



WGMS achievements and future challenges— View from IACS & GTN-G advisory board

& NVE



Liss Marie Andreassen

Norwegian Water Resources and Energy Directorate (NVE)

Section for Glaciers, Ice and Snow

NVE measures the glaciers in Norway

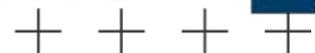


- MB: **15** glaciers
- Front: **30+** glaciers
- Geodetic surveys
- Ice thickness data
- Photographical records
- Glacier inventories



RGI

wgms



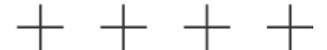
Global Terrestrial Network for Glaciers

GTN-G

Three bodies:

- World Glacier Monitoring Service
- U.S. National Snow and Ice Data Center
- Global Land Ice Measurements from Space initiative

wgms



- **compiling** and **disseminating** **standardized observations** and **methods** on **glacier distribution and their changes**

- Steering committee:
Executive & **Advisory board**

WGMS & IACS

- WGMS a service of IACS
- IACS leads the Advisory Board of GTN-G

Members of the ADVISORY BOARD



Dr. Liss M.
Andreassen Chair

email: lna@nve.no



Prof. Anthony Arendt

email:
arendta@qi.alaska.edu



Dr. Stephen Briggs

email:
Stephen.Briggs@esa.int



Prof. Graham Cogley

email:
gcogley@trentu.ca



Prof. Alex Gardner

email:
Alex.S.Gardner@ipl.nasa.gov



Prof. Ben Marzeion

email:
ben.marzeion@uni-bremen.de

IACS The International Association of Cryospheric Sciences

- Established in 2007

Association of International Union of Geodesy and Geophysics (IUGG)

- Promote cryosphere studies & public awareness
–collaboration & international co-ordination

- Standardize collection of cryosphere data, analysis, archiving & publication

- IACS Bureau

- Snow and Avalanches
- **Glaciers and Ice Sheets**
- Marine and Freshwater Ice
- Cryosphere, Atmosphere and Climate
- Planetary and other Ices of the Solar System

<http://www.cryosphericosciences.org>



President:
Charles Fierz

IACS Working Groups on glaciers

- **Mass balance terminology and methods** (2008 – 2012)

“early milestone in the work of the IACS”



Point mass balance

Mass balance at a particular location on the glacier, for example at an ablation stake or a snow pit.

The point referred to is at the top of a vertical column through the glacier. Most measurements of

World Glacier Monitoring Service (WGMS)

The leading organization for the collection, storage and dissemination of information about *glacier fluctuations*.

The WGMS, formed in 1986 by merging the *Permanent Service on the Fluctuations of Glaciers* and the *Temporary Technical Secretariat for the World Glacier Inventory*, is based in Zürich, Switzerland. It coordinates the work of local investigators through a network of national correspondents in countries involved in glacier monitoring. WGMS runs the *Global Terrestrial Network for Glaciers (GTN-G)* in close collaboration with the *National Snow and Ice Data Center* and the *Global Land Ice Measurements from Space* initiative.

Cogley, J.G., R. Hock, L.A. Rasmussen, A.A. Arendt, A. Bauder, R.J. Braithwaite, P. Jansson, G. Kaser, M. Möller, L. Nicholson and M. Zemp, 2011, *Glossary of Glacier Mass Balance and Related Terms*, IHP-VII Technical Documents in Hydrology No. 86, IACS Contribution No. 2, UNESCO-IHP, Paris.

IACS WG: Randolph Glacier Inventory and infrastructure for glacier monitoring

Period: 2014 – 2018

Chairs: Cogley & Hock

- **Randolph Glacier Inventory** a global inventory of glacier outlines (motivated by the 5th IPCC A. Report).
- RGI a complete **one-time coverage**, version control, attributes.
- GLIMS – **multiple outlines**
- RGI merging into GLIMS -> **RGI will be a downloadable subset of GLIMS.**

Journal of Glaciology, Vol. 60, No. 221, 2014 doi: 10.3189/2014jogG13176

537

The Randolph Glacier Inventory: a globally complete inventory of glaciers

W. Tad PFEFFER,¹ Anthony A. ARENDT,² Andrew BLISS,² Tobias BOLCH,^{3,4}
J. Graham COGLEY,⁵ Alex S. GARDNER,⁶ Jon-Ove HAGEN,⁷ Regine HOCK,^{2,8}
Georg KASER,⁹ Christian KIENHOLZ,² Evan S. MILES,¹⁰ Geir MOHOLDT,¹¹
Nico MÖLG,³ Frank PAUL,³ Valentina RADIC,¹² Philipp RASTNER,³ Bruce H. RAUP,¹³
Justin RICH,² Martin J. SHARP,¹⁴ THE RANDOLPH CONSORTIUM¹⁵

¹Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO, USA

²Geophysical Institute, University of Alaska Fairbanks, Fairbanks, AK, USA

³Department of Geography, University of Zürich, Zürich, Switzerland

⁴Institute for Cartography, Technische Universität Dresden, Dresden, Germany

⁵Department of Geography, Trent University, Peterborough, Ontario, Canada

E-mail: gcogley@trentu.ca

⁶Graduate School of Geography, Clark University, Worcester, MA, USA

⁷Department of Geosciences, University of Oslo, Oslo, Norway

⁸Department of Earth Sciences, Uppsala University, Uppsala, Sweden

Randolph Glacier Inventory 5.0

Dataset Description

The Randolph Glacier Inventory (RGI 5.0) is a global inventory of glacier outlines. It is supplemental to the Global Land Ice Measurements from Space initiative (GLIMS). Production of the RGI was motivated by the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5). Future updates will be made to the RGI and the GLIMS Glacier Database in parallel during a transition period. As all these data are incorporated into the GLIMS format, the RGI will evolve into a downloadable subset of GLIMS data in the RGI data coverage, version control, and a standard set of attributes.

For more details, and for a complete list of contributors, please see the **RGI 5.0 Technical Report** (PDF format).

Release History

- RGI Version 1.0: released Feb 22, 2012
- RGI Version 2.0: released June 12, 2012. Version 2.0 includes metadata on data sources, outlining techniques and incorporates newly available outlines.
- RGI Version 3.0: released April 7, 2013. Version 3.0 includes identification of all tidewater basins and delineation of glaciers from glacier complexes in nearly all regions.
- RGI Version 3.2: released August 31, 2013.
- RGI Version 4.0: released December 1, 2014.
- RGI Version 5.0: released July 20, 2015.

Data Access

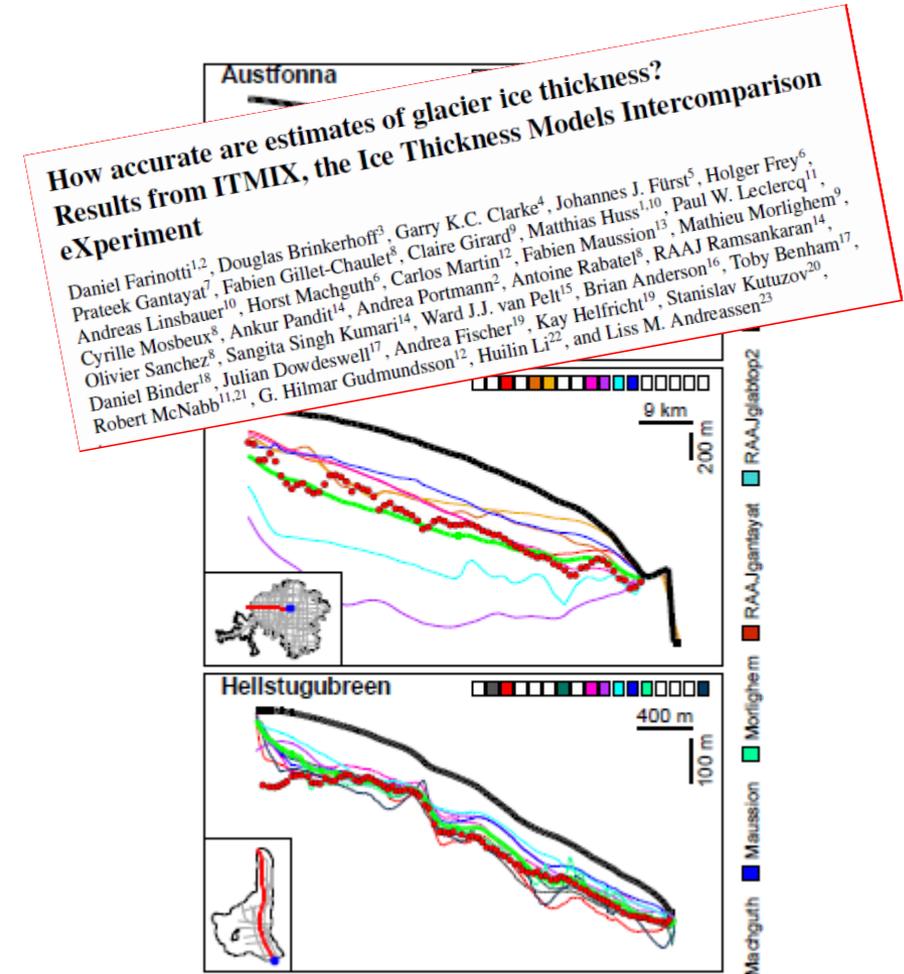
Get the RGI 5.0 (Recommended)

IACS WG: Glacier ice thickness estimation

Period: 2014 – 2018

Chairs: Farinotti, Li & Andreassen

- Perform a **model intercomparison** and validation experiment
- Continue the **WGMS** effort in the collection of **ice thickness measurements**

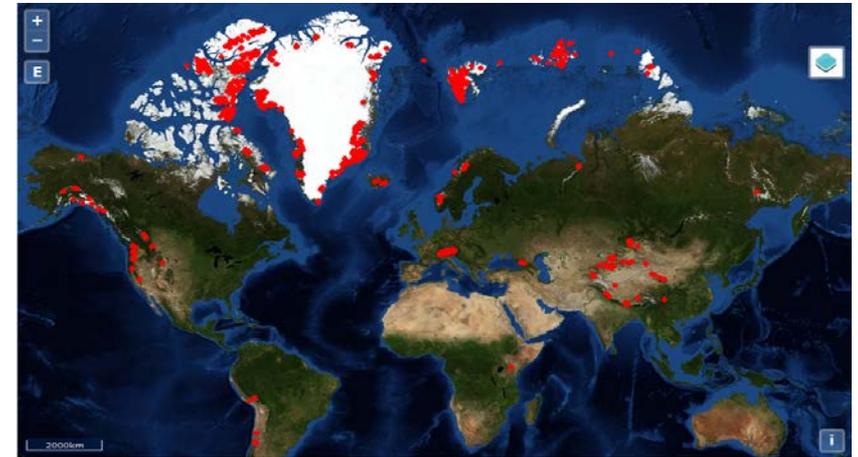


WGMS Achievements

Ice thickness – GlaThiDa

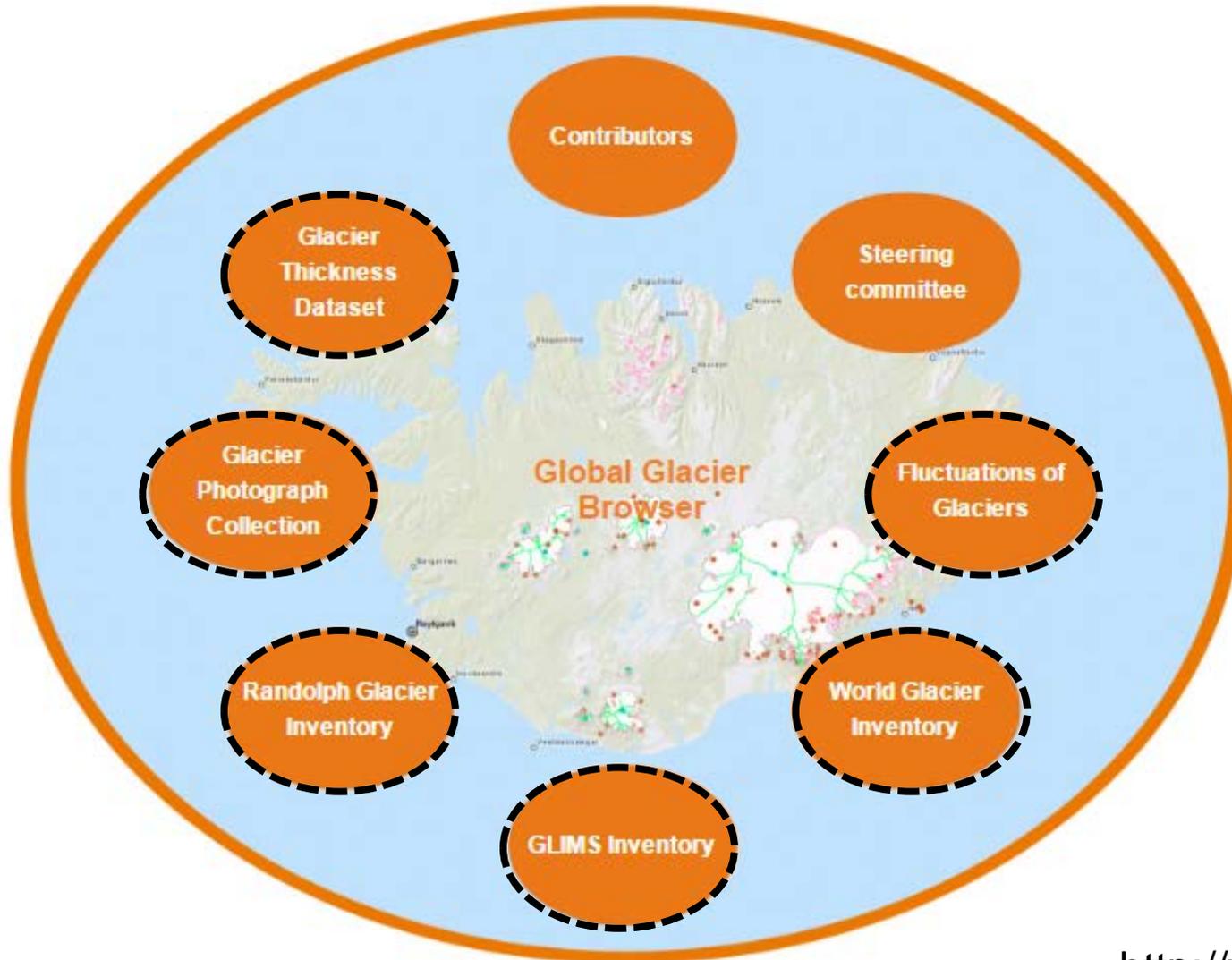


- **GlaThiDa 1.0** literature review & NASA's IceBridge (WGMS, 2014; Gärtner-Roer, 2014)
- **GlaThiDa 2.0**
Contribution to IACS WG on ice thickness estimation (WGMS, 2016)
- **GlaThiDa 3.0**
.....next year.....

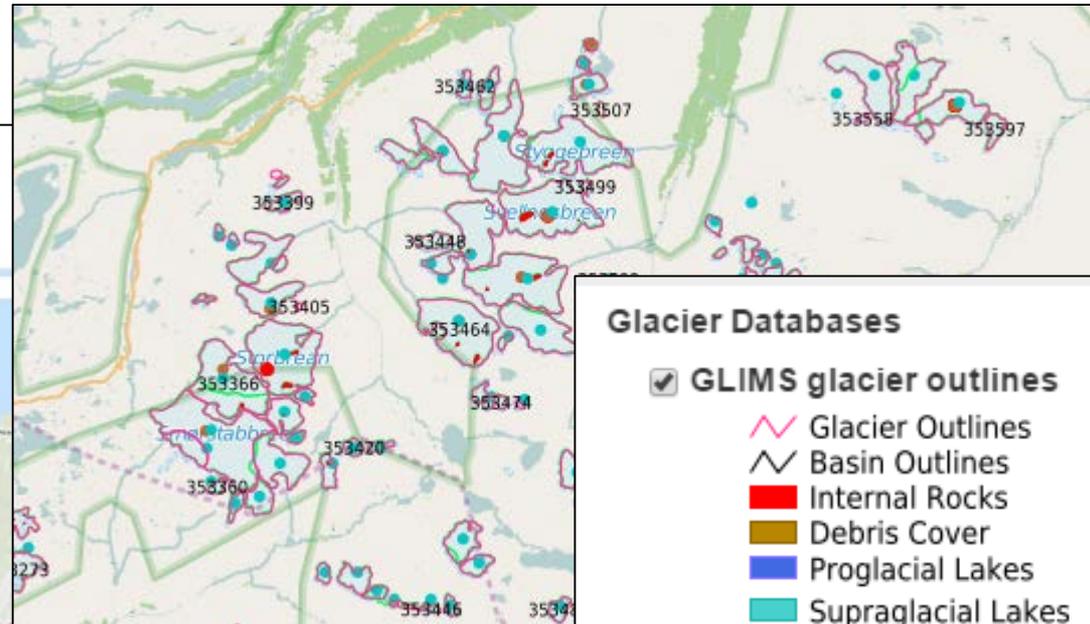
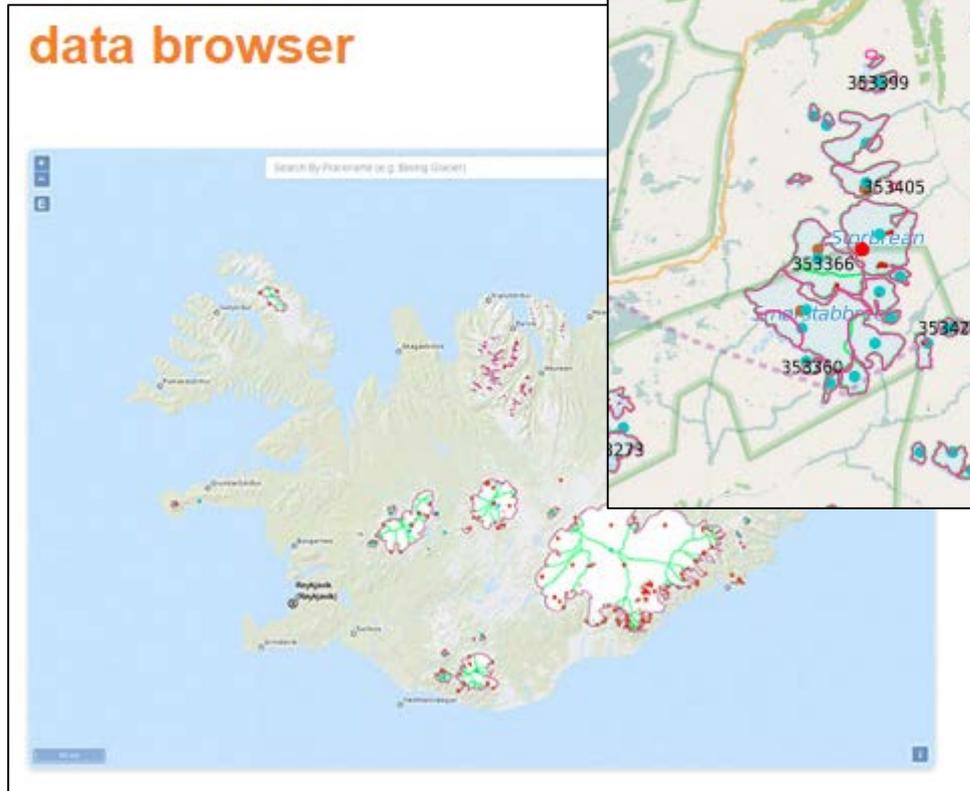


Citation: WGMS (2016): Glacier Thickness Database 2.0. Gärtner-Roer, I., Andreassen, L. M., Bjerre, E., Farinotti, D., Fischer, A., Fischer, M., Helfricht, K., Huss, M., Knecht, T., Kutuzov, S., Landmann, J., Lavrentiev, I., Li, H., Li, Z., Machguth, H., Naegeli, K., Navarro, F., Rabatel, A., Stentoft, P., Zemp, M. (eds.), World Glacier Monitoring Service, Zurich, Switzerland. DOI: [10.5904/wgms-glathida-2016-07](https://doi.org/10.5904/wgms-glathida-2016-07).

Global Glacier Browser



Viewing the GTN-G datasets



Glacier Databases

GLIMS glacier outlines

 Glacier Outlines

 Basin Outlines

 Internal Rocks

 Debris Cover

 Proglacial Lakes

 Supraglacial Lakes

 Randolph Glacier Inventory

 World Glacier Inventory

 Glacier Thickness Dataset

 Fluctuations of Glaciers

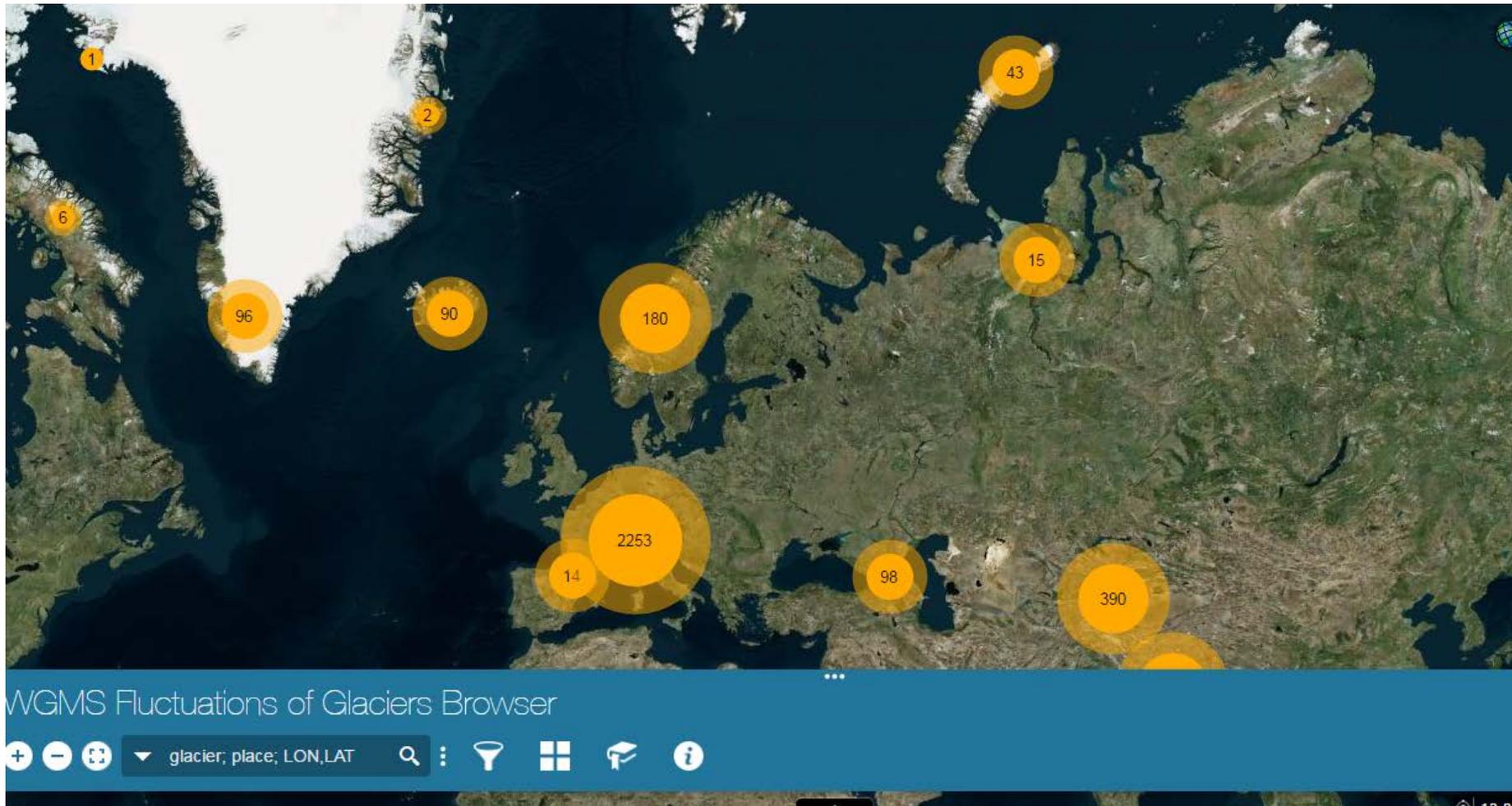
 Glacier Photograph Collection

Base maps

Open Street Map

http://www.gtn-g.ch/data_browser/

WGMS Fluctuations of Glaciers Browser



<http://www.wgms.ch/fogbrowser/>

WGMS Fluctuations of Glaciers Browser

Fluctuations of Glaciers browser

storbreen

61.5543 8.0759 Degrees

Filter by Map Extent Zoom to Clear Selection Refresh

Name	WGMS_ID	Length	Area	Min Elevation	Max Elevation	Measure Type	Current Status	First Reference Year	First Survey Year	Last Survey Year	Number of Observations	Latest Observer	Download Graph	Download Data
STORBREEN	302	2.9 km (2009)	5.1 sqkm (2015)	1400 m a.s.l. (2013)	2102 m a.s.l.	Mass Balance (from glaciological method)	net mass loss since 2005	1948	1949	2015	67	Andreassen, L. and colleagues (NVE)	Download	Download
TVERRAABREEI	2305	not available	5.9 sqkm (1963)	not available	not available	Mass Balance (from glaciological method)		1961	1962	1963	2	see MinimalDataSe	Download	Download
STORBREEN	302	2.9 km (2009)	5.1 sqkm (2015)	1400 m a.s.l. (2013)	2102 m a.s.l.	Thickness Change (from geodetic)		1940	1951	1997	5	see MinimalDataSe	Download	Download

WGMS reporting

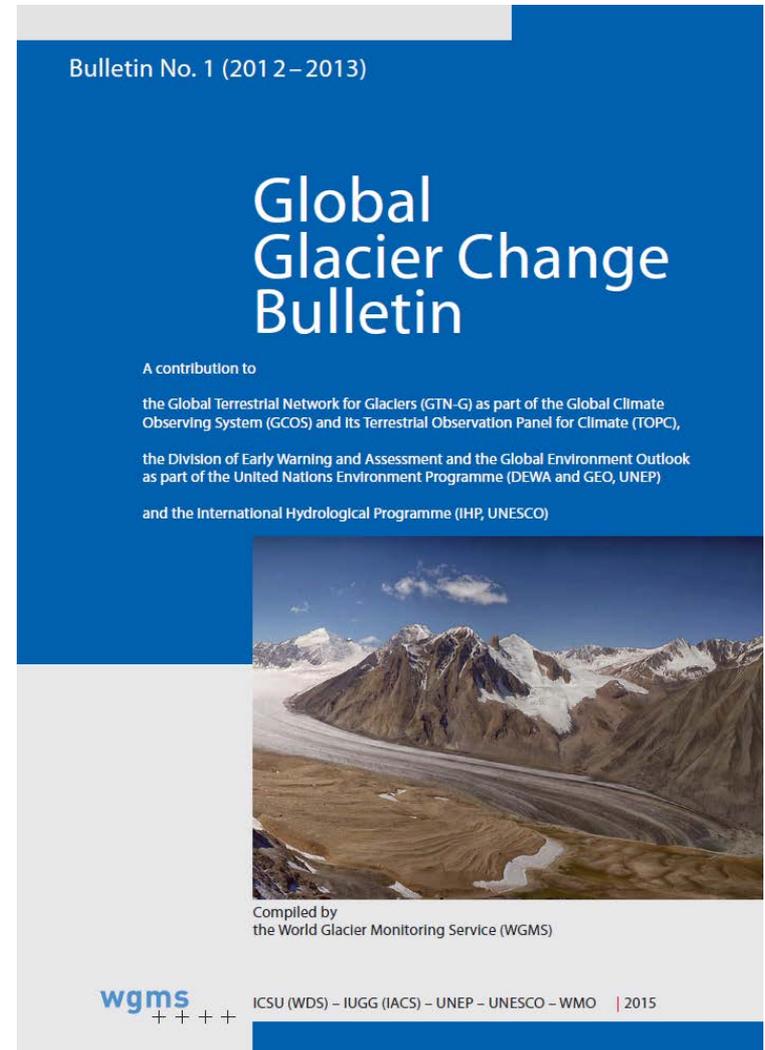
Merging of

- Glacier Mass Balance Bulletin (MBB)
- Fluctuations of Glaciers (FOG)



- Global Glacier Change Bulletin

“..free resources and offer the public a more timely product...”



Versioning

- Each database version gets a Digital Object Identifier (DOI)

Creator: World Glacier Monitoring Service (WGMS)

Title: Fluctuations of Glaciers Database

Publisher: World Glacier Monitoring Service (WGMS)

Publication Year: 2015

Release date: 2015-11-30

Citation:

WGMS (2015): Fluctuations of Glaciers Database.

World Glacier Monitoring Service, Zurich, Switzerland.

DOI:10.5904/wgms-fog-2015-11.

Online access: <http://dx.doi.org/10.5904/wgms-fog-2015-11>

VERSIONS	DOI	METADATA	DATA DOWNLOAD
2015 (current)	10.5904/wgms-fog-2015-11	website	zip file
2014	10.5904/wgms-fog-2014-09	info	zip file
2013	10.5904/wgms-fog-2013-11	info	zip file
2012	10.5904/wgms-fog-2012-11	info	zip file
2008	10.5904/wgms-fog-2008-12	info	zip file

New data sets

- Ice thickness
- Point mass balance
- Photos

More data

- Extension of geodetic
- Reconstruction length change

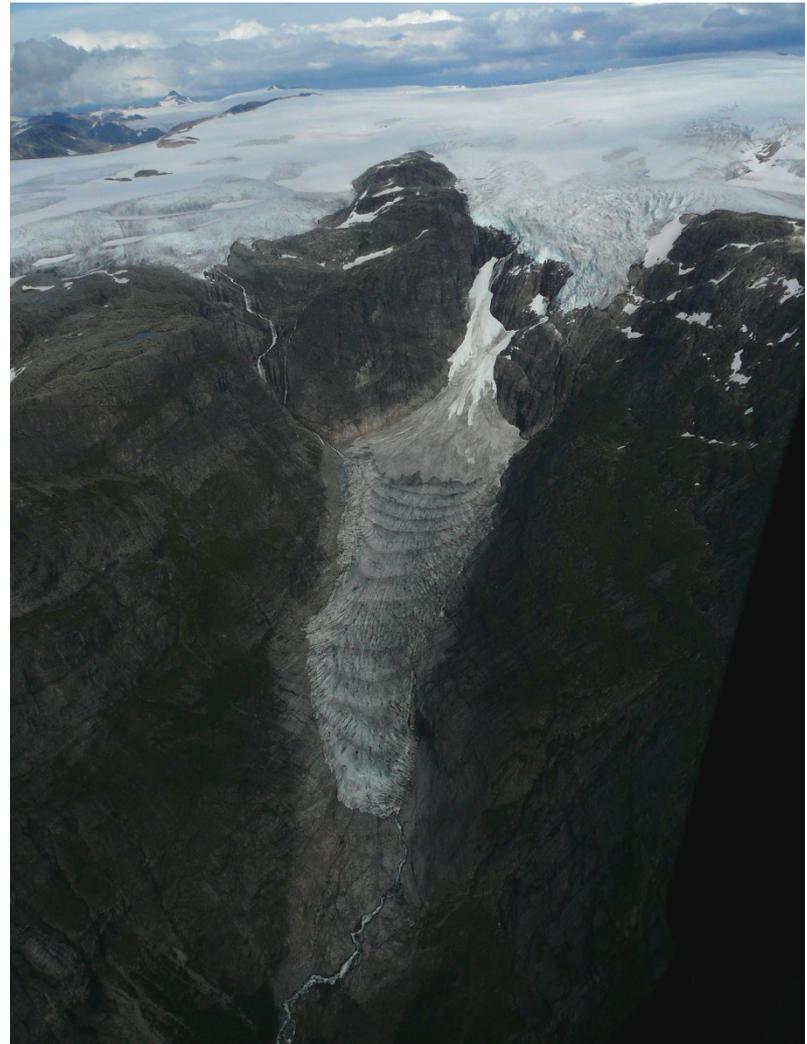


Photo: Hallgeir Elvehøy

Capacity building



Training courses

Traineeships

**General Assembly of
National Correspondents**

Workshops

Training course for mass balance measurements and analysis, Bolivia

Photo: WGMS

Mass balance workshops



Publications

The Cryosphere, 7, 1227–1245, 2013
www.the-cryosphere.net/7/1227/2013/
doi:10.5194/tc-7-1227-2013
© Author(s) 2013. CC Attribution 3.0 License.



Reanalysing glacier mass balance measurement series

M. Zemp¹, E. Thibert², M. Huss³, D. Stumm⁴, C. Rolstad Denby⁵, C. Nuth⁶, S. U. Nussbaumer¹, G. Mohold⁷, A. Mercer⁸, C. Mayer⁹, P. C. Joerg¹, P. Jansson⁸, B. Hynke¹⁰, A. Fischer¹¹, H. Escher-Vetter⁹, H. Elvehoj¹², and L. M. Andreassen¹²

¹Department of Geography, University of Zurich (UZH), Zurich, Switzerland

²IRSTEA, UR ETGR Erosion Torrentielle, Neige et Avalanches, Saint-Martin-d'Hères, France

³Department of Geosciences, University of Fribourg (UFR), Fribourg, Switzerland

⁴International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal

⁵Department of Mathematical Sciences and Technology, The Norwegian University of Life Sciences (UMB), Ås, Norway

⁶Department of Geosciences, University of Oslo (UiO), Oslo, Norway

⁷Scipios Institution of Oceanography, University of California, San Diego, USA

⁸Department of Physical Geography and Quaternary Geology, Stockholm University, Stockholm, Sweden

⁹Commission for Geodesy and Glaciology, Bavarian Academy of Sciences and Humanities, Munich, Germany

¹⁰Zentralanstalt für Meteorologie und Geodynamik (ZAMG), Vienna, Austria

¹¹Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences, Innsbruck, Austria

¹²Norwegian Water Resources and Energy Directorate (NVE), Oslo, Norway

Correspondence to: M. Zemp (michael.zemp@geo.uzh.ch)

Received: 1 February 2013 – Published in The Cryosphere Discuss.: 4 March 2013

Revised: 10 June 2013 – Accepted: 21 June 2013 – Published: 6 August 2013

Abstract. Glacier-wide mass balance has been measured for more than sixty years and is widely used as an indicator of climate change and to assess the glacier contribution to runoff and sea level rise. Until recently, comprehensive uncertainty assessments have rarely been carried out and mass balance data have often been applied using rough error estimation or without consideration of errors. In this study, we propose a framework for reanalysing glacier mass balance series that includes conceptual and statistical tools for assessment of random and systematic errors, as well as for validation and calibration (if necessary) of the glaciological with the geodetic balance results. We demonstrate the usefulness and limitations of the proposed scheme, drawing on an analysis that comprises over 50 recording periods for a dozen glaciers, and we make recommendations to investigators and users of glacier mass balance data. Reanalysing glacier mass balance series needs to become a standard procedure for every monitoring programme to improve data quality, including reliable uncertainty estimates.

1 Introduction

Changes in glacier mass are a key subject of glacier monitoring, providing important information for assessing climatic changes, water resources, and sea level rise. The most extensive dataset of glacier-wide in situ mass balance measurements covers the past six decades (WGMS, 2012; and earlier volumes) and is widely used to assess global glacier changes (e.g. Cogley, 2009) and related consequences of regional runoff (e.g. Weber et al., 2010) and global sea level rise (e.g. Kaser et al., 2006). However, most of these data series consist of just a few observation years, and most results are reported without uncertainties (Zemp et al., 2009).

There are a dozen mass balance programmes with continuous time series dating back to 1960 or earlier on relatively small mountain and valley glaciers (Zemp et al., 2009). Combined with multi-annual geodetic surveys, these long-term glaciological mass balance series provide a unique opportunity for quantitative assessment of the related uncertainties. Earlier works found both agreement (e.g. Funk et al., 1997) and disagreement (e.g. Ostrem and Haakensen, 1999) between the mass balance results from the two methods. Recent

Published by Copernicus Publications on behalf of the European Geosciences Union.

Journal of Glaciology, Vol. 61, No. 228, 2015 doi:10.3189/2015jgl51J017

745

Historically unprecedented global glacier decline in the early 21st century

Michael ZEMP,¹ Holger FREY,¹ Isabelle GÄRTNER-ROER,¹ Samuel U. NUSSBAUMER,¹ Martin HOELZLE,^{1,2} Frank PAUL,¹ Wilfried HAEBERLI,¹ Florian DENZINGER,¹ Andreas P. AHLSTRÖM,³ Brian ANDERSON,⁴ Samjwal BAJRACHARYA,⁵ Carlo BARONI,⁶ Ludvig N. BRAUN,⁷ Bolívar E. CÁCERES,⁸ Gino CASASSA,⁹ Guillermo COBOS,¹⁰ Luzmila R. DÁVILA,¹¹ Hugo DELGADO GRANADOS,¹² Michael N. DEMUTH,¹³ Lydia ESPIZUA,¹⁴ Andrea FISCHER,¹⁵ Koji FUJITA,¹⁶ Bogdan GADEK,¹⁷ Ali GHAZANFAR,¹⁸ Jon Ove HAGEN,¹⁹ Per HOLMLUND,²⁰ Neamat KARIMI,²¹ Zhongqin LI,²² Mauri PELTO,²³ Pierre PITTE,¹⁴ Victor V. POPOVNIN,²⁴ Cesar A. PORTOCARRERO,¹¹ Rainer PRINZ,^{25,26,27} Chandrashekar V. SANGEWAR,²⁸ Igor SEVERSKIY,²⁹ Oddur SIGURÐSSON,³⁰ Alvaro SORUCO,³¹ Ryskul USUBALIEV,³² Christian VINCENT³³

¹World Glacier Monitoring Service (WGMS), Department of Geography, University of Zurich, Zurich, Switzerland
National Correspondents for ²CH, ³GL, ⁴NZ, ⁵NP, ⁶IT, ⁷DE, ⁸EC, ⁹CL, ¹⁰ES, ¹¹PE, ¹²MX, ¹³CA, ¹⁴AR, ¹⁵AT, ¹⁶JP, ¹⁷PK, ¹⁸NO, ¹⁹SE, ²⁰IR, ²¹CN, ²²US, ²³RU, ²⁴KE, ²⁵TZ, ²⁶UG, ²⁷IN, ²⁸KZ, ²⁹IS, ³⁰BO, ³¹KG, ³²FR

Correspondence: michael.zemp@geo.uzh.ch

ABSTRACT. Observations show that glaciers around the world are in retreat and losing mass. Internationally coordinated for over a century, glacier monitoring activities provide an unprecedented dataset of glacier observations from ground, air and space. Glacier studies generally select specific parts of these datasets to obtain optimal assessments of the mass-balance data relating to the impact that glaciers exercise on global sea-level fluctuations or on regional runoff. In this study we provide an overview and analysis of the main observational datasets compiled by the World Glacier Monitoring Service (WGMS). The dataset on glacier front variations (~42 000 since 1600) delivers clear evidence that centennial glacier retreat is a global phenomenon. Intermittent readvance periods at regional and decadal scale are normally restricted to a subsample of glaciers and have not come close to achieving the maximum positions of the Little Ice Age (or Holocene). Glaciological and geodetic observations (~5200 since 1850) show that the rates of early 21st-century mass loss are without precedent on a global scale, at least for the time period observed and probably also for recorded history, as indicated also in reconstructions from written and illustrated documents. This strong imbalance implies that glaciers in many regions will very likely suffer further ice loss, even if climate remains stable.

KEYWORDS: glacier fluctuations, glacier mass balance, mountain glaciers

1. INTRODUCTION

Glacier fluctuations, i.e. changes in length, area, volume and mass, represent an integration of changes in the energy balance and, as such, are well recognized as high-confidence indicators of climate change (Bojinski and others, 2014). Past, current and future glacier changes impact global sea level (e.g. Raper and Braithwaite, 2006; Meier and others, 2007; Gardner and others, 2013; Radić and others, 2014; Marzeion and others, 2014), the regional water cycle (e.g. Fountain, 1996; Kaser and others, 2010; Weber and others, 2010; Huss, 2011; Bliss and others, 2014) and local hazard situations (e.g. Käb and others, 2003; Bajracharya and Mool, 2009; Haeberli and others, 2015). In the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Vaughan and others, 2013) glacier mass

budgets for 2003–09 were reconciled in order to obtain an estimate of the glacier contribution to sea level. This was achieved by combining traditional observations with satellite altimetry and gravimetry as a way of filling regional gaps and obtaining global coverage (Gardner and others, 2013). However, the analysis was possible only during a short time period; additional datasets are needed to detect climatic trends and to compare current change rates with earlier ones. In this study we present a joint analysis of data compiled by the World Glacier Monitoring Service (WGMS, 2008a, and references therein) and its National Correspondents in order to provide the scientific community with an in-depth summary of changes in glacier length, volume and mass. For this purpose we apply the observational dataset in its full richness for a comprehensive assessment of decadal glacier changes at global and regional levels. Results from different methods are not merged (as in Gardner and others, 2013), rather they are treated separately in order to demonstrate and discuss both the strengths and limitations of the respective

*Complete affiliations of the WGMS National Correspondents are given in the Appendix.

Network for Glaciers (GIM-G) as part of the Global Climate
35) and its Terrestrial Observation Panel for Climate (TOPC),
Monitoring and Assessment and the Global Environment Outlook
Terrestrial Environment Programme (DEWA and GEO, UNEP)

Hydrological Programme (IHP, UNESCO)



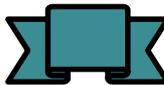
led by
World Glacier Monitoring Service (WGMS)

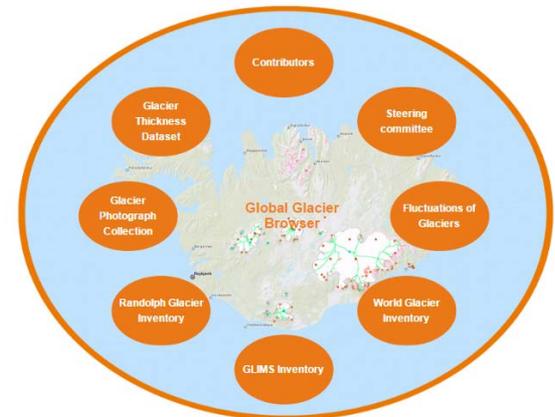
WGMS – IUGG (IACS) – UNEP – UNESCO – WMO | 2015

WGMS Challenges

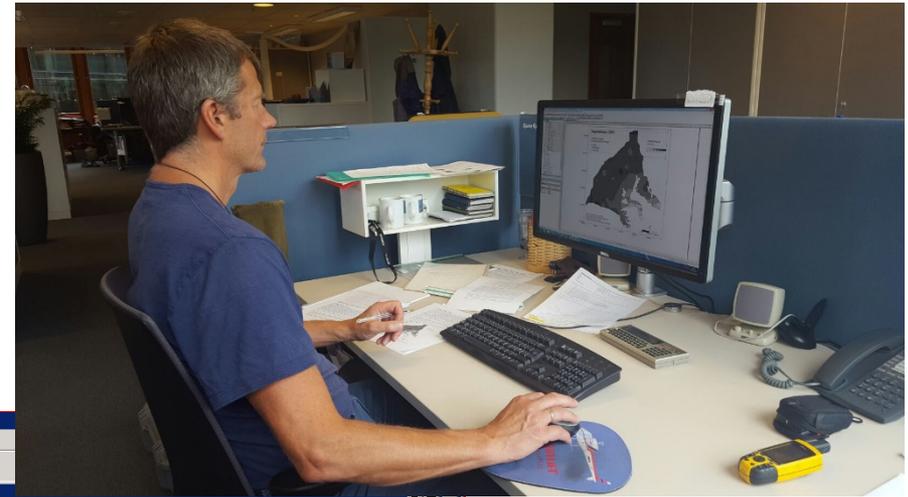
GTN-G vision

Recommended by the Advisory Board
in the evaluation report 2014

- **Products of value within - and beyond glaciology**  →
- A community that is **willing to contribute data**   →
- **Secured** long-term **funding** for stewardship, access, and accommodation of future needs  →
- A rich, highly visible and user-friendly **one-stop portal**  →



Data reporting & storage



Hysopp
 File Edit View Bre Ingeniør Stasjon Tools Box Record Query Window Help

Massebalanseregistrering

Bre id: 2636 Brenavn: Storbreen Alternativt brenavn: Storbreen
 Hovedbre id: Hysopp ID: 115

Søkemodus: Utfør søk Lagre Angre Forrige Neste Lukk vindu

Breareal	Generasjon	Observasjons dato	Gyldig fra dato	Gyldig til	Kommentar	Omr. ID	Massebalanse	Type	Dato forrige min. måling	Dato maks. måling	Dato min. måling	Va
1	17.10.2009	01.01.2009	01.01.2016			122	0	1 Original	18.09.2014	14.05.2015	09.09.2015	
0	17.10.2009	01.01.2003				186	0	1 Original	12.09.2013	14.05.2014	18.09.2014	
1	08.08.1997	01.01.2001	31.12.2008			17	0	1 Original	16.10.2012	07.05.2013	12.09.2013	
0	08.08.1997	31.12.1990	31.12.2002			187	0	1 Original	13.09.2011	03.05.2012	16.10.2012	

Nytt areal Angre Forrige Neste

Velg OmrID Kopiere Areal

Fra høyde	Til høyde	Areal
2050	2102	0.004
2000	2050	0.095
1950	2000	0.179
1900	1950	0.290
1850	1900	0.345
1800	1850	0.753
1750	1800	0.866
1700	1750	0.681
1650	1700	0.548
1600	1650	0.312
1550	1600	0.435
1500	1550	0.263
1450	1500	0.176
1400	1450	0.135

Velg Bal ID Kopiere massebalanse

Fra høyde	Til høyde	Vinterbalanse	Sommerbalanse	Nettobalanse
2050	2102	1.840	-0.450	1.390
2000	2050	1.840	-0.500	1.340
1950	2000	1.870	-0.550	1.320
1900	1950	2.056	-0.600	1.456
1850	1900	1.932	-0.670	1.262
1800	1850	1.652	-0.750	0.902
1750	1800	1.700	-0.850	0.850
1700	1750	1.372	-0.980	0.392
1650	1700	1.318	-1.080	0.238
1600	1650	1.453	-1.190	0.263
1550	1600	1.332	-1.360	-0.028
1500	1550	1.047	-1.700	-0.653
1450	1500	0.844	-2.050	-1.206
1400	1450	0.750	-2.400	-1.650

Ny høyde Angre

ELA prefiks: (null) ELA: 1575 ELA nøyaktighet: 10
 Beregnet av: Liss M. Andreassen Institusjon: NVE
 Registreringstidspkt: 29.06.2016 Referanse: NVE database 2016
 Kommentarer: Floating date. Ikke målinger i øverste og nederste intervall. Bak = 1.53.

NORGES
 VASSDRAGS- OG ELEKTRISITETSVESEN

GLASIO-HYDROLOGISKE
 UNDERSØKELSER I NORGE
 (RAPPORT)

REDIGERT AV
 RANDI PYTTE OG GUNNAR ØSTREM

Medarbeidere:
 Olav Freystein, Våbjørn Karlén, Olav Liestøl,
 Randi Pytte og Gunnar Østrem

Meddelelse nr. 14
 fra
 HYDROLOGISK AVDELING
 1965

Glaciological investigations
 in Norway in 2010

Bjarne Kjallmoen (Ed.)

3
 2011

R E P O R T

Bre

Bre id: 2636 Brenavn: Storbrean Alternativt brenavn: Storbrean Hysopp ID

Hovedbre id: Hovedbre akronym:

Søkemodus: Utfør søk Forrige Neste Lukk vindu

Bredetaljer: Egenskaper Område og massebalanse Brehendelse Brerisiko Sonderinger Massebalanse på stake Stakemålinger Tetthetsmålinger Frontposisjon Referanser

UTM koordinater: UTM-soner 33 UTM-øst 135731 UTM-nord 6845891 Lengde og breddegrad: Lengdegrad 8.131989 Breddegrad 61.573395

Glms-ID: G351868E61573N WGMS ID: 302 WGI id: N4A000AD041 Regine nr: 2

Bretype: 6 fjellbre Breform: 4 botnbre

URL norsk: https://www.nve.no/hydrologi/bre/bremalinger/massebalansemalinger/storbrean

URL engelsk: http://www.nve.no/Hydrology/Glaciars/Monitoring/Storbrean/

Ledetekst GLOF: Ledetekst GLOF (eng)

Ledetekst GPP: Storbrean (Storbrean) ligger i Jotunheimen i Sør-Norge. Noen av bildene Ledetekst GPP (eng) Storbrean (Storbrean) is situated in the Jotunheimen

Ledetekst CI: Storbrean (Storbrean) ligger i fjellområdet Jotunheimen i det sørlige Norge. Ledetekst CI (eng) Storbrean (Storbrean) is situated in the Jotunheimen

Bre

Bre id: 2636 Brenavn: Storbrean Alternativt brenavn: Storbrean Hysopp ID

Hovedbre id: Hovedbre akronym:

Søkemodus: Utfør søk Forrige Neste Lukk vindu

Bredetaljer: Egenskaper Område og massebalanse Brehendelse Brerisiko Sonderinger Massebalanse på stake Stakemålinger Tetthetsmålinger Frontposisjon Referanser

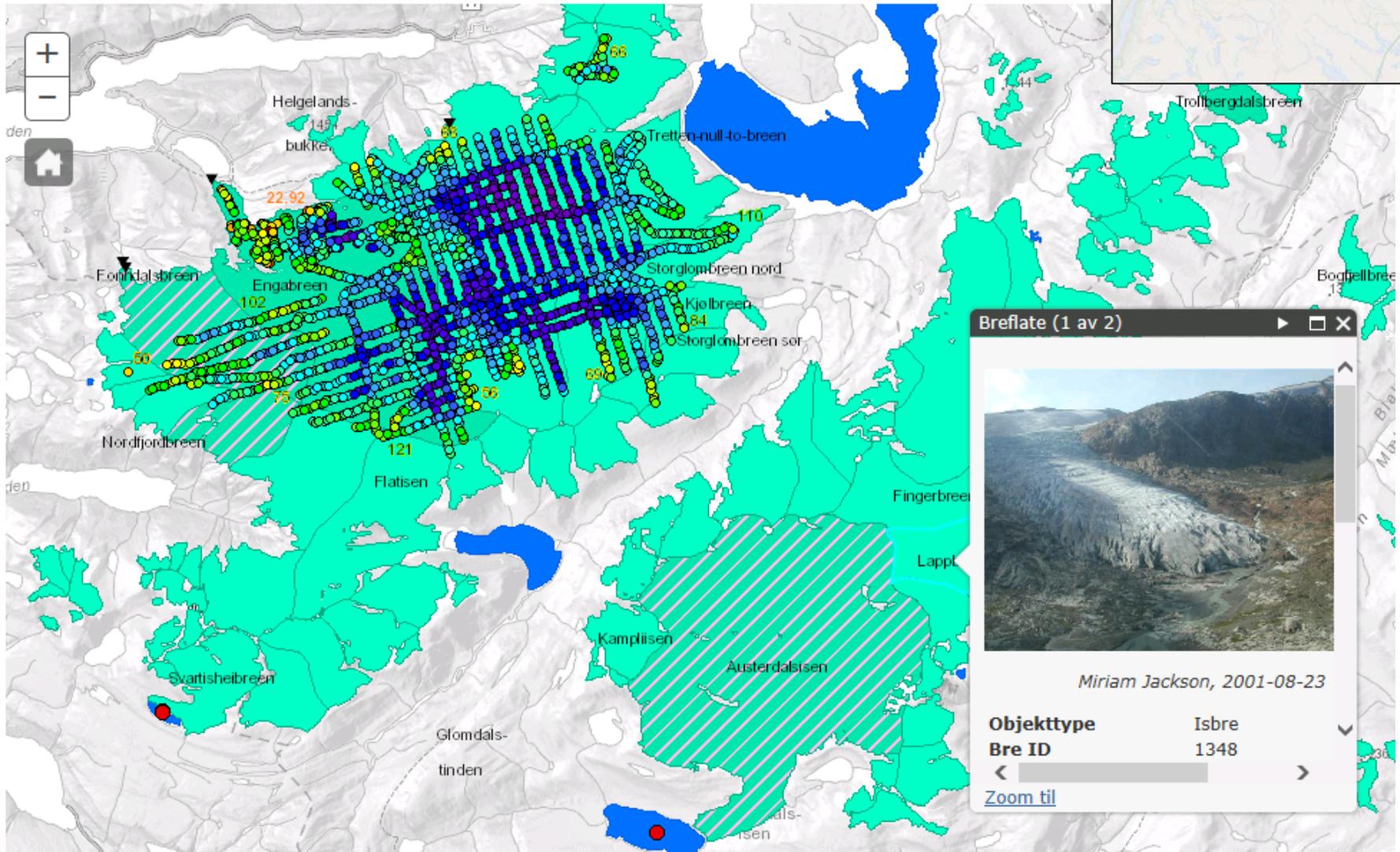
Sonderinger

Snr	Måledato	Kartdato	Observatør	Prosessert av	Tetthetsfunksjon	UTM sone	Kommentar
137	03.05.2012	17.10.2010	Liss M. Andreassen, O. Repp	L.M. Andreassen		32	
138	07.05.2013	17.10.2010	L.M. Andreassen, T. Fjeldstad	L.M. Andreassen		32	Målinger 7.-8. mai
139	07.05.2002	08.08.1997	L.P.Høivik, T.A. Drageset	L.P.Høivik		32	Målinger 6.-8. mai
387	19.05.2016	17.10.2016	L.M. Andreassen, S.H. Winsvold,	L.M. Andreassen		32	Målinger 19.mai (ovre), 12. mai (nedre)
390	14.05.2015	17.10.2009	L.M. Andreassen, K. Melvold	L.M. Andreassen		32	Målinger 14.-15. mai

Ny Lagre Angre Forrige Neste

Sonderingsstikk

Stikknr	UTM-aust	UTM-nord	Stakenr	Høgde	Snødjup	Sve	Tettleiks prøve	Initialer	Merknad
14	455285	6827108		1569	3.18	1.27	154	tfj	
15	455247	6827036		1576	3.1	1.234	154	tfj	
16	455203	6826961		1583	3.27	1.31	154	tfj	
17	455136	6826903		1591	3.26	1.306	154	tfj	



Breflate (1 av 2)



Miriam Jackson, 2001-08-23

Objekttype	Isbre
Bre ID	1348

Zoom til

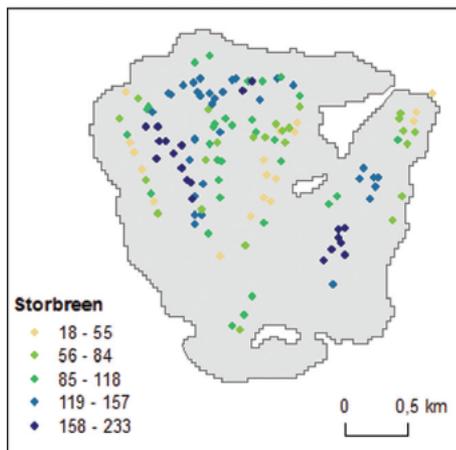
Citing the data

- Could we be better at citing?

WGMS: Fluctuation of glaciers

“When using the data, cite the World Glacier Monitoring Service (WGMS 2015, and earlier reports) **and/or** the original investigators and sponsoring agencies according to the available meta-information.”

- Local  Regional  Global



. *GlaThiDa 2.0* (WGMS, 2016)

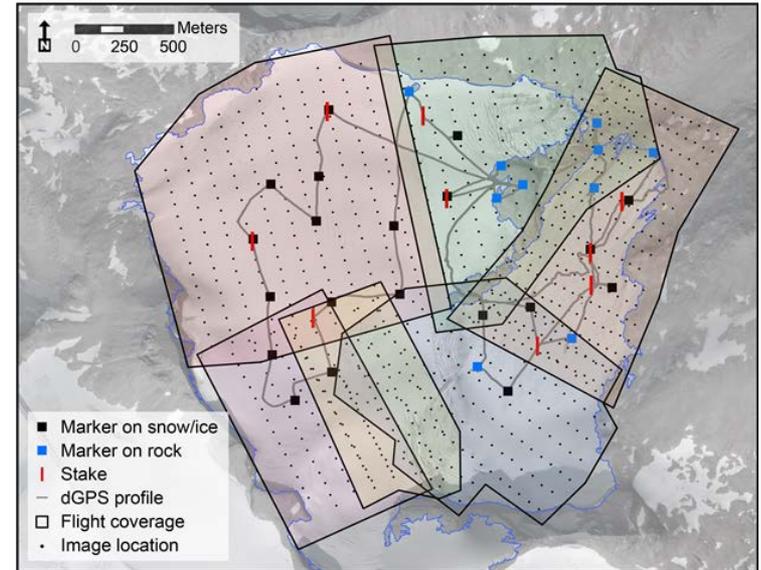
Data: NVE. Andreassen et al., 2015

Geodetic data

- wealth of new data:
 - laser scanning
 - UAV
 - satellite sensors
 - gravimetric
- extend the geodetic database
- surveys cover regions & parts of glaciers

Challenges:

- density conversions
- tabular (excel) vs spatial (GIS)
store DEM, glacier extents, area covered



UAV Storbreen 10 Sep 2015



Vestisen

PLEIADES© CNES, 2016, distribution Airbus DS

Summing up



WGMS a commendable job

- data compilation & archiving
- products of high quality & increasing detail
- scientific analysis, outreach & training
- data more available (download, browsers & app)

Challenges

- secure long-term funding for the service
- make it easy & attractive to submit data
- incorporate storage of spatial data

Community: submit to data archives

Congratulations on the 30th Anniversary

