler, S. *Environmental Modelling & Software*. 2016.
- Enhancing local action planning through quantitative flood risk analysis: a case study in Spain. Castillo-Rodríguez, J.T., Escuder-Bueno, I., Perales-Momparler, S. & Porta-Sancho, J.R. *Natural Hazards and Earth System Sciences*, 16(7), 1699-1718. 2016.
- The suitability of risk reduction indicators to inform dam safety management. Morales-Torres, A., Serrano-Lombillo, A., Escuder-Bueno, I., & Altarejos-García, L. *Structure and Infrastructure Engineering*. 2016.



- Building fragility curves of sliding failure of concrete gravity dams integrating natural and epistemic uncertainties. Morales-Torres, A., Escuder-Bueno, I., Altarejos-García, L., & Serrano-Lombillo, A. *Engineering Structures*, 125(2016), 227-235. 2016.
- Advances on the Failure Analysis of the Dam—Foundation Interface of Concrete Dams. Altarejos-García, L., Escuder-Bueno, I., & Morales-Torres, A. *Materials*, 8(12), 8255–8278. 2015.
- Practical risk assessment for embankments, dams, and slopes. Altarejos-García, L., Silva-Tulla, F., Escuder-Bueno, I., & Morales-Torres, A. *Cap. de Risk and Reliability in Geotechnical Eng.*, 437–469. CRC Press. 2015.
- The value of integrating information from multiple hazards for flood risk analysis and management. Castillo-Rodríguez, J.T., Escuder-Bueno, I., Altarejos-García, L., & Serrano-Lombillo, A. *Natural Hazards and Earth System Sciences*, 14, 379-400. 2014.
- Metodología para la evaluación del riesgo hidrológico de presas y priorización de medidas correctoras. Ed: Altarejos-García, L., & Escuder-Bueno, I. Autor de Capítulos 2, 3 y 4. Colegio de Ingenieros de Caminos, Canales y Puertos. 2014.
- Need of Transient Thermal Models, with Daily Inputs, to Explain the Displacements of Arch-Gravity Dams. Serrano-Lombillo, A., Galán-Martín, D., Escuder-Bueno, I. *Congreso de Métodos Numéricos en Ingeniería CMN*. Ed. CIMNE. 2013.
- A quantitative flood risk analysis methodology for urban areas with integration of social research data. Escuder-Bueno, I., Castillo-Rodríguez, J.T., Zechner, S., Jöbstl, C., Perales-Momparler, S., & Petaccia, G. *Natural Hazards and Earth System Sciences*, 12, 2843-2863. 2012.
- Assessing the impact of uncertainty on flood risk estimates with reliability analysis using 1-D and 2-D hydraulic models. Altarejos-García, L., Martínez-Chenoll, M.L., Escuder-Bueno, I., & Serrano-Lombillo, A. *Hydrology and Earth System Science*, 16, 1985-1994. 2012.
- Risk Analysis, Dam Safety, Dam Security and Critical Infrastructure Management. Escuder-Bueno, I., Matheu, E., Altarejos-García, L., & Castillo-Rodríguez, J.T. Eds. Leiden: CRC Press, 2012.
- Methodology for estimating the probability of failure by sliding in concrete gravity dams in the context of risk analysis. Altarejos-García, L., Escuder-Bueno, I., Serrano-Lombillo, A., & de Membrillera-Ortuño, M.G. *Structural Safety*, 34 (1). 2012.
- Coordinador y coautor de la Guía Técnica Número 8, Tomo 1 de SPANCOLD: Análisis de riesgos aplicado a la gestión de seguridad de presas y embalses. 2012.
- Coauthor of ICOLD Bulletin 155: Guidelines for use of numerical models in dam Engineering. 2011.
- Methodology for the calculation of annualized incremental risks in systems of dams. Serrano, A., Escuder, I., Membrillera, M., & Altarejos, L. *Risk Analysis*, 31. 2011.
- Analysis of the elastic behaviour of an arch gravity dam. Escuder, I., Blázquez, F. *International Journal on Hydropower and Dams*. Vol 30, Issue 5, Pages 76-84. 2007.
- Reliability assessment of granular filters in embankment dams. Mínguez, R., Delgado, F., Escuder, I., G. de Membrillera, M. *Internacional Journal for Numerical and Analytical Methods in Geomechanics*. 2006.
- Evaluation of the behaviour and safety of the new Tous rockfill dam. Escuder, I., Utrillas, J.L., Fleitz, J. *International Journal on Hydropower and Dams*. 2006.
- Aplicación del Análisis de Riesgos a la Seguridad de Presas. Membrillera, M.G., Escuder, I., González, J., & Altarejos, L. Editorial Universidad Politécnica de Valencia (UPV). 2005.
- An Analysis of stress-strain behaviour of quarried rock shells. Escuder, I., Andreu, J., Rechea, M. *Canadian Geotechnical Journal*. Vol. 42. 51-60. 2005.
- Estudio del comportamiento tenso-deformacional de pedraplenes inundables mediante simulaciones numéricas formuladas en diferencias finitas y calibradas con lecturas de instrumentación. Escuder Bueno, I. Ed. Chadwyck-Healey. ISBN 0 493 11796 2. 2001.





## MAIN COURSES AND LECTURES

- Tutor of the course: Disaster Risk Analysis and Climate Change in infrastructure projects, both in the 5 SPOC (Private Online Course) and the MOOC (Open Online Course) editions. Organised by the Inter-American Development Bank (IDB). 2020.
- Lecturer and coordinator of courses on dams, hydraulic infrastructures, and risk analysis at the Civil Engineering Faculty at the Polytechnic University of Valencia (UPV).
- SPOC Course on Natural hazards and climate change Risk Assessment for infrastructure projects. Inter-American Development Bank. 2020.
- Course on Risk Analysis techniques for Dam Safety Management organized by Ministry of Environment and Water of Bolivia and CAF. 2019.
- Methods to compute natural disasters risk (including climate change effects) organized by the Inter-American Development Bank. 2016 and 2017.
- Course on Risk Analysis applied to Dam Safety Management organized by the Argentinian National Committee on Large Dams (CAP). 2016.
- 1st edition of the Course on Risk Analysis applied to Dam Safety Management - Advanced Level, organized by the Spanish National Committee on Large Dams (SPANCOLD). 2016.
- Course on "Urban stormwater management using Sustainable Drainage Systems", organized by the Polytechnic University of Valencia. 2016.
- Practical course: E<sup>2</sup>STORMED software for the multi-criteria evaluation of urban drainage solutions. Organised by the Polytechnic University of Valencia. 2015.
- Seminar titled "Smart governance and community resilience with an application to dams" at the Princeton University (New Jersey). 2014.
- 4 editions of the Course on Risk Analysis applied to Dam Safety Management - Basic Level, conducted in English and Spanish, organized by the Spanish National Committee on Large Dams (SPANCOLD). 2013-2016.
- Since 2011, lecturer of Dam Safety Management, International Master on Dam Safety and Operation, organized by SPANCOLD.
- Course on Risk Analysis applied to Dam Safety Management, organized by the Swedish National Committee on Large Dams (SWEDCOLD). 2010.

## OTHER MERITS AND ACTIVITIES

- President of the Spanish National Committee on Large Dams (SPANCOLD) from 2017 to 2021.
- Elected member of Spanish National Committee on Large Dams (SPANCOLD) Board since 2016.
- Member of the Spanish Commission for Legal Codes for Design and Safety of Dams in Spain since 2016.
- From 2011 until 2017, Chairman of ICOLD International Committee on Computational Aspects of Dams.
- From 2010 until 2017, Secretary General of the ICOLD European Club.
- From 2007, elected member of the Spanish National Committee on Large Dams (SPANCOLD).
- Member of the Organizing Committee of the Spanish Conference on Dams in 2008, 2010 and 2015, organized by SPANCOLD.
- Formulator of 3 themes related to risk analysis for the last editions of the ICOLD International Benchmark Workshop on Numerical Analysis of Dams, in Valencia (2011), Graz (2013) and Lausanne (2015).
- Chairman of session "Innovation in the use of dams and reservoirs", during the XXV ICOLD Congress, in Stavanger (Norway). 2015.
- Invited speaker at HydroVision International Conference (Nashville, Tennessee) with title "Risk Assessment: What in this world are we doing?". 2014.
- Visiting professor at Utah State University (2006) and University of Maryland (2014), and Assistant Professor at the University of Wisconsin-Milwaukee (1995-1996).
- Chairman of the Organizing Committee of the 3rd International Forum on Risk Analysis, Dam Safety, Dam Security and Critical Infrastructure Management, organized at the UPV, Valencia. 2011.
- BANCAJA Entrepreneurs 2010 Award, iPresas Business Plan.
- Chairman of the Organizing and Scientific Committee of the 3 editions of the International Week on Risk Analysis, Dam Safety, Dam Security and Critical Infrastructure Management, Valencia, 2005-2008-2011.
- Co-developer of iPresas software for risk analysis of dams using event tree modelling.

