

Real Time Hydrometric and Water Monitoring Platforms – New and Emerging Technologies

Scott Brown, M.Sc. – Integrated Systems



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ENVIRONMENTAL • INSTRUMENTATION • GEOTECHNICAL
SERVICE • INTEGRATED SYSTEMS • RENTALS

Real-Time Water Quality Monitoring Workshop – Govt. NFLD
Wednesday, November 8th, 2023

HOSKIN OVERVIEW



For over 75 years Hoskin Scientific has provided expert consultative support to find the right product to fit your application needs.



Whether you require monitoring or testing instrumentation, rentals or service, we are where you need us to be across Canada.



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ENVIRONMENTAL MONITORING



Sampling and monitoring instruments for air, water and soil for the environmental, agricultural, mining and forestry markets.

- Water Quality
- Meteorology and Climate Monitoring
- Surface Water Hydrology
- Groundwater & Remediation
- Coastal & Oceanographic
- Limnology & Fisheries Equipment
- Soil
- Plant Science
- Data Acquisition, Loggers & Software
- Museums & Conservation
- General Laboratory

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Outline for our time together...

1. Introduction to Sommer Messtechnik

- RQ30 Contact Free Discharge Measurement (new in CAN)
- Snow Water Analyzer (SWE and LWC) (new to market)



2. Sontek RS5 Acoustic Doppler Current Profiler define new...lets call '21 new(ish)



3. Real Time Climate and Camera Systems (always new)



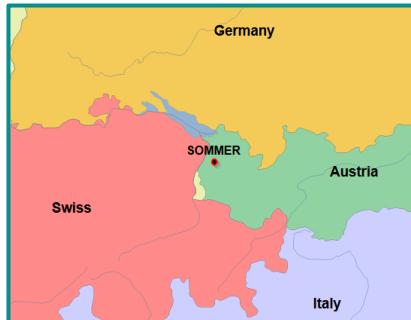
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SOMMER – Company Information

sommer was founded in 1987 in **AUSTRIA** and provides more than 30 years experience in development and production of high quality and **innovative measurement equipment** for hydrology and meteorology.

sommer is a **family owned company** with excellent reputation. Customer focus, reliability, excellent service and high-end products are our commitment to you.



SOMMER Headquarter is located in west Austria



SOMMER production facility





SOMMER – Area of activity



Meteorology – Measurement of different snow parameters and snow melt analysis



Hydrology – Discharge and water level measurement of Rivers and streams
Flood warning systems and networks



Sewer and industrial waters – Discharge measurement of open manmade channels and sewer systems



Mining industry – Measurement of water resources in snow and measuring of water flows in the mining process



Ice detection – Detection of ice and ice growth in different industries. (Wind power, Aviation, Power lines communication, Railway,...)



Sommer RQ-30 Contact Free Discharge Measurements



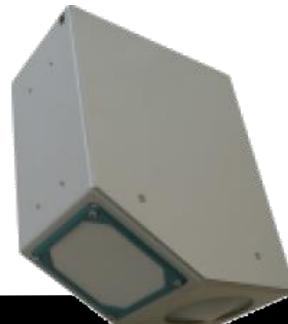


CONTACT FREE DISCHARGE MEASUREMENT



Advantages of Contact free discharge measurement with RQ-30

- ✓ Contact free measurement
- ✓ Easy mounting and installation
- ✓ Maintenance free (because not in the water)
- ✓ High reliability at floods
- ✓ No damage of sensor by flotsam, trees, debris, bed load,...
- ✓ Discharge calculation in the sensor



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RQ-30 WATER LEVEL SENSOR



Water level (stage)

Transit time measurement

Radar (26 GHz) Vertical to water surface

Time between transmitting and reflecting the pulse = directly proportional to the distance

Radar: independent of air temperature and medium (e.g. foam)





RQ-30 VELOCITY SENSOR



Flow velocity

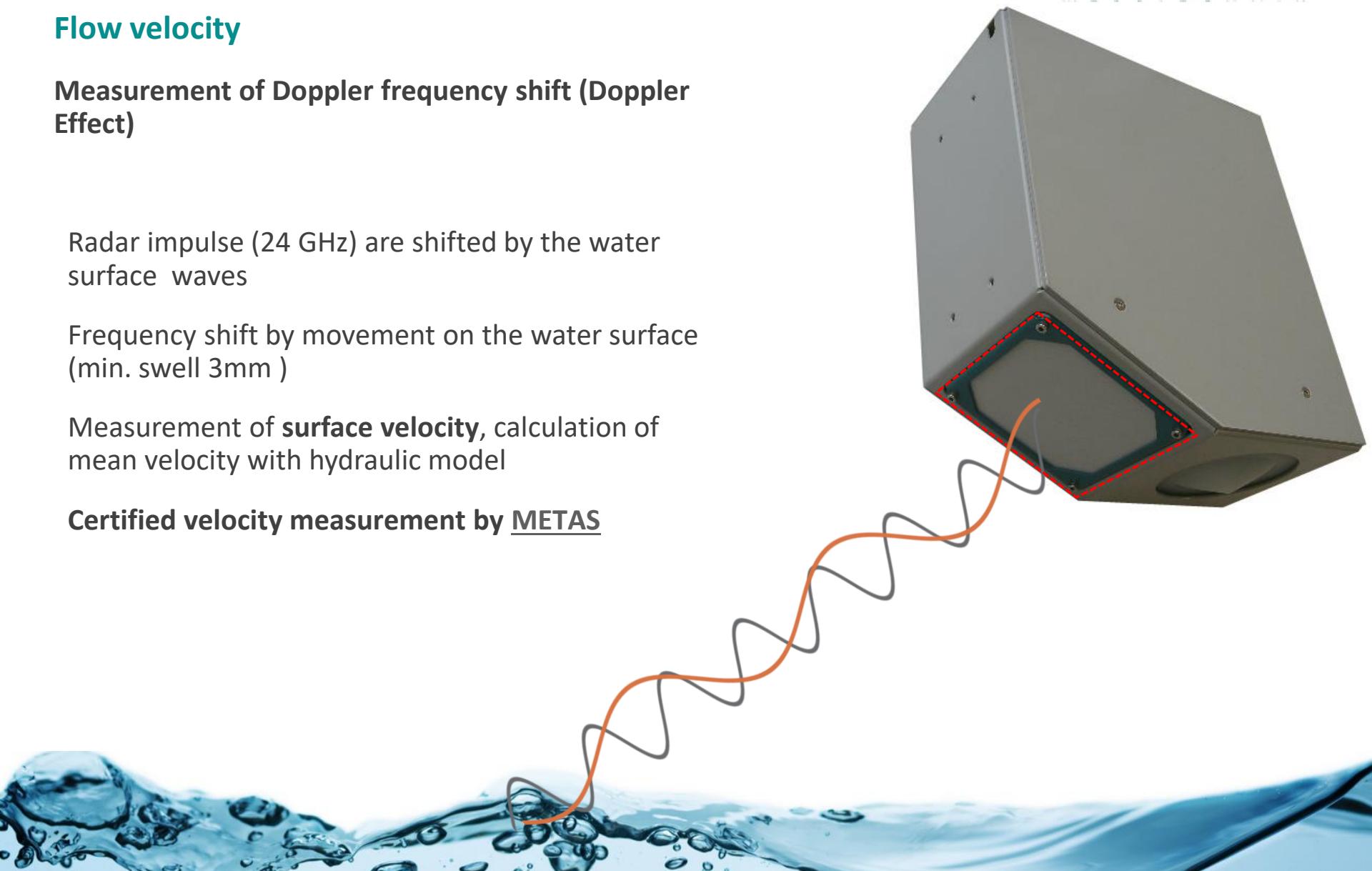
Measurement of Doppler frequency shift (Doppler Effect)

Radar impulse (24 GHz) are shifted by the water surface waves

Frequency shift by movement on the water surface (min. swell 3mm)

Measurement of **surface velocity**, calculation of mean velocity with hydraulic model

Certified velocity measurement by [METAS](#)





RQ-30 - RATING CURVE



Water level sensor with Rating Curve

Investment costs look lower (but operation cost are high)

Need Rating curve to calculate discharge

Good rating curve need up to 2 years to create

Very expensive equipment necessary to create rating curve (current meter, ADCP boats)

No accurate flood measurement (rating curve need to be calculated)

Only water level information to get to the discharge

No information about velocity change

If riverbed change, NEW rating curve necessary !!

Flood warning only with water level

NO information about the real flow

RQ-30 Method

Same infrastructure and same RTU station

Calculates discharge in the sensor

Discharge right after the installation available

NO reference measurements necessary (but possible)

Reliable Measurement even during floods

Water level and velocity to calculate accurate discharge

Detection of dynamic processes in the water

Detection of riverbed change

Hysteresis

...

Input new cross section and DONE

Earlier warning of floods (velocity increase)

Detection of flow stop, blockage and backwater





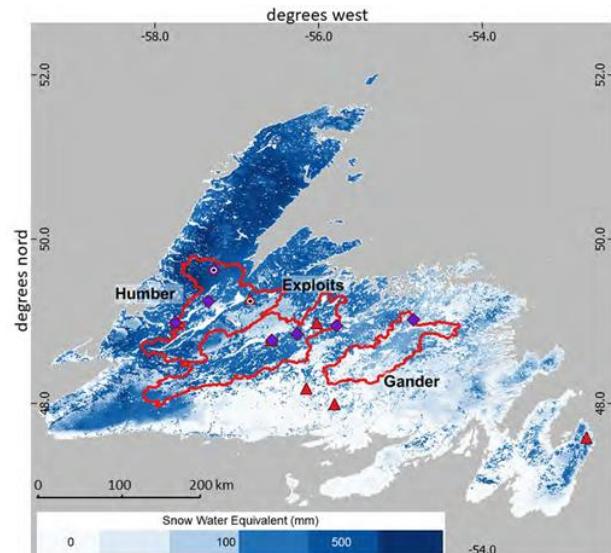
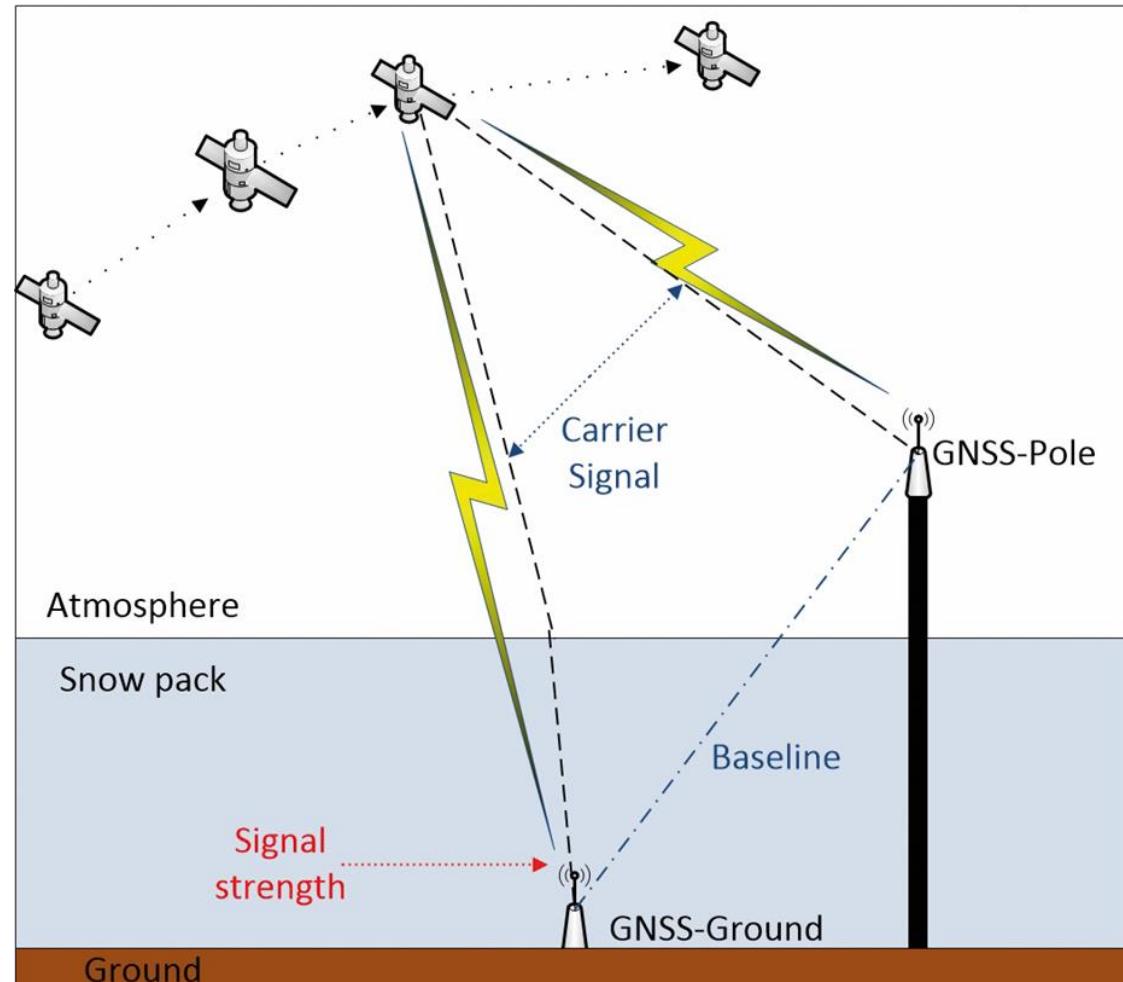
RQ-30 – OPERATING IN FLOODS

Limits of conventional discharge measurement during flood conditions

- Manual measurement (current meter e.g. ultrasound, ADCP boat, ...) not possible
- Damage of instrumentation by bed load, trees,...
- Danger for employees during manual measurement
- Availability of employees during the flood for measurement jobs
- extrapolation of stage-discharge curve $Q(h)$ at high flow conditions



Sommer SWA – Snow Water Analyzer



 **geosciences**

 **MDPI**

Article
Advances in Snow Hydrology Using a Combined Approach of GNSS In Situ Stations, Hydrological Modelling and Earth Observation—A Case Study in Canada

Florian Appel ^{1,*}, Franziska Koch ^{2,3}, Anja Rösel ¹, Philipp Klug ¹, Patrick Henkel ⁴, Markus Lamm ⁴, Wolfram Mauser ^{1,3} and Heike Bach

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SWA – Snow Water Analyzer

Unique Concept:

Using GNSS for snow monitoring

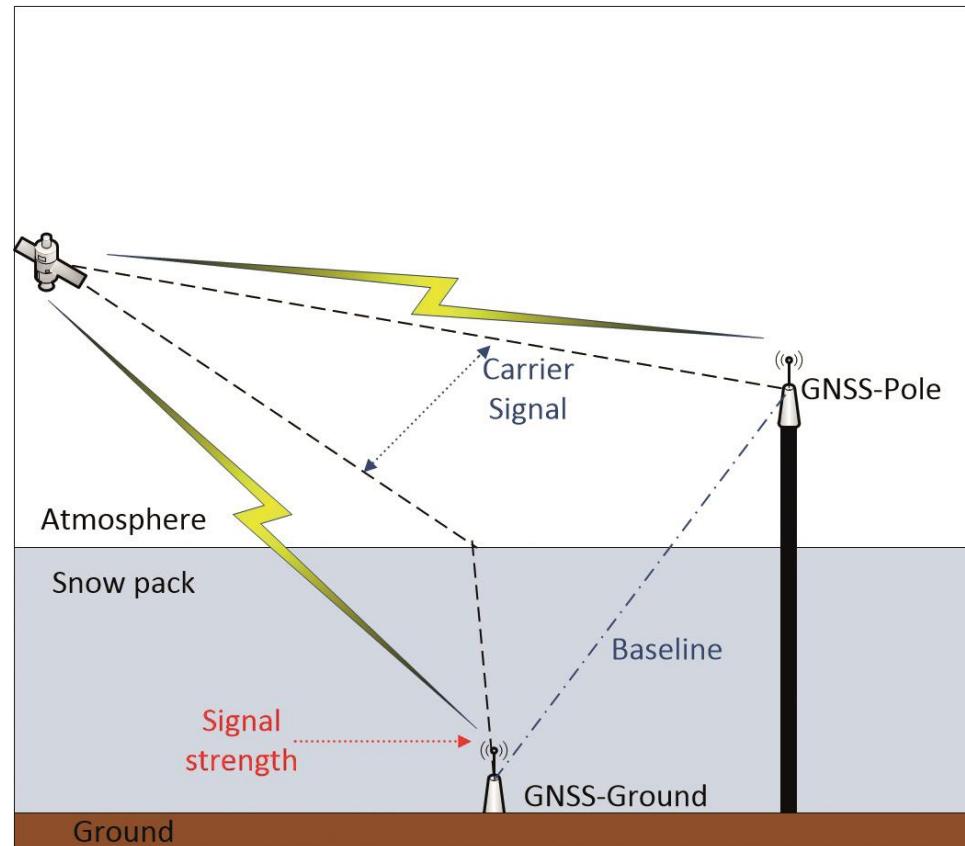
Using energy efficient low-cost hardware

Using stat-of-the-art sensor communication

GPS:

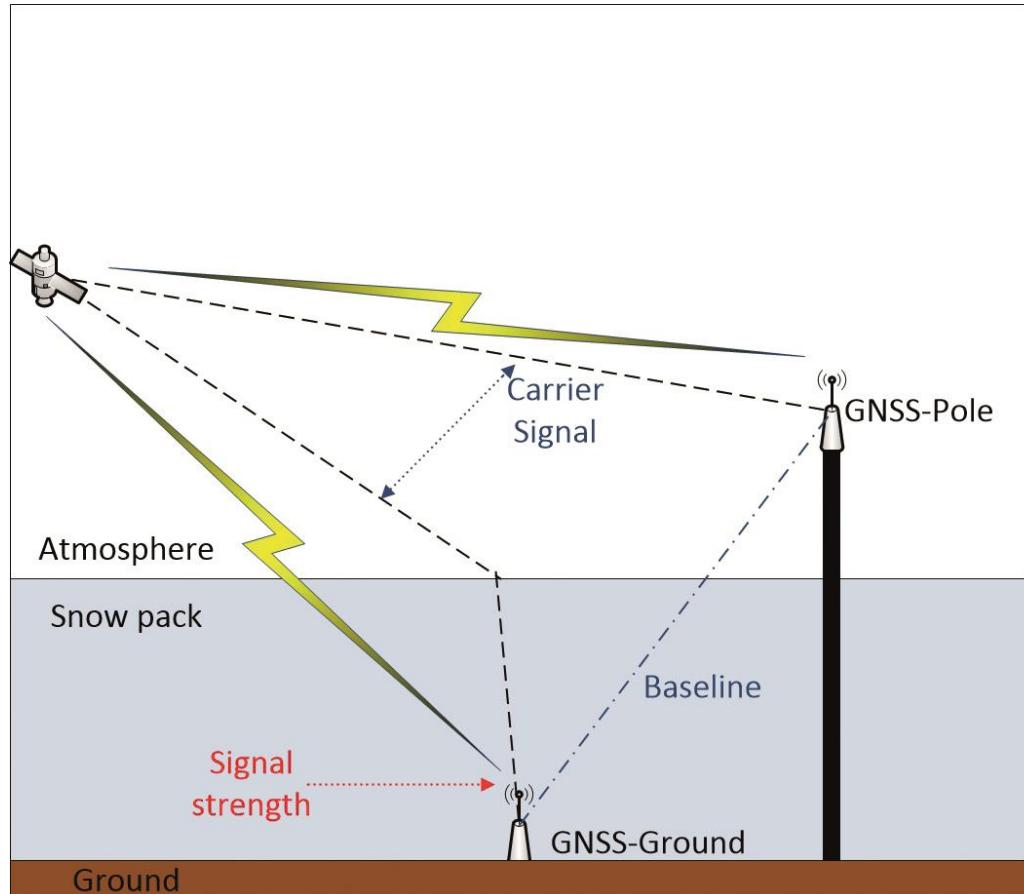
- L1-Band 1.575GHz
- 32 Satellites at 20.200Km Orbit
- 23h56min repetition

Manufactured in cooperation with
SNOWSENSE™





SWA – Snow Water Analyzer

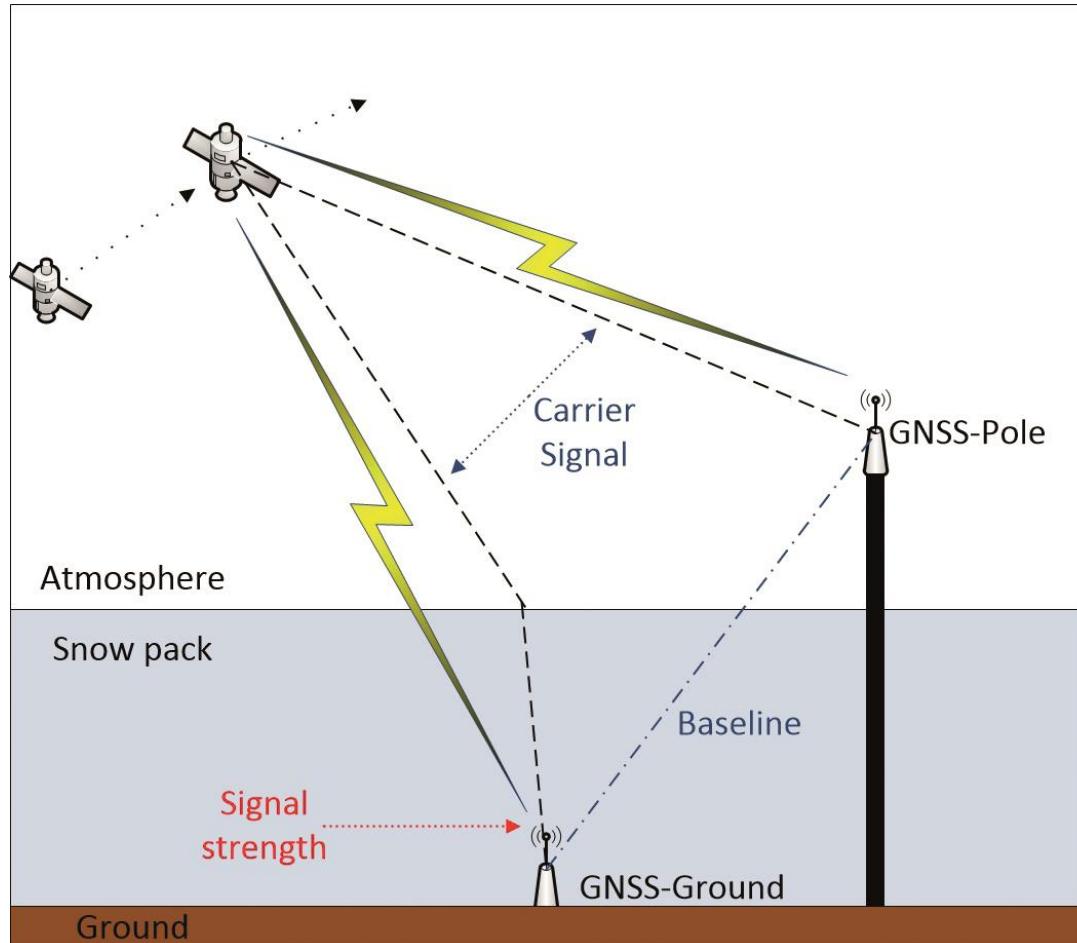


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SWA – Snow Water Analyzer

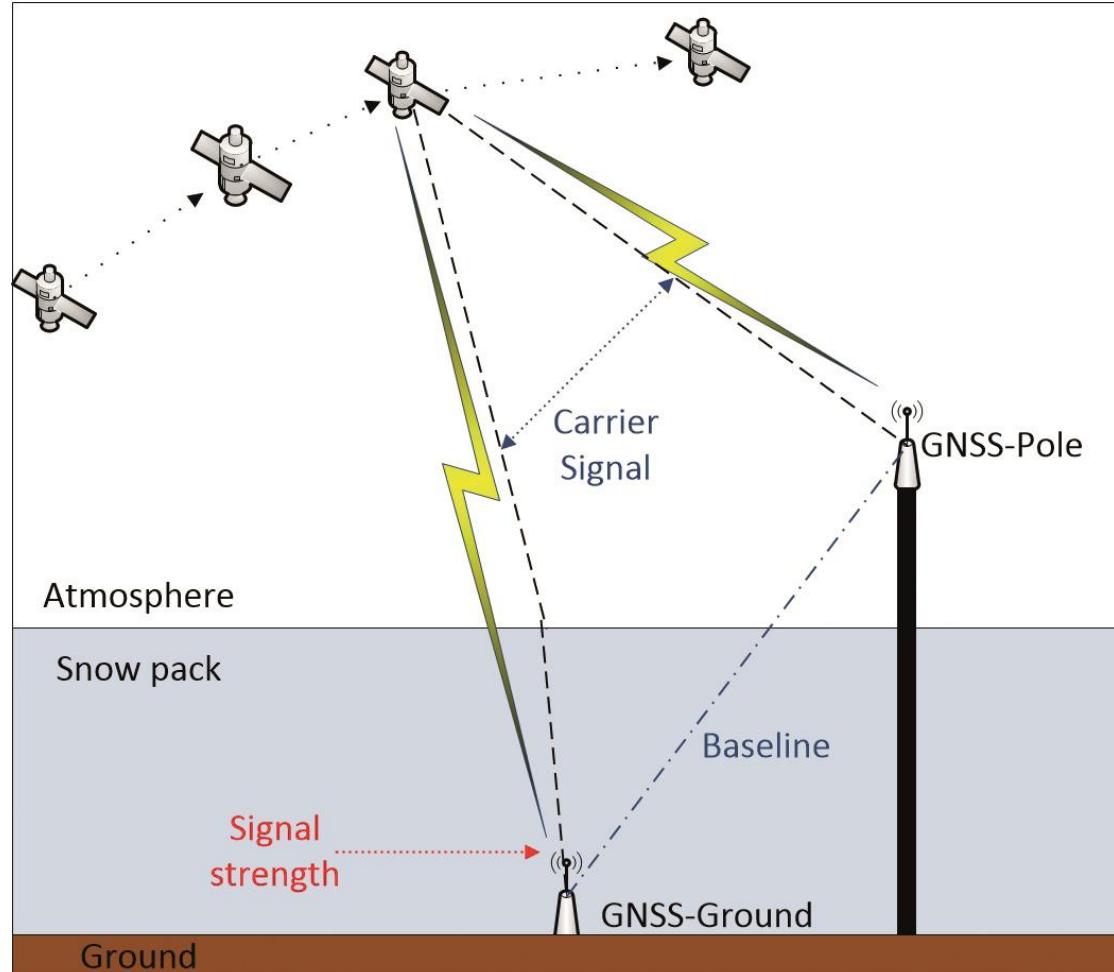


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SWA – Snow Water Analyzer

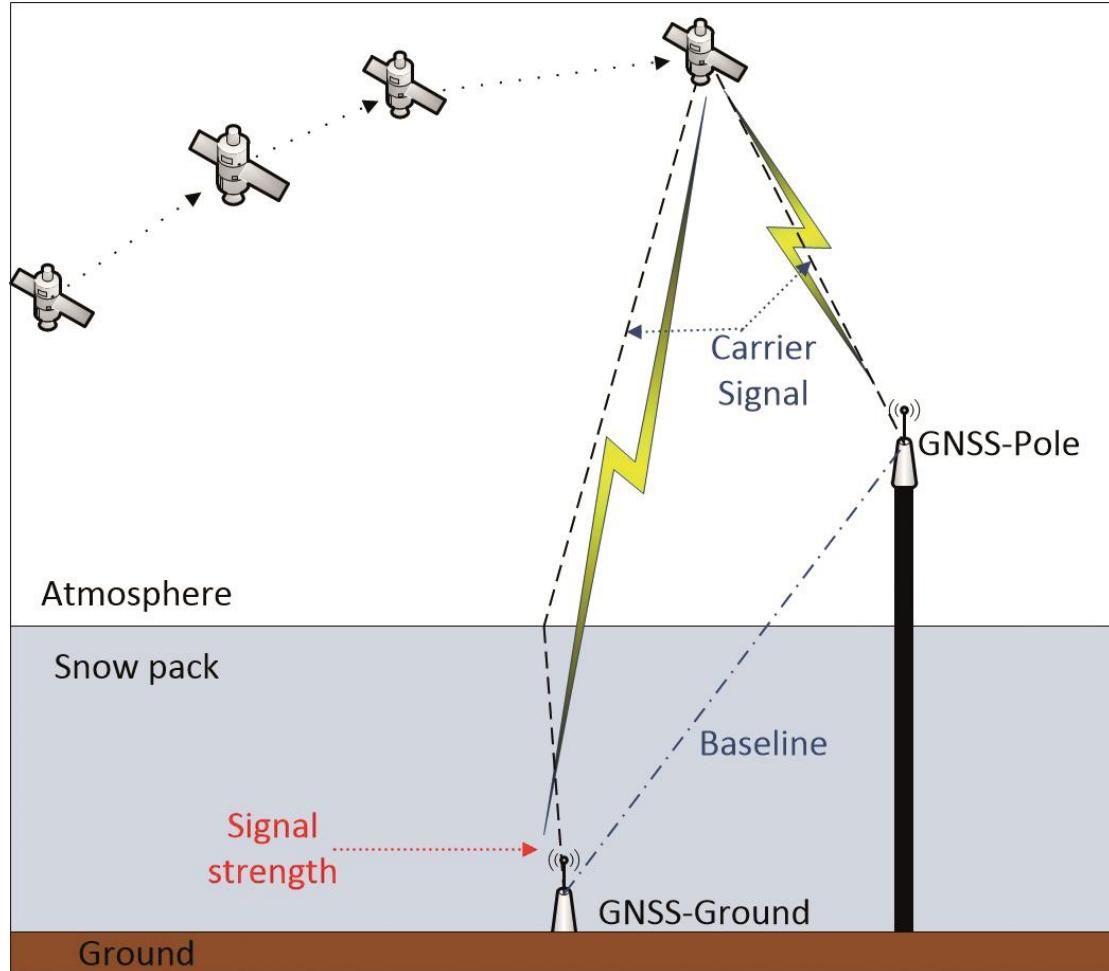


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SWA – Snow Water Analyzer



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SWA – Snow Water Analyzer

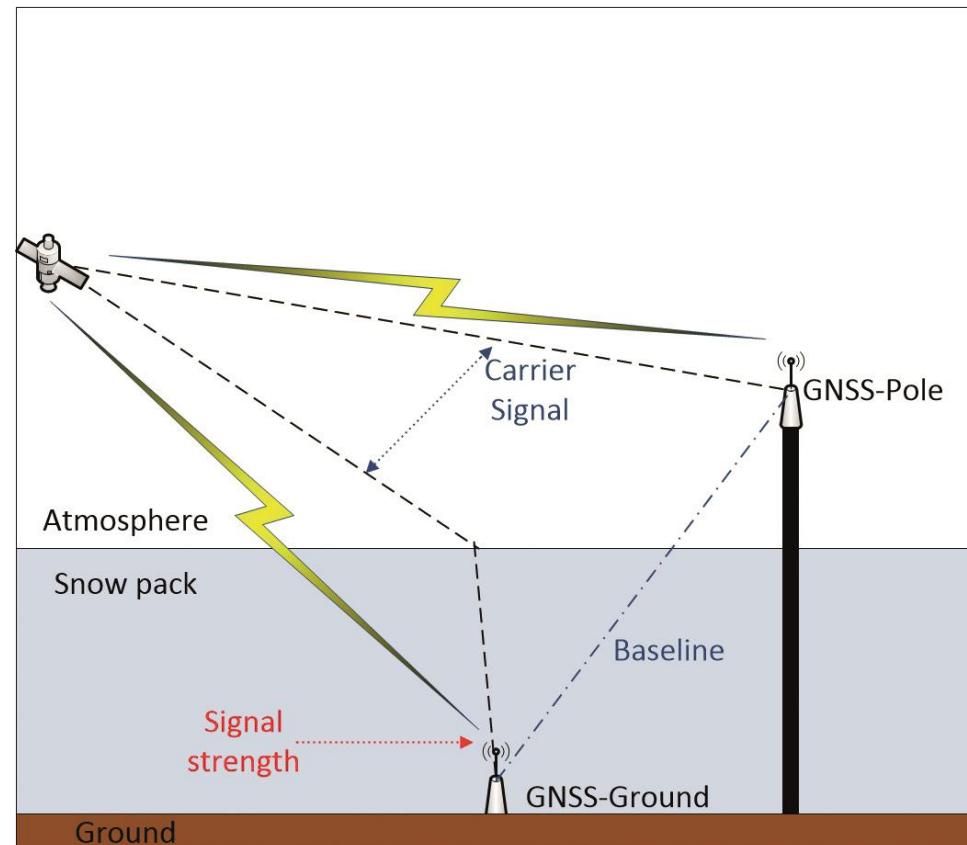
How do we do it?

SWE Measurement:

- Using the delay /Carrier Phase

LWC Measurement:

- Using the C/NO Signal (Signal strength)
- C/NO Signal/SNR



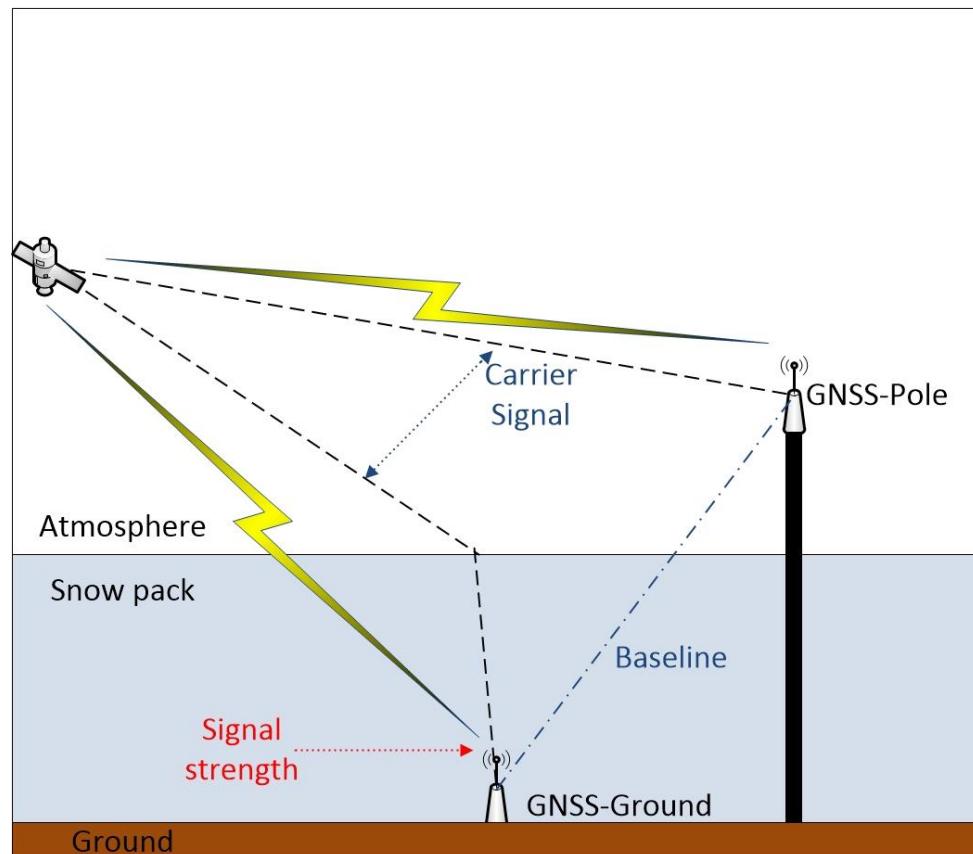


SWA – Snow Water Analyzer

Measuring SWE:

SWE Measurement:

- Using the delay /Carrier Phase
- The SWE is causing a phase shift of the signal



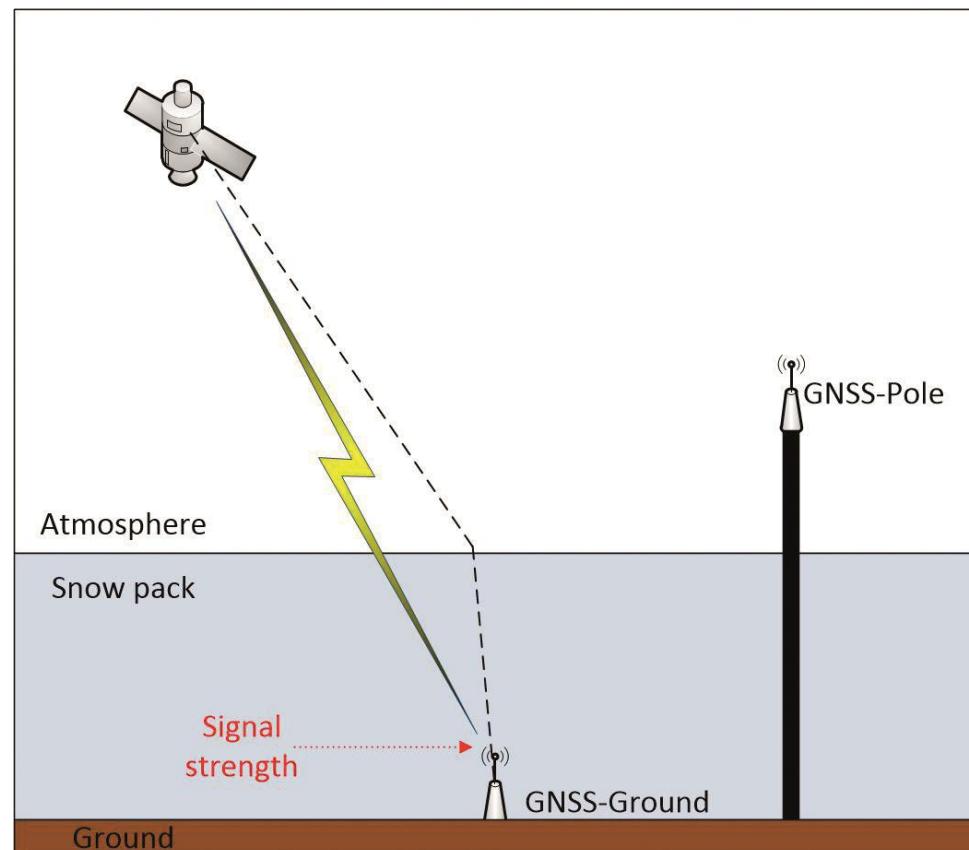


SWA – Snow Water Analyzer

Measuring SWE:

LWC Measurement:

- Using the C/NO Signal (Signal strength)
- The LWC is damping the signal strength and we are measuring that

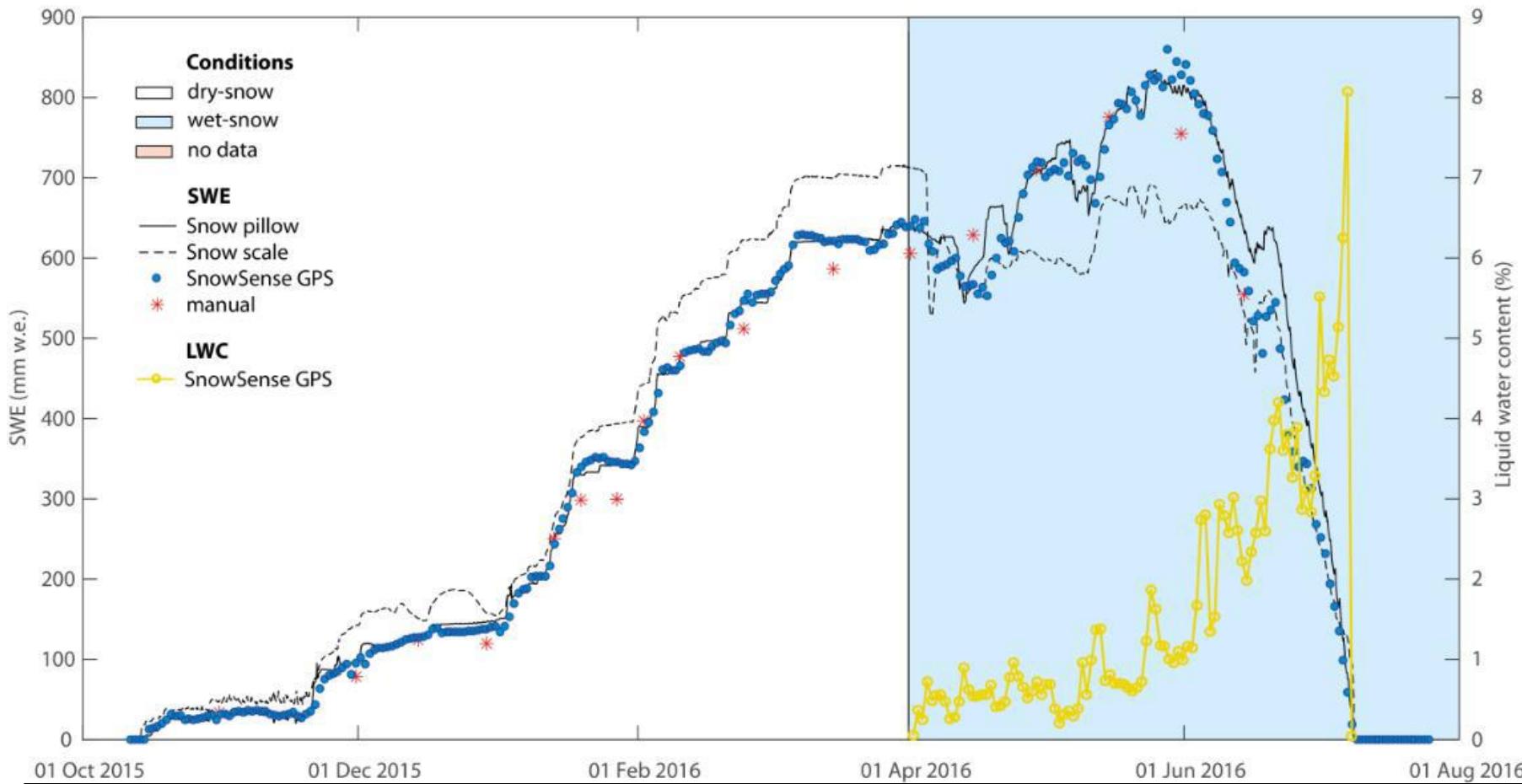




SWA – Snow Water Analyzer

Results from an Alpine Station

- Weissfluhjoch (Swiss)
- At the SLF – Swiss Snow and Avalanche Institute





SWA – Snow Water Analyzer

Physical Installation in the Field?

- Antenna with base plate (right top)
- SWA-Analyzer (right bottom)
- Sensor during the season



Article

Advances in Snow Hydrology Using a Combined Approach of GNSS In Situ Stations, Hydrological Modelling and Earth Observation—A Case Study in Canada

Florian Appel ^{1,*}, Franziska Koch ^{2,3}, Anja Rösel ¹, Philipp Klug ¹, Patrick Henkel ⁴, Markus Lamm ⁴, Wolfram Mauser ^{1,3} and Heike Bach ¹

¹ VISTA Remote Sensing in Geosciences GmbH, Gabelsbergerstr. 51, D-80333 Munich, Germany; roesel@vista-geo.de (A.R.); klug@vista-geo.de (P.K.); w.mauser@lmu.de (W.M.); bach@vista-geo.de (H.B.)

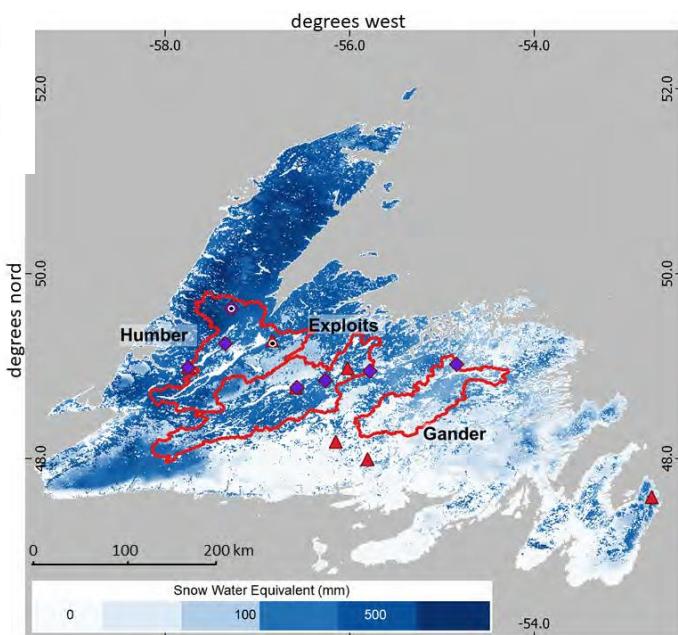
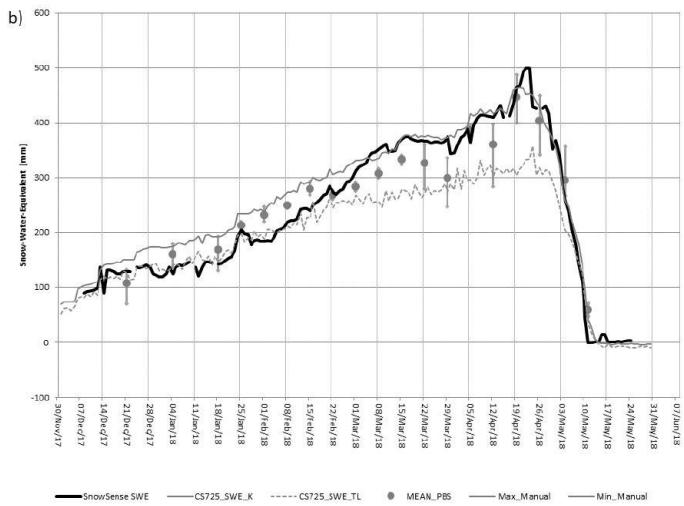
² Institute of Water Management, Hydrology and Hydraulic Engineering, University of Natural Resources and Life Sciences, 1190 Vienna, Austria; franziska.koch@boku.ac.at

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SWA – Snow Water Analyzer

Recording of the snow parameters

- Snow water equivalent (SWE)
- Liquid water content (LWC)

Sensor integration via RS 485 or SDI-12 interface

Not affected by snow bridging

No site preparation

No construction work required

Maintenance free operation

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SWA – Snow Water Analyzer

Energy-saving sensor operation

- Sleep mode between the measuring intervals
- Solar-powered stations

No parametrization needed, Easy to install

No antifreeze needed or other chemicals

Information about SWE and liquid water content

- Of the whole snow pack

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Sontek RS5 – The Worlds Smallest ADCP



Originally Released in 2021...

What exactly is the RS5 anyway?



It's a handy grab-and-go ADCP that you can:

- Take anywhere
- Setup in minutes
- Visualize flow data like never before

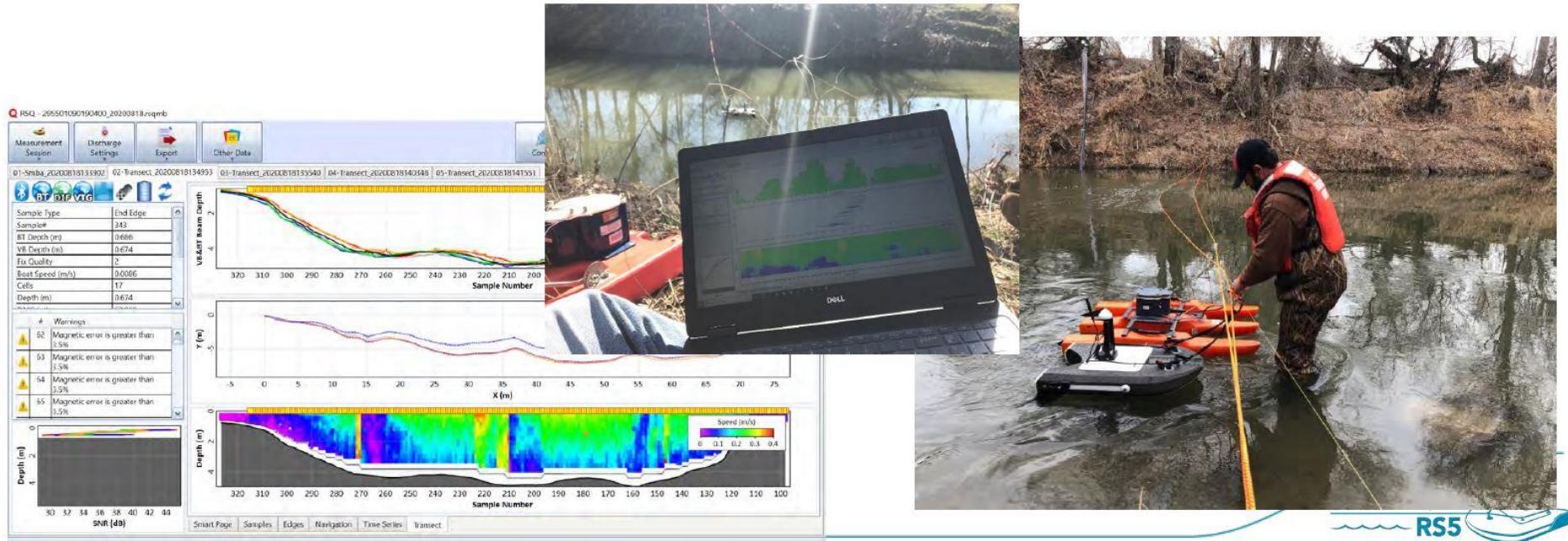
The Improvements...

- Small, easily transportable ADCP
- Improve acoustic performance in common problematic conditions
 - Losing bottom track
 - Ultra-shallow
 - Closer to edges/walls
- Works well in wide range of velocity conditions
- Minimize time in field to make discharge measurements
- Easy to use - Modern software



The Backstory...

- Comprehensive testing began in 2018
- Testing included Xylem Application Engineers and experienced ADCP users from around the world.
- Extensive testing with USGS for over a year (since late 2019)



What's Unique vs. Competition

How is the RS5 different from “those other guys”?

1. Broadband transducers
2. SmartPulse+ - broadband plus pulse coherent acoustic processing
3. Optimized for ultra-shallow conditions
4. Improved bottom tracking
5. RSQ Software – intuitive and familiar, flexible post-processing options



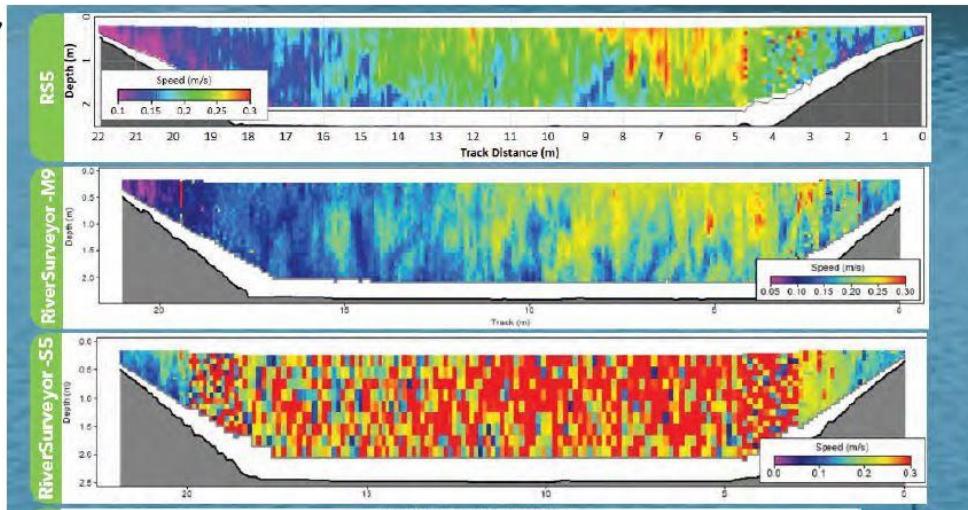
Now it's time to let the data speak for itself...

www.ricohydro.com

High Resolution Results...

Broadband Transducers and SmartPulse+

Beautiful, high-resolution data!



Application Engineer RS5 testing, Yuma, AZ (USA).

Capabilities in Difficult Environments...

Collect data in never-before locations

Ultra-shallow capabilities

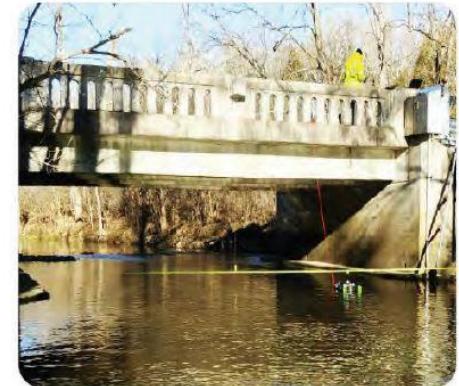
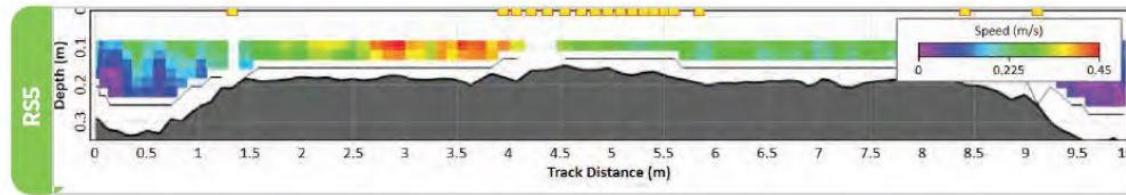
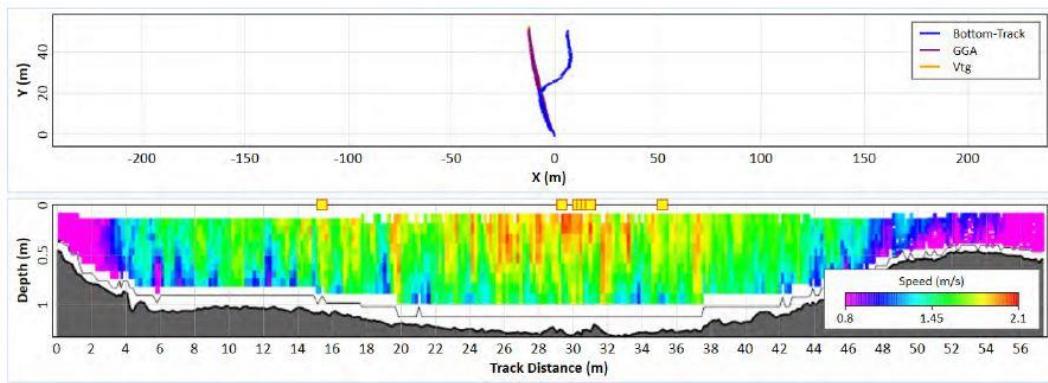


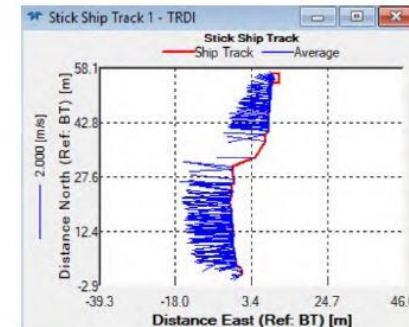
Photo and data courtesy of Tim [Shawn] LeMaster, USGS.

Improvements to Bottom Tracking...

Improved Bottom Tracking



Data courtesy of Icelandic Met Office (site V066 Kljafoss)



Real-Time Climate and Camera Systems – Telemetry is Key



BGAN Satellite Camera equipment

Cameras

Stand-alone cameras

Strategically placed around the site

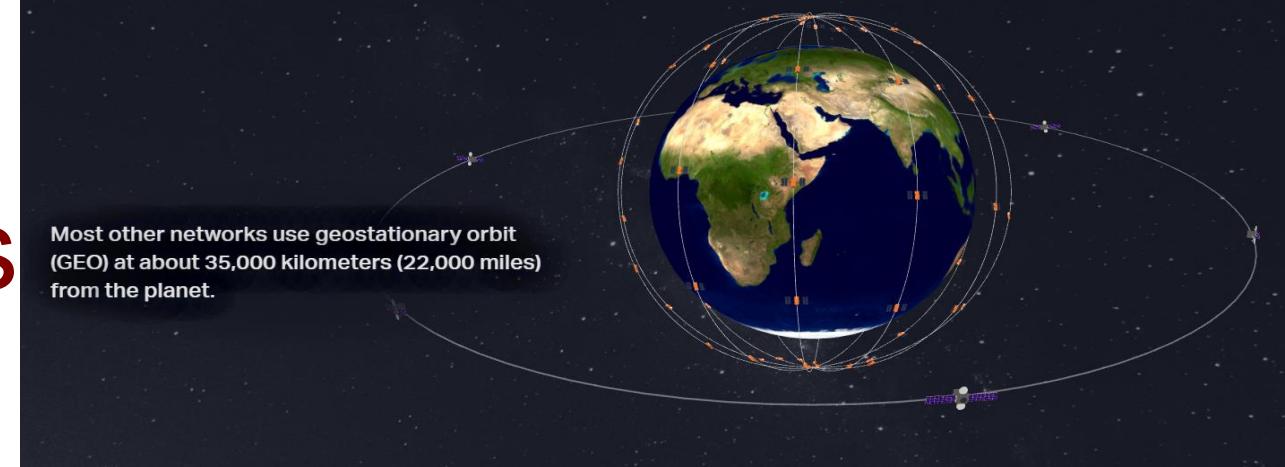
Photographs collected daily



World-Wide Coverage
One-Service Plan



Iridium SBD/Certus Systems



- Complete circumpolar coverage
- Crosslinked mesh architecture
- Certus100 IP data speeds of up to 88Kbps
- Certus200 IP data speeds of up to 176Kbps
- Certus700 IP data speeds of up to 704Kbps

Short Burst Data® Packet Data		Narrowband 2.4 Kbps	Midband Up to 88 Kbps
			
Data Transfer	Short Burst Data	Circuit Switched Data & Short Burst Data	IP & Iridium Messaging Transport™
Gateway Connectivity	Iridium CloudConnect, Direct IP	Direct IP / PSTN	Partner Colocation & VPN*
Applications	Asset Tracking, Fleet Management, Remote Monitoring, Security Alerts, Personal & Personnel Tracking, GPS Location, Telemetry, UAV, Sensor Data	Oceanographic Data & Buoy Data, Tracking, Monitoring, GPS, Command & Control, Environmental Monitoring	Personal & Lone Worker / Personnel Tracking, Messaging, Command & Control, UAV, Remote Telemetry, Still Image Capture, Rail Positive Train Control, Remote Site Connectivity
Pricing	\$ / KB	\$ / Minute	\$ / MB
Module	Iridium 9602, Iridium 9603	Iridium Core 9523	Iridium Certus™ 9770
Go-to-Market Options	Direct from Iridium, Approved Distribution Partners	Approved Partner Products	Approved Partner Products
Monthly Data Usage	~1 KB - 100 KB	~50 KB - 3 MB	~1 MB - 50 MB



High Arctic Water level from Remote Cameras



Wildlife Monitoring from Remote Cameras



BC Hydro Peace River Ice Monitoring System



SUTRONWIN
Weather Information Network

Satellite GSM/GPRS Modem LOS Radio

Real-Time Data Directly to you via Smart Phone, Web, SMS, E-mail text, Voice, Event Triggered Alarms

Map

Alberta Map Satellite

Map 91 Open

Map data ©2012 Google. Report a map error

Navigation

- Map
- Dashboard
- Custom Reports
- Station List
- Time Series List
- Alarms
- Account
- Account Settings
- Admin Functions
- Define Seasons
- Define Alarm Actions

Current Data

Graph

Station Info

Live Images

2012

- December
- 15
- 14
- 13
- 12
- 11
- 10
- 09
- 08
- 07
- 06
- 05
- 04
- 01
- November
- October
- September

2012-12-12 11:30

Note: click on image to enlarge it.



Colomac and Tundra Mines Sutron Iridium Monitoring System



Project Background



- Located 220 km north of Yellowknife, NWT
- Open pit mine
- Started operations in 1990 and abandoned in 1999
- Aboriginal Affairs and Northern Development Canada (AANDC) took responsibility of site
- A Remedial Action Plan was completed in 2004



Yukon Geological Survey Iridium Climate Stations



IN

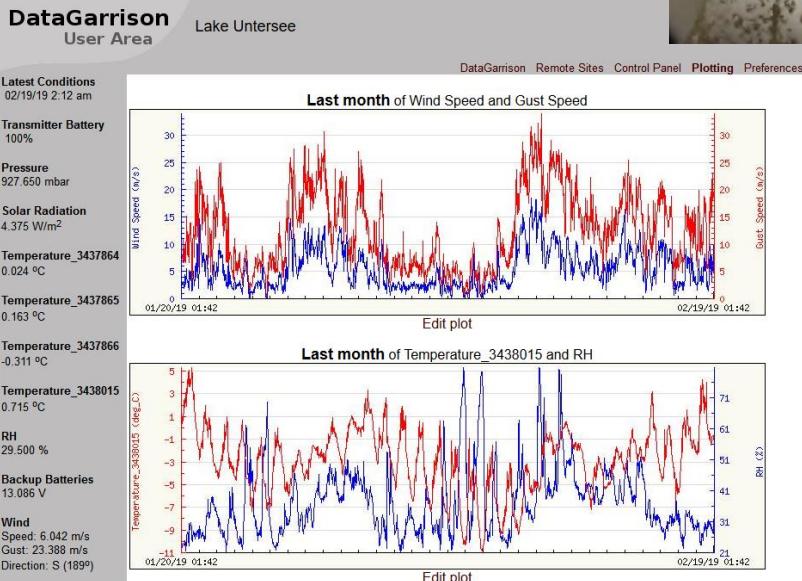
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Real Time Ice Floe and Climate Monitoring System using Iridium Telemetry in Beaufort Sea



Lake Untersee Climate Stations Antarctica

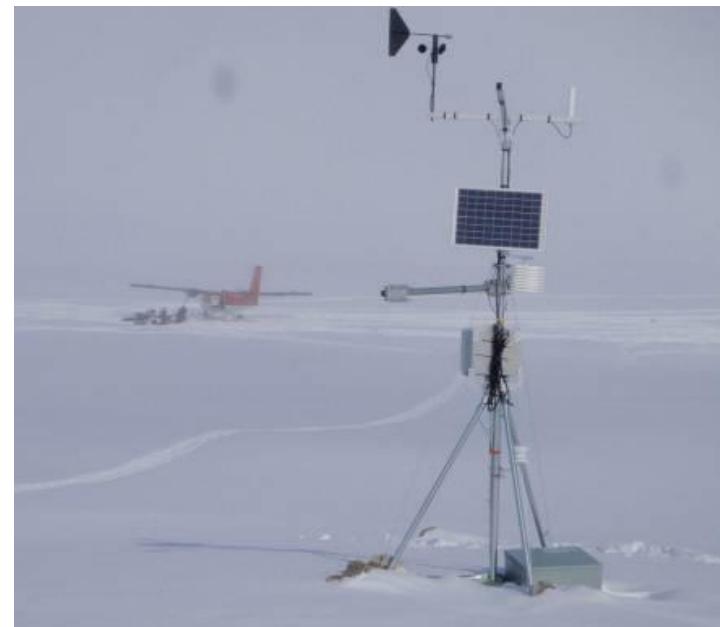


Hoskin Scientific has provided the SETI Institute with Three Real Time Climate Stations Installed at Lake Untersee, Queen Maud Land



Northern Ellesmere Milne Ice Shelf Iridium Climate Station

- ❖ 83 North Latitude
- ❖ Transmitting Since 2008 Real time through Polar Winters
- ❖ Captured Important Climate Data During Ice Shelf Release



Real Time Iridium Weather Station Located at Cape Adare next to Ross Ice shelf, Antarctica



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DataGarrison
User Area

Cape Adare

Latest Conditions
03/27/15 4:11 pm

Transmitter Battery
100%

Pressure
943.950 mbar

Water Content
0.032 m³/m

Temperature_10573429
-9.542 °C

Temperature_10589686
-13.888 °C

RH
84.000 %

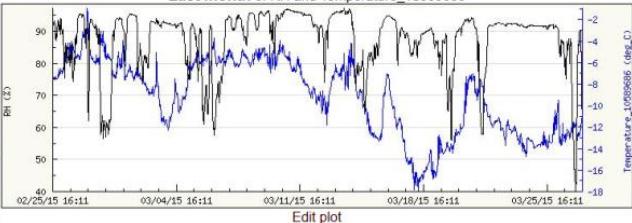
Solar Radiation
66.875 W/m²

Wind
Speed: 2.729 m/s
Gust: 3.898 m/s
Direction: WSW (255°)

Station Status
Trans: every 720 min.
Logging: every 30.0 min.

DataGarrison Remote Sites Control Panel Plotting Preferences

Last month of RH and Temperature_10589686



Last month of Pressure and Solar Radiation

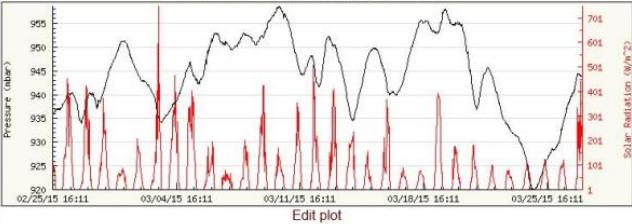
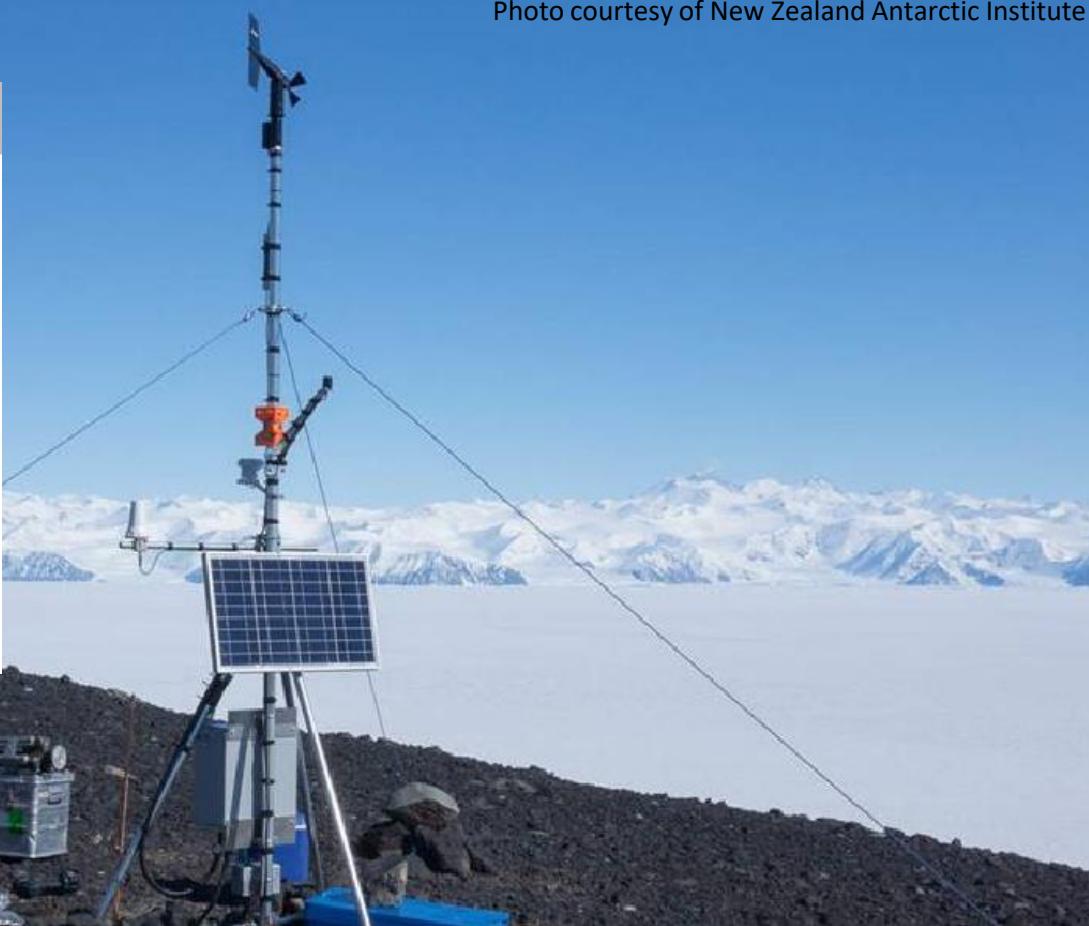


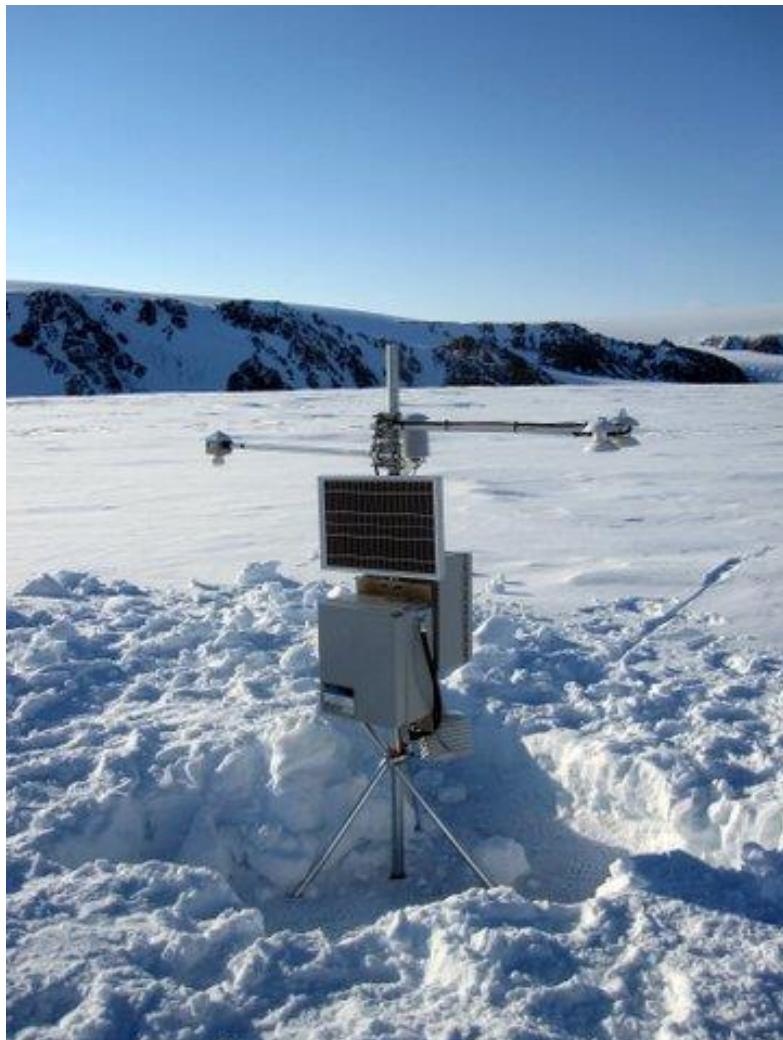
Photo courtesy of New Zealand Antarctic Institute



Mount Logan Iridium Satellite Climate Station for Research and Aviation



Devon Island Ice Cap Glacier Iridium Mass Balance Study



N

QUESTIONS & ANSWERS

