Michael R. Gallagher

Curriculum Vitae
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$LANGUAGE = :
$LC_ALL = en_US

Education

Ph.D. Atmospheric and Oceanic Sciences **Summer 2019**
University of Colorado

Doctorant Invité **Jan-Dec 2018**
L'École Polytechnique, Paris France

B.Sc. Engineering Physics, sub-disciplines of Computer Science and Applied Math — SUMMA CUM LAUDE **Dec 2011**
University of Colorado

Research

Research Scientist — Specializing in Cryosphere Climate Processes **2019-current**
Cooperative Institute for Research in Environmental Sciences (CIRES/NSIDC/NOAA affiliate)

Please view my publications on page two. Science topics of interest include: Arctic climate and global impacts as well as local-scale drivers of melt and their implications. In more detail: energy budget, snowfall, moisture budgets, net Greenland mass balance, central Arctic sea-ice extent, and microphysical processes such as cloud formation and boundary layer turbulence and their broad connections to global atmospheric transport. Engineering topics of interest include: in situ observation platforms/hardware, applications of machine learning algorithms, and software development for data processing.

In my career I'd like to advance our understanding of the Arctic and its changing climate by contributing scientific and engineering expertise to the following specific goals: **(1)** improvements in quality, cost, and size, of in situ platforms that make observations of socially relevant climate phenomena using expertise across multiple domains of expertise from across research domains. **(2)** advancements in data processing methods and algorithmic techniques to better utilize observations **(3)** production of quality near-realtime datasets and post-processing to enhance uptake for the improvement of internal model physics of forecasts and climate projections

Outreach and Mentorship

The usefulness of (climate) research is, in my opinion, determined by the clear communication of scientific conclusions and the resulting implications. Because of the extreme geographic/socioeconomic disparities in the USA, outreach to underserved communities and students is of particular concern for "climate science literacy". I will give presentations of photography from my work at Arctic field sites — in the sea ice, tundra, and on icesheets — to classrooms or community spaces at any opportunity. Communities prioritized for outreach are: "Title 1" schools, public libraries, and "low resource" rural communities. If you would like to discuss outreach, a classroom visit, or are a student from such a community interested in science, please don't hesitate to send e-mail or call.

Teaching

Instructor **2010 - 2017**
Courses in Physics, Atmospheric Science, and Computing *CU Boulder*

- Devised and gave lectures for 200+ students, including weekly discussions in office hours.
- Worked as a laboratory instructor to improve students' tactile understanding of science.
- Coordinated local science education and outreach to local K-12 schools

Awards & Activities

- NCAS visiting scientist, Leeds University UK, June 2024
- Invited speaker at Aspen Global Climate Change conference on "Arctic Climate and Weather Extremes", Spring 2022
- Award for "Excellence in Science Pedagogy and Teaching" by University of Colorado
- Conferred awards for "Outstanding Graduate in Engineering" and "Outstanding Undergraduate Research" December 2011.

Technical Skills

Software: Proficient in, with at least 5 years experience, python, NCL, LaTeX, C++, git, (e)Lisp, bash, csh, fish et. al., BASIC, and matlab. Moderate skills and proficiency, with at minimum 1 year experience using C, R, Fortran, Julia, and Java. FOSS advocate.

Hardware: Observation platform hardware integration, centralized data acquisition, hardware design from prototype to fabrication, design of PCBs, oscilloscope debugging, and other test-bench shenanigans.

Publications:

Cox, C. J., Intrieri, J. M., Butterworth, B., Boer, G. de, Gallagher, M. R., Hamilton, J., Hulm, E., Meyers, T., *et al.* Observations of surface energy fluxes and meteorology in the seasonally snow-covered high-elevation East River Watershed during SPLASH, 2021–2023. *Earth System Science Data Discussions* **2024,** 1–32. https://doi.org/10.5194/essd-2024-158 (2024).

Lac, J., Chepfer, H., Arouf, A., Shupe, M. D. & Gallagher, M. R. Polar Low Circulation Enhances Greenland's West Coast Cloud Surface Warming. *Journal of Geophysical Research: Atmospheres* **129.** e2023JD040450 2023JD040450, e2023JD040450. https://doi.org/10.1029/2023JD040450 (2024).

Mariani, Z., Morris, S. M., Uttal, T., Akish, E., Crawford, R., Huang, L., Day, J., Tjernström, J., *et al.* Special Observing Period (SOP) data for the Year of Polar Prediction site Model Intercomparison Project (YOPPsiteMIP). *Earth System Science Data* **16,** 3083–3124. https://doi.org/10.5194/essd-16-3083-2024 (2024).

Adler, B., Wilczak, J. M., Bianco, L., Bariteau, L., Cox, C. J., Boer, G. de, Djalalova, I. V., Gallagher, M. R., *et al.* Impact of Seasonal Snow-Cover Change on the Observed and Simulated State of the Atmospheric Boundary Layer in a High-Altitude Mountain Valley. *Journal of Geophysical Research: Atmospheres* **128,** e2023JD038497. https://doi.org/10.1029/2023JD038497 (2023).

Boer, G. de, White, A., Cifelli, R., Intrieri, J., Hughes, M., Mahoney, K., Meyers, T., Lantz, K., *et al.* Supporting Advancement in Weather and Water Prediction in the Upper Colorado River Basin: The SPLASH Campaign. *Bulletin of the American Meteorological Society* **104,** E1853–E1874. https://doi.org/10.1175/BAMS-D-22-0147.1 (2023).

Cox, C. J., Gallagher, M. R., Shupe, M. D., Persson, P. O. G., Solomon, A., Fairall, C. W., Ayers, T., Blomquist, B., *et al.* Continuous observations of the surface energy budget and meteorology over the Arctic sea ice during MOSAiC. *Scientific Data* **10.** ISSN: 2052-4463. https://doi.org/10.1038/s41597-023-02415-5 (Aug. 2023).

Day, J., Svensson, G., Casati, B., Uttal, T., Khalsa, S.-J., Bazile, E., Akish, E., Azouz, N., *et al.* The YOPP site Model Intercomparison Project (YOPPsiteMIP) phase 1: project overview and Arctic winter forecast evaluation. *EGUsphere* **2023,** 1–44. https://doi.org/10.5194/egusphere-2023-1951 (2023).

Nandan, V., Willatt, R., Mallett, R., Stroeve, J., Geldsetzer, T., Scharien, R., Tonboe, R., Yackel, J., *et al.* Wind redistribution of snow impacts the Ka- and Ku-band radar signatures of Arctic sea ice. *The Cryosphere* **17,** 2211–2229. https://tc.copernicus.org/articles/17/2211/2023/ (2023).

Nomura, D., Kawaguchi, Y., Webb, A. L., Li, Y., Dall'osto, M., Schmidt, K., Droste, E. S., Chamberlain, E. J., *et al.* Meltwater layer dynamics in a central Arctic lead: Effects of lead width, re-freezing, and mixing during late summer. *Elementa: Science of the Anthropocene* **11,** 00102. ISSN: 2325-1026. https://doi.org/10.1525/elementa.2022.00102 (May 2023).

Arouf, A., Chepfer, H., Guulis, T. V. de, Chiriaco, M., Shupe, M. D., Guzman, R., Feofilov, A., Raberanto, P., *et al.* The surface longwave cloud radiative effect derived from space lidar observations. *Atmospheric Measurement Techniques* **15,** 3893–3923. https://doi.org/10.51942Famt-15-3893-2022 (July 2022).

Gallagher, M. R., Shupe, M. D., Chepfer, H. & L'Ecuyer, T. Relating snowfall observations to Greenland ice sheet mass changes: an atmospheric circulation perspective. *The Cryosphere* **16,** 435–450. https://doi.org/10.5194/tc-16-435-2022 (2022).

Kawaguchi, Y., Koenig, Z., Nomura, D., Hoppmann, M., Inoue, J., Fang, Y.-C., Schulz, K., Gallagher, M., *et al.* Turbulent Mixing During Late Summer in the Ice–Ocean Boundary Layer in the Central Arctic Ocean: Results From the MOSAiC Expedition. *Journal of Geophysical Research: Oceans* **127.** e2021JC017975 2021JC017975, e2021JC017975. https://doi.org/10.1029/2021JC017975 (2022).

Shupe, M. D., Rex, M., Blomquist, B., Persson, P. O. G., Schmale, J., Uttal, T., Althausen, D., Angot, H., *et al.* Overview of the MOSAiC expedition: Atmosphere. *Elementa: Science of the Anthropocene* **10.** 00060. ISSN: 2325-1026. https://doi.org/10.1525/elementa.2021.00060 (2022).

Stroeve, J., Nandan, V., Willatt, R., Dadic, R., Rotosky, P., Gallagher, M., Mallett, R., Barrett, A., *et al.* Rain-on-Snow (ROS) Understudied in Sea Ice Remote Sensing: A Multi-Sensor Analysis of ROS during MOSAiC. *The Cryosphere Discussions* **2022,** 1–42. https://doi.org/10.5194/tc-16-435-2022 (2022).

Gallagher, M. R., Chepfer, H., Shupe, M. D. & Guzman, R. Warm Temperature Extremes Across Greenland Connected to Clouds. *Geophysical Research Letters* **47.** https://doi.org/10.1029/2019GL086059 (2020).

Cox, C. J., Stone, R. S., Douglas, D. C., Stanitski, D. M. & Gallagher, M. R. The Aleutian Low-Beaufort Sea Anticyclone: A Climate Index Correlated With the Timing of Springtime Melt in the Pacific Arctic Cryosphere. *Geophysical Research Letters* **46,** 7464–7473. https://doi.org/10.1029/2019GL083306 (2019).

Gallagher, M. R., Shupe, M. D. & Miller, N. B. Impact of Atmospheric Circulation on Temperature, Clouds, and Radiation at Summit Station, Greenland, with Self-Organizing Maps. *Journal of Climate* **31,** 8895–8915. https://doi.org/10.1175/JCLI-D-17-0893.1 (2018).

Prior Research

Researcher, High Energy Nuclear Physics — **RHIC/PHENIX/CU, Boulder, CO**

Research Advisor: Professor James Nagle — 2008 - 2013

In a previous life I developed and tested potential hardware upgrades to segments of the PHENIX detector at the Relativistic Heavy Ion Collider Experiment (RHIC). Developed custom FPGA chipset drivers in C for data acquisition and processing of detector I/O. Designed and fabricated scintillator detector segments, including machine shop fabrication and testing of custom fiber optic scintillator panels, vacuum chamber testing, and novel applications of silicon photomultipliers in detection. On the software side, also simulated and tested particle decay pathways that could be explored and detected by these newly designed upgrades. This was the foundation of my undergraduate thesis and postgraduate work, contributing in broader part to 15 published papers and the eventually successful upgrade proposal

Vestigial publications:

Abdulameer, N. J., Acharya, U., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., *et al.* Measurement of ϕ-meson production in $\mathrm{Cu}+\mathrm{Au}$ collisions at $\sqrt{s_{NN}}=200$ GeV and $\mathrm{U}+\mathrm{U}$ collisions at $\sqrt{s_{NN}}=193$ GeV. *Phys. Rev. C* **107,** 014907. https://link.aps.org/doi/10.1103/PhysRevC.107.014907 (1 Jan. 2023).

Acharya, U., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Aoki, K., Apadula, N., *et al.* Production of π^0 and η mesons in U+U collisions at $\sqrt{s_{NN}}=192$ GeV. *Phys. Rev. C* **102,** 064905. https://link.aps.org/doi/10.1103/PhysRevC.102.064905 (6 Dec. 2020).

Adare, A., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Andrieux, V., *et al.* Nonperturbative-transverse-momentum effects and evolution in dihadron and direct photon-hadron angular correlations in $p+p$ collisions at $\sqrt{s}=510\ \mathrm{GeV}$. *Phys. Rev. D* **95,** 072002. https://link.aps.org/doi/10.1103/PhysRevD.95.072002 (7 Apr. 2017).

Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Andrieux, V., Aoki, K., *et al.* B-meson production at forward and backward rapidity in $p+p$ and Cu + Au collisions at $\sqrt{s_{NN}}=200$ GeV. *Phys. Rev. C* **96,** 064901. https://link.aps.org/doi/10.1103/PhysRevC.96.064901 (6 Dec. 2017).

Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Aoki, K., Apadula, N., *et al.* Cross section and transverse single-spin asymmetry of muons from open heavy-flavor decays in polarized $p+p$ collisions at $\sqrt{s}=200\ \mathrm{GeV}$. *Phys. Rev. D* **95,** 112001. https://link.aps.org/doi/10.1103/PhysRevD.95.112001 (11 June 2017).

Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Aoki, K., Apadula, N., *et al.* Measurements of $B\to J/\psi$ at forward rapidity in $p+p$ collisions at $\sqrt{s}=510\ \mathrm{GeV}$. *Phys. Rev. D* **95,** 092002. https://link.aps.org/doi/10.1103/PhysRevD.95.092002 (9 May 2017).

Adare, A., Afanasiev, S., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Al-Bataineh, H., Alexander, J., *et al.* Transverse energy production and charged-particle multiplicity at midrapidity in various systems from $\sqrt{s_{NN}}=7.7$ to 200 GeV. *Phys. Rev. C* **93,** 024901. https://link.aps.org/doi/10.1103/PhysRevC.93.024901 (2 Feb. 2016).

Adare, A., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Aoki, K., *et al.* Inclusive cross section and double-helicity asymmetry for π^0 production at midrapidity in $p+p$ collisions at $\sqrt{s}=510\ \mathrm{GeV}$. *Phys. Rev. D* **93,** 011501. https://link.aps.org/doi/10.1103/PhysRevD.93.011501 (1 Jan. 2016).

Adare, A., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Aoki, K., *et al.* Measurements of directed, elliptic, and triangular flow in Cu + Au collisions at $\sqrt{s_{NN}}=200$ GeV. *Phys. Rev. C* **94,** 054910. https://link.aps.org/doi/10.1103/PhysRevC.94.054910 (5 Nov. 2016).

Adare, A., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Al-Ta'ani, H., *et al.* ϕ meson production in the forward/backward rapidity region in Cu + Au collisions at $\sqrt{s_{NN}}=200$ GeV. *Phys. Rev. C* **93,** 024904. https://link.aps.org/doi/10.1103/PhysRevC.93.024904 (2 Feb. 2016).

Adare, A., Afanasiev, S., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Aoki, K., *et al.* An Upgrade Proposal from the PHENIX Collaboration. *arXiv e-prints,* arXiv:1501.06197. arXiv: 1501.06197 [nucl-ex] (Jan. 2015).

Adare, A., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Alfred, M., Aoki, K., *et al.* Nuclear matter effects on J/ψ production in asymmetric Cu + Au collisions at $\sqrt{s_{NN}}=200$ GeV. *Phys. Rev. C* **90,** 064908. https://link.aps.org/doi/10.1103/PhysRevC.90.064908 (6 Dec. 2014).

Adare, A., Aidala, C., Ajitanand, N. N., Akiba, Y., Akimoto, R., Alexander, J., Aoki, K., Apadula, N., *et al.* sPHENIX: An Upgrade Concept from the PHENIX Collaboration. *arXiv e-prints,* arXiv:1207.6378. arXiv: 1207.6378 [nucl-ex] (July 2012).

Hanks, J. A., Sickles, A. M., Cole, B. A., Franz, A., McCumber, M. P., Morrison, D. P., Nagle, J. L., Pinkenburg, C. H., *et al.* Method for separating jets and the underlying event in heavy ion collisions at the BNL Relativistic Heavy Ion Collider. *Phys. Rev. C* **86,** 024908. https://link.aps.org/doi/10.1103/PhysRevC.86.024908 (2 Aug. 2012).

Field work photography

Photography is an incredible tool for science communication, here is a small sample of my photos from Alaska, Greenland, and the central Arctic. These show sea ice melt ponds in summer, snowflakes from the north pole, the vast infinite Greenland ice sheet at the 11k foot summit, a Glacier encampment on the northern slope of Alaska, a tower at 88^{o}N during Arctic winter, and a melting permafrost ice wedge. Everything from the frozen cold of winter to the tundra collapsing with the impact of climate change in summer, illustrations of the realities of the remote north. A CV easter egg for anyone who made it this far.