

Curriculum vita:

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KENNETH L. CUMMINS

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Biographical Summary

Dr. Cummins received his Ph.D. degree in Electrical Engineering from Stanford University in 1978, with an emphasis on digital and statistical signal processing and physiological modeling. He worked in the neurosciences until 1989, as a research scientist at Stanford Medical Center and the Veterans' Administration, and then as a staff scientist for Nicolet Instruments. From 1989 until 2005, Dr. Cummins served as the R&D Manager and chief Scientist for Vaisala's Thunderstorm Business Unit (formally Global Atmospheric, Inc.), located in Tucson, Arizona. After retiring from Vaisala in 2005, Dr. Cummins served as a Research Professor in the Department of Hydrology and Atmospheric Sciences at the University of Arizona. He is now a part-time Research Scientist in the Aerospace, Physics and Space Sciences department at Florida Institute of Technology. He is the author of over 100 scientific papers and holds 9 U.S. patents and many related international patents.

Dr. Cummins' current research is focused in two broad areas: applied research on the physics and phenomenology of lightning, and intercomparison/validation of remote-sensing instruments and systems used in atmospheric electricity. Recent work on lightning physics and phenomenology includes the use of multiple high-speed cameras, lightning locations systems, direct lightning current measurements, and remote electric and magnetic field measurements to study the incidence, ground/tower attachment, and behavior of cloud-to-ground lightning. Specific recent applications include (1) exploring the differences in lightning behavior over land and ocean; (2) studying upward leaders and lightning attachment to a moderate-height instrumented tower; (3) evaluating the time-evolution of surface-measured quasi-static electric fields during fair-weather and thunderstorm development and decay; (4) studying the impact of terrain variations on the strike location and parameters of cloud-to-ground lightning. Recent work in this last area involves high-resolution (sub-kilometer) mapping of lightning parameters onto a 30 arc-second digital elevation model, and evaluating the effects of terrain gradient and meteorological forcing. Recent validation work has focused on intercomparing the new geostationary lightning mappers on GOES satellites with other ground-based and low-earth-orbit lightning mapping systems.

Biographical Details:

Birth date: October 2, 1948

Birthplace: Glendale, California

Marital Status: Married, two children

Veteran, U.S. Navy (1968 - 1972)

Degrees Conferred:

BS ENGR. - U.C. Irvine, Irvine, California - June, 1974

MSEE - Stanford University, Stanford, California - June, 1975

Ph.D. (EE) - Stanford University, Stanford, California - September, 1978

Current Professional Honors, Activities and Memberships:

- Member, NASA Geostationary Lightning Mapper (GLM) Science Team (2012 -)
- Member, NASA Lightning Advisory Panel (2012 -) (chair 2019-2022)
- NASA Silver Medal, UAV Lightning Research Team Group Award, 2014
- NASA Silver Medal, Lightning Advisory Panel Group Award, 2013
- NASA Visiting Scientist, 2012
- Senior Member, IEEE, 2000
- Member, American Geophysical Union
- Member, American Meteorological Society
- Member, IEEE Working Group on Lightning Protection of Distribution Systems (1995-2000)
- Member, CIGRE 33.01 Working Group on Lightning Detection Systems (1996-2007)
- Member, CIGRE C4.401 WORKING group on Lightning Parameters (2008 - 2010)
- Member, IEEE BME S.I.G. Committee on Neurophysiological Techniques (1985-1987)
- Co-organized IEEE BME Conference Track (7 technical sessions) on Critical Care Monitoring (1986)
- Co-chair IEEE BME conference technical session on Evoked Potential Processing (1982)

Current Principal Research Areas

- Physical Meteorology and physics, as related to lightning
- Development of algorithms, sensors, and systems for the detection and location of lightning discharges, and for atmospheric electricity research
- Time domain and frequency domain processing of transient signals

Employment Summary

FLORIDA INSTITUTE OF TECHNOLOGY (January 2017 to present)

(July 2022 – present) Research Professor, Aerospace, Physics and Space Sciences

(Jan. 2017 – June 2022) Visiting Research Scientist, Aerospace, Physics and Space Sciences

THE UNIVERSITY OF ARIZONA (1998 to present):

(March 2023 - present) Research Associate, Hydrology and Atmospheric Sciences

(April 2005- March 2023) Research Professor, Hydrology and Atmospheric Sciences

(1998 – April 2005) Adjunct Professor, Atmospheric Sciences, College of Science

VAISALA, Inc. (1989-2013) (formerly Global Atmospheric, Inc.):

(April 2005 – 2013) - Consulting Scientist

(November 2002 – April 2005) – Research Manager / Chief Scientist

(February 1989 – November 2002) - Vice President of Research & Development (Global Atmospheric Inc., Tucson)

NICOLET INSTRUMENT CORPORATION (1983 - 1989):

(1987 - 1989) Scientific Coordinator/Staff Scientist, Biomedical Division, Nicolet Instrument Corporation, Madison, Wisconsin

(1985 - 1987) Module Head (director) of Engineering Development, and Senior Signal Processing Engineer, Project Phoenix of Madison (Acoustic and speech signal processing), Nicolet Instrument Corporation, Madison, Wisconsin

(1983 - 1985) Engineering Project Manager, Biomedical Division, Nicolet Instrument Corporation, Madison, Wisconsin

STANFORD UNIVERSITY/PALO ALTO VA MEDICAL CENTERS (1978-1983):

(1980 - 1983) Lecturer in Neurology, Stanford University Medical Center (SUMC)

(1979 - 1983) Staff Scientist/Engineer, Rehabilitative Engineering Research and Development Center, Palo Alto VA Medical Center/Stanford University Medical Center

(1978 - 1979) Postdoctoral Fellow, Department of Neurology, SUMC

Ph.D. Dissertation Director or Co-director

Carlos Minjarez-Sosa (ATMO – May 2013) – Use of lighting to improve quantitative precipitation estimates in mountainous regions

Daile Zhang (ATMO – March 2019) – Inter-comparison of Space- and ground-based observations of lightning

M.S. Thesis Director or Co-director

Tyler Kranz (ATMO – May 2017) – A Radar Climatology of convective storms at the Grand Canyon

Gina Medici (ATMO – May 2015) – The Intra-Cloud Lightning Fraction in the Contiguous United States

Jason Ninneman (ATMO – May 2011) – COSMOS in Walnut Gulch During the 2010 Monsoon: A Technical Report – with Xubin Zeng

Bill Scheftic (ATMO – November 2009) – Use of lightning and anthropogenic signals to infer wide-area Changes in soil moisture

Christina Stall (ATMO – August 2008) – Assessment of multiple-ground-contact lightning using video and remote electromagnetic measurements – with Phil Krider

Prakash Ramani (ECE – May 2008) – Modeling the effects of finite electrical conductivity on the propagation of lightning electromagnetic fields – with Nathan Goodman (ECE)

Stacy Fleenor (ATMO - 2007) -- Characteristics of Cloud-to-Ground Lightning in Warm-Season Thunderstorms in the Great Plains - with Phil Krider

Jennifer Wilson (ATMO 2007) -- Assessment of lightning measurement systems at Kennedy Space Center / Eastern Range – with Phil Krider

Chris Biagi (ATMO - 2006) – Lightning phenomenology and detection system performance analysis - with Phil Krider

Dissertation or Thesis Committee Membership (other Universities)

Ryan Said (Ph.D. September 2009 – Stanford University Electrical Engineering second reader) – Lightning Detection and Geo-location at Long Range Using VLF Radio Atmospheric

Vandoir Borscheit (Ph.D. June 2012 - Brazilian National Institute for Space Research – second reader) – Singularities on the the Spatial and Temporal Distribution of CG Lightning based in Location Systems Data

Leandro Campos (Ph.D. May 2015- Brazilian National Institute for Space Research co-Advisor) - On the mechanisms that lead to current cutoff and multiple ground contacts in lightning

Megan Mark (Ph.D. in process 2022 – Florida Institute of Technology 3rd Reader) - Investigating Modulation of Terrestrial Lightning by Solar Phenomena

Mathieu Plaisir (Ph.D. in process 2022 – Florida Institute of Technology 3rd Reader) – Topics in Atmospheric Electricity

Issued Patents

- U.S. 7,804,309
“System and Methods for Soil Moisture Estimation”, 2010
- U.S. 6,868,339
“Systems and Methods for Time Corrected Lightning Detection”, 2005
- U.S. 6,788,043 and 6,791,311
“Lightning Detection and Data Acquisition System”, 2004
- U.S. 5,729,144
“Systems & Methods for Determining Location of a Fault on an Electric Utility Power Distribution System”, March 1998.
- U.S. 5,278,777
“Efficient Canceling of AC Line Interference in Electronic Instrumentation”, 1994.
- U.S. 5,168,212
“Autonomous Electro-optical Lightning Identification and Ranging Apparatus for, and Method of, Altering Humans and Protecting Equipment”, 1992.
- U.S. 5,027,410
“Adaptive Programmable Signal Processing and Filtering for Hearing Aids”, 1991.
- U.S. 4,887,299
“Adaptive Programmable Signal Processing Hearing Aid”, 1989.

Also, various international patents which are equivalent to the U.S. Patents

Publications: Refereed Journal Articles, Invited Papers, and Book Chapters

- Zhang, D, K.L. Cummins, T.J. Lang, D. Buechler, S. Rudlosky (2023), Performance Evaluation of the Lightning Imaging Sensor on the International Space Station, *J. Atmos. & Oceanic Tech.*, 40,9, <https://doi.org/10.1175/JTECH-D-22-0120.1>
- Nag, A., K.L. Cummins, M.N. Plaisir, R.C. Brown, J.G. Wilson, D.E. Crawford. R.G. Noggle, H.K. Rassoul (2023), Characteristics of upward-connecting-leader current leading to attachment in downward negative cloud-to-ground lightning strokes *Atmospheric Research*, 294, <https://doi.org/10.1016/j.atmosres.2023.106943>
- Nag, A., Khounate, H., Cummins, K. L., Goldberg, D. J., Imam, A. Y., Plaisir, M. N., & Rassoul, H. K. (2023). Parameters of the lightning attachment processes in a negative cloud-to-ground stroke observed on a microsecond timescale. *Geophysical Research Letters*, 50, e2023GL104196. <https://doi.org/10.1029/2023GL104196>
- Handel, S.C., Cummins, K.L., Krider, E.P. (2022), Surface Potential Gradients and NEXRAD Radar Reflectivities Before the Onset of Lightning at the KSC-ER, submitted to *Journal of Geophysical Research: Atmospheres*.
- Wilson, J.G. and K.L. Cummins (2021), Thunderstorm and fair-weather quasi-static electric fields over land and ocean, *Atmospheric Research*, 257, doi.org/10.1016/j.atmosres.2021.105618
- Nag, A., K.L. Cummins, M.N. Plaisir, J.G. Wilson, D.E. Crawford. R.G. Brown, R.C. Noggle, H.K. Rassoul (2021), Inferences on upward leader characteristics from measured currents, *Atmospheric Research*, 251, doi.org/10.1016/j.atmosres.2020.105420
- Holle, R.L., W.A. Brooks, K.L. Cummins (2021), Lightning occurrence and casualties in U.S. national parks, *Weather, Climate, and Society*, 13,3, 525-540

- Zhang, D., K.L. Cummins (2020). Time evolution of satellite-based optical properties in lightning flashes, and its impact on GLM flash detection. *Journal of Geophysical Research: Atmospheres*, 125, e2019JD032024. [https://doi.org/ 10.1029/2019JD032024](https://doi.org/10.1029/2019JD032024)
- Cummins, K.L., J. G. Wilson and A. S. Eichenbaum, (2020). The Impact of Cloud-To-Ground Lightning Type on the Differences in Return Stroke Peak Current Over Land and Ocean, *IEEE Access*, vol. 7, pp. 174774-174781, 2019, doi: 10.1109/ACCESS.2019.2956685
- Cummins, K.L., A. Nag, M. Plaisir, M. Austin, D. Crawford, J. Wilson, R. Brown, C. Noggle, H. Rassoul (2019). Characteristics of Upward Leader Currents Measured at the KSC Industrial Area Tower, Invited paper, *American Geophysical Union Fall Meeting*, December 2019, San Francisco, CA, USA.
- Zhang, D., K. L. Cummins, P. Bitzer, W. J. Koshak (2019). Evaluation of the Performance Characteristics of the Lightning Imaging Sensor, *J. Atmos. & Oceanic Tech.*, 36, 6, 1015-1031.
- Nag, A. and K.L. Cummins (2018). Magnetic Field Risetimes of Negative Lightning First Return Strokes Over Land and Ocean, *Geophys. Res. Lett.*, 45, doi:10.1002/2018GL080038.
- Cummins, K.L., M. K. Tippet, W.J. Koshak (2018). 20+ Years of Cloud-to-ground Lightning Observations in the U.S., and Comparison with Climatological Co-variates. Invited paper, 25th *International Lightning Detection Conference*, March 12-15, 2018, Ft. Lauderdale, FL.
- Cummins, K.L., E.P. Krider, M. Olbinski, R.L. Holle (2017), A case study of lightning attachment to flat ground showing multiple unconnected upward leaders, *Atmospheric Research*, 202, 169-174, doi.org/10.1016/j.atmosres.2017.11.007
- Medici G., K.L. Cummins, D. Cecil, W. Koshak, S. Rudlosky (2017), The Intra-cloud lightning fraction in the contiguous United States, *Monthly Weather Review*, 145, 4481-4498, doi: 10.1175/MWR-D-16-0426.1.
- Cummins, K.L. (2017). Lightning Locating Systems: History, Methods, and their Roles in Meteorological Applications, Invited Lecture, 8th *Conference in the Met. Appl. of Lightning. Data*, 97th *Ann. Meeting of the Amer. Met. Soc.*, Seattle, WA, January 22-26, 2017.
- Minjarez-Sosa, C., C. L. Castro, K.L. Cummins, J. Waissmann, D.K. Adams (2017), An Improved QPE Over Complex Terrain Employing Cloud-to-ground Lightning Occurrences, *J. Appl. Met. and Climatology*, 56, 2489-2507. doi: 10.1175/JAMC-D-16-0097.1.
- Nag, A., K. Cummins (2017), Negative First Stroke Leader Characteristics in Cloud-to-Ground Lightning over Land and Ocean, *Geophys. Res. Lett.*, 44, doi:10.1002/2016GL072270.
- Holle R.H., K.L. Cummins, W. Brooks (2016), Seasonal, Monthly, and Weekly Distributions of NLDN and GLD360 Cloud-to-Ground Lightning, *Monthly Weather Review*, 144, 2855-2870, doi: 10.1175/MWR-D-16-0051.1
- Cummins, K.L. and W. Chisholm (2015), Value from Lightning Data, *T&D World Magazine*, November 2015 (invited paper).
- Nag, A., M. J. Murphy, W. Schulz, and K. L. Cummins (2015), lightning locating systems: Insights on Characteristics and validation techniques, *Earth and Space Sciences*, v2, 4, 65-93, doi: 10.1002/2014EA000051.
- Roeder W., B.H. Cummins, K.L. Cummins, et al. (2015), Lightning Fatality Map of the contiguous United States, *Natural Hazards*, v79, 3, 1681-1693.
- Garolera, A.C., K.L. Cummins, F. Madsen, J. Holboell (2015), Multiple Lightning Discharges in Wind Turbines Associated with Nearby Cloud -to -Ground Lightning, *IEEE Transactions on Sustainable Energy*, v6, 2, 526-533.
- Chronis, T., Cummins K.L., Said R., and others (2015), Climatological Diurnal Variation of negative CG Lightning Peak Current over the Continental United States, *J. Geophys. Res.*, v120, 2, 582-589.

- Koshak, W.J., Cummins K.L., Beuchler D.E., and other (2015), Variability of CONUS Lightning in 2003–12 and Associated Impacts, *J. Appl. Met. & Clim.*, v54, pp 15-41, doi: 10.1175/JAMC-D-14-0072.1, 2015.
- Cooray V., R. Jayaratne, K. Cummins (2014), On the peak amplitude of lightning return stroke currents striking sea water, *Atmospheric Research*, v149, pp372-376, doi:10.1016/j.atmosres.2013.07.012, 2014
- Nag A., Rakov V., Cummins K. (2014), Positive Lightning Peak Currents Reported by the U.S. National Lightning Detection Network, *IEEE Trans EMC*, v56:2, pp404-412, doi: 10.1109/TEMC.2013.2280000, 2014.
- Rakov V.A., A. Borghetti, K.L. Cummins, et al. (2013), CIGRE Technical Brochure 549 on Lightning Parameters for Engineering Applications, IISBN: 978-2-85873-244-9, 118 pgs.
- Honma N., K.L. Cummins, M.J. Murphy, A.E. Pifer, T. Rogers (2013), Improved lightning locations in the Tohoku region of Japan using propagation and waveform onset corrections, *IEEJ Trans. Power and Energy*, v133, doi: 10.1541/ieejpes.133.195, 2013.
- Minjarez-Sosa, C., C. L. Castro, K.L. Cummins, E. P. Krider, J. Waissmann (2012), Toward development of improved QPE in complex terrain using cloud-to-ground lightning data: a case study for the 2005 monsoon in southern Arizona, *J. Hydrometeorology*, doi: 10.1175/JHM-D-11-0129.1, December 2012.
- Warner, T., K.L. Cummins, R.E. Orville (2012), Upward Lightning Observations in Rapid City, South Dakota and Comparison with National Lightning Detection Network Data, 2004-2010, *J. Geophys. Res.*, v117, doi: 10.1029/2012JD018346, June 2012.
- Bourscheidt, V., K.L. Cummins, O. Pinto, K.P. Naccarato (2012), Methods to Overcome Lightning Location Systems Performance Limitations on Spatial and temporal analysis: Brazilian Case, *J. Atmos. Ocean. Tech.*, v29, doi: 10.1175/JTECH-D-11-00213.1, September 2012.
- Cummins, K.L., N. Honma, A.E. Pifer, T. Rogers, M. Matsumi (2012), Improved detection of winter lightning in the Tohoku Region of Japan using Vaisala's LS700x technology, *IEEJ Transactions*, v132, doi: 10.1541/ieejpes.132.1, May 2012.
- Orville E.R., G.R. Huffines, W.R. Burrows, K.L. Cummins, (2011), The North American Lightning Detection Network (NALDN): Analysis of Flash Data – 2001-2009, *Monthly Weather Review*, 139, doi: 10.1175/2010MWR3452.1.
- Said R.K., U.S. Inan, K.L. Cummins (2010), Long-range lightning geolocaliton using a VLF radio atmospheric waveform bank, *J. Geophys. Res.*, 115, D23108, doi:10.1029/2010JD013863.
- Cummins K.L., A.E. Pifer, N. Honma, M. Pezze, T. Rogers, M. Tatsumi (2010), Improved detection of winter lightning in the Tohoku region of Japan using Vaisala's LS700x Technology", preprints, 21st International Lightning Detection Conference, Orlando, FL., 19-20 April, 2010 (*invited paper*)
- Saba, M. M. F., W. Schulz, T. A. Warner, L. Z. S. Campos, C. Schumann, E. P. Krider, K. L. Cummins, and R. E. Orville (2010), High-speed video observations of positive lightning flashes to ground, *J. Geophys. Res.*, 115, D24201, doi:10.1029/2010JD014330.
- Saraiva, A.C.V, M.M.F.Saba, O.Pinto, K.L. Cummins, E.P.Krider, L.Z.S.Campos, Comparative study of negative cloud-to-ground lightning characteristics in São Paulo (Brazil) and Arizona (USA) based on high-speed video observations, *J. Geophys. Res.*, accepted
- Murphy. M. J. F., K. L. Cummins, R.L. Holle (2009), "Lightning Warning Systems", in *Lightning Protection*, Vernon Cooray (Ed.), INSPEC/IEE, 2010.
- Wilson J G, K. L. Cummins, and E. P. Krider (2009), Small negative cloud-to-ground lightning reports at the NASA Kennedy Space Center and Air Force Eastern Range, *J. Geophys. Res.*, 114, D24103, doi:10.1029/2009JD012429, in press.

- Cummins K and Murphy M. (2009), An Overview of Lightning Locating Systems: History, Techniques, and Data Uses, With an In-Depth Look at the U.S. NLDN (2009 - invited paper), IEEE Transactions on Electromagnetic Compatibility, Vol. 51 (3), pp. 499-518, August 2009.
- Stall C, K.L. Cummins, E.P. Krider, J. Cramer (2009), Detecting Multiple Ground Contacts in Cloud-to-Ground Lightning Flashes. *Journal of Atmospheric & Oceanic Technology*, Vol. 26 (11), pp. 2392-2402, November 2009.
- Fleenor, S. A., C. J. Biagi, K. L. Cummins, E. P. Krider, X.M. Shao (2009), Characteristics of Cloud-to-Ground Lightning in Warm-Season Thunderstorms in the Great Plains, *Atmospheric Research*, Vol. 91, pp 333-352, doi:10.1016/j.atmosres.2008.08.011.
- Pessi, A., S. Businger, K. L. Cummins, N. W. S. Demetriades, M. Murphy, B. Pifer (2009), Development of a Long-Range Lightning Detection Network for the Pacific: Construction, Calibration, and Performance, *J. Atmo. & Oceanic Tech.*, Vol. 26, pp 145-166, doi: 10.1175/2008JTECHA1132.1.
- Lafkovic, A.; Hussein, A.M.; Janischewskyj, W.; Cummins, K.L., (2008), Evaluation of the Performance Characteristics of the North American Lightning Detection Network Based on Tall-Structure Lightning, *IEEE Trans. Electromagnetic Compatibility*, Vol. 50, Aug. 2008, pp. 630 – 641.
- Saba, M.M.F, K.L. Cummins, T.A. Warner, E.P. Krider, L.Z.S Campos, M.G. Ballarotti, S.A. Fleenor, O. Pinto (2008), Positive Leader Characteristics from High-speed Video Observations, *Geophysical Research Letters*, Vol. 35, doi:10.1029/2007GL033000, April 2008.
- Biagi, C. J., K. L. Cummins, K. E. Kehoe, E. P. Krider (2007), NLDN Performance in Southern Arizona, Texas and Oklahoma in 2003-2004, *J. Geophys. Res.*, Vol. 112, D05208, doi:10.1029/2006JD007341.
- Beirle, S., N. Spichtinger, A. Stohl, K. L. Cummins, T. Turner, D. Boccippio, O. R. Cooper, M. Wenig, M. Grzegorski, U. Platt, and T. Wagner (2006), Estimating the NO_x produced by lightning from GOME and NLDN data: a case study in the Gulf of Mexico, *Atmos. Chem. Phys.*, vol. 6, pp. 1075–1089.
- Cummins, K.L. (2006), The Interdependence of Lightning Detection Technology and Applications: A Historical Look at the U.S. National Lightning Detection Network, *International Conference on Grounding and Earthing & 2nd International Conference on Lightning Physics and Effects*, Maceió - Brazil November, 2006 (Invited paper)
- Cummins, K., L., J. A. Cramer, C. J. Biagi, E. P. Krider, J. Jerauld, M. A. Uman, V. A. Rakov (2006), The U.S. National Lightning Detection Network: Post-upgrade status, 2nd Conf. on Meteorological Appl. of Lightning Data, AMS Annual Meeting, Atlanta, 2006 (Invited paper).
- Jerauld J., V. A. Rakov, M. A. Uman, K. J. Rambo, D. M. Jordan, K. L. Cummins, J. A. Cramer (2005), An evaluation of the performance characteristics of the U.S. National Lightning Detection Network in Florida using rocket-triggered lightning, *J. Geophys. Res.*, 110, D19106, doi:10.1029/2005JD005924.
- Schulz W., K. Cummins, G. Diendorfer, M. Dorninger (2005), Cloud-to-ground lightning in Austria: A 10-year study using data from a lightning location system, *J. Geophys. Res.*, 110, D09101, doi:10.1029/2004JD0053
- Orville, R.E., G.R. Huffines, W.R. Burrows, R.L. Holle, K.L. Cummins (2002), The north-American lightning detection network (NALDN) – First results: 1998-2000, *Monthly Weather Review*, Vol. 130, No. 8, August 2002.

- Cummins K.L., Lightning Information for use in power systems analysis: How much more do we need to know? 2002 Asia Power Engineering Society Meeting, Yokohama, Japan, October 2002. (invited paper).
- Boccippio, DJ, Cummins, KL, Christian, HJ, Goodman, SJ: Combined satellite- and surface-based estimation of the intracloud-cloud-to-ground lightning ratio over the Continental United States, *Monthly Weather Review*, Volume 129, January 2001.
- Defer E, Blanchet P, Thery C, Laroche P, Dye J, Venticinque M, Cummins KL: Lightning activity for the July 10, 1996, storm during the Stratosphere-Troposphere Experiment: Radiation, Aerosol, and Ozone-A (STERAO-A) experiment, *Journal of Geophysical Research*, Vol. 106, No. D10, pgs. 10,151-10,172, May 27, 2001.
- Cummins, KL, Murphy, MJ, Tuel, JV: Lightning detection methods and meteorological applications (invited paper). presented at the IV International Symposium on Military Meteorology, Malbork, Poland, September 25-28, 2000.
- Jacobson, AR, Cummins, KL, Carter, M, Klingner, P, Roussel-Dupre, D, Knox, SO: FORTE radio-frequency observations of lightning strokes detected by the National Lightning Detection Network. *JGR*, Vol. 105, No. D12, Pages 15,653-15,662, June 27, 2000.
- Cummins, KL: Continental-scale detection of cloud-to-ground lightning. *T.IEE Japan*, Vol. 120-B, No. 1, January, 2000.
- Cummins KL: Power line fault analysis using wide-area lightning locating systems. International Workshop on High Voltage, Okinawa, Japan, January, 1999. (Invited paper)
- Cummins KL, Krider, EP, Malone, MD: The U.S. national lightning detection networkTM and applications of cloud-to-ground lightning data by electric power utilities. *IEEE Transactions on Electromagnetic Compatibility*, Vol. 40, No. 4, November 1998.
- Cummins KL, Bardo EA, Hiscox WL, Pyle RB, Pifer AE, Murphy MJ: A combined TOA/MDF technology upgrade of the US national lightning detection network. *Journal of Geophysical Research*, 103 (08): 9035-9044, April 1998.
- Orville RE, Zisper EJ, Brook M, Weidman C, Aulich G, Krider EP, Christian H, Goodman S, Blakeslee R, and Cummins KL: Lightning in the region of the TOGA COARE. *Bulletin of the American Meteorological Society*, 78(6): 1055-1067, June 1997.
- Holle RL, Lopez RE, Howard KW, Cummins KL, Malone MD, Krider EP: An isolated winter cloud-to-ground lightning flash causing damage and injury in Connecticut. *Bulletin of the American Meteorological Society*, 78(3): 437-441, March 1997.
- Van House, DL, Cummins KL, Tuel, JV: Applications of the U.S. national lightning detection network in line reliability and fault analysis (Invited paper). *Cigré International Workshop on Line Surge Arresters and Lightning*, Rio de Janeiro, Brazil, April 24 / 26, 1996.
- Cummins KL: Lightning location technology – present and future (Invited paper). *International Symposium on Winter Lightning in Hokuriku*, Kanazawa, Japan, June 17-18, 1996.

Bernstein R, Samm R, Cummins K, Pyle R, Tuel J: Lightning detection network averts damage and speeds restoration. *IEEE Computer Applications in Power*, 12-17, April 1996.

(Not listed: 22 reviewed articles or book chapters related to neurophysiology)

Selected Conference Papers:

- Cummins, K.L. (2021). On the spatial and temporal variation of GLM flash detection and how to manage it, *10th Conference on the Met. Appl. of Lightning. Data, 101st Ann. Meeting of the Amer. Met. Soc.*, Virtual, January 10-15, 2021.
- Nag, A., K.L. Cummins, M. Plaisir, M. Austin, J. Wilson, D. Crawford, R. Brown, C. Noggle, H. Rassoul (2020). Characteristics of Upward Leader Currents Measured at the KSC Industrial Area Tower, *American Geophysical Union Fall Meeting*, December 2020, San Francisco, CA, USA.
- Cummins, K.L., W.A. Brooks, R. Holle (2019). Mapping the Impact of Local Terrain on Lightning Ground Attachment Location, *American Geophysical Union Fall Meeting*, December 2019, San Francisco, CA, USA.
- Biagi, C., A. Nag, K. Cummins, H. Rassoul (2019). A Modeling Study of the Spatial Structure of Electric Fields Near Tall Towers, *American Geophysical Union Fall Meeting*, December 2019, San Francisco, CA, USA.
- Zhang, D., K.L. Cummins (2019). Ground- and Space-based Observations of Horizontally-extensive Lightning Flashes, *9th Conference on the Met. Appl. of Lightning. Data, 99th Ann. Meeting of the Amer. Met. Soc.*, Phoenix AZ, January 6-10, 2019.
- Cummins, K.L., J.G. Wilson, A.A. Simpson, R. Brown, A. Hinckley (2018). Electrostatic Fields Over Land and Ocean in Florida Thunderstorms, 2018 AGU Fall Meeting, Washington D.C., December 2018.
- Zhang, D., K.L. Cummins, P. Bitzer (2017). Ground- and Space-based Observations of Horizontally-extensive Lightning Flashes, 2017 AGU Fall Meeting, New Orleans, LA, December 2017.
- Biagi, C. and Cummins, K. (2016), On the spatial structure of electric fields generated by clouds with simple charge structures, *24th Intl. Lightning Detection Conference*, San Diego, CA, USA, 18-21 April, 2016
- Cummins, K, Olbinski M., Krider E.P., Holle, R. (2016), Photo of Cloud-to-Ground Lightning Showing Multiple Upward Leaders, *24th Intl. Lightning Detection Conference*, San Diego, CA, USA, 18-21 April, 2016.
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