# Howard E. Motteler

## Education

Ph.D., Computer Science, University of Maryland at College Park, 1987

M.S., Computer Science, Purdue University, 1982

B.S., Mathematics, University of Puget Sound, 1980

B.Mus., Flute Performance, Pacific Lutheran University, 1974

## Professional Experience

Associate Research Scientist, UMBC/JCET, March 2011–Dec 2024

Associate Research Professor, UMBC/JCET, Aug. 1998–June 2008

Associate Professor, UMBC/CSEE, May 1994–Aug. 1998

NRC Research Associate, NASA/GSFC, July 1992–July 1993

Assistant Professor, UMBC/CSEE, Aug. 1987–May 1994

Instructor, UMBC/CSEE, Aug. 1986–May 1987

Research Assistant, UMCP, May 1984–Aug. 1986

Teaching Assistant, UMCP, Aug. 1983–May 1984

Systems programmer, Purdue University, Aug. 1980–Aug. 1983

## Research Interests

Scientific computation and applications, including instrument modeling and calibration, passive infrared and microwave sounding, atmospheric radiative transfer calculations, and parallel and distributed processing.

## Journal Papers

L. L. Strow, C. Hepplewhite, H. E. Motteler, S. Buczkowski, and S. G. DeSouza-Machado. A climate hyperspectral infrared radiance product (CHIRP) combining the AIRS and CrIS satellite sounding record. *Remote Sensing*, 13(3):418, 2021

S. G. DeSouza-Machado, L. L. Strow, H. E. Motteler, and S. Hannon. kCARTA: A fast pseudo line-by-line radiative transfer algorithm with analytic jacobians, fluxes, non-local thermodynamic equilibrium and scattering for the infrared. *AMT*, 13:323–339, 2020

H. E. Motteler and L. L. Strow. AIRS deconvolution and the translation of AIRS to CrIS radiances with applications for the IR climate record. *IEEE Transactions on Geoscience and Remote Sensing*, 57(3):1793–1803, 2018

L. L. Strow, H. Motteler, D. Tobin, H. Revercomb, S. Hannon, H. Buijs, J. Predina, L. Suwinski, and R. Glumb. Spectral calibration and validation of the Cross-track Infrared Sounder on the Suomi NPP satellite. *Journal of Geophysical Research (Atmospheres)*, 118(D17):12486, Nov. 2013

Y. Han, H. Revercomb, M. Cromp, D. Gu, D. Johnson, D. Mooney, D. Scott, L. Strow, G. Bingham, L. Borg, Y. Chen, D. DeSlover, M. Esplin, D. Hagan, X. Jin, R. Knuteson, H. Motteler, J. Predina, L. Suwinski, J. Taylor, D. Tobin, D. Tremblay, C. Wang, L. Wang, L. Wang, and V. Zavyalov. Suomi NPP CrIS measurements, sensor data record algorithm, calibration and validation activities, and record data quality. *Journal of Geophysical Research (Atmospheres)*, 118(D17):12734, Nov. 2013

S. G. DeSouza-Machado, L. L. Strow, S. E. Hannon, H. E. Motteler, M. Lopez-Puertas, B. Funke, and D. Edwards. Fast forward radiative transfer modeling of 4.3 $\mu$m nonlocal thermodynamic

equilibrium effects for infrared temperature sounders. *Geophysical Research Letters*, 34(1), 2007

L. L. Strow, S. E. Hannon, S. DeSouza-Machado, H. E. Motteler, and D. Tobin. Validation of the Atmospheric Infrared Sounder radiative transfer algorithm. *Journal of Geophysical Research: Atmospheres*, 111(D9), 2006

S. G. DeSouza-Machado, L. L. Strow, S. E. Hannon, and H. E. Motteler. Infrared dust spectral signatures from AIRS. *Geophysical research letters*, 33(3), 2006

L. L. Strow, S. E. Hannon, S. G. DeSouza-Machado, H. E. Motteler, and D. Tobin. An overview of the AIRS radiative transfer model. *IEEE Transactions on Geoscience and Remote Sensing*, 41(2):303–313, 2003

L. L. Strow, H. E. Motteler, R. G. Benson, S. E. Hannon, and S. G. De Souza-Machado. Fast computation of monochromatic infrared atmospheric transmittances using compressed look-up tables. *Journal of Quantitative Spectroscopy and Radiative Transfer*, 59(3-5):481–493, 1998

H. E. Motteler, L. L. Strow, L. McMillin, and J. A. Gualtieri. Comparison of neural networks and regression-based methods for temperature retrievals. *Applied Optics*, 34(24):5390–5397, 1995

H. E. Motteler, A. Chung, and D. P. Sidhu. Undetected faults in protocol testing. *IEEE Transactions on Communications*, 43(8):2289–2297, 1995

D. P. Sidhu, H. E. Motteler, and R. Vallurupalli. On testing hierarchies for protocols. *IEEE/ACM Transactions on Networking*, 1(5):590–599, 1993

H. E. Motteler and D. P. Sidhu. Executable logic specification for protocol design verification. *Journal of Computer and Software Engineering*, 1(2):81–94, 1993

H. E. Motteler and C. H. Smith. A complexity measure for data flow models. *International Journal of Computer & Information Sciences*, 14(2):107–122, 1985

**Proceedings**

Y. Chen, F. Iturbide-Sanchez, L. Strow, H. Motteler, D. Tobin, D. Johnson, L. Suwinski, and D. Tremblay. Derivation of JPSS-2 CRIS pre-launch spectral calibration parameters from the thermal vacuum test data. In *IGARSS 2020-2020 IEEE International Geoscience and Remote Sensing Symposium*, pages 6043–6046. IEEE, 2020

L. L. Strow, S. G. DeSouza-Machado, C. L. Hepplewhite, and H. E. Motteler. An infrared radiance climate record combining AIRS and CrIS. *AGUFM*, 2015:A14C–08, 2015

C. L. Hepplewhite, L. L. Strow, H. E. Motteler, S. G. DeSouza-Machado, D. C. Tobin, G. Martin, and L. Gumley. CrIS high resolution hyperspectral radiances. In *AGU Fall Meeting Abstracts*, 2014

L. L. Strow, S. G. Desouza-Machado, H. E. Motteler, and C. L. Hepplewhite. An emerging ESDR: Multi-platform hyperspectral infrared radiances from EOS-AIRS, S-NPP/JPSS CrIS, and METOP IASI. *AGUFM*, 2014:IN34A–05, 2014

S. G. DeSouza-Machado, L. L. Strow, A. Tangborn, C. Hepplewhite, and H. E. Motteler. Geophysical trends from 12+ years of AIRS radiance trends. *AGUFM*, 2014:A33A–3160, 2014

S. G. DeSouza-Machado, D. A. Chu, N. R. Nalli, L. L. Strow, S. E. Hannon, H. E. Motteler, and P. J. Minnett. Estimation of dust loading and height using MODIS, AIRS, and M-AERI data. In *Remote Sensing of Aerosol and Chemical Gases, Model Simulation/Assimilation, and Applications*

*to Air Quality*, volume 6299, page 62990D. International Society for Optics and Photonics, 2006

D. C. Tobin, H. E. Revercomb, L. L. Strow, S. E. Hannon, and H. E. Motteler. Analysis of cross-track infrared sounder (CrIS) prelaunch test data. In *Fourier Transform Spectroscopy*, page FMB2. Optical Society of America, 2005

L. L. Strow, S. E. Hannon, S. G. DeSouza-Machado, and H. E. Motteler. Validation of the AIRS radiative transfer algorithm using ECMWF datafields. In *Remote Sensing of Clouds and the Atmosphere VII*, volume 4882, pages 90–99. International Society for Optics and Photonics, 2003

L. L. Strow, S. E. Hannon, S. G. DeSouza-Machado, and H. E. Motteler. Validation of the AIRS radiative transfer algorithm. In *Optical Remote Sensing*, page OMB1. Optical Society of America, 2003

S. G. DeSouza-Machado, S. E. Hannon, L. L. Strow, and H. E. Motteler. Infrared atmospheric spectroscopy using AIRS. In *AGU Fall Meeting Abstracts*, 2003

S. G. DeSouza-Machado, L. L. Strow, S. E. Hannon, and H. E. Motteler. Radiative transfer observations with AIRS. In *Optical Remote Sensing of the Atmosphere and Clouds III*, volume 4891, pages 84–94. International Society for Optics and Photonics, 2003

J. Y. Fan, X. Zhao, J. P. Zhang, F.-S. Choa, Y. Chai, J.-H. Chen, E. Miller, H. E. Motteler, P.-L. Liu, T. Tanbun-Ek, et al. Wavelength-division-multiplexed (WDM) data-block switching for parallel computing and interconnects. In *1998 International Conference on Applications of Photonic Technology III: Closing the Gap between Theory, Development, and Applications*, volume 3491, pages 634–638. International Society for Optics and Photonics, 1998

L. L. Strow, R. G. Benson, S. E. Hannon, and H. E. Motteler. Fast computation of monochromatic infrared atmospheric transmittances using compressed look-up tables. In *Optical Spectroscopic Techniques and Instrumentation for Atmospheric and Space Research II*, volume 2830, pages 106–115. International Society for Optics and Photonics, 1996

H. E. Motteler, L. L. Strow, J. A. Gualtieri, L. McMillin, and J. Lo. Neural nets for temperature retrievals. In *Optical Remote Sensing of the Atmosphere*, page 135. Optical Society of America, 1993

H. E. Motteler, J. A. Gualtieri, L. L. Strow, and L. McMillin. Neural networks for atmospheric retrievals. In *Goddard Conference on Space Applications of Artificial Intelligence*, page 155. NASA, 1993

H. E. Motteler, A. Chung, and D. P. Sidhu. Fault coverage of UIO-based methods for protocol testing. In *Proceedings of the IFIP TC6/WG6. 1 Sixth International Workshop on Protocol Test systems VI*, pages 21–34, 1993

H. E. Motteler and C. K. Nicholas. Some experiences with occam 2 and the TDS environment. In *Transputer Research and Applications, 2: NATUG-2, Proceedings of the Second Conference of the North American Transputer Users Group, October 18-19, 1989, Durham, NC*, number 3, page 381. IOS Press, 1990

H. E. Motteler. Occam and dataflow. In *Proceedings of the Second Conference of The North American Transputer Users Group*, 1989

H. E. Motteler and L. N. Kanal. The complexity of searching several classes of and/or graphs. In *IJCAI-85, Los Angeles, Aug. 18–23*, 1985

**Conference Talks**

H. E. Motteler, L. L. Strow, "AIRS deconvolution and the translation of AIRS to CrIS radiances," Fall 2017 NASA Sounder Science Team Meeting: Marriott Greenbelt, October 24-26, 2017, https://motteler.com/vitae/pubs/decon_talk.pdf

H. E. Motteler, L. L. Strow, "Pre-Flight ILS Testing of the CrIS Interferometer on NPOESS," Calcon 2007, ITAR restricted session, Utah State University, Logan Utah, Sept 10-13, 2007.

H. E. Motteler, "Neural Nets and Related Methods for Microwave Water and Temperature Retrievals," SIAM Conference on Geosciences, special session on applications of neural networks to problems in meteorology and oceanography, San Antonio, Texas, Feb. 8, 1995.

H. E. Motteler, "The consistency of a graph computation schema," Logic and Computer Science Workshop, Lexington, Kentucky, June 9–14, 1985.

**Technical Reports**

H. E. Motteler and L. L. Strow. CHIRP user guide. Technical report, Joint Center for Earth Systems Technology, Atmospheric Spectroscopy Lab, 2021

C. L. Hepplewhite, L. L. Strow, H. E. Motteler, S. G. de Souza-Machad, and S. Buczkowski. A new highly stable multi-decade satellite climate data set derived from polar hyperspectral infrared sensors. Technical report, Copernicus Meetings, 2020

H. E. Motteler, L. L. Strow, S. Hannon, "Retrieving CO2 Column Variations: Feasibility and Initial Results, " Aug, 1998, https://motteler.com/vitae/pubs/co2.pdf

H. E. Motteler, "An Evaluation of Neural Networks for Retrieval of Water and Temperature Profiles from SSM-T/T2/I Soundings," May, 1995, https://motteler.com/vitae/pubs/ssm95.pdf

H. E. Motteler and D. P. Sidhu, "Self-Stabilization in Iteration Systems," Jan., 1993; revised Jan., 2000, https://motteler.com/vitae/pubs/iter00.pdf

**Invited Articles**

H. E. Motteler and D. P. Sidhu, "Abstract Syntax Notation One (ASN.1)," ConneXions, Jan. 1992.

H. E. Motteler and D. P. Sidhu, "OSI Conformance Testing," ConneXions, Dec. 1992.

**Software and Data**

Software for AIRS (Atmospheric Infrared Sounder) deconvolution and the translation of AIRS to CrIS (Cross-grack Infrared Sounder) radiances. Methods are described in the AIRS deconvolution paper, listed above. We have been using these tools for some time to evaluate AIRS and CrIS simultaneous nadir overpasses (SNOs). We also have software for deconvolution and the translation of IASI (Infrared Atmospheric Sounding Interferometer) to CrIS radiances, a much easier task than the AIRS translation. Software is available at GitHub, https://github.com/strow/airs_deconv and https://github.com/strow/iasi_decon.

Based in part on the work above we developed CHIRP, a Climate Hyper-spectral Infrared Product. This is a translation of AIRS, CrIS, and we hope eventually IASI radiances to a common format, as part of a long term global climate record. CHIRP takes advantage of similar spatial sampling, translates AIRS and CrIS radiances to a common spectral response function, and attempts to remove inter-satellite biases. Software is available at https://github.com/motteler/chirp_test, data is available as a NASA product, at GES DISC, https://tinyurl.com/GES-DISC-CHIRP, and a User Guide is available at https://tinyurl.com/CHIRP-User-Guide.

Software to reorganize AIRS L1c data as a tiling in which each tile has approximately the same number of observations, saved in time order for that tile. This can be convenient for local or regional analysis. Source for the AIRS tiling is available at GitHub, `https://github.com/motteler/airs_tiling`. We have the AIRS tiling as a local product from mission start to a few months ago. There is a similar tiling for CHIRP, done by JPL using the AIRS tiling as a prototype, available on AWS with entry point `aws s3 ls s3://nasa-chirp-tiling`

Tools for spectral calibration and analysis of data from pre-launch thermal vacuum (TVAC) tests of the Cross-track Infrared Sounder (CrIS), a Fourier transform infrared spectrometer on the NOAA Suomi NPP and JPSS weather satellites. Software and summary data are at GitHub, for example `http://github.com/motteler/tvac_j4`, for J4. See the README in the git repos for an overview of the software. Test reports for J1–J4 are available at `https://motteler.com/tvac_rpts`.

The UMBC verson of the CrIS Calibration Algorithm and Sensor Testbed (CCAST), software to take CrIS level 0 (telemetery) data to calibrated radiances. We used this for most of our CrIS tests and analysis through around 2022, and have periodically reprocessed all SNPP, J1 and J2 data from the start of their respective missions. See the README for a list of significant features relative to the similar NOAA and NASA/UW products. `https://github.com/strow/ccast`

A package "obs_stats" to do long-span all-obs stats from AIRS and CrIS SDR and other supporting data, including equal area maps of mean, variance, PDFs, and trends. See the README files in the top level and obs_source directories for more details. `https://github.com/motteler/obs_stats`

An early version of a Matlab package for radiative transfer calculations from compressed tabulated optical depths (a Matlab version of "kcarta", see references above), along with tools and scripts for building a database of compressed tabulated optical depths from HITRAN data.

The Radiative Transfer Profile (RTP) package, an HDF 4 data format and application interface for storage and manipulation of atmospheric profiles and associated spectra. Also assorted Matlab HDF 4 tools, including a Matlab RTP interface. RTP is used extensively in our applications. `https://github.com/motteler/rtp`

**Teaching**

Courses such as Operating Systems and Parallel and Distributed Processing, that I taught more than once, are listed with the last semester I taught the class. The courses for 1987–1988 are listed with the old (pre-1990) CS course numbers.

Parallel and Distributed Processing, CMSC 483/691P, Spring 2006

Numerical Computation, CMSC 655, Spring 1999

Operating Systems, CMSC 421, Spring 1997

Logic for Computer Science, CMSC 691, Spring 1992

Principles of Programming Languages, CMSC 331, Fall 1991

Symbolic and Algebraic Processing, CMSC 656, Spring 1991

Analysis of Algorithms, CMSC 641, Fall 1990

Theory of Processes, CMSC 721, Spring 1990

Semantics and Program Verification, CMSC 654, Spring 1988

Automata Theory and Formal Languages, CMSC 379, Fall 1987

Theory of Computation, CMSC 679, Spring 1987

**Grants and Awards**

"Creation of a GigaPOP Serving the Baltimore-Washington Corridor," with Jack Suess, NSF, $350,000, 1997

"Information Content in Atmospheric Retrievals and Radiative Transfer Calculations," NASA, $20,000, 1995

"Algorithm Development for SSM/T2," NOAA, $20,000, 1993

"Neural Networks and Related Methods for Atmospheric Retrievals," NASA, $21,000, 1993

National Research Council Research Associate Award, a one-year fellowship at NASA/GSFC, 1992. My research advisor at GSFC was Dr. Milton Halem

**Notes**

This slightly condensed CV lists relevant professional experience and publications from 1980 on. Some minor publications, technical reports, presentations, and talks or poster sessions where I was a co-author but not the presenter are omitted.