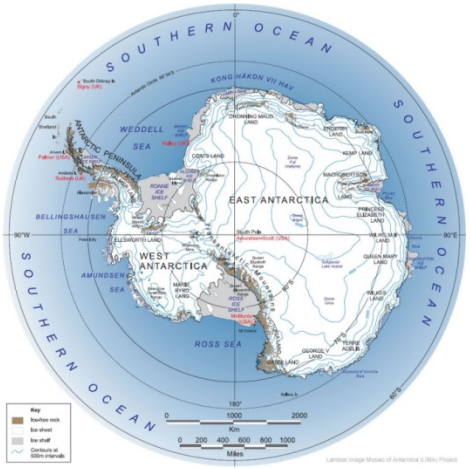
Polar Meteorology Group, Byrd Polar Research Center, The Ohio State University, Columbus, Ohio, USA

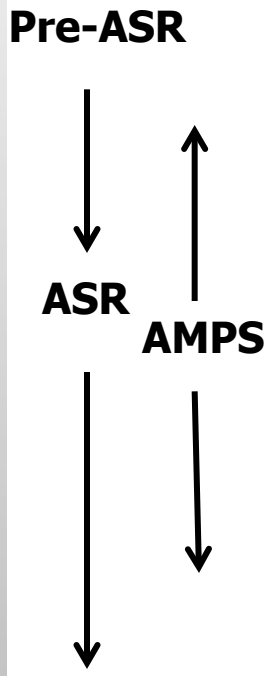
Status of Polar WRF

David H. Bromwich and Keith M. Hines

Polar Meteorology Group
Byrd Polar Research Center
The Ohio State University
Columbus, OH, USA



History of Polar WRF



•	V2.1.1	snow/ice changes for Noah LSM	~2006
•	V2.2	fractional sea ice	2007
•	V3.0.1.1	Polar WRF goes public	August 2008
•	V3.1.1	variable sea ice thickness	Sept. 2009
•	V3.2.1	MYNN OK for fractional sea ice	August 2010
•	V3.3.1		Nov. 2011
•	V3.4.1		Oct. 2012
•	V3.5.1		Oct. 2013
•	V3.6		July 2014

Polar optimized code supplement to WRF

From Polar WRF to Standard WRF

- Noah LSM updates
- Updates to ice sheet heat transfer
- Sea ice fraction
  - Mosaic landuse
  - Input through WPS
  - Use satellite observations, reanalysis, or sea ice model
- Sea ice thickness and snow depth on sea ice
  - Datasets exist! - no longer just speculating
  - Use WPS
- Sea ice albedo seasonal specifications (ASR-inspired)

Polar WRF 3.5.1 (http://polarmet.osu.edu/PolarMet/pwrf.html)

- 157 Registered users in 28 countries
- Based upon WRF 3.5.1
- Tested for 1998 SHEBA
- Supplemental files to replace standard WRF files
- Supplemental files have compiler directives with options
  - power of Polar WRF is based upon best selection of options for your case
- Run WPS additions first to produce sea ice concentration, Arctic sea ice thickness, Arctic snow on sea ice, and Arctic sea ice albedo
- Has option for temperature-based, non-specified sea ice albedo from Univ. of Illinois (designed for Arctic)

Motivation for Sea Ice Work with WRF

- NSF goal of improved cyberinfrastructure
- WRF use with AMPS real-time forecasts
- Noah land surface model upgrades
  - sea ice/glaciers separated from soil
- Continuing upgrades to WRF
  - include sea ice upgrades into standard WRF

Sea Ice Developments in Polar WRF

- Fractional Sea Ice (in standard WRF)
- Sea Ice Thickness (now in standard WRF)
- Snow on Sea Ice (now in standard WRF)
- Arctic Seasonal Albedo Cycle

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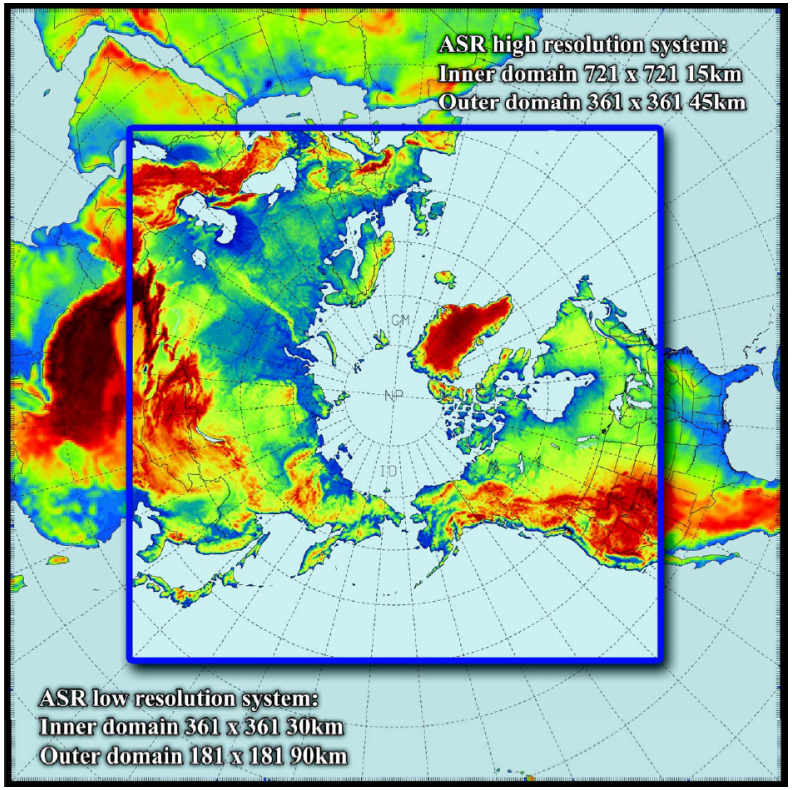
Arctic System Reanalysis 2000-2012

Variable	Wind Speed			2-m T			2-m Dew Point			Sfc Pressure		
	bias	rmse	corr	bias	rmse	corr	bias	rmse	corr	bias	rmse	corr
ASR	-0.19	1.79	0.69	0.11	1.35	0.96	-0.05	1.77	0.92	0.03	0.84	0.99
ERA-Interim	0.41	2.12	0.64	0.29	1.99	0.92	0.33	2.05	0.89	-0.06	*0.98*	0.98

Domain



30 km version available from NCAR CISL

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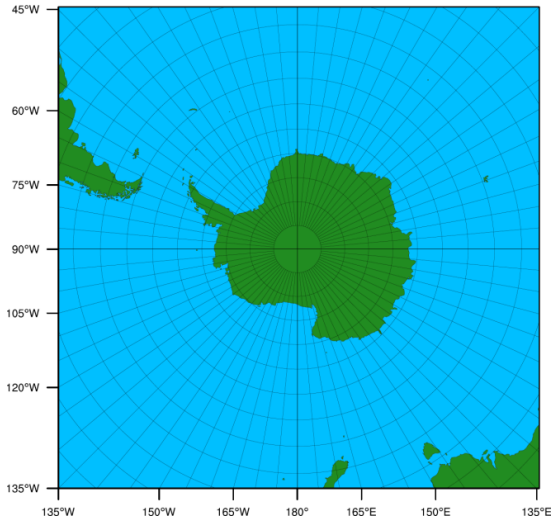
Atmosphere Ocean Coupling Causing Ice shelf Melt in Antarctica (ACCIMA)



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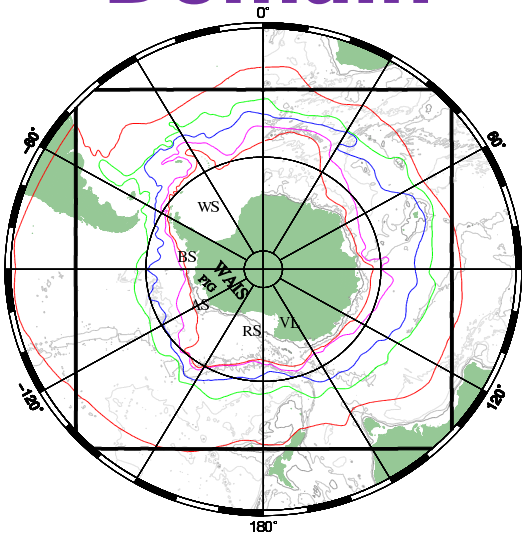
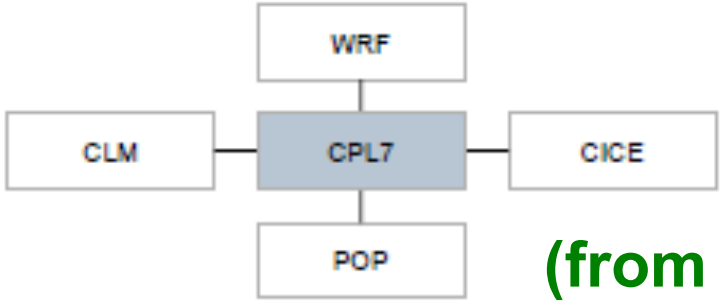
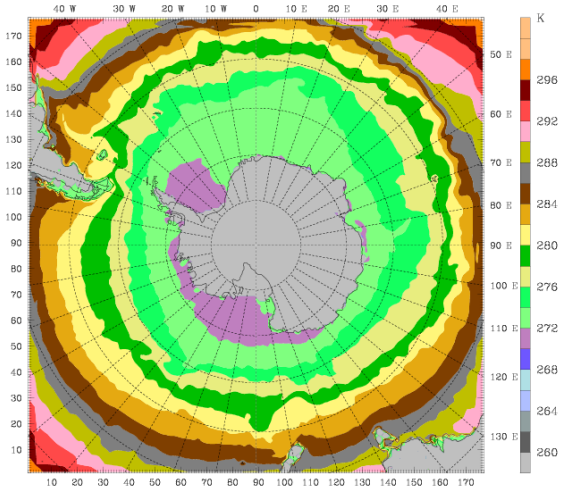


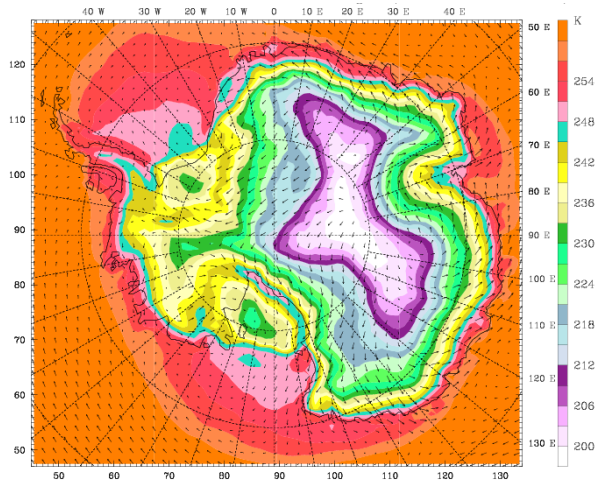
ACCIMA Coupled Model



(from RASM)

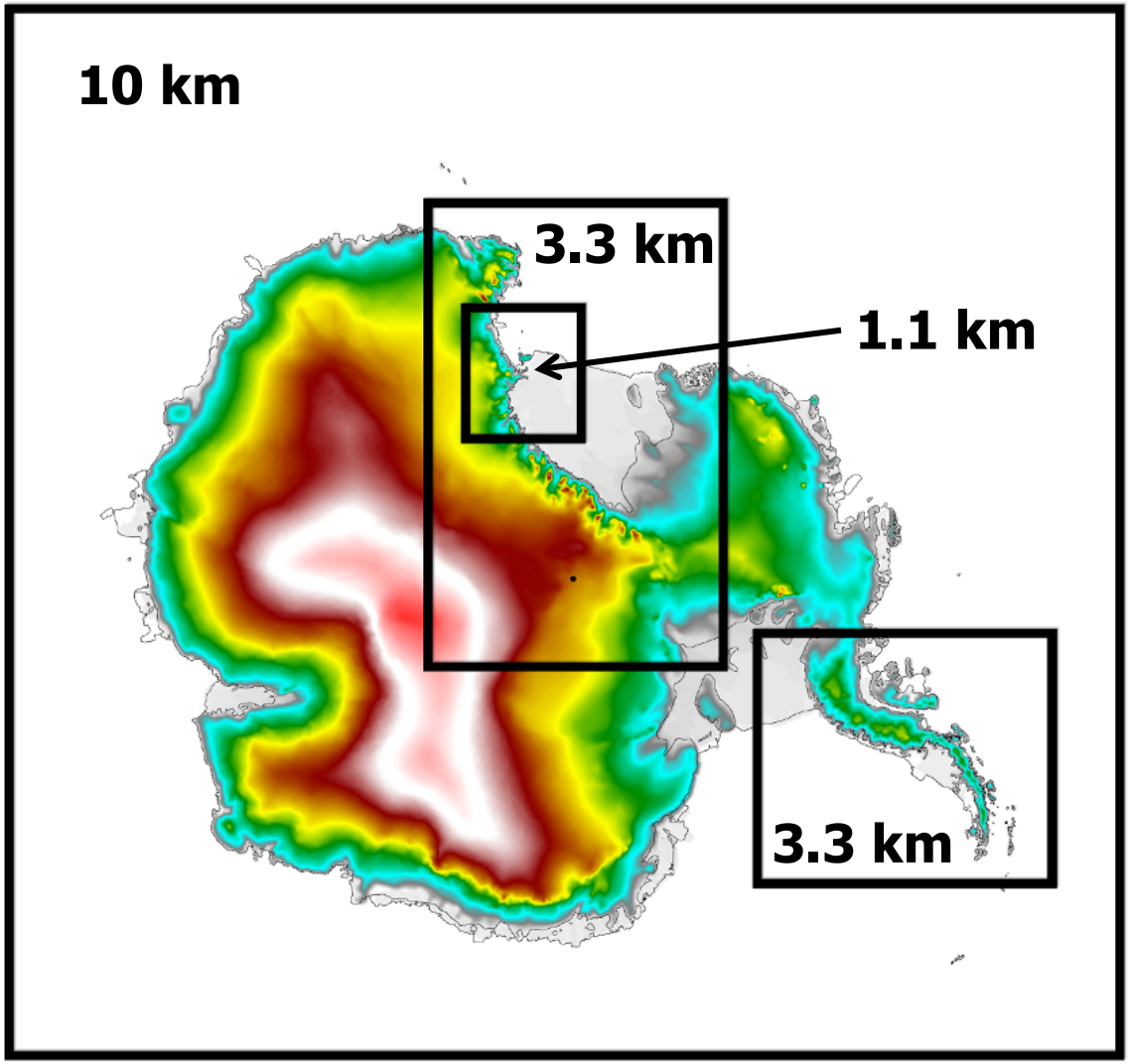


Annual-mean SST



JJA 2-m T + 10-m Winds

Antarctic Mesoscale Prediction System Domains



Real-Time Forecasts for Antarctic Operations

Future for Polar WRF

- **Version 3.6 is being tested** **(anticipated release date July 2014)**
- **Adapt CLM LSM for specified variable sea ice thickness?**
- **Polar cloud work in both Arctic and Antarctic**
  - **Field Work**
  - **Cloud fraction updates**
- **Improved sea ice albedo prognostic calculations**
- **Downloadable datasets for ice thickness and snow depth**
- **Coupled model work (Current projects for Antarctic and Arctic)**
- **2nd Polar WRF Workshop – Fall 2014?**

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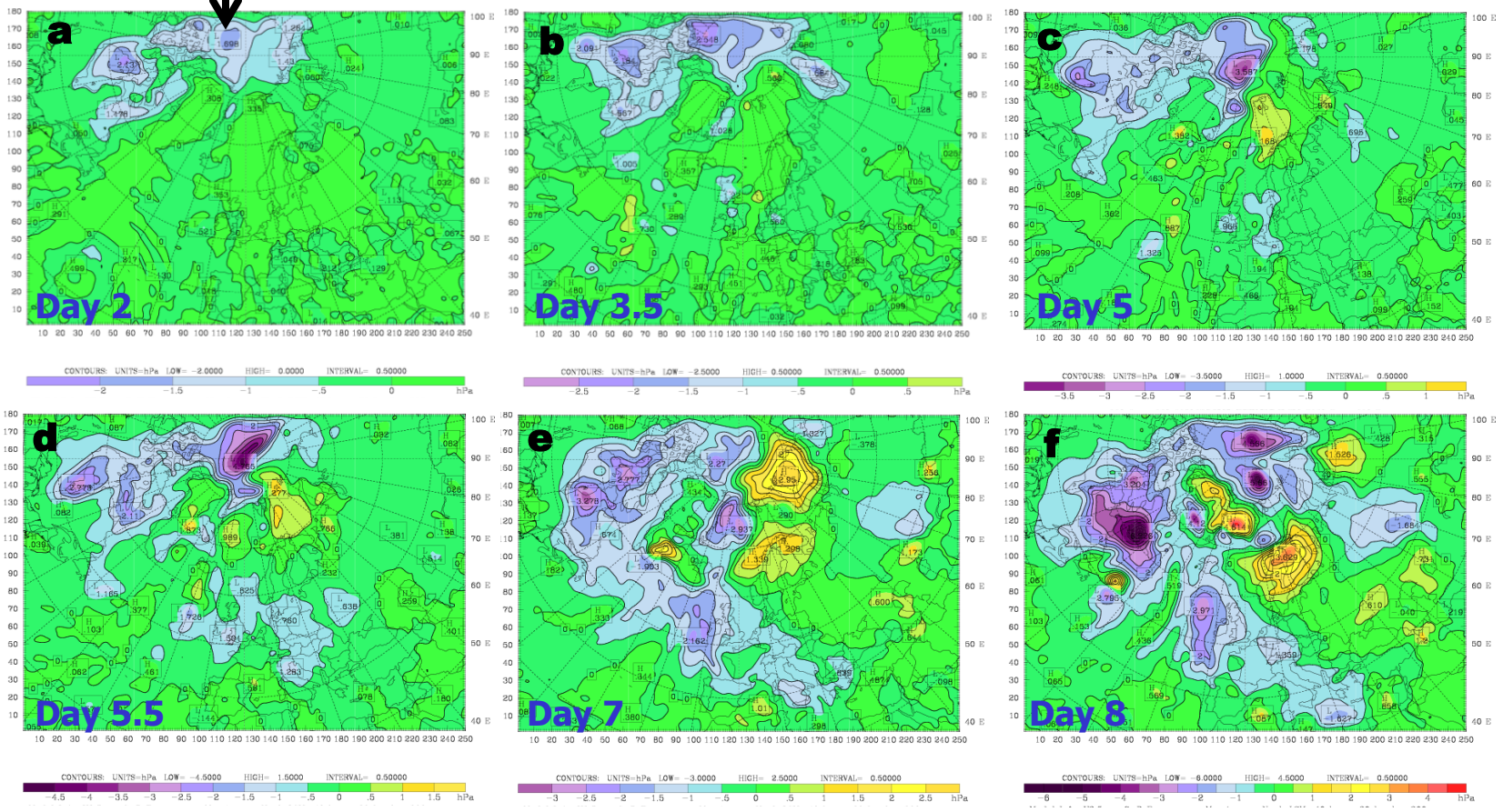
Non-local impacts of Arctic sea ice thickness show up in about 8 days in surface pressure difference fields

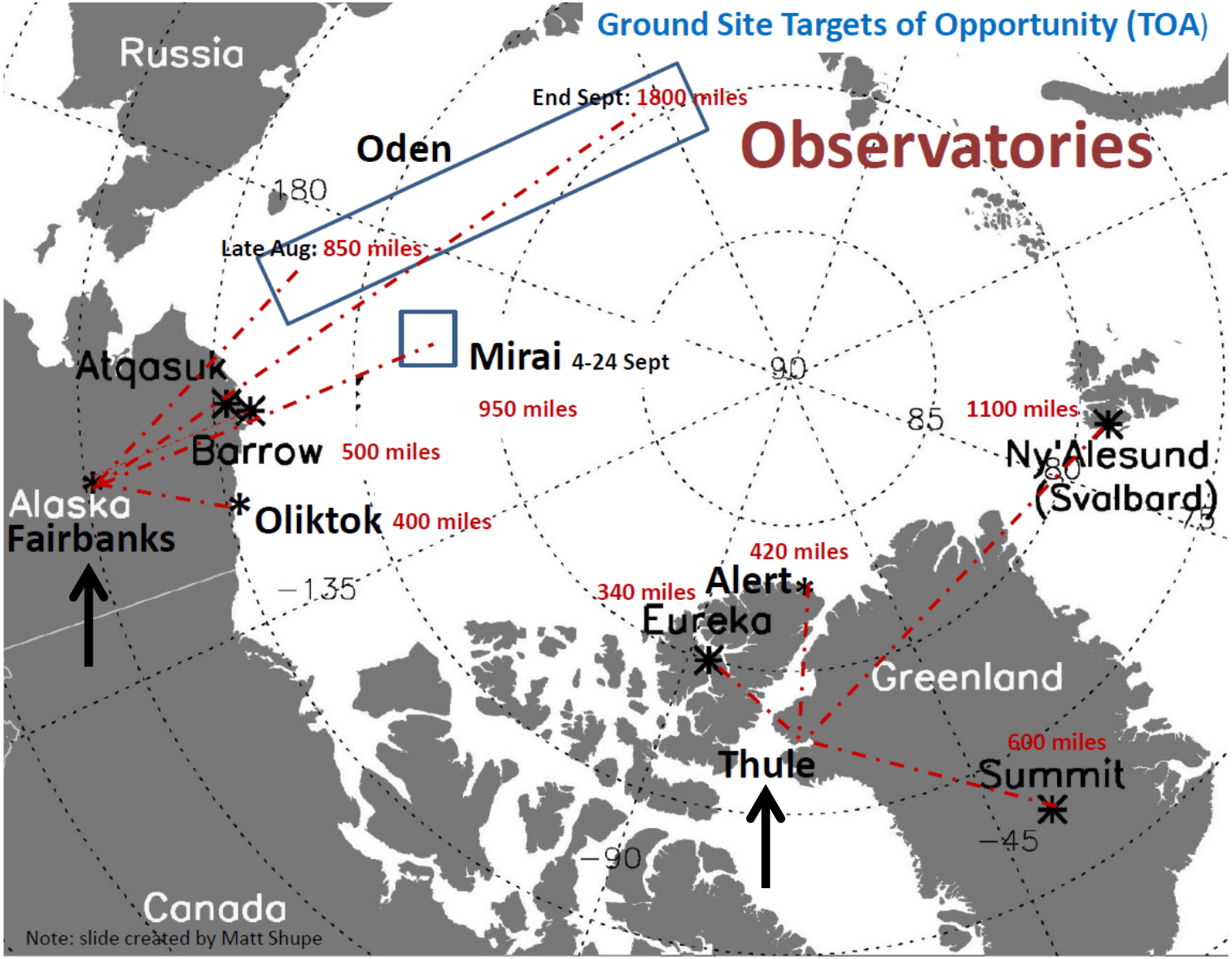
Sea ice thickness changed here

0.1 m sea ice – 1 m sea ice



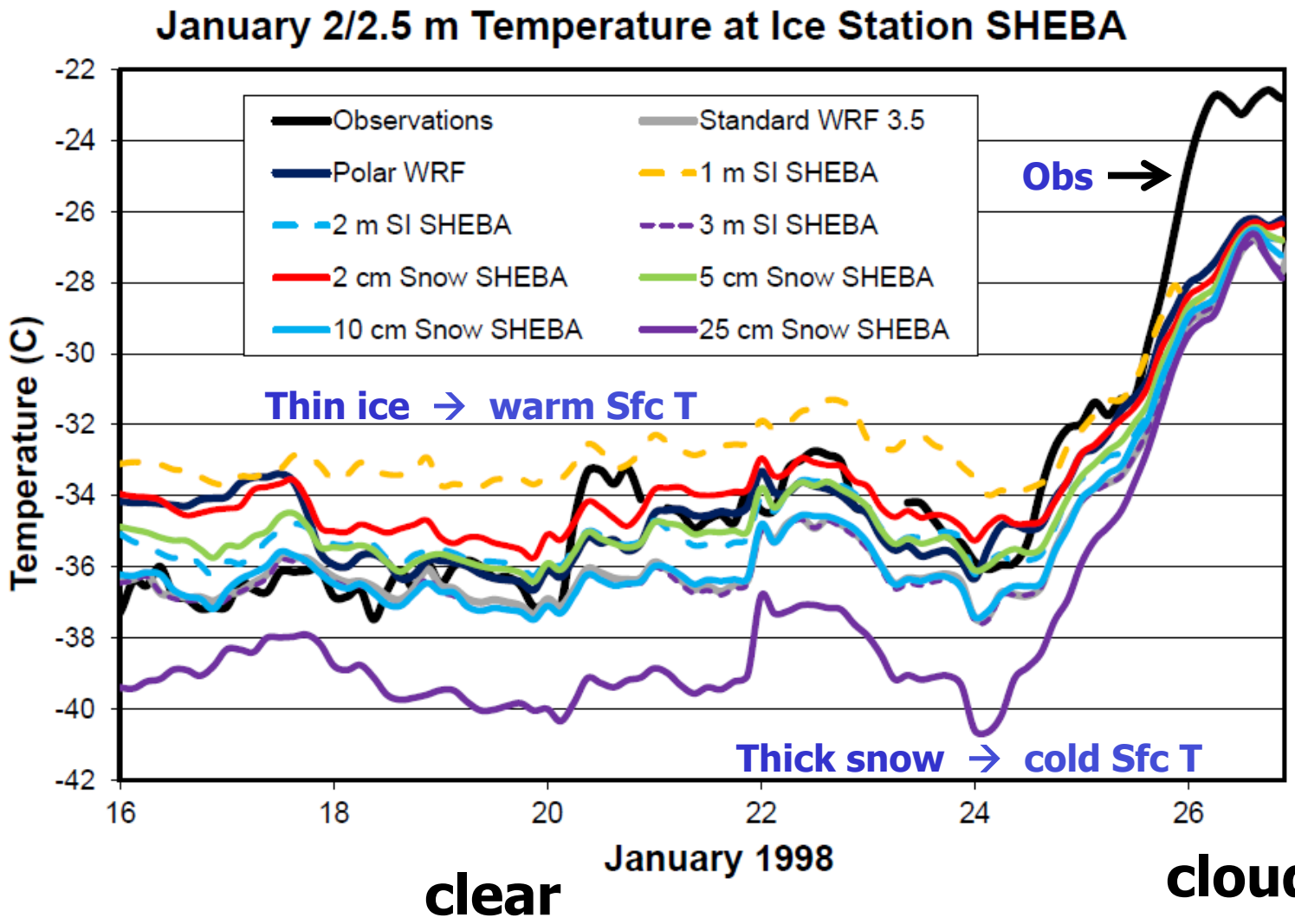
24 January – 01 February 2012 Surface Pressure Difference (hPa)

Arctic Radiation – IceBridge Sea & Ice Experiment (ARISE)

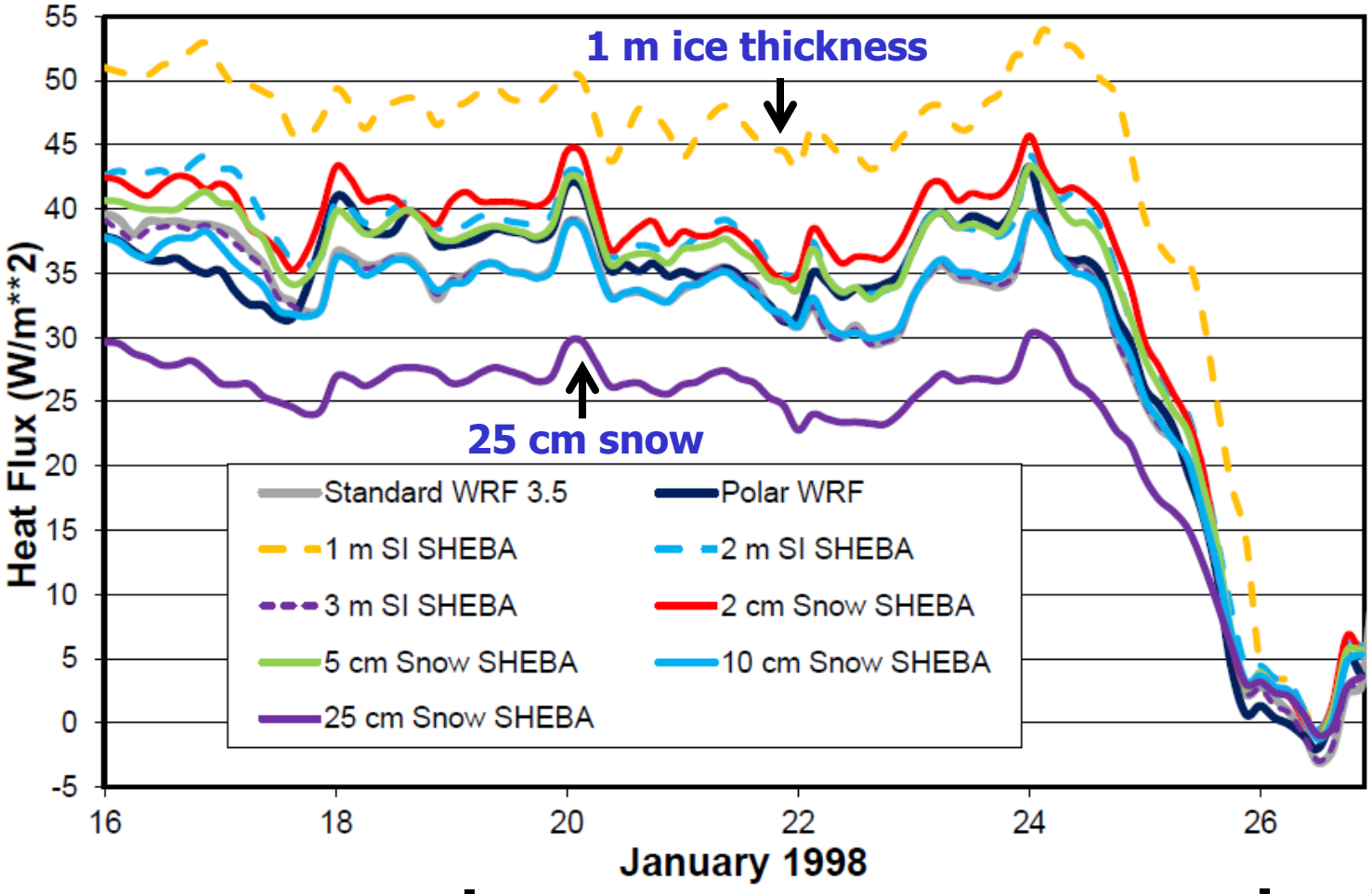


C-130 flights 27 August – 1 October 2014

Test Polar WRF 3.5 with different sea ice thickness and snow depth over sea ice



Heat flux through sea ice is sensitive to specification of ice thickness and snow depth



clear **cloudy**