

## **KAREN E. FREY**

Associate Professor

Graduate School of Geography, Clark University  
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### EDUCATION

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#### **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

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**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

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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 Environmental Biology (Long-Term Ecological Research)** **pending**  
“Preliminary Proposal: LTER: Physical, Biological and Biogeochemical Processes and Human Connections in the Pacific-Arctic Marine Ecosystem” with J. Grebmeier (Lead PI, Chesapeake Biological Laboratory), K. Frey (PI, Clark University), S. Danielson (PI, University of Alaska Fairbanks), V. Hill (PI, Old Dominion University), and H. Huntington (PI, Huntington Consulting).

**NASA Interdisciplinary Research in Earth Science Program (2014 – 2017)** **\$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 – 2017)** **\$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 – 2017)** **\$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 – 2016)** **\$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 – 2016)** **\$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 – 2016)** **\$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

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

## PUBLICATIONS: BOOKS, REFEREED

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Grebmeier, J. M., J. C. Prisco, 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

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**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

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**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 ([www.climatewatch.noaa.gov/article/2012/melt-pond-skylights-enable-massive-under-ice-bloom-in-arctic](http://www.climatewatch.noaa.gov/article/2012/melt-pond-skylights-enable-massive-under-ice-bloom-in-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 ([www.climatewatch.noaa.gov/article/2011/sea-ice-declines-boost-arctic-phytoplankton-productivity](http://www.climatewatch.noaa.gov/article/2011/sea-ice-declines-boost-arctic-phytoplankton-productivity))

**PUBLICATIONS: JOURNAL ARTICLES, REFEREED** (\*Ph.D. student author, \*\*M.S./M.A. student author, \*\*\*B.A. student author)

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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 (in press), Mass balance estimates of carbon export in different water masses of the Chukchi Sea shelf. *Deep-Sea Research II*.

Piper, M., C. Benitez-Nelson, **K. E. Frey**, M. Mills & S. Pal (in press), Dissolved and particulate phosphorus distributions and elemental stoichiometry throughout the Chukchi Sea. *Deep-Sea Research II*.

Hinkel, K., A. Townsend-Small, C. Arp & **K. Frey** (in press), Connecting geochemistry and hydrogeology of lakes in Arctic Alaska. *Permafrost and Periglacial Processes*.

Logvinova, C. L. \*\*, **K. E. Frey** & L. W. Cooper (in press), The role of sea ice melt in the distribution of chromophoric dissolved organic matter in the Chukchi and Beaufort seas. *Deep-Sea Research II*.

Cooper, L. W., **K. E. Frey**, C. L. Logvinova \*\*, D. M. Biasatti & J. M. Grebmeier (in press), 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*.

Schade, J. D., E. C. Seybold, T. Drake, W. V. Sobczak, **K. E. Frey**, R. M. Holmes & N. Zimov (in press), Variation in summer nitrogen and phosphorus uptake among Siberian headwater streams. *Polar Research*.

**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 Walruses and Indigenous Hunters. *Ecological Applications* 26, 24–41, doi:10.1890/15-0430.

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 21<sup>st</sup> century climate scenarios. *Nature Geoscience* 8, 927–932, doi:10.1038/ngeo2563 (6 pp.). (Cover Feature)

Polashenski, C., D. K. Perovich, **K. E. Frey**, L. W. Cooper, C. L. Logvinova \*\*, R. Dacic, 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 CO<sub>2</sub> 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 CO<sub>2</sub>-carbonate chemistry in the western Arctic Ocean: meltwater contributions to air-sea CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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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Das, S. B., I. Joughin, A. S. Criscitiello \*, B. Medley, H. Conway, M. J. Evans, **K. E. Frey**, J. McConnell, E. Steig & L. Trusel\*. Ice core records of 20<sup>th</sup> century climate change along the Amundsen Sea Embayment, West Antarctica. *First Open Science Conference of the International Partnerships in Ice Core Sciences (IPICS)*. Côte d'Azur, France, 1–5 October 2012.

Criscitiello, A. S. \*, S. Das, K. Karnauskas, M. J. Evans, **K. E. Frey**, I. Joughin, E. Stieg & J. McConnell. Tropical Pacific influence on source and transport of marine aerosols to West Antarctica. *First Open Science Conference of the International Partnerships in Ice Core Sciences (IPICS)*. Côte d'Azur, France, 1–5 October 2012.

Griffin, C. G. \*, J. W. McClelland, J. E. Vonk, R. M. Holmes & **K. E. Frey**. Chromophoric dissolved organic matter during the Mackenzie River spring freshet: Observations and freeze-thaw experiments. *2012 European Geosciences Union General Assembly*. Vienna, Austria, 22–27 April 2012.

Grebmeier, J. M., L. W. Cooper, M. K. Kedra, **K. E. Frey**, S. E. Moore, S. Vagle & E. Carmack. The Distributed Biological Observatory (DBO): Seasonal and interannual time series observations in the Pacific Arctic. *2012 International Polar Year (IPY) Conference*. Montréal, Canada, 22–27 April 2012.

Denfeld, B. A. \*\*, **K. E. Frey**, W. V. Sobczak & R. M. Holmes. Summer CO<sub>2</sub> evasion from streams and rivers in the Kolyma River basin, Northeast Siberia. *2012 International Polar Year (IPY) Conference*. Montréal, Canada, 22–27 April 2012.

Wood, C. L. \* & **K. E. Frey**. Optical characteristics of chromophoric dissolved organic matter associated with sea ice in the Chukchi and Beaufort Seas. *2012 International Polar Year (IPY) Conference*. Montréal, Canada, 22–27 April 2012.

Lenters J. D., K. M. Hinkel, C. D. Arp, B. Jones, **K. E. Frey**, G. Grosse, R. A. Beck, W. R. Eisner, C. Kim, H. Liu, A. Townsend-Small. Toward a circum-Arctic lakes observation network (CALON). *2012 American Water Resources Association Alaska Section Annual Conference: Alaska's Waters: Challenges and Opportunities*. Juneau, Alaska, 5–7 March 2012.

**Frey, K. E.**, L. W. Cooper, J. M. Grebmeier, B. Light, D. P. Mayer\*, D. K. Perovich, C. Polashenski, L. D. Trusel\* & C. L. Wood\*. Light transmission through ocean waters beneath melt-season sea ice in the Chukchi and Beaufort Seas. *2012 TOS/ASLO/AGU Ocean Sciences Meeting*. Salt Lake City, Utah, 20–24 February 2012.

Wood, C. L. \* & **K. E. Frey**. Optical characteristics of chromophoric dissolved organic matter associated with sea ice in the Chukchi and Beaufort Seas. *2012 TOS/ASLO/AGU Ocean Sciences Meeting*. Salt Lake City, Utah, 20–24 February 2012.

Polashenski, C., D. K. Perovich, **K. E. Frey**, C. L. Wood\*, B. Light, M. Webster, R. Dadic, L. D. Trusel\*, D. P. Mayer\* & H. Kelly. Morphological properties of the ice in the Chukchi and Beaufort Seas during the 2010 and 2011 ICESCAPE missions. *2012 TOS/ASLO/AGU Ocean Sciences Meeting*. Salt Lake City, Utah, 20–24 February 2012.

Jones, B. M., K. M. Hinkel, J. D. Lenters, G. Grosse, C. D. Arp, R. A. Beck, W. E. Eisner, **K. E. Frey**, H. Liu, C. Kim, A. Townsend-Small. Towards a Circum-Arctic Lakes Observation Network (CALON). *AGU Chapman Conference on Remote Sensing of the Terrestrial Water Cycle*. Kona, Hawaii, 19–22 February 2012.

**Frey, K. E.**, J. M. Grebmeier, L. W. Cooper, C. L. Wood\* & P. K. Panday\*, Trends in Sea Ice Cover, Sea Surface Temperature, and Chlorophyll Biomass across a Marine Distributed Biological Observatory in the Pacific Arctic Region. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Trusel, L. D. \*, **K. E. Frey**, S. B. Das, Antarctic surface and subsurface melting dynamics: Enhanced perspectives from radar scatterometer data. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Mayer, D. P. \* & **K. E. Frey**, Measuring Seasonal Variations of East Siberian Thermokarst Lake Areas using PALSAR Data. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Panday, P. K. \*, J. M. Thibeault & **K. E. Frey**, A multi-model analysis of changing climate in the Hindu Kush-Himalayan region using CMIP3 projections for temperature and precipitation. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Griffin, C. G. \*, J. W. McClelland, R. M. Holmes, **K. E. Frey** & J. E. Vonk, Variations in CDOM concentration and quality during the spring freshet on the Mackenzie River. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Tank, S. E., P. Raymond, R. G. Striegl, **K. E. Frey**, J. W. McClelland, R. M. Holmes, B. J. Peterson, Basin-scale Controls on the Flux of Dissolved Inorganic Carbon across Diverse Circumpolar Watersheds. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

**INVITED:** Grebmeier, J. M., S. E. Moore, L. W. Cooper, **K. E. Frey**, R. S. Pickart, The Distributed Biological Observatory (DBO) – A Change Detection Array in the Pacific Arctic Sector. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Criscitello, A. \*, S. B. Das, M. Evans, **K. E. Frey**, I. R. Joughin, B. Medley, H. Conway, Sea-ice behavior and biological productivity in the Amundsen Sea: New insight from West Antarctic Ice Sheet records. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Hinkel, K. M., J. D. Lenters, G. Grosse, C. D. Arp, B. Jones, R. A. Beck, W. R. Eisner, **K. E. Frey**, H. Liu, C. Kim, A. Townsend-Small. Initial Results from the Circumarctic Lakes Observation Network (CALON) Project. *2011 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2011.

Lenters, J., K. Hinkel, C. Arp, R. Beck, W. Eisner, **K. E. Frey**, G. Grosse, H. Liu, B. Potter & A. Townsend-Small. The Circumarctic Lakes Observation Network (CALON): A new opportunity for GLEON expansion on the Arctic Coastal Plain of northern Alaska. *Global Lake Ecological Observatory Network (GLEON) 13 Meeting*. Lake Sunapee, New Hampshire, 10–14 October, 2011.

Denfeld, B. A. \*\*, **K. E. Frey**, R. M. Holmes & W. V. Sobczak, Outgassing of CO<sub>2</sub> from streams and rivers in the Kolyma River basin, Northeast Siberia. *2011 Association of American Geographers Meeting*, Seattle, Washington, 12–16 April 2011.

Trusel, L. D. \*, **K. E. Frey** & S. B. Das, Quantifying the extent, duration, and intensity of surface melting across the Antarctic Ice Sheet, 1999–2009. *2011 Association of American Geographers Meeting*, Seattle, Washington, 12–16 April 2011.

**Frey, K. E.**, J. M. Grebmeier, L. W. Cooper, C. L. Wood\* & P. K. Panday\*, Satellite-Derived Trends across a Marine Distributed Biological Observatory in the Pacific Arctic Region. *2011 Arctic Science Summit Week*, Seoul, Korea, 27 March – 1 April 2011.

Grebmeier, J. M., L. W. Cooper & **K. E. Frey**, Biological Time Series Observations in the Pacific Arctic. *2011 Arctic Science Summit Week*, Seoul, Korea, 27 March – 1 April 2011.

Wood, C. L. \* & **K. E. Frey**, Optical characteristics of chromophoric dissolved organic matter associated with first-year sea ice in the Chukchi Sea. *Gordon Research Conference on Polar Marine Science*, Ventura, California, 20–25 March 2011.

**Frey, K. E.**, C. L. Wood\*, L. D. Trusel\*, L. W. Cooper & J. M. Grebmeier, Optical properties of ocean waters beneath melt-season first-year sea ice in the Chukchi Sea. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Griffin, C. G. \*\*\*, **K. E. Frey**, J. Rogan & R. M. Holmes, Late summer variability of dissolved organic matter in the Kolyma River observed using satellite imagery. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Denfeld, B. A. \*\*, **K. E. Frey**, E. B. Bulygina, T. Drake, R. M. Holmes, J. D. Schade, W. V. Sobczak & N. Zimov, Carbon processing in the Kolyma River Watershed and the role it plays in CO<sub>2</sub> outgassing. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Zapatka, B. \*\*, **K. E. Frey**, K. M. Barrett & J. Rogan, Using aerial and satellite-borne radar data and ground-based measurements to assess soil moisture characteristics in the Anaktuvuk River Fire, Alaska. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Wegner, C., A. Forest, M. Forwick, **K. E. Frey**, J. T. Mathis, C. Michel, A. Nikolopoulos, M. O'Regan, I. Peeken & M. Reigstad, Arctic in Rapid Transition (ART): Integrating priorities for Arctic marine science over the next decade. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Polashenski, C., D. K. Perovich, K. Claffey, **K. E. Frey**, L. D. Trusel\* & C. Wood\*, The fresh meltwater in the sea ice system. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Chandra, S., J. Heslop\*\*\*, W. V. Sobczak, J. D. Schade, V. Spektor, R. M. Holmes, A. G. Bunn, E. B. Bulygina, K. M. Walter Anthony, **K. E. Frey**, N. Zimov & S. A. Zimov, Nutrient limitation of a thermokarst lake and large river ecosystem in the Kolyma River basin (Russia). *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

Heslop, J. <sup>\*\*\*</sup>, S. Chandra, W. V. Sobczak, V. Spektor, A. Davydova, R. M. Holmes, E. B. Bulygina, J. D. Schade, **K. E. Frey**, A. G. Bunn, K. M. Walter Anthony, S. A. Zimov & N. Zimov, Quantifying Carbon Bioavailability in Northeast Siberian Soils. *2010 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2010.

**INVITED:** Grebmeier, J. M., L. W. Cooper, **K. E. Frey** & S. E. Moore, Pacific Arctic Sector: Biological and ecosystem response to climate warming. *Second International Symposium on Arctic Research*. Tokyo, Japan, 7–9 December 2010.

Das, S., **K. Frey** & I. Joughin, Ruminations on the history and role of sea-surface variability in West Antarctic Ice Sheet (WAIS) behavior. *2010 West Antarctic Ice Sheet Workshop*. Raystown, PA, 22–25 September 2010.

Criscitello, A. <sup>\*</sup>, S. Das, B. Medley, I. Joughin, H. Conway, M. Evans, **K. Frey**, Physical and chemical stratigraphy of snow pits on the West Antarctic Ice Sheet: Preliminary implications for sea-ice reconstruction. *2010 West Antarctic Ice Sheet Workshop*. Raystown, PA, 22–25 September 2010.

Panday, P. K. <sup>\*</sup> & **K. E. Frey**, Detection of the timing and intensity of snowmelt in the Hindu Kush-Himalaya using QuikSCAT (2000–2008). *2010 Association of American Geographers Meeting*. Washington, DC, 14–18 April 2010.

Denfeld, B. A. <sup>\*\*\*</sup> & **K. E. Frey**, Impacts of watershed characteristics on the biogeochemistry of the Kolyma River basin, Northeast Siberia. *2010 Association of American Geographers Meeting*. Washington, DC, 14–18 April 2010.

Griffin, C. G. <sup>\*\*\*</sup>, **K. E. Frey** & J. R. Rogan, Modeling dissolved organic matter in northeastern Siberian lakes and rivers using Landsat TM and ETM+ satellite imagery. *2010 Association of American Geographers Meeting*. Washington, DC, 14–18 April 2010.

**Frey, K. E.**, J. Mathis, C. Michel, A. Nikolopoulos, M. O'Regan, M. Reigstad & C. Wegner, The Arctic in Rapid Transition (ART) Initiative: Integrating Priorities for Arctic Marine Science Over the Next Decade. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Moore, S. E., J. M. Grebmeier, J. E. Overland, **K. E. Frey** & R. Gradinger, Linking Biology to Physics in an Arctic Ocean Observing System. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Denfeld, B. A. <sup>\*\*\*</sup>, **K. E. Frey**, E. B. Bulygina, A. Bunn, S. Chandra, S. Davydov, R. M. Holmes, J. Schade, W. Sobczak, V. Spektor & S. Zimov, Impacts of Watershed Characteristics on the Biogeochemistry of the Kolyma River Basin, Northeast Siberia. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Drake, T. <sup>\*\*\*</sup>, E. Seybold <sup>\*\*\*</sup>, J. Schade, E. Bulygina, A. Bunn, S. Chandra, S. Davydov, **K. Frey**, R. Holmes, W. Sobczak, V. Spektor & S. Zimov, Transient Storage, Discharge, and Nutrient Uptake in Streams of the Kolyma River Basin. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Griffin, C. G. <sup>\*\*\*</sup>, **K. E. Frey**, E. B. Bulygina, A. Bunn, S. Chandra, S. Davydov, R. M. Holmes, J. Schade, W. Sobczak & V. Spektor, Modeling Dissolved Organic Matter in Northeastern Siberian Lakes and Rivers Using Landsat TM and ETM+ Satellite Imagery. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010

Heslop, J. <sup>\*\*\*</sup>, V. Spektor, N. Torgovkin <sup>\*\*\*</sup>, S. Chandra, R. Holmes, E. Bulygina, A. Bunn, **K. Frey**, J. Schade, W. Sobczak, S. Zimov, N. Zimov & S. Davydov. Comparison of Three Permafrost Profiles along a Small Subwatershed in North Siberia. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Hough, M. A. <sup>\*\*\*</sup>, **K. Frey**, W. Sobczak, A. Bunn, E. Bulygina, S. Chandra, S. Davydov, R. Holmes, J. Schade, V. Spektor & S. Zimov, Potential Impacts of Permafrost Degradation on Carbon Storage of Peat Soils in the Kolyma River Basin, East Siberia. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Seybold, E. <sup>\*\*\*</sup>, T. Drake <sup>\*\*\*</sup>, J. Schade, E. Bulygina, A. Bunn, S. Chandra, S. Davydov, **K. Frey**, R. Holmes, W. Sobczak, V. Spektor & S. Zimov, Assessing Biogeochemical Cycling and Transient Storage of Surface Water in Eastern Siberian Streams Using Short-Term Solute Additions. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Spektor, V., E. Bulygina, A. Bunn, S. Chandra, S. Davydov, **K. Frey**, R. Holmes, J. Schade, W. Sobczak & A. Falina <sup>\*\*\*</sup>, On Genesis of the Lower Kolyma Edoma Based on New AMS 14C Dates from Duvanny Yar. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

Zapatka, B. J.<sup>\*\*\*</sup> & **K. E. Frey**, Using Landsat and Radar Satellite Data to Assess Burn Severity of Two Fires in East Siberia Using a Differenced Normalized Burn Ratio Approach. *2010 State of the Arctic Meeting*. Miami, Florida, 16–19 March 2010.

**INVITED: Frey, K. E.**, L. W. Cooper, J. M. Grebmeier & P. K. Panday<sup>\*</sup>, Impacts of recent sea ice variability on biological productivity in the Pacific Arctic sector. *2010 Ocean Sciences Meeting*. Portland, Oregon, 22–26 February 2010.

Grebmeier, J. M., S. E. Moore, **K. E. Frey**, R. J. Nelson, L. W. Cooper, The Pacific Arctic sector: Biological and ecosystem response to climate warming. *2010 Ocean Sciences Meeting*. Portland, Oregon, 22–26 February 2010.

**INVITED: Frey, K. E.** Impacts of permafrost degradation on the riverine delivery of organic matter, inorganic nutrients, and major ions to the Arctic Ocean. *2009 Fall American Geophysical Union Meeting*. San Francisco, California, 14–18 December 2009.

**Frey, K. E.**, E. B. Bulygina, A. Bunn, S. Chandra, S. Davydov, R. M. Holmes, J. Schade, W. Sobczak, V. Spektor & S. Zimov, Ultraviolet-visible absorption spectra of chromophoric dissolved organic matter (CDOM) in waters throughout the Kolyma River basin, East Siberia. *2009 Fall American Geophysical Union Meeting*. San Francisco, California, 14–18 December 2009.

Bulygina, E. B., S. Davydov, A. Davydova, **K. Frey**, L. Russell-Roy<sup>\*\*</sup>, A. Bunn, S. Chandra, J. Schade, W. Sobczak, V. Spektor, S. Zimov & R. M. Holmes, Application of absorption spectrophotometry to the study of the seasonal dynamics of dissolved organic matter in Arctic streams. *2009 Fall American Geophysical Union Meeting*. San Francisco, California, 14–18 December 2009.

Schade, J. D., E. Seybold<sup>\*\*\*</sup>, T. Drake<sup>\*\*\*</sup>, K. Bulygina, A. Bunn, S. Chandra, S. Davydov, **K. Frey**, R. M. Holmes, W. Sobczak, V. Spektor & S. Zimov, Assessing biogeochemical cycling and transient storage of surface water in eastern Siberia using short-term solute additions. *2009 Fall American Geophysical Union Meeting*. San Francisco, California, 14–18 December 2009.

Sobczak, W. V., E. Bulygina, A. Bunn, S. Chandra, **K. Frey**, R. M. Holmes, J. Schade, V. Spektor, N. Zimov & S. Zimov, Bioavailability of organic matter in aquatic environments throughout Siberia's Kolyma River watershed during summer baseflow. *2009 Fall American Geophysical Union Meeting*. San Francisco, California, 14–18 December 2009.

Bozeman, M.<sup>\*\*</sup>, **K. Frey**, R. Eastman & J. Rogan, Greenland ice sheet melt dynamics revealed from Seasonal Trend Analysis of QuikSCAT image time series. *The Arctic Freshwater Budget International Symposium*, Nuuk, Greenland, 25–27 August 2009.

**Frey, K. E.** Impacts of terrestrial permafrost degradation on biogeochemical fluxes to the Arctic Ocean. *2009 Arctic Science Summit Week Symposium*, Bergen, Norway, 23–28 March 2009.

**Frey, K. E.**, L. W. Cooper, J. M. Grebmeier & P. K. Panday<sup>\*</sup>, Impacts of recent sea ice decline on biological productivity in the northern Bering and Chukchi Seas. *2009 Arctic Science Summit Week Symposium*, Bergen, Norway, 23–28 March 2009.

Grebmeier, J. M., L. W. Cooper, **K. E. Frey**, M. Janout & J. E. Lovvorn, Organic carbon export and benthic population dynamics with changing ice conditions in the northern Bering Sea. *2009 Arctic Science Summit Week Symposium*, Bergen, Norway, 23–28 March 2009.

Bozeman, M.<sup>\*\*</sup>, R. Eastman & **K. Frey**, Satellite-derived QuikSCAT radar scatterometer time series of Greenland ice sheet melt (2000–2007). *2009 Association of American Geographers Meeting*. Las Vegas, Nevada, 22–27 March 2009.

Panday, P. K.<sup>\*</sup>, H. N. Bulley, U. Haritashya, **K. Frey** & J. Rogan, Supra-glacial lake classification in the Sagarmatha region of Nepal Himalaya. *2009 Association of American Geographers Meeting*. Las Vegas, Nevada, 22–27 March 2009.

Cooper, L. W., M. Janout, **K. E. Frey**, R. Pirtle-Levy, J. M. Grebmeier, & J. R. Lovvorn, Progression of the spring bloom in the northern Bering Sea and transmission of particulates to the sea floor. *Alaska Marine Science Symposium*, Anchorage, Alaska, 19–23 January 2009.

**Frey, K. E.**, L. W. Cooper & J. M. Grebmeier, Recent trends in sea ice-associated phytoplankton blooms in the northern Bering and Chukchi Seas. *2008 Fall American Geophysical Union Meeting*. San Francisco, California, 15–19 December 2008.



Holmes, R. M., J., Beld, E. Bulygina, A. Bunn, S. Chandra, **K. Frey**, J. Schade, V. Spektor, W. Sobczak, K. Walter & S. Zimov, The Polaris Project: Rising Stars in the Arctic. *2008 Fall American Geophysical Union Meeting*. San Francisco, California, 15–19 December 2008.

Willis, K. S. <sup>\*\*\*</sup>, K. R. Abbott <sup>\*\*\*</sup>, E. Bulygina, **K. E. Frey**, R. M. Holmes & J. D. Schade, Biogeochemical characteristics of Siberia's Kolyma River watershed in relation to climate warming and permafrost degradation. *2008 Fall American Geophysical Union Meeting*. San Francisco, California, 15–19 December 2008.

Cooper, L. W., M. Janout, J. M. Grebmeier, **K. E. Frey**, R. Pirtle-Levy & J. R. Lovvorn, Progression of the spring bloom in the northern Bering Sea and transmission of particulates to the sea floor. *2008 ASLO Ocean Sciences Meeting*, Orlando, Florida, 2–7 March 2008.

**INVITED: Frey, K. E.**, L. W. Cooper & J. M. Grebmeier, A shift in the northern Bering Sea carbon sink: Linkages between spring phytoplankton blooms and seasonal sea ice retreat. *2008 Association of American Geographers Meeting*. Boston, Massachusetts, 15–19 April 2008.

**Frey, K. E.**, L. W. Cooper & J. M. Grebmeier, Satellite-derived distribution of surface chlorophyll biomass and its relation to variability in sea ice cover in the northern Bering Sea. *2007 Fall American Geophysical Union Meeting*. San Francisco, California, 10–14 December 2007.

**Frey, K. E.**, L. W. Cooper & J. M. Grebmeier, Impacts of sea ice variability on biological productivity in the northern Bering Sea. *2007 Arctic Science Summit Week Symposium*. Hanover, New Hampshire, 14–20 March 2007.

**INVITED: Frey, K. E.** & L. C. Smith, Impacts of warming on carbon cycling in northern peatlands. *2006 Geological Society of America Annual Meeting*. Philadelphia, Pennsylvania, 22–25 October 2006.

**Frey, K. E.**, D. I. Siegel & L. C. Smith, Effects of permafrost degradation on the river transport of solutes to the Kara Sea. *2005 Fall American Geophysical Union Meeting*. San Francisco, California, 5–9 December 2005.

**Frey, K. E.**, L. C. Smith & D. I. Siegel, Predicted increases in river transport of carbon and solutes from West Siberia to the Arctic Ocean. *Second International Conference on Arctic Research Planning*. Copenhagen, Denmark, 10–12 November 2005.

**Frey, K. E.** Field-based research in West Siberia 1999–2001: Logistics and lessons learned. *NSF Russian American Initiative for Land-Shelf Environments (RAISE) Workshop for Facilitating U.S. and Russian Research Collaborations in the Arctic*. St. Thomas, U.S. Virgin Islands, 11–16 June 2005.

**Frey, K. E.** & L. C. Smith, Impacts of warming and permafrost degradation on the export of carbon and solutes from West Siberia to the Arctic Ocean. *3<sup>rd</sup> Annual NSF Arctic System Science (ARCSS) Freshwater Initiative (FWI) All-Hands Meeting*. Seattle, Washington, 1–3 June 2005

**Frey, K. E.** & L. C. Smith, Amplified carbon release from vast West Siberian peatlands by 2100. *2004 Fall American Geophysical Union Meeting*. San Francisco, California, 13–17 December 2004.

**Frey, K. E.** & L. C. Smith, Increased release of carbon from West Siberian peatlands by 2100. *First Symposium for the Earth System Scholars Network (a NASA-sponsored symposium)*. Adelphi, Maryland, 27–29 September 2004.

**Frey, K. E.** & L. C. Smith, Dissolved organic carbon in peatland watersheds of West Siberia. *34<sup>th</sup> Annual International Arctic Workshop 2004*. Institute of Arctic & Alpine Research. Boulder, Colorado, 11–13 March 2004.

**Frey, K. E.**, L. C., Smith, G. M. MacDonald, O. Borisova, K. Kremenetski & A. Velichko, Dissolved organic carbon export from West Siberian peatlands. *2002 Fall American Geophysical Union Meeting*. San Francisco, California, 6–10 December 2002.

**Frey, K. E.**, L. C. Smith, G. M. MacDonald, A. Velichko, O. Borisova & K. Kremenetski, Surface water biogeochemistry of West Siberian peatlands and linkages to carbon accumulation and export. *NSF Arctic System Science (ARCSS) Program All Hands Workshop*. Seattle, Washington, 20–23 February 2002.

**Frey, K. E.,** L. C. Smith, G. M. MacDonald, A. A. Velichko, O. K. Borisova & K. V. Kremenetski, Peatland and river water biogeochemistry of the West Siberian Plain. *2001 Fall American Geophysical Union Meeting*. San Francisco, California, 10–14 December 2001.

**Frey, K. E.,** L. C. Smith, G. M. MacDonald, A. Velichko, O. Borisova, K. Kremenetski, Surface water biogeochemistry of West Siberia: Implications for carbon accumulation. *International Field Symposium, West Siberian Peatlands and Carbon Cycle: Past and Present*. Noyabrsk, Russia, 18–22 August 2001.

**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

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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

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**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

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- 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](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](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](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](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

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### Positions Held:

- *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–present)
- *Interagency Arctic Research Policy Committee (IARPC) Distributed Biological Observatory (DBO) Team Member* (2012–present), 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
- *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 on the Workshop: Frontiers in Understanding Climate Change and Polar Ecosystems* (2010–2011)
- *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>)
- *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:

- *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 AOOS 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

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## 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)

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## 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)

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**Clark University:**

Editorial Advisory Board

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:**

Edna Bailey Sussman Foundation Review Committee

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)

Graduate Admissions Committee

2015–2016

2013–2014/Chair

2012–2013/Chair

2011–2012/Chair

2010–2011

2009–2010

Facilitated and organized the filming of two promotional films (ESS/GISci) for the GSG

2015–2016

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

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### **Arctic System Science (GEOG 119)**

*Clark University: Spring 2008, Spring 2009, Spring 2010, Spring 2011, Spring 2012*

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*

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](http://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*

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)

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### **Ph.D. Dissertations**

Melishia Santiago\*, Clark University (Ph.D. in Geography, expected 2017)

*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 2017)

*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 2016)

*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 2016)

*Remote Sensing and Modeling of Primary Production in the Arctic Ocean*

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

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 CO<sub>2</sub> 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**

- Warren Scott\*, Clark University (B.A. in Geography, expected 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/](http://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)

**STUDENT FELLOWSHIPS AND GRANTS SPONSORED**

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**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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