Regional models of ice shelf-ocean interaction

- lessons for CISM+O

Paul Holland

British Antarctic Survey

(and Adrian Jenkins, David Holland, Keith Makinson, Danny Feltham, etc.)

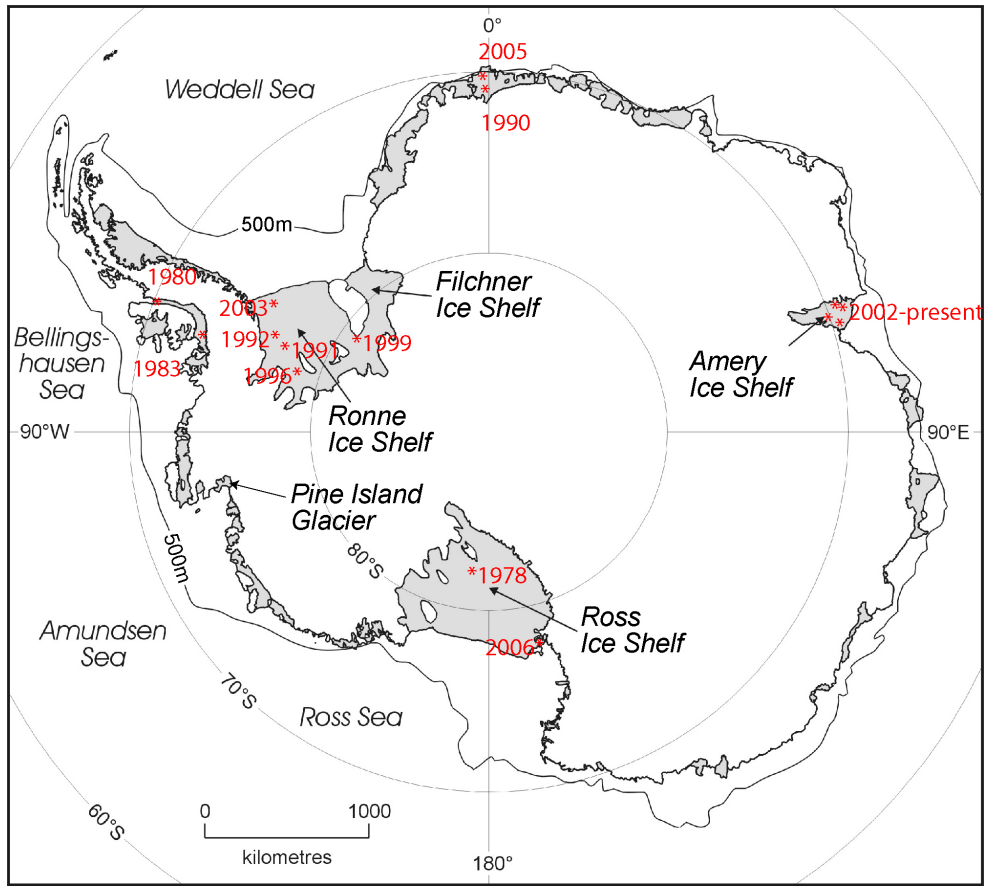
British Antarctic Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

Why does BAS do regional modelling?

- Observations are sparse in space and time
- Processes not understood
- Global ocean models aren't great in Antarctica*
- Ocean modellers can't afford Cambridge*

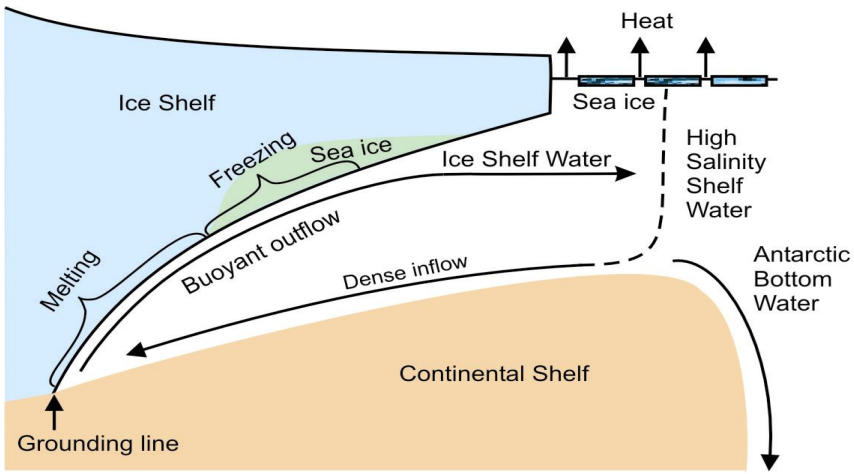
*The world needs CISM + ocean



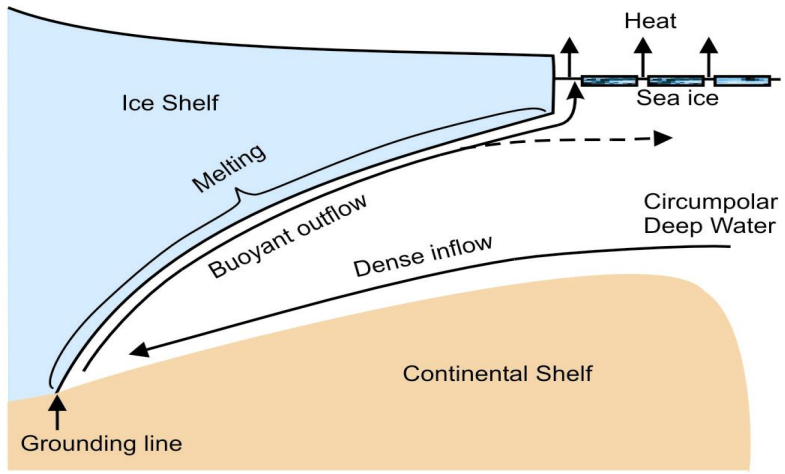
British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Ocean-ice shelf interaction

Cold (e.g. Filchner-Ronne)



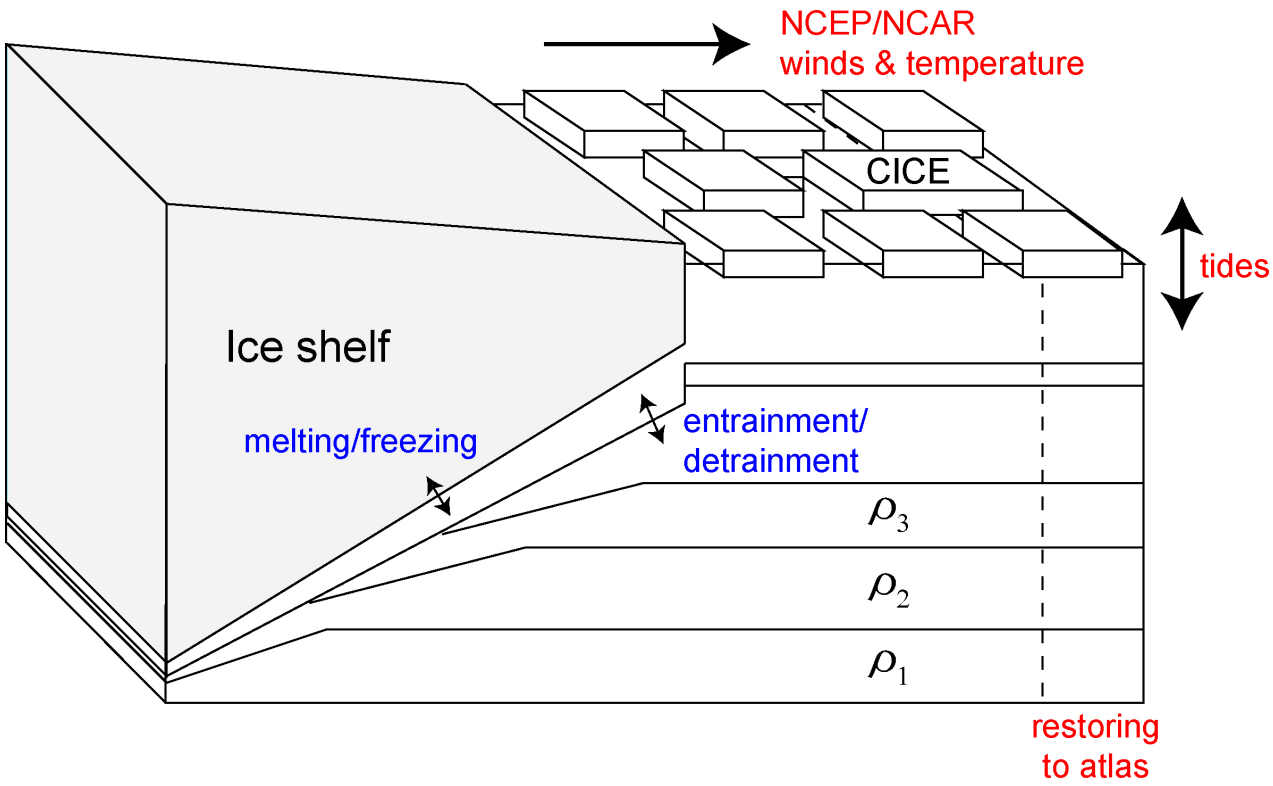
Warm (e.g. Pine Island)



CISM + ocean must do both!

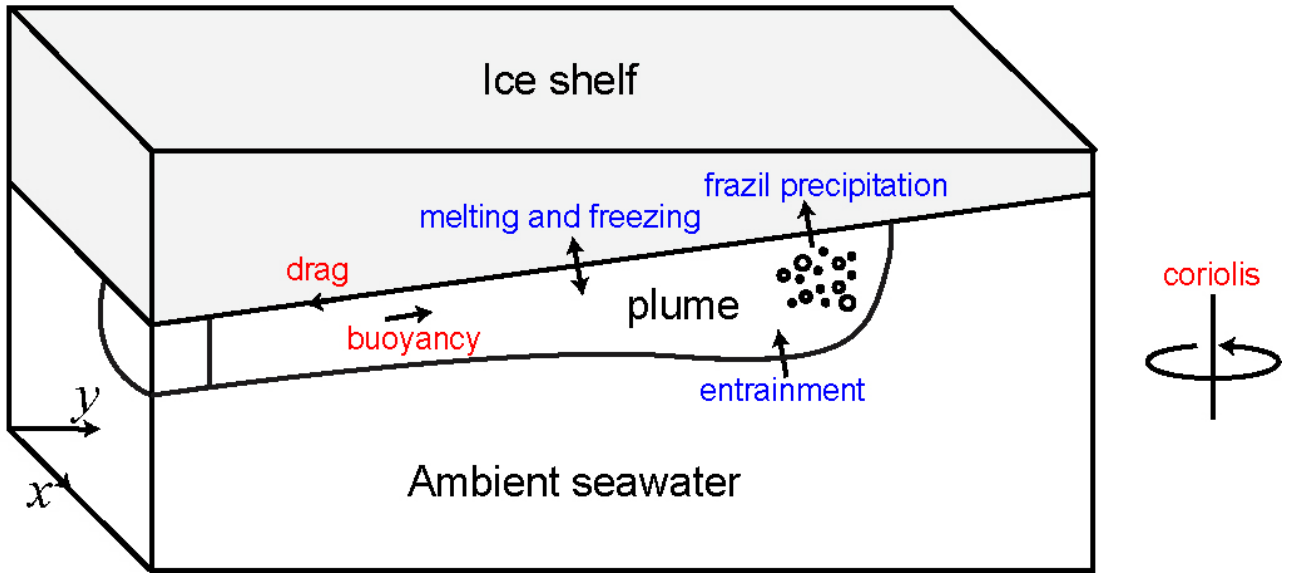
British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

MICOM

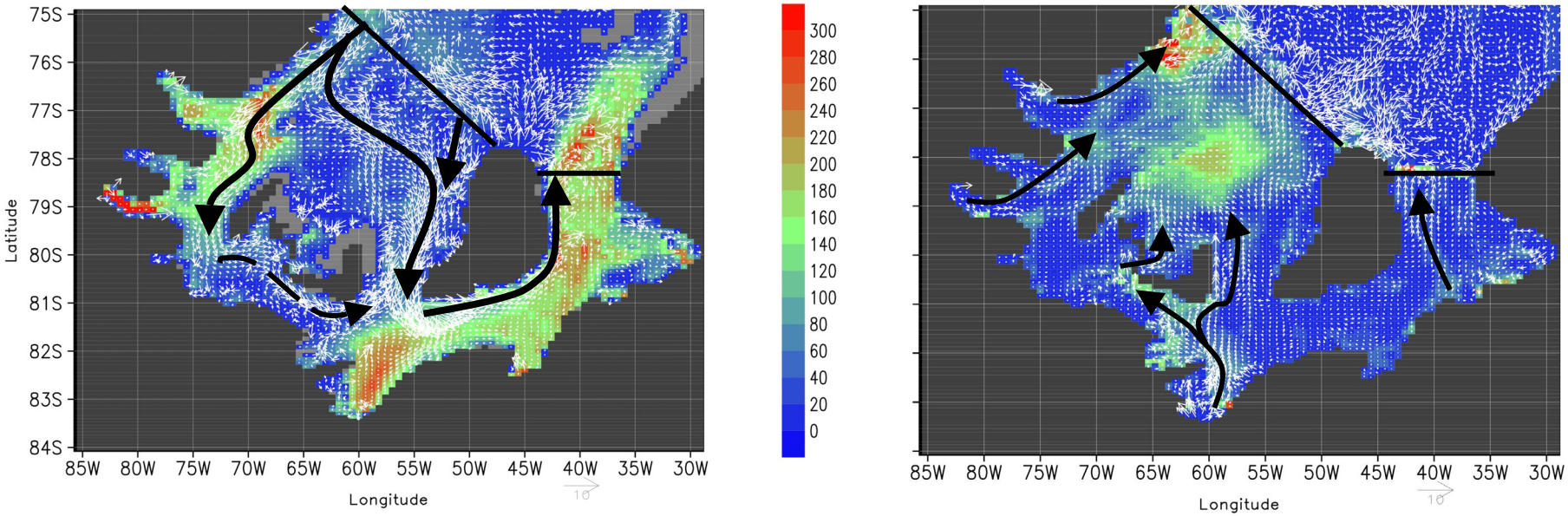


British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Plume Model


Ice shelf
frazil precipitation
melting and freezing
drag
plume
buoyancy
entrainment
coriolis
y
x
Ambient seawater

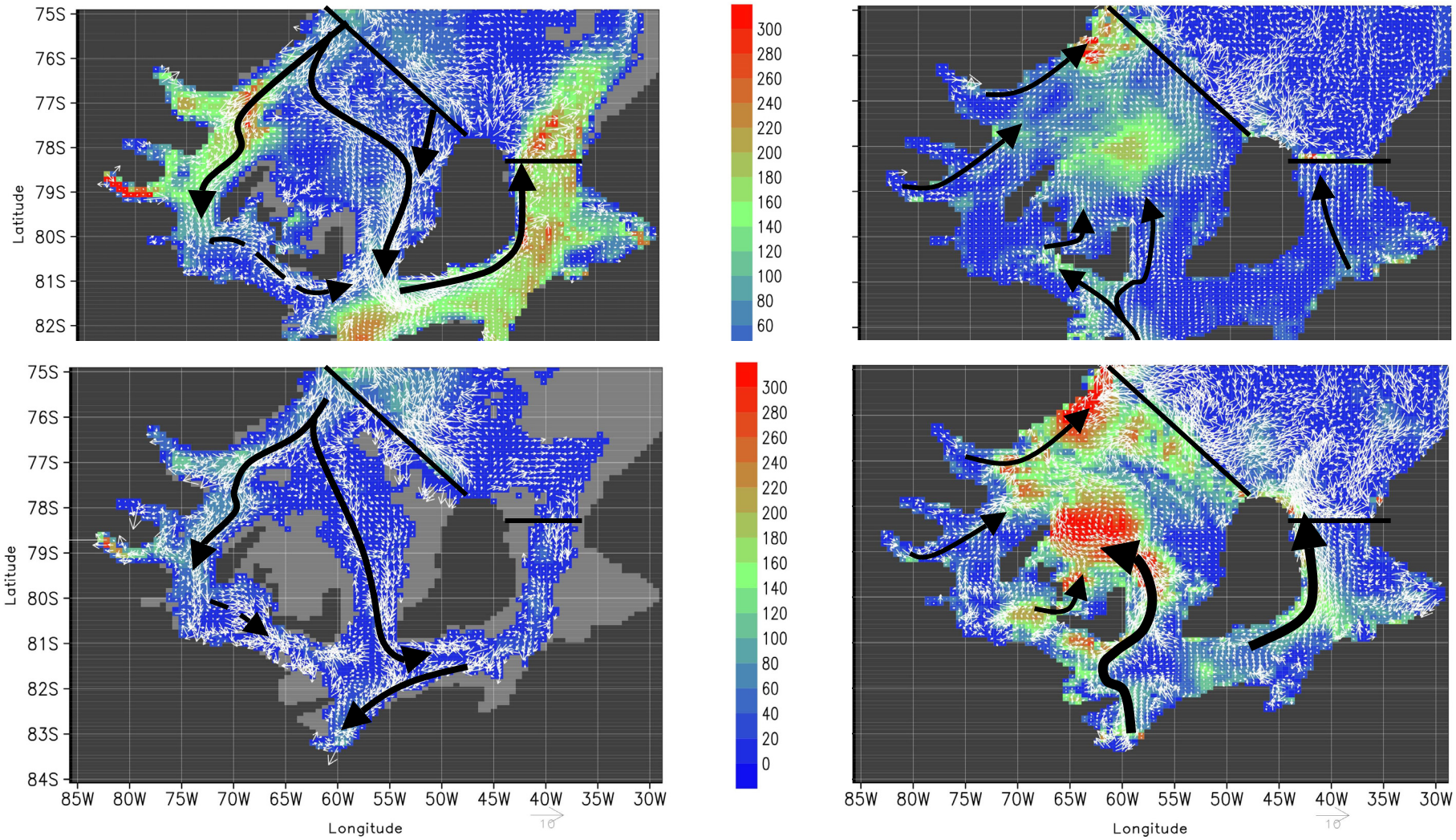
Filchner-Ronne Ice Shelf - MICOM



British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Makinson et al., in prep)

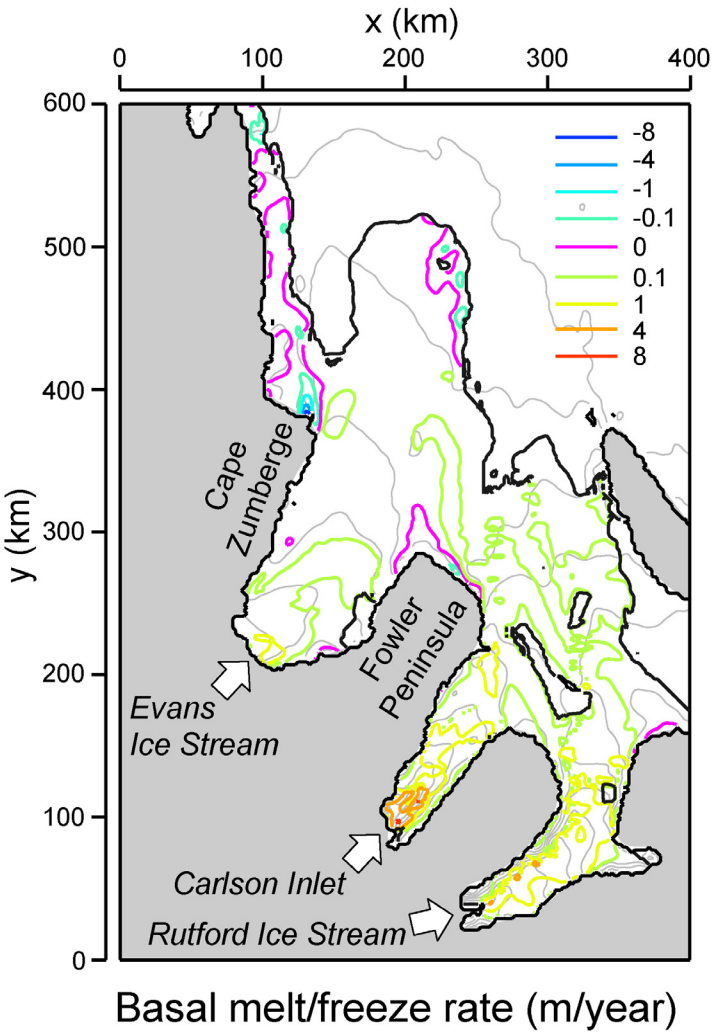
Filchner-Ronne Ice Shelf - MICOM



British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Makinson et al., in prep)

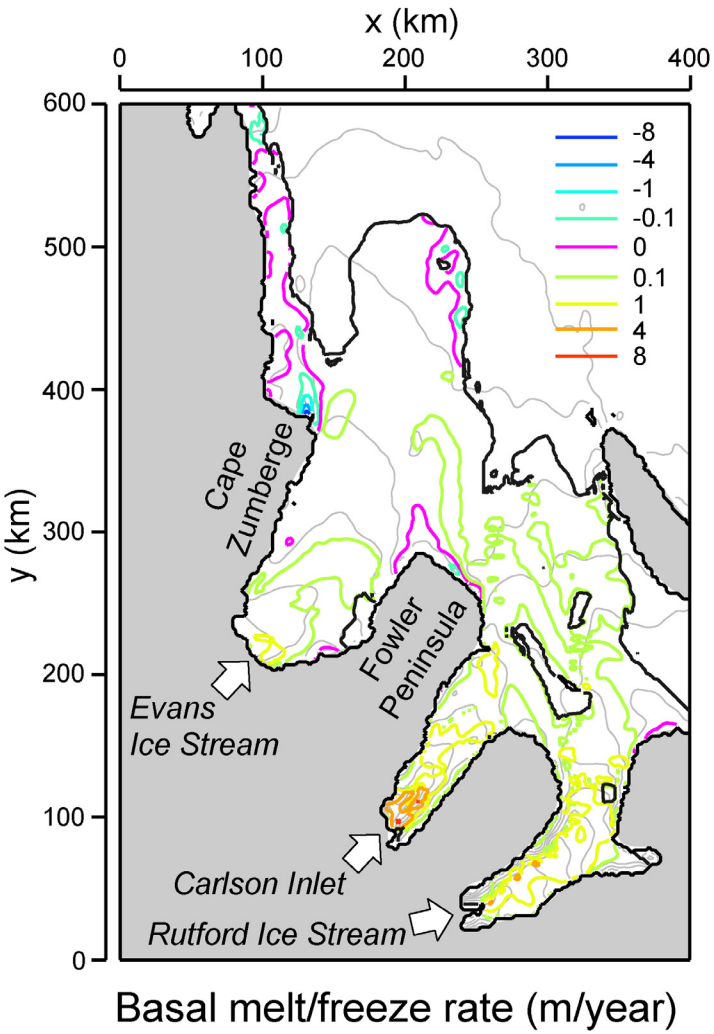
Filchner-Ronne Ice Shelf - plume

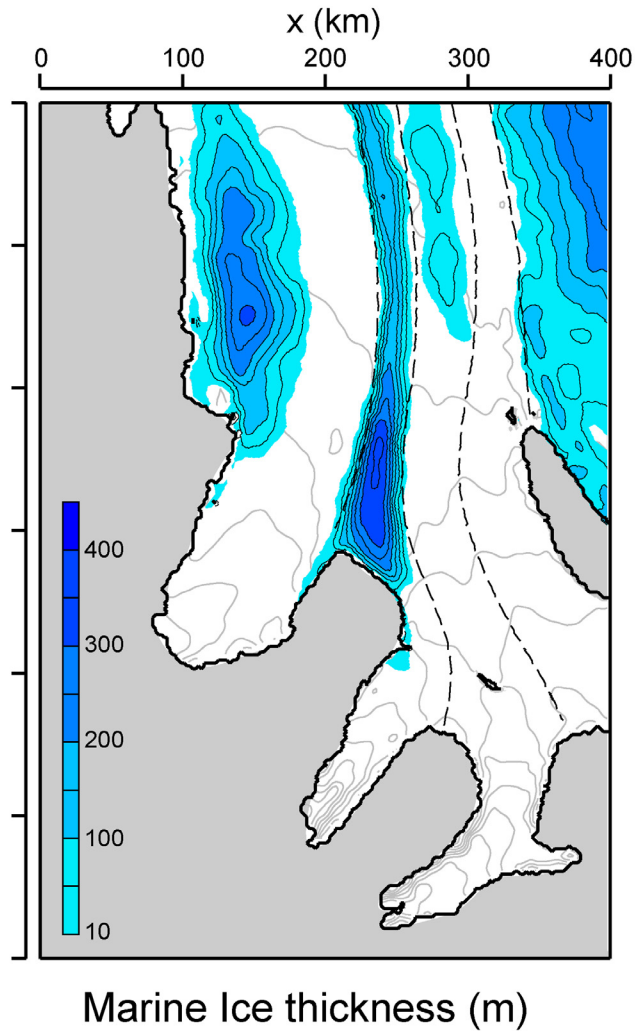


British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Holland, Feltham & Jenkins, 2007)

Filchner-Ronne Ice Shelf - plume

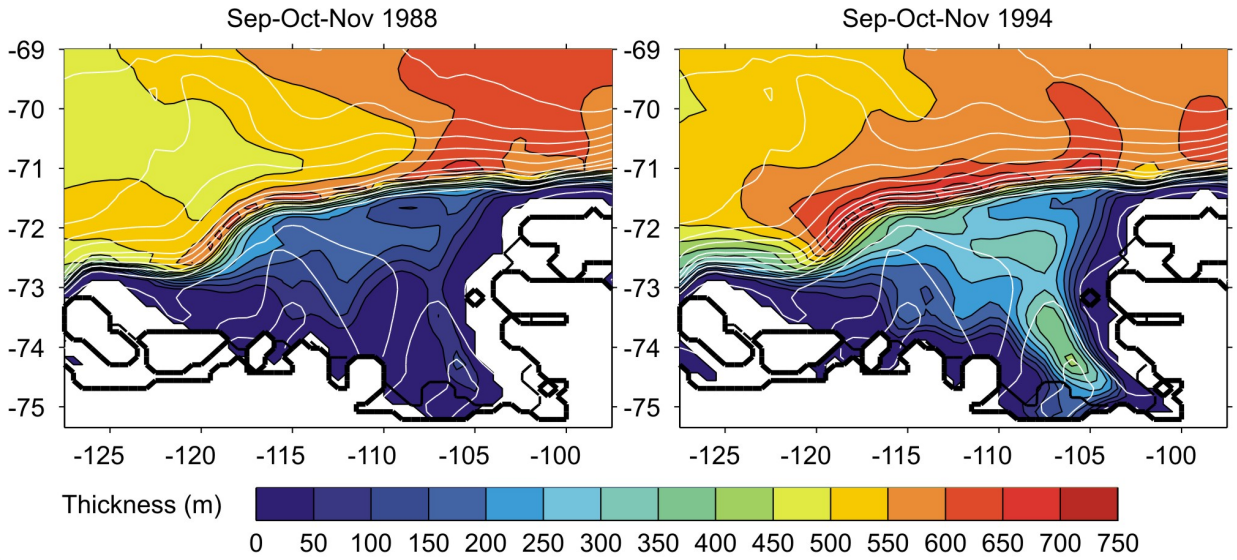




British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Holland, Feltham & Jenkins, 2007)

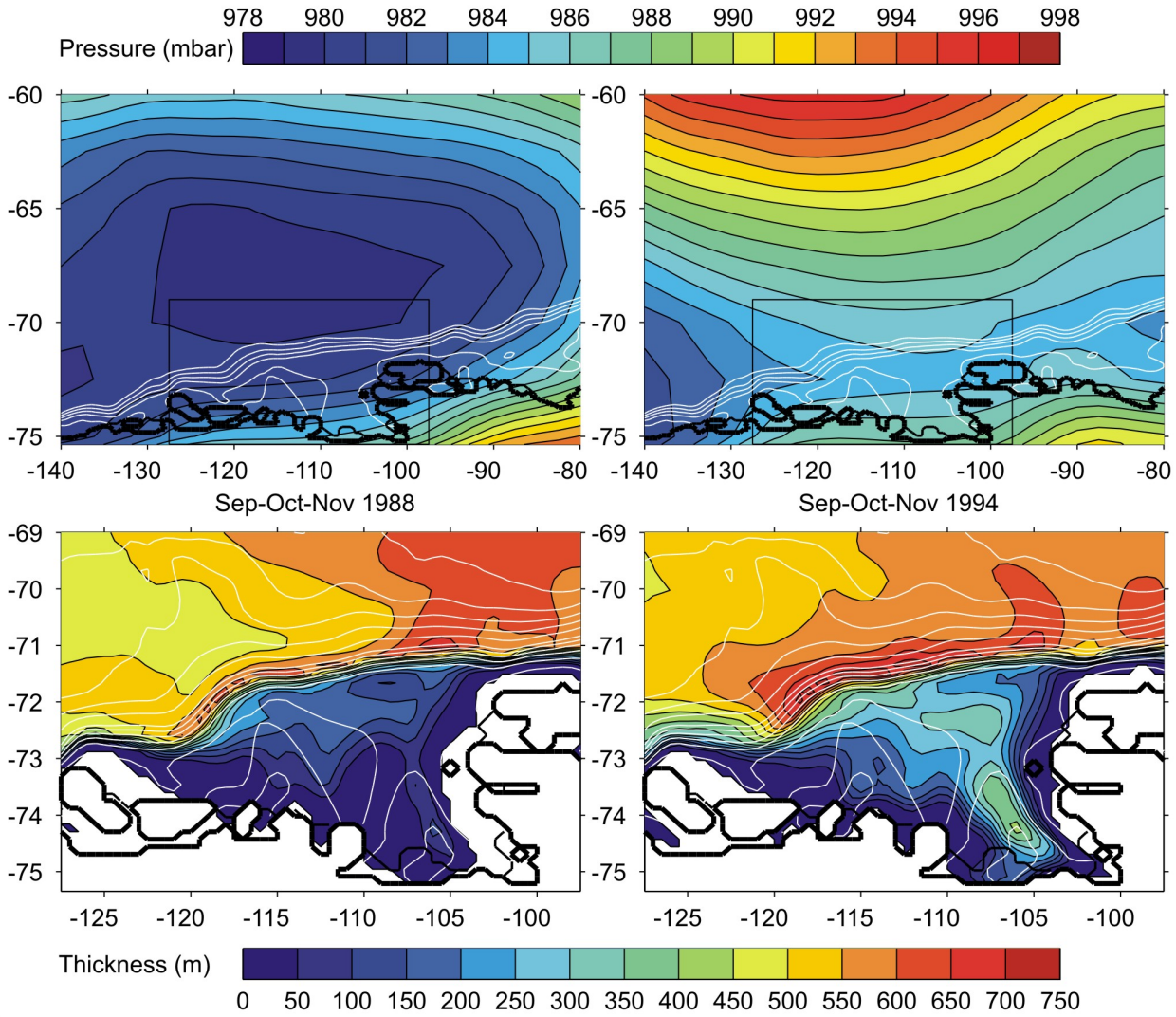
Pine Island Glacier - MICOM



British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Thoma et al., in press)

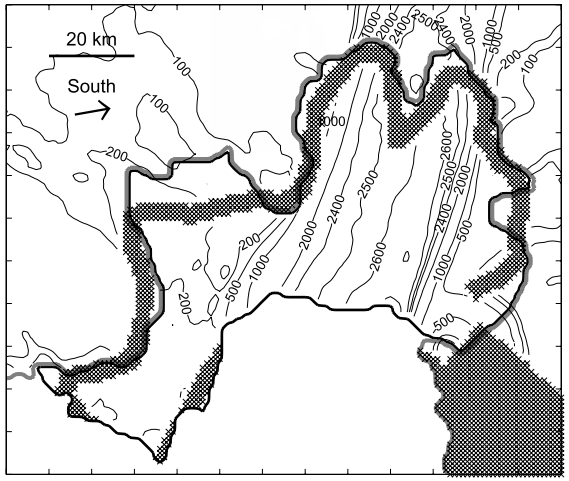
Pine Island Glacier - MICOM

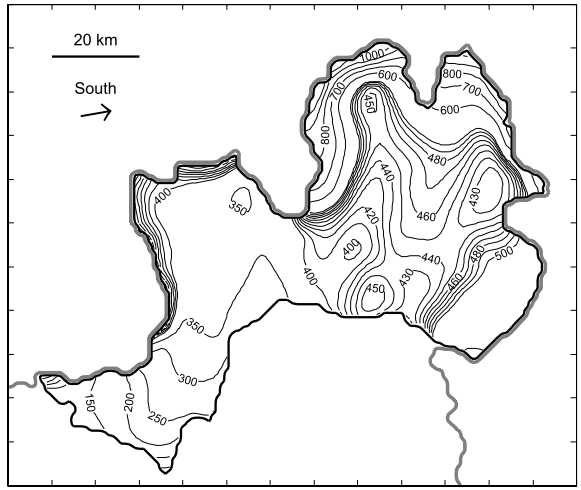


British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Thoma et al., in press)

Pine Island Glacier - plume

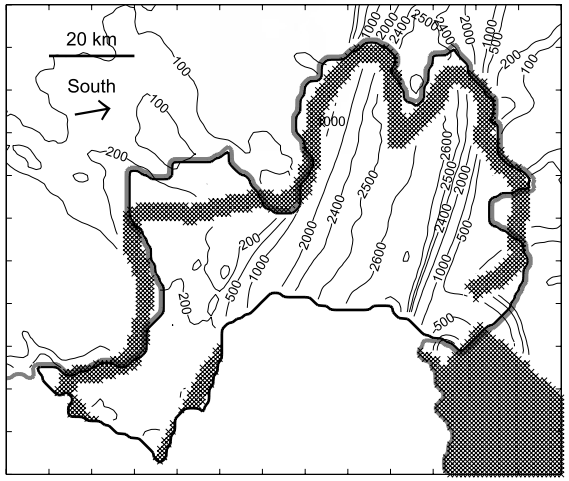


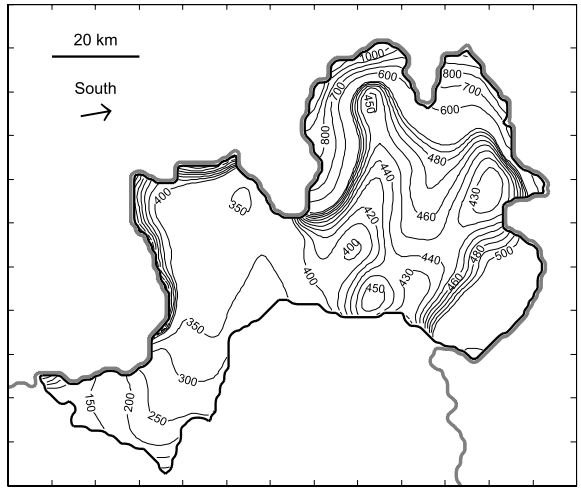


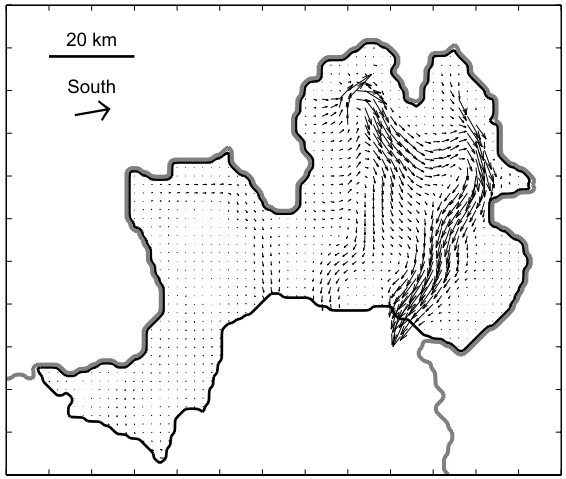
British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

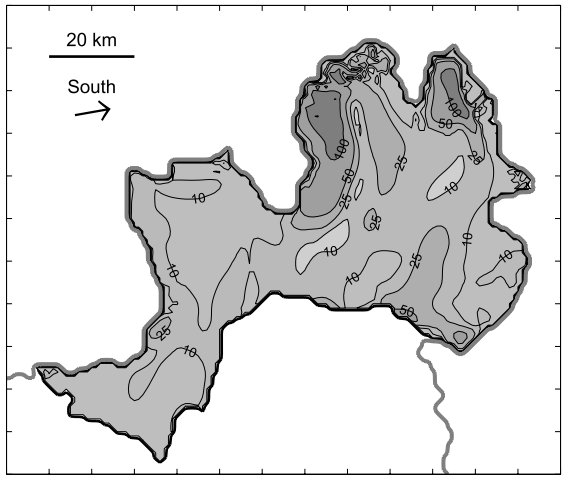
(Payne et al., 2007)

Pine Island Glacier - plume









British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

(Payne et al., 2007)

Pertinent notes for CISM + ocean

- Grid coarseness is still a serious issue
- Continental-shelf oceanography is key
  - sea ice, shelf-break upwelling
- Complex features locally important
  - tides, small-scale topography, frazil ice

Immediate BAS modelling plans

- Tied to understanding observations and processes

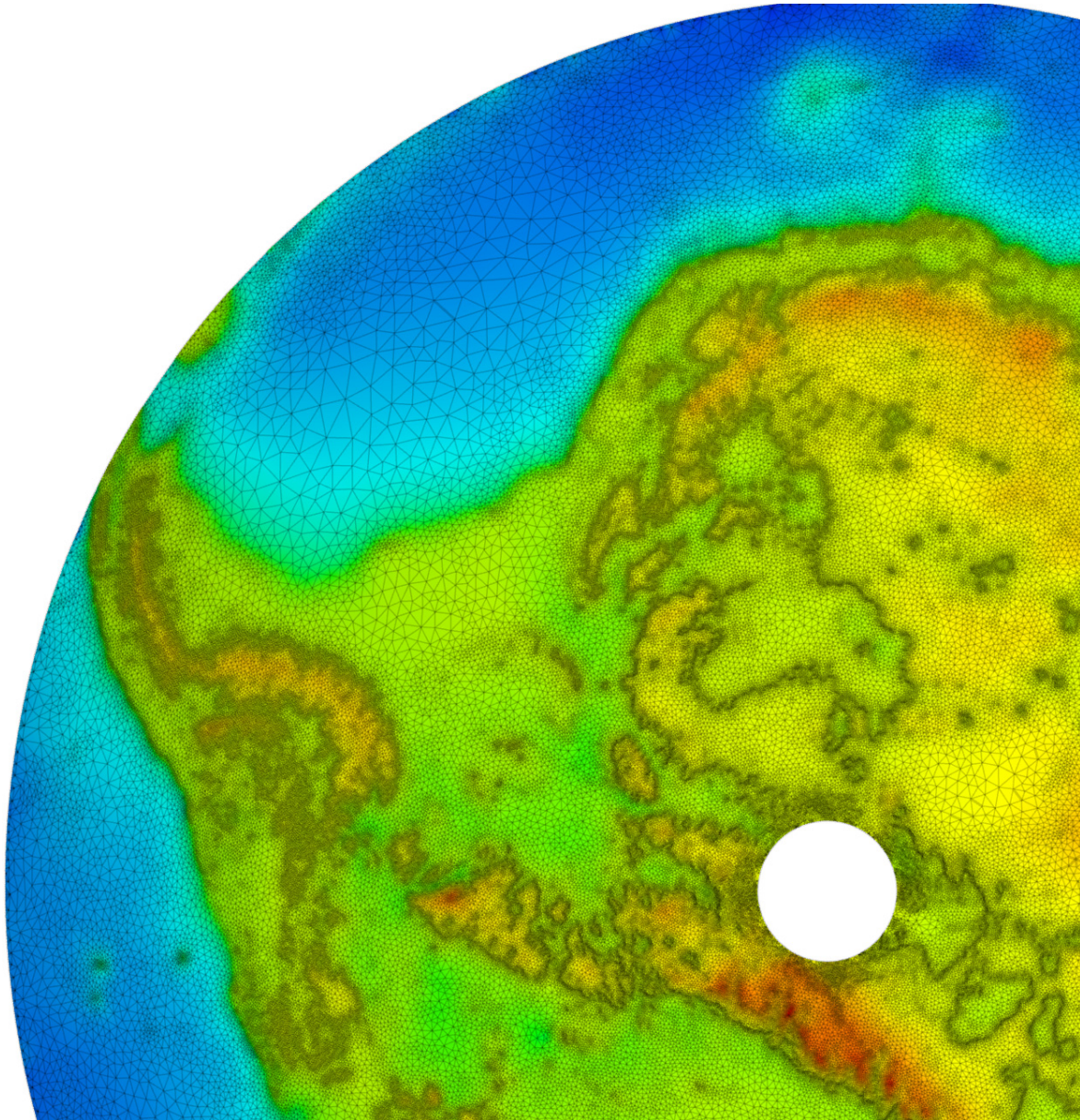
- Plume modelling using high-resolution ice-shelf drafts

- New MICOM domains

- Model nesting in MICOM

Medium-term BAS modelling plans

- Imperial College Ocean Model
- High-resolution models for basic process studies
- Ice2Sea
- Hadley Centre



British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL