

Report to WCRP JSC meeting, July 2014

WCRP Polar Climate Predictability Initiative (PCPI)

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

&

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Reading, UK; representing SPARC)

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

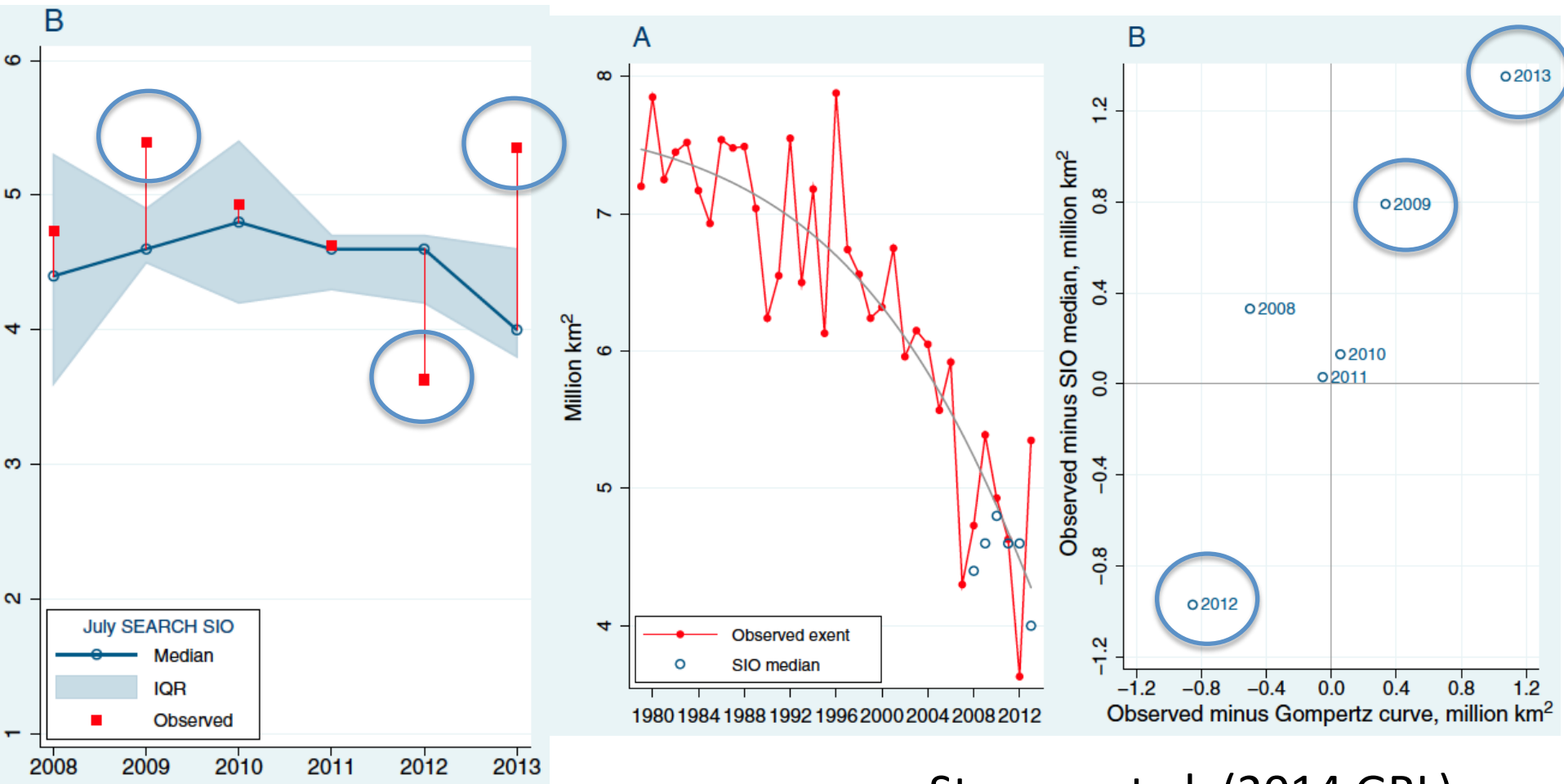
Initiative 2

- 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

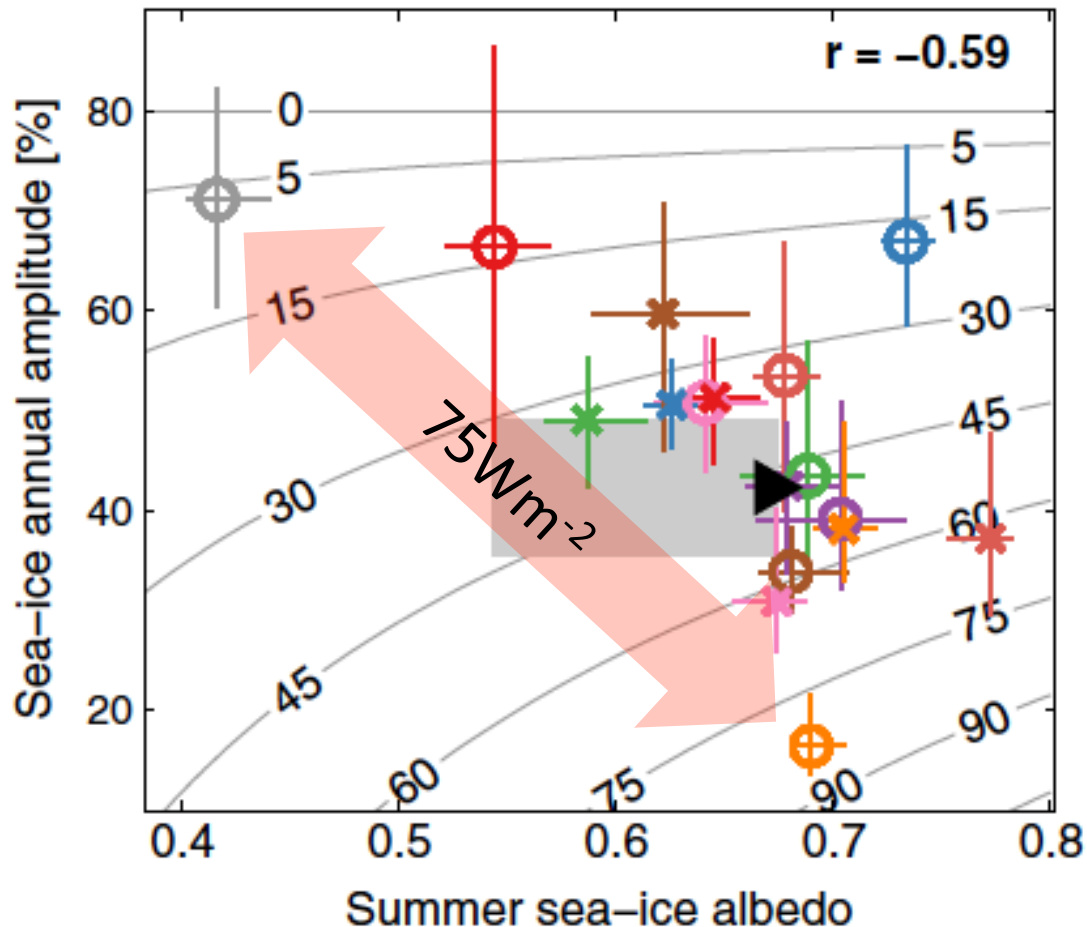
- Arctic sea-ice prediction is a new but rapidly growing area
- SEARCH Sea-Ice Outlook (SIO): any skill comes from the trend
- Anomalous years are more difficult to predict; need to determine where predictability may lie, e.g. in springtime sea-ice thickness



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)

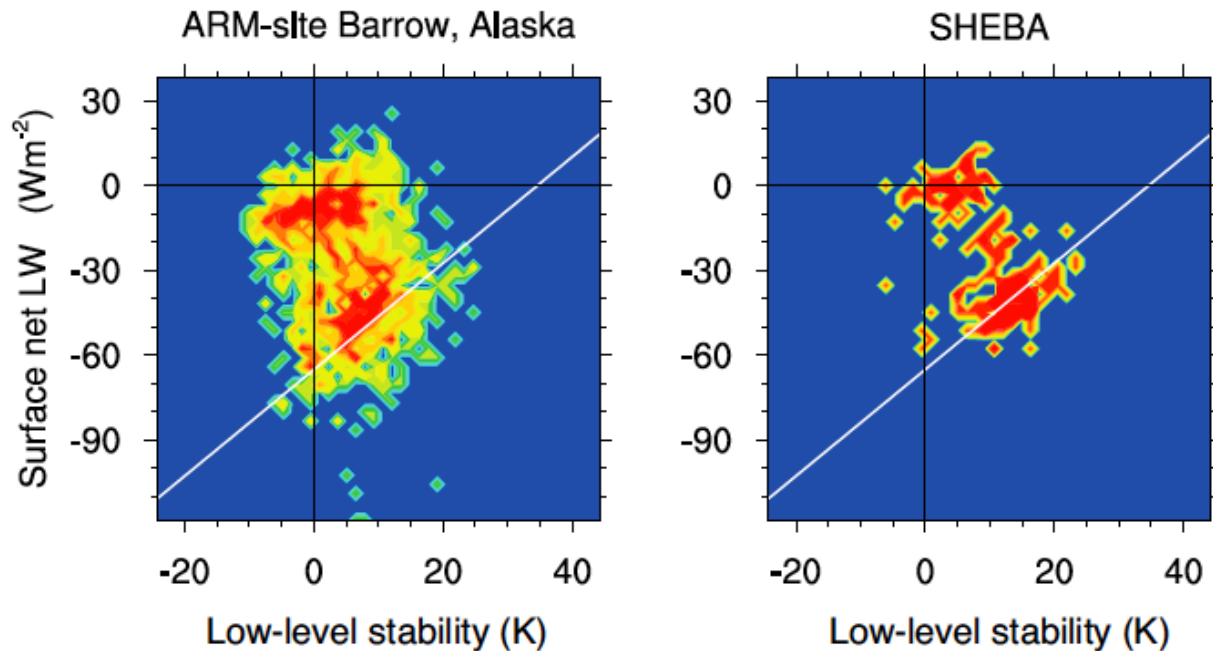


Model range translates into difference of 75 W/m^2 in additional summertime absorbed surface SW radiation in ice-free conditions (assuming no change in clouds)

Initiative 5

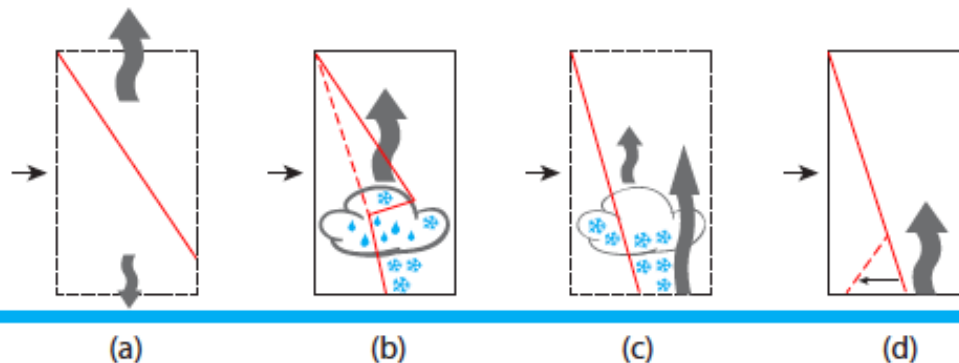
- Topic: *Model error* (joint with PPP)
- Co-leads: Markus Jochum (U Copenhagen, Denmark; CLIVAR) and Gunilla Svensson (U Stockholm, Sweden; GEWEX GABLS co-Chair and WWRP-PPP SSG)
- Planning small workshop (possibly at Bolin Centre in Stockholm) on systematic fast-timescale errors in coupled systems 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



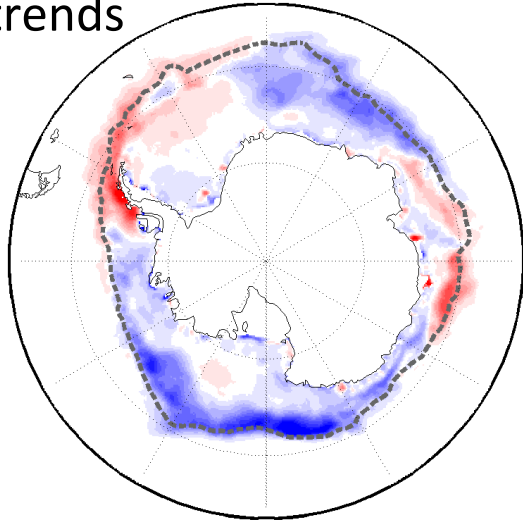
Pithan et al. (2013
Clim. Dyn.)

Initiative 6

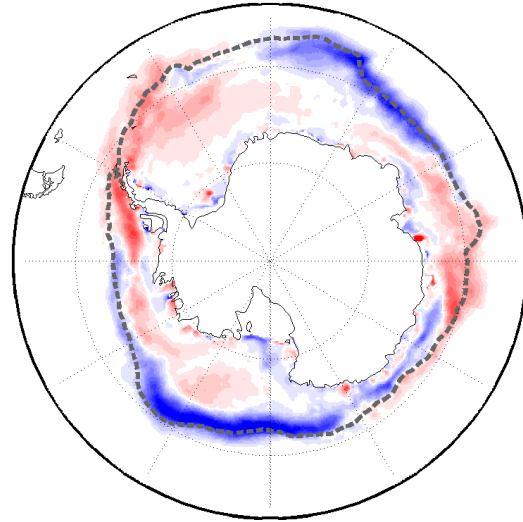
- Topic: *Improve understanding of how jets and non-zonal circulation couple to the rest of the system in the Southern Hemisphere*
- Co-leads: Gareth Marshall (BAS, UK; CLIVAR) and Marilyn Raphael (UCLA, USA; CliC)
- Organized session at 2013 AGU Fall Meeting on Southern Hemisphere atmospheric circulation and climate
- Two-day meeting at UCLA just before, on Amundsen-Bellinghausen 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

Jun.-Aug.

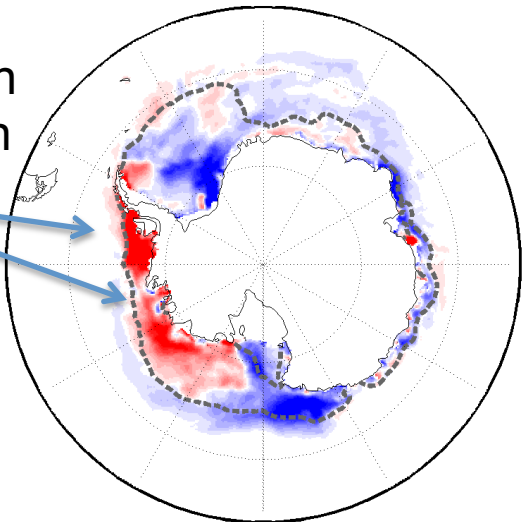
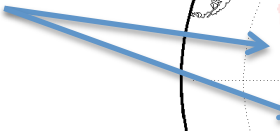


Sep.-Nov.



Dec.-Feb.

Bellingshausen and Amundsen Seas



Mar.-May

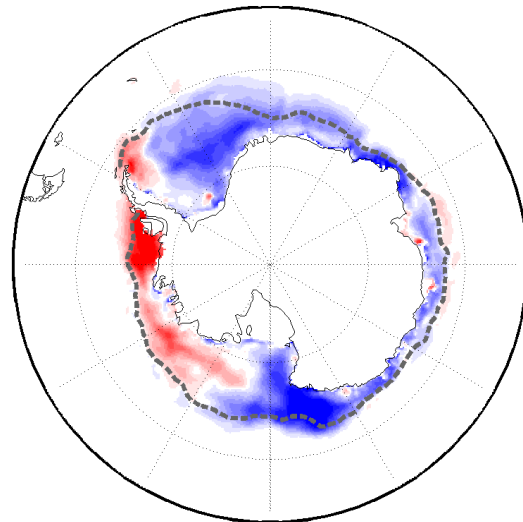


Figure produced by Cecilia Bitz

