MUST-LNEC Workshop on

Coastal Circulation and Water Quality Forecasting using On-Demand Cloud-Based Systems

Organized by

Faculty of Innovation Engineering

Macau University of Science and Technology (MUST) and

Laboratório Nacional de Engenharia Civil (LNEC) Portugal

In collaboration with

National Observation and Research Station of Coastal Ecological Environments in Macao (NORSCEM)

June 28-29, 2023

Workshop Outline:

This two-day workshop aims to introduce cutting-edge forecast systems for emergency response and routine management of coastal regions. The OPENCoastS service, which is developed by LNEC, will be introduced to assist coastal engineers and researchers who have needs for accurate and timely predictions on water conditions.

OPENCoastS builds on-demand circulation forecast systems for user-selected sections of the coast and maintains them running operationally in real time. This daily service generates forecasts of water levels, 2D/3D velocities, salinity, temperature, fecal contamination indicators and wave parameters over the spatial region of interest for periods of 48 hours, based on numerical simulations of all relevant physical processes. Presently, all forecasts are made with the model SCHISM (http://ccrm.vims.edu/schismweb/).

This workshop on coastal ocean forecasting using OPENCoastS aimst to:

- Introduce the participants to coastal ocean forecasting and Digital Twins of the Ocean.
- Present OPENCoastS, LNEC's unique platform to generate ocean forecast systems.
- Train the participants in the generation of coastal forecast systems for areas of their choice using the OPENCoastS platform.
- Discuss possible avenues for collaboration between MUST and LNEC.

WHO SHOULD ATTEND:

This workshop contains the knowledge of the predictions on water conditions timely and accurately, supporting multiple uses such as navigation aid, monitoring of harbour activities, dredging and building works on the coast. It is open to students/researchers of MUST and invited guests from partner institutions, and governmental organizations. Participants (limited to 20) should preferably have a background on basic fluid mechanics, numerical methods and related engineering or science fields.

Speakers:

Dr. André B. Fortunato - Principal Researcher, Estuaries and Coastal Zones Division, Hydraulics and Environmental Department, LNEC, Portugal

Biography

André is a Principal Researcher at the National Civil Engineering Laboratory (LNEC). His activity includes mostly advanced consultancy and applied research. In the former, he develops and analyzes coastal engineering solutions for public and private clients, in Portugal and abroad (e.g., harbor administrations, water authorities). In the latter, he develops the methods, models and knowledge required for the solution of coastal engineering problems related to hydrodynamics, sediment dynamics and water quality. This goal has led him to pursue several research threads: 1) the development and analysis of numerical models and methods to simulate circulation, morphodynamics and transport in coastal zones, with an emphasis on unstructured grids; 2) the analysis of physical processes in coastal zones, such as tidal propagation and distortion, the inundation of estuarine and coastal areas, and the exchange of water and suspended matter between estuaries and the sea.

Dr. Anabela Oliveira

Senior Researcher, Head, Information Technology in Water and Environment Research Group, Hydraulics and Environmental Department, LNEC, Portugal

Biography

Anabela is a Senior Researcher at the National Civil Engineering Laboratory (LNEC). Anabela has a long experience in the development and application of numerical models for coastal engineering, primarily to address problems related to hydrodynamics, water quality and morphodynamics in estuarine and coastal areas. Since 2009, she has led LNEC's Information Technology in Water and Environment Research Group. This group develops research, development and innovation activities (R&D&I) in information systems and technologies applied to the water and environment domains. Its goals are to promote: 1) the integration and technology transfer between LNEC and its external partners in the areas of information systems and computational applications; 2) the development and application of innovative products at LNEC, to address the societal challenges and needs of LNEC's partners and end-users. The strategic research focuses on the following areas: 1) real-time forecast and monitoring systems for environmental phenomena; 2) data acquisition systems, including wireless sensor networks, UAVs and robot platforms; 3) intelligent systems for risk and emergency management, including early-warning systems.

Prof. Joseph Hun-wei Lee

President and Chair Professor, Macau University of Science and Technology

Biography

Prof Lee's research interests revolve around the use of fluid mechanics to solve environmental problems. He is President of the International Association for Hydro-environment Engineering and Research (IAHR), and the Founding Editor-in-Chief of the *Journal of Hydro-environment Research.* He has served as expert consultant on numerous hydro-environmental projects and contributed to the theory and design of several major environmental management and flood control infrastructure projects. Over the past decade he has been the master mind behind the development of the WATERMAN real time coastal water quality forecast and management system. He is a Fellow of the Royal Academy of Engineering in the UK and the Hong Kong Academy of Engineering Sciences.

Continuing Professional Development Credit: The course is considered suitable for CPD credit.
A Certificate of Attendance will be issued to those who attend all sessions.

Date: June 28-29, 2023 (Wed.-Thurs.) (9:00 a.m. - 5:00 p.m.)

Course Venue: (Classroom) Room N221, Building N, Macau University of Science and Technology
(Computer Lab) Room C408, Building C, Macau University of Science and Technology

Course Fee (Non-refundable): Free for MUST staff/students (subject to availability of vacancy)

Registration Deadline: June 26, 2023.

Inquiries: Mr. Eric Zhang (Tel: +853 88971758, Email: gzhang@must.edu.mo)

COURSE PROGRAMME

This workshop will have a total duration of 2 days (June 28-29, 2023). Each day comprises sessions of scientific/technical presentations and sessions with practical exercises.

Day	Time	Topic	Trainer(s)
Day 1	09:00 – 09:30	Opening session: brief presentation of coastal research at MUST and LNEC	
	09:30 – 09:45	Workshop introduction and structure	Anabela Oliveira
	09:45 – 10:45	Session 1: ocean forecasting and Digital Twins of the Ocean	Anabela Oliveira
		Coffee break	
	11:00 – 11:30	Session 2: Introduction to OPENCoastS	Anabela Oliveira
	11:30 – 12:30	Session 3: using OPENCoastS to generate forecasts	André Fortunato
		Lunch break	
	14:00 – 14:45	Hands-on exercise: Generating a 2D barotropic forecast	Anabela Oliveira
	14:45 – 15:30	Hands-on exercise: Generating a 3D baroclinic and water quality forecast	André Fortunato
		Coffee break	
	15:45 – 17:00	Field visit to National Observation and Research Station of Coastal Ecological Environments in Macao	
Day 2	09:00 – 10:00	Session 5: the SCHISM model: circulation and waves	André Fortunato
	10:00 – 10:45	Session 6: the SCHISM model: transport and water quality	André Fortunato
		Coffee break	
	11:00 – 11:30	Session 7: grid generation	André Fortunato
	11:30 – 12:00	Session 8: the OPENCoastS viewer	Anabela Oliveira
	12:00 – 12:30	Hands-on exercise: visualization of the results from the students' forecasts	Anabela Oliveira
		Lunch break	
	14:00 – 15:00	Session 9: an IT perspective of OPENCoastS	Anabela Oliveira
		Coffee break	
	15:15 – 16:00	Session 10: Introduction to WATERMAN coastal water quality forecast system + storm surge prediction in Macao	Joseph Hun-wei LEE
	16:00 – 17:00	Discussion on MUST-LNEC collaboration	