



ice 2 sea

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**British
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL



The Call



Area 6.1.1.1. The Earth System and Climate: Functioning and abrupt changes

Expected impact: Quantification of the risk of substantial acceleration of sea level rise due to continental ice melting. The project will reduce uncertainties in these important processes in sea level changes and contribute to the Fifth IPCC Assessment.

The Response: ice2sea partnership



UNIVERSITY OF COPENHAGEN



Universiteit Utrecht



UNIVERSITY OF SILESIA IN KATOWICE



Vrije Universiteit Brussel



The Response: Budget



- Overall Budget = ~ €13.6 M
- EU contribution = 83% for research, 7% for programme management
- Many constraints on spend!
- EU contribution = ~ €10 M

Scope: atmosphere/ocean-modelling



- Regionalisation of Global Circulation Model output
- Delivery of heat to ice sheets and glaciers
- Temperature change and circulation change
- Drivers of ice-loss

The Response: timescale



- IPCC 4AR = 100 years
- Inadequate for Delta Committee (Netherlands), Environment Agency (UK)
- Inadequate to inform mitigation debate



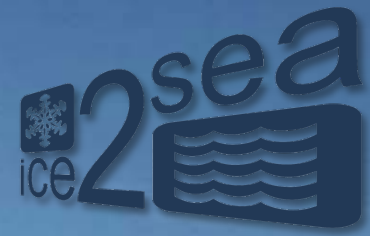
- Ice2sea timescale = 200 years

The Response: Critical Path



- GHG emission scenarios
- Climate projections
- Regionalisation of ocean and atmosphere changes
- Ensemble / intercomparison of glacier/ice-sheet models
- Application of models
- Uncertainty pathways analysis

Scope: Fieldwork



- Greenland – basal lubrication / accumulation rate changes

Led by Michiel van den Broeke (UU) - Russell Glacier (West Greenland)

Hot water drill to glacier base to continuously monitor sub-glacier water pressure

Led by Dorthe Dahl-Jensen (NBI)

Compile shallow (20-40m) ice core record of precipitation and obtain new cores linked by ASIRAS snow radar and Cryosat II.

- Svalbard – Tidewater glaciers

Led by Klaus Grosfeld (AWI)

Collect data on the interaction between surface and basal melt & detailed calving fluxes

- Antarctica – Ice-sheet change

Led by Christophe Genthon (CNRS)

Precipitation estimates and effect of snow drift on regional mass balance

Scope: Ice Sheets (Antarctica and Greenland)



Inventories of glaciers and ice caps

Led by Frank Paul (UZH) – Global glaciers

Concatenate datasets from GLIMS, WGI, WGMS and coordinate with GlobGlaciers to fill spatial gaps with new satellite derived observations – dynamic and static.

Mass balance time series for the ice sheets

Led by Jonathan Bamber (UoB) Greenland & Antarctica

Integrate surface and satellite observations to provide an observational time series of surface elevation and velocity changes.

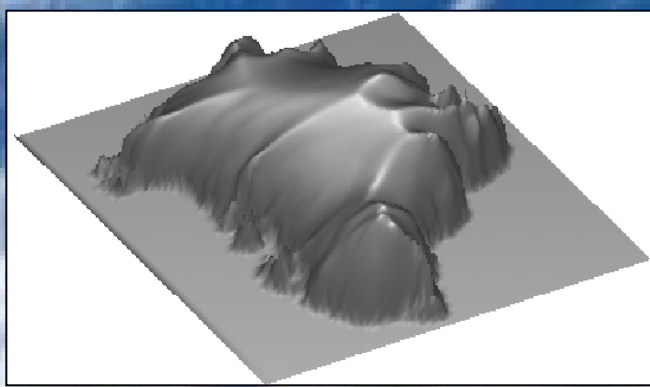
Sensitivity to change in near-polar ice caps

Led by Jon Ove Hagen (UiO)

Field measurements of Austfonna and Devon ice caps as validation for satellite retrievals

Apply to Antarctic Peninsula region to improve understanding of glacier speed-up

Ensemble of ice sheet simulations



Forcing from ERA-40 and E1 and SRES A1B scenarios from HadCM3 and ECHAM5

Investigate uncertainty using different SMB and ice dynamics schemes and impact of spatial resolution.

DMI (HIRHAM5 including Snow model) 25 km for Greenland

UU (RACMO2/ANT ARCM) 55 km for Antarctica (27km for peninsula)

CNRS (LMDZ) 60 km for Antarctica

MOHC (HadRM3Q ARCM) 25 km for Greenland

ULG (MAR ARCM, including CROCUS snow model) 25 km Greenland

Assess model performance against data gathered in earlier work packages

Resolution impacts precipitation pattern (mm/day)

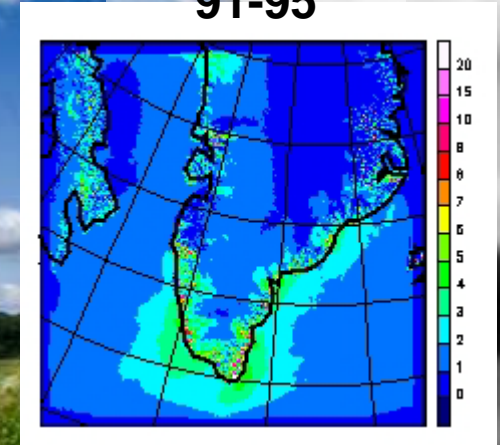
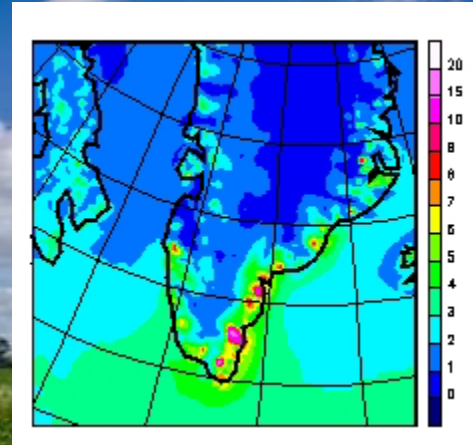
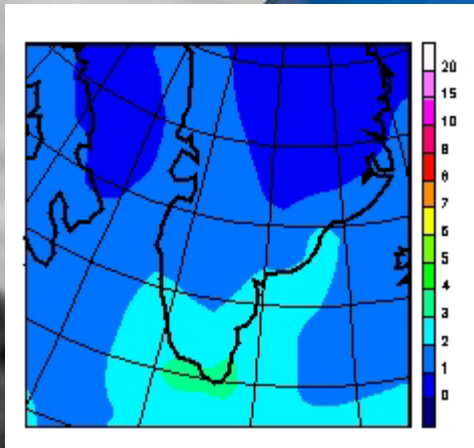


ERA40
~150km 61-90

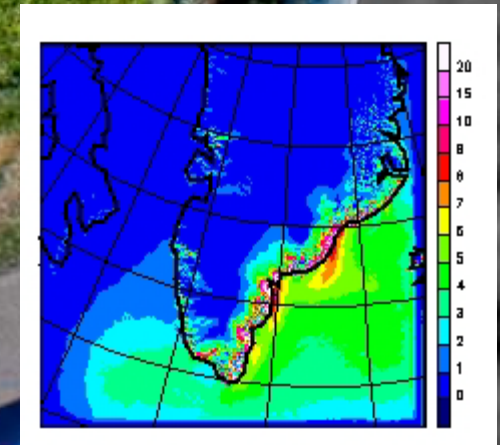
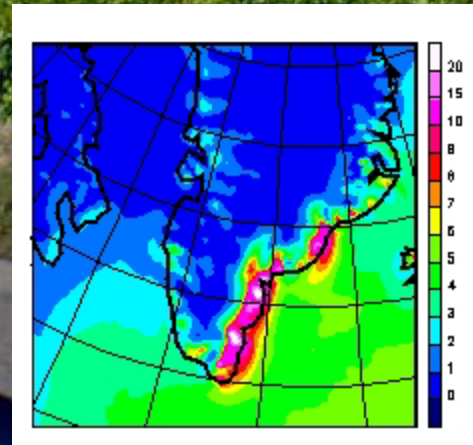
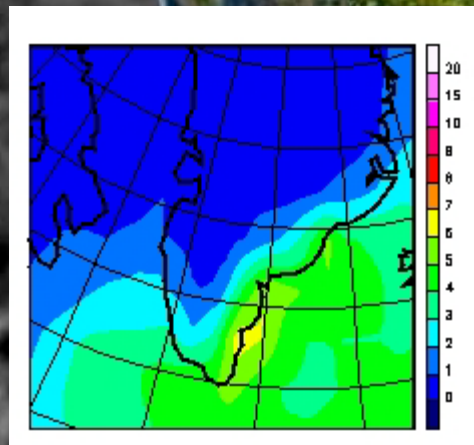
HIRHAM 25km
GCM 61-90

HIRHAM
5km ERAI
91-95

Summer

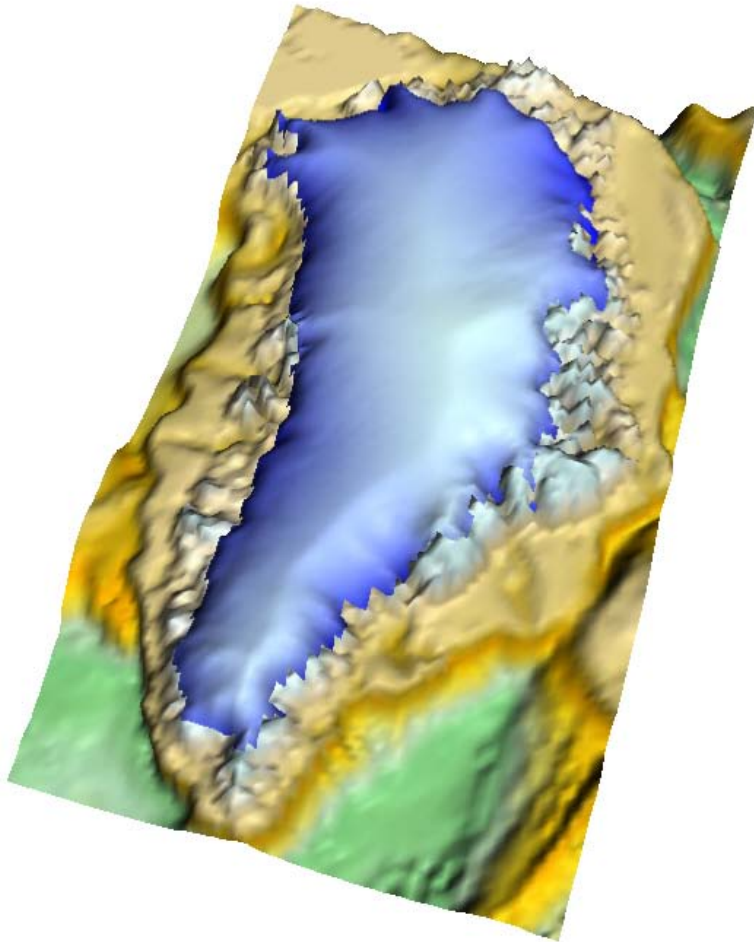


Winter

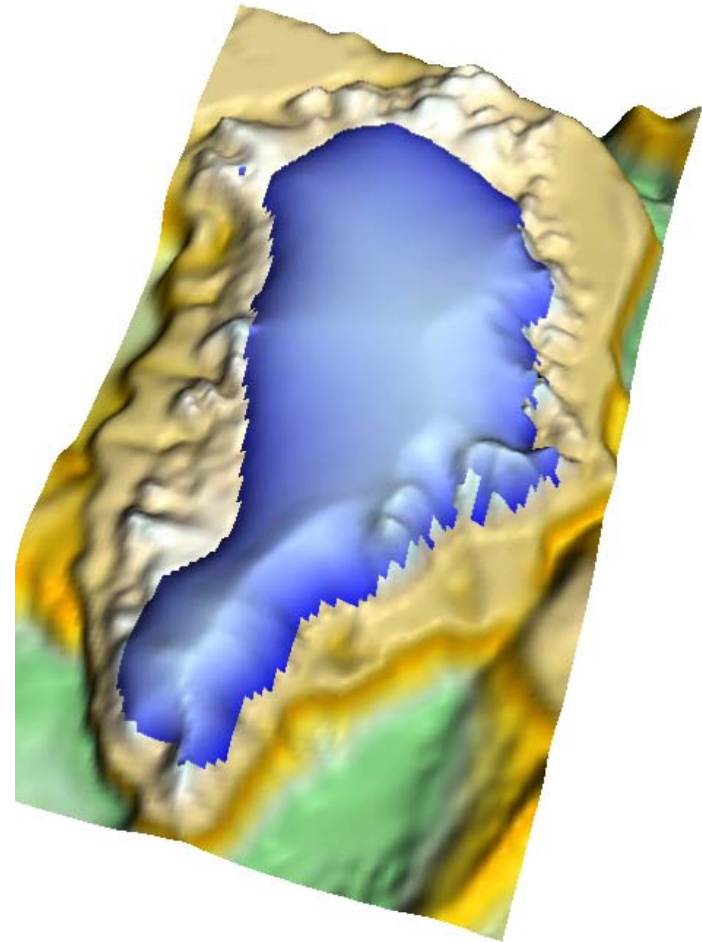


Result of coupled climate-ice sheet model

Measured ice sheet



Modelled ice sheet
forced with HIRHAM (25km)



Global Finite Element Model (AWI)

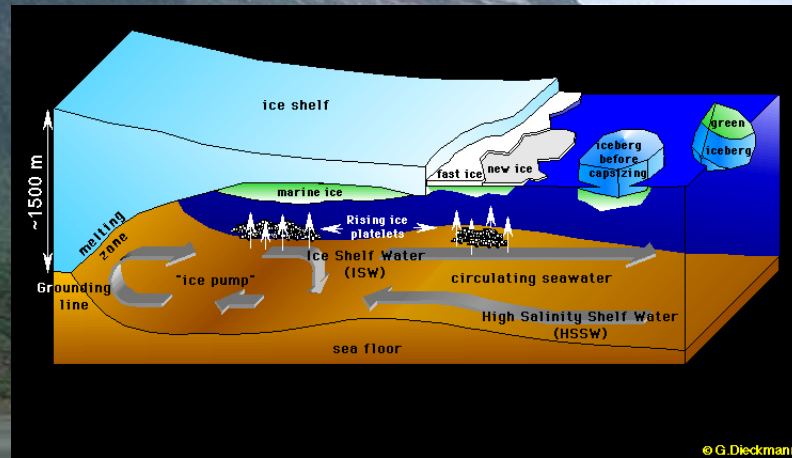
Resolution:

0.5 ° - Southern Ocean south of 50°S

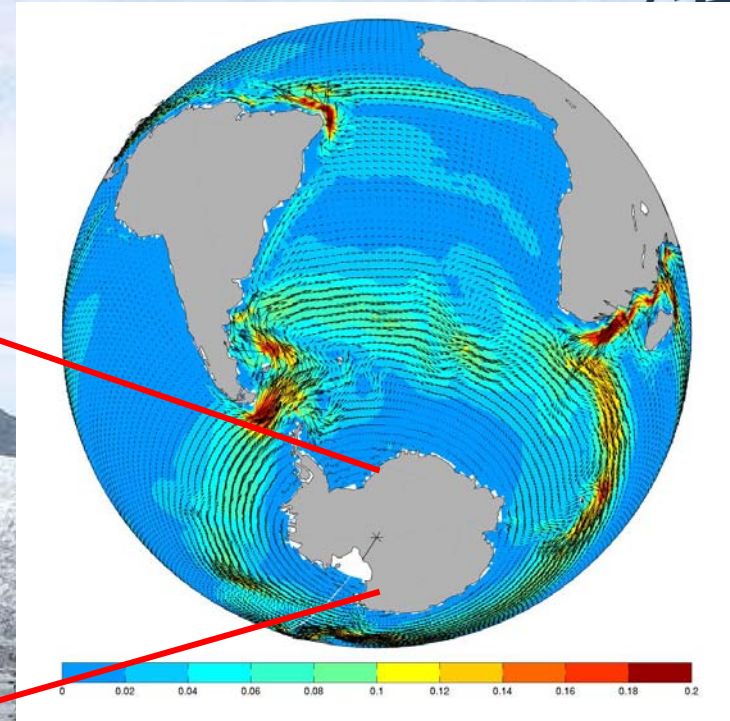
- all other coastal areas

0.25° - Antarctic continental shelf including ice shelf caverns

- Weddell and Bellingshausen Seas

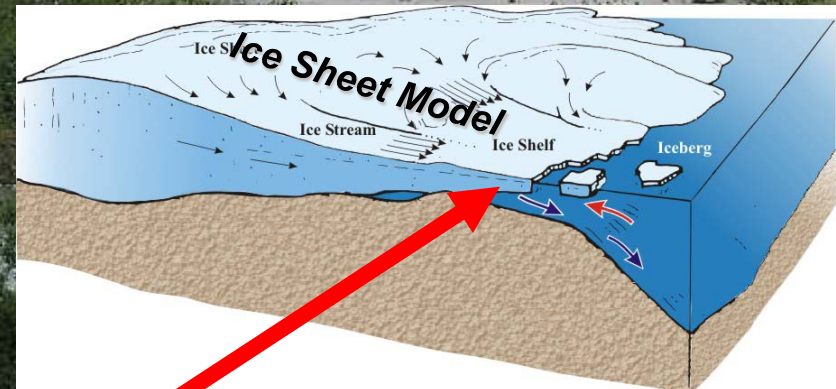


Ocean currents in FESOM (150 m depth)



Ocean-Ice Shelf Model

- 3-Equation approach at ocean-ice shelf interface
- GEBCO-S2004 bedrock topography (W. Smith)
- BEDMAP2 ice shelf thickness (D. Vaughan)
- Amery cavern specs (B. Galton-Fenzi)
- Grounding line positions (E. Rignot)



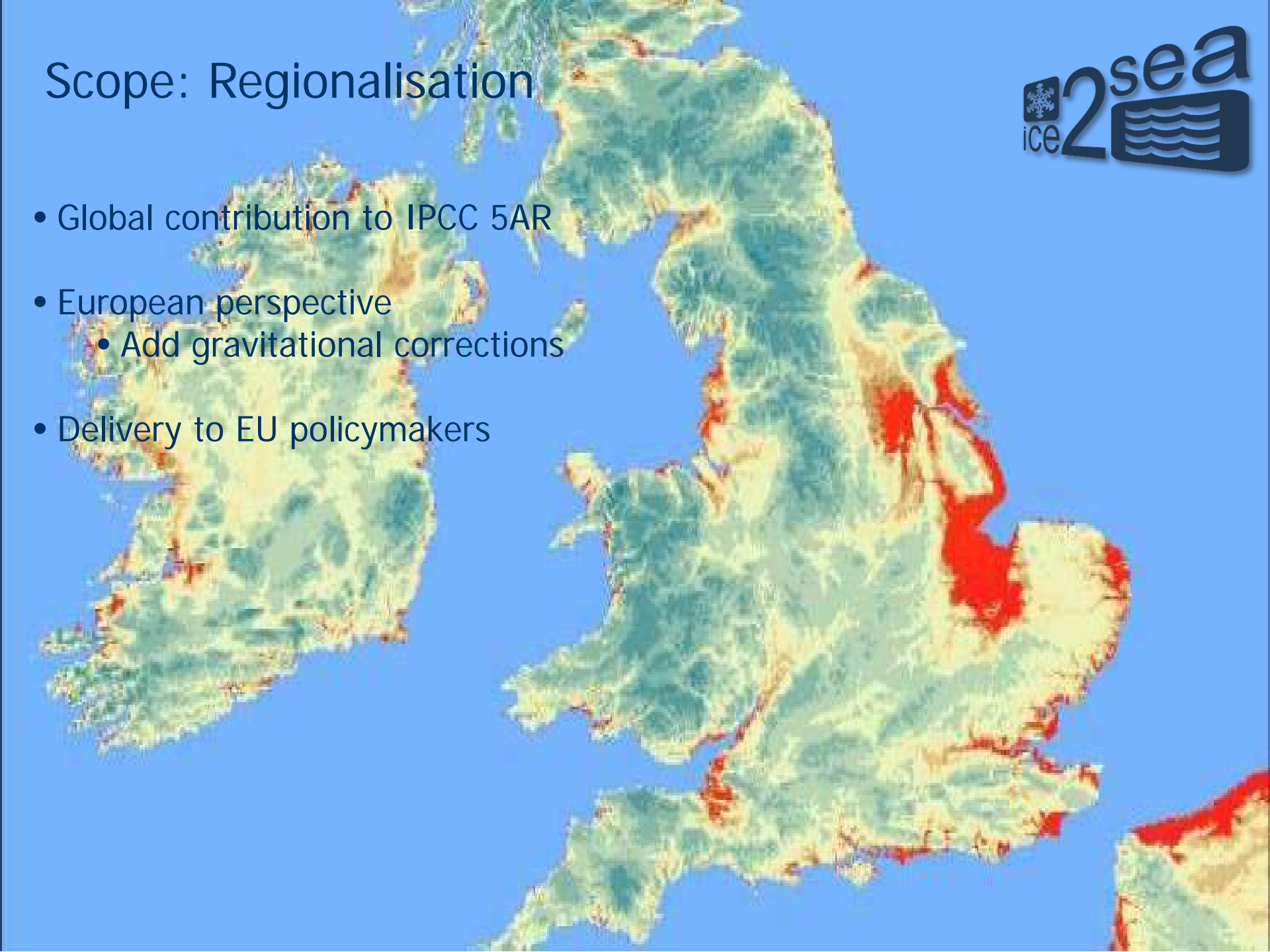
Donna62 @

Both combined to provide Basal Mass Fluxes for the ice sheet model

Scope: Regionalisation



- Global contribution to IPCC 5AR
- European perspective
 - Add gravitational corrections
- Delivery to EU policymakers



Links



Other FP7 projects

Combine: GCM improvements

Damocles: Thermohaline circulation changes

HighNoon: Himalayan glaciers

Internal programs (EU)

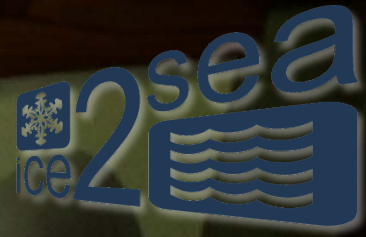
Model development activities

Observational campaigns

International

SeaRISE ??

Scope: outreach/development



- Stakeholder review
- Student/early-career scientist development
- Delivery to policymakers and advisors





www.ice2sea.eu