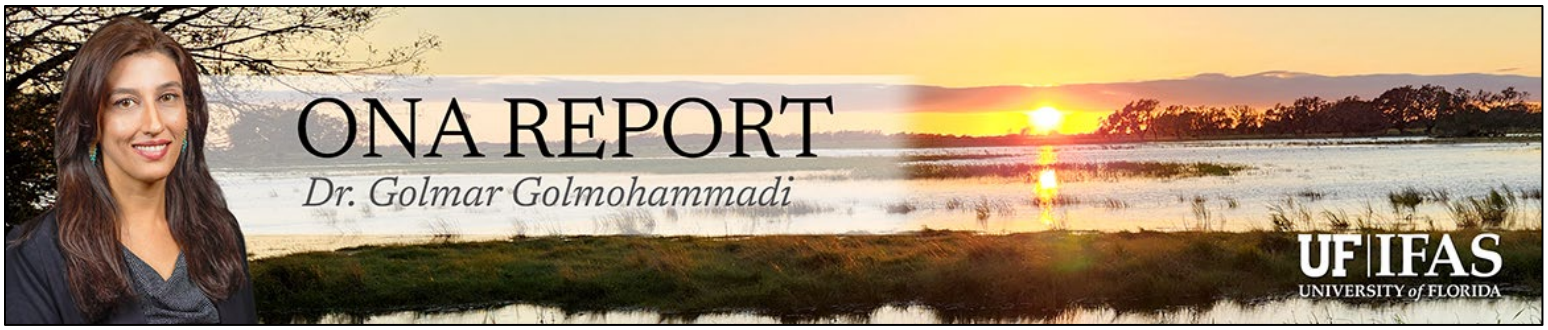

Applications of Artificial Intelligence in Water Resources Forecasting

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The advent of Artificial Intelligence, an emerging transformative technology, has permeated every aspect of our lives, from computer vision, to healthcare, and now the environment. Artificial Intelligence (AI) technologies and machine learning (ML) algorithms are expected to revolutionize environmental health, improve efficiency, and reduce costs.

Recent advancements in AI techniques have shown promising potential in improving the accuracy of hydrological forecasting. With their ability to capture complex nonlinear relationships and how hydrologic information changes over time, these models are well-suited for predicting hydrological variables. Atmospheric variables such as temperature and precipitation play a great role in predicting stream flow, groundwater level, soil moisture, and soil temperature (Beven, 2011). The main goal of this article is to introduce new AI techniques to predict all parameters of climate, soil, and water.

The climate drives the hydroclimatic characteristics of an area affecting the availability of natural resources, soil health, the functioning and services of ecosystems, and human health (Field, 2014). There is great demand for the development of models to evaluate, predict, and optimize the performance of complex hydrological systems. AI could help to understand the complex relationships between the earth's climate, soil, and water processes. AI, with its ability to learn from databases, make predictions and automate decision-making processes, presents a compelling solution to the multifaceted challenges of climate, soil, and water resources management (Schmidhuber, 2015). Therefore, it is expected that AI could potentially improve forecasting environmental parameters (i.e., soil characteristics and hydrologic parameters) at the field and regional levels. Recent advancements in AI techniques have shown promising potential in improving the accuracy of hydrological forecasting (Goodfellow, 2016; Brownlee, 2016; Campbell et al., 2021; Kelleher, 2019; Reichstein, 2019). With their ability to capture complex nonlinear relationships and temporal dependencies in data, these models are well-suited for predicting hydrological variables (Shen, 2018; Reichstein et al., 2019; Russel et al., 2016; Sietsma, 2024). With the created database, it would also be possible to predict the most examined meteorological fields (precipitation, temperature) using advanced AI methods.

The main goal of our AI research in Florida is to introduce new AI techniques to predict all parameters of climate, soil, and water. With the available Florida hydrology database, we have started research that uses advanced AI methods to predict the most examined

meteorological, hydrological, and hydrogeological fields (i. e., precipitation, temperature, stream flow, groundwater level, soil moisture, and soil temperature).

Forecasting Surface Water Discharge and Groundwater Levels using AI Methods in Florida

Accurately forecasting surface water discharge and groundwater levels is crucial for effective water resource management and planning, particularly in regions like Florida where water resources are pivotal in supporting the local ecosystem and economy. Florida's unique hydrological characteristics, including an extensive surface water network and the productive Floridan Aquifer, present a complex yet crucial area for hydrological studies.

We investigated the applicability of AI and machine learning models in forecasting daily surface water discharge and groundwater levels across 45 stations in Florida. Our study introduced and validated a novel hybrid model for forecasting surface water discharges and groundwater levels in Florida.

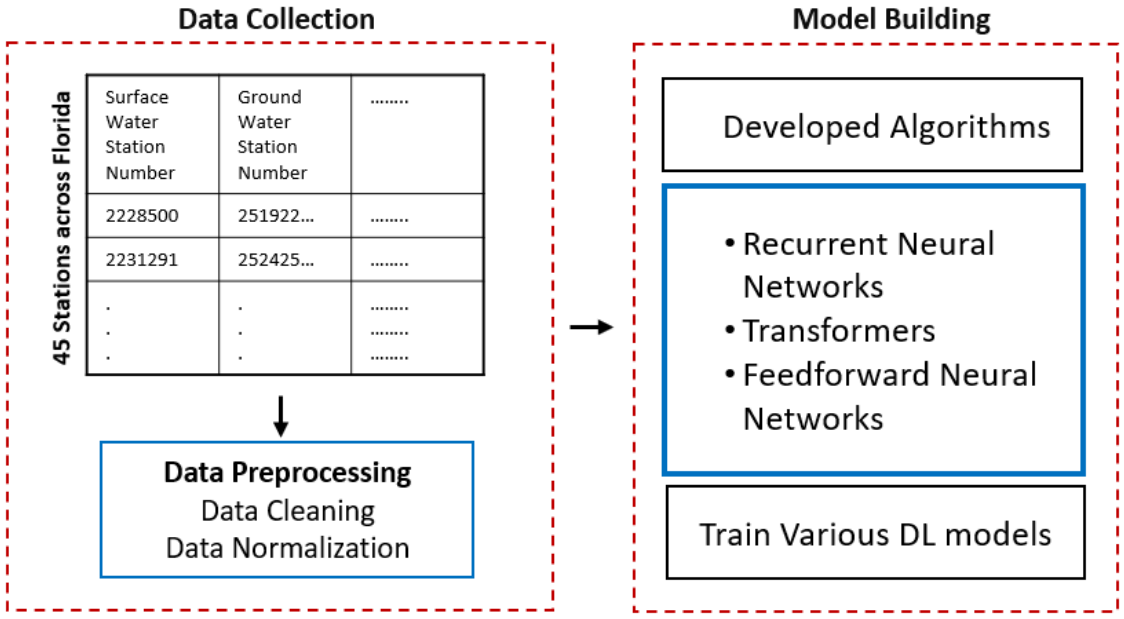

Figure 1. Schematic Diagram of AI Models to Forecast Hydrological Parameters

The findings of this research have the potential to inform the development of more accurate and reliable hydrological forecasting models, which are crucial for sustainable water resource management in the face of changing environmental conditions and increasing water demands. The results demonstrate that the deep learning models performed consistently well across all stations and established their superiority in capturing the temporal dynamics of both surface water and groundwater in the region.

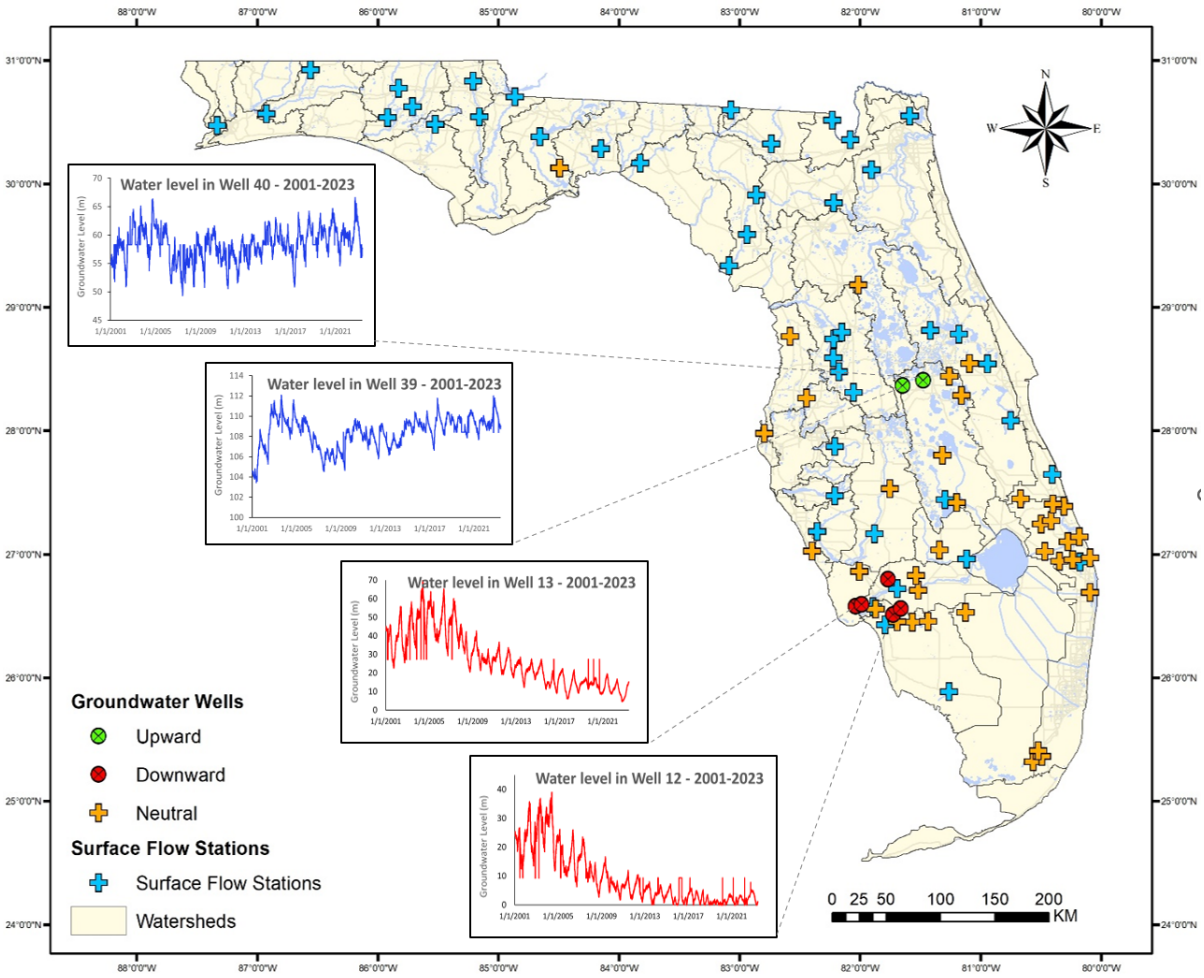

Figure 2. Groundwater level trends across Florida

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UPCOMING EVENTS

Ona Highlight – 'Water Quality' – Dec. 10, 11:00 – 11:45 a.m. with Dr. Golmar Golmohammadi, a Hydrology and Water Quality Specialist at the UF/IFAS Range Cattle REC in Ona. Visit our website calendar to register for the Zoom or call us to attend in person. 863-735-1001.

Cattle Management for Women – Dec. 12, 9:00 a.m. – 3:00 p.m. Location: 18724 Hancock Farm Road, Dade City. Space is limited. Registration: $40 on Eventbrite.

Florida Cattlemen's Institute and Allied Trade Show – Jan. 23, 8:30 a.m. – 3:30 p.m. Okeechobee Agri-Civic Center, 4601 hwy 710 E, Okeechobee, FL
Registration is $5, on Eventbrite.

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UF/IFAS Range Cattle REC - 3401 Experiment Station Rd., Ona - http://rcrec-ona.ifas.ufl.edu/