Opportunity Title: USDA-ARS SCINet/AI-COE Postdoctoral Fellowship to Modernize Hydrologic Models for High-Performance Computing
Opportunity Reference Code: USDA-ARS-SCINet-2024-0307

Organization U.S. Department of Agriculture (USDA)

Reference Code USDA-ARS-SCINet-2024-0307

How to Apply ***To submit your application, scroll to the bottom of this opportunity and click APPLY.***

A complete application consists of:

- An application
- Transcript(s) – For this opportunity, an unofficial transcript or copy of the student academic records printed by the applicant or by academic advisors from internal institution systems may be submitted. Click here for detailed information about acceptable transcripts.
- A current resume/CV, including academic history, employment history, relevant experiences, and publication list
- Two educational or professional recommendations
- A copy of an abstract or reprint of an article

All documents must be in English or include an official English translation.

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Application Deadline 10/25/2024 3:00:00 PM Eastern Time Zone

Description **ARS Office/Lab and Location:** A postdoctoral research opportunity is available with the U.S. Department of Agriculture (USDA), Agricultural Research Service (ARS), Grassland Soil and Water Research Laboratory (GSWRL) at Temple, Texas.

The Agricultural Research Service (ARS) is the U.S. Department of Agriculture's chief scientific in-house research agency with a mission to find solutions to agricultural problems that affect Americans every day from field to table. ARS will deliver cutting-edge, scientific tools and innovative solutions for American farmers, producers, industry, and communities to support the nourishment and well-being of all people; sustain our nation's agroecosystems and natural resources; and ensure the economic competitiveness and excellence of our agriculture. The vision of the agency is to provide global leadership in agricultural discoveries through scientific excellence.

The SCINet/Big Data Research Participation Program of the USDA ARS offers research opportunities to motivated postdoctoral fellows interested in solving agriculture-related problems at a range of spatial and temporal scales, from the genome to the continent, and sub-daily to evolutionary time scales. One of the goals of the SCINet Initiative is to develop and apply new technologies, including artificial intelligence (AI) and machine learning, to help solve complex agricultural problems that also depend on collaboration across scientific disciplines and geographic locations. In addition, many of these technologies rely on the synthesis, integration, and analysis of large, diverse datasets that benefit from high-performance

computing (HPC) clusters. The objective of these fellowships is to facilitate cross-disciplinary, cross-location research through collaborative research on problems of interest to each applicant and amenable to or requiring the HPC environment. Training will be provided in data science, scientific computing, AI/machine learning, and related topics as needed for the fellow to complete their research.

Research Project: The Soil & Water Assessment Tool (SWAT+) is a watershed modeling system used internationally to estimate impacts of land management practices on water quality in complex watersheds. Among other applications, it has been used extensively within the USDA Conservation Effects Assessment Program (CEAP) for evaluating the effectiveness of conservation practices to improve water quality in U.S. watersheds. There are also many possible SWAT+ applications using data sets collected within the ARS Long-Term Agroecosystem Research (LTAR) network. Serving as the basis for modeling efforts in CEAP and LTAR, the National Agroecosystem Model (NAM) is an implementation of SWAT+ for the continental U.S., which considers field-scale hydrologic, nutrient, and plant production processes as well as routing of water and nutrient flows through the national watershed system. An important goal is to identify the opportunities and limitations for conducting SWAT+ and NAM simulations using SCINet supercomputers. Additionally, efforts to modernize SWAT+ by moving it to a fully open-source development paradigm are ongoing. Another goal is to make SWAT+ and NAM more accessible and useful to collaborators and stakeholders through the agency's computing infrastructure.

Under the guidance of a mentor, the participant will have the opportunity to be involved in the following aspects of the project:

- Making the SWAT+ source code compatible with open-source development tools and compilers, which will facilitate model use in Linux computing environments,
- Developing an open-source Python package that facilitates SWAT+ input/output (I/O) and enhances modeling workflows on SCINet supercomputers,
- Establishing git/Github repositories for version control and collaborative development of SWAT+ and its supporting tools, and
- Implementing national-scale NAM simulations on SCINet supercomputers, while assessing the value of this approach compared to the current method.

Learning Objectives: The SWAT+ research group at Temple provides a highly collaborative environment for early career scientists to get involved with high-impact hydrologic modeling research. The participant will learn about improvement of SWAT+ model code, use of machine learning methods to facilitate model calibration, ways to integrate SWAT+ with geographic information systems, and use of remote sensing data to parameterize and evaluate the model. The participant will also learn about a wide range of activities related to organizational and operational planning,

training coordination, and science communication in support of SCINet and the ARS AI Center of Excellence (AI-COE). The participant will also have the opportunity to take online courses in topics such as R, Python, and statistics, and to learn collaboration and leadership skills through workshop and working group experience.

USDA-ARS Contact: If you have questions about the nature of the research, please contact Kelly Thorp, kelly.thorp@usda.gov

Anticipated Appointment Start Date: Start date is flexible and will depend on a variety of factors.

Appointment Length: The appointment will initially be for one year but may be renewed for a second year upon recommendation of the mentor and ARS.

Level of Participation: The appointment is full-time.

Participant Stipend: The participant(s) will receive a monthly stipend commensurate with educational level and experience. **The current stipend range for this opportunity is $90,000 - $100,000/year plus a supplement to offset a health insurance premium.**

Citizenship Requirements: This opportunity is available to U.S. citizens, Lawful Permanent Residents (LPR), and foreign nationals. Non-U.S. citizen applicants should refer to the Guidelines for Non-U.S. Citizens Details page of the program website for information about the valid immigration statuses that are acceptable for program participation.

ORISE Information: This program, administered by ORAU through its contract with the U.S. Department of Energy (DOE) to manage the Oak Ridge Institute for Science and Education (ORISE), was established through an interagency agreement between DOE and ARS. Participants do not become employees of USDA, ARS, DOE or the program administrator, and there are no employment-related benefits. Proof of health insurance is required for participation in this program. Health insurance can be obtained through ORISE.

Questions: Please visit our Program Website. If you have additional questions about the application process, please email ORISE.ARS.SCINet@orau.org and include the reference code for this opportunity.

Qualifications The qualified candidate should be currently pursuing or have received a doctoral degree in the one of the relevant fields.

Preferred skills:

- Experience in developing, evaluating, and applying process-based agroecosystem models.
- Experience working with Microsoft SQL Server and/or mySQL.
- Experience in computer programming in Python and/or Fortran.
- Experience developing HPC workflows.

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- Excellent written and oral communication skills.
- Experience in team and collaborative scientific environments.

Eligibility Requirements

- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Computer, Information, and Data Sciences** (9 👁)
  - **Earth and Geosciences** (3 👁)
  - **Engineering** (3 👁)
  - **Environmental and Marine Sciences** (2 👁)
  - **Life Health and Medical Sciences** (3 👁)

Affirmation I affirm that:

I am a US Citizen, OR;
I am a non-US citizen currently living in the United States