# SHAHAB A. SHOJAEEZADEH

Consultant of Water Resource Management, GIS Developer, and Research Paper Developer, Assistant, and Editor

## SKILLS

- **Windows/Macos/Linux** — 15+ yrs
- **Microsoft Office/Latex** — 15+ yrs
- **Python** — 10+ yrs
- **R** — 7+ yrs
- **QGIS/ArcGIS** — 7+ yrs
- **Adobe Photoshop** — 7+ yrs
- **Data Science** — 7+ yrs
- **Google Earth Engine** — 5+ yrs
- **Machine Learning/Deep Learning** — 5+ yrs
- **Software Development** — 4+ yrs
- **Stochastic Modeling** — 3+ yrs
- **MATLAB** — 3+ yrs
- **Delft3D FM/Flow** — 3+ yrs
- **Particle/Plastic Tracking** — 3+ yrs
- **Remote Sensing** — 3+ yrs

## PROFILE

Water Resource Management and GIS Consultant with strong theoretical skills and a passion for Open Source software.

I am an Engineer, specialized both in automation and in custom application development, experienced with large projects and Scientific background. The link between development and Science or Paper backed, comfortable in both.

Customer-oriented and structured method of working, focused on quality and maintainability. Highly motivated to work in a team, both comfortable in big companies as in small teams.

## WORK EXPERIENCE

**Consultant of Kamal Saleh Dam Operational Designer** — 2013 - 2015
**Design and Maintenance**

A Huge works of consultant to show weakness on design, operation and maintenance issues from structural to scientific backgrounds. It was intense work to speak, design and develop new methods to make work comparable to other types with lower complexity on design and maintenance. It has a large team workers to be contacted and convince them to work as it is designed. Maintenance operation has its complexities as well. Fortunately, passion and efforts made work to be done in Scheduled time.

**Teaching Fellow and Lecturer** — 2015 - 2020
**Shiraz University Teaching Fellow and Lecturer**

I am working along with Department of Civil Engineering in Shiraz University Fellowships to teach undergraduate and postgraduate courses of Hydrology/Hydraulic/River Engineering. I am also present different lectures about new advances in sediment transport and hydrological modeling as well as some workshops on statistical modelings and Python language algorithms.

**Manager of family-owned Company** — 2009 - 2020
**Manager and Designer**

The family-owned company has been established in Arak-Iran in 2009. We worked together to provide variety of consultant, design, and maintenance work in Arak city. This company constructed and designed buildings and consulted juridical and legal information for buildings in engineering system of Arak-Iran.

**FDM/FVM algorithms** 3+ yrs

**Maple/Mathematica** 3+ yrs

**Expert-N** 2+ yrs

**ANSYS FLUENT** 2+ yrs

**FLOW-3D** 2+ yrs

**Watershed Erosion Prediction Project (WEPP)** 1+ yrs

**Hec-RAS/Hec-HMS** 1+ yrs

**Smooth Particle Hydrodynamics (SPH)** 1+ yrs

**Regional Ocean Modeling System (ROMS)** 1+ yrs

# EDUCATION

**2016 - 2021**

**Ph.D. Water Resource Management**
Shiraz University

The scientific background and expertise's of my courier is sediment transport modeling from global to regional scales. My PhD thesis was on sediment transport modeling across US to with statistical and stochastic backgrounds. Also, I developed algorithms and Apps in Google Earth Engine and python language to analyze remote sensing data in water quality management issues from heavy metal nutrients and sediment transport series of rivers in Norway and U.S.

**Research Assistant (Full time)** 2021-2023
**Sultan Qaboos University, Oman**

I worked as a research assistant in Sultan Qaboos university to develop new methods to estimate the soil erosion condition and hazards across Oman. Also, I worked as a sediment scientist in this university to full fill the Oman's plan for future on conserving the lands and prepare it for agricultural conditions using sediment carried by rivers.

**Research Assistant-Habilitation (Full time)** 2023-ongoing
**Kassel University, Germany**

I am working in Kassel university at faculty of soil science in agricultural department to develop new methods to estimate/predict food security using crop modeling approaches and remote sensing data employing recent advancements in AI and ML. At university I am working on a major project of DigiPlus to digitalis agriculture in Germany

# SCIENTIFIC DEGREES

**M. Sc. Thesis** 2013 - 2016
**Research and Scientific Development**

Responsible for design and development of a flume in research lab of Shiraz University to make a new methodology for sediment transport and any factors that affect it under seepage circumstances. I developed a new Finite Volume Model (FVM) to simulate this phenomenon considering positive or negative seepage. Additionally, I developed a new theory to modify traditional shield's theory for critical shear stress and a new method based on Ergun Model and Conservation laws to calculate shear stress imposing on bed sediments under the seepage influences.

**Ph.D. Thesis** 2016 - 2021
**Research and Scientific Development**

In my Ph.D. I developed a stochastic model to predict sediment transport in 67 different streams and three hydrological regimes of U.S. considering underlying processes. I am published my Ph.D. paper in peer-reviewed journal of CATENA, which is an special journal in Geology studies. I used Copula theory to statistically predict sediment transport with remarkable precision and accuracy.

# PUBLICATIONS AND TEAM WORKS

**Probabilistic Hazard Assessment of Contaminated Sediment in Rivers** Paper
**Research and Scientific Development**

We proposed a probabilistic framework rooted in multivariate and Copula theory to assess heavy metal hazard associated with contaminated sediment in freshwater rivers that provide crucial ecosystem services such as municipal water source, ecotourism, and agricultural irrigation. Exploiting the dependence structure between suspended sediment concentration (SSC) and different heavy metals, we estimate the hazard probability associated with each heavy metal at different Suspended Sediment Concentration levels.

**2013 - 2016**

**M. Sc. Hydraulic Structures**
Shiraz University

Main thematic priority of those master studies was fundamental studies about general water management systems along with design and modeling. Besides, Finite Difference and Finite Volume modeling was the main subject of the half assignments and tests. In the Master thesis a general study (e.g. experimental, numerical and analytical) on the effect of seepage flow on bed load sediment transport, and critical and normal shear stress was performed with the help of MATLAB and FLUENT software on numerical simulation.

**2009 - 2013**

**B. Sc. Civil Engineering**
Arak University

Main thematic priority of those bachelor studies was fundamental studies about general civil engineering studies.

## CONTACT


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Kassel University (Please Click)


**Stochastic modeling of suspended sediment load in alluvial rivers** Paper
**Research and Scientific Development**

Sediment is a major source of non-point pollution. Suspended sediment can transport nutrients, toxicants and pesticides, and can contribute to eutrophication of rivers and lakes. Modeling suspended sediment in rivers is of particular importance in the field of environmental science and engineering. However, understanding and quantifying nonlinear interactions between river discharge and sediment dynamics has always been a challenge. In this paper, we introduce a parsimonious probabilistic model to describe the relationship between Suspended Sediment Load (SSL) and discharge volume. This model, rooted in multivariate probability theory and Bayesian Network, infers conditional marginal distribution of SSL for a given discharge level.

**Estimation of two-dimensional velocity distribution profile using General Index Entropy in open channels** Paper
**Research and Scientific Development**

Estimation of velocity distribution profile is a challenging subject of open channel hydraulics. In this study, an entropy-based method is used to derive two-dimensional velocity distribution profile. The General Index Entropy (GIE) can be considered as the generalized form of Shannon entropy which is suitable to combine with the different form of Cumulative Distribution Function (CDF). Using the principle of maximum entropy (POME), the velocity distribution is defined by maximizing the GIE by treating the velocity as a random variable.

**A novel Bayesian maximum entropy-based approach for optimal design of water quality monitoring networks in rivers using value of information and transinformation entropy** Paper
**Research and Scientific Development**

This paper presents a Bayesian Maximum Entropy (BME)-based framework to optimize Water Quality Monitoring Stations (WQMS) in rivers to obtain the highest value of information with the lowest number of monitoring stations. While previous studies have used optimization-based approaches to obtain the optimal design of WQMS in rivers, they did not investigate collective features of suitable locations, cost-effectiveness, spatial coverage, and mutual information as important factors. In this study, BME is employed as a flexible, accurate, and powerful approach in geostatistics to optimize the spatiotemporal coverage of potential WQMS.

**Hydro-pedotransfer functions: a roadmap for future development** Paper
**Research and Scientific Development**

Hydro-pedotransfer functions (PTFs) relate easy-to-measure and readily available soil information to soil hydraulic properties (SHPs) for applications in a wide range of process-based and empirical models, thereby enabling the assessment of soil hydraulic effects on hydrological, biogeochemical, and ecological processes. At least more than 4 decades of research have been invested to derive such relationships. However, while models, methods, data storage capacity, and computational efficiency have advanced, there are fundamental concerns related to the scope and adequacy of current PTFs, particularly when applied to parameterise models used at the field scale and beyond. Most of the PTF development process has focused on refining and advancing the regression methods, while fundamental aspects have remained largely unconsidered. Most soil systems are not represented in PTFs, which have been built mostly for agricultural soils in temperate climates.

**Historical Hazard Assessment of Climate and Land Use–Land Cover Effects on Soil Erosion Using Remote Sensing: Case Study of Oman**

Paper

**Research and Scientific Development**

Human activities, climate change, and land-use alterations accelerated soil erosion in recent decades and imposed significant threats to soil fertility and stability worldwide. Understanding and quantifying the spatiotemporal variation of soil erosion risks is crucial for adopting the best management practices for surface soils conservation. Here, we present a novel high-resolution (30 m) soil erosion framework based on the G2 erosion model by integrating satellite and reanalysis datasets and Machine Learning (ML) models to assess soil erosion risks and hazards spatiotemporally. The proposed method reflects the impacts of climate change in 1 h time resolutions and land use in 30 m scales on soil erosion risks for almost 4 decades (between 1985 and 2017).

**Suspended sediment load modeling using Hydro-Climate variables and Machine learning**

Paper

**Research and Scientific Development**

Machine learning (ML) models have the potential to improve the accuracy of Suspended Sediment Load (SSL) predictions. However, their ability to incorporate climate data to enhance SSL predictions remains underexplored. This study investigates the efficacy of ML models in modeling sediment transport using hydro-climate variables as input data. Boosted decision tree models, including Xgboost, LightGBM, and Catboost, were employed to estimate SSL using hydro-climate variables such as streamflow and precipitation, as well as maximum and minimum temperatures.

**Soil erosion in the United States: Present and future (2020–2050)**

Paper

**Research and Scientific Development**

Brought on by anthropogenic actions, accelerated soil erosion inflicts extreme changes in terrestrial and aquatic ecosystems. These field-scale (30 m) changes have neither been fully surveyed in the present, nor predicted for a probable future. Water-driven soil erosion (i.e., sheet and rill erosion) rates across the contiguous United States were estimated for the present, and then predicted for the future using three alternative Shared Socioeconomic Pathway and Representative Concentration Pathway (SSP-RCP) scenarios (2.6, 4.5, and 8.5) of the Coupled Model Intercomparison Project Phase 6 (CMIP6). The G2 erosion model which is integrated with Machine Learning (ML) and Remote Sensing (RS) techniques were used to estimate soil erosion based on gauge observations of long-term precipitation, and climate and land use land cover (LULC) scenarios. The baseline model (2020) estimated soil erosion rates of 2.32 Mg ha1 yr1 under current conservation agriculture practices (CPs).

**A novel fusion of Sentinel-1 and Sentinel-2 with climate data for crop phenology estimation using Machine Learning**

Paper

**Research and Scientific Development**

Crop phenology describes the physiological development stages of crops from planting to harvest which is valuable information for decision makers to plan and adapt agricultural management strategies. In the era of big Earth observation data ubiquity, attempts have been made to accurately detect crop phenology using Remote Sensing (RS) and high resolution weather data.

**A Multi-model approach for remote sensing-based actual evapotranspiration mapping using Google Earth Engine (ETMapper-GEE)** Paper

**Research and Scientific Development**

Accurate estimation of actual evapotranspiration ($ET_a$) through remote sensing (RS) is essential for effective large-scale water management. We developed an EvapoTranspiration Mapper in the Google Earth Engine environment (ETMapper-GEE) to estimate RS-$ET_a$ using Landsat satellite data employing four models: Surface Energy Balance Algorithm for Land (SEBAL), Mapping EvapoTranspiration at high Resolution with Internalized Calibration (METRIC), surface temperature-vegetation-based triangle (TriAng), and Operational Simplified Surface Energy Balance (SSEBop).

**Assessing road construction effects on turbidity in adjacent water bodies using Sentinel-1 and Sentinel-2** Paper

**Research and Scientific Development**

Road construction significantly affects water resources by introducing contaminants, fragmenting habitats, and degrading water quality. This study examines the use of Remote Sensing (RS) data of Sentinel-1 (S1) and Senitnel-2 (S2) in Google Earth Engine (GEE) to do spatio-temporal analysis of turbidity in adjacent water bodies during the construction and operation of the E18 Arendal-Tvedestrand highway in southeastern Norway from 2017 to 2021.

**Team Works** 2014 - now

**Research and Scientific Development**

I worked with four groups of teams by developing new methodologies to estimate, predict, and model different aspects of sediment transport from soil erosion, deposition, eutrophication to water quality issues, agricultural modeling, and hydrological problems with statistical, experimental, numerical, and analytical models. I am working with authors of Boise State University, California Irvine University, Mcgill university, Ager university, Sydney university, Sultan Qaboos university, Oklahama university, Shiraz university, Kassel university, and LMU Munich.

## RESEARCH INTERESTS AND EXPERTISE

I learned about soil fate through watershed processes ranging from soil erosion across the basin to sediment transport in rivers. I always try to connect hydrological processes to soil fate. So I honed my skills to adjust this goal using new methods like remote sensing, deep learning, and cloud computing platforms like Google Earth Engine. I am interested in the interaction of hydrogeology, river engineering, and agricultural fields, as well as mathematical problem solving in modeling real-world situations. I looked into the physical mechanisms that underpin hydrological processes, sedimentation engineering, and a river engineering problem. The unwavering curiosity of the sediment transport mechanism resonated with my own, and I was hooked on learning new skills to satisfy my interests. This interest was accompanied and pursued by my research works on sediment transport modeling, field and lab research works, remote sensing application in environmental studies, and hydraulic and hydrological modeling of rivers and soil-water interactions.