

## BIOGRAPHICAL SKETCH

March, 2017

### Michael Steele

Senior Principal Oceanographer  
Polar Science Center, Applied Physics Laboratory  
University of Washington, Seattle, WA 98105

Phone: (206) 543-6586  
Fax: (206) 616-3142  
Email: mas@apl.washington.edu

### Education

1987 PhD: Geophysical Fluid Dynamics, Princeton University, Princeton, NJ  
1981 BA (Phi Beta Kappa): Physics, Reed College, Portland, OR

### Experience

2011-present Senior principal oceanographer, Polar Science Center, Seattle, WA  
1997-2010 Senior oceanographer, Polar Science Center, Seattle, WA  
1996-1999 Chairman, Polar Science Center  
1987-1997 Oceanographer, Polar Science Center  
1982-1987 Assistant in Research, Geophysical Fluid Dynamics Lab, Princeton, NJ  
1980 Research Assistant, Goddard Institute for Space Studies, New York, NY

### Community Service

#### Committees, Panels, Chairs:

2009-ongoing Lead organizer: FAMOS/AOMIP School for arctic marine modeling  
2016-ongoing Review board member: EU project "Blue Action"  
2016 Organizer: 2 SF AGU sessions: (i) sea ice and (ii) sea surface temperature  
2015 Organizer: SF AGU sea ice session in coupled climate systems  
2013 Review board member: Multi-institutional Danish project "NAACOS"  
2006-2012 Member, SEARCH Science Steering Committee  
2002-2012 Member, Polar Advisory Group, PoDAG (NASA)  
2002-2011 Member, ARCSS Hydrology Science Steering Comm., CHAMP (NSF)  
2010 Member, SEARCH Understanding Change Task Force (NSF)  
2007-2010 Ocean/Ice Section Leader, USARC Scaling Study  
2006-2009 Member, ARCSS Committee (NSF)  
2008 Co-organizer, Arctic Ocean Circulation Workshop, JPL, Oct'08  
2007 Co-chair, Freshwater in the Arctic session (AGU mt., SF, CA)  
2006 Member, SEARCH Data Management Working Group (NSF)  
2005-2006 Member, SEARCH Observing Change panel (NSF)  
2004-2007 Member, ARCUS Advisory Board  
2006 Co-chair, Arctic shelf processes session (AGU Ocean Sci. mtg., Honolulu)  
2004 Co-chair, Freshwater in the Arctic session (AGU mtg., S.F., CA)  
2000-2004 Member, ARCSS OAI Science Steering Committee (NSF)  
2002 Co-chair, Arctic model-data comparison workshop (ACSYS/IARC)  
2002 Co-chair, High latitude ocean processes Chapman conference (AGU)  
1999-2000 Member, Committee on NASA's Polar Geophysical Data Sets (NRC)

### Other:

1999-ongoing	Developer of the ocean database PHC (last major update spring, 2005): ( <a href="http://psc.apl.washington.edu/Climatology.html">http://psc.apl.washington.edu/Climatology.html</a> )
ongoing	Reviewer for JGR, GRL ( <i>excellence in reviewing</i> , 2012), Polar Research, DSR, ARCUS student research award, NSF, NASA and other agencies.
ongoing	Lectures and demonstrations in K-12 schools, colleges, and museums.
2012-2013	Lead science consultant, Arctic buoy exhibit at Pacific Science Center
2007-2010	Leader, “Dylan the Arctic Diatom” educational cartoon development team
2004-2011	Quarterly lecture in General Environmental Science 215 at the Art Institute of Seattle; material provided for student term papers
2005-2006	Leader, Art Institute of Seattle – Polar Science Center student internship program. Pilot project: “The Life of Sea Ice” video

### **Observational Program Experience**

2012-ongoing	SIZRS: Air-deployed buoy observations of upper ocean temperature
2010-ongoing	UpTempO: Upper ocean temperature measurement by drifting buoys
2010-2013	Arctic bio-optical ARGO floats deployed in the Greenland Sea
2012-2013	MIZOPEX: UAV and buoy observations of upper ocean and sea ice
2007	Baffin Bay hydrographic sampling in collaboration with narwhal studies
2003-2013	Switchyard Project
2000-2014	North Pole Environmental Observatory (NPEO)
1995	Scientific Ice Expeditions (SCICEX’95)
1991	Lead Experiment (LEADEX) Pilot Study
1988	Coordinated Eastern Arctic Experiment (CEAREX)

### **Employees (as of 2017)**

W. Ermold (*part time*): field scientist, scientific programmer  
K. Colburn (*part time*): project coordinator, initial data processing  
S. Dickinson (*part time*): scientific programmer

### **Peer-Reviewed Publications**

- (99) Ma, B., M. Steele, and C. M. Lee, Ekman circulation in the Arctic Ocean: Beyond the Beaufort Gyre, *J. Geophys. Res.*, *in press*, **2017**.
- (98) Cottier, F., Steele, M. and Nilsen, F., Sea ice and Arctic Ocean oceanography, in *Sea Ice* (ed D. N. Thomas), *John Wiley & Sons, Ltd, Chichester, UK*, doi: 10.1002/9781118778371.ch7, **2017**.
- (97) Castro, S., G. Wick, and M. Steele, Validation of satellite sea surface temperature analyses in the Beaufort Sea using UpTempO buoys, *Rem. Sens. Environ.*, *187*, doi:10.1016/j.rse.2016.10.035, **2016**.
- (96) Zhang, J., M. Steele, K. Runciman, S. Dewey, J. Morison, C. Lee, L. Rainville, S. Cole, R. Krishfield, M.-L. Timmermans, and J. Toole, The Beaufort Gyre intensification and stabilization: A model-observation synthesis, *J. Geophys. Res.*, *121*, doi:10.1002/2016JC012196, **2016**.
- (95) Steele, M. and S. Dickinson, The phenology of Arctic Ocean surface warming, *J. Geophys. Res.*, *121*, doi:10.1002/2016JC012089, **2016**.

- (94) Zhang, J., H. Stern, B. Hwang, A. Schweiger, M. Steele, and M. Stark, Modeling the seasonal evolution of the Arctic sea ice floe size distribution, *Elem Sci Anth*, 4, doi: [10.12952/journal.elementa.000126](https://doi.org/10.12952/journal.elementa.000126), **2016**.
- (93) Proshutinsky, A., M. Steele, and M.-L. Timmermans, Forum for Arctic Modeling and Observational Synthesis (FAMOS): Past, current, and future activities, *J. Geophys. Res.*, 121, doi:[10.1002/2016JC011898](https://doi.org/10.1002/2016JC011898), **2016**.
- (92) Ding, Y., J. A. Carton, G. A. Chepurin, M. Steele, and S. Hakkinen, Seasonal heat and freshwater cycles in the Arctic Ocean in CMIP5 coupled models, *J. Geophys. Res.*, 121, doi:[10.1002/2015JC011124](https://doi.org/10.1002/2015JC011124), **2016**.
- (91) Bieniek, Peter, U. Bhatt, D. Walker, M. Raynolds, J. Comiso, H. Epstein, J. Pinzon, C. Tucker, R. Thoman, H. Tran, N. Mölders, M. Steele, J. Zhang, and W. Ermold, The role of climate drivers in the seasonality of Alaska coastal tundra vegetation change, *Earth Interactions*, doi:[10.1175/EI-D-15-0013.1](https://doi.org/10.1175/EI-D-15-0013.1), **2015**.
- (90) Steele, M., and W. Ermold, Loitering of the retreating sea ice edge in the Arctic Seas, *J. Geophys. Res. Oceans*, 120, 7699–7721, doi:[10.1002/2015JC011182](https://doi.org/10.1002/2015JC011182), **2015**.
- (89) Doherty, S., M. Steele, I. Rigor, and S. G. Warren, Springtime light-absorbing particles in snow north of Greenland 2008-2013, *J. Geophys. Res.*, 120, doi:[10.1002/2015JD024018](https://doi.org/10.1002/2015JD024018), **2015**.
- (88) Zhang, J., A. Schweiger, M. Steele, and H. Stern, Sea ice floe distribution in the marginal ice zone: Theory and numerical experiments, *J. Geophys. Res.*, 120, doi:[10.1002/2015JC010770](https://doi.org/10.1002/2015JC010770), **2015**.
- (87) Zhang, J., C. Ashjian, R. Campbell, Y. Spitz, M. Steele, and V. Hill, The influence of sea ice and snow cover and nutrient availability on the formation of massive under-ice phytoplankton blooms in the Chukchi Sea, *Deep Sea Res. II*, doi:[10.1016/j.dsr2.2015.02.008](https://doi.org/10.1016/j.dsr2.2015.02.008), **2015**.
- (86) Steele, M., S. Dickinson, J. Zhang, and R. Lindsay, Seasonal ice loss in the Beaufort Sea: Toward synchrony and prediction, *J. Geophys. Res.*, 120, [10.1002/2014JC010247](https://doi.org/10.1002/2014JC010247), **2015**.
- (85) Timmermans, M.-L., I. Ashik, I. Frolov, H. K. Ha, R. Ingvaldsen, T. Kikuchi, T. W. Kim, R. Krishfield, H. Loeng, S. Nishino, R. Pickart, I. Polyakov, B. Rabe, U. Schauer, P. Schlosser, W. M. Smethie, V. Sokolov, M. Steele, J. Toole, W. Williams, R. Woodgate, and S. Zimmermann, The Arctic, g. Ocean temperature and salinity [in “State of the Climate 2013”], *Bull. Amer. Meteor. Soc.*, 95(7), S128-132, **2014**.
- (84) Martin, T., M. Steele, and J. Zhang, Seasonality and long-term trend in Arctic Ocean surface stress in a model, *J. Geophys. Res.*, 119, [10.1002/2013JC009425](https://doi.org/10.1002/2013JC009425), **2014**.
- (83) Zhang, J., C. Ashjian, R. Campbell, V. Hill, Y. Spitz, and M. Steele, The great 2012 Arctic Ocean summer cyclone enhanced productivity on the shelves, *J. Geophys. Res.*, 119, [10.1002/2013JC009301](https://doi.org/10.1002/2013JC009301), **2014**.
- (82) Lique, C., J. Guthrie, M. Steele, A. Proshutinsky, J. H. Morison, and R. Krishfield, Diffusive vertical heat flux in the Canada Basin of the Arctic Ocean inferred from moored instruments, *J. Geophys. Res.*, 119, [10.1002/JC009346](https://doi.org/10.1002/JC009346), **2014**.
- (81) Jackson, J. M., C. Lique, M. Alkire, M. Steele, C. M. Lee, W. M. Smethie, and P. Schlosser, The origin of waters that flow through Nares Strait, Arctic Ocean, from 1991-2010, *Cont. Shelf Res.*, 73, [10.1016/j.csr.2013.11.025](https://doi.org/10.1016/j.csr.2013.11.025), **2014**.
- (80) Clement Kinney J., Maslowski W., Aksenov Y., de Cuevas B., Jakacki J., Nguyen A., Osinski R., Steele M., Woodgate R.A., Zhang J., On the flow through Bering Strait: A synthesis of model results and observations, In: The Pacific Arctic Region: Ecosystem Status and Trends in a Rapidly Changing Environment, J. M. Grebmeier and W. Maslowski, eds., *Springer Netherlands*, [10.1007/978-94-017-8863-2\\_7](https://doi.org/10.1007/978-94-017-8863-2_7), **2014**.
- (79) Timmermans, M.-L., A. Proshutinsky, I. Ashik, Y. Cao, I. Frolov, R. Ingvaldsen, T. Kikuchi, R. Krishfield, H. Loeng, S. Nishino, R. Pickart, B. Rabe, I. Semiletov, U. Schauer, P. Schlosser, N.

- Shakhova, W.M. Smethie, V. Sokolov, M. Steele, J. Su, J. Toole, W. Williams, R. Woodgate, J. Zhao, and S. Zimmermann, The Arctic, c. Ocean [in “State of the Climate 2012”], *Bull. Amer. Meteor. Soc.*, 94(8), S128-130, **2013**.
- (78) De Steur, L., M. Steele, E. Hansen, J. Morison, I. Polyakov, S. M. Olsen, H. Melling, F. A. McLaughlin, and R. Kwok, A freshwater anomaly passing through the Lincoln Sea in the Arctic Ocean, *J. Geophys. Res.*, 118, 4699-4715, 10.1002/jgrc.20341, **2013**.
- (77) Zhang, J., R. Lindsay, A. Schweiger, and M. Steele, The impact of an intense summer cyclone on 2012 Arctic sea ice retreat, *Geophys. Res. Lett.*, DOI: 10.1002/grl.50190, **2013**.
- (76) Lique, C., and M. Steele, Seasonal to decadal variability of Arctic Ocean heat content: A model-based analysis and implications for autonomous observing systems, *J. Geophys. Res.*, 118, doi:10.1002/jgrc.20127, **2013**.
- (75) Matrai, P. A., E. Olson, S. Suttles, V. Hill, L.A. Codispoti, B. Light, M. Steele, Synthesis of primary production in the Arctic Ocean: I. Surface waters, 1954–2007, *Prog. Oceanogr.*, 110, doi:10.1016/j.pocean.2012.11.004, **2013**.
- (74) Codispoti, L. A., V. Kelly, A. Thessen, P. Matrai, S. Suttles, V. Hill, M. Steele, B. Light, Synthesis of primary production in the Arctic Ocean: III. Nitrate and phosphate based estimates of net community production, *Prog. Oceanogr.*, 110, 10.1016/j.pocean.2012.11.006, **2013**.
- (73) Hill, V. J., P. A. Matrai, E. Olson, S. Suttles, M. Steele, L.A. Codispoti, R. C. Zimmerman, Synthesis of integrated primary production in the Arctic Ocean: II. In situ and remotely sensed estimates, *Prog. Oceanogr.*, 110, doi:10.1016/j.pocean.2012.11.005, **2013**.
- (72) Proshutinsky, A., M.-L. Timmermans, I. Ashik, A. Beszczynska-Moeller, E. Carmack, I. Frolov, R. Ingvaldsen, M. Itoh, T. Kikuchi, R. Krishfield, H. Loeng, F. McLaughlin, S. Nishino, R. Pickart, B. Rabe, B. Rudels, I. Semiletov, U. Schauer, N. Shakhova, K. Shimada, V. Sokolov, M. Steele, J. Toole, T. Weingartner, W. Williams, R. Woodgate, M. Yamamoto-Kawai, and S. Zimmermann, The Arctic, c. Ocean [in “State of the Climate in 2011”], *Bull. Amer. Meteor. Soc.*, 93(7), S143-147, **2012**.
- (71) Lique, C. and M. Steele, Where can we find a seasonal cycle of the Atlantic water temperature within the Arctic Basin?, *J. Geophys. Res.*, 117, C3, doi:10.1029/2011JC007612, **2012**.
- (70) Morison, J. R. Kwok, C. Peralta-Ferriz, M. Alkire, I. Rigor, R. Andersen, and M. Steele, Changing Arctic Ocean freshwater pathways measured with ICESat and GRACE, *Nature* 481, 66-70, DOI: 10.1038/nature10705, **2012**.
- (69) Popova, E. E., A. Yool, A. C. Coward, F. Dupont, C. Deal, S. Elliott, E. Hunke, M. Jin, M. Steele, J. Zhang, What controls primary production in the Arctic Ocean? Results from an ecosystem model intercomparison, *J. Geophys. Res.*, 117, doi:10.1029/2011JC007112, **2012**.
- (68) Schweiger, A., R. Lindsay, J. Zhang, M. Steele, H. Stern, R. Kwok, Uncertainty in modeled arctic sea ice volume, *J. Geophys. Res.*, 116, C00D06, doi:10.1029/2011JC007084, **2011**.
- (67) Steele, M., W. Ermold, and J. Zhang, Modeling the formation and fate of the near-surface temperature maximum in the Canadian Basin of the Arctic Ocean, *J. Geophys. Res.*, 116, C11015, doi:10.1029/2010JC006803, **2011**.
- (66) Proshutinsky, A., Y. Aksenov, J. Clement-Kinney, R. Gerdes, E. Golubeva, D. Holland, G. Holloway, A. John, M. Johnson, E. Popova, M. Steele, and E. Watanabe, Recent advances in Arctic Ocean studies employing models from the Arctic Ocean Model Intercomparison Project, *Oceanography*, 24(3), 102-113, **2011**.
- (65) Proshutinsky, A., M.-L. Timmermans, I. Ashik, A. Beszczynska-Moeller, E. Carmack, I. Frolov, M. Itoh, T. Kikuchi, R. Krishfield, F. McLaughlin, S. Nishino, B. Rabe, U. Schauer, K. Shimada, V. Sokolov, M. Steele, J. Toole, and W. Williams, R. Woodgate, M. Yamamoto-Kawai, Z. Zimmermann, The Arctic, c. Ocean [in “State of the Climate in 2010”], *Bull. Amer. Meteor. Soc.*, 92 (6), S145-148, **2011**.

- (64) Polyakov, I. V., and others, incl. M. Steele, Arctic Ocean warming contributes to reduced polar ice cap, *J. Phys. Oceanogr.*, 40, 2743-2756, **2010**.
- (63) Rawlins, M., M. Steele, M. Holland, J. Adam, J. Cherry, J. Francis, P. Groisman, L. Hinzman, T. Huntington, D. Kane, J. Kimball, R. Kwok, R. Lammers, C. Lee, D. Lettenmaier, K. McDonald, E. Podest, J. Pundsack, B. Rudels, M. Serreze, A. Shiklomanov, Ø. Skagseth, T. Troy, C. Vörösmarty, M. Wensnahan, E. Wood, R. Woodgate, D. Yang, K. Zhang, and T. Zhang, [Analysis of the Arctic System for Freshwater Cycle Intensification: Observations and Expectations](#), *J. Climate*, 23, 5715–5737, doi: 10.1175/2010JCLI3421.1, **2010**.
- (62) Steele, M., J. Zhang, and W. Ermold, Mechanisms of summertime upper Arctic Ocean warming and the effect on sea ice melt, *J. Geophys. Res.*, 115, C11004, doi:10.1029/2009JC005849, **2010**.
- (61) Zhang, J., M. Steele, and A. Schweiger, Arctic sea ice response to atmospheric forcings with varying levels of anthropogenic warming and climate variability, *Geophys. Res. Lett.*, 37, L20505, doi:10.1029/2010GL044988, **2010**.
- (60) Proshutinsky, A., M.-L. Timmermans, I. Ashik, A. Beszczynska-Moeller, E. Carmack, I. Frolov, R. Krishfield, F. McLaughlin, J. Morison, I. Polyakov, K. Shimada, V. Sokolov, M. Steele, J. Toole, and R. Woodgate, The Arctic, c. Ocean [in “State of the Climate in 2009”], *Bull. Amer. Meteor. Soc.*, 91 (6), S85-87, **2010**.
- (59) Zhang, J., Y. H. Spitz, M. Steele, C. Ashjian, R. Campbell, L. Berline, and P. Matrai, Modeling the impact of declining sea ice on the arctic marine planktonic ecosystem, *J. Geophys. Res.*, 115, C10015, doi:10.1029/2009JC005387, **2010**.
- (58) Laidre, K., M. P. Heide-Jorgensen, W. Ermold, and M. Steele, Narwhals document continued warming of Baffin Bay, *J. Geophys. Res.*, 115, C10049, doi:10.1029/2009JC005820, **2010**.
- (57) Kwok, R., S. Farrell, R. Forsberg, K. Giles, S. Laxon, D. McAdoo, J. Morison, L. Padman, C. Peralta-Ferriz, A. Proshutinsky, and M. Steele, "Combining satellite altimetry, time-variable gravity, and bottom pressure observations to understand the Arctic Ocean: A transformative opportunity," in Proceedings of the "OceanObs09: Sustained Ocean Observations and Information for Society" Conference (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., Harrison D.E. and Stammer, D., Eds., ESA Publication WPP-306, **2010**.
- (56) Francis, J. A., D. M. White, J. J. Cassano, W. J. Gutowski, Jr., L. D. Hinzman, M. M. Holland, M. Steele, and C. J. Vörösmarty, An arctic hydrologic system in transition: Feedbacks and impacts on terrestrial, marine, and human life, *J. Geophys. Res.*, 114, G04019, doi:10.1029/2008JG000902, **2009**.
- (55) Proshutinsky, A., R. Krishfield, M. Steele, and others, The Arctic: Oceans [in “State of the Climate in 2008”], *Bull. Amer. Meteor. Soc.*, 90(8), S99-S102, **2009**.
- (54) McPhee, M., A. Proshutinsky, J. Morison, M. Steele, and M. Alkire, Rapid change in freshwater content of the Arctic Ocean, *Geophys. Res. Lett.*, 36, L10602, doi:10.1029/2009GL037525, **2009**.
- (53) Rawlins, M. A., M. Steele, M. C. Serreze, C. J. Vorosmarty, W. Ermold, R. B. Lammers, K. C. McDonald, T. M. Pavelsky, A. Shilomanov, and J. Zhang, Tracing freshwater anomalies through the air-land-ocean system: A case study from the Mackenzie River Basin and the Beaufort Gyre, *Atmos. Ocean*, 47(1), 79–97, doi:10.3137/OC301, **2009**.
- (52) Lindsay, R. W., J. Zhang, A. Schweiger, M. Steele, and H. Stern, Arctic sea ice retreat in 2007 follows thinning trend, *J. Climate*, 22, 165-176, doi:10.1175/2008JCLI2521.1, **2009**.
- (51) Zhang, J., M. Steele, and R. Woodgate, The role of Pacific water in the dramatic retreat of arctic sea ice during summer 2007, *Chinese J. Polar Sci.*, 19(2), 93-107, **2008**.
- (50) Lindsay, R. W., J. Zhang, A. J. Schweiger, and M. Steele, Seasonal predictions of ice extent in the Arctic Ocean, *J. Geophys. Res.*, 113, C02023, doi:10.1029/2007JC004259, **2008**.

- (49) Schweiger, A. J., J. Zhang, R. W. Lindsay, M. Steele, Did unusually sunny skies help drive the record sea ice minimum of 2007? *Geophys. Res. Lett.*, 35, L10503, doi:10.1029/2008GL033463, **2008**.
- (48) Zhang, J., M. Steele, R. Lindsay, A. Schweiger, and J. Morison, Ensemble one-year predictions of arctic sea ice for the summer of 2008, *Geophys. Res. Lett.*, 35, L08502, doi:10.1029/2008GL033244, **2008**.
- (47) Zhang, J., R. Lindsay, M. Steele, and A. Schweiger, What drove the dramatic retreat of arctic sea ice during summer 2007? *Geophys. Res. Lett.*, 35, L11505, doi:10.1029/2008GL034005, **2008**.
- (46) Steele, M., W. Ermold, and J. Zhang, Arctic Ocean surface warming trends over the past 100 years, *Geophys. Res. Lett.*, 35, L02614, doi:10.1029/2007GL031651, **2008**.
- (45) Polyakov, I. V., V. Alexeev, G. I. Belchansky, I. A. Dmitrenko, V. Ivanov, S. Kirillov, A. Korablev, M. Steele, L. A. Timokhov, and I. Yashayaev, Arctic Ocean freshwater changes over the past 100 years and their causes, *J. Climate*, 21, 364-384, **2008**.
- (44) White, D., L. Hinzman, L. Alessa, J. Cassano, M. Chambers, K. Falkner, J. Francis, B. Gutowski, M. Holland, M. Holmes, H. Huntington, D. Kane, A. Kliskey, C. Lee, J. McClelland, B. Peterson, F. Straneo, M. Steele, R. Woodgate, D. Yang, K. Yoshikawa, T. Zhang, The Arctic Freshwater System: Changes and impacts, *J. Geophys. Res.*, 112, G04S54, doi:10.1029/2006JG000353, **2007**.
- (43) Polyakov, I. V., et al., M. Steele, et al., Observational program tracks Arctic Ocean transition to a warmer state, *EOS, Trans. Amer. Geophys. Union*, 88(40) 398-399, **2007**.
- (42) Alkire, M. B., K. K. Falkner, I. Rigor, M. Steele, and J. H. Morison, The return of Pacific waters to the upper layers of the central Arctic Ocean, *Deep-Sea Res. Part I*, 54, 1509–1529, **2007**.
- (41) Holloway, G., F. Dupont, E. Goloubeva, G. Platov, S. Hakkinen, D. Worthen, E. Hunke, M. Maltrud, M. Karcher, F. Kauker, M. Maqueda, D. Stark, M. Steele, and J. Zhang, Water properties and circulation in Arctic Ocean models, *J. Geophys. Res.*, 112, C04S03, doi:10.1029/2006JC003642, **2007**.
- (40) Zhang, J. and M. Steele, The effect of vertical mixing on the Atlantic Water layer circulation in the Arctic Ocean, *J. Geophys. Res.*, 112, C04S04, doi:10.1029/2006JC003732, **2007**.
- (39) Steele, M. and W. Ermold, Steric sea level change in the Northern Seas, *J. Climate*, 20(3), 403–417, **2007**.
- (38) Serreze, M. C., A. P. Barrett, A. J. Slater, M. Steele, J. Zhang and K. Trenberth, The large-scale energy budget of the arctic, *J. Geophys. Res.*, 112, D11122, doi:10.1029/2006JD008230, **2007**.
- (37) Serreze, M. C., A. P. Barrett, A. J. Slater, R. A. Woodgate, K. Aagaard, R. Lammers, M. Steele, R. Moritz, M. Meredith, C. Lee, The large-scale freshwater cycle of the arctic, *J. Geophys. Res.*, 111, C11010, doi:10.1029/2005JC003424, **2006**.
- (36) Morison, J., M. Steele, T. Kikuchi, K. Falkner, and W. Smethie, Relaxation of central Arctic Ocean hydrography to pre-1990s climatology, *Geophys. Res. Lett.*, 33, L17604, doi: 10.1029/2006GL026826, **2006**.
- (35) Steele, M., A. Porcelli, and J. Zhang, Origins of the SHEBA freshwater anomaly in the Mackenzie River delta, *Geophys. Res. Lett.*, 33, L09601, doi:10.1029/2005GL024813, **2006**.
- (34) Proshutinsky, A., J. Yang, R. Krishfield, R. Gerdes, M. Karcher, F. Kauker, C. Koeberle, S. Hakkinen, W. Hibler, D. Holland, M. Maqueda, G. Holloway, E. Hunke, W. Maslowski, M. Steele, and J. Zhang, Arctic Ocean study: Synthesis of model results and observations, *Eos*, 86, pp. 368, 371, **2005**.
- (33) Polyakov, I.V., Beszczynska, A., Carmack, E.C., Dmitrenko, I.A., Fahrbach, E., Frolov, I.E., Gerdes, R., Hansen, E., Holfort, J., Ivanov, V.V., Johnson, M.A., Karcher, M., Kauker, F., Morison, J., Orvik, K.A., Schauer, U., Simmons, H.L., Skagseth, Ø., Sokolov, V.T., Steele, M., Timokhov, L.A.,

- Walsh, D., Walsh, J.E., One more step toward a warmer Arctic, *Geophys. Res. Lett.*, 32, L17605, 10.1029/2005GL023740, **2005**.
- (32) Falkner, K., M. Steele, R. Woodgate, J. Swift, K. Aagaard, and J. Morison, Dissolved oxygen extrema in the Arctic Ocean halocline from the North Pole to the Lincoln Sea, *Deep-Sea Res. I*, 52, 1138-1154, **2005**.
- (31) Steele, M. and W. Ermold, Salinity trends on the Siberian shelves, *Geophys. Res. Lett.*, 31, L24308, 10.1029/2004GL021302, **2004**.
- (30) Zhang, J., M. Steele, D. A. Rothrock, and R. Lindsay, Increasing exchanges at Greenland-Scotland ridge and their links with the North Atlantic Oscillation and arctic sea ice, *Geophys. Res. Lett.*, 31, L09307, 10.1029/2003GL019304, **2004**.
- (29) Steele, M., J. Morison, W. Ermold, I. Rigor, M. Ortmeyer, and K. Shimada, Circulation of summer Pacific halocline water in the Arctic Ocean, *J. Geophys. Res.*, 109(C2), C02027, 10.1029/2003JC002009, **2004**.
- (28) Steiner, N., G. Holloway, R. Gerdes, S. Häkkinen, D. Holland, M. Karcher, F. Kauker, W. Maslowski, A. Proshutinsky, M. Steele, J. Zhang, Comparing modeled streamfunction, heat and freshwater content in the Arctic Ocean, *Ocean Modelling*, 6, 265-284, **2004**.
- (27) Morison, J. H., K. Aagaard, K. K. Falkner, K. Hatakeyama, R. Moritz, J. E. Overland, D. Perovich, K. Shimada, M. Steele, T. Takizawa, R. Woodgate, Early results from the North Pole Environmental Observatory, *EOS Trans.*, 83(33), pp. 357, 360-361, **2002**.
- (26) Boyd, T. J., M. Steele, R. D. Muench, and J. T. Gunn, Partial recovery of the Arctic Ocean halocline, *Geophys. Res. Lett.*, 29, 10.1029/2001GL014047, **2002**.
- (25) Björk, G., S. Söderkvist, P. Winsor, A. Nikolopoulos, and M. Steele, Partial return of the cold halocline layer to the Amundsen Basin of the Arctic Ocean: Implications for the sea ice mass balance, *Geophys. Res. Lett.*, 29, 10.1029/2001GL014157, **2002**.
- (24) Proshutinsky, A., M. Steele, J. Zhang, G. Holloway, N. Steiner, S. Häkkinen, D. Holland, R. Gerdes, C. Koeberle, M. Karcher, M. Johnson, W. Maslowski, Y. Zhang, W. Hibler, and J. Wang, Multinational effort studies differences among Arctic Ocean models, *EOS Trans.*, 82 (51), 637, 643-644, **2001**.
- (23) Walsh, J. E., J. Curry, M. Fahnestock, M. C. Kennicutt II, A. D. Mcguire, W. B. Rossow, M. Steele, C. J. Vorosmarty, and R. Wharton, Enhancing NASA's contributions to polar science: A review of polar geophysical data sets, National Academy Press, Washington, D.C., 124 pp., **2001**.
- (22) Steele, M., W. Ermold, S. Häkkinen, D. Holland, G. Holloway, M. Karcher, F. Kauker, W. Maslowski, N. Steiner, and J. Zhang, Adrift in the Beaufort Gyre: A model intercomparison, *Geophys. Res. Lett.*, 28, 2935-2938, **2001**.
- (21) Steele, M., R. Morley, and W. Ermold, PHC: A global ocean hydrography with a high quality Arctic Ocean, *J. Climate*, 14, 2079-2087, **2001**.
- (20) Martinson, D. G., and M. Steele, Future of the arctic sea ice cover: Implications of an antarctic analog, *Geophys. Res. Lett.*, 28, 307-310, **2001**.
- (19) Forman, S. L., W. Maslowski, J. T. Andrews, D. Lubinski, M. Steele, J. Zhang, R. Lammers, and B. Peterson, Researchers explore arctic freshwater's role in ocean circulation, *EOS Trans.*, 81, 169, **2000**.
- (18) Morison, J. H., K. Aagaard, and M. Steele, Recent environmental changes in the Arctic: A review, *Arctic*, 53, 359-371, **2000**.
- (17) Steele, M. and G. Flato, Sea ice growth, melt, and modeling: A survey, in: *The Freshwater Budget of the Arctic Ocean*, pp 549-587, Kluwer, The Netherlands, **2000**.
- (16) Zhang, J., D. Rothrock, and M. Steele, Recent changes in Arctic sea ice: The interplay between ice dynamics and thermodynamics, *J. Climate*, 13, 3099-3114, **2000**.

- (15) Steele, M. and T. Boyd, Retreat of the cold halocline layer in the Arctic Ocean, *J. Geophys. Res.*, *103*, 10,419-10,435, **1998**.
- (14) Zhang, J., D. Rothrock, and M. Steele, Warming of the Arctic Ocean by a strengthened Atlantic inflow: Model results, *Geophys. Res. Lett.*, *25*, 1745-1748, **1998**.
- (13) Morison, J. H., M. Steele, and R. Andersen, Hydrography of the upper Arctic Ocean measured from the nuclear submarine USS Pargo, *Deep Sea Res. I*, *45*, 15-38, **1998**.
- (12) Zhang, J., W. Hibler, M. Steele, and D. Rothrock, Arctic ice-ocean modeling with and without climate restoring, *J. Phys. Oceanogr.*, *28*, 191-217, **1998**.
- (11) Steele, M., J. Zhang, D. Rothrock and H. Stern, The force balance of sea ice in a numerical model of the Arctic Ocean, *J. Geophys. Res.*, *102*, 21,061-21,079, **1997**.
- (10) Steele, M., D. Thomas, D. Rothrock, and S. Martin, A simple model study of the Arctic Ocean freshwater balance, 1979-1985, *J. Geophys. Res.*, *101*, 20,833-20,848, **1996**.
- (9) Thomas, D., D. Rothrock, S. Martin, and M. Steele, Assimilating satellite concentration data into an Arctic sea ice mass balance model, 1979-1985, *J. Geophys. Res.*, *101*, 20,849-20,868, **1996**.
- (8) Steele, M., J. H. Morison, and T. Curtin, Halocline water formation in the Barents Sea, *J. Geophys. Res.*, *100*, 881-894, **1995**.
- (7) Steele, M. and J. Morison, Hydrography and vertical fluxes of heat and salt northeast of Svalbard in autumn, *J. Geophys. Res.*, *98*, 10,013-10,024, **1993**.
- (6) Steele, M., Sea ice melting and floe geometry in a simple ice-ocean model, *J. Geophys. Res.*, *97*, 17729-17738, **1992**.
- (5) Steele, M. and J. H. Morison, Obtaining smooth hydrographic profiles from a buoy deployed in sea ice, *J. Atmos. and Ocean. Technol.*, *9*, 812-826, **1992**.
- (4) Steele, M., G. L. Mellor, and M. G. McPhee, Role of the molecular sublayer in the melting or freezing of sea ice, *J. Phys. Oceanogr.*, *19*, 139-147, **1989**.
- (3) Steele, M., J. H. Morison, and N. Untersteiner, The partition of air-ice-ocean momentum exchange as a function of ice concentration, floe size, and draft, *J. Geophys. Res.*, *94*, 12,739-12,750, **1989**.
- (2) Steele, M., Numerical models of sea ice - ocean interaction in the Marginal Ice Zone, Ph.D. thesis, Princeton University, 203 pp., **1987**.
- (1) Mellor, G. L., M. G. McPhee, and M. Steele, Ice-seawater turbulent boundary layer interaction with melting or freezing, *J. Phys. Oceanogr.*, *16*, 1829-1846, **1986**.

### **Non-Reviewed Publications**

- Kawaguchi, Y., M. Steele, K. Colburn, S. Nishino, and K. Oshima, Upper ocean heat observation using UpTempO buoys during RV Mirai Arctic cruise MR14-05, *JAMSTEC Rep*, vol 21, **2015**.
- Meinig, C., M. Steele, and K. Wood, Taking the temperature of the arctic with UMVs, *Sea Technol.*, September, **2012**.
- Vorosmarty, C. J., A. D. McGuire, J. Hobbie, et al. incl. M. Steele, Scaling Studies in Arctic System Science and Policy Support, U.S. Arctic Research Commission, **2010**.
- Proshutinsky, A., R. Gerdes, D. Holland, G. Holloway and M. Steele, AOMIP: Coordinated activities to improve models and model predictions, *CLIVAR Exchanges*, No. 44, unpublished manuscript, **2008**.
- Steele, M., The cold halocline, pp 399-401, in: *The Encyclopedia of the Arctic*, Routledge, 3 vols., M. Nuttall editor, New York, NY, **2005**.
- Morison, J., K. Aagaard, and M. Steele, Report on: The study of the Arctic Change workshop, University of Washington, Seattle, Washington, Report #8, **1998**.
- McPhee, M.G., and M. Steele, Comparison of SACM and turbulence cluster measurements, *Proc. IEEE 4th Working Conf. on Current Measurement*, Clinton, MD, **1990**.



## **Advisors**

BA (physics) senior project: Dr. D. Griffiths, Reed College

PhD advisor: Dr. G. Mellor, Princeton University

Postdoctoral advisor: Dr. J. Morison, Polar Science Center

## **Mentoring**

*Undergraduate research assistants:*

- 2010 : C. Ozimek, Physics
- 2008-09: A. Czoski, Digital Arts
- 2004: W. Williams, Physics/Astronomy
- 1998-99: R. Morley, Physics
- 1998: S. Norman, Chemistry
- 1997-98: T. Saunders, Physics
- 1996-97: J. Annis, Oceanography
- 1997: N. Huang, Computer Science

*Masters degree student:*

- 2003-2005: W. Ermold, Appl. Physics

*PhD students:*

- 2016-2017: I. Onarheim, Phys. Ocean.
- 2006-2010: M. Alkire, Chem. Ocean.
- 2005-2012: C. Peralta-Ferriz, Phys. Ocean.
- 2013-present: S. Dewey, Phys. Ocean.

*Thesis defense opponent for:*

- 2011: J. Jackson (U of Br. Columbia, Canada)
- 2011: O. Segtnan (U of Bergen, Norway)

*Postdoctoral students:*

- 2016-present: W. Zhong
- 2013-2015: Y. Kawaguchi
- 2012-2014: T. Martin
- 2011-2012 : C. Lique
- 2011-2012: J. Shi
- 2009: L. deSteur