CIVIL AND ENVIRONMENTAL ENGINEERING

DIATI - Numerical studies of ice-ocean interactions

Funded By	Dipartimento DIATI
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Contact	
Context of the research activity	The research work includes the application of fluid mechanics and hydrology to address issues concerning the natural and built environment. The research approach will be based on the development of numerical and analytical methods. More in detail, specific issues to be addressed within the PhD include: • Environmental Fluid Mechanics • Fluid Mechanics • Turbulent flows • Heat and mass transport processes • Large-scale simulations • Upscaling of Micro and meso-scale processes
Objectives	The general aim is to develop a better understanding of fundamental processes in Fluid Mechanics and Hydrology. Publication on peer reviewed international journals are foreseeable (and expected) outcomes of the research work. Specifically, the objective of the work is to understand the interactions between the ocean and ocean waves and ice sheets. In addition, we wish to understand how ice melting is affected by the presence of sediments and how discharged sediment, in turn, affect the flow. A secondary objective of the work is to develop an accurate numerical tool for interface-resolved simulations of three-phase systems composed of air, water and ice, which includes phase change. The work will be based on numerical simulations (CFD) using the in-house numerical code for interface-resolved computations of multiphase flows with phase change. The objective is to model ice melting/formation in turbulent flows, including the presence of a free surface and waves. This interface-resolved will aim to quantify micro and mesoscale phenomena related to mixing and heat/mass transfer under different condition, including potentially the presence of solid sediments in the melting ice. Ice models will consider porosity and non-Newtonian effects, possibly considering ice as a viscoplastic material. The simulations will be run in parallel on clusters and accelerated architectures. The obtained data will be analyzed to obtain inputs and parametrization for large-scale models in oceanic/climate models. If possible,

	simulation data will be compared with experiments performed at DIATI, PoliTo and international collaborators.

Skills and competencies for the development of the activity	Knowledge of fluid dynamics, multiphase and non-Newtonian flows, numerical algorithms for interface-tracking in multiphase flows. Experience with large-scale simulations and parallel computing.