ORGANIZATION ROLE
Research Environmental Engineer

PROJECT ROLE / FOCUS AREAS
Groundwater modeling
Coastal hydrodynamics
Real-time forecasting

EDUCATION
Ph.D., Engineering for the Built & Natural Environment, Politecnico di Torino, Italy, 2015

MS, Environmental engineering, Politecnico di Torino, Italy, 2011

BS Environmental Engineering, Politecnico di Torino, Italy, 2009

CERTIFICATIONS
Delft3D and Delft3D Flexible Mesh (training course)
Delft-FEWS (basic and advanced training courses)
MIKE flood & flexible mesh (training course)

FRANCESCA MESSINA, PH.D.

Research Environmental Engineer

Francesca Messina, Ph.D., is a Research Environmental Engineer with The Water Institute's Natural Systems Modeling and Monitoring group.

Her research focuses on coastal and deltaic biophysical modeling, mainly focusing on hydrodynamic and salinity dynamic. She is heavily involved in the numerical modeling being used by Louisiana to help refine the design of sediment diversions at Mid-Barataria and Mid-Breton along the Mississippi River. She is also heavily involved in developing and applying real-time forecasting systems, for both coastal and inland regions.

She developed her modeler experience during her graduate studies. Francesca obtained her Ph.D. in environmental engineering at Politecnico di Torino, Italy, in 2015 with a thesis entitled "Pore-scale simulation of micro and nanoparticle transport in porous media." During her doctoral research, she worked with the Groundwater Engineering group, and her research was primarily devoted to modeling flow and colloidal particle transport and deposition in saturated porous media from a microscale point of view.

As a research scientist and environmental engineer, she also has skill sets that delve into environmental fluid dynamics, reclamation of polluted sites, pollutant dynamic, and sanitary and environmental engineering.

PROFESSIONAL EXPERIENCE

2018–Present: Research Scientist-Technical Lead, The Water Institute

2016–2018: Research Scientist, The Water Institute

2015–2016: Postdoctoral Fellow, The Water Institute

2015: Postdoctoral Fellow, Politecnico di Torino, Italy

2011–2012: Consultant for Quality/Environmental Management Systems, Prosystem Ingegneria S.r.l., Pinerolo, Torino, Italy

SELECTED PROJECTS

Basin-Wide Model Development for the Mississippi River Hydrodynamic and Delta Management (MRHDM). *Coastal Protection and Restoration Authority (CPRA). (2015–2017).* Team member**.** Developing a calibrated and validated Delft3D model capable of simulating the morphological evolution processes that occur in coastal Louisiana during the creation of a new delta and wetland areas, and the nutrient dynamic and effects to the wetland vegetation, soil, and the estuarine primary producers of Breton Sound and Barataria Basin (in Louisiana).

Delft3D Basin-wide model 50-year Production Runs to support Mid-Barataria and Mid Breton Environmental Impact Statement (EIS) and for Evaluation of Diversion Operations. *CPRA. (Ongoing).* Principal Investigator (Mid-Barataria EIS project) and Co-Principal Investigator (Mid-Breton EIS project). Led the effort to perform numerical simulations with the Basin-wide integrated biophysical Delft3D model developed under the Mississippi River Hydro and Delta Management (MRHDM). The intent of this project is to evaluate and examine sediment diversion operation plans (i.e., multiple operation strategies, synergies with marsh creation projects, interactions with existing projects, effect on salinity, etc.) and the 50-year evolution of the Mississippi River delta and its receiving basins.

Real Time Forecasting for Coastal Louisiana (CERF). *CPRA. (2015–2017).* Team member in collaboration with Deltares**.** Was a key player in developing a forecasting and information system which represents a seven-day forecast on the hydrodynamics (i.e., water level, salinity and temperature) of a pilot location in coastal Louisiana (i.e. the Mississippi River Delta at its receiving basins). The system can provide forecasted guidance on the optimal operation of the freshwater and sediment diversions to reduce the impacts to ecological health and increase the volume of sediment diverted to the receiving areas. Delft-FEWS has been used to develop the real time forecasting (RTF) framework. Delft3D has been used as engine of the RTF system.

Forecasting Louisiana's Coastal Estuaries in Real-Time. *Coypu Foundation in collaboration with Deltares. (2016).* Principal Investigator**.** Led the effort to expand the capabilities of the CERF real time forecasting system developed by The Water Institute, together with Deltares. In particular, the capabilities of this system have been expanded in order to include total suspended sediment (TSS), and some ecological parameters, such as nitrate (NO3), dissolved oxygen (DO), algal biomass (using the proxy, chlorophyll a (Chla)), an important influence algal growth and longer term and marsh sustainability. Delft-FEWS has been coupled with Delft3D and DWAQ.

Calcasieu Parish Police Jury (CPPJ) - Real-time forecasting system development. *Calcasieu Parish in collaboration with Deltares USA and Fenstermaker. (2017–2018).* Team member**.** Played a key role in developing an urban flash flood forecasting and warning system for a pilot location in the Calcasieu Parish, Louisiana. The system provides forecasted estimates of flood depths, potential road closures, and flood duration for the Contraband sub-catchment. Local authorities can use this tool to better prepare and respond to flood events more efficiently, and ultimately reduce flood related damages. Delft-FEWS has been used to develop the real time forecasting (RTF) framework. HEC-HMS and HEC-RAS have been used as engines of the RTF system.

HERMES Reservoir Optimization at BPA. *Bonneville Power Administration (BPA) in collaboration with Deltares USA. (2018–2020).* Team member**.** Providing technical support to Deltares USA during the implementation of a Delft-FEWS real time forecasting system for Bonneville Power Administration (BPA) for reservoir optimization. The performed tasks include analyzing issues identified by the final users of the system, determining, and testing possible configuration solutions.