

**KEVIN E. TRENBERTH**

**Affiliations: Distinguished Scholar**

National Center for Atmospheric Research, Boulder, Colorado, USA

**Honorary Academic**, Department of Physics

University of Auckland, Auckland, New Zealand

**ADDRESS:** 127A Churchill Road, Rothesay Bay, Auckland, New Zealand

**DATE AND PLACE OF BIRTH:** 8 November 1944, Christchurch, New Zealand

**EDUCATION:**

B.Sc. (HONS First Class): 1966, University of Canterbury, Christchurch, New Zealand

Sc.D.: 1972, Massachusetts Institute of Technology, Cambridge, Massachusetts

**PROFESSIONAL EXPERIENCE:**

New Zealand Meteorological Service:

Meteorologist 1966–1977

Junior forecaster, research 1966–1968

M.I.T. graduate student 1968–1972

Research meteorologist 1972–1977

Superintendent -dynamic meteorology 1977

University of Illinois 1977 –1984

Associate Professor of Meteorology 1977–1982

Professor of Meteorology 1982–1984

Adjunct Professor 1984–1989

Editor, Monthly Weather Review 1981–1985

Associate Editor, Monthly Weather Review 1986–1988

Associate Editor, J. Climate 1987–1995

Editor, Earth Interactions 1996–1998

National Center for Atmospheric Research

Scientist III 1984–1986

Senior Scientist 1986–

Leader, Empirical Studies Group 1987

Leader, TOGA/CLIVAR activities 1986–2008

Head, Climate Analysis Section 1987–2011

Deputy Director, CGD 1991–1995

Distinguished Scholar 2019-

University of Auckland, *honorary academic, Faculty of Science* 2019-

**AWARDS:**

New Zealand Research Fellowship 1968–1972

NSF research grants 1978–1988

NOAA research grants 1986–

NASA research grants 1989–

Fellow American Meteorological Society 1985–

Fellow American Association for the Advancement of Science 1994–

Honorary Fellow Royal Society of New Zealand Te Apārangī 1995–

NCAR Best Publication Award Nominee 1988, 1989, 1992, 1993, 1994, 2008, 2012

NCAR Outstanding Education Performance Award Nominee 1996

NCAR Distinguished Achievement Award	2003
NCAR Education and Outreach award nominee	2007, 2008
Keuhnast annual lecture, Univ. Minnesota, 15 Oct.	1998
American Meteorological Society Editors Award (J. Climate)	1989
Jule G. Charney award, American Meteorological Society,	2000
Highly Cited Researcher (top 25 Geosciences), ISI.	2002-15
Symons Lecture, Royal Meteorological Society, London, 21 May	2004
Fellow American Geophysical Union	2006
American Geophysical Union Editor's citation for excellence in reviewing,	2007
Massachusetts Marine Educators award of Certificate of Appreciation	2007
Shared Nobel Peace Prize that went to the IPCC 2007	2007
Atmospheric Science Librarians International 2007 ASLI CHOICE award for the 2007 IPCC WG I assessment volume.	2007
Yoshi Ogura lecture, Univ. Illinois at Champaign-Urbana, 30 Apr.	2008
Honorary fellow of the Institute of Green Professionals, 15 Oct.	2008
Prince Sultan Bin Abdulaziz International Prize for Water: Surface water prize (joint award with Aiguo Dai for \$133,000), Riyadh, Saudi Arabia,	January 2013.
AGU's 2013 Climate Communication Prize (\$25,000)	December 2013
Honorable mention, 2014 Colorado Governor's Award for High-Impact Research in the Sustainability category for the Global Energy and Water Exchanges (GEWEX) Project.	Oct 2014.
AGU's Roger Revelle Medal for 2017	December 2017
Honorary member New Zealand Meteorological Society	December 2017
John Ludwick lecture, Old Dominion University, Norfolk, Va	30 April-2 May 2018
Bownocker medal and lectures, The Ohio State University,	27-28 September 2018
Julian E. Mack Lecture, The University of Wisconsin-Madison,	Oct 4-5, 2018.
Tzvi Gal-Chen Memorial Lecture and medal 2018, University of Oklahoma,	27 Oct, 2018.
Edward Kidson medal, Meteorological Society of New Zealand,	December, 2018
NCAR Distinguished Scholar	November 2019
<b>Trenberth Symposium</b> , given by American Meteorological Society in (delayed from 2021 by pandemic).	January 2022
<i>A booklet for the 2022 AMS Kevin E. Trenberth Symposium, designed by A. Dai and J. W. Hurrell with materials from Kevin Trenberth, published by AMS, Boston, 2021. Available from <a href="https://annual.ametsoc.org/index.cfm/2022/program-events/conferences-and-symposia/kevin-e-trenberth-symposium/">https://annual.ametsoc.org/index.cfm/2022/program-events/conferences-and-symposia/kevin-e-trenberth-symposium/</a></i>	

## PROFESSIONAL ACTIVITIES:

Member of 48 different committees, panels or advisory groups within USA 1979-2019 (National Academy of Sciences, NOAA, NASA, NSF, DOE, etc).

### ***International memberships include:***

Committee to report on possible effects of halomethanes on the ozone layer (New Zealand), 1975.

Member for New Zealand on the working group of the Global Data Processing Systems of the Commission for Basic Systems of the World Meteorological Organization, 1976–77.

### **Intergovernmental Panel on Climate Change (IPCC):**

*Scientific Assessment of Climate Change*, WMO/UNEP),

1990, 1992: contributor, reviewer multiple chapters and volumes

1995: WG I Convening Lead Author Chapter 1, Lead Author Technical Summary;

2001: WG I Lead Author Chapter 7, Lead Author Technical Summary, Lead Author Summary for Policy Makers;

2001 Synthesis Report: Lead Author;

2007: WG I Coordinating Lead Author Chapter 3; contributor Technical Summary, Summary for Policy Makers.

2007: WG II contributor and reviewer

2013: WG I Review Editor (chapter 14).

### **World Climate Research Programme (WCRP):**

TOGA: Member International Tropical Oceans Global Atmosphere Scientific Steering Group (SSG) 1989–94.  
CLIVAR: International Climate Variability and Predictability (CLIVAR) Member SSG 1995–2004.  
Member CLIVAR 2004 International Scientific Conference committee, 2002-04.  
Member organizing committee for International CLIVAR workshop on Ocean Reanalysis 2004.  
Co-chair CLIVAR SSG 1996–99.  
Co-chair “Consistency between planetary energy balance and ocean heat storage (CONCEPT-HEAT)” working group, 2014-18  
Executive Committee member CLIVAR Open Science Conference 2015-16  
CLIVAR/PAGES/IPCC Workshop “A multi-millennia perspective on drought and implications for the future”, Tucson, AZ November 18-21, 2003. Co-convener with Jon Overpeck.  
JSC: Member Joint Scientific Committee 1999–2006. Officer (member Exec. Committee) 2003–2006.  
WOAP: Chair WCRP Observation and Assimilation Panel (WOAP) 2004–2010.  
Member Third International Reanalysis Conference organizing committee. 2006-08. Tokyo, Japan.  
Member Fourth International Reanalysis Conference organizing committee. 2010-12. Maryland, USA.  
WCRP Modeling Panel: Member 2004–09.  
COPES: Member Task Force on Coordinated Observation and Prediction of the Earth System (COPES) 2003-04  
GEWEX: Member Global Energy and Water Cycle Experiment/Global Energy and Water Exchanges (GEWEX) Scientific Steering Group 2007– 2014; Chair GEWEX SSG 2010–13; Co-chair Seventh International Scientific Conference on the Global Water and Energy Cycle, The Hague, The Netherlands, July 2014.  
WCRP Open Science Conference committee member, 2009-2011 (held Denver October 2011).

### **Global Climate Observing System (GCOS):**

Member Atmospheric Observation Panel for Climate of the Global Climate Observing System. 1994–99.  
Lead Author and Member of team of experts to write several reports.  
Member ECMWF ReAnalysis (ERA) Project Advisory Group. February 1993–2004.

### **American Meteorological Society**

AMS Committee on Southern Hemisphere Meteorology, 1981–1986. Member of program committee of First International Conference on Southern Hemisphere Meteorology, San Jose dos Campos, Brazil; 31 July–6 August 1983.  
Program chairman Second International Conference on Southern Hemisphere Meteorology, 1984–1986.  
Chairman, AMS Committee on the Southern Hemisphere, 1985–1987.  
Member Program Committee of Third International Conference on Southern Hemisphere Meteorology and Oceanography, Buenos Aires, Argentina 13–17 November 1989.  
Member Program Committee AMS Special Session on Climate Variations, Anaheim, CA 7–9 February 1990.  
Member AMS Committee on Climate Variations, January 1991–1994.  
Member AMS Committee on Atmospheric Research Awards Committee. 2001–2004.  
Member, AMS Board on Global Strategies, Commission on the Weather and Climate Enterprise, 2013-18.  
Member, AMS Centennial Committee, 2015-

### **National Academy of Sciences**

Member of Committee on Earth Sciences of the Space Science Board, 1982–1985. [Co-author of: *A Strategy for Earth Science from Space in the 1980's and 1990's Part II: Atmosphere and Interactions with the Solid Earth, Oceans, and Biota*. National Academy Press, 1985, 149pp.]  
Member TOGA Advisory Panel, Board on Atmospheric Sciences and Climate, 1984–1987. [Co-author of *U.S. Participation in the TOGA Program. A Research Strategy*. National Academy Press, 1986, 24pp.]  
Member Polar Research Board 1986–1990.  
Member Climate Research Committee, Board on Atmospheric Sciences and Climate, 1987–1990.  
Member Global Ocean Atmosphere Land System (GOALS) Panel, 1994–98.  
Corresponding member Panel on Climate Observing System Status, Board on Atmospheric Sciences and Climate, 1998–99.

Member Climate Research Committee Panel on Reconciling Temperature Observations. Board on Atmospheric Sciences and Climate, 1999–2000.

Member Committee on Global Change Research, Division of Earth and Life Sciences. 1999–2002.

Member NRC Panel on “Evaluation of climate change indicators for EPA”. Washington D.C. 2004.

Member writing team “*Climate Change: Evidence and Causes*”, 33pp. National Academy Press <http://nas-sites.org/americasclimatechoices/events/a-discussion-on-climate-change-evidence-and-causes/> and <http://royalsociety.org>.

### Other Professional Activities

- 366 Invited scientific talks in workshops or conferences
- 180 Invited general, keynote or public lectures
- Participation on radio talkback shows, radio programs, and local television news
- *Many appearances on National TV news and other shows.*
- *Many interviews on National Public Radio, and other radio programs.*
- Testimony before US Congress (6 times), and State of Colorado Congress (8 times)
- Taught courses at University of Illinois 1978-1984
- Member of University of Illinois Senate 1979-1984
- Supervised Masters (4) and PhD students (2)
- Received many research grants and contracts, NSF, NASA, NOAA, DOE

### LIST OF PUBLICATIONS

The total (June, 2022) is 71 books or book chapters, and 293 journal articles, 23 Tech. Notes, 117 proceedings or preprints, and 87 other articles, plus four videos, for a total of 591 publications plus 4 videos, and many blogs and podcasts. On the Web of Science, there are 50,545 citations and an H index of 99 (99 publications have 99 or more citations). On Google Scholar, there are > 119,000 citations and an **H index of 129** (or 85 since 2017).

### Selected Books and Encyclopedia articles (does not include IPCC chapters)

Trenberth, K. E., Editor, 1992: *Climate System Modeling*. Cambridge University Press, 788pp.

Trenberth, K. E., 1996: What is happening to El Niño? *1997 Yearbook of Science and the Future*. Encyclopaedia Britannica, 88–99.

Trenberth, K. E., 1996: What's happening to El Niño? *1996 Book of the Year* Encyclopaedia Britannica, p 164.

Trenberth, K. E., K. Miller, L. Mearns, and S. Rhodes, 2000: *Effects of Changing Climate on Weather and Human Activities*. Understanding Global Change: Earth Science and Human Impacts Series, Global Change Instruction Program, UCAR. University Science Books. 46 pp.

Trenberth, K. E., 2001: Earth System Processes. *Encyclopedia of Global Environmental Change*. T. Munn (Ed. in Chief). Vol. 1. The Earth System: Physical and Chemical Dimensions of Global Environmental Change. M. C. MacCracken and J. S. Perry (Eds) John Wiley & Sons Ltd. 13–30.

Trenberth, K. E., 2001: Global Ocean-Atmosphere-Land System (GOALS), *Encyclopedia of Global Environmental Change*. T. Munn (Ed. in Chief). Vol. 1. The Earth System: Physical and Chemical Dimensions of Global Environmental Change. M. C. MacCracken and J. S. Perry (Eds) John Wiley & Sons Ltd. 411–413.

Trenberth, K. E., 2001: Climate: El Niño–Southern Oscillation (ENSO) *Encyclopedia of Ocean Sciences*. Elsevier. J. Steele, S. Thorpe, and K. Turekian Eds. 815–827.

Trenberth, K. E., 2004: Earth's energy balance. *Encyclopedia of Energy*, Elsevier. Cutler J. Cleveland (Editor-in-Chief). Vol 1. 859–870.

Trenberth, K. E., 2011: *Global warming*. In *The Encyclopedia of Climate and Weather*, second Ed. Oxford Univ. Press.

Trenberth, K. E., 2013: *El Niño Southern Oscillation (ENSO)*. Reference Module in *Earth Systems and Environmental Sciences*, ISBN: 978-0-12-409548-9 <http://www.sciencedirect.com/science/referenceworks/9780124095489>

Trenberth, K.E., 2015. *Intergovernmental Panel on Climate Change*. In: Gerald R. North (editor-in-chief), John Pyle and Fuqing Zhang (editors). *Encyclopedia of Atmospheric Sciences*, 2nd edition, Vol 2, pp. 90–94. ISBN: 9780123822253

Trenberth, K. E. 2022: *The changing flow of energy through the climate system*. Cambridge University Press. 319pp. Hardback 978-1-108-83886-3; Paperback 978-1-108-97246-8. [https://www.amazon.com/Changing-Energy-Through-Climate-System/dp/1108972462/ref=sr\\_1\\_2?keywords=Trenberth&qid=1639208299&s=books&sr=1-2](https://www.amazon.com/Changing-Energy-Through-Climate-System/dp/1108972462/ref=sr_1_2?keywords=Trenberth&qid=1639208299&s=books&sr=1-2)

### Selected Journal articles

- Trenberth, K. E., 1976: Spatial and temporal variations of the Southern Oscillation. *Quart. J. Roy. Met. Soc.*, **102**, 639–653.
- Trenberth, K. E., and A. A. Neale, 1977: Numerical weather prediction in New Zealand. *Mon. Wea. Rev.*, **104**, 817–825.
- Trenberth, K. E., G. W. Branstator, P. A. Arkin, 1988: Origins of the 1988 North American Drought. *Science*, **242**, 1640–1645.
- Trenberth, K. E., 1991: Storm tracks in the southern hemisphere. *J. Atmos. Sci.*, **48**, 2159–2178.
- Trenberth, K. E., 1992: The crisis in New Zealand Meteorology. *Search*, **23**, 45–47.
- Trenberth, K. E., 1992: Fragmentation of the New Zealand Meteorological Service. *Search*, **23**, 106.
- Trenberth, K. E., 1997: The use and abuse of climate models in climate change research. *Nature*, **386**, 131–133.
- Trenberth, K. E., and J. W. Hurrell, 1997: How accurate are satellite 'thermometers'. *Nature*, **389**, 342–343.
- Trenberth, K. E., 1997: The definition of El Niño. *Bull. Amer. Met. Soc.*, **78**, 2771–2777.
- Trenberth, K. E., 2001: Climate variability and global warming. *Science*, **293**, 48–49.
- Trenberth, K. E., and B. L. Otto-Bliesner, 2003: Toward integrated reconstructions of past climates. *Science*, **300**, 589–591.
- Trenberth, K. E., A. Dai, R. M. Rasmussen and D. B. Parsons, 2003: The changing character of precipitation. *Bull. Amer. Meteor. Soc.*, **84**, 1205–1217.
- Karl, T. R., and K. E. Trenberth, 2003: Modern global climate change. *Science*, **302**, 1719–1723.
- Trenberth, K. E., 2005: Uncertainty in hurricanes and global warming. *Science*, **308**, 1753-1754.
- Trenberth, K. E., 2007: Warmer oceans, stronger hurricanes. *Scientific American*, July, 2007, 45–51.
- Trenberth, K. E., and J. T. Fasullo, 2010: Tracking Earth's energy. *Science*, **328**, 316-317.
- Trenberth, K. E., 2010: The ocean is warming, isn't it? *Nature*, **465**, 304.
- Trenberth, K. E., 2010: Fixing the Planet? *Science*, **330**, 1178-1179.
- Trenberth, K. E., 2011: Changes in precipitation with climate change. *Climate Research*, **47**, 123-138. <https://doi.org/10.3354/cr00953> .
- Trenberth, K. E. 2012: Framing the way to relate climate extremes to climate change. *Climatic Change*, **115**, 283-290, <https://doi.org/10.1007/s10584-012-0441-5> .
- Trenberth, K. E., J. T. Fasullo, and T. G. Shepherd, 2015: Attribution of climate extreme events. *Nature. Clim. Change*, **5**, 725-730, <https://doi.org/10.1038/NCLIMATE2657> .
- Trenberth, K. E., 2015: Has there been a hiatus? *Science*, **349**, 691-692. <https://doi.org/10.1126/science.aac9225> .
- Cheng, L., K. Trenberth, J. Fasullo, T. Boyer, J. Abraham, and J. Zhu, 2017: Improved estimates of ocean heat content from 1960-2015. *Sci. Adv.* **3**, 3, e1601545, Doi:10.1126/sciadv.1601545. <http://advances.sciencemag.org/content/3/3/e1601545>
- Cheng, L., J. Abraham, Z. Hausfather, K. E. Trenberth, 2019: How fast are the oceans warming? Observational records of ocean heat content show that ocean warming is accelerating, *Science*, **363**, 128-129. <https://doi.org/10.1126/science.aav7619>
- Trenberth, K. E., 2020: Understanding climate change through Earth's Energy Flows. *J. Royal Society New Zealand*, **50**, 331-347. NZJR-2020-0003, <https://doi.org/10.1080/03036758.2020.1741404>

### Selected Op Ed/Blog list: <http://www.cgd.ucar.edu/cas/Trenberth/blogs.html>

#### Climate Feedback: The climate change blog on nature.com

1. *Global climate change and hurricanes*, 14 May 2007
2. *Predictions of climate*. 4 June 2007
3. *Atmospheric aerosols: Correlation is not causation*. 26 June 2007
4. *Global warming and forecasts of climate change*. 11 July 2007
5. *Medicanes?* 24 July 2007
6. *Clarity emerging on hurricanes?* 17 Sept 2007
7. *Some climate change fallacies*. 19 Sept 2007
8. *Natural global warming*. 26 November 2007
9. *More knowledge, less certainty*. *Nature Reports Climate Change*. 21 Jan 2010. <http://www.nature.com/climate> ; <http://www.nature.com/climate/2010/1002/full/climate.2010.06.html>

**THE CONVERSATION** *The Conversation is a collaboration between editors and academics to provide informed news analysis and commentary. Each contribution is reviewed and edited by at least 2 editors.*

- "Hurricane Sandy mixes super-storm conditions with climate change" 28 Oct 2012: <http://theconversation.edu.au/hurricane-sandy-mixes-super-storm-conditions-with-climate-change-10388>
- "Global warming is here to stay, whichever way you look at it" 23 May 2013  
<http://theconversation.com/global-warming-is-here-to-stay-whichever-way-you-look-at-it-14532>
- "Time to change how the IPCC reports?" 28 Sep 2013. <http://theconversation.com/time-to-change-how-the-ipcc-reports-18039>
- "What caused the 'pause' in global warming?" US edition, 29 Oct. 2014. <http://theconversation.com/what-caused-the-pause-in-global-warming-32257>
- "Does global warming mean more or less snow?" US Edition, 30 Jan 2015 <https://theconversation.com/does-global-warming-mean-more-or-less-snow-36936>
- "Study predicts multi-meter sea level rise this century, but not everyone agrees." US Edition, 24 Jul 2015  
<https://theconversation.com/study-predicts-multi-meter-sea-level-rise-this-century-but-not-everyone-agrees-45139>
- "Is the global warming 'hiatus' over?" US Edition, 14 August, 2015. <https://theconversation.com/is-the-global-warming-hiatus-over-45995>
- "What North America can expect from El Niño" US Edition 4 Jan 2016 <http://theconversation.com/what-north-america-can-expect-from-el-nino-51959>
- "The hottest year on record signals that global warming is alive and well" US Edition, 20 Jan 2016  
<http://theconversation.com/the-hottest-year-on-record-signals-that-global-warming-is-alive-and-well-53480> and in French, Jan 24 2016
- "2015 aura bien été l'année la plus chaude jamais enregistrée" <https://theconversation.com/2015-aura-bien-ete-lannee-la-plus-chaude-jamais-enregistree-53623>
- "Has climate change really made the weather better in the U.S.?" US Edition 22 April 2016 <http://theconversation.com/has-climate-change-really-improved-u-s-weather-58269>
- 'Yes, we can do 'sound' climate science even though it's projecting the future' with Rheto Knutti, . US Edition, 5 April 2017  
<http://theconversation.com/yes-we-can-do-sound-climate-science-even-though-its-projecting-the-future-75763>
- "Why Trump's decision to leave Paris accord hurts the U.S. and the world: A race to the bottom to destroy the planet." US and Australian editions 2 June 2017 <http://theconversation.com/why-trumps-decision-to-leave-paris-accord-hurts-the-u-s-and-the-world-78707>
- "Climate change and wildfires – how do we know if there is a link?" US Edition 10 August 2018  
<http://theconversation.com/climate-change-and-wildfires-how-do-we-know-if-there-is-a-link-101304>
- "Seemingly small climate changes can have big consequences" US Edition 17 August 2021.  
<https://theconversation.com/climate-change-is-relentless-seemingly-small-shifts-have-big-consequences-166139>
- Stemming methane leaks from oil fields, pipelines and landfills could help us slow global warming quickly Australasian edition. 17 Nov. 2021. <https://theconversation.com/stemming-methane-leaks-from-oil-fields-pipelines-and-landfills-could-help-us-slow-global-warming-quickly-171839>
- Ocean heat is at record levels, with major consequences. 14 Jan 2022 <https://theconversation.com/ocean-heat-is-at-record-levels-with-major-consequences-174760>
- How not to solve the climate change problem. 20 July 2022. US edition <https://theconversation.com/how-not-to-solve-the-climate-change-problem-187222>

Newsroom. Nov. 17, 2021 **Climate change: NZ should cut emissions, not buy overseas offsets**  
<https://www.newsroom.co.nz/ideasroom/kevin-trenberth-cut-emissions-dont-buy-overseas-offsets>

Newsroom. 26 Jan 2022 **Climate: NZ's role on spaceship Earth**  
[https://www.newsroom.co.nz/whats-nzs-role-on-spaceship-earth?utm\\_source=Friends+of+the+Newsroom&utm\\_campaign=ca206a952d-Daily+Briefing+26.01.2022&utm\\_medium=email&utm\\_term=0\\_71de5c4b35-ca206a952d-97981709](https://www.newsroom.co.nz/whats-nzs-role-on-spaceship-earth?utm_source=Friends+of+the+Newsroom&utm_campaign=ca206a952d-Daily+Briefing+26.01.2022&utm_medium=email&utm_term=0_71de5c4b35-ca206a952d-97981709)

Newsroom. 1 February 2022 **CLIMATE CHANGE: Denying science with opinions and fairy tales**  
<https://www.newsroom.co.nz/trenberth-denying-science-with-opinions-and-fairy-tales>

Newsroom. 4 March 2022. **CLIMATE CHANGE: Our rapidly closing climate window**  
<https://www.newsroom.co.nz/ideasroom/our-rapidly-closing-climate-window>

Newsroom 17 May 2022 **Emissions plan is good, as far as it goes**  
<https://newsroom.us14.list-manage.com/track/click?u=e0ae259e8f9472b9c54037c25&id=b83a73839b&e=9a1503b566>

Newsroom 2 July 2022. **Sustainable Future: Absurd US Supreme Court decision leaves climate leadership in limbo**  
<https://www.newsroom.co.nz/ideasroom/absurd-us-supreme-court-decision-leaves-climate-leadership-in-limbo>

Royal Society Te Apārangi Newsletter, 21 June 2022  
<https://www.royalsociety.org.nz/fellows-and-members/forum/forum-hotoke-2022/emissions-plan-is-good-as-far-as-it-goes/>