

McKenzie L. Larson

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GitHub: github.com/mckenzielarson

Research Group Profile:

acwinters.weebly.com/people.html

INTERESTS

Earth system modeling, high performance computing, synoptic and mesoscale meteorology, forecast verification, model improvement, data assimilation

EDUCATION

Ph.D. in Atmospheric and Oceanic Sciences

Boulder, CO

University of Colorado Boulder

August 2022 - Present | Expected May 2027

- Advisor: Dr. Andrew C. Winters
- Research topic: Understanding Extratropical Cyclone Predictability Along the Colorado Front Range
- Cumulative GPA: 4.000

B.A. in Atmospheric and Oceanic Sciences; Physical Geography (Double Major)

Boulder, CO

University of Colorado Boulder

2022

- Cumulative GPA: 3.982, *with distinction*
- Honors Thesis: “Downslope Wind Verification of the National Blend of Models Across the Northern Front Range of Colorado,” *summa cum laude*
- Dean’s List: Fall 2018 - Spring 2022

RESEARCH EXPERIENCE

Graduate Research Assistant in Atmospheric and Oceanic Sciences

Boulder, CO

University of Colorado Boulder (Full-time: 40-hrs/week)

August 2022 - Present

Project: An Updated Climatology of Extratropical Cyclones Across the Central U.S.

Advisor: Dr. Andrew C. Winters

- Creating an updated climatology of extratropical cyclones that impact Colorado and including information about cyclone seasonal frequency and pressure trends
- Training Self-Organizing Maps (SOMs) on mean sea-level pressure anomalies from ERA5 to examine the variability in large-scale weather regimes conducive to cyclogenesis along the Colorado Front Range

National Center for Atmospheric Research Student Visitor

Boulder, CO

National Center for Atmospheric Research (NCAR) (Full-time: 40-hrs/week)

May - August 2022

Project: Present and Future Climate Sensitivity Studies of Downslope Winds in Boulder, Colorado

Advisors: Christine Shields & Dr. Gerald Meehl, NCAR

Dr. Andrew Winters & Dr. Aneesh Subramanian, Univ. of Colorado Boulder

- Expanded upon previous downslope windstorm research (see below) by running WRF simulations to understand what atmospheric conditions are necessary to reproduce the extreme January 1982 downslope windstorms in Boulder, Colorado
- Examined how downslope winds will change in a future climate by forcing WRF simulations with Community Earth System Model (CESM) anomalies
- Findings will be included in a co-authored paper in the Bulletin of the American Meteorological Society (BAMS) scientific journal

Honors Thesis in Atmospheric and Oceanic Sciences

University of Colorado Boulder

Boulder, CO

August 2021 - April 2022

Project: Downslope Wind Verification of the National Blend of Models (NBM) Across the Northern Front Range of Colorado

Advisor: Dr. Andrew Winters, University of Colorado Boulder

- Expanded upon NOAA Ernest F. Hollings summer internship (see below) by running WRF downslope wind simulations for a specific Chinook event in December 2020
- Prepared for graduate school research by improving scientific writing and presentation skills
- Submitted thesis for a first-authored publication in 2023

NOAA Ernest F. Hollings Internship

Boulder, Colorado National Weather Service Weather Forecast Office (Full-time: 40-hrs/week) June - August 2021

Boulder, CO

Project: Downslope Wind Verification of the National Blend of Models (NBM) Across the Northern Front Range of Colorado

Mentor: Paul Schlatter, Science and Operations Officer at Boulder NWS WFO

- Quantified and analyzed the multiplicative biases, mean absolute errors (MAE), and timing errors of the wind speeds and gusts for each downslope wind event to provide a better understanding of the NBM magnitude and timing errors
- Cultivated data management and statistical skills to apply to future research projects and coursework

Browne Research Group at the University of Colorado Boulder

Independent Study (Part-time: 12-hrs/week)

Boulder, CO

August 2019 - May 2022

Project: Quantification of Atmospheric Gases Emitted During Dew Evaporation

Advisor: Dr. Eleanor Browne, University of Colorado Boulder and CIRES

- Built a chamber for use with the Time-of-Flight Chemical Ionization Mass Spectrometer (CIMS) to better understand dew evaporation chemistry
- Gained experience working with analytical instruments (CIMS and Ion Chromatography System) and analyzing data from experiments

Summer Research Project (Part-time: 12-hrs/week)

April - August 2020

Project: Investigating Wintertime Sources of Organic Aerosols in Cape Cod, MA

Advisor: Dr. Eleanor Browne, University of Colorado Boulder and CIRES

- Learned various data analysis techniques, such as Positive Matrix Factorization (PMF), source apportionment, and NOAA HYSPLIT back trajectories, to identify aerosol sources from Aerosol Mass Spectrometer (AMS) measurements
- Learned how to effectively and efficiently conduct independent research virtually

PUBLICATIONS

Larson, M. L., A. C. Winters, and P. T. Schlatter 2024: Downslope Wind Verification of the National Blend of Models v4.0 Across the Northern Front Range of Colorado During the 2020/2021 Cool Season. *Journal of Operational Meteorology*, [in press]

CONFERENCE POSTER AND ORAL PRESENTATIONS

Larson, M. L. and A. C. Winters (2024), An Updated Climatology of Extratropical Cyclones Across the Central United States, Abstract [20] presented at 2024 Annual Meeting, AMS, Baltimore, MD 28 Jan -1 Feb. (Oral)

Larson, M. L. and A. C. Winters (2023), An Updated Climatology of Extratropical Cyclones Across the Central United States, Abstract [20] presented at 2023 Annual Program Review, DOE CSGF, Washington D.C., 16-20 Jul. (Poster)

- Larson, M.**, Shields, C. A., Meehl, G., Winters, A. C., Myers, B., Morales, A., Subramanian, A. (2023), Present and Future Climate Sensitivity Studies of Downslope Winds in Boulder, Colorado, Abstract [A55P-1332] presented at 2023 Annual Meeting, AMS, Denver, CO 8-12 Jan. **(Oral)**
- Larson, M.**, Shields, C. A., Meehl, G., Winters, A. C., Myers, B., Morales, A., Subramanian, A. (2022), Present and Future Climate Sensitivity Studies of Downslope Winds in Boulder, Colorado, Abstract [A55P-1332] presented at 2022 Fall Meeting, AGU, Chicago, IL 12-16 Dec. **(Poster)**
- Larson, M.**, Schlatter, P. T. (2021), Downslope Wind Verification of the National Blend of Models Across the Northern Front Range of Colorado, Abstract [390508] presented at 2022 Annual Meeting - Annual Student Conference, AMS, Houston, TX 22-23 Jan. **(Poster)**
- Larson, M.**, Schlatter, P. T. (2021), Downslope Wind Verification of the National Blend of Models Across the Northern Front Range of Colorado, Abstract [A41E-07] presented at 2021 Fall Meeting, AGU, New Orleans, LA 13-17 Dec. **(Oral)**
- Larson, M.**, Schlatter, P. T. (2021), Downslope Wind Verification of the National Blend of Models Across the Northern Front Range of Colorado, Abstract [B3] presented at 2021 Annual Earth System and Space Science Poster Conference, University of Colorado Boulder, Boulder, CO 3 Dec. **(Poster)**
- Larson, M.**, Schlatter, P. T. (2021), Downslope Wind Verification of the National Blend of Models Across the Northern Front Range of Colorado, Abstract [TMAW-4] presented at 2021 Midwest Student Conference on Atmospheric Research (MSCAR), University of Illinois at Urbana-Champaign, 25 Sept. **(Oral)**
- Larson, M.**, Browne, E. C. (2021), Investigating Wintertime Sources of Organic Aerosols in Cape Cod, Abstract [EC-10] presented at 2021 Rendezvous, CIRES, 21 May. **(Poster)**
- Larson, M.**, Browne, E. C. (2020), Investigating Wintertime Sources of Organic Aerosols in Cape Cod, [A036-0009] presented at 2020 Fall Meeting, AGU, 1-17 Dec. **(Poster)**

FELLOWSHIPS, AWARDS, AND RESEARCH GRANTS

- Department of Energy Computational Science Graduate Fellowship (DOE CSGF)** 2022
 – Four year fellowship including additional computer science, high-performance computing, math, and statistic courses and a practicum at a DOE facility during the fellowship period
- National Science Foundation Graduate Research Fellowship (NSF GRF) (Declined)** 2022
 – Five year fellowship with three years of financial support that recognizes outstanding students in STEM fields
 – Declined this fellowship to accept the DOE CSGF
- American Meteorological Society (AMS) Graduate Fellowship** 2022
 – One year fellowship that recognizes outstanding students who are pursuing graduate degrees in atmospheric science or related fields and provides support to attend the 2023 AMS Annual Meeting
- CU Boulder Graduate Recruitment Diversity Fellowship** 2022
 – Nominated by the Department of Atmospheric and Oceanic Sciences as a diverse applicant to CU Boulder and to the department's doctoral program
- College of Arts & Sciences Honors Scholar** 2022
 – Completed 3 Honors courses, attended at least 2 Honors events per semester, and completed 5 hours of community service per semester
 – Selected as the Featured Honors Scholar to speak at the 2022 Honors Scholars Reception
- NOAA Ernest F. Hollings Undergraduate Scholar** 2020
 – Summer 2021 Internship Project with the Boulder, Colorado National Weather Service Weather Forecast Office (NWS WFO)
- Undergraduate Research Opportunities Program (UROP) Grants** 2020 - 2022
 Advisor: Dr. Eleanor Browne

- Project 1: Investigating Wintertime Sources of Organic Aerosols in Cape Cod, Massachusetts
- Project 2: Quantification of Atmospheric Gases Emitted During Dew Evaporation

University of Colorado Boulder Presidential Scholarship

2018

- Awarded to the top 1-3% of the admitted nonresident class at CU Boulder

LEADERSHIP EXPERIENCE

Social Committee Student Lead

Boulder, CO

University of Colorado Dept. of Atmospheric and Oceanic Sciences (Part-time: 4-hrs/week) August 2023 - Present

- Member of the ATOC Social Committee since August 2022
- Host social events (i.e., community hours, coffee hours, tournaments, etc.) to encourage community building
- Delegate tasks to other committee members and manage the logistical aspects of social events

Co-Chair

Boulder, CO

CU Arts and Sciences Honors Program Student Advisory Board (Part-time: 4-hrs/week) February 2020 - May 2022

- Technology Liaison from February 2020 to January 2021; Co-chair from January 2021 to present
- Ran weekly board meetings to discuss potential Honors Program events, enrollment, logistics, the blog, social media, and outreach
- Managed the program email and spoke with the Co-Chair and Faculty Advisor frequently throughout the week

Piccolo Section Leader

Boulder, CO

University of Colorado Golden Buffalo Marching Band (Part-time: 10-hrs/week) August 2018 - May 2022

- Piccolo Squad Leader from April 2019 to April 2020; Piccolo Section Leader from April 2020 to present
- Ensured the facilitation of efficient and focused marching band rehearsals three times a week
- Provided feedback on marching technique and music, recorded attendance, and reminded members of meetings and deadlines

MENTORSHIP AND TEACHING EXPERIENCE

Research Mentor

Boulder, CO

Browne Research Group (Part-time: 6-hrs/week) September 2021 - May 2022

- Mentored a new undergraduate researcher to use Ion Chromatography to measure amine concentrations in the air to improve our knowledge of Boulder's air quality
- Provided me with the opportunity to teach proper analytical instrumentation techniques and explain how to formulate scientific questions and experiments

Laboratory Assistant

Boulder, CO

Statistics and Geographic Data Course (Part-time: 3-hrs/week) January - May 2021

- Assisted students and answered questions about using R for statistical analysis during lab period
- Prepared for the weekly lab period by reviewing statistical concepts and running through R commands

Eighth Grade Capstone Project Mentor

Denver, CO

Denver Language School (Part-time: 8-hrs every year) Spring 2020 - Present

- Mentored students who chose topics on atmospheric or environmental sciences (such as coral reef deterioration and ocean pollution)
- Attended Mentor Days in Denver or online to discuss project progress

WORK EXPERIENCE

Senior Science Adventure Camp Counselor

Plantation, FL

American Heritage Summer Camp

June - July 2018 and 2019

- Taught children (ages 5-13) the basic concepts of earth science, physics, and chemistry
- Managed daily activities and field trips to educational parks and the ocean

SKILLS

- **Programming Languages:** Python, C++, R, MATLAB
- **Operating Systems:** Linux
- **Programs:** OpenMP, Message Passing Interface (MPI)
- **Software:** ArcGIS, Anaconda, Jupyter Notebook, Ubuntu, Spyder, R Studio, Igor Pro, Microsoft Office Suite, Google Suite, Panoply, Overleaf
- **Models:** Weather Research and Forecasting Model (WRF), WRF-Data Assimilation Testbed (WRF-DART), Community Earth System Model (CESM), NOAA Hybrid Single-Particle Lagrangian Integrated Trajectory Model (HYSPLIT)
- **Supercomputers:** NCAR's Derecho and Cheyenne, CU Boulder's Alpine and Summit
- **Forecasting Experience:** Participant in WxChallenge Collegiate Forecasting Competition (January 2021 - Present), 2022 NOAA Hazardous Weather Testbed Spring Forecasting Experiment (HWT SFE), 2023 AMS Annual Meeting Student Weather Briefing

RELEVANT COURSEWORK

Graduate:

- **Computer Science:** High Performance Scientific Computing
- **Applied Mathematics:** Data Assimilation in Higher Dimensions
- **Oceanography:** Introduction to Physical Oceanography
- **Atmospheric Science:** Atmospheric Thermodynamics and Dynamics, Synoptic Meteorology, Dynamics of the Atmosphere and Oceans, Radiative Transfer and Remote Sensing, Physics and Chemistry of Clouds and Aerosols

Undergraduate:

- **Mathematics:** Calculus 1-3, Introduction to Differential Equations with Linear Algebra
- **Physics:** Physics 1-2 with laboratory
- **Statistics:** Statistics and Geographic Data
- **Oceanography:** Introduction to Oceanography, Physical Oceanography and Climate
- **Atmospheric Science:** Atmospheric Dynamics, Atmospheric Physics, Principles of Weather, Principles of Climate, Weather Modeling Laboratory, Climate Modeling Laboratory, Scientific Programming and Data Laboratory, Physical Oceanography and Climate, Weather Analysis and Forecasting