



Elevation-Dependent Climate Change

MRI Working Group Fact Sheet
(Updated 30 June 2020)

The MRI has been working on issues surrounding elevation-dependent climate change since 2012, assessing if, where, to what extent, and why mountains and other high elevation regions of the world are warming more rapidly than lowlands. The Elevation-Dependent Climate Change (EDCC) Working Group was formerly known as “Elevation-Dependent Warming Working” but has since expanded its interest and work from warming to include additional climate processes specific to mountains and high elevation regions.

Key Working Group Details

This Working Group was created in 2014 and is in its third phase (2020-2021).

The EDCC Working Group works in close collaboration with the [MRI Mountain Observatories Working Group](#) and its work provides information for objectives and tasks of the current [GEO-GNOME Implementation Plan \(2020 2022\)](#).

Working Group Lead:

Nick Pepin, University of Portsmouth, UK | [Visit Webpage](#)

A full member list can be found in the appendix.

Outputs and achievements to date:

PUBLICATION | ELEVATION-DEPENDENT WARMING IN MOUNTAIN REGIONS OF THE WORLD

[Mountain Research Initiative EDW Working Group](#)

[N. Pepin, R. S. Bradley, H. F. Diaz, M. Baraer, E. B. Caceres, N. Forsythe, H. Fowler, G. Greenwood, M. Z. Hashmi, X. D. Liu, J. R. Miller, L. Ning, A. Ohmura, E. Palazzi, I. Rangwala, W. Schöner, I. Severskiy, M. Shahgedanova, M. B. Wang, S. N. Williamson & D. Q. Yang.](#)

['Elevation-dependent warming in mountain regions of the world' in *Nature Climate Change* 5, 424–430 \(2015\).](#)

Planned Activities and Outputs for 2020-2021:

- Synthesis paper on mountain meteorology and climatology - based on the EGU side-event workshop - to be submitted in 2020
- Synthesis paper “From Elevation Dependent Warming to Elevation-Dependent Climate Change” – based on input of the AGU side-event - to be submitted in 2020

- Workshop 1: Technical cross-network workshop to define standards for metadata and calibration
- Workshop 2: Discuss more specific needs of the UHOPs stations ([Unified High Elevation Observing Platform](#))

Latest News

MRI WORKING GROUP NEWS | FROM ELEVATION-DEPENDENT WARMING TO ELEVATION-DEPENDENT CLIMATE CHANGE (28 April 2020)

The MRI Working Group “Elevation-Dependent Warming” expands its scope of work to include climate processes in addition to warming, and therefore announces a name change to “Elevation-Dependent Climate Change”.

[Read more here.](#)

MRI AT THE AGU FALL MEETING (17 December 2020)

This year, the famous AGU Fall Meeting returned to San Francisco for the AGU’s Centennial Celebrations, gathering nearly 30,000 geoscientists – among them a great number of mountain-oriented researchers. During the AGU week, the MRI organized scientific sessions and a side-event workshop that offered mountain researchers a chance to connect and engage in discussion on mountain climate research.

[Read more here.](#)

GEO-GNOME WORKSHOP ON ESSENTIAL CLIMATE VARIABLES FOR MOUNTAINS (30 September 2019)

The working group lead Nick Pepin participated as a moderator and presented plans of the Elevation-dependent Warming Working Group at the GEO-GNOME ‘Essential Climate Variables for Observations in Mountains’.

[Read more here.](#)

MAKING CONNECTIONS AT THE EGU GENERAL ASSEMBLY 2019 (24 MAY 2019)

Last month, the MRI was present at the [European Geosciences Union General Assembly 2019](#), held in Vienna between 8-12 April. During the week, we attended a number of events that provided opportunities to further connect and bring the mountain research community together at one of the largest, and key, meets for the geosciences research community in Europe.

[Read more here.](#)

Working Group Background

During the last century, global surface air temperature increased by 0.75°C according to the Intergovernmental Panel on Climate Change Fourth Assessment Report (AR4). Between 1975 and 2010, land temperatures increased at a rate of 0.30°C/decade – more than double the rate (0.12°C/decade) of ocean warming. It has been proposed that mountainous regions may be more sensitive to global scale climate change than other land surfaces at the same latitude

(e.g., Messerli and Ives 1997; Beniston et al. 1997). Several studies have suggested that mountain regions have warmed at a greater rate than their low elevation counterparts, often with greater increases in daily minimum temperatures than daily maximum temperatures (e.g. Diaz and Bradley 1997; Beniston et al. 1997; Rangwala et al. 2009; Liu et al. 2009; Qin et al. 2009; Pederson et al. 2010). Most climate models find enhanced warming in mountains and do so more consistently than found in observations (Pepin and Lundquist 2008). A conclusive understanding of these responses will continue to elude us in the absence of a more comprehensive network of climate monitoring in mountains.

This working group aims to both review existing science and collect new data on mountain climate change, as the current paucity of high-elevation station data precludes definitive answers.

Working Group Activities

The activities of this working group were set out as follows:

- Assess the significance of mountain elevation-dependent climate change.
- Specify the mechanisms that underlie elevation-dependent climate change.
- Review the evidence for elevation-dependent climate change.
- Assess projections of future elevation-dependent climate change, and their implications for water, ecosystems, and society.
- Develop satellite-based monitoring of temperatures and other variables (e.g. orographic precipitation) in mountain regions.
- Apply high-resolution regional and global modelling to improve understanding of mountain climate change.
- Design targeted in situ observational campaigns.
- Collate metadata on existing mountain observational networks and encourage data sharing between countries.

Past Working Group Events

- [Scientific sessions GC44B and GC51L Mountain Weather and Climate in a Warmer World I and II at the AGU Fall Meeting 2019 | San Francisco, USA | 12 - 13 December 2019](#)
- [Workshop “Synthesis Workshop on Future Mountain Climate Change - From Elevation-Dependent Warming to Elevation-Dependent Climate Change” | San Francisco, USA | 11 December 2019](#)
- [Workshop “Synthesis Workshop on Mountain Meteorology & Climatology: Drivers, Processes, & Related Impacts” | Vienna, Austria | 12 April 2019](#)
- [Scientific session AS4.47/CR1.13/HS11.22/CL4.30 Mountain Climatology and Meteorology at the EGU General Assembly 2019 | Vienna, Austria | 9 April 2019](#)
- Workshop “Elevation Dependent Warming” | Payerbach, Austria | 23 - 25 April 2014

How to join

As community-led activities, these Working Groups are open to anyone from the [MRI members](#) to participate and contribute to the Working Group's work plan. **Early career researchers (typically up to 5 years since attaining a postgraduate degree), women, and researchers and practitioners from developing countries and less represented mountain regions are particularly encouraged to join and participate.** Please contact the Working Group lead to seek information to join:

Nick Pepin, University of Portsmouth, UK | [Visit Webpage](#)

APPENDIX

Members of the MRI Mountain Observatories Working Group (as of 30.6.2020):

- 1 Nick Pepin, University of Portsmouth, UK
- 2 Ray Bradley, University of Massachusetts , US
- 3 Henry Diaz
- 4 Michael Baraer
- 5 Bolivar Caceres, Ecuador
- 6 Nathan Forsythe, Water resources research group (Infrastructure),
School of Engineering, Newcastle University, UK
- 7 H. Fowler
- 8 Greg Greenwood, Switzerland
- 9 M. Z. Hashmi
- 10 Xiaodong Liu,
- 11 Jim Miller, Rutgers University, US
- 12 L. Ning, Nanjing Normal University & University of Massachusetts Amherst, China/US
- 13 Atsume Ohmura
- 14 Elisa Palazzi, ISAC-CNR, Italy
- 15 Imtiaz Rangwala
- 16 Wolfgang Schöner, University of Graz, Austria
- 17 I. Severskiy
- 18 Maria Shahgedanova, University of Reading, UK
- 19 Mengben Wang
- 20 Scott Williamson, University of Ottawa, Canada
- 21 Daqing Yang
- 22 John All, US
- 23 Mahendra Bhutiyani
- 24 Mathias Vuille, University at Albany, US
- 25 Christian Huggel, University of Zürich, Switzerland
- 26 Robert Marchant, University of York, UK
- 27 Ricardo Grau, Argentina
- 28 Aster Gebrekirstos, Ethiopia
- 29 Veerle Vanacker, Belgium
- 30 Sven Kotlarski, MeteoSwiss, Switzerland
- 31 Gobiet Andreas, ZAMG, Austria
- 32 Carolina Adler, MRI, Switzerland
- 33 Enrico Arnone, University of Turin, Italy
- 34 Samuel Morin, Meteo-France, France
- 35 David Pritchard, Newcastle University, UK
- 36 Stefano Serafin, University of Innsbruck, Austria
- 37 Petra Selbert, BOKU - Met, Austria
- 38 Marc Olfes, ZAMG, Austria
- 39 Mathias Rotach, Austria
- 40 Anaïs Zimmer, University of Texas at Austin, US

41 Jessica Lundquist, University of Washington, US
42 Eric Sproles, Department of Earth Sciences - Montana State University, US
43 Rosemary Carroll, Desert Research Institute, US
44 Charles Luce, US Forest Service, US
45 Peter Deneen, GlacierHub, US
46 Hans Mikhail Segura, IRD-IGE-UGA, France
47 Kelly Gleason, Portland State University, US
48 Aji John, University of Washington, US
49 Scott Hotaling, Washington State University, US
50 Brittany Johnson, University of Washington, US
51 Bryan Mark, The Ohio State University, US
52 Elise Osenga, Aspen Global Change Institute, US
53 David Rupp, Oregon State University, US
54 Juan Ignacio Lopez Moreno, Spanish Research Council, Spain
55 Martha Apple, Montana Technological University, US
56 John Knowles, University of Colorado Institute of Arctic and Alpine Research (INSTAAR), US
57 Adrienne Marshall, University of Idaho, US
58 William Rudisill, Boise State University, US
59 Adrian Harpold, University of Nevada, Reno, US
60 Scotty Strachan, Nevada Climate-ecohydrology Assessment Network, US
61 Daniel Feldman, Lawrence Berkeley National Laboratory, US
62 Louis Scuderi, University of New Mexico, US
63 Brian Smithers, Montana State University, US
64 Connie Millar, USDA Forest Service, Pacific Southwest Research Station, US
65 Alan Rhoades, Lawrence Berkeley National Laboratory, US
66 Justin Minder, University at Albany, US
67 Aino Kulonen, MRI, Switzerland
68 Hari Mix, Santa Clara University, US
69 Adam Csank, University of Nevada-Reno, US
70 David Hik, Simon Fraser University, Canada
71 Sarah Shafer, USGS, US
72 Alan Flint, USGS, US
73 Lorrey Flint, USGS, US
74 Thierry Lebel, University of Grenoble, France
75 Daniel R Cayan, University of California San Diego, US
76 Teresa Pérez Ciria, University of Innsbruck, US
77 Michael Josef Pidwirny, University of British Columbia, Canada
78 Abby G Frazier, East-West Center, US
79 Jamila Smith, SUNY at Fredonia, US
80 Adam J Terando, USGS, US
81 Lulin Xue, National Center for Atmospheric Research, US
82 Qinglong You, Fudan University, China
83 Ethan Clark, University of British Columbia, Canada
84 Susan Stillman, Desert Research Institute Las Vegas, US
85 Isabella Oleksy, Cary Institute for Ecosystem Studies, US