

KAREN E. FREY

Associate Professor

Graduate School of Geography, Clark University

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EDUCATION

Ph.D. (December 2005)

Department of Geography

University of California, Los Angeles: Los Angeles, California

Dissertation title: *Establishing a baseline for West Siberia in scenarios of global change: Climate, land cover and stream biogeochemistry*; Committee members: Laurence Smith (chair), Glen MacDonald, Marilyn Raphael, Steven Margulis

M.A. (December 2000)

Department of Geography

University of California, Los Angeles: Los Angeles, California

Thesis title: *Controls on Eurasian coastal sea ice formation, melt onset and breakup from ERS scatterometry: Regional contrasts and effects of river influx*; Committee members: Laurence Smith (chair), Glen MacDonald, Yongkang Xue

B.A. magna cum laude and with distinction in all subjects (May 1998)

Department of Earth & Atmospheric Sciences

Cornell University: Ithaca, New York

Honors thesis title: *Measurements of topography using dual-frequency interferometric SAR*; Advisor: Bryan Isacks

PROFESSIONAL EXPERIENCE

Associate Professor, Graduate School of Geography, Clark University (2013–present)

Research Associate Professor, George Perkins Marsh Institute, Clark University (2013–present)

Assistant Professor, Graduate School of Geography, Clark University (2007–2013)

Research Assistant Professor, George Perkins Marsh Institute, Clark University (2007–2013)

Courses taught: *Introduction to GISci, Arctic System Science, The Climate System and Global Environmental Change, Emerging Issues in Climate Change Science, Controversies in Earth System Science, Polar Environmental Change Research, Applications of Radar Remote Sensing*

Visiting Scientist, Woods Hole Research Center (September 2010 – January 2011)

Visiting position while on sabbatical leave from Clark University

Assistant Research Scientist, Department of Physical Sciences, Virginia Institute of Marine Science (2006–2007)

Visiting Assistant Professor, Department of Geology, The College of William and Mary (2006–2007)

Courses taught: *GIS in the Environmental Sciences*

Courses contributed to: *Fundamentals of Environmental Science for Policy*

Research Assistant, Department of Geography, UCLA

Impacts of climate warming on West Siberian peatlands (Summer 2001, Fall 2003 – Summer 2004)

Observations of Eurasian coastal sea ice with satellite-borne radar scatterometry (Fall 1998 – Summer 2000)

Teaching Assistant, Department of Geography, UCLA

Glacier Environments of California's High Sierra (Summer 2003, Summer 2004)

Introduction to Geographic Information Systems (Spring 2001, Summer 2002)

Advanced Geographic Information Systems (Spring 2001)

Research Assistant, Department of Earth & Atmospheric Sciences, Cornell University

Measurements of topography in N. Chile using interferometric synthetic aperture radar (Summer 1997 – Fall 1998)

RESEARCH INTERESTS

Climate and Global Environmental Change, Polar Climate Change, Cryospheric Responses and Feedbacks to Climate, Land-Ocean Linkages, Hydrology and Biogeochemistry of Rivers/Estuaries, Permafrost Hydrology and Vegetation Dynamics, Sea Ice and Ecosystem Responses to Sea Ice Variability, Remote Sensing and Spatial Analysis.

FELLOWSHIPS AND GRANTS

Grants Awarded (2007–present): \$13,784,027 total; \$2,201,226 awarded directly to Frey (\$670,760 as indirect costs to Clark University)

- NSF Division of Polar Programs, Arctic Observing Network (AON) Program** **pending**
“*Collaborative Research: The Distributed Biological Observatory (DBO)-A Change Detection Array in the Pacific Arctic Region*” with J. Grebmeier (Lead PI, Chesapeake Biological Laboratory), K. Frey (PI, Clark University), R. Pickart (PI, Woods Hole Oceanographic Institution), L. Cooper (Chesapeake Biological Laboratory), and S. Moore (PI, NMML/NOAA).
- NASA Interdisciplinary Research in Earth Science Program (2014 – 2018)** **\$1,394,855**
“*Observing and Understanding the Impacts of a Thinning and Retreating Sea Ice Cover on Light Propagation, Primary Productivity, and Biogeochemistry in the Pacific Arctic Region*” with K. Frey (Lead PI, Clark University), D. Perovich (co-PI, ERDC-CRREL), C. Polashenski (co-I, ERDC-CRREL), B. Light (co-PI, University of Washington), and J. Comiso (co-PI, NASA GSFC). Frey portion: \$313,722.
- US Office of Naval Research, Arctic and Global Prediction Program (2013 – 2018)** **\$642,610**
“*Developing Remote Sensing Capabilities for Meter-Scale Sea Ice Properties*” with C. Polashenski (Lead PI, ERDC-CRREL), K. Frey (co-PI, Clark University), E. Deeb (co-PI, ERDC-CRREL), and D. Perovich (co-PI, ERDC-CRREL). Frey portion: \$158,598.
- NSF Office of Polar Programs, Arctic Observing Network Program (2012 – 2018)** **\$2,304,973**
“*Collaborative Research: The Distributed Biological Observatory (DBO) – A Change Detection Array in the Pacific Arctic Region*” with J. Grebmeier (Lead PI, Chesapeake Biological Laboratory), K. Frey (PI, Clark University), R. Pickart (PI, Woods Hole Oceanographic Institution), L. Cooper (Chesapeake Biological Laboratory), and S. Moore (PI, NMML/NOAA). Frey portion: \$201,016.
- NSF Office of Polar Programs, Arctic Natural Sciences Program (2012 – 2017)** **\$943,326**
“*Collaborative Research: Investigating the Influence of Sea-Surface Variability on Ice Sheet Mass Balance and Outlet Glacier Behavior using Records from Disko Bugt, West Greenland*” with S. Das (Lead PI, Woods Hole Oceanographic Institution), K. Frey (PI, Clark University), M. Evans (PI, Wheaton College), and B. Smith (PI, University of Washington). Frey portion: \$184,872.
- US Bureau of Ocean Energy Management and NOAA/PMEL (2012 – 2014)** **\$36,980**
“*Satellite Observations of Sea Ice Variability and Primary Production in the Pacific Sector of the Arctic Ocean*” with K. Frey (Lead PI, Clark University). Frey portion: \$36,980.
- NSF Office of Polar Programs, Arctic Observing Network Program (2011 – 2017)** **\$1,830,728**
“*Collaborative Research: Toward a Circumarctic Lakes Observation Network (CALON): Multiscale observations of lacustrine systems*” with K. Hinkel (Lead PI, University of Cincinnati), K. Frey (PI, Clark University), C. Arp (PI, University of Alaska Fairbanks), and J. Lenters (PI, University of Nebraska-Lincoln). Frey portion: \$76,231.
- NSF Office of Polar Programs, Arctic Research and Education Program (2011 – 2017)** **\$2,635,000**
“*Collaborative Research: The Polaris Project II: Amplifying the Impact*” with R. Holmes (Lead PI, Woods Hole Research Center), K. Frey (PI, Clark University), S. Zimov (PI, Northeast Science Station, Russia), A. Bunn (PI, Western Washington University), J. Schade (PI, St. Olaf College), and W. Sobczak (PI, College of the Holy Cross). Frey portion: \$93,320. Project Website: <http://www.thepolarisproject.org>.
- NSF Office of Polar Programs, Arctic System Science Program (2011 – 2015)** **\$586,970**
“*Collaborative Research: Pacific-Arctic Carbon Synthesis – Transformations, Fluxes, and Budgets*” with J. Mathis (Lead PI, University of Alaska, Fairbanks), K. Frey (PI, Clark University), N. Bates (PI, Bermuda Institute of Ocean Sciences), and L. Juranek (PI, University of Washington). Frey portion: \$102,573.
- NASA Cryospheric Sciences Program (2010 – 2015)** **\$736,101**
“*The Potential Impacts of Sea Ice Decline and River Discharge Shifts on Biological Productivity in the Chukchi and Beaufort Seas*” with K. Frey (Lead PI, Clark University), L. Cooper (co-PI, Chesapeake Biological Laboratory), and J. Grebmeier (co-PI, Chesapeake Biological Laboratory). Frey portion: \$457,799.
- NASA Interdisciplinary Research in Earth Science Program (2010 – 2014)** **\$707,112**
“*An Interdisciplinary Study of Recent Ice Sheet Melt, Sea Ice Decline, and Enhanced Ocean Biological Productivity Along the Amundsen Coast, West Antarctica*” with S. Das (Lead PI, Woods Hole Oceanographic Institution), K. Frey (co-PI, Clark University), and M. Evans (co-PI, Wheaton College). Frey portion: \$218,046.

- NSF Office of Polar Programs, Arctic Research Support and Logistics Program (2010 – 2012)** **\$21,697**
“Collaborative Research: A Workshop to Draft the Implementation Plan for the Arctic in Rapid Transition (ART) Initiative”
 with J. Mathis (Lead PI, University of Alaska, Fairbanks) and K. Frey (PI, Clark University). Frey portion: \$3,876.
 Project Website: <http://www.iarc.uaf.edu/ART/>.
- NSF Office of Polar Programs, Arctic Research Support and Logistics Program (2009 – 2010)** **\$47,513**
“Collaborative Research: A Workshop and Science Plan for the Arctic in Rapid Transition (ART) Initiative” with K. Frey
 (Lead PI, Clark University) and J. Mathis (PI, University of Alaska, Fairbanks). Frey portion: \$9,238.
 Project Website: <http://www.iarc.uaf.edu/ART/>.
- Alaska Satellite Facility Americas ALOS Data Node (2009)** **\$4000 in data**
“InSAR Detection of Icy Permafrost Degradation and Subsequent Land Subsidence in East Siberia” with K. Frey (sole PI,
 Clark University).
- NSF Office of Polar Programs, Arctic Natural Sciences Program (2007 – 2010)** **\$101,514**
“Impacts of Sea Ice Variability and Polynya Formation on Biological Productivity in the Northern Bering Sea” with K. Frey
 (sole PI, Clark University). Frey portion: \$101,514.
- NSF International Polar Year and Division of Undergraduate Education (2007 – 2010)** **\$1,611,557**
“Collaborative Research. IPY: The Polaris Project: Rising Stars in the Arctic” with R. Holmes (Lead PI, Woods Hole
 Research Center), K. Frey (PI, Clark University), S. Zimov (PI, Northeast Science Station, Russia), K. Walter (PI, University
 of Alaska, Fairbanks), A. Bunn (PI, Western Washington University), S. Chandra (PI, University of Nevada, Reno), J.
 Schade (PI, St. Olaf College), W. Sobczak (PI, College of the Holy Cross). Frey portion: \$59,441.
 Project Website: <http://www.thepolarisproject.org>.
- Chancellor’s Dissertation Year Fellowship (2004 – 2005)** **\$24,478**
 UCLA, Dept. of Geography. One year of stipend and tuition awarded by the UCLA Graduate Division to students in their
 final year of graduate school and who are planning to start teaching and research appointments soon after the end of their
 dissertation fellowship year.
- NSF Office of Polar Programs Grant Supplement (2002 – 2003)** **\$41,042**
 UCLA, Dept. of Geography. Through investigators Laurence Smith, Glen MacDonald, and Andrei Velichko. This study
 added a component of surface water biogeochemistry to the larger NSF-funded study *“Sensitivity of the West Siberian
 Lowland to Past and Present Climate.”*
- NASA Earth System Science Fellowship (2000 – 2003)** **\$68,000**
 UCLA, Dept. of Geography. Three years of stipend and tuition awarded by the NASA Office of Earth Science for graduate
 research in global change. Proposal funded was entitled *“Estimation of the Terrestrial Carbon Pool and Hydrological
 Sensitivity of the West Siberian Lowland.”*
- Geological Society of America Graduate Student Research Grant (2001)** **\$2,400**
 UCLA, Dept. of Geography. Summer support for fieldwork in West Siberia. Proposal was entitled *“Peatland
 biogeochemistry in the West Siberian Lowland: Implications for potential carbon accumulation.”*
- UCLA Center for European and Eurasian Studies Pre-Dissertation/Dissertation Fellowship (2001)** **\$2,100**
 UCLA, Dept. of Geography. Summer support for fieldwork in West Siberia. Proposal was entitled *“Peatland
 biogeochemistry in the West Siberian Lowland of Arctic Russia: Implications for the global carbon cycle.”*
- NASA/New York Space Grant (1996)** **\$4,000**
 Cornell University, Dept. of Earth & Atmospheric Sciences. Research using Geostationary Observational Environmental
 Satellite images to estimate the probability of precipitation over the Northern and Southern Patagonia Icefields.
- GE Fund, Faculty for the Future Undergraduate Researcher Fellowship (1995)** **\$4,000**
 Syracuse University, Dept. of Physics. Research using the Palomar Observatory Sky Survey to devise a model for the
 geometry of the Milky Way Galaxy.

HONORS AND AWARDS

Oliver and Dorothy Hayden Junior Faculty Fellowship	Clark University, 2013–2014
George Perkins Marsh Research Enhancement Award	Clark University, Spring 2013
NASA Group Achievement Award	Contributions to the ICESCAPE Program, 2012
US Coast Guard Arctic Service Medal	21+ days of duty north of the Arctic Circle, June–July 2011
Young Scientist Scholarship <i>Arctic Science Summit Week</i>	Scholarship to attend ASSW (Seoul, Korea), 2011
US Coast Guard Arctic Service Medal	21+ days of duty north of the Arctic Circle, June–July 2010
Hodgkins Junior Faculty Award	Clark University, 2009–2010
Young Scientist Scholarship <i>Arctic Science Summit Week</i>	Scholarship to attend ASSW (Bergen, Norway), 2009
Exceptional Merit Award	Clark University, 2008
Young Scientist Scholarship <i>Arctic Science Summit Week</i>	Scholarship to attend ASSW (Hanover, NH), 2007
Young Scientist Scholarship <i>Int'l. Conference on Arctic Research Planning</i>	Scholarship to attend ICARP (Potsdam, Germany), 2006
Young Scientist Scholarship <i>Int'l. Conference on Arctic Research Planning</i>	Scholarship to attend ICARP (Copenhagen, DK), 2005
Graduate Research Publication Award <i>Most outstanding biophysical pub.</i>	UCLA Department of Geography, 2005
The Society of Woman Geographers Award	Cash prize of \$9500, 2004–2005
Graduate Research Publication Award <i>Most outstanding biophysical pub.</i>	UCLA Department of Geography, 2004
Graduate Research Publication Award <i>Most outstanding biophysical pub.</i>	UCLA Department of Geography, 2003
NASA Earth System Science Fellow	Fellowship for graduate stipend/tuition, 2000–2003
Outstanding Student Paper Award <i>Ocean Sciences Section</i>	American Geophysical Union, 2000
Phi Beta Kappa	Cornell University, inducted 1998
Chester Buchanan Award <i>Most outstanding senior in Earth & Atm. Sciences</i>	Cornell University, 1998
Phi Kappa Phi	Cornell University, inducted 1998
Golden Key National Honor Society	Cornell University, inducted 1998
Dean's List	Cornell University, 1994–1997

PUBLICATIONS: BOOKS, REFEREED

Grebmeier, J. M., J. C. Priscu, R. D'Arrigo, H. W. Ducklow, C. Fleener, **K. E. Frey** & C. Rosa (2011), National Research Council of the National Academies Report: *Frontiers in Understanding Climate Change and Polar Ecosystems*. The National Academies Press: Washington D.C., 84 pp.

- *Nature News* Highlight, 12 January 2011 (vol. 469, p. 145)

PUBLICATIONS: BOOK CHAPTERS, REFEREED

Frey, K. E., J. A. Maslanik, J. Clement Kinney & W. Maslowski (2014), Recent variability in sea ice cover, age, and thickness in the Pacific Arctic Region. In: Grebmeier, J. M. & W. Maslowski (eds.) *The Pacific Arctic Region: ecosystem status and trends in a rapidly changing environment*. Springer: Dordrecht, pp. 31–64.

PUBLICATIONS: ANNUAL REPORT CONTRIBUTIONS, REFEREED

Frey, K. E., J. C. Comiso, L. W. Cooper, R. R. Gradinger, J. M. Grebmeier, & J. -É. Tremblay (2016), Arctic Ocean Primary Productivity, In *Arctic Report Card 2016*, <http://www.arctic.noaa.gov/reportcard>.

- Featured by NOAA's *ClimateWatch Magazine*, February 2017 (<https://www.climate.gov/news-features/featured-images/ocean-plant-growth-blooms-springtime-arctic-sea-ice-thins>)

Frey, K. E., J. C. Comiso, L. W. Cooper, R. R. Gradinger, J. M. Grebmeier, & J. -É. Tremblay (2015), Arctic Ocean Primary Productivity, In *Arctic Report Card 2015*, <http://www.arctic.noaa.gov/reportcard>.

Frey, K. E., J. C. Comiso, L. W. Cooper, R. R. Gradinger, J. M. Grebmeier, S. -I. Saitoh & J. -É. Tremblay (2014), Arctic Ocean Primary Productivity, In *Arctic Report Card 2014*, <http://www.arctic.noaa.gov/reportcard>.

Frey, K. E., K. R. Arrigo & W. J. Williams (2012), Arctic Ocean Primary Productivity and Nutrient Distributions. In *Arctic Report Card 2012*, <http://www.arctic.noaa.gov/reportcard>.

- Featured by NOAA's *ClimateWatch Magazine*, December 2012 (<https://www.climate.gov/news-features/features/melt-pond-skylights-enable-massive-under-ice-bloom-arctic>)

Grebmeier, J. M., R. S. Pickart, C. J. Ashjian, L. W. Cooper, **K. E. Frey**, J. He, M. Itoh, M. Kedra, T. Kikuchi, S. E. Moore, J. Nelson & S. Vagle (2012), Ecosystem Observations in Barrow Canyon: A Focus for the International Distributed Biological Observatory. In *Arctic Report Card 2012*, <http://www.arctic.noaa.gov/reportcard>.

Frey, K. E. & S. E. Moore (2012), [The Arctic] Arctic Ocean Marine Ecosystem Response to Changing Sea Ice and Ocean Conditions. In *State of the Climate in 2011, Bulletin of the American Meteorological Society* 93 (7), S146–S147.

Frey, K. E., K. R. Arrigo & R. R. Gradinger (2011a), Arctic Ocean Primary Productivity. In *Arctic Report Card 2011*, <http://www.arctic.noaa.gov/reportcard>.

- Featured by NOAA's *ClimateWatch Magazine*, December 2011 (<https://www.climate.gov/news-features/features/sea-ice-declines-boost-arctic-phytoplankton-productivity>)

PUBLICATIONS: JOURNAL ARTICLES, REFEREED (53 total)

*Ph.D. student author, **M.S./M.A. student author, ***B.A. student author

Griffin, C. G. *, J. W. McClelland, **K. E. Frey**, G. Fiske; R. M. Holmes (accepted), Estimating Dissolved Organic Matter Concentrations in Major Arctic Rivers Using Landsat Data. *Remote Sensing of Environment*.

Shake, K. L. *, **K. E. Frey**, D. G. Martin & P. E. Steinberg (accepted), (Un)frozen spaces: Exploring the role of sea ice in the marine socio-legal spaces of the Bering and Beaufort seas. *Journal of Borderland Studies*.

Strong, A. L., K. E. Lowry, Z. W. Brown, M. M. Mills, G. L. van Dijken, R. S. Pickart, L. W. Cooper, **K. E. Frey**, R. Benner, C. G. Fichot, J. T. Mathis, N. R. Bates & K. R. Arrigo (2016), Mass balance estimates of carbon export in different water masses of the Chukchi Sea shelf. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2016.05.003> (12 pp.).

Piper, M., C. Benitez-Nelson, **K. E. Frey**, M. Mills & S. Pal (2016), Dissolved and particulate phosphorus distributions and elemental stoichiometry throughout the Chukchi Sea. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2016.05.009i> (12 pp.).

Logvinova, C. L. **, **K. E. Frey** & L. W. Cooper (2016), The role of sea ice melt in the distribution of chromophoric dissolved organic matter in the Chukchi and Beaufort seas. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2016.04.017i> (15 pp.).

Cooper, L. W., **K. E. Frey**, C. L. Logvinova **, D. M. Biasatti & J. M. Grebmeier (2016), Variations in the proportions of melted sea ice and runoff in surface waters of the Chukchi Sea: A retrospective analysis, 1990–2012, and analysis of the implications of melted sea ice in an under-ice bloom. *Deep-Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2016.04.014> (8 pp.).

Schade, J. D., E. C. Seybold, T. Drake, W. V. Sobczak, **K. E. Frey**, R. M. Holmes & N. Zimov (2016), Variation in summer nitrogen and phosphorus uptake among Siberian headwater streams. *Polar Research* 35, 24571, <http://dx.doi.org/10.3402/polar.v35.24571> (10 pp.).

Hinkel, K. M., C. D. Arp, A. Townsend-Small, **K. E. Frey** (2016), Can Deep Groundwater Influx be Detected from the Geochemistry of Thermokarst Lakes in Arctic Alaska? *Permafrost and Periglacial Processes*, doi:10.1002/ppp.1895 (6 pp.).

Frey, K. E., W. V. Sobczak, P. J. Mann & R. M. Holmes (2016), Optical properties and bioavailability of dissolved organic matter along a flow-path continuum from soil pore waters to the Kolyma River mainstem, East Siberia. *Biogeosciences* 13, 2279–2290, doi:10.5194/bg-13-2279-2016 (12 pp.).

Ray, G. C., G. L. Hufford, J. E. Overland, I. Krupnik, J. McCormick-Ray, **K. E. Frey** & E. Labunski (2016), Decadal Bering Sea Seascape Change: Consequences for Pacific Walrus and Indigenous Hunters. *Ecological Applications* 26, 24–41, doi:10.1890/15-0430 (18 pp.).

Logvinova, C. L. **, **K. E. Frey**, P. J. Mann, A. Stubbins, & R. G. M. Spencer (2015), Assessing the potential impacts of declining Arctic sea ice cover on the photochemical degradation of dissolved organic matter in the Chukchi and Beaufort seas. *Journal of Geophysical Research-Biogeosciences* 120, 2326–2344, doi:10.1002/2015JG003052 (19 pp.).

- Trusel, L. D. *, **K. E. Frey**, S. Das, K. B. Karnauskas, P. Kuipers Menneke, E. van Meijgaard & M. R. van den Broeke (2015), Divergent trajectories of Antarctic ice shelf surface melt under 21st century climate scenarios. *Nature Geoscience* 8, 927–932, doi:10.1038/geo2563 (6 pp.). (Cover Feature)
- Polashenski, C., D. K. Perovich, **K. E. Frey**, L. W. Cooper, C. L. Logvinova**, R. Dadic, B. Light, H. P. Kelly, L. D. Trusel* & M. Webster (2015), Physical and morphological properties of sea ice in the Chukchi and Beaufort Seas during the 2010 and 2011 NASA ICESCAPE missions. *Deep-Sea Research II* 118, Part A, 7–17, doi:10.1016/j.dsr2.2015.04.006.
- Evans, W., J. T. Mathis, J. N. Cross, N. R. Bates, **K. E. Frey**, B. G. T. Else, T. N. Papkyriakou, M. D. DeGrandpre, F. Islam, W. -J. Cai, B. Chen, M. Yamamoto-Kawai, L. A. Miller, E. Carmack, W. J. Williams, and T. Takahashi (2015), Sea-air CO₂ exchange in the western Arctic coastal ocean. *Global Biogeochemical Cycles* 29, doi:10.1002/2015GB005153 (20 pp.).
- Frey, K. E.**, G. W. K. Moore, J. M. Grebmeier & L. W. Cooper (2015), Divergent Patterns of Recent Sea Ice Cover across the Bering, Chukchi, and Beaufort Seas of the Pacific Arctic Region. *Progress in Oceanography* 136, 32–49, <http://dx.doi.org/10.1016/j.pocean.2015.05.009>.
- Grebmeier, J. M., B. A. Bluhm, L. W. Cooper, S. L. Danielson, K. R. Arrigo, A. L. Blanchard, J. T. Clark, R. H. Day, **K. E. Frey**, R. R. Gradinger, M. Kedra, B. Konar, K. J. Kuletz, S. H. Lee, J. R. Lovvorn, B. L. Norcross & S. R. Okkonen (2015), Ecosystem characteristics and processes facilitating persistent macrobenthic biomass hotspots and associated benthivory in the Pacific Arctic. *Progress in Oceanography* 136, 92–114, <http://dx.doi.org/10.1016/j.pocean.2015.05.006>.
- Broderick, D. E. **, **K. E. Frey**, J. Rogan, H. D. Alexander & N. S. Zimov (2015), Estimating upper soil horizon carbon stocks in a permafrost watershed of Northeast Siberia by linking field measurements to Landsat-5 TM and WorldView-2 satellite data. *GIScience and Remote Sensing*, doi:10.1080/15481603.2015.1010434 (27 pp.).
- Bates, N. R., R. Garley, **K. E. Frey**, K. L. Shake & J. T. Mathis (2014), Sea-ice melt CO₂-carbonate chemistry in the western Arctic Ocean: meltwater contributions to air-sea CO₂ gas exchange, mixed-layer properties and rates of net community production under sea ice. *Biogeosciences* 11, 6769–6789, doi:10.5194/bg-11-6769-2014.
- Panday, P. K. *, J. Thibeault & **K. E. Frey** (2014), Changing temperature and precipitation extremes in the Hindu Kush-Himalayan region: An analysis of CMIP3 and CMIP5 simulations and projections. *International Journal of Climatology*, doi:10.1002/joc.419 (20 pp.).
- Cross, J. N., J. T. Mathis, **K. E. Frey**, C. Cosca, S. L. Danielson, N. R. Bates, T. Takahashi & W. Evans (2014), Annual sea-air CO₂ fluxes in the Bering Sea: Insights from new autumn and winter observations of a seasonally ice-covered continental shelf. *Journal of Geophysical Research-Oceans* 119, doi:10.1002/2013JC009579 (16 pp.).
- Bhatt, U. S., D. A. Walker, J. E. Walsh, E. C. Carmack, **K. E. Frey**, W. N. Meier, S. E. Moore, F. W. Parmentier, E. Post, V. E. Romanovsky, W. R. Simpson (2014), Implications of Arctic Sea Ice Decline for the Earth System. *Annual Reviews of Environment and Resources* 39, doi:10.1146/annurev-environ-122012-094357 (33 pp.).
- Arrigo, K. R., D. K. Perovich, R. S. Pickart, Z. W. Brown, G. L. van Dijken, K. E. Lowry, M. M. Mills, M. A. Palmer, W. M. Balch, N. R. Bates, C. R. Benitez-Nelson, E. Brownlee, **K. E. Frey**, S. R. Laney, J. Mathis, A. Matsuoka, B. G. Mitchell, G. W. K. Moore, R. A. Reynolds, H. M. Sosik & J. H. Swift (2014), Phytoplankton blooms beneath sea ice in the Chukchi Sea. *Deep Sea Research II*, <http://dx.doi.org/10.1016/j.dsr2.2014.03.018> (16 pp.).
- Criscitello, A. S., S. B. Das, K. B. Karnauskas, M. J. Evans, **K. E. Frey**, I. Joughin, E. J. Steig, J. R. McConnell & B. Medley (2014), Tropical Pacific influence on source and transport of marine aerosols to West Antarctica. *Journal of Climate* 27, 1343–1363, doi:10.1175/JCLI-D-13-00148.1.
- Trusel, L. D. *, **K. E. Frey**, S. B. Das, P. Kuipers Munneke & M. R. van den Broeke (2013), Satellite-based estimates of Antarctic surface meltwater fluxes. *Geophysical Research Letters* 40, doi:10.1002/2013GL058138 (6 pp.).
- Denfeld, B. A. **, **K. E. Frey**, W. V. Sobczak, P. J. Mann & R. M. Holmes (2013), Summer CO₂ evasion from streams and rivers in the Kolyma River basin, north-east Siberia. *Polar Research* 32, 19704, <http://dx.doi.org/10.3402/polar.v32i0.19704> (15 pp.).
- Panday, P. K. *, C. A. Williams, **K. E. Frey** & M. E. Brown (2013), Application and evaluation of a snowmelt runoff model in the Tamor River basin, eastern Himalaya using a Markov Chain Monte Carlo (MCMC) data assimilation approach. *Hydrological Processes*, doi:10.1002/hyp.10005 (17 pp.).

- Beck, R. A., K. M. Hinkel, W. R. Eisner, D. Whiteman, C. D. Arp, R. Machida, C. Cuomo, H. Liu, C. Kim, A. J. Rettig, C. Ivenso, B. Yang, Q. Wu, H. Su, S. Wang, **K. E. Frey**, J. Lenters & B. Potter (2013), Transition from Mechanical to Thermal Breakup on the Meade River of Arctic Alaska. *American Journal of Climate Change* 2, 165–172.
- Criscitello, A. S., S. B. Das, M. J. Evans, **K. E. Frey**, H. Conway, I. Joughin, B. Medley & E. J. Steig (2013), Ice sheet record of recent sea-ice behavior and polynya variability in the Amundsen Sea, West Antarctica. *Journal of Geophysical Research-Oceans* 118, doi:10.1029/2012JC008077 (13 pp.).
- Tank, S. E., **K. E. Frey**, R. G. Striegl, P. A. Raymond, R. M. Holmes, J. W. McClelland & B. J. Peterson (2012), Landscape-level controls on dissolved carbon flux from diverse catchments of the circumboreal. *Global Biogeochemical Cycles* 26, GB0E02, doi:10.1029/2012GB004299 (15 pp.).
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Frey, K. E., L. C. Smith & D. E. Alsdorf, Observations of Russian coastal sea ice dynamics from temporal ERS scatterometer data. *2000 Fall American Geophysical Union Meeting*. San Francisco, California, 15–19 December 2000.

Frey, K. E., L. C. Smith & D. E. Alsdorf, Effects of arctic Eurasian runoff on coastal sea ice from ERS scatterometry. *1999 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 1999.

Frey, K. E., B. L. Isacks, D. E. Alsdorf & J. S. Yu, Measurements of topography using dual-frequency interferometric SAR. *1998 Fall American Geophysical Union Meeting*. San Francisco, California, 6–10 December 1998.

INVITED SEMINARS AND PRESENTATIONS

Panelist at the Wheaton Summit for Women in STEM: Wheaton College, Norton MA (April 8, 2017)

Clark University Climate Change Teach-In (March 23, 2016)

Synthesis of Arctic Research (SOAR) Science Workshop: Anchorage, Alaska (March 14, 2012)

Distributed Biological Observatory Workshop/Pacific Arctic Group Meeting: Sidney, British Columbia (November 15, 2011)

TOS/ASLO/AGU Ocean Sciences Meeting: Portland, Oregon (February 22, 2010)

American Geophysical Union Meeting: San Francisco, California (December 17, 2009)

College of the Holy Cross: Department of Biology (October 27, 2009)

Clark University Board of Trustees (May 1, 2009)

Nobel Peace Prize Forum (Northfield, Minnesota): Honoring the IPCC (March 6–7, 2009)

Carleton College: Department of Biology (March 4, 2009)

Clark University: George Perkins Marsh Institute (February 26, 2009)

University of Massachusetts Amherst: Department of Geosciences (February 20, 2009)

Association of American Geographers Annual Meeting: Boston, Massachusetts (April 16, 2008)

Boston University: Department of Geography and Environment (October 19, 2007)

UNH: Complex Systems Research Center, Institute for the Study of Earth, Oceans, and Space (September 21, 2007)

University of Virginia: Department of Environmental Sciences (February 15, 2007)

World Affairs Council (Norfolk, VA): Great Decisions Lecture on Climate Change (January 20, 2007)

Geological Society of America Annual Meeting: Philadelphia, Pennsylvania (October 24, 2006)

University of California, Irvine: Department of Earth System Science (March 28, 2006)

Virginia Institute of Marine Science: Department of Physical Sciences (March 23, 2006)

Dartmouth College: Department of Earth Sciences (February 23, 2006)

The College of William and Mary: Department of Geology (February 15, 2006)

University of California, Los Angeles: Department of Geography (April 29, 2005)

FIELD EXPERIENCE

- Summer 2012:** Collecting samples for lake biogeochemical parameters across the Alaskan North Slope (CALON Project)
- Summer 2012:** Sampling for land-ocean carbon/nutrient linkages in Cherskiy, East Siberia (Polaris Project II)
- Summer 2011:** Measurements of biogeochemical parameters and sea ice properties onboard the *US Coast Guard Cutter Healy* icebreaker in the Chukchi and Beaufort Seas, NASA ICESCAPE Mission (HLY1101)
- Summer 2010:** Measurements of biogeochemical parameters and sea ice properties onboard the *US Coast Guard Cutter Healy* icebreaker in the Chukchi and Beaufort Seas, NASA ICESCAPE Mission (HLY1001)
- Summer 2009:** Sampling for land-ocean carbon/nutrient linkages in Cherskiy, East Siberia (Polaris Project I)
- Summer 2008:** Sampling for land-ocean carbon/nutrient linkages in Cherskiy, East Siberia (Polaris Project I)
- Spring 2008:** Measurements of biological productivity and sea ice cover onboard the *US Coast Guard Cutter Healy* icebreaker in the northern Bering Sea (HLY0801)
- Spring 2007:** Measurements of biological productivity and sea ice cover onboard the *US Coast Guard Cutter Healy* icebreaker in the northern Bering Sea (HLY0702)
- Spring 2006:** Measurements of biological productivity and sea ice cover onboard the *US Coast Guard Cutter Healy* icebreaker in the northern Bering Sea (HLY0601)
- Summer 2004:** Teaching assistant for the UCLA field course *Glacier Environments of California's High Sierra*
- Fall 2003:** Hydrological impacts of the October 2003 wildfires in the San Bernardino Mountains, Southern California (Ph.D. candidacy exam, field portion)
- Summer 2003:** Teaching assistant for the UCLA field course *Glacier Environments of California's High Sierra*
- Summer 2001:** Peat coring, stream/river water sampling and ground-truthing of satellite data in southern West Siberia
- Spring 2001:** Field mapping, surveying and ground-truthing of remotely sensed data (LIDAR, InSAR) on the post-jökulhlaup outwash plain of Skeiðarársandur, Iceland
- Summer 2000:** Peat coring, stream/river water sampling and ground-truthing of satellite data in northern West Siberia
- Summer 1999:** Peat coring, stream/river water sampling and ground-truthing of satellite data in central West Siberia
- Summer 1997:** Field mapping in the Precordilleran Andes, Argentina (Cornell University summer field course)

SELECTED MEDIA AND PUBLIC OUTREACH

- Appointment to the International Arctic Science Committee highlighted in *GoLocalWorcester.com* (<http://www.golocalworcester.com/news/clark-geographer-named-to-international-arctic-science-committee>), 6 April 2017
- Frey presented a talk on her Arctic sea ice/marine biology research to all high school students at *Bancroft School* (Worcester, MA), 22 April 2013
- Frey presented her sea ice optics NASA ICESCAPE research via a live webinar for the public with the *American Museum of Natural History* (New York City), 9 April 2013
- The 2012 Arctic Report Card entry, Arctic Ocean Primary Productivity and Nutrient Distributions (Frey et al., 2012), was featured by NOAA's *ClimateWatch Magazine* (December 2012, seen at <http://www.climatewatch.noaa.gov/article/2012/melt-pond-skylights-enable-massive-under-ice-bloom-in-arctic>)
- Frey presented a talk on her Arctic marine biology/biogeochemistry research to high school Environmental Science students at *Milton Academy* (Milton, MA), 25 October 2012
- For her contribution to the NOAA 2011 Arctic Report Card, Frey participated in a live webinar and Q&A session with reporters from the *Associated Press*, *Reuters*, *ClimateWire*, etc., which was reported on by *Nature News* (1 December 2011, seen at http://blogs.nature.com/news/2011/12/the_arctics_new_normal_1.html), among multiple other news outlets
- The 2011 Arctic Report Card entry, Arctic Ocean Primary Production (Frey et al., 2011), was featured by NOAA's *ClimateWatch Magazine* (December 2011, seen at <http://www.climatewatch.noaa.gov/article/2011/sea-ice-declines-boost-arctic-phytoplankton-productivity>)
- Published sea ice optics research (Frey et al., 2011) was featured in *Optics & Photonics Focus* magazine (December 2011, seen at <http://www.opfocus.org/index.php?topic=story&v=15&s=7>)
- Frey featured in a Q&A by the *NASA blog* for her participation in the NASA ICESCAPE mission (13 July 2011, seen at http://blogs.nasa.gov/cm/blog/icescape/posts/post_1310624142845.html)
- Frey interviewed by *Alaska Public Radio* for her participation in the NASA ICESCAPE mission (28 June 2011, heard at <http://www.alaskapublic.org/2011/06/28/nasa-wraps-up-icescape-mission/>)
- Frey interviewed by *Alaska Public Radio* for her Distributed Biological Observatory research and participation in Arctic Science Summit Week in Seoul, Korea (14 April 2011, heard at <http://www.alaskapublic.org/2011/04/14/observatory-offers-new-glimpse-of-northern-seas/>)
- NASA-funded West Antarctic research highlighted in the *Worcester Telegram and Gazette* (27 February 2011, seen at <http://www.telegram.com/article/20110227/NEWS/102270486/1101/local>)

- Frey’s NASA research featured in “Digging the Ice” in the *Worcester Telegram and Gazette* (19 May 2010, seen at <http://www.telegram.com/article/20100519/NEWS/5190419/1101>)
- Photographs of northern Bering Sea walrus published in *Highlights for Children* magazine (April 2010 issue)
- The NSF-funded Polaris Project and Clark University student featured by Andrew Revkin, *The New York Times* (24 July 2009, seen at <http://dotearth.blogs.nytimes.com/2009/07/24/a-postcard-from-the-pleistocene/>)
- The NSF-funded Polaris Project featured by the *Worcester Telegram and Gazette* “College Town” section (26 July 2009, seen at <http://www.telegram.com/article/20090726/NEWS/907260462>)
- Two talks given by Frey via satellite to teachers and the general public for “Polar Weekend” at the *Carnegie Museum of Natural History* (Pittsburg, PA) about impacts of Siberian climate warming while in the field in E. Siberia (10/11 July 2009)
- Frey featured in “On the Job” in the *Worcester Telegram and Gazette* (8 June 2009, seen at <http://www.telegram.com/article/20090608/BUSINESS01/906080334>)
- Frey featured as “Scientist of the Day” on the *International Polar Year blog* for northern Bering Sea research (March 2009, seen at http://www.ipy.org/index.php?ipy/detail/more_than_frozen_water)
- Frey’s northern Bering Sea research shown in a four-part *NOVA* special entitled “On Thin Ice in the Bering Sea” (released February 2009, seen at <http://www.pbs.org/wgbh/nova/extremeice/thinice.html>)
- The NSF-funded Polaris Project and Clark University featured in the *Worcester Telegram and Gazette* (December 2008, seen at <http://www.telegram.com/article/20081202/NEWS/812020397>)
- The Polaris Project featured in Clark University’s *ClarkNews* magazine (July 2008, seen at <http://libref.clarku.edu/alumni/clarknews/summer08/siberia.cfm>)
- Several photographs of the northern Bering Sea published in multiple *The New York Times* print and online publications (e.g., <http://www.nytimes.com/2008/05/20/science/20count.html?fta=y>)
- Contributed to talks at the *Museum of the Aleutians* to the general public in Unalaska, Alaska presenting research in the northern Bering Sea (March 2008)
- Several photographs of the northern Bering Sea on large-format display at a children’s exhibition on Arctic climate change entitled “Polar Perspectives” at the *Liberty Science Museum* in Jersey City, New Jersey (July–November 2007)
- *Geotimes* featured West Siberian carbon research in “Carbon leaching out of Siberian peat” (5 July 2005, seen at http://www.geotimes.org/july05/NN_arcticpeatCO2.html)
- *The Discovery Channel* featured West Siberian carbon research in “Thawing Siberia Triggers Global Warming Alarm” (21 June 2005, seen at <http://dsc.vip.ashb.att.discovery.com/news/briefs/20050620/carbon.html>)

NATIONAL/INTERNATIONAL POLAR SCIENCE PLANNING ACTIVITIES

Positions Held:

- *Marine Working Group Member, International Arctic Science Committee* (2016–present), one of two US members appointed by the National Academy of Sciences (<http://iasc.info/>)
- *Interagency Arctic Research Policy Committee (IARPC) Marine Ecosystems Team Member* (2016–present), which seeks to further the IARPC 5-year Arctic Research Plan released by the Executive Office of the President in December 2016 (<http://www.iarpcollaborations.org/index.html>)
- *Science Steering Committee Member, Distributed Biological Observatory Program* (2011–present), a change detection array program in the Pacific Arctic marine region (<http://www.arctic.noaa.gov/dbo/>)
- *The National Academies/National Research Council Committee Member* for Arctic Matters: Understanding How the Arctic is Changing and What it Means for People and Places Around the Globe (2014–2016)
- *Interagency Arctic Research Policy Committee (IARPC) Distributed Biological Observatory (DBO) Team Member* (2012–2016), which will develop a five-year DBO plan for federally sponsored research in the Arctic, bridging 13 agencies, departments, and offices across the federal government
- *UNOLS Arctic Icebreaker Coordinating Committee (AICC) Member* (2009–2016), one of eight elected committee members serving as the liaison group between the NSF, US Coast Guard, and general arctic science community (<http://www.unols.org/committees/aicc/index.html>)
- *Executive Committee Member, Arctic Ocean Sciences Board Arctic in Rapid Transition Initiative* (2009–2014), (<http://www.iarc.uaf.edu/en/ART>)
- *The National Academies/National Research Council Committee Member on the Workshop: Frontiers in Understanding Climate Change and Polar Ecosystems* (2010–2011)
- *Management Committee Member, Arctic Ocean Sciences Board New Research Generation Project* (2008–2009)
- *Roundtable Member, Arctic Ocean Sciences Board ICARP II* Marine Group* (2007–2009)

Meeting Session Coordination:

- *Impacts of Changing Seasonality on Arctic Systems and an Arctic in Rapid Transition*, Fall American Geophysical Union Meeting (San Francisco, California: December 2011), session co-chair
- *Ecosystem Responses to Climate Change: Past, Present and Future*, Arctic Science Summit Week (Seoul, Korea: March 2011), session co-chair
- *Challenges in Arctic System Studies*, State of the Arctic Meeting (Miami, Florida: March 2010), session co-chair
- *Coastal Environments as a link between Land and Sea in the Arctic*, Arctic Science Summit Week (Bergen, Norway: March 2009), session co-chair

Workshop Involvement and Other Science Planning Activities:

- *Arctic-COLORS (Arctic-COastal Land Ocean inteRactions) Open Community Workshop* (Woods Hole, MA: 28–29 July 2016), invited participant
- *Second Distributed Biological Observatory Data Workshop* (Seattle, WA: 29–31 October 2014), invited participant and plenary presenter
- *Distributed Biological Observatory Data Workshop* (Seattle, WA: 27 February – 1 March 2013), invited participant and plenary presenter
- *Pacific Marine Arctic Regional Synthesis (PacMARS) Workshop* (Seattle, WA: 10–11 December 2012: Sponsored by the North Pacific Research Board), invited participant and plenary presenter
- *Arctic-Boreal Vulnerability Experiment (ABOVE) Workshop* (Boulder, Colorado: 13–15 June 2012: Sponsored by NASA to address recommendations and further evaluate the feasibility of an expanded Arctic-Boreal field-based research experiment), invited participant
- *Synthesis of Arctic Research Science Workshop* (Anchorage, Alaska: 14–16 March 2012: Sponsored by the US Bureau of Ocean Energy Management), invited participant and plenary presenter
- *Distributed Biological Observatory Workshop* (Sidney, British Columbia: 15–16 November 2011: Sponsored by NOAA and the Pacific Arctic Group), invited participant and plenary presenter
- *The Legacy and Lessons of the International Polar Year 2007–2008 Workshop* (Leesburg, Virginia, 15–16 June 2011: Sponsored by the National Academies/National Research Council), invited participant
- *Arctic Science Summit Week* (Seoul, Korea: March 2011), participant
- *Distributed Biological Observatory Workshop* (Seoul, Korea: 27 March 2011), invited participant and plenary presenter
- *Arctic in Rapid Transition Implementation Workshop* (Winnipeg, Canada, 18–20 October 2010: Sponsored by NSF and IASC to help develop an implementation plan that integrates, updates, and develops priorities for internationally-coordinated Arctic Marine Science activities for the next decade), co-organizer and participant
- *Frontiers in Understanding Climate Change and Polar Ecosystems Workshop* (Cambridge, Maryland, 24–25 August 2010: Sponsored by the National Academies/National Research Council), committee member and participant
- *Arctic in Rapid Transition Initiation Workshop* (Fairbanks, Alaska, 7–9 November 2009: Sponsored by NSF, IASC, and IARC to help develop a science plan that integrates, updates, and develops priorities for internationally-coordinated Arctic Marine Science activities for the next decade), co-organizer and participant
- *Bering Strait Environmental Observations Workshop* (Pack Forest, WA, 12–14 May 2009: Sponsored by NSF, NOAA, and AOS to help specify instrumentation and observation infrastructure that is appropriate to support a cohesive set of marine environmental observation systems in the Bering Strait region), invited participant
- *Biological Response to Reduced Sea Ice in the Pacific Arctic Region Workshop* (Seattle, WA, 6–8 May 2009: Sponsored by NOAA as part of the international Pacific Arctic Group (PAG) post-International Polar Year synthesis effort), invited participant
- *Arctic Science Summit Week* (Bergen, Norway: March 2009), participant
- *Arctic Science Summit Week* (Hanover, New Hampshire: March 2007), participant and plenary presenter
- *ICARP II** (Potsdam, Germany: November 2006), invited participant
- *ICARP II** (Copenhagen, Denmark: November 2005), invited participant
- *Russian American Initiative for Land-Shelf Environments (RAISE) Workshop for Facilitating U.S. and Russian Research Collaborations in the Arctic* (11–16 June 2005, St. Thomas, U.S. Virgin Islands: Sponsored by NSF), invited participant and plenary presenter

*ICARP II = Second International Conference on Arctic Research Planning

EDITORIAL/REVIEW SERVICE

Positions Held:

Editorial Board Member, *The Professional Geographer* (2011–present)

Article, book, and proposal reviews:

American Geophysical Union Monographs, Geophysical Research Letters, Global Biogeochemical Cycles, Global Change Biology, Human Geography, Journal of Geophysical Research-Biogeosciences, Nature, Nature Geoscience, Polar Research, Remote Sensing of Environment, NASA Cryospheric Sciences Program, NASA Earth and Space Science Fellowship Program, NASA Terrestrial Hydrology Program, NSF Arctic Natural Sciences Program, NSF Arctic Observing Network Program, NSF Arctic System Science Program, NSF Office of Polar Programs Postdoctoral Program, NSF Geography and Spatial Science Program

Panelist:

NASA Cryospheric Sciences Branch (February 2014, New Investigator Program)
NSF Office of Polar Programs (May 2010, Arctic Observing Network (AON))
NASA Cryospheric Sciences Branch (April 2010, Earth Venture-1)
NASA Cryospheric Sciences Branch (September 2009, Studies with ICESat and CryoSat-2)
NASA Hydrological Sciences Branch (February 2007, International Polar Year)

PROFESSIONAL AFFILIATIONS

American Association for the Advancement of Science (member, 2007–present)
American Geophysical Union (member, 1997–present)
American Society for Photogrammetry & Remote Sensing (member, 1998–present)
Association of American Geographers (member, 1998–present)
Association of Polar Early Career Scientists (member, 2007–present)
Geological Society of America (member, 1997–present)
Permafrost Young Researchers Network (member, 2007–present)
Society of Woman Geographers (member, 2004–present)

UNIVERSITY/DEPARTMENTAL SERVICE

Clark University:

Graduate Board

2016–2017

Editorial Advisory Board

2016–2017

2015–2016

George Perkins Marsh Institute Steering Committee

2016–2019

2012–2015

Climate Change Teach-In (speaker)

March 2016

Research Board Member

2008–2011

Earth System Science Representative, Environmental Science Steering Committee

2009–2010

2008–2009

Clark University Open House (speaker/participant)

October 2011, April 2011, April 2010

Presidential Scholars Panel on Undergraduate Research (panelist/participant)

April 2009

Traina Presidential Scholars Day (participant and interviewer)

February 2009, February 2008

Clark University Sciences Preview Day (participant and presenter/speaker)

October 2008

New Faculty Orientation Panelist

September 2008

Art from the Arctic, Difficult Dialogues Symposium on Climate Change (presenter/panelist)

April 2008
An Inconvenient Truth, Difficult Dialogues Symposium on Climate Change (presenter/panelist)
February 2008
Focus the Nation Teach-In, Difficult Dialogues Symposium on Climate Change (presenter)
January 2008

Clark University, Graduate School of Geography:

Faculty Search Committee, GISci Professorship
2016–2017/Chair

Edna Bailey Sussman Foundation Review Committee
2016–2017/Chair (\$21,375 total received in grants)
2015–2016/Chair (\$29,585 total received in grants)
2014–2015/Chair (\$17,380 total received in grants)
2013–2014/Chair (\$15,650 total received in grants)

Web Committee
2017/Chair

Graduate Admissions Committee
2015–2016
2013–2014/Chair
2012–2013/Chair
2011–2012/Chair
2010–2011
2009–2010

Facilitated and organized the filming of four promotional films (HE/UE/ESS/GISci) for the GSG
2017–2018 (HE/UE)
2015–2016 (ESS/GISci)

Strategic Plan Final Writing Committee
2012–2013

Faculty Search Committee, GISci Professorship
2011–2012

Faculty Search Committee, Two GISci Visiting Professorships
Spring 2011

Undergraduate Studies Committee for Geography and Global Environmental Studies
Spring 2011

Atwood and Colloquium Committee
Spring 2011

Earth System Science Undergraduate Major Coordinator
2009–2010
2008–2009

Coordinator for Capstone and Research Application Requirements, Geography Undergraduate Major
2008–2009

Tenure and Promotion Committee, John Rogan
2008–2009

Faculty Search Committee, Earth System Science Professorship
2007–2008

COURSES DEVELOPED AND TAUGHT

The Arctic in the Anthropocene/Arctic System Science (GEOG 119)

Clark University: Spring 2008, Spring 2009, Spring 2010, Spring 2011, Spring 2012, Fall 2016

This undergraduate course focuses on the interfaces of systems in the Arctic, including land-atmosphere-ocean-ice-human interactions. Topics include arctic hydrology, climatology, biogeochemical cycling, permafrost, glacier/ice sheet dynamics, terrestrial and marine ecology, sea ice, physical oceanography, and human-environment interactions. The course also gives students a perspective on arctic climate variability over past, present, and predicted future time scales.

The Climate System and Global Environmental Change (GEOG 263/363)

Clark University: Fall 2008, Fall 2009, Fall 2011, Fall 2012, Spring 2016, Spring 2017

Serving both upper-level undergraduate and graduate students, this course utilizes an Earth systems approach towards climate science. To this end, this course provides students an understanding of the climate system's overall response to both external and internal forcings, rather than simply cataloging the Earth's history of climate change. Earth's climate history is examined

at a range of time scales covering the entire 4.55 billion year period, with particular emphasis on major climate events and changes occurring on a global scale. The first portion of the course focuses on processes controlling *natural* variability of the Earth's climate system, while the latter portion of the course is geared towards *anthropogenic* climate change. In order to understand, contextualize, and predict the Earth's current and future climate, it is imperative to know the forces that can drive both these natural and anthropogenic climate changes.

Introduction to Geographic Information Science (GEOG 190/390)

Clark University: Fall 2007, Fall 2008

Geographic Information Science (GISci) has revolutionized the way we store, query, and analyze spatial data. In this course, students gain both a working knowledge of the theory and applications of raster and vector based GISci. Class meetings are a combination of both lecture material and laboratory exercises, making extensive use of the Idrisi software developed by Clark Labs and the ArcGIS software developed by Environmental Systems Research Institute (ESRI). Weekly laboratory exercises and a final independent project provide intensive hands-on exposure to GISci software. At the conclusion of this course, students have the ability to independently develop, manage, and complete a GISci project.

The Polaris Project Field Experience for Undergraduates (www.thepolarisproject.org)

Clark University: Summer 2008–2015

Although not an official Clark University course on record, the NSF-funded Polaris Project (taught and led by several scientists, including Frey) has taken undergraduates from multiple institutions across the country to the Northeast Science Station in Cherskiy, East Siberia over the past several summers since 2008. During the annual month-long field expedition to the Siberian Arctic, undergraduate students conduct cutting-edge investigations that advance scientific understanding of the changing Arctic. In particular, students focus on field measurements and laboratory analyses that further understanding of the transport and transformation of carbon and nutrients as they move with water from terrestrial uplands to the Arctic Ocean. Students develop independent field- and laboratory-based projects that they further develop alongside their advisors over subsequent semesters once at home institutions (typically as B.A. honors theses and M.A. theses).

Applications of Radar Remote Sensing (GEOG 322)

Clark University: Spring 2012

This graduate-level seminar focuses on the applications of satellite-based radar remote sensing to a full suite of Earth Science related fields. Radar remote sensing offers fundamentally different potential applications compared to optical remote sensing owing to its sensitivity to wetness and surface roughness as well as its independence from sunlight and cloud conditions. As such, radar remote sensing lends itself to a variety of fields, including the investigation of forest ecology, land cover/land use, soil moisture, snow and ice, hydrology, geomorphology, oceanography, and urban spaces. This seminar introduces students to both seminal and recent, cutting-edge research in the field of radar remote sensing. Students will additionally focus on independent research projects that will allow them to analyze and apply radar data within their particular fields of interest.

Emerging Issues in Climate Change Science/Controversies in Earth System Science (GEOG 378)

Clark University: Spring 2008, Spring 2009, Spring 2010, Spring 2014, Fall 2016

This graduate-level seminar examines emerging issues surrounding global climate change and Earth System Science. Climate Change Science is inherently interdisciplinary and processes within this field involve significant interactions between land, atmosphere, ocean, ice, and humans. Specific topics discussed in this seminar include abrupt climate change, biogeochemical cycling, biocomplexity, oscillatory climate phenomena, trace gas exchange, glacier/ice sheet dynamics, sea ice variability, sea level rise, paleoclimate, extreme weather events, and human-induced environmental change. Readings will be focused on the most recent climate literature, including the latest Intergovernmental Panel on Climate Change (IPCC) assessment reports. This seminar not only introduces students to recent, cutting-edge research, but given the sometimes controversial nature of these issues also gives students insight into the process of critically evaluating Climate Change Science studies.

Polar Environmental Change Research (GEOG 396)

Clark University: Spring 2011, Spring 2013, Spring 2016

Earth's polar regions are particularly vulnerable to observed and projected shifts in climate and act as harbingers of global change, as these regions are poised to warm more than any other region over the next century. This graduate-level seminar focuses on recent advances in polar environmental change research, providing a system-science approach to understanding land-ocean-atmosphere-ice-human interactions at high latitudes. Students also focus on independent research projects that can be contextualized within existing primary and cutting-edge polar science literature.

GIS in the Environmental Sciences (GEOL 204)

The College of William & Mary: Fall 2006, Spring 2007

This course provides an introduction to Geographic Information Systems (GIS). Emphasis is placed on hands-on application of GIS to create maps, organize and visualize spatial data, and query spatial data to elucidate answers to environmental

questions. Through reading and research, students gain an appreciation and understanding of the theory behind GIS. Through laboratory assignments and research projects, students gain practical working knowledge in the latest GIS technology and the ability to put theory into practice.

STUDENTS ADVISED (*denotes Frey as chair, **denotes Frey as committee member)

Ph.D. Dissertations

Luisa Young*, Clark University (Ph.D. in Geography, expected 2020)

TBD

Scott Odell**, Clark University (Ph.D. in Geography, expected 2019)

Bridge over Troubled Water: Assessing hydrosocial relations among communities, mining companies, and policymakers in Chile

Melishia Santiago*, Clark University (Ph.D. in Geography, expected 2018)

Observing and Understanding the Impacts of a Thinning and Retreating Sea Ice Cover on Light Propagation and Biogeochemistry in the Pacific Arctic Region

Ashley York*, Clark University (Ph.D. in Geography, expected 2018)

Investigating the Influence of Sea-Surface Variability on Ice Sheet Mass Balance and Outlet Glacier Behavior using Ice Core Records from Disko Bugt, West Greenland

Kristen Shake* (co-advised with D. Martin), Clark University (Ph.D. in Geography, expected 2017)

Polar Shift: Examining the Significance of Economic Development in the Context of a Changing Arctic Marine Environment

Aimee Neeley**, University of Maryland (Ph.D. in Marine Science, expected 2017)

Remote Sensing and Modeling of Primary Production in the Arctic Ocean

Claire Griffin**, University of Texas at Austin (Ph.D. in Marine Science, 2016)

Dissolved Organic Matter in major rivers across the pan-Arctic from remote sensing

Luke Trusel*, Clark University (Ph.D. in Geography, 2014)

Quantifying Antarctic Ice Sheet Surface Melt: Recent Dynamics and Future Trajectories

Qingling Wu**, Clark University (Ph.D. in Geography, 2013)

From Phenomena to Objects: Segmentation of Fuzzy Objects and its Application to Ocean Eddies

Prajjwal Panday*, Clark University (Ph.D. in Geography, 2013)

Cryospheric and Hydrological Processes in the Hindu Kush–Himalayan Region: An Assessment of Snowmelt Dynamics, Snowmelt Hydrology, and Multimodel Ensemble Climate Projections

M.A./M.S. Theses

Warren Scott*, Clark University (M.S. in GISci, 2017)

TBD

Nelson Crone*, Clark University (M.S. in GISDE, 2015)

Comparison of Sea Ice Classification Techniques using High Resolution WorldView-2 Imagery in the Chukchi and Beaufort Seas

Samuel Berman*, Clark University (M.S. in GISci, 2015)

Chromophoric Dissolved Organic Matter across a Marine Distributed Biological Observatory in the Pacific Arctic Region

Emily Sturdivant*, Clark University (M.S. in GISci, 2015)

Snowmelt Detection from QuikSCAT and ASCAT Satellite Radar Scatterometer Data across the Alaskan North Slope, 2000–2014

Lucas Earl**, Clark University (M.S. in GISci, 2015)

Satellite-Derived Glacier Area Change in North Asia: 1985–2014

Dylan Broderick*, Clark University (M.A. in GISci, 2013)

Below Ground Carbon Storage in the Kolyma River Basin, East Siberia Estimated Through In Situ and Satellite Observations

Meghan Helmberger*, Clark University (M.S. in Environmental Science & Policy, 2013)

Chromophoric Dissolved Organic Matter: A Spatial, Temporal, and Lake Morphological Exploration across the Alaskan North Slope

Christie Wood Logvinova*, Clark University (M.A. in Geography, 2012)

Impacts of a Melting Sea Ice Cover on the Biogeochemistry of the Chukchi and Beaufort Seas

Boyd Zapatka*, Clark University (M.A. in GISci, 2012)

Using Aerial and Satellite-Borne Radar Data and Ground-Based Measurements to Assess Soil Moisture Characteristics in the Anaktuvuk River Fire, Alaska

Blaize Denfeld*, Clark University (M.A. in GISci, 2011)

Carbon Processing in the Siberian Kolyma River Basin and its Role in CO₂ Evasion from Streams and Rivers
Michelle Bozeman **, Clark University (M.A. in GISci, 2009)
Greenland Ice Sheet Melt Dynamics Revealed From Seasonal Trend Analysis of QuikSCAT Image Time Series

B.A. Senior Honors Theses

Anela Layugan *, Clark University (B.A. in Earth System Science, expected 2017)
The Timing of Change-Points in Arctic Sea Ice at Different Spatial Scales and Locations
Saraneh Fitzgerald *, Clark University (B.A. in Geography, expected 2017)
A Time Series of Sea Ice Melt Pond Distribution across the Arctic
Warren Scott *, Clark University (B.A. in Geography, 2016)
Variability in Sea Ice in the St. Lawrence Island and Cape Bathurst Polynyas in the Pacific Arctic Region
Samuel Berman *, Clark University (B.A. in Earth System Science, 2014)
Thermokarst Lake Dissolved Organic Carbon Storage near Cherskiy, Northeast Siberia
Lucas Earl **, Clark University (B.A. in Geography, 2014)
A Glacier Inventory for North Asia
Emily Sturdivant *, Clark University (B.A. in Geography, 2013)
Detection of Arctic Lake Melt: Spatio-Temporal Variability for Six Lakes across the Alaskan North Slope from QuikSCAT, 2000–2009
Lauren Ziemer **, Clark University (B.A. in Earth System Science, 2013)
Land Cover and Land Use Change in Massachusetts in the Context of Socio-Economic Development, 1976–2009
Dylan Broderick *, Clark University (B.A. in Geography, 2012)
Using Landsat-5 TM and Field Data for Land Cover Classification and Terrestrial Carbon Stock Estimation along the Kolyma River near Cherskiy, Russia
Blaize Denfeld *, Clark University (B.A. in Earth System Science/Geography, 2010)
Recent Climate Trends in the Kolyma River Watershed and their Potential Influences on the Carbon Cycle
Claire Griffin *, Clark University (B.A. in Geography/Environmental Science, 2010)
Mapping Late Summer Dissolved Organic Matter in the Kolyma River Using Landsat TM and ETM+ Imagery
Boyd Zapatka *, Clark University (B.A. in Geography/Environmental Science, 2010)
Burn Scar Recognition in the Boreal Forest near Cherskiy, Russia Using Synthetic Aperture Radar and Landsat TM Data
Sara Coren *, The College of William & Mary (B.A. in Geology/Environmental Science, 2007)
Influence of Bedrock Geology on Debris Flow Initiation, Madison County, VA
Laura Sauls *, The College of William & Mary (B.A. in Int. Relations/Environmental Studies, 2007)
Green Aid Meets Grassroots Development: Explaining Environmental Aid Flows to Central America since the Rio Earth Summit
Matthew Wolak **, The College of William & Mary (B.A. in Biology/Environmental Science, 2007)
Modeling of a Diamondback Terrapin Population in Chesapeake Bay

Clark University Polaris Project Undergraduates (www.thepolarisproject.org/team/students/)

2013: Samuel Berman (Earth System Science, 2014)
Casey DeMarsico (Geography, 2014)
2012: Samuel Berman (Earth System Science, 2014)
Dylan Broderick (Geography, 2012)
2011: Dylan Broderick (Geography, 2012)
Emily Sturdivant (Geography, 2013)
2010: Blaize Denfeld (Earth System Science, 2010)
Cassandra Volatile-Wood (Earth System Science, 2012)
2009: Blaize Denfeld (Earth System Science, 2010)
Claire Griffin (Geography, 2010)
2008: Katherine Willis (Environmental Science & Policy, 2008)
Boyd Zapatka (Geography, 2010)

No. Undergraduate Advisees

2007–2008 (6), 2008–2009 (15), 2009–2010 (15), 2010–2011 (7), 2011–2012 (16), 2012–2013 (14), 2013–2014 (9), 2014–2015 (sabbatical), 2015–2016 (1), 2016–2017 (22)

STUDENT FELLOWSHIPS AND GRANTS SPONSORED

NASA Earth and Space Science Fellowship

pending

“Quantifying the Biogeochemical Impacts of Sea-ice Decline in the Western Arctic Ocean” submitted with Melishia Santiago to support her dissertation research at Clark University.

NSF Doctoral Dissertation Research Improvement Grant (2016 – 2017)

\$12,760

“The Uncertainties of Sea Ice: Socio-Legal Dynamics in a Changing Arctic Oceanscape” awarded to Kristen Shake (with Martin and Frey as co-PIs) to support her dissertation research at Clark University.

Edna Bailey Sussman Foundation Graduate Fellowship (2016)

\$6,775

“Climate change effects on dissolved organic matter distribution in the Pacific Arctic Region” awarded to Melishia Santiago to support her dissertation research at Clark University.

NASA Earth and Space Science Fellowship (2012 – 2015)

\$90,000

“Antarctic Surface Melting: Intensity, Climatology, and Driving Mechanisms” awarded to Luke Trusel (with Frey as PI) to support his dissertation research at Clark University.

NASA Earth and Space Science Fellowship (2010 – 2013)

\$90,000

“Cryospheric and Hydrological Processes in the Hindu Kush-Himalayan Region: Implications of Climate Change for Snowmelt Hydrology, Seasonal Snow Cover and Glaciated Regions” awarded to Prajjwal Panday (with Frey as PI) to support his dissertation research at Clark University.

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