

# Kevin McGouldrick

Research Scientist, Ph.D.

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## Education

- Philosophiæ Doctor (Ph.D.)**, Astrophysical, Planetary, and Atmospheric Sciences, 2007  
University of Colorado Boulder  
Subject of the dissertation: Microphysics and Radiative-Dynamical Feedback in the Near Infrared Brightness Features in the Venus Clouds. Supervisor: Owen Brian Toon
- Master of Science (M.S.)**, Astrophysical, Planetary, and Atmospheric Sciences, 2002  
University of Colorado Boulder
- Bachelor of Science (B.S.)**, Astronomy and Astrophysics, The Pennsylvania State University, 1999
- Bachelor of Science (B.S.)**, Physics, The Pennsylvania State University, 1999

## Work Experience

- Research Scientist III**, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Boulder, CO 2021–  
A “soft money” position, comparable to Full Professor. Primary responsibility is a balanced workload including self-directed research, education through teaching and/or student mentorship, and service to the discipline and the Lab.
- Research Scientist II**, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Boulder, CO 2010–2021  
A “soft money” position, comparable to Assistant Professor. Primary responsibility is sustaining an active and lively research program; secondary responsibilities are education and service, at levels approaching that expected of a Full Professor.
- Planetary Atmospheres Postdoctoral Scholar**, Planetary Science Division, Denver Museum of Nature & Science, Denver, CO 2007–2010  
Primary Responsibility was to complete research projects under the guidance of supervisor Dr. David Grinspoon; secondary responsibilities included content support for the Space Odyssey (Earth and Space Science) exhibits and events.

## Funding Successes (PI-only)

- NASA Akatsuki Participating Scientist Program.** PI: Kevin McGouldrick. *1.00fte/3yr* VCOPSP2019  
“Complementing the Akatsuki mission goals to characterize Venusian clouds and dynamics through microphysical simulations and other spacecraft observations.”
- NASA Solar System Workings Program.** PI: Kevin McGouldrick. *1.00fte/3yr* SSW2015  
“Groundwork for a Coupled Microphysics and Dynamical Model of the Venus Cloud System.”
- NASA Planetary Mission Data Analysis Program.** PI: Kevin McGouldrick. *1.00fte/3yr* PMDAP2013  
“Meteorology of the middle and lower cloud decks of Venus Using VIRTIS/Venus Express.”
- NASA Planetary Atmospheres Program.** PI: Kevin McGouldrick. *0.75fte/3yr* PATM2011  
“A Comprehensive Model of the Venus Cloud System.”
- NASA VCO Participating Scientist Program.** PI: Kevin McGouldrick. *2.83 fte/4yr* VCOPSP2009  
“Combined Theoretical and Observational Multi-Disciplinary Analysis of the Structure and Evolution of the Clouds and Hazes of Venus.” *Funding for the program was withdrawn by NASA after JAXA’s Venus Climate Orbiter (Akatsuki) failed to achieve orbit insertion in December, 2010. But was restored upon successful second attempt at orbit insertion in December, 2015.*

## Teaching Experience: Instructor of Record

**Instructor**, Astrophysical and Planetary Sciences, University of Colorado Boulder Spring 2021  
**ASTR 5835: Seminar in Planetary Science.** 1 credit-hour; 4 such credit hours are a part of the requirements for the graduate degree. Topical Seminar for Graduate Students. This semester, the topic was "Venus Past Discoveries & Future Missions." I served as a co-instructor in this course with Dr. Nick Schneider and Dr. Larry Esposito.

**Instructor**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2015  
**ASTR 5835: Seminar in Planetary Science.** 1 credit-hour; 4 such credit hours are a part of the requirements for the graduate degree. Topical Seminar for Graduate Students. This semester, the topic was "Venus: Looking Forward from Venus Express." This course was co-taught between myself and Dr. Larry Esposito.

**Instructor**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2014  
**ASTR 1030: Accelerated Introductory Astronomy I: Solar System.** 3 credit-hours (plus a required lab). The first part of a two-part survey course for STEM majors covering topics of planetary science (the second part covers topics of Astronomy and Astrophysics beyond the Solar System). A required course for ASTR majors, an optional elective for several other STEM majors.

**Instructor**, Astrophysical and Planetary Sciences, University of Colorado Boulder Spring 2014  
**ASTR 1000: Introductory Astronomy – The Solar System.** 3 credit-hours. A survey course for non-majors covering topics of planetary science with a primary emphasis on developing critical thinking techniques and a secondary emphasis on developing mathematics skills (and comfort level).

**Part-Time Instructor**, Front Range Community College, Westminster, CO Spring 2013  
**PHY105: Conceptual Physics with Lab** 4 credit-hours. A broad survey course covering the majority of topics in the field of Physics, with a primary focus on breadth of coverage, and a secondary focus on hands-on experience through lab activities.

## Teaching Experience: Temp/Substitute/Subordinate

**Instructor**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2020  
**ASTR 5835: Seminar in Planetary Science.** 1 credit-hour; 4 such credit hours are a part of the requirements for the graduate degree. Topical Seminar for Graduate Students. This semester, the topic was "The Planetary Decadal Survey." I served as a supporting instructor in this course led by Dr. David Brain.

**Substitute Lecturer**, Astrophysical and Planetary Sciences, University of Colorado Boulder Spring 2019  
**ASTR 3720: Planetary Atmospheres.** *Instructor of Record: Dr. Nicholas Schneider.* Prepared and delivered a lecture on greenhouse effect and atmospheric loss assessment and mechanisms for a Junior/Senior level class when regular instructor was away at a conference.

**Substitute Lecturer**, Astrophysical and Planetary Sciences, University of Colorado Boulder Spring 2016  
**ASTR 3720: Planetary Atmospheres.** *Instructor of Record: Dr. Nicholas Schneider.* Prepared and delivered two lectures on Radiative Transfer and Atmospheric Structure (with focus on Venus, of course ;-)) for a Junior/Senior level class when regular instructor was away at a conference.

**Substitute Lecturer**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2011  
**ASTR 3750: Planets, Moons, and Rings.** *Instructor of Record: Dr. Larry Esposito.* Prepared and delivered a lecture on Venus atmosphere for a Junior/Senior level class when regular instructor was away at a conference.

**Substitute Lecturer**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2010  
**ASTR 3750: Planets, Moons, and Rings.** *Instructor of Record: Dr. Larry Esposito.* Prepared and delivered a series of three lectures on Mercury and Venus for a Junior/Senior level class when regular instructor was away at a conference.

**Lab and Lecture TA**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2003  
**ASTR 1030: Accelerated Introductory Astronomy I: Solar System** *Instructor of Record: Dr. Ted Snow.* Instructor for once-weekly meetings of a section of accelerated Intro Astronomy (for majors); also prepared a lecture on Venus, the greenhouse effect, and loss of water.

**Lab and Lecture TA**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 2002

**ASTR 1030: Accelerated Introductory Astronomy I: Solar System** *Instructor of Record: Dr. Bob Ergun*. Instructor for once-weekly meetings of a section of accelerated Intro Astronomy (for majors).

**Lecture TA**, Astrophysical and Planetary Sciences, University of Colorado Boulder Spring 2000

**ASTR 1120: Introductory Astronomy II: Stars and Galaxies** *Instructor of Record: Dr. Brad Gibson*. Grading of weekly homework and monthly exams. Also prepared two lectures on Stellar Evolution when Instructor was out of town.

**Lab TA**, Astrophysical and Planetary Sciences, University of Colorado Boulder Autumn 1999

**ASTR 1010: Introductory Astronomy I: Solar System** *Instructor of Record: Dr. Ted Snow*. Instructor for once-weekly meetings of two laboratory sections of Intro Astronomy.

**Grading Assistant**, Astronomy and Astrophysics, The Pennsylvania State University Spring 1996

**ASTRO 1: Introductory Astronomy** *Instructor of Record: Dr. Eric Feigelson*. Graded weekly quizzes and monthly examinations.

## Student Mentoring

Ryan McCabe, Ph. D. student at Hampton University. Primary Advisor: Dr. Kunio Sayanagi, Hampton University. 2016–

I serve as Science advisor for this project focused on characterizing the atmospheric dynamics of Venus using data from a variety of ground based and space based platforms.

Eric Petersen, NSF Research Experience for Undergraduates. University of Colorado Boulder. Summer 2011

Primary advisor for a project to analyze the evolution of individual cloud features in the atmosphere of Venus seen in  $1.74\mu\text{m}$  images taken with the VIRTIS instrument on Venus Express.

## Observational Experience

**NASA Infrared Telescope Facility** 2020 Jun-Jul

Participated in 20-day observation campaign (in two segments) led by Eliot Young of SwRI at NASA's IRTF to obtain H-band, K-band, and (approximately) M-band spectra and time series imagery of cloud motions in the Venus atmosphere.

**NASA Infrared Telescope Facility** 2018 Nov-Dec

Participated in 20-day observation campaign led by Eliot Young of SwRI at NASA's IRTF to obtain H-band and K-band spectra and time series imagery of cloud motions in the Venus atmosphere.

**NASA Infrared Telescope Facility** 2017 Apr-May

Participated in 20-day observing run led by Eliot Young of Southwest Research Institute at NASA's Infrared Telescope Facility (IRTF); goal was to obtain spectra and images of Venus at H-band and K-band.

**Apache Point Astrophysical Research Consortium 3.5m** 2017 Apr

Observed Venus in grism mode with NICFPS to obtain H-band spectral cubes using this instrument.

**Apache Point Astrophysical Research Consortium 3.5m** 2016 Dec – 2017 Jun

Numerous remote observations with APO ARC 3.5m, using ARCTIC (ARC Telescope Imaging Camera).

**Apache Point Astrophysical Research Consortium 3.5m** 2016 Nov

Trained on Apache Point Observatory 3.5m Astrophysical Research Consortium telescope. Observed Venus using NICFPS (Near Infrared Camera & Fabry-Perot Spectrometer).

## Public Outreach (EPO and Science Communication)

**Citizen Science**, Denver Museum of Nature & Science, Denver, CO 2008-2017

Part of a three-member team at the Denver Museum of Nature & Science leading a "citizen-scientists" research effort to analyze more than 100,000 near-infrared images of the planet Venus obtained by NASA's Infrared Telescope Facility over a ten-year (and growing) span of time.

- Middle School Outreach**, University of Colorado Boulder, Boulder, CO 2017 Oct 29  
Interactive Presentation for middle school students at "Science Club" at Tokyo National Museum of Nature and Science on the topic of Venus Atmospheric Science and the science of Akatsuki.
- Adult Outreach**, Denver Museum of Nature & Science, Denver, CO 2017 Jun 28  
Summary of early Akatsuki Science Results: "60 Minutes in Space" at Denver Museum of Nature & Science.
- Adult and International Outreach**, Shimokitazawa, Tokyo, Japan 2017 Apr 18  
"Space Cafe" talk at Good Heavens Pub on the Akatsuki mission and relevance to exoplanetary studies.
- Popular Science Publication** 2017 Jan 19  
Authored article, "Akatsuki Returns from the Dead," published by *Boulder Weekly*
- Middle School and International Outreach** 2016 Oct 01  
Interactive Presentation for middle school and junior high school students at "Science Club" at Tokyo National Museum of Nature and Science on the topic of Venus Atmospheric Science and my experience as Participating Scientist in Residence In Japan.
- Adult and International Outreach**, Japan Aerospace Exploration Agency 2016 Jul 30-31  
Facilitated ISAS/JAXA "Open Campus," explaining Akatsuki mission goals and results.
- Adult Outreach**, Denver Museum of Nature & Science 2016 Apr 27  
Summary of Akatsuki Science and the difficulty in its arrival at Venus: "60 Minutes in Space" at Denver Museum of Nature & Science.
- Adult Outreach**, Niwot, CO 2016 Mar 15  
"Tuesday Nerd Talk" at Powder Keg Brewery, Niwot, CO, on the history of international collaboration in Venus research.
- Citizen Science Outreach**, Boulder Astronomy and Space Society, Boulder, CO 2014 May 17  
Guest lecture and discussion on Venus observations and Science with the Boulder Astronomy and Space Society.
- Adult and Young Adult Outreach**, Denver Museum of Nature & Science, Denver, CO 2013 May 16  
Participation as a local "expert" on the planet Venus at a "Science Lounge" outreach event at the Denver Museum of Nature & Science.
- Adult Education Outreach**, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Boulder, CO 2012 Jun 19  
Presentation on how to incorporate observations of Venus into Trigonometry lessons for teachers' workshop held at LASP.
- Astronomical Event Outreach**, Sommers-Bausch Observatory, University of Colorado Boulder, Boulder, CO 2012 Jun 05  
Facilitated Transit of Venus observation activities through monitoring operation of telescopes and solar projection devices, and science discussions.
- Adult Outreach**, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Boulder, CO 2012 April 04  
LASP Public Lecture on Transits and Observations of Venus
- Junior High Outreach**, Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Boulder, CO 2011 Oct 18  
30-minute presentation about Venus for visiting Junior High students
- Astronomical Event Outreach**, Sommers-Bausch Observatory, University of Colorado Boulder, Boulder, CO 2011 Apr 23  
Facilitated Astronomy Day activities.
- Adult Outreach**, Denver Museum of Nature & Science, Denver, CO 2010 Nov 03  
Curators' Lunchtime Lecture
- Adult Outreach**, Denver Museum of Nature & Science, Denver, CO 2009 Jul 08  
Curators' Lunchtime Lecture

- Middle School Outreach**, Denver Museum of Nature & Science, Denver, CO 2009 Feb  
Volunteer Judge at Denver Metro Regional Science Fair
- Adult Outreach**, Denver Museum of Nature & Science, Denver, CO 2008 Sep 24  
Curators' Lunchtime Lecture
- Middle School Outreach**, Denver Museum of Nature & Science, Denver, CO 2008 Feb  
Volunteer Judge at Denver Metro Regional Science Fair
- Middle School Outreach** 2002 Feb 22  
Volunteer Judge at High Peaks Elementary Science Fair
- Astronomical Event Outreach**, Sommers-Bausch Observatory, University of Colorado 1999–2007  
Boulder, Boulder, CO  
Hosted multiple Open House Observing Nights and Astronomy Day festivities while a graduate student.
- Astronomical Event Outreach**, The Pennsylvania State University, University Park, PA 1994–1999  
Hosted multiple Open House Observing Nights while an undergraduate student and a member of the Penn State Astronomy Club.

## Professional Service Activities

- Co-convenor of Venus Science sessions (3) at Japan Geosciences Union Meeting (hybrid)** 2021 May  
With Co-conveners Takehiko Satoh, Hideo Sagawa, and Thomas Widemann.
- Co-convenor of “Science of Venus: Venus Express, Akatsuki, and beyond” sessions (3) at Japan Geosciences Union Meeting (virtual)** 2020 July  
With Co-conveners Takehiko Satoh, Hideo Sagawa, and Thomas Widemann.
- NASA Participating Scientist in Residence with Akatsuki** 2016–2019  
Facilitate cross-oceanic communication between JAXA Akatsuki Team and NASA Participating scientists; local support for remote participants in Akatsuki Science Team Meetings, held at ISAS, JAXA, Sagamihara, Japan, etc.
- VEXAG At-Large Steering Committee Member** 2017 Feb – 2020 Jun
- Member of VEXAG Goals, Objectives, and Investigations (GOI) document committee.** 2019
- Member of VEXAG Roadmap document committee.** 2019
- Local Host of 2019 VEXAG meeting (held 6-8 November 2019 at Laboratory for Atmospheric and Space Physics, Boulder, CO)** Nov 2019  
Local Co-organizer (with Dr. Emilie Royer), part of Organizing Committee (with Dr. Darby Dyar and Dr. Noam Izenberg).
- Member of the Scientific Organizing Committee for the International Venus Conference** 2017 Apr - 2019 Jun  
Originally planned to be held in Niseko, Hokkaido, Japan in September 2018 (*postponed by major earthquake in Sapporo, Hokkaido until May, 2019*)
- Co-convenor of “Recent advances of Venus science” sessions (3) at Japan Geosciences Union Meeting** 2019 May  
With Co-conveners Takehiko Satoh, Takeshi Horinouchi, and Masaru Yamamoto.
- Co-convenor of “Results from Akatsuki and advances in Venus science” sessions (3) at Japan Geosciences Union Meeting** 2018 May  
With Co-conveners Takehiko Satoh, Takeshi Horinouchi, and Masaru Yamamoto.
- Member of Venus Aerial Platforms Study Team.** 2017 May - 2018 Feb  
Resulted in publication of findings, “Aerial Platforms for the Scientific Exploration of Venus” by Cutts et al.
- Guest Editor** for a Special Issue of *Earth, Planets, Space* about the initial *Akatsuki* mission results. 2017 May-Nov

- Co-convenor of “Results of Venus science with Akatsuki in orbit for 1.5 year” sessions (3) at Japan Geosciences Union Meeting** 2017 May  
With Co-conveners Takehiko Satoh, Takeshi Horinouchi, and Masaru Yamamoto.
- Lead of Revision to VEXAG GOI document** 2016 Jan-Jul  
Led a small team tasked with ensuring that space physics topics were adequately addressed in a revision of the VEXAG GOI document.
- Participant and sub-panel assistant chair in Venus Technology and Laboratory Needs Workshop.** 2015 Apr
- Participant and sub-panel chair in Venus Exploration Targets Workshop.** 2014 May
- Member of VEXAG Goals, Objectives, and Investigations document committee.** 2013 May - 2014 Sep
- Co-convenor of “Using Numerical Models to Understand the Venus Atmosphere and Surface” session at American Geophysical Union Fall Meeting** 2012 Dec  
With Co-conveners Chris Lee and Constantine Tsang.
- Proposal Reviews** 2008 –  
Served on numerous (seven as panelist, over a dozen as external reviewer) NASA R&A and Mission Concept Study Reviews in various roles, including external reviewer, panelist, Group Chief, and Panel Lead.
- Research Article Reviews** 2011 –  
Peer Reviewer of 17 original research articles that had been submitted to *Nature Astronomy*, *Advances in Space Research*, *Icarus*, *Journal of Geophysical Research: Planets*, *Planetary and Space Science*, *Arabian Journal of Chemistry*, *Astrophysical Journal*, and *Astrophysical Journal Letters*; and of a review article on planetary atmospheres for a conference proceedings.

## Professional Memberships

Japan Geosciences Union	2016 Oct –
American Geophysical Union	2012 Aug –
AAS: Division for Planetary Sciences	2000 Oct –
American Astronomical Society	1999 Jan –
$\Phi BK$ : Lambda of Pennsylvania	1999 May –

## Languages

Mothertongue: **English**  
Familiar, but not fluent: **Latin, Italian, Spanish, Japanese**

## Publications

### First-Author Peer-reviewed Articles

- [1] **K. McGouldrick**, J. Peralta, J. K. Barstow, C. C. C. Tsang  
Using VIRTIS on Venus Express to Constrain the Properties of the Enormous Dark Cloud observed in images of Venus by IR2 on Akatsuki  
*Planet. Sci. J.* 2 (2021) p. 153. 2021. doi: 10.3847/PSJ/ac0e39
- [2] **K. McGouldrick**  
Effects of variation in coagulation and photochemistry parameters on the particle size distributions in the Venus clouds  
*Earth Planets Space* 69.1 (2017) p. 161. 2017. doi: 10.1186/s40623-017-0744-x
- [3] **K. McGouldrick**, C. C. C. Tsang  
Discovery of a 150 day period in the Venus Condensational Clouds  
*Icarus* 286 (2017) pp. 118–133. 2017. doi: 10.1016/j.icarus.2016.10.005
- [4] **K. McGouldrick**, T. W. Momary, K. H. Baines, D. H. Grinspoon  
Quantification of middle and lower cloud variability and mesoscale dynamics from Venus Express / VIRTIS observations at  $1.74\mu\text{m}$

*Icarus* 217.2 (2012) pp. 615–628. 2012. doi: 10.1016/j.icarus.2011.07.009

- [5] **K. McGouldrick**, O. B. Toon, D. H. Grinspoon  
Sulfuric acid aerosols in the atmospheres of the terrestrial planets  
*Planet. Space Sci.* 59.10 (2011) pp. 934–941. 2011. doi: 10.1016/j.pss.2010.05.020
- [6] **K. McGouldrick**, K. H. Baines, T. W. Momary, D. H. Grinspoon  
Venus Express / VIRTIS observations of middle and lower cloud variability and implications for dynamics  
*J. Geophys. Res.* 113 (2008) E00B14. 2008. doi: 10.1029/2008JE003113
- [7] **K. McGouldrick**, O. B. Toon  
Observable effects of convection and gravity waves on the Venus condensational cloud  
*Planet. Space Sci.* 46 (2008) pp. 1112–1131. 2008. doi: 10.1016/j.pss.2008.02.010
- [8] **K. McGouldrick**, O. B. Toon  
Modeling the effects of shear on the evolution of the holes in the condensational clouds of Venus  
*Icarus* 196 (2008) pp. 35–48. 2008. doi: 10.1016/j.icarus.2008.02.020
- [9] **K. McGouldrick**, O. B. Toon  
Investigation of possible causes of the holes in the condensational Venus cloud using a microphysical cloud model with a radiative-dynamical feedback  
*Icarus* 191 (2007) pp. 1–24. 2007. doi: 10.1016/j.icarus.2007.04.007

## All Peer-reviewed Articles

- [1] **K. McGouldrick**, J. Peralta, J. K. Barstow, C. C. C. Tsang  
Using VIRTIS on Venus Express to Constrain the Properties of the Enormous Dark Cloud observed in images of Venus by IR2 on Akatsuki  
*Planet. Sci. J.* 2 (2021) p. 153. 2021. doi: 10.3847/PSJ/ac0e39
- [2] J. Peralta, T. Navarro, C. W. Vun, A. Sánchez-Lavega, **K. McGouldrick**, T. Horinouchi, T. Imamura, R. Hueso, J. P. Boyd, G. Schubert, T. Kouyama, T. Satoh, N. Iwagami, E. F. Young, M. A. Bullock, P. Machado, Y. J. Lee, S. S. Limaye, M. Nakamura, S. Tellmann, A. Wesley, P. Miles  
A Long-Lived Sharp Disruption on the Lower Clouds of Venus  
*Geophys. Res. Lett.* 47.11, e87221 (June 2020) e87221. 2020. doi: 10.1029/2020GL087221
- [3] J. Peralta, A. Sánchez-Lavega, T. Horinouchi, **K. McGouldrick**, I. Garate-Lopez, E. F. Young, M. A. Bullock, Y. J. Lee, T. Imamura, T. Satoh, S. S. Limaye  
New cloud morphologies discovered on the Venus's night during Akatsuki  
*Icarus* 333 (2019) pp. 177–182. 2019. doi: 10.1016/j.icarus.2019.05.026
- [4] J. Peralta, R. Hueso, T. Horinouchi, A. Sánchez-Lavega, S.-Y. Murakami, P. Machado, E. F. Young, Y. J. Lee, T. Kouyama, H. Sagawa, **K. McGouldrick**, T. Satoh, T. Imamura, S. S. Limaye, T. M. Sato, K. Ogohara, M. Nakamura, D. Luz  
Nightside winds at the lower clouds of Venus with Akatsuki/IR2: Longitudinal, local, time, and decadal variations from comparison with previous measurements  
*Astrophys. J. Suppl.* 239.2 (2018) p. 29. 2018. doi: 10.3847/1538-4365/aae844
- [5] D. Titov, N. I. Ignatiev, **K. McGouldrick**, V. Wilquet, C. F. Wilson  
Venus III: Clouds and hazes of Venus  
*Space Sci. Rev.* 214 (2018) p. 126. 2018. doi: 10.1007/s11214-018-0552-z
- [6] M. Nakamura, D. Titov, **K. McGouldrick**, P. Drossart, J.-L. Bertaux, H. Liu  
Akatsuki at Venus: The first year of scientific operation  
*Earth Planets Space* 70 (2018) p. 144. 2018. doi: 10.1186/s40623-018-0916-3
- [7] **K. McGouldrick**  
Effects of variation in coagulation and photochemistry parameters on the particle size distributions in the Venus clouds  
*Earth Planets Space* 69.1 (2017) p. 161. 2017. doi: 10.1186/s40623-017-0744-x
- [8] T. Horinouchi, S. Murakami, T. Satoh, J. Peralta, K. Ogohara, T. Kouyama, T. Imamura, H. Kashimura, S. S. Limaye, **K. McGouldrick**, M. Nakamura, T. M. Sato, K. Sugiyama, M. Takagi, S. Watanabe, M. Yamada, A. Yamazaki, E. F. Young  
Equatorial jet in the lower to middle cloud layer of Venus revealed by Akatsuki

*Nat. Geosci.* 10 (2017) pp. 646–651. 2017. doi: 10.1038/ngeo3016

- [9] C. C. C. Tsang, **K. McGouldrick**  
General Circulation of Venus from a long-term synoptic study of tropospheric CO by Venus Express / VIRTIS  
*Icarus* 289 (2017) pp. 173–180. 2017. doi: 10.1016/j.icarus.2017.02.018
- [10] J. Peralta, Y. J. Lee, **K. McGouldrick**, H. Sagawa, A. Sánchez-Lavega, T. Imamura, T. Widemann, M. Nakamura  
Overview of useful spectral regions for Venus: An update to encourage observations complementary to the Akatsuki mission  
*Icarus* 288 (2017) pp. 235–239. 2017. doi: 10.1016/j.icarus.2017.01.027
- [11] **K. McGouldrick**, C. C. C. Tsang  
Discovery of a 150 day period in the Venus Condensational Clouds  
*Icarus* 286 (2017) pp. 118–133. 2017. doi: 10.1016/j.icarus.2016.10.005
- [12] **K. McGouldrick**, T. W. Momary, K. H. Baines, D. H. Grinspoon  
Quantification of middle and lower cloud variability and mesoscale dynamics from Venus Express / VIRTIS observations at  $1.74\mu\text{m}$   
*Icarus* 217.2 (2012) pp. 615–628. 2012. doi: 10.1016/j.icarus.2011.07.009
- [13] K. Molaverdikhani, **K. McGouldrick**, L. W. Esposito  
The abundance and vertical distribution of the unknown ultraviolet absorber in the Venusian atmosphere from analysis of Venus Monitoring Camera images  
*Icarus* 217.2 (2012) pp. 648–660. 2012. doi: 10.1016/j.icarus.2011.08.008
- [14] J. K. Barstow, C. C. C. Tsang, C. F. Wilson, P. G. J. Irwin, F. W. Taylor, **K. McGouldrick**, P. Drossart, G. Piccioni, S. Tellmann  
Models of the global cloud structure on Venus derived from Venus Express observations  
*Icarus* 217.2 (2012) pp. 542–560. 2012. doi: 10.1016/j.icarus.2011.05.018
- [15] **K. McGouldrick**, O. B. Toon, D. H. Grinspoon  
Sulfuric acid aerosols in the atmospheres of the terrestrial planets  
*Planet. Space Sci.* 59.10 (2011) pp. 934–941. 2011. doi: 10.1016/j.pss.2010.05.020
- [16] C. C. C. Tsang, C. F. Wilson, J. K. Barstow, P. G. J. Irwin, F. W. Taylor, **K. McGouldrick**, G. Piccioni, P. Drossart, H. Svedhem  
Correlations between cloud thickness and sub-cloud water abundance on Venus  
*Geophys. Res. Lett.* 37 (2010) p. L02202. 2010. doi: 10.1029/2009GL041770
- [17] **K. McGouldrick**, K. H. Baines, T. W. Momary, D. H. Grinspoon  
Venus Express / VIRTIS observations of middle and lower cloud variability and implications for dynamics  
*J. Geophys. Res.* 113 (2008) E00B14. 2008. doi: 10.1029/2008JE003113
- [18] **K. McGouldrick**, O. B. Toon  
Observable effects of convection and gravity waves on the Venus condensational cloud  
*Planet. Space Sci.* 46 (2008) pp. 1112–1131. 2008. doi: 10.1016/j.pss.2008.02.010
- [19] **K. McGouldrick**, O. B. Toon  
Modeling the effects of shear on the evolution of the holes in the condensational clouds of Venus  
*Icarus* 196 (2008) pp. 35–48. 2008. doi: 10.1016/j.icarus.2008.02.020
- [20] **K. McGouldrick**, O. B. Toon  
Investigation of possible causes of the holes in the condensational Venus cloud using a microphysical cloud model with a radiative-dynamical feedback  
*Icarus* 191 (2007) pp. 1–24. 2007. doi: 10.1016/j.icarus.2007.04.007
- [21] D. C. Hong, **K. McGouldrick**  
Measurement of isothermal pressure of lattice gas by random walk  
*Physica A* 255 (1998) pp. 415–422. 1998. doi: 10.1016/S0378-4371(98)00080-6

## Commentary and White papers (not peer-reviewed)

- [1] **McGouldrick, K.** A. Kleinboehl, J. Bellan, N. Izenberg, J. Whitten, C. Tsang, E. Young, J. Balcerski, S. Kane, K. Baines, T. N. Titus, P. McGovern, S. Curry, E. Royer, K. Hensley, A. Brecht, J. Elston, C. Dong, R. McCabe, A. Akins, S. Brueshaber, T. Kremic, P. Beauchamp, M. Way, S. Guzewich, A. Spiga, S. Lebonnois, L. Li, C. Gray, R. Lillis, S. Diniega



The Atmospheric eXploration and Investigative Synergy (AXIS) Group: A proposal for a new interdisciplinary NASA advisory group

*Bulletin of the AAS* 53.4 (Mar. 2021). 2021. doi: 10.3847/25c2cfef.f4cee16e

- [2] **McGouldrick, K.** G. Arney, A. Brecht, A. Colaprete, S. Curry, J. Deighan, T. Fukuhara, C. Gray, R. Lillis, T. Navarro  
Venus Orbital Mission Concept: Kythiran Eolian dYnamics from the Surface to the Thermosphere from an Orbital NETWORK (KEYSTONE)  
*Bulletin of the AAS* 53.4 (18th Mar. 2021). 2021. doi: 10.3847/25c2cfef.6df2d140
- [3] **K. McGouldrick**  
Atmospheric science looks to Venus  
*Nat. Geosci.* 11 (2018) pp. 4–5. 2018. doi: 10.1038/s41561-017-0037-9

## Invited Talks and Colloquia

- Ad Aspera Per Venerem (To the Stars, through Venus)* **University of Colorado Boulder** 2021 Jan 28  
Laboratory for Atmospheric and Space Physics Colloquium
- Venus Atmospheric Dynamics from the Surface to Orbit.* **Venus Exploration Analysis Group**, Invited Tutorial Talk 2019 Nov 6
- Aerosol Cloud Microphysics in the Solar System.* **Rikkyo University, Tokyo, Japan**, 2018 Oct 30  
Planetary Atmospheres Group Seminar
- Microphysical Modelling of the Venus Clouds, Including Radiative Transfer.* **Venera-D Modelling Workshop** Space Research Institute (IKI), Moscow, Russia. 2017 Oct 05
- Akatsuki Rises from the Dead to Explore the Depths of Hell.* **University of Colorado Boulder** Laboratory for Atmospheric and Space Physics Colloquium 2017 Sep 07
- Effect of Coagulation on Particle Sizes in the Venus Clouds.* **Institute for Space and Astronautical Science, Japan Aerospace Exploration Agency, Sagamihara, Japan** 2016 Oct 07  
Planetary Atmospheres Group Seminar
- The Clouds of Venus in a Global Context.* **University of North Dakota, Grand Forks, ND** 2015 Mar 23  
Department of Space Studies Colloquium
- The Variable Visage of Venus: Understanding the Clouds of Venus through Simulations and Multi-wavelength Observations.* **New Mexico State University, Las Cruces, NM** 2014 Mar 01  
Department of Astronomy Colloquium
- First Results of an Investigation of Sulfur Dioxide in the Ultraviolet from Pioneer Venus through Venus Express.* **University of Colorado Boulder** Laboratory for Atmospheric and Space Physics Colloquium 2012 Feb 16
- Quantifying the Evolution of the Venus Clouds.* **Southwest Research Institute, Boulder, CO** Department of Space Studies Colloquium 2010 Nov 30
- Comparing Apples and Oranges: Coming to Know Earth by Way of Venus.* **Ball Aerospace, Boulder, CO** Colloquium 2008 Oct 24

## Conference Abstracts (first-author only)

- [1] K. McGouldrick  
Microphysics Implications of the Venus Bow Wave seen by LIR on Akatsuki  
*Japan Geoscience Union Meeting (Virtual)* PPS02 (2021) P07. 2021
- [2] K. McGouldrick, A. Brecht, S. Curry, T. Navarro, J. Deighan, T. Fukuhara, C. Gray, A. Colaprete, R. Lillis, G. Arney  
KEYSTONE: Kythiran Eolian dYnamics from the Surface to the Thermosphere from an Orbital NETWORK (A Venus orbital mission concept)  
*43<sup>rd</sup> COSPAR General Scientific Assembly (Virtual)* B4.4: Venus Science and Exploration (2021) #8. 2021
- [3] K. McGouldrick, J. Peralta, J. Barstow, C. Tsang

Toward understanding the nature of the 'Disruption' and 'Enormous Cloud' seen by Akatsuki in the Venus atmosphere

*52<sup>nd</sup> Meeting of the DPS (Virtual)* 52 (2020) #505.01. 2020

- [4] K. McGouldrick  
Effect of Insoluble Sulfur on the Microphysics of the Sulfuric Acid Clouds of Venus  
*Japan Geoscience Union Meeting (Virtual)* PPS06 (2020) P16. 2020
- [5] K. McGouldrick, J. Peralta, J. Barstow, C. Tsang, T. Satoh  
Understanding the Clouds of Venus through models and observations (Finding Earth in the Clouds of Venus).  
*European Planetary Science Congress* Genève, Switzerland (2019) #L2.79.1205. 2019
- [6] K. McGouldrick, J. Peralta, T. Satoh  
Cytherometeorology  
*2019 International Venus Conference* Niseko, Hokkaido, Japan (2019) D3-AM1-1. 2019
- [7] K. McGouldrick, J. Peralta, T. Satoh  
Mesoscale dynamics in the Venus atmosphere: The weather on Venus  
*Japan Geoscience Union Meeting, Chiba, Japan* PPS05 (2019) P09. 2019
- [8] K. McGouldrick, J. Peralta, C. Tsang, J. Barstow, T. Satoh  
Capricious Cytherian Clouds: How VIRTIS can help us understand the lessons taught by Akatsuki  
*2018 VEXAG Meeting* Laurel, MD (2018) p. 8055. 2018
- [9] K. McGouldrick  
Lessons from Akatsuki: The dawn of a new view of planetary atmospheres?  
*Comparative Climatology of Terrestrial Planets III* Lunar and Planetary Institute, Houston, TX (2018). 2018
- [10] K. McGouldrick  
Detailed analysis of long-term cloud evolution using Akatsuki/IR2 and Venus Express/VIRTIS-M-IR  
*Japan Geoscience Union Meeting, Chiba, Japan* PPS04 (2018) P09. 2018
- [11] K. McGouldrick  
A paradigm shift in planetary exploration?  
*15<sup>th</sup> meeting of Venus Exploration Analysis Group* Laurel, MD (2017). 2017
- [12] K. McGouldrick  
Venus Aerosol Properties from Modelling and Akatsuki IR2 Observations  
*European Planetary Science Congress* Riga, Latvia (2017) EPSC2017-155. 2017
- [13] K. McGouldrick  
Examination of potential microphysical drivers of NIR emitted radiance variations on the Venus night side  
*Joint Meeting of the Japan Geoscience Union and the American Geophysical Union Spring Meeting* PPS06 (2017) P07. 2017
- [14] K. McGouldrick  
Microphysical modelling investigation of coalescence efficiency and photochemical production rates on particle size distributions in the Venus cloud system  
*American Geophysical Union, Fall Meeting* P53B (2016) p. 2191. 2016
- [15] K. McGouldrick, C. C. C. Tsang  
A 145 day period in the Venus condensational clouds  
*International Venus Conference, Oxford, England, UK* (2016). 2016
- [16] K. McGouldrick, C. C. C. Tsang  
Variability of the Venus condensational clouds from analysis of VIRTIS-M-IR observations of the near-infrared spectral windows  
*47<sup>th</sup> Meeting of the DPS, Washington, DC* 47 (2015) p. 201.02. 2015
- [17] K. McGouldrick  
Microphysical model of the Venus clouds between 40km and 80km  
*45<sup>th</sup> Meeting of the DPS, Denver, CO* 45 (2013) p. 118.06. 2013
- [18] K. McGouldrick, L. W. Esposito  
Re-analysis of Pioneer Venus UVS SO<sub>2</sub> measurements

*International Venus Conference, Catania, Sicily, Italy* (2013). 2013

- [19] K. McGouldrick  
Simulation of the Upper Clouds and Hazes of Venus using a Microphysical Cloud Model  
*2012 AGU Fall Meeting, San Francisco, CA* 2012FA (2012) P13F-03. 2012
- [20] K. McGouldrick, L. W. Esposito, K. E. Simmons, M. Dorey, C. K. Pankratz  
Re-analysis of Sulfur Dioxide Variability in the Venus Atmosphere Using Restored Pioneer Venus Orbiter UVS Data  
*44<sup>th</sup> DPS Meeting, Reno, NV* 44 (2012) p. 512.03. 2012
- [21] K. McGouldrick  
Microphysical and radiative transfer model of the lower, middle, and upper clouds of Venus  
*Joint conference of the DPS and EPSC, Nantes, France* 43 (2011) p. 1609. 2011
- [22] K. McGouldrick  
Modelling the microphysics of Venus clouds  
*2011 VEXAG conference and science workshop, Chantilly, VA* (2011). 2011
- [23] K. McGouldrick, K. Molaverdikhani, L. W. Esposito, C. K. Pankratz  
First results of an investigation of sulfur dioxide in the ultraviolet from Pioneer Venus through Venus Express  
*42<sup>nd</sup> DPS Meeting, Pasadena, CA* 42 (2010) p. 15.03. 2010
- [24] K. McGouldrick, K. H. Baines, T. W. Momary, D. H. Grinspoon, L. W. Esposito  
Observing the clouds of Venus from the ultraviolet to the infrared  
*2010 VEXAG Conference and Science Workshop, Madison, WI* (2010). 2010
- [25] K. McGouldrick, D. H. Grinspoon  
Effects of Temporal and Spatial Variability of Insolation on the Venus Clouds  
*41<sup>st</sup> DPS Meeting, Fajardo, PR* 41.3 (2009) p. 48.01. 2009
- [26] K. McGouldrick, O. B. Toon, D. H. Grinspoon  
Sulfuric Acid in the clouds of terrestrial planets  
*International Conference on Comparative Planetology: Venus-Earth-Mars, Noordwijk, The Netherlands* (2009). 2009
- [27] K. McGouldrick, O. B. Toon, D. H. Grinspoon  
A Microphysical Basis for Lightning on Venus?  
*40<sup>th</sup> DPS Meeting, Ithaca, NY* 40.3 (2008) p. 62.09. 2008
- [28] K. McGouldrick, K. H. Baines, T. W. Momary, D. H. Grinspoon  
Observation of the Distribution, Morphology, and Evolution of Holes in the Venus Clouds with VIRTIS  
*Venus Express Science Workshop, La Thuile, Valle d'Aosta, Italy.* (2008). 2008
- [29] K. McGouldrick, O. B. Toon  
Modelling the Formation and Dissipation of Holes in the Venus Condensational Cloud  
*39<sup>th</sup> DPS Meeting, Orlando, FL* 39.3 (2007) p. 58.03. 2007
- [30] K. McGouldrick, O. B. Toon  
Exploring the Effects of Waves on the Middle and Lower Clouds Decks of Venus with a Microphysical Model Including a Radiative-Dynamical Feedback  
*38<sup>th</sup> DPS Meeting, Pasadena, CA* 38.3 (2006) p. 526. 2006
- [31] K. McGouldrick, O. B. Toon  
Exploring the Effects of Gravity Waves on the Venus Condensational Cloud with a Microphysical Model Including Radiative-Dynamical Feedback  
*AGU Chapman Conference Venus as a Terrestrial Planet* (2006). 2006
- [32] K. McGouldrick, O. B. Toon  
A Microphysical Model of the Venus Condensational Cloud with Radiative-Dynamical Feedback  
*37<sup>th</sup> DPS Meeting, Cambridge, England, UK* 37.3 (2005) p. 742. 2005
- [33] K. McGouldrick, O. B. Toon  
Modelling the Radiative-Dynamical Feedback in the Clouds of Venus  
*36<sup>th</sup> DPS Meeting, Louisville, KY* 36.3 (2004) p. 1163. 2004

- [34] K. McGouldrick, O. B. Toon  
Microphysical and Radiative Modelling of the Venus Condensational Cloud  
*35<sup>th</sup> DPS Meeting, Monterey, CA* 35.3 (2003) p. 983. 2003
- [35] K. McGouldrick, O. B. Toon  
Holes in the Venus Condensational Cloud  
*34<sup>th</sup> DPS Meeting, Birmingham, AL* 34.3 (2002) p. 876. 2002
- [36] K. McGouldrick, O. B. Toon  
A Microphysical Model of the 'Holey' Condensational Venus Cloud  
*33<sup>rd</sup> DPS Meeting, New Orleans, LA* 33.3 (2001) p. 1037. 2001
- [37] K. McGouldrick, J. Maywalt, L. Engel, B. Rhoads, D. Andersen, L. Ramsey  
Optical Fibre Evaluation for the Hobby\*Eberly Telescope  
*193<sup>rd</sup> Meeting of the AAS, Austin, TX* 30 (1999) p. 10.06. 1999