



*Institute of Geophysics
Polish Academy of Sciences*



**POLISH-NORWEGIAN
RESEARCH
PROGRAMME**



Arctic Climate System Study of Ocean, Sea Ice and Glaciers Interactions in Svalbard Area

WP5: Freshwater from the land

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Polish Academy of Sciences





- **Main goal of the study**
- **Study sites**
- **Fieldwork 2013-2014 and collected data**
- **Polish Polar Station Hornsund – meteorological site, measured parameters and data**



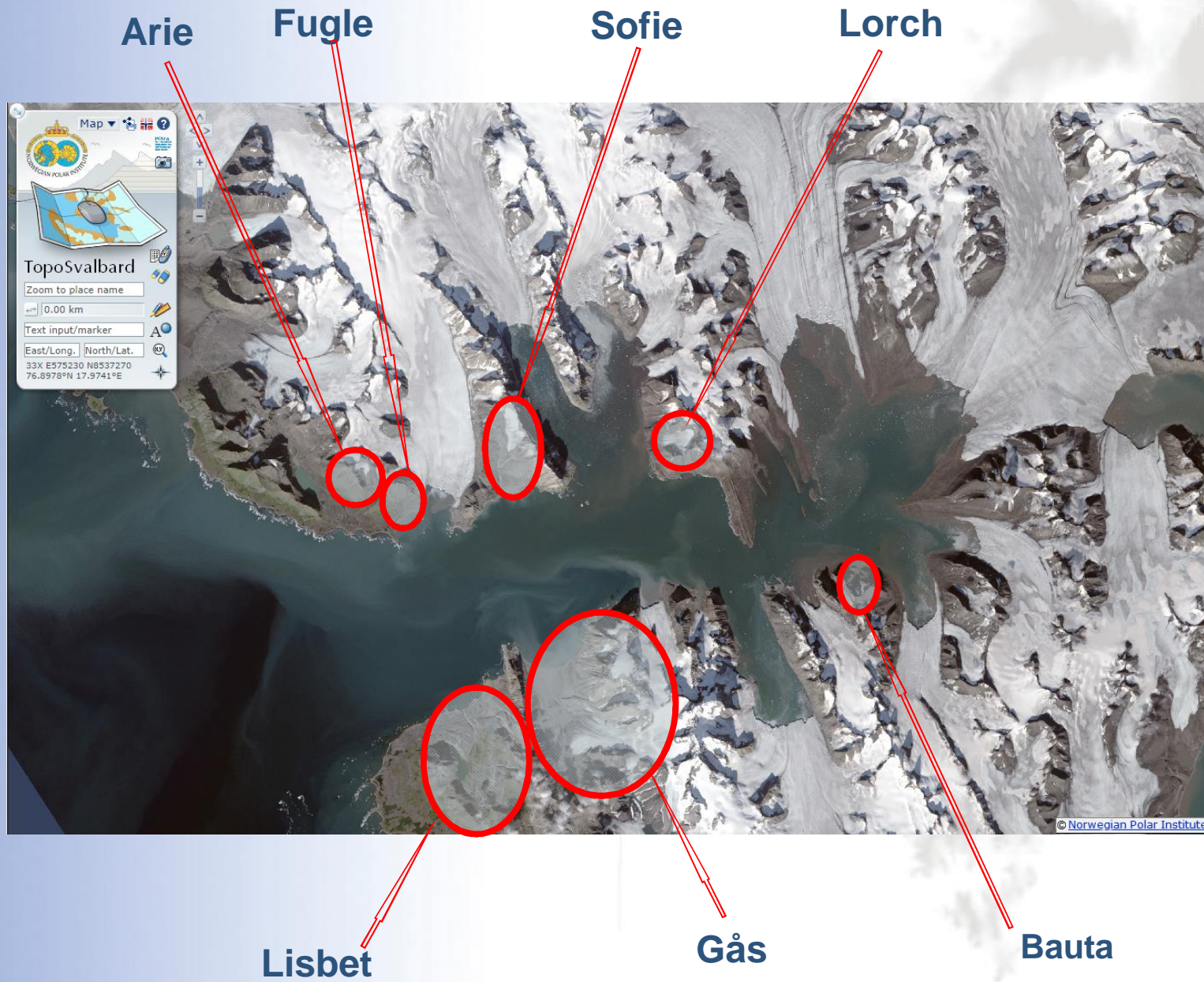
Aim of the research



Task 5.2. Studies of factors and regimes of outflow from specific terrestrial sources i.e. partly glaciated and unglaciated catchments



Catchments

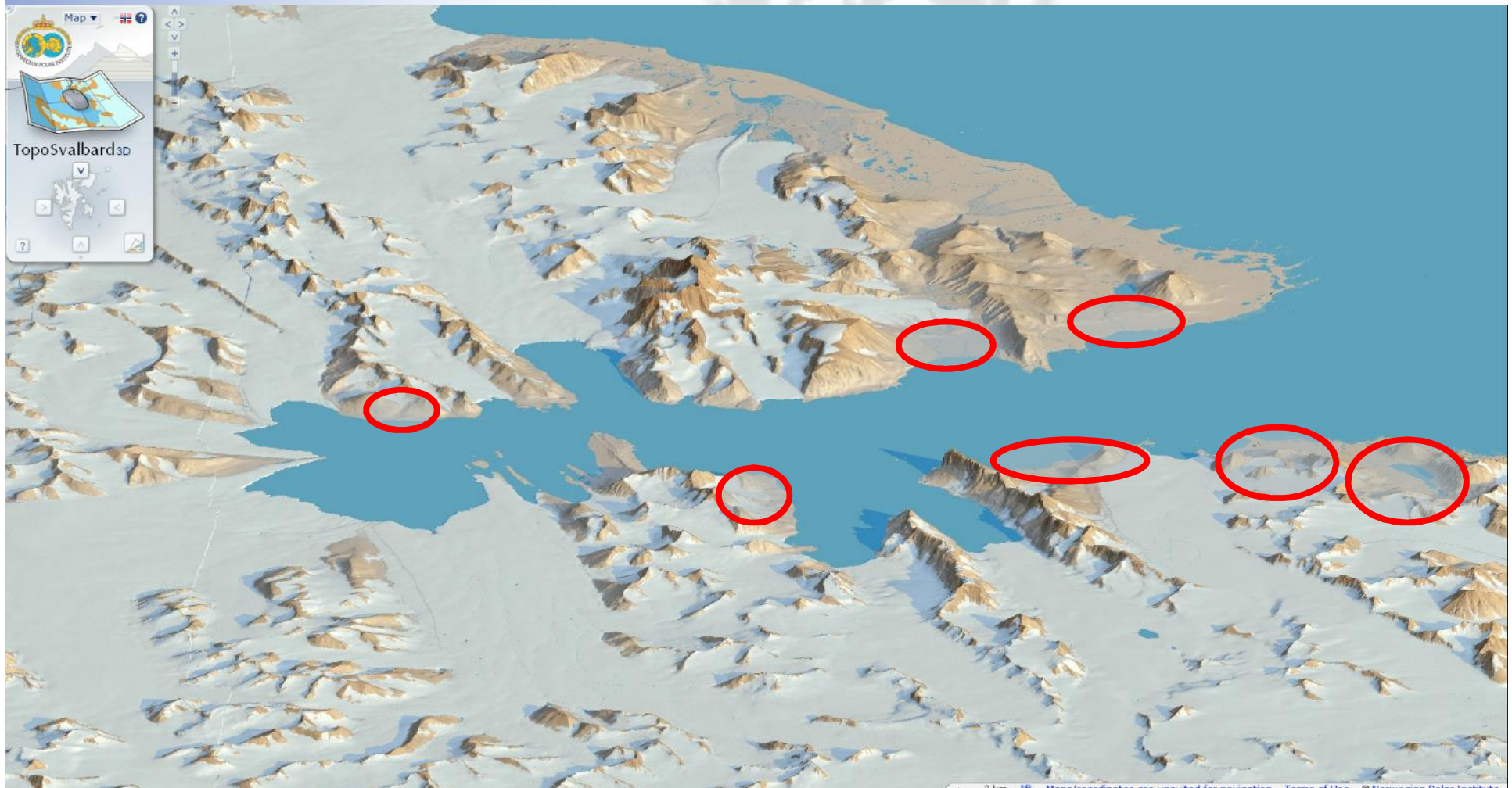


How much snow is accumulated and then melted away?



Snow cover

- More than 350 point measurements of depths and around 50 of snow water equivalent: Revdalen, Ariedalen, Fuglebekken, Oceanographer, Bogstranda, Lorchedalen, Bautadalen, Gåshamnoyra, Lisbetdalen





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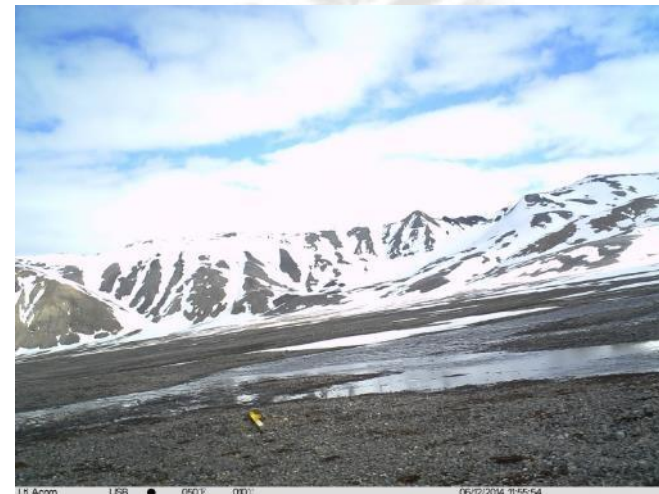
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Arjun Nawrot

Automatic time-lapse cameras

- Fuglebekken ○ Lisbetdalen
- Gåshamnoyra ○ Bautabreen



Fuglebekken

26.06



L: Acom FUGL 0397 004v 06/26/2014 22:22:53

31.07



L: Acom FUGL 0427 005v 07/31/2014 01:57:04

26.08



L: Acom FUGL 0617 007v 08/26/2014 15:28:37

30.08



L: Acom FUGL 0357 001v 08/30/2014 03:37:35



Temperature loggers



Mass balance

- Ariebreen
- Sofiebreen
- Lorchbreen
- Bautabreen



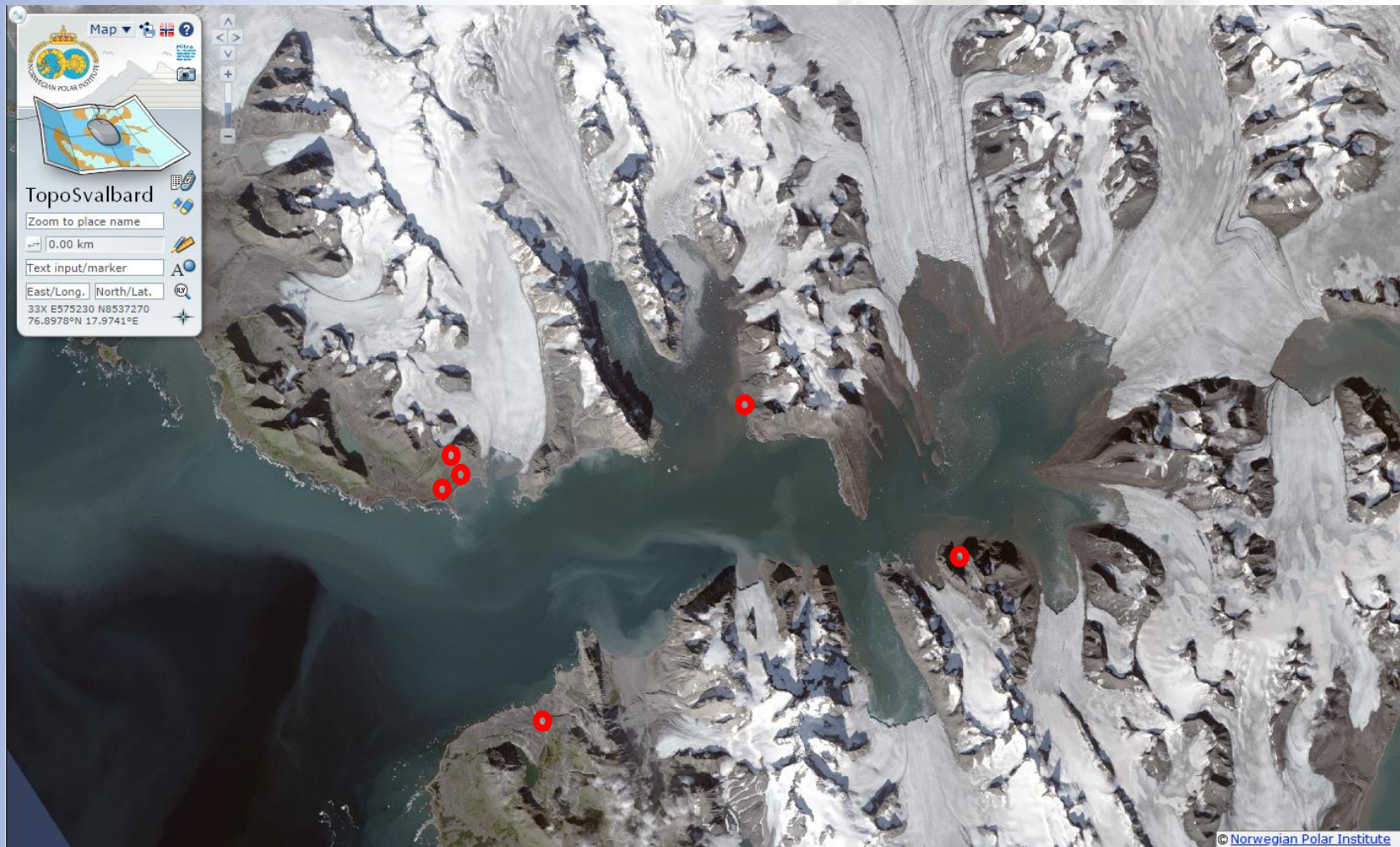
Ablation stakes and snowpits



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Sum of precipitation





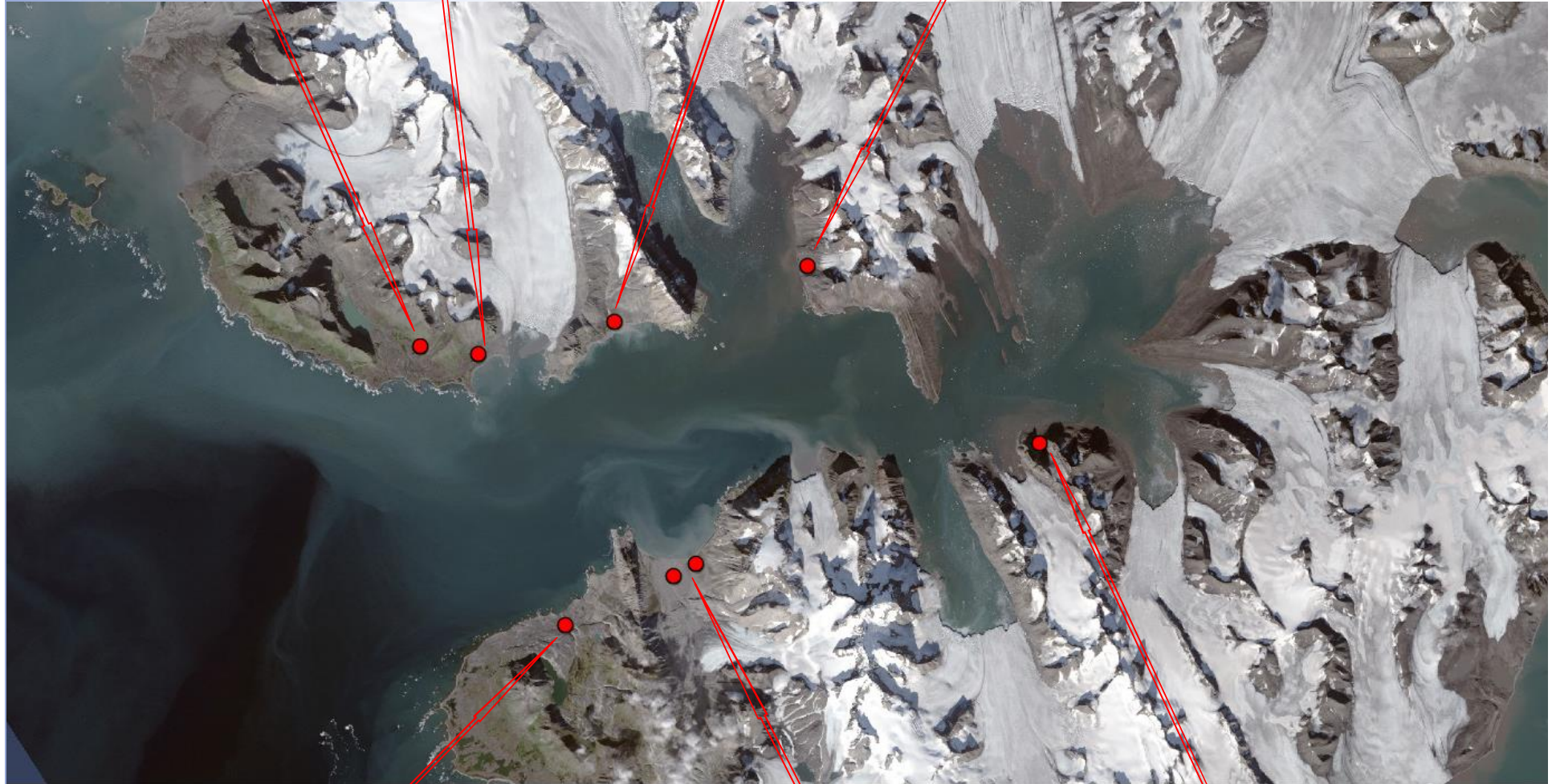
Discharge measurements (2014)

Arie
(once a week)

Fugle
(every 10
minutes)

Sofie (7)

Lorch (6)



Lisbet (6)

Gås (6)

Bauta (4)

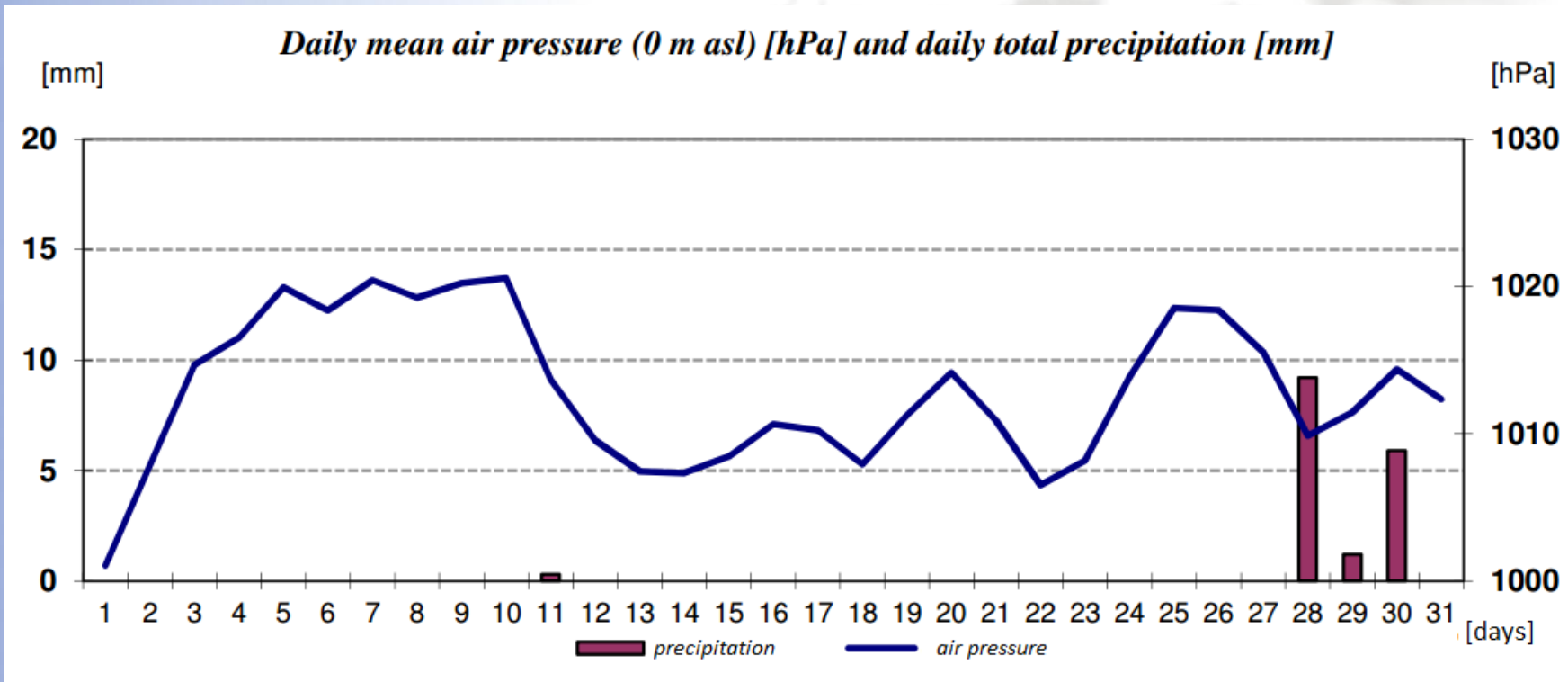
Hydromagnetic propeller measurements



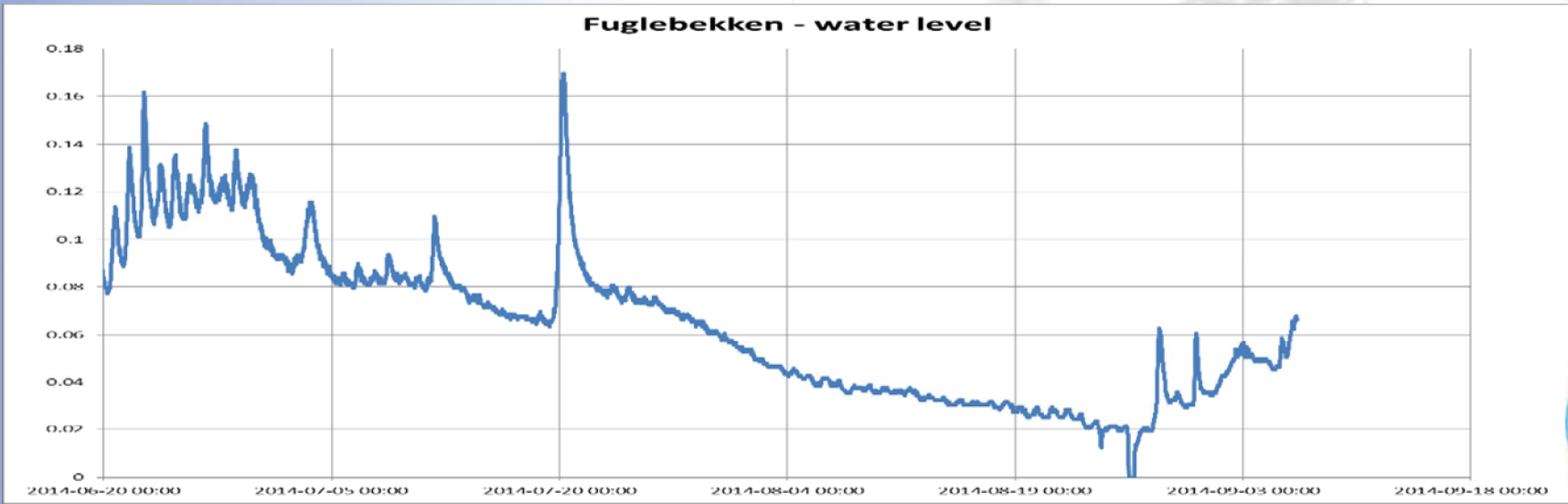
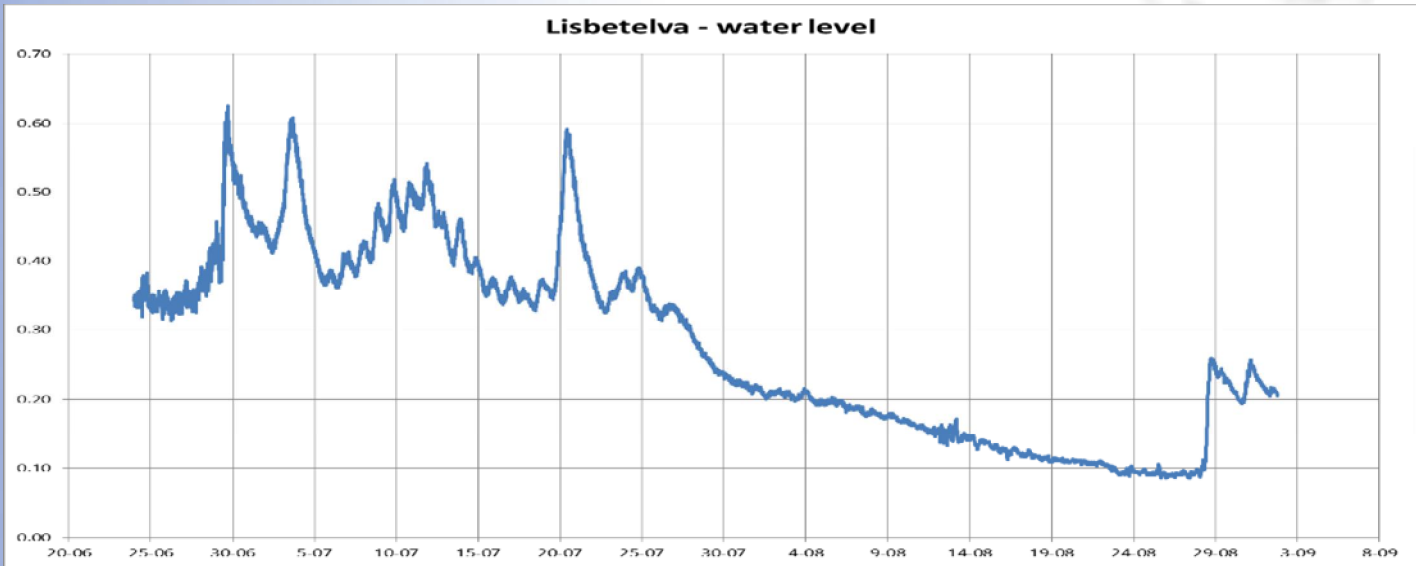
August 2014 - DROUGHT



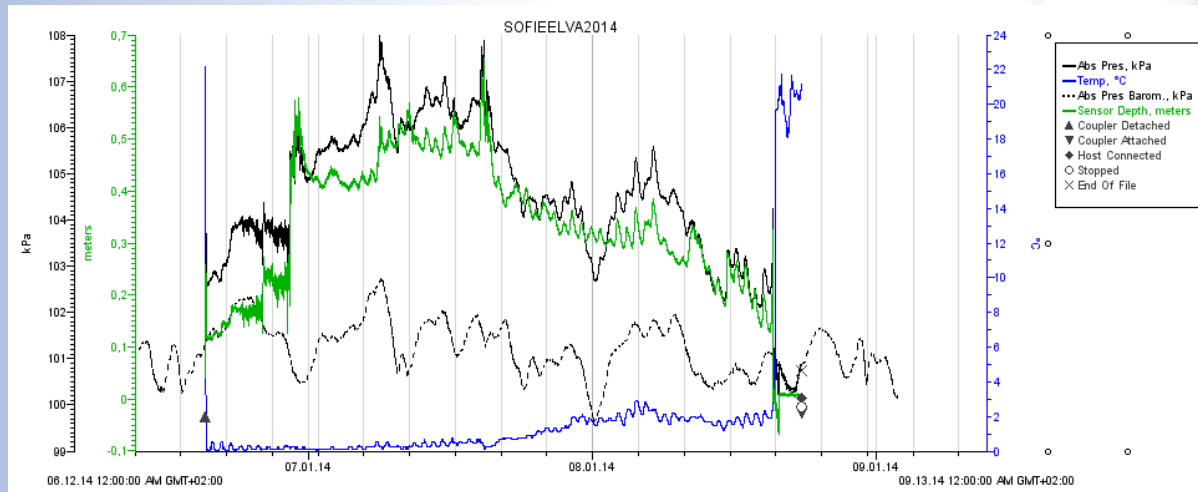
Precipitation at the Polish Polar Station in August 2014 amounted 16,6 mm



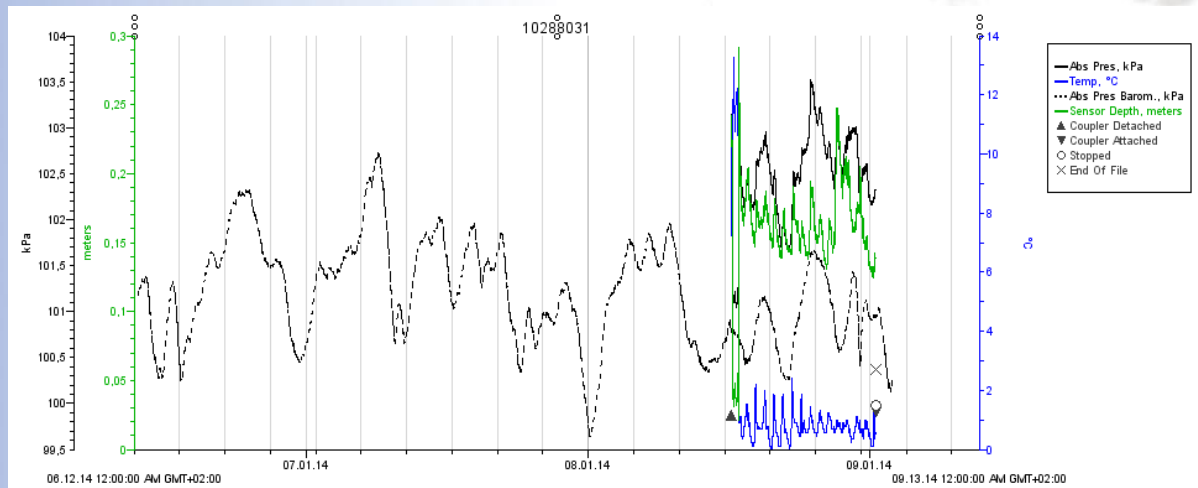
Water level loggers – measurements in every 10 minutes



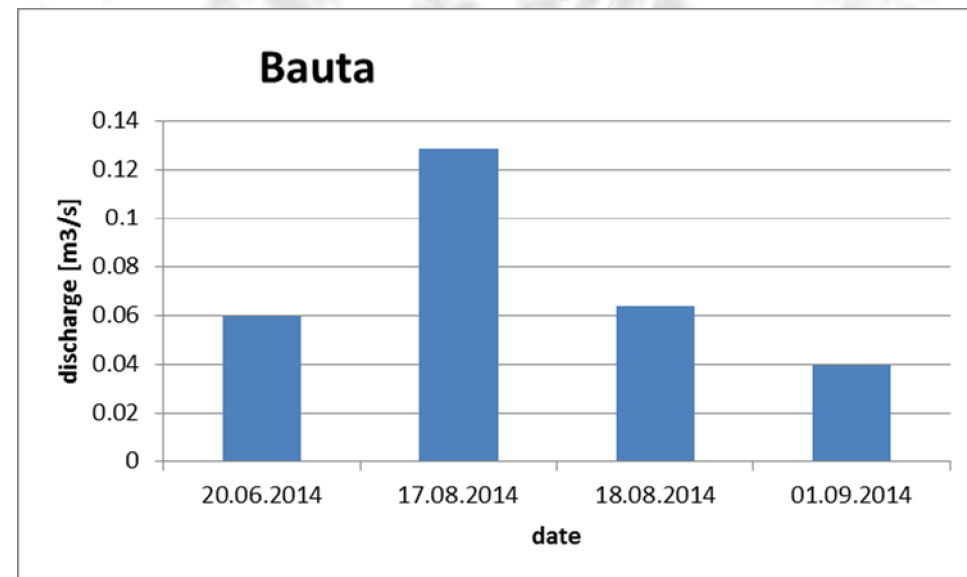
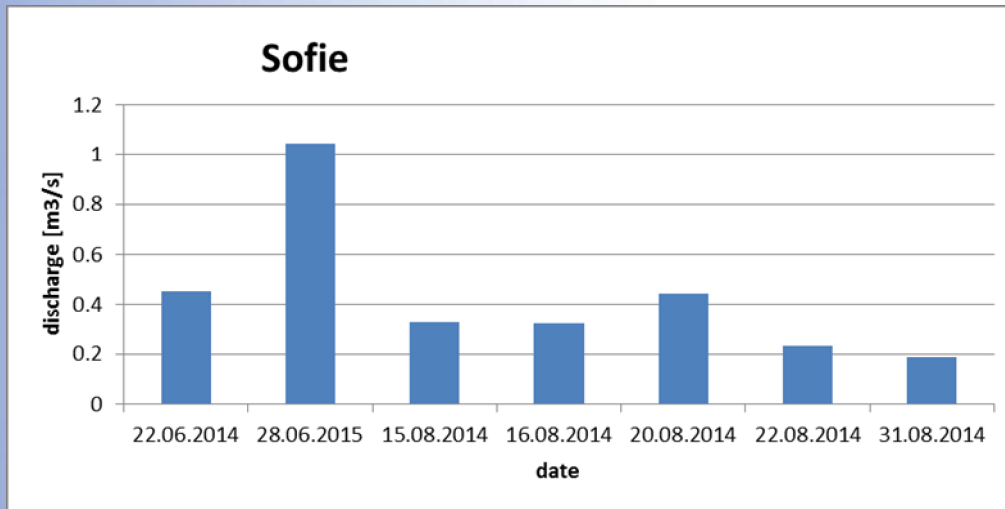
Sofie



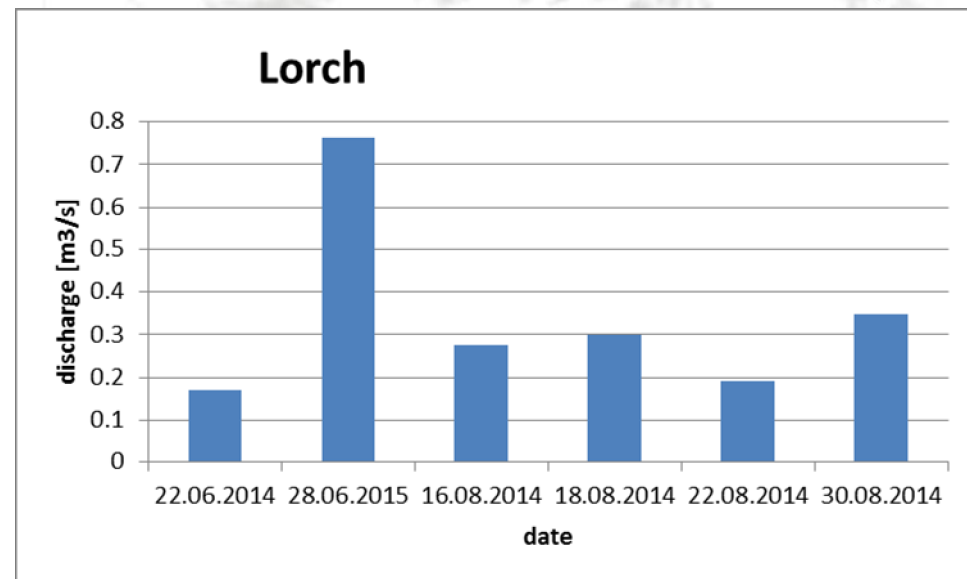
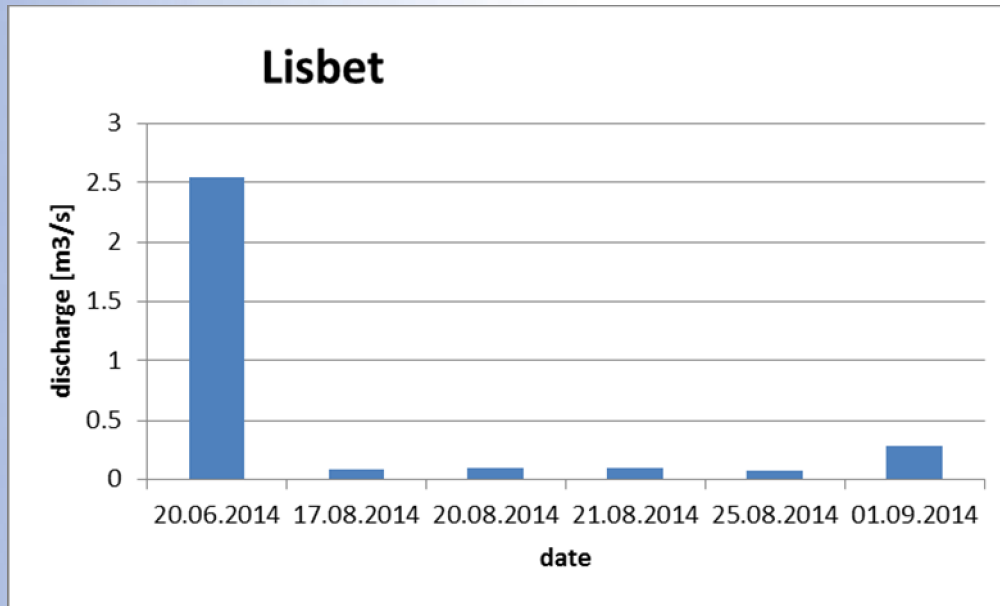
Bauta



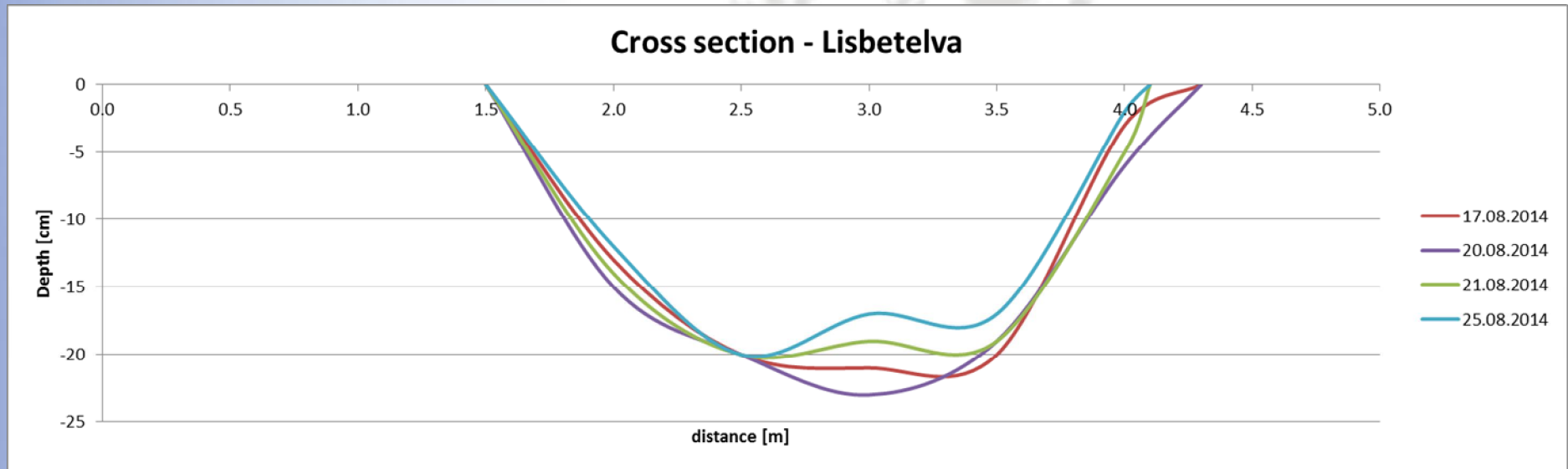
Discharge



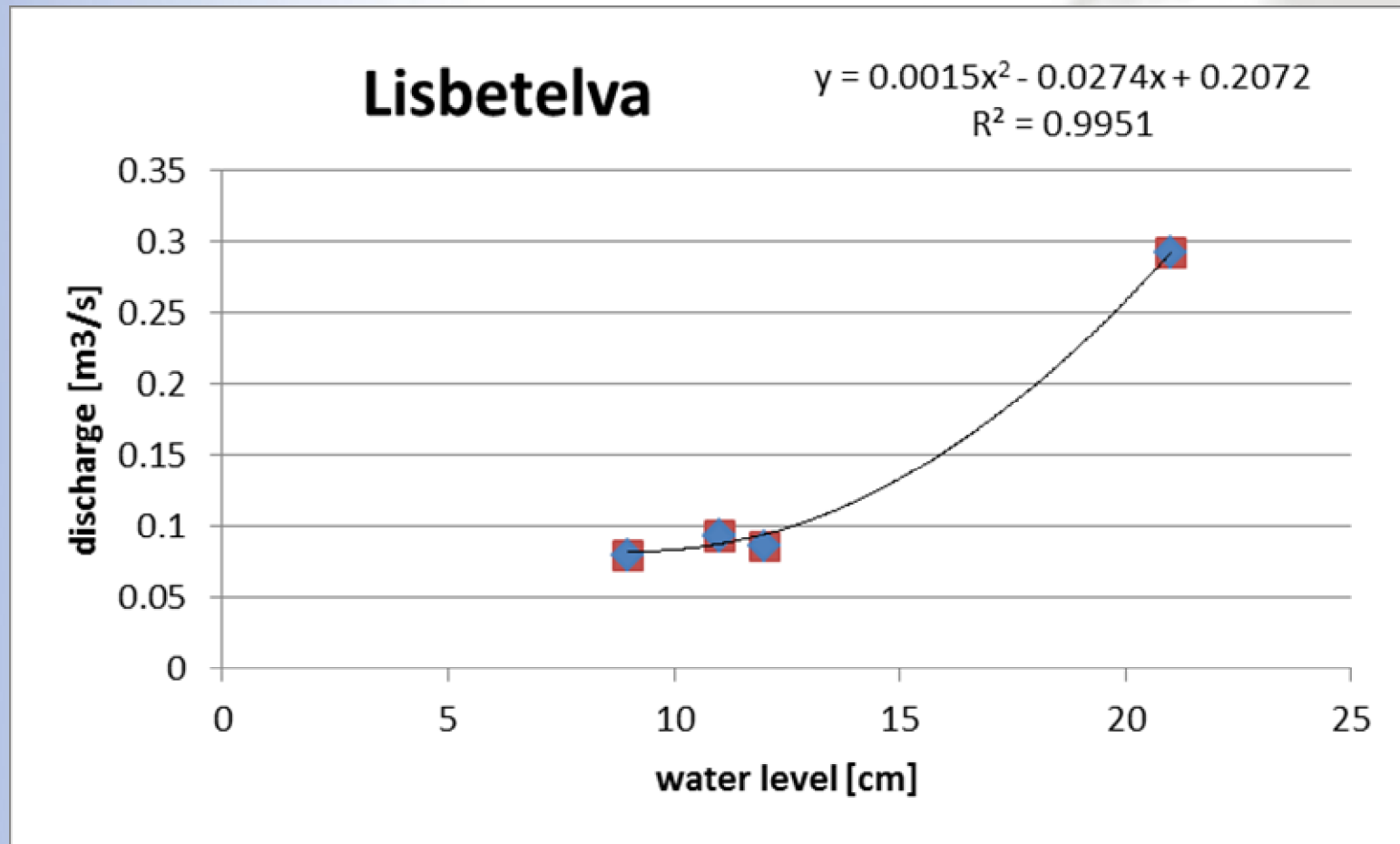
Discharge



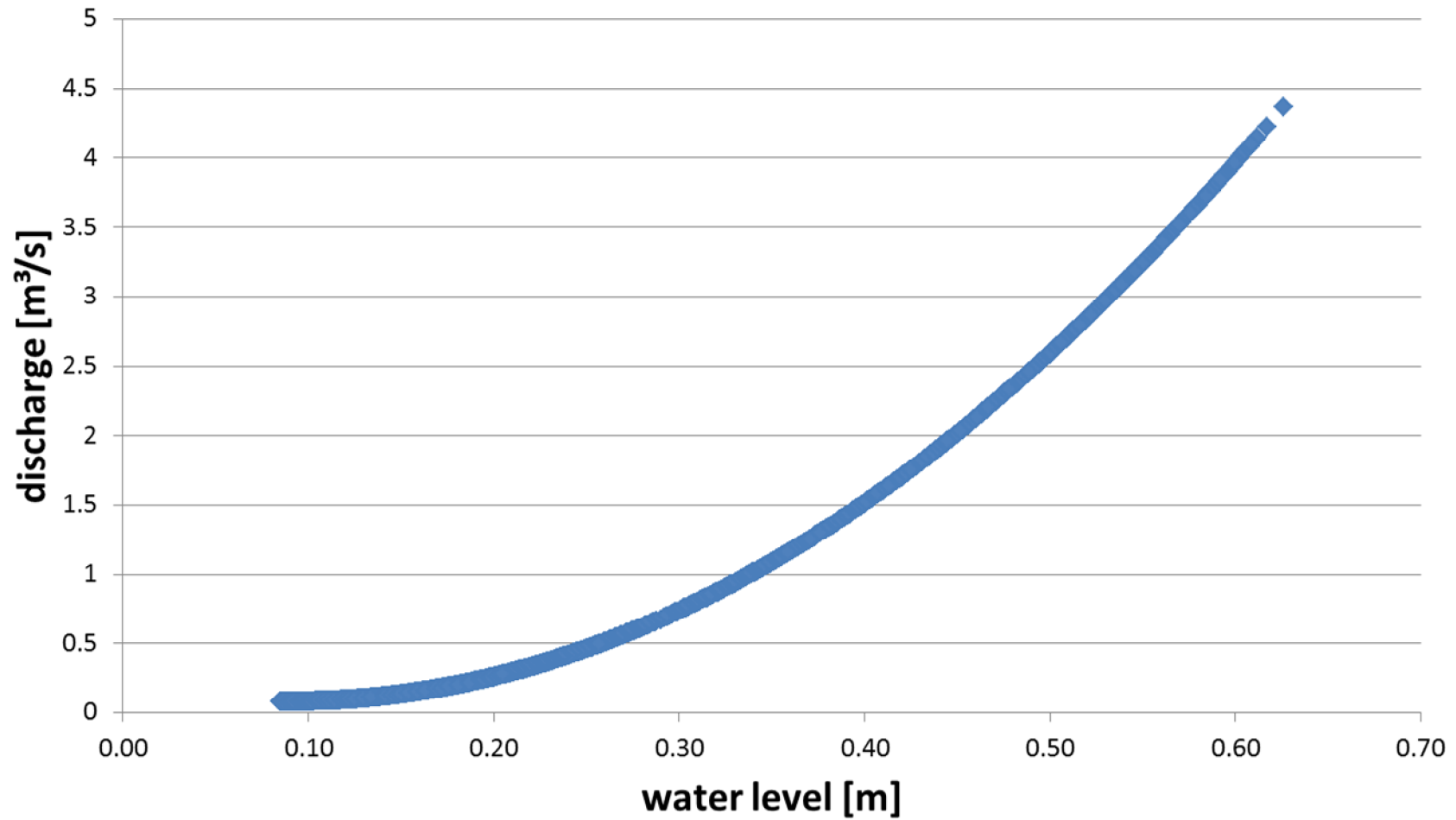
Morphodynamics of the bed



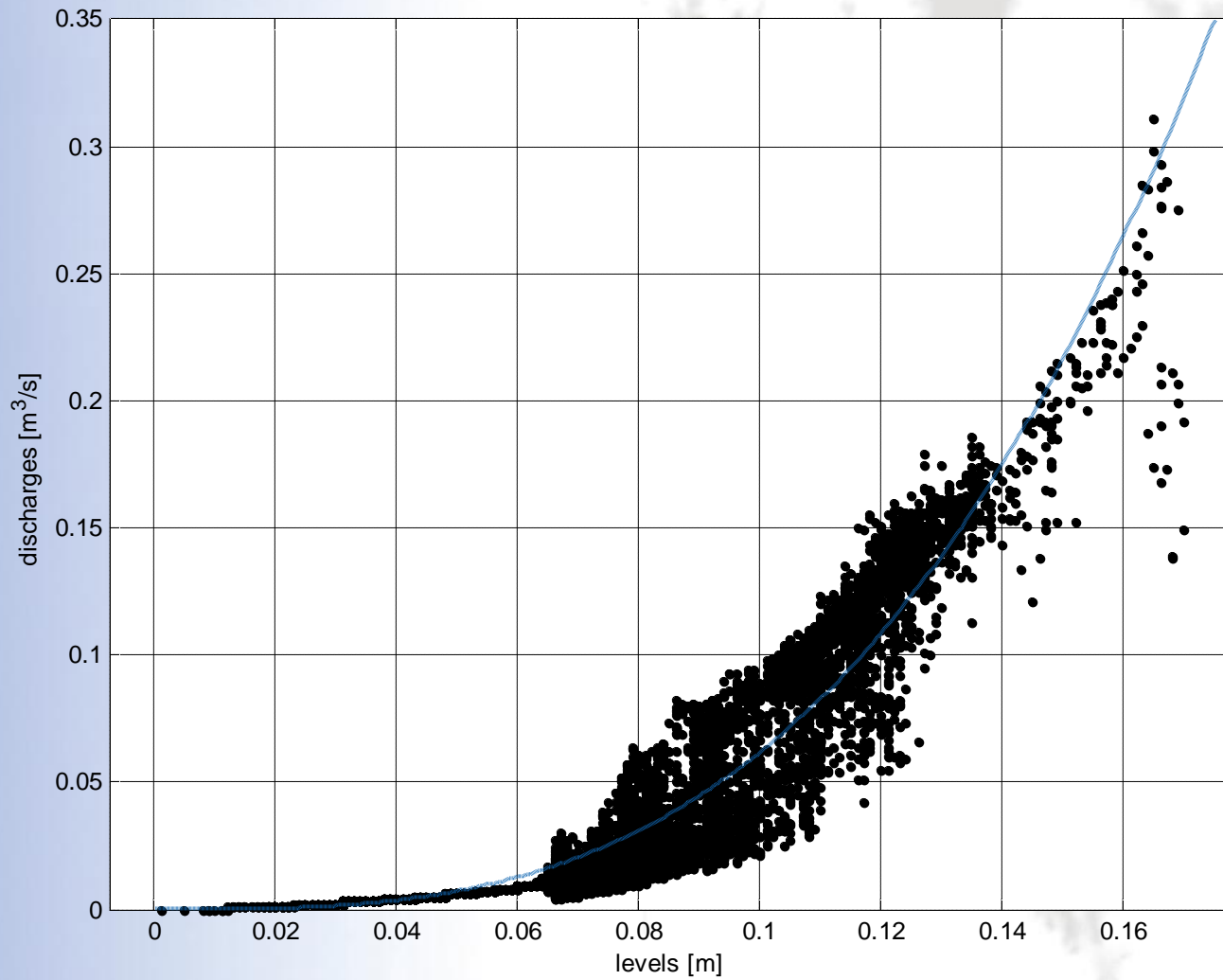
Rating curve (discharge versus stage)



Lisbetelva - rating curve



Rating curve - Fuglebekken



**How much fresh water is discharged to
Hornsundfjord? Calculating in progress...**



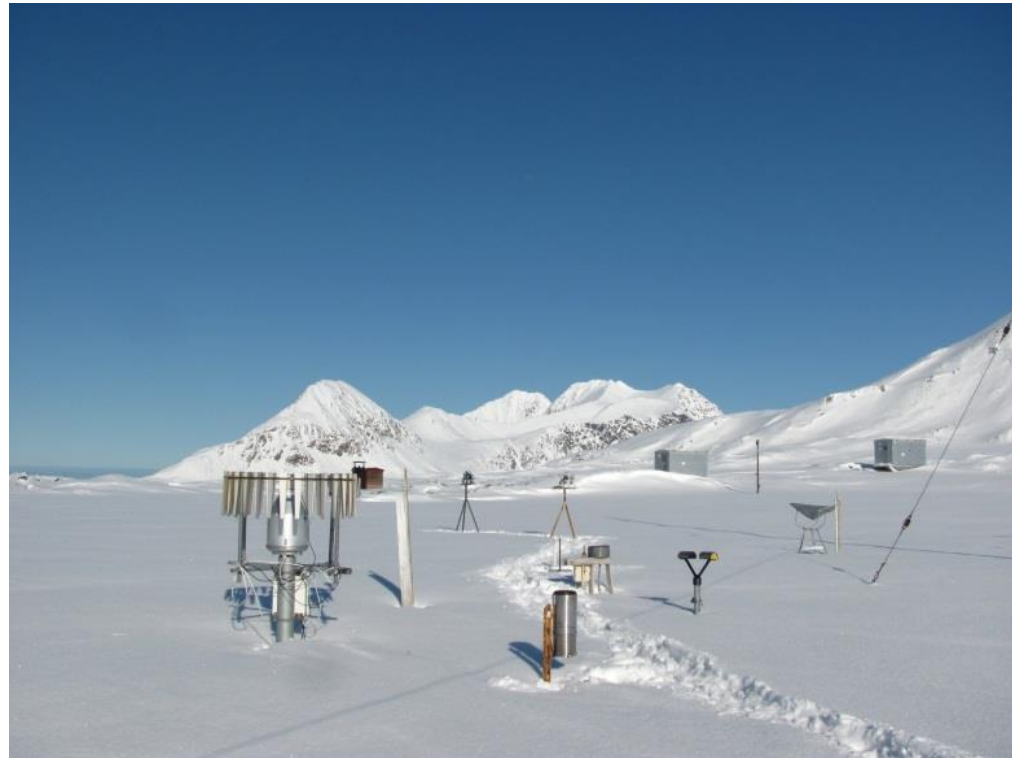
Data from Polish Polar Station Hornsund meteorological site



- Latitude: **N 77.00036°**
- Longitude: **E 15.53673°**
- Altitude: **8 m.a.s.l.**

Description:

- The meteorological station 01003 in Hornsund has been working as a part of World Meteorological Organisation since 1978.
- In every 3 hours observers working year-round at the station send meteorological observations as SYNOP-codes to Oslo.



Measured meteorological parameters:

- automatic weather station:
 - measurement of air temperature, air humidity, wind speed and direction, air pressure, ground temperature (5, 10, 20, 50 cm), solar radiation;
 - measurement of air temperature and air humidity (HMP 45D Vaisala), wind speed and direction (Vaisala WAV151, WAA151 and WindObserver™ II Gill Instruments), air pressure (PTB200A Vaisala), ground temperature (5, 10, 20, 50 cm)
 - modern laser-based optical system for continuous measurement of all kinds of precipitation (GEONOR and OTT Parsivel).
- manual measurements and observations:
 - precipitation (Hellman), visibility, cloud cover, total sunshine, snow cover and snow water equivalent, phenomena, total sunshine, water temperature on the shore of Hornsundfjord.

Programy międzynarodow x Hornsund GLACIO-TOPO x

← → ↻ 🏠 www.glacio-topoclim.org

Google Nowa karta met.no Ice Chart Ma... YR Weather forecast for... SpaceWeather.com ... Profil publiczny

Język strony: angielski Chcesz ją przetłumaczyć? Tłumacz Nie Nigdy nie tłumacz z języka an

www.glacio-topoclim.org

Hornsund GLACIO-TOPOCLIM database

- FRONT PAGE
- DATA ACCESS
- REPORTS
- PUBLICATIONS
- SITES
- LINKS



Hornsund GLACIO-TOPOCLIM Database

- **Mean annual air temperature in Hornsund (1979-2013) is -4.1°C**
 - **Minimum -35.9°C (16.01.1981),**
 - **Maximum +13.5°C (07.07.2005),**
 - **Maximum daily amplitude 22.5°C (16.02.1980).**
- **The warmest month is July with mean air temperature +4.4°C,**
- **The coldest month is February with mean temperature -10.5°C.**
- **Annual mean air pressure is 1008.2 hPa.**
- **Air humidity 80%.**
- **Annual sum of precipitation 458 mm.**
- **Annual mean wind speed 5.6 m/s.**

Linear trends of meteorological elements 1983 - 2013

$$y = \beta x + \alpha$$

		Temperature	Air pressure	Sum of precipitation	Mean wind speed	Air humidity	Total sunshine	Cloud cover	Days with fog
JAN	trend	↗	↗	↗	-	↘	-	↗	↗
	β	0.15	0.10	0.80	0.00	-0.02	-	0.04	0.07
FEB	trend	↗	↗	↗	↗	↘	↗	-	↘
	β	0.17	0.06	0.28	0.05	-0.07	0.07	0.00	-0.01
MAR	trend	↗	↘	↘	↗	↘	↘	↗	↗
	β	0.02	-0.04	-0.36	0.01	-0.08	-0.23	0.01	0.02
APR	trend	↗	↘	↗	↗	↘	↘	↗	↗
	β	0.09	-0.06	0.06	0.01	-0.03	-1.54	0.01	0.03
MAY	trend	↗	↗	↗	↗	↘	↘	-	↗
	β	0.05	0.04	0.17	0.06	-0.12	-1.38	0.00	0.03
JUN	trend	↗	↗	↘	↗	↘	↘	↘	↘
	β	0.03	0.06	-0.88	0.04	-0.07	-0.28	-0.01	-0.12
JUL	trend	↗	↗	↘	↗	↗	↘	↗	↗
	β	0.01	0.02	-0.01	0.00	0.02	-1.19	0.02	0.08
AUG	trend	↗	↗	↗	↗	↗	↘	↗	↗
	β	0.02	0.14	0.88	0.01	0.02	-0.02	0.01	0.11
SEP	trend	↗	↘	↗	↗	↘	↘	↗	↗
	β	0.05	-0.07	2.03	0.04	-0.02	-0.36	0.01	0.07
OCT	trend	↗	↗	↗	↗	↗	↗	↗	↗
	β	0.10	0.15	1.06	0.01	0.04	0.33	0.01	0.09
NOV	trend	↗	↘	↗	↗	↗	-	↗	↗
	β	0.19	-0.07	0.96	0.03	0.11	-	0.03	0.05
DEC	trend	↗	↗	↗	↗	↗	-	↗	↗
	β	0.24	0.09	0.73	0.01	0.09	-	0.04	0.02
ANNUAL	trend	↗	↗	↗	↗	↘	↘	↗	↗
	β	0.09	0.04	5.72	0.02	-0.01	-0.59	0.02	0.45

↗ Statistically significant trend

The coldest and the warmest months of the year

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1983	-8.9	-13.5	-7.8	-9.9	-3.5	0.8	4.3	3.3	1.6	-4.3	-12.7	-15.3	-5.5
1984	-7.2	-6.5	-11.4	-7.3	-2.6	2.1	4.3	4.0	2.0	-0.7	-2.7	-1.2	-2.3
1985	-10.2	-8.2	-9.2	-10.9	-3.1	1.8	5.0	3.8	1.3	-4.1	-7.4	-11.3	-4.4
1986	-13.6	-15.3	-8.8	-10.8	-2.4	2.3	4.2	4.0	-0.9	-2.0	-7.1	-9.9	-5.0
1987	-9.0	-14.9	-10.9	-7.2	-3.4	2.1	4.3	4.0	0.4	-4.2	-8.2	-15.3	-5.2
1988	-13.9	-10.5	-14.5	-14.2	-2.3	1.6	4.0	3.8	-0.7	-7.9	-14.9	-17.5	-7.3
1989	-14.6	-15.7	-12.5	-4.9	-1.2	2.3	3.9	3.8	1.6	-3.6	-7.1	-12.2	-5.0
1990	-4.8	-7.5	-11.4	-6.3	-2.2	2.2	5.4	4.5	4.5	-1.3	-9.7	-7.4	-2.8
1991	-9.1	-6.3	-7.6	-9.7	-2.8	1.4	4.5	5.2	1.2	-3.3	-9.2	-10.1	-3.8
1992	-10.5	-13.1	-9.5	-5.5	-2.0	2.4	5.0	3.9	2.6	-6.5	-4.6	-10.5	-4.0
1993	-14.3	-13.2	-12.5	-11.3	-3.4	1.4	4.3	4.4	-0.1	-7.5	-1.8	-9.3	-5.3
1994	-14.3	-11.3	-7.1	-5.0	-3.3	1.8	3.7	3.0	0.8	-6.4	-10.3	-6.1	-4.5
1995	-14.2	-10.7	-12.1	-5.6	-2.5	2.4	3.8	3.5	1.8	-5.0	-12.1	-12.6	-5.3
1996	-7.9	-12.0	-5.9	-8.8	-4.3	1.1	4.0	3.9	1.2	-2.2	-3.4	-14.3	-4.1
1997	-15.5	-12.5	-10.0	-11.3	-2.6	1.6	3.6	3.8	1.1	-3.1	-6.1	-7.4	-4.9
1998	-15.0	-16.1	-10.4	-10.1	-4.5	1.8	5.3	5.1	1.0	-2.0	-3.8	-10.2	-4.9
1999	-8.3	-10.9	-6.0	-8.8	-2.6	2.6	4.3	3.9	3.1	-3.3	-2.1	-8.5	-3.1
2000	-7.1	-9.4	-12.3	-11.4	-3.5	1.9	4.8	4.1	2.5	1.9	-1.9	-8.2	-3.2
2001	-6.5	-7.2	-13.7	-11.3	-2.7	2.0	4.6	4.7	3.1	-3.4	-8.3	-7.5	-3.9
2002	-10.7	-11.4	-13.9	-4.3	-3.7	3.2	5.5	5.3	0.7	-2.1	-3.9	-6.9	-3.5
2003	-16.4	-9.1	-15.1	-7.5	-2.0	2.3	4.7	4.4	1.2	-2.7	-4.6	-15.3	-5.0
2004	-13.8	-14.4	-4.9	-2.7	-2.3	1.3	4.7	3.5	2.0	-2.2	-9.3	-5.0	-3.6
2005	-5.9	-5.1	-12.5	-7.9	-2.2	1.9	4.3	4.6	0.6	-3.5	-2.5	-2.7	-2.6
2006	-1.7	-7.5	-12.0	-0.4	-0.2	3.1	4.7	4.6	1.1	-2.9	-2.7	-4.1	-1.5
2007	-7.4	-7.5	-5.6	-8.7	-2.1	2.7	4.2	4.3	1.6	-0.9	-3.4	-5.6	-2.4
2008	-5.0	-7.0	-13.4	-9.3	-1.6	2.4	4.2	3.9	2.9	-3.8	-6.0	-6.0	-3.2
2009	-9.9	-9.1	-8.9	-11.7	-0.8	2.7	5.3	4.3	1.9	-2.3	-0.6	-3.5	-2.7
2010	-5.3	-7.9	-13.2	-6.5	-0.5	1.7	3.8	3.6	2.5	-2.0	-8.4	-9.5	-3.5
2011	-12.5	-9.4	-9.9	-3.7	-1.7	3.2	3.9	4.2	4.1	-0.9	-3.8	-4.6	-2.6
2012	-1.9	-3.6	-3.5	-7.9	-2.0	2.2	4.7	4.6	2.9	-0.6	-3.9	-4.8	-1.1
2013	-6.3	-8.5	-13.6	-9.4	-1.2	3.3	5.9	5.8	4.5	-2.7	-6.1	-6.0	-2.9
2014	-3.0	-0.9	-6.8	-7.3	-1.9	3.3	5.6	5.0					

The coldest and the warmest of the months

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1983	-8.9	-13.5	-7.8	-9.9	-3.5	0.8	4.3	3.3	1.6	-4.3	-12.7	-15.3	-5.5
1984	-7.2	-6.5	-11.4	-7.3	-2.6	2.1	4.3	4.0	2.0	-0.7	-2.7	-1.2	-2.3
1985	-10.2	-8.2	-9.2	-10.9	-3.1	1.8	5.0	3.8	1.3	-4.1	-7.4	-11.3	-4.4
1986	-13.6	-15.3	-8.8	-10.8	-2.4	2.3	4.2	4.0	-0.9	-2.0	-7.1	-9.9	-5.0
1987	-9.0	-14.9	-10.9	-7.2	-3.4	2.1	4.3	4.0	0.4	-4.2	-8.2	-15.3	-5.2
1988	-13.9	-10.5	-14.5	-14.2	-2.3	1.6	4.0	3.8	-0.7	-7.9	-14.9	-17.5	-7.3
1989	-14.6	-15.7	-12.5	-4.9	-1.2	2.3	3.9	3.8	1.6	-3.6	-7.1	-12.2	-5.0
1990	-4.8	-7.5	-11.4	-6.3	-2.2	2.2	5.4	4.5	4.5	-1.3	-9.7	-7.4	-2.8
1991	-9.1	-6.3	-7.6	-9.7	-2.8	1.4	4.5	5.2	1.2	-3.3	-9.2	-10.1	-3.8
1992	-10.5	-13.1	-9.5	-5.5	-2.0	2.4	5.0	3.9	2.6	-6.5	-4.6	-10.5	-4.0
1993	-14.3	-13.2	-12.5	-11.3	-3.4	1.4	4.3	4.4	-0.1	-7.5	-1.8	-9.3	-5.3
1994	-14.3	-11.3	-7.1	-5.0	-3.3	1.8	3.7	3.0	0.8	-6.4	-10.3	-6.1	-4.5
1995	-14.2	-10.7	-12.1	-5.6	-2.5	2.4	3.8	3.5	1.8	-5.0	-12.1	-12.6	-5.3
1996	-7.9	-12.0	-5.9	-8.8	-4.3	1.1	4.0	3.9	1.2	-2.2	-3.4	-14.3	-4.1
1997	-15.5	-12.5	-10.0	-11.3	-2.6	1.6	3.6	3.8	1.1	-3.1	-6.1	-7.4	-4.9
1998	-15.0	-16.1	-10.4	-10.1	-4.5	1.8	5.3	5.1	1.0	-2.0	-3.8	-10.2	-4.9
1999	-8.3	-10.9	-6.0	-8.8	-2.6	2.6	4.3	3.9	3.1	-3.3	-2.1	-8.5	-3.1
2000	-7.1	-9.4	-12.3	-11.4	-3.5	1.9	4.8	4.1	2.5	1.9	-1.9	-8.2	-3.2
2001	-6.5	-7.2	-13.7	-11.3	-2.7	2.0	4.6	4.7	3.1	-3.4	-8.3	-7.5	-3.9
2002	-10.7	-11.4	-13.9	-4.3	-3.7	3.2	5.5	5.3	0.7	-2.1	-3.9	-6.9	-3.5
2003	-16.4	-9.1	-15.1	-7.5	-2.0	2.3	4.7	4.4	1.2	-2.7	-4.6	-15.3	-5.0
2004	-13.8	-14.4	-4.9	-2.7	-2.3	1.3	4.7	3.5	2.0	-2.2	-9.3	-5.0	-3.6
2005	-5.9	-5.1	-12.5	-7.9	-2.2	1.9	4.3	4.6	0.6	-3.5	-2.5	-2.7	-2.6
2006	-1.7	-7.5	-12.0	-0.4	-0.2	3.1	4.7	4.6	1.1	-2.9	-2.7	-4.1	-1.5
2007	-7.4	-7.5	-5.6	-8.7	-2.1	2.7	4.2	4.3	1.6	-0.9	-3.4	-5.6	-2.4
2008	-5.0	-7.0	-13.4	-9.3	-1.6	2.4	4.2	3.9	2.9	-3.8	-6.0	-6.0	-3.2
2009	-9.9	-9.1	-8.9	-11.7	-0.8	2.7	5.3	4.3	1.9	-2.3	-0.6	-3.5	-2.7
2010	-5.3	-7.9	-13.2	-6.5	-0.5	1.7	3.8	3.6	2.5	-2.0	-8.4	-9.5	-3.5
2011	-12.5	-9.4	-9.9	-3.7	-1.7	3.2	3.9	4.2	4.1	-0.9	-3.8	-4.6	-2.6
2012	-1.9	-3.6	-3.5	-7.9	-2.0	2.2	4.7	4.6	2.9	-0.6	-3.9	-4.8	-1.1
2013	-6.3	-8.5	-13.6	-9.4	-1.2	3.3	5.9	5.8	4.5	-2.7	-6.1	-6.0	-2.9
2014	-3.0	-0.9	-6.8	-7.3	-1.9	3.3	5.6	5.0					

Thank you for your attention

