HIGH LATITUDE DYNAMICS

Presentation to AICC

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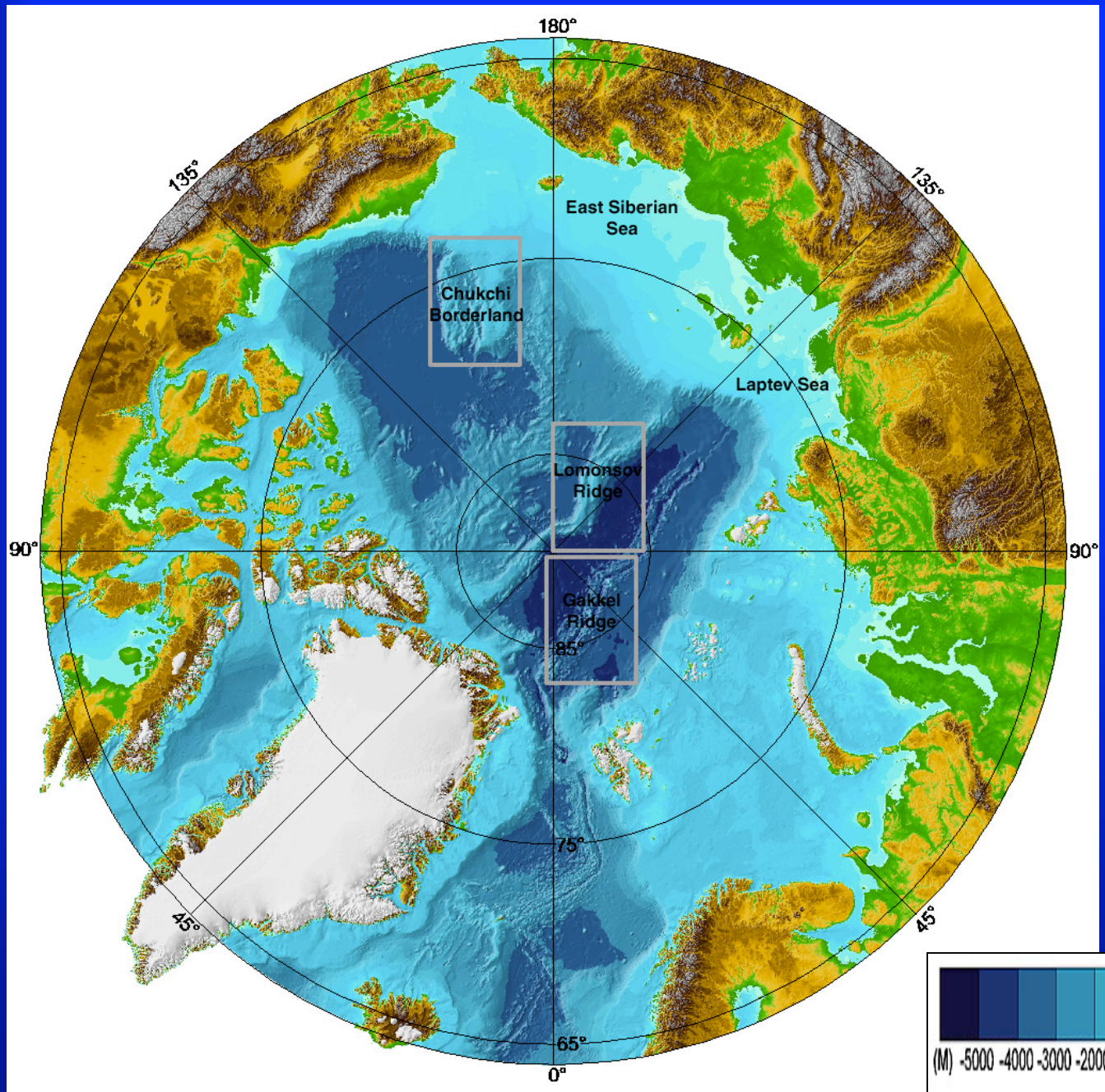
Climatic Role -
A Basic Research Issue

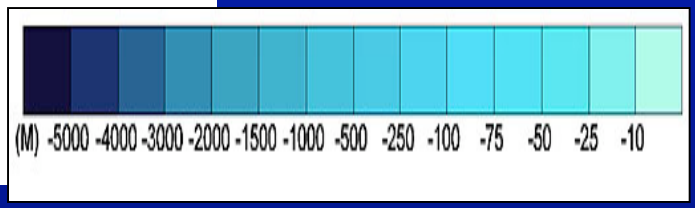

Photo by UCAR/JOSS Moore–Pennington 1997

- Heat input at equator and lost at poles
- Production region for deep water that drives North Atlantic MOC
- Heat and freshwater feedbacks involve ice and cloud cover



Boundaries Dominate

- A semi-enclosed basin
- 60% is shelf area
- MIZ is circumArctic



Ice Cover Issues

- Air-Sea-Ice interaction processes and feedback
- Ocean turbulence and heat fluxes
- Internal ice dynamics
- Operational issues, such as lead field and MIZ location prediction

Operational Issues:
SSBN/USW/ASW

- A basin-scale "bastion"
- No clearly defined enemy
- Undersea warfare is regionally difficult
- Operational proficiency is deteriorating
- Existing paradigms, operational or strategic, may no longer be valid

Overarching Objectives

- Understand processes, such as ice dynamics, that are unique to ice-covered seas
- Understand basic ocean physics, emphasizing the mesoscale and smaller processes
- Develop prediction models for the Arctic ice cover
- Develop improved instrumentation and techniques for use in the Arctic
- Build up our emerging awareness of environmental change

Topical Areas

- Sea ice dynamics and thermodynamics
- Ocean margin processes, emphasizing shelf-basin exchange and continental slope processes
- Central basin processes, emphasizing mesoscale and smaller phenomena
- Predictive modeling, emphasizing short-term ice and winds
- Newly developed technology, and new uses for existing technology

Polar Ice Prediction System (PIPS)

- VERSION 2.0
  - Low resolution (60-100 km ice model
  - Low resolution (15-layer) ocean
  - 7 ice levels, either "thin" or "thick"

… in transition to ...

- VERSION 3.0
  - High resolution (9 km) ice
  - High resolution (21-layer) ocean
  - 7 true thicknesses
  - Improved MIZ predictions
  - Frazil-pancake model in development

HIGH LATITUDE DYNAMICS
Collaborations with NSF

- Surface Heat Budget of the Arctic (SHEBA) (1997-2003)
- Shelf-Basin Interactions (SBI) (1999-2008)
- Long-term observational programs
  - ACOUS feasability
  - ALTEX AUV preliminary studies
  - Submarine deployments
  - Bering Strait mooring program
- Arctic Freshwater Cycle

Summary

- Navigable Arctic Scenario *is* a concern
- Studies are planned to focus increasingly on *processes*
- Continental and sea ice *boundary* regions are a high priority
- Model development emphasizes *operational prediction*
- Field measurements will rely on new technology and platforms of opportunity
- Opportunistic collaborations are sought with NSF and other agency programs and with foreign activities