




## Hamada S. Badr


*Senior Applied Scientist*


Data, Analytics, and Science (DAS)  
Sales, Marketing, and Global Services (SMGS) Ops  
Amazon Web Services (AWS)

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Today, there are many skilled and talented scientists applying their abilities to solve challenging problems of their field and contributing to the scientific literature. It is rare, however, to find interdisciplinary scientists who dynamically combine multiple disciplines, creative ideas, and innovative approaches to solve complex real-world problems using machine learning and numerical simulations. I am an applied scientist with broad and in-depth skills and more than two decades of experience in statistical analysis, numerical modeling of physical processes, data visualization, and software engineering as well as project management and leadership. I am a language-agnostic software developer who can easily and quickly switch between different platforms and master new solutions. I am trained first in aerospace engineering and earth sciences, and I have developed my skills in software engineering, mathematics, statistics, machine learning, and physics to address grand challenges in aerodynamics, hydroclimate, infectious diseases, global health, and business intelligence.

## Interests

- Machine Learning (ML) & Artificial Intelligence (AI)
- Natural Language Processing (NLP) & Computer Vision
- Interpretable Modeling & Uncertainty Quantification
- Computational Statistics & Bayesian Inference
- High Performance Computing (HPC)
- Computational Fluid Dynamics (CFD)
- Numerical Weather Prediction (NWP)
- Numerical Modeling & Data Assimilation
- Multiscale Hydroclimate Dynamics & Modeling
- Statistical & Dynamical Downscaling
- Satellite Remote Sensing & Earth Observation
- Spatiotemporal Analysis of Hydroclimate Variability
- Extreme Weather Events & Climate Change
- Environmental Health & Infectious Diseases
- Applications of Big Data in Real Life Problems

## Education

**2011 – 2016** Ph.D. Earth & Planetary Sciences

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

**Dissertation:** Applications of Climate Regionalization: Statistical Prediction & Patterns of Precipitation Variability in Observations & Global Climate Models

**2011 – 2013** M.A. Earth & Planetary Sciences

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

**2003 – 2011** M.Sc. Aerospace Engineering

*Department of Aerospace Engineering, Cairo University, Giza, Egypt*

**Thesis:** Ensemble Forecasting & Data Assimilation in Numerical Weather Modeling for Egypt

**1997 – 2003** B.Sc. Aerospace Engineering

*Department of Aerospace Engineering, Cairo University, Giza, Egypt*

## Employment

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- 2022 –** Senior Applied Scientist  
*Data, Analytics, and Science (DAS) – Sales, Marketing, and Global Services (SMGS) Ops, Amazon Web Services (AWS), Washington, District of Columbia, USA*
- 2020 – 2022** Associate Research Scientist  
*Center for Systems Science and Engineering (CSSE), Department of Civil and Systems Engineering, Johns Hopkins University (JHU), Baltimore, Maryland, USA*
- 2016 – 2020** Assistant Research Scientist  
*Hydroclimate Research Group (HCRG), Department of Earth and Planetary Sciences, Johns Hopkins University (JHU), Baltimore, Maryland, USA*
- 2016 – 2016** Postdoctoral Fellow  
*Hydroclimate Research Group (HCRG), Department of Earth and Planetary Sciences, Johns Hopkins University (JHU), Baltimore, Maryland, USA*
- 2011 – 2016** Graduate Research Assistant  
*Hydroclimate Research Group (HCRG), Department of Earth and Planetary Sciences, Johns Hopkins University (JHU), Baltimore, Maryland, USA*
- 2011 – 2018** Assistant Research Scientist  
*Data Reception, Analysis, and Receiving Station Affairs, National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*
- 2005 – 2011** Group Chief Executive  
*Data Reception, Analysis, and Receiving Station Affairs, National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

## Awards

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- 2020 – 2022** Co-PI, COVID-19 Supplement to “Environmental Determinants of Enteric Infectious Disease “  
**Award:** NNH16ZDA001N-GEO      **Amount:** \$200,000      **Source of Support:** NASA
- 2019 – 2023** Co-PI, GMELT Ahead: Leveraging Earth Observations for Improved Climate Projections  
**Award:** NNH19ZDA001N-HMA      **Amount:** \$114,708      **Source of Support:** NASA
- 2019 – 2022** Co-PI, PREEVENTS/T2: Multi-Scale Prediction of Flash Drought in the United States  
**Award:** NSF 1854902      **Amount:** \$471,929      **Source of Support:** NSF
- 2019 – 2020** Co-PI, USAID/ICBA: Improved MENA Regional Drought Monitoring System  
**Award:** ICBA-JHU-19097730      **Amount:** \$161,487      **Source of Support:** ICBA
- 2017 – 2020** Co-PI, GEO: Environmental Determinants of Enteric Infectious Disease  
**Award:** NNH16ZDA001N-GEO      **Amount:** \$598,000      **Source of Support:** NASA
- 2016 – 2022** Assistant Research Scientist  
*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*
- 2016 – 2016** Postdoctoral Fellowship  
*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*
- 2013 – 2013** Honorable Mention Award  
*American Meteorological Society (AMS), Boston, Massachusetts, USA*
- 2012 – 2016** Research Assistantship  
*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*
- 2011 – 2012** Morton K. Blaustein Fellowship  
*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*
- 2011 – 2018** Research Assistantship  
*National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

## Skills

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**Programming:** R > 10 years, Python > 10 years, Fortran > 10 years, C++ > 5 years, Stan > 5 years

**Deep Learning:** R > 10 years, Python > 10 years, Keras > 5 years, TensorFlow > 5 years, Torch > 5 years

**Big Data:** R > 10 years, Python > 10 years, MATLAB > 10 years, Hadoop > 3 years, Hive > 3 years, Spark > 3 years

**Visualization:** R > 10 years, Python > 10 years, MATLAB > 20 years, NCL > 10 years, Ferret > 7 years

**Numerical Modeling:** WRF > 20 years, NU-WRF > 5 years, LIS > 5 years, MM5 > 5 years

**High Performance Computing:** Porting > 20 years, Parallel Computing (OpenMP & MPI) > 20 years

**Shell Scripting:** BASH > 20 years, CSH > 5 years, KSH > 5 years, MKSH > 5 years, TCSH > 5 years, ZSH > 5 years

**Data Tools:** R > 10 years, Python > 10 years, NCL > 10 years, NCO > 10 years, CDO > 10 years, Ferret > 7 years

**Version Control:** Git > 10 years, SVN > 5 years, CVS > 3 years, Other Open-Source Tools 1-20 years

**Databases:** R > 10 years, Python > 10 years, MySQL > 5 years, PostgreSQL > 3 years, Redshift > 2 years, Spark > 2 years

**Productivity:** R Markdown > 10 years, LaTeX > 20 years, Office > 20 years, Web Design (HTML/CSS) > 10 years

**Operating Systems:** Unix/Linux > 20 years, Windows > 20 years, MacOS > 10 years, Android > 5 years

**Languages:** Arabic Mother Tongue, English Proficient, Turkish Beginner

**General Skills:** Amazon Web Services (AWS), Android Development, Code Optimization, ...

## Software

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**Lead Author & Maintainer of:**

- *additive*: Bindings for Additive *TidyModels*
- *bayesian*: Bindings for Bayesian *TidyModels*
- *HiClimR*: Hierarchical Climate Regionalization

**Contributor of:**

- *brms*: Bayesian generalized multivariate non-linear multilevel models using *Stan*
- *EpiNow2*: Estimate Realtime Case Counts and Time-varying Epidemiological Parameters
- *LISF*: NASA Land Information System Framework
- *projpred*: Projection predictive variable selection
- *RcppParallel*: High-level functions for parallel programming with *Rcpp*
- *rstan*: The R interface to *Stan*
- *Stan*: State-of-the-art platform for statistical modeling and high-performance computing
- *tidymodels*: A collection of R packages for machine learning using *tidyverse* principles
- *torch*: Tensors and Neural Networks with 'GPU' Acceleration
- *WRF*: Weather Research and Forecasting

Some of my contributed opensource software are listed on my GitHub account at <https://github.com/hsbadr>.

## Services

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- Developer, Contributions to Open-Source Software (OSS) projects
- Peer-review, MDPI Remote Sensing – Deep Learning Applications
- Peer-review, Theoretical and Applied Climatology (TAAC)
- Peer-review, Journal of Climate (JCLI)
- Member, American Meteorological Society (AMS)
- Member, American Geophysical Union (AGU)
- Member, Geological Society of America (GSA)
- Session Chair, Geological Society of America (GSA)

## Experience

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### 2022 – Data, Analytics, and Science (DAS)

*Data, Analytics, and Science (DAS) – Sales, Marketing, and Global Services (SMGS) Ops, Amazon Web Services (AWS), Washington, District of Columbia, USA*

I take a high impact role at AWS to automate recommendations and provide actionable insights, using *Machine Learning (ML)* and *Artificial Intelligence (AI)*.

### 2020 – 2022 Tracking and Modeling of COVID-19 Pandemic

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

COVID-19 Supplement to the “Determinants of Enteric Infectious Disease” is a project to develop an environmentally informed risk monitoring and early warning system to inform decision makers.

*Machine learning* and epidemic modeling are used for generating risk maps as well as prospective tracking and modeling of the impacts of hydrometeorological factors on COVID-19 pandemic.

### 2019 – 2023 Leveraging Earth Observations for Improved Climate Projections

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

GMELT Ahead: Leveraging *Earth Observations* for Improved Climate Projections in High Mountain Asia is a 3-year project to generate high-resolution projections of future climate and hydrology that grounded in best-available historical observations and understanding of atmospheric processes.

Different approaches are used for downscaling, including *regionalization* and *Convolutional Neural Network (CNN)* pattern reconstruction.

### 2019 – 2022 Multi-scale Prediction of Flash Drought in the United States

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

PREEVENTS Track 2: Collaborative Research: Flash droughts: process, prediction, and the central role of vegetation in their evolution is a 3-year project to advance efforts to understand and forecast flash droughts (FD) by targeting three characteristic features: (1) land surface memory is a key component of FD, (2) evaporative demand is a leading driver of FD onset, (3) vegetation plays a central role in FD development through its influence on soil moisture and turbulent heat fluxes. *Deep Learning* algorithms are used for the prediction and classification of flash droughts.

### 2017 – 2020 Applications of Deep Learning to S2S Prediction & Downscaling

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

*Convolutional Neural Networks (CNN)* are implemented and optimized with a custom loss function (based on *objective* climate *regionalization*) to improve and downscale dynamical forecasts at subseasonal to seasonal (S2S) timescales.

### 2017 – 2020 Environmental Determinants of Enteric Infectious Disease

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

Determinants of Enteric Infectious Disease: a GEO Platform for Analysis and Risk Assessment is a 3-year project to develop an environmentally informed risk monitoring and early warning application that will inform decision makers for appropriate interventions and investments needed to reduce enteric infectious (EID) diseases. *Regionalization* and *Machine Learning (ML)* are used to build a *predictive modeling* framework that generates risk maps and estimates variable importance and effects.

### 2017 – 2018 Instructor: Advanced Seminar in Remote Sensing

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

This seminar focused on the application, interpretation, and *visualization* of Land Data Assimilation Systems (LDAS). Through lectures, exercises, and a semester project, students learnt the theory behind LDAS, run LDAS simulations using the NASA Land Information System (LIS), and built web apps for LDAS output using the *open-source* Tethys scientific *visualization* platform.

### 2015 – 2018 Instructor: The NASA Land Information System (LIS)

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

Contributions to the *development* and *training* workshops on the NASA Land Information System (LIS) and its applications, including a workshop at the National Authority for Remote Sensing and Space

Sciences (NARSS) in Cairo, Egypt in August 2017 and a similar workshop at Korea Water Resources Corporation (K-Water) in Daejeon, South Korea in January 2018.

#### **2015 – 2016 Porting NU-WRF to HHPC & MARCC**

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

*Porting* NASA-Unified Weather Research & Forecasting (NU-WRF) to JHU Homewood High Performance Cluster (HHPC) & Maryland Advanced Research Computing Center (MARCC) to facilitate weather prediction and analysis for researcher at JHU and other MARCC users.

#### **2015 – 2016 Climate Regionalization of Africa**

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

*Regionalizing* Africa based on interannual variability of precipitation to study the impacts of climate change on patterns of rainfall variability in Africa at different times from geological periods to historical simulations and future climate projections.

#### **2013 – 2015 Objective Climate Regionalization**

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

*Development* of an *open-source* software in R for **H**ierarchical **C**limate **R**egionalization (*HiClimR*) to facilitate the application of rigorous *regionalization* for climate studies.

#### **2011 – 2013 Seasonal Precipitation Predictions**

*Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA*

Application of different *statistical models*, including *artificial neural network* (ANN, best-performing model), to understand and predict seasonal rainfall anomalies as a function of large-scale variability from indices of temperature, pressure, and other variables.

#### **2010 – 2011 Prediction of Dust Storms**

*National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

*Development* of a framework for dust/sand-storms prediction using *numerical weather prediction* and *remote sensing* technology.

#### **2010 – 2010 Porting WRF to EUMEDGRID**

*Africa 4 2010 - Joint EUMEDGRID-Support / EPIKH School for Application Porting, Cairo, Egypt*

*Porting* the Weather Research and Forecasting (WRF) model to EUMEDGRID.

#### **2010 – 2010 High Performance Computing (HPC)**

*IBM-Egypt and National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

IBM AIX 5L *system administration* and running *Code\_Saturne* Computational Fluid Dynamics (CFD) Solver on NARSS Blue-Gene/L.

#### **2008 – 2010 Ensemble Forecasting**

*National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

*Development* of a preliminary ensemble *forecasting system* for Egypt, designed for operational use.

#### **2008 – 2008 Estimation of Evaporative Rates**

*National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

Evaluation of Lake Nasser water loss by evaporation using *numerical weather prediction* and *remote sensing*.

#### **2006 – 2008 Data Assimilation**

*National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

Implementation of conventional and remotely-sensed observational data into the numerical weather modeling system for Egypt using Four-Dimensional *Data Assimilation*.

#### **2005 – 2006 ATOVS Data Processing and Visualization**

*National Authority for Remote Sensing and Space Sciences (NARSS), Cairo, Egypt*

Development of automatic *processing* and *visualization* framework for NOAA/ATOVS *satellite data*.

#### **2001 – 2003 Terrain Aerodynamics**

*Department of Aerospace Engineering, Cairo University, Giza, Egypt*

*Generation of a digital surface grid* for Greater Cairo area and Giza plateau from raster maps, measuring the flow over prototypes in a wind tunnel, and comparing the numerical and experimental results.

## Publications

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**Badr, H. S.,** Colston et al., B. F. Zaitchik, M. N. Kosek, **2023:** Spatiotemporal variation in risk of Shigella infection in childhood: a global risk mapping and prediction model using individual participant data. *The Lancet Global Health*, **12**, E373-E384.

**DOI:** 10.1016/S2214-109X(22)00549-6

Kerr, G. H., **H. S. Badr**, A. F. Barbieri, Lauren M. Gardner, M. N. Kosek, and B. F. Zaitchik, **2023:** Evolving Drivers of Brazilian SARS-CoV-2 Transmission: A Spatiotemporally Disaggregated Time Series Analysis of Meteorology, Policy, and Human Mobility. *One Health*, In Review.

**DOI:** 10.1016/InReview

Colston et al., **H. S. Badr**, M. N. Kosek, B. F. Zaitchik, **2023:** Effects of hydrometeorological and other factors on SARS-CoV-2 reproduction number in three contiguous countries of tropical Andean South America: a spatiotemporally disaggregated time series analysis. *IJID regions*, **6**, 29-41.

**DOI:** 10.1016/j.ijregi.2022.11.007

Colston J., M. N. Kosek, B. F. Zaitchik, **H. S. Badr**, **2022:** Spatiotemporal variation and environmental sensitivity of childhood enteric pathogen infection risk: a Planetary Health approach to predictive modelling and risk mapping. *The Lancet Planetary Health*, **6**, S13.

**DOI:** 10.1016/S2542-5196(22)00275-3

**Badr, H. S.,** Colston et al., B. F. Zaitchik, M. N. Kosek, **2022:** Spatiotemporal variation in risk of Shigella infection in childhood: a global risk mapping and prediction model using individual participant data. *MedRxiv*, 2022.08.04.22277641.

**DOI:** 10.1101/2022.08.04.22277641

H. Du, E. Dong, **H. S. Badr**, M. E. Petrone, N. D. Grubaugh, L. M. Gardner, **2022:** A Deep Learning Approach to Forecast Short-Term COVID-19 Cases and Deaths in the US. *MedRxiv*, 2022.08.23.22279132.

**DOI:** 10.1101/2022.08.23.22279132

Petrone, M. E., J. E. Rothman, M. I. Breban, I. M. Ott, A. Russel, E. Lasek-Nesselquist, **H. S. Badr**, ..., N. D. Grubaugh, **2022:** Combining genomic and epidemiological data to compare the transmissibility of SARS-CoV-2 variants Alpha and Iota. *Communications Biology*, **5**, 439.

**DOI:** 10.1038/s42003-022-03347-3

Osman, M. A., B. F. Zaitchik, **H. S. Badr**, J. I. Christian, T. Tedesse, J. A. Otkin, Y. Zhong, David Lorenz, M. C. Anderson, T. D. Keenan, D. L. Miller, C. Hain, and T. Holmes, **2022:** Diagnostic classification of flash drought events reveals distinct classes of forcings and impacts. *Journal of Hydrometeorology (JHM)*, 10 January 2022.

**DOI:** 10.1175/JHM-D-21-0134.1

Colston et al., **Badr, H. S., 2021:** Associations between 8 Earth Observation-derived climate variables and enteropathogen infection: An Independent Participant Data Meta-Analysis of surveillance studies with broad spectrum nucleic acid diagnostics. *GeoHealth*, 17 December 2021.

**DOI:** 10.1029/2021GH000452

**Badr, H. S., 2021:** additive: Bindings for Additive TidyModels. *Comprehensive R Archive Network (CRAN)*, <http://cran.r-project.org/package=additive>.

**URL:** <https://hsbadr.github.io/additive/>

**Badr, H. S. and B. C. Bürkner, 2021:** bayesian: Bindings for Bayesian TidyModels. *Comprehensive R Archive Network (CRAN)*, <http://cran.r-project.org/package=bayesian>.

**URL:** <https://hsbadr.github.io/bayesian/>

**Badr, H. S.,** B. F. Zaitchik, G. H. Kerr, N. Nguyen, Y. Chen, P. Hinson, J. M. Colston, M. N. Kosek, E. Dong, H. Du, M. Marshall, K. Nixon, A. Mohegh, D. L. Goldberg, S. C. Anenberg, and L. M. Gardner, **2021:** Unified real-time environmental-epidemiological data for multiscale modeling of the COVID-19 pandemic. *MedRxiv*, 2021.05.05.21256712.

**DOI:** 10.1101/2021.05.05.21256712

- Kerr, G. H., **H. S. Badr**, Lauren M. Gardner, J. Perez-Saez, and B. F. Zaitchik, **2021**: Associations between meteorology and COVID-19 in early studies: Inconsistencies, uncertainties, and recommendations. *One Health*, **12**, 100225.  
**DOI**: 10.1016/J.OneHlt.2021.100225
- Yang, G., B. F. Zaitchik, **H. S. Badr**, and P. Block, **2021**: A Bayesian adaptive reservoir operation framework incorporating streamflow non-stationarity. *Journal of Hydrology (HYDROL)*, **594**, 125959.  
**DOI**: 10.1016/J.JHYDROL.2021.125959
- Osman, M. A., B. F. Zaitchik, **H. S. Badr**, J. I. Christian, T. Tedesse, J. A. Otkin, and M. C. Anderson, **2021**: Flash drought onset over the Contiguous United States: Sensitivity of inventories and trends to quantitative definitions. *Hydrology and Earth System Sciences (HESS)*, **25(2)**, 565–581.  
**DOI**: 10.5194/hess-25-565-2021
- Osman, M. A., B. F. Zaitchik, **H. S. Badr**, and S. Hameed, **2021**: North Atlantic Centers of Action and Seasonal to Subseasonal Temperature Variability in Europe and Eastern North America. *International Journal of Climatology (JOC)*, **41**, E1775–E1790.  
**DOI**: 10.1002/joc.6806
- Arsenault et al., **H. S. Badr**, **2021**: Better Advance Warnings of Drought: A New NASA Hydrological Forecast System. *Bulletin of the American Meteorological Society (BAMS)*, **101(10)**, 899–903.  
**DOI**: 10.1175/BAMS-D-18-0264.A
- Arsenault et al., **H. S. Badr**, **2020**: The NASA Hydrological Forecast System for Food and Water Security Applications. *Bulletin of the American Meteorological Society (BAMS)*, **101(7)**, E1007–E1025.  
**DOI**: 10.1175/BAMS-D-18-0264.1
- Badr, H. S.**, and L. M. Gardner, **2020**: Limitations of using mobile phone data to model COVID-19 transmission in the USA. *The Lancet Infectious Diseases*, 1473–3099.  
**DOI**: 10.1016/S1473-3099(20)30861-6
- Badr, H. S.**, H. Du, M. Marshall, E. Dong, M. M. Squire, and L. M. Gardner, **2020**: Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modelling study. *The Lancet Infectious Diseases*, **20(11)**, 1247–1254.  
**DOI**: 10.1016/S1473-3099(20)30553-3
- Badr, H. S.**, H. Du, M. Marshall, E. Dong, M. M. Squire, and L. M. Gardner, **2020**: Social Distancing is Effective at Mitigating COVID-19 Transmission in the United States. *MedRxiv*, 2020.05.07.20092353.  
**DOI**: 10.1101/2020.05.07.20092353
- Nie, W., B. F. Zaitchik, M. Rodell, S. V. Kumar, K. R. Arsenault, and **H. S. Badr**, **2020**: Irrigation water demand sensitivity to climate variability across the Contiguous United States. *Water Resources Research (WRR)*, e2020WR027738.  
**DOI**: 10.1029/2020WR027738
- Jordan, A., B. F. Zaitchik, A. Gnanadesikan, Dongchul Kim, and **H. S. Badr**, **2020**: Strength of Linkages Between Dust and Circulation Over North Africa: results from a coupled modeling system with active dust. *Journal of Geophysical Research (JGR)*, **125(11)**, e2019JD030961.  
**DOI**: 10.1029/2019JD030961
- Satti, S., B. F. Zaitchik, **H. S. Badr**, and S. Tadesse, **2017**: Enhancing Dynamical Seasonal Predictions through Objective Regionalization. *Journal of Applied Meteorology & Climatology (JAMC)*, **56**, 1432–1442.  
**DOI**: 10.1175/JAMC-D-16-0192.1
- Dezfuli, A. K., B. F. Zaitchik, **H. S. Badr**, E. Jason, and C. D. Peters-Lidard, **2017**: The Role of Low-Level Terrain-Induced Jets in Rainfall Variability in Tigris-Euphrates Headwaters. *Journal of Hydrometeorology (JHM)*, **18**, 819–835.  
**DOI**: 10.1175/JHM-D-16-0165.1
- Badr, H. S.**, B. F. Zaitchik, A. K. Dezfuli, and C. D. Peters-Lidard, **2016**: Regionalizing Africa: Patterns of Precipitation Variability in Observations and Global Climate Models. *Journal of Climate*

(JCLI), **29**, 9027–9043.

**DOI:** 10.1175/JCLI-D-16-0182.1

Regonda, S. K., B. F. Zaitchik, **H. S. Badr**, and M. Rodell, **2016**: Using Climate Regionalization to Understand Climate Forecast System Version 2 (CFSv2) Precipitation Performance for the Conterminous United States (CONUS). *Geophysical Research Letters (GRL)*, **43**, 6485–6492.

**DOI:** 10.1002/2016GL069150

F. Berhane, B. Zaitchik, and **H. S. Badr**, **2015**: The Madden-Julian Oscillation's influence on Spring Rainy Season Precipitation over Equatorial West Africa, *Journal of Climate (JCLI)*, **28**, 8653–8672.

**DOI:** 10.1175/JCLI-D-14-00510.1

**Badr, H. S.**, B. F. Zaitchik, and A. K. Dezfuli, **2015**: A Tool for Hierarchical Climate Regionalization. *Earth Science Informatics (ESIN)*, **8**, 949–958.

**DOI:** 10.1007/s12145-015-0221-7

**Badr, H. S.**, B. F. Zaitchik, and A. K. Dezfuli, **2014**: HiCLimR: Hierarchical Climate Regionalization. *Comprehensive R Archive Network (CRAN)*, <http://cran.r-project.org/package=HiCLimR>.

**URL:** <https://hsbadr.github.io/HiCLimR/>

**Badr, H. S.**, B. F. Zaitchik, and S. D. Guikema, **2014**: Application of Statistical Models to the Prediction of Seasonal Rainfall Anomalies over the Sahel. *Journal of Applied Meteorology & Climatology (JAMC)*, **53**, 614–636.

**DOI:** 10.1175/JAMC-D-13-0181.1

Nasr, A. H., B. M. El Leithy, and **H. S. Badr**, **2012**: Estimation of Radiometric Calibration Coefficients of Egyptsat-1 Sensor. The XXII Congress of the International Society for Photogrammetry and Remote Sensing, Melbourne, Australia, **XXXIX-B1**, 139–143.

**DOI:** 10.5194/isprsarchives-XXXIX-B1-139-2012

**Badr, H. S.**, H. A. Kandil, B. M. N. Elhadidi, and A. O. Sherif, **2011**: Evaluating the Physics Options of Regional Weather Models for Areas with Complex Land-Use Characteristics. *Proceedings of IEEE 2011 International Geoscience and Remote Sensing Symposium (IGARSS)*, Vancouver, Canada, 3257–3260.

**DOI:** 10.1109/IGARSS.2011.6049914

**Badr, H. S.**, **2011**: Ensemble Forecasting and Data Assimilation in Numerical Weather Modeling for Egypt. *M.Sc. Thesis, Department of Aerospace Engineering, Cairo University, Giza, Egypt*.

**Badr, H. S.**, B. M. N. Elhadidi, and A. O. Sherif, **2010**: Evaluation of Data Assimilation on Numerical Weather Prediction for Egypt. *Proceedings of IEEE 2010 International Geoscience and Remote Sensing Symposium (IGARSS)*, Honolulu, Hawaii, USA, 3526–3529.

**DOI:** 10.1109/IGARSS.2010.5652441

## Presentations

K. Bergaoui, K., M. D. Svoboda, A. Hazra, **Badr, H. S.**, M. B. Fraj, R. McDonnell, K. Arsenault, B. F. Zaitchik, and C. Peters-Lidard, **2021**: Drought Monitoring and Seasonal Forecasting in the Middle East and North African (MENA) region. *35th Conference on Hydrology - Improvements to the Analysis and Prediction of Drought*, 101<sup>st</sup> American Meteorological Society (AMS) Annual Meeting, USA.

**Badr, H. S.**, K. Bergaoui, and B. F. Zaitchik, **2020**: Applications of Deep Learning to S2S Precipitation Prediction and Downscaling for the Middle East and North Africa. *19th Conference on Artificial Intelligence for Environmental Sciences*, 100<sup>th</sup> American Meteorological Society (AMS) Annual Meeting, Boston, Massachusetts, USA.

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