

Curriculum Vita

Jeffrey R. Key

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PROFESSIONAL POSITIONS

Supervisory Physical Scientist and Branch Chief, Advanced Satellite Products Branch, National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite, Data, and Information Service (NESDIS), Madison, WI, 2003-present. Perform satellite meteorology and climatology research focusing on the polar regions. Manage a seven-member NOAA team involved in the algorithm development, the specification of future satellite systems, calibration, and the use of satellite products in weather prediction systems. Support 5-7 university scientists and manage multiple projects with funding over \$1M/year. Oversee funding to the Cooperative Institute for Meteorological Satellite Studies (CIMSS) on the order of \$12M/year.

Acting Division Chief, Cooperative Research Program (CoRP) division, Center for Satellite Applications and Research (STAR), NOAA/NESDIS, Madison, WI, 02/2018-present. Supervise STAR federal employees in three branches stationed at cooperative institutes (CI) in Madison, WI, Fort Collins, CO, and College Park, MD; oversee processing of more than 130 grants per year. Work with the NOAA Research Council Cooperative Institute Committee on CI matters.

Adjunct Professor, Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison, 2007-present. Adjunct Associate Professor, 1999-2006.

Past Positions

Physical Scientist, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Madison, WI, 1999-2002. Perform satellite meteorology research with applications in numerical weather prediction. **Acting Team Leader**, Advanced Satellite Products Team, 4/2001-12/2002.

Associate Professor (tenured), Department of Geography, Boston University, 1995-1999. Taught courses in meteorology, climatology, and remote sensing; conducted research in climatology and satellite remote sensing. **Director of Graduate Studies**, 1996-1998.

Research Associate, Cooperative Institute for Research in Environmental Sciences (CIRES), 1989-1995, University of Colorado, Boulder. Performed climatology research, with an emphasis on remote sensing of the polar radiation budget. Supervised and supported 2-4 research assistants and graduate students/yr. **Assistant Professor Attendant Rank**, Department of Geography, 1994-1995; **Fellow**, Program in Atmospheric and Oceanic Sciences (PAOS), 1994-1995; **Lecturer**, Astrophysical, Planetary and Atmospheric Sciences Department, 1990-1995 (taught courses in meteorology).

Instructor, Department of Mathematical Sciences, University of Alaska, Anchorage, 1984-1987. Taught courses in applied statistics and computer science.

Other

Research Assistant (1983-1984, 1987-1988), CIRES, University of Colorado; **Graduate Part-time Instructor; Teaching Assistant** (1982-1984), Dept. of Geography, University of Colorado; (1981-1982), Dept of Geography, Northern Michigan University.

EDUCATION

- Ph.D., University of Colorado, Boulder, Dept. of Geography (Climatology), 1988.
Thesis: "Cloud analysis in the Arctic from combined AVHRR and SMMR data"
- M.A., Northern Michigan University, Marquette, Dept. of Geography (Resource Analysis), 1982.
Thesis: "SHORELINE: a model for the prediction of shoreline changes"
- B.S., Northern Michigan University, Marquette, Dept. of Geography (Environmental Conservation), 1979. Summa Cum Laude. Academic scholarships all years. National Dean's List.
- Other: Wayne State University, Detroit, MI, Dept. of Music (performance major, classical guitar, 1971-1975). Academic scholarships all years.

AWARDS

- NASA Agency Honor Awards, Group Achievement Award for "For excellence resulting in the successful GOES-R satellite launch, providing the nation's foundation for the world's highest quality weather monitoring and forecasting", 2017 (with 500+ others).
- U.S. Department of Commerce Bronze Medal "For the timely creation and leadership of the team to increase the scientific value of the Suomi satellite environmental data products to meet NOAA users' needs", 2014 (with 12 others).
- NASA Group Achievement Award to Suomi NPP Mission Development Team "For extraordinary dedication, skill, teamwork, and perserverance in developing and delivering the Suomi NPP Mission for the Nation", 2012.
- NOAA Administrator's Award for scientific leadership and excellence in support of domestic and international polar observing activities during the International Polar Year (with Pablo Clemente-Colón), 2009.
- U.S. Department of Commerce Bronze Medal, 2008, for "innovative uses of operational weather satellites to understand climate change and to quantify trends in the global climate system" (with A. Heidinger, R. Ferraro, T. Smith, M. Eakin, and K. Gallo).
- U.S. Department of Commerce Silver Medal for Scientific and Engineering Achievement, 2005 - improving global weather forecasts through better utilization of satellite observations over the polar regions (with J. Daniels).
- Other (minor) recognition: DOC Gold Medal Organizational Award (not individual) to NESDIS for the success of the NOAA-20 and GOES-17 missions, 2018; JPSS Program Office Certificate of Recognition for contributing to key milestones, 2013; JPSS Program Office Certificate of Recognition for contributing to the successful launch and commissioning of S-NPP, 2012; NOAA/NESDIS Certificate of Achievemnet for property management, 2013; NOAA cash award for outstanding leadership in planning the first Global Cryosphere Watch (GCW) Implementation Meeting at WMO headquarters in Geneva, 2012; NOAA cash award for a successful GOES-R Algorithm Working Group Cryosphere Team critical design review, 2009; NOAA cash award for leading the Integrated Global Observing Strategy (IGOS) Cryosphere Theme, 2007.

PROFESSIONAL ACTIVITIES

Advisory Groups and Committees

Current

- World Meteorological Organization (WMO) Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Services (EC-PHORS), U.S. representative (one of three), 2009-present.
- WMO Global Cryosphere Watch (GCW), co-lead on implementation, 2008-2011; Science Advisor,

2014-2016; representative to EC-PHORS, 2008-present; lead/co-lead on multiple teams, 2008-present. (<http://globalcryospherewatch.org>)
WMO Polar Space Task Group (formerly the International Polar Year STG), 2007-present; Vice Chair, 2011-present.
NOAA: NOAA Research Council's Cooperative Institute Committee (2018-present); Arctic Core Team/Arctic Task Force (2010-present); Tiksi Atmospheric Observatory Science Team (2008-present); GOES-R AWG Cryosphere Algorithm Team lead (2006-present); JPSS Cryosphere Algorithm Team lead (2010-present); GCOM-W1 Cryosphere Algorithm Team lead (2011-present).
University of Wisconsin: Cooperative Institute for Meteorological Satellite Studies (U. Wisconsin) Board of Directors, 2001-present.

Past

NOAA: NOAA-Canada Polar Communications and Weather mission Coordination Group (2010~2013); International Affairs Council Polar Committee (2006~2014); GIMPAP Technical Advisory Committee (2008~2013).
Polar Communications and Weather (PCW) Mission User and Science Team, 2009~2013.
Inter-Commission Coordination Group for WMO Integrated Global Observing System (ICG-WIGOS) Task Team on WIGOS Regulatory Material, 2012-2013.
WCRP Observations and Assimilation Panel (WOAP; CliC representative), 2004-2011.
Associate Editor (radiation), *Journal of the Atmospheric Sciences*, 2004~2011.
Space Science and Engineering Center (U. Wisconsin) Science Council, 2001-2013.
Arctic Council's Snow, Water, Ice, and Permafrost of the Arctic (SWIPA) Integration Team, 2009-2011.
Chair, Observation Products Panel, WCRP Climate and Cryosphere (CliC) project, 2004-2011.
Chair, Integrated Global Observing Strategy (IGOS) Cryosphere Theme, 2004-2009.
Polar DAAC Advisory Group (PoDAG), 2001-2008.
NOAA: NOAA SEARCH science team; GOES-R Technical Advisory Committee (2007-2008).
Member, MODIS Science Team (NASA EOS), (2004-2007; Adjunct Member 1992-2003).
Advisory committee for MODIS Snow and Ice products, 1996-2004.
AMS Committee on Polar Meteorology & Oceanography, 1998-2001.
DOE ARM North Slope of Alaska CART Site Advisory Panel, 1994-1998.
NASA EOS Cyrospheric Working Group, 1997-1999.
RADARSAT Geophysical Processing System Science Working Group, 1994-1996.
ATSR (ERS-1 Along Track Scanning Radiometer) Validation Team, 1992-1994.

Invited Speaker

JPSS Short Course, Seattle, January 2017 | EUMETSAT, July 2016 | WIGOS Vision 2040, Geneva, November 2015 | 2nd International Satellite Snow Products Intercomparison Workshop, Boulder, Colorado, September 2015 | Foreign Press Centers, (DC), May 2015 | NOAA Science Days, March 2015 | The Climate Symposium 2014, Darmstadt, Germany, October 2014 | IPY2012: From Knowledge to Action, Montreal, Quebec, April 2012 | EUMETSAT Meteorological Conference, Oslo, Norway, September 2011 | Second Workshop on Satellite Imaging of the Arctic, Montreal, September 2009 | First Workshop on Satellite Imaging of the Arctic, University of Copenhagen, August 2008 | NOAA/NESDIS Cooperative Research Program Symposium on Satellite Climatology, University of Maryland, June 2007 | EUMETSAT Meteorological Satellite Conference, Helsinki, Finland, June 2006 | First Asia CliC Symposium, Yokohama, Japan, April 2006 | National Satellite Meteorology Center, Beijing, July 2004 | Workshop on Numerical Weather Prediction in the Polar Regions, Fairbanks, Alaska, October 2003 | AMS Polar Meteorology and Oceanography Conference, Hyannis, Massachusetts, May 2003 | Goddard Institute for Space Studies, March 2002 | National Ice Center, May 2000 | SHEBA annual meeting, April 2000 | IGARSS'99 session on sea ice, June 1999 | Goddard Institute for Space Studies, September 1996 | RADARSAT Geophysical Processing System Science Group meeting, Seattle, April 1994 and Boulder, September 1994 | Goddard Institute for

Space Studies, February 1991 | National Center for Atmospheric Research, Advanced Studies Program, March 1989.

Invited Participant

Global Climate Observing System (GCOS) Terrestrial Observation Panel for Climate (TOPC) meeting, Boulder, Colorado, 2016 | WCRP Climate and Cryosphere (CliC) Science Steering Group meeting, Boulder, Colorado, 2015 | Tiksi Science Meeting, Saint Petersburg, 2012 | NOAA Sea Ice Forecasting Workshop, Anchorage, 2011 | Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) Executive Panel meeting, Darmstadt, 2010 | International Polar Year workshop on Sustaining Arctic Observing Networks (SAON), Edmonton, June 2008 | International Polar Year workshop on Sustaining Arctic Observing Networks (SAON), Stockholm, 2007 | International Polar Year workshop on Sustaining Arctic Observing Networks (SAON), 2007 | GEWEX Cloud Climatology Workshop, Madison, Wisconsin, 2006 | GEWEX Cloud Climatology Workshop, Madison, Wisconsin, 2005 | Sino-U.S. Joint Arctic Climate Workshop, Beijing, 2004 | Arctic climate change workshop, Lamont Doherty Earth Observatory, NY, 2004 | ARCSS Arctic Synthesis workshop, Big Sky, Montana, 2003 | ACSYS/CliC meeting, Beijing, China, October 2002 | ARCMIP meeting, Norrkoping, Sweden, 2002 | ISCCP Workshop, New York (GISS), 1996 | MODIS Snow and Ice Products Workshop, Greenbelt, MD (GSFC), 1995 | NASA Workshop on Polar Data Sets, Seattle, 1993 | NSF ARCSS Workshop on Arctic Surface Energy Balance (SHEBA), Orlando, February 1993 | NSF Arctic System Science (ARCSS OAI) Modeling Workshop, Monterey, 1992 | NASA Workshop on Sea Ice Thickness, Greenbelt, MD, 1991 | WMO Workshop on Polar Radiation Fluxes and Sea Ice Modeling, Bremerhaven, Germany (Alfred Wegner Institute), 1990.

Current Memberships

American Meteorological Society (AMS)
American Geophysical Union (AGU)
International Association of Cryospheric Sciences (IACS)

Other

Co-organized major WMO Global Cryosphere Watch meetings in Arusha, Tanzania (2017), Salekhard, Russia (2016), Santiago, Chile (2014), Beijing (2014), Geneva (2010).
Co-organized the US-Canada Group on Earth Observations (GEO) workshop, Arlington, VA, October 2008.
Co-organized IGOS Cryosphere Theme Workshops in Kananaskis, Alberta (2005), Noordwijk, The Netherlands (2006), Yokohama, Japan (2006).
Co-organized the NOAA Cooperative Research Program Annual Science Symposium on Calibration and Validation, Madison, WI, July 2005.
Conference program committees: AMS January 1999, AAG Spring 1998.
Reviewer for many major scientific journals; NASA, NSF, NOAA, and DOE proposals.

RESEARCH

Interests

Polar climatology; cloud radiative effects; satellite remote sensing of the atmosphere, snow and ice; surface energy budget.

Grants

Summary: PI, Co-PI, or Co-I on 69 grants totaling over \$31M since 1990.

(In the listing below, UWisc is University of Wisconsin-Madison, BU is Boston University, CU is University of Colorado-Boulder, UWash is University of Washington, UMD is University of Maryland-College Park, GMAO is the NASA Global Modeling and Assimilation Office)

Current

1. Development and Impact of Global Winds from Tandem S-NPP and NOAA-20 VIIRS, JPSS Proving Ground and Risk Reduction, \$250K, PI, NOAA/NESDIS with UWisc, 2018-2019.
2. Ice Motion from VIIRS, AMSR2, and SAR –Development and Operational Applications, JPSS Proving Ground and Risk Reduction, ~\$400K, Co-I, NOAA/NESDIS with UWisc, 2018-2020.
3. Polar Winds from Metop-C, NOAA Office of Projects, Planning, and Analysis (PSDI), PI, \$40K, NOAA/NESDIS with UWisc, 2018.
4. Enterprise Snow Algorithm Evaluation, NOAA Office of Projects, Planning, and Analysis (PSDI), PI, \$75K, NOAA/NESDIS with UWisc, 2018.
5. NOAT Top-5 Ice Product Checkout, NOAA Office of Projects, Planning, and Analysis (PSDI), PI, \$50K, NOAA/NESDIS with UWisc, 2018.
6. Diagnosis and Analysis of Arctic Sea-ice Leads, NASA ROSES-2017, Co-I (PI: S. Ackerman), \$440K, 2018-2020.
7. JPSS VIIRS Derived Winds Validation and Science, JPSS Program Office, PI, \$260K, NOAA/NESDIS with UWisc, 2016-2018.
8. Snow and Ice Products from GOES-R ABI, GOES-R Program Office, PI, \$3.32M, NOAA/NESDIS and UWisc (with NWS/NOHRSC, UMD, and CUNY), 2007-2017.
9. Science and Management Support for NPP VIIRS Snow and Ice EDRs, JPSS Program Office, PI, \$3.387M, NOAA/NESDIS (with UWisc, CU, and CUNY/CREST), 2011-2018.
10. Implementation of GCOM-W1 AMSR2 Cryosphere Products, JPSS Program Office, PI, \$1.26M, NOAA/NESDIS (with UWisc, CU, and UMD/CICS), 2012-2018.
11. Transition of Polar AVHRR Fundamental and Thematic Climate Data Records to NCDC, NOAA/NCEI, PI/Co-I, \$241.5K, NESDIS and UWisc, 2013-2018.

Past

12. Updates for JPSS-1 VIIRS Derived Motion Winds, NOAA Office of Projects, Planning, and Analysis (PSDI), PI, \$100K, NOAA/NESDIS with UWisc, 2016-2017.
13. An Algorithm to Determine the Spatial and Temporal Distributions of Sea-ice Leads in the Arctic, NASA, Co-I (PI: S. Ackerman), \$330K, 2014-2017.
14. Development of S-NPP Cryosphere EDRs to Extend the EOS Data Record for Earth System Science, NASA, Co-I (PI: D. Hall), \$699K, 2014-2017.
15. Transition of MODIS and AVHRR Winds to GOES-R/VIIRS Algorithm, NOAA Office of Systems Development, PI, \$214K, NOAA/NESDIS and UWisc, 2014-2016.
16. Assimilation and forecast impact of high temporal resolution Leo/Geo AMVs in the high-latitude data-gap corridor, GOES-R Risk Reduction Program, Co-I (PI: B. Hoover); \$211K, UWisc and NOAA/NESDIS, 2014-2016.
17. Implementing the GOES-R Future Capability Ice Products into the GOES-R Processing System, GOES-R Program Office, PI, \$342K, NOAA/NESDIS and UWisc, 2015-2016.
18. Collaborative Research: Impact of Storm Activity on Recent Changes in Arctic Sea Ice Mass Balance, NSF, Co-PI (PI: X. Zhang, U. Alaska-Fairbanks; UWisc PI: X. Wang), \$306K (UWisc), 2010-2015.
19. Cryosphere Products from Himawari-8 for the High-Latitude Proving Ground, GOES-R Program

- Office, PI, \$30K, NOAA/NESDIS and UWisc, 2014-2015.
20. JPSS Risk Reduction: Uniform Multi-Sensor Algorithms for Consistent Products, NOAA Office of Systems Development, Co-PI (PI: W. Wolf), \$346K, NESDIS and UWisc, 2012-2014.
 21. Development, Generation, and Demonstration of New JPSS Ice Products in Support of a National Ice Center JPSS Proving Ground and Risk Reduction Activity, JPSS Program Office, Co-I (PI: Y. Liu, UWisc), \$152K, NESDIS and UWisc, 2013-2014.
 22. VIIRS Polar Winds, NOAA Office of Systems Development, PI, \$366K, NOAA/NESDIS and UWisc, 2009-2014.
 23. Sea Ice Thickness from Aqua and Terra Data: Generation, Evaluation and Application, NASA, Co-I (PI: J. Maslanik, CU), \$754K, NESDIS and UWisc, 2011-2013.
 24. A Blended Polar Winds Product using Atmospheric Motion Vectors from MODIS Imager and AIRS Moisture Retrieval Data, NASA, Co-I (PI: D. Santek, UWisc), \$229K, 2011-2012.
 25. Combined Geo/Leo High Latitude Atmospheric Motion Vectors, NOAA, Co-I (PI: M. Lazzara, UWisc), \$140K, UWisc, 2009-2011.
 26. A Product Development Team for Snow and Ice Climate Data Records, NOAA (NCDC), PI, \$957K, NOAA/NESDIS and UWisc (\$325K), UColorado, 2009-2012.
 27. Sea Ice Thickness from Aqua and Terra Data: Generation, Evaluation and Application, NASA, Co-I (PI: J. Maslanik, CU), \$754K, NESDIS and UWisc (\$292K), 2011-2013.
 28. NPP Science Team Participation in Support of Cryosphere Products, NASA, Co-I (PI: M. Tschudi, CU), \$355K, NESDIS and UWisc (\$140K), 2011-2013.
 29. Generation and Initial Evaluation of a 27-Year Satellite-Derived Wind Data Set for the Polar Regions, NASA, Co-I (PI: D. Santek), \$210K, UWisc, 2009-2011.
 30. NPP/NPOESS Cryospheric Products Calibration and Validation Activities, NPOESS Integrated Program Office, PI, \$500K, NOAA/NESDIS and UWisc (with UColorado), 2008-2009.
 31. Cloud-drift and Water Vapor Winds in the Polar Regions from Polar-orbiting Imagers, NOAA Office of Systems Development, PI (NOAA; PI at CIMSS: C. Velden), \$1.17M, NOAA/NESDIS and UWisc, 2001-2009.
 32. Improving ice thickness and age estimate with GOES-R ABI, NOAA GOES-R Program Office, Co-I, \$80K, UWisc, 2008-2009.
 33. Assessment of Satellite-derived Cloud Motion Vectors height assignments utilizing active remote sensing measurements from CALIPSO, Joint Center for Satellite Data Assimilation (NOAA), Co-I, \$50K, UWisc, 2007-2008.
 34. Satellite Products for the International Polar Year, NESDIS, PI, \$120K, NOAA/NESDIS and UWisc, 2008.
 35. Generating and Validating NPOESS Products at Direct Broadcast Sites in the Arctic and Antarctic, Integrated Program Office, PI, \$403K, NOAA/NESDIS and UWisc, 2004-2008.
 36. A Land Surface Model Hind-Cast for the Terrestrial Arctic Drainage System, NSF, Co-PI (PI: M. Serreze, CU, Co-PIs: M. Clark, CU, A. Slater, CU, D. Lettenmaier, UWash), \$199K, UWisc, 2003-2007.
 37. Polar Winds from Satellite Imagers and Sounders, NASA, PI, \$979K, NOAA/NESDIS, UWisc, Rutgers Univ., NASA GMAO, 2004-2007.
 38. Development and Application of a 20-Year Satellite-Derived Wind Data Set for the Polar Regions, NOAA/NESDIS/ORA, PI, \$60K, NOAA/NESDIS, UWisc, 2003 and 2006.
 39. Retrospective Analysis of Arctic Clouds and Radiation from Surface and Satellite Measurements, NOAA Arctic Research Office, PI, \$176K, NOAA/NESDIS and UWisc, 2003-2006.
 40. Interactions Among Observations of Laterally Advected Heat and Moisture, Cloud Properties,

- Surface Temperature, Surface Radiation Fluxes, and Net Precipitation in the Arctic, NSF, Co-PI (PI: J. Francis, Rutgers Univ.; Co-PI: S. Ackerman), \$170K, UWisc, 2003-2006.
41. Polar winds data assimilation experiments, NOAA/NASA Joint Center for Satellite Data Assimilation, PI (Co-PI: C. Velden), \$172K, NOAA/NESDIS, UWisc, and NASA Data Assimilation Office, 2003-2005.
 42. VIIRS Snow and Ice Product Risk Reduction, Integrated Program Office, PI (Co-PI: P. Romanov, CIRA), \$130K, NOAA/NESDIS and UWisc, 2003-2004.
 43. VIIRS Risk Reduction Activities, Integrated Program Office, Co-PI (NOAA; NOAA PI: W.P. Menzel, Co-PI: A. Heidinger; CIMSS PI: S. Ackerman), \$477K, NOAA/NESDIS and UWisc, 2001-2002.
 44. Interactions of Laterally Advected Heat and Moisture with Arctic Cloud Properties, NOAA, Co-PI (PI: J. Francis, Rutgers Univ.; Co-PI: S. Ackerman), \$77K, UWisc, 2001-2003.
 45. Cloud-Drift Winds in the Polar Regions from MODIS, NOAA/GIMPAP, Co-I and Program Manager (PI: C. Velden), \$40K, UWisc/NOAA, 2000-2001.
 46. Development and Summary of Arctic Basin-Scale to Local-Scale Gridded Products in Support of Modeling Investigations During the SHEBA Period, NSF, Co-I (PI: J. Maslanik, CU, Co-Is: C. Fowler, A. Lynch, T. Arbetter), \$430K, CU, 2000-2003.
 47. Antarctic Cloud Properties and Their Effect on the Surface Energy Budget, NSF, PI, \$225K, BU, UWisc, 1999-2001.
 48. NPOESS Algorithm Development, AER and ITT, Co-PI (PI: C. Schaaf, Co-PIs: A. Strahler, C. Woodcock, M. Friedl), \$609K, BU, 1998-2000.
 49. Center for Excellence in Remote Sensing at Boston University, NASA, Co-I (PI: C. Woodcock, Co-Is: El-Baz, Cleveland, Friedl, Gopal, Kaufmann, Dye, Myneni, Salvucci, Strahler), \$444K, BU, 1998-1999.
 50. AVHRR-Based Polar Pathfinder Products - Evaluation, Enhancement, and Transition to MODIS, NASA, Co-I, (PI: C. Fowler; Co-PI: J. Maslanik), \$293K, CU, 1998-2000.
 51. Documenting, Understanding, and Predicting the Aggregate Surface Radiation Fluxes for SHEBA, NASA and NSF. PI at BU (PI: J. Curry, Co-PIs: F. Evans, J. Maslanik, K. Steffen), \$800K, CU, BU, 1997-2000.
 52. Polar Exchange at the Sea Surface (Poles), NASA EOS Interdisciplinary Program, PI at BU (PI at UWash: D. Rothrock), \$1.7M, UWash, BU, 1991-2000.
 53. Polar-wide Geophysical Products Derived from AVHRR Data, NASA, PI at BU (PI at CU: J. Maslanik, Co-PIs: T. Scambos, C. Fowler), \$700K, CU, BU, 1995-1998.
 54. Sea Ice and Atmospheric Characteristics of the SHEBA Field Area, NSF, PI at BU (PI at CU: M. Serreze, Co-PI: J. Maslanik), \$89K, CU, BU, 1995-1996.
 55. Analysis of Existing Aircraft Datasets of Arctic Clouds, Radiation, and Surface Characteristics: Applications to SHEBA Planning, NSF, Co-PI (PI: J. Curry, CoPIs: G. Liu, J. Tilley, J. Maslanik), \$340K, CU, 1995-1997.
 56. Arctic System Science Data Coordination Center at NSIDC, NSF, Co-PI (PI: C. Hanson, Co-PIs: R. Barry, R. Armstrong), \$490K, CU, 1995-1998.
 57. The Arctic Radiation Balance, NSF, PI (Co-PIs: M. Serreze, R. Stone, R. Barry, K. Steffen), \$350K, CU, BU, 1994-1997.
 58. RADNET: A Neural Network-based Estimation of the Surface Radiation Budget in the Arctic from TOVS and AVHRR Data, NASA, Co-PI (PI: A. Schweiger), \$90K, CU, BU, 1994-1995.
 59. Evolution of Sea Ice Characteristics, Cloud Properties and Radiation Fluxes During the Autumnal Freezing of the Beaufort Sea Coastal Waters, NSF, Co-PI (PI: J. Curry, Co-PI: G. Liu), \$342K, CU,

1994-1995.

60. Ice Surface Temperature Retrieval from AVHRR, ATSR, and Passive Microwave Satellite Data: Algorithm Development and Application, NASA, PI (Co-PIs: J. Maslanik, K. Steffen), \$237K, CU, BU, 1993-1996.
61. Assessment of Climate Variability of the Greenland Ice Sheet: Integration of In Situ and Satellite Data, NASA, Co-PI (PI: K. Steffen), \$479K, CU, 1993-1996.
62. Modeled and Observed Sea Ice Variability in the Arctic: Sensitivity to Atmospheric Conditions and the Surface Energy Budget, NASA, Co-PI (PI: J. Maslanik), \$151K, CU, 1991-1993.
63. Characterization of Sea Ice and Clouds in the Arctic, NASDA (National Space Development Agency of Japan), Co-I (PI: J. Maslanik), data request only (no \$), CU, 1992-1993.
64. Lead Detection and Mapping with Reference to Relationships Between Scale, Sensor Characteristics, Surface Conditions, and Atmospheric Properties, ONR, PI (Co-PI: J. Maslanik), \$182K, CU, 1990-1993.
65. Sea Ice-Atmosphere Interaction: Application of Multispectral Satellite Data in Polar Surface Energy Flux Estimates, NASA, Co-PI (PI: K. Steffen, Co-PIs: J. Maslanik, R. Barry), \$358K, CU, 1990-1993.
66. Artificial Intelligence Applications for Sea Ice Classification and Processes NASA, Co-PI (PI: J. Maslanik), \$254K, CU, 1990-1993.
67. Observations in Support of Remote Sensing and Modeling of Arctic Sea Ice and Atmospheric Conditions, NSF, Co-PI (PI: M. Serreze, Co-PI: J. Maslanik), \$94K, CU, 1991-1992.
68. Development and Trend Analyses of an Arctic TOVS Temperature Sounding Record, NOAA, Co-I, PI last 6 months (PI: S. Khalsa, Co-PIs: J. Kahl, R. Schnell, M. Serreze), \$273K, CU, 1991-1993.
69. Parameterization and Scaling of Arctic Ice Conditions in the Context of Ice-Atmosphere Processes, NASA, Co-PI (PI: R. Barry, Co-PIs: K. Steffen, J. Maslanik), \$290K, CU, 1991-1994.

TEACHING

Summary: Taught 15 different courses (total of 33 sections) in remote sensing, meteorology, statistics, geography, and computer science at four universities. Evaluation average, all universities, all courses: 87% (with 75%= "average").

Courses Taught

Boston University (1995-99)

Natural Environments: The Atmosphere (GG 101)

Physical Climatology (GG 504)

Remote Sensing of the Lower Atmosphere (GG 646/446)

Directed Studies: Problems in Climatology (GG 925)

University of Colorado, Boulder (1982-84, 1990-95)

Environmental Systems 1: Climate and Vegetation (GEOG 100)

Environmental Systems 2: Soils and Landforms (GEOG 101)

Atmospheric Science I: Severe Storms (APAS 115)

Dynamic Earth III (meteorology) (GEOG/APAS 319)

Remote Sensing (labs) (GEOG 409/509)

Nominated for Teaching Excellence Award, 1983.

University of Alaska, Anchorage (1984-87)

Elementary Statistics (AS 300)

Probability and Statistics (AS 307)

Intermediate Statistics (AS 308)
Fortran Programming (CS 105)
Software and Hardware Concepts (CS 201)
Programming Language Structures (CS 331)
Artificial Intelligence (CS 405)
Directed Studies: Scientific Sampling (AS 402)

Northern Michigan University (1980-82)

Physical Geography, GC 100
Map Interpretation (labs), GC 225
Cartography (labs), GC 230

Advising

Supported and/or supervised 2-4 graduate students annually, 1990-2008. **Theses supervised** (research or academic advisor, 1st or 2nd Reader; other committee participation is not listed):

- Letterly, Aaron D., 2015, The Influence of Winter Cloud on Summer Sea Ice in the Arctic, 1982-2013, M.S. thesis, University of Wisconsin-Madison (Research advisor).
- Nelson, Kyle, 2014, The Role of Optically Thin Liquid Clouds in the 2012 Greenland Ice Sheet Surface Melt Event, M.S. thesis, University of Wisconsin-Madison (Research advisor).
- Santek, David, 2007, The Global Impact of Satellite-Derived Polar Winds on Model Forecasts, *Ph.D. thesis*, University of Wisconsin-Madison (Research advisor).
- Dworak, Richard, 2007, Historical AVHRR Satellite-Derived Winds Archive (1982-2002), Validation and Comparison to the ERA-40, *M.S. thesis*, University of Wisconsin-Madison (Research advisor).
- Liu, Yinghui, 2006, Possible Causes of Recent Changes in the Arctic Cloud Cover, Surface Temperature, and Temperature Inversions, *Ph.D. thesis*, University of Wisconsin-Madison (Research advisor).
- Wang, Xuanji, 2003, Arctic Climate Characteristics and Recent Trends from Space, *Ph.D. thesis*, University of Wisconsin-Madison (Research advisor).
- Pavolonis, Michael J., 2002, Antarctic cloud radiative forcing at the surface estimated from the ISCCP D1 and AVHRR Polar Pathfinder data sets, 1985–1993. *M.S. thesis*, University of Wisconsin-Madison (Research advisor).
- Wong, Adeline, 2000, Estimating the Cloudy Sky Surface Temperature of Sea Ice from Space, *M.A. thesis*, Boston University (1st Reader).
- Chan, Alan C.K., 1998, A Global Climatology of 500 mb Cyclones, *Independent Work for Distinction (BA)*, Boston University (Advisor).
- Fan, Shaohua, 1998, EIFOV as a Function of View Geometry for MODIS, *M.A. paper*, Boston University (2nd Reader).
- Klein, Rachael, 1997, The Whole Thing Could Be Chaos, *Boston University Academy undergraduate thesis* (1st Reader).
- Box, Jason E., 1997, Polar Day Effective Cloud Opacity in the Arctic from Measured and Modeled Solar Radiation Fluxes, *M.A. thesis*, University of Colorado (2nd Reader).
- Silcox, Robert A., 1994, Downwelling Radiation Fluxes at the Arctic Surface Based on Parameterizations, *M.A. thesis*, University of Colorado (Research advisor, 2nd Reader).
- Schweiger, Axel J., 1992, Arctic Radiative Fluxes Modeled from the ISCCP-C2 Data Set, 1983-1986, *Ph.D. dissertation*, University of Colorado (Research advisor, 2nd Reader).

Additional thesis committee participation (3rd, 4th, or 5th Reader):

Cuzzone, Joshua, 2010, The Relationship between Arctic Sea Ice and Cloud-related Variables in ERA Interim Reanalysis and Climate Model Data, *M.S. thesis*, University of Wisconsin-Madison (3rd Reader).

Lazzara, Matthew A., 2008, A Diagnostic Study of Antarctic Fog, *Ph.D. thesis*, University of Wisconsin-Madison (Ad hoc committee member).

Ali, Ali Hamid A., 1997, Statistical Analysis of Meteorological Events in the Arabian Peninsula and the Gulf Region, *Ph.D. dissertation*, Boston University (5th Reader).

Stroeve, Julienne C., 1996, Radiation Climatology of the Greenland Ice Sheet, *Ph.D. dissertation*, University of Colorado (3rd Reader).

Haefliger, Marcel P.S., 1995, Radiation Balance Over the Greenland Ice Sheet Derived by NOAA AVHRR Satellite Data and In Situ Observations, *Ph.D. dissertation*, Swiss Federal Institute of Technology, Zurich (3rd Reader).

FIELD WORK

Atmospheric and Cryospheric Sciences

GLAWEX, Green Bay, Wisconsin, February 2017

Measurements of ice thickness, snow properties, and surface meteorology on Green Bay for the validation of satellite products. Part of the Great Lakes Winter Experiment (GLAWEX). The Coast Guard icebreaker Mobile Bay also participated.

McMurdo, Antarctica, October-November 2004

Developed and implemented a system to produce real-time MODIS polar winds from direct broadcast data at McMurdo. Worked with Space and Naval Systems Center (SPAWAR) forecasters regarding the use of satellite data in an operational forecasting environment. Serviced automatic weather stations.

SHEBA, July 1998

Measurements of radiation and cloud microphysical properties on-board the NCAR C-130 aircraft for process studies and remote sensing validation. Done in conjunction with the Surface Heat Budget of the Arctic Ocean (SHEBA) surface campaign, Beaufort Sea.

Greenland, May-June 1995

Part of a multi-year study of the surface energy balance of the Greenland Ice Sheet, at the equilibrium snow line. Measurements of surface radiation fluxes, atmospheric temperature and humidity, aerosols, and clouds for process studies.

BASE, September-October 1994

Measurements of radiation and cloud microphysical properties on-board the NCAR C-130 aircraft. Done in conjunction with the Canadian Beaufort and Arctic Seas Experiment (BASE), Beaufort Sea.

SIMMS'93, May 1993

Aerosol optical depth (sun photometer), cloud base height and atmospheric extinction (laser ceilometer), radiation and energy budget measurements (temperature, reflectance, snow depth, radiative fluxes, etc.) at the sea ice surface; done in conjunction with the Canadian SIMMS (The Seasonal Sea Ice Monitoring and Modeling Site) program; Baffin Strait/Lancaster Sound.

SIMMS'92, May-June 1992

Radiation and energy budget measurements (temperature, reflectance, snow depth, radiative fluxes, etc.) at the sea ice surface primarily for the validation of satellite retrieval algorithms; done in conjunction with the Canadian SIMMS (The Seasonal Sea Ice Monitoring and Modeling Site) program; Baffin Strait/Lancaster Sound/Wellington Channel near Resolute, N.W.T.

LEADEX, April 1992

Sun photometer measurements on-board the NOAA P-3 for studies of tropospheric and stratospheric Arctic aerosols in support of LEADEX (ONR and NOAA-sponsored) and AGASP-IV (Arctic Gas and Aerosol Sampling Program); Beaufort Sea.

Biological Sciences

U.S. Fish and Wildlife Service, 1981, 1982 (summers)

Sea lamprey adult population studies by trapping, tagging, and radio tracking; Lake Superior and Michigan's Upper Peninsula rivers.

U.S. Fish and Wildlife Service, 1979, 1980 (summers)

Stream survey for sea lamprey larvae assessment by electro-shocking methods; Michigan, Wisconsin, and Minnesota rivers.

MAJOR/OPERATIONAL SATELLITE PRODUCTS AND SOFTWARE TOOLS

AVHRR Polar Pathfinder (APP-x) – More than 30-year satellite fundamental climate data record the Arctic and Antarctic. Citation: Key, Jeffrey; Liu, Yinghui; Wang, Xuanji; and NOAA CDR Program (2015). NOAA Climate Data Record (CDR) of AVHRR Polar Pathfinder (APP) Cryosphere, Version 1.0. NOAA National Centers for Environmental Information (NCEI). doi:10.7289/V5BC3WHM.

Extended AVHRR Polar Pathfinder (APP-x) – More than 30-year satellite thematic climate data record for cloud, surface, and radiation properties over the Arctic and Antarctic. Citation: Key, Jeffrey; Wang, Xuanji; Liu, Yinghui; NOAA CDR Program (2014). NOAA Climate Data Record of AVHRR Polar Pathfinder Extended (APP-X), Version 1.0. Revision 1. NOAA National Climatic Data Center. doi:10.7289/V5MK69W6.

Real-time polar winds – Tropospheric winds in the polar regions from MODIS, AVHRR (all NOAA POES satellites plus Metop-A and -B), and VIIRS, tropospheric winds used by 13 operational numerical weather prediction centers in nine countries. Winds are also generated on-site at three direct broadcast stations in the Arctic and two in the Antarctic. With D. Santek, J. Daniels, and H. Qi. (Operational)

GCOM-W1 AMSR2 snow and ice products: snow cover, depth, and snow water equivalent. With Y.-K. Lee, C. Kongoli, and W. Meier. (Operational)

S-NPP VIIRS ice products: ice concentration, temperature, and thickness. With Y. Liu and X. Wang. (Operational).

GOES-R ABI ice and snow products: ice concentration, temperature, motion, and thickness. With Y. Liu, X. Wang, and T. Painter. (Operational in 2018).

Historical polar winds from AVHRR – A 30-year satellite climate data record for reanalysis use. With R. Dworak.

Streamer, a radiative transfer model (<http://stratus.ssec.wisc.edu/streamer>), for research and education.

FluxNet, a neural network for surface and top-of-atmosphere radiative fluxes (<http://stratus.ssec.wisc.edu/fluxnet>).

CASPR, the Cloud and Surface Parameter Retrieval system (no longer available).

PUBLICATIONS

Summary: Author/co-author on 120+ journal papers and other peer-reviewed publications, 5 book chapters, 16 technical and data reports (some peer-reviewed), numerous workshop reports, and 83 conference proceedings papers and newsletter articles. h-index: 51, i10-index: 97 (October 2018, Google Scholar). PDFs of the papers below are available at <https://stratus.ssec.wisc.edu/jk-papers/>.

Peer-Reviewed Journal Papers

1. Liu, Y., R. Dworak, and J. Key, 2018, Ice Surface Temperature Retrieval from a Single Satellite Imager Band, *Remote Sens.* (submitted October 2018).
2. Liu, Y., J. Key, S. Vavrus, and C. Woods, 2018, Time evolution of cloud response to moisture intrusions into the Arctic during winter, *J. Climate*, 31, 9389-9405, doi: 10.1175/JCLI-D-17-0896.1.
3. Letterly, A., J. Key, and Y. Liu, 2018, Arctic Climate: Changes in Sea Ice Extent Outweigh Changes in Snow Cover, *The Cryosphere*, 12, 3373–3382, <https://doi.org/10.5194/tc-12-3373-2018>.
4. Riihelä, A., T. Manninen, J. Key, Q. Sun, M. Sütterlin, A. Lattanzio, and C. Schaaf, 2018, A multisensor approach to global retrievals of land surface albedo, *Remote Sens.*, 10(6), 848, <https://doi.org/10.3390/rs10060848>.
5. Manninen, T., A. Riihelä, A. Heidinger, C. Schaaf, A. Lattanzio, J. Key, 2018, Intercalibration of polar-orbiting spectral radiometers without simultaneous nadir observations, *IEEE Trans. Geosci. Remote Sens.*, 56(3), 1507-1519, doi: 10.1109/TGRS.2017.2764627.
6. Katlein, C., S. Hendricks, and J. Key, 2017, Brief communication: Increasing shortwave absorption over the Arctic Ocean is not balanced by trends in the Antarctic, *The Cryosphere*, 11, 2111-2116, <https://doi.org/10.5194/tc-11-2111-2017>.
7. Riihelä, A., J. R. Key, J. F. Meirink, P. Kuipers Munneke, T. Palo, and K.-G. Karlsson, 2017, An intercomparison and validation of satellite-based surface radiative energy flux estimates over the Arctic, *J. Geophys. Res. Atmos.*, 122, 4829–4848, doi:10.1002/2016JD026443.
8. Meier, W.N., J.S. Stewart, Y. Liu, J. Key, and J. Miller, 2017, Operational implementation of sea ice concentration estimates from the AMSR2 sensor, *IEEE J. Selected Topics Appl. Earth Obs. Remote Sens. (J-STARS)*, 10(9), 3904-3911, doi: 10.1109/JSTARS.2017.2693120.
9. Dorofy, P., R. Nazari, P. Romanov, and J. Key, 2016, Development of a mid-infrared sea and lake ice index (MISI) using the GOES Imager, *Remote Sens.*, 8, 1015, doi:10.3390/rs8121015.
10. Wang, X., J. Key, R. Kwok, and J. Zhang, 2016, Comparison of sea ice thickness from satellites, aircraft, and PIOMAS data, *Remote Sens.*, 8, 713, doi:10.3390/rs8090713.
11. Liu, Y. and J. Key, 2016, Assessment of Arctic cloud cover anomalies in atmospheric reanalysis products using satellite data, *J. Climate*, 29, 6065-6083, doi: <http://dx.doi.org/10.1175/JCLI-D-15-0861.1>.
12. Liu, Y., J. Key, and R. Mahoney, 2016, Sea and Freshwater Ice Concentration from VIIRS on Suomi NPP and the Future JPSS Satellites, *Remote Sens.*, 8(6), 523; doi:10.3390/rs8060523.
13. Letterly, A., J. Key, and Y. Liu (2016), The influence of winter cloud on summer sea ice in the Arctic, 1983–2013, *J. Geophys. Res. Atmos.*, 121, doi:10.1002/2015JD024316.
14. Key, J., X. Wang, Y. Liu, R. Dworak, A. Letterly, 2016, The AVHRR Polar Pathfinder Climate Data Records, *Remote Sens.*, 8(3), 167, doi:10.3390/rs8030167.
15. Lee, K.-L., C. Kongoli, and J. Key, 2015, An in-depth evaluation of heritage algorithms for snow cover and snow depth using AMSR-E and AMSR2 measurements, *J. Atmos. Oceanic Tech.*, 32, 2319-2336, doi: 10.1175/JTECH-D-15-0100.1.

16. Liu, Y., J. Key, M. Tschudi, R. Dworak, R. Mahoney, and D. Baldwin, 2015, Validation of the Suomi NPP VIIRS Ice Surface Temperature Environmental Data Record, *Remote Sensing*, 7, 17258–17271, doi:10.3390/rs71215880.
17. Key, J., B. Goodison, W. Schöner, Ø. Godøy, M. Ondráš, and Á. Snorrason, 2015, A Global Cryosphere Watch, *Arctic*, 68 (Suppl. 1), 48-58, doi: <http://dx.doi.org/10.14430/arctic4476>.
18. Meier, W., G. Hovelsrud, B. van Oort, J. Key, K. Kovacs, C. Michel, C. Haas, M. Granskog, S. Gerland, D. Perovich, A. Makshtas, and J. Reist, 2014, Arctic sea ice in transformation: A review of recent observed changes and impacts on biology and human activity, *Rev. Geophys.*, 51, doi: 10.1002/2013RG000431.
19. Overland, J., J. Key, E. Hanna, I. Hanssen-Bauer, B.-M. Kim, S.-J. Kim, J. Walsh, M. Wang, U. Bhatt, Y. Liu, R. Stone, C. Cox, V. Walden, 2014, The Lower Atmosphere: Air Temperature, Clouds and Surface Radiation [in “State of the Climate in 2013”], *Bull. Amer. Meteor. Soc.*, 95(7), S115-S120, doi: <http://dx.doi.org/10.1175/2014BAMSStateoftheClimate.1>.
20. Liu, Y. and J. Key, 2014, Less Winter Cloud Aids Summer 2013 Arctic Sea Ice Return from 2012 Minimum, *Environ. Res. Lett.* 9 044002, doi:10.1088/1748-9326/9/4/044002.
21. Lazzara, M., R. Dworak, D. Santek, B. Hoover, C. Velden, and J. Key, 2013, High-latitude Atmospheric Motion Vectors from Composite Satellite Data, *J. Appl. Meteorol. Climatol.*, 53, 534–547. doi: <http://dx.doi.org/10.1175/JAMC-D-13-0160.1>.
22. Key, J. R., R. Mahoney, Y. Liu, P. Romanov, M. Tschudi, I. Appel, J. Maslanik, D. Baldwin, X. Wang, and P. Meade, 2013, Snow and ice products from Suomi NPP VIIRS, *J. Geophys. Res. Atmos.*, 118, doi:10.1002/2013JD020459.
23. Overland, J., J. Key, B.-M. Kim, S.-J. Kim, Y. Liu, J. Walsh, M. Wang, U. Bhatt, and R. Thoman, 2013, Air temperature, atmospheric circulation, and clouds [in “State of the Climate in 2012”], *Bull. Amer. Meteor. Soc.*, 94(8), S121–S123, doi: <http://dx.doi.org/10.1175/2013BAMSStateoftheClimate.1>.
24. Wang, X., J. Key, Y. Liu, C. Fowler, J. Maslanik, and M. Tschudi, 2012, Arctic climate variability and trends from satellite observations, *Adv. Meteorol.*, v2012, 22 pp, doi:10.1155/2012/505613.
25. Overland, J., U. Bhatt, J. Key, Y. Liu, J. Walsh, and M. Wang, 2012, Air Temperature, Atmospheric Circulation and Clouds, [in “State of the Climate in 2011”], *Bull. Amer. Meteorol. Soc.*, 93, S1-S264, doi: 10.1175/2012BAMSStateoftheClimate.1.
26. Hall, D., J. Comiso, N. DiGirolamo, C. Shuman, J. Key, and L. Koenig, 2012, A Satellite-Derived Climate-Quality Data Record of the Clear-Sky Surface Temperature of the Greenland Ice Sheet, *J. Climate*, 25, 4785-4798, doi:10.1175/JCLI-D-11-00365.1.
27. Liu, Y., J. Key, S. Ackerman, G. Mace, and Q. Zhang, 2012, Arctic cloud macrophysical characteristics from CloudSat and CALIPSO, *Remote Sensing of Environment*, 124, 159-173, doi:10.1016/j.rse.2012.05.006.
28. Liu, Y., J. R. Key, Z. Liu, X. Wang, and S. J. Vavrus, 2012, A cloudier Arctic expected with diminishing sea ice, *Geophys. Res. Lett.*, 39, L05705, doi:10.1029/2012GL051251.
29. Olsen, M.S., T. Callaghan, J. Reist, L.O. Reiersen, D. Dahl-Jensen, S. Gerland, B. Goodison, G. Hovelsrud, M. Johansson, R. Kallenborn, J. Key, A. Klepikov, W. Meier, J. Overland, T. Prowse, M. Sharp, W. Vincent, and J. Walsh, 2011, The changing Arctic cryosphere and likely consequences: An overview, *Ambio*, 40, 111-118, doi 10.1007/s13280-011-0220-y.
30. Callaghan, T., M. Johansson, J. Key, T. Prowse, M. Ananicheva, and A. Klepikov, 2011, Feedbacks and interactions: From the Arctic cryosphere to the climate system, *Ambio*, 40, 75-86, doi 10.1007/s13280-011-0215-8.
31. Wang, X., J. Key, and Y. Liu, 2010, A thermodynamic model for estimating sea and lake ice thickness with optical satellite data, *J. Geophys. Res.-Oceans*, 115, C12035, doi:10.1029/2009JC005857.

32. Liu, Y., S. Ackerman, B. Maddux, J. Key, and R. Frey, 2010, Errors in cloud detection over the Arctic using a satellite imager and implications for observing feedback mechanisms, *J. Climate*, 23(7), 1894-1907.
33. Fernandes, R., H. Zhao, X. Wang, J. Key, X. Qu, and A. Hall, Controls on Northern Hemisphere snow albedo feedback quantified using satellite Earth observations, *Geophys. Res. Lett.*, 36, 21, doi:10.1029/2009GL040057, 2009.
34. Liu, Y., J. Key, and X. Wang, 2009, Influence of changes in sea ice concentration and cloud cover on recent Arctic surface temperature trends, *Geophys. Research Lett.*, 36, L20710, doi:10.1029/2009GL040708.
35. Dworak, R. and J. Key, 2009, 20 Years of Polar Winds from AVHRR: Validation and Comparison to the ERA-40, *J. Appl. Meteorol. Clim.*, 48(1), 24-40.
36. Frey, R., S. Ackerman, Y. Liu, K. Strabala, H. Zhang, J. Key, and X. Wang, 2008, Cloud Detection with MODIS, Part I: Improvements in the MODIS Cloud Mask for Collection 5, *J. Atmos. Ocean. Tech.*, 25, 1057-1072, DOI: 10.1175/2008JTECHA1052.1.
37. Drinkwater, M.R., K.C. Jezek, J.R. Key, 2008, Coordinated Satellite Observations during the International Polar Year 2007-2008: Towards achieving a Polar Constellation, *Space Res. Today*, 171, 6-17.
38. Liu, Y., J. Key, and X. Wang, 2008, The influence of changes in cloud cover on recent surface temperature trends in the Arctic, *J. Climate*, 21, 705-715, DOI: 10.1175/2007JCLI1681.1.
39. Goodison, B., J. Brown, K. Jezek, J. Key, T. Prowse, A. Snorrason, and T. Worby, 2007, State and fate of the polar cryosphere, including variability of the Arctic hydrological cycle, *World Meteorological Organization Bulletin*, 56(4), 284-292.
40. Wang, X., J.R. Key, C. Fowler, and J. Maslanik, 2007, Diurnal cycles in Arctic surface radiative fluxes in a blended satellite-climate reanalysis data set, *J. Appl. Remote Sensing*, Vol. 1, 013535 (13 September 2007).
41. Liu, Y., J. Key, J. Francis, and X. Wang, 2007, Possible causes of decreasing cloud cover in the Arctic winter, 1982-2000, *Geophys. Res. Letters*, 34, L14705, doi:10.1029/2007GL030042.
42. Liu, Y., J. Key, A. Schweiger, and J. Francis, 2006, Characteristics of satellite-derived clear-sky atmospheric temperature inversion strength in the Arctic, 1980-1996, *J. Climate*, 19(19), 4902-4913.
43. Francis, J.A., E. Hunter, J. Key, and X. Wang, 2005, Clues to variability in Arctic minimum sea ice extent, *Geophys. Res. Letters*, vol. 32, L21501, doi: 10.1029/2005GL024376, November 15.
44. Chapin, F.S., M. Sturm, M.C. Serreze, J.P. McFadden, J.R. Key, A.H. Lloyd, A.D. McGuire, T.S. Rupp, A.H. Lynch, J.P. Schimel, J. Beringer, H.E. Epstein, L.D. Hinzman, G. Jia, C.-L. Ping, K. Tape, W.L. Chapman, E. Euskirchen, C.D.C. Thompson, J.M. Welker, and D.A. Walker, 2005, Role of land surface changes in Arctic summer warming, *Science*, vol. 310, doi: 10.1126/science.1117368, October 28.
45. Overpeck, J.T., M. Sturm, J.A. Francis, D.K. Perovich, M.C. Serreze, R. Benner, E.C. Carmack, F.S. Chapin III, S.C. Gerlach, L.C. Hamilton, L.D. Hinzman, M. Holland, H.P. Huntington, J.R. Key, A.H. Lloyd, G.M. MacDonald, J. McFadden, D. Noone, T.D. Prowse, P. Schlosser, and C. Vörösmarty, 2005, Arctic system on trajectory to new, Seasonally ice-free state, *EOS*, 86(34), 309-314.
46. Wang, X. and J. Key, 2005, Arctic surface, cloud, and radiation properties based on the AVHRR Polar Pathfinder data set. Part I: Spatial and temporal characteristics, *J. Climate*, 18(14), 2558-2574.
47. Wang, X. and J. Key, 2005, Arctic surface, cloud, and radiation properties based on the AVHRR Polar Pathfinder data set. Part II: Recent trends, *J. Climate*, 18(14), 2575-2593.
48. Aoki, T. T.Y. Tanaka, A. Uchiyama, M. Chiba, M. Mikami, S. Yabuki, and J. Key, 2005, Sensitivity experiments of direct radiative forcing by mineral dust simulated with a chemical transport model, *J.*

- Meteorol. Soc. Japan*, 83A, 315-331.
49. Liu, J., J.A. Curry, W.B. Rossow, J.R. Key, and X. Wang, 2005, Comparison of surface radiative flux data sets over the Arctic Ocean, *J. Geophys. Res.*, Vol.110, C02015, doi:10.1029/2004JC002381.
 50. Velden, C., J. Daniels, D. Stettner, D. Santek, J. Key, J. Dunion, K. Holmlund, G. Dengel, W. Bresky, and P. Menzel, 2005, Recent innovations in deriving tropospheric winds from meteorological satellites, *Bull. Amer. Meteorol. Soc.*, 86(2), 205-223.
 51. Zuidema, P., B. Baker, Y. Han, J. Intrieri, J. Key, P. Lawson, S. Matrosov, M. Shupe, R. Stone, T. Uttal, 2005, An Arctic springtime mixed-phase cloudy boundary layer observed during SHEBA, *J. Atmos. Sci.*, 62, 160-176.
 52. Liu, Y., J. Key, R. Frey, S. Ackerman, and W.P. Menzel, 2004, Nighttime polar cloud detection with MODIS, *J. Appl. Meteorol.*, 92, 181-194.
 53. Hall, D.K., J. Key, K.A. Casey, G.A. Riggs, and D.J. Cavalieri, 2004, Sea ice surface temperature product from the Moderate Resolution Imaging Spectroradiometer (MODIS), *IEEE Trans. Geosci. Remote Sensing*, 42(5), 1076-1087.
 54. Gultepe, I., G. Isaac, J. Key, T. Uttal, J. Intrieri, D. Starr, and K. Strawbridge, 2004, Dynamical and Microphysical Characteristics of Arctic Clouds Using Integrated Observations Collected Over SHEBA During the April 1998 FIRE-ACE Flights of the Canadian Convair, *Meteorol. Atmos. Physics*, 85, 235-263.
 55. Pavolonis, M., J. Key, and J. Cassano, 2004, A study of the Antarctic surface energy budget using a coupled regional climate model forced with satellite-derived cloud properties, *Mon. Wea. Rev.*, 132, 654-661.
 56. Liu, Y. and J. Key, 2003, Detection and analysis of clear sky, low-level atmospheric temperature inversions with MODIS, *J. Atmos. Ocean. Tech.*, 20, 1727-1737.
 57. Pavolonis, M. and J. Key, 2003, Antarctic cloud radiative forcing at the surface estimated from the AVHRR Polar Pathfinder and ISCCP D1 data sets, 1985-1993, *J. Appl. Meteorol.*, 42(6), 827-840.
 58. Key, J., D. Santek, C.S. Velden, N. Bormann, J.-N. Thepaut, L.P. Riishojgaard, Y. Zhu, and W.P. Menzel, 2003, Cloud-drift and Water Vapor Winds in the Polar Regions from MODIS, *IEEE Trans. Geosci. Remote Sensing*, 41(2), 482-492.
 59. Wang, X. and J. Key, 2003, Recent trends in Arctic surface, cloud, and radiation properties from space, *Science*, 299(5613), 1725-1728.
 60. Schweiger, A., R. Lindsay, J. Francis, J. Key, J. Intrieri, and M. Shupe, 2002, Validation of TOVS Path-P data during SHEBA, *J. Geophys. Res.*, 107(C10), 8041, doi:10.1029/2000JC0004538.
 61. Key, J., P. Yang, B. Baum, and S. Nasiri, 2002, Parameterization of shortwave ice cloud optical properties for various particle habits, *J. Geophys. Res.*, 107(D13), 4181, doi:10.1029/2001JD000742.
 62. Wang, X. and J. Key, 2002, Aggregate-area radiative flux biases, *Annals Glaciol.*, 34, 101-105.
 63. Wang, X. and J. Key, 2001, Spatial variability of the sea ice radiation budget and its effect on aggregate area fluxes, *Annals Glaciol.*, 33, 248-252.
 64. Maslanik, J., J. Key, C. Fowler, T. Nyguen, X. Wang, 2001, Spatial and temporal variability of surface and cloud properties from satellite data during FIRE-ACE. *J. Geophys. Res.*, 106(D14), 15233-15249.
 65. Key, J., X. Wang, J. Stroeve, C. Fowler, 2001, Estimating the cloudy sky albedo of sea ice and snow from space, *J. Geophys. Res.*, 106(D12), 12489-12497.
 66. Stroeve, J., J. Box, C. Fowler, T. Haran, J. Key, and J. Maslanik, 2000, Intercomparison between in situ and AVHRR Polar Pathfinder-derived surface albedo over Greenland, *Rem. Sens. Environ.*, 75, 360-374.

67. Key, J. and J. Intrieri, 2000, Cloud particle phase determination with the AVHRR, *J. Appl. Meteorol.*, 36(10), 1797-1805.
68. Key, J. and A. Chan, 1999, Multidecadal global and regional trends in 1000 mb and 500 mb cyclone frequencies, *Geophys. Res. Lett.*, 26(14), 2053-2056.
69. Schweiger, A.J., R. Lindsay, J. Key, and J. Francis, 1999, Arctic clouds in multiyear satellite data sets, *Geophys. Res. Lett.*, 26(13), 1845-1848.
70. Key, J. and A.J. Schweiger, 1998, Tools for atmospheric radiative transfer: Streamer and FluxNet, *Computers and Geosciences*, 24(5), 443-451.
71. Serreze, M.C., J. Box, and J. Key, 1998, A new monthly climatology of global radiation for the Arctic and comparisons with NCEP/NCAR reanalysis and ISCCP-C2 fields, *J. Climate*, 11(2), 121-136.
72. Key, J., Y. Liu, and R. Stone, 1997, Development and evaluation of surface shortwave flux parameterizations for use in sea ice models, *Annals Glaciol.*, 25, 33-37.
73. Maslanik, J., C. Fowler, T. Scambos, J. Key, and W. Emery, 1997, AVHRR-based polar pathfinder products for modeling applications, *Annals Glaciol.*, 25, 388-392.
74. Meier, W., J. Maslanik, and J. Key, 1997, Multiparameter AVHRR-derived products for Arctic climate studies, *Earth Interactions*, 1(5), 1-29.
75. Key, J., A.J. Schweiger, and R.S. Stone, 1997, Expected uncertainty in satellite-derived estimates of the high-latitude surface radiation budget, *J. Geophys. Res.*, 102(C7), 15837-15847.
76. Key, J., J. Collins, C. Fowler, and R. Stone, 1997, High-latitude surface temperature estimates from thermal satellite data, *Remote Sensing Environ.*, 61, 302-309.
77. Schweiger, A. and J. Key, 1997, Estimating surface radiation fluxes in the Arctic from TOVS brightness temperatures, *International J. Remote Sensing*, 18(4), 955-970.
78. Key, J., R.S. Silcox, and R.S. Stone, 1996, Evaluation of surface radiative flux parameterizations for use in sea ice models, *J. Geophys. Research*, 101(C2), 3839-3849.
79. Maslanik, J. and J. Key, 1995, On treatments of fetch and stability sensitivity in large-area estimates of sensible heat flux over sea ice, *J. Geophys. Res.*, 100(C3), 4573-4584.
80. Khalsa, S.J.S. and J. Key, 1995, Atmospheric temperature variability in the Arctic as revealed in a TOVS data record, *Polar Record*, 31(177), 199-210.
81. Serreze, M.C., J.A. Maslanik, J. Key, R.F. Kokaly, and D.A. Robinson, 1995, Diagnosis of the record minimum arctic sea ice extent during 1990, *Geophys. Res. Letters*, 22(16), 2183-2186.
82. Schweiger, A.J. and J. Key, 1994, Arctic Ocean radiation fluxes and cloud forcing based on the ISCCP C2 cloud data set, 1983-90, *J. Appl. Meteorol.*, 33(8), 948-963.
83. Key, J., J.A. Maslanik, and E. Ellefsen, 1994, The effects of sensor field-of-view on the geometrical characteristics of sea ice leads and implications for large-area heat flux estimates, *Remote Sensing Environ.*, 48(3), 347-357.
84. Key, J., 1994, The area coverage of geophysical fields as a function of sensor field-of-view, *Remote Sensing Environ.*, 48(3), 339-346.
85. Barry, R.G. and J.R. Key, 1994, Observational studies of Arctic ocean ice-atmosphere interactions, *Polar Geography and Geology*, 8, 1-14.
86. DeAbreu, R.A., J. Key, J.A. Maslanik, M.C. Serreze, and E.F. LeDrew, 1994, Comparison of *in situ* and AVHRR-derived surface broadband albedo over Arctic sea ice, *Arctic*, 47(3), 288-297.
87. Key, J., J.A. Maslanik, T. Papakyriakou, M.C. Serreze, and A.J. Schweiger, 1994, On the validation of satellite-derived sea ice surface temperature, *Arctic*, 47(3), 280-287.
88. Schweiger, A.J., M.C. Serreze, and J. Key, 1993, Arctic sea ice albedo: a comparison of two satellite-derived data sets, *Geophys. Res. Letters*, 20(1), 41-44.

89. Stone, R. and J. Key, 1993, The detectability of winter sea ice leads in thermal satellite data under varying atmospheric conditions, *J. Geophys. Res.*, 98(C7), 12469-12482.
90. Key, J., R. Stone, J. Maslanik, and E. Ellefsen, 1993, The detectability of sea ice leads in satellite data as a function of atmospheric conditions and measurement scale, *Annals Glaciol.*, 17, 227-232.
91. Steffen, K., R. Bindschadler, C. Casassa, J. Comiso, D. Eppler, F. Fetterer, J. Hawkins, J. Key, D. Rothrock, R. Thomas, R. Weaver, and R. Welch, 1993, Snow and ice applications of AVHRR in polar regions: report of a workshop held in Boulder, Colorado, May 20, 1992. *Annals Glaciol.*, 17, 1-16.
92. Maslanik, J. and J. Key, 1993, Comparison and integration of ice-pack temperatures derived from AVHRR and passive microwave imagery, *Annals Glaciol.*, 17, 372-378.
93. Stone, R.S., J. Key, and E. Dutton, 1993, Properties and decay of stratospheric aerosols in the Arctic following the 1991 eruptions of Mount Pinatubo, *Geophys. Res. Letters*, 20(21), 2359-2362.
94. Key, J., 1993, Estimating the area fraction of geophysical fields from measurements along a transect, *IEEE Trans. Geosci. Remote Sensing*, 31(5), 1099-1102.
95. Key, J. and M. Haefliger, 1992, Arctic ice surface temperature retrieval from AVHRR thermal channels. *J. Geophys. Res.*, 97(D5), 5885-5893.
96. Schweiger, A.J. and J. Key, 1992, Comparison of ISCCP-C2 and Nimbus-7 satellite-derived cloud products with a surface-based cloud climatology in the arctic, *J. Climate*, 5(12), 1514-1527.
97. Key, J. and A.S. McLaren, 1991, Fractal nature of the sea ice draft profile, *Geophys. Res. Letters*, 18(8), 1437-1440.
98. Key, J. and S. Peckham, 1991, Probable errors in width distributions of sea ice leads measured along a transect, *J. Geophys. Res.*, 96(C10), 18417-18423.
99. Key, J., 1990, Cloud cover analysis with Arctic AVHRR, part II: classification with spectral and textural measures, *J. Geophys. Res.*, 95 (D6), 7661-7675.
100. Key, J. and R.G. Barry, 1989, Cloud cover analysis with Arctic AVHRR, part 1: cloud detection, *J. Geophys. Res.*, 94 (D15), 18521-18535.
101. Key, J.R., J.A. Maslanik, and R.G. Barry, 1989, Cloud classification from satellite data using a fuzzy sets algorithm: a polar example, *Int. J. Rem. Sens.*, 10 (12), 1823-1842.
102. Key, J., J.A. Maslanik, and A. Schweiger, 1989, Classification of merged AVHRR and SMMR Arctic data with neural networks, *Photogram. Eng. Rem. Sens.*, 55 (9), 1331-1338.
103. Key, J.R., and A.S. McLaren, 1989., Periodicities and keel spacing in the under-ice draft of the Canada Basin recorded by the USS QUEENFISH, August 1970, *Cold Regions Science and Technology*, 16, 1-10.
104. Maslanik, J.A., J. Key, and R.G. Barry, 1989, Merging AVHRR and SMMR data for remote sensing of ice and cloud in the polar region, *Int. J. Rem. Sens.*, 10 (10), 1691-1696.
105. Key, J.R., and A.S. McLaren, 1988, Spectral analysis of Canada Basin under-ice topography recorded by the USS QUEENFISH, August 1970, *Geophys. Res. Letters*, 15 (10), 1117-1120.
106. Key, J. and R.G. Crane, 1986, A comparison of synoptic classification schemes based on 'objective' procedures, *J. Climatology*, 6, 375-388.
107. Gordon, W.L. and J. R. Key, 1986, Artificial Intelligence in support of small business information needs, *J. Systems Mngmnt.*, 38 (1), 24-28.
108. Greenland, D., J. Burbank, J. Key, L. Klinger, J. Moorhouse, S. Oaks, D. Shankman, 1985, Bioclimates of the Colorado Front Range, *Mountain Res. and Devel.*, 5 (3), 251-262.
109. Tramoni, F., R.G. Barry, and J. Key, 1985, Lake ice cover data as a temperature index for monitoring climate perturbations, *Zeitschrift fur Gletscherkunde und Glazialogie*, 21, 43-49.
110. Bennet, J.O., P.S. Johnson, J.R. Key, D.C. Pattie, A.H. Taylor, 1984, Foreseeable effects of nuclear

detonations on a local environment: Boulder County, Co., *Environmental Conservation*, 11 (2), 155-165.

Other Peer-Reviewed Publications

111. Schöner, W., J. Key, C. Fierz, B. Goodison, Ø. Godøy, M. Citterio, Þ. Þorsteinsson, K. Luojus, Á. Snorrason, M. Ondráš, 2016, 2013, The Global Cryosphere Watch surface network in the Arctic and beyond, *Proceedings of the Arctic Observing Summit 2016*, Fairbanks, Alaska, 12-18 March 2016.
112. Vihma, T., T. Uttal, V. Walden, C. Cox, S. Starkweather, A. Makshtas, J. Key, 2016, Application of IASOA circumpolar observations in studies of atmospheric transports into and out of the Arctic for the Year of Polar Prediction, *Proceedings of the Arctic Observing Summit 2016*, Fairbanks, Alaska, 12-18 March 2016.
113. Key, J., B. Goodison, W. Schöner, M. Ondráš, and Ø. Godøy, 2013, A Global Cryosphere Watch, *Proceedings of the Arctic Observing Summit 2013*, Vancouver, Canada, April 30–May 2.
114. Starkweather, S., V. Walden, T. Uttal, J. Drummond, J. Key, J. Kay, T. Vihma, H. Skov, J. Burkhart, 2013, Advancing Arctic Atmospheric Science through Developing Collaborative, Use-Informed Targets for International Observing Development, *Proceedings of the Arctic Observing Summit 2013*, Vancouver, Canada, April 30–May 2.
115. Key, J.R., 2011, Observational needs and knowledge gaps for the cryosphere. In Snow, Water, Ice, and Permafrost in the Arctic (SWIPA): Climate Change and the Cryosphere, Arctic Monitoring and Assessment Programme, Oslo, Norway, 538 pp, 11-33 - 11-42.
116. Callaghan, T., M. Johansson, J.R. Key, and T. Prowse, 2011, Synthesis of feedbacks and interactions: From the cryosphere to the climate system – effects over various spatial and temporal scales. In Snow, Water, Ice, and Permafrost in the Arctic (SWIPA): Climate Change and the Cryosphere, Arctic Monitoring and Assessment Programme, Oslo, Norway, 538 pp, 11-3 – 11-14.
117. Meier, W., S. Gerland, M.A. Granskog, J.R. Key, 2011, Sea ice. In Snow, Water, Ice, and Permafrost in the Arctic (SWIPA): Climate Change and the Cryosphere, Arctic Monitoring and Assessment Programme, Oslo, Norway, 538 pp, 9-1 – 9-88.
118. Reist, J.D., T.V. Callaghan, D. Dahl-Jensen, G.K. Hovelsrud, M. Johansson, R. Kallenborn, J.R. Key, W.N. Meier, M.S. Olsen, J. Overland, T. Prowse, L.-O. Reiersen, M. Sharp, W.F. Vincent, J. Walsh, 2011, SWIPA synthesis: Implications of Findings. In Snow, Water, Ice, and Permafrost in the Arctic (SWIPA): Climate Change and the Cryosphere, Arctic Monitoring and Assessment Programme, Oslo, Norway, 538 pp, 12-1 – 12-15.
119. Calder, J., A. Proshutinsky, E. Carmack, I. Ashik, H. Loeng, J. Key, M. McCammon, H. Melling, D. Perovich, M. Johnson, and I. Rigor, 2009, Community White Paper: An integrated international approach to Arctic Ocean observations for Society (A legacy of the International Polar Year), *Proceeding of OceanObs '09*, Venice, Italy, September 21-25.
120. Key, J. and others, 2007, Integrated Global Observing Strategy Cryosphere Theme Report, WMO/TD-No. 1405, World Meteorological Organization, Geneva, 100 pp.

Book Chapters

1. J. Key, X. Wang, and Y. Liu, 2013, Monitoring Change in the Arctic. In Satellite-based Applications on Climate Change, J. Qu, A. Powell, M.V.K. Sivakumar (eds.), Springer, 371 pp., ISBN 978-94-007-5872-8.
2. Key, J., 2012, Arctic Climate Interactions, in STAR Looks at the Earth: Satellite Measurements of the Atmosphere, Oceans and Land, A. Powell, G. Ohring, M. Kalb, and M. Goldberg (ed.), 162 pp.
3. Goodison, B. and J. Key, 2011, “Global Cryosphere Watch and the Cryosphere Observing System”, in Understanding Earth’s Polar Challenges: International Polar Year 2007-2008, Krupnik, I., I. Allison, R. Bell, P. Cutler, D. Hik, J. Lopez-Martinez, V. Rachold, E. Sarukhanian, and C.

Summerhayes (eds), University of the Arctic publications series (4). University of the Arctic and ICSU/WMO Joint Committee for International Polar Year 2007–2008, Rovaniemi, Finland, 700 pp., ISBN 978-1-896445-55-7.

4. Key, J., 1994. Chapter Eight: Classification of Arctic Cloud and Sea Ice Features in Multi-spectral Satellite Data. In Neural Nets: Applications in Geography, B. Hewitson and R. Crane (eds.), Boston: Kluwer, 164 pp.
5. Steffen, K., J. Key, J. Comiso, K. StGermain, P. Gloersen, and I. Rubinstein, 1992. Chapter 10: The estimation of geophysical parameters using passive microwave algorithms, (J. Key: Knowledge-based systems and neural network approaches). In Microwave Remote Sensing of Sea Ice, F. Carsey (ed.), Geophysical Monograph 68, American Geophysical Union, 462 pp.

Technical and Data Reports (some peer-reviewed)

1. Wang, X. and J. Key, 2015, ABI and VIIRS ice thickness and age algorithm theoretical basis document, NOAA/NESDIS Center for Satellite Applications and Research, 64 pp.
2. Liu, Y. and J. Key, 2015, ABI and VIIRS ice surface temperature, ice concentration, and ice cover algorithm theoretical basis document, NOAA/NESDIS Center for Satellite Applications and Research, 43 pp.
3. Lee, Y.-K., C. Kongoli, and J. Key, 2015, Algorithm Theoretical Basis Document for AMSR2 snow product, NOAA/NESDIS Center for Satellite Applications and Research, 25 pp.
4. Key, J. and X. Wang, 2015, Climate Algorithm Theoretical Basis Document, Extended AVHRR Polar Pathfinder (APP-x), NOAA/NESDIS Center for Satellite Applications and Research and the National Climatic Data Center, CDRP-ATBD-0573, Revision 1.0, September 2015, 85 pp.
5. Liu, Y., J. Key, and A. Heidinger, 2015, Climate Algorithm Theoretical Basis Document, AVHRR Polar Pathfinder (APP), NOAA/NESDIS Center for Satellite Applications and Research and the National Climatic Data Center, CDRP-ATBD-0572, Revision 1.0, September 2015, 37 pp.
6. Daniels, J., W. Bresky, J. Key, S. Wanzong, and A. Bailey, 2014, Algorithm Theoretical Basis Document for VIIRS Polar Winds, NOAA/NESDIS Center for Satellite Applications and Research, 68 pp.
7. Wang, X. and J. Key, 2011, Algorithm Theoretical Basis Document for ABI ice thickness and age, NOAA/NESDIS Center for Satellite Applications and Research, 62 pp.
8. Liu, Y. and J. Key, 2011, Algorithm Theoretical Basis Document for ABI ice cover and concentration, NOAA/NESDIS Center for Satellite Applications and Research, 25 pp.
9. Liu, Y., J. Key, and W. Straka III, 2011, Algorithm Theoretical Basis Document for ABI ice motion, NOAA/NESDIS Center for Satellite Applications and Research, 24 pp.
10. Bequignon, J., J. Caughey, W. Cramer, J.-L. Fellous, C. Heip, C. Justice, J. Key, T. Koike, J.-P. Lacaux, M. Lafaye, J. Lafeuille, P.-P. Mathieu, T. Ranchin, B. Scholes, and M. Schroedter-Homscheidt, 2010, GEO and Science: A report prepared by the European Space Agency in the framework of the GEO Science and Technology Committee, J.-L. Fellous and J. Bequignon, eds., 50 pp.
11. Key, J., 1994-2003. Streamer User's Guide. Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin, Madison, WI 53706, 72 pp.
12. Key, J., 1995-2003. The Cloud and Surface Parameter Retrieval (CASPR) System User's Guide. Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin, Madison, WI 53706, 59 pp.
13. Key, J., E. Amano, J. Collins, 1996-1999. FluxNet User's Guide. Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin, Madison, WI 53706, 22 pp.
14. Serreze, M.C., J.A. Maslanik, and J. Key, 1997, Atmospheric and sea ice characteristics of the Arctic

Ocean and the SHEBA field region in the Beaufort Sea, in NSIDC Special Report 4, University of Colorado, Boulder, 219 pp.

15. Key, J., J.A. Maslanik, and A.J. Schweiger, 1996. The surface energy balance. in E.C. Weatherhead (ed.), Chapter 10, *Report of the Arctic Monitoring and Assessment Program (AMAP)*.
16. Serreze, M., J.A. Maslanik, and J. Key, 1992, Addendum, in Reddan, S.P., D.G. Barber, and E.F. LeDrew, 1992, in the SIMMS-92 Data Report. Earth Observations Laboratory Technical Report ISTS-EOL-SIMMS-TR-92-003, 226 pp.
17. Serreze, M.C., J.A. Maslanik, and J.R. Key, 1993, Section 6.5: Cloud data, albedo transects, and multi-year ice floe analysis, in Misurak, K.M., D.G. Barber and E.F. LeDrew, SIMMS'93 Data Report, Earth Observations Laboratory Technical Report, ists-eol-sims-tr-93-007.
18. Key, J., 1992. Artificial intelligence applications of Arctic passive microwave data. *Glaciological Data*, GD-24, World Data Center A for Glaciology (Snow and Ice), 11-14.

Newsletter and Other Articles

1. Manninen, T., A. Riihelä, A. Heidinger, C. Schaaf, A. Lattanzio, J. Key, 2018, Intercalibration without simultaneous nadir observations, Global Space-based Inter-Calibration System (GSICS) Quarterly Newsletter, 11(4), doi: 10.7289/V5/QNGSICS-11-4-2018.
2. Key, J., Y. Liu, R. Stone, C. Cox, and V. Walden, 2013, Cloud cover and surface radiation budget [in Arctic Report Card 2013], <http://www.arctic.noaa.gov/reportcard>. (Peer-reviewed)
3. Santek, D. and J. Key, VIIRS – A Better Look at Polar Winds, *Through the Atmosphere*, the Space Science and Engineering Center Newsletter, Summer 2012.
4. Overland, J., J. Key, B.-M. Kim, S.-J. Kim, Y. Liu, J. Walsh, M. Wang, U. Bhatt, and R. Thoman, 2012, Air temperature, atmospheric circulation, and clouds [in Arctic Report Card 2012], <http://www.arctic.noaa.gov/reportcard>. (Peer-reviewed)
5. Overland, J., U. Bhatt, J. Key, Y. Liu, J. Walsh, and M. Wang, 2011, Air temperature, atmospheric circulation, and clouds [in Arctic Report Card 2011], <http://www.arctic.noaa.gov/reportcard>. (Peer-reviewed)
6. Key, J., The IGOS The Fourth Meeting of the WCRP Observations and Assimilation Panel, *Ice and Climate News*, the World Climate Research Programme Climate and Cryosphere Project Newsletter, No. 14, June 2010.
7. Jezek, K., M. Drinkwater, and the WMO Space Task Group for IPY, 2010, Satellite observations from the International Polar Year, EOS, Transactions of the American Geophysical Union, 91(14), 125-126.
8. Avila, L. and J. Key, Unraveling the Mysteries of the Arctic: A New Look at Changing Climate, *Through the Atmosphere*, the Space Science and Engineering Center Newsletter, Winter 2009.
9. Key, J. and V. Ryabinin, The IGOS Partnership Cryosphere Theme: Where Are We Now?, *Ice and Climate News*, the World Climate Research Programme Climate and Cryosphere Project Newsletter, No. 12, June 2009.
10. Key, J. and V. Ryabinin, The IGOS Partnership Cryosphere Theme: A Framework for Coordinating Cryospheric Observations, *Ice and Climate News*, the World Climate Research Programme Climate and Cryosphere Project Newsletter, March 2006.

Conference Proceedings Papers

1. Key, J., D. Santek, and R. Dworak, 2016, Polar winds from shortwave infrared cloud tracking, *Proceedings of the Thirteenth International Winds Workshop*, Monterey, California USA, June 27 – July 1.
2. Qi, H., J. Daniels, J. Key, P. Chang, N. Esposito, A. Bailey, J. Augenbaum, 2016, Operational wind

- products at NOAA/NESDIS, *Proceedings of the Thirteenth International Winds Workshop*, Monterey, California USA, June 27 – July 1.
3. Manninen, T., A. Riihelä, C. Schaaf, J. Key, and A. Lattanzio, 2016, Intercalibration of two polar satellite instruments without simultaneous nadir observations, Living Planet Symposium 2016, Prague, Czech Republic, 9-13 May 2016.
 4. Key, J., J. Daniels, S. Wanzong, A. Bailey, H. Qi, W. Bresky, D. Santek, C. Velden, and W. Wolf, 2014, VIIRS Polar winds status and use, *Proceedings of the Twelfth International Winds Workshop*, Copenhagen, Denmark, June 16-20.
 5. Román, M.O., I. Csiszar, C. Justice, J. Key, J. Privette, S. Devadiga, C. Davidson, R. Wolfe, and E. Masuoka, 2012, Status of the Suomi NPP visible/infrared imager radiometer suite's (VIIRS) land environmental data records (EDRs) after early evaluation of on-orbit performance, IGARSS 2012, Munich, Germany, July.
 6. Key, J., R. Dworak, D. Santek, W. Bresky, S. Wanzong, J. Daniels, A. Bailey, C. Velden, H. Qi, P. Keehn, and W. Wolf, 2012, Polar winds from VIIRS, *Proceedings of the Eleventh International Winds Workshop*, Auckland, New Zealand, February 20-24.
 7. Hoover, B., D. Santek, M. Lazzara, R. Dworak, C. Velden, J. Key, and N. Bearson, 2012, High latitude satellite-derived winds from combined geostationary and polar orbiting satellite data, *Proceedings of the Eleventh International Winds Workshop*, Auckland, New Zealand, February 20-24.
 8. Csiszar, I., C. Barnet, D. Hillger, A. Ignatov, A. Heidinger, S. Kondragunta, I. Laszlo, J. Key, R. Ferraro, M. Wang and L. Flynn, 2012, Overview of NPP/JPSS algorithm development and data products, American Meteorological Society (AMS) 18th Conference on Satellite Meteorology, Oceanography, and Climatology, New Orleans, January 22-26.
 9. Román, M.O., C. Justice, I. Csiszar, J. Key, S. Devadiga, C. Davidson, R. Wolfe, and J. Privette, 2011, Pre-Launch Evaluation of the NPP Visible/Infrared Imager Radiometer Suite's (VIIRS) Land and Cryosphere Environmental Data Records (EDRs) to meet NASA's Science Requirements, IGARSS 2011, Vancouver, Canada, July, paper #3297.
 10. Garand, L., N. Wagneur, R. Sarrazin, D. Santek, and J. Key, 2010, Polar winds from highly elliptical satellites: A new perspective, *Proceedings of the Tenth International Winds Workshop*, Tokyo, Japan, February 22-26.
 11. Key, J., D. Santek, R. Dworak, C. Velden, J. Daniels, and A. Bailey, 2010, The polar wind product suite, *Proceedings of the Tenth International Winds Workshop*, Tokyo, Japan, February 22-26.
 12. Santek, D., J. Key, R. Dworak, M. Rienecker, R. Gelaro, 2010, A 27-year record of satellite-derived polar winds for retrospective analyses, *Proceedings of the Tenth International Winds Workshop*, Tokyo, Japan, February 22-26.
 13. Privette, J.L., C. Justice, P. Romanov, E. Vermote, I. Csiszar, J. Key, Y. Yu, M. Friedl, C. Schaaf, B. Hauss, J. Ip, R. Moahoney, A. Sei, A. Huete, A. Lyapustin, J. Maslanik, J. Nightingale, and M. Roman, 2010, Validating VIIRS land and cryosphere products from the NPOESS Preparatory Project (NPP), Proceedings of the 90th American Meteorological Society Annual Meeting, Atlanta, GA, 17-21 January 2010.
 14. Lazzara, M., R. Dworak, D. Santek, C. Velden, and J. Key, 2009, Antarctic atmospheric motion vectors: Application of Antarctic composite satellite imagery, *Proceedings of the 4th Antarctic Meteorological Observation, Modeling, and Forecasting Workshop*, North Charleston, South Carolina, July 14-16.
 15. Key, J., D. Santek, C. Velden, J. Daniels, and R. Dworak, 2008, The polar wind product suite, *Proceedings of the Ninth International Winds Workshop*, Annapolis, Maryland, April 14-18.
 16. Dworak, R. and J. Key, 2008, Assessing the quality of historical AVHRR polar wind height assignment, *Proceedings of the Ninth International Winds Workshop*, Annapolis, Maryland, April 14-

- 18.
17. Dworak, R., J. Key, D. Santek, and C. Velden, 2007, A 20-year record of satellite-derived polar winds for climate studies, 15th American Meteorological Society (AMS) Satellite Meteorology and Oceanography Conference, Amsterdam, The Netherlands, September 24-28.
18. Straka III, W., J. Daniels, M. Forsythe, D. Santek, J. Key, and C. Velden, 2007, Assessing the quality of MODIS and AVHRR polar winds, 15th American Meteorological Society (AMS) Satellite Meteorology and Oceanography Conference, Amsterdam, The Netherlands, September 24-28.
19. Key, J., W. Straka III, D. Santek, C. Velden, and R. Pauley, 2006, Satellite-derived winds at direct broadcast sites in the polar regions, *Proceedings of the Eighth International Winds Workshop*, Beijing, China, 24-28 April 2006.
20. Dworak, R. and J. Key, 2006, The AVHRR Polar Winds Reprocessing Project, *Proceedings of the Eighth International Winds Workshop*, Beijing, China, 24-28 April 2006.
21. Key, J. and V. Ryabinin, 2006, The Integrated Global Observing Strategy Cryosphere Theme, *Proceedings of the 1st Asia CliC Symposium*, Yokohama, Japan, 20-22 April 2006.
22. Uttal, T., S. Frisch, X. Wang, J. Key, A. Schweiger, S. Sun-Mack, and P. Minnis, 2005, Comparison of monthly mean cloud fraction and cloud optical depth determined from surface cloud radar, TOVS, AVHRR, and MODIS over Barrow, Alaska, *Proceedings of the 8th Conference on Polar Meteorology and Oceanography*, January 9-13, San Diego.
23. Uttal, T., S. Frisch, X. Wang, and J. Key, 2004, Long-term observations of cloudiness, radiation, and aerosols with permanent atmospheric observatories, *Proceedings of the ACIA International Scientific Symposium "Climate Change in the Arctic"*, Reykjavik, Iceland, November 9-12.
24. Wang, X. and J. Key, 2004, Arctic climate characteristics and recent trends from space, *Proceedings of the SPIE International Asia-Pacific Symposium*, Honolulu, Hawaii, November 8-12.
25. Wang, X. and J. Key, 2004, Satellite-derived Arctic climate characteristics and recent trends, *Proceedings of the 13th Conference on Satellite Meteorology and Oceanography*, Norfolk, Virginia, September 20-24.
26. Liu, Y. and J. Key, 2004, Spatial and temporal characteristics of satellite-derived clear-sky atmospheric temperature inversions in the polar regions, *Proceedings of the 13th Conference on Satellite Meteorology and Oceanography*, Norfolk, Virginia, September 20-24.
27. Key, J., D. Santek, and C. Velden, 2004, Polar winds from MODIS: Project status, *Proceedings of the 7th International Winds Workshop*, Helsinki, Finland, June 14-17.
28. Francis, J. E. Hunter, C.-Z. Zou, and J. Key, 2004, Arctic tropospheric winds from satellite sounders, *Proceedings of the 7th International Winds Workshop*, Helsinki, Finland, June 14-17.
29. Santek, D., C. Velden, J. Key, J. Daniels, and W. Bresky, 2004, Polar winds from MODIS: Algorithm and processing improvements, *Proceedings of the 7th International Winds Workshop*, Helsinki, Finland, June 14-17.
30. Liu, Y. and J. Key, 2003, Study of clear sky, low-level atmospheric temperature inversions using satellite data, *Proceedings of the Seventh Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Hyannis, MA, May 12-16.
31. Wang, X. and J. Key, 2003, Recent Arctic climate trends observed from space and the cloud-radiation feedback, *Proceedings of the Seventh Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Hyannis, MA, May 12-16.
32. Santek, D., J. Key, and C. Velden, 2003, Real-time Derivation of Cloud Drift and Water Vapor Winds in the Polar Regions from MODIS Data, *Proceedings of the 12th Conf. on Satellite Meteorology and Oceanography*, American Meteorological Society, Long Beach, CA, 9-13 February 2003.
33. Wang, X., J. Key, and M. Pavolonis, 2002, Arctic climate characteristics and recent trends revealed

- by the AVHRR Polar Pathfinder data set, *Proceedings of the SPIE Third International Asia-Environmental Remote Sensing Symposium 2002*, Hangzhou, China, October 23-27.
34. Wang, X. and J. Key, 2002, The Arctic climate and its change revealed by surface and cloud properties and radiation fluxes based on the AVHRR Polar Pathfinder data set, *Proceedings of the SPIE 47th Annual Meeting*, Seattle, WA, 7-11 July 2002.
 35. Bormann, N., J-N. Thépaut, J. Key, D. Santek, and C. Velden, 2002, Impact of polar cloud track winds from MODIS on ECMWF analyses and forecasts, *Proceedings of the 15th Conf. on Numerical Weather Prediction*, American Meteorological Society, San Antonio, TX, 12-16 August, 2002.
 36. Liu, Y., J. Key, and S. Ackerman, 2002, Detection and analysis of atmospheric temperature inversions with MODIS, *IGARSS'02 Proceedings*, Toronto, 24-28 June 2002.
 37. Pavolonis, M. and J. Key, 2002, Antarctic cloud radiative forcing at the surface estimated from the ISCCP D2 and AVHRR Polar Pathfinder data sets, 1985-1993, *IGARSS'02 Proceedings*, Toronto, 24-28 June 2002.
 38. Wang, X. and J. Key, 2002, Arctic climate characteristics and recent trends based on the AVHRR Polar Pathfinder data set, *IGARSS'02 Proceedings*, Toronto, 24-28 June 2002.
 39. Pavolonis, M. and J. Key, 2001, The influence of Antarctic cloud and surface properties on cloud radiative forcing at the surface, *Proceedings of the 11th Conference on Satellite Meteorology and Oceanography*, American Meteorological Society, Madison, Wisconsin, 15-18 October 2001, 172-175.
 40. Key, J., D. Santek, C.S. Velden, and W.P. Menzel, 2001, Cloud-drift and water vapor winds in the polar regions from MODIS, *Proceedings of the 11th Conference on Satellite Meteorology and Oceanography*, American Meteorological Society, Madison, Wisconsin, 15-18 October 2001, 320-323.
 41. Riggs, G., D. Hall, and J. Key, 2001, Initial evaluation of MODIS sea ice products, *Proceedings of the 58th Annual Meeting of the Eastern Snow Conference*, Ottawa, Ontario, May 14-17, 2001.
 42. Key, J., C. Velden, and D. Santek, 2001, High-latitude cloud-drift and water vapor winds from MODIS, *Proceedings of the Sixth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, San Diego, 14-18 May 2001, 351-354.
 43. Wang, X. and J. Key, 2001, Aggregate-area Radiative Fluxes, *Proceedings of the Sixth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, San Diego, 14-18 May 2001, 293-296.
 44. Clothiaux, E.E., T.P. Ackerman, S.A. Ackerman, P. Minnis, M.A. Miller, J. Verlinde, T.A. Berendes, L. Di Girolamo, J. Key, D.D. Turner, R.A. Frey, C.M. Bachmann, and A. Nolin, 1999, Cloud detection: One possible future in the ARM and EOS timeframes, *Proceeding of the 10th Conference on Atmospheric Radiation*, American Meteorology Society, Madison, Wisconsin, 28 June - 2 July.
 45. Key, J. and A.M. Wong, 1999, Estimating the cloudy sky surface temperature of sea ice with optical satellite data, *IGARSS'99 Proceedings*, Hamburg, Germany, 28 June - 2 July.
 46. Key, J.R. and A.C.K. Chan, 1999, Global and regional trends in 1000 mb and 500 mb wave cyclone frequencies, 1958-1997, *Proceedings of the Tenth Symposium on Global Change Studies*, American Meteorological Society, Dallas, TX, January 10-15, 388-391.
 47. Key, J., D. Slayback, C. Xu, and A. Schweiger, 1999, New climatologies of polar clouds and radiation based on the ISCCP "D" products, *Proceedings of the Fifth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Dallas, TX, January 10-15, 227-232.
 48. Wong, A.M., J.R. Key, and R.S. Stone, 1999, The effect of clouds on surface temperature and implications for remote sensing at high latitudes, *Proceedings of the Fifth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Dallas, TX, January 10-15, 294-299.

49. Key, J. and M. Friedl, 1997, A comparison of cloud optical depths derived from surface irradiance and satellite radiance data at Barrow, Alaska, *Proceedings of the International Radiation Symposium*, Fairbanks, Alaska, August 1996, 33-36.
50. Box, J., J. Heinrichs, and J. Key, 1997, An arctic surface radiation budget climatology from in situ and satellite-derived data, *Proceedings of the International Radiation Symposium*, Fairbanks, Alaska, August 1996, 29-32.
51. Key, J., R. Stone, and A. Schweiger, 1996, Expected errors in satellite-derived estimates of the high-latitude surface radiation budget, *IGARSS96 Digest*, Lincoln, Nebraska, May, Vol. 1, 636-638.
52. Meier, W., J. Maslanik, J. Key, and C. Fowler, 1996, Energy budget parameters from AVHRR data: A time series for the Beaufort Sea, *IGARSS96 Digest*, Lincoln, Nebraska, May, Vol. 1, 73-75.
53. Key, J. and R.S. Stone, 1995, Accuracies of satellite-derived cloud and surface parameters in the polar regions and their effect on radiative flux estimates, *Proceedings of the Fourth Conference on Polar Meteorology and Oceanography*, Dallas, January 1995, 32-37.
54. Key, J. and M.C. Serreze, 1995, Relationships between the Arctic surface radiation budget and atmospheric circulation, *Proceedings of the Fourth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Dallas, January 1995, 38-42.
55. Maslanik, J.A., J. Key, and A.S. Schweiger, 1995, Cloud amount and radiation: effects of climatology and method on Arctic sea ice simulations, *Proceedings of the Fourth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Dallas, January 1995, 168-173.
56. Khalsa, S.J.S. and J. Key, 1995, A climatology of surface, tropospheric and stratospheric temperatures in the Arctic from a new TOVS data set, *Proceedings of the Fourth Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Dallas, January 1995, 13-18.
57. Key, J., 1995, Retrieval of cloud optical depth and particle effective radius at high latitudes using visible and thermal satellite data, *Proceedings of the European Symposium on Satellite Remote Sensing II*, Paris, September, SPIE Volume 2578, 318-325.
58. Schweiger, A., J. Key, and J. Francis, 1995, RADNET: A neural network-based estimation of the surface radiation budget in the Arctic from TOVS HIRS and MSU brightness temperatures, *Proceedings of the Eighth International TOVS Conference*, Queenstown, New Zealand, April, 1995, 430-440.
59. Stone, R.S., E. Dutton, and J. Key, 1994, Properties and decay of Pinatubo aerosols in the Arctic compared with tropical observations, *Proceedings of the Eighth AMS Conference on Atmospheric Radiation*, 23-28 January, 432-434.
60. Khalsa, S.J.S., J. Key, and J.J. Bates, 1994, Spatial and temporal variability in Arctic temperatures as revealed in the upper air and TOVS data record, *Proceedings of the Sixth AMS Conference on Climate Variations*, 23-28 January, 373-376.
61. Key, J., R. Stone, and J. Maslanik, 1994, Lead retrieval using visible and thermal AVHRR imagery: testing theoretical atmospheric and geometric effects with LEADDEX data, *IGARSS'94 Proceedings*, Vol. 2, 8-12 August, Pasadena, 1012-1014.
62. Key, J., R. Stone, and M. Rehder, 1994, Estimating high latitude radiative fluxes from satellite data: problems and successes, *IGARSS'94 Proceedings*, Vol. 2, 8-12 August, Pasadena, 1018-1020.
63. Serreze, M.C., A.J. Schweiger, and J. Key, 1993, Comparison of two satellite-derived albedo data sets for the Arctic Ocean, *Snow Watch 92*, Glaciological Data Report GD-25, 172-187.
64. Steffen, K., J. Heinrichs, J. Maslanik, and J. Key, 1993, Sea ice feature and type identification in merged ERS-1 SAR and Landsat Thematic Mapper Imagery, *Proceedings of the First ERS-1 Symposium*, ESA SP-359, Cannes, France, 4-6 November 1992, 361-365.

65. Key, J., S.J.S. Khalsa, and J. Bates, 1993, Assessing the completeness of the TIGR data base for Arctic retrievals, *Seventh International TOVS Study Conference (ITSC-VII)*, Igls, Austria, 10-16 February, 200-208.
66. Winebrenner, D., J. Key, A. Schweiger, E. Nelson, R. Colony, D. Barber, and E. LeDrew, 1993, On links between microwave and shortwave signatures of multiyear sea ice during the onset of melt, *Topical Symposium on Combined Optical-Microwave Earth and Atmosphere Sensing*, 22-25 March, Albuquerque, NM, 74-77.
67. Schweiger, A.J. and J. Key, 1992, Arctic radiative fluxes and cloud forcing estimated from the ISCCP C2 cloud data set, *Proceedings of the Third Conference on Polar Meteorology and Oceanography*, American Meteorological Society, Portland, Oregon, 29 Sept - 2 Oct 1992, 13-16.
68. Maslanik, J.A. and J. Key, 1992, Assimilation of a knowledge base and physical models to reduce errors in passive-microwave classifications of sea ice, *IGARSS'92*, Houston, Texas, May 26-29, Vol. 1, 579-581.
69. Khalsa, S.J.S., J.R. Key, J.D. Kahl, M.C. Serreze, R.C. Schnell, and J.J. Bates, 1991, A TOVS temperature sounding record for the Arctic, *Fifth Conference on Climate Variations*, American Meteorological Society, Denver, Colorado, October 1991, 366-367.
70. Key, J. and A.S. McLaren, 1990, Periodicities and keel spacings in the under-ice draft distribution, In: Ackley, S.F. and W.F. Weeks (eds.), *Sea Ice Properties and Processes*, CRREL Monograph 90-1, 156-160.
71. Key, J., A.J. Schweiger, and J.A. Maslanik, 1990, Mapping sea ice leads with a coupled numeric/symbolic system, *ACSM/ASPRS Proceedings*, Vol. 4, Denver, Colorado, March 18, 228-237.
72. Maslanik, J., J. Key, and A.J. Schweiger, 1990., Neural network identification of sea-ice seasons in passive microwave data, *IGARSS'90 Proceedings*, Vol. 2, 1281-1284, Washington D.C., May.
73. Key, J., J.A. Maslanik, and A.J. Schweiger, 1990, Neural network vs. maximum likelihood classifications of spectral and textural features in visible, thermal, and passive microwave data, *IGARSS'90 Proceedings*, Vol. 2, 1277-1280, Washington, D.C., May.
74. Key, J. and A.S. McLaren, 1989, Statistical descriptions of keel-related features in the under-ice draft distribution, *IGARSS'89 Proceedings*, Vol. 4, 2346-2349, July 10-14.
75. Key, J. and R.G. Barry, 1989, Adaptation of the ISCCP cloud detection algorithm to combined AVHRR and SMMR Arctic data, *IGARSS'89 Proceedings*, Vol. 1, 188-191, July 10-14.
76. Gordon, W. and J. Key, 1986, Expert systems in support of small business information needs, *SBIDA Proceedings*, Small Business Institute Directors' Association, Washington, D.C., February, 72-78.
77. Key, J. and W. Gordon, 1986, Artificial intelligence in support of small business information needs, *DSI Proceedings*, 1986 Midwest Decision Sciences Institute, Lincoln, Nebraska, April.
78. Gordon, W. and J. Key, 1986, The current impact of artificial intelligence on small business information systems, *DSI Proceedings*, 1986 National Decision Sciences Institute, Honolulu, Hawaii, November.

Workshop Reports

(Note: This list is incomplete after 2007)

1. Key, J., T. Prowse, and A. Prick, 2007, Report of the Hydrology/Cryosphere Breakout Group, in 1st IPY Workshop on Sustaining Arctic Observing Networks Workshop Report.
2. Goldberg, M., A. Heidinger, R. Ferraro, F. Weng, C.-Z. Zou, L. Flynn, H.-T. Lee, F. Kogan, and J. Key, 2007, Report on climate product development at NOAA/NESDIS/STAR, in Report of the 35th Meeting of the Coordination Group for Meteorological Satellites (CGMS), EUMETSAT.

3. Key, J., D. Santek, C. Velden, J. Daniels, L.-P. Riishojgaard, R. Dworak, W. Straka, and I. Genkova, 2007, Wind products from polar orbiters, in Report of the 35th Meeting of the Coordination Group for Meteorological Satellites (CGMS), EUMETSAT.
4. Daniels, J., W. Bresky, C. Velden, J. Key, D. Santek, and W.P. Menzel, 2005, 2004/2005 report on NOAA/NESDIS satellite-derived winds, in Report of the 33th Meeting of the Coordination Group for Meteorological Satellites (CGMS), EUMETSAT.
5. Key, J., D. Santek, C. Velden, S. Levinson, N. Bormann, L. von Bremen, J.-N. Thepaut, L.-P. Riishojgaard, Y. Zhu, and W.P. Menzel, 2003, Cloud-drift and water vapor winds in the polar regions from MODIS, in Report of the 32th Meeting of the Coordination Group for Meteorological Satellites (CGMS), EUMETSAT.
6. Daniels, J., C. Velden, W.P. Menzel, and J. Key, 2002, Report on NOAA/NESDIS Satellite-Derived Winds, in Report of the 30th Meeting of the Coordination Group for Meteorological Satellites (CGMS), EUMETSAT.
7. Santek, D., J. Key, C.S. Velden, N. Bormann, J.-N. Thepaut, L.P. Riishojgaard, Y. Zhu, and W.P. Menzel, 2002, Cloud-drift and Water Vapor Winds in the Polar Regions from MODIS, in Report of the 30th Meeting of the Coordination Group for Meteorological Satellites (CGMS), EUMETSAT.
8. Key, J., 2002, Cloud and radiation data sets, in SEARCH Workshop on Large-Scale Atmosphere/Cryosphere Observations, J. Overland (ed.), in Contribution 2452 from NOAA/Pacific Marine Environmental Laboratory, U.S. Department of Commerce, 82 pp.
9. Key, J., 1995. Estimating cloud and surface properties at high latitude using AVHRR data. in *First MODIS Snow and Ice Workshop Proceedings*, September 1995, Greenbelt, MD, 73-77.
10. Key, J. and M. Haefliger, 1992. Retrieval of ice surface temperature, outgoing longwave radiation, and cloud cover from AVHRR data. In Report on *Polar Radiation Fluxes and Sea Ice Modeling*, World Meteorological Organization, WCRP-62, WMO/TD-No. 442, Geneva, Switzerland, C22-C28.
11. Key, J., 1992. Satellite observations of clouds and the radiation balance. In *Report on the ARCSS-OAI Modeling Workshop*, Monterey, California, August 1992, 37-39.
12. Key, J., A.J. Schweiger, and J.A. Maslanik, 1992. Arctic radiation forcing fields for dynamic-thermodynamic sea ice models. In *Report of the Sea Ice Thickness Workshop*, NASA Goddard Space Flight Center, 19-21 November 1991, C9-C13.

Other Conference Abstracts, Posters, and Presentations

(Note: This list is incomplete after 2008)

- Y. Liu, J. Key, and X.J. Wang, 2013, Impacts of Arctic Sea Ice Changes on Cloud, Temperature, and Precipitation from Satellite Observations, 35th International Symposium on Remote Sensing of Environment, Beijing, China, April 22-26.
- Wang, X.J., J. Key, and Y.H. Liu, 2013, Remote Sensing of Polar Climate and Its Recent Changes from Satellites, 35th International Symposium on Remote Sensing of Environment, Beijing, China, April 22-26.
- Wang, X.J., J. Key, and Y.H. Liu, 2012, Preliminary Analysis of Recent Arctic Climate Change Based on the Extended AVHRR Polar Pathfinder (APP-x) Dataset from 1982, American Geophysical Union Annual Meeting, San Francisco, December.
- Key, J. and B. Goodison, 2012, A Global Cryosphere Watch, IPY2012: From Knowledge to Action, Montreal, Quebec, April 23-27.
- Wang, X. J. Key, and Y. Liu, 2012, Arctic Climate Change: Trends in Surface, Cloud, Radiation, and Sea Ice Properties from Satellite Data, IPY2012: From Knowledge to Action, Montreal, Quebec, April 23-27.
- Olsen, M.S., M. Johansson, D. Dahl-Jensen, J. Key, W. Meier, T. Prowse, L-O. Reiersen, J. Reist, M.

- Sharp, J. Walsh, et al., 2012, Snow, Water, Ice and Permafrost in the Arctic (SWIPA), Synthesis, IPY2012: From Knowledge to Action, Montreal, Quebec, April 23-27.
- Liu, Y., J. Key, and X. Wang, 2012, Observed Arctic Cloud Cover Response to Sea Ice Changes, IPY2012: From Knowledge to Action, Montreal, Quebec, April 23-27.
- Wang, X., J. Key, Y. Liu, and W. Straka, 2008, Estimating sea and lake ice characteristics with GOES-R ABI, Amer. Meteorol. Soc. Annual Meeting, New Orleans, January 21-24.
- Y. Liu, J. Key, X. Wang, T. Schmit, and J. Li, 2008, On the use of geostationary for remote sensing in the high latitudes, Amer. Meteorol. Soc. Annual Meeting, New Orleans, January 21-24.
- Zou, C.-Z., W. Zheng, M. Gao, and J. Key, 2007, Three-dimensional polar winds retrieved from AIRS and MODIS, 9th Conference on Polar Meteorology and Oceanography, St. John's, Newfoundland, Canada, 05/28/07-06/01/07.
- Key, J. and R. Dworak, 2007, A 23-year record of satellite-derived polar winds for climate studies, 15th American Meteorological Society (AMS) Satellite Meteorology and Oceanography Conference, Amsterdam, The Netherlands, September 24-28.
- Santek, D., J. Key, and C. Velden, 2007, Feature-tracked winds from polar satellites: Status and outlook, 15th American Meteorological Society (AMS) Satellite Meteorology and Oceanography Conference, Amsterdam, The Netherlands, September 24-28.
- Dworak, R., J. Key, D. Santek, and C. Velden, 2007, A 23-Year Record of Satellite-Derived Polar Winds and Its Importance for Climate Reanalysis, 87th Annual Meeting of the American Meteorological Society, San Antonio, TX, January 15-18.
- Key, J., D. Santek, C. Velden, J. Daniels, W. Bresky, and W.P. Menzel, 2005, Polar Winds from Satellite Imagers for Numerical Weather Prediction and Climate Applications, 8th Conference on Polar Meteorology and Oceanography, January 9-13, San Diego.
- Key, J., 2004, Atmospheric motion vector height assignments in the polar regions: Issues and recommendations. 7th International Winds Workshop, Helsinki, Finland, June 14-18.
- Key, J., X. Wang, A. Wong, J. Maslanik, C. Fowler, 2000. Cloud and surface properties from space during SHEBA: validation and analysis. SHEBA Investigators Meeting, Boulder, CO, April 17-20.
- Gultepe, I., G.A. Isaac, J.R. Key, K.B. Strawbridge, t. Uttal, and J. Intrieri, 2000. Dynamical and microphysical characteristics of Arctic clouds obtained from observations collected during FIRE-ACE flights over SHEBA in April 1998. SHEBA Investigators Meeting, Boulder, CO, April 17-20.
- Schweiger, A.J., J. A. Francis, R.W. Lindsay, and J.R. Key, 1999. Arctic clouds from satellite: Validation of multiyear data sets using surface data from the SHEBA and NP ice stations. AGU Annual Meeting, San Francisco, CA, December.
- Key, J., X. Wang, A.M. Wong, and J. Pinto, 1999. Remote sensing of clouds and the cloudy sky surface temperature. SHEBA Investigators Meeting, Tucson, AZ, January 24-28.
- Key, J., 1998. Approximations to the radiative transfer equation for the calculation of surface radiative fluxes. Association of American Geographers Annual Meeting, March, Boston, Massachusetts.
- Khalsa, S.J.S. and J. Key, 1995. Correcting intersatellite biases in a TOVS polar dataset. *EOS*, S50, American Geophysical Union Spring Meeting, May, Baltimore, MD.
- Box, J. And J. Key, 1995. Radiation climatology of the Arctic: comparison of ISCCP-derived fluxes and long-term in situ surface measurements. *IUGG XXI General Assembly Abstracts*, A224, July, Boulder, Colorado.
- Serreze, M., J. A. Maslanik, J. Key, and R. Kokaly, 1995. Diagnosis of the record minimum arctic sea ice area during 1990. *IUGG XXI General Assembly Abstracts*, B316, July, Boulder, Colorado.
- Khalsa, S.J.S and J. Key, 1994. Atmospheric temperature variability in the Arctic as revealed in a TOVS data record. *3rd Circumpolar Symposium on Remote Sensing of Arctic Environments*, 16-20 May, Fairbanks, AK.

- Maslanik, J.A., J. Key, and O. Brousse, 1992. Applications of Neural Networks and Rule-Based Systems for Remote Sensing in Polar Regions. *American Geophysical Union*, San Francisco, December.
- Serreze, M., J. Maslanik, J. Key, and R.G. Barry, 1991. Atmospheric circulation patterns over the Canadian Arctic Archipelago and relationships to the "Great Salinity Anomaly" of the Northern North Atlantic. *American Geophysical Union*, San Francisco, December 9-13, *EOS*, October 29, 238.
- Haefliger, M. and J. Key, 1991. Sea ice surface temperature retrieval from AVHRR thermal channels. *American Geophysical Union*, San Francisco, December 9-13, *EOS*, October 29, 170.
- Schweiger, A., J. Key, and M. Haefliger, 1991. Arctic radiative fluxes and cloud forcing estimated from the ISCCP C2 cloud data set, 1983-1986. *American Geophysical Union*, San Francisco, December 9-13, *EOS*, October 29, 238.
- Schweiger, A.J., J.A. Maslanik, and J. Key, 1990. Addressing Problems of classification using artificial intelligence techniques. *Proceedings of Oceans from Space*, Venice, 1990.
- Key, J., 1990. Lead width distributions observed in Landsat imagery and their relationship to model distributions, *AGU/ASLO*, New Orleans, February 12-16, *EOS*, 71 (2), 99.
- Maslanik, J.A. and J. Key, 1990. Fetch sensitivity in bulk-transfer estimates of turbulent heat flux from leads in sea ice. *AGU/ASLO*, New Orleans, February 12-16, *EOS*, 71 (2), 100.
- Key, J., R.G. Barry, and J.A. Maslanik, 1989. Cloud analysis in the Arctic with combined AVHRR and SMMR data. *IAMAP 89 Abstracts*, Vol. 2, RP-6, Reading, UK, July 31-August 11.
- Key, J. and A.S. McLaren, 1988. Periodicities and keel spacings in the under-ice draft in the Canada Basin and North Pole areas. *American Geophysical Union*, San Francisco, December, *EOS*, 69 (44), pg. 1270.
- Key, J. and R. Crane, 1986. A comparison of objective typing schemes. *Association of American Geographers Annual Meeting*, Twin Cities, May.
- Crane, R. and J. Key, 1985. Synoptic climatology of the North Polar Basin. *IAMAP/IAPSO Joint Assembly*, Honolulu, Hawaii.
- Key, J., 1983. A computer simulation for the prediction of shoreline erosion. *Association of American Geographers*, Great Plains/Rocky Mountain Region Annual Meeting, Boulder, CO.