

Aaron Hill

Curriculum Vitae

Research Interests

Data science and statistical methods, artificial intelligence and machine learning, mesoscale meteorology, predictability, data assimilation, ensemble forecasting, targeted observing, innovative observing systems

Research Experience

- 2021-present **Research Scientist I**, *Colorado State University*.
- 2019-2021 **Postdoctoral Research Fellow**, *Colorado State University*.
Advisor: Dr. Russ Schumacher
- 2012 - 2019 **Graduate Research Assistant**, *Texas Tech University*.
Advisors: Drs. Chris Weiss and Brian Ancell
- July - Sep 2018 **Graduate Student Visitor**, *Mesoscale and Microscale Meteorology Laboratory, National Center for Atmospheric Research*.
Sponsor: Dr. Glen Romine
- 2011-2012 **Undergraduate Research Assistant**, *University of Washington*.
Advisor: Dr. Robert Houze, Jr.

Education

- 2019 **Ph.D., Geosciences**, *Texas Tech University*.
Dissertation: Demonstration of ensemble sensitivity-based targeted observing for convective-scale applications: Perfect-model experiments
- 2014 **M.S., Atmospheric Sciences**, *Texas Tech University*.
Thesis: Mesoscale data assimilation and ensemble sensitivity analysis towards improved predictability of dryline convection
- 2012 **B.S., Atmospheric Sciences**, *University of Washington*.
Minor: Applied Mathematics

Teaching Experience

Instructor of Record

- Summer 2016 and 2017 ATMO 1300: Introduction to Atmospheric Science, Texas Tech University

Guest Lecturer

- 2019 ATMO 3316: Severe and Hazardous Weather
- 2015 ATMO 1300: Introduction to Atmospheric Science
- 2014 ATMO 2301: Weather, Climate, and Human Activities

Other

- 2020 **Co-Instructor:** Department of Atmospheric Science Machine Learning Workshop, Colorado State University
- 2015, 2017-2018 **Writing Tutor:** Graduate Student Writing Center, Texas Tech University
- 2015 **Guest Speaker:** 6th Grade Science Class, Tahoka Middle School, Tahoka, TX

Funding Support

Co-Principal Investigator (PIs: Christopher Weiss, Daniel Dawson, Eric Bruning, Vanna Chmielewski, Matthew Kumjian, Russ Schumacher): "Environmental and Storm-generated Controls in Modulating Quasi-linear Convective System Vertical Vorticity: Dynamics and Detection", National Oceanic and Atmospheric Administration, \$135,065, 9/21-8/24.

Co-Principal Investigator (PI: Russ Schumacher): "Medium-range excessive rainfall forecasts with machine learning models", National Oceanic and Atmospheric Administration Joint Technology Transfer Initiative, ~\$338,000, 8/21-7/23

Co-Principal Investigator (PI: Russ Schumacher): "Generating calibrated forecast guidance for severe weather beyond day 1", National Oceanic and Atmospheric Administration Joint Technology Transfer Initiative, \$433,209, 9/20-8/22.

Doctoral Dissertation Completion Fellowship: one year of salary (\$24,000), 9/1/18-8/31/19.

Student Travel Award: 20th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, \$550, January 2017.

Refereed Publications

- 2021 Cheeseman, Michael, B. Ford, Z. Rosen, E. Wendt, A. DesRosiers, **A. J. Hill**, C. L'Orange, C. Quinn, M. Long, S. H. Jathar, J. Volckens, and J. R. Pierce, 2021: Investigating sub-city gradients of air quality: lessons learned with low-cost PM2.5 and AOD monitors and machine learning. In preparation for submission to Atmospheric Chemistry and Physics.
- Hill, A. J.** and R. S. Schumacher, 2021: Forecasting excessive rainfall with random forests and a deterministic convection-allowing model. Weather and Forecasting, in review.
- Schumacher, R. S., **A. J. Hill**, M. Klein, J. Nelson, M. Erickson, S. M. Trojaniak, and G. R. Herman, 2021: From random forests to flood forecasts: A research to operations success story. Bulletin of the American Meteorological Society, in press, doi.org/10.1175/BAMS-D-20-0186.1.
- Hill, A. J.**, C. C. Weiss, and D. C. Dowell, 2021: Influence of a portable near-surface observing network on experimental ensemble forecasts of deep convection hazards during VORTEX-SE. Weather and Forecasting, 36, 1141-1167, doi.org/10.1175/WAF-D-20-0237.1.
- 2020 **Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2020: Factors influencing ensemble sensitivity-based targeted observing prediction at convection-allowing resolutions. Monthly Weather Review, 148, 4497-4517, doi:10.1175/MWR-D-20-0015.1.
- Hill, A. J.**, G. R. Herman, and R. S. Schumacher, 2020: Forecasting severe weather with random forests. Monthly Weather Review, 148, 2136-2161, doi:10.1175/MWR-D-19-0344.1.
- 2016 **Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2016: Ensemble sensitivity analysis for mesoscale forecasts of dryline convection initiation. Monthly Weather Review, 144, 4161-4182. doi:10.1175/MWR-D-15-0338.1.
- 2014 Rasmussen, K. L., **A. J. Hill**, V. E. Toma, M. D. Zuluaga, P. J. Webster, and R. A. Houze, Jr., 2014: Multiscale analysis of three consecutive years of anomalous flooding in Pakistan. Quart. J. Roy. Meteor. Soc., 141, 1259-1276. doi:10.1002/qj.2433.

Presentations

- 2021 **Hill, A. J.**, E. James, R. S. Schumacher, M. Klein, J. Nelson, and M. J. Erickson, 2021: CSU CAM-based First Guess Excessive Rainfall Outlook Products. Hydrometeorological Testbed Flash Flood and Intense Rainfall Experiment, virtual.
- Schumacher, R. S. and **A. J. Hill**, 2021: Advancing Probabilistic Prediction of High-Impact Weather Using Ensemble Reforecasts and Machine Learning. UFS Webinar Series, virtual.
- (invited) **Hill, A. J.**, 2021: Learning from machines: High-impact weather forecasting with Artificial Intelligence. University of Florida Department of Geography, virtual.
- (invited) **Hill, A. J.**, 2021: Learning from machines: improving high-impact weather forecasts with Artificial Intelligence. Northern Illinois University Department of Geographic and Atmospheric Sciences, virtual.
- Hill, A. J.** and R. S. Schumacher, 2021: Medium-range severe weather forecasts with random forests, 20th Conference on Artificial Intelligence for Environmental Science, 3.2., virtual.

- Hill, A. J.** and R. S. Schumacher, 2021: Short-term excessive rainfall forecasts using random forests and a deterministic convection-allowing model, 20th Conference on Artificial Intelligence for Environmental Science, joint 12.8., virtual.
- Schumacher, R. S., A. J. Hill, M. Klein, J. Nelson, M. J. Erickson, and G. R. Herman, 2021: From Random Forests to Flood Forecasts: A Research to Operations Success Story, 11th Conference on Transition of Research to Operations, 14.9., virtual.
- 2020 **Hill, A. J.** and R. S. Schumacher, 2020: Random-Forest Severe Guidance from the GEFS. Storm Prediction Center Fall Forecaster Training.
- (invited) Hill, A. J.**, 2020: Machine learning for convection hazard forecasts. NWS Southern Region Science and Technology Services Division Science Circle, virtual.
- (invited) Hill, A. J.**, 2020: Forecasting our future: machine learning and AI for high-impact weather. National Weather Association Annual Meeting, virtual.
- Hill, A. J.**, R. S. Schumacher, M. Klein, J. Nelson, and M. Erickson, 2020: First-guess excessive rainfall outlooks from machine learning models. Hydrometeorological Testbed Flash Flood and Intensive Rainfall Experiment.
- (invited) Hill, A. J.**, 2020: Statistical tools for high-impact weather. Naval Postgraduate School, Monterey, CA.
- Hill, A. J.** and R. S. Schumacher, 2020: Heavy precipitation and flash flood forecasts using random forests and convection-allowing models. 30th Conference on Weather and Forecasting / 26th Conference on Numerical Weather Prediction, Boston, MA., J71.2
- Hill, A. J.**, C. C. Weiss, and D. C. Dowell, 2020: Assimilating near-surface observations from a portable mesoscale network of StickNet platforms during VORTEX-SE with the High Resolution Rapid Refresh Ensemble. Severe Local Storms Symposium, Boston, MA., 950
- Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2020: Factors influencing ensemble sensitivity-based targeted observing predictions at convection-allowing resolutions. 24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Boston, MA., 10.4
- McDonald, J. M., C. C. Weiss, and **A. J. Hill**, 2020: Properties of cold pools observed during the VORTEX-SE: Meso18-19 field campaign. Severe Local Storms Symposium, Boston, MA., 946
- Schumacher, R. S., **A. J. Hill**, G. R. Herman, M. Erickson, B. Albright, M. Klein, and J. A. Nelson Jr., 2020: If a flood falls in a (random) forest, does it get counted? Advances and challenges in predicting excessive precipitation using machine learning. 30th Conference on Weather and Forecasting / 26th Conference on Numerical Weather Prediction, Boston, MA., J71.3
- 2019 Ancell, B. C., A. A. Coleman, and **A. J. Hill**, 2019: Ensemble sensitivity-based subsetting overview and evaluation activities at the 2018 NOAA HWT. European Geophysical Union General Assembly 2019, Vienna, Austria, EGU2019-2435.
- Weiss, C. C., E. C. Bruning, J. Dahl, and **A. J. Hill**, 2019: Texas Tech VORTEX-SE Activities. VORTEX-SE Workshop, Huntsville, AL.
- Ancell, B. C., A. A. Coleman, and **A. J. Hill**, 2019: Ensemble sensitivity-based subsetting overview and evaluation activities at the 2018 NOAA HWT. 23rd Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Phoenix, AZ, paper 2.3A.
- Weiss, C. C., D. C. Dowell, N. Yussouf, and **A. J. Hill**, 2019: Insights into mesoscale and storm-scale predictability gained through ensemble sensitivity analysis. 23rd Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Phoenix, AZ, paper 20.1.
- 2018 Ancell, B. C., A. A. Coleman, and **A. J. Hill**, 2018: Ensemble sensitivity-based subsetting overview and evaluation activities at the 2018 NOAA HWT. American Geophysical Union Fall Meeting, Washington, D.C.
- Ancell, B. C., A. A. Coleman, **A. J. Hill**, and C. C. Weiss, 2018: Ensemble sensitivity-based subsetting overview and evaluation activities at the 2018 NOAA HWT. 29th Conference on Severe Local Storms, Stowe, VT, paper 3A.4.
- Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2018: Towards improving forecasts of severe convection along the dryline through targeted observing with ensemble sensitivity analysis. 29th Conference on Severe Local Storms, Stowe, VT, paper 14.2.

- Hill, A. J.**, C. C. Weiss, and D. C. Dowell, 2018: Exploring the utility of assimilating observations from a mesoscale network of StickNet platforms during VORTEX-SE with the High Resolution Rapid Refresh Ensemble. 29th Conference on Severe Local Storms, Stowe, VT, paper 74.
- Weiss, C. C., D. C. Dowell, **A. J. Hill**, J. McDonald, E. C. Bruning, and J. Dahl, 2018: An update on VORTEX-SE activities at Texas Tech University. 29th Conference on Severe Local Storms, Stowe, VT, paper 3B.1.
- (invited) Hill, A. J.**, 2018: The utility of ensemble-sensitivity analysis for targeted observing, ensemble subsetting, and investigating environmental controls on storm characteristics. Cooperative Institute for Research in the Atmosphere, Fort Collins, CO.
- Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2018: Ensemble-sensitivity analysis based observation targeting experiments for mesoscale convection forecasts and factors influencing observation-impact prediction. 22nd Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Austin, TX, paper 613.
- Weiss, C. C., D. C. Dowell, **A. J. Hill**, and N. Yussouf, 2018: Ensemble sensitivity analysis of controls on storm-scale vertical vorticity for two southeastern U.S. tornado events. 22nd Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Austin, TX, paper 610.
- 2017 **Hill, A. J.**, C. C. Weiss, and B.C. Ancell, 2017: Ensemble-sensitivity analysis based observation targeting for mesoscale convection forecasts and factors influencing observation-impact prediction. American Geophysical Union Fall Meeting, New Orleans, LA, paper NG31A-0157.
- Weiss, C. C., E. C. Bruning, J. Dahl, D. C. Dowell, C. R. Alexander, **A. J. Hill**, and V. C. Chmielewski, 2017: Preliminary results from the 2016 and 2017 VORTEX-SE project. 9th European Conference on Severe Storms, Pula, Croatia, paper ECSS2017-155.
- Kenyon, A. and **A. J. Hill**, 2017: Using Python to process and visualize real-time atmospheric data during VORTEX-SE. Scipy 2017: Scientific Computing with Python, Austin, TX.
- Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2017: Ensemble sensitivity-based observation targeting experiments for Southern Plains dryline convection. 21st Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Seattle, WA, paper 15.5.
- Weiss, C. C., E. C. Bruning, J. Dahl, D. C. Dowell, C. R. Alexander, **A. J. Hill**, and V. C. Chmielewski, 2017: An overview of Texas Tech operations during VORTEX-SE 2016. Special Symposium on Severe Local Storms: Observation Needs to Advance Research, Prediction, and Communication, Seattle, WA, paper 939.
- Weiss, C. C., D. C. Dowell, **A. J. Hill**, and N. Yussouf, 2017: Ensemble sensitivity analysis of controls on updraft rotation for two southeastern US tornado events. 21st Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Seattle, WA, paper 11.6.
- 2016 Bruning, E. C., V. C. Chmielewski, C. C. Weiss, J. Dahl, **A. J. Hill**, C. J. Schultz, and J. Bailey, 2016: Flash size distributions characterized by mobile LMA deployments during VORTEX-SE. 28th Conference on Severe Local Storms, Portland, OR, paper 9.4.
- Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2016: Ensemble sensitivity-based observation targeting experiments for Southern Plains dryline convection. 28th Conference on Severe Local Storms, Portland, OR, paper 7B.6.
- Weiss, C. C., E. C. Bruning, J. Dahl, D. C. Dowell, C. R. Alexander, **A. J. Hill**, and V. C. Chmielewski, 2016: An overview of Texas Tech operations during VORTEX-SE 2016. 28th Conference on Severe Local Storms, Portland, OR, paper 3.5.
- Weiss, C. C., D. C. Dowell, **A. J. Hill**, and N. Yossouf, 2016: Ensemble sensitivity analysis of controls on updraft rotation for the 27 April 2011 Tornado Outbreak. 28th Conference on Severe Local Storms, Portland, OR, paper 137.
- Ancell, B. C., **A. J. Hill**, and B. Burghardt, 2016: The TTU WRF ensemble prediction system. 2nd Ensemble Design Workshop for Convection Allowing Models, College Park, Maryland. MD.
- Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2016: Ensemble sensitivity-based observation targeting OSSEs for Southern Plains dryline convection. 20th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, New Orleans, LA, paper J7.7.
- 2015 **Hill, A. J.**, B. Burghardt, and B. C. Ancell, 2015: Advanced ensemble techniques for improved predictability of storm-scale features. 1st Ensemble Design Workshop for Storm-Scale Ensembles, Boulder, CO.

Ancell, B. C., **A. J. Hill**, and B. Burghardt, 2015: The use of ensemble-based sensitivity with observations to improve predictability of severe convective events. 27th Conference on Weather Analysis and Forecasting / 23rd Conference on Numerical Weather Prediction, Chicago, IL, paper 8B.5.

Ancell, B. C., **A. J. Hill**, and B. Burghardt, 2015: The use of ensemble-based sensitivity with observations to improve predictability of severe convective events. Preprints, 19th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Phoenix, AZ, paper 9.1.

Hill, A. J., C. C. Weiss, and B.C. Ancell, 2015: Mesoscale ensemble sensitivity and observation targeting of dryline convection. Preprints, 19th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, Phoenix, AZ, paper 9.3.

2014 Ancell, B. C., **A. J. Hill**, and B. Burghardt, 2014: The use of ensemble-based sensitivity and observations to improve predictability of severe convective events. American Geophysical Union Fall Meeting, San Francisco, CA, NG31B-3798.

Hill, A. J., C. C. Weiss, and B. C. Ancell, 2014: Mesoscale ensemble sensitivity of dryline convective initiation. Preprints, 27th Conference on Severe Local Storms, Madison, WI, paper 8B.4.

Hill, A. J., C. C. Weiss, and B. C. Ancell, 2014: Application of mesoscale ensemble-based sensitivity analysis to observation targeting. 26th Conference on Weather Analysis and Forecasting / 22nd Conference on Numerical Weather Prediction, Atlanta, GA, paper 610.

2013 **Hill, A. J.**, C. C. Weiss, and B. C. Ancell, 2013: Utilizing ensemble sensitivity for data denial experiments of the 4 April 2012 Dallas, Texas dryline-initiated convective outbreak using West Texas Mesonet observations and WRF-DART data assimilation. Preprints, 15th Conference on Mesoscale Processes, Portland, OR, paper 11.

Houze, R. A., Jr., K. L. Rasmussen, and **A. J. Hill**, 2013: TRMM insights into recent floods in Pakistan. PMM Science Team Meeting, Annapolis, MD.

Houze, R. A., Jr., K. L. Rasmussen, **A. J. Hill**, and M. D. Zuluaga, 2013: Using TRMM Precipitation Radar to understand the Pakistan and India floods of 2010-2012. American Geophysical Union Fall Meeting, San Francisco, CA.

Honors and Awards

2019-2020 WxChallenge Category 1 cumulative winner, runner-up in Cold Bay, AK and Cheyenne, WY

2017 WxChallenge final-four finalist in 2017 end-of-year tournament

2013 **TTU Geoscience Scholarship**: Awarded to graduate students nominated by their respective department

2012 **Jurica Fellowship**: Awarded to new, incoming graduate students nominated by their prospective department

2012 **Atmospheric Sciences Achievement Award**: Graduating seniors in the Department of Atmospheric Sciences (Washington) who have achieved a GPA of 3.5 or higher in degree courses

2012 **Phil Church Award**: Graduating senior in the Department of Atmospheric Sciences (Washington) with the most outstanding record of scholarship, leadership, and service

2010-2012 **Naval Weather Service Association Scholar**: Proven academic achievement and student community leadership

Leadership Activities and Service

2021-present **Member**: Research to Operations Nexus Meetup Planning Committee

2020-present **Associate Editor**: Monthly Weather Review

2020-present **Chair**: AMS 31st Conference on WAF/27th Conference on NWP Program Committee

2019-present **Member**: AMS Scientific and Technological Activities Commission, Committee on Weather Analysis and Forecasting

2016-present **Reviewed Manuscripts for**: Weather and Forecasting, Monthly Weather Review, Journal of Atmospheric Sciences, Journal of Applied Meteorology and Climatology, JGR-Atmospheres, Geophysical Research Letters, Weather and Climate Dynamics, Meteorological Applications, Energies, and Journal of Operational Meteorology

2019, 2020, 2021 **Participant**: Hydrometeorological Testbed (NOAA) Flash Flooding and Intense Rainfall Experiment

2014, 2018, 2021 **Participant**: Hazardous Weather Testbed (NOAA) Spring Forecast Experiment

- 2021 **Contributor:** National Oceanic and Atmospheric Administration White Paper on exploring ways to increase the near-term operational utility of existing observations and analysis systems
- 2021 **Session Co-Chair:** Special Symposium on Global and Mesoscale Models: Updates and Center Overviews: Utilization and Development of Rapidly Updating Mesoscale Models for Impact-Based Decision Support Services, AMS Annual Meeting 2021
- 2019-2020 **Member:** AMS 30th Conference on WAF/26th Conference on NWP Program Committee, Conference Session Chair
- 2019 **Participant:** Workshop: Increasing Inclusivity in the Engineering Classroom
- 2013-2019 **Team Manager:** WxChallenge Competition, Texas Tech University
- 2017-2018 **Member:** AMS 29th Conference on WAF/25th Conference on NWP Program Committee
- 2017-2018 **Student Member:** Texas Tech University College of Arts and Sciences Committee on Academic Programs
- Rapporteur:** 2017 NOAA R2O meeting and 2018 AMS Community Meeting
- 2015-2016 **Member:** 15th AMS Student Conference Planning Committee
Poster Session Subcommittee and Session Chair
- 2014-2015 **Member:** 14th AMS Student Conference Planning Committee
- 2013-2015 **Secretary:** American Meteorological Society Student Chapter, Texas Tech University
- 2013, 2014 **Reviewer:** Texas Tech University Undergraduate Research Conference
- 2012-2013 **President:** American Meteorological Society Student Chapter, Texas Tech University
- 2011-2012 **President:** American Meteorological Society Student Chapter, University of Washington

Fieldwork Participation

- 2019 Targeted Observations by Radars and UAS of Supercells (**TORUS**): Assisted fieldwork operations and led numerous forecast discussions.
- 2013-2019 Deploying mobile radars for interceptions of outflow boundaries, tornadoes, and mesoscale convective systems for the Texas Tech University Severe Storm Research Group.
- 2018 National Robotics Initiative: Assisted fieldwork operations with two mobile Ka-band radars to support unmanned aircraft flights in and around supercell thunderstorms.
- 2017 Rivers of VORTicity in Supercells (**RiVorS**): Assisted fieldwork operations with a mobile Ka-band radar to observe vorticity rivers.
- 2016-2017 Verification of the Origins of Rotation in Tornadoes Experiment-Southeast (**VORTEX-SE**): Student technician responsible for: integrating solar panel hardware into the Texas Tech StickNet observing platforms, altering existing hardware and software, maintaining stationary observing sites, developing web display, and producing analysis graphics.
- 2014-2015 Air Force Office of Scientific Research (**AFOSR**) project: Assisted fieldwork operations with mobile Ka-band radars to adaptively sample baroclinic boundaries near supercells. Contributed to development of computer processing techniques and communications for real-time dual-doppler analyses.
- 2013 Assisted in the rebuilding of TTU StickNet data acquisition systems in support of the TTU Hurricane Research Team.

Professional Interviews

- 9/24/18 Daily Toreador newspaper regarding severe storm research in the Texas Tech Atmospheric Sciences Group
- 2/24/17 Texas Tech University Communications for the VORTEX-SE 2017 field program
- 3/16/16 Alabama Public Radio for Texas Tech involvement with the VORTEX-SE field program
- 2/11/16 Texas Tech University Climate Science Center Videos for Science series
- 12/15 Texas Living Magazine (online) regarding Texas weather

Professional Associations and Activities

- 2017-present American Geophysical Union
- 2012-present American Meteorological Society

Technical Skills

* indicates proficiency

Programming Languages: Python*, shell*, Fortran, NCL, LabVIEW, HTML/CSS/PHP/Javascript

Meteorological Software: WRF*, DART*