INTERACT Svartberget, 10-11 September 2019

WGMS/GCW

1894-2019: 125 years of internationally coordinated glacier monitoring

Per Holmlund and Michael Zempf

wgms
World Glacier Monitoring Service

under the auspices of: ICSU (WDS), IUGG (IACS), UNEP, UNESCO, WMO

ICSU WORLD DATA SYSTEM
IUGG
IACS International Association of Cryospheric Sciences
UNEP
UNESCO United Nations Educational, Scientific and Cultural Organization
WMO

University of Zurich[UZH]
Department of Geography

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

MeteoSwiss

Untersuchungen über die Gletscher

von

L. Agassiz.

Nach der Natur gezeichnet und lithographirt.


1886


2014

1894-2019: 125 years of int. coordinated glacier monitoring

LES

VARIATIONS PÉRIODIQUES DES GLACIERS

par F.-A. FOREL

président de la Commission internationale des glaciers.

Sur l'initiative de M. le capitaine Marshall Hall, F.G.S., à Parkstone, Dorset, Angleterre, le VI^me^ Congrès international de Géologie, réuni à Zurich en août 1894, a décidé la création d'une commission chargée d'étudier les variations en grandeur des glaciers actuels, dans les diverses contrées de la terre.

Cette Commission est composée de :

MM. D^r^ F.-A. Forel, prof. à Morges, *président* (Suisse).
D^r^ Léon Du Pasquier, prof. à Neuchâtel, *secrétaire* (Suisse).
D^r^ Seb. Finsterwalder, prof. à Munich (Allemagne).
D^r^ Ed. Richter, prof. à Graz (Autriche).
D^r^ K.-J.-V. Steenstrup, géologue à Copenhague (Danemark et colonies).
D^r^ H.-F. Reid, prof. à Baltimore (États-Unis d'Amérique).
Prince Roland Bonaparte, à Paris (France).
Capitaine Marshall Hall, à Parkstone (Grande-Bretagne et colonies).
D^r^ Torquato Taramelli, prof. à Pavie (Italie).
P.-A. Oyen, géologue à Christiania (Norwège).
D^r^ Iwan Mouchketow, géologue à St-Pétersbourg (Russie).
D^r^ F.-U. Svenonius, géologue à Stockholm (Suède).

1894-2019: historical background & int. monitoring strategy

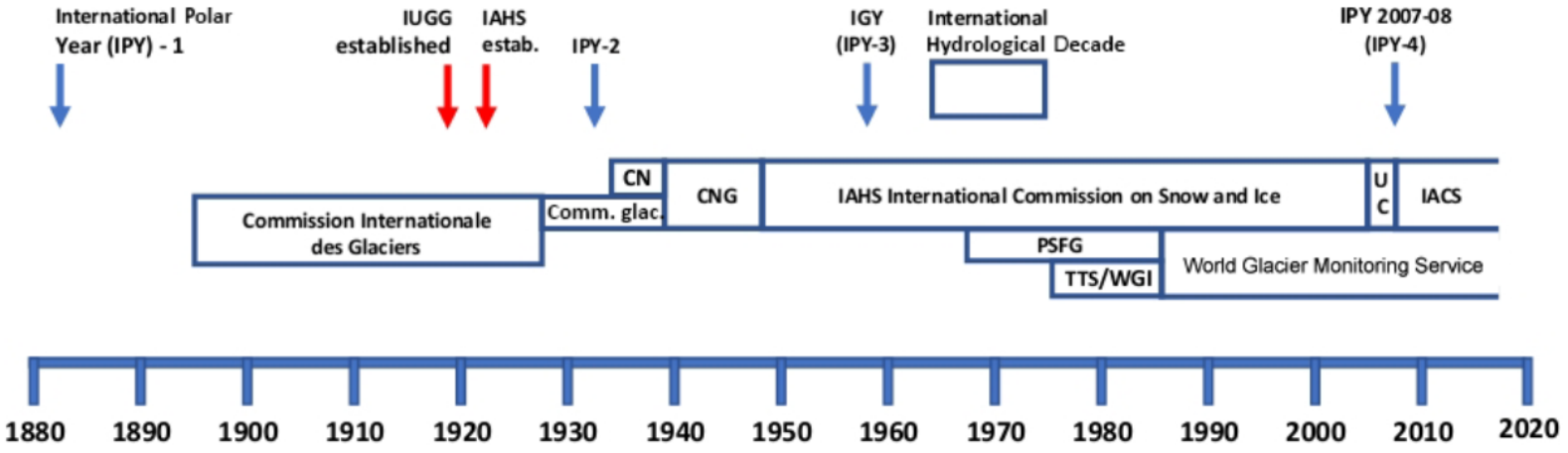
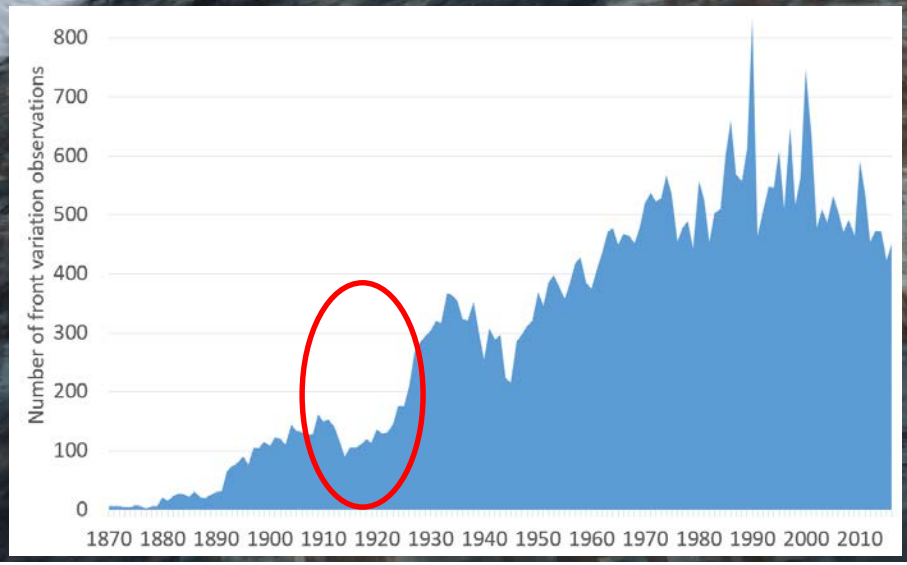


Figure 1. Schematic timeline showing the progression from the Commission Internationale des Glaciers (CIG) to the IUGG International Association of Cryospheric Sciences (IACS). This distinguishes two equally important heritage lines: monitoring glacier fluctuations and their link to climate (bottom) and cryospheric science more broadly (top). It also shows other major scientific programs and events relevant to the progression. (CN = IASH Commission des Neiges; Comm. Glac. = IASH Commission des Glaciers; CNG = IASH Commission des Neiges et des Glaciers; UC = IUGG Union Commission for the Cryospheric Sciences; PSFG = Permanent Service on the Fluctuations of Glaciers; TTS/WGI = Temporary Technical Secretariat for the World Glacier Inventory.)

Allison et al. (2019), Hist. Geo Space Sci.

1914

Rastner et al. (2016)

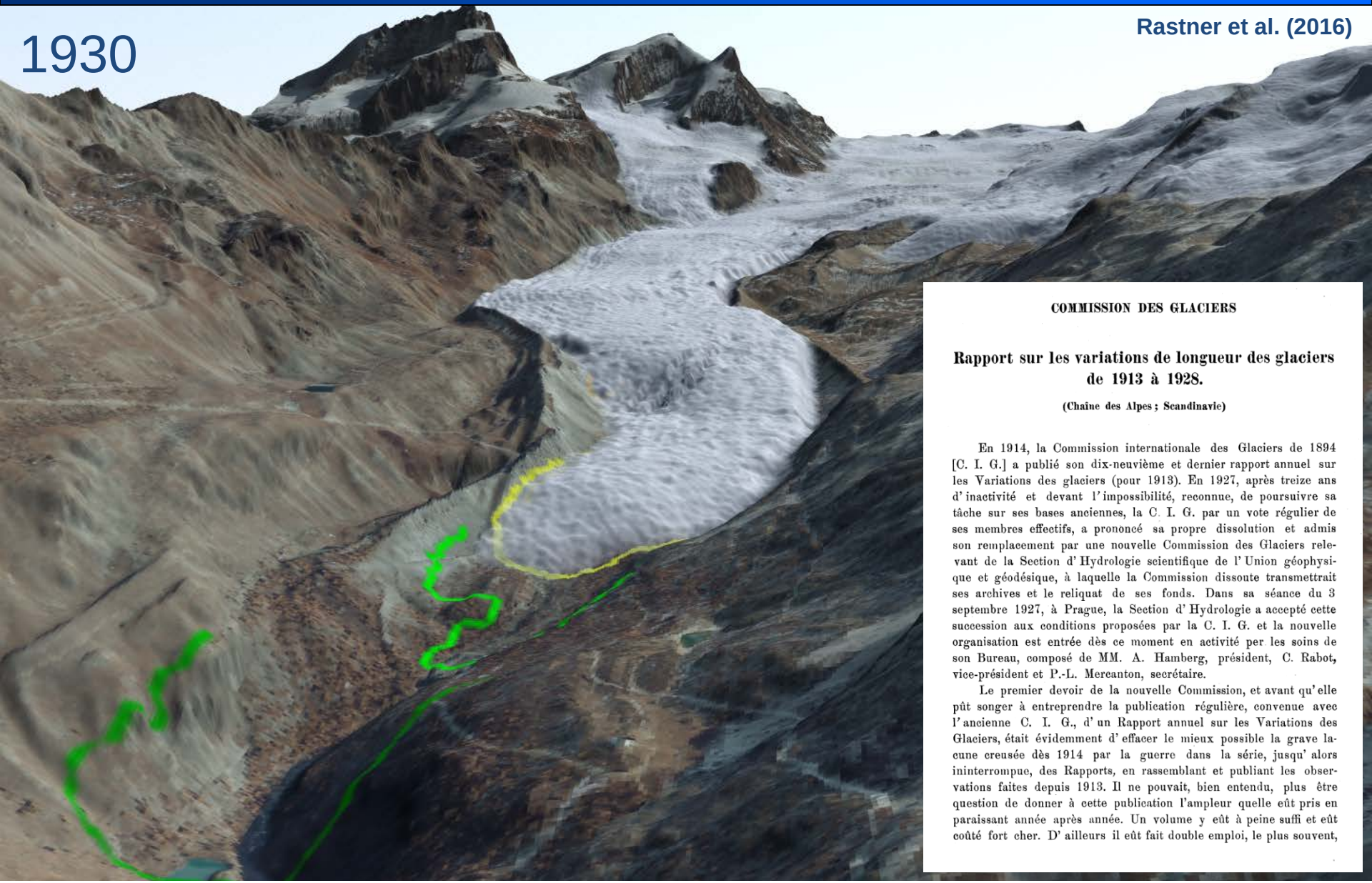


WWI. Interruption of data reporting.

WGMS FoG (2018)

1930

Rastner et al. (2016)



COMMISSION DES GLACIERS

Rapport sur les variations de longueur des glaciers de 1913 à 1928.

(Chaîne des Alpes ; Scandinavie)

En 1914, la Commission internationale des Glaciers de 1894 [C. I. G.] a publié son dix-neuvième et dernier rapport annuel sur les Variations des glaciers (pour 1913). En 1927, après treize ans d'inactivité et devant l'impossibilité, reconnue, de poursuivre sa tâche sur ses bases anciennes, la C. I. G. par un vote régulier de ses membres effectifs, a prononcé sa propre dissolution et admis son remplacement par une nouvelle Commission des Glaciers relevant de la Section d'Hydrologie scientifique de l'Union géophysique et géodésique, à laquelle la Commission dissoute transmettrait ses archives et le reliquat de ses fonds. Dans sa séance du 3 septembre 1927, à Prague, la Section d'Hydrologie a accepté cette succession aux conditions proposées par la C. I. G. et la nouvelle organisation est entrée dès ce moment en activité per les soins de son Bureau, composé de MM. A. Hamberg, président, C. Rabot, vice-président et P.-L. Mercanton, secrétaire.

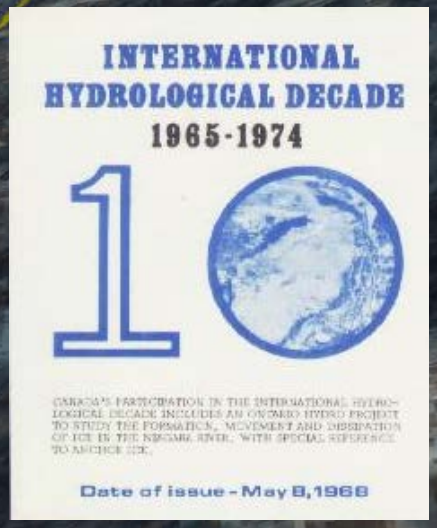
Le premier devoir de la nouvelle Commission, et avant qu'elle pût songer à entreprendre la publication régulière, convenue avec l'ancienne C. I. G., d'un Rapport annuel sur les Variations des Glaciers, était évidemment d'effacer le mieux possible la grave lacune creusée dès 1914 par la guerre dans la série, jusqu'alors ininterrompue, des Rapports, en rassemblant et publiant les observations faites depuis 1913. Il ne pouvait, bien entendu, plus être question de donner à cette publication l'ampleur quelle eût pris en paraissant année après année. Un volume y eût à peine suffi et eût coûté fort cher. D'ailleurs il eût fait double emploi, le plus souvent,

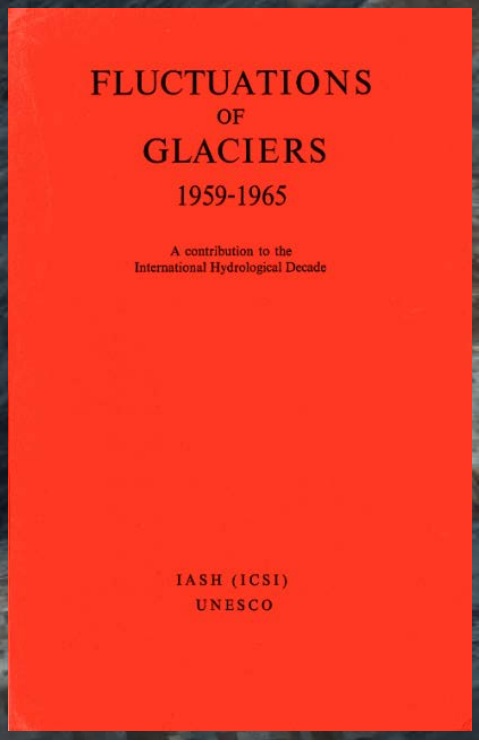
Mercanton (1930)

Resumption of reporting, still focusing on front variations & climatic cycles

1967

Rastner et al. (2016)



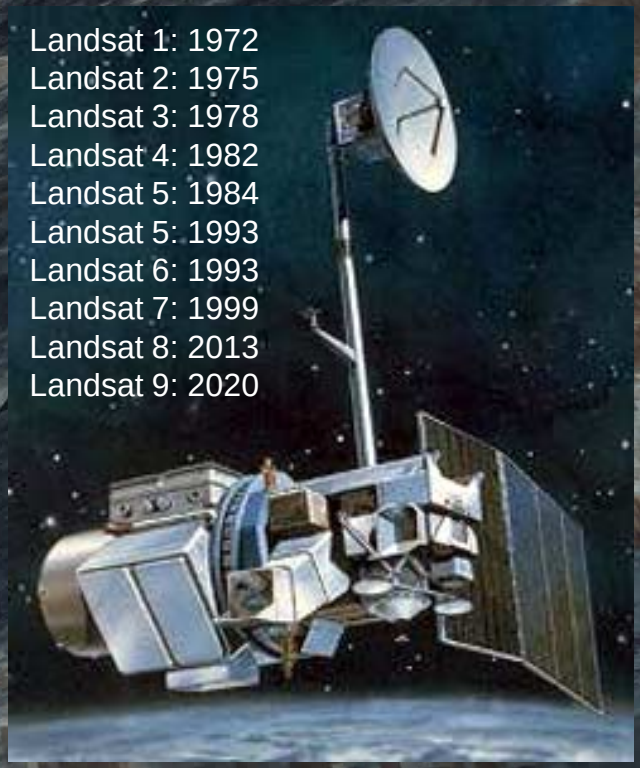


First consideration of the need for a World Glacier Inventory. Start of FoG series.

1984

Rastner et al. (2016)

Landsat 1: 1972
Landsat 2: 1975
Landsat 3: 1978
Landsat 4: 1982
Landsat 5: 1984
Landsat 5: 1993
Landsat 6: 1993
Landsat 7: 1999
Landsat 8: 2013
Landsat 9: 2020

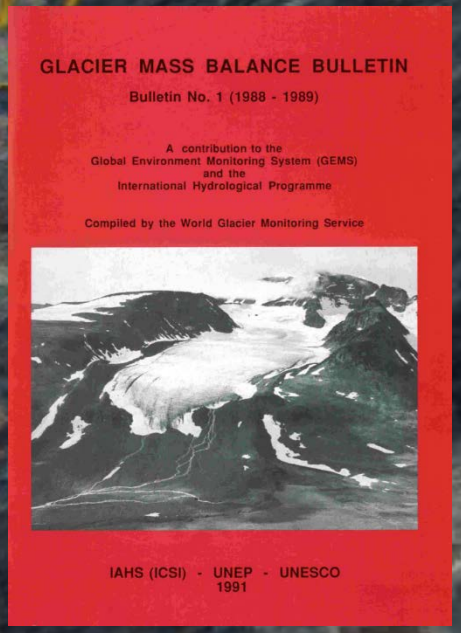


Launch of Landsat 5 with Thematic Mapper on board

Artist rendering from NASA

1990

Rastner et al. (2016)



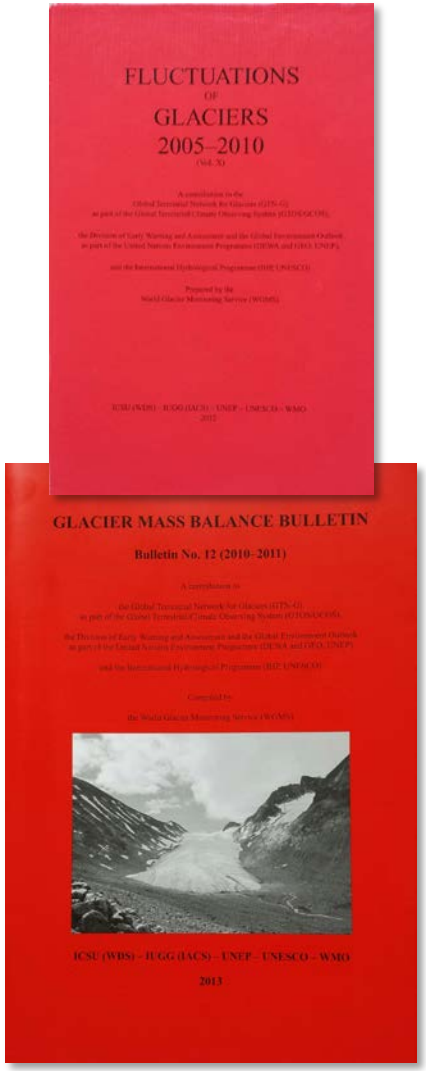
First IPCC Assessment Report (FAR). Start of GMBB series.

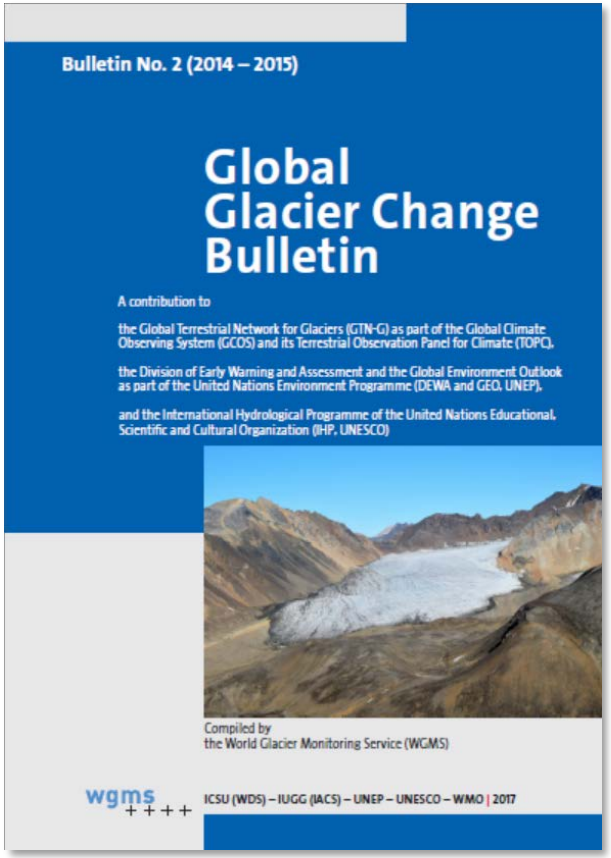
2000

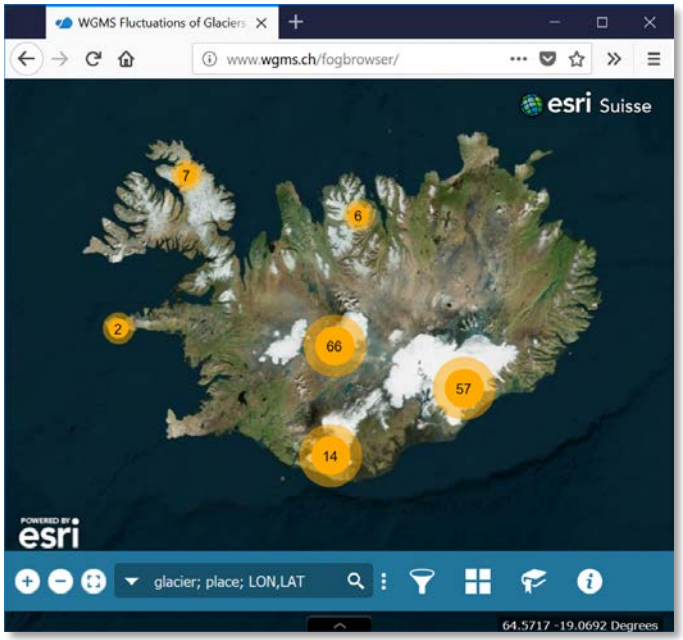
Rastner et al. (2016)

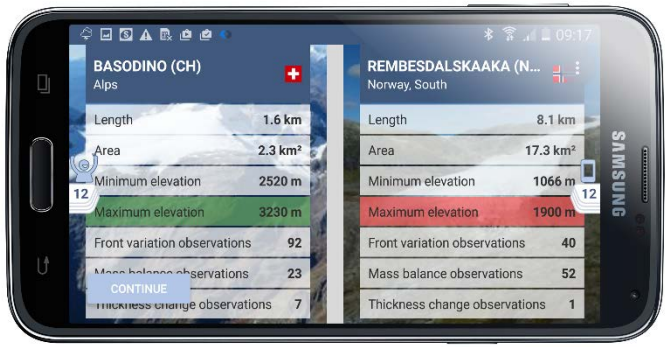
ASTER, Shuttle Radar Topography Mission (SRTM), GLIMS.

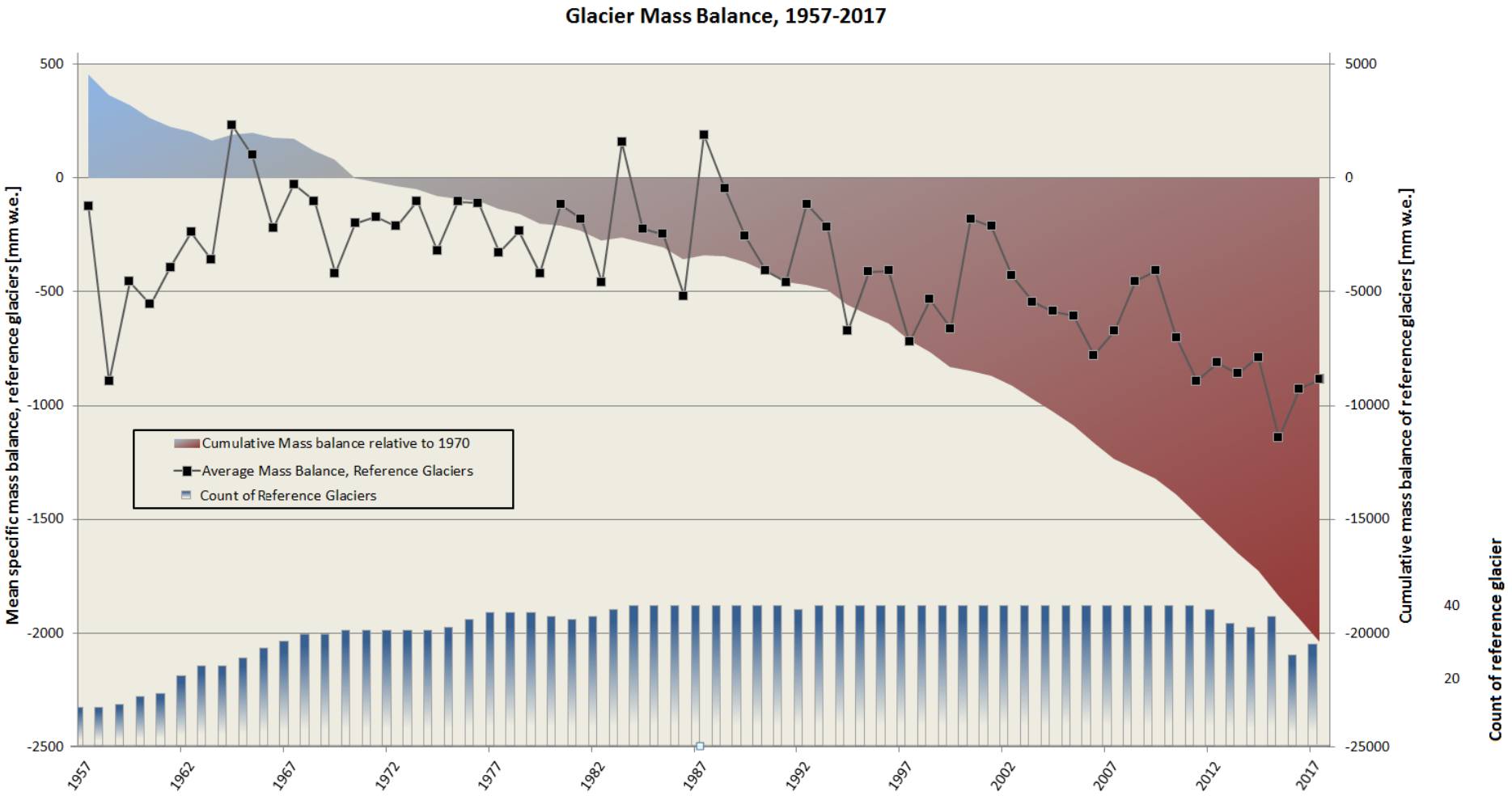
WGMS product development



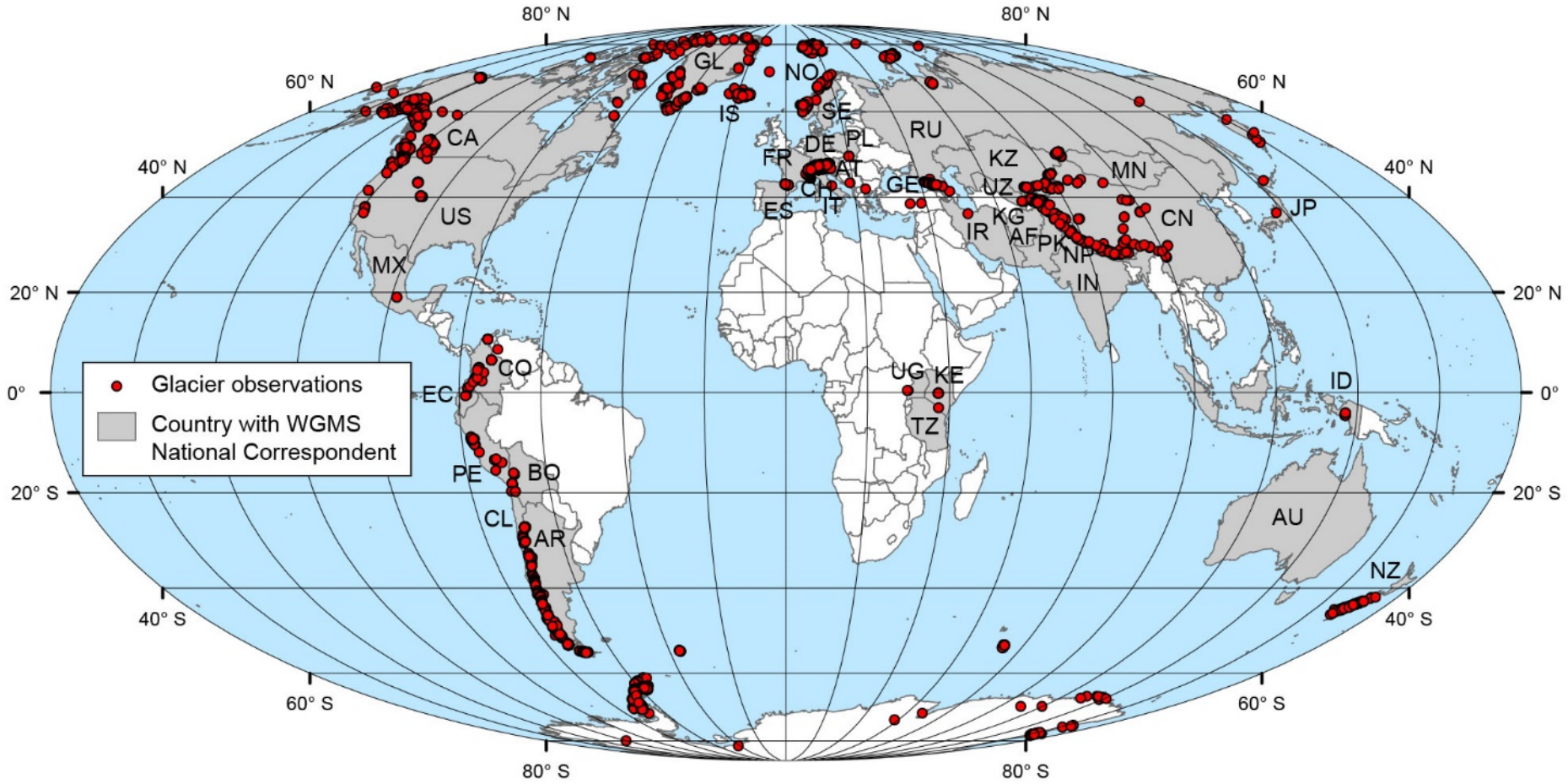






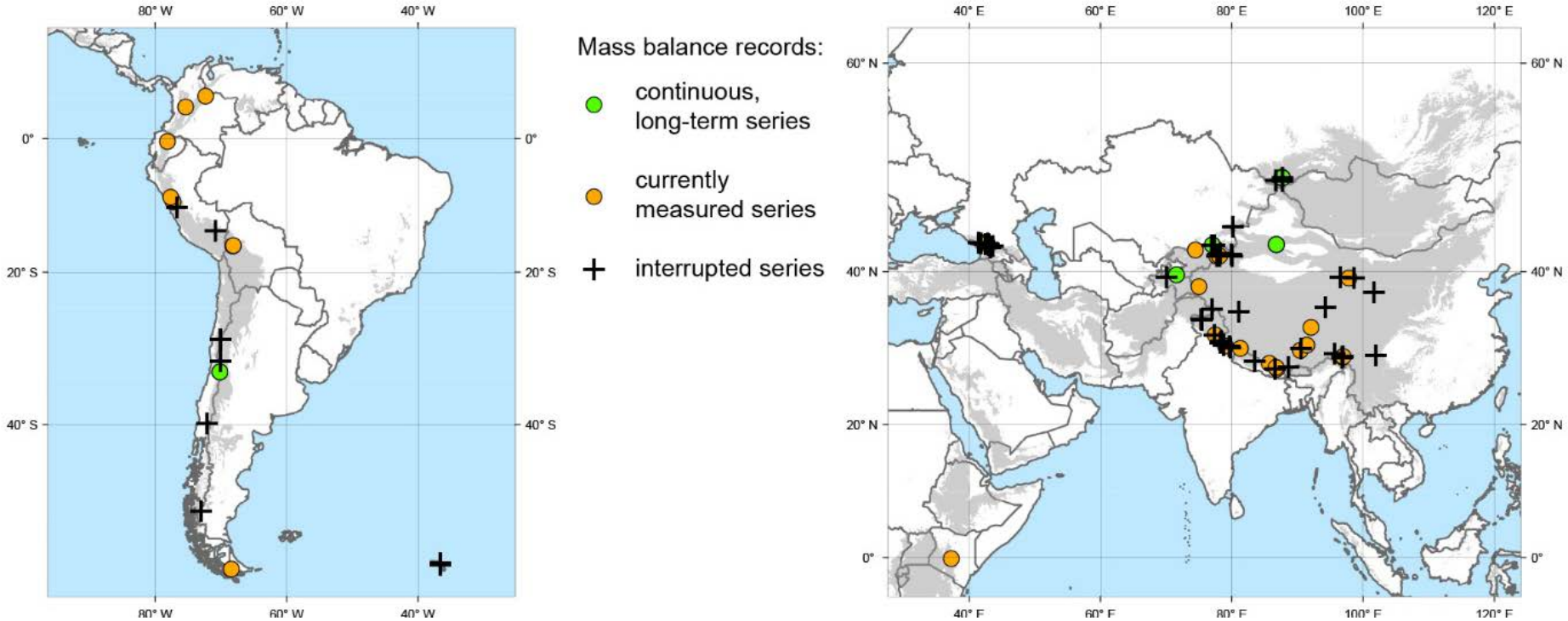

Glacier Mass Balance, 1957-2017
Mean specific mass balance, reference glaciers [mm w.e.]
Cumulative mass balance of reference glaciers [mm w.e.]
Count of reference glacier
500
0
-500
-1000
-1500
-2000
-2500
5000
0
-5000
-10000
-15000
-20000
-25000
40
20
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012
2017
Cumulative Mass balance relative to 1970
Average Mass Balance, Reference Glaciers
Count of Reference Glaciers

a worldwide scientific collaboration network



WGMS National Correspondents for: Afghanistan, Antarctica, Argentina, Austria, Bhutan, Bolivia, Canada, Chile, China, Colombia, Ecuador, France, Georgia, Germany, Greenland, Iceland, India, Indonesia, Iran, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, Mexico, Mongolia, Nepal, New Zealand, Norway, Pakistan, Peru, Poland, Spain, Sweden, Switzerland, Russia, Tanzania, Uganda, USA, Uzbekistan

missing data / poor data coverage



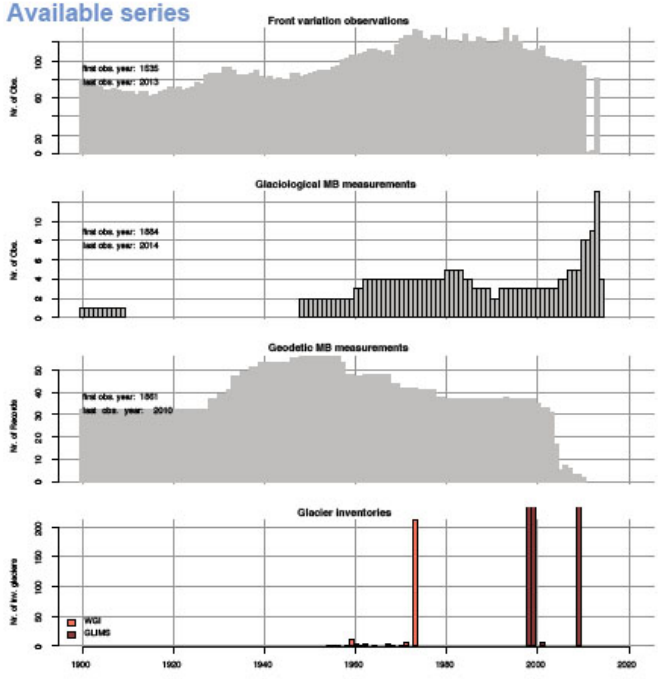
Glacier data up to 2015 (WGMS 2015, updated)

standardized survey for each country

GLACIER MONITORING: SWITZERLAND

Being a mountainous country glacier montioring has a very long tradition in Switzerland. A great number of length change and mass balance measurements with many long-term data series and comprehensive intentory data are available. Switzerland can be considered a benchmark-country for glacier monitoring.

Available series



With a total of 178 series, Switzerland has a very dense glacier monitoring network. Further-more, most of the series have been constantly maintained and offer long-term information. First front variation observations are available from 1880. The mass balance series have increased over the last years while a peak in thickness change records is found in the 1940s. Likewise, the inventories offer a complete coverage of the glaciated area in GLIMS and RGI.

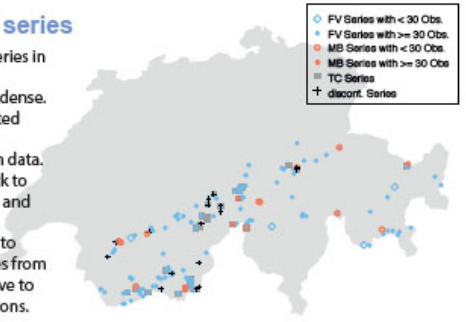
Key statistics

		Front Variation	Mass Balance	Thickness Change
total glaciated area: 1'039 km²	Number of series:	126	17	35
total coverage WGI: 45 %	Average length [years]:	112	21	33
total coverage GLIMS: 100 %	Average number of observations:	78	16	5

Present state	Future potential/needs
Nationally well coordinated glacier monitoring with website (www.cryosphere.ch), partial data access, and periodically published data reports	Foster regional coordination and knowledge exchange with neighbouring countries in the Alps and across Europe
Several glaciers with long-term MB monitoring programmes including energy balance, flow velocity, and firn temperature. Different measurement types on different glaciers.	Selection of one or a few benchmark glacier for long-term and detailed measurement programmes for process understanding and model calibration.
Good spatial distribution of long-term MB series. Under current climate change scenarios, some glaciers of monitoring programmes are endangered to vanish within next few decades.	Continue long-term mass measurement programmes. Early start replacement measurements for vanishing glaciers.
Good spatial distribution of long-term FV series. Geodetic TC results are reported for a few glaciers only.	Continue long-term FV series, extend sample size with decadal length change assessments from remote sensing. Make available geodetic TC results for large glacier samples.
National inventories available for full glacier sample around 1973 (WGI), 1998/99, 2003 (RGI) and 2009/10 (both GLIMS).	Make available national inventories from around 1850 and plan next repeat inventory around 2020.

Spatial distribution of series

The distribution of measurement series in Switzerland is considered spatially comprehensive and comparatively dense. Only few series have been interrupted before 2005 and a large part of the observational series offer long-term data. The earliest FV series even date back to the second half of the 19th century and are of unique value today. Such long-term data series are expected to allow for analyses of glacier changes from a local to a global scale and can serve to investigate glacier-climate interactions.



wgms

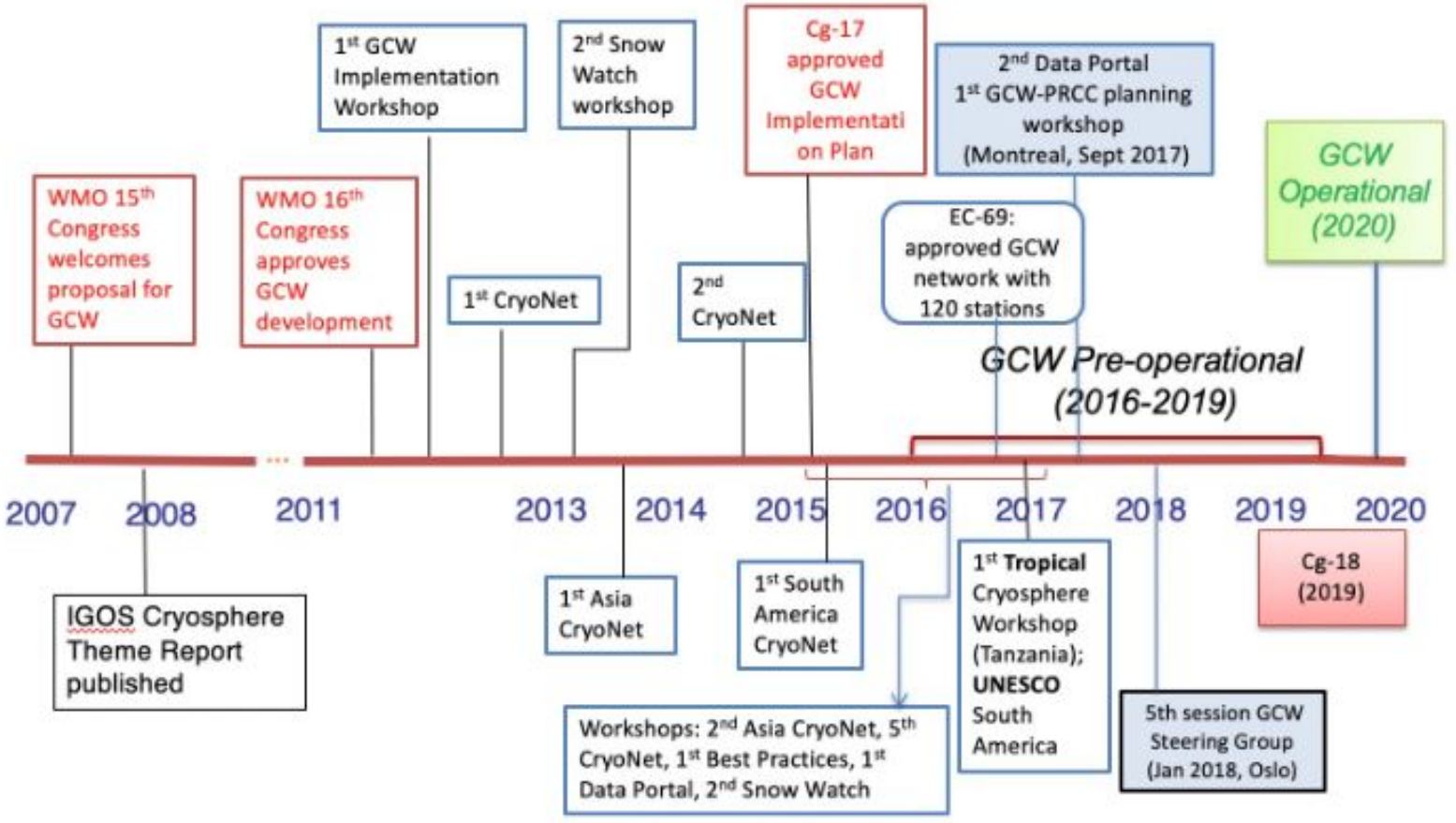
baseline as of 2015

wgms

Global terrestrial network for Glaciers (1998)

- **WGMS** World Glacier Monitoring Service
- **NSIDC** National Snow and Ice Data Center
- **GLIMS** Global Land Ice Measurements from Space

GCW Development Timeline



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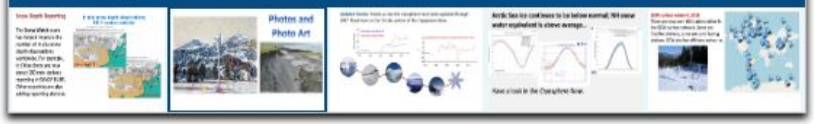
Highlights

Photo Gallery



Cryosphere in the News

Do Arctic mobility devices need a rethink? – Eye on the Arctic video archive
7 September 2019, 5:01 am
rcinet.ca

India's moon landing suffers last-minute communications loss
6 September 2019, 10:12 pm
feeds.guardian.co.uk

Swedish mountain loses highest peak title due to global heating
6 September 2019, 12:52 pm
feeds.guardian.co.uk

Summer's not over until bottom melt ends
5 September 2019, 3:40 pm
nsidc.org

Greenland: 'It's scary to see the ice melting'
4 September 2019, 11:15 pm
newsrss.bbc.co.uk

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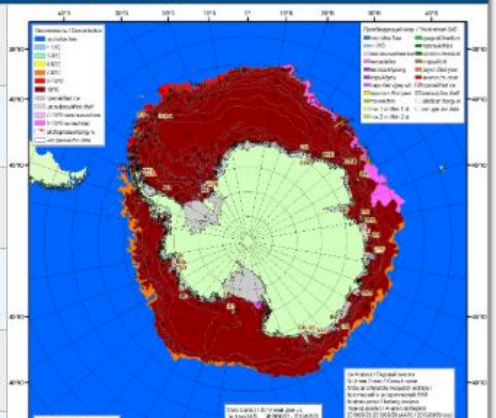

GCW News

A very warm October (2019-07-09)

Glacier mass balance continues to decrease into 2018 (2019-06-27)

18th World Meteorological Congress agrees to continued GCW development (2019-06-17)

David Grimes, GCW proponent, ends final term as WMO President (2019-06-17)

New sea ice extent trackers from the OSI SAF (2019-05-30)

New snow trackers for NH, South America, and Australia/NZ (2019-05-09)

Improvements in international reporting of

gms

Cryosphere in the News

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» GCW News
» Cryosphere in the News
» Community Announcements
» Community Calendar

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Thank you!
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