

## DYNAMO Allocation Request

***Project Title:*** *Dynamo: AI approaches to dynamic analysis, modeling, and information management for groundwater, rivers, and coasts*

***Brief overview:*** The DYNAMO allocation supports dynamic analysis and modeling workflows for physics-based systems with the goal of modernizing existing simulation tools and adding to the existing collection of models for the state of Texas. The DYNAMO compute allocations support testing and management of modeled information at scale for simulations data and tools. Modeling domains will include groundwater aquifers, fluvial and riverine surface water systems, and coastal systems. Additional domains of interest, such as subsidence and coastal spill conditions, may be incorporated into DYNAMO applications and test cases.

As part of the DYNAMO effort, storage and applications are in development to support big data collections composed of modeled outputs and ancillary or complementary datasets. The DYNAMO data collections need to follow FAIR principles for findable, accessible, interoperable, and reusable tools and collections.

**The project aims to:** These compute hours are expected to include 1) simulation modeling and parallelization of dynamic modeling for the state of Texas by the TWDB team and 2) testing for the AI-enabled model integration platform with reusable environment designs in development by the Decision Support Office at TACC.

**How TACC resources will be used:** We anticipate supporting model emulation design and execution for a number of models across water-related domains. Spatial and temporal data for environmental systems will be stored on Corral to support rapid configuration and instantiation of model experiments. Integration across systems may include water domain information and models, as well as core environmental data or information about ancillary systems.

Software and Applications will include common domain simulation software applications, such as MODFLOW (groundwater) and HEC-RAS (surface water) are the initial software applications that will be tested on the DYNAMO allocation. After testing capabilities the collaborative team will assess priority for 26 modeling software applications that are used in the state of Texas to inform our understanding of coastal hazards.

### ***Supporting grant information.***

AIM Flagship: AI-enabled modeling for the Planet Texas 2050 project via the Bridging Barriers Program of The University of Texas at Austin.

Subsidence data management project is a joint effort to support the collection, cataloging and management of subsidence datasets. The data require geographic location in relation to specific projects that are developed and included in each dataset.

**IDENTIFYING INFORMATION:**

NAME: Pierce, Suzanne A.

POSITION TITLE: Director

PRIMARY ORGANIZATION AND LOCATION: Texas Disaster Information System, Texas A&amp;M and The University of Texas at Austin, Austin, TX, United States

**Professional Preparation:**

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Massachusetts Institute of Technology, CSAIL, Cambridge, MA, United States	Other training	01/2021 - 06/2021	Human-Computer Interaction for User Experience Design Certificate
Australian International Centre for Water Resource Management, Adelaide, Not Applicable, N/A, Australia	Fellow	06/2012 - 05/2013	ICE WaRM Fellow, Decision Support and Sustainable Water Management
Australian National University, National Center for Groundwater Research and Training, Canberra, Not Applicable, N/A, Australia	Fellow	06/2011 - 08/2014	Fellow, Decision Support Systems for Science Applications
Fulbright Nexus, U.S. Department of State, Washington D.C., Texas, United States	Fellow	01/2011 - 12/2011	Fellow, ENCOMPASS Cyberinfrastructure to combine science and stakeholder perspectives in the Atacama Desert, Chile
Fielding University, Human Organizational Systems Program, Santa Barbara, California, United States	Other training	09/2009 - 05/2010	Dialog, Deliberation, and Public Engagement Certificate
The University of Texas at Austin, Austin, Texas, United States	PHD	12/2006	Geosciences and intelligent Decision Support Systems
The University of Texas at Austin, Austin, Texas, United States	Other training	01/2002 - 12/2006	Integrated Watershed Sciences Certificate
Environmental Protection Agency, Austin, Texas, United States	Fellow	01/2002 - 12/2006	EPA STAR Fellow, Groundwater Decision Support: Linking causal narratives, numerical models, and combinatorial search techniques to determine available yield for an aquifer system
University of Arkansas, Fayetteville, AR, United States	BS	12/1993	Geology

### **Appointments and Positions**

2021 - present	Director, Texas Disaster Information System, Texas A&M and The University of Texas at Austin, Austin, TX, United States
2015 - present	Research Scientist, Participatory Technologies and DSS, Texas Advanced Computing Center, The University of Texas at Austin, Austin, TX, United States
2013 - 2015	Assistant Professor of Research, Jackson School of Geosciences, The University of Texas at Austin, Austin, TX, United States
2011 - 2015	Assistant Director, Digital Media Collaboratory, Center for Agile Technology, The University of Texas at Austin, Austin, TX, United States
2009 - 2012	Assistant Research Professor, Center for International Energy & Environmental Policy, The University of Texas at Austin, Austin, TX, United States
2007 - 2008	Research Scientist, Sandia National Laboratories, Albuquerque, NM, United States

### **Products**

#### **Products Most Closely Related to the Proposed Project**

1. Badham J, ElSawah S, Guillaume J, Hamilton S, Hunt R, Jakeman A, Pierce S, et al.,. Effective modeling for Integrated Water Resource Management: A guide to contextual practices by phases and steps and future opportunities. Environmental Modelling & Software. 2019 June; 116:40-56. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1364815218304456> DOI: 10.1016/j.envsoft.2019.02.013
2. Hamilton S, Fu B, Guillaume J, Badham J, ElSawah S, Gober P, Hunt R, Iwanaga T, Jakeman A, Ames D, Curtis A, Hill M, Pierce S, Zare F. A framework for characterising and evaluating the effectiveness of environmental modelling. Environmental Modelling & Software. 2019 August; 118:83-98. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1364815218307692> DOI: 10.1016/j.envsoft.2019.04.008
3. Pennington D, Ebert-Uphoff I, Freed N, Martin J, Pierce S. Bridging sustainability science, earth science, and data science through interdisciplinary education. Sustainability Science. 2019 September 25; 15(2):647-661. Available from: <http://link.springer.com/10.1007/s11625-019-00735-3> DOI: 10.1007/s11625-019-00735-3
4. Hamilton S, ElSawah S, Guillaume J, Jakeman A, Pierce S. Integrated assessment and modelling: Overview and synthesis of salient dimensions. Environmental Modelling & Software. 2015 February; 64:215-229. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1364815214003600> DOI: 10.1016/j.envsoft.2014.12.005
5. Gil Y, .. Pierce S, et al. Artificial Intelligence for Modeling Complex Systems: Taming the Complexity of Expert Models to Improve Decision Making. ACM Transactions on Interactive Intelligent Systems. 2021 July 21; 11(2):1-49. Available from: <https://dl.acm.org/doi/10.1145/3453172> DOI: 10.1145/3453172

#### **Other Significant Products, Whether or Not Related to the Proposed Project**

1. Gil Y, Pierce S, et al. Intelligent systems for geosciences. Communications of the ACM. 2018 December 19; 62(1):76-84. Available from: <https://dl.acm.org/doi/10.1145/3192335> DOI: 10.1145/3192335

2. Pierce S, Sharp J, Eaton D. Decision Support Systems and Processes for Groundwater. In: Jakeman A, Barreteau O, Hunt R, Rinaudo J, Ross A, editors. Integrated Groundwater Management [Internet] Cham: Springer International Publishing; 2016. Chapter Chapter 25639-665p. Available from: [http://link.springer.com/10.1007/978-3-319-23576-9\\_25](http://link.springer.com/10.1007/978-3-319-23576-9_25) DOI: 10.1007/978-3-319-23576-9\_25
3. Voinov A, Kolagani N, McCall M, Glynn P, Kragt M, Ostermann F, Pierce S, Ramu P. Modelling with stakeholders – Next generation. Environmental Modelling & Software. 2016 March; 77:196-220. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1364815215301055> DOI: 10.1016/j.envsoft.2015.11.016
4. Elsayah S, Pierce S, Hamilton S, van Delden H, Haase D, Elmahdi A, Jakeman A. An overview of the system dynamics process for integrated modelling of socio-ecological systems: Lessons on good modelling practice from five case studies. Environmental Modelling & Software. 2017 July; 93:127-145. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S136481521631091X> DOI: 10.1016/j.envsoft.2017.03.001
5. Garijo D, et al. (includes Pierce S.A.). An intelligent interface for integrating climate, hydrology, agriculture, and socioeconomic models. Proceedings of the 24th International Conference on Intelligent User Interfaces: Companion. IUI '19: 24th International Conference on Intelligent User Interfaces; 16 0 19; Marina del Ray California. New York, NY, USA: ACM; c2019. Available from: <https://dl.acm.org/doi/10.1145/3308557.3308711> DOI: 10.1145/3308557.3308711

### **Synergistic Activities**

1. 2019 - Inaugural recipient for the Mavis D. Kent Award for Mid-Career Excellence from the Association for Women Geoscientists (AWG). Recognizes significant contributions and scientific excellence in the Earth & space sciences. Balancing between professional science careers, and outstanding service to their communities.
2. 2018-2020, Chair, Data and Modeling Integration Committee for Planet Texas 2050 initiative funded by The University of Texas at Austin. Established governance, design, and implementation of a cyber-ecosystem for transdisciplinary research projects.
3. 2015 - present, PI-lead for the EarthCube IS-GEO RCN, Developed a successful sustainability plan to maintain activities and engagement with Artificial Intelligence and Geoscience research community at least 5 years beyond the original NSF funding
4. 2010-present, Instructor/Lecturer “Decision Pathways Adaptive Management and Human Dimensions for Integrated Energy and Earth Resources“. Teaches integrated modeling and participatory co-design skills to undergrad/graduate students. Recognized for Ethics & Leadership, Quantitative Reasoning and won teaching with technology Innovation Award 2013 & 2015.
5. 2015-2018, Pursuit Team Lead, Core Modeling Practices for Integrated Water Management, funded by the NSF Synthesis Center for Socio-Environmental Research and Education (SESYNC). Research focused on identifying best practices for integrated modeling across specializations in technical computing, environmental sciences, and participatory processes.