

Raymond T. Pierrehumbert

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Atmospheric, Oceanic and Planetary Physics
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RESEARCH INTERESTS Physics of climate, especially regarding the long term evolution of the climates of solar system and extrasolar planets. Water vapor and global change. Baroclinic instability. Hamiltonian chaos and fluid mixing.

EDUCATION ♦ **Massachusetts Institute of Technology**, Cambridge, MA
Ph.D. March, 1980 (Dept. of Aeronautics and Astronautics)
♦ **University of Cambridge** Cambridge, England
Knox Fellow, 1976-1977 (Dept. of Applied Mathematics and Theoretical Physics)
♦ **Harvard College**, Cambridge, MA
A.B. Magna cum Laude in Physics June, 1975

POSITIONS AND FELLOWSHIPS ♦ **Halley Professor of Physics** University of Oxford, 2015-present
♦ **Professorial Fellow** Jesus College, Oxford, 2015-present
♦ **Kung Karl XVI Gustaf Professorship** (visiting), Stockholm 2014-2015
♦ **Louis Block Professor** University of Chicago, 2005-2015
♦ **Professor in Geophysical Sciences** University of Chicago, 1989-2015
♦ **Directeur de Recherche** Ecole Polytechnique, France (2003-2004, visiting position)
♦ **John Simon Guggenheim Fellow** Laboratoire de Meteorologie Dynamique, Ecole Normale Supérieure, Paris. 1996/1997 (sabbatical visit)
♦ **Professor of Geology and Geophysics** Princeton University 1988-1989
♦ **Guest Investigator** Stockholms Universitet, Meteorologiska Institutionen 1987/1988 (sabbatical visit)
♦ **Research Scientist** Geophysical Fluid Dynamics Laboratory/NOAA. 1982-1988.
Concurrent appointments at Princeton University: Visiting Lecturer with Rank of Associate Professor (Atmospheric & Oceanic Sciences Program), Affiliated Faculty Member, Applied & Computational Mathematics Program.
♦ **Assistant Professor of Meteorology** Massachusetts Institute of Technology, 1980-1982

AWARDS ♦ **John Simon Guggenheim Fellow**
♦ **Fellow, American Geophysical Union**
♦ **Chevalier de l'Ordre des Palmes Academiques**
♦ **Kung Karl XVI Gustaf Professorship (visiting), Stockholm 2014-2015**
♦ **Fellow, American Academy of Arts and Sciences**

◇ **PhD. *honoris causa*, Stockholms University**

SELECTED
PROFES-
SIONAL
ACTIVITIES

- ◇ Scientific Advisory Board, Bolin Center for Climate Research, Stockholm
- ◇ Science and Security Board, *Bulletin of the Atomic Scientists*
- ◇ Editorial board, *Annual Reviews of Earth and Planetary Science*.
- ◇ Co-organizer *Exoclines 2012*, Aspen, CO, *Exoclines 2014*, Davos, CH and *Exoclines 2016*, Vancouver, BC.
- ◇ Co-author National Research Council Report on Climate Intervention
- ◇ Co-author National Research Council Report on Climate Stabilization Targets
- ◇ Member, National Research Council Board on Atmospheric Science and Climate, 2009-2014
- ◇ Member, City of Chicago Mayor's Task Force on Climate Change, 2007-2008
- ◇ Co-organizer, 2008 Kavli Institute of Theoretical Physics Program on Physics of Climate.
- ◇ Lead Author, Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (1997-2001)
- ◇ Member, National Research Council Panel on Abrupt Climate Change and its Societal Impacts (2000-2001).
- ◇ Editor, Journal of the Atmospheric Sciences (1988-1991)

PHD
STUDENTS

- ◇ **B. Reinhold** (PhD, MIT 1981) Dynamics of Weather Regimes: Quasi-Stationary Waves & Blocking
- ◇ **D. Dritschel** (PhD, Princeton 1984) The Stability of Certain two dimensional and three dimensional Vortical Motions
- ◇ **J. Bacmeister** (Princeton GFD program, PhD 1987) Nonlinearity in Transient two dimensional flow over topography.
- ◇ **B. Carissimo** (Princeton GFD program, PhD Aug. 1987) Observation and modelling of drag during transient airflow over mountains
- ◇ **F. Parham** (Princeton Appl. Math. PhD. June 1988) Rossby wave critical levels in a baroclinic atmosphere.
- ◇ **S. Lin** (Princeton GFD program, PhD. July 1988) The instability mechanism of synoptic scale eddies
- ◇ **K. Lamb** (Princeton Appl. Math, PhD. July 1988) Nonlinear gravity wave critical levels
- ◇ **M. Dahleh** (Princeton Appl. Math 1989) Subject: Discrete vortex methods on the beta plane
- ◇ **J. Anderson** (Princeton GFD program 1989, jointly advised with Isaac Held) Subject: Numerical methods for large non Hermitian eigenvalue problems
- ◇ **Kyle Swanson** (U. of C. Geophysical Sciences, Ph.D 1995) Subject: Storm tracks and low frequency variability
- ◇ **Stefanella Boatto** (U. of C. Physics, Ph.D 1995) Subject: Chaotic mixing by aperiodic flows.
- ◇ **Yongyun Hu** (U. of C. Geophysical Sciences PhD 2001) Subject: Atmospheric stirring and mixing.
- ◇ **Hui Zhang** (U. of C. Geophysical Sciences PhD 2002) Tropical upper tropospheric water vapor distribution.
- ◇ **Jai Sukhatme** (U. of C. Geophysical Sciences PhD 2003) Subject: Multifractal and stochastic models in geophysics
- ◇ **Jude Sabado** (U. of C. Geophysical Sciences PhD 2006) Subject: Baroclinic instability on Early Mars

- ◇ **Jonathan Mitchell** (U. of C. Astrophysics PhD 2007) Subject: Climate Dynamics of Titan
- ◇ **Ian N. Williams** (U. of C. Geophysical Sciences PhD 2011) Subject: Tropical convection and Climate Sensitivity

- ◇ **Dawei Li** (U. of C. Geophysical Sciences PhD, in progress) Subject: Sea glaciers and neo-proterozoic climate

- ◇ **Feng Ding** (U. of C. Geophysical Sciences PhD, in progress) Subject: GCM modeling of exoplanet climates

- ◇ **Andrew Malone** (co-supervised) (U. of C. Geophysical Sciences PhD, in progress) Subject: Mountain glaciers as climate proxies

- ◇ **Jonah Bloch-Johnson** (co-supervised) (U. of C. Geophysical Sciences PhD, in progress) Subject: Bifurcations and climate sensitivity

RECENT
POSTDOCS

- ◇ **Huijun Yang**
- ◇ **Keith Ngan**
- ◇ **Chris Poulsen**
- ◇ **Gilles DeLaygue**
- ◇ **Jason Goodman**
- ◇ **Rodrigo Caballero**
- ◇ **Johnny Lin**
- ◇ **Christian Dieterich**
- ◇ **Yannick Donnadieu**
- ◇ **Helene Brogniez**
- ◇ **Dargan Frierson**
- ◇ **David McInerney**
- ◇ **Dorian Abbot**
- ◇ **Jung-Eun Lee**
- ◇ **Robin Wordsworth**

SELECTED
INVITED
LECTURES

- ◇ **Haldane Lecture**, Wolfson College, University of Oxford (2017)
- ◇ **Lobanov-Rostovsky Lecture**, University of Oxford (2016)
- ◇ **Distinguished Planetary Science Lecturer**, Bern University (2014)
- ◇ **Tyndall Lecture**, American Geophysical Fall Meeting (2012)
- ◇ **Distinguished Atmospheric Science Lecturer**, Beijing University (2012)
- ◇ **Invited lecturer**, Swedish Royal Academy Bolin Symposium (2012)
- ◇ **University Lecturer**, Cornell University (2012)
- ◇ **Niels Bohr Lecture**, Copenhagen University (2011)
- ◇ **Fairchild Lecture**, University of Rochester (2010)
- ◇ **Noble Lecturer**, University of Toronto (Toronto, 2010)
- ◇ **Invited lecturer**, Vatican study group on astrobiology (Rome, 2009)
- ◇ **Halley Lecture** (Oxford University, 2009)

Raymond T. Pierrehumbert

- ◇ **K**ibbe lecture (Bowdoin College, 2008)
- ◇ **B**erkeley Distinguished Atmospheric Science Lecture (Berkeley, 2008)
- ◇ **A**ggasiz Lectures (Harvard, 2008)
- ◇ **T**hompson Lectures (National Center for Atmospheric Research, 2008)
- ◇ "Low Order Models" Invited lecture at The Lorenz Symposium (MIT, Dec. 1987)

Open access versions of most papers are available at
<https://users.physics.ox.ac.uk/~pierrehumbert/papers/publist.html>

Allen, M., Fuglestedt, J., Shine, K., Reisinger, A., Pierrehumbert, R. & Forster, P. (2016), ‘New use of global warming potentials to compare cumulative and short-lived climate pollutants’, *Nature Climate Change* **6**, 773–776.

Clark, P., Shakun, J., Marcott, S., Mix, A., Eby, M., Kulp, S., Levermann, A., Milne, G., Pfister, P., Santer, B., Schrag, D., Solomon, S., Stocker, T., Strauss, B., Weaver, A., Winkelmann, R., Archer, D., Bard, E., Goldner, A., Lambeck, K., Pierrehumbert, R. & Plattner, G.-K. (2016), ‘Consequences of twenty-first-century policy for multi-millennial climate and sea-level change’, *Nature Climate Change* **6** pp. 360–369.

Ding, F. & Pierrehumbert, R. (2016), ‘Convection in condensible-rich atmospheres’, *Astrophysical Journal*, **822**.

Malone, A., Pierrehumbert, R., Lowell, T., Kelly, M. & Stroup, J. (2015), ‘Constraints on southern hemisphere tropical climate change during the little ice age and younger dryas based on glacier modeling of the Quelccaya ice cap, Peru’, *Quaternary Science Reviews* **125**, 106–116.

Pierrehumbert RT 2016: How to decarbonize? Look to Sweden, *Bulletin of the Atomic Scientists* **72**(2), 105–111.

Pierrehumbert RT and Eshel G 2015: Climate impact of beef: an analysis considering multiple time scales and production methods without use of global warming potentials, *Environmental Research Letters* **10** (8), 085002.

McNutt, M. K., Abdalati, W., Caldeira, K., Doney, S. C., Falkowski, P. G., Fetter, S., Fleming, J. R., Hamburg, S. P., Morgan, M. G., Penner, J. E., Pierrehumbert, R. T., Rasch, P. J., Russell, L. M., Snow, J. T., Titley, D. W. & Wilcox, J. (2015a), *Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration*, National Academies Press.

McNutt, M. K., Abdalati, W., Caldeira, K., Doney, S. C., Falkowski, P. G., Fetter, S., Fleming, J. R., Hamburg, S. P., Morgan, M. G., Penner, J. E., Pierrehumbert, R. T., Rasch, P. J., Russell, L. M., Snow, J. T., Titley, D. W. & Wilcox, J. (2015b), *Climate Intervention: Reflecting Sunlight to Cool Earth*, National Academies Press.

Wordsworth, R., Kerber, L., Pierrehumbert, R., Forget, F. & Head, J. (2015), ‘Comparison of “warm and wet” and “cold and icy” scenarios for early Mars in a 3-d climate model’, *Journal of Geophysical Research E: Planets* **120**, 1201–1219.

Bloch-Johnson J, Pierrehumbert RT and Abbot DS 2015: Feedback temperature dependence determines the risk of high warming, *Geophys. Research Lett.* **42**(12), 4973–4980.

Wordsworth R and Pierrehumbert RT 2014: Abiotic Oxygen-dominated Atmospheres on Terrestrial Habitable Zone Planets. *Ap. J. Lett.*, **785** 785 L20. doi:10.1088/2041-8205/785/2/L20

Glotter M, Pierrehumbert RT, Elliott J and Moyer, EJ 2014: A Simple Carbon Cycle Representation for Economic and Policy Analyses. *Climatic Change*, **126**, 319–335.

Pierrehumbert RT 2014: Short Lived Climate Pollution. *Annual Reviews of Earth and Planetary Sciences* **42**, doi:10.1146/annurev-earth-060313-054843

Pierrehumbert RT 2013: Hot Climates, High Sensitivity. *Proc. Nat. Acad. Sci.*, **110**, 14118–14119, doi:10.1073/pnas.1313417110

Wordsworth R and Pierrehumbert RT 2013: Water loss from terrestrial planets with CO₂-rich atmospheres. *Astrophysical J.*, **778** doi:10.1088/0004-637X/778/2/154

Abbot DS, Voigt A, Li D, Le Hir G, Pierrehumbert RT *et al* 2013: Robust elements of Snowball Earth atmospheric circulation and oases for life. *J. Geophys. Res. – Atmospheres*, **118**(12), 6017–6027, doi:10.1002/jgrd.50540

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- Pierrehumbert RT 2013: Strange news from other stars. *Nature Geoscience* **6**, 81-83. doi:10.1038/ngeo1711
- Wordsworth R and Pierrehumbert RT 2013: Hydrogen-nitrogen greenhouse warming in Earth's early atmosphere. *Science*, **339**, 64-67. doi:10.1126/science.1225759
- Pierrehumbert RT 2012: Cumulative Carbon and Just Allocation of the Global Carbon Commons. *Chicago Journal of International Law*, **13.2** pp 527-548 .
- Pierrehumbert RT 2012: *Computation in Python for the Mathematical and Physical Sciences*. Princeton University Press (under contract).
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- Mitchell J, Pierrehumbert RT, Frierson D and Caballero R 2006: The dynamics behind Titan's tropospheric methane clouds. *Proc. Nat. Acad. Sci.* **103 (49)**, 18421-18426.
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- Pierrehumbert 2004b: Translation of *Mémoire sur les Températures du Globe Terrestre et des Espaces Planétaires* by J-B J. Fourier. *Nature* **432** (online supplementary material to Pierrehumbert, 2004a)
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