Climate and Cryosphere (CliC) Update

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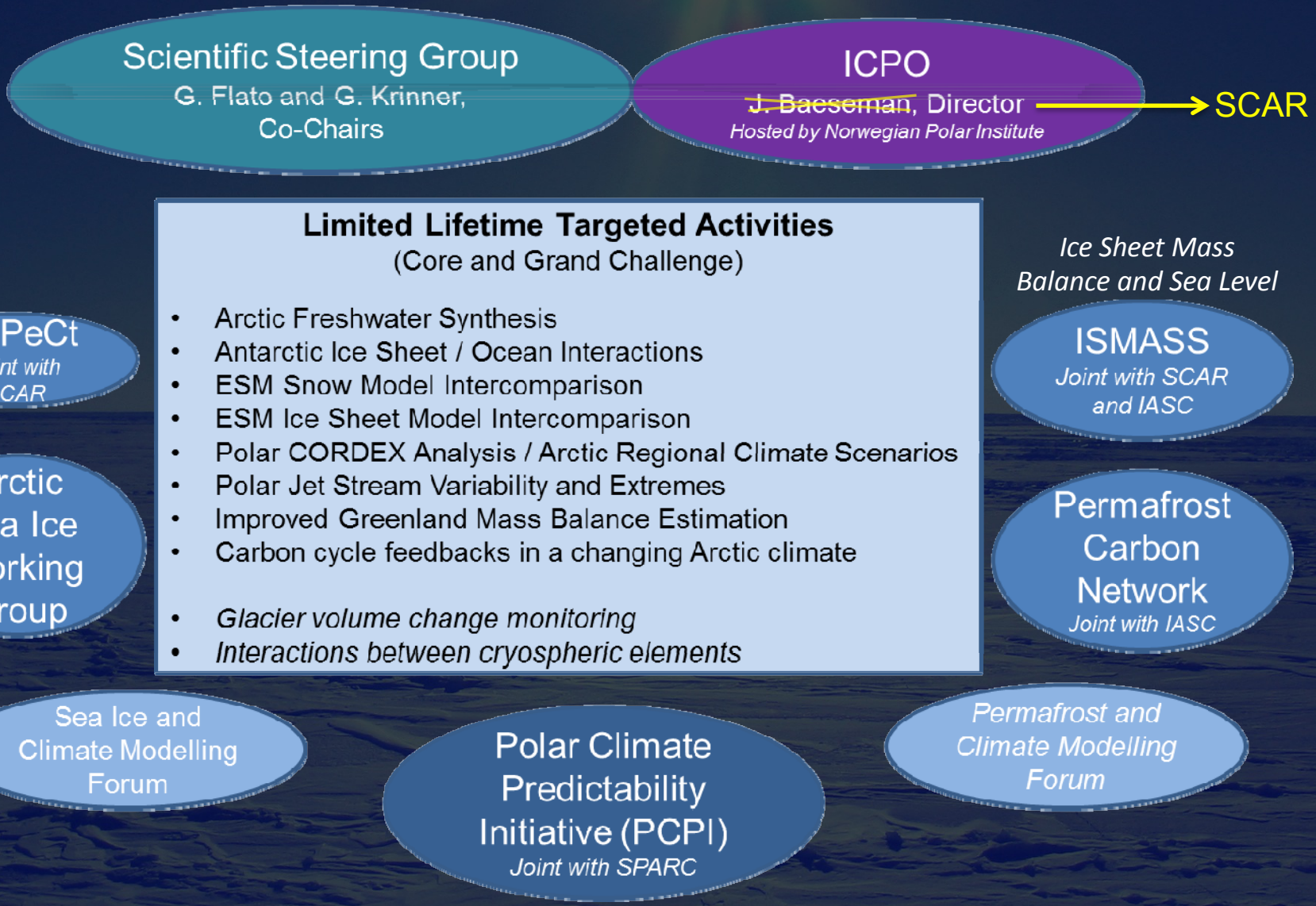
NASA Goddard Space Flight Center

WDAC Meeting, Reading, UK
2 July 2015

CliC Structure

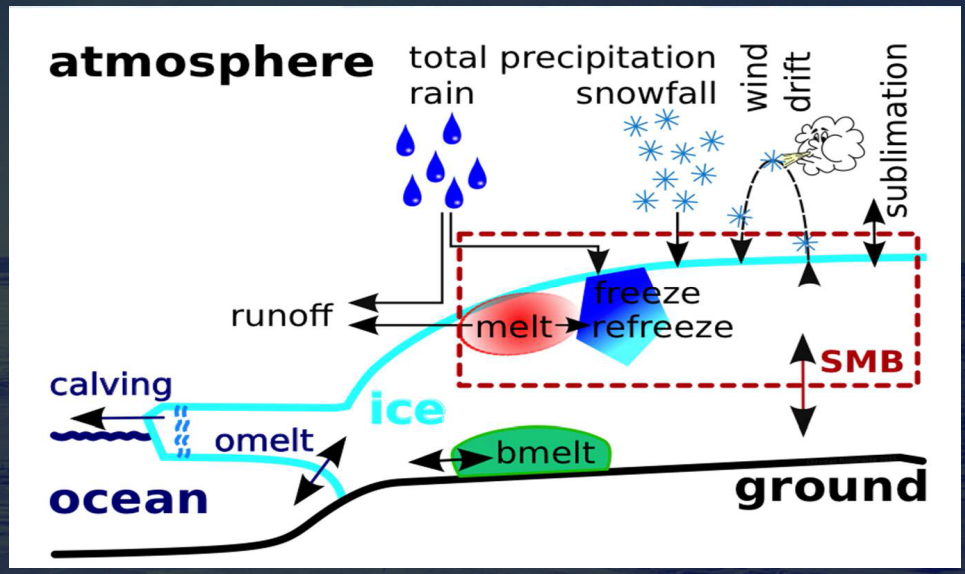


CliC Actvities

- 11th Science Steering Group (SSG) workshop held in Boulder, CO, 9-12 February 2015
  - Presentations: http://www.climate-cryosphere.org/meetings/ssg11/downloads
- Shift in focus of CliC to modeling, including contributing to MIPs, CMIP6, etc.:
  - Polar CORDEX: regional atmospheric climate model projections [J. Cassano, Univ. Colorado]
  - MISOMIP: Marine Ice Sheet-Ocean MIP [D. Holland, NYU], formerly W. Antarctica Glacier-Ocean Modeling
  - SIMIP: Sea Ice MIP [A. Jahn, Univ. Colorado, and D. Notz, Univ. Hamburge], diagnostic MIP (analysis of MIP output; SIMIP requested variables)
  - GlacierMIP: proposed [R. Hock, Univ. Alaska-Fairbanks, and B. Marzeione, Univ. Innsbruck]

Ice Sheet Model Intercomparison Project for CMIP6

- Ice sheets responding much faster than expected, major contributor of SLR and uncertainty in future SLR projections
- July 2014 workshop at NASA Goddard
- Proposal submitted to include ice sheet MIP in CMIP6
  - S. Nowicki, NASA Goddard, PI
  - Proposal approved, plans underway

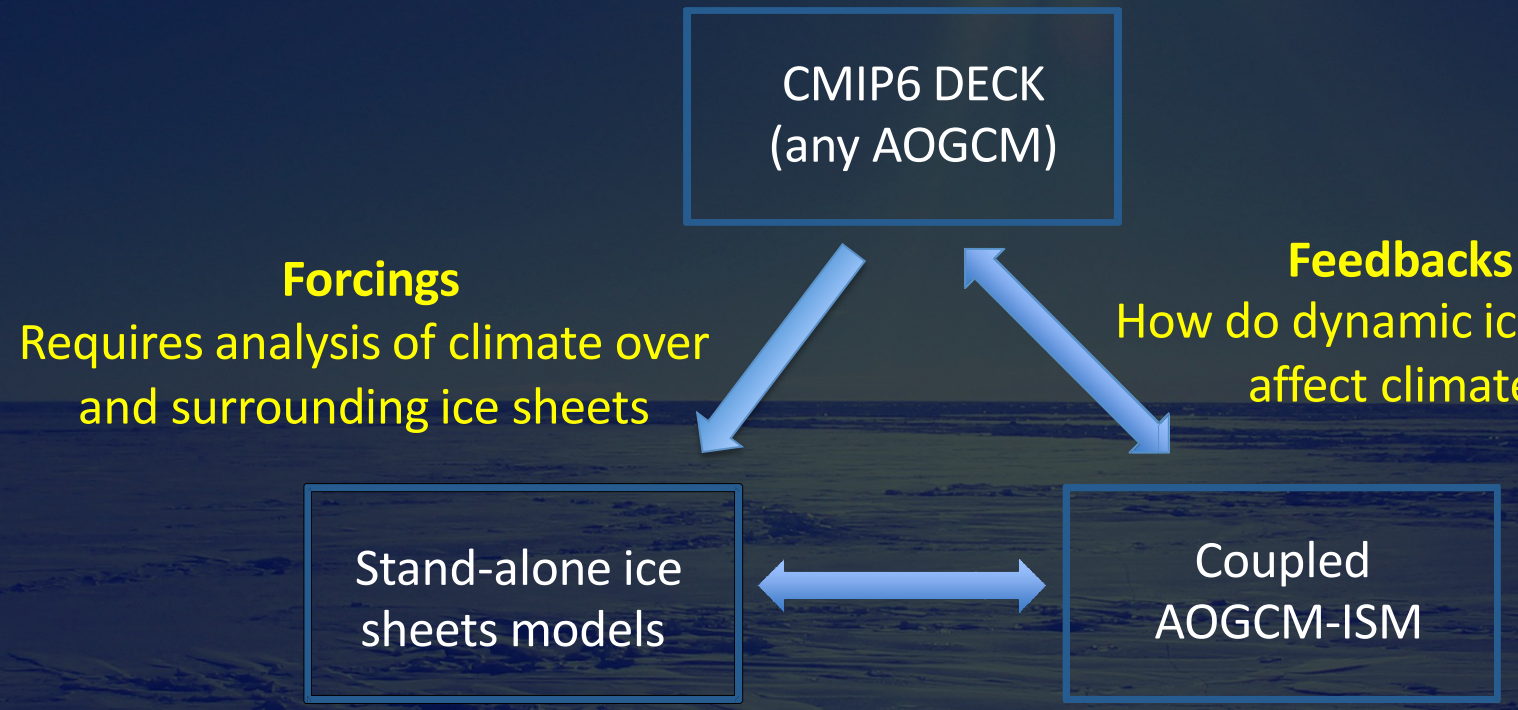


Drawing courtesy of C. Rodehacke

ISMIP6
Ice Sheet Model Intercomparison Project for CMIP6

ISMIP info courtesy S. Nowicke, NASA Goddard

Experimental framework



Projections

Historical and future sea level due to ice sheets, and associated uncertainty due to ice sheets.

Next steps

- Identify variables that need to be saved in CMIP6
- Identify needed observations
- Develop ISM experiments
- Run models and analyze

- Communication with ISMASS and other ice sheet mass balance efforts

CMIP6 exp to be used by ISMIP6 (all AOGCM)

- Pre-industrial control
- AMIP
- Historical Simulation
- 1% per yr CO2 to 4xCO2
- ScenarioMIP SSP5-8.5 (up to year 2300?)

New proposed ISMIP6 exp (coupled AOGCM-ISM)

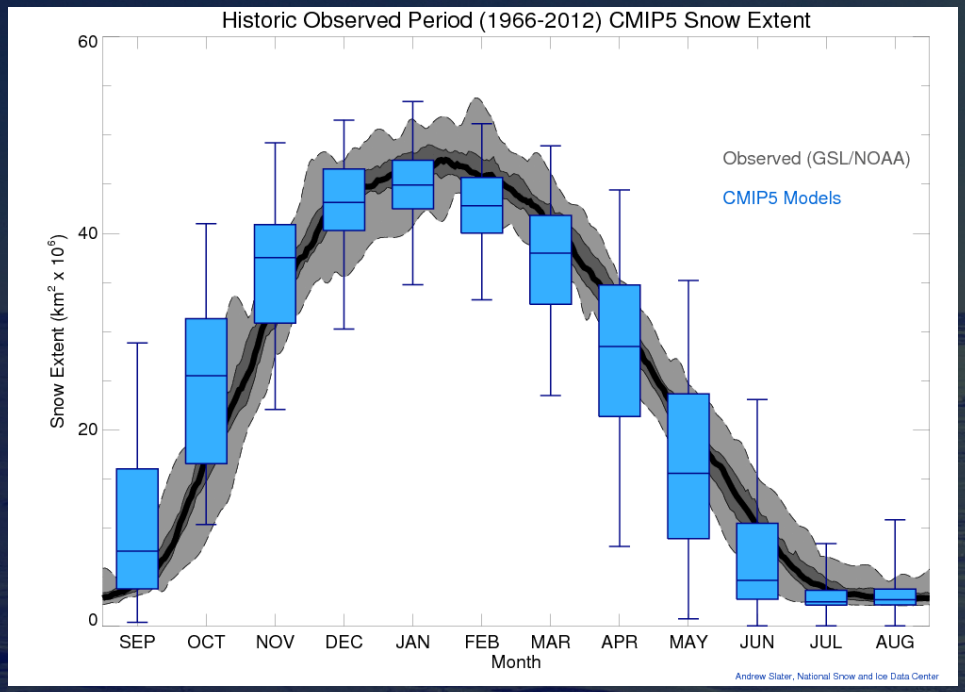
- Pre-industrial control
- 1% per yr CO2 to 4xCO2
- ScenarioMIP SSP5-8.5 (up to year 2300?)

Standalone ISMIP6 exp (ISM only)

- ISM control
- ISM for last few decades (AMIP)
- ISM for the historical period
- ISM for 21st / 23rd century sea level forced by SSP5-8.5
- ISM forced by 1% per yr CO2 to 4xCO2
- ISM specific experiments to explore uncertainty in sea level

ISMIP slides courtesy S. Nowicke, NASA Goddard

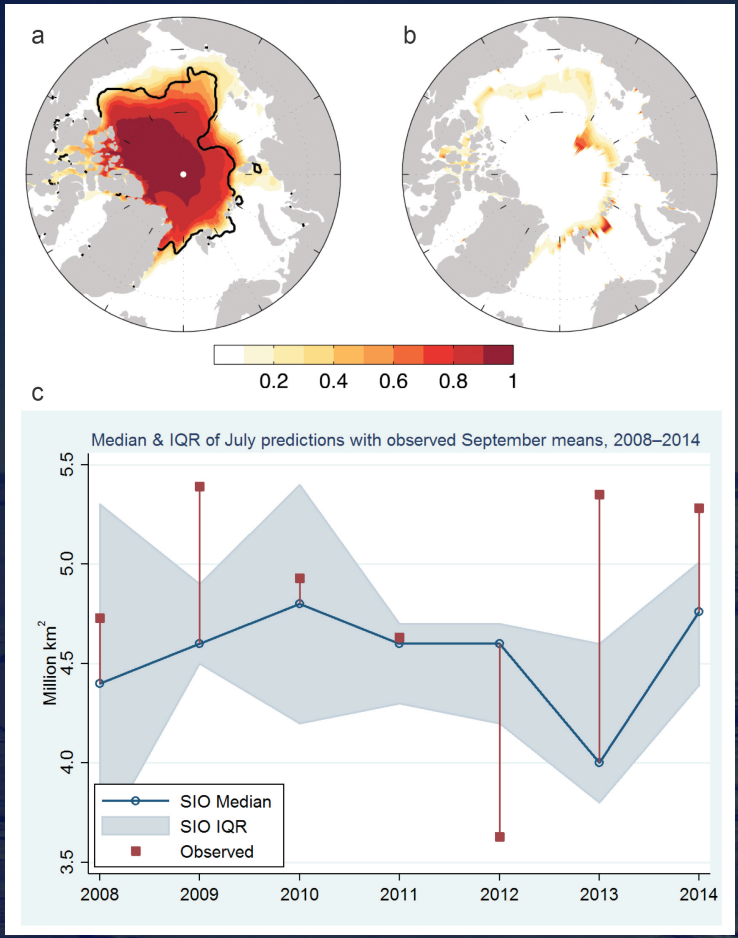
ESM-SnowMIP



- Goals of SnowMIP
  - Improve representation of snow in earth system models
  - Better quantify snow-related climate feedbacks
- Simulation protocol developed – interest and feedback from community being solicited
- Plan to initiate local and global-scale simulations in 2016; coupled models in 2018, after CMIP6
- Observation super sites, satellite data sources for model evaluation being identified
- http://www.climate-cryosphere.org/activities/targeted/esm-snowmip

Figure from A. Slater, NSIDC

Sea Ice Prediction Network

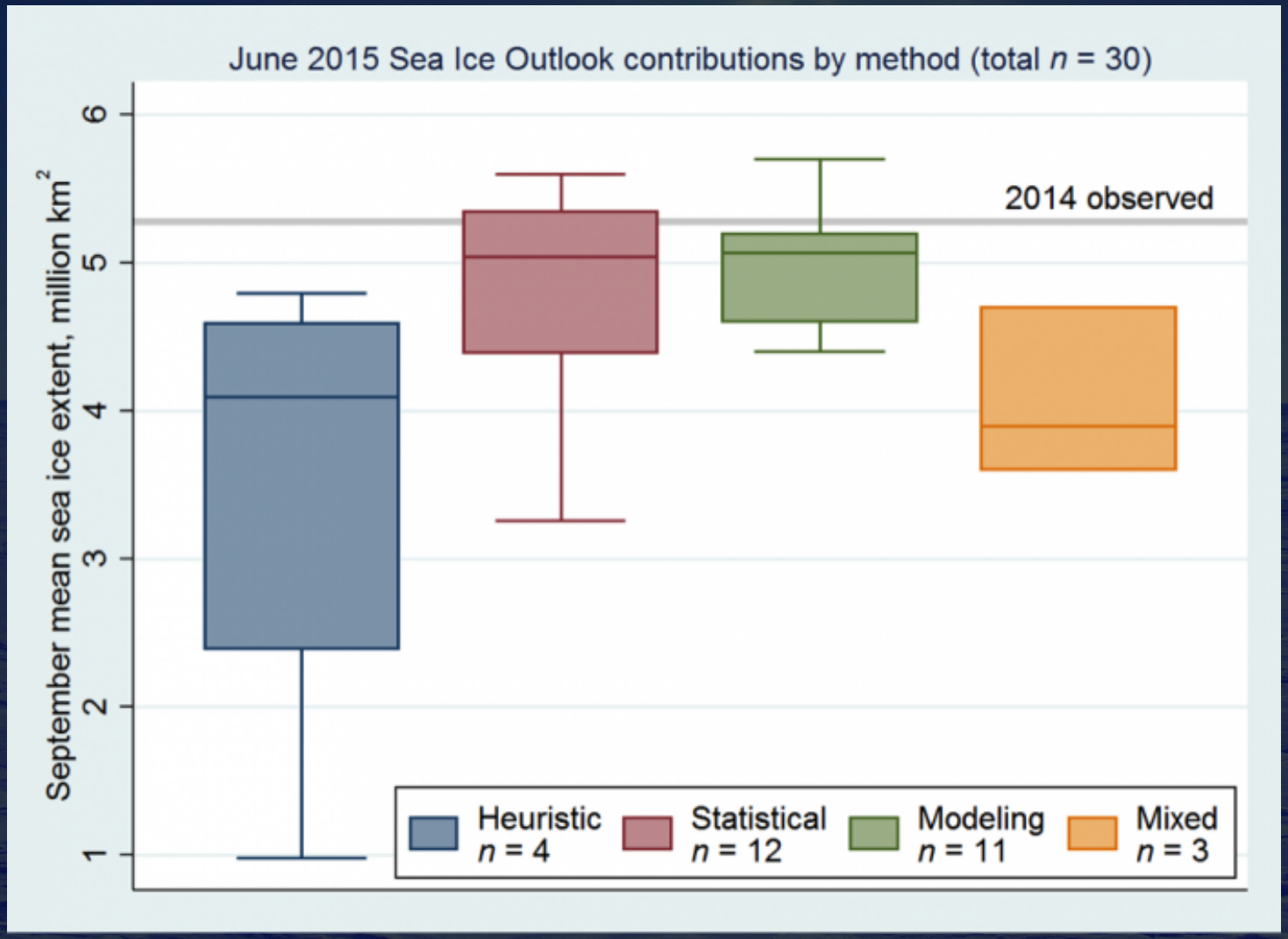


(Top) multimodel ensemble for Sep 2014 ice edge and observed extent (black line); [Bottom] median and interquartile range of July predictions compared with observed mean September extent, 2008-2014

- U.S. supported project (NSF, ONR, DOE, NASA): http://www.arcus.org/sipn
- Focus on seasonal sea ice prediction
  - Sea Ice Outlook: http://www.arcus.org/sipn/seaiceoutlook
  - Framework for model intercomparison and evaluation
  - Provide resource for observations to initialize and validate models: http://nsidc.org/data/sipn/
  - Design metrics to assess model performance
- Will collaborate with other prediction efforts
  - WCRP Polar Climate Predictability Initiative
  - WMO Polar Prediction Project
  - Year of Polar Prediction (YOPP)
    - mid-2017 to mid-2019
    - Summit, 13-15 July 2015 ← report to be presented on CliC contributions (including SIPN)
    - http://www.polarprediction.net

Figure from Stroeve et al., Eos, 2015

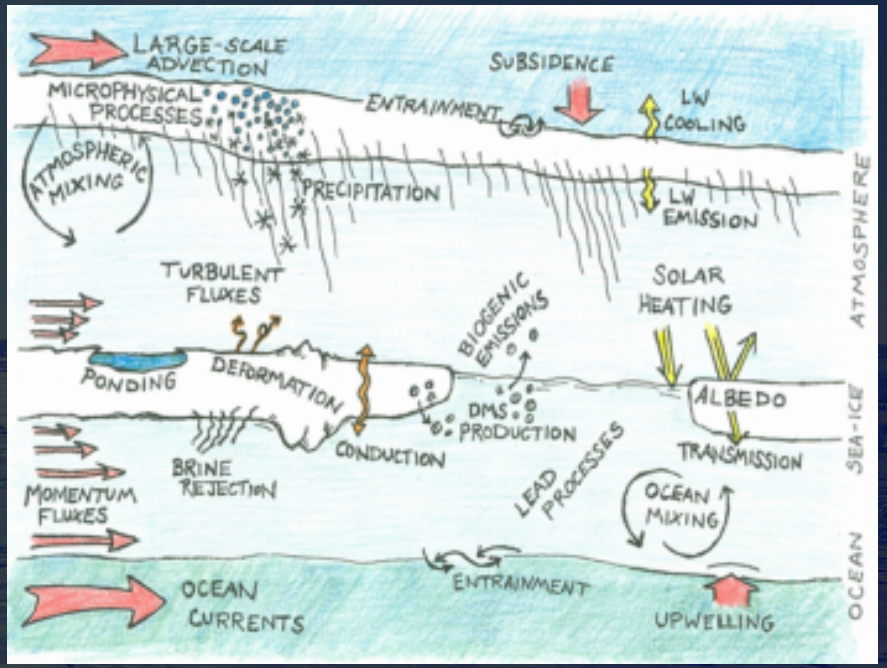
Sea Ice Outlook 2015



http://www.arcus.org/sipn/sea-ice-outlook/2015/june

MOSAiC

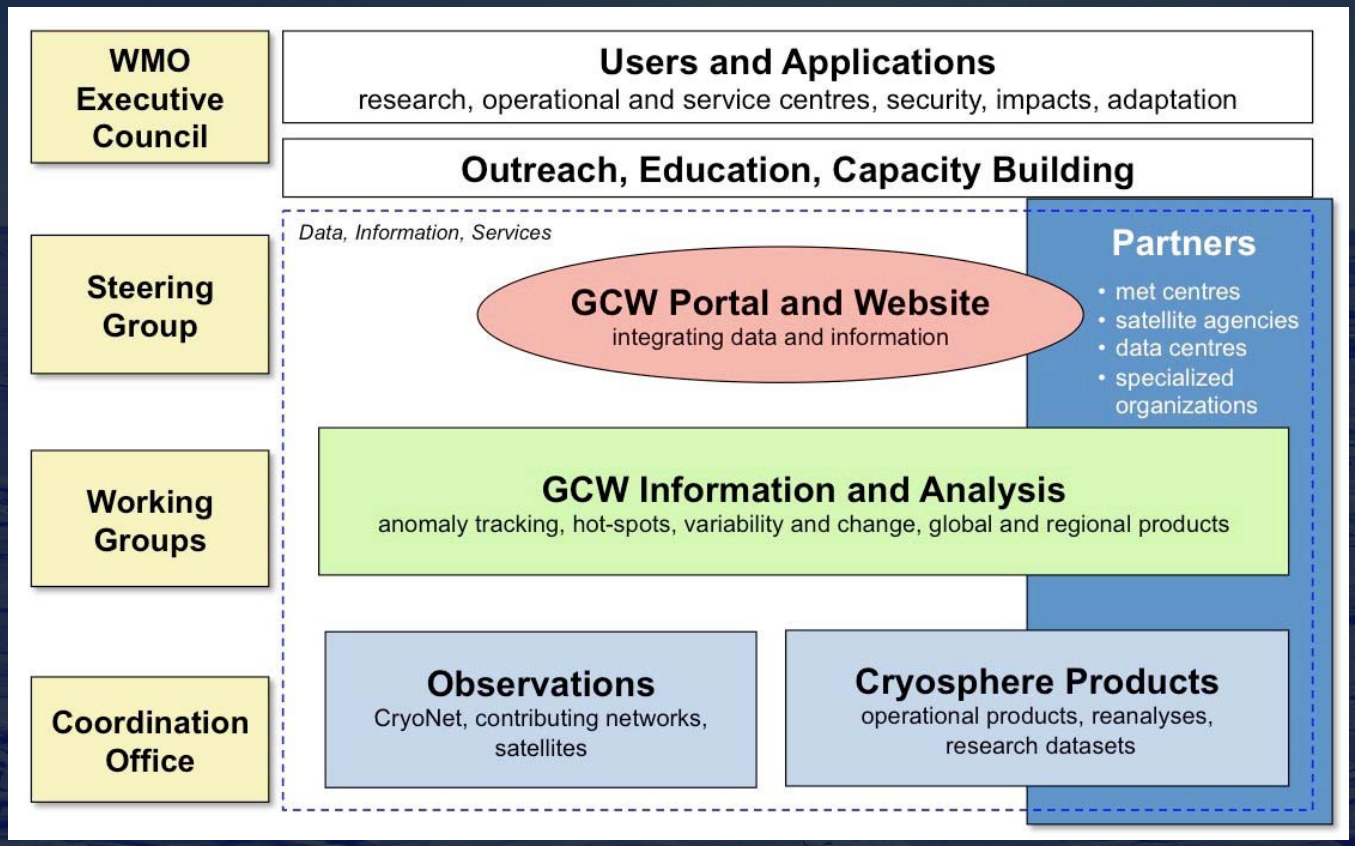
- Multidisciplinary drifting Observatory for the Study of Arctic Climate
- http://www.mosaicobservatory.org
- Focus on transfer of heat, moisture, density, momentum, and nutrients through the Arctic system
- Intensive international field campaign
  - Icebreaker frozen in for a full year with various surrounding observing platforms
  - Follow-on from SHEBA – update from 20 years ago, particularly dramatic changes in ice cover (e.g., loss of multi-year ice)
- IASC and CliC sponsors
- Plan for 2017 or 2018 deployment
- Science plan draft published
- Implementation workshop, 22-24 July 2015, Potsdam, Germany



Global Cryosphere Watch

Mission: to provide authoritative, clear, and useable data, information, and analyses on the past, current, and future state of the cryosphere

globalcryospherewatch.org

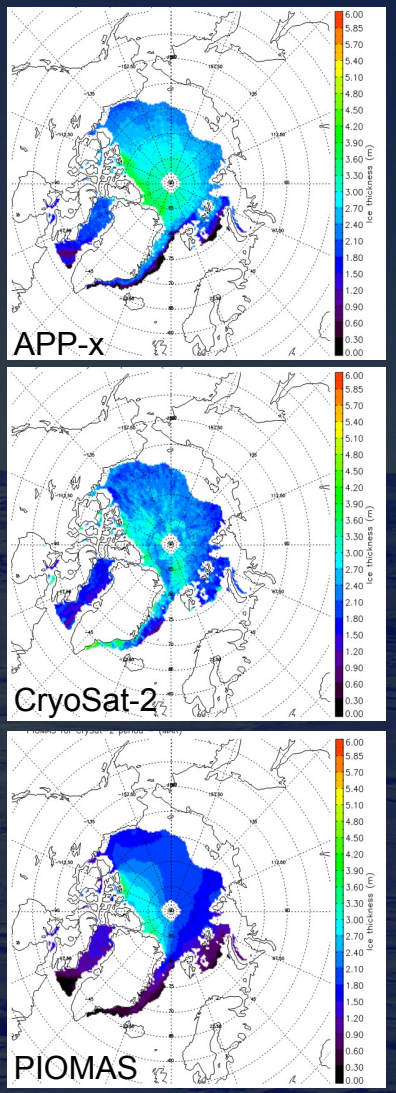


GCW info courtesy J. Key, NOAA/NESDIS

GCW Activities

- developing a network of surface observations called "CryoNet", which builds on existing networks;
- developing measurement guidelines and best practices;
- refining observational requirements for the WMO Rolling Review of Requirements;
- engaging in and supporting intercomparisons of products, e.g., the GCW Snow Watch project, and sea ice thickness;
- creating unique products, e.g., the SWE Tracker, in collaboration with partners;
- engaging in historical data rescue (e.g., snow depth);
- building a cryosphere glossary;
- providing up-to-date information on the state of the cryosphere;
- providing access to metadata and data through a portal.

Sea Ice Thickness Estimates



GCW info courtesy J. Key, NOAA/NESDIS

GCW Activities

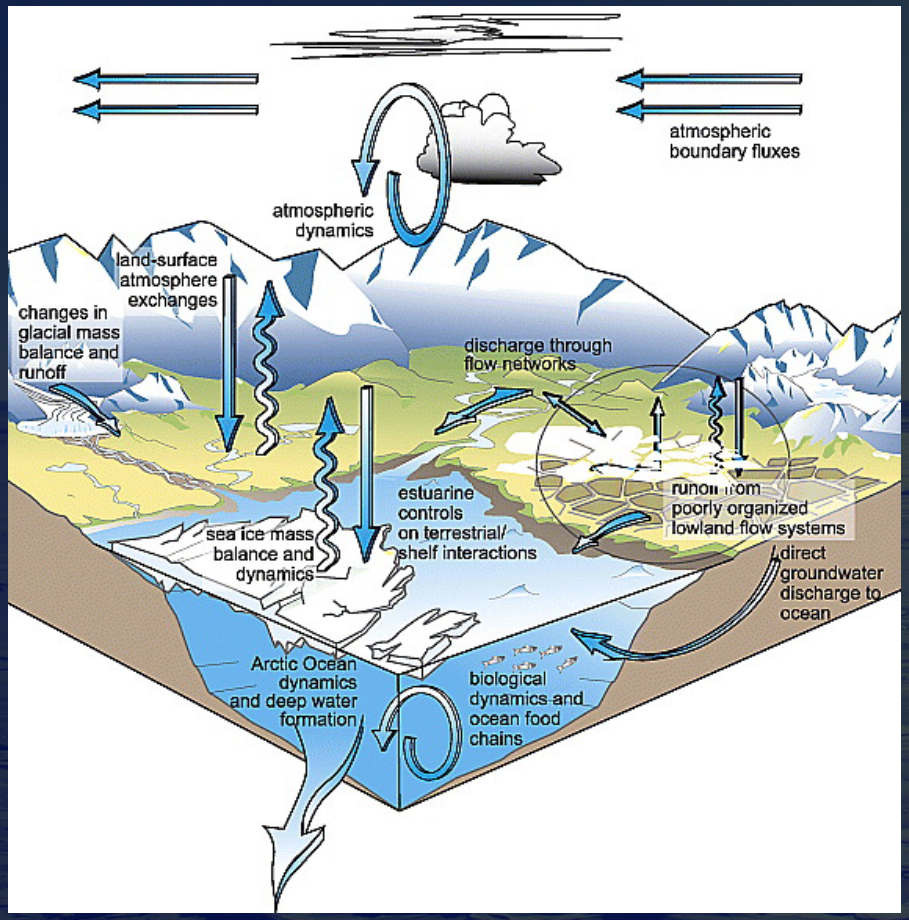
25 June 2015: strong endorsement by 17th World Meteorological Congress

- Polar and high mountain monitoring one of seven WMO priorities for 2016-2019
- GCW to be operationalized in support of polar monitoring
- Priority to implement CryoNet, 36 sites approved for pre-operational testing phase
  - Data and metadata accessibility through GCW Data Portal is a requirement for CryoNet

CryoNet sites

GCW info courtesy J. Key, NOAA/NESDIS

Arctic Freshwater Synthesis



- Assess freshwater sources, fluxes, storage, and effects
- Water vapor transport, P/E, river flow, glacier and ice cap ablation, sea ice melt/growth, ocean salinity/density transports
- IASC and AMAP are co-sponsors
- T. Prowse (Univ. Victoria), Chair
- Final science meeting 12-14 May 2015
- Papers submitted to peer-reviewed journal special issue July 2015

http://www.climate-cryosphere.org/activities/targeted/afs

Image from Francis et al., JGR-Atm, 2009

ICARP III

- Third International Conference on Arctic Research Planning
  - Toyama, Japan, 23-30 April 2015
  - http://assw2015.org
  - Goals
    - Identify Arctic science priorities for the next decade
    - Improve coordination of various Arctic research agendas
    - Inform policymakers, Arctic residents, and the global community
    - Build constructive relationships between producers and users of knowledge
  - CliC was a co-sponsor with IASC (lead sponsor), AMAP, APECS, IACS, FARO, IPA

IARPC

- Interagency Research Policy Committee
  - Goal is to foster collaboration between U.S. federal agencies, and with national and international part
  - Several collaborations, open to all
  - http://www.iarpccollaborations.org
- New initiative: SIRTA, Sustained Improvements to Reanalyses of the Arctic
  - Chaired by NOAA and NASA
  - Evaluate current Arctic reanalyses and potential to improve
  - Potential interaction with YOPP and CMIP6

Photo by Terry Haran, NSIDC