

Vitae of Robert M. Mackay

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Education

Ph.D. (Atmospheric Physics) Oregon Graduate Institute of Science & Technology (1994)
M.S. (Atmospheric Physics) Oregon Graduate Institute of Science & Technology (1991)
M.S. (Physics) Portland State University (1983)
B.A. (Physics and Mathematics, [double major]) California State University (1978)

Experience

8/2017-5/2018: Professor/Administrator, APU educational group DaNang Vietnam. Taught university physics and astronomy, high school biology, and middle school physical science. Also worked on the administrative team for the American University in Vietnam.

9/1982 – 8/2017: Physics & Meteorology Professor; Clark College Physics, 1800 E. McLoughlin Blvd., Vancouver, Washington, 98663 . Teach: 1) Introductory through calculus based physics, and 2) introductory meteorology. Have also taught statics and engineering dynamics courses, and am proficient in mathematics.

6/2002 to Dec 2018: Adjunct Geoscience instructor for Washington State University Vancouver campus. Has taught courses on: 1) Environmental Modeling and Systems; and 2) Earth's Climate.

Nov 2014 to Dec 2016: Module developer/author for NSF sponsored “Integrate Project” and the Science Education Resource Center (SERC). Working on a team with two other undergraduate geoscience educators to develop “[Earth's Thermostat](http://serc.carleton.edu/integrate/index.html)” curriculum for undergraduate science education. See. <http://serc.carleton.edu/integrate/index.html>

3/03 – 6/03: Visiting Fellow with the Science Education Research Center (SERC) at Carleton College, Northfield, MN. Developed Web based material for introductory geoscience education. Focus on teacher resources for using interactive modeling activities in geoscience education. Have continued to work with SERC on a limited basis since June 2003. See <http://serc.carleton.edu/index.html> for information related to SERC.

4/99 – 4-02: Co-Investigator on NASA Sun-Earth climate connections project “Investigating the Climatic Effects of Solar Irradiance Variations”. Contract NASW-98037 awarded to Malcolm Ko of the Atmospheric Chemistry and Dynamics Division, of Atmospheric and Environmental Research(AER), Inc., 840 Memorial Drive, Cambridge, MA 02139. . Research focus on climate change detection and attribution.

1/95 - 9/96: Senior Research Associate, Atmospheric Chemistry and Dynamics, AER, Inc., 840 Memorial Drive, Cambridge, MA 02139. Responsible for maintaining and enhancing the

existing AER Two-Dimensional Interactive Climate Chemistry Model and help lead AER research efforts directed at understanding the interactions between climate and atmospheric chemistry. Also responsible for developing new programs and research directions at AER. Manager of NASA/Mission To Planet Earth/Tropospheric Emission Spectrometer (TESS) educational outreach project.

3/80 - 9/81: *Geophysical Field Engineer*; Schlumberger Well Services, Cody, Wyoming. Management position in charge of a well logging crew that typically grossed \$200,000 to \$300,000 monthly. Required technical expertise in data acquisition, data reduction and analysis, equipment repair and troubleshooting, and public relations and sales.

Membership/Affiliations

- American Association of Physics Teachers (since 1983)
- Pacific Northwest Association of College Physics (since 1983)
- American Geophysical Union (since 1991)
- American Meteorology Society (since 1994)
- Washington Education Association (NEA) Association of Higher Education (since 1985)

Selected Publications

- MacKay, R.M. and M.W.K. Ko, 2001. An analysis of simulated and observed global mean near surface air temperature anomalies from 1979 through 1999: trends and attribution of causes. Vol 3/4, pp 393-411, Chemosphere - Global Change Science.
- MacKay, R.M and M.A.K. Khalil, 2000. Greenhouse Gases and Global Warming. Chapter 1, In "Trace Gas Emissions and Plants. Edited by S.N. Singh, Kluwer Academic Publishers, the Netherlands.
- MacKay, R.M., M.K.W. Ko, 1997. Normal modes and the transient response of the climate system. Geophys. Res. Letts., 24,5,559-562.
- MacKay, R.M., M.K.W. Ko, S. Zhou, G. Molnar, R-L Shia, Y. Yang, 1997. An estimation of the climatic effects of stratospheric ozone losses during the 1980s. J. of Climate, 10, 4, 774-788.
- MacKay, R.M and M.A.K. Khalil, 1995. 2xCO₂ Experiments with the Global Change Research Center 2-D Statistical Dynamical Climate Model. Journal of Geophysical Research, Atmospheres, Vol. 100, D10, 21127 - 21135.
- MacKay, R.M. and M.A.K. Khalil, 1994. Climate Simulations Using The GCRC 2-D Zonally Averaged Statistical Dynamical Climate Model. Chemosphere, Vol. 29, No. 12, 2651-2683
- MacKay, R.M., 1994. The Global Change Research Center 2-D Statistical Dynamical Climate Model: Theory and Model Development. Ph.D. dissertation.
- MacKay R.M. and M.A.K. Khalil, 1991. Theory and Development of a One Dimensional Time Dependent Radiative Convective Climate Model. Chemosphere, Vol. 22 #3-4 pp. 383-417.
- MacKay, R.M., 1991. The OGI One Dimensional Time Dependent Radiative Convective Climate Model: Theory and Model Development. M.S. Thesis.

- Khalil M.A.K. and R.M. MacKay, 1991. Global Warming by Trace Gases in a One Dimensional Climate Model. World Resource Review, Vol. 3 # 2.
- MacKay R.M. and M.A.K. Khalil, 1990. Free Oscillations of the Earth Climate System: A Theory of the 100 kyr Climate Cycle. Annals of Glaciology 14. International Glaciological Society. (Extended Abstract)
- Khalil M.A.K., Zhao W., and R.M. MacKay, 1990. The Relationship Between Temperature and Precipitation. Encyclopedia of Earth System Science. Academic Press, San Diego, California.
- MacKay, R.M. 1983. "Tilt and Strain Measurements Near the Portland Hills Fault". M.S. Physics Thesis.

Selected papers presented at professional meetings

- MacKay, R.M. and C.A. Manduca, 2004. " Mass Balance and Atmospheric Chlorofluorocarbon CFC-12: Using Interactive Online Models and Data in Introductory Atmospheric Science ". EOS, Transactions, American Geophysical Union , Vol. 86, (proceedings of the 2004 Fall Meeting of the American Geophysical Union meeting held in San Francisco, CA).
- MacKay, R.M. and C.A. Manduca, 2003. " Teaching With Models: A Starting Point Resource Module ". EOS, Transactions, American Geophysical Union , Vol. 85, (proceedings of the 2004 Fall Meeting of the American Geophysical Union meeting held in San Francisco, CA).
- MacKay, R.M. 2002. "Online Student Learning and Earth System Processes". EOS, Transactions, American Geophysical Union , Vol. 84, (proceedings of the 2002 Fall Meeting of the American Geophysical Union meeting held in San Francisco, CA).
- MacKay, R.M. and M.K.W. Ko, 2002. Optimum estimates of 1950-1999 surface air temperature response patterns resulting from natural and human induced climate forcing. EOS, Transactions, American Geophysical Union , Vol. 83, (proceedings of the 2002 Spring meeting of the American Geophysical Union meeting held in Washington, DC)
- MacKay, R.M., 2002. Presented "Using Physlets in Meteorology ". Presented at The Pacific Northwest Association of College Physics annual meeting.
- MacKay, R.M. and M.K.W. Ko, 2000. The Climatic Response to Solar Irradiance Variations. EOS, Transactions, American Geophysical Union , Vol. 81, (proceedings of the 2000 Fall Meeting of the American Geophysical Union meeting held in San Francisco, CA)
- MacKay, R.M. and M.K.W. Ko, 2000. An Interactive Student Learning Activity for Understanding Global Pollution. EOS, Transactions, American Geophysical Union , Vol. 81, (proceedings of the 2000 Fall Meeting of the American Geophysical Union meeting held in San Francisco, CA)
- MacKay, R.M. and M.K.W. Ko, 2000. Sun-Climate Workshop in Tucson Arizona March 2000. 3 day workshop sponsored by NASA and the University of Arizona. Presented recent research results and discussed trends for future research focus.
- MacKay, R.M. and M.K.W. Ko, 1999. Understanding the Climatic Response to Solar Irradiance Variations. EOS, Transactions, American Geophysical Union , Vol. 80, (proceedings of the 1999 Fall Meeting of the American Geophysical Union meeting held in San Francisco, CA)

- MacKay, R.M.,1998. Using System dynamics models of atmospheric processes. Presented at the International System Dynamics Society meeting in Quebec, CA August 1998.
- MacKay, R.M.,1997. Understanding Climate Chemistry Interactions in the atmosphere. Presented at the Gordon Research Conference in Atmospheric Chemistry held June 1997 in New Port RI.
- MacKay, R.M. and M.K.W. Ko,1996. The Climatic and Chemical Structure of the Atmosphere for: Glacial, Preindustrial, and Present Conditions. EOS, Transactions, American Geophysical Union, Vol. 77, (proceedings of the 1996 Spring Meeting of the American Geophysical Union held in Baltimore, MD).
- MacKay, R.M. and M.K.W. Ko,1996. Warming From Chlorofluorocarbons and Their Alternatives Over the Next Century. EOS, Transactions, American Geophysical Union, Vol. 77, (proceedings of the 1996 Spring Meeting of the American Geophysical Union held in Baltimore, MD).
- MacKay, R.M.,1995. The Climatic Effects of Ozone Variations: Presented at the Gordon Research Conference in Atmospheric Chemistry held June 1995 in New Port RI.
- MacKay R.M, M.K.W. Ko, R-L Shia, and Y. Yang, 1995. Simulations of Ozone's Contribution to the Anthropogenic Climate Signal of the 1980s. EOS, Transactions, American Geophysical Union, Vol. 76, (Summary of the 1995 Spring Meeting of the American Geophysical Union held in Baltimore, MD).
- MacKay, R.M., 1994. Interactive Digitized Multimedia and Global Change Science. EOS, Transactions, American Geophysical Union, Vol. 75, No. 44. paper U41C-7. (Summary of the 1994 Fall Meeting of the American Geophysical Union held in San Francisco, CA.)
- MacKay, R.M. and M.A.K. Khalil, 1993. Experiments with the OGI 2-dimensional Statistical Dynamical Climate Model. EOS, Transactions, American Geophysical Union, Vol. 74, (Summary of the 1993 Fall Meeting of the American Geophysical Union held in San Francisco, CA.)
- MacKay R.M. and M.A.K. Khalil, 1993. "Computer Based Activities for Understanding Global Change". In the Proceedings of the 1st International Conference on Computer-aided Learning and Distance Learning in Meteorology, Hydrology, and Oceanography. Sponsored by the University Consortium for Atmospheric Research (UCAR).
- MacKay R.M., 1992. "Global Change Science and Education". Invited Paper presented at the two-week workshop on Climate and Global Change held at the Aspen Global Change Institute.

Invited presentations.

- "The Science of Climate Change: Data, Models, and Visualizations." A workshop for educators teaching topics related to global change. Elon, University, Elon, North Carolina, May 17 and 18, 2007
- Teaching Global Change Science. Portland State University Seminar Nov, 2003.
- Understanding Earth's Past, Present, and Future Climate: Detection and Attribution of Climate Change: Portland State University Seminar June 6, 2001.
- Global Change and Ozone. Presented at Clark College Earth Day Symposium, Apr. 2001.
- Detection and Attribution of Climate Change: Understanding our Global Environment". Presented at Clark College Earth Day Symposium, Apr. 1999.

- The Influence of Solar Irradiance Variations on Climate: Portland State University Seminar Nov 1999.
- Global Change and Atmospheric Chemistry. Presented to Lewis and Clark University Physics Department, Nov. 1998
- Global Change and the Atmosphere. Presented at Clark College Earth Day Symposium, Apr. 1998
- Modeling the Transient Response of the Climate System. Presented to Portland State University Physics Department, Mar. 1997
- Using Models to Understand Climate Chemistry Interactions. Presented to Pennsylvania State University Meteorology Department, Nov. 1995

Workshops or professional activities

- June 2011. Workshop Leader. "Navigating Climate Complexities in the Classroom". See: <http://cleanet.org/clean/community/climateworkshop/index.html>
- Oct 2010. Workshop presenter. "Teaching about earth's climate using Data and Numerical Models" See: <http://serc.carleton.edu/NAGTWorkshops/climatemodels/index.html>
- April 2010: Workshop participant: "Developing Student Understanding of Complex systems in the Geosciences" See: <http://serc.carleton.edu/NAGTWorkshops/complexsystems/workshop2010/index.html>
- July 2005. Workshop participant. "Teaching about the Ocean System Using New Research Techniques: Data, Models, and Visualization. See: <http://serc.carleton.edu/NAGTWorkshops/ocean05/index.html>
- Feb 2005. Building Strong Geoscience Departments. Sponsored by the National Science Foundation and the Science Education Resource Center (SERC). Held at the College of William and Mary.
- July 2004. Teaching Quantitative Skills in the Geosciences. Sponsored by the National Science Foundation and the Science Education Resource Center (SERC). Held at Carleton College. Contributed: http://serc.carleton.edu/quantskills/workshopactivities/co2_global.html
- March 2002. Pacific Northwest Weather Workshop. Co-Sponsored by National Weather Service, the University of Washington, and the Puget Sound Chapter of AMS. (Participant since 1993)
- August 2001- Participant in "Using Physlets in Physics education". A 4 day workshop held in Joliet Illinois. Sponsored by National Science Foundation.
- July 1996 Participant at The International System Dynamics Society Meeting held in Cambridge, MA.
- June 1994 - Participant in the two week workshop on Teaching Physics Using Interactive Digitized Multimedia held at the Air Force Academy.
- July 1993 - Participant of The 1st International Conference on Computer-aided Learning and Distance Learning in Meteorology, Hydrology, and Oceanography held at COMET in Boulder, Colo. Presented paper: "Computer Based Activities for Understanding Global Change".

- August 1992 - Participant at the two week workshop on Climate and Global Change held at the Aspen Global Change Institute. Paper presented: "Global Change Science and Education".
- July 1992 - Participant at the 4-day workshop on Microcomputer Based Laboratory (MBL) directed by Dr. Ronald Thorton of Tufts University and Dr. Priscilla Laws of Dickinson College.
- March 1992 and June 1991 - Co-directed two NSF sponsored Chautauqua short courses for college teachers "The Greenhouse Effect and Global Climate Change" held at The Oregon Graduate Institute of Science & Technology, Portland, OR.

Selected contributions to DELESE (Digital Library for Earth System Education) online peer review collection.

- Teaching with Models <http://serc.carleton.edu/introgeo/models/index.html>
- Teaching with Data <http://serc.carleton.edu/introgeo/teachingwdata/index.html>
- Stratospheric Ozone
<http://serc.carleton.edu/introgeo/teachingwdata/examples/StO3.html>
- Using Mass Balance to Understand Atmospheric CFCs
<http://serc.carleton.edu/introgeo/teachingwdata/examples/CFCsModel.html>
- Daisy World Model
<http://serc.carleton.edu/introgeo/mathstatmodels/examples/DaisyJAVA.html>
- Sun Spot Analysis
<http://serc.carleton.edu/introgeo/teachingwdata/examples/sunspots.html>

Reflection and Absorption of Light

<http://serc.carleton.edu/introgeo/teachingwdata/examples/RefAbsLght.html>