IOGP/JCOMM/WCRP WORKSHOP

Our Future Climate

Understanding the spread of physical risk for the oil and gas industry

25-27 September 2018

BP Upstream Learning Centre in Sunbury, UK
Chertsey Road, Sunbury Upon Thames, Middlesex, TW16 7LN

The organisers

International Association of Oil & Gas Producers

The International Association of Oil & Gas Producers (IOGP) is the voice of the global upstream industry. Oil and gas continue to provide a significant proportion of the world's energy to meet growing demands for heat, light, and transport.

Our Members produce 40% of the world's oil and gas. They operate in all producing regions: The Americas, Africa, Europe, the Middle East, the Caspian, Asia and Australia.

We serve industry regulators as a global partner for improving safety, environmental, and social performance. We also act as a specialised upstream forum in which our members identify and share knowledge and good practices to achieve improvements in health, safety, the environment, security and social responsibility.

JCOMM, the Joint Technical Commission for Oceanography and Marine Meteorology, is an intergovernmental body of technical experts that provides a mechanism for international coordination of oceanographic and marine meteorological observing, data management and services, combining the expertise, technologies and capacity building capabilities of the meteorological and oceanographic communities.

The creation of this Joint Technical Commission results from a general recognition that worldwide improvements in coordination and efficiency may be achieved by combining the expertise and technological capabilities of World Meteorological Organization (WMO) and UNESCO's Intergovernmental Oceanographic Commission (IOC).

To read more about JCOMM please visit www.jcomm.info.

The World Climate Research Programme (WCRP) mission is to facilitate the analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit, and value to society. The two overarching objectives of the WCRP are to determine the predictability of climate and the effect of human activities on climate.

WCRP was established in 1980 under the joint sponsorship of the International Council for Science (ICSU) and the World Meteorological Organization (WMO). In 1993 the Intergovernmental Oceanographic Commission (IOC) of UNESCO also became a sponsor.

The main objectives of WCRP, defined at its inception and still valid today, are to determine the predictability of climate and to determine the effect of human activities on climate.

WCRP has made enormous contributions to advancing climate science over the past 30+ years (see the 25th Anniversary Brochure). As a result of WCRP efforts, it is now possible for climate scientists to monitor, simulate and project global climate with unprecedented accuracy, and provide climate information for use in governance, decision-making and in support of a wide range of practical end-user applications.

To read more about WCRP please visit www.wcrp-climate.org.

Workshop Organizing Committee

James Stear, Chair of IOGP's Metocean Committee
Børge Kvingedal, Vice-Chair of IOGP's Metocean Committee
Alison Brown, past Chair of IOGP's Climate Change Workshop TF
Grant Elliott, Vice Chair of IOGP's Climate Change Workshop TF
Oliver Jones, Vice Chair of IOGP's Climate Change Workshop TF
Claire Channelliere, IOGP's Climate Change Workshop TF
Chris Yetsko, IOGP's Climate Change Workshop TF
Einar Nygaard, IOGP's Climate Change Workshop TF
Oleg Esenkov, IOGP's Metocean Committee
Paul Verlaan, IOGP's Climate Change Workshop TF
Jan Flynn, IOGP's Climate Change Workshop TF
Lucyna Kryla-Straszewska, IOGP's Geomatics and Metocean Manager
Sarah Grimes, JCOMM's Joint Secretariat
Val Swail, Environment and Climate Change Canada, JCOMM
Boram Lee, WCRP Joint Planning Staff

Changes in climate have the potential to create significant disruption and uncertainty in the oil and gas sector.

These include:

- **cost impacts** such as reduced plant efficiency from temperature rise and environmental impacts from the overflow of drainage systems from increased precipitation.
- **social impacts** related to increased water stress and physical risks from, for example, increased flood levels, sea level rise, and changing storm patterns. Climate change can impact the communities and environments in which the industry operates. Stakeholder expectations around climate change (including shareholders and governments) are also changing and are likely to continue to change.

Understanding both the physical risks and vulnerabilities of the oil and gas sector will help IOGP Members develop and implement adaptation strategies to manage the physical impacts of climate change.

Workshop objectives

1. Raise awareness and disseminate knowledge related to risks, methodologies, and approaches that help organisations adapt to climate change
2. Improve confidence in the use of climate data by identifying its limitations and develop improved methodologies that reduce and quantify uncertainty
3. Understand the potential risk picture that climate change poses for all aspects of the industry

Programme – Day 1

Tuesday 25 September 2018

08:00-09:00	Registration and welcome coffee
09:00-09:15	**Welcome by the Host** **Aleida Rios**, BP's Head of Upstream Engineering
09:15-09:35	**Foreword by IOGP's Metocean Committee** **James Stear**, IOGP Metocean Committee Chair
09:35-10:00	**Co-sponsors Overview** IOGP Overview by **Gordon Ballard**, Executive Director JCOMM Overview by **Val Swail**, Environment and Climate Change Canada WCRP Overview by **Boram Lee**, Senior Scientific Officer
10:00-10:50	**Oral Session 1 – Emissions Scenarios** **Chaired by: Oliver Jones** and **James Stear** **Sergey Paltsev**, Massachusetts Institute of Technology (MIT) **Piers Forster**, Priestley International Centre for Climate, University of Leeds
10:50-11:00	Questions and Discussion
11:00-11:30	Coffee Break
11:30-12:20	**Oral Session 2 – Air and Seawater Temperatures** **Chaired by: Claire Channelliere** and **Chris Yetsko** **Michelle Cain**, University of Oxford **Shang-Ping Xie**, Scripps Institution of Oceanography, University of California
12:20-12:30	Questions and Discussion
12:30-13:30	Lunch
13:30-15:10	**Oral Session 3 – Sea Level Rise and Ice Coverage** **Chaired by: Oleg Esenkov** and **Catherine Jahre-Nilsen** **Pat Harr**, Jupiter Intelligence **Patrick Heimbach**, University of Texas **Svetlana Jevrejeva**, NOC **Laurent Bertino**, Nansen Centre
15:10-15:30	Questions and Discussion
15:30-16:00	Coffee Break
16:00-17:00	**Breakout sessions** **Discussion in groups** **Group 1: Emissions Scenarios** **Chairs: Oliver Jones** and **James Stear** **Group 2: Air and Seawater Temperatures** **Chairs: Claire Channelliere** and **Chris Yetsko** **Group 3: Sea Level Rise and Ice Coverage** **Chairs: Oleg Esenkov** and **Catherine Jahre-Nilsen**
17:00-17:10	Reconvene at Auditorium
17:10-17:45	**Breakout groups reporting**
17:45-18:00	**Closing of Day 1** **James Stear**, IOGP Metocean Committee Chair

Programme – Day 2

Wednesday 26 September 2018

08:00-09:00	Registration and welcome coffee
09:00-09:15	**Welcome** **Oliver Jones**, IOGP Metocean Committee
09:15-10:00	**Foreword** **Francis Zwiers**, President & Chief Executive Officer at Pacific Climate Impacts Consortium and past Vice-Chair of IPCC
10:00-10:15	Comfort Break
10:15-11:30	**Oral Session 1 – Tropical Storms** **Chaired by: James Stear** and **Jan Flynn** **Thomas Knutson**, NOAA / Geophysical Fluid Dynamics Laboratory **James Kossin**, NOAA's National Centers for Environmental Information **Pier Luigi Vidale**, Department of Meteorology, University of Reading / NCAS-Climate
11:30-11:45	Questions and Discussion
11:45-12:30	Lunch
12:30-12:55	**Oral Session 2 – Extra-Tropical Storms** **Chaired by: Oliver Jones** and **Kieran Bhatia** **Assessing Abnormal Sea-states in Extra Tropical Regions using Climate Models** **Oliver Jones**, IOGP Metocean Committee
12:55-14:10	**Oral Session 2 – Extra-Tropical Storms** *(continued)* **Øyvind Breivik**, Norwegian Meteorological Institute **Alvaro Milho Semedo**, IHE Delft **Len Shaffrey**, Department of Meteorology, University of Reading / NCAS-Climate
14:10-14:30	Questions and Discussion
14:30-15:00	Coffee Break
15:00-16:30	**Breakout sessions** **Discussion in groups** **Group 1: Tropical Storms and Extra-Tropical Storms** **Chairs: James Stear** and **Jan Flynn** **Group 2: Tropical Storms and Extra-Tropical Storms** **Chairs: Oliver Jones** and **Kieran Bhatia** **Group 3: Tropical Storms and Extra-Tropical Storms** **Chairs: Chris Yetsko** and **Einar Nygaard**
16:30-16:40	Reconvene at Auditorium
16:40-17:15	**Breakout groups reporting**
17:15-17:30	**Closing of Day 2** **Oliver Jones**, IOGP Metocean Committee
17:30-19:30	Reception / Dinner

Programme – Day 3

Thursday 27 September 2018

08:00-09:00	Registration and welcome coffee
09:00-09:15	**Welcome** **Claire Channelliere**, IOGP Metocean Committee
09:15-10:05	**Oral Session 1 – Rainfall and flooding** **Chaired by: Chris Yetsko** and **Claire Channelliere** **Thomas Knutson**, NOAA / Geophysical Fluid Dynamics Laboratory **Francis Zwiers**, Pacific Climate Impacts Consortium
10:05-10:15	Questions and Discussion
10:15-10:45	Coffee Break
10:45-11:35	**Oral Session 2 – Drought, Fire and Water Availability** **Chaired by: Alistair Wyness** and **Paul Verlaan** **Guiling Wang**, University of Connecticut **Mohamad Hejazi**, Pacific Northwest National Laboratory
11:35-11:45	Questions and Discussion
11:45-13:00	Lunch
13:00-14:00	**Breakout sessions** **Discussion in groups** **Group 1: Rainfall and flooding** **Chairs: Chris Yetsko** and **Claire Channelliere** **Group 2: Drought, Fire and Water Availability** **Chairs: Alistair Wyness** and **Paul Verlaan**
14:00-14:10	Reconvene at Auditorium
14:10-14:45	**Breakout groups reporting**
14:45-15:00	**Closing of Day 3** **Claire Channelliere**, IOGP Metocean Committee

Presenters

Laurent Bertino

Nansen Centre

Laurent Bertino holds a PhD in Geostatistics from the Ecole des Mines de Paris. He has 16 years of experience in data assimilation, applying the Ensemble Kalman Filter to the HYCOM ocean model and has been responsible for the development and operations of the TOPAZ ice-ocean forecasting system since January 2003. Laurent leads the Arctic element of the Copernicus Marine Environment Monitoring Service and co-leads a Nordic Center of Excellence on environmental forecasting and the European SWARP project ("Ships and waves reaching polar regions"). He has also managed industry-driven modelling studies in the South China Sea, in the Gulf of Mexico, and in the Barents and Kara Seas.

Øyvind Breivik

Norwegian Meteorological Institute

Professor Øyvind Breivik is Head of Division at MET Norway. He has over 20 years' experience in wind and wave climate research and was involved in the development of the ocean-surface wave coupling at ECMWF. He oversees the development of the Norwegian wave forecast system and the OpenDrift oil drift trajectory forecast models. He was involved in the development of the NORA10 hindcast and is responsible for the development of a new high-resolution hindcast archive for the Norwegian Sea.

Michelle Cain

Oxford Martin School

Michelle Cain is an Oxford Martin Fellow and Science and Policy Research Associate at the Environmental Change Institute, University of Oxford. Michelle's work is focused on methane's impact on climate and its role in climate mitigation.

Piers Forster

Priestley International Centre for Climate, University of Leeds

Piers Forster is the director of the Priestley International Centre for Climate at the University of Leeds. His main research areas are radiative forcing, climate sensitivity, precipitation changes, and the policy implications of climate science. He is currently Lead Author of both the IPCC Special Report of 1.5C and the upcoming IPCC 6th Assessment Report.

Pat Harr

Jupiter Intelligence

Dr. Patrick Harr recently joined Jupiter Intelligence as a Science Fellow. Previously, Dr. Harr was Professor of Meteorology at the Naval Postgraduate School in Monterey, California. Dr. Harr's research interests are in tropical cyclones, statistics and decision sciences, and dynamic meteorology. Dr. Harr lead several international research field studies in conjunction with U.S., international, and World Meteorological Organization research programs.

Most recently, Dr. Harr was Head of Atmospheric Sciences at the U.S. National Science Foundation. He is a fellow of the American Meteorological Society (AMS), was Editor of the Monthly Weather Review journal, Chaired the AMS Committee on Hurricanes and Tropical Meteorology, and has served in various capacities on committees of the World Weather Research Program of the World Meteorological Organization.

Patrick Heimbach

University of Texas

Patrick Heimbach is Associate Professor at the University of Texas at Austin and fellow of the W. A. "Tex" Moncrief, Jr., Chair III in Simulation-Based Engineering and Sciences. Previously, he worked for 16 years at the Massachusetts Institute of Technology. Patrick earned his Ph.D. in 1998 in Geosciences from the Max-Planck-Institute for Meteorology and the University of Hamburg, Germany.

Presenters

Mohamad Hejazi

Pacific Northwest National Laboratory

Dr. Mohamad Hejazi is a research scientist. He leads the integrated water research program at the Joint Global Change Research Institute (JGCRI), a collaboration between the University of Maryland and the Pacific Northwest National Laboratory (PNNL). His research efforts include: Integrated modeling of energy-water-land-climate systems, coupled human-Earth system dynamics, global hydrologic modeling, and water resources management. Dr. Hejazi holds B.S and M.S degrees from the University of Maryland, College Park, and a Ph.D from the University of Illinois at Urbana-Champaign.

Thomas Knutson

NOAA / Geophysical Fluid Dynamics Laboratory

Tom Knutson is a climate scientist with NOAA's Geophysical Fluid Dynamics Laboratory, in Princeton, New Jersey.

He is a Fellow of the American Meteorological Society, Chair of a WMO "Task Team on Tropical Cyclones and Climate Change", and a lead author for the 2017 U.S. Climate Science Special Report. His research interests include hurricanes and climate change, and climate change detection and attribution.

James Kossin

NOAA's National Centers for Environmental Information

Dr. James Kossin is an atmospheric scientist in the U.S. National Oceanic and Atmospheric Administration specializing in tropical cyclone and climate research. He has served as a Lead Author on numerous international (IPCC) and U.S. National (NCA) climate assessment reports and is an active member of the United Nations WMO Expert Team on Climate Change Impacts on Tropical Cyclones, and the U.S. CLIVAR Working Group on Hurricanes and Climate.

Svetlana Jevrejeva

NOC

Dr. Svetlana Jevrejeva is a physical oceanographer (Principal Senior Scientist) working at the National Oceanography Centre (NOC) and the Natural Environment Research Council (NERC) since 2002.

She is an internationally acknowledged sea level expert, and was the lead author of a chapter on sea level changes that appeared in the Intergovernmental Panel on Climate Change's Fifth Assessment Report (AR5 IPCC).

Sergey Paltsev

Massachusetts Institute of Technology (MIT)

Dr. Sergey Paltsev is a Deputy Director of the MIT Joint Program on the Science and Policy of Global Change, Massachusetts Institute of Technology (MIT), Cambridge, USA. He is the lead modeler in charge of the MIT Economic Projection and Policy Analysis (EPPA) model of the world economy.

Alvaro Milho Semedo

IHE Delft

Alvaro Semedo is a certified hydrographer and a marine scientist. He is a graduate of the Naval Postgraduate School in Monterey, California, with MSc Degrees in Physical Oceanography and Meteorology and a PhD in Meteorology from Uppsala University in Sweden. He has worked for the Portuguese Hydrographic Office, and for the Risø-DTU National Laboratory for Sustainable Energy (Roskilde, Denmark) in the wind energy department, before starting his doctoral studies.

He taught Meteorology, Oceanography, and Remote Sensing for several years at the Portuguese Naval Academy, as well as Wave Modelling at University of Lisbon. He was the Dean of Postgraduate Studies at the Portuguese Naval Academy from 2010 to 2016.

Currently he is a Senior Lecturer in Coastal Oceanography at IHE Delft, in The Netherlands.

Presenters

Len Shaffrey

Department of Meteorology, University of Reading / NCAS-Climate

Len Shaffrey is a Professor of Climate Science at the University of Reading and the Theme Leader for Climate and High Impact Weather in the National Centre for Atmospheric Science. His personal research focuses on the impact of climate change and variability on weather extremes such as storms, floods and droughts. External links include being the Lead Academic for a Knowledge Transfer Partnership with BP on wind and wave risk to offshore oil and gas platforms.

Pier Luigi Vidale

Department of Meteorology, University of Reading / NCAS-Climate

Pier Luigi Vidale is Professor of Climate System Science at the University of Reading and Head of High-Resolution Global Climate Modelling at NCAS. His research interests include global weather and climate modeling, including GCM development, with a special focus on tropical cyclones, and land-atmosphere interactions at the local to regional scale. He is currently the Scientific Coordinator of EU-Horizon 2020 PRIMAVERA and Director of the NCAS Climate Modelling Summer School (2007-present).

Guiling Wang

University of Connecticut

Dr. Wang is a Professor of Environmental Engineering at the University of Connecticut. She received her B.E. and M.S. degrees from Tsinghua University, and PhD degree from MIT. Dr. Wang has research experience and expertise in hydroclimatological extremes (focus on drought and flood), ecosystem-climate interactions and hydrological and climate modeling/predictions.

Shang-Ping Xie

Scripps Institution of Oceanography, University of California

Shang-Ping Xie is a professor of climate science and holds the Roger Revelle Chair at Scripps Institution of Oceanography, University of California - San Diego. He studies ocean-atmosphere interactions, climate variability and change. His research contributes to answering such fundamental questions as what determines the spatio-temporal variations of climate, how preferred patterns of climate variability form, how predictable climate is, and how climate will change in the face of increasing atmospheric greenhouse gases. Dr. Xie is a lead author of the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, and a fellow of the American Geophysical Union and American Meteorological Society (AMS). He received the AMS Sverdrup Gold Medal.

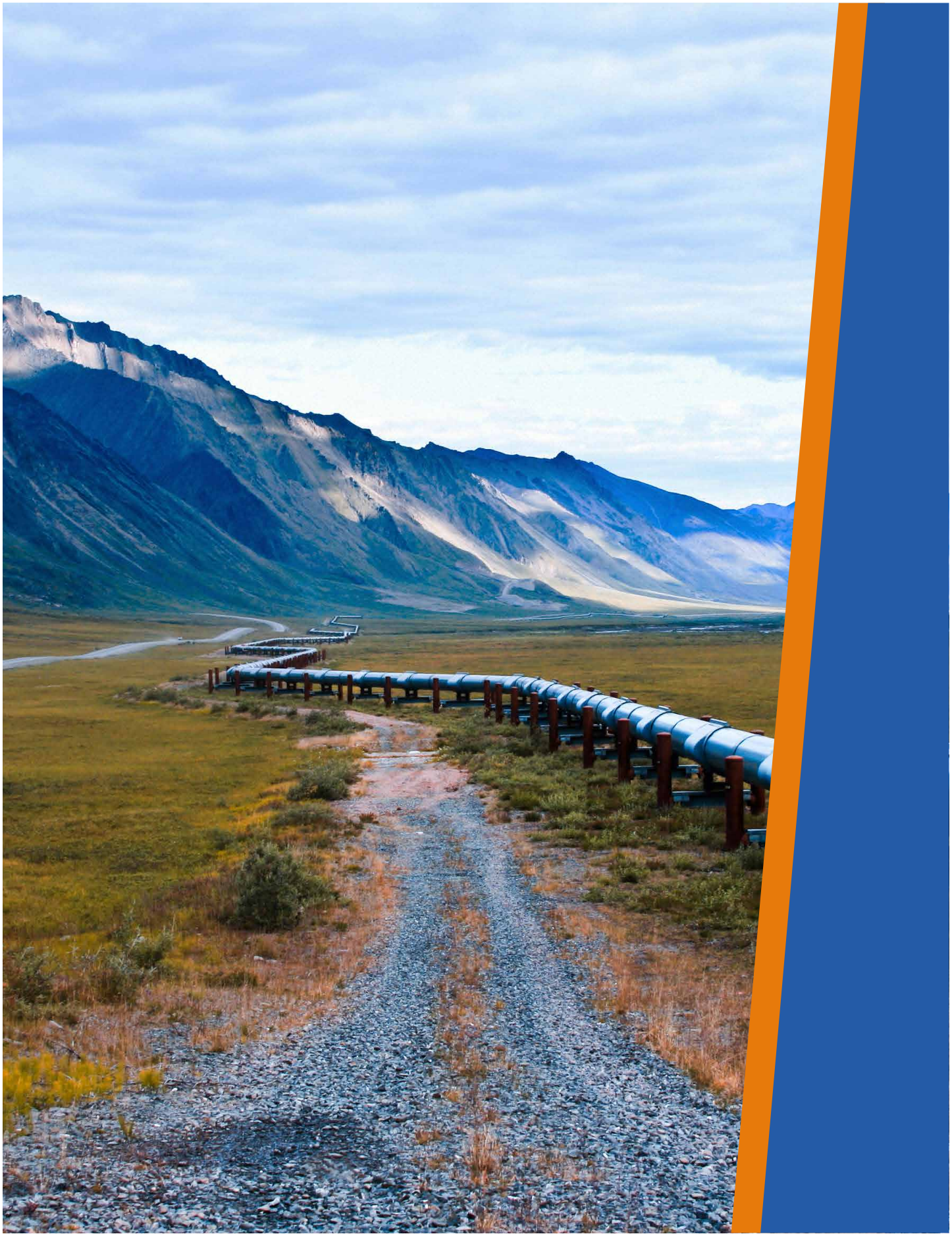
Francis Zwiers

Pacific Climate Impacts Consortium

Dr. Francis Zwiers is director of the Pacific Climate Impacts Consortium (PCIC) at the University of Victoria. His former roles include chief of the Canadian Centre for Climate Modelling and Analysis and director of the Climate Research Division, both at Environment and Climate Change Canada. As a research scientist, his expertise is in the application of statistical methods to the analysis of observed and simulated climate variability and change. Dr. Zwiers is a Fellow of the Royal Society of Canada and of the American Meteorological Society, a recipient of the Patterson Medal and President's Prize, has served as an IPCC Coordinating Lead Author of the Fourth Assessment Report and as an elected member of the IPCC Bureau for the Fifth Assessment Report.

Attendees list

Robin Stephens	ABPmer
Regina Anthony	Aker Solutions
Susan Ninan	BHP Billiton
Mark Calverley	Blue Ocean Consulting
Ken Gottselig	BP
Philip Smedley	BP
Aleida Rios	BP
Paul Page	BP
Sarah Wilford	BP
Kieran Bhatia	BP
Michelle Horsfield	BP
Oliver Jones	BP
Samuel Walker	BP
Michael Zhang	BP
Alistair Wyness	BP
Michael Hunter	Cairn Energy
Amy Guan	Chevron
Don Danmeier	Chevron
James Stear	Chevron
Mauricio Fragoso	CLS
Chris Yetsko	ConocoPhillips
Ole Petersen	DHI
Donald Smith	Eni
Michele Romano	Eni
Val Swail	Environment Canada
Anne Cavendish	Equinor
Catherine Jahre-Nilsen	Equinor
Caroline Dezecot Glawe	Equinor
Einar Nygaard	Equinor
Adel Younan	ExxonMobil
Oleg Esenkov	ExxonMobil
Ambre Trehin	Fugro
Jill Bradon	Fugro
Elke Meyer	Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research
Alvaro Semedo	IHE Delft
Valerie Quiniou-Ramus	Independent Consultant
Alison Brown	Independent Consultant
Mikako Mochizuki	INPEX
Ichimaru Yoshikazu	INPEX / JOGMEC
Lucyna Kryla	IOGP
Carla Lloret	IOGP
Gordon Ballard	IOGP
Kamila Piotrowska	IOGP
Olaf Martins	IOGP
Lloyd Slater	IOGP
Jim Herbertson	IPIECA
Yuji Hisaizumi	JOGMEC
Patrick Harr	Jupiter Intelligence
Øyvind Breivik	MET Norway
Sergey Paltsev	MIT
Kevin Ewans	MRL
Laurent Bertino	Nansen Center
Patrick Hogan	Naval Research Laboratory
Thomas Knutson	NOAA
James Kossin	NOAA
Svetlana Jevrejeva	NOC
Trym Edvardsson	Norwegian Oil and Gas Association
Gus Jeans	Oceanalysis
Rory Smyth	OceanMetrix
Richard Gibson	OCG
Francis Zwiers	Pacific Climate Impacts Consortium
Mohamad Hejazi	Pacific Northwest National Laboratory
Cesar Henrique de Assis Ribeiro	Petrobras
Clarisse Kaufmann	Petrobras
Jose Antonio Lima	Petrobras
Jens Petter Aabel	PGNiG
Steve Buchan	RPS
Linda Weijers	Shell
Paul Verlaan	Shell
Jon Upton	Shell
Emma Boorman	Shell
Maxim Yazarov	Total
Robert Bridges	Total
Claire Channelliere	Total
Edward Steele	UK Met Office
Shang-Ping Xie	University of California
Guiling Wang	University of Connecticut
Piers Forster	University of Leeds
Michelle Cain	University of Oxford
Pier Luigi Vidale	University of Reading
Len Shaffrey	University of Reading
Alex Baker	University of Reading
Rosmeri Porfirio da Rocha	University of Sao Paulo
Patrick Heimbach	University of Texas
Boram Lee	WCRP
Robert Hamilton	Woods Hole Group
Jan Flynn	Woodside



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