

## BONNIE LIGHT

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### EDUCATION

#### **DOCTOR OF PHILOSOPHY, ATMOSPHERIC SCIENCES, 2000**

University of Washington, Seattle, WA

Dissertation: Structural-Optical Relationships in First-Year Sea Ice

Advisors: Professors Gary A. Maykut and Thomas C. Grenfell

#### **MASTER OF SCIENCE, ATMOSPHERIC SCIENCES, 1995**

University of Washington, Seattle, WA

Thesis: A Structural-Optical Model of Cold Sea Ice

Advisor: Professor Gary A. Maykut

#### **MASTER OF SCIENCE, ELECTRICAL ENGINEERING, 1990**

University of Maryland, College Park, MD

#### **BACHELOR OF SCIENCE, 1986**

College of Engineering, Cornell University, Ithaca, NY

### RESEARCH EXPERIENCE

#### **PRINCIPAL PHYSICIST**

July 2011 - present

#### **PHYSICIST IV**

2002 - 2011

Polar Science Center, Applied Physics Laboratory, University of Washington

- Synthesis of remotely sensed and *in situ* field data, along with model results, for quantifying solar heating in the Arctic basin over the satellite record
- Development of new laboratory techniques for growing and studying salt precipitates in sea ice and their optical effects in earth's cryosphere
- Field investigations of Arctic sea ice
- Development of new radiative transfer parameterization for sea ice in the Community Climate System Model
- Study of structural, morphological, and optical properties of sea ice cores sampled during a trans-Arctic scientific survey
- Development and management of Laboratory for Environmental Cryosphere Science at APL
- Mentoring undergraduate research assistants (A. Wright, 2009 – 2010; T. Black, 2010 – 2013; S. Farley, 2016)
- Postdoctoral mentor (C. Frantz, 2014 – 2016; R. Carns, Future of Ice Fellow, 2015 - present)
- Co-developed 3 month museum installation demonstrating ice-albedo feedback at Pacific Science Center, 2012 - 2015

#### **AFFILIATE ASSOCIATE PROFESSOR**

January 2013 - present

#### **AFFILIATE ASSISTANT PROFESSOR**

2009 - 2012

Department of Atmospheric Sciences, University of Washington

- Enhanced collaboration with faculty, postdocs, and graduate students
- Co-mentored visiting postdoctoral scholar (R. Dacic, Dept Atmos Sci), 2010
- Supervised graduate student field assistants during fieldwork in Norwegian Arctic, 2011
- Thesis committee member for Naomi Goldenson, Brandon Ray (Dept Atmos Sci)

- Manage and oversee maintenance of department cold room facility (ATG 523)

**RESEARCH ASSOCIATE** 2000 - 2002

Department of Atmospheric Sciences, University of Washington, Seattle

- Synthesis of field data from vertical optical profiling instrument
- Further development of radiative transfer model from dissertation project
- Preparation of three manuscripts for publication based on dissertation

**RESEARCH ASSISTANT** 1990 - 2000

Department of Atmospheric Sciences, University of Washington, Seattle

- Designed and executed project investigating relationships between structural and optical properties of sea ice
- Designed and used radiative transfer models for sea ice and snow
- Designed and executed laboratory experiments involving sea ice physical processes

## FIELD EXPERIENCE

**INVESTIGATOR**

Polar Science Center, Applied Physics Laboratory, University of Washington 2015

- Field work carried out for the project “Rotten Ice” on sea ice off Barrow, AK
- 3-phase field project May, June, July 2015
- Development of sampling techniques for heavily melted summer ice
- Designed, built, tested laboratory and field tools for investigating permeability and optical properties of melting sea ice

**INVITED RESEARCHER**

Polar Science Center, Applied Physics Laboratory, University of Washington 2011

- Collaborative research carried out in Svalbard, Norway at the invitation of colleagues from Norwegian Polar Institute
- Development of sampling techniques for early summer ice
- Supervised and mentored two graduate students (N. Goldenson, Atmos. Sci, UW and R. Carns, ESS, UW)

**CoINVESTIGATOR**

Polar Science Center, Applied Physics Laboratory, University of Washington 2010

- Participated in ICESCAPE field project on board USCGC Healy, June - July
- Carried out under-ice spectral transmittance measurements
- Developed techniques for measuring complexities in the light field beneath melting ice covers
- Supervision of a postdoctoral scholar (R. Dadic, Dept of Atmospheric Sciences, UW) while in the field

**CoINVESTIGATOR**

Polar Science Center, Applied Physics Laboratory, University of Washington 2005

- Designed, built, and implemented novel device for detecting optical properties of sea ice
- Coordinated logistics and managed a staff member while in the field

**RESEARCH STAFF** 1998

Department of Atmospheric Sciences, University of Washington, Seattle

- Prepared field experiments for monitoring summer evolution of sea ice properties
- Performed four months continuous field duty on ice station SHEBA in the Beaufort Sea

## TEACHING EXPERIENCE

### INVITED LECTURER

- Teach unit on Sea Ice for ESS 431, Principles of Glaciology Autumn Quarter 2004 – present
- Lecture on Arctic Sea Ice for Geography 260, Olympic College, Bremerton 2011 - 2015

### TEACHING ASSISTANT

1991

Department of Atmospheric Sciences, University of Washington, Seattle

- Undergraduate meteorology course for non-majors, Autumn Quarter

## ENGINEERING EXPERIENCE

### ELECTRONICS ENGINEER, GS-11

1986-1990

Applied Optics Division, United States Naval Research Laboratory, Washington D.C. and Sachs-Freeman Associates, Landover, MD (1986-1987)

- Participated in international field project evaluating performance of passive infrared sensors
- Co-developed laser test system for satellite-mounted optical sensors
- Co-published two technical reports

## AWARDS

Receiptient of NASA Group Achievement Award for Project ICESCAPE, 2012

Quality Step Increase for Outstanding Performance, Naval Research Laboratory, 1989

Fellow, Thomas Edison Fellowship for Graduate Study, 1988 - 1990

Dean's List, Cornell University 1986

## ACADEMIC SERVICE

Advisory Board Member, Pacific Science Center IMLS National Leadership Grant, 2016 – present

APL Advisory Board Presentation, “Rotten Ice: Emergence of a new type of sea ice”, April 2016

Keynote Speaker, Seattle Expanding Your Horizons, Seattle University, March 2015

Science Communication Fellow, Pacific Science Center, 2010 - present

Outreach presentations on sea ice, field work, and hands-on demonstrations of physical concepts relating to ice, salinity and heat, various times 2003 – present

Annual participant in Polar Science Weekend outreach events at Pacific Science Center, Seattle

Teaching Assistant Trainer, Department of Atmospheric Sciences, 1992-1994

Participant in Public School Outreach Program, Department of Atmospheric Sciences

Reviewer for various journals, including Journal of Geophysical Research, Geophysical Research

Letters, Limnology and Oceanography, Cold Regions Science and Technology, Applied Optics,

Climate Dynamics, Remote Sensing of the Environment, Boreal Environmental Research, Polar

Biology, Journal of Glaciology; and funding agencies, including National Science Foundation,

NASA, DOE, National Environmental Research Council (UK), Norwegian Research Council.

Graduate Student Thesis Committee Member: N. Goldenson, Dept. Atmos. Sciences; R. Carns,

Earth and Space Sciences; Brandon Ray, Dept. Atmos. Sciences

Post Doctoral Research Associate Mentor: R. Dacic (2010), J. Toner (2012 – 2014), C. Frantz

(2014 – 2016); R. Carns (2015 – present)

## PUBLICATIONS

- Light, B., R. Carns, and S. G. Warren (2016), The spectral albedo of sea ice and salt crusts on the tropical ocean of Snowball Earth: 1. Laboratory measurements, *J. Geophys. Res. Oceans*, *121*, doi:10.1002/2016JC011803.
- Carns, R., B. Light, and S. G. Warren (2016), The spectral albedo of sea ice and salt crusts on the tropical ocean of Snowball Earth: 2. Optical modeling, *J. Geophys. Res. Oceans*, *121*, doi:10.1002/2016JC011804.
- Zatko, M., J. Erbland, J. Savarino, L. Geng, L. Easley, A. Schauer, T. Bates, P. Quinn, B. Light, D. Morison, H. Osthoff, S. Lyman, W. Neff, B. Yuan, and B. Alexander (2016), The magnitude of the snow-sourced reactive nitrogen flux to the boundary layer in the Uintah Basin, Utah, USA, *Atm. Chem. and Phys. Disc.*
- Light, B., D. K. Perovich, M. A. Webster, C. Polashenski, and R. Dadic (2015), Optical properties of melting first-year Arctic sea ice, *J. Geophys. Res. Oceans*, *120*, doi:10.1002/2015JC011163.
- Light, B., R. C. Carns, and S. G. Warren (2015), Albedo dome: a method for measuring spectral flux-reflectance in a laboratory for media with long optical paths, *Appl. Optics*, *54*, 17 5260-5269.
- Light, B., S. Dickinson, D. K. Perovich, and M. M. Holland (2015), Evolution of summer Arctic sea ice albedo in CCSM4 simulations: Episodic summer snowfall and frozen summers, *J. Geophys. Res. Ocean.*, *120*(1), 1–20, doi:10.1002/2014JC010149.
- Polashenski, C., D. K. Perovich, K. E. Frey, L. W. Cooper, C. I. Logvinova, R. Dadic, B. Light, H. P. Kelly, L. D. Trusel, and 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. Res. Part II Top. Stud. Oceanogr.*, *118*, 7–17, doi:10.1016/j.dsr2.2015.04.006.
- Toner, J. D., D. C. Catling, and B. Light (2015), Modeling salt precipitation from brines on Mars : Evaporation versus freezing origin for soil salts, *Icarus*, *250*, 451–461, doi:10.1016/j.icarus.2014.12.013.
- Toner, J. D., D. C. Catling, and B. Light (2015), A revised Pitzer model for low-temperature soluble salt assemblages at the Phoenix site, Mars, *Geochim. Cosmochim. Acta*, *166*, 327–343, doi:10.1016/j.gca.2015.06.011.
- Webster, M. A., I. G. Rigor, D. K. Perovich, J. A. Richter-Menge, C. M. Polashenski, and B. Light (2015), Seasonal evolution of melt ponds on Arctic sea ice, *J. Geophys. Res. Oceans*, *120*, 5968–5982, doi:10.1002/2015JC011030.
- Toner, J. D., D. C. Catling, and B. Light (2014), The formation of supercooled brines, viscous liquids, and low-temperature perchlorate glasses in aqueous solutions relevant to Mars, *Icarus*, *233*, 36–47, doi:10.1016/j.icarus.2014.01.018.
- Toner, J. D., D. C. Catling, and B. Light (2014), Soluble salts at the Phoenix Lander site, Mars: A reanalysis of the Wet Chemistry Laboratory data, *Geochim. Cosmochim. Acta*, *136*, 142–168, doi:10.1016/j.gca.2014.03.030.
- Matrai, P.A., E. Olson, S. Suttles, V. Hill, L.A. Codispoti, B. Light, and M. Steele (2013), Synthesis of primary production in the Arctic Ocean: I. Surface waters, 1954-2007, *Prog. Oceanogr.*, *110*, 93-106, doi:10.1016/j.pocean.2012.11.004.
- Codispoti, L. A., V. Kelly, A. Thessen, P. Matrai, S. Suttles, V. Hill, M. Steele, and B. Light (2013), Synthesis of primary production in the Arctic Ocean: III. Nitrate and phosphate based estimates of net community production, *Prog. Oceanogr.*, *110*, 126-150, doi:10.1016/j.pocean.2012.11.006.
- Goldenson, N, S. J. Doherty, C. M. Bitz, M. M. Holland, B. Light, and A. J. Conley (2012), Arctic climate response to forcing from light-absorbing particles in snow and sea ice in CESM, *Atmos. Chem. Phys.* *12*, 7903-7920, doi:10.5194/acp-12-7903-2012.
- Holland, M. M., D. A. Bailey, B. P. Briegleb, B. Light, and E. Hunke (2012), Improved sea ice shortwave radiation physics in CCSM4: the impact of melt ponds and aerosols on Arctic sea ice, *J. Climate*, *25*, 1413-1430.

- Frey, K. E., D. K. Perovich, and B. Light (2011), The spatial distribution of solar radiation under a melting Arctic sea ice cover, *Geophys. Res. Lett.*, 38, doi:10.1029/2011GL049421.
- Perovich, D. K., K. F. Jones, B. Light, H. Eicken, T. Markus, J. Stroeve, R. Lindsay (2011), Solar partitioning in a changing Arctic sea-ice cover, *Ann. Glac.*, 52, 192 – 196.
- Perovich, D. K., J. A. Richter-Menge, K. F. Jones, B. Light, B. C. Elder, C. Polashenski, D. Laroche, T. Markus, R. Lindsay (2011), Arctic sea-ice melt in 2008 and the role of solar heating, *Ann. Glac.*, 57, 355-359.
- Dadic, R., B. Light, and S. G. Warren (2010), Migration of air bubbles in ice under a temperature gradient, with application to ‘Snowball Earth’, *J. Geophys. Res.*, 115, D18125, doi:10.1029/2010JD014148.
- Light, B. (2010), Theoretical and observational techniques for estimating light scattering in first-year Arctic sea ice, invited contribution to *Light Scattering Reviews*, vol. 5, edited by A. Kokhanovsky, Springer-Praxis, Berlin.
- Light, B., R. E. Brandt, S. G. Warren, (2009) Hydrohalite in cold sea ice: Laboratory observations of single crystals, surface accumulations, and migration rates under a temperature gradient, with application to 'Snowball Earth', *J. Geophys. Res.*, doi:10.1029/2008JC005211.
- Perovich, D. K., T. C. Grenfell, B. Light, B. C. Elder, J. Harbeck, C. Polashenski, W. B. Tucker, III, and C. Stelmach (2009), Transpolar observations of the morphological properties of Arctic sea ice, *J. Geophys. Res.*, 114, C00A04, doi:10.1029/2008JC004892.
- Light, B., T. C. Grenfell, and D. K. Perovich (2008), Transmission and absorption of solar radiation by Arctic sea ice during the melt season, *J. Geophys. Res.*, 113, C03023, doi:10.1029/2006JC003977.
- Perovich, D. K., J. A. Richter-Menge, K. F. Jones, and B. Light (2008), Sunlight, water, and ice: Extreme Arctic sea ice melt during the summer of 2007, *Geophys. Res. Lett.*, 35, L11501, doi:10.1029/2008GL034007.
- Perovich, D. K., B. Light, H. Eicken, K. F. Jones, K. Runciman, and S. V. Nghiem (2007), Increasing solar heating of the Arctic Ocean and adjacent seas, 1979–2005: Attribution and role in the ice-albedo feedback, *Geophys. Res. Lett.*, 34, L19505, doi:10.1029/2007GL031480.
- Briegleb, B. P. and B. Light (2007), A Delta-Eddington Multiple Scattering Parameterization for Solar Radiation in the Sea Ice Component of the Community Climate System Model, NCAR/TN-472+STR, 100pp.
- Huck, P., B. Light, H. Eicken, and M. Haller (2007), Mapping sediment-laden sea ice in the Arctic using AVHRR remote-sensing data: Atmospheric correction and determination of reflectances as a function of ice type and sediment load, *Remote Sensing of Environment*, 107, 484-495.
- Grenfell, T. C., B. Light, and D. K. Perovich (2006), Spectral transmission and implications for the partitioning of shortwave radiation in arctic sea ice, *Ann. Glac.*, 44, 1-6.
- Light, B., G. A. Maykut, and T. C. Grenfell (2004), A temperature-dependent, structural-optical model of first-year sea ice, *J. Geophys. Res.*, 109, C06013, doi:10.1029/2003JC002164.
- Light, B., G.A. Maykut, and T.C. Grenfell (2003), A two-dimensional Monte Carlo model of radiative transfer in sea ice, *J. Geophys. Res.*, 108(C7), 3219, doi:10.1029/2002JC001513.
- Light, B., G. A. Maykut, and T. C. Grenfell (2003), Effects of temperature on the microstructure of first-year Arctic sea ice, *J. Geophys. Res.*, 108(C2), 3051, doi:10.1029/2001JC000887.
- Perovich, D. K., T. C. Grenfell, J. A. Richter-Menge, B. Light, W. B. Tucker III, and H. Eicken (2003), Thin and thinner: Sea ice mass balance measurements during SHEBA, *J. Geophys. Res.*, 108(C3), 8050, doi: 10.1029/2001JC001079.
- Grenfell, T.C., B. Light, and M. Sturm (2002), Spatial distribution and radiative effects of soot in the snow and sea ice during the SHEBA experiment, *J. Geophys. Res.*, 107(C10), 8032, 10.1029/2000JC000414.
- Perovich, D.K., T.C. Grenfell, B. Light, and P.V. Hobbs (2002), Seasonal evolution of the albedo of multiyear Arctic sea ice, *J. Geophys. Res.*, 107(C10), 8044, doi:10.1029/2000JC000438.

- Frey, K., H. Eicken, D. K. Perovich, T. C. Grenfell, B. Light, L. H. Shapiro, and A. P. Stierle (2001), Heat budget and decay of clean and sediment-laden sea ice off the northern coast of Alaska, *Port and Ocean Eng. in the Arctic Conference (POAC'01) Proceedings (3)*, Ottawa, Canada, 1405-1412.
- Perovich, D.K., T.C. Grenfell, B. Light, J.A. Richter-Menge, M. Sturm, W.B. Tucker III, H. Eicken, G.A. Maykut, and B. Elder (1999), SHEBA: Snow and Ice Studies CD-ROM.
- Light, B., H. Eicken, G.A. Maykut, and T. C. Grenfell (1998), The effect of included particulates on the spectral albedo of sea ice, *J. Geophys. Res.*, 103, 27,739-27,752.
- Maykut, G.A. and B. Light (1995), Refractive-index measurements in freezing sea-ice and sodium chloride brines, *Appl. Opt.*, 34, 950-961.
- Welch, J. A., B. Light, G. L. Trusty, and T. H. Cosden (1991), A laser test set for the low-power atmospheric compensation experiment satellite, Rep. NRL-FR-9360, 50 pp., Naval Research Laboratory, Washington DC.
- Light, B. and G. L. Trusty (1990), One-dimensional translation measurement of speckle from rough rotating objects in ultraviolet illumination, Rep. NRL-FR-9293, 68 pp., Naval Research Laboratory, Washington DC.

## PRESENTATIONS

- Light, B. (2014) Modeling the physics of summer melt on Arctic sea ice: changing snow, shrinking ice, and plenty of sunshine, FAMOS, Woods Hole MA (invited lecture)
- Light, B., D. Perovich, and M. Webster (2014) Light transmittance by a ponded first-year Arctic sea ice cover, IGS Sea Ice Symposium, Hobart Tasmania (oral presentation).
- Light, B., S. R. Hudson, M. Granskog, R. Carns, and N. Goldenson (2014) Observations and model simulations of light transmission through springtime, high-salinity, first-year Arctic sea ice, IGS Sea Ice Symposium, Hobart Tasmania (poster).
- Light, B., D. Perovich, M. Webster (2013), Transmittance of solar radiation through a melting first-year sea ice cover: effects of ice thickness, surface melt ponds, and ice microstructure, AMS 12<sup>th</sup> Conference on Polar Meteorology and Oceanography, Seattle WA (poster).
- Light, B., D. Perovich, M. Holland, S. Dickinson, T. Black (2012), Arctic sea ice albedo through the summer melt cycle: CCSM4 compared with a satellite/empirical record over 1979-2005, Fall AGU, San Francisco CA (poster).
- Light, B., C. Tang, and D. Catling (2012), Laboratory simulation of low-temperature hydrated salt crystals relevant to water on Mars, Lunar and Planetary Institute Third International Conference on Early Mars, Lake Tahoe, Nevada (poster).
- Light, B., T. E. Black, R. Carns, R. Brandt, R. Dadic, and S. G. Warren (2012), Albedo of cold sea ice with precipitated salt on the tropical ocean of Snowball Earth: field measurements and laboratory experiments, European Geophysical Union, Vienna, Austria (poster).
- Light, B., M. Webster, D. Perovich, C. Polashenski, and R. Dadic (2012), Transmission of solar radiation through ponded Arctic sea ice, AGU Ocean Sciences, Salt Lake City, UT (poster).
- Light, B. S. G. Warren, A. Wright, R. Dadic, M. C. Wyant, and R. Brandt (2010), A technique for albedo measurements of laboratory-grown sea ice in extreme climates, International Glaciological Society Sea Ice Symposium, Tromso, Norway (poster).
- Light, B., D. K. Perovich, T. C. Grenfell, K. Runciman, K. Jones, and M. C. Wyant (2009), Transmission of Sunlight through melting Arctic Sea Ice, American Geophysical Union Fall Meeting, San Francisco, CA (invited oral presentation).
- Light, B., and R. E. Moritz (2006), Formation and development of surface scattering layers on Arctic sea ice, American Geophysical Union Fall Meeting, San Francisco, CA (poster).
- Light, B. and B. Briegleb (2006), A New Parameterization for Shortwave Radiative Transfer in Sea Ice, CCSM3 Polar Climate Working Group, Boulder, CO.

- Light, B (2006), Laboratory Observations of Terrestrial Sea Ice Microstructure, Europa Focus Group, Mountain View, CA.
- Light, B, T. C. Grenfell, and D. K. Perovich (2004), Transmission of Solar Radiation Through Summer Melt Ponds, American Geophysical Union Fall Meeting, San Francisco, CA.
- Light, B., T. C. Grenfell, and D. K. Perovich (2003), Transmission of Solar Radiation by a Summer Sea Ice Cover, 7th Conference on Polar Meteorology and Oceanography, AMS, Hyannis, MA (poster).
- Light, B. (2002), Structural, Optical, and Structural-Optical Properties in First-Year Arctic Sea Ice, 6th Conference on Electromagnetic Transport and Optical Properties of Inhomogeneous Media, Snowbird, UT (invited talk).
- Light, B. and G. A. Maykut (2002), Light Transmission Through Pondered Sea Ice: A Two-Dimensional View, ARCSS All-hands Workshop, Seattle, WA (poster).
- Light, B. (2001), Observations and modeling of structural-optical properties in first-year sea ice, 6th Conference on Polar Meteorology and Oceanography, AMS, San Diego, CA, (invited talk).
- Light, B., G.A. Maykut, and T.C. Grenfell (2001), Observing and Modeling Structural-Optical Relationships in First-Year Sea Ice, Gordon Research Conference, Ventura, CA (poster).
- Light, B. and G. A. Maykut (1999), Observations of Sea Ice Microstructure, American Geophysical Union Fall Meeting, San Francisco, CA (poster).
- Light, B., H. Eicken, G.A. Maykut, and T.C. Grenfell (1997), The Effect of Particulates on Radiative Transfer in Sea Ice, Gordon Research Conference, Ventura, CA (poster).
- Light, B., H. Eicken, G.A. Maykut, and T.C. Grenfell (1996), A Model Study of the Effect of Particulates on the Albedo of Sea Ice, International Radiation Symposium, Fairbanks, AK, (poster).
- Light, B. and G.A. Maykut (1994), The Role of Precipitated Salts in Radiative Transfer in Sea Ice, Advanced Study Institute on the Physics of Ice-Covered Seas, Savonlinna, Finland.
- Maykut, G.A., and B. Light (1994), Effects of Precipitated Salts on Radiative Transfer in Sea Ice, American Geophysical Union Spring Meeting, Baltimore, MD.