Data Store Content

Examples courtesy of CCI project teams

mark doherty
European Space Agency

Key Questions (i)

- *Which Users and Applications?*
- *Which ECVs ?*
- *Which Geophysical parameters ?*
- *What Product Levels ?*
- *What Epoch(s) ?*

Key Questions (ii)

- *What Data Sources ?*
- *How many Versions ?*
- *Independent Validation ?*
- *Uncertainties ? also Validated ?*
- *Current state-of-art ?*

Key Questions (iii)

- *Open ?*
- *Traceable ? Repeatable ?*
- *Benefits & Impact ?*

Key Questions (iv)

- *How ?*
- *How Long ?*
- *How Often ?*
- *What Systems ?*
- *Who and where ?*

Which **users** and **applications** ?

- **EC Services, Council & Parliament**
- **Member States**
- **International Climate Research Community**
- **General Public, Media & Educational**
- **=> *Mitigation* => *Adaptation***
- ***…. are source of requirements***
- ***should be engaged throughout***
- ***assess impact***
- ***give critical feedback***
- ***will always have the last word….***

Which ECVs ?

33 ECVs & 7+ indicators -
Observed, re-analyzed and model projected products

ATMOSPHERE	OCEAN	LAND
Surface Air Temperature	Ocean Color	Snow Cover
Surface Precipitation	Sea Ice	Glaciers & Ice Caps
Water Vapor	Sea Level	Albedo
Surface Radiation Budget	Sea Surface Temperature	FAPAR
Earth Radiation Budget	Global Ocean Heat Content	Fire Disturbances
Carbon Dioxide & Methane		Ice Sheets
Ozone & Aerosols		Lakes
Cloud properties	CO2 partial pressure	Permafrost
Upper Air Temperature	Ocean Activity	Land Cover
Other Long-Lived GHGs	Sea Surface Salinity	Leaf Area Index
Wind Speed & Direction	Current Salinity	Soil Moisture

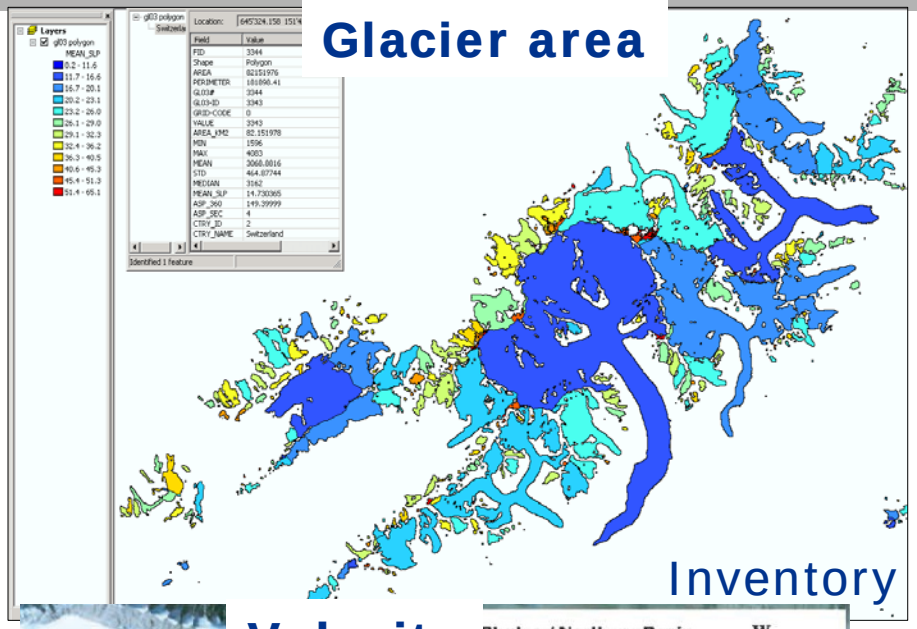
ESA CCI & Eumetsat ECV capabilities

Atmosphere	Ocean	Terrestrial
Composition	Surface	
Aerosol Properties	Sea Surface Temperature	Land Cover
Methan & Long Lived GHGs	Sea Level	Fire Disturbance
Ozone	Sea Ice	Soil Moisture
Carbon Dioxide	Ocean Colour	Glacier and Ice Caps
Precursors (for Aerosol & O3)	Sea State	Ice Sheets
Upper Air	Current	Snow Cover
Cloud Properties	Sea Surface Salinity	Albedo
Temperature	Carbon Dioxide Partial Pressure	Leaf Area Index
Water Vapour	Phytoplankton	FAPAR
Wind Speed and Direction	Ocean Acidity	Lakes
Earth Radiation Budget	Sub Surface	Above Ground Biomass
Surface	Carbon	Permafrost
Surface Air Pressure	Current	Ground Water
Surface Air Temperature	Nutrients	River Discharge
Surface Precipitation	Ocean Acidity	Soil Carbon
Surface Radiation Budget	Oxygen	Land Surface Temperature
Water Vapour (Surface Humidity)	Salinity	
Near-surface Wind Speed	Temperature	
	Tracers	
	Global Ocean Heat Content	

EUMETSAT | CCI Started | CCI Scope

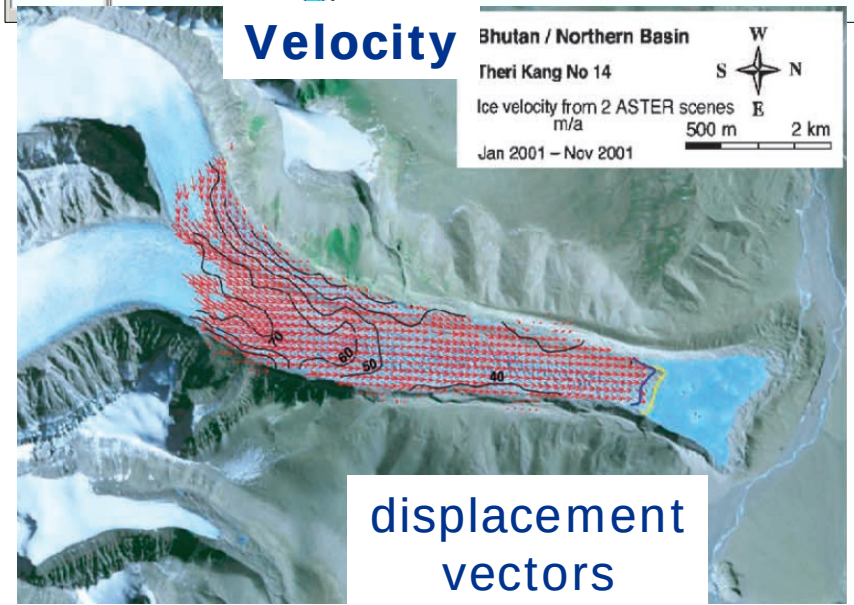
Which Geophysical Parameters ?

Glacier area



Inventory

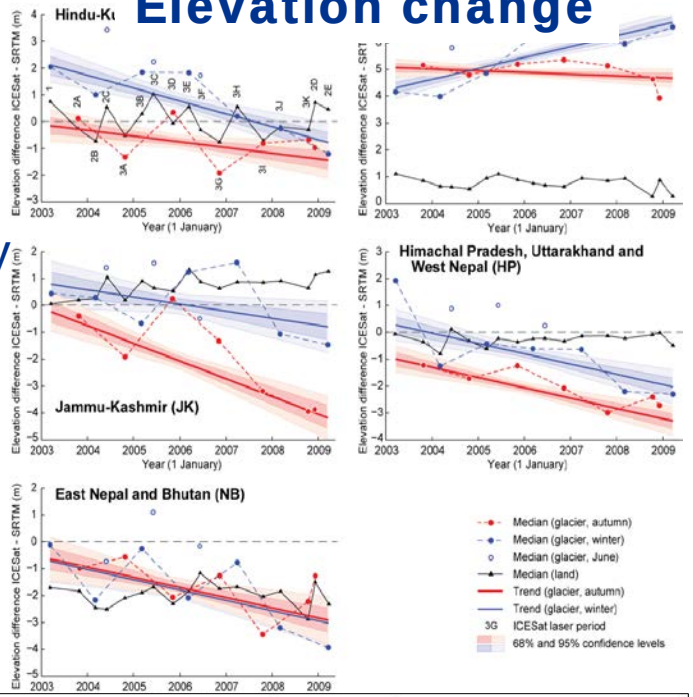
Velocity



displacement vectors

Elevation change

dh/dt trends from altimetry



mean changes from DEM differencing

What product levels?

esa

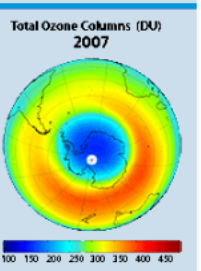
climate change initiative

ESA | CCI | Aerosol | Cloud | Cmug | Fire | Ghg | Glaciers | Land Cover | Ocean Colour | Ozone | Sea Ice | Sea Level | Sst | Ice Sheets | Soil Moisture

Ozone

Navigation

- About OZONE CCI
- Project Plan
- Project Content
- Support
- CRDP
- Private Area



Website Hosted By
BIRA-IASB

Belgian Institute For Space Aeronomy

Recent Updates

- Project Team *3 Weeks 4 Days* Ago
- Validation *20 Weeks 3 Days*

Product identifier	Source/ Processing center	Time periods																
		96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Level-2 Data Sets																		
TC_L2_GOME	BIRA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
TC_L2_SCIA	BIRA							■	■	■	■	■	■	■	■	■	■	■
TC_L2_GOME2	BIRA												■	■	■	■	■	■
NP_L2_GOME	RAL		■															
NP_L2_GOME2	RAL												■	■				
LP_L2_SCIA	UBR							■	■	■	■	■	■	■	■	■	■	■
LP_L2_MIPAS	KIT										■	■	■	■	■	■	■	■
LP_L2_GOMOS	ESA							■	■	■	■	■	■	■	■	■	■	■
LP_L2_OSIRIS	SASK						■	■	■	■	■	■	■	■	■	■	■	■
LP_L2_SMR	CHALMERS						■	■	■	■	■	■	■	■	■	■	■	■
LP_L2_ACE	UOFT									■	■	■	■	■	■	■	■	■
Level-3 Data Sets																		
TC_L3_MRG	DLR/BIRA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
NP_L3_MRG	RAL/KNMI		■										■	■				
LP_L3_SCIA	UBR							■	■	■	■	■	■	■	■	■	■	■
LP_L3_MIPAS	KIT										■	■	■	■	■	■	■	■
LP_L3_GOMOS	FMI							■	■	■	■	■	■	■	■	■	■	■
LP_L3_OSIRIS	SASK						■	■	■	■	■	■	■	■	■	■	■	■
LP_L3_SMR	CHALMERS						■	■	■	■	■	■	■	■	■	■	■	■
LP_L3_ACE	UOFT									■	■	■	■	■	■	■	■	■
LP_L3_MRG-MZM	FMI												■	■				
LP_L3_MRG-MBW	FMI												■	■				
Level-4 Data Sets																		
NP_L4_MRG	KNMI		■										■	■				

http://www.esa-ozone-cci.org

What product levels?
FCDRs ?

esa climate change initiative

ESA | CCI | Aerosol | Cloud | Cmug | Fire | Ghg | Glaciers | Land Cover | Ocean Colour | Ozone | Sea Ice | Sea Level | Sst | Ice Sheets | Soil Moisture

Ozone

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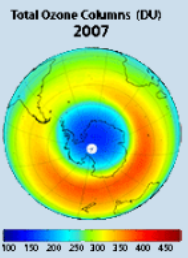

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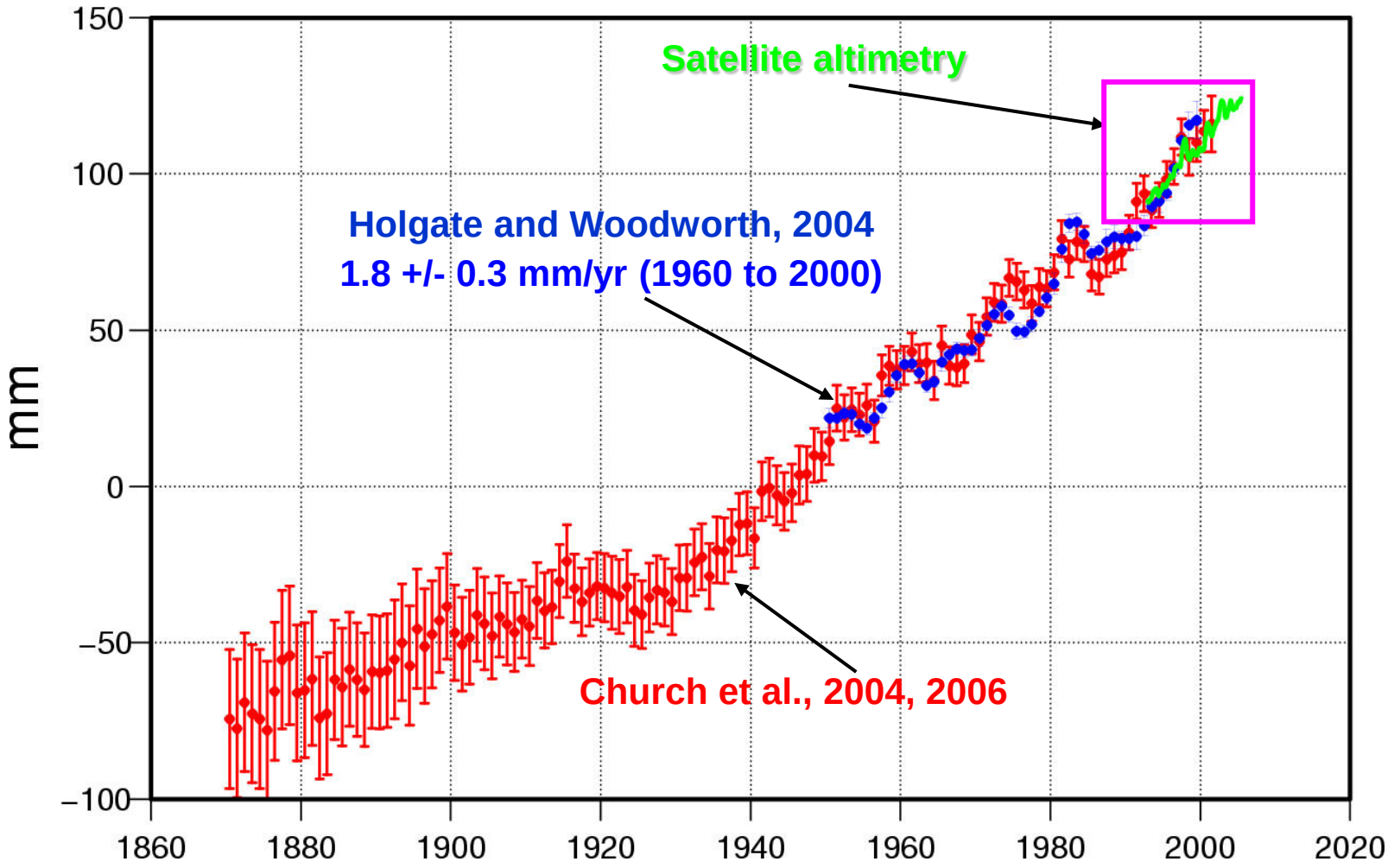
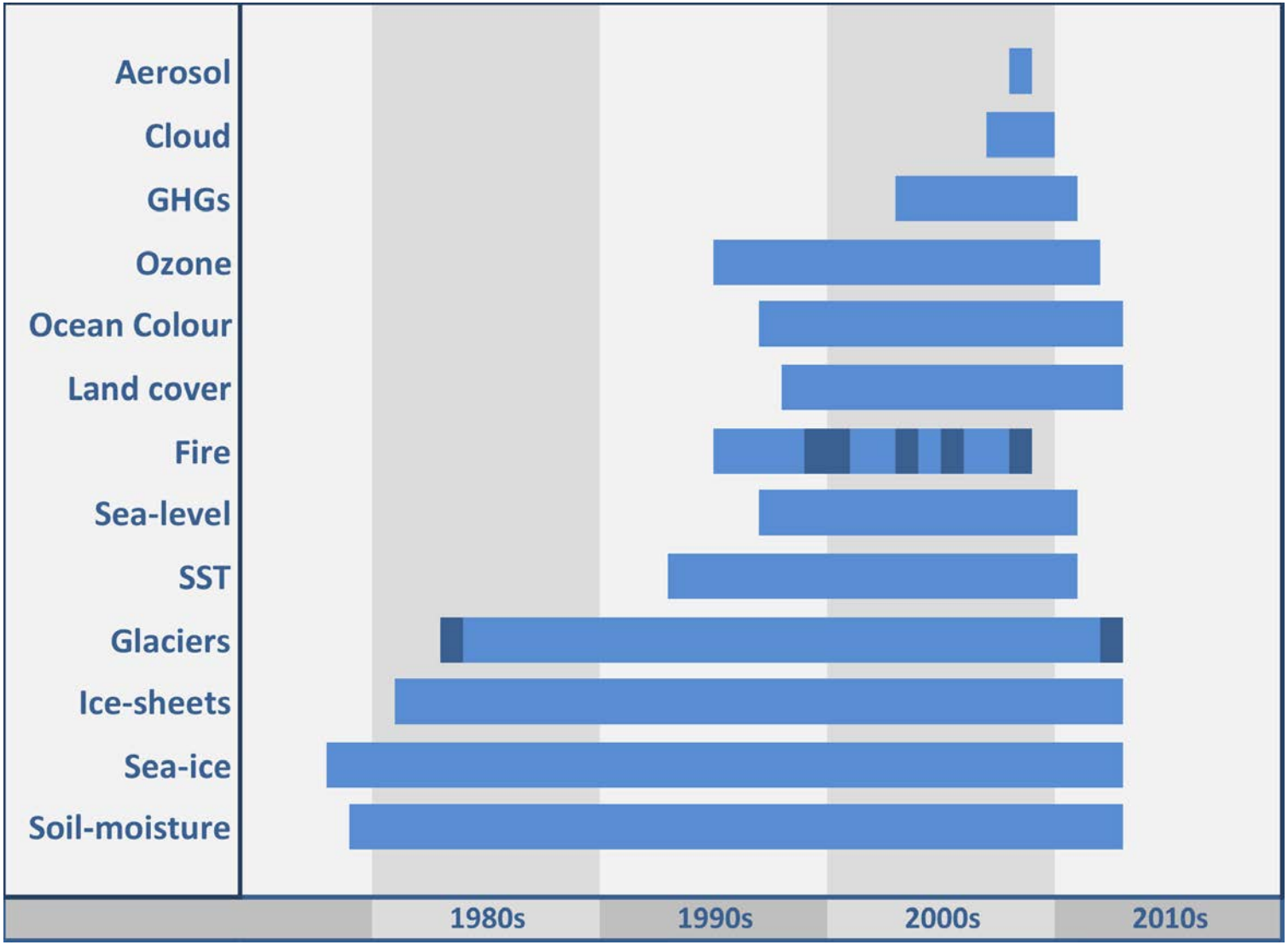
TC_L2_SCIA	BIRA							■	■	■	■	■	■	■	■	■	■	■
TC_L2_GOME2	BIRA												■	■	■	■	■	■
NP_L2_GOME	RAL		■															
NP_L2_GOME2	RAL												■	■				
LP_L2_SCIA	UBR							■	■	■	■	■	■	■	■	■	■	■
LP_L2_MIPAS	KIT										■	■	■	■	■	■	■	■
LP_L2_GOMOS	ESA							■	■	■	■	■	■	■	■	■	■	■
LP_L2_OSIRIS	SASK						■	■	■	■	■	■	■	■	■	■	■	■
LP_L2_SMR	CHALMERS						■	■	■	■	■	■	■	■	■	■	■	■
LP_L2_ACE	UOFT									■	■	■	■	■	■	■	■	■
Level-3 Data Sets																		
TC_L3_MRG	DLR/BIRA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
NP_L3_MRG	RAL/KNMI		■										■	■				
LP_L3_SCIA	UBR							■	■	■	■	■	■	■	■	■	■	■
LP_L3_MIPAS	KIT										■	■	■	■	■	■	■	■
LP_L3_GOMOS	FMI							■	■	■	■	■	■	■	■	■	■	■
LP_L3_OSIRIS	SASK						■	■	■	■	■	■	■	■	■	■	■	■
LP_L3_SMR	CHALMERS						■	■	■	■	■	■	■	■	■	■	■	■
LP_L3_ACE	UOFT									■	■	■	■	■	■	■	■	■
LP_L3_MRG-MZM	FMI												■	■				
LP_L3_MRG-MBW	FMI												■	■				
Level-4 Data Sets																		
NP_L4_MRG	KNMI		■										■	■				

http://www.esa-ozone-cci.org

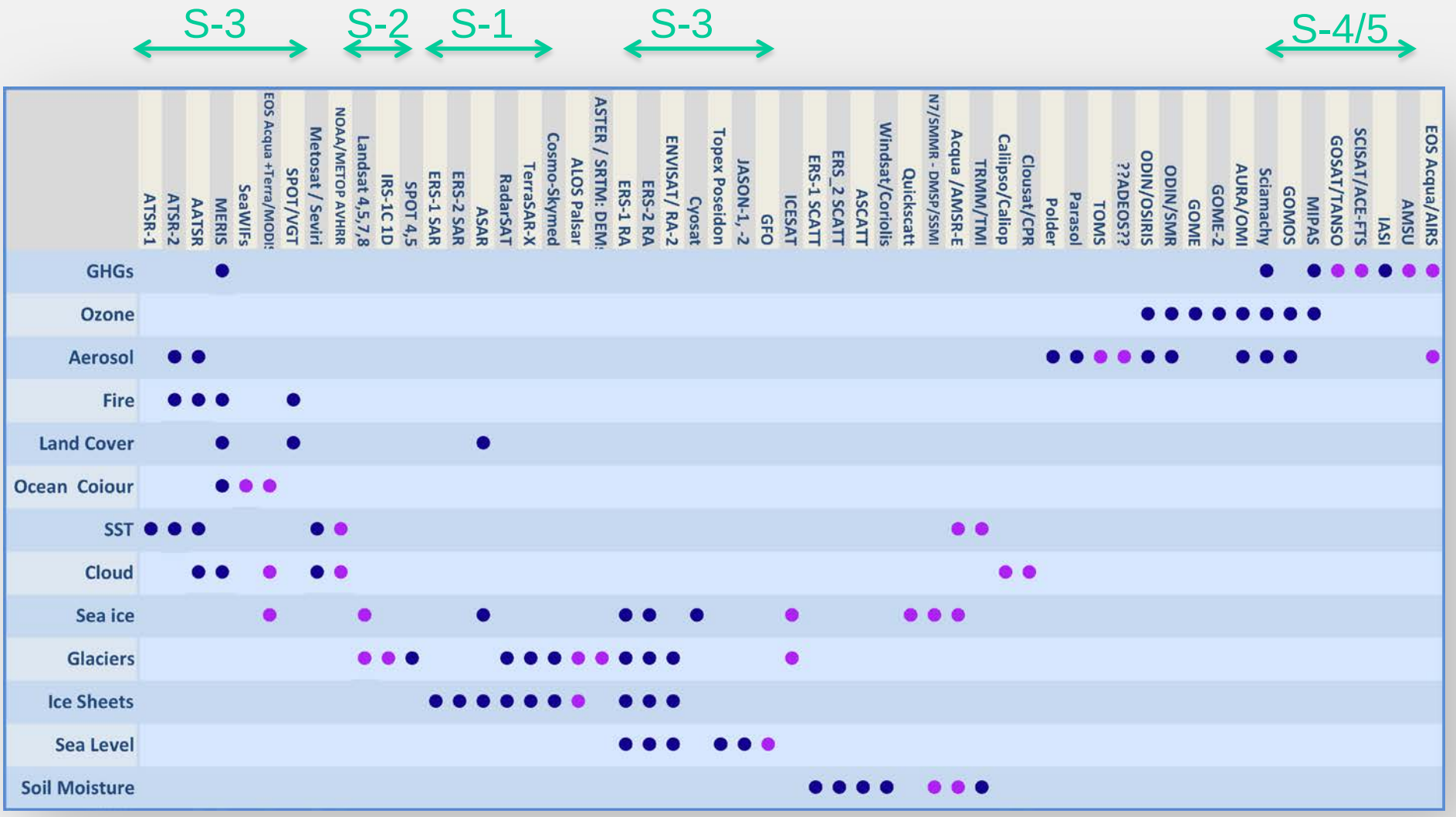
What Epoch ?
instrumentation era



What Epoch ?
satellite era



What Data Sources ?
satellites



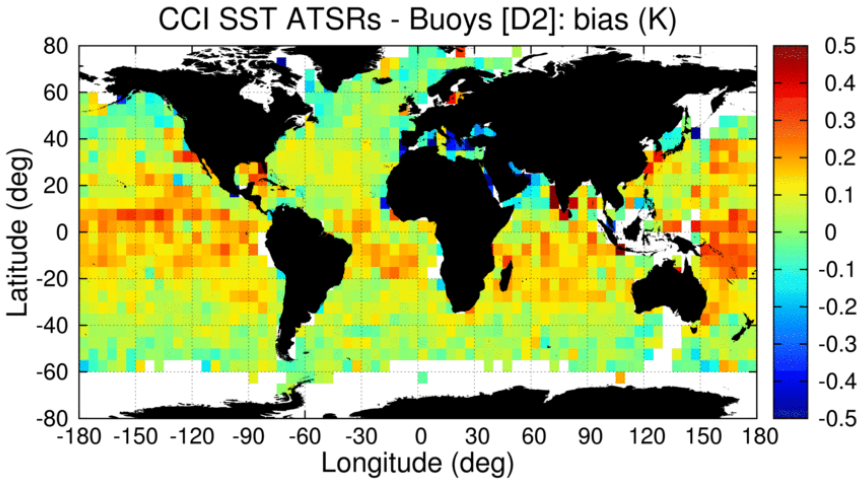
What data sources ?
in-situ networks and re-analysis

	TCCON	WMO/GAW	AERONET	GC Project	GAW/WMO	ARGO	GLOSS	GTN-G	ISMN	National N/W	ERACLIM
GHG_cci	✔										✔
Ozone_cci		✔									✔
Aerosol_cci			✔								✔
Fire_cci				✔						✔	✔
Land Cover_cci										✔	✔
Ocean Coiour_cci						✔				✔	✔
SST_cci						✔					✔
Cloud_cci		✔									✔
Sea ice_cci										✔	✔
Glaciers_cci								✔			✔
Ice Sheets_cci										✔	✔
Sea Level_cci						✔	✔				✔
Soil Moisture_cci									✔		✔
CMUG_cci										✔	✔

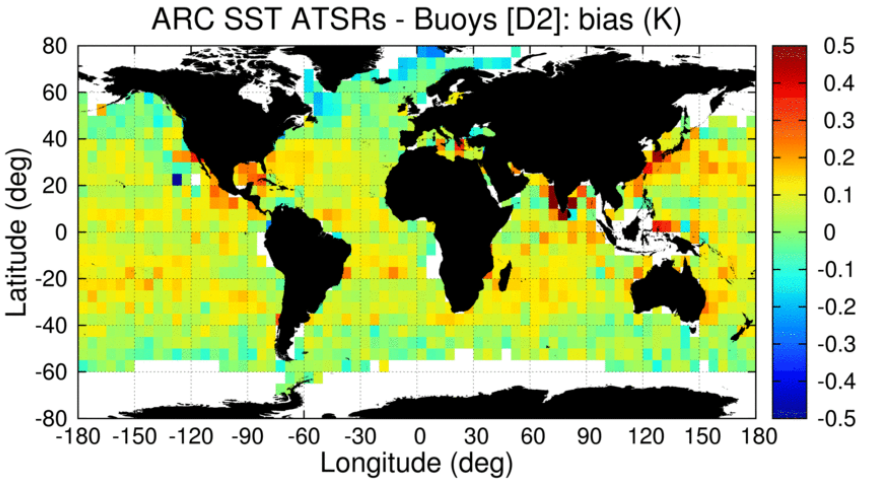
How many ECV versions ?

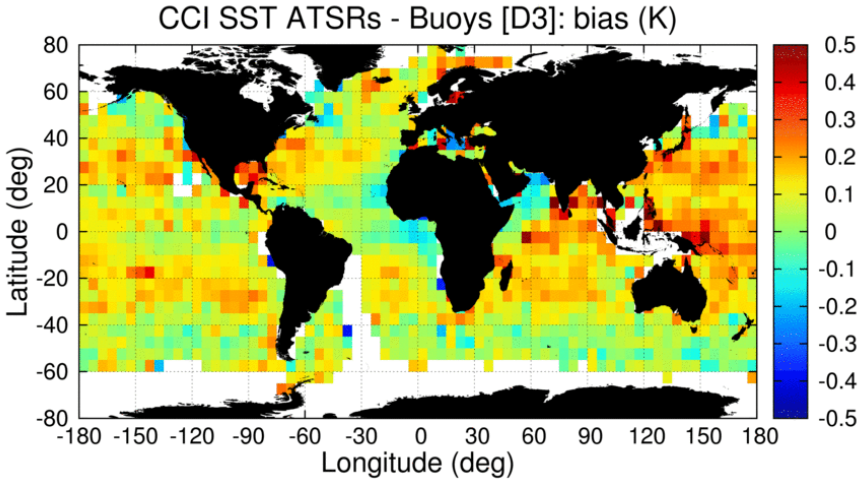
bias-map

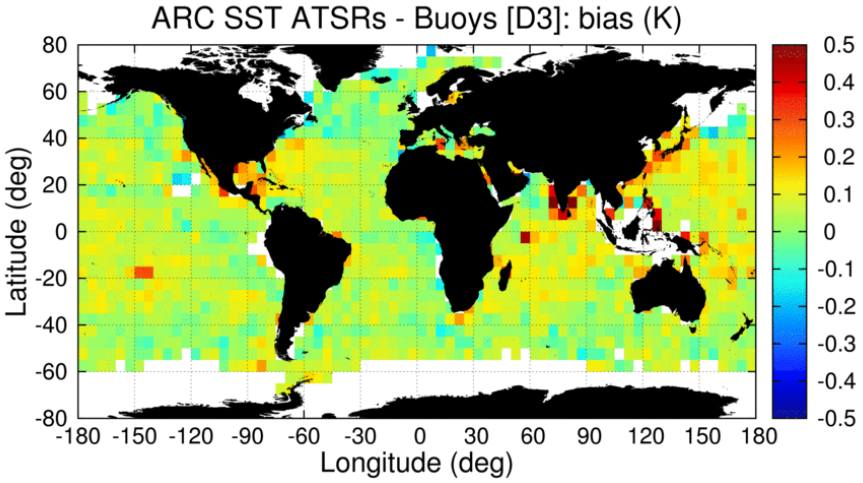
CCI



ARC





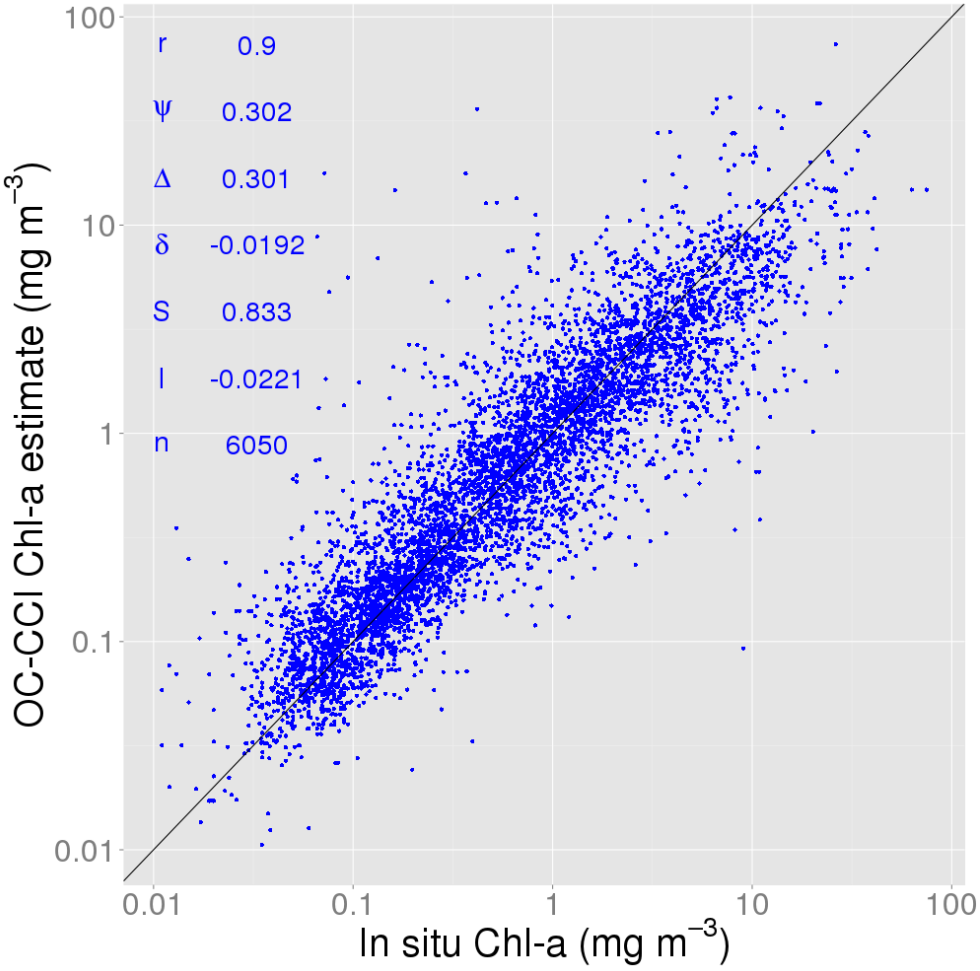


Validation
Independent ?

Match-up analysis

In situ datasets

- MERMAID (MERIS Match up in-situ Data: 2007 - Present
- MOBY (Marine Optical Buoy program):1996 - Present
- NOMAD (NASA bio-Optical Marine Algorithm Data): 1997 – 2007
- SeaBASS (SeaWiFS Bio-optical Archive and Storage System):1997 – 2012
- AMT (Atlantic Meridional Transect):1995 – Present
- AERONET-OC: 2001 – Present
- Bedford Institute of Oceanography Bio-optical Database:1997 – Present
- Boussole (Buoy for the Acquisition of Long Term Optical Time Series): 2005 - Present



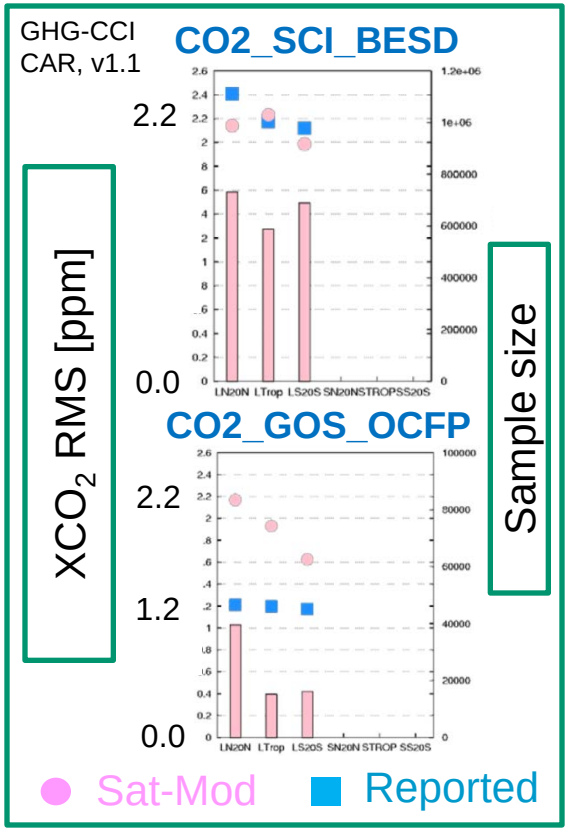
Uncertainties *also validated ?*

„Uncertainty validation“ by validation team using TCCON as reference:

XCO_2 Product	Mean value of Reported Uncertainty	Ratio True / Reported Uncertainty
CO2_SCI_BESD	2.3 ppm	0.99
CO2_SCI_WFMD	3.2 ppm	1.24
CO2_GOS_OCFP	1.0 ppm	2.18
CO2_GOS_SRFP	0.7 ppm	2.88
CO2_EMMA v1.5a	3.0 ppm	0.92
CO2_EMMA v1.5b	2.1 ppm	0.99
CO2_EMMA v1.5c	2.0 ppm	0.97

Dils et al., GHG-CCI Phase 1 Final Meeting, 30 Oct. 2013

Verification by CRG using model as reference:



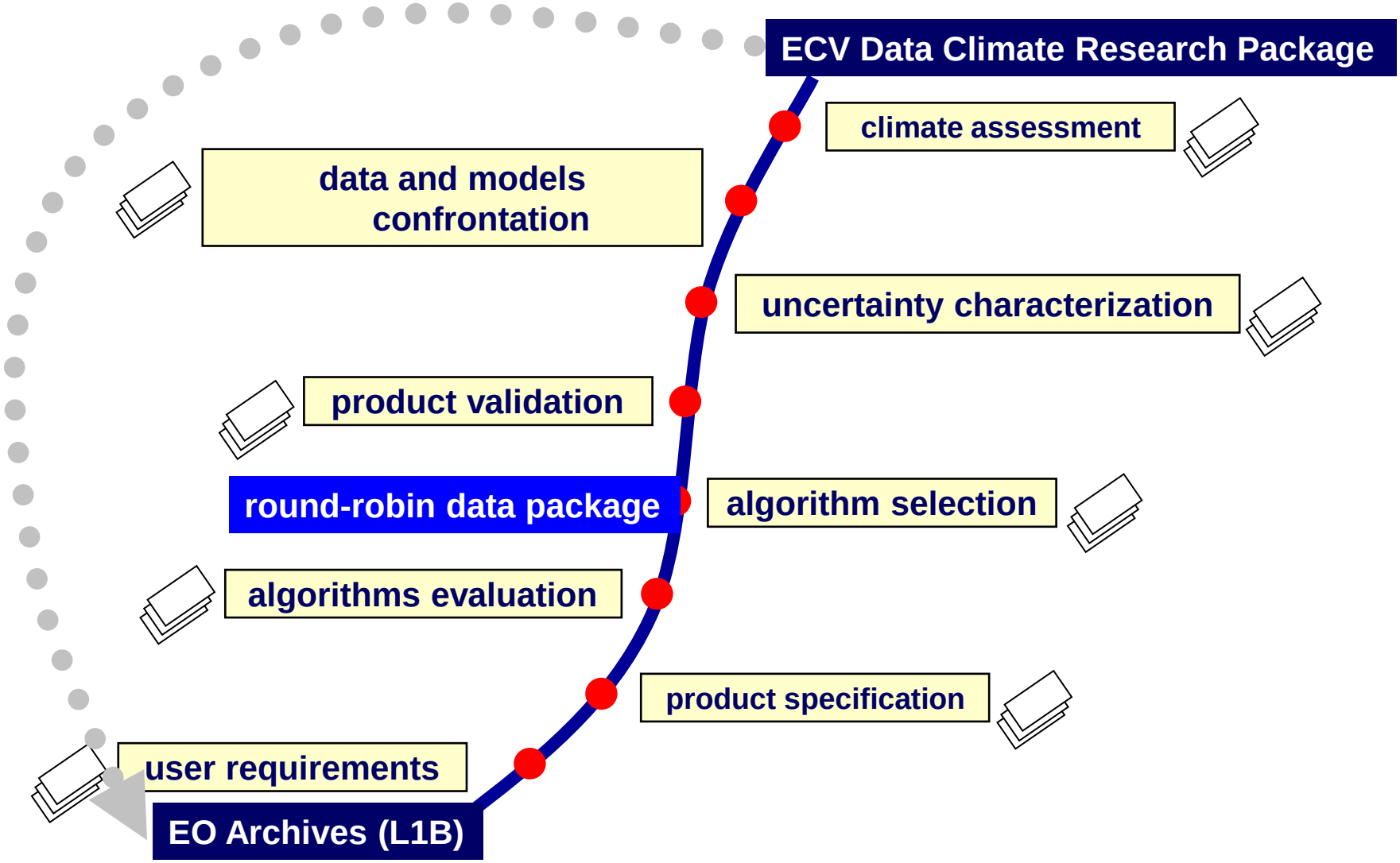
Consistent findings from inital validation / verification of reported uncertainties: Reported uncertainties are realistic for most products but not for all (for two XCO_2 products approx. a factor of 2 too optimistic, see above). This will be improved in Phase 2.

Current State-of-the-art ?

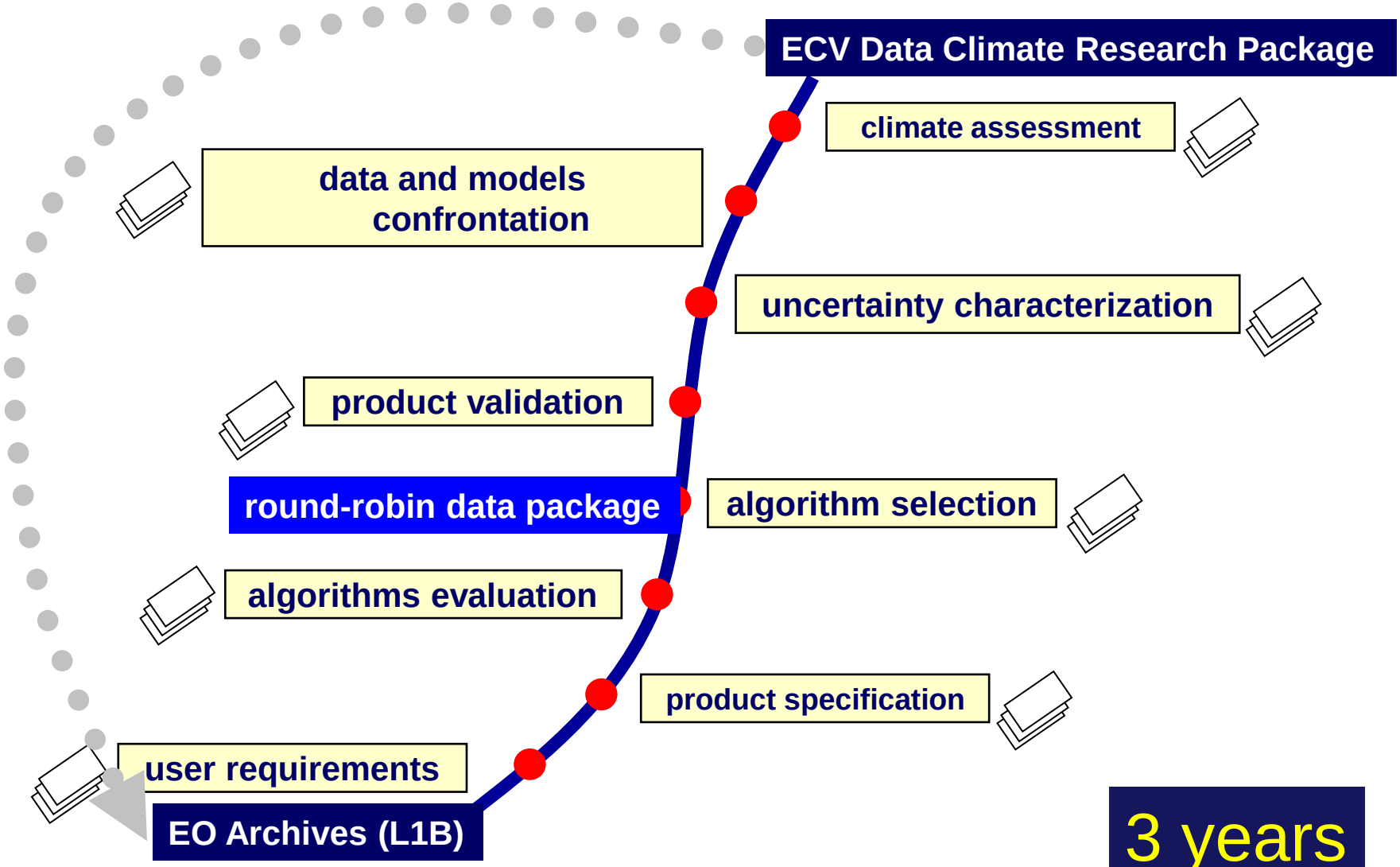
Requirement	GCOS (2011)	SST CCI URD L3/L4 breakthrough'	SST CCI Ph 1 target	SST CCI Ph 1 result
Accuracy / demonstrated on scale	0.1 K / 100 km	0.02 K / 100 km	0.1 K / 1000 km	Generally ~0.2 K / regionally
Precision	None	0.05 K / 100 km	Varies, quantify it	Varies, quantify it
Stability (retrospectively assessable against tropical moorings only, using current methods)	0.03 K / decade	0.02 K per decade; 0.05 K seasonally, diurnally	0.05 K per decade, 0.05 K seasonally	Mostly <0.05 K per decade for 1996 – 2010; seasonal stability generally ~0.2 K, locally greater
Spatial resolution	1 km	0.1 deg	0.05 deg	0.05 deg
Temporal resolution	Daily	Day/night (UTC)	Day/night on standardized local time (L2, L3); daily (L4)	Day/night on standardized local time (L2, L3); daily (L4)
Uncertainty information	None	Total uncertainty	Total and components	Total and components
Type of SST	Blended	Skin & buoy-depth	Skin and buoy-depth	Skin and buoy-depth
Period		~1980 - now	1991 - 2010	1991 - 2010

Open - Traceable - Repeatable ?

How ?


ECV Data Climate Research Package
climate assessment
data and models confrontation
uncertainty characterization
product validation
round-robin data package
algorithm selection
algorithms evaluation
product specification
user requirements
EO Archives (L1B)

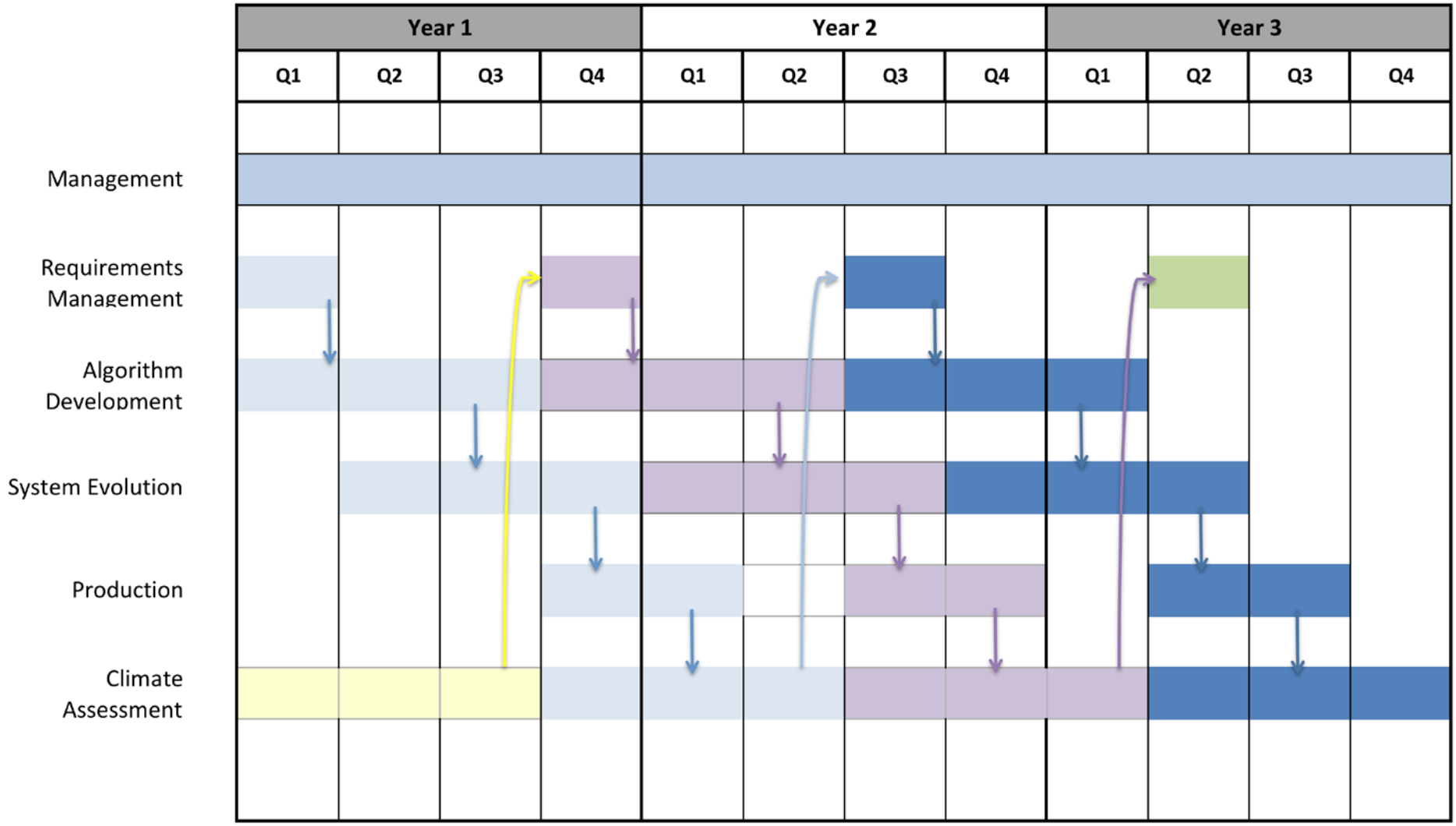
How ?
long ?



3 years

How often ?

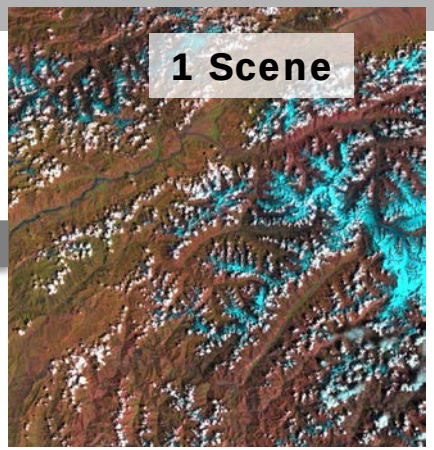
Annual cycle => *"operation"*



What System(s) ?

Most CCI Teams

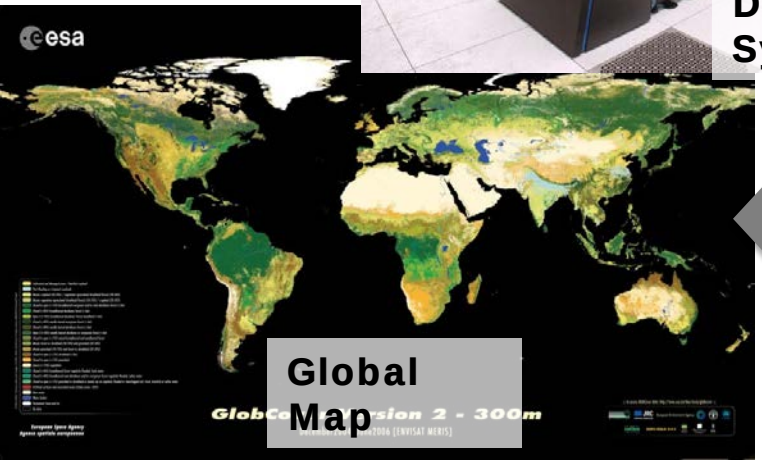
Glacier_cci

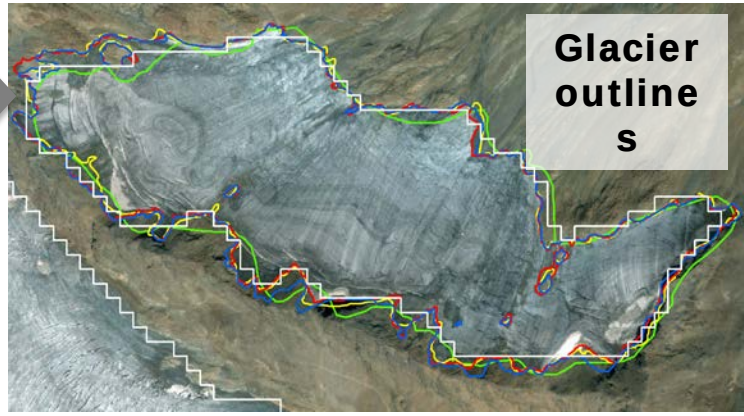


central computation

Distributed Systems

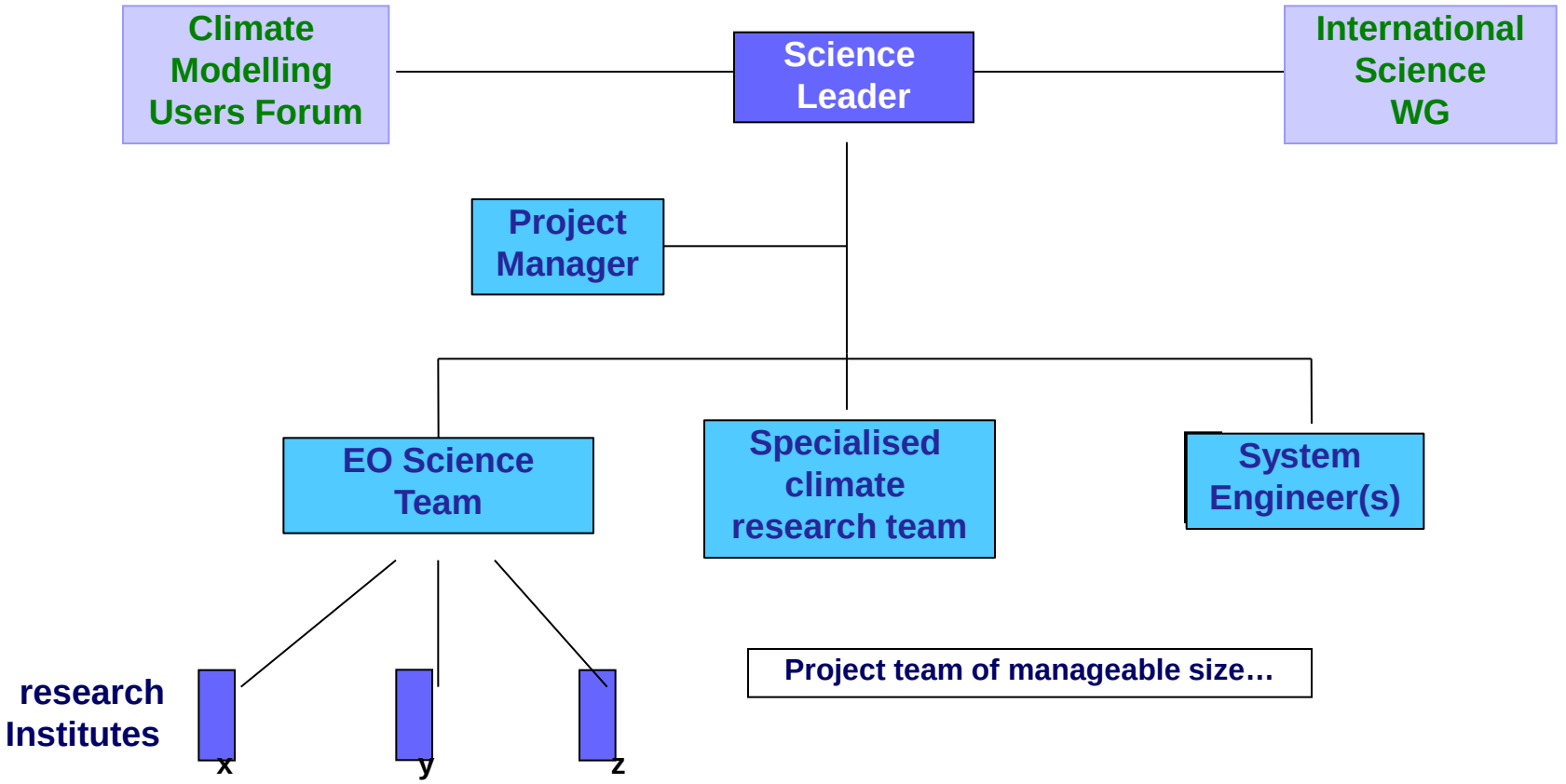
distributed computation





Who ?

one dedicated team per ECV



Who and where ?
Network of 14 distributed teams

Satellites Ground Segments

- ESA
- Eumetsat
- NASA
- NOAA
- Jaxa
- ...
- Others

ECV Teams

Climate Data Users

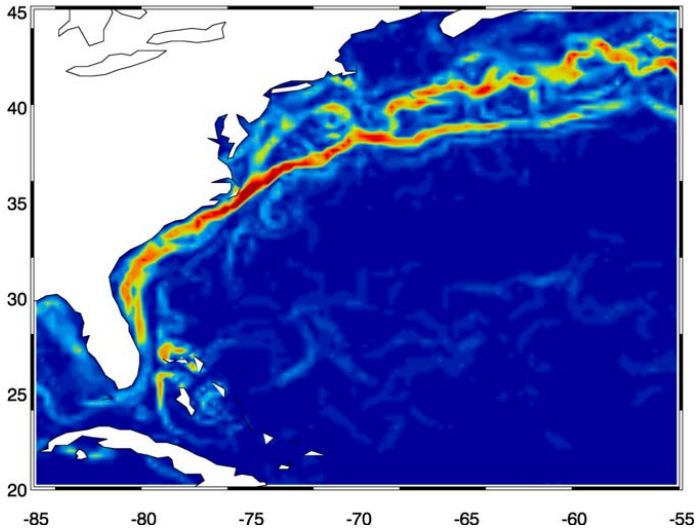
- ECV DP
- ECV DP
- ECV DP

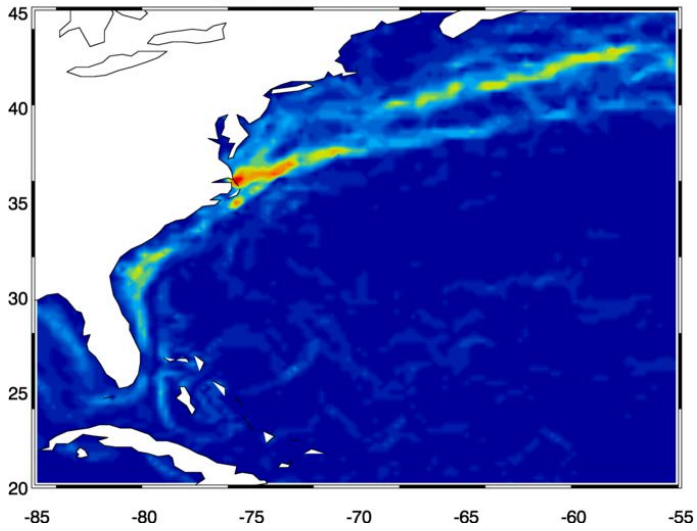
Climate Reanalysis

Climate Modellers

Climate Services

Benefits - Impacts ?
SST





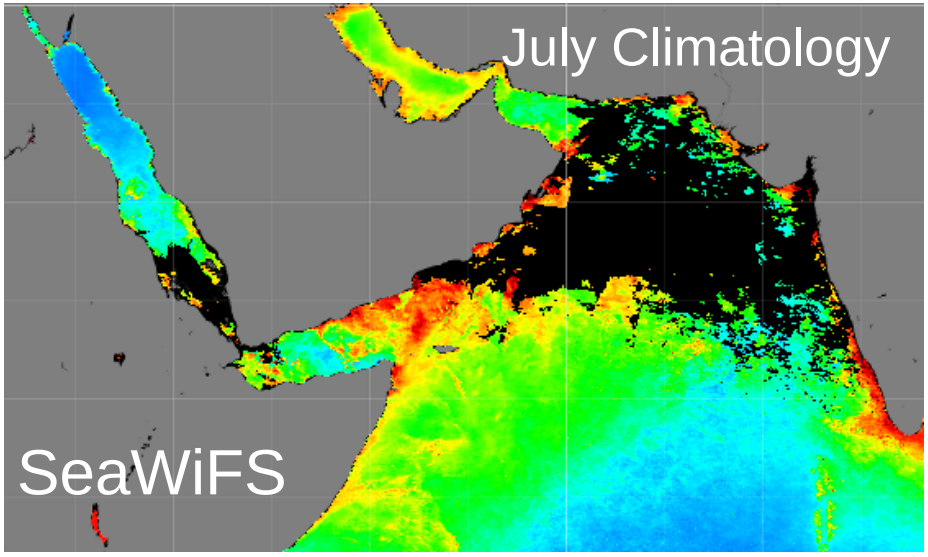
ESA SST CCI on 01 Jan 2006

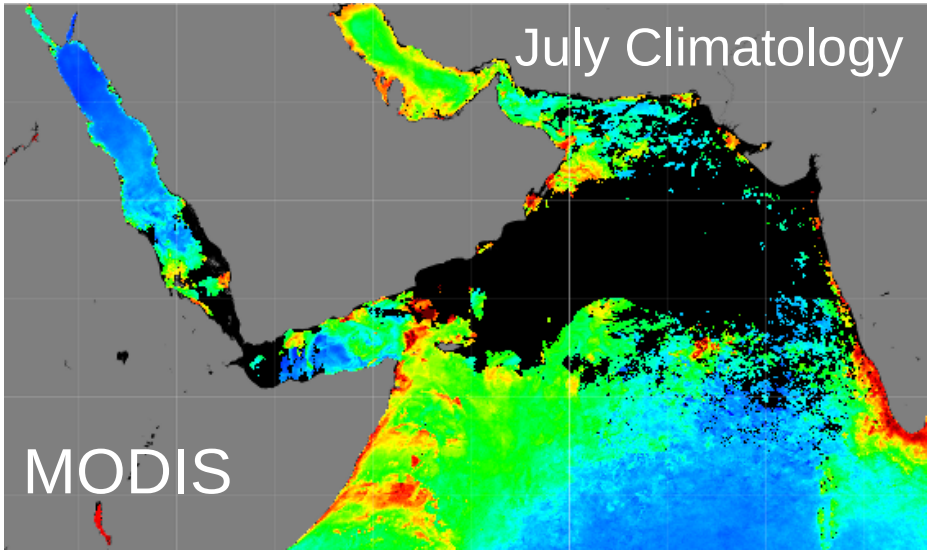
MyOcean OSTIA v1.0 on 01 Jan 2006

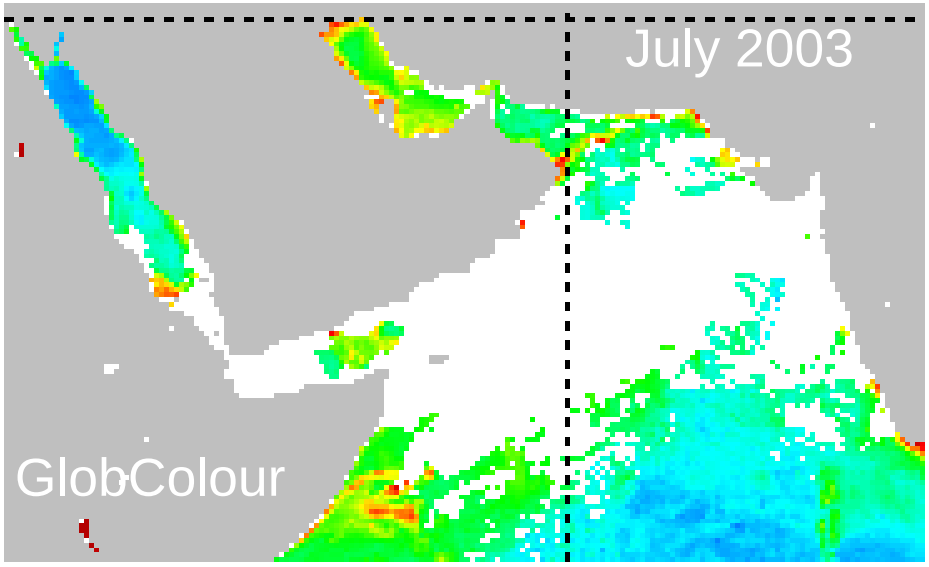
Horizontal SST gradients are greater for SST CCI cf. precursor dataset, illustrating the improved resolution of ocean features.

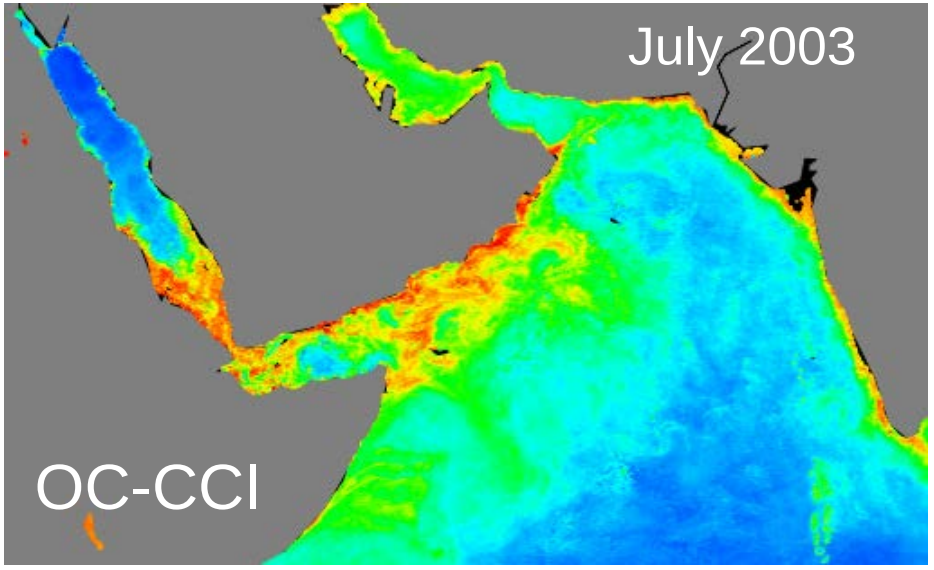
Benefits - Impacts ?

Ocean Colour



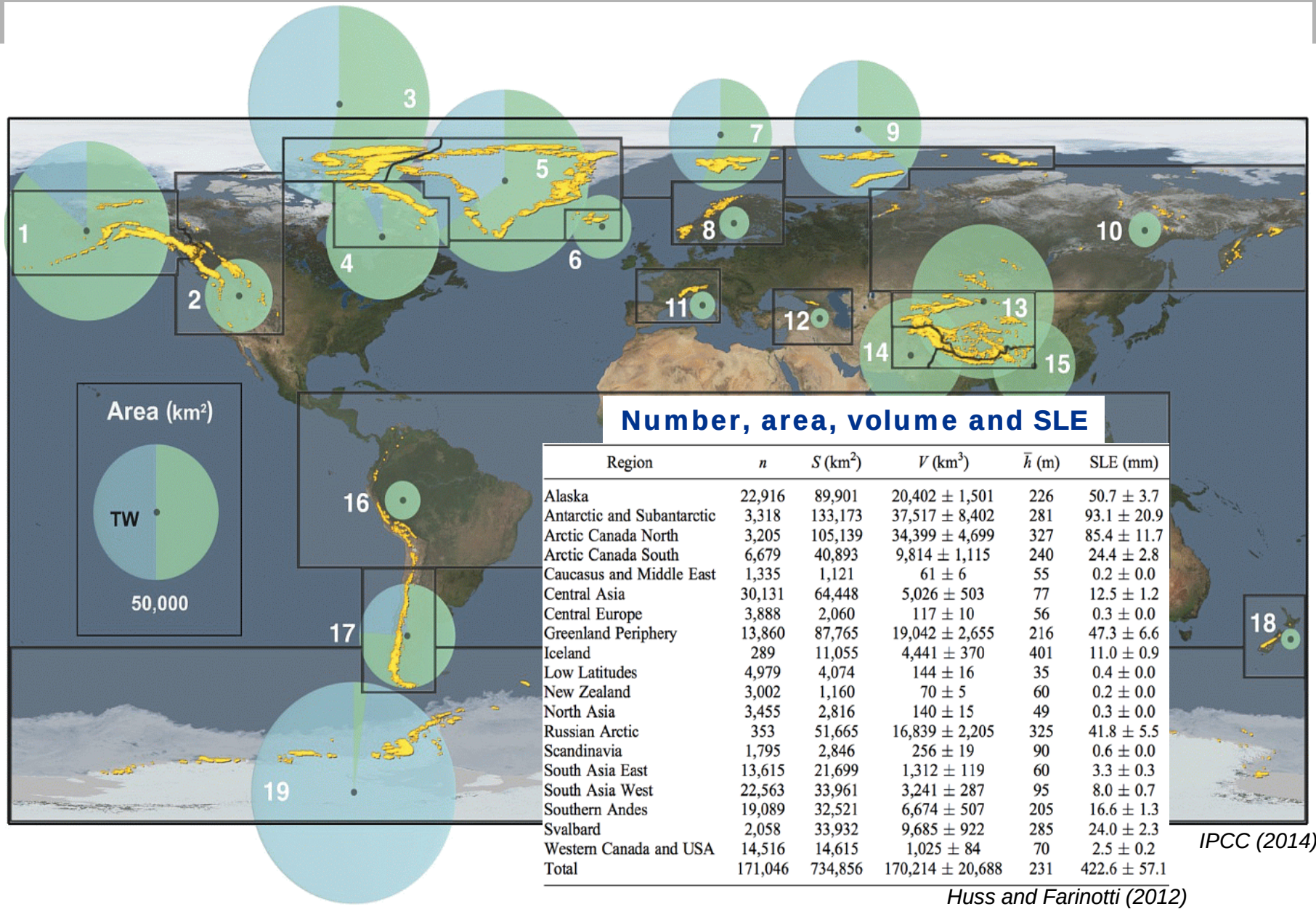






Benefits - Impacts ?

The Randolph Glacier Inventory / IPCC AR5



Number, area, volume and SLE

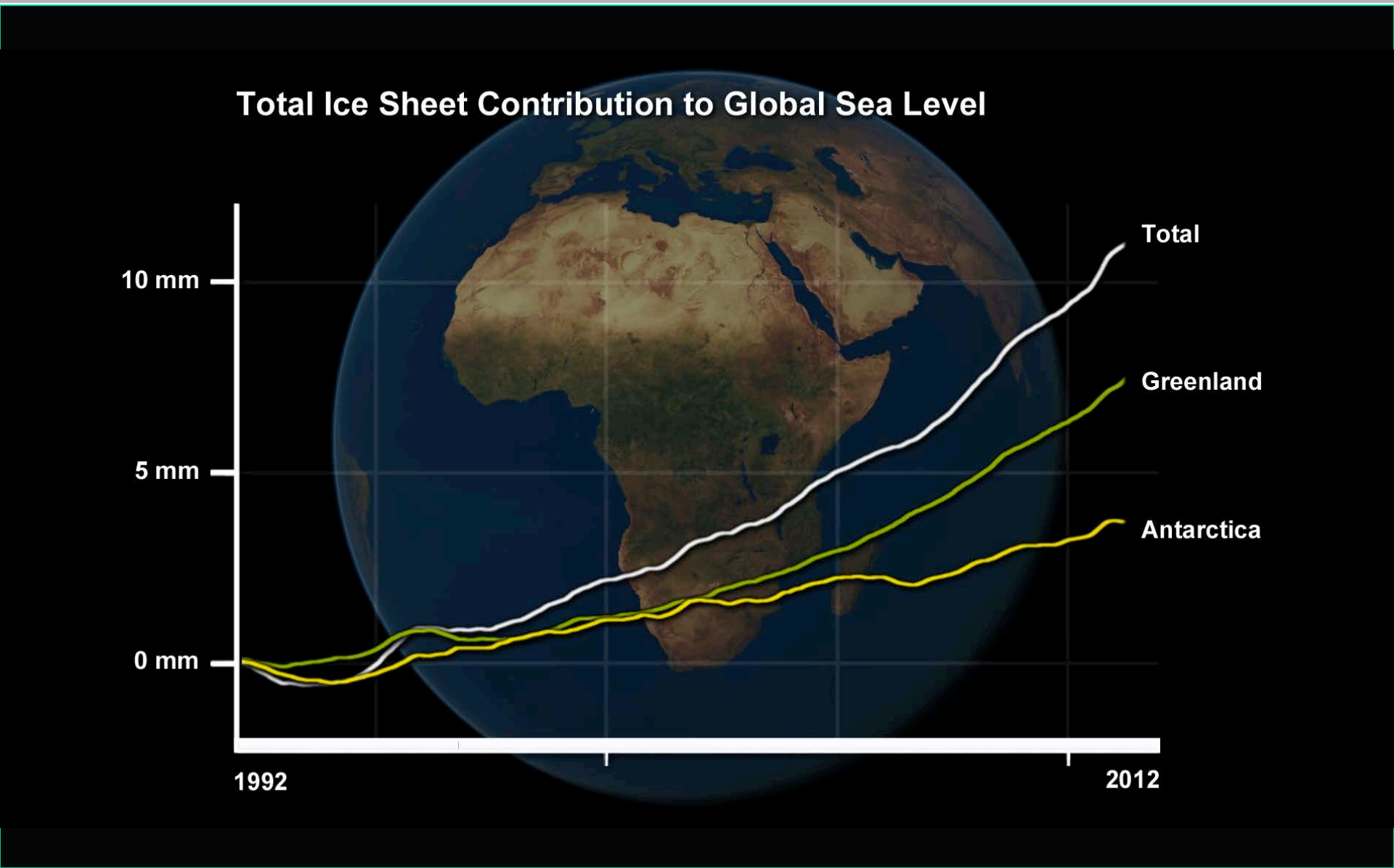
Region	n	S (km^2)	V (km^3)	$\bar{h}$ (m)	SLE (mm)
Alaska	22,916	89,901	20,402 ± 1,501	226	50.7 ± 3.7
Antarctic and Subantarctic	3,318	133,173	37,517 ± 8,402	281	93.1 ± 20.9
Arctic Canada North	3,205	105,139	34,399 ± 4,699	327	85.4 ± 11.7
Arctic Canada South	6,679	40,893	9,814 ± 1,115	240	24.4 ± 2.8
Caucasus and Middle East	1,335	1,121	61 ± 6	55	0.2 ± 0.0
Central Asia	30,131	64,448	5,026 ± 503	77	12.5 ± 1.2
Central Europe	3,888	2,060	117 ± 10	56	0.3 ± 0.0
Greenland Periphery	13,860	87,765	19,042 ± 2,655	216	47.3 ± 6.6
Iceland	289	11,055	4,441 ± 370	401	11.0 ± 0.9
Low Latitudes	4,979	4,074	144 ± 16	35	0.4 ± 0.0
New Zealand	3,002	1,160	70 ± 5	60	0.2 ± 0.0
North Asia	3,455	2,816	140 ± 15	49	0.3 ± 0.0
Russian Arctic	353	51,665	16,839 ± 2,205	325	41.8 ± 5.5
Scandinavia	1,795	2,846	256 ± 19	90	0.6 ± 0.0
South Asia East	13,615	21,699	1,312 ± 119	60	3.3 ± 0.3
South Asia West	22,563	33,961	3,241 ± 287	95	8.0 ± 0.7
Southern Andes	19,089	32,521	6,674 ± 507	205	16.6 ± 1.3
Svalbard	2,058	33,932	9,685 ± 922	285	24.0 ± 2.3
Western Canada and USA	14,516	14,615	1,025 ± 84	70	2.5 ± 0.2
Total	171,046	734,856	170,214 ± 20,688	231	422.6 ± 57.1

IPCC (2014)

Huss and Farinotti (2012)

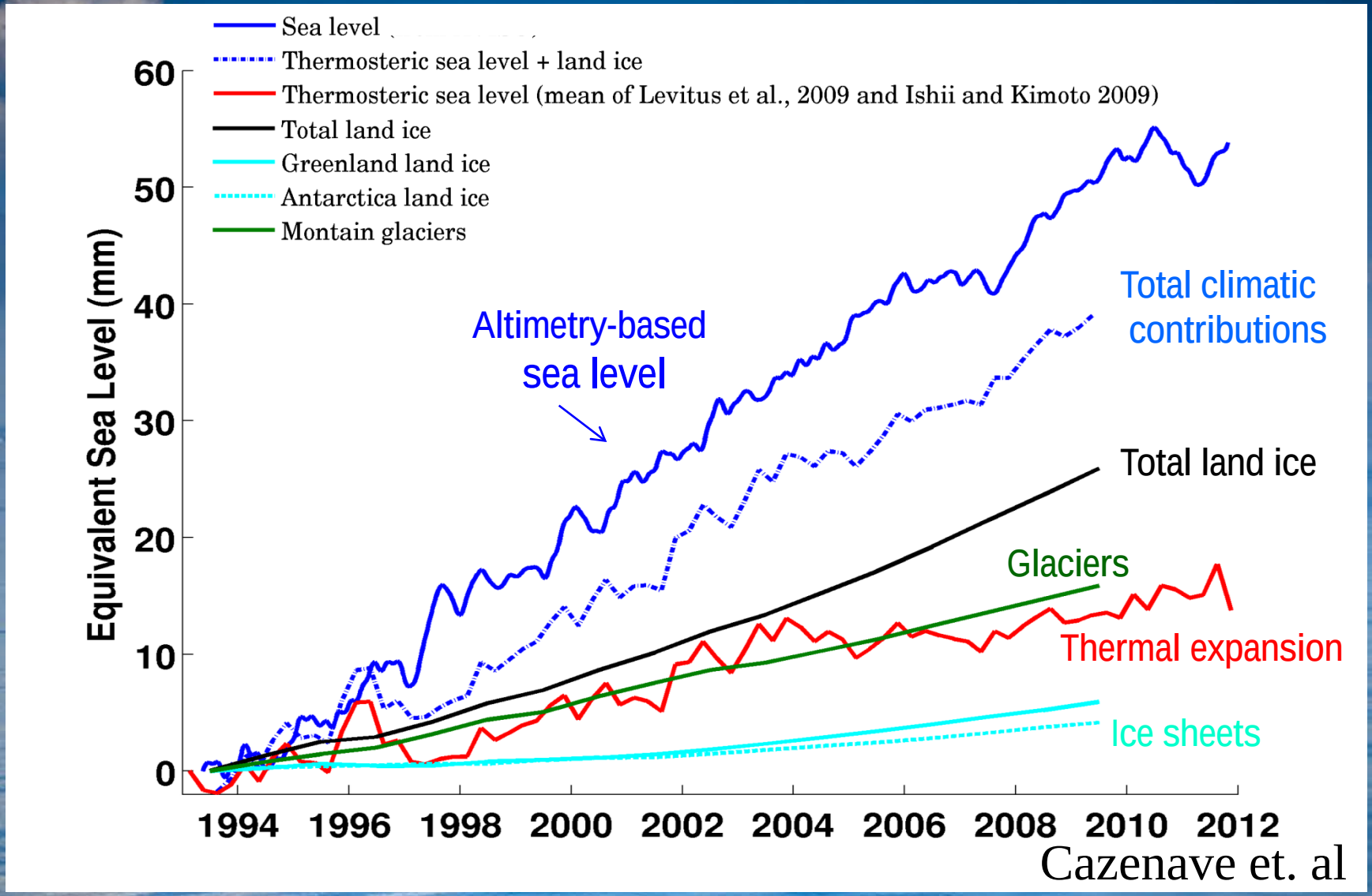
Benefits - Impacts ?

Reconciled Ice Sheets Mass Balance



Benefits - Impacts ?

Closing the sea-level budget



Key Questions (iv)

- ***Feasible ?***