

## PETER WADHAMS MA PhD ScD (Cantab)

### **Current position**

Emeritus Professor of Ocean Physics, Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge, Wilberforce Road, Cambridge CB3 0WA.

Concurrently: Professor, Università Politecnica delle Marche, Ancona.

Born 14 May 1948. Married to Maria Pia Casarini of Milan, Italy.

### **Education**

1966-69 Churchill College, Cambridge. College Scholar. 1969 **BA** in Natural Sciences (Physics). 1972 **MA** (Cantab).

1970-74 Scott Polar Research Institute, University of Cambridge. **PhD** awarded April 1974. Thesis "The effect of a sea ice cover on ocean surface waves".

1994 **ScD** (Cantab) awarded for published work.

### **Appointments**

1969 Sept - 1970 Oct. Research scientist, Bedford Institute of Oceanography, Dartmouth, Canada. Assistant to Senior Scientist on "Hudson-70" Expedition, an 11-month oceanographic cruise which accomplished the first circumnavigation of the Americas, by way of Antarctica, Chilean fjords, south and north Pacific, Northwest Passage.

1974 Apr -1975 Dec. Postdoctoral fellow of National Research Council of Canada at Institute of Ocean Sciences, Victoria, B.C., Canada, working on sea ice structure and dynamics in the Beaufort Sea and oil spill impacts.

1976 Jan – 2002 Dec. Scott Polar Research Institute, University of Cambridge. Initially Senior Research Associate (Principal Investigator for Office of Naval Research); 1981-7 Assistant Director of Research; 1987-1992 **Director**; 1992-2001 **Reader in Polar Studies**; 2001-2 **Professor of Ocean Physics**. 2003 Jan. Transferred Chair to DAMTP.

1980-1990 Senior Research Fellow, Churchill College, Cambridge

2013- Fellow, Clare Hall, Cambridge.

### Visiting professorships:-

1980-81. Office of Naval Research **Chair of Arctic Marine Science**, Naval Postgraduate School, Monterey, California.

1987-88. **Cecil and Ida Green Scholar** at Institute of Geophysics and Planetary Physics, **Scripps Institution of Oceanography**, La Jolla (further visits 1989-92 working with acoustic tomography group of Walter Munk; further Green Scholarship awarded for calendar year 2017); and **Walker-Ames Professor**, University of Washington, Seattle.

1995. **Invited Visiting Professor, Arctic Environmental Research Centre**, National Institute of Polar Research, Tokyo, Japan.

1996. **British Council - Monbusho Visiting Professor** at Graduate University of Advanced Studies, Tokyo, Japan, based at National Institute of Polar Research. Revisited 2000 and 2001 under **Royal Society grant** to develop Anglo-Japanese joint programme in Arctic research.

2002. Visiting scholar, Laboratoire d'Océanographie de Villefranche (LOV), France. From 2007 Professeur Associé Recherche, Université Pierre et Marie Curie, Paris, based at LOV.

2003-4 Professorial Fellow, Scottish Association for Marine Science, Dunstaffnage Marine Laboratory, Oban, Scotland.

### **Honours**

- 1977 **W.S. Bruce Prize**, Royal Society of Edinburgh, "for oceanographic investigations and for studies of pack ice behaviour near Spitsbergen, the North Pole and off East Greenland".
- 1983 Elected **Fellow of the Arctic Institute of North America** "in recognition of significant contributions to the knowledge of the polar and sub-polar regions".
- 1987 **The Polar Medal** (H.M. The Queen) with Arctic and Antarctic clasps.
- 1990 **Italgas Prize** for Research and Innovation in Environmental Sciences, Turin.
- 2006 Elected **Foreign Member of Finnish Academy of Science and Letters** (Academia Scientiarum Fennica).
- 2008 Listed as no. 5 among "Britain's top 100 environmentalists" by "Independent on Sunday" (Oct 12 2008).
- 2008 Recognised by IPCC "for contributing to the work of the Nobel Peace Prize".

### **Committees**

- Member of US National Academy of Sciences Panel on Responding to Oil Spills in Arctic Marine Environments, 2012-13, report published 2014.
- Member of Scientific Committee, **European Environment Agency**, Copenhagen, 2004-12.
- Review Editor for Chapter 1, 5<sup>th</sup> Assessment Report (AR5), Intergovernmental Panel on Climate Change, 2012-3.
- Member of Committee for electing annual ENI Prizes, Rome.
- Member of Scientific Commission for the Holy Shroud, Diocese of Turin, for determining new experimental programme.
- Co-ordinator of several EU projects, including ECOPS (European Co-operation on Ocean and Polar Science) 1991-3; ESOP (European Subpolar Ocean Programme) 1993-6; INTERICE 1998-2008 (consortium of European laboratories using ice tank at Hamburg for sea ice physics experiments); CONVECTION (Greenland Sea convection) 2000-4; GreenICE (Greenland Arctic Shelf Ice and Climate Experiment) 2003-7; on steering committee of DAMOCLES (EU FP6, 2006-2010) and ACCESS (Arctic climate, economy and society) 2011-4. Co-coordinator of new EU project ICE-ARC, on impacts of Arctic summer sea ice retreat, 2014-8. Principal Investigator for ONR Arctic Program 1976-1997, 2011-6 (two new programmes on wave interaction with ice, MIZ-DRI and Sea State).
- Formerly: President, IAPSO (International Association for the Physical Sciences of the Ocean) Commission on Sea Ice; Co-ordinator, International Programme for Antarctic Buoys (IPAB), World Climate Res. Prog.; member of Scientific Steering Comm., ASPECT (Antarctic Sea-ice properties and climate); UK delegate, Arctic Ocean Sciences Board; member of NERC Peer Review College.

### **Societies**

Fellow of the Royal Geographical Society (**FRGS**); American Geophysical Union; European Geosciences Union; International Glaciological Society; Society for Underwater Technology; Intl. Assoc. Hydrological Sciences; Remote Sensing Soc.; Challenger Society for Marine Science; The Oceanography Society; Society for Scientific Exploration; Arctic

Club; Antarctic Club; The Explorers' Club (New York); BIO-Oceans Association (Dartmouth NS); Cambridge Rotary Club.

**PhD theses supervised: 21** (Squire, Langhorne, Kristensen, Bratchie, Crocker, O'Farrell, Rottier, Gray, Sheard, Brandon, Low, Tadross, Huddleston, Cottier, Brigham, Jonsdottir, Aksenov, Flocco, Von Eye, Fletcher, Wagner).

**Editorships** Editorial Board, "Cold Regions Science and Technology" (Elsevier); "Journal of Oceanography Research and Data" (LOV); "Underwater Technology" (Society for Underwater Technology). Associate Editor, "Oceanography" (The Oceanography Soc., Washington D.C.). Formerly Associate Editor, "Journal of Physical Oceanography." Guest editor, "Polar Science" special issue (vol. 10) on ISAR-4, Rapid Arctic Change meeting Tokyo 2015, and special issue on ISAR-5, Tokyo 2018.

### **Research experience**

Organiser and leader of internationally respected research group since 1976, working on the physical oceanography of the polar seas and the physics of sea ice and icebergs. 50 field projects carried out in Arctic and Antarctic seas, involving work from ships, submarines, AUVs, aircraft and ice camps, including large-scale collaboration among ships, aircraft and ice-based groups. Projects have included major studies of waves in ice and marginal ice zone processes (MIZEX Science plan leader, 1983-7, new ONR-MIZ programme 2011-); 6 RN submarine voyages under Arctic Ocean 1971-2007 (most recently aboard HMS "Tireless" 2007 which included the first use of a multibeam sonar from a submarine to obtain 3D ice imagery); sidescan and multibeam sonar profiling from under-ice AUVs including Autosub off NE Greenland and Gavia and WHOI AUVs (4 campaigns 2004-12); studies of strain and deformation fields in sea ice (FRAM1-3, SIMI projects for ONR; Weddell Sea work for NERC); measurement of mass balance on melting floes in Fram Strait (Sept 2009); modelling work on under-ice tomography (Scripps); convective chimney mapping in Greenland Sea (first multiyear winter and summer tracking; polar eddies (first section); iceberg dynamics and flexure (1980 with "Endurance", then 2012 with BBC shown as "Operation Iceberg", BBC2 Nov 2012).

In recent years I have co-ordinated a sequence of EU research projects (as well as being a partner in many others). Those that I have led are: ECOPS (European Co-operation on Ocean and Polar Science) 1991-3, involving deployment of upward sonar moorings in East Greenland Current; ESOP (European Subarctic Ocean Programme 1993-6 (22 partners), a comprehensive study of the physics, chemistry and biology of the central Greenland Sea gyre and its convective systems; INTERICE, 1998-2003 (consortium of laboratories using ice tank at Hamburg for sea ice physics experiment); CONVECTION, 2000-3 (12 partners), a study of the physics of chimney convection in the Greenland Sea and its relation to ice formation; and GreenICE (Greenland Arctic Shelf Ice and Climate Programme) 2003-6 (6 partners) which involved setting up an ice camp north of Ellesmere Island in 2004 for ice physics and seabed sediment coring studies. Recently I was workpackage leader and steering committee member of the ACCESS project (Arctic climate, economy and society, 28 partners), a successor of DAMOCLES (45 partners), and am co-coordinator of a newly funded EU project in Horizon 2020 called ICE-ARC (Arctic ice changes and their economic impact) as well as a partner in another new project SPICES (EU, remote sensing of ice).

Having written the first textbook on sea ice (*Ice in the Ocean*, 2000, Taylor and Francis), I have become deeply concerned with the problem of global feedbacks from Arctic sea ice retreat, leading to acceleration of global warming rates, sea level rise, offshore methane emissions and thermohaline circulation changes. This has led to the book *A Farewell to Ice* (2016, Allen Lane) and is a strong factor in my teaching and in planned future research.

**Conference organization (a few examples):-**

- Co-organizer, “The Arctic and Environmental Change”, Royal Society Discussion Meeting, Oct 12-13 1994.
- Member of Organizing Committee and Convenor of Polar Session, Oceanology International '94, Brighton, April 1994, and Oceanology International '96, March 1996.
- Member of Scientific Committee, IAPSO Advanced Study Institute on the Physics of Ice-Covered Seas, Savonlinna, Finland, June 6-17 1994.
- Conference Director, ITC'94 (Fourth International Conference on Ice Technology), Southampton, Sept 1994; Member of Scientific Committee, POAC-99, Helsinki (Int. Conf. on Port & Ocean Engng. under Arctic Condns).
- Convenor, Sea Ice Dynamics Session, Nordic Seas Symposium, Hamburg, 7-9 Mar 1995.
- Member of Organizing Committee, ISOPE'95 (International Society of Offshore and Polar Engineers), The Hague, May 1995, and ISOPE'96, Los Angeles, May 1996.
- Convenor of session P13 on ice-ocean dynamics, IUGG-99 (International Union of Geodesy and Geophysics), Birmingham, July 1999. Convenor: Climate of the Polar Regions session EGS Assembly 2001-4, Nice, 2005-2011 Vienna. Typically 120-150 attendees.
- Co-organiser of Hudson-70 40<sup>th</sup> anniversary event, Bedford Institute of Oceanography Dartmouth, Oct 2010; received prize for Hudson-70 at BIO 50<sup>th</sup> Anniversary 2012.
- Co-organiser, International Advanced Workshop on Oil Spills in Sea Ice – Past, Present and Future, Zavatti Polar Institute, Fermo, Italy, September 2011.

**Teaching**

- Cambridge University** Part III Mathematics (MMaths): taught 4<sup>th</sup> year course on polar oceans and climate change, annually 2008-15. Part II (3rd year) Geography: lecture course on sea ice, icebergs and polar oceanography, 1982-2003. Textbook based on course, “Ice in the Ocean”, published 2000. Seminars to MPhil in Polar Studies, SPRI, 1976-date.
- Université Pierre et Marie Curie**, Paris. Cours de thèse (examined course for graduate students) on polar oceanography, 2005-9.
- Università Politecnica delle Marche, Ancona**. Master’s course on polar oceans and climate change 2013 – date
- Arctic University (UNIS)**, Longyearbyen, Svalbard, Master’s course on sea ice and climate change 2016 onwards
- Frequent invited lectures at summer schools, conferences etc. Examples: Orkney International Science Festival, 1995, 1997, 1999, 2008, 2011, 2012, 2013, 2016; Wadati Conferences on Climate Change in the Polar Regions, Fairbanks 1994, Tsukuba 1995 and 2001; Okhotsk Sea and Sea Ice Symposium, Mombetsu, 1997, 1998 (keynote address), 2001; International Conferences on the Oceanography of the Ross Sea, Antarctica, Lerici, 1997 and Ischia, 2001; ACSYS Sea Ice Thickness Workshops, 1997, 2003; Gordon Research Conference on Sea Ice Biology, 1999; World Economic Forum, New York, 2002; AGU Fall Meeting 2007; MIT Global Change Fora, Rome 2009, Brussels 2011;

NERC Spring Schools; Ice Technology (Ice Tech), Banff 2008, Anchorage, 2010; ISAR-1 (Tokyo, International Symposium on Arctic Research) 2008; ISAR-2 (Tokyo) 2010 – invited lecture in presence of HIH Princess Takamado, chief editor for conference proceedings in journal “Polar Science”; ISAR-3 Tokyo 2013, ISAR-4 Tokyo 2015, ISAR-5 Tokyo 2018.

- Contributor to Open University Foundation Course in Oceanography.
- Examiner for 11 PhD theses in UK, France, Finland, Norway, Sweden, most recently Finland June 2013.

#### **Named lectures (some examples)**

W.S. Bruce Lecture, Royal Society of Edinburgh, 1980

Walker-Ames Lecture, University of Washington, 1988

Italgas Prize Lecture, University of Turin, 1990

Finnish Academy Acceptance Lecture, 2007

Royal Institution Friday Night Discourse, March 7 2008, on “The Polar Oceans and Climate Change”.

FEEM Lecture 2016 (Fondazione Eni Enrico Mattei, Milan) on climate change.

**Publications.** 5 books authored, 7 books edited or coedited, **290** other publications.

#### **Public interactions**

Frequent contributions on Arctic climate change to TV, radio, press in several countries, including BBC2 “Newsnight” special edition Sept 2012. Most recent public interactions followed Nature piece on cost of Arctic methane emissions July 2013 [ref. 20], which resulted in 600 media reports worldwide.

Briefings to All Party Parliamentary Committee on Climate Change 2007-13, following earlier briefings to Prime Minister (Rt. Hon. Margaret Thatcher) 1990,

Briefings to Environmental Audit Committee, House of Commons.

Trustee, Meridian Project, London (modelling of climate change impacts).

Lecturer on behalf of Faith and Science Initiative, COP-22 Marrakech, 2016.

#### **Current address**

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#### **PETER WADHAMS – 20 MOST SIGNIFICANT PUBLICATIONS**

1981 **Wadhams, P.** Sea-ice topography of the Arctic Ocean in the region 70°W to 25°E. *Phil. Trans. Roy. Soc., London*, **A302**(1464), 45-85. (**Draft and ridges, 1976 voyage**)

1983 **Wadhams, P.** Sea ice thickness distribution in Fram Strait. *Nature, Lond.*, **305**(5930), 108-111. (**Produced first evidence-based ice mass flux estimate for Fram Strait**)

- 1986 **Wadhams, P.**, and T. Davy. On the spacing and draft distributions for pressure ridge keels. *J. Geophys. Res.*, **91**(C9), 10,697-10,708.
- 1986 **Wadhams, P.**, V. A. Squire, J. A. Ewing and R. W. Pascal. The effect of the marginal ice zone on the directional wave spectrum of the ocean. *J. Phys. Oceanogr.*, **6**(2), 358-376.  
**(First directional wave spectra measured in ice)**
- 1987 **Wadhams, P.**, M. A. Lange and S. F. Ackley. The ice thickness distribution across the Atlantic sector of the Antarctic Ocean in midwinter. *J. Geophys. Res.*, **92**(C13), 14535-14552.
- 1988 **Wadhams, P.**, V. A. Squire, D. J. Goodman, A. M. Cowan and S. C. Moore. The attenuation rates of ocean waves in the marginal ice zone. *J. Geophys. Res.*, **93**(C6), 6799-6818.  
**(Full results of all wave attenuation experiments, several seasons)**
- 1988 **Wadhams, P.** The underside of Arctic sea ice imaged by sidescan sonar. *Nature, Lond.*, **333**, 161-164. **(First paper on high quality sidescan sonar of ice underside)**
- 1990 **Wadhams, P.** Evidence for thinning of the Arctic ice cover north of Greenland. *Nature, Lond.*, **345**, 795-797. **(First-ever paper on sea ice thinning in the Arctic Ocean)**
- 1999 **Wadhams, P.**, J.-C. Gascard and L. Miller (eds.). *The European Subpolar Ocean Programme: ESOP. Sea ice - ocean interactions, deep convection and carbon cycling in the Greenland Sea. Deep-Sea Res. Part II: Topical Studies in Oceanography.*, **46** no. 6-7, 1011-1530.
- 2000 **Wadhams, P.** *Ice in the Ocean*. Taylor and Francis, 351pp. ISBN 90-5699-296-1.  
**(First textbook on sea ice physics)**
- 2000 **Wadhams, P.** and N.R. Davis. Further evidence of ice thinning in the Arctic Ocean. *Geophys. Res. Letters*, **27**(24), 3973-3976.  
**(Paper confirming for Eurasian Basin the 40+% thickness loss reported by Rothrock et al, 1999, for Canada Basin)**
- 2002 **Wadhams, P.** J. Holfort, E. Hansen and J.P. Wilkinson. A deep convective chimney in the winter Greenland Sea. *Geophys. Res. Lett.*, **29**(10), 10.1029/2001GL014306.  
**(First-ever CTD survey of structure of a Greenland Sea chimney)**
- 2004 **Wadhams, P.** and W. Munk. Ocean freshening, sea level rising, sea ice melting. *Geophys. Res. Lett.*, **31**, L11311, doi:10.1029/2004GLO20039.  
**(Major anomaly in estimation of global sea level rise from census hydrography, in that sea ice melt explains freshening rate of ocean but does not in itself cause sea level rise, while eustatic sources would give too much freshening. Anomaly is**

**still unexplained)**

- 2004 **Wadhams, P.**, F. Parmiggiani and G. de Carolis, D. Desiderio and M.J. Doble. SAR imaging of wave dispersion in Antarctic pancake ice and its use in measuring ice thickness. *Geophys. Res. Lett.* **31**, doi:10.1029/2004GL020340.  
(**Field test of SAR technique against pancakes recovered from ship; good fit between theory and observation; technique recommended**).
- 2004 **Wadhams, P.**, G. Budeus, J.P. Wilkinson, T. Loyning and V. Pavlov The multi-year development of long-lived convective chimneys in the Greenland Sea. *Geophys. Res. Lett.*, **31**, L06306, doi:10.1029/2003GL019017.  
(**Discovery that a given chimney can be tracked through three winter and two summer seasons**)
- 2006 **Wadhams, P.**, J.P. Wilkinson and S.D. McPhail. A new view of the underside of Arctic sea ice. *Geophys. Res. Lett.*, **33**, L04501, doi:10.1029/2005GL025131.  
(**First use of an AUV to obtain 3D imagery of ice underside from multibeam sonar**)
- 2008 **Wadhams, P.** and M.J. Doble . Digital terrain mapping of the underside of sea ice from a small AUV. *Geophys. Res. Lett.*, **35**, L01501, doi:10.1029/2007GL031921.  
(**First use of a through-ice AUV to obtain under-ice 3D imagery**)
- 2012 **Wadhams, P.** Arctic ice cover, ice thickness and tipping points. *AMBIO (Royal Swedish Acad. Sci)*, **41**, 23-33.
- 2013 Whiteman, G., C. Hope and **P. Wadhams**. Vast costs of Arctic change. *Nature*, **499** (7459), 401-403.
- 2016 **Wadhams, P.** *A Farewell to Ice*. London, Allen Lane.