VIVIENNE HELEN PAYNE

Work:
Earth Atmospheric Science
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Nationality: British (US Legal Permanent Resident)

Education

2001-2006 **University of Oxford, DPhil**
"Retrieval of Water Vapor and Methane from the MIPAS Satellite Instrument"

1996-2001 **University of Edinburgh, MPhys (Physics) First Class**

Experience

Oct 2014-present **Group Supervisor, Tropospheric Sounding, Assimilation and Modeling Group,** Jet Propulsion Laboratory, Pasadena, CA

Jan 2012-present **Scientist**, Jet Propulsion Laboratory

JPL Projects:

- ***Orbiting Carbon Observatory (OCO-2)*** - a mission designed to make precise, time-dependent global measurements of atmospheric carbon dioxide from an Earth orbiting satellite. Currently leading the team responsible for modeling molecular absorption in the OCO-2 forward model.
- ***Tropospheric Emission Spectrometer (TES)*** – a high spectral resolution spectrometer flying on the NASA Aura satellite, designed to make global measurements of trace gases in Earth's atmosphere. Involved in development of new data products and scientific utilization of the data.

Other current NASA ROSES-funded research:

- PI, "Intercalibration of measurements from microwave sensors: Water vapor sounding channels and window channels over land" on the Precipitation Measurement Mission Science Team
- Co-I, "Fresh constraints on the global ozone budget through the analysis of new peroxyacetyl nitrate (PAN) observations from TES" on the Aura Science Team
- PI, "Verification of spectroscopic input to the OCO-2 forward model" on the Orbiting Carbon Observatory-2 Science Team
- Co-I, "Refined atmosphere data products from CrIS and ATMS" on the Suomi NPP Science Team

Jan 2009-Jan 2012 **Staff Scientist, Atmospheric and Environmental Research (AER), Lexington, MA**

- Principal Investigator (PI) on AER contract with JPL to provide forward model and retrieval support for TES. Maintenance and development of AER's Line By Line Radiative Transfer Model (LBLRTM) and associated spectroscopic input, validation of the TES forward model, supporting the JPL team with validation of Level 2 products, analysis of systematic errors in retrieval residuals, implementation of new

retrieval products, collaboration with university-based product users.

- PI on a NASA-funded project to use ground-based, aircraft and satellite measurements to constrain high latitude CH_4 fluxes.
- Co-I on NASA Aura Science Team effort to retrieve additional species from TES (e.g., ammonia, methanol, formic acid).
- PI on a NASA/Joint Center for Satellite Data Assimilation project to improve microwave and infrared spectroscopy for data assimilation for numerical weather prediction. (Emphasis on CO_2, O_2, H_2O, and O_3.)
- PI on a NASA Precipitation Science project to use infrared and microwave sensors in conjunction with AER's radiative transfer modeling tools for intercalibration of microwave sensors for the Global Precipitation Mission.

Jan 2006-Jan 2008 **Senior Research Associate, AER**

- Validation of AER's radiative transfer models and associated spectroscopic parameters against spectrally resolved radiometric measurements from ground-based, aircraft and satellite platforms.
- Ongoing improvements to spectroscopic line parameters and continuum used in AER models
- Validation of TES Level 2 products.
- Developed information-based representation to allow greater confidence in scientific utilization of TES CH_4 product.
- Technical lead on project to extend AER's Monochromatic Radiative Transfer Model (MonoRTM) to frequencies beyond microwave.

2005 **Research Associate**
University of Colorado, Boulder, CO

- Developed and refined retrievals of HDO, $H_2{}^{18}O$, $H_2{}^{17}O$ and CH_3D. Analyzed global HDO/H_2O and O_3 measurements to study water vapor transport in the tropical tropopause region.

Awards and Fellowships

2014	NASA Group Achievement Award for the Aura Tropospheric Emission Spectrometer
2012, 2014	JPL Team Awards, for contributions to the Orbiting Carbon Observatory-2
2010	AER Employee of the Year.
2005	Rupert Ford Fund Fellowship (administered by the Royal Meteorological Society) to carry out a research visit to the University of Colorado.
2001-2004	Natural Environmental Research Council studentship.
1996-1997	Margaret Campbell Scott Entrance Bursary to study undergraduate physics.

Professional Activities

- **Associate Editor**, IEEE Trans. Geosci. Remote Sens., 2012-present
- **Member,** AGU and IEEE (Geoscience and Remote Sensing Section)

Reviewer:

- Journals: ***J. of Geophys. Res., IEEE Trans. Geosci. Remote Sens***, ***J. Quant. Spec. Radiat. Transfer, Atmos. Meas. Tech.***, ***J. Appl. Met. Clim.***
- Grant Agencies: NASA, DoE, NOW (Netherlands Science Council), NERC (National Environmental Research Council)
- Conferences: International Geoscience and Remote Sensing Symposium (IGARSS)

Refereed Publications

M. J. Alvarado, **V. H. Payne**, K. E. Cady-Pereira, J. D. Hegarty, S. S. Kulawik, K. J. Wecht, J. R. Worden, and S. C. Wofsy, Impacts of updated spectroscopy on thermal infrared retrievals of methane evaluated with HIPPO data, *Atmos. Meas. Tech.*, 8, 965-985, (2015)

A. J. Turner, D. J. Jacob, K. J. Wecht, J. D. Maasakkers, S. C. Biraud, H. Boesch, K. W. Bowman, N. M. Deutscher, M. K. Dubey, D. W. T. Griffith, F. Hase, A. Kuze, J. Notholt, H. Ohyama, R. Parker, **V. H. Payne**, R. Sussmann, V. A. Velazco, T. Warneke, P. O. Wennberg, and D. Wunch, Estimating global and North American methane emissions with high spatial resolution using GOSAT satellite data, *Atmos. Chem. Phys. Discuss*., 15, 4495-4536 (2015)

V. H. Payne, M. J. Alvarado, K. E. Cady-Pereira, J. R. Worden, S. S. Kulawik and E. V. Fischer, Satellite observations of peroxyacetyl nitrate from the Tropospheric Emission Spectrometer, *Atmos. Meas. Tech*., 7, 3737-3749 (2014)

H. Oetjen, **V. H. Payne**, S. S. Kulawik, A. Eldering, J. Worden, D. P. Edwards, G. L. Francis, H. M. Worden, C. Clerbaux, J. Hadji-Lazaro and D. Hurtmans, Extending the satellite data record of tropospheric ozone profiles from Aura-TES to MetOp-IASI, *Atmos. Meas. Tech.,* 7, 4223-4236, doi:10.5194/amt-7-4223-2014 (2014)

G. Clain, H. Brogniez, **V. H. Payne**, V. O. John and M. Luo, An assessment of SAPHIR calibration using quality tropical soundings, *J. Atmos. Oceanic. Tech*., doi: http://dx.doi.org/10.1175/JTECH-D-14-00054.1 (2014)

B. J. Drouin, **V. H. Payne**, F. Oyafuso, K. Sung and E. J. Mlawer, Pressure broadening of oxygen by water, *Journal of Quantitative Spectroscopy and Radiative Transfer*, Volume 133, January 2014, Pages 190-198, ISSN 0022-4073, http://dx.doi.org/10.1016/j.jqsrt.2013.08.001 (2014)

J. Worden, Z. Jiang, D. Jones, M. Alvarado, K. Bowman, C. Frankenberg, E. A. Kort, S. S. Kulawik, M. Lee, J. Liu, **V. Payne**, K. Wecht and H. Worden, El Nino, the 2006 Indonesian peat fires and the distribution of atmospheric methane, *Geophys. Res. Lett*., 40 (18), 4938-4943 (2013)

M. J. Alvarado, **V. H. Payne**, E. J. Mlawer, G. Uymin, M. W. Shephard, K. E. Cady-Pereira, J. S. Delamere and J-L. Moncet, Performance of the line-by-line radiative transfer model (LBLRTM) for temperature and species retrievals: Recent updates evaluated with IASI case studies, *Atmos. Chem. Phys*., 13, 6687-1711 (2013)

J. Worden, K. Wecht, C. Frankenberg, M. Alvarado, K. Bowman, E. Kort, S. Kulawik, M. Lee, **V. Payne**, and H. Worden, CH_4 and CO distributions over tropical fires as observed by the Aura TES satellite instrument and modeled by GEOS-Chem, *Atmos. Chem. Phys.*, 13, 3679-3692 (2013)

K. W. Wecht, D. J. Jacob, S. C. Wofsy, E. A. Kort, J. R. Worden, S. S. Kulawik, D. K. Henze, M. Kopacz, and **V. H. Payne**, Validation of TES methane with HIPPO aircraft observations: implications for inverse modeling of methane sources, *Atmos. Chem. Phys*., 12, 1823–1832 (2012)

J. Worden, S. Kulawik, C. Frankenberg, **V. Payne**, K. Bowman, K. Cady-Pereira, K. Wecht, J.-E. Lee, and D. Noone, Profiles of CH4, HDO, H2O, and N2O with improved lower tropospheric vertical resolution from Aura TES radiances, *Atmos. Meas. Tech*., 5, 397–411 (2012)

K. E. Cady-Pereira, M. W. Shephard, D. B. Millet, M. Luo, K. C. Wells, Y. Xiao, **V. H. Payne**, J. Worden, Methanol from TES Global Observations: Retrieval Algorithm and Seasonal and Spatial Variability, *Atmos. Chem. Phys.,* 12, 8189-8203 (2012**)**

Y. Xiao, K. E. Cady-Pereira, **V. H. Payne**, D. B. Millet, M. W. Shephard, M. Luo, M. Alvarado, K. C. Wells, E. C. Apel, T. L. Campos, H. B. Singh, and G. W. Sachse, Methanol-CO correlations

in Mexico City Pollution outflow from aircraft and satellite during MILAGRO, *Atmos. Chem. Phys. Discuss.*, 12, 5705-5783 (2012)

E. J. Mlawer, **V. H. Payne**, J-L. Moncet, J. S. Delamere, M. J. Alvarado and D. C. Tobin, Development and evaluation of the MT_CKD model of continuum absorption, *Phil. Trans. R. Soc. A*, 370, 2520-2556, doi:10.1098/rsta.2011.0295 (2012)

V. H. Payne, E. J. Mlawer, K. E. Cady-Pereira and J-L. Moncet, Water vapor continuum absorption in the microwave, *IEEE Trans. Geosci. Remote Sens.,* vol 49 (6), 2194-2208 (2011)

M. J. Alvarado, K. E. Cady-Pereira, Y. Xiao, D. B. Millet and **V. H. Payne**, Emission Ratios for Ammonia and Formic Acid and Observations of Peroxy Acetyl Nitrate (PAN) and Ethylene in Biomass Burning Smoke as Seen by the Tropospheric Emission Spectrometer (TES), Atmosphere, 2(4), 633-654, doi:10.3390/atmos2040633 (2011)

T. C. Connor, M. W. Shephard, **V. H. Payne**, K. E. Cady-Pereira, S. S. Kulawik, M. Luo, G. Osterman and M. Lampel, Long term stability of TES satellite radiance measurements, *Atmos. Meas. Tech.*, 4, 1481-1490 (2011)

M. W. Shephard, K. E. Cady-Pereira. M. Luo, D. K. Henze, R. W. Pinder, J. T. Walker, C. P. Rinsland, J. O. Bask, L. Zhu, **V. H. Payne** and L. Clarisse, TES ammonia retrieval strategy and global observations of the spatial and seasonal variability of ammonia, *Atmos. Chem. Phys*., 11, 10743-10763 (2011)

J. S. Delamere, S. A. Clough, **V. H. Payne**, E. J. Mlawer, D. D. Turner and R. R. Gamache, A far-infrared radiative closure study in the Arctic: Application to water vapor, *J. Geophys. Res.,* vol. 115, D17106, doi:10.1029/2009JD012968 (2010)

V. H. Payne, M. W. Shephard, S. A. Clough, J. A. Logan and R. Nassar, Information-centered representation of retrievals with limited degrees of freedom for signal: Application to methane from the Tropospheric Emission Spectrometer, *J. Geophys. Res*., vol 114, D10307, doi:1029/2008JD101055 (2009)

D. Cimini, F. Nasir, E. R. Westwater, **V. H. Payne**, D. D. Turner, E. J. Mlawer, M. L. Exner and M. P. Cadeddu, Comparison of ground-based millimeter wave observations in the Arctic winter, *IEEE Trans. Geosci. Remote Sens,* vol. 47, no. 9, 3098 (2009)

M. W. Shephard, S. A. Clough, **V. H. Payne**, W. L. Smith, S. Kireev and K. E. Cady-Pereira, Performance of the line-by-line radiative transfer model (LBLRTM) for temperature and species retrievals: IASI case studies from JAIVEx, *Atmos. Chem. Phys.*, 9, 7397-7417 (2009)

S. Payan, C. Camy-Peyret, H. Oelhaf, G. Wetzel, G. Maucher, C. Keim, M. Pirre, N. Huret, A. Engel, M. C. Volk, H. Kuellmann, J. Kuttippurath, U. Cortesi, G. Bianchini, F. Mencaraglia, P. Raspollini, G. Redaelli, C. Vigouroux, M. De Mazière, S. Mikuteit, T. Blumenstock, V. Velazco, J. Notholt, E. Mahieu, P. Duchatelet, D. Smale, S. Wood, N. Jones, C. Piccolo, **V. Payne,** A. Bracher, N. Glatthor, G. Stiller, K. Grunow, P. Jeseck, Y. Te, and A. Butz, Validation of version-4.61 methane and nitrous oxide observed by MIPAS, *Atmos. Chem. Phys*., 9, 413-442 (2009)

C. Piccolo, A. Dudhia and **V. H. Payne**, Heavy ozone enrichments from MIPAS Limb emission spectra, Atmos. Chem. Phys. Discuss., 9, 25127-25128 (2009)

V. H. Payne, J. S. Delamere, K. E. Cady-Pereira, R. R. Gamache, J-L. Moncet, E. J. Mlawer and S. A. Clough, "Air-broadened halfwidths of the 22 GHz and 183 GHz water vapor lines", *IEEE Trans. Geosci. Remote Sens*., vol. 46 (11), 3601-3617 (2008)

R. Beer, M. W. Shephard, S. S. Kulawik, S. A. Clough, A. Eldering, K. W. Bowman, S. P. Sander, B. M. Fisher, **V. H. Payne**, M. Luo, G. B. Osterman and J. R. Worden, First satellite observations of lower tropospheric ammonia and methanol, *Geophys. Res. Lett.*, 35, L09801, doi:10.1029/2008GL033642 (2008)

M. W. Shephard, R. L. Herman, B. M. Fisher, K. E. Cady-Pereira, S. A. Clough, **V. H. Payne** et al., Comparison of Tropospheric Emission Spectrometer (TES) Water Vapor Retrievals with *In Situ* Measurements, *J. Geophys. Res.*, 113 (D15), D15S24, doi:10.1029/2007JD008822 (2008)

V. H. Payne, D. Noone, A. Dudhia, C. Piccolo and R. G. Grainger, "Global satellite measurements of HDO and implications for understanding the entry of water vapour into the stratosphere", *QJRMS*, 133, 1459-1471 (2007)

M. P. Cadeddu, **V. H. Payne**, S. A. Clough, K. E. Cady-Pereira and J. C. Liljegren, Effect of the oxygen line-parameter modeling on temperature and humidity retrievals from ground-based microwave radiometers, *IEEE Trans. Geosci. Remote Sens*., 45, 2216-2223 (2007).

P. Raspollini, C. Belotti, A. Burgess, B. Carli, M. Carlotti, S. Ceccherini, B. M. Dinelli, A. Dudhia, J-M. Flaud, B. Funke, M. Hoepfner, M. Lopez-Puertas, **V. Payne**, C. Piccolo, J. J. Remedios, M. Ridolfi, R. Spang, MIPAS Level 2 operational analysis, *Atmos. Chem. Phys*., 6, 5605-5630 (2006)

B. Carli, D. Alpaslan, M. Carlotti, E. Castelli, S. Ceccherini, B. M. Dinelli, A. Dudhia, J.-M. Flaud, M. Hoepfner, V. Jay, L. Magnani, H. Oelhaf, **V. Payne**, C. Piccolo, M. Prosperi, P. Raspollini, M. Ridolfi, J. Remedios and R. Spang, First results from MIPAS/ENVISAT with operational Level 2 code, *Advances in Space Research*, 33(7), 1012-1019 (2004)

A. B. Burgess, R. G. Grainger, A. Dudhia, **V. H. Payne** and V. L. Jay, MIPAS measurement of sulfur hexafluoride, *Geophys. Res. Lett*, Vol. 31, No. 5, doi:10.1029/2003GL019143 (2004)

T. von Clarmann, S. Ceccherini, A. Doicu, A. Dudhia,B. Funke, U. Grabowski, S. Hilgers, V. Jay, A. Linden, M. López-Puertas, F.-J. Martín-Torres, **V. Payne**, J. Reburn, M. Ridolfi, F. Schreier, G. Schwarz, R. Siddans, and T. Steck, A blind test retrieval experiment for infrared limb emission spectrometry, *J. Geophys. Res*., Vol. 108, No. D23, 4746, doi:10.1029/2003JD003835 (2003)