

Kevin W. Bowman

Senior Technical Staff
Jet Propulsion Laboratory
California Institute of Technology

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

Experience

Senior Member of Technical Staff, Jet Propulsion Laboratory, Pasadena, CA - 1997-Present

- Assimilation and inverse modeling of TES ozone, carbon monoxide, and HDO observations into global chemistry and transport models
- Conception and development of non-linear optimal estimation and error analysis algorithms for vertical trace gas retrievals.
- Conception and development of calibration algorithms for Fourier Transform Spectrometers.

NASA Graduate Student Researcher's Program Fellow, Georgia Institute of Technology, 1993-1997

- Wavelet-based algorithms for wavefront estimation and reconstruction in adaptive optical systems.
- Developed wavelet-based Wiener filtering techniques for stationary and non-stationary stochastic processes.

Education

Georgia Institute of Technology, Georgia - Phd in Electrical Engineering, 1997
Thesis: Application of Wavelets to Adaptive Optical Systems and Multiresolution Wiener Filtering

Georgia Institute of Technology, Georgia - MSEE, 1992
Concentrations: Optics and Signal Processing

Ecole Supérieure d'Electricité (SUPELEC), Metz, FRANCE - Diplôme de Spécialisation en Traitement et Transmission des Informations, 1993

Auburn University, Alabama - Bachelor of Electrical Engineering, 1991

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

Projects

Chemical evolution of Boreal Fires from TES during the Arctic Research of the Composition of the Troposphere from Aircraft and Satellites campaign, (2008-11)
Co-I NASA ROSES 2007 Tropospheric Chemistry: Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS),

Sensor Web Operations Explorer: a tool for exploring the scientific impact of different mission simulations (2006-09)

Co-I NASA ROSES 2005 Advanced Information Systems Technology (AIST)

Analysis of Aura and Related Satellite Observations: Mapping Trace Gas Emissions and Quantifying Long-range Transport of Pollution (2006-09):

Co-I NASA ROSES 2005

Convective scale transport of trace gases assessed with models and satellite observations (2006-09)

Co-I NASA ROSES 2005

Atmospheric Chemical Data Assimilation: A Critical Tool for Enhancing Scientific Return from Space-based Observations and for Defining and Designing New Atmospheric Composition Missions (2005-06)

Co-I JPL Director's Research Discretionary Fund (DRDF)

Parallelization of the GEOS-Chem model on the JPL Institutional Cluster (2004-05)

PI JPL R&TD Strategic Initiative

Assessing the Potential of TES Observations for Mapping Global Sources of Atmospheric Carbon Monoxide (2002-03)

JPL Principle Investigator (PI)—Caltech President's Fund,

Awards

NASA Group Achievement Award as a member of the Aura Project(2005)

NASA Group Achievement Award – Aura Tropospheric Emission Spectrometer instrument team and the ground data system development teams (2005)

Goddard Space Flight Center Group Achievement Award as a member of the Aura Team (2005)

Field Campaigns

INTEX-B/MILAGRO (NASA/NSF) satellite team member (2006)

TexAQS/GoMACCS (Texas Air Quality Study/Gulf of Mexico Atmospheric Composition and Climate Study) (NOAA/NASA/Texas) Rapid Science Synthesis (RSS) panel member (2006)

Professional Activities

JPL Earth system assimilation working group lead (ESAWG) (2007-08)

GEOS-Chem adjoint working group lead (2007-08)

AGU Fall Meeting (2007). Presiding: Evaluation of Air Quality Models and Assessment of Emissions Inventories Using Bottom-Up and Top-Down Approaches III: Source and State Data Assimilation of Satellite and in Situ Measurements in Atmospheric Chemistry

Member of AGU

Reviewer for Journal of Geophysical Research, Geophysical Research Letters, Atmospheric Chemistry and Physics, Journal of Computational Physics, Applied Optics

Review panels

CNES Infrared Atmospheric Sounder Interferometer (IASI) calibration algorithm review board (2000)

NASA Orbital Carbon Observatory (OCO) internal JPL review panel (2003)

NASA Modeling, Analysis, and Prediction: Climate variability and change review panel (2005)

NASA Measurements, Modeling, and Analyses in Support of AURA and other NASA Satellite Observations of the Earth's atmosphere review panel (2005)

Selected Conference Presentations and Invited Talks

K. **Bowman**, et al, "Assimilation of TES ozone into the GEOS-Chem and GFDL AM2 models: implications for chemistry-climate coupling", September, 2007, Aura science team meeting, Pasadena, CA.

K. **Bowman** and H. Worden, "Perspectives on atmospheric chemistry and climate from the Tropospheric Emission Spectrometer", Invited seminar, Geophysical Fluid Dynamics Laboratory, April 2007, Princeton, NJ.

K. **Bowman**, "Ozone without borders: perspectives of chemistry and climate from the Tropospheric Emission Spectrometer", Invited seminar, School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Jan. 2007, Atlanta, GA

K. **Bowman** et al, "Transpacific transport of pollution during INTEX-B: a synthesis approach using TES observations and RAQMS model", AGU Fall Meeting, Dec. 11-15, 2006, San Francisco, California

K. **Bowman** et al, "Observing Signatures of Air Pollution from Space: Prospects and Challenges for Nadir Thermal Infrared Spectrometers", Community workshop on air quality remote sensing from space: defining an optimum observing strategy, Feb, 2006, Boulder, Colorado

B. Pierce, K. **Bowman**, et al, "Regional Influences on Houston and Dallas Air Quality During TEXAQS 2006", Rapid Science Synthesis Workshop, Oct 12-13, 2006, Austin, Texas

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

G. Bal, B. Borchers, K. **Bowman** et al, "Atmospheric retrievals with the Tropospheric Emission Spectrometer", Inverse Problems: Computational Methods and Emerging Applications, Institute for Pure and Applied Mathematics, UCLA, Sept 15-18, 2003.

Publications

Submitted/in press

K.W. **Bowman**, et al, "Impact of surface emissions to the zonal variability of tropical tropospheric ozone and carbon monoxide for November 2004", *Atmos. Chem. Phys. Discuss.*, 8, 1505-1548, 2007

Jones, D.B., K.W. **Bowman**, et al, "Inversion analysis of carbon monoxide emissions using data from the TES and MOPITT satellite instruments", *Atmos. Chem. Phys. Discuss.*, 7, 17625-17662, 2007

Parrington, M, D.B. Jones, K.W. **Bowman**, et al, "Estimating the summertime tropospheric ozone distribution over North America through assimilation of observations from the Tropospheric Emission Spectrometer", *J. Geophys. Res.*, 113, D18307, doi:10.1029/2007JD009341.

Fishman, J.D., K.W. **Bowman**, et al, "Remote Sensing of Chemically Reactive Trace Gases from Space", submitted, *Bulletin of the American Meteorological Society*, 2007

Worden, H., K.W. **Bowman**, et al., "Direct global observations of tropospheric ozone as a greenhouse gas", submitted, *Nature Geosciences*, 2007

Logan, J. A., I. Megretskaya, R. Nassar, L.T. Murray, L. Zhang, K. W. **Bowman**, H. M. Worden, and M. Luo, "The effects of the 2006 El Niño on tropospheric composition as revealed by data from the Tropospheric Emission Spectrometer (TES)", in press, *Geophys. Res. Letters*, 2007

S. S. Kulawik, K. W. **Bowman**, M. Luo, C. D. Rodgers, and L. Jourdain, "Technical Note: Impact of nonlinearity on changing the a priori of trace gas profiles estimates from the Tropospheric Emission Spectrometer (TES)", *Atmos. Chem. Phys. Discuss.*, 8, 1261-1289, 2008

Al-Saadi, J., A. Soja, B. Pierce, J. Szykman, C. Wiedinmyer, L. Emmons, S. Kondragunta, X. Zhang, C. Kittaka, T. Schaack, and K. W. **Bowman**, "Evaluation of Near-Real-Time Biomass Burning Emissions Estimates Constrained by Satellite Active Fire Detections", submitted, *J. Applied Remote Sensing*, 2007

Nassar, R., J. A. Logan, H. M. Worden, I. A. Megretskaya, K. W. **Bowman**, et al., "Validation of Tropospheric Emission Spectrometer (TES) Nadir Ozone Profiles Using Ozone Sonde Measurements", *J. Geophys. Res.*, 2007, in press

Osterman, G., S.S. Kulawik, H.M. Worden, N.A.D. Richards, B.M. Fisher, A. Eldering, M.W. Shephard, L. Froidevaux, G. Labow, M. Luo, R.L. Herman, K.W. **Bowman**,

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

“Validation of Tropospheric Emission Spectrometer (TES) Measurements of the Total, Stratospheric and Tropospheric Column Abundance of Ozone”, *J. Geophys. Res.*, 2007, in press.

Shephard M. W., H. M. Worden, K. E. Cady-Pereira, M. Lampel, M. Luo, K. W. **Bowman**, et al, “Tropospheric Emission Spectrometer Nadir Spectral Radiance Comparisons”, *J. Geophys. Res.*, 2007, in press.

Published

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

Worden, J, D. Noone, K.W. **Bowman**, et al, “Importance of rain evaporation and continental convection in the tropical water cycle”, *Nature*, 445, 2007, doi:10.1038/nature05508

Preliminary Findings from the Second Texas Air Quality Study (TexAQS II) A Report to the Texas Commission on Environmental Quality by the TexAQS II Rapid Science Synthesis Team, October, 2006, K.W. **Bowman**-RSS team member, available at

[http://www.tceq.state.tx.us/assets/public/implementation/air/am/workshop/20061012-13/RSST Preliminary Findings Report 20061031.pdf](http://www.tceq.state.tx.us/assets/public/implementation/air/am/workshop/20061012-13/RSST_Preliminary_Findings_Report_20061031.pdf)

Bowman, K.W., C. D. Rodgers, et al, “Tropospheric Emission Spectrometer: Retrieval Method and Error Analysis”, *IEEE Transactions on Geoscience and Remote Sensing*, vol. 44, no. 5, May 2006

L. Zhang, D. J. Jacob, K. W. **Bowman**, et al. “Ozone-CO correlations determined by the TES satellite instrument in continental outflow regions.” *Geophys. Res. Lett.*, 33, 2006.

Richards, N. A. D., Q. Li, K. W. **Bowman** et al, “Assimilation of TES CO into a global CTM: First results”, *Atmos. Chem. Phys. Discuss*, 6:11727–11743, 2006

Jourdain, L, H. M. Worden, J. R. Worden, K. **Bowman**, et al, (2007) “Tropospheric vertical distribution of tropical Atlantic ozone observed by TES during the Northern African biomass burning season”, *Geophys. Res. Lett.*, 34, L04810, 10.1029/2006GL028284

Worden, J, X. Liu, K.W. **Bowman** et al,(2007) “Improved Tropospheric Ozone Profiles using OMI and TES Radiances”, *Geophys. Res. Lett.*, 34, L01809, 10.1029/2006GL027806

Worden, H.M., J. A. Logan, J. R. Worden, R. Beer, K. **Bowman**, et al, (2007), “Comparisons of Tropospheric Emission Spectrometer (TES) ozone profiles to

ozonesondes: methods and initial results.” *J. Geophys. Res.*, 112, D03309, 10.1029/2006JD007258

Worden, J, K.W. **Bowman** et al, (2006) “Tropospheric Emission Spectrometer observations of the tropospheric HDO/H₂O ratio: Estimation approach and characterization, *J. Geophys. Res.*, 111, D16309, doi:10.1029/2005JD006606.

Kulawik, S.S.; Worden, H.; Osterman, G.; Ming Luo; Beer, R.; Kinnison, D.E. **Bowman**, K.W. et al, “TES atmospheric profile retrieval characterization: an orbit of simulated observations”, *IEEE Transactions on Geoscience and Remote Sensing*, Vol 44, Issue 5, May 2006 Page(s):1324 - 1333

Kulawik, S.S.; Osterman, G.; Jones, D.B.A.; **Bowman**, K.W., “Calculation of altitude-dependent Tikhonov constraints for TES nadir retrievals”, *IEEE Transactions on Geoscience and Remote Sensing*, Volume 44, Issue 5, May 2006 Page(s):1334 - 1342

Kulawik, S.S.; Worden, H.; Osterman, G.; Ming Luo; Beer, R.; Kinnison, D.E.; **Bowman**, K.W. et al, “TES atmospheric profile retrieval characterization: an orbit of simulated observations”, *IEEE Transactions on Geoscience and Remote Sensing*, Volume 44, Issue 5, May 2006 Page(s):1324 – 1333

S. S. Kulawik, J. Worden, A. Eldering, K. **Bowman**, et al (2006) “Implementation of cloud retrievals for Tropospheric Emission Spectrometer (TES) atmospheric retrievals: part 1. description and characterization of errors on trace gas retrievals.” doi: 10.1029/2005JD006733 *J. Geophys. Res.*, 111, 2006.

Rinsland, C. P., M. Luo, J. A. Logan, R. Beer, H. M. Worden, J. R. Worden, K. **Bowman**, et al, “Nadir Measurements of carbon monoxide distributions by the Tropospheric Emission Spectrometer onboard the Aura Spacecraft: Overview of analysis approach and examples of initial results, *Geophys. Res. Lett.*, 33, L2280610.1029/2006GL027000, November 22, 2006.

Worden, H., R. Beer, K.W. **Bowman**, et al, “TES level 1 algorithms: interferogram processing, geolocation, radiometric, and spectral calibration”, *IEEE Transactions on Geoscience and Remote Sensing*, Volume 44, Issue 5, May 2006 Page(s):1288 - 1296

Clough, S.A.; Shephard, M.W.; Worden, J.; Brown, P.D.; Worden, H.M.; Mingzhao Luo; Rodgers, C.D.; Rinsland, C.P.; Goldman, A.; Brown, L.; Kulawik, S.S.; Eldering, A.; Lampel, M.; Osterman, G.; Beer, R.; **Bowman**, K.; Cady-Pereira, K.E.; Mlawer, E.J.; “Forward model and Jacobians for Tropospheric Emission Spectrometer retrievals”, *IEEE Transactions on Geoscience and Remote Sensing*, Volume 44, Issue 5, May 2006 Page(s):1308 - 1323

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

MS 183-601
4800 Oak Grove Dr.
Pasadena, CA 91109
T 818-354-2995
F 818-354-5148
kevin.bowman@jpl.nasa.gov
science.jpl.nasa.gov

Bowman, K. W., J. Worden, T. Steck, H. M. Worden, S. Clough, and C. Rodgers (2002), "Capturing time and vertical variability of tropospheric ozone: A study using TES nadir retrievals", *J. Geophys. Res.*, 107(D23),4723, doi:10.1029/2002JD002150.

Jones, D. B. A., K. W. **Bowman**, et al (2003), "Potential of observations from the Tropospheric Emission Spectrometer to constrain continental sources of carbon monoxide", *J. Geophys. Res.*, 108(D24), 4789, doi:10.1029/2003JD003702.

Worden, J.R., K.W. **Bowman**, D.B. Jones, (2004), "Two-dimensional characterization of atmospheric profile retrievals from limb sounding observations", *J. Quant. Spectros. Radiat. Transfer*, 86(1), 45–71.

Worden, J., S. S. Kulawik, M. W. Shephard, S. A. Clough, H. Worden, K. **Bowman**, and A. Goldman (2004), "Predicted errors of tropospheric emission spectrometer nadir retrievals from spectral window selection", *J. Geophys. Res.*, 109, D09308, doi: 10.1029/2004JD004522.

Sarkissian, E, and K.W. **Bowman**, "Application of a nonuniform spectral resampling transform in Fourier-transform spectrometry (2003)", *Appl. Optics*, Vol 42. No. 6.

Worden, J., T. Woods, and K.W. **Bowman**, "Far-ultraviolet intensities and center-to-limb variations of active regions and quiet sun using UARS SOLSTICE irradiance measurements and ground-based spectroheliograms", *ASTROPHYSICAL JOURNAL* 560 (2): 1020-1034 Part 1, OCT 20 2001

Bowman, K.W., H.M. Worden, and R. Beer, "Instrument line-shape modeling and correction for off-axis detectors in Fourier-transform spectrometry" (2000), *Appl. Optics*, Vol 39, No. 21

Bowman, K. W. and W.T. Rhodes, "Application of wavelets to wavefront reconstruction in adaptive optical systems", *Proceedings SPIE Conf. 3126 Adaptive Optics and Applications* July, San Diego, CA 1997

Bowman, K.W. and C. Houdré, "Wavelet Analysis of Random Fields and Multiresolution Wiener Filtering", *Proceedings SPIE Conf. 2569 Wavelet Applications to Signal and Image Processing III* July, San Diego, CA 1995