Sustainable Water Management Doctoral Programme (Water4All)

Title of the PhD Project	Model-based assessment of the broken surface-subsurface link under drought conditions
Acronym	MASSL
Research Fields of the Project	Mathematical modeling, Surface-Subsurface interactions, Drought
Keywords	Surface water, subsurface water, mathematical modeling, drought, coupled system
Host Institution, Department and Campus Location	Izmir Institute of Technology Department of Environmental Engineering Gülbahçe Campus, İzmir, Türkiye
PhD Awarding Institution and Graduate Programme	Izmir Institute of Technology Graduate School PhD in Environmental Engineering
Name and Affiliation of Main Supervisor	Prof. Dr. Orhan GÜNDÜZ Izmir Institute of Technology Department of Environmental Engineering and Department of International Water Resources
Name and Affiliation of Co-Supervisors	Assoc. Prof. Dr. Koray K. YILMAZ, Middle East Technical University Prof. Dr. İsmail YÜCEL, Middle East Technical University
Research Environment and Infrastructure	The selected candidate will have access to the research infrastructure available at Izmir Institute of Technology.
Scientific Context of the Project	Hydrological cycle is a cyclic process, in which individual components are all interlinked to each other. Understanding the interconnection between surface and subsurface processes are crucial for proper water management. Based on this premise, this research project aims to model surface and subsurface water processes in a compact manner via a physics-based approach to better understand numerous extreme events such as floods and droughts. In arid to semi-arid landscapes, the link between surface and subsurface waters are typically broken and the two systems behave in an isolated manner. A coupled mathematical model linking the two domains in a single mathematical framework forms the core of this project.

Brief Workplan	The main aim of this research is to develop a physics-based model to simulate the dynamic interactions of surface and subsurface domains under extreme climatic conditions and variable spatio-temporal variations. The developed model is expected to be fully functional under completely interacting and fully broken conditions. A tentative work plan is given as follows: 1. Conceptualizing the surface-subsurface system 2. Mathematical formulation of the conceptual model 3. Collection of hydrological data necessary for model implementation 4. Model testing and implementation 5. Analyzing the extreme conditions with the developed model to predict hydrological responses
Innovative Aspects of the Project	Mathematical modeling of coupled surface-subsurface system, overcoming numerical challenges associated with nonlinear system behaviors and restricting boundary conditions, assessing climatic extremes and related mathematical challenges in hydrological modeling
Training Opportunities of the Project	The doctoral candidate will have a chance for training on subjects such as hydrological modeling, field applications and mathematics in renown government and private organizations as well as academic institutions. The training program will be custom designed for the selected candidate according to his/her needs and interests.
Interdisciplinary Aspects	This research involves a complementary analysis of mathematics, hydrology and engineering. Knowledge of civil, environmental and geological engineering will be coupled with information on hydrology and climatic sciences.
Intersectoral Mobility ☐ **Short Visit** ☒ **Secondment**	State Hydraulic Works
Intersectoral Mobility ☒ **Short Visit** ☐**Secondment**	Izmir Water and Sewerage Administration
International Academic Secondment	Villanova University

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Main Supervisor	
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Co-supervisors	
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	https://scholar.google.com.tr/citations?user=olbhvrYAAAAJ&hl=tr&oi=ao ResearchGate: https://www.researchgate.net/profile/Koray-Yilmaz-5 Scopus: https://www.scopus.com/authid/detail.uri?authorId=56568516600 ORCID: http://orcid.org/0000-0002-6244-8826
Brief CV	**Prof. Dr. İsmail YÜCEL** **E-mail:** iyucel@metu.edu.tr **Academic Degrees** Ph.D. Hydrology, The University of Arizona, USA 2001 M.Sc. Hydrology, The University of Arizona, USA 1996 B.Sc. Meteorological Engineering, İstanbul Technical University, Türkiye 1993 **Professional Networks** Google Scholar: https://scholar.google.com/citations?user=RGHnl3YAAAAJ ResearchGate: https://www.researchgate.net/profile/Ismail-Yucel-2 Scopus: https://www.scopus.com/authid/detail.uri?authorId=57204345432 ORCID: https://orcid.org/0000-0001-9073-9324