Francesca Messina, PhD

Research Scientist – Technical Lead
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EDUCATION

PhD in Engineering for the Built and Natural Environment, April 2015
Politecnico di Torino, Torino, Italy; PhD student visitor at The University of Texas, Austin, Texas, from July to December 2013

M.S. in Environmental Engineering, December 2011
Politecnico di Torino, Torino, Italy

B.S. in Environmental Engineering, October 2009
Politecnico di Torino, Torino, Italy

PROFESSIONAL EXPERIENCE

The Water Institute of the Gulf   2018 (November) – present
Baton Rouge (Louisiana)
- *Research Scientist – Technical Lead*

The Water Institute of the Gulf   2016 (June) – 2018 (October)
Baton Rouge (Louisiana)
- *Research Scientist*

The Water Institute of the Gulf   2015 (Sept) – 2016 (May)
Baton Rouge (Louisiana)
- *Postdoctoral Fellow*

Politecnico di Torino   2015 (Jan-Sept)
Torino (Italy)
- *Postdoctoral Fellow*

Politecnico di Torino   2012 (Feb-July)
Torino (Italy)
- *Teaching assistant (geometry)*

Prosystem Ingegneria S.r.l.   2011-2012
Pinerolo (Torino - Italy)
- *Company consultant - Quality Management Systems, Environment Management System (UNI EN ISO 9001 - UN EN ISO 14001) and FSC Certification (FSC-STD-40-004)*

Politecnico di Torino   2007-2011
Torino (Italy)
  - *Student tutor (mathematical analysis I and II, geometry, groundwater engineering)*

RECENT RESEARCH PROJECTS

Delft3D Basin-wide model 50-year Production Runs to support Mid-Barataria Environmental Impact Statement (EIS) and for Evaluation of Diversion Operations
Sponsored by Coastal Protection and Restoration Authority (CPRA)
Role: Principal Investigator
Year: 2019-ongoing
Lead 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. Specifically, the operation plans and environmental effects of the proposal Mid-Barataria sediment diversion in Breton Basin, in Louisiana, was investigated.

Delft3D Basin-wide model 50-year Production Runs to support Mid-Breton Environmental Impact Statement (EIS) and for Evaluation of Diversion Operations
Sponsored by Coastal Protection and Restoration Authority (CPRA)
Role: Co-Principal Investigator
Year: 2020-ongoing
Lead the effort to perform numerical simulations with the Basin-wide integrated biophysical Delft3D model developed under the Mississippi River Hydro and Delta Management (MRHDM) and other related projects. 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. Specifically, the operation plans and environmental effects of the proposal Mid-Breton sediment diversion in Breton Basin, in Louisiana, was investigated.

Basin-Wide Model Development for the Mississippi River Hydrodynamic and Delta Management (MRHDM)
Sponsored by Coastal Protection and Restoration Authority (CPRA)
Role: Team member
Year: 2015-2017

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).

Barataria Basin Water Quality Data Collection for Model Refinement
Sponsored by Coastal Protection and Restoration Authority (CPRA)
Role: Team member
Year: 2016
Providing numerical modelling expertise during the development of the project. The goal was to understand the past ecological conditions of Barataria Basin (in Louisiana), and examine how Barataria Basin may respond without Davis Pond freshwater diversion or with a freshwater or sediment diversion at a different location.

Real Time Forecasting for Coastal Louisiana (CERF)
Sponsored by Baton Rouge Area Foundation Coastal Protection and Restoration Authority (CPRA)
Role: Team member
Year: 2015-2017
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.
In collaboration with Deltares

Forecasting Louisiana's Coastal Estuaries in Real-Time
Sponsored by Coypu Foundation - In collaboration with Deltares.
Role: Principal Investigator
Year: 2016
Lead the effort to expand the capabilities of the CERF real time forecasting system developed by The Water Institute of The Gulf, 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 (NO_3), 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
Sponsored by Calcasieu Parish - In collaboration with Deltares USA and Fenstermaker

Role: Team member
Year: 2017-2018
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 engine of the RTF system.

HERMES Reservoir Optimization at BPA
Sponsored by Bonneville Power Administration (BPA) - In collaboration with Deltares USA
In collaboration with Deltares USA
Role: Team member
Year: 2018-2020
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.

Manitoba Hydro – Delft-FEWS System
Sponsored by Manitoba Hydro / Deltares USA
Role: Team member
Year: 2019-2020
Providing technical support to Deltares USA during the implementation of a Delft-FEWS real time forecasting system for Manitoba Hydro for hydrological modelling and river forecasting for hydropower operations. The performed tasks include linking Delft-FEWS with HEC-HMS models.

Chincoteague Island Modeling Study
Sponsored by Virginia Institute of Marine Science
Role: Co-Principal Investigator
Year: 2020-2021
Developing a calibrated and validated Delft3D hydrodynamic model (flow and waves) and sediment transport model for the Assateaque and Chincoteague Islands. Performance of exploratory simulations to evaluate selected scenarios of alternate morphology.

Lowermost Mississippi River Management Program
Sponsored by Baton Rouge Area Foundation Coastal Protection and Restoration Authority (CPRA)
Role: Team member

Year: 2021-ongoing
This is large-scale program with the objective of moving toward a more Mississippi River holistic management philosophy that relies on a science-based decision-making framework. Numerical and physical models are powerful scientific tools that serve as a foundation to this framework along with focused observational data collection and the synthesis and analysis of the large but under-utilized trove of historical river datasets.

SmartPort
Sponsored by
Role: Team member
Year: 2021-ongoing
Goal of the project is to better understand shoaling dynamics in the Mississippi River, to develop a technology tool able to share and forecast shoaling data with river operators and researchers.

Model Repository
Sponsored by Baton Rouge Area Foundation Coastal Protection and Restoration Authority (CPRA)
Role: Program Manager
Year: 2021-ongoing
Goal of the project is to develop a model repository that will make numerical models searchable to promote better collaboration across the modeling community, consultant, academic, and public sector, and to let the community build on what has been done previously.

AWARDS AND HONORS

- National RemTech 2012 awards for the best Master degree thesis
- *Premio Optime*, best graduates 2011-2012, assigned by *Unione Industriale di Torino*
- *Premio Ambiente Domani* given by *Camera di Commercio Industria Artigianato e Agricoltura di Torino* in 2012
- Winner in the academic year 2008/2009 of the Scholarship *Ing. Giulio Axerio* banned by the institution *Ing. Giulio Axerio*. In the academic years 2009/2010 and 2010/2011, the same institution conferred her financial benefits on the basis of the academic merit

COMPUTATIONAL SKILLS

- C++ programming language
- COMSOL Multiphysics
- Matlab
- Visual Modflow
- ENVI

- Autocad
- ArcGis
- Microsoft Office (Word, Excel and Power Point)
- MIKE flood (32-hour course)
- MIKE flood flexible mesh (32-hour course)
- Delft3D
- Delft3D FM (40-hour course)
- Delft-FEWS (16-hour course)

TRAINING COURSES

- Understanding the Benefits of Operational Ocean and Forecasting Systems (OOFS) – June 2021

PERSONAL SKILLS

- Mother Language: Italian
- Other Languages: English (advanced), French (elementary)

CERTIFICATIONS

- Qualification to the Engineer profession in Italy, Sector *Civile-Ambientale*, Class 38/S by *Ordine degli Ingegneri di Torino* (Italy)
- FIRST Diploma by the *University of Cambridge*
- DELF B1 Diploma by the *Commission nationale du DELF et du DALF*
- Project Management Training by PSMJ (December 2022)

PUBLICATIONS

- F. Messina, D. Marchisio, R. Sethi, *An extended and total flux normalized correlation equation for predicting single-collector efficiency,* Journal of Colloid and Interface Science, 2015 Volume 446, pages 185-193, 10.1016/j.jcis.2015.01.024
- F. Messina, *Pore-scale simulation of micro and nanoparticle transport in porous media,* Dissertation for the Ph.D. Degree in Engineering for the Built and Natural Environment, Politecnico di Torino, Torino (Italy), April 2015, Supervised by Prof. Rajandrea Sethi and Prof. Daniele Marchisio
- Messina F., Tosco T., Sethi R., *On the failure of upscaling the single-collector efficiency to the transport of colloids in an array of collectors*, Water Resour. Res., 2016, 52, 5492–5505, doi:10.1002/2016WR018592.

- White E., Messina F., Moss L., Meselhe E., *Salinity and Marine Mammal Dynamics in Barataria Basin: Historic Patterns and Modeled Diversion Scenarios,* Water 2018, 10, 1015; doi:10.3390/w10081015
- Boccardo C., Tosco T.,Fujisaki A., Messina F.,Raoof A., Aguilera D.R., Crevacore E., Marchisio D.L., Sethi R., *Chapter 13 - A review of transport of nanoparticles in porous media: From pore- to macroscale using computational methods*, Nanomaterials for the Detection and Removal of Wastewater Pollutants - Micro and Nano Technologies, 2020, Pages 351-381, https://doi.org/10.1016/B978-0-12-818489-9.00013-X

- Takeshita R., Balmer B.C., Messina F., Zolman E.S., Thomas L., Wells R.S., Smith C.R., Rowles T.K., Schwacke L.H., *High site-fidelity in common bottlenose dolphins despite low salinity exposure and associated indicators of compromised health*, PLoS ONE 16(9): e0258031. https://doi.org/10.1371/journal.pone.0258031

CONFERENCE PROCEEDINGS AND PRESENTATIONS

- Messina F., Icardi M., Marchisio D., Sethi R., *Microscale Simulation of Nanoparticles Transport in Porous Media for Groundwater Remediation,* COMSOL Conference 2012, Milano, 10th-12th October 2012
- Messina F., Sethi R., *Microscale modeling of zerovalent iron micro and nanoparticles transport in porous media,* Remtech 2012, Ferrara, 19th - 21st September 2012
- Icardi M., Boccardo G., Messina F., Marchisio D., Sethi R., *Two and three dimensional simulation of flow and particle transport in porous media,* SIMAI 2012, Torino, 25th - 28th June 2012
- Messina F., Icardi M., Marchisio D., Sethi R., *Pore scale simulation of micro and nanoscale zerovalent iron particles transport,* 5th International Conference on Porous Media, Prague, 22nd - 24th May 2013
- Icardi M., Boccardo G., Messina F., Marchisio D., Sethi R., Tempone R., Prudhomme S., *Pore-scale investigation of flow in saturated and unsaturated media: computational tools and upscaling,* XXI congresso associazione italiana meccanica teorica e applicata, Torino, 17th - 20th September 2013
- Messina F., Sethi R., *A new definition of a correlation equation for single collector efficiency,* European Geosciences Union General Assembly 2014, Vienna, 27th April – 2nd May 2014
- Messina F., Sethi R., Marchisio D., *Normalization and extension of the single-collector efficiency correlation equation for predicting transport of (nano)particles,* Nanosafety Forum for Young Scientists, Siracusa, 9th - 10th October 2014
- Messina F., Marchisio D., Sethi R., *Normalization and extension of single-collector efficiency correlation equation,* European Geosciences Union General Assembly 2015, Vienna, 13th - 17th April 2015
- Messina F., Marchisio D., Sethi R., *A Normalized and Extended Correlation Equation for*

Predicting Single-Collector Efficiency in Physicochemical Filtration in Saturated Porous Media, 7th International Conference on Porous Media, Padova, 18th - 21th May 2015

- Messina F., Marchisio D., Sethi R., *A new Correlation Equation for Predicting Single-Collector Efficiency in Physicochemical Filtration in Saturated Porous Media,* ECCE10-ECAB3-EPIC5, Nice, 27th September - 1st October 2015

- Sethi R., Messina F., Marchisio D., *A novel total flux normalized correlation equation for predicting single-collector efficiency,* AGU FALL MEETING, San Francisco, 14th-18th December 2015

- Meselhe E., Twight D., Messina F., Khadka A., Costanza K., *Coastal Eco-morphological Real-time Forecasting (CERF) System*, State of The Coast, New Orleans, LA, June 1-3, 2016

- Meselhe E., Pereira J., Messina F., Khadka *A., Miller R.,* Mallory R., Scott D.S., Couvillion B., Beck H., Feldbaum A., Ramatchandirane C., Allison M., *Comprehensive Modeling Approach to Analyze the Calcasieu Ship Channel Salinity Control Measures Project*, State of The Coast, New Orleans, LA, June 1-3, 2016

- Messina F., Khadka A., Meselhe E., Twight D., Buckman L., *Coastal Eco-Morphological Real-Time Forecasting (Cerf) System*, Bays and Bayous symposium, Biloxi, MS, Nov.30-Dec. 1, 2016

- Messina F., Khadka A., Meselhe E., Twight D., Buckman L., *Coastal Eco-Morphological Real-Time Forecasting (Cerf) System*, Northern Gulf of Mexico Operational Forecast System (NGOFS) workshop, Louisiana State University, Baton Rouge, LA, August 2, 2016

- Messina F., Meselhe E., Khadka A., Twight D., Buckman L., *Coastal Eco-morphological Real-time Forecasting (CERF) System*, AGU Chapman Conference on Extreme Climate Event Impacts on Aquatic Biogeochemical Cycles and Fluxes, San Juan, Puerto Rico, 22-27 January 2017

- Messina F., Meselhe E., Twight D., Buckman L., *Coastal Eco-morphological Real-time Forecasting tool to predict hydrodynamic, sediment and nutrient dynamic in Coastal Louisiana*, RCEM2017 10th Symposium on River, Coastal and Estuaries Morphodinamic, Padova, Italy, 15-22 September 2017

- Meselhe E., Sadid K., Jung H., Messina F., Esposito C., Liang M., *Ecologic and Morphologic Analysis of a Proposed Network of Sediment Diversions,* RCEM2017 10th Symposium on River, Coastal and Estuaries Morphodinamic, Padova, Italy, 15-22 September 2017

- Meselhe E., Sadid K., Jung H., Messina F., Esposito C., Liang M., *Ecologic and Morphologic Analysis of a Proposed Network of Sediment Diversions,* AGU Fall Meeting, New Orleans, Louisiana, 11-15 December 2017

- Messina F., Meselhe E., Twight D., Buckman L., *Eco-morphological Real-time Forecasting tool to predict hydrodynamic, sediment and nutrient dynamic in Coastal Louisiana,* AGU Fall Meeting, New Orleans, Louisiana, 11-15 December 2017

- Tosco T., Messina F., Sethi R., *On the Failure of Upscaling the Single-Collector Efficiency to the Transport of Colloids in an Array of Collectors,* AGU Fall Meeting, New Orleans, Louisiana, 11-15 December 2017

TECHNICAL REPORTS

- Bregman, M., Jung, H., Liu, B., Baustian, M. M., Messina, F., & Georgiou, I. Y. (2021). Basin Wide Model Version 4 Sensitivity Analysis (Technical Memorandum) (p. 113). Baton Rouge, LA: The Water Institute of the Gulf, Produced for the Louisiana Coastal Protection and Restoration Authority under Task Order 77.

- Bregman, M., Messina, F., Yuill, B., & Jung, H. (2019). QA/QC Procedures for Mid-Barataria Sediment Diversion Alternatives Modeling (Technical Memorandum under Task Orders 48 and 51) (p. 48). Baton Rouge, LA: The Water Institute of the Gulf, produced for the Coastal Protection and Restoration Authority.

- Liang, M., Meselhe, E., Messina, F., & Ortals, C. (2017). TO41_div_opt_FINAL.docx.
- Messina, F., Bregman, M., Zou, S., Georgiou, I. Y., Dalyander, S., & Miner, M. (2022a). Lake Borgne Gulf Sturgeon monitoring and habitat characterization (Draft). The Water Institute of the Gulf. Produced for and funded by Coastal Protection and Restoration Authority under Task Order 81.

- Messina, F., Georgiou, I., Bregman, M., Jung, H., Yuill, B., Liu, B., Cobell, Z., & Baustian, M. M. (2022b). Mid-Breton sediment diversion engineering modeling support: Production runs with the Basin Wide model Version 4 (Task Order 77. Draft report submitted to the Coastal Protection and Restoration Authority). Baton Rouge, LA: The Water Institute of the Gulf. Funded by the Coastal Protection and Restoration Authority.

- Messina, F., Georgiou, I. Y., Bregman, M., Holm, G. O., & Marino, R. (2021a). Analysis of existing and predicted coastal water surface elevation trends in Breton Sound Basin: In support of the Mid-Breton Sediment Diversion Environmental Impact Statement. Baton Rouge, LA.: The Water Institute of the Gulf. Prepared for and Funded by the Coastal Protection and Restoration Authority under Task Order 77.

- Messina, F., Georgiou, I. Y., Bregman, M., Jung, H., Yuill, B. T., Liu, B., Cobell, Z., & Baustian, M. M. (2021b). Mid-Breton Sediment Diversion Engineering Modeling Support: Production Runs with the Basin Wide model Version 4 (Revised March 2022). Baton Rouge, LA: The Water Institute of the Gulf. Funded by the Coastal Protection and Restoration Authority under Task Order 77.

- Messina, F., & Meselhe, E. A. (2017). The effects of various Mississippi River and Mid-Barataria Sediment Diversion hydrographs on salinity in Barataria Basin (Technical Memorandum) (p. 21). Baton Rouge LA: The Water Institute of the Gulf.

- Sakib, M. M., Georgiou, I., Hein, C., Fenster, M., Zou, S., Esposito, C., Foster-Martinez, M., Messina, F., & Trembanis, A. (2021). Mechanisms and Rates of Sand Bypassing along a Rapidly Evolving Inlet-Spit System, 2021, OS15D-1021. Presented at the AGU Fall Meeting Abstracts.