

CURRICULUM VITÆ

David C. Catling

PERSONAL INFORMATION

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PROFILE

Research interests include the evolution and habitability of planets with particular emphasis on atmospheres, climates and planetary surfaces. Teaching experience includes courses in astrobiology, planetary science, planetary atmospheres, geobiology, science communication, and global environmental change at undergraduate and graduate levels. Other experience includes development of space instrumentation and involvement in missions to Mars. A Co-Investigator on NASA's Phoenix Mars Lander Mission, which successfully conducted landed operations in the north polar region of Mars during 2008.

EMPLOYMENT

- Autumn, 2012- Full Professor (tenured), Dept. Earth & Space Sciences, University of Washington and Astrobiology Program.
Adjunct Prof. in Dept. of Atmospheric Sciences.
- 2009-2012 Associate Professor, Dept. Earth & Space Sciences, University of Washington and Astrobiology Program.
Adjunct Associate Prof. in the Dept. of Atmospheric Sciences, 2009-present
- 2005-2009 Dept. Earth Sciences, University of Bristol.
European Union Marie Curie Chair (2005-2008) and Reader. Affiliate Associate Prof., University of Washington.
- 2001-2005 University of Washington. Assistant Professor
A joint appointment to the Dept. Atmospheric Sciences and cross-campus Astrobiology Program (then 10 departments).
Adjunct Asst. Prof. in the Dept. of Astronomy 2003-2005.
- 1995-2001 Research scientist at NASA Ames Research Center (Planetary Systems Branch), California, with co-affiliations and titles as follows:
- 1999-2001, Research Scientist, Center for the Study of Life in the Universe, SETI Institute, Mountain View, California
 - 1996-1999, Research Associate (fellowship), National Research Council.
 - 1995-1996, Research Scholar, San Jose State University, California.

EDUCATION

1994: D.Phil., Atmospheric, Oceanic & Planetary Physics, University of Oxford, England.

1990: B.Sc. (1st Class Honors) in Physics with Astrophysics, University of Birmingham, England.

KEY CONTRIBUTIONS TO SCIENCE

(1) Pioneered simulations of expected evaporite salt sequences on Mars (Catling, *J. Geophys. Res.*, 1999), which were then applied to real salts discovered in Martian meteorites (Bridges, Catling et al., *Space Science Reviews*, 2001). Since this time, the discovery of salts from possible dried-up water has been a key success of NASA's and the ESA's Mars missions, as described in *Nature News and Views* I wrote on such reports (e.g., Catling, *Nature*, 2004, 2005, 2007). Worked for ~15 years with Dr. Giles Marion (of the Desert Research Institute) and more lately with Dr. Jon Toner on development of theoretical salt chemistry models at cold temperatures and over a range of pressures, applicable to many Solar System bodies.

(2) Together with a then-student, I originated a general physical explanation for why the minimum temperatures at the top of the tropospheres on Earth, Titan, Jupiter, Saturn, Uranus and Neptune all occur around 0.1 bar (within a factor of ~2) (Robinson & Catling, 2014, *Nature Geosci.*). We presented a hypothesis of a "0.1 bar tropopause rule" that should also apply throughout the galaxy to billions of exoplanet atmospheres that have stratospheric temperature inversions above their tropospheres.

(3) Originated a theory explaining how methane-enrichment in Earth's ancient atmosphere may have played an essential role in how Earth acquired its oxygen-rich atmosphere hundreds of millions of years after the advent of oxygenic photosynthesis (Catling et al., *Science*, 2001). Also, showed for the first time how mass-independent fractionation of sulfur isotopes is an indirect tracer of abundant methane before 2.4 Ga (Zahnle et al., *Geobiology*, 2006), not just a tracer for low O₂. The methane-induced hydrogen escape theory is generally relevant for understanding the possible presence of O₂—a potential biosignature gas—on all Earth-like exoplanets elsewhere.

(4) Atmospheric chemical disequilibrium has been proposed as a method for detecting extraterrestrial biospheres on exoplanets. With students, I made the first accurate calculations of a metric of thermodynamic chemical disequilibrium in Solar System atmospheres, in which we quantified the available Gibbs free energy, i.e., that of an observed atmosphere minus that of atmospheric gases reacted to equilibrium (Krissansen-Totton, Bergsman and Catling, 2016). We found that the Earth stands out by a factor of ~20 but that there are many subtleties.

(5) Came up with an idea of using the visible “Pale Blue Dot” color of the Earth as a possible future biosignature to detect Earth-twin exoplanets using broadband photometry. Published with students and colleagues (Krissansen-Totton, ..., D. C. Catling (2016)).

(6) A Science Team member on NASA’s Mars *Phoenix Lander Mission*. *Phoenix* was the first spacecraft ever to land (in 2008) in the ice-rich high latitudes of Mars. There, *Phoenix* sampled the surface and subsurface environment. I was co-author on papers reporting several key discoveries:

- i) first *in situ* identification of water ice on Mars at 5-10 cm depth
- ii) first measurement (unexpectedly high) of perchlorate at 0.6 wt% in Martian soil
- iii) first *in situ* measurement of calcium carbonate at 3-5 wt% in Martian soil.
- iv) first measurement of soluble sulfate at 1.5 wt% in Martian soil and pH of the soil
- v) the first *in situ* atmospheric structure from the Martian arctic. Specifically, I was the Science Team member responsible for coordinating the experimental protocol and analysis reported in Withers and Catling (2011).
- vi) As a result of exploring Earth analogs to Mars, I worked with colleagues (particularly former student, Mark Claire) on the first photochemical model of atmospheric salt deposition in the Atacama desert, Chile (Catling et al., 2010).

(7) Co-discovered that solutions of perchlorate salts (detected on Mars) can greatly supercool and never crystallize. They eventually form glasses (amorphous solids) around -120°C. Glasses are known by biologists to be far better for preserving microbes and biological molecules than crystalline salts, which is relevant to the search for life on Mars, Jupiter’s moon Europa, and Saturn’s moon Enceladus.

(8) Ancient Earth is so different that it is like another planet. I came up with an idea for the first measurements of air density and pressure from billions of years ago on Earth using fossil raindrop imprints. These were used to deduce an upper limit to air density 2.7 billion years ago. Former student, Sanjoy Som put this into practice, developing crucial methodological details as part of his PhD (Som, Catling, et al., *Nature* 2012). I also worked with Som and Roger Buick on another method using differential size of basaltic vesicles to infer that air pressure was <0.5 bar, 2.7 billion years ago (Som et al., *Nature Geosci.*, 2016). The techniques have implications for understanding the nitrogen cycle on Earth-like planets anywhere.

(9) In early 2004, I noted that because selenium isotopes behave somewhat like sulfur ones (both are in the same Periodic Table group), selenium might be a new tracer of the redox evolution of the early Earth. Eventually, this led to two funded projects: one at the UW and the other at University of Bristol, UK. Results show that selenium does trace oxygenation, particularly Neoproterozoic oxygenation (Stueeken et al., 2015; Pogge von Strandmann et al., 2015).

PROFESSIONAL AWARDS, HONORS

2014 *Astrobiology: A Very Short Introduction* book (Catling, 2013) is awarded “Outstanding Academic Title” by *Choice Magazine* in 2014, which reviews books suitable for college students.

- 2010 *Top-50 most cited articles* award in Earth and Planetary Science Letters, 2005-2010 from Elsevier Publishing
- 2009 *NASA Group Achievement Award* “for outstanding performance in the planning for the execution of the science” in NASA’s Phoenix Lander Mission to Mars.
- 2005 *Marie Curie Chair* from the European Commission of the European Union, awarded “in particular to attract world-class researchers”, tenable at the University of Bristol, England (2005-2008).
- 1996 *US National Research Council Fellowship* tenable at NASA’s Ames Research Centre awarded “to provide postdoctoral scientists and engineers of unusual promise and ability opportunities for research”

PROFESSIONAL EXPERIENCE IN INTERNATIONAL RESEARCH PROJECTS

- 2017-present Investigator in the *Simons Collaboration on the Origin of Life*.
- 2015-present Co-advising a graduate student with Tim Elam, working on the Planetary Instrument for X-ray Lithochemistry (PIXL) instrument for NASA’s *Mars-2020 rover*.
- 2002-2009 *Co-Investigator* on NASA’s *Phoenix Mars Lander*, a lander that successfully conducted characterization (geochemical and environmental) of the water-rich near-surface environment in the arctic of Mars during 2008.
- 2000-2002 *Co-Investigator* on “Matador” (*Mars Atmosphere and Dust in the Optical and Radio*), a Mars Lander payload definition team. Responsibility for an integrated payload to characterise electrostatic hazards on Mars. Funded by NASA Human Exploration and Development of Space Program.
- 2000-2003 Advisor for *Beagle 2* Mars Lander ultraviolet sensor experiment (described in Patel, Zarnecki & Catling, *Planet. Space Sci.*, 2002).
- 1996-2003 *Co-Investigator* on a proposed US-French mission called *Pascal* to deploy a global network of 18-20 miniature surface stations on Mars and characterise the climate of Mars hourly over 20 Earth years. In 2001, *Pascal* was selected for feasibility study in NASA’s *Mars Scout Program*. Jointly conceived and designed this mission (Haberle and Catling, 1996).
- 2000 *Co-Investigator* on proposed mission called *Piccard, Mars Balloon Magnetometer Mission*.

1998-1999 *Science Team member* for NASA's Mars Microprobe Mission. Responsible for designing and building a precision computer-controlled Mars pressure-temperature chamber to calibrate sensors to NIST-traceable standards. Collaborated with Stanford University researchers/students to develop microsensors to withstand 100,000g.

PROFESSIONAL SERVICE ON NATIONAL BODIES IN THE UNITED STATES

2017 NASA Earth and Space Sciences Fellowship panel

2014 Chair, Atmospheres Group, NASA/NSF/Smithsonian "Early Earth Habitability" Workshop, August 20-22.

2014 NASA Astrobiology Institute Review Panel. Chair, Habitability Sub-Panel.

2011 Sub-Panel Chair, NASA Mars Fundamental Research Program, Washington DC, October

2011 Sub-Panel Chair, NASA Astrobiology/Exobiology Program Review Panel, Washington DC, May

2010 Judge, *Davidson Institute for Talent Development*: Gives \$10K-50K awards to gifted under-18-year-olds in the USA to help them do great things

2006 NASA's Exobiology and Astrobiology Program Review Panel.

2003 NASA's Astrobiology Institute Executive Council Program Review Panel.

2003 NASA's Astrobiology Institute Review Panel.

2000, 2001 NASA's Planetary Geology and Geophysics Program Review Panel.

SERVICE ON INTERNATIONAL OR OVERSEAS BODIES

2006-2009 Member of the European Space Agency's (ESA's) *Solar System Working Group* (SSWG), invited by the Director of ESA's Scientific Programme. The SSWG is an advisory committee of up to 15 recognized international scientists that advises ESA on its current and future missions to the planets, the Sun, asteroids and comets. For this appointment, I reviewed mission proposals for ESA's Cosmic Vision Programme to define ESA's planetary missions to 2025, including joint missions with NASA. Meetings at ESA HQ in Paris, France, approximately quarterly.

2006-2009 Space Science Advisory Committee of the UK Science and Technology Facilities Council (STFC). Meetings in London, UK, approximately quarterly.

2006 Served on the UK Science and Technology Facilities Council (STFC). ESA ExoMars Lander Science Instrument Review Panel. London, UK.

OTHER PROFESSIONAL SERVICE

1) Reviewing and editorial

- Reviewer for the following journals, covering a broad range of disciplines: *Science*, *Nature*, *Nature Geoscience*, *Phil. Trans. of the Royal Society*, *Proc. National Acad. Sci. USA*, *Geophysical Research Letters*, *Earth and Planetary Science Letters*, *Geochimica et Cosmochimica Acta*, *Journal of Geophysical Research*, *Geology*, *Icarus*, *American Journal of Science*, *Planetary and Space Science*, *Astrobiology*, *Geobiology*, *Origins of Life*, *Mars Journal*, *Advances in Space Research*, *Tellus*, *Sensors and Actuators*
- External reviewer for NASA (research proposals for NASA programs including Solar System Workings, Mars Data Analysis, Mars Fundamental Research, Planetary Geology and Geophysics, Exobiology/Astrobiology, Planetary Atmospheres, Planetary Instrument Definition and Development, and the NASA Postdoc Fellowship Program), NSF, UK Space Agency, UK Science and Technology Facilities Council, Deutsche Forschungsgemeinschaft (DFG = German Research Foundation), Austrian Science Fund (FWF).
- Reviewer for Book proposals: Cambridge University Press, Blackwells Publishing, Taylor & Francis, Elsevier. Reviewed entire manuscript of the researcher-level book *Early Earth Systems* by Hugh Rollinson (published by Blackwells, 2007)).
- Editorial Advisory Board, *Geobiology* and *Astrobiology*
- Special editor for issue vol.4, no. 4, 2006 of *Geobiology* on the early Earth.
- Membership of professional bodies: Division of Planetary Sciences of the American Astronomical Society Member, American Geophysical Union, and The Geochemical Society. Fellow of the Royal Meteorological Society. Member, Astrobiology Society of Great Britain. Member, British Society for Geomorphology.

2) Conference convening

- Scientific Organizing Committee, *Astrobiology Science Conference (AbSciCon)*, Mesa, AZ, 2017.
- Co-Convenor, “What Processes Regulate Atmospheric Carbon Dioxide, and Stabilize Climate, on Earth and Other Planets” session, Fall AGU 2016.
- Conference Session Convenor, “Redox evolution of the mantle, oceans, and early atmosphere”, *Annual Goldschmidt Geochemistry Conference*, Prague, August 2011.
- Organizer and Chair of “Oxygen and Evolution” session at the *Earth System Processes 2 Conference* in Calgary, Canada August 8-11, 2005. Also arranged conference sponsorship by NASA’s Astrobiology Institute.

CONTRIBUTION TO FACULTY/ DEPARTMENTAL/ UNIVERSITY ACADEMIC GROUPS

- 2017 Member, University of Washington Astrobiology Graduate Admissions
- 2016 Chair, University of Washington Astrobiology Graduate Admissions
- 2011-present University of Washington Astrobiology Program Steering Committee
- 2015-present Earth & Space Sciences (ESS) Promotion, Merit and Tenure committee.
- 2015 University of Washington Astrobiology Graduate Admissions Committee (member)
- 2015 ESS Prelim Committee
- 2015 ESS Bassett Teaching Award Committee
- 2015 Chair, ESS Chair responsibilities and Dept. Governance Committee
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- 2013, 2014 1. Chair, University of Washington Astrobiology Graduate Admissions Committee
2. ESS Graduate Admissions Committee
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- 2010-2011 1. University of Washington Astrobiology Graduate Admissions Committee
2. ESS Prelim Exam Committee
3. ESS Search Committee for Research Faculty position in Atmospheric Electrodynamics
4. Chair, ESS Promotion Committee for a Res. Asst. Prof. to Res. Assoc.
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- 2009-2010 1. Dept. Earth and Space Sciences Graduate Admissions Committee,
2. ESS Prelim Exam Committee
3. ESS Faculty Excellence Teaching Award Committee,
4. ESS Search Committee for a Research Asst. Prof. in Planetary Oceans
5. University of Washington Astrobiology Graduate Admissions Committee
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- 2011 Organizer for university-wide Feb 2011 Mindlin Lecture on “The Origin of Life” by Prof. Bill Martin of Univ. of Dusseldorf.
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- 2010, 2011 Judge for Washington Aerospace Scholar high-school students on Mars rover designs.
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- 2008-2009 Undergraduate Year Abroad Program Coordinator, Dept. of Earth Sciences, University of Bristol. Responsible for: Maintaining overseas departmental exchange programs (in Europe, Canada, US, Australia, New Zealand, and Singapore), approving students’ overseas 1-yr course selections, chairing grade assessment and grade translation committees on students’ return from 1-yr overseas courses, providing academic assistance to students during all stages of the process (applications, deadlines, queries while overseas).
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- 2005-2006 Organizer of an interdepartmental Geobiology seminar series at the University of Bristol.
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- 2002-2003 Organizer of the Astrobiology Seminar Series for the University of Washington, with speakers from across the U.S. and elsewhere.

- 2004 Organizer of departmental seminars in Dept. of Atmospheric Sciences, at the University of Washington
- 2001-2005 Development of a curriculum for a new Graduate Certificate in Astrobiology at the University of Washington as an extra for Ph.D. students.

INVITED CONFERENCE TALKS AND UNIVERSITY LECTURES, WORLDWIDE

54. Catling, D. C., Finding life on Exo-Earths through its imprint on atmospheric composition, *Breakthrough Discuss*, organized by the *Breakthrough Initiatives*, Stanford University, CA, April 20-21, 2017.
53. Catling, D. C., What we can and can't learn from Titan about the early Earth, *Titan Through Time IV Workshop*, NASA Goddard Space Flight Center, April 3-5, 2017.
52. Catling, D. C. What do we really know about the Earth's early atmosphere? *American Geophysical Union Fall Meeting*, abstract id 16755, San Francisco, CA, Dec. 2016.
51. Catling, D. C., Rise of O₂ on Earth and other planets (and thoughts about Proxima Centauri-b), *M-star Planet Opportunity Meeting*, Harvard Center for Astrophysics, August, 2016.
50. Catling, D. C., Metrics to find life from remote sensing data and their limitations, NExSS (NASA Nexus for Exoplanet System Science) *Exoplanet Biosignature Workshop*, July 27-29, Seattle, WA.
49. Catling, D. C., Earth's early atmosphere and climate, *Simons Collaboration on the Origin of Life* team meeting, Harvard University, July 21, 2016.
48. Catling, D. C., The atmosphere and environment of the early Earth, University of Victoria, Canada, April 2016.
47. Catling, D. C. The atmosphere and environment of the early Earth, UC Davis, Davis, California, March 2016.
46. Catling, D. C. Why O₂ is our best biosignature and phantoms of false positives, *Upstairs Downstairs Workshop: Consequences of Internal Planet Evolution for the Habitability and Detectability of Life on Extrasolar Planets*, Arizona State Univ, Tempe, Arizona, February 2016.
45. Catling, D. C. The environment of a different planet: The early Earth, Dept. of Geological Sciences, Central Washington University, Ellensburg, WA, Oct 16, 2015.

44. Catling, D. C. Planetary Atmospheres, in *Conference on Astrobiology and Planetary Atmospheres*, European Southern Observatory (ESO) HQ, Santiago, Chile, Oct 1, 2015.
43. Catling, D. C. The Evolution of Atmospheres on Inhabited and Lifeless Planets, University of Heidelberg/ Max Planck Institute for Astronomy, July 8, 2015.
42. J. Krissansen-Totton & D. C. Catling, Do Pale Blue Dots have unique atmospheric disequilibrium and photometric color? NASA Goddard Space Flight Center, June 24, 2015.
41. Catling, D. C. The Evolution of Atmospheres on Inhabited and Lifeless Planets, University of Chicago, May 29, 2015.
40. Catling, D. C. Planetary Atmospheres. *International Symposium on Life as a Planetary Phenomenon*, European Southern Observatory, Santiago, Chile, Nov 27, 2014.
39. Catling, D. C. Atmospheric evolution on the early Earth, Dept. Earth, Atmospheric and Planetary Sciences, MIT, November 5, 2014.
38. Catling, D. C. Atmosphere and environment of the early Earth, *Origins 2014 Conference*, Nara, Japan, July 8, 2014.
37. Catling, D. C. Atmospheric evolution on the early Earth, University of Tokyo, Dept. of Complexity Science and Engineering, Tokyo, Japan, July 4, 2014.
36. Catling, D. C., Planetary atmospheres in the Solar System: Their properties and evolution as guides to exoplanet atmospheres, *Fermor Meeting: Comparative Planetology*, Geological Society of London, May 19-20, 2014.
35. Catling, D. C., Planetary Atmospheres and Evolution of Complex Life, *Habitable Worlds Across Space and Time Workshop*, Space Telescope Science Institute, Baltimore MD, April 28-May 1, 2014.
34. Catling, D. C., Claire, M., Zahnle, K. J., Waiting ages for oxygen: A titration hourglass and the oxidation of the solid Earth, *AGU Fall Meeting*, abstract #V41E-02, December, 2013.
33. Catling, D. C., Robinson, T. D. Atmospheric chemistry and radiation in the Solar System as Guides to Exoplanet Atmospheres. *Chapman Conference: Crossing Boundaries in Planetary Atmospheres: From Earth to Exoplanets*, Annapolis, MD, June 24-28, 2013.
32. Catling, D. C., M. Smith, K. J. Zahnle, M. W. Claire, Formation of perchlorate on Mars, *Present-day Habitability of Mars Workshop*, UCLA, Feb 2013.

31. Catling, D. C., K. J. Zahnle, M. W. Claire, What caused the rise of atmospheric oxygen? *Goldschmidt Geochemistry Conference*, Montreal, June, 2012. #1459
30. Catling, D. C., K. J. Zahnle, Atmospheric escape, redox evolution, and planetary habitability, *AGU Fall Meeting*, Planetary Evolution and Life session, San Francisco, December, 2011.
29. Catling, D. C., Causes and Consequences of the Great Oxidation Event, *Life and the Planet: New Perspectives in Earth System Science*. The Geological Society, London, UK, May 5-6, 2011.
28. D. C. Catling, Connections between Mars meteorites and past atmospheres, *Workshop on Quantifying Martian Geochemical Reservoirs*, ISSI, Bern, Switzerland, 2011.
27. D. C. Catling, Can atmospheric disequilibrium indicate life on a planet? in *Workshop on Planetary Evolution and Life*, at the German Space Agency (Deutsches Zentrum für Luft- und Raumfahrt (DLR)), Berlin, Germany, 9-10 Sept, 2010.
26. D. C. Catling, Oxygen and Evolution. *Darwin's Lost World Lecture Series*, Dept. of Earth Sciences, University of Oxford, UK, February 19, 2009.
25. D. C. Catling, The Rise of Oxygen, Swedish Museum of Natural History, Stockholm, Sweden, November 4, 2008.
24. D. C. Catling, Preliminary Results from NASA's Phoenix Lander Mission, University of Washington, Seattle, October 21, 2008.
23. D. C. Catling, Evolution of Atmospheres on Habitable Planets, Harvard University, Radcliffe Institute for Advanced Studies *Symposium on the Origins of Life*, Cambridge, MA, March 7, 2008.
22. D. Catling, Evolution of Earth's Atmosphere. *Geobiology 2008* Graduate Summer School. University of Southern California Wrigley Marine Science Centre on Catalina Island, CA, June, 2008.
21. D. C. Catling, Divergent Fates: Evolution of Early Earth and Early Mars, University of Washington, Seattle, Feb 27, 2008.
20. D. C. Catling, M. W. Claire and K. J. Zahnle, **Keynote**: Archean methane, oxygen and sulfur, *Goldschmidt Geochemistry Conference*, abstract A151, 2007.
19. D. Catling, Methane and Oxygen in Earth's Early Atmosphere, *Discussion Meeting on Trace Gas Biogeochemistry and Global Change*, November 14, 2006. The Royal Society, London.

18. D. Catling, Aqueous geochemistry on Mars. US National Research Council, Washington D.C., May 11, 2006.
17. D. Catling, The Biogeochemistry of Earth's Atmosphere: Bulk and Isotopic Composition, International Institute for Space Studies, Bern, Switzerland, April 24-28, 2006.
16. D. C. Catling, Biogeochemical modeling of the rise of oxygen. *Agouron Conference on Oxygen*, Santa Fe, NM, April 6-10, 2006.
15. D. C. Catling, **Keynote**: "Planetary Habitability". *1st Brazilian Workshop on Astrobiology*. Federal University of Rio de Janeiro, Brazil March 20-21, 2006.
14. D. Catling, Mars and the Phoenix Lander Mission, Space Research Centre, University of Leicester, Leicester, UK, March 7, 2006.
13. D. Catling, Evolution of the surface and atmosphere of Mars, Open University, Milton Keynes, UK, Feb 23, 2006.
12. D. Catling, Evolution of the atmosphere, *Evolution of the Earth Meeting*, Cambridge Philosophical Society, Cavendish Lab, Cambridge, UK, Dec 16, 2005.
11. D. Catling, Oxygen and evolution in the Precambrian, Dept. of Earth Sciences, University of Oxford, UK, December 2, 2005.
10. D. Catling, Earth's Early Atmosphere and Life, University of Washington, Seattle November 15, 2005.
9. D. Catling, The Evolution of the Atmospheres of Earth, Venus and Mars, *Second International Early Mars Conference*, Jackson Hole, Wyoming, October 2004.
8. D. Catling, Understanding Earth's transition to an oxygen-rich atmosphere. *Geobiology 2004* Graduate Summer School. University of Southern California Wrigley Marine Science Centre on Catalina Island, CA, July 17, 2004.
7. D. Catling, Understanding the Evolution of Atmospheric Redox State from the Archaean to the Proterozoic, *Processes on the Early Earth*, *S. Africa Field Forum*, Johannesburg, South Africa, 2004.
6. D. Catling, The Effect of Volcanoes on Atmospheric Chemistry and Climate over the Course of Earth History. *Chapman Conference on Volcanism and the Earth's Atmosphere*, Santorini, Greece, 2002.
5. D. C. Catling. Geochemistry of Sediments on Early Mars. *Workshop on the Martian Highlands and Mojave Desert Analogs*, Barstow, CA, October 20-27, 2001.

4. D. C. Catling and C. P. McKay, **Keynote**: Aqueous iron chemistry on early Mars: Was it influenced by life? *Goldschmidt 2000 Geochem. Conf.*, Sept 3-8, 2000, Oxford, UK, *J. Conf. Abstracts* **5**, 291.
3. D. Catling, The co-evolution of atmospheric oxygen and life, University of California at Santa Cruz, CA, May 2004.
2. D. Catling, Biogenic Methane, Hydrogen Escape, and the Rise of Oxygen on Early Earth, at The New York Centre for the Origin of Life, Rensselaer Polytechnic Institute, 2001.
1. D. Catling, Live Fast, Die Young, and Leave a Red Corpse: The Evolution of the Planet Mars, University of Washington Astrobiology Seminar, Seattle, 2000.

SUMMER/ WINTER SCHOOLS, SHORT COURSES

- February, 2017 **Invited** lecturer, *Molecules in Astrophysics and Astrobiology*, February 13-17, 2017, Zurich, Switzerland, for graduate students and postdocs.
- June-July, 2016 **Invited** lecturer, *Kavli Summer Program in Astrophysics: Exoplanet Atmospheres*. University of California at Santa Cruz.
- February, 2016 **Invited** lecturer, NExSS (NASA Nexus for Exoplanet System Science) Winter School, Biosphere 2, Oracle, Arizona.
- November, 2014 **Invited** faculty participant, *Reaching the Limits of the Sky: Astronomical Instrumentation in the 21st Century*, University of Heidelberg Center for Latin America, Santiago, Chile.
- September, 2014 **Invited** lecturer for the *First Brazilian Astrobiology School*, National Observatory, Rio de Janeiro, Brazil. The course was attended by ~50 graduate students.
- June-July, 2010 **Invited** lecturer and tutor for a European Science Foundation short course entitled “*Analyzing the Archean*” (28 June – 1 July, Utrecht, The Netherlands). The course was attended by 29 graduate students and 9 postdocs from around the world.
- 2004, 2008 **Invited** lecturer, *Geobiology Summer School*, U. Southern California, Catalina Island, CA.

OUTREACH AND PUBLIC UNDERSTANDING OF SCIENCE

I have volunteered considerable time in helping major news organizations (e.g., NPR, PBS, BBC) in their science reporting. I am particularly happy to help TV/radio producers or

reporters with fact-checking and scientific advice. Since 2002, such activities for public awareness of science through international media, include:

54. April, 2017 – Answered queries from Tracy Watson, writing for *USA Today*, about possible life on Enceladus
53. August, 2016 – Answered queries from Oliver Morton of *The Economist* on the implications of the discovery of exoplanet, Proxima Centauri-b.
52. Jan, 2016 - Answered scientific queries for Robert MacAndrew, Story Producer for National Geographic TV's "One Strange Rock", celebrating life on Earth
51. Nov, 2015 – talked to Natalie Wolchover, a reporter for *Quanta Magazine*, about the history of life and association with atmospheric oxygen
50. Sept, 2015 – talked to Adam Frank about successes of climate science on other planets. <http://www.npr.org/sections/13.7/2015/09/10/438913284/the-climate-story-nobody-talks-about>
49. May, 2015 – answered science questions for Jane Teeling, Assistant Producer for PBS Nova “Life’s Rocky Start”. This show aired in January, 2016. <http://www.pbs.org/wgbh/nova/earth/life-rocky-start.html>
48. March, 2015 – talked to Nina Shapiro, a reporter at *Seattle Weekly*, to help with background info for a feature article about human missions to Mars. <http://www.seattleweekly.com/home/957816-129/a-would-be-martian-signs-up-to>
47. Oct 14, 2014 -- public presentation "Astrobiology: Life in its Cosmic Context", Science Cafe, Olympia, WA.
46. Oct 6, 2014 -- in conversation at UW bookstore with Caleb Scharf concerning his new book, *The Copernicus Complex*
45. Jan, 2014: Presentation for Lynnwood Rotary Club, Seattle on "Astrobiology and Early Earth".
44. Fact-checked popular book manuscript by Yoram Bauman about climate change ("Cartoon Introduction to Climate Change").
- 43: Dec, 2013: Talked to *LA Times* journalist Amina Khan, at length about latest results from NASA's Curiosity rover. <http://www.latimes.com/science/la-sci-mars-life-20131210,0,2384378.story>
- 42: May 2, 2013: Talked to journalist Carl Franzen, about habitability of exoplanets. <http://www.theverge.com/2013/5/2/4294156/habitable-zone-should-be-extended-scientists-say>
- 41: March, 2013: Live interview on "Weekday" Seattle Public Radio (KOUW/ NPR) about life on Mars and astrobiology
- 40: November, 2012: Talked to Bruce Dominey (journalist at *Forbes Magazine*) about an article on advanced life on other planets and oxygen-rich atmospheres (<http://www.forbes.com/sites/brucedorminey/2012/11/20/why-e-t-would-also-breathe-oxygen/2/>)
- 39: November, 2012: Talked to Bruce Dominey (journalist at *Forbes Magazine*) about an article concerning life on Mars. (<http://www.forbes.com/sites/brucedorminey/2012/11/15/5-reasons-mars-may-never-have-seen-life/>)
39. June, 2012: Briefed Dick Kerr (*Science* magazine) about methane on Mars and Curiosity Rover (<http://www.sciencemag.org/content/336/6088/1500.full>)

38. June, 2012: Contributed to *Conservation Quarterly*, published by the Ascension Island Government concerning past terraforming of the island.
37. Mar, 2012: Briefed *PBS Newshour* about research on raindrop imprints from 2.7 Ga published in *Nature*. (<http://www.pbs.org/newshour/rundown/2012/03/what-a-cake-pan-hairspray-taught-us-about-earths-ancient-atmosphere.html>)
36. Sept, 2011: Briefed Dennis Overbye, *New York Times*, about the biosphere and atmosphere on the early Earth
35. June, 2011: Briefed *BBC TV* on science background about the co-evolution of the atmosphere and life for developing a 5-part "*Wonders of Life*" TV Series.
34. Dec, 2010 Provided input for journalist Oliver Morton concerning an article in *The Economist* about the atmosphere of Mars (<http://www.economist.com/node/17797286>).
33. Aug 25, 2010: Talked to Diogo Bercito of *Folha de S.Paulo* (largest circulation newspaper in Brazil) concerning an article on the prevalence of life in the universe
32. May, 2010: Interviewed by John Matson of *Scientific American* about carbonates on Mars. (<http://www.scientificamerican.com/article.cfm?id=water-mars-carbonate>)
31. Sept 9, 2009: Advised and fact-checked for *BBC TV* on a major BBC TV series *Wonders of Solar System*.
30. Sept 11, 2008: Interviewed for *Chemistry World* magazine concerning water on Mars.
29. July 24, 2008: *BBC Radio 4*, live interview on "The Material World" about Mars exploration.
28. June 22, 2008: Quoted in UK *Mail on Sunday* newspaper "NASA water discovery on Mars gives hope of possible life"
27. June 13, 2008: Quoted in UK *The Sun* newspaper story "Ice on Mars"
26. May 29, 2008: *BBC Wales Radio*; interviewed about Mars
25. May 28, 2008: Interviewed on *BBC TV* "Points West" program, re: Phoenix Mars Lander
24. May 26, 2008: Quoted in the UK *Daily Express* "NASA Celebrates as Phoenix Probe lands on Mars"
23. May 19, 2008: Interviewed on "Science Weekly" podcast for *The Guardian* concerning life on Mars
22. May 11, 2008: Featured in UK *Sunday Telegraph* article "Return to the red planet"
21. Jan 29, 2008: Interviewed for BBC Radio 4's *Leading Edge* about Mars exploration, broadcast on April 10, 2008.
20. Aug 4, 2007: Interviewed for *The Guardian*, for an article about the Phoenix Mars Lander: <http://www.guardian.co.uk/science/2007/aug/04/sciencenews.spaceexploration>
19. July 27, 2007: Interviewed by *Original Radio* 106.5FM for the 27 July morning show.
18. July 27, 2007: Interviewed for by the *Bristol Evening Post* for an article about the Phoenix Mars Lander
17. July 5, 2007: Interviewed for *New Scientist* article about early Mars (<http://space.newscientist.com/article/dn12202-more-doubt-cast-on-warm-wet-early-mars.html>)
16. March 20, 2006: Interviewed by *Scientific American Brasil* about astrobiology.
15. August 10, 2006: Interviewed for U.S. *National Public Radio* for a story entitled "Mars mania led to the discovery of Pluto".
<http://www.npr.org/templates/story/story.php?storyId=5630660>

14. Nov 10, 2005: Public lecture in Bristol, UK: "From the origin of life to planet-sized Snowballs: The climate of early Earth". Organised in cooperation with the Public Programmes Office, University of Bristol.
13. Nov 8, 2005: Interviewed by Boris Bellanger for an article in *Science & Vie* (Paris, France) about "Snowball Earth"
12. Oct 2005: Error-checked a manuscript for a popular book on photosynthesis and life ("*Eating the Sun: How Plants Power the Planet*" published by Fourth Estate, 2007) by Oliver Morton.
11. Sept 1, 2005: interviewed by Pierre Grumberg for an article in Parisian publication *Science & Vie* about oxygen in the Earth's atmosphere
10. 22 June, 2005: My research on the evolution of atmospheric oxygen and importance for complex life was featured in the national UK newspaper, *The Guardian*, "Aliens would need abundant oxygen, research shows"
9. April 7, 2005: Interviewed by Gabrielle Walker for BBC Radio 4's "*An Earth Made for Life*" series.
8. April 21, 2004: Public talk, "The Evolution of Mars" for the Seattle Astronomical Society
7. March 17, 2004: Interviewed by Robert Burnham for an article in *Astronomy Magazine* concerning Martian tropics.
6. Jan 27, 2004: Live on U.S. National Public Radio's *Talk of the Nation* with Neil Conan, for a program about Mars: science, history, and public perceptions.
5. July 2003: Filmed and interviewed by U.S. *Public Broadcasting System* (PBS) TV for the *Space Millennium* documentary series.
4. Feb 2003. Guest for live phone-in show on CBS KIRO radio Seattle, concerning the Columbia Space Shuttle disaster and the future of NASA's space programme
3. Jan 4, 2003: Interviewed by physicist Prof. Paul Davies for *The Science Show* ABC (Australian public network) radio (Transcript: <http://www.abc.net.au/rn/science/ss/stories/s752996.htm>)
2. July, 2002: Solar system science presentation to schoolchildren at Waterfall School, Sydney, Australia
1. Jan 29, 2002. Interviewed for U.S. National Public Radio's *Earth and Sky* on atmospheric methane.

TEACHING EXPERIENCE

Teaching achievements

Developing courses in emerging interdisciplinary areas (e.g., geobiology, climate change, and planetary sciences), to bring the excitement of discovery and new research to undergraduates and graduates. The purpose has been to place fundamental principles into the larger context of real-world unsolved problems. At Univ. of Washington, a major success was helping to develop an Astrobiology graduate curriculum for Ph.D. students doing a Ph.D. in a traditional subject, such as Microbiology or Astronomy, but also gaining an additional postgraduate certificate in Astrobiology. In 2011, this moved to a dual title PhD.

Courses taught (2001-present) include:

At University of Washington, 2009-present, 2001-2005

- Astrobiology Disciplines (graduate)
- Astrobiology Special Topics (graduate)
- Planetary Atmospheres (graduate)
- Planetary Sciences and Astrobiology (upper level undergraduate)
- Astrobiology: Life in the Universe (lower level undergraduate)
- Geoscience Communication (upper level undergraduate)
- Instruments and Observations in Atmospheric Sciences (undergraduate)
- Climate and Climate Change (undergraduate)

At University of Bristol, 2005-2009

- Earth System Science MSc, contributed lectures (graduate)
- Biogeochemistry (undergraduate)
- Geobiology (undergraduate)
- Global Environmental Change (undergraduate)

2000 Teaching water physics and hydrology to NASA *Astrobiology Academy* students. Supervised student project on the behaviour of water in porous rocks with applications to Mars and extreme dry environments on Earth.

1998 Teaching laboratory techniques and scientific methods to NASA summer interns. Supervised undergraduate insect respiration experiments. (Cockell et al., 1999)

Undergraduate researcher mentorship

I am happy to have mentored undergraduates who have gone to successful training in other institutions and/or productive jobs.

	Undergraduate researcher	Subsequent path or position
2013	Sean Halbert (UW)	graduated Univ. of Washington
2010	MacKenzie Day (UW intern from Caltech)	PhD at U. Texas
2009,2010	David Bergsman (@UW)	PhD student, Stanford University
2007-2008	Meelis Lootus (@Univ. of Bristol)	Quantitative analyst in finance. After D.Phil. Oxford.
2004-2005	Christopher Glein (@Univ. of Washington)	Scientist, Southwest Research Institute
2004	Carie Frantz (@Univ. of Washington)	Assistant Prof., Weber State.
2002-2004	Elliot Ginder (@Univ. of Washington)	Assistant Prof., Hokkaido Univ., Japan
2003-2004	Charlie Barnhart (@Univ. of Washington)	Assistant Prof., Western Washington U. (after PhD at UC Santa Cruz)
2003-2004	Cindy Peacock (@Univ. of Washington)	Chemist, NOAA
2001	Joannah Metz (@ NASA Ames)	Industry after Caltech PhD.
2000	Carol Paty (@ NASA Ames)	Associate Prof., Georgia Tech (after PhD at UW).
1997	Hillary Waites (@ NASA Ames)	Attorney, specializing in Climate Change issues, Santa Clara, CA

Graduate student advising and mentorship:

Time	Advising role	Student (Institution)	Thesis title/area	Subsequently
2016-	Co-Chair	Erik Goosmann (UW)	Early Earth	N/A
2015-	Chair	Owen Lehmer (UW)	Planetary atmospheres and habitability	In NASA Pathways Program for post-PhD as NASA Ames scientist
2015-	Co-Chair	Lauren O'Neill (UW)	Mars-2020 PIXL	N/A
2013-	Chair	Steven Sholes (UW)	Global Habitability of Environments on Past Mars (PhD expected 2018-9)	N/A
2013-	Chair	Josh Krissansen-Totton (UW)	Planetary atmospheres and life (PhD expected 2018)	N/A
2010-2015	Chair	Megan Smith (UW)	"Photochemical modeling of the atmospheres of early Mars and early Earth" (MS, 2015)	Staff, Aerospace Corporation, CA
2006-2010	Chair	Elliot Sefton-Nash (U. Bristol)	"Water-altered mineralogy and landforms in the equatorial region of Mars" (2010)	Staff scientist, European Space Agency.
2004-2010	Chair, 2004-5*	Sanjoy Som (UW)	"Investigating the Early Atmospheres of Earth and Mars through Rivers, Raindrops, and Lava Flows" (2010)	Research scientist, Blue Marble Space/ NASA Ames Research Center, CA
2002-2008	Chair	Mark Claire (UW)	Quantitative modeling in the rise of atmospheric oxygen (2008)	Research Fellow, St. Andrews University, Scotland, 2013- Lecturer, Univ. of East Anglia, UK, 2011-12
1998-2001	Mentor**	J. Kurth Reynolds (Stanford)	A piezoresistive pressure sensor to measure low absolute pressures over a wide sub-zero temperature range (2001)	Synaptics Inc., CA (Human Interface technology)
2016-	Committee Member	Michael Kipp (UW)		N/A
2015-	Committee Member	Matthew Koehler (UW)	The co-evolution of Earth's nitrogen cycle and surface redox conditions	N/A
2016-	Committee Member	Paul Kintner (UW)		N/A
2015-	Committee Member	Rodrigo Luger (UW)		N/A

2016-	Committee Member, GSR	Marshall J. Styczinski (UW)		N/A
2013-	Committee (reading) Member	Elena Amador (UW)	Characterizing Habitable Environments on Mars Using Infrared Spectroscopy from Orbit	Postdoc, Caltech
2013-2016	Committee (reading) Member	Edward Schwieterman (UW)	Exploring Habitability Markers, Biosignatures, and Their False Positives Using Spectral Models of Exoplanets	NASA postdoc, UC Riverside
2015	Committee Member, GSR	Isaac Backus (UW)		
2015	Committee Member, GSR	Jonathan Craig (UW)		
2014	Committee Member, GSR	Myron Grover (UW)		
2009-2014	Committee (reading) Member	Eva Stuekken (UW)	Precambrian selenium isotopes	Research fellow, St. Andrews Univ.
2009-2012	Committee (reading) Member, Rotation advisor	Tyler Robinson (UW)	“Simulating and characterizing the Pale Blue Dot”	NASA Sagan Fellow, UC Santa Cruz
2011	Committee (reading) Member	Amit Misra (UW)	“The effects of refraction and forward scattering on exoplanet transmission spectroscopy”	PhD 2014. Job at Microsoft.
2010	Committee Member	Jon Bapst (UW)	Response of subsurface water ice to orbital cycles on Mars	N/A

*Transferred role of Chair when I went overseas to Bristol, UK, but remained active on his committee.

**Kurth worked full-time in my lab at NASA Ames for much of his PhD using my equipment.

Other Graduate Student Activities:

2017 External examiner for Sukrit Rajan for the award of Ph.D. from Harvard.
Thesis: “*The UV Environment for Prebiotic Chemistry: Connecting Origin-of-Life Scenarios to Planetary Environments*”

2006 Examiner for Emma Leighton for the award of Ph.D. from Univ. of Bristol.
Thesis: “*Early Life on Earth: the Microbial Fractionation of Iron Isotopes*”.

- 2006 Examiner for Helen Bowes for the award of Ph.D. from the Univ. of Bristol. Thesis: “*The influence of methanogenic pathways on the stable isotope composition of methane emission from wetlands*”
- 1996 Teaching instrument design to grad students at Stanford University Space Systems Development Laboratory.

Postdoc advising

- 2017- MaKenzie Day will arrive in July 2017 as a NASA Postdoctoral Fellow.
- 2014-2016 Dr. Benjamin Charnay (U. Washington co-advisor) doing GCM simulations of exoplanet atmospheres and the atmosphere of early Earth.
- 2012- Dr. Jon Toner (U. Washington) employed on a NASA grant to study salts relevant to exploration of the surface of Mars, then started a NASA Postdoctoral Fellowship with me as advisor from 2014, and transitioned to grant funding after the fellowship.
- 2009-2011 Dr. Phil Pogge von Strandmann (U. of Bristol) was employed on a UK grant that I obtained for examining Se isotopes in Neoproterozoic shales. Phil is now a lecturer at University College, London.
- 2005-2008 Co-advisor (with Prof. Roger Buick) of Dr. Julian Foriel who worked on sulfur isotope measurements and initial set-up of selenium isotope measurements for graduate student Eva Stueeken. After employment as at Washington Univ., St. Louis, he is now Earth history and geochemistry lab manager at the Earth-Life Science Institute, Tokyo Institute of Technology.

Contribution to Continuing Education

At University of Washington, mature students (working adults) have commonly enrolled for my classes, incl. *Planetary Sciences and Astrobiology*, *Astrobiology Disciplines*, and *Planetary Atmospheres*.

Collaborative Teaching

The Astrobiology Program at the University of Washington -- a collaborative teaching program between staff from 8 different departments.

At the University of Bristol, *Geobiology* course -- a collaborative teaching effort between Earth Sciences and organic chemists in the Dept. of Chemistry.

CONFERENCE PRESENTATIONS AND CONTRIBUTIONS

116. Toner J. D., and Catling D. C. Chlorate salts and the potential for liquid water on Mars. *Astrobiology Science Conference 2017*, Abstract #3645, 2017.
115. Krissansen-Totton, J., Olson, S., Catling, D. C., Atmospheric disequilibrium biosignatures on earth through time, *Astrobiology Science Conference*, abstract #3104, 2017.
114. Sholes S. F., Krissansen-Totton J., and Catling D. C. How many blue whales on

- Mars? Obtaining a maximum extant martian biomass using CO antibiosignatures. *Astrobiology Science Conference 2017*, Abstract #3189, 2017.
113. O'Neil L. P., Catling D. C., and Elam W. T. Extending anticipated Mars 2020 rover capabilities through modeling of x-ray scattering ratios. *Astrobiology Science Conference 2017*: Abstract #3229, 2017.
 112. Lehmer, O. R., Catling, D. C. Early hydrodynamic escape limits rocky planets to ≤ 1.6 Earth radii, *Astrobiology Science Conference*, abstract #3068, 2017.
 111. Korycansky, D. G., Catling, D. C. and Zahnle, K. J. Planetary impacts and escape. *48th Lunar Planet. Sci. Conf.*, abstract #1387, 2017b.
 110. Korycansky, D. G., Catling, D. C., Zahnle, K. J. Atmospheric erosion by planetary impacts. *48th Lunar and Planetary Science Conference*, abstract 1356, 2017a.
 109. Sholes, S. F., Catling, D. C., Montgomery, D. R. Quantified identification of paleoterraces along a proposed martian ocean contact, *48th Lunar and Planetary Science Conference*, abstract 1764, 2017.
 108. Krissansen-Totton, J., Catling, D. C., Continental and seafloor weathering in the global carbon cycle: Inverse modeling and implications for the Precambrian. abstract PP22b-043, *AGU Fall Meeting*, San Francisco, CA, 2016.
 107. Toner, J. D., Catling, D. C. The formation of liquid water on present-day Mars: Calcium-magnesium chloride brines in the Antarctic dry valleys as a Mars analog, *Sixth International Conference on Mars Polar Science and Exploration*, 5-9 September, Reykjavik, Iceland, abstract 6005, 2016.
 106. Korycansky, D. G., Catling, D. C., Zahnle, K. J. Atmospheric erosion by planetary impacts. *47th Lunar and Planetary Science Conference*, abstract 1903, 2016.
 105. Catling, D. C., Zahnle, K. J., Stability of oceans against escape on warm Ganymedes and Callistos around giant planets in the habitable zone, *Astrobiology Science Conference*, #7431, 2015.
 104. Krissansen-Totton, J., Bergsman, D. S., Catling, D. C. On detecting biospheres from chemical disequilibrium in planetary atmospheres, *Astrobiology Science Conference*, #7084, 2015.
 103. Krissansen-Totton, J., Catling, D. C., A statistical analysis of the carbon isotope record from the Archean to Phanerozoic and implications for atmospheric oxygen, *Goldschmidt Conference*, Abstract # 1324, 2014.

102. Catling, D. C., Bergsman, D. S. Chemical disequilibrium in planetary atmospheres as a way to look for life or its absence, *Goldschmidt Conference*, Abstract # 3455, 2014.
101. Catling, D. C., Claire, M. W., Zahnle, K. J., Waiting ages for atmospheric oxygen: A titration hourglass and the oxidation of the solid Earth (invited). *AGU, Fall Meeting 2013*, abstract # V41E-02.
100. Robinson, T. D., Catling, D. C., A ~0.1 bar Rule for Tropopause Temperature Minima in Thick Atmospheres of Planets and Large Moons, *AGU, Fall Meeting 2013*, abstract #A23B-0227.
99. J. Toner, D. C. Catling, B. Light. Experimental evidence for supercooled brines, viscous liquids, and low temperature perchlorate glasses on Mars *AGU, Fall Meeting 2013*, abstract #P23F-1853.
98. Tripathi, A., Beerling, D., Bristow, T., Campbell, K., Catling, D. C., Reinhard, C., Rohrsen, M., Sample, J. C. From wetlands to sauropods (?) and cold seeps: New perspectives on methane cycling in the Phanerozoic, *AGU, Fall Meeting 2013*, abstract #U33A-02.
97. Catling, D. C., Smith, M. L., Claire, M. W., Zahnle, K. J., Atmospheric chemistry of nitrogen on Mars: A link between oxidants in the soil and chlorine cycling? *European Planetary Science Congress*, vol. 8, EPSC2013-792, 2013.
96. Catling, D. C. A framework for understanding the first and second rises of O₂. *Goldschmidt Conference*, Abstract # 842, 2013.
95. Catling, D. C., Robinson, T. D. Atmospheric chemistry and radiation in the Solar System as Guides to Exoplanet Atmospheres. *Chapman Conference: Crossing Boundaries in Planetary Atmospheres: From Earth to Exoplanets*, Annapolis, MD, June 24-28, 2013.
94. Robinson, T. D., Catling, D. C., Explanation of a "0.1 bar Tropopause Rule" in Thick Atmospheres of Planets and Large Moons, *44th Lunar and Planetary Science Conference*, abstract 3083, 2013.
93. Zahnle, K. J., Catling, D. C., The cosmic shoreline, *44th Lunar and Planetary Science Conference*, abstract 2787, 2013.
92. Catling, D. C., Zahnle, K. J., An Impact Stability Limit Controlling the Existence of Atmospheres on Exoplanets and Solar System Bodies, *44th Lunar and Planetary Science Conference*, abstract 2665, 2013.

91. Toner, J. D., Catling, D. C., Light, B., Experimental Formation and Persistence of Metastable Aqueous Salt Solutions on Mars, *Present-day Habitability of Mars Workshop*, UCLA, Feb 2013.
90. Catling, D. C., Smith, M., Claire, M. W., Zahnle, K. J., Formation of perchlorate on Mars, *Present-day Habitability of Mars Workshop*, UCLA, Feb 2013.
89. Toner, J. D., Catling, D. C., Light, B. Reanalysis of Wet Chemistry Laboratory data with implications for parent salt assemblages at the Phoenix site, *3rd Conference on Early Mars*, abstract 1639, 2013.
88. Catling, D. C., Leovy, C. B., Wood, S. E., Day, M. D. Does the Vastitas Borealis Formation Contain Oceanic or Volcanic Deposits? *3rd Conference on Early Mars*, abstract 7031, 2012.
87. Light, B., Tang, C., Catling, D. C. Laboratory simulation of low-temperature hydrated salt crystals relevant to water on Mars, *3rd Conference on Early Mars*, abstract 7064, 2012.
86. Catling, D. C., Zahnle, K. J., Claire, M. W. What caused the 2.4 Ga rise of oxygen? *Goldschmidt Conference*, 2012.
85. G. M. Marion, D. C. Catling, J. Crowley, J. S. Kargel. Sulfite-Sulfide-Carbonic Equilibria on Earth and Mars, *43rd Lunar and Planetary Science Conference*, abstract 1659, 2012.
84. D. C. Catling, K. J. Zahnle, Atmospheric escape, redox evolution, and planetary habitability, *AGU Fall Meeting*, abstract #P24B-03, 2011.
83. Smith, M., Catling, D. C., Claire, M., Zahnle, K. J., Atmospheric formation of perchlorate on Mars, *AGU Fall Meeting*, abstract #P13A-1655, 2011.
82. S. M. Som, D. C. Catling, R. Buick. Earth's early atmospheric density revealed from Archean raindrop imprints, *Goldschmidt Conference*, p. 1907, 2011.
81. P. A. E. Pogge von Strandmann, T. Elliott, D. Catling, S. W. Poulton, Se isotope evidence for atmospheric oxidation ~0.6 Ga. *Goldschmidt Conference*, p. 1651, 2011.
80. Catling, D. C., Causes and Consequences of the Great Oxidation Event, *Life and the Planet: New Perspectives in Earth System Science*. The Geological Society, London, p.9 (abstract volume), 2011. (Invited).
79. Catling, D. C., Leovy, C. B., Wood, S. E., Day, M. D. A lava sea in the northern plains of Mars: Circumpolar Hesperian oceans reconsidered. *42nd Lunar and Planetary Science Conference*, abstract 1957, 2011.

78. K. J. Zahnle, R. S. Freedman, D. C. Catling. Is there methane on Mars? Part II. *42nd Lunar and Planetary Science Conference*, abstract 2427, 2011.
77. G. M. Marion, J. S. Kargel, D. C. Catling, Lunine, J. I. Modeling ammonia-ammonium chemistries in the outer planet regions, *42nd Lunar and Planetary Science Conference*, abstract 1220, 2011.
76. Claire, M., Sheets, J., Cohen, M., Ribas, I., Catling, D. C., The evolution of the solar flux: Quantitative estimates for planetary studies, *Bulletin of the American Astronomical Society*, Vol. 43, #113.07, 2011.
75. Kuiper, T. B. H., Majid, W. A., Bower, G., Catling, D., Garcia Miro, C., Martinez, S., de Pater, I., Renno, N. O., Ruf, C. Siemion, A., Monitoring Mars for Electrostatic Discharges with the DSN, *Bulletin of the American Astronomical Society*, Vol. 42, p.1029, 2010.
74. Claire, M., Catling, D. C., Cohen, M. The evolution of solar flux from 2nm to 160 microns: Quantitative estimates for planetary studies, *Bulletin of the American Astronomical Society*, Vol. 41, p.433, 2010.
73. D. C. Catling and D. S. Bergsman, On Detecting Exoplanet Biospheres from Atmospheric Chemical Disequilibrium, *Astrobiology Science Conference*, April 26-20, 2010, League City, TX . LPI Contribution No. 1538, p.5533
72. E. Sefton-Nash and D. C. Catling, An Integrated Study of Light-toned Layered Outcrops (LLOs) in Iani Chaos, *41st Lunar and Planetary Science Conference*, abstract 1957, 2010.
71. K. J. Zahnle, R. S. Freedman, D. C. Catling. Is there methane on Mars? *41st Lunar and Planetary Science Conference*, abstract 2456, 2010.
70. G. M. Marion, J. S. Kargel, J. K. Crowley, D. C. Catling, Modeling Hydrothermal Systems on Mars, *41st Lunar and Planetary Science Conference*, abstract 1393, 2009.
69. S. P. Kounaves, M. H. Hecht, J. Kapit, R. C. Quinn, D.C. Catling, B. C. Clark, D. W. Ming, et al., Soluble sulfate in the Martian soil at the Phoenix landing site, Confirmation of Soluble Sulfate at the Phoenix Landing Site: Implications for Martian Geochemistry and Habitability, *41st Lunar and Planetary Science Conference*, abstract 2199.
68. P. Withers. D. Catling. Preliminary reconstruction of martian atmospheric structure from Phoenix entry measurements, *AGU, Fall Meeting 2009*, abstract #P54B-08.

67. M. W. Claire, D. C. Catling, K. J. Zahnle, Atmospheric Production of Perchlorate on Earth and Mars, *AGU, Fall Meeting 2009*, abstract #P51D-1160.
66. D. C. Catling, D. C.; Claire, M. W.; Zahnle, K. J.; Quinn, R. C.; Clark, B. C.; Hecht, M. H.; Kounaves, S. P., Perchlorate Origins in the Atacama and on Mars. *The New Martian Chemistry Workshop*, held July 27-28, 2009 in Medford, Massachusetts. LPI Contribution No. 1502, p.7
65. Catling, D. C., Claire, M. W., Quinn, R. C., Zahnle, K. J., Clark, B. C., Kounaves, S.; Hecht, M. H. Possible atmospheric origins of perchlorate on Mars, *40th Lunar and Planetary Science Conference*, abstract 2420, 2009.
64. Hecht, M. H., Catling, D. C., Clark, B. C., Deflores, L., Gospodinova, K., Kapit, J., Kounaves, S. P., Ming, D. W., Quinn, R. C., West, S. J., Young, S. M. M. Perchlorate in Martian soil: Evidence and Implications. *40th Lunar and Planetary Science Conference*, abstract 2420, 2009.
63. Kounaves, S. P., Catling, D., Clark, B. C., Deflores, L., Gospodinova, K., Hecht, M. H.; Kapit, J.; Ming, D. W., Quinn, R. C., Phoenix Science Team. *40th Lunar and Planetary Science Conference*, abstract 2489, 2009.
62. Fisher, D. A., Hecht, M. H., Kounaves, S., Catling, D. C., Perchlorate Found by Phoenix Could Provide a Mobile Brine Sludge at the Bed of Mars Northern Ice Cap that Would Allow Flow with Very Low Basal Temperatures: Possible Mechanism for Water Table Re-Charge, *40th Lunar and Planetary Science Conference*, abstract 2281, 2009.
61. Stoker, C. R., Archer, P. D., Catling, D., Clark, B., Marshall, J., Smith, P., Young, S., Phoenix Science Team, The Habitability of the Phoenix Landing Site: A Comparative Assessment. *40th Lunar and Planetary Science Conference*, abstract 2082, 2009.
60. G. M. Marion, D. C. Catling, Claire, M., Zahnle, K. J., Modeling Aqueous Perchlorate Chemistries with Applications to Mars, *40th Lunar and Planetary Science Conference*, abstract 1959, 2009.
59. Sefton-Nash, E., Catling, D. C., Wood, S. E., Developments in Deriving Best-Fit Thermal Inertia of the Surface of Mars Using THEMIS Images. *40th Lunar and Planetary Science Conference*, abstract 1773, 2009.
58. C. Stoker, D. Blaney, M. Hecht, D. Catling, W. T. Pike, M. Mellon, S. Kounaves, Lemmon, M. Possible segregated ice at the Phoenix landing site: Was liquid water involved? *EOS Trans. AGU* 89(53), Fall Meet. Suppl., Abstract, U11B-008.
57. Noe Dobrea, E. Z., Moore, J., Howard, A., Catling, D., Grant, J. Spectral and geomorphic evidence for a past inland sea in Eridania Basin, Mars, *Eos Trans. AGU*, 89(53), Fall Meet. Suppl., 2008, abstract #P32B-03.

56. Fisher, D. A., Hecht, M. H., Kounaves, S., Catling, D. C., Effects of deliquescent salts in soils of polar Mars on the flow of the Northern Ice Cap. *Eos Trans. AGU*, 89(53), Fall Meet. Suppl., abstract #U11B-0019
55. Catling, D. C. Atmospheric structure from Phoenix atmospheric entry data. *Eos Trans. AGU*, 89(53), Fall Meet. Suppl., abstract #U11B-0017.
54. M. W. Claire, D. C. Catling, K. J. Zahnle. The great collapse of methane: Rethinking the rise of oxygen, *Geochim Cosmochim. Acta*, 72(12), Suppl. 1, A166, 2008.
53. E. Sefton-Nash, D. C. Catling. Hematitic concretions at Meridiani Planum, Mars: Their growth timescale and probable sourcing of iron from iron sulfates. *39th Lunar and Planetary Science Conference*, abstract 1249, 2008.
52. M. W. Claire, D. C. Catling, K. J. Zahnle. A very weakly reducing atmosphere prior to the rise in atmospheric oxygen. *Eos Trans. AGU*, 88(52), Fall Meet. Suppl., Abstract PP21A-06, 2007.
51. G. M. Marion, J. S. Kargel, D. C. Catling, Br/Cl partitioning in halite and hydrohalite on Mars, *Eos Trans. AGU*, 88(52), Fall Meet. Suppl., Abstract P21A-0223, 2007.
50. D. C. Catling, M. W. Claire and K. J. Zahnle, Archean methane, oxygen and sulfur, *Goldschmidt Geochemistry Conference*, abstract A151, 2007.
49. M. W. Claire, D. C. Catling and K. J. Zahnle, Sulfate, methane and the rise in atmospheric oxygen, *Goldschmidt Geochemistry Conference*, abstract A176, 2007.
48. D. C. Catling. Microbes in Archean Sediments and the Archean Atmosphere, *European Science Foundation Workshop on Archean Oceans*, Nerva, Spain, April 12-14, 2007.
47. S. E. Wood, Schneider, M. A., Cardell, G., Hecht, M., Knowlen, C., Bruckner, A. P., Catling, D. C., Cobos, D., Zent, A. Characterization and Calibration of the Phoenix TECP Relative Humidity Sensor in a Mars Atmospheric Simulation Chamber, *4th International Conference on Mars Polar Science and Exploration*, October 2-6, 2006, Davos, Switzerland. LPI Contribution No. 1323, p.8080.
46. D. C. Catling, Biogeochemical modeling of the rise of oxygen. *Agouron Conference on Oxygen*, Santa Fe, NM, April, 2006.
45. G. M. Marion, D. C. Catling, J. S. Kargel, Modelling ferrous/ferric iron chemistry with application to Martian surface geochemistry, *37th Lunar and Planetary Science Conference*, March 13-17, 2006, League City, Texas, abstract no.1898

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