

Marie C. McGraw, Ph.D.

Cooperative Institute for Research in the Atmosphere
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Google Scholar

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Profile

Atmospheric scientist studying weather and climate variability and extreme events using statistical and machine learning tools to harness the power of geospatial data:

- Strong publication record across a breadth of topics in atmospheric and climate science;
- Thrives working on dynamic, cross-disciplinary teams;
- Enjoys communicating about science, particularly for non-expert audiences.

Research Experience

- 08/2022 - present **Research Scientist I**, Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, CO, USA
–**Analyzed AI-enhanced synthetic satellite images** to quantify tropical cyclone evolution and identify new predictors for intensification.
–**Improved AI model for tropical cyclone forecasting** as part of its transition to operations at the National Hurricane Center.
–**Created AI education materials** for the NOAA Center for Artificial Intelligence.
- 01/2023-03/2023 **Visiting scholar**, Data-Driven Atmospheric and Water Dynamics Group, University of Lausanne, Lausanne, Switzerland
–**Designed** climate-invariant machine learning model for tropical cyclone intensity prediction.
–**Helped develop** causally-informed feature selection methods.
–**Developed evaluation strategies** for a tropical cyclone benchmarking data set.
- 06/2019 - 06/2021 **Postdoctoral Researcher**, Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, CO, USA
–**Developed AI model** for tropical cyclone rapid intensification, an extreme event
–**Compared various uncertainty quantification methods** for AI-based predictive tasks for geosciences; gave seminars and lectures on this topic.
–**Studied data biases** in AI models using tropical cyclone extreme events.
- 06/2019 - 06/2021 **Postdoctoral Researcher**, Department of Atmospheric Science, University of Washington, Seattle, WA, USA
–**Analyzed predictability of extreme sea ice loss events** on subseasonal timescales.
- 06/2013 - 05/2019 **Graduate Research Assistant**, Department of Atmospheric Science, Colorado State University, Fort Collins, CO, USA
–**Studied Arctic-midlatitude climate dynamics** with statistical & causal methods.
–**Analyzed climate models** to study changes in Arctic moisture transport.
–**Quantified the seasonal changes** in jet variability in idealized climate models.

Education

- 10/2015 - 03/2019 **Ph.D., Atmospheric Science**, Colorado State University, Fort Collins, CO, USA.
- 06/2013 - 10/2015 **M.S., Atmospheric Science**, Colorado State University, Fort Collins, CO, USA
- 09/2008 - 06/2012 **B.Sc., Mechanical and Ocean Engineering**, Massachusetts Institute of Technology, Cambridge, MA, USA

Selected Publications (14 total)

6. V. Eyring, W.D. Collins, and coauthors (inc. **M. McGraw**) (2024): Pushing the Frontiers in Climate Modeling and Analysis with Machine Learning. *Nature Climate Change*, **14**, 916-928, <https://doi.org/10.1038/s41558-024-02095-y>.
5. McGovern, A., A. Bostrom, **M. McGraw**, R.J. Chase, D.J. Gagne II, I. Ebert-Uphoff, K. Musgrave, and A. Schumacher (2024): Identifying and Categorizing Bias in AI/ML for Earth Sciences, *Bull. Amer. Meteorol. Soc.*, **105**, <https://doi.org/10.1175/BAMS-D-23-0196.1>.
4. McGovern, A., and coauthors (inc. **M. McGraw**) (2023): Trustworthy artificial intelligence for environmental sciences: An innovative approach for summer school. *Bull. Amer. Meteorol. Soc.*, **104**, <https://doi.org/10.1175/BAMS-D-22-0225.1>.
3. Haynes, K., R. Lagerquist, **M. McGraw**, K. Musgrave, and I. Ebert-Uphoff (2023): Creating and evaluating uncertainty estimates with neural networks for environmental-science applications. *Artificial Intelligence for Earth Systems*, **1**, <https://doi.org/10.1175/AIES-D-22-0061.1>.
2. **McGraw, M.C.** and E.A. Barnes (2020): New Insights on Subseasonal Arctic-Midlatitude Causal Connections from a Regularized Regression Model. *Journal of Climate*, doi:10.1175/JCLI-D-19-0142.1.
1. **McGraw, M.C.**, and E.A. Barnes (2018): Memory matters: A case for Granger causality in climate variability studies. *J. Climate*, **31**, doi:10.1175/JCLI-D-17-0334.1.

Selected Presentations

Invited

Seminar, ITU “AI for Good” Seminar Series, 03/2023. *AI for Tropical Meteorology: Challenges and Opportunities*. T. Beucler and **M.C. McGraw**.

Presentation, Aspen Global Change Institute Workshop on Earth System Modeling with Machine Learning and Big Data, 06/2022. *Causality and Interpretability*. **McGraw, M.C.**, and I. Ebert-Uphoff.

Submitted

36th AMS Conference on Hurricanes and Tropical Meteorology, Long Beach, CA. *Exploring Tropical Cyclone Structure and Evolution with AI-based Synthetic Passive Microwave Data*. **McGraw, M.C.**, K. Haynes, K.D. Musgrave, C.J. Slocum, I. Ebert-Uphoff, and J.A. Knaff.

22nd AI Conference, AMS Annual Meeting, Denver, CO, USA. *Using AI To quantify Uncertainty on Tropical Cyclogenesis*. Baldwin, M.R., C. Slocum, and **M. McGraw**.

Tackling Climate Change with Machine Learning Workshop, NeurIPS 2022, remote. *Statistical adjustment of decadal climate predictions using deep learning*. Sospreda-Alfonso, R., Exenberger, J., Dang, K., and **M.C. McGraw** (spotlight presentation).

Teaching, Mentoring, & Service

Mentoring: Angelie Nieves Jiménez (graduate student, 2022-2024); Marshall Baldwin (undergraduate, summer 2022); Julia Shates (undergraduate, summer 2014); ClimateChangeAI summer school (2022)

Teaching: Guest lecturer, “Uncertainty Quantification and Machine Learning”, AI2ES Summer School on Trustworthy AI; assistant instructor for Trustworthy AI hackathon; Graduate teaching assistant for Atmospheric Dynamics I and Objective Analysis.

Diversity, Equity, and Inclusion: Member, DEI Committee, University of Washington (2019-2021)