WCRP Polar Climate Predictability Initiative (PCPI)

Cecilia Bitz (Department of Atmospheric Sciences, University of Washington, USA; representing CliC)

&

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Scientific Context (in brief)

• Disagreement between models and observations opposite at the two poles
• Polar regions may contain sources of predictability on both seasonal and decadal time scales
• Much more
Programmatic context (in brief)

- Polar climate predictability cuts across all elements of WCRP, but tends to fall between the cracks
- WMO EC-PORS is promoting a Global Integrated Polar Prediction System (GIPPS)
  - WWRP Polar Prediction Project: hours to seasonal
  - WCRP PCPI: seasonal to multi-decadal
  - Will liaise closely, have a common coordination office
- Logistical support also provided by CliC Project Office, including web site: http://www.climate-cryosphere.org/wcrp/pcpi
- Environment Canada providing substantial funding for PCPI and PPP meetings through GFCS
- IASC is developing its own Polar Prediction Network in order to liaise with both PPP and PCPI
A brief history of the PCPI

- Bergen workshop (October 2010), informal WCRP report
- Toronto workshop (April 2012), draft implementation plan identifying six initiatives
- Discussion at WWRP-PPP Steering Committee meeting in December 2012 identified *three joint initiatives*
- Cecilia Bitz joined Ted Shepherd as PCPI co-lead in spring 2013
- Two champions subsequently identified for each initiative
  - Careful thought given to ensure strong connections to related activities within WCRP and with WWRP-PPP
- No formal Steering Committee; champions act collectively, together with the co-leads, to move PCPI ahead
- Boulder meeting (April 2014)
- Next pan-PCPI meeting planned in conjunction with IUGG Prague (summer of 2015)
Joint PPP/PCPI workshop on polar-lower latitude linkages and their role in weather and climate prediction
Barcelona, 10-12 December 2014

ORGANISATION

SCIENTIFIC COMMITTEE:
Francisco Doblas-Reyes (co-chair, WGSIP and SPECS), Thomas Jung (co-chair, WWRP-PPP and Arctic ECRA), Frédéric Vitart (WWRPS2S), Brian Mills (WWRP-SERA and WWRP-PPP), James Overland (IASC), Thomas Spengler (IAMAS-ICDM and IASC), David Bromwich (IAMAS-ICPM and WWRP-PPP), Cecilia Bitz (WCRP-PCPI), Hugues Goosse (WCRP-PCPI), Jonny Day (APECS), Claus Brüning (European Commission), Vladimir Ryabinin (WCRP), Carlo Buontempo (EUPORIAS).

LOCAL ORGANISING COMMITTEE:
Virginie Guemas (IC3 and Météo-France), Neven Fuckar (IC3), Ramiro Saurral (CIMA and Univ. of Buenos Aires), Javier García-Serrano (IPSL), François Massonnet (UCL), Matthieu Chevallier (Météo-France).

FURTHER INFORMATION ON REGISTRATION, ACCOMMODATION AND ORGANISATION:
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SPONSORS

The workshop is supported by:
IC³, AWI, WWRP, WCRP, SPECS-FP7, ECRA,
GFCS, EGU, European Commission
PCPI session at 2014 AGU Fall Meeting

• Title: Polar Climate: Processes and Predictability

• Convenors: Cecilia Bitz, Sarah Gille, Ed Hawkins, Marilyn Raphael

• Description: Few climate models have accurately predicted recent changes in polar climate and, as a result, projections of seasonal to multidecadal polar climate variability remain uncertain. ..... This session seeks to connect the community of atmospheric, oceanic, and cryospheric scientists working on topics relevant to the new Polar Climate Predictability Initiative of the World Climate Research Program.
Year of Polar Prediction (YOPP): mid-2017 to mid-2019

- A flagship activity of the PPP, covering Arctic and Antarctic
  - PCPI will participate through its three joint initiatives
- An extended period of coordinated intensive observational and modelling activities in order to improve polar prediction capabilities on a wide range of time scales
  - Augmented by preparation and consolidation phases
- Will encourage coupled assimilation in the Arctic on an experimental basis, to guide future reanalyses
- Several planning meetings have already taken place, and a Draft Implementation Plan exists
- Could connect to MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate), a proposed experiment of IASC
Initiative 1

• Topic: *Improve knowledge and understanding of past polar climate variations (up to 100 years)*

• Co-leads: Sarah Gille (SIO, USA; WCRP JSC) and Julie Jones (U Sheffield, UK)

• Initial focus on SH: Together with Hugues Goosse (Initiative 4), planning a joint workshop with FE PAGES project ($10k PAGES funding approved), provisionally at SIO-UCSD in March 2015
  – Large-scale climate variability in Antarctica and the Southern Ocean over decades to centuries, and links to extra-polar climate
  – Aim is to bring together researchers from the proxy, modelling, and data rescue/historical communities
  – Goal is to produce a review paper
Initiative 2

- **Topic:** Assess reanalyses in polar regions (joint with PPP)
- **Co-leads:** Dave Bromwich (OSU, USA; SCAR and WWRP-PPP SSG) and Jim Renwick (Victoria University, New Zealand; WMO EC-PORS and WCRP JSC)
- **Plan to lead a review paper** (also with Gareth Marshall, Initiative 6) on known issues with reanalyses in polar regions, to raise awareness of the challenges and promote best practices
  - May subsequently consider possible larger-scale effort which would systematically assess reanalyses in terms of polar processes (stimulating new work)
- **Give guidance to CORE project** on appropriate atmospheric reanalyses to drive ocean models (link to upcoming SOOS workshop): John Fyfe (Initiative 3) to carry forward
Initiative 3

• Topic: *Improve understanding of polar climate predictability on seasonal to decadal timescales* (joint with PPP)

• Co-leads: John Fyfe (CCCma, Canada) and Ed Hawkins (U Reading, UK; CLIVAR SSG)

• Building on activities in individual countries, scaling up workshops to provide international context and networking
  – SIPN in USA (April 2014)
  – APPOSITE IN UK (April 2015)
  – CanSISE in Canada (2016?)

• Goal is to generate experiments on predictability that inform those involved in predictions
• Arctic sea-ice prediction is a new but rapidly growing area
• SEARCH Sea-Ice Outlook (SIO): any skill comes from the trend
• Anomalous years are more difficult to predict; need to determine where predictability may lie, e.g. in springtime sea-ice thickness

Stroeve et al. (2014 GRL)
Initiative 4

• Topic: *Assess performance of CMIP5 models in polar regions*
• Co-leads: Hugues Goosse (UCL, Belgium) and Jennifer Kay (NCAR, USA)
• With Gunilla Svensson (Initiative 5), planning an ISSI-style focused activity on feedbacks/process aspects of climate models (emergent constraints) in polar regions, leading to a synthesis paper; target Spring 2015
• With Ed Hawkins (Initiative 3), encourage production of large ensembles of CMIP5 runs, to examine role of variability
• There appears to be a relationship in CMIP5 models between summertime Arctic sea-ice albedo and seasonal sea-ice retreat
• Many models lie well outside the observational estimates (grey)

Model range translates into difference of 75 W/m² in additional summertime absorbed surface SW radiation in ice-free conditions (assuming no change in clouds)

Karlsson & Svensson (2013 GRL)
Initiative 5

- **Topic:** *Model error* (joint with PPP)
- **Co-leads:** Markus Jochum (U Copenhagen, Denmark; CLIVAR) and Gunilla Svensson (U Stockholm, Sweden; GEWEX GABLS co-Chair and WWRP-PPP SSG)
- **Planning small workshop** (possibly at Bolin Centre in Stockholm) on systematic fast-timescale errors in coupled systems in polar regions, possibly joint with Initiative 2 (reanalysis), using available observations to assess models
- Observations show **two states of the Arctic boundary layer**
  - Cloudy state with little radiative cooling, clear state with strong radiative cooling (stronger inversion => less cooling)

Result of Arctic air-mass formation (bottom figure)

Cloudy state (mixed phase clouds) not well represented in climate models

Pithan et al. (2013 Clim. Dyn.)
Initiative 6

- **Topic:** Improve understanding of how jets and non-zonal circulation couple to the rest of the system in the Southern Hemisphere
- **Co-leads:** Gareth Marshall (BAS, UK; CLIVAR) and Marilyn Raphael (UCLA, USA; CliC)
- **Organized session at 2013 AGU Fall Meeting on Southern Hemisphere atmospheric circulation and climate**
- **Two-day meeting at UCLA just before, on Amundsen-Bellingshausen Sea Low (12 participants)**
- **Writing a review paper for BAMS:** “The Amundsen Sea Low: variability, change and impact on Antarctic climate”
- **Planning another focussed workshop in 2015, possibly in conjunction with ICSHMO, topic TBD**
- **John Fyfe and Nikki Lovenduski planning a workshop on Southern Ocean and carbon cycle (early summer 2015)**
Antarctic sea ice concentration trends and mean for 1979-2011

Figure produced by Cecilia Bitz