David R. Thompson, Ph.D.

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David R. Thompson is a Technical Group Lead of the JPL Imaging Spectroscopy Group, Instrument Scientist for NASA's EMIT and Lunar Trailblazer missions, and Investigation Scientist for NASA's Airborne Visible Infrared Imaging Spectrometer (AVIRIS) project. His research advances the algorithms and practice of imaging spectroscopy for characterizing Earth and other planetary bodies. David's approaches have been fielded to North America, South America, the Atlantic Ocean, Airborne campaigns on multiple continents, multiple Earth-orbiting spacecraft, and the surface of Mars. He has received the NASA Exceptional Technology Achievement Medal, the Lew Allen Award for Excellence, and the NASA Early Career Achievement Medal. His internships, postdoctoral positions and recruitment efforts have brought six PhD-level researchers to JPL.

Education

Ph. D., Robotics, The Robotics Institute, Carnegie Mellon University, 2008.
M.Sc. Informatics, University of Edinburgh, Scotland, 2002. Degree First Class.
B.A., Computer Science, Carleton College, 2001. Magna Cum Laude.

Professional Positions

2018- present: Principal Research Technologist, Jet Propulsion Laboratory
2017- 2018: Research Technologist V, Jet Propulsion Laboratory
2012- 2017: Research Technologist IV, Jet Propulsion Laboratory
2008- 2012: Member Technical and Research Staff, Jet Propulsion Laboratory
2004 – 2008: PhD Student, Carnegie Mellon Robotics Institute

Current Roles

Instrument Scientist, EMIT Mission (JPL 2018-) Lead of Radiometric (Level 1) and Surface Reflectance (Level 2a) analysis for a NASA space mission to observe mineral dust sources. Science team.

Investigation Scientist, AVIRIS (JPL 2016-) Investigation scientist for NASA's next generation Airborne Visible Infrared Imaging Spectrometer, AVIRIS-NG.

Instrument Scientist, HVM3 on the Lunar Trailblazer Mission (JPL 2019-) Imaging spectroscopy instrument characterization and analysis for a mission to map lunar ice.

Technical Group Lead, Imaging Spectroscopy (JPL 2016-) Technical Group Leader for Science, Algorithms and Calibration of the Imaging Spectroscopy Group. Provided leadership for a subgroup of fourteen individuals including seven PhD-level researchers. Responsibilities included planning work, making individual assignments, providing effective direction, mentoring and technical oversight. Was accountable for subgroup accomplishments and technical quality. Maintained working relationships with other organizations in and outside of JPL.

Science Team, Delta-X Airborne Mission (JPL 2019-) Co-I on a NASA Earth Venture Suborbital mission to understand ocean mesoscale vertical transport.

Science Team, S-MODE Airborne Mission (JPL 2019-) Co-I for a NASA Earth Venture Suborbital mission to monitor and understand processes driving river delta formation and subsidence worldwide.

Science Steering Committee, Surface Biology and Geology Architecture Study (JPL 2019-).

Science Team Professional Affiliate, Europa Clipper Mission (JPL 2018-) Performing MISE instrument analysis

Visiting Researcher, California Institute of Technology (2018-) advanced algorithms for imaging spectroscopy at the department of Geophysics and Planetary Sciences.

Co-I, UCIS-Moon (JPL 2019-) Lunar imaging spectroscopy technology development by the NASA DALI program.

Co-I, Imaging Arctic Methane Plumes (JPL 2018-) Co-investigator in a NASA science team effort to monitor methane emissions in the Arctic using remote spectroscopic techniques.

PI, Remote Sensing of Canopy Water (JPL 2021-2023) JPL Principal of a grant to develop microwave and optical/infrared remote sensing methods for measuring tree canopy water.

PI, Global Visible Shortwave Infrared Imaging Spectroscopy (JPL 2019-). PI of a Strategic University Partnership Grant with Arizona State University to advance imaging spectroscopy for ecological conservation applications.

Selected Honors

NASA Exceptional Technology Achievement Medal, "For exceptional technical contributions in the development of advanced algorithms enabling paradigm shifting imaging spectroscopy results for NASA missions," 2020.

Eight NASA/JPL Team and Group Achievement Awards, 2010-2020

JPL Discovery Award, "Surface Biology and Geology Architecture Study," 2019.

NASA Early Career Achievement Medal, "Autonomous In-Situ Science and Remote Sensing," 2014

Caltech / JPL Lew Allen Award for Excellence, 2013-14

JPL Mariner Award, 2009, 2014

NASA Software of the Year Award, 2011

Journal Publications

M. D. Foote , P. E. Dennison , P. R. Sullivan , K. B. O'Neill , A. K. Thorpe, **D. R. Thompson**, D. H. Cusworth, R. Duren, S. C. Joshi, Impact of Scene-Specific Absorption Spectra on Matched Filter Greenhouse Gas Retrievals from Imaging Spectroscopy. *Remote Sensing of Environment*, in press, 2021.

N. Bohn, **D. R. Thompson**, N. Carmon, J. Susiluoto, M. J. Turmon, J. M. Cook, L. Guanter. Optimal estimation of snow and ice surface parameters from spaceborne imaging spectroscopy measurements, *Remote Sensing of Environment*, in press, 2021.

D. R. Thompson, P. G. Brodrick, K. Cawse-Nicholson, K. D. Chadwick, R. O. Green, B. Poulter, S. Serbin, P. Townsend, A. Shiklomanov, Spectral Fidelity of Earth's Terrestrial and Aquatic Ecosystems. *Journal of Geophysical Research - Biogeosciences*, in press, 2021.

M. Richardson, **D. R. Thompson**, M. Kurowski, M. Lebsock - Boundary layer water vapour statistics from high spatial resolution spaceborne visible spectrometry. *Atmospheric Measurement Techniques*, in press, 2021.

J. P. Harringmeyer, K. Kaiser, **D. R. Thompson,** M. M. Gierach, C. L. Cash, and C. G. Fichot, Assessing the utility of remotely-sensed UV reflectance for retrieving DOM-related water quality of urban coastal waters. *Frontiers in Marine Science*, in press, 2021.

C. Bruegge, T. G. Arnold, J. Czapla-Myers, R. Dominguez, **D. R. Thompson**, J. Van den Bosch, B. N. Wenny, Radiometric cross comparison of eMAS, AirMSPI, and AVIRIS sensors over Railroad Valley. *IEEE Transactions on Geoscience and Remote Sensing*, 2021.

P. G. Brodrick, **D. R. Thompson**, J. E. Fahlen, M. Eastwood, C. M. Sarture, S. R. Lundeen, W. Olson-Duvall, N. Carmon, R. O. Green, Generalized radiative transfer emulation for imaging spectroscopy reflectance retrievals. *Remote Sensing of Environment*, 2021, in press.

G. Stephens, O. Kalashnikova, J. J. Gristey, P. Pilewskie, **D. R. Thompson,** X. Huang, M. Lebsock, S. Schmidt. The Spectral Nature of Earth's Reflected Radiation: Measurement and Science Applications. Frontiers in Remote Sensing 2, 2021. doi: 10.3389/frsen.2021.664291

D. S. Connelly, **D. R. Thompson**, N. Mahowald, L. Li, N. Carmon, G. Okin, R. Green. The EMIT Mission Information Yield for Mineral Dust Radiative Forcing, *Remote Sensing of Environment,* 2021.

D. R. Thompson, A. Braverman, N. Bohn, P. G. Brodrick, N. Carmon, M. Eastwood, R. O. Green, M. Johnson, D. A. Roberts, J. Susiluoto, Scene Invariants for Quantifying Radiative Transfer

Uncertainty, *Remote Sensing of Environment* 260, 2021.https://doi.org/10.1016/j.rse.2021.112432

D. R. Thompson, B. H. Kahn, P. G. Brodrick, M. D. Lebsock, M. Richardson. Spectroscopic Imaging of Sub-Kilometer Spatial Structure in Lower Tropospheric Water Vapor. *Atmospheric Measurement Techniques*, 2021.

K. Cawse-Nicholson, and others incl. **D. R. Thompson**, NASA's Surface Biology and Geology Designated Observable: A Perspective on Surface Imaging Algorithms. *Remote Sensing of Environment* 257, 2021. https://doi.org/10.1016/j.rse.2021.112349

J. Borchardt, K. Gerilowski, S. Krautwurst, H. Bovensmann, A. K. Thorpe, **D. R. Thompson**, C. Frankenberg, and J. P. Burrows. Detection and Quantification of CH4 Plumes using the WFM-DOAS retrieval on AVIRIS-NG hyperspectral data. *Atmospheric Measurement Techniques*, 2021.

L. Li, N. M. Mahowald, Y. Balkanski, P. Ginoux, M. Goncalves Ageitos, R. O. Green, D. S. Hamilton, O. Kalashnikova, M. Klose, J. F. Kok, R. L. Miller, V. Obiso, D. Paynter, C. Perez Garcia-Pando, **D. R. Thompson**, Quantifying the range of dust direct radiative forcing due to source mineralogy uncertainty, *Atmospheric Chemistry and Physics*. 2021.

D. R. Thompson, P. G. Brodrick. Making Machine Learning Work for Geoscience: A Case Study in Imaging Spectroscopy, *Eos*, the American Geophysical Union (editorial review only). in press, 2021.

M. Sandford, **D. R. Thompson**, W. Olson-Duvall, R. O. Green, Amruta Yelamachili, S. Chien, R. Vitulli. Global Cloud Property Models for Real Time Triage Onboard Visible-Shortwave Infrared Spectrometers. *Atmospheric Measurement Techniques* 13, 2020.

A. C. Allwood, J.A. Hurowitz, L.A. Wade, M.Foote, and others incl. **D. R. Thompson**. Planetary Instrument for X-ray Lithochemistry. *Space Science Reviews*. 216 (8), 2020.

N. Carmon, **D. R. Thompson**, J. Susiluoto, N. Bohn, D. S. Connelly, M. J. Turmon, K. Cawse-Nicholson, R. O Green, M. R Gunson. Uncertainty Quantification for a Global Imaging Spectroscopy Surface Composition Investigation. *Remote Sensing of Environment,* 247, 111898, 2020.

D. R. Thompson, Amy Braverman, Philip Brodrick, Alberto Candela, Nimrod Carmon, Roger N. Clark, David Connelly, Robert O. Green, Raymond Kokaly, Nathalie Mahowald, Gregory Okin, Jouni Susiluoto, Gregg A. Swayze, Michael Turmon, and David S. Wettergreen, "Quantifying Uncertainty for Remote Spectroscopy of Surface Composition," *Remote Sensing of Environment.* 247, 2020.

A. Thorpe, R. Duren, S. Conley, K. Prasad, B. Bue, V. Yadav, K. Foster, T. Rafiq, F. Hopkins, M. Smith, M. Fischer, **D. R. Thompson,** C. Frankenberg, I. McCubbin, M. Eastwood, R. O. Green, C. E. Miller. Methane emissions from underground gas storage in California. *Environmental Research Letters.* 15 (4), 2020.

M. D. Foote, P. E. Dennison, A. K. Thorpe, **D. R. Thompson**, S. Jongaramrungruang, C. Frankenberg, S. C. Joshia, Fast and Accurate Retrieval of Point-Source Methane Emissions from Imaging Spectrometer Data Using Sparsity Prior, *Transactions on Geoscience and Remote Sensing* 58:9, 2020.

C. D. Elder, **D. R. Thompson**, A. K. Thorpe, P. Hanke, K. M. Walter Anthony, C. E. Miller, "A Wide Area Survey Reveals Emergent Scaling Properties of Arctic Methane Emissions," *Geophysical Research Letters,* 47 (3), 2020.

D. H. Cusworth, D. J. Jacob, D. J. Varon, C. C. Miller, X. Lu, K. Chance, A. K. Thorpe, R. M. Duren, C. E. Miller, **D. R. Thompson**, C. Frankenberg, L. Guanter, and C. A. Randles, "Potential of next-generation imaging spectrometers to detect and quantify methane point sources from space ," *Atmospheric Measurement Techniques* 12, 5655–5668, 2019.

K. Cawse-Nicholson, S. J. Hook, C. E. Miller, **D. R. Thompson**, Intrinsic Dimensionality in Combined Visible to Thermal Infrared Imagery. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, Oct. 2019.

A. K. Ayasse, Dennison, P. E., Foote, M., Thorpe, A. K., Joshi, S., Green, R. O., **Thompson, D. R.**, Roberts, D. A. Methane Mapping with Future Satellite Imaging Spectrometers. Remote Sensing, 11(24), 3054, 2019.

P. E. Dennison, R. F. Kokaly, **D. R. Thompson,** Y. Qi, C. S.T. Daughtry, S. K. Meerdink, M. Quemada, P. D. Gader, D. A. Roberts, E. B. Wetherley, "Comparison of Methods for Modeling Fractional Cover using Simulated Satellite Hyperspectral Imager Spectra," *Remote Sensing,* 11(18), 2072, 2019.

R. Duren, A. Thorpe, K. Foster, T. Rafiq, F. Hopkins, V. Yadav, B. D. Bue, **D. R. Thompson**, S. Conley,

N. Columbi, I. McCubbin, C. Frankenberg, M. Falk, J. Herner, B. Croes, R. O. Green, C. E. Miller, "California's Methane Super-Emitters." *Nature* 575, p. 180-4, 2019.

H. M. Dierssen, K. J. Bostrom, A. Chlus, K. Hammerstrom, **D. R. Thompson**, and Z. P. Lee. Pushing the Limits of Seagrass Remote Sensing in the Turbid Waters of Elkhorn Slough, California. *Remote Sensing*, 11:14, 1664, 2019. https://doi.org/10.3390/rs11141664.

J. Chapman, **D. R. Thompson**, M. C. Helmlinger, M. L. Eastwood, Sven Geier, R. O. Green, S. R. Lundeen, W. Olson-Duvall. "Spectral and Radiometric Calibration of the Next Generation Airborne Visible Infrared Spectrometer (AVIRIS-NG)," *Remote Sensing*, 11:18, p. 2129, 2019.

D. R. Thompson, K. N. Babu, A. Braverman, M. Eastwood, R. O. Green, J. Hobbs, J. B. Jewell, M. Mishra, A. Mathur, V. Natraj, F. C. Seidel, P. Townsend, M. Turmon. "Optimal Estimation of Spectral Surface Reflectance in Challenging Atmospheres," *Remote Sensing of Environment,* 232, 111258, 2019.

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D. R. Thompson, K. Cawse-Nicholson, Z. Erickson, C. Fichot, C. Frankenberg, B-C. Gao, M. M. Gierach, R. O. Green, D. Jensen, V. Natraj, A. Thompson. "A unified approach to estimate land and water reflectances with uncertainties for coastal imaging spectroscopy," *Remote Sensing of Environment* 231, 111198, 2019. https://doi.org/10.1016/j.rse.2019.05.017

B. D. Bue, **D. R. Thompson**, S. Deshpande, M. Eastwood, C. Fichot, R. O. Green, T. Mullen, V. Natraj, and M. Parente, "Neural Network Radiative Transfer for Imaging Spectroscopy." *Atmospheric Measurement Techniques* 12, 2567–2578, 2019 https://doi.org/10.5194/amt-12-2567-2019

S. Jongaramrungruang, C. Frankenberg, G. Matheou, A. Thorpe, D. R. Thompson, L. Kuai, and R. Duren: Towards accurate methane point-source quantification from high-resolution 2D plume imagery, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2019-173, 2019.

K. N. Babu, A. K. Mathur, **D. R. Thompson**, R. O. Green, P. N. Patel., P. R. P. Prajapati, B. D. Bue, S. Geier, M. L. Eastwood, M. C. Helmlinger. "An empirical comparison of calibration and validation methodologies for airborne imaging spectroscopy," *Current Science*, 116: 07, 2019.

C. Ong, V. Carrère, S. Chabrillat, R. Clark, T. Hoefen, R. Kokaly, R. Marion, C. R. Souza Filho, C. R., G. Swayze, **D. R. Thompson**, "Imaging Spectroscopy for the Detection, Assessment and Monitoring of Natural and Anthropogenic Hazards," *Surveys in Geophysics*, March 2019.

Z. K. Erickson, C. Frankenberg, **D. R. Thompson**, A. F. Thompson. "High-resolution aircraft measurements of ocean fluorescence: Towards a vertical profile of chlorophyll." *Geophysical Research Letters* 46, 1571–1579, 2019. https://doi.org/10.1029/2018GL081273

M. A. Chan, B. B. Bowen, Frank Corsetti, W. Farrand, E. Law, H. Newsom, J. Spear, **D. R. Thompson**, "Exploring and Mapping Habitable Environments in Astrobiology." *Frontiers in Microbiology* 10:147, 2019. doi:10.3389/fmicb.2019.00147

D. Brown, W. C. Huffman, H. Sierks, **D. R. Thompson**, and S. A. Chien. "Automatic Detection and Tracking of Plumes from 67P/Churyumov-Gerasimenko in OSIRIS/ROSETTA Image Sequences." *The Astronomical Journal* 151:1, 2019.

D. R. Thompson, L. Guanter, A. Berk, B-C Gao, R. Richter, D. Schläpfer, K. J. Thome. "Retrieval of atmospheric parameters and surface reflectance from VSWIR imaging spectroscopy data," *Surveys in Geophysics*, 40:3, 2019. doi:10.1007/s10712-018-9488-9.

H. A. Bender, P. Mouroulis, H. M. Dierssen, T. H. Painter, **D. R. Thompson,** C. D. Smith, J. Gross, R. O. Green, J. M. Haag, B. E. Van Gorp, E. Diaz. "Snow and Water Imaging Spectrometer (SWIS): Mission and instrument concepts for Earth-orbiting CubeSats." *Journal of Applied Remote Sensing* 12, no. 4: 044001, 2018.

D. R. Thompson, V. Natraj, R. O. Green, M. Helmlinger, B.-C. Gao, and M. L. Eastwood, "Optimal Estimation for Imaging Spectrometer Atmospheric Correction." *Remote Sensing of Environment* 216, p. 355-373, 2018.

D. R. Thompson, B. Kahn, R. O. Green, S. Chien, D. Tran, E. Middleton. "Global Spectroscopic Survey of Cloud Thermodynamic Phase at High Spatial Resolution, 2005-2015." *Atmospheric Measurement Techniques,* 11, 1019–1030, 2018.

D. R. Thompson, A. Candela, D. S. Wettergreen, E. N. Z. Dobrea, R. Clark, G. Swayze, R. Greenberger,

"Spatial Spectroscopic Models for Remote Exploration." *Astrobiology*, Vol. 18 Issue 8, 2018.

D. Jensen, M. Simard, **D. R. Thompson,** K. Cavanaugh. Imaging Spectroscopy BRDF Correction for Mapping Louisiana's Coastal Ecosystems. *Transactions on Geoscience and Remote Sensing*, 56 (3), 2018.

D. R. Thompson, Joseph W. Boardman, Michael L. Eastwood, Robert O. Green, Justin M. Haag, Byron Van Gorp. "Imaging Spectrometer Stray Spectral Response: In-Flight Characterization, Correction, and Validation" *Remote Sensing of Environment*, 204, 850-860, 2018.

A. K Thorpe, C. Frankenberg, **D. R. Thompson,** R. M. Duren, A. D. Aubrey, B. D. Bue, B. B., R. O. Green, K. Gerilowski, T. Krings, J. Borchard, E. A. Kort, C. Sweeney, S. Conley, D. A. Roberts, and P. E. Dennison: Airborne DOAS retrievals of methane, carbon dioxide, and water vapor concentrations at high spatial resolution: application to AVIRIS-NG, *Atmos. Meas. Tech*., doi:10.5194/amt-2017-51, 2017.

D. R. Thompson, E. Hochberg, G. P. Asner, R. O. Green, D. Knapp, B-C. Gao, R. Garcia, M. Gierach, Z. Lee, S, Maritorena, R. Fick. Airborne Mapping of Benthic Reflectance Spectra with Bayesian Linear Mixtures, *Remote Sensing of Environment* 200, p. 18-30, 2017.

Krautwurst, S., Gerilowski, K., Jonsson, H. H., **Thompson, D. R.,** Kolyer, R. W., Iraci, L. T., Thorpe, A. K., Horstjann, M., Eastwood, M., Leifer, I., Vigil, S. A., Krings, T., Borchardt, J., Buchwitz, M., Fladeland, M. M., Burrows, J. P., and Bovensmann, H.: Methane emissions from a Californian landfill, determined from airborne remote sensing and in situ measurements, *Atmos. Meas. Tech*., 10, 3429-3452, https://doi.org/10.5194/amt-10-3429-2017, 2017.

D. R. Thompson, J. W. Boardman, R. O. Green, M. Eastwood. A Large Airborne Survey of Earth's Visible-Infrared Spectral Dimensionality. *Optics Express*, Vol. 25, Issue 8, pp. 9186-9195, 2017.

C. Frankenberg, A. Thorpe**, D. R. Thompson**, G. Hulley, E. Kort, N. Vance, J. Borchard, T. Krings, K. Gerilowski, C. Sweeney, S. Conley, B. Bue, A. Aubrey, S. Hook, and R. O. Green. Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region. *Proc. National Academy of Sciences*, 113 (35), 2016.

D. R. Thompson, A. K. Thorpe, C. Frankenberg, R. O. Green, R. Duren, A. Hollstein, L. Guanter, E. Middleton, L. Ong, S. Ungar, Space based remote imaging spectroscopy of the Aliso Canyon CH_4 Super-emitter. *Geophysical Research Letters.* 43, 6571–6578, 2016.

D. R. Thompson, I. McCubbin, B-C Gao., R. O. Green, A. A. Matthews, F. Mei, K. Meyer, S. Platnick, B. Schmid, J. Tomlinson, and E. Wilcox. Measuring cloud thermodynamic phase with shortwave infrared imaging spectroscopy. *Journal of Geophysical Research - Atmospheres,* 121 (15), 2016.

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D. R. Thompson, B. C. Gao, R. O. Green, P. E. Dennison, D. A. Roberts, S. Lundeen. Atmospheric Correction for Global Mapping Spectroscopy: Advances for the HyspIRI Preparatory Campaign. *Remote Sensing of Environment*, 167, 64–77, 2015. ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2015.02.010.

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D. R. Thompson, M. de la Torre Juarez, C. M. Barker, J. Holeman, S. Lundeen, S. Mulligan, T. H. Painter, E. Podest, F. C. Seidel, E. Ustinov, Airborne imaging spectroscopy to monitor the evolution of urban mosquito microhabitats. *Remote Sensing of Environment,* 137, 2013.

C. Trott., S. J. Tingay, R. B. Wayth, **D. R. Thompson,** A. T. Deller, W. F. Brisken, K. L. Wagstaff, W. A. Majid, S. Burke-Spolaor, J-P R. Macquart, D. Palaniswamy. A framework for interpreting fast radio transient search experiments: application to the V-FASTR experiment. *The Astrophysical Journal* 767:4, 2013.

D. R. Thompson, L. Mandrake, R. O. Green, S. A. Chien.A Case Study of Subpixel Spectral Signature Detection in Multimodal and Outlier-contaminated Scenes. *Geoscience And Remote Sensing*

Letters, 2013.

D. R. Thompson, B. J. Bornstein, S. A. Chien, S. Schaffer, D. Q. Tran, B. D. Bue, R. Castano, D. Gleeson, A. Noell. Autonomous Spectral Discovery and Mapping Onboard the EO-1 Spacecraft, *IEEE Transactions on Geoscience and Remote Sensing* 2013.

D. R. Thompson, D. C. Benner, L. R. Brown, D. Crisp, V. M. Devi, Y. Jiang, F. Oyafuso, D. Wunch, R. Castaño, C. E. Miller. Atmospheric Validation of High Accuracy CO_2 Absorption Coefficients for the OCO-2 Mission, *Journal of Quantitative Spectroscopy and Radiative Transfer.* Volume 113, Issue 17, November 2012.

X. Wang, Y. Chao, **D. R. Thompson,** S. A. Chien, J. Farraraa, P. Li, Q. Vu, H. Zhang. Multi-model Ensemble Forecasting and Glider Path Planning in the Mid-Atlantic Bight. *Continental Shelf Research,* 2012.

R. Wayth, S. Tingay, A. Deller, W. Brisken, **D. R. Thompson**, K. Wagstaff. Limits on the event rates of fast radio transients from the V-FASTR experiment, *The Astrophysical Journal Letters,* 753:L36, 2012.

D. R. Thompson, W. A. Majid, C. Reed, and K. L. Wagstaff. Semi-supervised novelty detection with adaptive eigenbases, and application to radio transients. *Statistical Analysis and Data Mining,* 2012.

D. Crisp, B. M. Fisher, C. O'Dell, C. Frankenberg, R. Basilio, H. Bösch, L. R. Brown, R. Castano, B. Connor, N. M. Deutscher, A. Eldering, D. Griffith, M. Gunson, A. Kuze, L. Mandrake, J. McDuffie, J. Messerschmidt, C. E. Miller, I. Morino,V. Natraj, J. Notholt, D. M. O'Brien, F. Oyafuso, I. Polonsky, J. Robinson, R. Salawitch, V. Sherlock, M. Smyth, H. Suto, T. E. Taylor, **D. R. Thompson**, P. O. Wennberg, D. Wunch, and Y. L. Yung: The ACOS CO2 retrieval algorithm--Part II: Global XCO2 data characterization, *Atmos. Meas. Tech*., 5, 687–707, 2012, doi:10.5194/amt-5-687-2012.

T. Estlin, B. Bornstein, D. Gaines, R. C. Anderson, **D. R. Thompson**, M. Burl, R. Castano, M. Judd. AEGIS Automated targeting for the MER Opportunity Rover. *ACM Transactions on Intelligent Systems and Technology*, 3:3, 2012.

L. Mandrake, U. Rebbapragada, K. Wagstaff, **D. R. Thompson,** S. Chien, D. Tran, R. T. Pappalardo, D. Gleeson, R. Castano. Surface Sulfur Detection via Remote Sensing and Onboard Classification. *ACM Transactions on Intelligent Systems and Technology 3:3,* 2012.

D. R. Thompson, W. Johnson, R. Kremens. Multi-frame Subpixel Wildfire Tracking. *Geoscience And Remote Sensing Letters* 9 (4) 2012, pages 639 - 643.

D. R. Thompson, M. Bunte, R. Castaño, S. Chien, R. Greeley, Onboard Image Processing for Autonomous Spacecraft Detection of Volcanic Plumes. *Planetary and Space Science.* 62, 2012. p. 153-159. doi:10.1016/j.pss.2011.11.006

D. Hayden, S. Chien, **D. R. Thompson**, R. Castano. Using Clustering and Metric Learning to Improve Science Return of Remote Sensed Imagery. *ACM Transactions on Intelligent Systems and Technology*, 3 (3), 2012.

D. Wunch, P. O. Wennberg, G. C. Toon, B. J. Connor, B. Fisher, G. B. Osterman, C. Frankenberg, L. Mandrake, C. O'Dell, P. Ahonen, S. C. Biraud, R. Castano, N. Cressie, D. Crisp, N. M. Deutscher, A. Eldering, M. L. Fisher, D. W. T. Griffith, M. Gunson, P. Heikkinen, G. Keppel-Aleks, E. Kyro, R. Lindenmaier, R. Macatangay, J. Mendonca, J. Messerschmidt, C. E. Miller, I. Morino, J. Notholt, F. A. Oyafuso, M. Rettinger, J. Robinson, C. M. Roehl1, R. J. Salawitch, V. Sherlock, K. Stron, R. Sussmann, T. Tanaka, **D. R. Thompson,** O. Uchino, T. Warneke, and S. C. Wofsy. A method for evaluating bias in global measurements of CO2 total columns from space. Atmos. Chem. Phys. 201., 2011.

D. R. Thompson, D. Wettergreen, and F. Calderon P. "Autonomous Science for Large-Scale Robotic Survey." *Journal of Field Robotics,* July/August 2011.

M. Gilmore, **D. R. Thompson**, L. J. Anderson, N. Karamzadeh, L. Mandrake, R. Castano. "Superpixel segmentation for analysis of hyperspectral datasets, with application to CRISM data, M3 data and Ariadnes Chaos, Mars." J*ournal of Geophysical Research:* 116, E07001, doi:10.1029/2010JE003763. 2011.

R. Wayth, W. Brisken, A. Deller, S. Tingay, **D. R. Thompson**, K. Wagstaff. V-FASTR: The VLBA Fast Transients Project. *The Astrophysical Journal*, 2011.

D. R. Thompson, K. Wagstaff, W. Brisken, A. Deller, W. Majid, S. Tingay, R. Wayth. Detection of Fast Radio Transients With Multiple Stations: A Case Study Using the Very Long Baseline Array. *The Astrophysical Journal*, 735:98, 2011.

Oscar Schofield and others incl. **D. R. Thompson.** A Regional Slocum Glider Network in the Mid-Atlantic Bight Leverages Broad Community Engagement. *Marine Technology Society Journal* 2010. 44(6): 64-74.

Oscar Schofield and others incl. **D. R. Thompson**. Automated Sensor Networks to Advance Ocean Science, *EOS Transactions, American Geophysical Union*. Vol. 91, No. 39, 28 Sept. 2010.

D. R. Thompson, L. Mandrake, M. S. Gilmore, R. Castaño. Superpixel Endmember Detection, *Transactions on Geoscience and Remote Sensing*, 48 (11), 2010.

J-P Macquart and the CRAFT collaboration team incl. **D. R. Thompson** "Commensal Real-time ASKAP Fast Transients (CRAFT) Survey," *Proceedings of the Astronomical Society of Australia 2010.*

D. Hayden, S. Chien, **D. R. Thompson** and R. Castano. Onboard Clustering of Aerial Data for Improved Science Return *IEEE Intelligent Systems, May 2010*.

T. Smith, **D. R. Thompson**, D. Wettergreen N. Cabrol, K. Warren-Rhodes and S. Weinstein. Life in the Atacama: Science Autonomy for Improved Data Quality. Journal of Geophysics Research vol. 112, G04S03, Dec. 2007.

Professional societies, outreach and other affiliations

IEEE Senior Member (2019-)

Organizer of an AGU Fall Meeting Session on Global Imaging Spectroscopy and Thermal IR Measurements, 2015, 2016, 2017, 2019, 2020, 2021

NASA PACE mission Ocean Color Instrument, external Subject Matter Expert (SME), 2017-18.

NASA Review Panelist, multiple technology development and Earth science programs, 2014-2021

National Science Foundation Information Science & Geosciences (IS-GEO) Research Coordination Group, Benchmarks co-lead, 2017

NASA Lunar Capabilities Roadmap Selective Action Team (LCR-SAT) 2016-2017

National Science Foundation Panelist 2016, 2017

Other professional organizations including IEEE Geoscience and Remote Sensing Society, IEEE GRSS Imaging Spectroscopy Working Group, Phi Beta Kappa, Sigma Xi 2008-present

Reviewer for high-impact Journals and Conferences including: Remote Sensing of Environment, Remote Sensing, Icarus, Journal of Geophysical Research, Trans. Geoscience and Remote Sensing, IJCAI, Optics Express, Journal of Field Robotics, Pattern Recognition, Program Committee for AAAI (2013-15). IJCAI (2016), ICML, IROS, AIAA, J. Planetary and Space Science, Field and Service Robotics.

Prior Roles and Projects

PI, Neural Network Radiative Transfer (JPL 2017-2019) A NASA Center Innovation Fund Award for new science retrievals incorporating machine learning techniques to more accurately estimate atmospheric and surface effects from imaging spectrometer data.

PI, SBG Datasystem Pilot (JPL 2018-) Advancing data analysis for future NASA global spectroscopy observations with a cloud-natve science data framework.

PI, NASA Science Team for AVIRIS-NG India (JPL 2017-2019) PI of a NASA Science project to deploy advanced atmospheric and surface reflectance analyses for an imaging spectrometer campaign in India

Lead for NSF Research in Hypothesis Maps, JPL Team (JPL 2016-2019) JPL Lead Co-investigator for an National Science Foundation National Robotics Initiative project. The project is developing the mathematical foundations to enable autonomous robotic field spectroscopy during remote exploration.

Lead for Onboard Data Analysis, PIXL Instrument for the Mars 2020 Mission (JPL 2013-) Led design and development of onboard image and spectroscopic analysis - a "smart instrument" capable of adaptive placement and sampling.

Lead, for Science Software, NEAScout Mission (JPL 2013-) Led design and development of science image analysis software for NASA's first deep space solar sail mission to rendezvous with a Near Earth Asteroid.

Co-I, Coupled Atmosphere-Surface Retrievals for Visible/Shortwave Infrared Imaging Spectroscopy (JPL 2017-) Research and Technology Development for next generation atmospheric

correction and uncertainty quantification.

Co-I, Airborne Imaging Spectroscopy Investigations (JPL 2015-2020) Including NASA rapid response campaigns to Four Corners (real-time CH4 mapping with AVIRIS-NG) and the Southern Ocean (ORCAS, phytoplankton mapping with PRISM).

Co-I, Methane Source Finder (JPL 2017-2019) NASA ACCESS project to measure fugitive CH_4 emissions.

Lead, JPL L2 Algorithms, HyspIRI Preparatory Campaign (JPL 2013-2018) Developed algorithms for surface reflectance estimation in a multi-.

PI, Phytoplankton Fluorescence in the Southern Ocean (JPL 2017-18) Led JPL side of a Caltech partnership to develop retrieval algorithms.

PI, Visual Maps of Non-Image Instrument Data (JPL 2013 - 2015): PI of a NASA technology development project to develop low-dimensional manifold representations for non-image data from exploration spacecraft.

PI, TextureCam Intelligent Camera Project (JPL 2011 - 2014): PI of a NASA instrument development project to integrate next-generation computer vision techniques into an FPGA-enabled camera. The system is targeted for use in large-scale autonomous astrobiology survey by remote spacecraft.

Co-I, Subterranean Life in the Atacama: Astrobiology Survey with a Long Range Rover (JPL/CMU 2011 - 2015) Leading the science autonomy component of a three-year field expedition. This work focuses on science-driven autonomous rover decision making, using machine learning algorithms to enable adaptive navigation, feature identification, and biogeologic mapping of the surface and subsurface environment in the Atacama Desert, Chile.

PI, Spectroscopy Analysis JPL 2009-2015: Led a technology development project to design algorithms for analyzing hyperspectral imagery in NASA's Advanced MultiMission Operations System (AMMOS), for use in future terrestrial and planetary missions. A flight demonstration onboard the EO-1 spacecraft occurred in late 2011.

PI, Agile Science Planning (JPL 2012-2015): Researching machine learning strategies for onboard science feature detection and response. Leading a study into "Agile Science" mission planning incorporating AI for next-generation exploration missions.

Machine Learning for Radio Astronomy (JPL 2009–2013): Researched methods for real-time radio astronomy analysis leveraging machine learning. Designed data mining algorithms for "petascale" radio astronomy datasets.

Lead of Spectroscopy Theme Group, OCO-2 Carbon Observatory (JPL 2009 – 2013): Led a team of scientists and technologists to develop spectroscopic techniques that will be used by the Orbital Carbon Observatory mission to estimate atmospheric carbon dioxide.

Autonomous Target Selection for the Mars Exploration Rovers (JPL 2007–2011): Developed object recognition for autonomous geologic analysis. Recently demonstrated the first fully autonomous geologic target detection and response by a rover spacecraft.

PI, Backcountry Fire Detection (JPL 2011): Led a technology research project to investigate pattern recognition for wildfire early warning networks with airborne and orbital components.

Mission Planning for Autonomous Ocean Sensorwebs (JPL 2009–2011): Ran glider mission planning as well as algorithm development for autonomous submersibles during the Ocean Sciences Simulation Experiment field campaign conducted through the NSF Ocean Observatories Initiative.

Autonomous Science by Remote Spacecraft (Carnegie Mellon 2006 – 2008): Conducted field experiments in the Mojave and Atacama deserts to test technologies for autonomous science understanding by remote agents.Designed algorithms for automatic image analysis, instrument deployment, path planning, and experiment design incorporating remote sensing and surface data.

Mentoring Service

Evan Greenberg, University of California Santa Barbara, PhD Candidate, 2021
Dr. Daniel Jensen, JPL NASA Postdoctoral Scholar, 2019-21
Dr. Nimrod Carmon, JPL Postdoctoral Fellow, 2019-20
Niklas Bohn, U. Potsdam GFZ, PhD Candidate, 2019-20

Dave Connelly, Cornell University, 2019, 2020
Siraput Jongaramrungruang, California Institute of Technology, PhD Committee, 2018-21
Macy Sandford, University of Hawaii PhD Candidate, 2018, 2019
Terry Mullen, University of Massachusetts Ph.D Candidate, 2018
Alberto Candela, Carnegie Mellon University PhD Candidate 2016-18, PhD Committee, 2018-21
Shuhankar Deshpande, JPL/Caltech SURF Awardee 2017
Dr. Jenna Kloosterman, JPL Employee Mentor, 2017
Holly Andrews (PhD FIELDS scholar co-advisor), UC Davis, 2017
Ron Fick, University of Florida Ph.D Candidate 2016-17
Kerrie Wu, Massachusetts Institute of Technology 2016
Jack Lightholder, Arizona State University, Undergraduate, 2015
Stephanie R. Debats, PhD Candidate, Princeton, 2013, 2015
Greydon Foil, PhD Candidate, Carnegie Mellon University 2012, 2015. PhD Committee, 2012-15.
Emily Hand, PhD Candidate, University of Maryland 2014
Ryan Casey, Undergraduate, California Institute of Technology 2014
Kern Ding, MS Candidate, CalPoly Pomona 2014
Elyse Pennington, Undergraduate, Harvey Mudd College 2014
Raymond Francis, UWO Canada, JPL Visiting Scholar, PhD 2013-14
Raquel Barata, MSc. Applied Mathematics, JPL Visiting Scholar, 2013-14
Daniel Howarth, Carnegie Mellon School of Computer Science Undergraduate, 2012
Colorado Reed - MS Cambridge, PhD Candidate, Berkeley, 2012 Churchill Scholar, Cambridge Fellow
D. S. Hayden - PhD Candidate, MIT Media Lab
Kristina Dahl - California Institute of Technology 2011, Monticello & Caltech Housner Fellowships
Doris Xin - California Institute of Technology 2011, Caltech Noland Fellowship

Invited Talks

D. R. Thompson, Scene Invariants for Radiative Transfer Uncertainty Quantification, SBG Cal/Val Working Group, 2021.
D. R. Thompson, The EMIT mission L2 products. SBG Algorithms Working Group, 2021.
D. R. Thompson, Scene Invariants for Radiative Transfer Uncertainty Quantification, SBG Cal/Val Working Group, 2020.
D. R. Thompson, Uncertainty Quantification for Surface Biology and Geology. JPL Uncertainty Quantification Workshop, 2021.
D. R. Thompson, The EMIT Mission, Geoscience and Remote Sensing Society, 2021.
D. R. Thompson, Toward comprehensive uncertainty models of remote imaging spectrometer measurements, SPIE Optics and Photonics 2020.
D. R. Thompson, Imaging Spectroscopy for Terrestrial Ecosystems. Arizona State University, Fall 2019.
D. R. Thompson, Imaging Spectroscopy for Earth and Planetary Science. Computer Vision and Pattern Recognition (CVPR) workshop on Perception Beyond the Visible Spectrum, Long Beach, CA, June 2019.
D. R. Thompson, Bayesian Methods for Coastal Ocean Spectroscopy. Optical Society of America Sensors and Sensing Congress: Hyperspectral Imaging and Sounding of the Environment, San Jose, June 2019.
D. R. Thompson, Data Science for Global Imaging Spectroscopy. JPL Data Science Forum, April 2019.
D. R. Thompson, Atmospheric Correction with Closure of Uncertainties: Optimal Estimation for Surface Reflectance Retrievals by Airborne Visible / Shortwave IR Imaging Spectrometers. Yuk Young Seminar, California Institute of Technology, April 2018.
D. R. Thompson, Neural Network Radiative Transfer: A Revolution in Atmospheric Correction. JPL Director's Review and Discussion, Nov. 2017.
D. R. Thompson, Exploring the Earth with NASA's Next Generation Airborne Visible Infrared Imaging Spectrometer (AVIRIS-NG). IGARSS NASA Hyperwall Talk, July 2017.
D. R. Thompson, Imaging Spectroscopy: Applications and Algorithms. UC Irvine Computer Science / Machine Learning Seminar, April 2017.
D. R. Thompson, Joseph W. Boardman, Robert O. Green, Michael Eastwood. "On the Dimensionality

of Earth's VSWIR Upwelling Light Field." Opening keynote address at EARSeL-IS Imaging Spectroscopy Workshop, Zurich, Switzerland 2017. **Most Catching Presentation Award (2nd).**

D. R. Thompson, Detecting, Monitoring, and Measuring Natural and Anthropogenic Hazards. Invited talk at the ISSI Workshop on Imaging Spectroscopy, Bern, Switzerland, November 2016.

D. R. Thompson, Imaging Spectroscopy at the Jet Propulsion Laboratory. EECS seminar, University of Florida, November 2016.

D. R. Thompson, The CORAL mission: retrieving and mapping benthic composition through airborne imaging spectroscopy. University of Florida, November 2016.

D. R. Thompson, Imaging Spectroscopy for Remote Sensing. IEEE GRSS Caravan Tour: RCMRD and Kenyatta University, Nairobi, Kenya; National University of Rwanda; INES Rhuingeri, Rwanda, September - October 2016.

D. R. Thompson, Autonomous data analysis for the PIXL instrument onboard the Mars 2020 Rover. Field Robotics Center Seminar, Robotics Institute, Carnegie Mellon University 2016.

D. R. Thompson, Dimensionality Reduction. Caltech Lectures on Data Science Series, May 2015., May 2016

D. R. Thompson, Radiometric calibration and atmospheric correction. HyspIRI Aquatic Forum, Greenbelt, MD, June 2015.

D. R. Thompson, Ravi Kiran, Abigail Allwood, Alphan Altinok, Tara Estlin, David Flannery, Smarter Instruments, Smarter Archives: Machine Learning for Tactical Science. American Geophysical Union Fall Meeting, Dec. 2014, Identifying and Better Understanding Data Science Activities, Experiences, Challenges, and Gaps Areas.

J. Bellardo, S. A. Chien, J. Doubleday, and **D. R. Thompson.** Onboard Autonomy on the Intelligent Payload EXperiment (IPEX) Cubesat Mission as a pathfinder for the proposed HyspIRI mission Intelligent Payload Module. JPL seminar, July 24 2014.

D. R. Thompson. Dimensionality Reduction. Caltech Lectures on Data Science Series, September 2014.

D. R. Thompson, Advances in the HyspIRI Level 2 Reflectance Products. *HyspIRI Science Workshop*, Washington, DC. March 2014.

D. R. Thompson, D. Wettergreen, G. Foil, M. Furlong. Rover Science Autonomy in the Atacama and Beyond. *IEEE International Conference on Robotics and Automation Planetary Rover Workshop,* 10 May 2013.

D. R. Thompson. OCO-2 Absorption Cross Sections. OCO-2 Science Meeting, California Institute of Technology, 2 Oct. 2012.

D. R. Thompson, Autonomous science during robotic exploration, from monochrome to hyperspectral images Carnegie Mellon University VASC seminar, Oct 29, 2012

D. R. Thompson, Exploring with Robots. Invited TEDx talk, TEDx Intuit, Oct 5 2012.

D. R. Thompson, Bornstein, B ; Bue, B ; Tran, D ; Castano, R, Chien, S. Hyperspectral Feature Detection onboard the Earth Observing One Spacecraft using Superpixel Segmentation and Endmember Extraction. *Invited Plenary Talk, International Symposium On Artificial Intelligence, Robotics and Automation in Space, Turin Italy.* 6 Sept. 2012.

D. R. Thompson, Autonomous Science for Remote Spacecraft. Astronomy.fm interview, 13 August 2012.

D. R. Thompson, Agile Science Operations. *Keck Institute For Space Studies: workshop on Engineering Resilient Space Systems,* Pasadena, CA. 31 July 2012.

D. R. Thompson Machine Learning for Exploring Data Streams: Lessons from the VLBA. SETI Institute Talk, Mountain View, CA. 6 June 2012.

D. R. Thompson. OCO-2 Absorption Cross Sections. OCO-2 Science Meeting, California Institute of Technology, 16 Feb. 2012.

D. R. Thompson. Adaptive Detection of Weak Signals through Interference. Digging Deeper: Computationally Limited Searches in Time Domain Astronomy. Keck Institute, California Institute of Technology, 12 Dec. 2011.

D. R. Thompson, On-line data mining and event detection in petascale data streams. Special session on Cyber-Discovery and Science for the Decade, 219th AAS Meeting, Austin TX, Jan. 2012.

D. R. Thompson, HiiHAT: A New Tool for Automated Hyperspectral Image Analysis, Jet Propulsion Laboratory Seminar, 23 June 2011.

D. R. Thompson, Hidden Markov Models in 10 Minutes. Keck Institute for Space Studies workshop on Computationally Limited Searches in Astronomy, June 2011.

D. R. Thompson, Autonomous Science for Robotic Exploration. Presentation to the Caltech Board of Trustees, 20 April 2011.

D. R. Thompson, K. L. Wagstaff, K.L., W. A. Majid, D. L. Jones, D.L., "Multi-Station Transient Detection," *CRAFT Design Workshop* (Aug. 2010)

D. R. Thompson, K. L. Wagstaff, W. A. Majid, and D. Xin, D., "Machine Learning Methods for Detection of Radio Transients," University of Sydney Astronomy Colloq. (Aug. 2010)

D. R. Thompson. Machine Learning for Science Autonomy and Robotic Exploration. Invited Seminar, California State University, Northridge Depts. Computer Science, Mechanical Engineering. March 2010.

D. R. Thompson. Machine Learning for Science Autonomy with the Zoe Rover. Plenary Presentation, California IEEE SF-VEC 2010.

D. R. Thompson, ABSCO Validation, Spectroscopy and Recent Developments. OCO Science Team Meeting, Pasadena CA 2010.

D. R. Thompson. Glider Mission Planning in the OSSE. NSF OOI Meeting, Devil's Thumb, CO. 2009.

D. R. Thompson. Machine Learning for Autonomous Exploration. Rutgers University Dept. Computer Science, 2009.

D. R. Thompson. Intelligent Mapping for Autonomous Science. Field Robotics Center Seminar, 2008.