

CCI Phase 1 results and Phase 2 recommendations

Cryosphere and Sea Level

(Glaciers, Ice Sheets, Sea Ice, Sea Level)

Glaciers

- Glacier area, velocity, elevation change
- 170k Glaciers now in RGI
- According to IPCC, Greenland glaciers and ice caps need to be distinguished from ice sheet
- Distinction now made by CCI using 3 connectivity levels
- Primary and secondary publications used heavily in IPCC

Ice sheets

- Ice sheet calving front location, grounding line location, ice velocity, surface elevation changes
- 1 yr behind other CCI's, now in production phase
- Parallel activity IMBIE contributed heavily to IPCC
- IMBIE / IPCC agreement better for Greenland than Antarctica
- Future CCI add-ons for Antarctica; CryoSat; Sentinel-1 velocity rates

Sea ice

- Sea ice extent, thickness, drift, melt season
- Extent & thickness, have decreased; drift & melt season have increased
- Decrease in summer extent more pronounced
- Bootstrapping frequency and Bristol were found to be most optimal method
- SIC product provided includes new uncertainty model
- For the thickness, SMOS can be used for thin sea ice and altimetry for thicknesses $>0.5\text{m}$

Sea level

- Use 7 missions included -> 50 years of combined data
- Long-term trends tend to be in agreement; annual and inter-annual signals differ
- Atmospheric correction provides improvement on early altimetry results (1993 – 2000); errors reduced by 2cm/yr
- Gridded monthly mean anomalies provided on CCI website
- Products used by CMUG and external users (e.g. NASA)
- Budget study shows better coherence between global mean sea level and mass+steric components
- Phase 2: user requirements not reached; external corrections need evaluating; geographical areas require improvement; describe errors better; include new missions

Reception of CCI data by IPCC & wider community

Glaciers

- Indirectly through input into modeling efforts contributing to IPCC
- 7 papers cited directly; 7 secondary papers cited
- Regional applications of RGI also of scientific value
- Impact is not just data, but also uncertainty characterisations and consensus

Ice Sheets

- IMBIE project which was included in IPCC

Sea Level

- IPCC focuses on trends, closing the SL budget, and predictions
- Main improvement provided by CCI is on regional variability and inter-annual global variability
- Reduction of errors has led to a more reliable product
- CCI project highlighted methodology errors, e.g. the way tide gauges are averaged
- Discrepancy between IMBIE and IPCC affects closure of sea level budget

Reasons for bringing cci products together

Sea level

- Ice Sheets, Glaciers, Sea Level & other CCI's output can be used as input to close sea level budget

Sea ice

- SMOS mission used for thin sea ice
- Sea ice affected by SST and ocean colour -> merge sea ice margins with SST and ocean colour products (ice margins are the most productive areas)

General

- Data are now mature enough to consider combinations
- This would provide even more usable data

Recommendations for phase 2

- Serve the societal need for climate data
- Community inter-comparison exercises (IMBIE-2; Sea level Inter-comparison including 5 international data producers)
- IPCC include chapter on data inter-comparison exercises
- Ice Sheets / Glaciers convert volume estimates to mass
- Some synthesis should be paramount; make SL, IS and Glaciers numbers comparable (this will make for instance SL product highly reliable)
- Long-term outlook: necessary to extend CCI beyond Phase 2
- Periodic data reports in support of eg IPCC