

FLOODS, WATER SCARCITY AND EXTREME EVENTS 2023

Research challenges and LNEC's strategies on floods, water scarcity and extreme events

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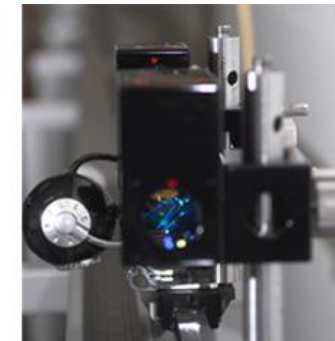
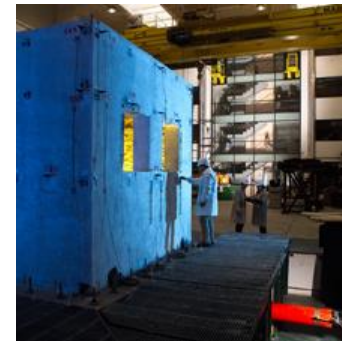
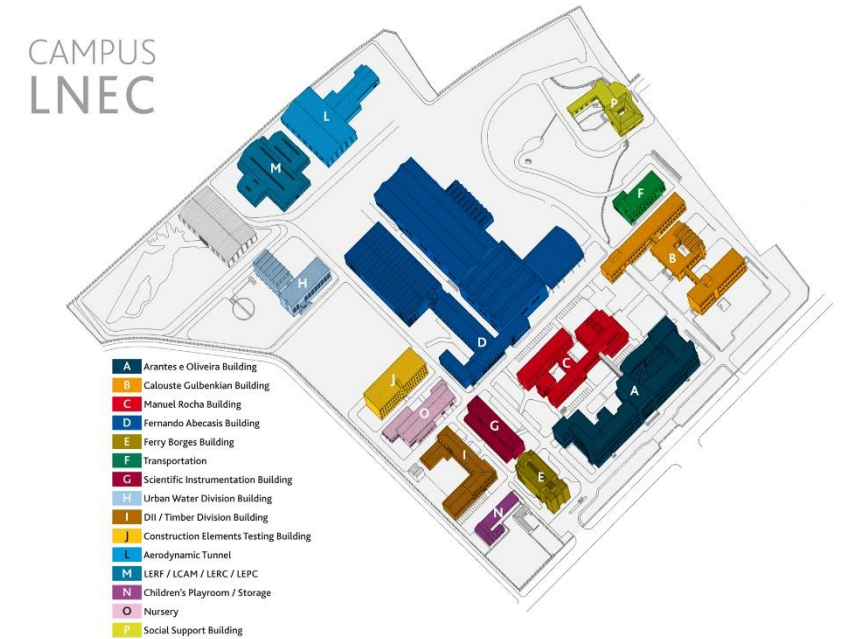


LNEC
LISBON
CONFERENCE



About LNEC

- National Civil Engineering Laboratory
- Founded in 1946
- Public R&D institution
- 22 ha campus in Lisbon, Portugal
- Unique multidisciplinary perspective in civil engineering
- R&D, best practices, unbiased and independent advisory body
- 30+ testing laboratories
- 515 total staff





Hydraulics and
Environment

Geotechnics

- Water cycle – natural (rivers, transitional waters, coastal waters) and urban water
- Quantity and quality, including ecological systems
- Uses in human activities; water - structures interactions

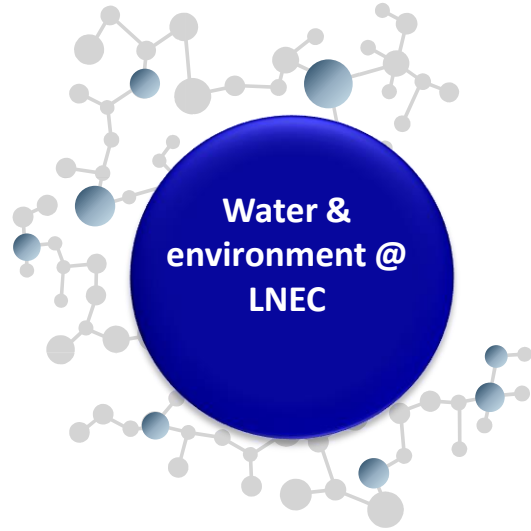
Buildings

Water for Climate, Resilience,
and Environment: Source to
Sea, Biodiversity, Climate
adaptation, Resilience, and
Disaster Risk Reduction

Structurers

Transportation

Materials



Hydraulics and Environment

- ▶ Estuaries and Coastal Zone Unit
- ▶ Ports and Maritime Structures Unit
- ▶ Urban Water Unit
- ▶ Water Resources and Hydraulic Structures Unit
- ▶ Information Technology in Water and Environment Research Group

93 collaborators (today)
76/93 permanent staff

45/93 PhDs

18/93 MSc/PhD
Students

Gender Balance
49 F / 44 M





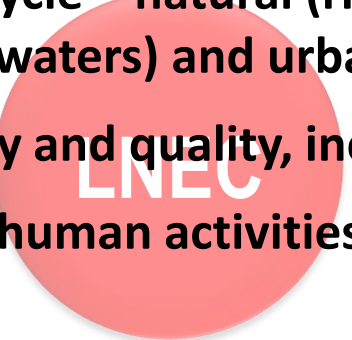
Hydraulics and Environment

- Water cycle – natural (rivers, transitional waters, coastal waters) and urban water
- Quantity and quality, including ecological systems
- Uses in human activities; interactions structures – water

Geotechnics

Buildings

Concret dams



Structurers

Transportation

Materials

Objectives of water systems

- We expect that our water systems ...
- ... provide good quality services for all, at all times
- ... deliver an efficient, effective and sustainable management
- ... become more reliable, flexible, resilient, safe, low-impact

Climate change

Emerging contaminants

Demographic pressure

Resource scarcity

Sustainable development goals

Human Rights to Water and Sanitation

Green Deal da UE

Social engagement

Economic efficiency

Nature-based solutions

Circular economy

Water-Energy-Food nexus

Water reuse

Artificial intelligence, information management

Governance

Technology

Education training and capacity building

Pressures

Frameworks

Axes of action

Strategic research programs until 2027

- Management, protection and restoration of coastal systems
- Water in the city: transition to the urban water services of tomorrow
- Water Resources and Sustainable Development
- Risk and safety in ports and maritime structures
- Digital research services in the water and environment domains



Research

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Floods

Hazards / challenges

R&D topics

Approaches /Solutions

Urban Water

Urban flooding:
People, assets and economy at risk

Integrated water management
NBS
Numerical modelling

Smart monitoring
NBS
Inflow & Infiltration control
Infrastructure asset management

Water Resources and Hydraulic Structures

River flooding / People, property, economy and environment at risk

Climate change Impacts:
Hydrological & hydraulic modelling (flood propagation)
NBS

Warning systems
NBS
Flood Directive support

Estuaries and Coastal Zone

Estuarine and coastal floods:
People, assets and economy at risk

Estuarine and coastal modelling
Multi-source flood risk analysis
Remote sensing services

Flood forecasting and early warning
Flood hazard and risk maps
NBS

Ports and Maritime Structures

Port areas flooding: People, goods and ships at risk
Operational downtimes
Maritime structures at risk

Overtopping, flooding, and inundation risks associated with maritime structures
Impact on Navigation (moored ships)

Risk assessment,
Early warning systems
Inspection and monitoring
Hybrid solutions



Research

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LN&E<

Water scarcity

Hazards / challenges

R&D topics

Approaches /Solutions

Urban Water

Non-potable uses at risk
Decreased water quality

Water reuse:
Reclamation technologies
Risk management
Circular economy

Tailored treatment
Software tools for smart operation
and monitoring
Policy & regulation instruments

Water Resources and Hydraulic Structures

Water scarcity/ Assure water:
people, stock, sectoral activities

Climate change impacts
Risk management
Drought resilience increase
NBS

NBS
Water resources governance
Drought plans
Sectorial adaptation

Estuaries and Coastal Zone

Decreased water quality
Salinity intrusion

Water quality modelling and
monitoring
Water security

Remote sensing for leak detection
Web-based water quality
observatories

Ports and Maritime Structures

Pressure on marine ecosystems
Increased demand for food and
energy from sea
Loss of territory in coastal areas

Develop better desalination methods
Exploit new renewable energy
sources to power desalination
plants

Planning strategies using existing
coastal structures
Sustainable Desalination Techn.
Aquaculture



Research

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Extreme events

	Hazards / challenges	R&D topics	Approaches /Solutions
Urban Water	Flash floods Major systems failures Heat waves	Urban planning Cascading resilience	Resilience assessment framework NBS
Water Resources and Hydraulic Structures	Dam break floods Debris flow floods/ People, assets and economy at risk	Advanced numerical modelling + physical modelling calibration. Water and sediment modelling	Real time flow prediction Warning systems Check dams
Estuaries and Coastal Zone	Coastal erosion Destruction of coastal infrastructure	Coastal and shoreline modelling Resilience in a changing climate	Hazard and risk maps Hybrid / non-structural approaches Restoration of sediment budgets
Ports and Maritime Structures	More frequent and severe storms Maritime structure & services failure Increase in operational downtimes Ships and navigation safety	Wave-structures interaction Ship/structure behaviour Early warning systems Risk analysis	Numerical and physical modelling Probabilistic analysis Adaptation measures Early warning systems Maritime structure's inspection

Our research and innovation strategy



- PhD theses
- National Research Foundation projects

- European projects (Missions, RIA, IA, Life, Interreg, ...)
- National projects (Fundo Ambiental, Fundo Azul, ...)
- National initiatives (Innovation alliances)

- Advisory boards, associations, standardization committees (ISO, CEN)
- Partnerships with consultants and technology providers
- Training and capacity building

Examples of research projects



European projects

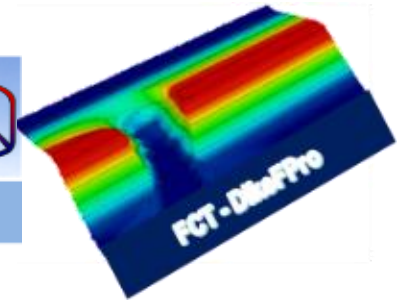


National Research Foundation projects

AQUAMON



EW Coast



National initiatives

iGPI 2015

iPerdas 2016



iAFLUI

Iniciativa Nacional para o Controlo de Afluências Indevidas



iEQTA

Other national funded projects



For more information

Videos playing at the Conference Centre Hall on:

- Reference research projects
- DHA activity

Thanks!



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