

Michael S. Town, Ph.D.

CONTACT INFORMATION

Institution

Geofysisk Institutt - Geophysical Institute
Bjerknes Centre for Climate Research
Universitetet i Bergen - University of Bergen

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RESEARCH INTERESTS

Polar meteorology, Antarctica, Greenland, Climate modelling, Field work, Data science

EDUCATION INTERESTS

Equitable education, Project-based learning, Experiential education, Data-based pedagogy, Evidence-based decisions

ACADEMIC EDUCATION

Seattle University, Seattle, Washington USA

Masters in Teaching, (AΣN), 2011

University of Washington, Seattle, Washington USA

Department of Atmospheric Sciences

Ph.D., Atmospheric Sciences, 2007

Dissertation: "Investigations into the Climate of the South Pole"

Advisors: Stephen G. Warren, Von P. Walden

M.S., Atmospheric Sciences, 2005

Masters thesis: "Spectral and broadband longwave downwelling radiative fluxes, cloud radiative forcing, and fractional cloud cover over the South Pole"

Advisors: Stephen G. Warren, Von P. Walden

University of Michigan, Ann Arbor, Michigan USA

B.Sc., Physics (honors), 1999

Honors thesis: "Regional and Local Variability of Flow Regimes and Source Regions for a Rural Site in Northern Michigan"

Advisor: Mary Anne Carroll

PROFESSIONAL ROLES

Earth and Space Research, Seattle, USA *Research Scientist*

Jul 2023 - Present

ICECAPS-MELT

Modeling the influence of clouds, the surface energy budgets, and evolving snow properties on melt events in the 'dry zone' of the Greenland Ice Sheet. Planning and executing field measurements in Greenland in support of these efforts.

Reflective Earth

Developing state-of-the-art techniques to monitor equitable, sustainable reflective cooling interventions. Interfacing with local governments, non-profits, and academic institutions in pursuit of equitable geoengineering solutions to human-induced climate change.

Earth and Space Research - Summer Institute

Offer authentic geoscience research experiences to secondary and undergraduate students in an equity-minded educational setting.

Mt. Baker Climate Project (MBCP)

Maintaining iButton temperature array network on the south side of Mt. Baker, Washington USA through the Lakeside Summer Research Institute (*LSRI*), and the Lakeside Outdoor Program. Analyzing and presenting data from this temperature network. Advising high school students in geoscience research.

Lyte Probe Development

Continuing development of Lyte Probe functionality and uses including: revised positioning algorithm further reducing location uncertainty. Comparison of Lyte Probe to radar and snow pit profiles in collaboration with the Alfred Wegener Institut and the Noregs Vassdrags og Energidirektorat (NVE, Norwegian Water Resources and Energy Directorate). Investigation of retrievals of density and thermal conductivity from direct Lyte Probe measurements.

Geophysical Institute, Bjerknes Centre for Climate Research, Bergen, Norway

Research Scientist

Dec 2021 - Aug 2023

SNOWISO

Investigated improved understanding of water isotope records from air temperature to stable water isotopes in near-surface snow. Analyzed data from near-surface polar snow. Developed forward model of near-surface snow processes. Advised UiB graduate students.

Lyte Probe

Deployed and tested novel, light, ski-pole snow hardness probe developed by Adventure Data. Developed new positioning algorithm reducing location uncertainty 10x. Currently comparing Lyte Probe results to radar and snow pit profiles in collaboration with the Alfred Wegener Institut and the Noregs Vassdrags og Energidirektorat (NVE, Norwegian Water Resources and Energy Directorate)

Mt. Baker Climate Project (MBCP)

Maintaining iButton temperature array network on the south side of Mt. Baker, Washington USA through the Lakeside Summer Research Institute (*LSRI*), and the Lakeside Outdoor Program. Analyzing and presenting data from this temperature network. Advising high school students in geoscience research.

Nisqually Land Trust Climate Project (NLTCP)

Developed temperature array network in cooperation with the Nisqually Land Trust for monitoring of Nisqually Tribe land. Developed an educational program that would incorporate tribal youth involvement in monitoring climate of tribal lands.

UiO/UiB Snow and Isotope Workshop

18 April 2023

Organized a bridge-building workshop at the University of Bergen for snow hydrology, cloud physics, and stable water isotope experts. Participants were members of the University of Oslo and University of Bergen geoscience communities.

Lecturer at iceFinse 2023

11-14 March 2023

Developed and deployed engaging hands-on and theoretical snow properties (e.g., strength, hard-

ness, density) curriculum for international undergraduate and masters students.

Earth and Space Research,

Seattle, USA

Affiliate Research Scientist

Nov 2022 - present

Department of Geosciences,

University of Oslo, Oslo, NORWAY

Guest Researcher

August 2022 - present

Department of Earth and Space Sciences,

University of Washington, Seattle, Washington USA

Affiliate Assistant Professor

April 2022 - present

Ballard Data Science, Seattle, Washington USA

Owner/Operator, Lead Data Scientist

www.ballarddatascience.com

Sept 2021 - present

Northwest Avalanche Center Consulting

Advising and consulting with the Northwest Avalanche Center on operational incorporation of the SNOWPACK model forced with WRF data into avalanche forecasts.

Climate advocacy consulting

Advised environmental professional in climate advocacy debate with high profile climate skeptic.

COVID19 prevention and mitigation

Using health and safety guidelines published by CDC, made quantitative assessments of workplaces and a school for adequate ventilation. Designed and assessed air handling solutions for these sites.

Lakeside School, Seattle, Washington USA

Science Faculty

Summer School Faculty

Aug 2013 - Jun 2021

June 2018 - Present

Physics and Honors Physics

Algebra-based Physics courses for which I developed project-based curricula that incorporates diversity/equity/inclusion, data science, and climate science into the standard Physics cannon.

Aug 2013 - Jun 2021

Specific projects:

Analyzing acceleration data from the Phoenix Mars Lander to understand Force.

Monitoring and modeling the flight of Stomp Rockets to understand energy.

Studying the impacts of oppression and stereotype-threat on the historically marginalized in the field of science through media (e.g. *Think Black, Hidden Figures*) discussion, and reflection.

Using energy conservation to model the surface temperature of the Earth through simple radiative transfer.

Engineering

Aug 2015 - Jun 2021

Developed a new course centered around the engineering design process. The course was run with specific focus on service and design empathy. Community partners included: Skate Like a Girl, Seattle Audobon Society, Northwest Avalanche Center, Lakeside School Service Learning Program, and Lakeside School Outdoor Program.

Specific projects:

Design and build skateboards for at risk youth in Seattle Area.

Avalanche science and safety practices in the Washington Cascades, including field work, data analysis, and equipment design/implementation.

Engineering and Geosciences in the Washington Cascades, including analysis of Northwest Avalanche Center forecasts and weather data from Mt. Baker, Washington.

Lakeside Summer Research Institute (LSRI) in partnership with ESR

Jun 2017 - present

Developed a summertime, geoscience-focused data science internship for high school students. Students engage in authentic geoscience research using cutting edge tools like Python and physical models of intermediate complexity (e.g., SNOWPACK). Curated data sets and external partnerships to support the authentic science experience. This is a unique, ongoing partnership between an educational and a research institution.

Specific ongoing projects:

The Mt. Baker Climate Project - MBCP. Routine deployment and analysis of temperature data from the southern aspect of Mt. Baker in partnership with the Lakeside School Outdoor Program.

The Northwest Avalanche Center Forecast Consistency Project - NFCP. Students analyze the consistency of NWAC avalanche forecasts and report patterns to the NWAC forecasters and observers.

The Seattle Microclimate Project - SMP. Students analyze weather station data from around Seattle, including on the school's roof, to understand urban microclimates.

Faculty Mentorship

Aug 2015 - Jun 2021

Teacher mentor to early-career teachers, or teachers new to the Lakeside community. Performed non-evaluative observations. Provided feedback on lessons, assessments, curriculum, and classroom climate.

Professional Community

Planned, funded, and executed a school-wide assembly featuring Dr. Clyde Ford, author of *Think Black*. The experience included a breakout session with Dr. Ford for African-American identifying students and faculty.

Developed and implemented 3-minute teacher observation club at Lakeside School.

Instrumental in implementing proactive course selection advising to mitigate impact of stereotype threat on historically marginalized students.

Performed three year study on student performance based on self-identified gender in Honors Physics.

Assessed student performance from 2014-2019 at Lakeside School using anti-racist analysis and compositing techniques.

Participated in the hiring of six faculty.

Developed Engineering/Theater maker space in close collaboration with multiple stake-holders.

Participated in a national teaching fellowship organization (Knowles Teaching Initiative) (three national meetings/year), 2013-2016.

Developed, led, and funded a regional teacher observation network in the Pacific Northwest (Observation Northwest, 2011-2017).

Technology, Engineering, and Communications High School, Burien, Washington USA

Engineering teacher and Robotics coach

Aug 2012 - Jun 2013

Introduction to Engineering and Design

Aug 2013 - Jun 2021

Developed project-based curriculum that incorporates diversity/equity/inclusion, data science, and design in an engineering class.

Specific projects:

Comfort design: design and assessment of a soundproofing solution.

Useful design: skateboard design and build unit in which students use design empathy and the engineering design process to make skateboards from scratch.

Sustainable Design and Engineering

Developed a new course centered around climate science and the engineering design process.

Specific projects:

Climate action: Reviewed the IPCC AR5 WG1 report for the US State Department. Our primary recommendations were directly quoted to the IPCC review committee.

Useful design: Project-based learning effort in which students independently investigated an environmental question or solved an environmental problem under mentorship from a local professional.

FIRST Robotics Coach

Co-led a team in the 'Frisbee Challenge' of 2012-2013.

Student Mentorship

Co-leader of after-school club in which we offered athletic activities and adult-male mentorship to all students.

Professional Community

Developed, led, and funded a regional teacher observation network in the Pacific Northwest (Observation Northwest, 2011-2017)

Developed and implemented 3-minute teacher observation club at TEC High School.

University Preparatory Academy, Seattle, Washington USA

Science Faculty

Aug 2011 - Jun 2012

9th Grade Physics

Executed and augmented a project-based curriculum in the traditional Physics cannon.

Senior Physics

Executed and augmented a project-based curriculum in the traditional algebra-based Physics canon. Developed new projects science-investigation project with community partners (e.g. local P-patch).

Professional Community

Developed and implemented 3-minute teacher observation club at University Preparatory Academy.

Organized race-awareness discussion for faculty: White People: what are they all about?

Laboratoire de Glaciologie et Géophysique de l'Environnement (LGGE), Grenoble, France

Research Associate

Dec 2008 - Dec 2009

Polar Model Evaluation

Evaluated a polar mesoscale model (Model Atmospherique Regional, MAR) over the East Antarctic interior using in situ observations and Kalman-filter spectral analysis.

Stable boundary layer investigations

Analyzed summertime meteorological measurements for Dome C, Antarctica. Planned boundary layer measurements for 2009-2010 field season at Dome C, Antarctica.

**University of Washington,
Department of Atmospheric Science, Seattle, Washington USA**

Research Associate

Aug 2007 - Nov 2008

Stable boundary layers and surface energy budget at the South Pole

Used the South Pole as a laboratory for understanding stable boundary layers. Curated routine meteorology and radiation measurements. Simulated subsurface energy fluxes.

Post-depositional processes in near-surface polar snow

Used the surface energy budget of the South Pole to understand potential impacts of large energy fluxes and temperature gradients in the near-surface snow on the stable water isotope climate signal.

**University of Washington,
Department of Atmospheric Science, Seattle, Washington USA**

Graduate Student

May 2000 - Aug 2007

The surface energy budget at the South Pole

Examined the surface energy budget using curated routine meteorology and radiation measurements. Simulated subsurface energy fluxes. Made major contributions to "Collaborative Research: Longwave radiation processes and surface energy budget on the Antarctic Plateau", Award: 0540087.

Clouds and longwave radiative transfer over the South Pole

Analyzed spectral infrared measurements of the sky and snow surface to understand longwave radiation over East Antarctica. Developed accurate cloud climatology for the South Pole. Evaluated satellite performance over the South Pole.

Winterover technician and field team leader at the South Pole Dec 2000 - Nov 2001
Winterover field team leader for the South Pole Atmospheric Radiation and Cloud Lidar Experiment (SPARCLE). Ran and maintained passive and active remote sensing of atmosphere, clouds, and surface properties. Performed tethered balloon and kite soundings of the near-surface atmosphere. Performed other duties as necessary.

University of Michigan, Department of Atmospheric, Oceanic, and Space Science (AOSS),
Ann Arbor, MI USA

Research Assistant

Jun 1998 - Aug 1999

Global Monitoring Laboratory Technician Sep 1998 - Aug 1999
Maintained measurements of CO and O₃ at the AOSS site in Ann Arbor, MI. Mentored other undergraduate students. Calibrated and CO and O₃ measurements from the PROPHET Experiment.

Field work in rural Michigan Jun 1998 - Aug 1998
Deployed and maintained field measurements of CO and O₃ at the University of Michigan Biological Station as part of the PHotochemistry, Emissions, and Transport (PROPHET) Experiment.

PUBLICATIONS

Town, M., Steen-Larsen, H. C., Wahl, S., Faber, A.-K., Behrens, M., Jones, T., and Sveinbjornsdottir, A., 2024: Post-depositional modification on seasonal-to-interannual timescales alters the deuterium excess signals in summer snow layers in Greenland, EGUsphere [preprint], <https://doi.org/10.5194/egusphere-2023-2462>.

Dietrich, L., Steen-Larsen, H. C., Wahl, S., Jones, T. R., Town, M. S., and Werner, M., 2023: Snow-atmosphere humidity exchange at the ice sheet surface alters annual mean climate signals in ice core records, *Geophysical Research Letters*, <https://doi.org/accepted>.

Rowe, P.M., V.P. Walden, R.E. Brandt, M.S. Town, S.R. Hudson, and S. Neshyba, 2021: Evaluation of Temperature-Dependent Complex Refractive Indices of Supercooled Liquid Water Using Downwelling Radiance and In-Situ Cloud Measurements at South Pole. *J. Geophys. Res.: Atmospheres*, 127, e2021JD035182. <https://doi.org/10.1029/2021JD035182>.

Town, M. S., 2018: Avalanche Science and Safety Practices in a High School Classroom. *The Avalanche Review*, 37.1, pp. 14-17.

Warren, S. G., and M. S. Town, 2011: Antarctica. *Encyclopedia of Climate and Weather* 2nd Ed., Oxford Univ. Press.

Froyland, H. K., N. Untersteiner, M. S. Town, S. G. Warren, 2010: Evaporation from Arctic sea ice in summer during the International Geophysics Year, 1957-1958. *J. Geophys. Res.*, 115, D15104, doi:10.1029/2009JD012769.

Genthon, C., M. S. Town, D. Six, V. Favier, S. Argentini, A. Pellegrini, 2010: Meteorological atmospheric boundary layer measurements and ECMWF analyses during summer at Dome C, Antarctica. *J. Geophys. Res.*, 115, D05104, doi:10.1029/2009JD012741.

Town, M. S., 2009: Training Scientists to Manage. *Science*, 326, DOI: 10.1126/science.326.5956.1062-a.

Town, Michael S. and Walden, Von P., 2009, "Surface energy budget over the South Pole and turbulent heat fluxes as a function of an empirical bulk Richardson number" *Journal of Geophysical Research* Vol. 114, No. D22, 0148-0227

Town, M.S., S.G. Warren, V.P. Walden, and E.D. Waddington, 2008: Effect of atmospheric water vapor on modification of stable isotopes in near-surface snow on ice sheets. *J. Geophys. Res.*, 113, D24303, doi:10.1029/2008JD009852.

Town, M.S., E.D. Waddington, V.P. Walden, S.G. Warren, 2008: Temperatures, heating rates, and vapor pressures in the near-surface snow of East Antarctica. *J. Glaciol.*, 54, 487-498.

Hagler, G., M. Bergin, E. Smith, M. Town, and J. Dibb, 2008: Local anthropogenic impact on particulate elemental carbon concentrations at Summit, Greenland. *Atmos. Chem. Phys.*, 8, 2485-2491.

Town, M.S., V.P. Walden, S.G. Warren, 2007: Cloud cover climatology over the South Pole from visual observations, satellite retrievals, and surface based infrared measurements. *J. Climate*, 20, pp. 544-559.

Town, M.S., V.P. Walden, S.G. Warren, 2005: Spectral and broadband longwave downwelling radiative fluxes, cloud radiative forcing and fractional cloud cover over the South Pole. *J. Climate*, 18, pp. 4235-4252.

Walden, V.P., M.S. Town, B. Halter, and J.W.V. Storey, 2005: First Measurements of the Infrared Sky Brightness at Dome C, Antarctica. *Publications of the Astronomical Society of the Pacific*, 117 (829), pp. 300-308.

Hudson, S.R., M.S. Town, V.P. Walden, S.G. Warren, 2004: Temperature, humidity, and pressure response of radiosondes at low temperatures. *J. Atmos. and Oce. Technol.*, 21 (5), pp. 825-836.

Cooper, O.R., J.L. Moody, T.D. Thornberry, M.S. Town, M.A. Carroll, 2001: PROPHET 1998 meteorological overview and air-mass classification. *J. Geophys. Res.-Atmos.*, 106 (D20), pp. 24289-24299.

Pippin, M., S. Bertman, T. Thornberry, M. Town, M.A. Carroll, S. Sillman, 2001: Seasonal variations of PAN, PPN, and O-3 at the upper Midwest PROPHET site. *J. Geophys. Res.-Atmos.*, 106 (D20), pp. 24451-24463.

SELECTED
PRESENTATIONS

Town, M.S., C. Mehring, L. Searl, D. Parry, T. Anand. Air temperature and snow extent from iButton temperature measurements on the southern aspect of Mt. Baker, WA USA. Northwest Science Association, Cal Poly, Humboldt, CA, USA, 16 May 2022.

Town, M.S., I. Gorodetskaya, H. Gallee, S.G. Warren, V.P. Walden, E.D. Waddington. The surface energy budget at South Pole, Antarctica, from observations and a regional model. Risk Management Solutions, London, May 2021. (Invited Talk).

Town, M.S., Student performance based on race and gender at Lakeside School from 2014-2019. Lakeside School, March 2021.

Town, M.S., Gleaming your own Cube: How to make a skateboard. CO Corvallis Maker Fair, Oregon State University, April 9, 2016. (Invited Interactive Presentation).

Town, M.S., Integrating Arts into STEM Education: Providing a Visceral Experience. CO Corvallis Maker Fair, Oregon State University, April 8, 2016. (Invited Talk).

Town, M.S., Current Issues in Climate Change. Lakeside School, Seattle, WA USA, May 2014.

Town, M.S., I. Gorodetskaya, H. Gallee, S.G. Warren, V.P. Walden, E.D. Waddington. The surface energy budget at South Pole, Antarctica, from observations and a regional model. University of New South Wales, Sydney, Australia, 25 May 2009. (Invited Talk).

Town, M.S., S.G. Warren, V.P. Walden, E.D. Waddington. Effect of atmospheric water vapor on water stable isotopes in near-surface snow on ice sheets. Niels Bohr Institute, Copenhagen, Denmark, 21 February 2008. (Invited talk).

Town, M.S., V.P. Walden, S.G. Warren. Model evaluation using a South Pole data set: An observational perspective. Laboratoire de Glaciologie et Géophysique de l'Environnement, Grenoble, France, 12 February 2008. (Invited talk).

Town, M.S., V.P. Walden, S.G. Warren. Energy transfer processes affecting isotopic fractionation in the near- surface snow on the Antarctic Plateau. International Union of Geodesy and Geophysics, Perugia, Italy, 2- 13 July 2007. (Talk).

Town, M.S., V.P. Walden, S.G. Warren. Energy transfer processes over the Antarctic Plateau. American Geophysical Union Fall Assembly, San Francisco CA, 11-15 December 2006. (Talk).

Town, M.S. A summary of: Adaptation and mitigation: Responses to climate change. The NCCR Climate summer school Swiss Climate Research. Program on Climate Change Summer Institute, Leavenworth WA, 22 September 2006. (Talk).

Town, M.S., V.P. Walden, S.G. Warren. Cloud cover climatology for the South Pole from surface-based infrared radiation measurements. Graduate Climate Conference, Pack Forest, April 2006. (Poster).

Town, M.S., V.P. Walden, S.G. Warren. Cloud cover from ground-based infrared measurements at the South Pole. Cloud Climatology Workshop 2005, Madison Wisconsin, 5-6 April 2005. (Talk).

Town, M.S., V.P. Walden, S.G. Warren. Cloud cover climatology for the South Pole from surface-based infrared radiation measurements. 8 th Conference on Polar Meteorology, American Meteorological Society, San Diego CA, 9-13 January 2005. (Extended Abstract and Poster).

Town, M.S., V.P. Walden. Uncertainty analysis of data from the Polar Atmospheric Emitted Radiance Interferometer (PAERI) during the South Pole Atmospheric Radiation and Cloud Lidar Experiment (SPARCLE). International Radiation Symposium, International Radiation Commission, Busan Korea, 23- 28 August, 2004. (Extended Abstract and Poster).

COMPUTER SKILLS

- Operating Systems: Linux/Unix, Windows, MacOS,
- Languages: Python, Matlab, some Unix shell scripts, some SQLite
- Packages: Pandas, SkiLearn, \LaTeX , DB Browser, common Linux/Windows/MacOS database, spreadsheet, and presentation software
- Models: LBLRTM, SNOWPACK, MAR, finite-element heat transfer modeling

OTHER SKILLS

- Wilderness First Aid (2016-present)
- Wilderness First Aid Instructor (2019-present)
- Avalanche Recreation Level 1 (2016), Level 2 (2018), Rescue Course (2019)

HONORS AND AWARDS

- Knowles Teacher Initiative (Senior Fellow, 2016-present)

- Knowles Teacher Initiative (Fellow, 2011-2016)
- Alpha Sigma Nu (ΣN) Honors Society (2011)
- Antarctic Service Medal (2001).
- Member of Sigma Pi Sigma (National Physics Honors Society, 1999)
- Research Undergraduate Experience Fellowship (1998)
- Member of Golden Key National Honor Society (1998)
- Dean's List (1995-1998)

CURRENT
PROFESSIONAL
SOCIETIES

- American Avalanche Association
- Northwest Science Association
- Knowles Teacher Initiative