

Special Issue

AI and Machine Learning in Hydrogeology

Message from the Guest Editors

This Special Issue focuses on the transformative role of artificial intelligence (AI) and machine learning (ML) in hydrogeology and hydrological systems, spanning both surface and subsurface domains. We welcome contributions that address applications in groundwater modeling, surface water management, contaminant transport, subsurface energy systems, oil and gas recovery, geological carbon storage, geothermal energy, and hydrogen storage. Emphasis is placed not only on traditional ML techniques but also on emerging AI paradigms such as generative models, large language models (LLMs), and graph neural networks. The issue covers a range of topics including forward and inverse modeling, uncertainty quantification, real-time decision support, and deep learning architectures designed for hydrological processes. Particular attention is given to challenges in multi-source data integration, model interpretability, and physics-informed learning. Through this interdisciplinary collection, we aim to demonstrate how cutting-edge AI tools can improve predictive capabilities, support sustainable resource management, and deepen our understanding of complex environmental systems.

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Message from the Editor-in-Chief

Understanding the Earth's origin and its bio-geological evolution, the multiple implications of the geosciences (as a coherent set of interconnected disciplines), and the sociocultural and ethical interdisciplinary approaches, will be crucial for a better understanding of Nature, and also for undertaking scientifically based political decisions.

We are committed to drive *Geosciences* to a position in which it is recognized for its high-quality, cutting-edge research and scientific influence, and strongly encourage and invite your participation and manuscripts.

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