POLAR SCIENCE
FOR PLANET EARTH

Use of ice-sheet and glacier CCI products

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CCI – Ice sheets products Overview

- Grounding Line Location – GLL
- Calving Front Location (Greenland only) – CFL
- Surface Elevation Change – SEC
- Gravimetric Mass Balance – GMB
- Ice velocity – IV

CCI – Ice sheets products Overview

- Ice-sheet modelling – small groups
- polar atmospheric modelling – few measurements
- Polar ocean modelling – poorly defined ocean domain

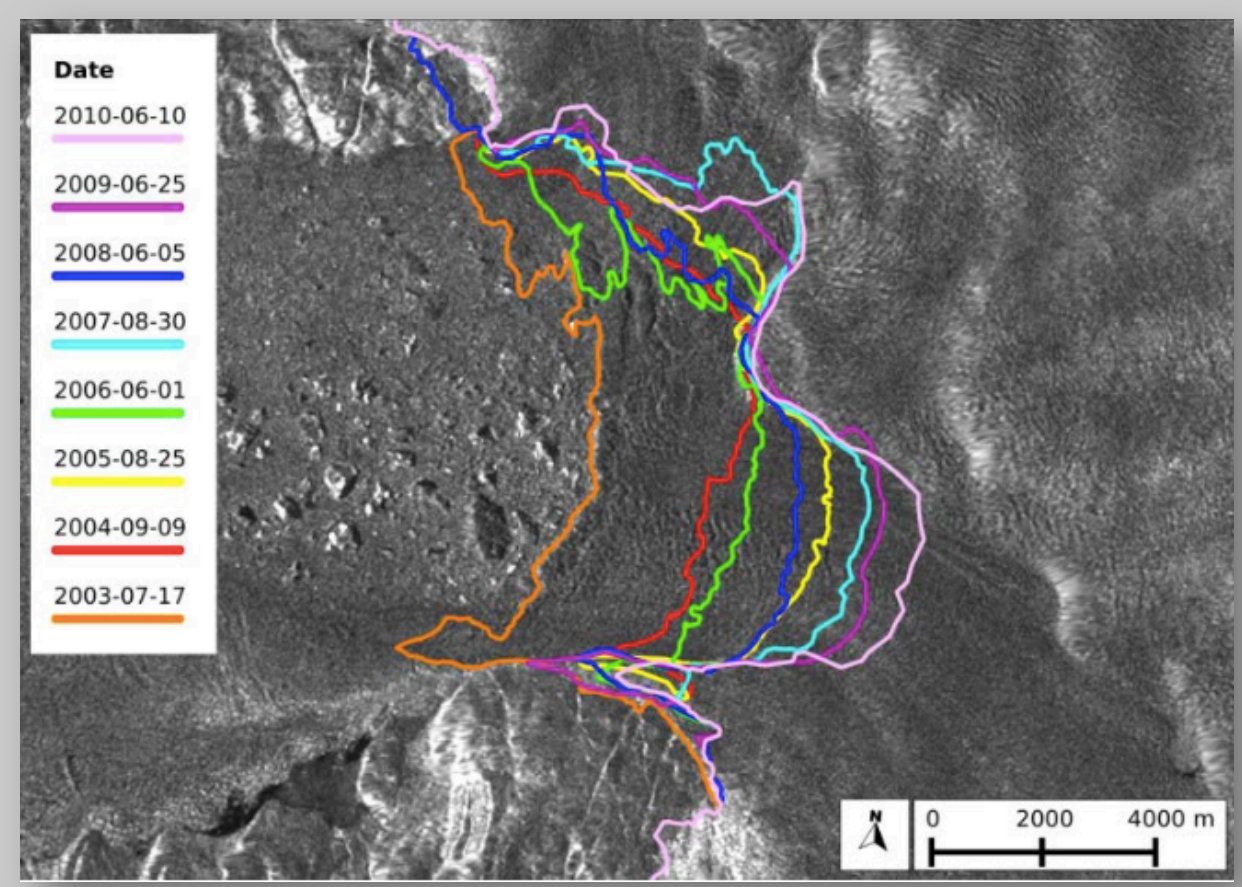
- IMBIE

- Sea-level contribution - budget
- Partitioning of mass-balance terms - multiple

CCI – Ice sheets products

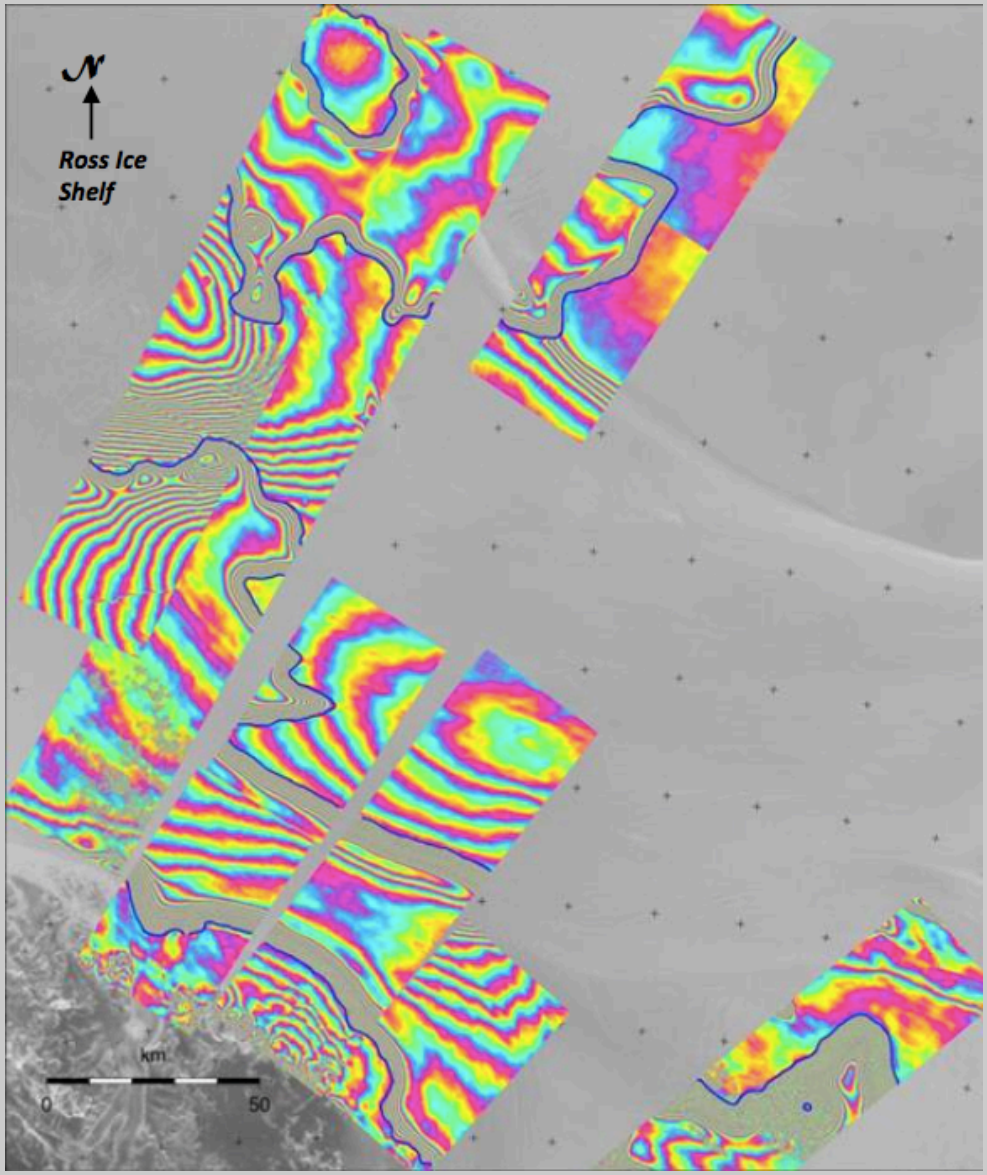
Calving Front Location (Greenland only) – CFL

- Identifcation of natural cyclicity vs. change
- Icebergs production points / fluxes (operational?)
- Local users
- Lower relevance for Antarctic



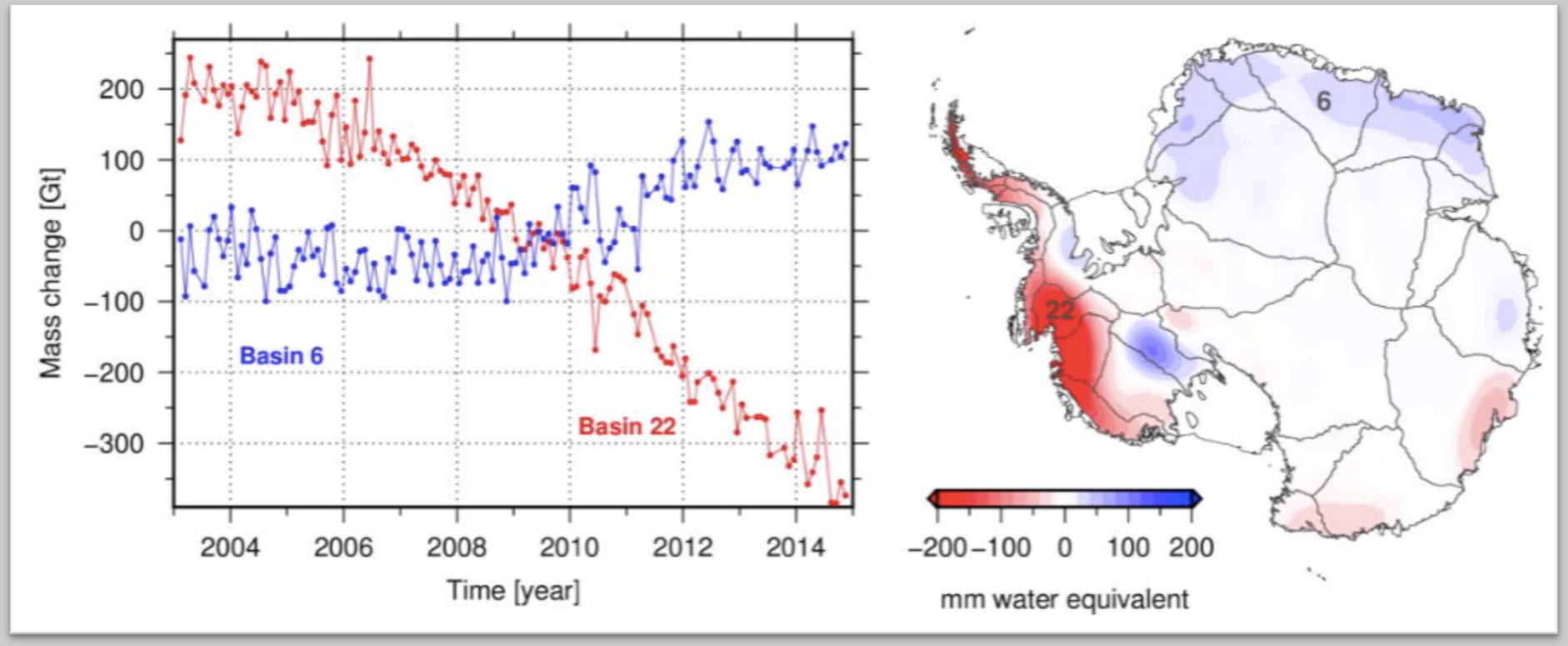
CCI – Ice sheets products

- Grounding Line Location – GLL
  - Definition of ocean/ice-sheet domains
  - Perturbation vs. state-change
  - Forcing on ice sheet
  - Early-warning
  - Higher relevance to Antarctic



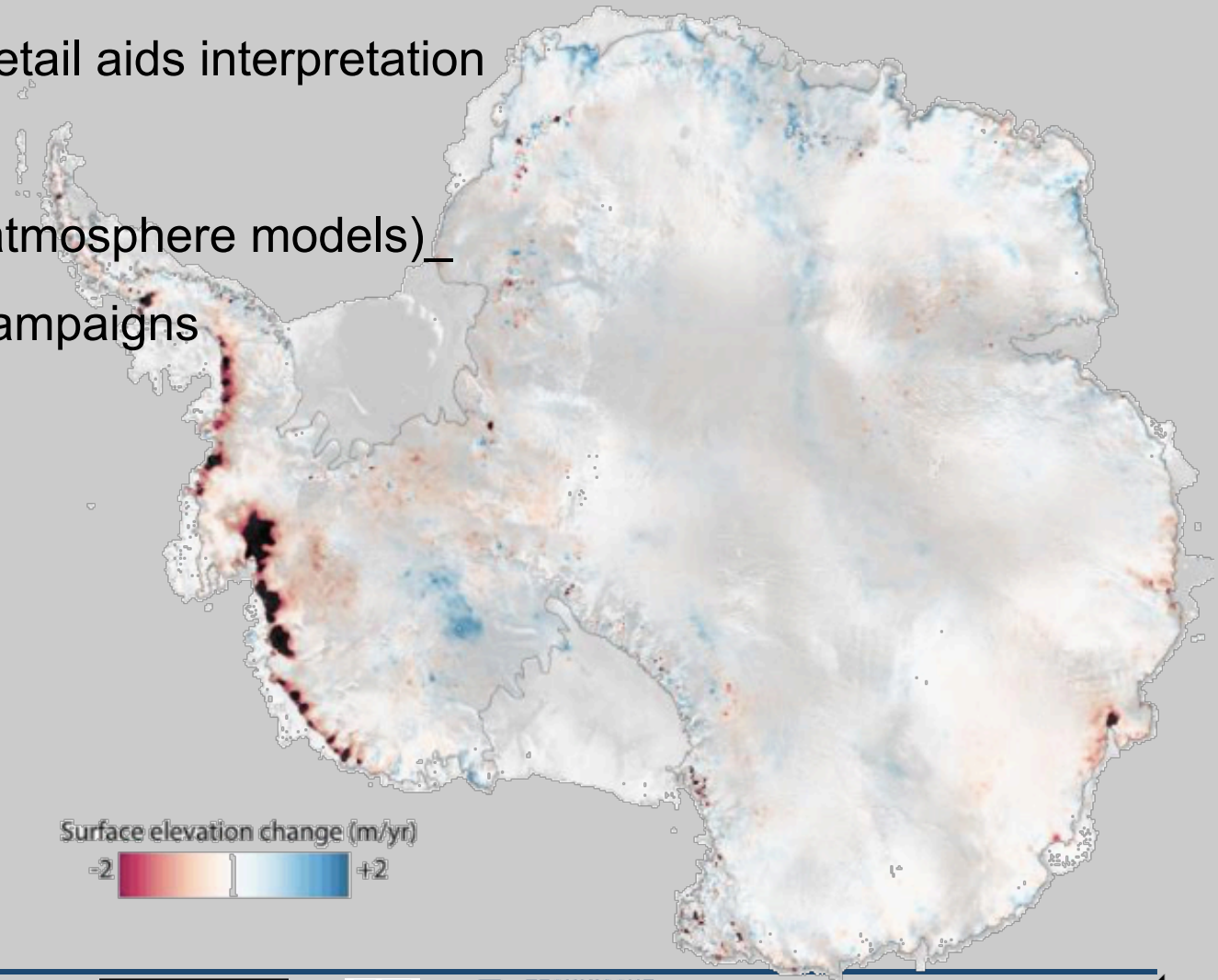
CCI – Ice sheets products

- Gravimetry Mass Balance – GMB
  - Key integrating measurement
  - Temporal change
  - Baseline issue in Antarctica



CCI – Ice sheets products

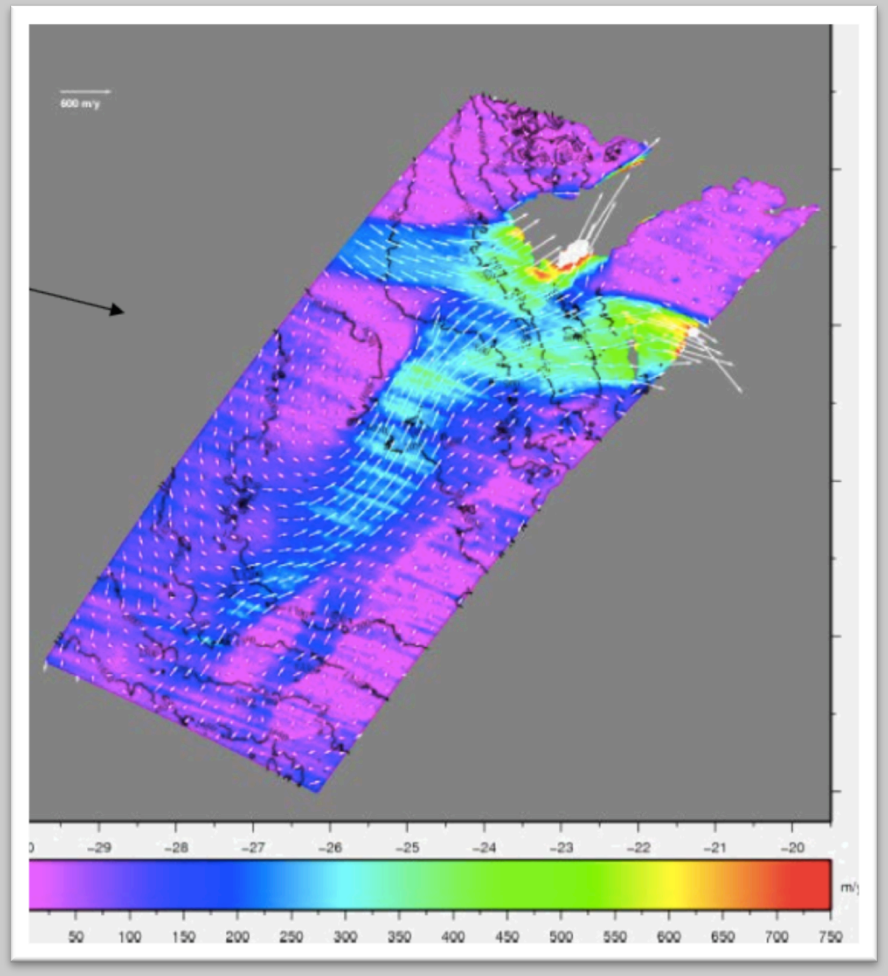
- Surface Elevation Change – SEC
  - Geographical detail aids interpretation
  - Initialisation
  - Validation (ice/atmosphere models)_
  - Focuses field campaigns



CCI – Ice sheets products

Ice Velocity – IV

- Existing products epochs
- Initialisation / testing
- Novel uses (interpolation)
- Dynamic change



Exploitation of Glaciers_cci products
Frank Paul

- The glacier outlines produced by Glaciers_cci are integrated in larger global datasets (RGI and GLIMS)
- The globally complete RGI is used for a wide range of applications from global to regional scales
- This creates new products of societal relevance & scientific importance (ice thickness distribution, global sea-level rise, regional hydrology, future glacier & run-off evolution, …)
- The related publications are valuable for global assessments (e.g., IPCC) and are highly-cited (data users: 220)
- Glaciers_cci is also contributing "non-glacier outline products" to publications of high relevance (e.g. mass changes Himalaya – Kaab, 2012)
- Key to data exploitation is the added value of a global database & transformation of data into information products

Introduce discussion

1. What is the project experience of exploitation of CCI products?
2. Were CMUG and CRG approaches effective? (what can be done to improve them?)
3. Was the LPF a successful exercise in helping to improve exploitation of CCI products (what improvements can be made?)
4. What alternative could be introduced in CCI+
5. What other exploitation projects, bringing together multiple CCI teams, are needed following the success of IMBIE and sea-level budget closure projects?

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IPCC view of the cryosphere

- Sea ice -
- Glaciers and ice caps
- Ice Sheets
- Snow-cover
- Lake and River ice
- Permafrost

CCI – Ice sheets users

- Ice sheet modellers who are using the ECV parameters to validate and/or initialize their models or using the ECV parameters to constrain model parameters, e.g. constrain basal drag and ice viscosity by fitting modelled and observed IV.
- Remote sensing scientists who are deriving volume and mass changes from satellite observations.
- Surface mass balance modellers, who are interpreting satellite observed volume and mass changes, e.g. deriving mass change from observed volume changes by using firn densification models, or comparing observed mass loss with estimates from surface mass balance models based on climate models and observations.
- Climate and Ocean modellers, who are interested in the ice sheet component of the climate system and its interactions with other parts of the climate system, e.g. freshwater fluxes from ice sheet on shorter timescales or orographic forcing of wind patterns on longer timescales.
- Authorities and organizations who are interested in monitoring of the ice sheets for political or practical decisions, for example hydro-power plant planning and maintenance, and information on iceberg production from calving glaciers, of specific interest to future oil- and gas exploration off Greenland.

Sea ice – key features

Domain

- Polar

Key features

- Inhomogenous
- High spatial variability
- Rapid rates of change
- Thickness / composition / transport

Sea ice – uses of satellite data

Routine

- Monitoring
  - Extent
  - Thickness
  - Type
- Operational forecasting
- Model verification and validation

Emerging uses

- Ice-type discrimination
- ype

Outlook

- Lkj

Glaciers and ice caps – key features

Domain

- Global

Key features

- >200 k
- Obscured for much of the year

Glaciers and ice caps – uses of satellite data

Routine

- Inventory (complete?)
- Monitoring
  - Extent

Emerging

- Monitoring mass / volume

Outlook

- Automated monitoring?

Ice sheets – key features

Domain

- 2 x (

Key features

- Multiple drivers

Ice sheets – uses of satellite data

Routine

- Monitoring
  - Extent

Emerging uses

- Volume content

Outlook

- Automated monitoring?

Snow cover – key features

Domain

- Global

Key features

- >200 k
- (

Snow cover – uses of satellite data

Routine

- Monitoring
  - Extent

Emerging uses

- Volume content

Outlook

- Automated monitoring?

River and lake ice – key features

Domain

- Global

Key features

- >200 k
- (

River and lake ice – uses of satellite data

Routine

- Monitoring
  - Extent

Emerging uses

- Volume content

Outlook

- Automated monitoring?

Permafrost – key features

Domain

- High spatially-variability

Key features

- Subsurface
- >200 k
- (

Permafrost– uses of satellite data

Routine

- Talik (inception, growth/shrinkage, draining)

Emerging uses

- Coastine erosion

Outlook

- Heave and subsidence