

## ***RICHARD WILLIAM ZUREK***

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**CURRENT ADDRESS:** Mail Stop 264-535 11572 Dellmont Dr.  
Jet Propulsion Laboratory Tujunga, CA 91042  
4800 Oak Grove Drive  
Pasadena, CA 91109-8099  
PHONE: (818) 354-3725  
FAX: (818) 393-2347  
EMAIL: Richard.W.Zurek@jpl.nasa.gov

**EDUCATION:** 1974 Ph.D. Atmospheric Sciences  
University of Washington, Seattle  
1969 B.Sc. (with High Honors), Mathematics  
Michigan State University  
1965 High School Diploma, Buhl, Idaho

**MEMBER:** AAS Division of Planetary Sciences  
American Geophysical Union  
American Meteorological Society  
Phi Beta Kappa

### **EMPLOYMENT:**

1976 - Present Jet Propulsion Laboratory, California Institute of Technology  
Earth and Space Sciences Division (32)

#### Job Classification

2007 -	Chief Scientist, JPL Mars Exploration Program Office
2006 -	MRO Project Scientist / JPL Fellow
2001 - 2006	MRO Project Scientist / Senior Research Scientist
1998 - 2001	Manager III
1993 - 1998	Senior Research Scientist
1979 - 1993	Member of the Technical Staff
1976 - 1979	Senior Scientist

#### Line Management Roles

1998 - 2001	Manager, Earth and Space Sciences Division (32)
1994 - 1998	Lead Scientist, Earth & Planetary Atmospheres Research Element (3233)
1989 - 1994	Supervisor, Weather and Climate Group
1986 - 1989	Team Leader, Weather and Climate Group

### Other Positions

- 1983 - 1986            Visiting Associate Professor, Dept. of Geological and Planetary Sciences, California Institute of Technology
- 1975-1976            Research Associate, Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, Boulder, CO
- 1974-1975            Post-Doctoral Fellow, Advanced Study Program, National Center for Atmospheric Research (NCAR), Boulder, CO

### **INDIVIDUAL AWARDS:**

- NASA Outstanding Leadership Medal (2007)
- AGU Editor's Citation for Excellence in Refereeing (2005)

### **CURRENT ACTIVITIES:**

Chief Scientist, JPL Mars Exploration Program Office (2007 - )

Project Scientist, Mars Reconnaissance Orbiter (2000 - )

Co-Investigator, MRO Mars Climate Sounder (PI: D. McCleese)

### **SOME PAST ACTIVITIES:**

Member (2003-2005), NASA Solar System Exploration Subcommittee (SSES; awaiting re-chartering of parent committee)

Chair, NASA Science Definition Team, Mars Telecommunications Orbiter, 2004

Co-Chair, NASA Science Definition Team for the Mars Reconnaissance Orbiter (MRO), (2000-2001)

Project Scientist, Mars Climate Orbiter and Mars Polar Lander (1996-2000)

Principal Investigator on many NASA Planetary Atmospheres Program Research Tasks and Mars Data Analysis Tasks

Co-Investigator, Pressure Modulator IR Radiometer (PMIRR), an atmospheric sounder lost with Mars Observer and again with the Mars Climate Orbiter. (PI: D. J. McCleese, JPL)

Co-Investigator, Mars Volatiles and Climate Surveyor (MVACS), an integrated payload lost with the Mars Polar Lander. (PI: D. A. Paige, UCLA)

Principal Investigator (1979-1999), Theoretical Investigation in support of the Upper Atmosphere Research Satellite (UARS)

Member (1995-1996), NASA Solar System Exploration Subcommittee (SSES)

Member (1992-1997), Science Advisory Group, JPL Space and Earth Sciences Program Directorate (SESPD); Chair (1994-1997 )

Member (1994-1995), NASA Mars 98 Lander Science Definition Team

Member (1993), NASA Mars Science Working Group (M. Carr, Chairman)

Member (1989-1992), Committee on Planetary and Lunar Exploration (COMPLEX), Space Studies Board, National Research Council

**OTHER:**

Reviews and/or panel participation for Planetary Atmospheres, Mars Fundamental Research and Mars Data Analysis Programs

Reviews for JGR, GRL, ICARUS

JPL Project Manager Workshops (2000-2005)

**ATMOSPHERIC ADVISING ACTIVITIES FOR PROJECTS:**

Reviews of MSL atmospheric modeling activities, 2005 -

Reviews of PHOENIX atmospheric modeling activities 2005-2008

Reviews of MER atmospheric modeling activities, 2002-2004

Reviews of Genesis atmospheric modeling activities, 2004

Review of Cassini-Hyguens Titan atmosphere modeling, 2004

Coordinator, Atmospheric Advisory Group for aerobraking:

- Mars Global Surveyor (1997-1998)
- 2001 Mars Odyssey (2001)
- 2005 Mars Reconnaissance Orbiter (2006)

## Research Interests:

Large-scale circulations of planetary atmospheres:

- General Circulation & Atmospheric Tidal Models
- Analysis of Remote Sensing Data
- Comparative study

Planetary climates: Seasonal, Inter-annual and Long-term Change

- Stratospheric inter-annual variability
- Martian great dust storms
- Hydrological cycles on Earth and on Mars

## Key Papers-Research:

Zurek, R. W., G. L. Manney, A. J. Miller, M. Gelman, and R. Nagatani: Interannual variability of the north polar vortex in the lower stratosphere during the UARS mission. Geophys. Res. Lett., *23*, 289-292, 1996.

Manney, G. L., L. Froidevaux, J. W. Waters, R. W. Zurek, W. G. Read, L. S. Elson, J. B. Kumer, J. L. Mergenthaler, A. E. Roche, A. O'Neill, R. S. Harwood, I. MacKenzie, and R. Swinbank: Chemical depletion of ozone in the Arctic lower stratosphere during winter 1992-93. Nature, *370*, 429-434, 1994.

Zurek, R. W.: Free and forced modes in the Martian atmosphere. J. Geophys. Res., *93*, 9452-9462, 1988.

Zurek, R. W.: Diurnal tide in the Martian atmosphere. J. Atmos. Sci., *33*, 321-337, 1976.

## Key Papers-Reviews/Book Chapters:

Zurek, R. W. and S. E. Smrekar: An overview of the Mars Reconnaissance Orbiter (MRO) science mission. J. Geophys. Res., *112*, E05S01, doi:10.1029/2006JE002701, 2007.

Zurek, R. W.: Comparative aspects of the climate of Mars: An introduction to the current atmosphere. Mars, ed. H. Kieffer et al., U. Ariz. Press, Tucson, 799-817, 1992.

Zurek, R. W., J. R. Barnes, R. M. Haberle, J. B. Pollack, J. E. Tillman, and C. B. Leovy: Dynamics of the atmosphere of Mars. Mars, ed. H. Kieffer et al., U. Ariz. Press, Tucson, 835-933, 1992.

Zurek, R. W.: Martian great dust storms: An update. Icarus, *50*, 288-310, 1982.

## Publications:

- McCleese, D. J., J. T. Schofield, +16 others, and R. W. Zurek: Intense Polar Temperature Inversion in the Middle Atmosphere on Mars. Nature Geoscience, 1, 745-749, 2008.
- Zurek, R. W. and S. E. Smrekar: An overview of the Mars Reconnaissance Orbiter (MRO) science mission. J. Geophys. Res., 112, E05S01, doi:10.1029/2006JE002701, 2007.
- Graf, James E., R. W. Zurek, J. Erickson, B. Jai, M. D. Johnston, and R. de Paula: Status of Mars Reconnaissance Orbiter Mission, Acta Astronautica, 61, 44-51, 2007.
- Golombek, M. P., R. E. Arvidson, J. F. Bell III, P. R. Christensen, J. Crisp, L. S. Crumpler, B. L. Ehlmann, R. L. Fergason, J. A. Grant, R. Greeley, A. F. Haldemann, D. M. Kass, T. J. Parker, J. T. Schofield, S. W. Squyres, and R. W. Zurek: Assessment of Mars Exploration Rover landing site predictions. Nature, 436, no. 7047, 44-88, 2005.
- Wang, H. Q., R. W. Zurek, and M. I. Richardson: Relationship between frontal dust storms and transient eddy activity in the northern hemisphere of Mars as observed by Mars Global Surveyor, J. Geophys. Res., 110, E07005, 2005je002423, 2005.
- Graf, J. E., R. W. Zurek, H. J. Eisen, B. Jai, M. D. Johnston, and R. Depaula: The Mars Reconnaissance Orbiter Mission, Acta Astronautica, 57, 566-578, 2005.
- Golombek, M. P., R.e. Arvidson, J. F. Bell III, P. R. Christensen, J. A. Crisp, L. S. Crumpler, B. L. Ehlmann, R. L. Ferguson, J. A. Grant, R. Greeley, A. F. C. Haldemann, D. M. Kass, T. J. Parker, J. T. Schofield, S. W. Squyres & R. W. Zurek: Assessment of Mars Exploration Rover landing site predictions, Nature, 436, 44-48, 2005.
- Golombek, M. P., et al.: Selection of the Mars Exploration Rover landing sites, J. Geophys. Res., 108, 8072, doi:10.1029/2003JE002074, 2003.
- Wang, H., M. I. Richardson, R. J. Wilson, A. P. Ingersoll, A. D. Toigo, and R. W. Zurek: Cyclones, tides, and the origin of a cross-equatorial dust storm on Mars, Geophys. Res. Lett., 30, 1488, doi:10.1029/2002GL016828, 2003.
- Tamppari, L., R. W. Zurek, and D. A. Paige: Viking era diurnal water-ice clouds. J. Geophys. Res., 108, 5073, doi:10.1029/2002JE001911, 2003.
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- Bougher, S., G. Keating, R. Zurek, J. Murphy, R. Haberle, J. Hollingsworth, and R. T. Clancy: Mars Global Surveyor aerobraking: Atmospheric trends and model interpretation. *Adv. Space Res.*, 23, 1887-1897, 1999.
- Keating, G. M., S. W. Bougher, R. W. Zurek + 25 co-authors: The structure of the upper atmosphere of Mars: In situ accelerometer measurements from Mars Global Surveyor. *Science*, 279, 1672-1676, 1998.
- Nair, Hari, M. Allen, L. Froidevaux, and R. W. Zurek: Localized rapid ozone loss in the northern winter stratosphere: An analysis of UARS observations. *J. Geophys. Res.*, 103, 1555-1571, 1998.
- Santee, M. L., G. L. Manney, L. Froidevaux, R. W. Zurek, and J. W. Waters: MLS observations of ClO and HNO<sub>3</sub> in the 1996-97 Arctic polar vortex. *Geophys. Res. Lett.*, 24, 2713-2716, 1997.
- Jakosky, B. M., A. P. Zent, and R. W. Zurek: The Mars water cycle: Determining the role of exchange with the regolith. *Icarus*, 130, 87-95, 1997.
- Zurek, R. W., G. L. Manney, A. J. Miller, M. Gelman, and R. Nagatani: Interannual variability of the north polar vortex in the lower stratosphere during the UARS mission. *Geophys. Res. Lett.*, 23, 289-292, 1996.
- Manney, G. L., M. L. Santee, L. Froidevaux, J. W. Waters and R. W. Zurek: Polar vortex conditions during the 1995-96 Arctic winter: Meteorology and MLS ozone. *Geophys. Res. Lett.*, 23, 3203-3206, 1996.
- Manney, G. L., R. Swinbank, S. T. Massie, M. E. Gelman, A. J. Miller, R. Nagatani, A. O'Neill, and R. W. Zurek: Comparison of U. K. Meteorological Office and U. S. National Meteorological Center stratospheric analyses during northern and southern winter. *J. Geophys. Res.*, 101, 10311-10334, 1996.
- Manney, G. L., L. Froidevaux, J. W. Waters, M. L. Santee, W. G. Read, D. A. Flower, R. F. Jarnot, and R. W. Zurek: Arctic ozone depletion observed by UARS MLS during the 1994-95 winter. *Geophys. Res. Lett.*, 23, 85-88, 1996.
- Eluskiewicz, J., D. Crisp, R. Zurek, L. Elson, E. Fishbein, L. Froidevaux, J. Waters, R. G. Grainger, A. Lambert, R. Hardwood, and G. Peckham: Residual circulation in the stratosphere and lower mesosphere as diagnosed from Microwave Limb Sounder data. *J. Atmos. Sci.*, 53, 217-240, 1996.
- Manney, G. L., R. W. Zurek, L. Froidevaux, and J. W. Waters: Evidence for Arctic Ozone Depletion in Late February and Early March 1994. *Geophys. Res. Lett.*, 22, 2941-2944, 1995.

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- Manney, G. L., R. W. Zurek, W. A. Lahoz, R. S. Harwood, J. C. Gille, J. B. Kumer, J. L. Mergenthaler, A. E. Roche, A. O'Neill, R. Swinbank, and J. W. Waters: Lagrangian transport calculations using UARS data. Part I: Passive tracers. J. Atmos. Sci., 52, 3049-3068, 1995.
- Manney, G. L., L. Froidevaux, J. W. Waters, J. C. Gille, R. W. Zurek, J. B. Kumer, J. L. Mergenthaler, A. E. Roche, A. O'Neill, and R. Swinbank: Formation of low ozone pockets in the middle stratospheric anticyclone during winter. J. Geophys. Res., 100, 13,939-13,950, 1995.
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- Manney, G. L., R. W. Zurek, M. E. Gelman, A. J. Miller, and R. Nagatani: The anomalous Arctic lower stratospheric polar vortex of 1992-1993. Geophys. Res. Lett., 21, 2405-2408, 1994.
- Manney, G. L., R. W. Zurek, A. O'Neill, and R. Swinbank: On the motion of air through the stratospheric polar vortex. J. Atmos. Sci., 51, 2973-2994, 1994.
- Manney, G. L., L. Froidevaux, J. W. Waters, R. W. Zurek, W. G. Read, L. S. Elson, J. B. Kumer, J. L. Mergenthaler, A. E. Roche, A. O'Neill, R. S. Harwood, I. MacKenzie, and R. Swinbank: Chemical depletion of ozone in the Arctic lower stratosphere during winter 1992-93. Nature, 370, 429-434, 1994.
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- Zurek, R. W., and L. J. Martin: Interannual variability of planet-encircling dust storms on Mars. J. Geophys. Res., 98, 3247-3259, 1993.
- Martin, L. J., and R. W. Zurek: An analysis of the history of dust activity on Mars. J. Geophys. Res., 98, 3221-3246, 1993.

- Manney, G. L., and R. W. Zurek: Interhemispheric comparison of the development of the stratospheric polar vortex during fall: A 3-D perspective for 1991-1992. Geophys. Res. Lett., 20, 1275-1278, 1993.
- Manney, G. L., L. Froidevaux, J. W. Waters, L. S. Elson, E. F. Fishbein, R. W. Zurek, R. S. Harwood, and W. A. Lahoz: The evolution of ozone observed by UARS MLS in the 1992 late winter southern polar vortex. Geophys. Res. Lett., 20, 1279-1282, 1993.
- Haberle, R. M., J. B. Pollack, J. R. Barnes, R. W. Zurek, C. B. Leovy, J. R. Murphy, H. Lee, and J. Schaeffer: Mars atmospheric dynamics as simulated by the NASA-Ames general circulation model. 1. The zonal-mean circulation. J. Geophys. Res., 98, 3093-3123, 1993.
- Fishbein, E. F., L. S. Elson, L. Froidevaux, G. L. Manney, W. G. Read, J. W. Waters, and R. W. Zurek: MLS observations of stratospheric waves in temperature and O<sub>3</sub> during the 1992 southern winter. Geophys. Res. Lett., 20, 1255-1258, 1993.
- Bougher, S. W., C. G. Fesen, E. C. Ridley, and R. W. Zurek: Mars mesosphere and thermosphere coupling: Semidiurnal tides. J. Geophys. Res., 98, 3281-3295, 1993.
- Barnes, J. R., J. B. Pollack, R. M. Haberle, C. B. Leovy, R. W. Zurek, H. Lee, and J. Schaeffer: Mars atmospheric dynamics as simulated by the NASA-Ames general circulation model. 2. Transient baroclinic eddies. J. Geophys. Res., 98, 3125-3148, 1993.
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- Zurek, R. W.: Comparative aspects of the climate of Mars: An introduction to the current atmosphere. Mars, ed. H. Kieffer et al., U. Ariz. Press, Tucson, 799-817, 1992.
- Kahn, R., T. Z. Martin, R. W. Zurek, and S. W. Lee: The Martian dust cycle. Mars, ed. H. Kieffer et al., U. Ariz. Press, Tucson, 1017-1053, 1992.
- McCleese, D. J., R. D. Haskins, J. T. Schofield, R. W. Zurek, C. B. Leovy, D. A. Paige, and F. W. Taylor: Atmosphere and climate studies of Mars using the Mars Observer Pressure Modulator Infrared Radiometer. J. Geophys. Res., 97, 7735-7757, 1992.
- Yung, Y. L., M. Allen, D. Crisp, R. W. Zurek, and S. P. Sander: Spatial variation of ozone depletion rates in the springtime Antarctic polar vortex. Science, 248, 721-724, 1990.



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- Zurek, R. W. and D. J. McCleese: The role of climate studies in the future exploration of Mars. The Case for Mars III: Strategies for Exploration –General Interest and Overview, ed. Carol Stoker. Science and Technology Series, 74, 277-825, 1989.
- Zurek, R. W. and R. M. Haberle: Zonally symmetric response to atmospheric tidal forcing in the dusty Martian atmosphere. J. Atmos. Sci., 45, 2469-2485, 1988.
- Zurek, R. W: Free and forced modes in the Martian atmosphere. J. Geophys. Res., 93, 9452-9462, 1988.
- Jakosky, B. J., R. W. Zurek and M. R. LaPointe: The observed day-to-day variability of Mars atmospheric water vapor. Icarus, 73, 80-90, 1988.
- Michelangeli, D. V., R. W. Zurek and L. S. Elson: Barotropic instability of mid-latitude zonal jets on Mars, Earth and Venus. J. Atmos. Sci., 44, 2031-2041, 1987.
- Zurek, R. W: Atmospheric tidal forcing of the zonal-mean circulation: The Martian dusty atmosphere. J. Atmos. Sci., 43, 652-670, 1986.
- McCleese, D. J., J. T. Schofield, R. W. Zurek and 10 others: Remote sensing of the atmosphere of Mars using infrared pressure modulation and filter radiometry. Appl. Optics, 25, 4232-4345, 1986.
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- Zurek, R. W: The relations between linear and bilinear atmospheric tidal fields in geometric height and in log-pressure coordinates. PAGEOPH, 123, 902-920, 1985.
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- Fanale, F. P., W. B. Banerdt, L. S. Elson, T. V. Johnson and R. W. Zurek: Io's surface: Its phase composition and influence on Io's atmosphere and Jupiter's

- magnetosphere. In Satellites of Jupiter, ed. By D. Morrison, U. Arizona Press, Tucson, 756-781, 1982.
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- Zurek, R. W: Diurnal tide in the Martian atmosphere. J. Atmos. Sci., 33, 321-337, 1976.
- Zurek, R. W: Tides in the Martian atmosphere. Ph. D. Thesis, U. Washington, Seattle, 140 pp., 1974.
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