CURRICULUM VITAE

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EDUCATIONAL BACKGROUND

2002	Ph.D. in Physics; Thesis: 'Determination of three-dimensional wind-vector fields using bistatic Doppler radar' for the Department of Physics at the Ludwig-Maximilians University in Munich, under Professors Dr. Ulrich Schumann and Dr. Roger Smith.
1999	Diploma (equivalent to a Master's degree) in Meteorology; Thesis: 'Numerical investigation on the sensitivity of the Bowen-ratio' for the Department of Meteorology at Leipzig University, under Professors Dr. Nicole Mölders and Dr. Gerd Tetzlaff.
1996	Pre-diploma (equivalent to a Bachelor's Degree) in Physics for the Department of Physics at Leipzig University.

EMPLOYMENT HISTORY

2025 – present	Chair at the Department of Atmospheric and Oceanic Sciences, University of Colorado at Boulder, USA.
2022 – present	Professor at the Department of Atmospheric and Oceanic Sciences, University of Colorado at Boulder, USA.
2018 – 2024	Associate Chair at the Department of Atmospheric and Oceanic Sciences, University of Colorado at Boulder, USA.
2015 – 2022	Associate Professor at the Department of Atmospheric and Oceanic Sciences, University of Colorado at Boulder, USA.
2008 – 2015	Assistant Professor at the Department of Atmospheric and Oceanic Sciences, University of Colorado at Boulder, USA.
2005 – 2007	Research Scientist at the Swiss Weather Service, MeteoSwiss, Locarno, Switzerland.
2004 – 2005	Postdoctoral Researcher at the Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado at Boulder and National Oceanic and Atmospheric Administration's (NOAA) Physical Sciences Division, Boulder, USA.
2002 – 2004	Research Scientist at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt, DLR, Oberpfaffenhofen, Germany), Institute of Atmospheric Physics, Oberpfaffenhofen, Germany.
1999 – 2002	Graduate Student Research Associate employed by above-named Institute.
1995 – 1996	Research Assistant to Dr. Banzaff at the Center for Environmental Research Leipzig, Germany.
1993 – 1999	Research Assistant to Dr. Nicole Mölders, Institute of Meteorology, Leipzig University, Leipzig, Germany.

GRANTS, AWARDS, AND HONORS

FUNDED PROPOSALS

1. Project Title:	Collaborative Research: AGS-FIRP Track 3: In-situ Collaborative Experiment for the Collection of Hail In the Plains (ICECHIP)
Involvement:	CU Principal-Investigator
Funding Agency:	CU Boulder
Period of Performance:	09/01/2024-08/31/2028
Total award to CU:	$1,150,602

2. Project Title:	Innovating Large Courses Initiative: Revising ATOC 1050
Involvement:	Principal-Investigator
Funding Agency:	CU Boulder
Period of Performance:	09/01/2022-08/31/2025
Total award:	$30,000

3. Project Title:	Collaborative Research: WINTRE-MIX: Winter Precipitation Type Research
	Multi-scale Experiment
Involvement:	CU Principal-Investigator
Funding Agency:	National Science Foundation
Period of Performance:	09/01/2021-08/31/2025
Total award to CU:	$1,827,602

4. Project Title:	Collaborative Research: Further investigations from the Seeded and Natural Orographic Wintertime clouds: the Idaho Experiment (SNOWIE)
Involvement:	CU Principal-Investigator
Funding Agency:	National Science Foundation
Period of Performance:	09/01/2020-08/30/2025
Total award to CU:	$690,663

5. Project Title:	Collaborative Research: An Integrated Understanding of the Initiation and Subsequent Dynamical and Microphysical Characteristics of Deep Convective Storms during RELAMPAGO
Involvement:	CU Principal-Investigator
Funding Agency:	National Science Foundation
Period of Performance:	8/15/2017-8/14/2022
Total award to CU:	$694,277

6. Project Title:	Collaborative Research: Large Hail Accumulations in Thunderstorms
Involvement:	Principal-Investigator
Funding Agency:	National Science Foundation
Period of Performance:	8/21/2017-8/20/2022
Total award: to CU	$486,705

7. Project Title:	Evaluation of Thunderstorm Outflow Boundaries
Involvement:	Principal-Investigator
Funding Agency:	DOI - JFSP
Period of Performance:	9/18/2017-9/30/2021
Total award:	$335,809

8. Project Title:	Improving Understanding of Convection Initiation in Nocturnal Environments During PECAN (Plains Elevated Convection at Night) Using High-Resolution Ensemble Data Assimilation
Involvement:	Principal-Investigator
Funding Agency:	College of Arts and Sciences – CU Boulder
Period of Performance:	12/1/2015-11/30/2020
Total award:	$592,055

9. Project Title:	SEEC - Climate and Weather Collaboratory
Involvement:	Principal-Investigator
Funding Agency:	College of Arts and Sciences – CU Boulder
Period of Performance:	1/1/2019-12/31/2019
Total award:	$75,000

10. Project Title:	Collaborative Research: SNOWIE: Seeded and Natural Orographic Wintertime clouds – the Idaho Experiment
Involvement:	Principal-Investigator
Funding Agency:	National Science Foundation
Period of Performance:	9/1/2016-8/31/2019
Total award:	$560,351

11. Project Title:	Identifying Plowable Hailstorms using GOES-R
Involvement:	Principal-Investigator
Funding Agency:	COMET
Period of Performance:	11/15/2015-07/31/2016
Total award:	$19,286

12. Project Title:	Forecast Improvement in Complex Terrain near the Columbia River Gorge
Involvement:	Co-Investigator
Funding Agency:	Department of Energy
Period of Performance:	12/01/2014-02/28/2018
Total award:	$349,447

13. Project Title:	Observations of Wind Turbine Wakes Using Remotely Piloted Aircraft
Involvement:	Co-Investigator
Funding Agency:	CIRES Innovative Research Program, U. of Colorado
Period of Performance:	05/01/2013-04/31/2014
Total award:	$13,000

14. Project Title:	Analysis and Observations of Particle Size Distribution in Supercell Thunderstorms
Involvement:	Principal-Investigator
Funding Agency:	NSF
Period of Performance:	06/15/2010-05/31/2013 (extended to 11/31/2014)
Total award:	$363,399

15. Project Title:	A 10-yr Climatology (1999-2009) on 4-dimensional Precipitation Characteristics Using Weather Radar Observations in the European Alps
Involvement:	Principal-Investigator
Funding Agency:	NSF
Period of Performance:	01/15/2010-12/31/2012 (extended to 12/31/2013)
Total award:	$413,811

16. Project Title:	Collaborative Research: SGER - Measurements of Particle Size and Fall Velocity Distributions within Supercell Thunderstorms
Involvement:	Principal-Investigator
Funding Agency:	NSF
Period of Performance:	01/01/2009-07/31/2010
Total award:	$40,638

17. Project Title:	Estimation of Cloud Properties in Three-dimension (3D) from Cloud Resolving Data Assimilation
Involvement:	Principal-Investigator
Funding Agency:	NSF
Period of Performance:	12/24/09 – 08/31/10
Total award:	$43,869

18. Project Title:	An Atmospheric Science Laboratory for Undergraduate Education
Involvement:	Co-Investigator
Funding Agency:	NSF
Period of Performance:	12/01/08 – 11/30/10
Total award:	$144,359

AWARDS AND HONORS

2025	Fellow of the American Meteorological Society
2019-20	Excellent in Leadership Fellow at the University of Colorado
2015, 2016, 2021	ATOC Service Award
June 2014	Top 10 most read articles at the American Meteorological Society's journal "J. Atmos. Oceanic Technol." entitled "Articulating and Stationary PARSIVEL Disdrometer Measurements in Conditions with Strong Winds and Heavy Rainfall"; http://journals.ametsoc.org/loi/atot
2002	Ph.D. thesis entitled "Determination of three-dimensional wind-vector fields using bistatic Doppler radar" was requested by NASA as a reference book for how to use and implement bistatic receivers to radar ground validation stations for wind-vector field determination during the satellite-based Global Precipitation Mission.
2001	Spiros G. Geotis Prize, given for the best student paper presented by the American Meteorological Society at the 30th Conference on Radar Meteorology (Friedrich and Hagen 2001).

RESEARCH

FIELD EXPERIMENTS

1. SCOOP 2008-present - Study of COnvective and Orographic Precipitation: Deployment of rain measuring instruments (disdrometers, radars) and a microwave radiometer to study precipitation processes along the Colorado Front Range. Instruments are permanently deployed at various locations between Boulder and Niwot ridge. For instance, data were used to analyze precipitation structures during the Boulder flood and determine rain amounts in Fourmile creek burn area (Friedrich et al. 2014a, b).
2. CHAT 2012-present – Colorado Hail Accumulation in Thunderstorms project: CHAT is a collaboration between CU and the National Weather Service Forecast Office Boulder aiming at better identifying and forecasting hail accumulations from thunderstorms. It entails collecting improved and more frequent hail depth reports on the ground and studying characteristics of storms that produce hail accumulations with the goal to identify robust predictors used as operational products in the future.

3. ICECHIP 2025: The In-Situ Collaborative Experiment for the Collection of Hail in the Plains, is the first U.S. hail-focused field campaign in over 40 years, conducted over six weeks in the summer of 2025. Its goal is to improve hail detection, forecasting, and damage models by collecting synchronized observations of hail formation, trajectories, and storm structure using mobile radars, drones, probes, and ground instrumentation.
4. **ISOWEX 2025**: Isotopic Water Vapor Experiment was a field experiment designed to investigate seasonal and spatial variations in atmospheric water vapor isotopes along the Colorado Front Range. Three isotope analyzers were deployed at different elevations—from the plains near Boulder to mid-elevation foothills and a high-mountain site—to capture vertical gradients in water vapor composition. Continuous measurements from January through August provided a detailed cross-section of isotopic variability associated with regional moisture transport, evaporation, and precipitation processes.
5. WINTRE-MIX 2022: Winter Precipitation Type Research Multiscale Experiment (WINTRE-MIX) is an U.S.-Canadian research program, conducted in Montreal, CA, focusing on better understanding how multi-scale processes influence the variability and predictability of precipitation type and amount in near-freezing surface conditions.
6. SNOWIE 2017: Seeded and Natural Orographic Wintertime clouds – the Idaho Experiment Jan-Mar 2017: a comprehensive observational and modeling research program to address uncertainties regarding the effectiveness of orographic winter precipitation enhancement through cloud seeding.
7. WFIP 2015-2016 - Wind Forecasting Improvement Project: 1-year experiment in the Columbia River Gauge sponsored by the US Department of Energy to collect data in complex terrain and test improvements in wind forecasting; deployment of a microwave radiometer.
8. XPIA 2015: The A2e eXperimental Measurements Committee's Planetary Boundary Layer Instrument Assessment campaign was conducted between March and April 2015 at the Boulder Atmospheric Observatory in collaboration with the educational outreach project Characterizing the Atmospheric Boundary Layer (CABL). Deployment of a microwave radiometer and leading the comparison of radiometer observations with soundings, tower, sodar observations in preparation of the WFIPS experiment.
9. Remote sensing instruments for wind farm applications, 2011-2015: Remote sensing devices, Windcube lidar and a microwave radiometer, were compared to meteorological in-situ tower measurements to demonstrate the accuracy of these measurements and to assess the utility of the remote sensing instruments in overcoming tower limitations. The instruments were deployed at the National Wind Technology Center south of Boulder between May-October 2011, April 2012-Dec 2012, and March 2013-2015.
10. ASCII 2012-2013 - AgI Seeding of Clouds Impact Investigation: Using a variety of remote sensing (ground-based scanning and vertically-pointing radars, airborne radar and lidar, microwave radiometer) and in-situ observations (disdrometers, snow gauges, ice crystal imagery, airborne in-cloud measurements) to study natural microphysical processes in winter storms and the effect of cloud seeding on snow distribution and amount. Experiment was conducted between Jan-March 2012-2013.
11. TOM 2011 - Teaching flow Over Mountains: One Doppler on Wheels (DOW) mobile radar, which is a facility operated by the National Science Foundation (NSF), was requested as part of the NSF's Facility Request for Education in March and April 2011 to be deployed in two snow storms occurring along the Colorado foothills in the vicinity of Boulder, CO. The instrument was used to provide hands-on instrument experience for undergraduate students and teach basic concepts of orographic airflow and precipitation. The instrument was used in the ATOC's 300 student undergraduate course ATOC 1050: Weather and the Atmosphere (http://rain.colorado.edu/TOM-experiment).
12. ISPA 2010 - Inhibition of Snowfall by Pollution Aerosols: Using in-situ cloud and aerosol

measurements, disdrometers, and vertically-pointing radars to study whether an increase in cloud condensation nucleus concentration leads to an increase in supercooled cloud droplet concentrations while decreasing their size, lowering the efficiency of snow growth by accretion, and decreasing snowfall rate.

13. VORTEX2 2009-2010 - The second Verification of the Origins of Rotation in Tornadoes Experiment: Using mobile radars, in-situ surface and airborne observations, and mobile disdrometers to investigate thermodynamic and microphysical structures in supercells thunderstorms and evaluate their role for tornado formation. Deployed successfully mobile surface disdrometers to provide in-situ precipitation measurements – this is the first time that disdrometers were used in a mobile setup in supercell thunderstorms.
14. Gunnison Radar Project, 2009-2010: Using a ground-based scanning and vertically-pointing radars and surface observations (e.g., disdrometers) to demonstrate the potential of gap-filling Doppler radars within the coverage area of the National Weather Service WSR-88D radar at Grand Junction and to examine the terrain-induced circulations favorable for storm formation and motion.
15. Hurricane Ike, 2008: Deployment of Doppler on Wheels (DOW) mobile radar, 10 wind measuring platforms, two mobile mesonet vehicles with disdrometer during the landfall of hurricane Ike on Galveston Island, TX, to investigate kinematic and microphysical structures within hurricane rain bands.
16. **ROTATE 2008** - Radar Observations of Tornadoes and Thunderstorm Experiment: Deployment of the Doppler On Wheels (DOW) mobile radars, mobile mesonet stations, and mobile disdrometers to study kinematic and thermodynamic processes important for tornado formation, structure, and lifecycle.
17. **Radar de Franche-Comté, INTERREG[1] IIIa, 2005-2007**: Using a dual-polarization testbed radar to analyze the added benefit of polarimetric measurements for rainfall rate estimation and severe weather forecasting in the Alps and focusing on the influence of terrain and multiple water phases on the measurement accuracy of polarimetric quantities. This was an international project between the Swiss weather service, MeteoSwiss, and the French weather service, MétéoFrance.
18. Radarablösung MeteoSwiss 2005-2007 (Modernization of the Swiss national weather radar network): Study using a dual-polarization testbed radar to evaluate the utility and feasibility of polarimetry for operational applications in the Swiss Alps. The renewal of the Swiss radar network was conducted based on that study.
19. **VERTIKATOR 2002** - Vertical Exchange and Orography in Alpine foreland: Using ground-based weather radars together with a bistatic Doppler radar network (3 receivers) to investigate the onset of convection and downburst-producing thunderstorms using polarimetric radar data and wind-vector fields.

EXCELLENCE IN CLASSROOM TEACHING & SUPERVISION

CLASSROOM OR CLASSROOM-RELATED TEACHING

Since 2008 Teaching of a variety of undergraduate and graduate-level course at the University of Colorado at Boulder both during the regular academic year as well as online course during the summer and winter session

Provide undergraduate and graduate students regularly with internship, independent study, and paid research opportunities through either through courses like ATOC 4900 or ATOC 5900 Independent Study or paid research from research grants or other opportunities (CU SMART program, CU Studio Lab,

[1] Integration of regions within Europe, Initiative of the European Union

	UCAR SOARS program); provide on average research opportunities for 2-5 undergraduate students and 4-6 graduate students per year
	Provide undergraduate and graduate students the opportunity to participate in international field campaigns (e.g., VORTEX2, ASCII, SNOWIE, ICECHIP, WINTRE-MIX) or regional field campaigns (SCOOP, Isotope measurements along the Front Range). Students are responsible for taking measurements, deploying instruments, and analyzing data.
	Mentoring students on research communication how to present research results at conferences and meetings and how to summarize results in journal publication; encouraging students to present at international conference and help providing or seeking funding to participate in conferences
	Developed new in-person or online courses and developed/revised curricula (*ATOC 4550: Mountain Meteorology, ATOC 3180 Aviation Meteorology; ATOC 4990 Internship for Credit; ATOC 7500 Snowfall and Snowpack Stratigraphy; ATOC 4500 Undergraduate Professional Development Seminar*)
Since 2009	Overseeing ATOC's outdoor teaching facility ATOC Skywatch Laboratory together with Prof. Pilewskie and Mr. Kittelman. Maintaining and purchasing instruments and developing teaching material for ATOC's laboratory and hands-on lecture and method classes (e.g., ATOC 1050, ATOC 1070, ATOC 4500, ATOC 5600).
Since 2013	Curriculum development as a member of the steering committee of the Hydrological Science Graduate Program at the University of Colorado at Boulder
Since 2019	Building and maintaining the ATOC Collaboratory, a 21st century teaching and collaboration facility designed for visualizing climate and weather data
Since 2015	Integrating innovative teaching methods into the classroom, e.g., flipped classroom approach for *ATOC 4550/5550: Mountain Meteorology* and *ATOC 3880: Aviation Meteorology* where students learn the material through online classes and in-person classroom time is used to in cooperate date-driven and computational exercises to help students apply complex concepts in atmospheric sciences
2022-2025	Principal investigator on a grant that focused on improving learning outcomes in large (350+ student) classroom with the goal of creating a better sense of belonging and learning community that helps underperforming students. This grant involved regular meetings with the CU Center for Teaching and Learning and other instructors from large classrooms as well as implementing some of the ideas onto *ATOC 1050: Weather and the Atmosphere*.
2020	Curriculum development ATOC 4990 (1-3 credits) Internship for Credit (1-3 credit course)
	Lead the revision of the undergraduate and graduate curricula
2020-2024	Developing and overseeing the coordinated mentoring program for ATOC majors including student orientation (ATOC Welcoming Events, Slack & Facebook), professional development (ATOC Industry Night, ATOC 4500 Undergrad Professional Development), mentoring (connecting with industry/research mentors outside of CU)
2018-2024	Served as the Associate Chair with the role of overseeing all student teaching and mentoring in the department, e.g., managing the department teaching assignments and overseeing department teaching curricula; mentoring and advising undergraduate students; developing and revising learning goals, learning outcomes, and objectives for individual classes; developing learning outcome and tracking of undergraduate students
2018	Developed and since then regularly taught a 1-credit undergraduate class on Undergraduate Professional Development to expose students to diverse career

paths, help with professional communication (CV, resume, cover letters), provide opportunities network through interaction with alumni and outside professionals, and guide students through internships preparation and career planning.

2011 Conducted a student-lead field experiment as part of the ATOC 1050 curriculum by using a mobile Doppler radar to provide students with hand-on instrument experience and teach complex concepts about orographic airflow and precipitation. Students had to take the measurements and submit two additional homework assignments.

SUPERVISION OF INDIVIDUAL LEARNERS

(ATOC has a Ph.D. program since 2006 and a B.S./B.A. program since 2016)
Studio Lab program
REU - NSF program Research Experience for Undergraduates
SOARS - UCAR research program Significant Opportunities in Atmospheric Research and Science,
SMART - CU Summer Multicultural Access to Research Training
UROP – CU Undergraduate Research Opportunities Program

2008-2025 Primary mentor of **2 post-doctoral students**, **18 Ph.D. students**, **3 M.S. students**, served on **36 Ph.D. or Master thesis committees**, mentored over **25 undergraduate students** on research or internship project sometimes over multiple years.

2025 Supervised **2 undergraduate student** during the academic year on a research topic through the CU Studio Lab program, research was presented at a CU undergrad student conference and the AMS student conference; took **5 undergraduate students** for a 6-week field campaign (ICECHIP) where students were responsible for instrument deployments and operations; 2 **undergraduate students** on their independent study; supervised **4 graduate students** on their research

2024 Supervised **2 undergraduate student** during the academic year on a research topic through the CU Studio Lab program, research was presented at a CU undergrad student conference and the AMS student conference; 1 **undergraduate students** on their independent study; supervised **5 graduate students** on their research

2023 Supervised **2 undergraduate student** during the academic year on a research topic through the CU UROP program, research was presented at a CU undergrad student conference; supervised **5 graduate students** on their research

2022 Supervised **2 undergraduate student** during the academic year and summer on a research topic through the CU UROP program, research was presented at a CU undergrad student conference; **1 high school student** over the summer; supervised **5 graduate students** on their research; provided **4 graduate and 4 undergraduate students** the opportunity to participate in WINTE-MIX field campaign.

2021 Supervised **1 undergraduate student** over the summer on a research topic through the REU program, research was presented at a CU undergrad student conference; **1 undergraduate student** for the *ATOC 4990 Internship for Credit* class and **1 undergraduate student** for the *ATOC 4900 Independent Study* class; provided research funding for **1 undergraduate student** over the summer to conduct research; supervised **4 graduate students** on their research

2020 Supervised and provided research funding for **2 undergraduate students** over the summer; supervised **1 undergraduate student** for the *ATOC 4990 Internship for Credit* class; supervised **4 graduate students** on their research

2019 Supervised **1 undergraduate student** over the summer on a research topic through the SOARS program; supervised **1 undergraduate student** throughout the year on their honor thesis; supervised **4 graduate students** on their research

2018 Supervised **1 undergraduate student** over the summer on a research topic through the SOARS program; supervised **1 undergraduate student** throughout the year on their honor thesis; supervised **2 undergraduate students** as part of the UROP; supervised **1 undergraduate student** on their honor thesis; supervised **4 graduate students** on their research

2017 Supervised **1 undergraduate student** over the summer on a research topic through the SOARS program; supervised **1 undergraduate student** throughout the year on their honor thesis; supervised **2 undergraduate students** as part of the UROP; supervised **1 undergraduate student** on their honor thesis; supervised **5 graduate students** on their research; provided **2 graduate and 3 undergraduate students** the opportunity to participate in SNOWIE

2014-2015 Supervised **1 undergraduate student** over the summer on a research topic through the SOARS program; supervised **5 graduate students** on their research

2013 Supervised **1 undergraduate student** over the summer on a research topic through the SMART program; supervised **4 graduate students** on their research; provided **2 graduate students** the opportunity to participate in ACSII field campaign.

2009-2010 Supervised 4 graduate students on their research; provided 4 graduate students the opportunity to participate in the VORTX2 field campaign over the summer; supervised **3 graduate students** on their research

2008 Supervised **1 undergraduate student** over the summer on a research topic; supervised **3 graduate students** on their research

PUBLICATIONS

PEER-REVIEWED PUBLICATIONS (JOURNALS)

(* graduate student of Friedrich, # post-doc student of Friedrich)

1. Afrifa, F. O., B. Geerts, L. Xue, S. Chen, C. Hohman, C. Grasmick, **K. Friedrich**, J. French, S. Tessendorf, T. Zaremba, R. Rauber, 2025: A case study of cold-season emergent orographic convection and its impact on precipitation. Part 2: High-resolution LES analysis of convective cell evolution and precipitation processes. *Mon. Wea. Rev.*, (accepted).
2. Hohman C., and Coauthors, 2025: Invigoration Due to Cloud Seeding: New Observations Confirm an Old Hypothesis. Geophysical Research Letters (under review)
3. Valdivia*, J., **K. Friedrich**, T. Zaremba, S. Tessendorf, 2025: Temporal Evolution of Cloud-Top Generating Cells: A Case Study. *J. Appl. Meteor. Climatol., (accepted)*
4. Afrifa, F. O., B. Geerts, L. Xue, S. Chen, C. Hohman, C. Grasmick, J. French, **K. Friedrich**, R. Rauber, S. Tessendorf, T. Zaremba, 2025: A case study of cold-season emergent orographic convection and its impact on precipitation. Part 1: Mesoscale analysis. *Mon. Wea. Rev.*, **153**, 2229–2250.
5. Xie*, Z., **K. Friedrich**, L. Xue, S. Chen, S. A. Tessendorf, J. R. French, and C. C. Hohman, 2025: A Case Study of Cloud Microphysical Response to Cloud Seeding in Wintertime Orographic Clouds. *J. Appl. Meteor. Climatol.*, **64**, 1249–1270, https://doi.org/10.1175/JAMC-D-25-0001.1.
6. **Friedrich, K.**, R. M. Rauber, T. Whittock, J. French, S. Tessendorf, L. Xue, S. Chen, B. Geerts, Z. Xie, C. Hohman, K. Ikeda, M. L. Kunkel, and D. R. Blestrud, 2025: Precipitation Formation in Wintertime Orographic Clouds. Part 1: Environmental Conditions, Cloud Characteristics. *J. Appl. Meteor. Climatol.*, **64**, 529–548.
7. Zaremba, J. T., J. Minder, **K. Friedrich**, 2024: Small-scale wind fluctuations within melting layers of winter storms: results from WINTRE-MIX. Journal of the Atmospheric Sciences (in press)
8. Xie*, Z., **K. Friedrich**, S. A. Tessendorf, L. Xue, S. Chen, T. Whittock, B. Geerts, and K. Ikeda, 2024: Relationship between Synoptic Weather Patterns and Topography on

Snowfall in the Idaho Mountainous Regions. *J. Appl. Meteor. Climatol.,* **63**, 855-871. https://doi-org.colorado.idm.oclc.org/10.1175/JAMC-D-23-0170.1

9. Laiho*, R., **K. Friedrich**, A. Winters, 2024: Synoptic-scale Meteorological Patterns Associated with Heavy Rainfall in the Minnesota Region. *J. Appl. Meteor. Climatol.,* **63**, 837–854, https://doi-org.colorado.idm.oclc.org/10.1175/JAMC-D-23-0241.1.

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10. Minder, R. J., N. Bassill, F. Fabry, J. R. French, **K. Friedrich**, I. Gultepe, J. Gyakum, D. E. Kingsmill, K. Kosiba, M. Lachapelle, D. Michelson, L. Nichman, C. Nguyen, J. M. Theriault, A. C. Winters, M. Wolde, J. Wurman, 2023: P-type Processes and Predictability: The Winter Precipitation Type Research Multiscale Experiment (WINTRE-MIX). Bulletin of the American Meteorological Society. https://doi-org.colorado.idm.oclc.org/10.1175/BAMS-D-22-0095.1
11. Zaremba, T. J., R. M. Rauber, Geerts, B., French, J., Tessendorf, S. A., L. Xue, L., **Friedrich, K**., Weeks, C., Rasmussen, R. M., Kunkel, M. L., and Blestrud, D. R., 2023: Vertical Motions in Orographic Cloud Systems over the Payette River Basin. Part 4: Controls on Drop Number Concentrations and Supercooled Liquid Water Content *J. Appl. Meteor., Clim.*, **62**, 1389-1413. DOI: https://doi.org/10.1175/JAMC-D-23-0080.1
12. Warms*, M., **K. Friedrich**, L. Xue, S. Tessendorf, K. Ikeda, 2023: Drivers of Snowfall Accumulation in the Central Idaho Mountains using Long-Term High-Resolution WRF Simulations. *J. Appl. Meteor. Climatol., **62**, 1279–1295, https://doi.org/10.1175/JAMC-D-23-0050.1.*
13. Laiho*, R., **Friedrich, K**., and Winters, A. C. (2023). Characteristics of Warm Season Heavy Rainfall in Minnesota, Weather and Forecasting, 38(1), 163-177.
14. Geerts, B., C. Grasmick, R. M. Rauber, T. J. Zaremba, L. Xue, and **K. Friedrich**, 2023: Vertical motions forced by small-scale terrain and cloud microphysical response in extratropical precipitation systems. Journal of the Atmospheric Sciences. DOI: 10.1175/JAS-D-22-0161.1

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15. Zaremba, T. J., Rauber, R. M., Haimov, S., Geerts, B., French, J. R., Grasmick, C., Heimes, K., Tessendorf, S. A., **Friedrich, K**., Xue, L., Rasmussen, R. M., Kunkel, M. L., and Blestrud, D. R., 2022: Vertical Motions in Orographic Cloud Systems over the Payette River Basin. Part 1: Recovery of Vertical Motions and their Uncertainty from Airborne Doppler Radial Velocity Measurements. *J. Appl. Meteor. Climatol*. *61*(11), 1713-1731
16. Zaremba, T. J., Heimes, K., Rauber, R. M., Geerts, B., French, J. R., Graskmick, C., Tessendorf, S., Xue, L., **Friedrich, K.**, Rasmussen, R. M., Kunkel, M. L., & Blestrud, D. R., 2022: Vertical Motions in Orographic Cloud Systems over the Payette River Basin. Part 2: Fixed and Transient Updrafts and their Relationship to Forcing, *J. Appl. Meteor. Climatol*. *61*(11), 1733-1751
17. Xue, L., Weeks, C., Chen, S., Tessendorf, S. A., Rasmussen, R. M., Ikeda, K., Kosovic, B., Behringer, D., French, J. R., **Friedrich, K.,** Zaremba, T. J., Rauber, R. M., Lackner, C. P., Geerts, B., Blestrud, D., Kunkel, M., Dawson, N., & Parkinson, S., 2022: Comparison between Observed and Simulated AgI Seeding Impacts in a Well-Observed Case from the SNOWIE Field Program, Journal of Applied Meteorology and Climatology, 61(4), 345-367.
18. Nelson, T. C., J. Marquis, J. M. Peters, and **K. Friedrich**, 2022: Environmental Controls on Simulated Deep Moist Convection Initiation Occurring during RELAMPAGO-CACTI. J. Atmos. Sci., 79(7), 1941-1964.
19. Cann*, M. D., **K. Friedrich**, J. French, and D. Behringer 2022: A Case Study of Cloud-top Kelvin- Helmholtz Waves near the Dendritic Growth Zone. J. Atmos. Sci., 79(2), 531-549.

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20. Marquis, J., A. Varble, P. Robinson, T. C. Nelson#, **K. Friedrich**, 2021: Low-level mesoscale and cloud-scale interactions promoting deep convection initiation. Mon. Wea. Rev. 149, 2473-2495.
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49. Kalina*, E. A., **K. Friedrich**, H. Morrison, and G. Bryan, 2014: Aerosol effects on simulated supercell thunderstorms in different environments. J. Atmos. Sci., 71, 4558-4580.
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precipitation over mountains: a multi-sensor case study of shallow precipitating orographic cumuli. Atmos. Res., 147-148, 162-182.

53. **Friedrich, K.,** S. Higgins*, F. J. Masters, and C. R. Lopez, 2013: Articulating and stationary PARSIVEL disdrometer measurements in severe weather conditions. J. Atmos. Oceanic Technol., 30, 2063-2080.
54. Geerts, B., B. Pokharel, K. Friedrich, D. Breed, R. Rasmussen, Y. Yang, Q. Miao, S. Haimov, B. Boe, and B. Lawrence, 2013: The AgI Seeding Cloud Impact Investigation (ASCII) campaign 2012: overview and preliminary results. J. Wea. Mod., 45, 24-43.
55. Rudolph*, J. V., and **K. Friedrich**, 2013: Seasonality of vertical structure in radar-observed precipitation over southern Switzerland, J. Hydromet., 14, 318-330.
56. **Friedrich, K.**, E. A. Kalina*, F. J. Masters and C. R. Lopez, 2013: Drop-size distributions in thunderstorms measured by optical disdrometers during VORTEX2. Mon. Wea. Rev., 141, 1182-1203.
57. **Friedrich, K**., J. K. Lundquist, M. Aitken, E. A. Kalina*, and R. F. Marshall, 2012: Stability and turbulence in the atmospheric boundary layer: A comparison of remote sensing and tower observations. Geophys. Res. Lett., Vol. 39, No. 3, L03801, doi:10.1029/2011GL050413. (6 pages + 8 pages auxiliary material)
58. Rudolph*, J. V., **K. Friedrich**, and U. Germann, 2012: Model-based estimation of dynamic effect on 21st century precipitation for Swiss river basins. J. Climate, 25, 2897-2913.
59. Rudolph*, J. V., **K. Friedrich**, and U. Germann, 2011: Relationship between radar-estimated precipitation and synoptic weather patterns in the European Alps. J. Appl. Meteor. Climatol., 50, 944–957.
60. Dotzek, N., and K. Friedrich, 2009: Downburst-producing thunderstorms in southern Germany: Radar analysis and predictability. Atmos. Res., 93, 457–473.
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65. **Friedrich, K**., M. Hagen, and T. Einfalt, 2006: A quality control concept for radar reflectivity, polarimetric parameters, and Doppler velocity. J. Atmos. Oceanic Technol., 23, 865-887.
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67. **Friedrich, K**., and M. Hagen, 2004: Evaluation of wind vectors measured by a bistatic Doppler radar network. J. Atmos. Oceanic Technol., 21, 1840-1854.
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72. **Friedrich, K**., M. Hagen, and P. Meischner, 2000: Vector wind field determination by bistatic multiple-Doppler radar. Phys. Chem. Earth (B), 25, 1205-1208.
73. **Friedrich, K.**, and N. Mölders, 2000: On the influence of surface heterogeneity on latent heat fluxes and stratus properties. Atmos. Res. 54, 59-85.
74. **Friedrich, K.**, N. Mölders, and G. Tetzlaff, 2000: On the influence of surface heterogeneity on the Bowen-ratio: A theoretical case study. Theor. Appl. Climatol. 65, 181-196.

INVITED TALKS

1. Friedrich, K., 2025: Making Snow – Advances in orographic Cloud Seeding Research, ESSIC, U. of Maryland, MD.
2. Friedrich, K. 2025: Advances in Measuring Snow. Niwot Ridge Research Program, CU Boulder.
3. Friedrich, K. 2025: Radar Analyses. Course to train forecasters from the Korean Meteorological Agency (KMA) and The COMET Program. October 2025, Boulder, CO.
4. Friedrich, K. 2024: Making snow - new insights from orographic cloud seeding. July 2024, U. Munich, Germany.
5. Friedrich, K. 2022: "CHAT – Colorado Hail Accumulation from Thunderstorm project" May 2022, U. Albany, Albany, NY
6. Friedrich, K. 2021: "Making Snow – New Insights from Orographic Cloud Seeding" September 2021, Rotary Club, Westminster, CO
7. Friedrich, K. 2020: "CHAT – Colorado Hail Accumulation from Thunderstorm project". AMS Denver/Boulder Local Chapter (online)
8. Friedrich, K. 2019: "Making Snow – New Insights from Orographic Cloud Seeding" November 2019, CU Boulder, CO, as part of the CU Saturday Physics Series.
9. Friedrich, K. 2018: CHAT – Colorado Hail Accumulation from Thunderstorm project. University of Northern Colorado, September 2018, Greeley, CO.
10. Friedrich, K. 2018: Radar Analyses. Course to train forecasters from the Korean Meteorological Agency (KMA) and The COMET Program. May 2018, Boulder, CO.
11. Friedrich, K. 2018: Radar Analyses. Course to train forecasters from the Chinees Weather Service and The COMET Program. November 2018, Boulder, CO.
12. Friedrich, K., 2018: An Overview of the SNOWIE field campaign. Hydrological Symposium. CU Boulder.
13. Friedrich, K. 2017: Radar Analyses. Course to train forecasters from the Korean Meteorological Agency (KMA) and The COMET Program. December 2017, Boulder, CO.
14. Friedrich, K. 2017: Study of Convective and Orographic Precipitation (SCOOP). NCAR Advanced Study Program's summer colloquium on "The Interaction of Precipitation with Orography" (June 5-16) in Boulder.
15. Friedrich, K. 2017: Radar Analyses of Mountain Winter Precipitation. Course to train the next Winter Olympic Games forecasters organized by the Korean Meteorological Agency (KMA) and The COMET Program. July 2017, Boulder, CO.
16. Friedrich, K. 2017: Radar Analyses. Course to train forecasters from the Korean Meteorological Agency (KMA) and The COMET Program. July 2017, Boulder, CO.
17. Friedrich, K., 2017: The Future of Skiing: The Science Behind Snow. Panel discussion at the Arapahoe Basin Ski Resort, April.
18. Friedrich, K., 2017: Diurnal winds and dynamically-driven winds. REI Sports, January, Boulder, CO.

19. Friedrich, K. 2016: Radar Analyses of Winter Weather. Course to train weather service forecasters organized by the Korean Meteorological Agency (KMA) and The COMET Program. November 2016, Boulder, CO.
20. Friedrich, K. 2016: Rasante Hagelbildung in Gewittern. University of Leipzig, Germany. January 2016, Leipzig, Germany.
21. Friedrich, K. 2015: Radar Analyses of Mountain Winter Precipitation. Course to train the next Winter Olympic Games forecasters organized by the Korean Meteorological Agency (KMA) and The COMET Program. September 2015, Boulder, CO.
22. Friedrich, K. 2014: Radar Analyses of Mountain Winter Precipitation. Course to train the next Winter Olympic Games forecasters organized by the Korean Meteorological Agency (KMA) and The COMET Program. October 2014, Boulder, CO.
23. Friedrich, K. 2014: Series of four 2-hr seminar talks on radar applications given at the Korean Meteorological Administration, May 2014, Seoul, South Korea. Seminar titles include “The art of using weather radars”, “The art of using dual-polarization weather radars”, “Effects of orographic convection on cloud and precipitation development in winter storms”, “Studying microphysical characteristics in supercell thunderstorms using mobile dual-polarization radars and mobile disdrometers during VORTEX2”
24. Friedrich, K. 2013: Developing joint efforts in research and teaching between the atmospheric science departments at the U. of Colorado and U. of Cologne. Global Partner Network Conference, October 2013, Cologne, Germany.
25. Friedrich, K., 2013: Microphysical processes in supercell thunderstorms. October 2013, Dept. of Meteorology and Geophysics, University of Cologne, October 2013, Cologne, Germany.
26. Friedrich, K., 2013: 100 Jahre Gewitterforschung: Wolkenphysik in Superzellengewitter. Colloquium celebrating the 100th Anniversary of the Leipzig Institute of Meteorology at the University of Leipzig, Germany, July 2013, Leipzig, Germany
27. Friedrich, K., 2013: Measurements of Drop-Size Distributions in Thunderstorms during VORTEX2. Seminar at the Colorado State University, February 2013, Fort Collins, CO.
28. Friedrich, K., J. Lundquist, M. Aitkin, E. Kalina*, and R. Marshall, 2012: Stability and turbulence in the atmospheric boundary layer: A comparison of remote sensing and tower observations. Fourth Annual Center for Research and Education in Wind (CREW) symposium, August 2012, Fort Collins, CO.
29. Friedrich, K., J. Lundquist, M. Aitkin, E. Kalina*, and R. Marshall, 2012: Stability and turbulence in the atmospheric boundary layer: A comparison of remote sensing and tower observations. Summer School in Remote Sensing for Wind Energy, June 2012, Boulder, CO.
30. Friedrich K, J. Wurman, and K. Kosiba, 2010: Radar and Drop-Size Distribution Measurements in Hurricane Ike. Seminar at NOAA’s Atlantic and Oceanographic and Meteorological Laboratory, Hurricane Research Division. January 2010, Miami, FL, USA.
31. Friedrich K., 2008: Kinematische und thermodynamische Strukturen entlang einer stationaeren Kaltfront. Seminar at Deutsches Zentrum fuer Luft- und Raumfahrt, June 2008, Oberpfaffenhofen, Germany.
32. Friedrich K., 2008: Innovations in monitoring and nowcasting orographic precipitation by weather radars. Alaska Weather Symposium at University of Alaska, May 2008, Fairbanks, Alaska.
33. Friedrich K., 2007: Investigating processes controlling the formation and enhancement of precipitation using radar technology. Seminar at the University of Colorado at Boulder, March 2007, Boulder, USA.
34. Friedrich, K., 2007: Polarimetrisches Radar im Alpenraum. Invited talk at the general management of MeteoSwiss, May 2007, Zurich, Switzerland.
35. Friedrich, K., 2007: Weather radars in the Alps: Future trends and technology. Invited talk at the scientific colloquium at MeteoSwiss, May 2007, Zuerich, Switzerland.

36. Friedrich, K., 2007: Investigating processes controlling the formation and enhancement of precipitation using radar technology. Invited talk at University of Colorado, Boulder, March 2007, Boulder, CO, USA.
37. Friedrich, K., 2006: From research to operational usage – POLDIRAD's contribution to wind and precipitation measurements. Invited talk as part of the celebrations to the 20th anniversary of the Polarimetric Diversity Doppler Radar at the German Aerospace Center, October 2006, Oberpfaffenhofen, Germany.
38. Friedrich, K., U. Germann, G. Galli, J. J. Gourley, P. Tabary, J. Parent du Chatelet, 2006: The effect of beam shielding on polarimetric rainfall estimates – Do phase-based quantitative precipitation estimates at C-band really increase the accuracy? General Assembly of the European Geophysical Union, April 2006, Vienna, Austria.

OUTREACH

2025	Numerous interviews for newspapers and radio & TV stations (New York Times, Wall Street Journal, 9News, Fox31, Nature News)
	Panelist at the Boulder Climate Venture on Geonengineering
2024	Numerous interviews for newspapers and radio & TV stations (Wired, CNN, FactCheck)
	Hosted a U. of Colorado CU Wizard show on "The tumultuous life of cumulus clouds"
2023	Numerous interviews for newspapers and radio & TV stations (The Conversation, Nova PBS)
2022	Numerous interviews for newspapers and radio & TV stations (BBC World Service, Wall Street Journal Podcast)
	Hosted a U. of Colorado CU Wizard show on "The tumultuous life of cumulus clouds"
2021	Numerous interviews for newspapers and radio & TV stations (Deutsche Welle, NY Times Kids, TF1 French Television)
	Talk at the Rotary Club, Westminster Colorado (September)
2020	Numerous interviews for newspapers and radio & TV stations (Daily Camera, CU Today, Inverse, IFL Science, EOS, Colorado Matters, 4 Awesome Discoveries (NSF), Quirks, Quarks & Co - CBS Radio, The Conversation)
	Hosted a U. of Colorado CU Wizard show on "The tumultuous life of cumulus clouds"
2019	Numerous interviews for newspapers and radio & TV stations (Interview @ KUNC – NPR stations for northern Colorado, Colorado Matters, Colorado Sun, 9News, CNN Business, Missoula Current)
	Outreach to Boulder Foothill Elementary School and talked about weather with a 1st grade class
	Lecture at the U. of Colorado Saturday Physics Series "Making Snow – New Insights from Orographic Cloud Seeding"
	Moderated the 2019 Conference of World Affairs panel discussion on "When the Weather is Uggianaqtuq"
2018	Numerous interviews for newspapers and radio & TV stations (Interview @ KUNC - NPR stations for northern Colorado, Feb 2018; Interview @ VICE News Tonight on HBO, Feb 2018; Science, Jan 2018); NSF Press release, Jan 2018; CNN);

	Visit at the Boulder Foothill Elementary School and talked about weather with a Kindergarten class
	Hosted a U. of Colorado CU Wizard show on "The tumultuous life of cumulus clouds"
2017	Presenter at the NCAR Advanced Study Program's summer colloquium on "The Interaction of Precipitation with Orography" (June 5-16) in Boulder
	Speaker at the "After Ski Day Climate Science Panel" organized by CIRES, the management at Arapahoe Basin and a non-profit called Protect Our Winters
	Visit at the Boulder Friend's School and talked about weather at a 2nd grade
	Speaker to the Eldora Mountain Resort Ski Patrol and guides and avalanche instructors from Colorado Mountain School at REI Boulder
	Numerous interviews for newspapers (Popular Science, June 2017; Durango Herald, December 2017; CU Boulder Today, December 2017)
2014	Speaker at the "History Behind the Headlines" Fall 2014 series at the East Boulder Senior Center. Title: "The 2013 Great Colorado Flood".
	Interviews for various television programs (e.g., German TV program "Spiegel TV"; BBC series on "World's Weirdest Weather"; Weather Channel series on "Strangest Weather") on winter weather and tornadoes
2012-2013	Numerous interviews to newspapers and web forums during ASCII experiment, Interview for the Weather Channel on climatology of tornadoes and changes in orographic winter precipitation
2011	Numerous interviews to newspapers (e.g., Daily Camera)
2010	Numerous interviews to radio and television stations (Channel 4; NHK Japan; Arte Germany), newspapers, and web forums during VORTEX2 2010 (some articles and TV interviews can be found at http://clouds.colorado.edu/Vortex2-2010)
	CU Science Update: Episode 14 - VORTEX2
2009	Participation in developing the computer game entitled "Tornado hunting" for the Science exhibition commissioned by the Museum of Science and Technology in Chicago (deployment of mobile disdrometers)
	CU Science Update: Episode 1 – Chasing Hurricanes
	Numerous interviews to radio and television stations, newspapers, and web forums during VORTEX2 2009 (http://clouds.colorado.edu/vortex2; https://vimeo.com/101268793)