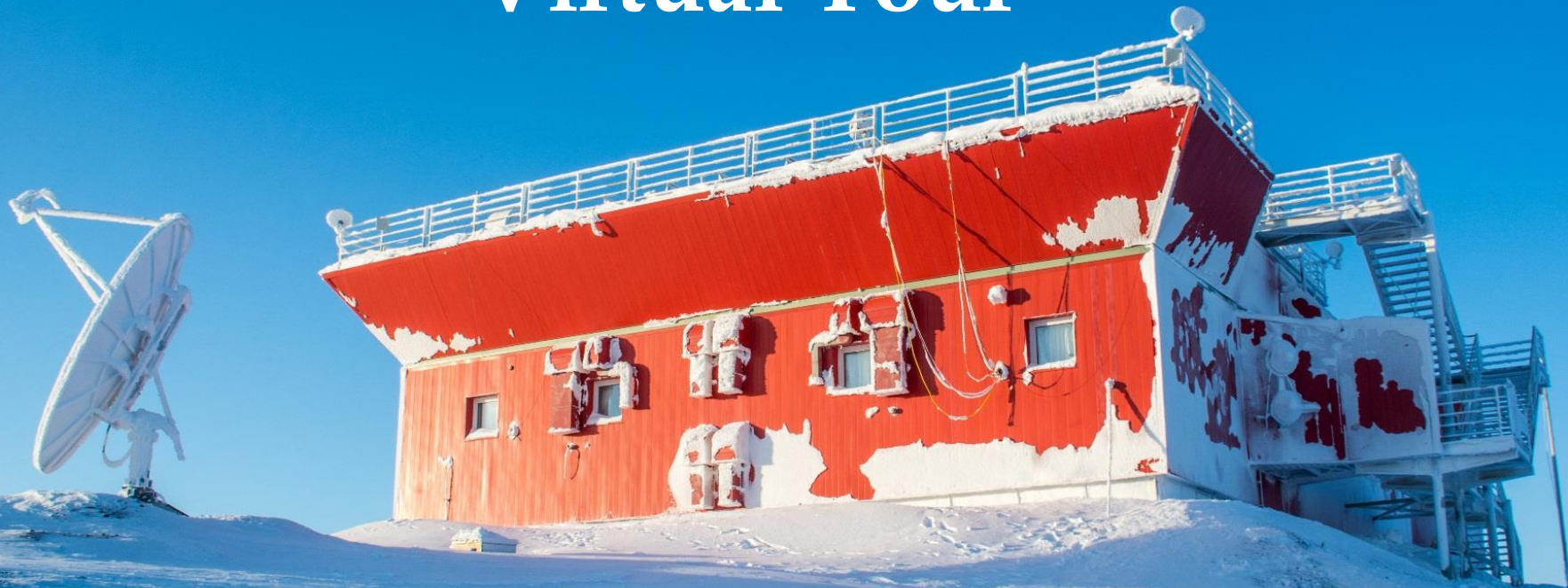


# PEARL

*Polar Environment Atmospheric Research Lab*

## Virtual Tour



**Dan Weaver**  
University of Toronto

# **Atmospheric science**

**measure & understand  
the changing atmosphere**



# Research at PEARL

Climate change

Ozone depletion

Arctic atmosphere



© Dan Weaver

Let's go to Eureka & PEARL...



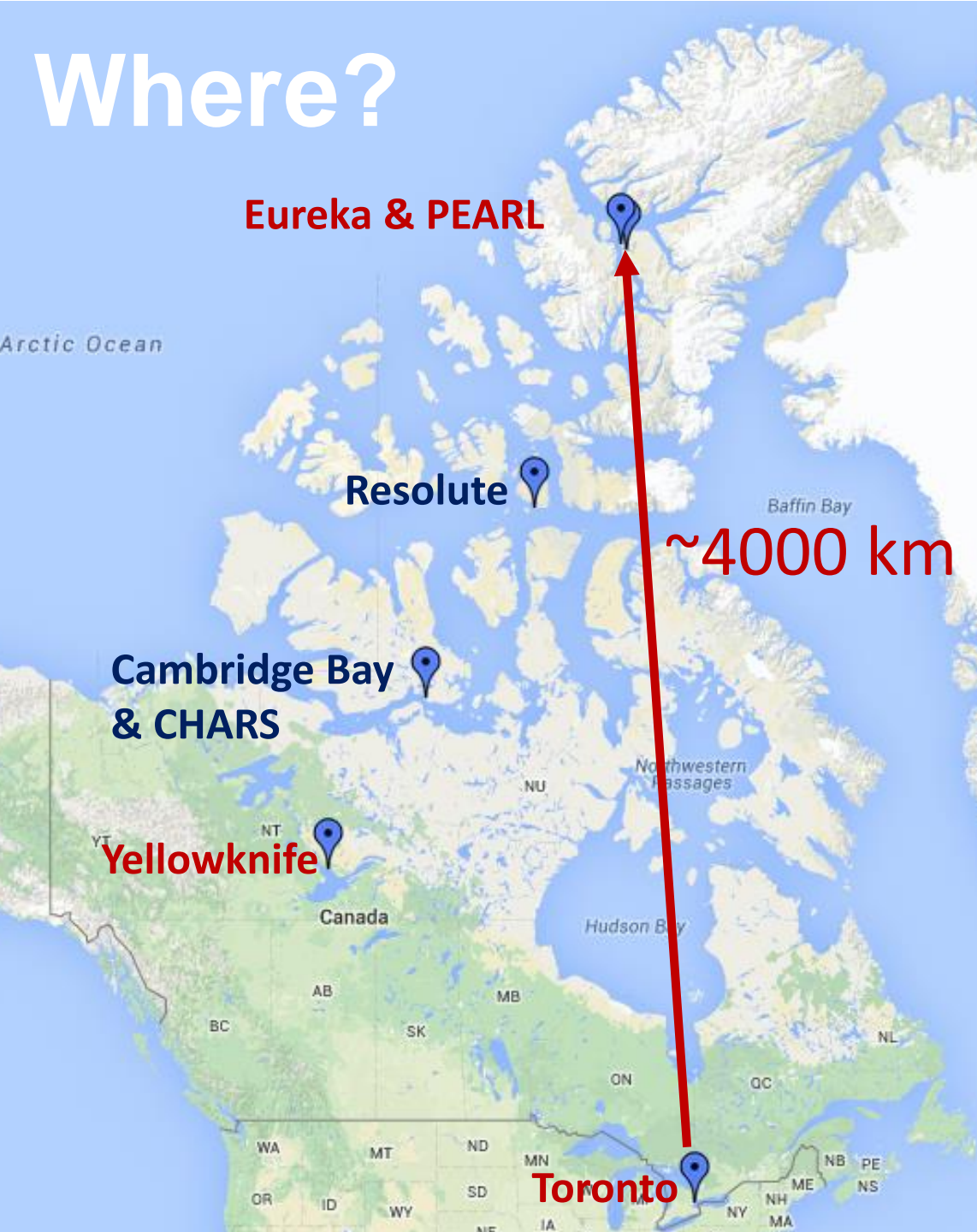


# Canadian Arctic

Our Arctic is 40% of Canada's landmass & is home to over 100,000 Canadians.



# Where?



Eureka, Nunavut is  
at 80°N  
on Ellesmere Island

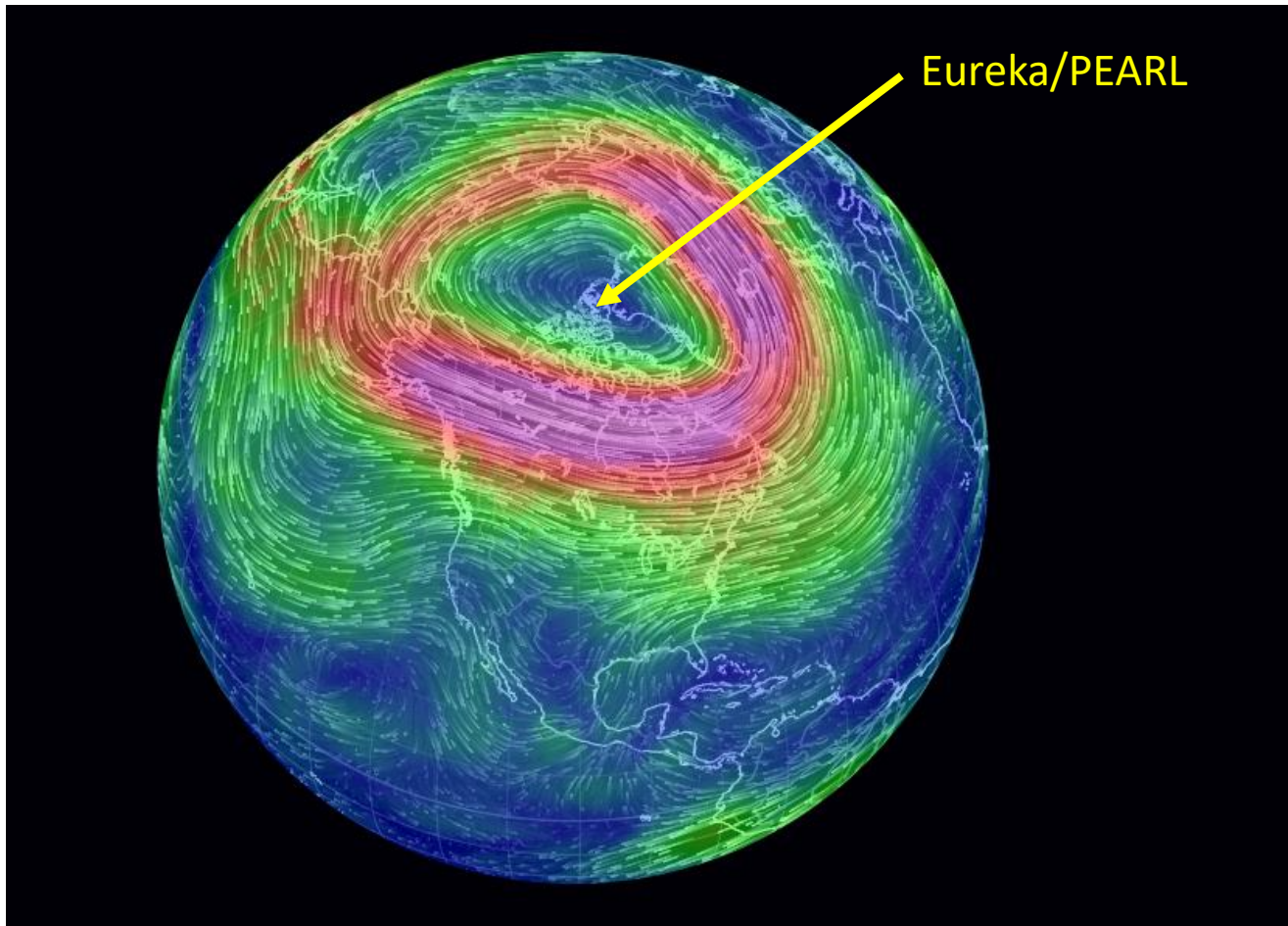
## Distances

- Eureka/PEARL is over 4000 km north of Toronto!
- Yellowknife is ~halfway point

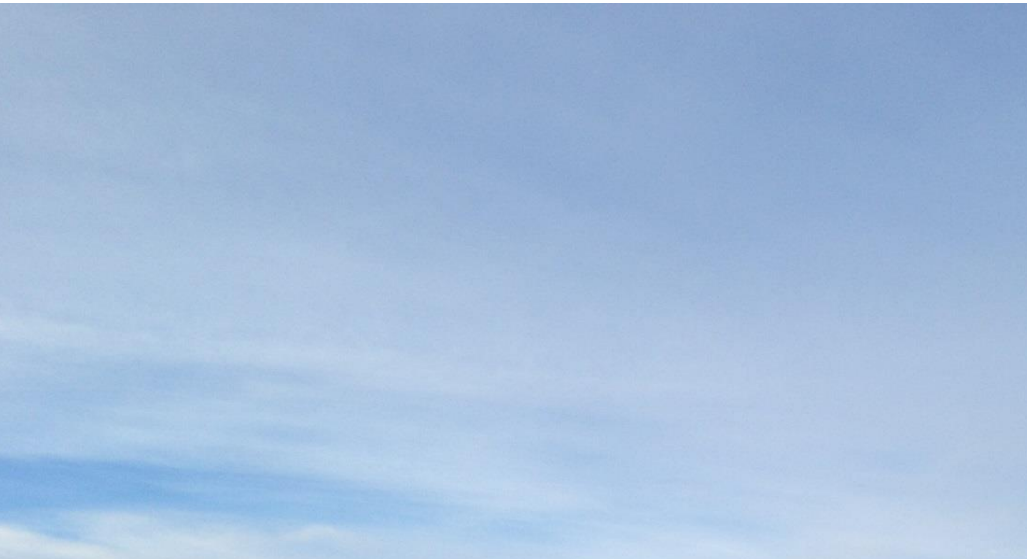


# Polar Vortex

March 10, 2015 (70 hPa, stratosphere)

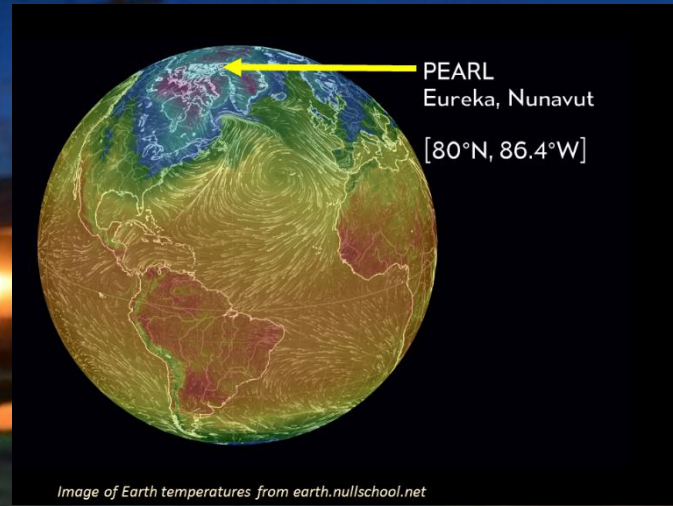


# Arriving at Eureka International Airport





# Dress warmly!



No Service 11:13 PM 45%

**Current** **-47°C**  
Clear Feels Like: -47

Wind Speed & Direction	Humidity	
<b>Calm</b>	—	
Pressure	Visibility	Ceiling
—	<b>16km</b>	<b>unlimited</b>
Sunrise/Sunset	Yesterday's High/Low	
—	<b>-46.8° -49.3°</b>	

<b>Evening</b> Sunday			<b>-36°</b>
Weather delays unlikely			
<b>Overnight</b> Sunday			<b>-36°</b>
Weather delays unlikely			
<b>Morning</b> Monday			<b>-35°</b>
Weather delays unlikely			
<b>Monday</b>			<b>-35°</b>

The Weather Network **Eureka** NU, Canada

# Eureka

- 8 permanent staff (Environment Canada)
- Short-term research teams



# Eureka at twilight

Hydrogen shed



Eureka  
Weather  
Station



Diesel &  
power  
generation



Zero-altitude  
PEARL  
auxiliary lab  
(OPAL)



# The Eureka Weather Station



WELCOME TO EUREKA  
WEATHER STATION

CANADA POSTES  
POST CANADA  
EUREKA, NU  
XOA OGO



“Mud room” for  
transitioning between  
inside & outside



# Eureka is like a tiny town, closer to the North Pole than any other civilian outpost.\*



\*Nord, Greenland and Alert, Nunavut are further north, but are primarily military

## There is:

- Post office
- Store
- Bar (BYOB)
- Airport
- Labs
- Guest rooms
- Power facilities
- Sewage facilities
- Water infrastructure
- ~~Hospital/clinic~~

# Dining room



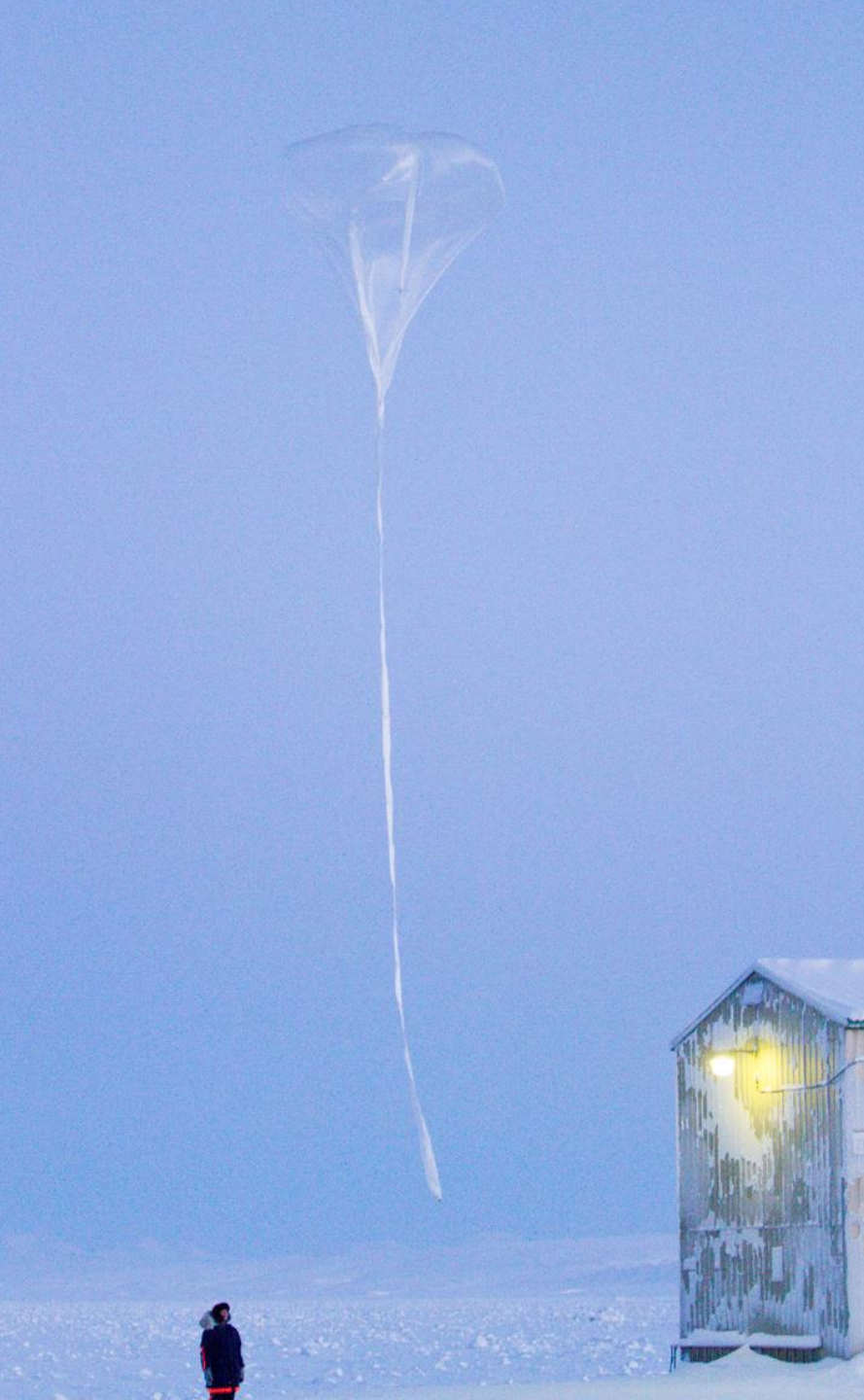


# Eureka Weather Station's recreation room



# The Hydrogen shed & radiosonde (weather balloon) launch site



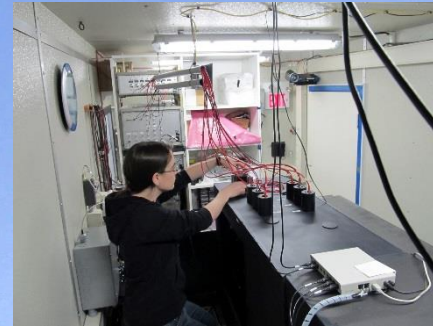


# PEARL includes 3 main facilities

- PEARL Ridge Lab
- Zero-altitude PEARL auxiliary lab (OPAL)
- SAFIRE



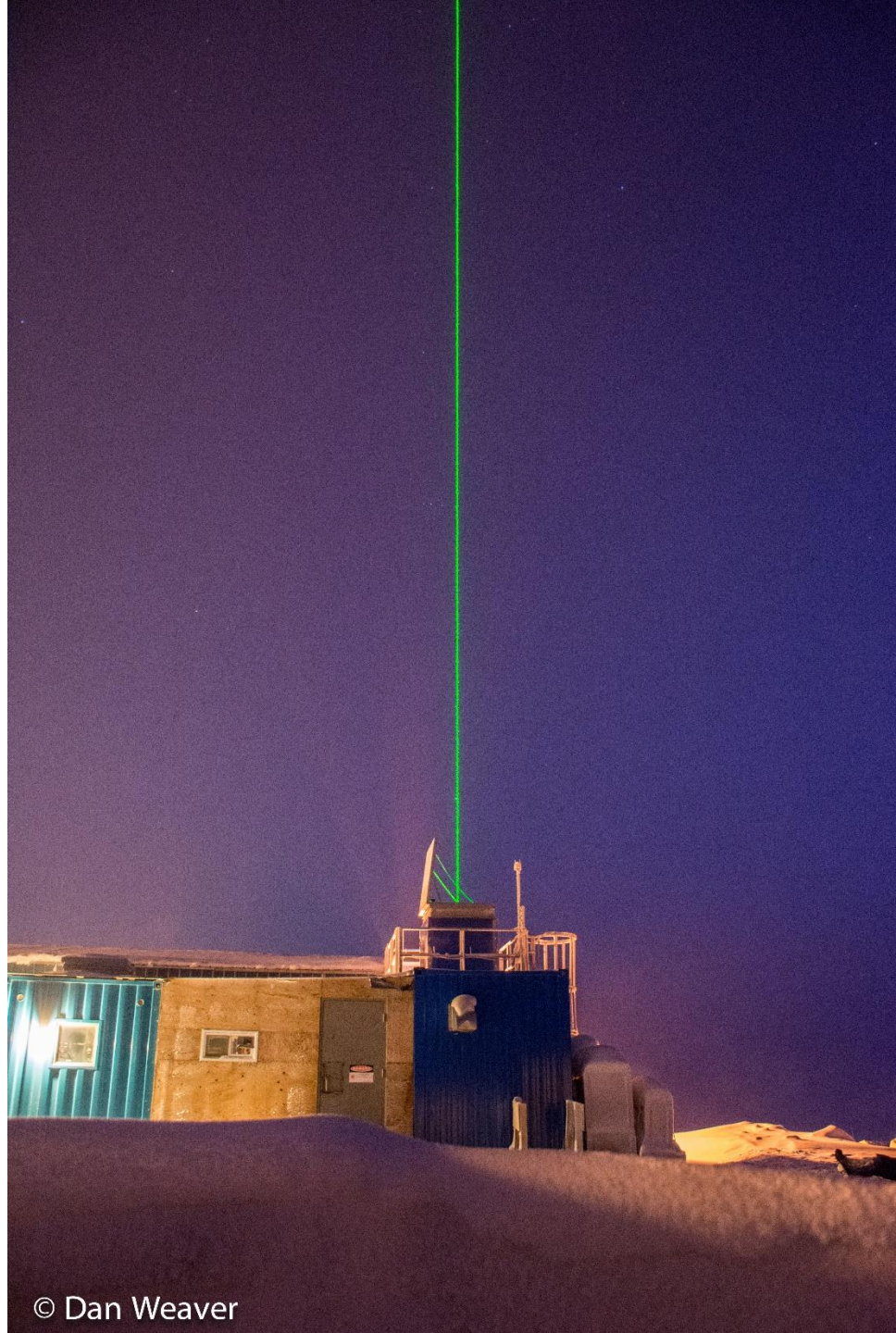
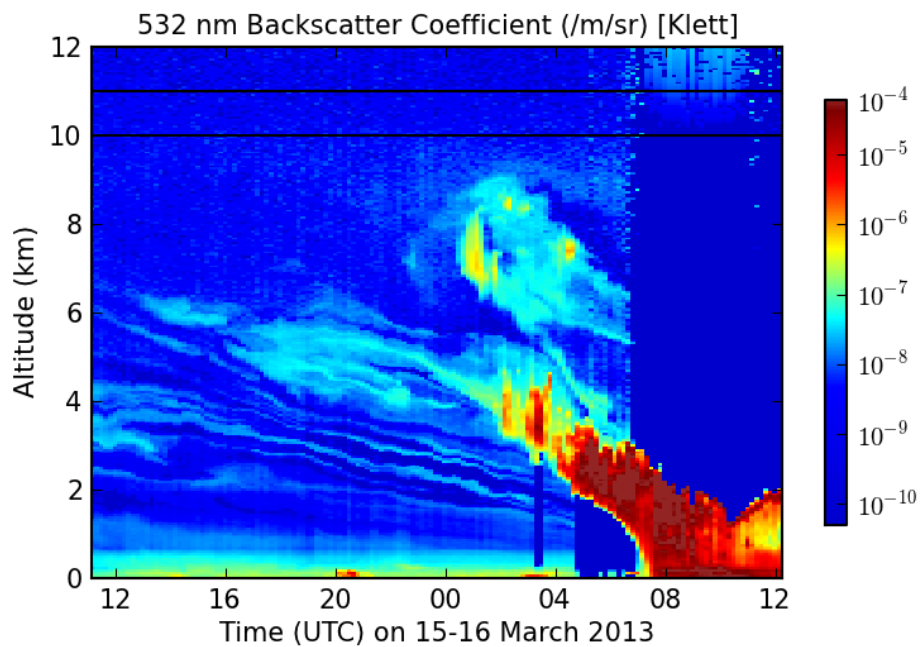
# Zero-altitude PEARL Auxiliary Lab (OPAL)

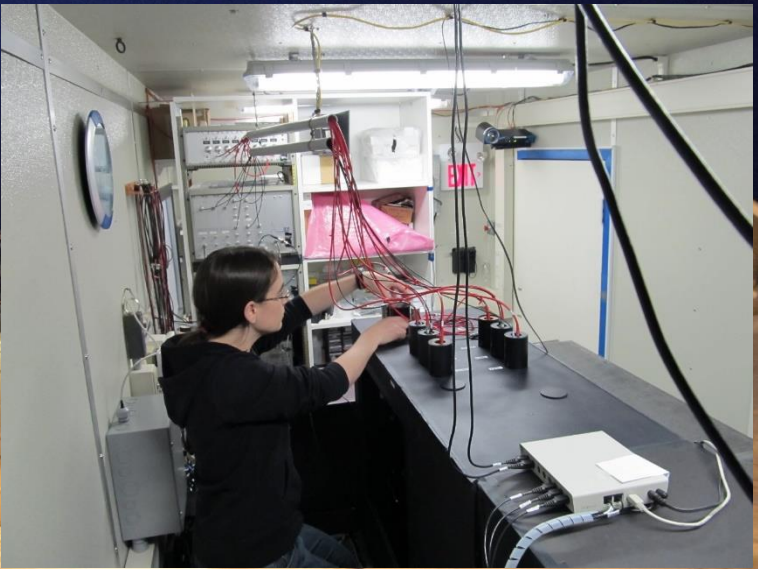


(Near the Eureka Weather Station)

# LIDARs

*Light detection and ranging*







# Driving to the PEARL Ridge Lab



DYK:  
Canada's high Arctic is a polar  
desert.  
There is very low humidity!

Be prepared to  
shovel snow  
when in the  
Arctic!



Figure .: Location of PEARL relative to Eureka.



If you're \*really\* stuck...  
Environment Canada can help



A group of five people, three men and two women, are standing in a snowy, mountainous landscape. They are dressed in heavy winter clothing, including parkas and snow pants. The group is positioned around a sign that reads "80° North". The background shows snow-covered hills under a clear blue sky. The sign is mounted on two metal poles. The people are smiling and appear to be posing for a photo. The ground is covered in snow with some small rocks and debris visible. The overall scene is bright and clear, suggesting a sunny day in a high-altitude or high-latitude environment.

80° North

# Upper Paradise







# Polar Environment Atmospheric Research Laboratory



- 80.05° North, 86.4° West
- 610 meters a.s.l.
- ~15 km from Environment Canada's Eureka Weather Station



Light fixture

Circular porthole

**DANGER**  
NO ENTRY  
NO UNLASHING OR  
RECOMPARING  
BY CARGO  
PERSONNEL  
**DANGER**

12/15/17

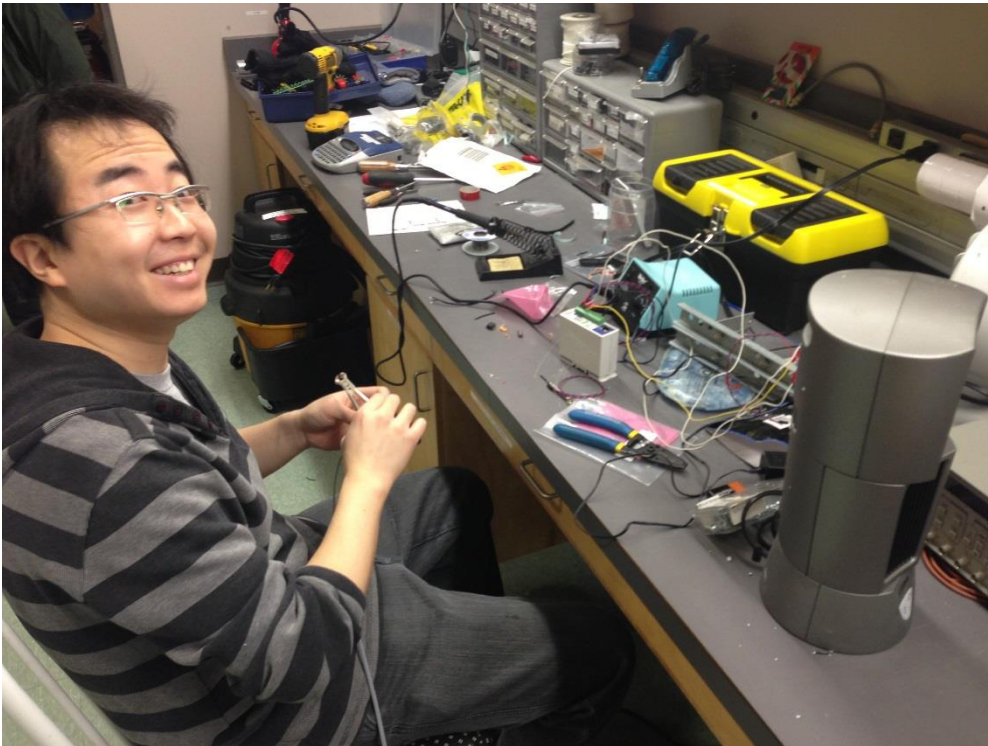
Metal shelving unit

# PEARL Ridge Lab kitchen



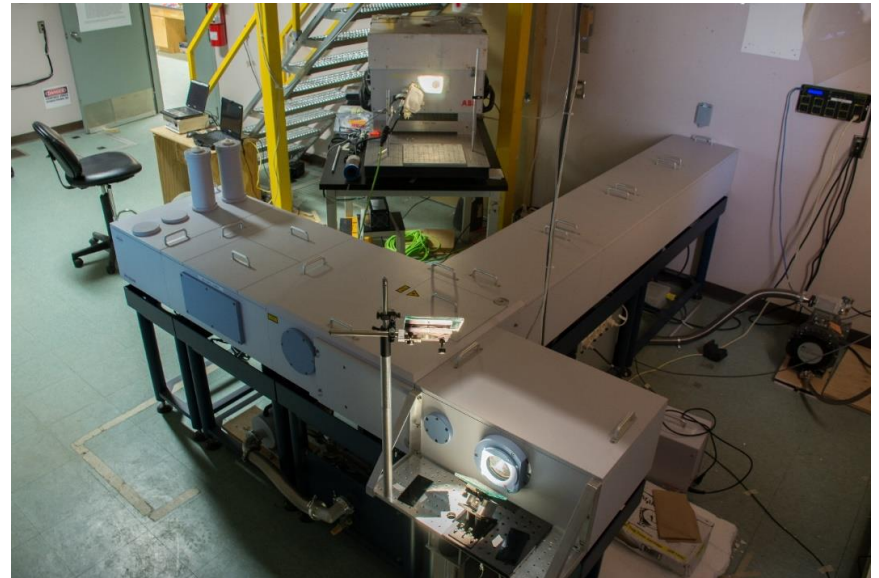
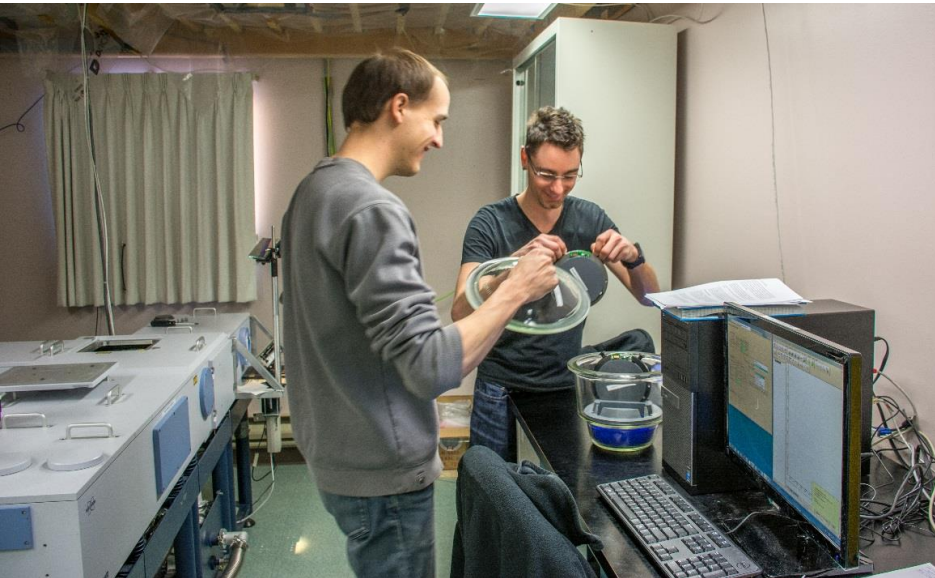


# Lab bench in the hallway



# IR lab

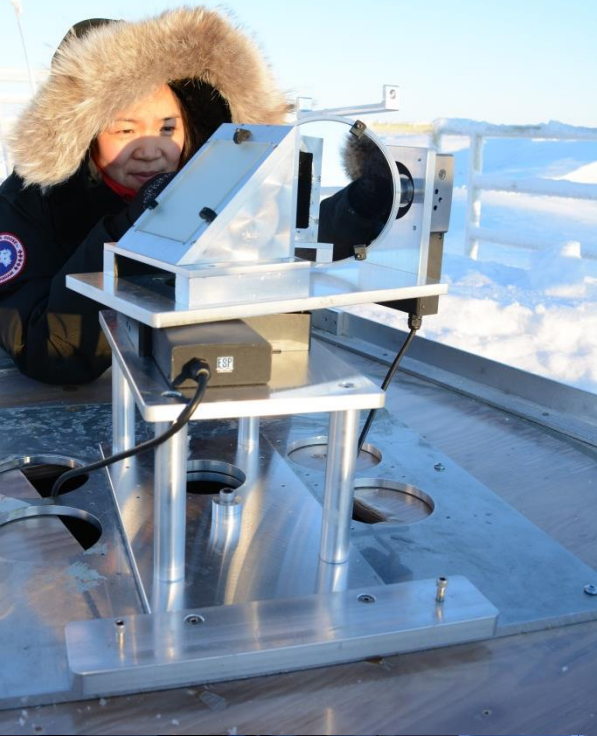
Using sunlight to create “maps” of the atmosphere



# PEARL 125HR



\* Sun is not to scale

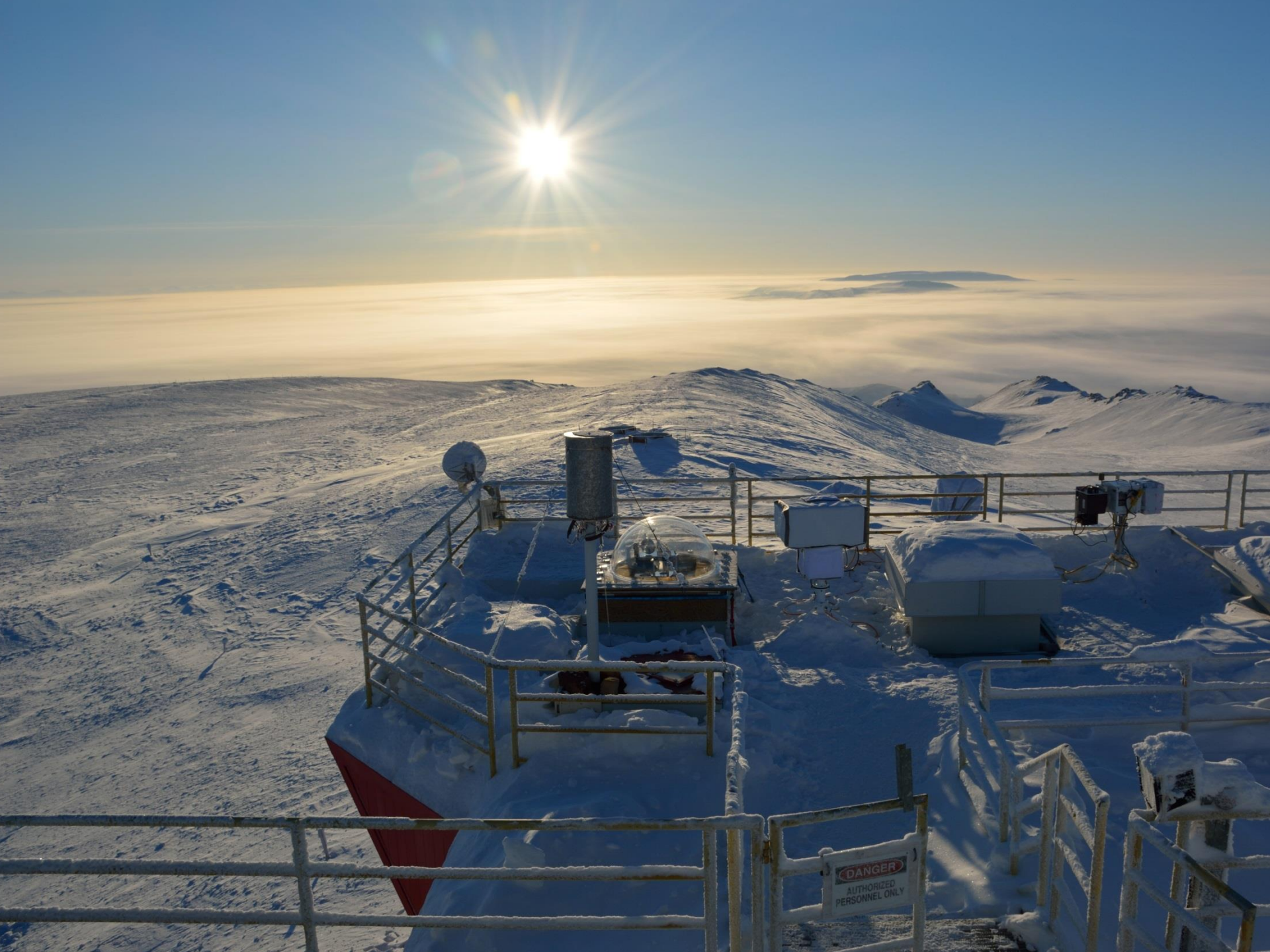


# UV-Vis Lab



# Up to the PEARL Ridge Lab roof





**DANGER**  
AUTHORIZED  
PERSONNEL ONLY



# Installing instruments for satellite validation











# Arctic challenges: cold temperatures!



# View looking back to Eureka











# SAFIRE

(Surface and Atmospheric Flux, Irradiance and Radiation Extension)



# The flux tower



## Arctic challenges:

Meteor antenna needed to be dug out of snow



# Measurement experimentation: the PEARL drone



Aiming to take measurements of air near the surface to improve understanding of boundary layer processes.



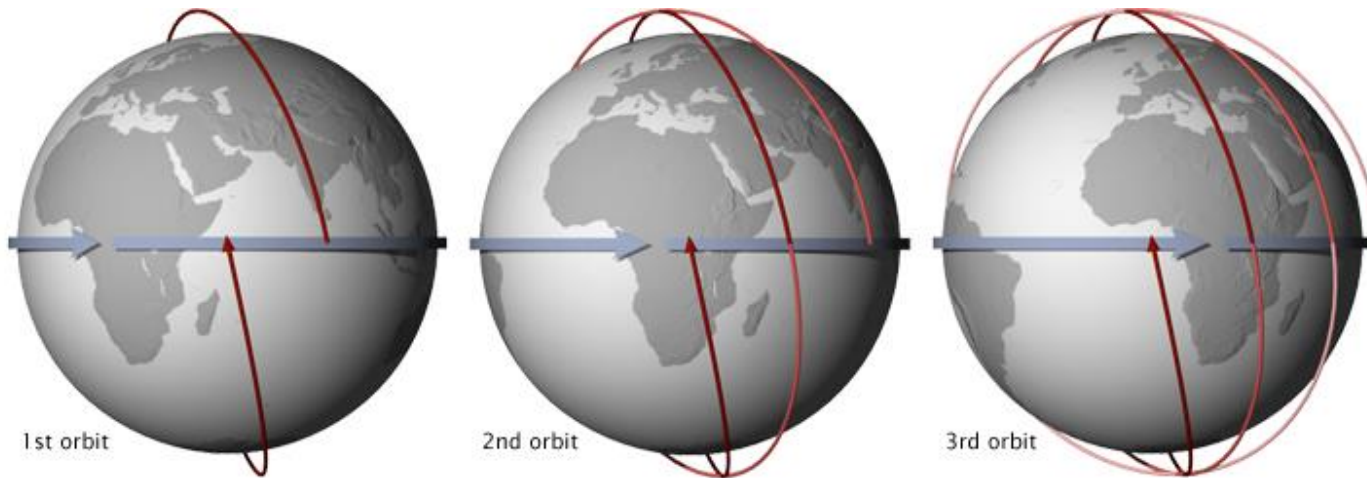
One more science objective...

# Satellite validation

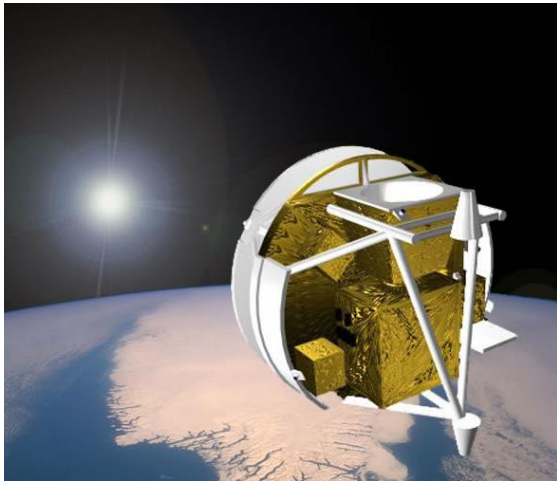


# Eureka is easy to get to ...for a satellite!

Sun-synchronous orbits provide global coverage,  
and frequently pass over the poles



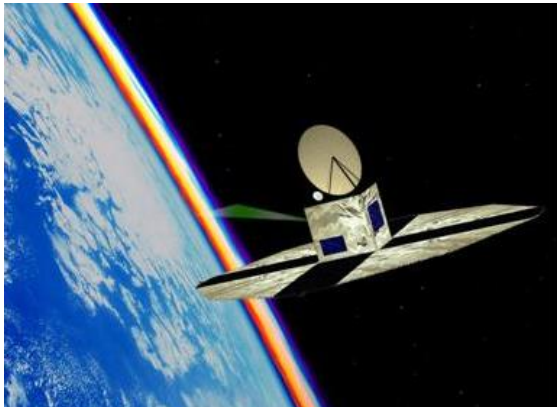
## ***ACE (Canada)***



## ***OCO-2 (U.S. NASA)***



## ***Odin (Sweden & Canada)***



## ***GOSAT (Japan)***



# Wildlife at 80°N?





Fox



# Muskox

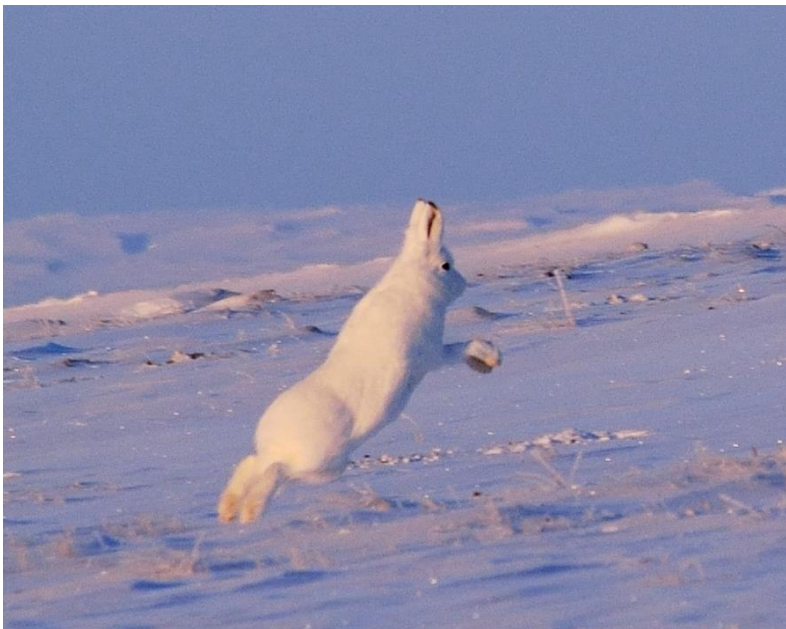
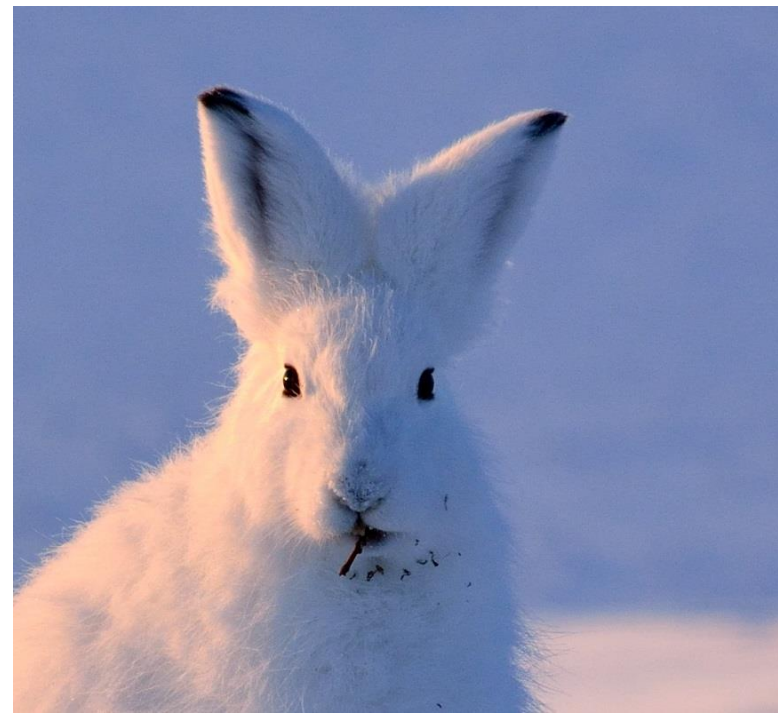




# Arctic Wolves



# Arctic Hare





# Scenery near PEARL















Thank you.



# More information:

CANDAC: [www.candac.ca](http://www.candac.ca)

ACE satellite validation campaigns at PEARL:

<http://eureka.physics.utoronto.ca/>

PEARL Social Media:

- **Twitter & Instagram:** @CreateArcticSci
- **Facebook:** Canadian Arctic Science
- **Blog:** [createarcticsscience.wordpress.com/](http://createarcticsscience.wordpress.com/)

Contact me:

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Web: [www.danweaver.ca](http://www.danweaver.ca)

Twitter: @DanWeaver\_ca