YOUNG-DON CHOI

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EDUCATION

University of Virginia   *Charlottesville, Virginia, USA*
  Ph.D. Candidate in Engineering Systems and Environment   Aug 2017 - July 2021
  - Advancing Reproducibility in Environmental Modeling: Integration of Open Repositories, Process Containerizations, and Seamless Workflows (https://doi.org/10.18130/g9tg-0c69)
    (Advisor: Dr. Jonathan Goodall)

Pusan National University   *Pusan, South Korea*
  M.S in Civil Engineering   Mar 2004 – Aug 2010
  - Water Supply Reliability Revaluation for Agricultural Water Supply Pattern Changes Considering Climate Changes
    (Advisor: Dr. Hyun-Seok Shin)

Research Experience

Principle Researcher, AI Research Laboratory, K-water Research Institute, K-water

Jan 2022 - Present

- Study Spatial Rainfall Distribution using Satellite Rainfall and Observation through ML and AI
- Study Multi-Time Scale LSTM for Long and Short-Term Runoff analysis
- Study Reinforcement Learning for Efficient Dam Operation

Graduate Research Assistant, Department of Engineering Systems and Environment, University of Virginia
  Advisor: Dr. Jonathan Goodall   Aug 2017 - July 2021

Project

- HydroShare project: Developing Cyberinfrastructure for Advancing Hydrologic Knowledge through Collaborative Integration of Data Science, Modeling and Analysis (Aug 2017 ~ July 2021)
    - Created Environmental and Hydrologic Modeling Environments on CUAHSI JupyterHub (CJH) and CyberGIS Jupyter for water (CJW)
- EarthCube Project: Integrating Reproducible Methods into Community Cyberinfrastructure (May 2019 ~ July 2021)
    - Strengthened Sciunit capabilities to containerize hydrological modeling environments and workflows for environmental modeling reproducibility and replicability

Study Areas

- Developed Reproducible Environmental and Hydrological Modeling Framework
    - Created methodology to integrate online data repositories (HydroShare), computational environments (docker-based cyberinfrastructure: CJH and CJW), and model APIs (pySUMMA for SUMMA) for reproducible environmental modeling (https://doi.org/10.1016/j.envsoft.2020.104888)

- Develop Python-based model APIs for environmental and hydrologic models and support end-to-end modeling in local and cloud computational environments
    - Develop pySUMMA for SUMMA and pyRHESSys for RHESSys
    - Support 1) pre-processing (collecting raw spatial and time-series data using Python APIs, Google Earth Engine, OPeNDAP, and creating model input using GRASS GIS Python API and R), 2) model execution using Python-based model API, and post-processing to support seamless modeling (spatial and temporal visualization using Python libraries and model calibration using Dream (Differential Evolution Adaptive Metropolis) method in SPOTPY Python package)
      * A RHESSys End-to-End workflow example, A SUMMA End-to-End workflow example
    - Use Camels dataset (NLDAS forcing, streamflow, local attributes) to simulate SUMMA in the USA
    - Create NetCDF files using forcing (precipitation, temperature and radiation) and spatial data (DEM, NLCD) to share them via OpenDAP

- Use High-Performance Computing for SUMMA and RHESSys models
    - Create job submission environments for SUMMA and RHESSys in CJW virtual environment to use XSEDE for data-intensive modeling
    - Use HPC (Rivanna) at University of Virginia to calibrate Environmental and Hydrological Models using SLURM
    - Parallelize model execution of different parameters and parameterizations using Dask in local and remote virtual environments for SUMMA and RHESSys
    - Create Singularity containers to create computational environments in HPC

- Compare Reproducible Approaches to Achieve Different Modeling Objectives such as Education and Data-Intensive Modeling
  - Compare and evaluate different reproducible approaches using GNU Make, Conda, Docker, Singularity, Sciunit, and Binder in both local and remote computational environments
- Create Jupyter notebooks and JupyterBook
  - Develop Jupyter notebooks to encapsulate modeling workflows and share them with other researchers
  - Develop JupyterBook for SUMMA and pySUMMA for sharing many Jupyter notebook collections using online interactive interfaces
  - Create interactive Visualization Map with distributed RHESSys output using geopandas, cartopy, geoviews and holoviews

Publications and Presentations

Journal Paper

YD Choi, JL Goodall, JM Sadler, AM Castronova, A Bennett, Zhiyu Li, B Nijssen, SW Wang, Daniel P. Ames, Jeffery S. Horsburgh, Hong Yi, Christina Bandaragoda, Martin Seul, Richard Hooper, MP Clark, DG Tarboton, (2021) Toward Open and Reproducible Environmental Modeling by Integrating Online Data Repositories, Computational Environments, and Model Application Programming Interfaces, Environmental modelling & software

Bakinam T, Essawy, JL Goodall, Daniel Voce, Mohamed M. Morsy, JM Sadler, **YD Choi**, DG Tarboton, Tanu Malik, (2020) A Taxonomy for Reproducible and Replicable Research in Environmental Modelling, Environmental modelling & software

(In progress) **YD Choi**, JL Goodall, Jared Nguyen, Raza Ahmad, Tanu Malik, Zhiyu Li, AM Castronova, SW Wang, DG Tarboton, Comparing Approaches to Achieve Reproducible Computational Modeling for Hydrological and Environmental Systems, Environmental modelling & software

(In progress) **YD Choi**, JL Goodall, LE Band, L Lin, L Saby, Zhiyu Li, SW Wang, DG Tarboton, Creating and Sharing Interoperable and Reusable Large Spatial Sample Datasets Online for Open and Reproducible Seamless Hydrological Modeling, Environmental modelling & software

Book

Jason CHUAH, Madeline DEEDS, Tanu MALIK, **YD Choi**, JL Goodall, (2020) Documenting Computing Environments for Reproducible Experiments, Advances in Parallel Computing, Volume 36: Parallel Computing: Technology Trends, IOS Press Ebooks

Conference Paper

Lyu F; Yin D; Padmanabhan A; **YD Choi**; Goodall, J. L; Castronova, A. M.; DG Tarboton; Wang, S. W. Reproducible Hydrologic Modeling with CyberGIS-Jupyter: A Case Study on SUMMA, PEARC '19

Conference Presentations

YD Choi, Goodall, J., Ahmad, R., Malik, T., and Tarboton, D.: An Approach for Open and Reproducible Hydrological Modeling using Sciunit and HydroShare, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-13763, https://doi.org/10.5194/egusphere-egu21-13763, 2021.

D Tarboton, T Malik, JL Goodall, **YD Choi** (2020) Integration of Reproducible Methods into Community Cyberinfrastructure, EarthCube Annual Meeting, June 15~19, Virtual Meeting

R Ahmad, M Deeds, T Malik, **YD Choi,** JL Goodall, DG Tarboton (2020) Sciunit: A Reproducible Container for EarthCube Community, EarthCube Annual Meeting, June 15~19, Virtual Meeting

YD Choi, JL Goodall, JM Sadler, AM Castronova, A Bennett, Zhiyu Li, B Nijssen, SW Wang, MP Clark, DG Tarboton, Enabling More Open and Reproducible Environmental Modelling, iEMSs 2020, Brussels, Belgium

Lyu F, Zhiyu Li, Padmanabhan A; SW Wang, JL Goodall, **YD Choi**, A Bennett, B Nijssen, DG Tarboton (2020), Reproducible Hydrological Modeling with CyberGIS-Jupyter for Water (CJW) and HydroShare, EarthCube Annual Meeting, June 15~19, Virtual Meeting

David Tarboton, Tanu Malik, JL Goodall, **YD Choi** (2020), Integration of Reproducible Methods into Community Cyberinfrastructure, EarthCube Annual Meeting, June 15~19, Virtual Meeting

Madeline Deeds, Raza Ahmad, Tanu Malik, **YD Choi**, JL Goodall, DG Tarboton (2020), Sciunit: A Reproducible Container for EarthCube Community, EarthCube Annual Meeting, June 15~19, Virtual Meeting

YD Choi, JM Sadler, AM Castronova, JL Goodall, A Bennett, B Nijssen, R Idaszk, SW Wang, MP Clark, DG Tarboton (2019) Design and Implementation of Cyberinfrastructure to Support a Cloud-Based, Community Hydrologic Modeling Ecosystem, CUAHSI Conference on Hydroinformatics, July 29~31, Provo, Utah, USA

YD Choi, JM Sadler, AM Castronova, JL Goodall, A Bennett, B Nijssen, R Idaszk, SW Wang, MP Clark, DG Tarboton (2019) Enhancement of Reproducibility in Advanced Collaborative Hydrologic Modeling for Published Computational Research, EarthCube Annual Meeting, June 12~14, Denver, Colorado, USA

YD Choi, JM Sadler, AM Castronova, JL Goodall, A Bennett, B Nijssen, R Idaszk, SW Wang, MP Clark, DG Tarboton (2018) The Development of Sharable pySUMMA Simulation Environment using Singularity on HydroShare, American Geophysical Union Fall Meeting, December 10-14, Washington DC, USA

Essawy, B.T., Goodall, J.L., Voce, D., **YD Choi**., Morsy, M.M., Sadler, J. M., Yuan, Z., Malik, T. (2018) Leveraging Scientific Cyberinfrastructures to Achieve Computational Hydrologic Model Reproducibility. American Geophysical Union Fall Meeting, December 10-14, Washington DC, USA

YD Choi., Sadler, J. M., Castronova, A. M., Goodall, J. L., Bennett, A., Nijssen, B., Idaszk, R., Wang, S. W., Clark, M. P., Tarboton, D. G. Prototyping a Python wrapper for the Structure for Unifying Multiple Modeling Alternatives (SUMMA) hydrologic modeling framework, iEMSs 2018, Fort Collins, CO, USA

MJ Park, HJ Shin, **YD Choi**, JY Park, SJ Kim (2011) Development of a hydrological drought index considering water availability, Journal of the Korean Society of Agricultural Engineers

YD Choi (2010) Water Supply Reliability Revaluation for Agricultural Water Supply Pattern Changes Considering Climate Changes, 10th International Symposium on Stochastic Hydraulics and 5th International Conference on Water Resources and Environment Research, Canada

WORK EXPERIENCE

Korea Water Resources Corporation (Jan 2003 – Present)   *Daejeon, South Korea*
K-water is the federal organization to implement national water resources management policies regarding multi-purpose dams, water supply dams and regional water supply systems

- Operated dams and water treatment plants (Mar 2003 - Apr 2007), supervised the development of Korea Drought Information System (2007-2012) and the National Water Plan in South Korea (2009-2010)
- Made K-water future strategy (2011)
- Analyzed the floodplain and design floodway in the proposal for the Thailand Water Resources Project (2012)
- Made K-water technology development plan (2013-2015)
- Supervised the development of Korea water portal (2016-2017)
- Operated Multi-purpose and water supply Dam in South Korea (2021)
- Study AI to apply Water Resource Field (2022~Present)

TEACHING EXPERIENCE

- Teaching Assistance, Course: Ground-Water Hydrology and Contaminant Transport (CE 5240), Prof. James A. Smith

Spring 2020

PROFESSIONAL AFFILIATION

- Serving as a Journal Reviewer for Environmental Modelling & Software Journal   2020 ~ Present