



## **SEMINAR ANNOUNCEMENT**

### **Barotropic vs baroclinic coastal flows in the framework of environmental assessment**

**Dr. Francesco Lalli**

Dipartimento di Ingegneria Civile, Edile e Architettura, Università Politecnica delle Marche

Thursday 27 February 2025, h.10:30, Room C-Class

Coastal flows are investigated by experimental vs numerical techniques. Barotropic features are studied by the shallow water model developed at ISPRA (National Institute for Environmental Protection and Research): the finite difference method is implemented in the time domain by a 3rd order Runge-Kutta time marching scheme. Complex geometries are described by body force approach. On the other hand, baroclinic flows are studied by 3D Navier Stokes equations, numerically implemented by Lee & Moin method. Both models are implemented to investigate river mouth hydrodynamics; in particular, jet-wall interaction features have been described. Indeed, the deviation of a jet from the straight direction due to the presence of a lateral wall is carefully investigated, by comparing numerical results with experimental data. This flow condition is known as Coanda jet (from the Romanian aerodynamicist Henry Marie Coanda who discovered and applied it at the beginning of XXth century). Finally, the environmental assessment of a channel harbour test case is carried out. Stratification effects, of course neglected in barotropic investigations by shallow water equations, are taken into account in the experiments and Navier Stokes simulations.

**Francesco Lalli**, formerly Research Director at the Higher Institute of Environmental Protection and Research (ISPRA), coordinated research activities for the development of tools for the monitoring and analysis of sea and coastal state scenarios, for the simulation of hydrodynamic, transport and coastal flooding phenomena, also taking into account water quality aspects and the interactions between biotic and abiotic processes. He managed the application of European directives regarding both sea and coasts, provided technical-scientific support to state administrations and local authorities in the context of the National Environmental Protection System, regarding problems related to the physical and quality aspects of marine-coastal waters and coastal erosion, even in emergency situations. He carried out research activities concerning flows in porous media, was interested in magneto-hydrodynamic flows, in numerical and experimental methodologies for the determination of the hydrodynamic resistance of hulls, in the study of the barotropic and baroclinic instability of cyclonic/anticyclonic structures, in the interaction between wave motion and marine structures, sedimentary dynamics using continuous medium models, in LDA, PIV and PTV experimental methods for the study of wave motion in the laboratory and in the field, numerical methods for the study of river mouths, jet-wall interaction, environmental effects of maritime works, quality of coastal waters, flooding phenomena. He produced around 90 publications in international and national journals, conference proceedings and technical reports.

**All interested people are invited to attend the seminar, in particular Master students in Environmental and Civil Engineering, PhD students and researchers in water science and engineering.**