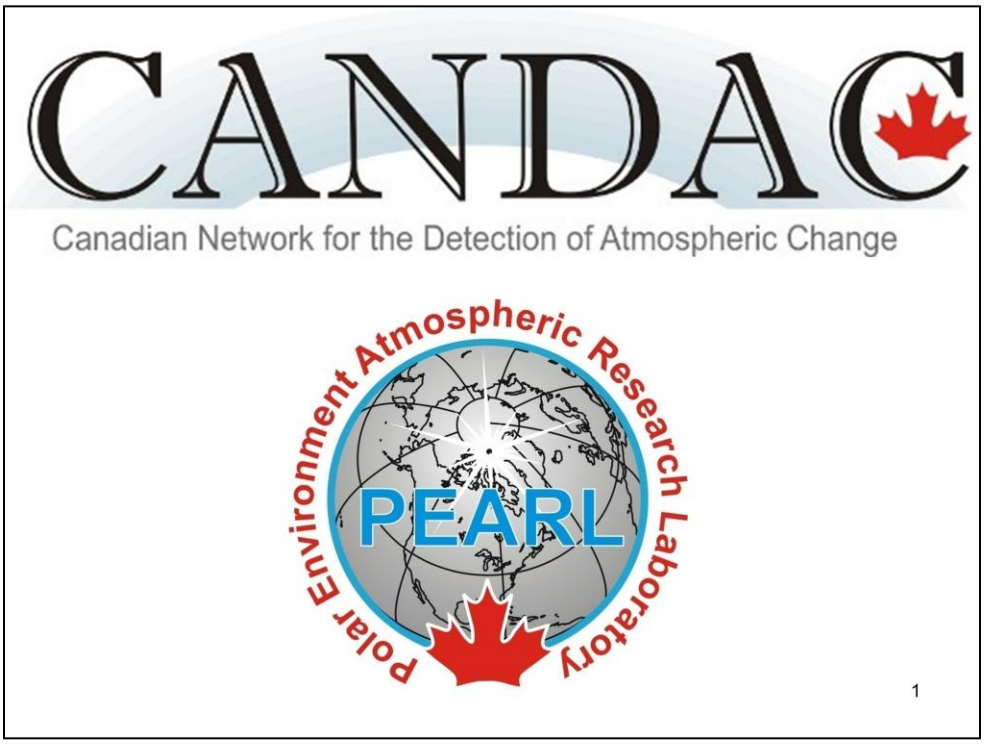

This will be a lesson for students in grades 1-3. The subject matter is weather, types of weather, and how the weather is measured. It is meant to be an interactive presentation with the teacher asking questions of the students on nearly every slide.

This presentation was assembled as part of the outreach initiative for the Canadian Network for the Detection of Atmospheric Change.

CANDAC

Canadian Network for the Detection of Atmospheric Change

- In 2002, a group of university researchers joined together under the title of the Canadian Network for the Detection of Atmospheric Change (CANDAC) with the objective of improving the state of observational atmosphere research in Canada.
- This group recognized the need for an Arctic laboratory and identified the Polar Environment Atmospheric Research Laboratory (PEARL) in Eureka, Nunavut as the ideal station.
- They worked enthusiastically to raise funds to run the facility and had a fully-functional Arctic lab operating in 2005.
- Since then, researchers have been taking various measurements to monitor and better understand current atmospheric conditions.

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Funding for CANDAC has been provided by:

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

Ontario Innovation Trust

Canada Foundation for Innovation
Fondation canadienne pour l'innovation

Environment Canada

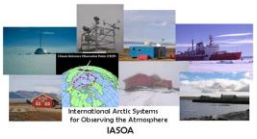
Environnement Canada

NSERC
CRSNG

Ontario MINISTRY OF RESEARCH & INNOVATION

CSA ASC

NOAA



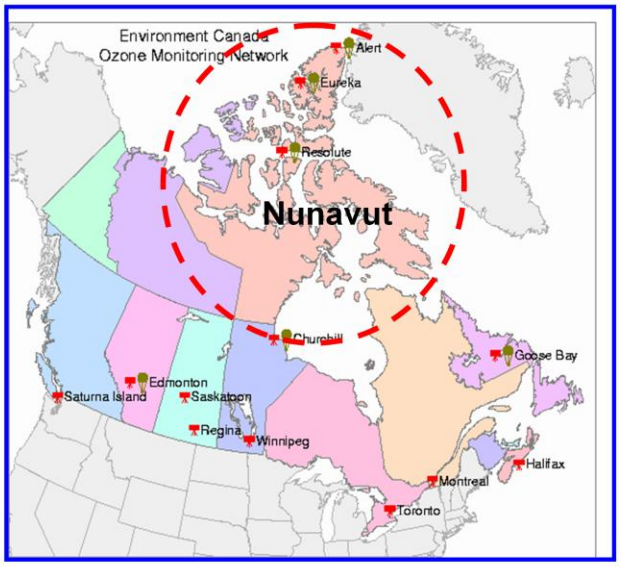
INTERNATIONAL POLAR YEAR 2007-2008

Nova Scotia Research and Innovation Trust

Polar Continental Shelf Project (PCSP)

3

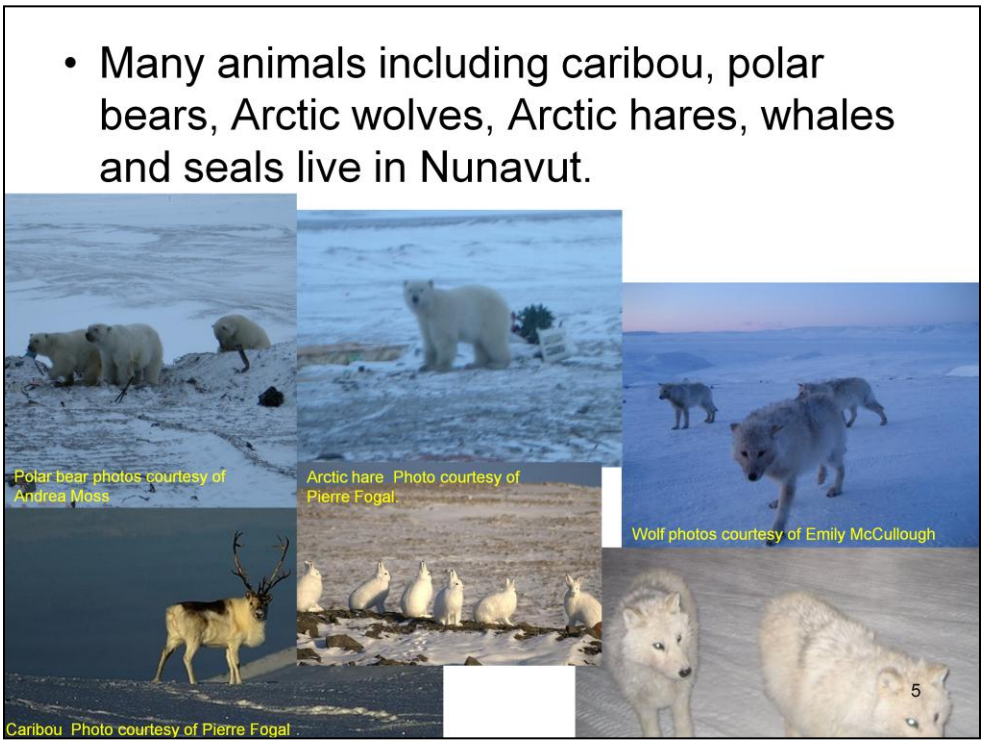
Where do we take measurements?



- CANDAC researchers collect data in Nunavut.
- Nunavut is a Canadian territory located in the Arctic.

4

http://exp-studies.tor.ec.gc.ca/e/ozone/ozonecanada.htm

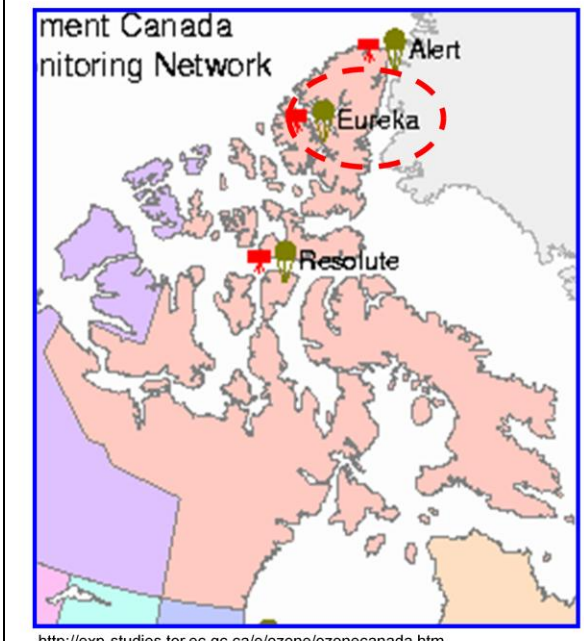


Teacher: What similarity do you notice in all of the animals shown?

Response: All of the animals have white fur.

Teacher: Correct. Why do you think many of the animals in the Arctic have white fur?

Response: In order to blend in (camouflage) with the snow and ice found in their environment.



- Eureka is located on Ellesmere Island in the High Arctic.
- It is not too far from the North Pole.

http://exp-studies.tor.ec.gc.ca/e/ozone/ozonecanada.htm 6

Teacher: Nunavut is the geographically the largest of all thirteen provinces and territories, but is the least populated.

Photo courtesy of Pierre Fogal

- Many CANDAC researchers operate their instruments from the Polar Environment Atmospheric Research Laboratory (PEARL) located in Eureka.
- Researchers typically travel to PEARL by airplane.


Photo courtesy of Pierre Fogal

7

CANDAC International Polar Year Legacy Project: Educational Resources

- As part of the International Polar Year (IPY) Legacy Project, CANDAC has created educational resources aimed at enhancing environmental science education in classes from kindergarten to grade 12.
- Educational materials can be found at: http://candac.ca/candac/Outreach/Outreach.php .
- This particular presentation is about:

Weather!

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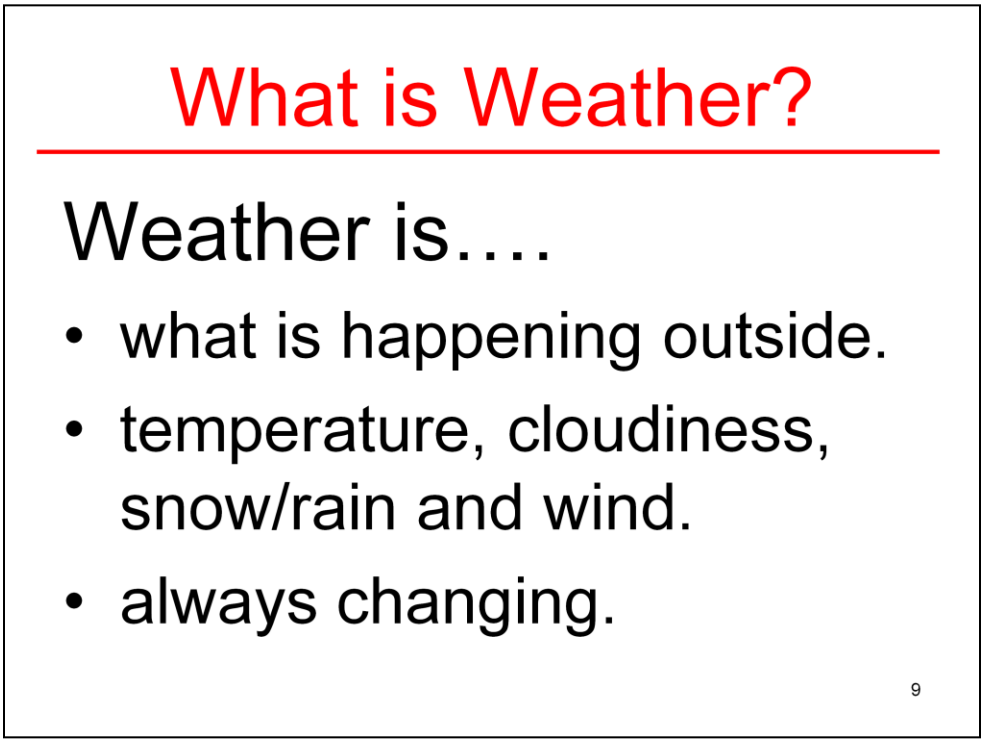


This slide is an opportunity for the teacher to ask the students about previous weather knowledge.

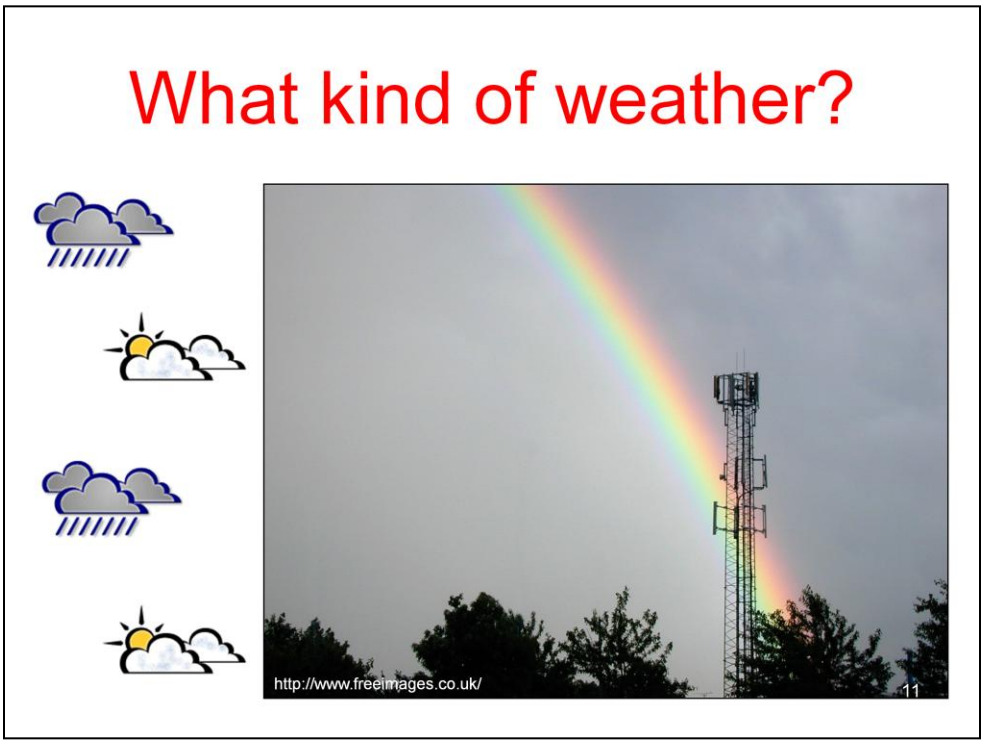
The teacher can then share the information on the slide to ensure a clear understanding of the weather.

For each of the following picture slides, the students are to identify the type of weather that is being represented.

Teacher: What kind of weather do you see?

Response: Cloudy, sunny, cold

Allow many students to provide their response to demonstrate that many different types of weather occur simultaneously.



Teacher: What kind of weather do you see?

Response: Rainbow, cloudy, wet

What kind of weather?

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Teacher: What kind of weather do you see?

Response: Cold, icy, snowy

Seasons

WINTER
What kind of weather?

Teacher: What kind of weather do we have in the winter?

Response: Snowy, icy, cold, windy, rainy

Teacher: What kind of weather do we have in the spring?

Response: Rainy, foggy, warm, sunny, rainbows

SUMMER
What kind of weather?

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Teacher: What kind of weather do we have in the summer?

Response: Sunny, windy, warm, muggy/humid

This slide is an opportunity for the teacher to ask the students if they know the name of the fourth season.

Teacher: What is the name of the fourth season?

Response: Fall or autumn

Teacher: What kind of weather do we have in the fall?

Response: Warm, sunny, rainy, cold, windy

The study of weather is call meteorology.

How do we measure the weather?

18

In this section of the presentation, the teacher will show different instruments (tools) that are used to measure some of the aspects of weather. This section is more informative with fewer questions asked to the students.

Stevenson Screens

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Stevenson screen is the name for the white boxes shown. They are located in hundreds of places in Canada, including all weather stations. Inside the boxes are instruments used to measure temperature and sometimes humidity or pressure.

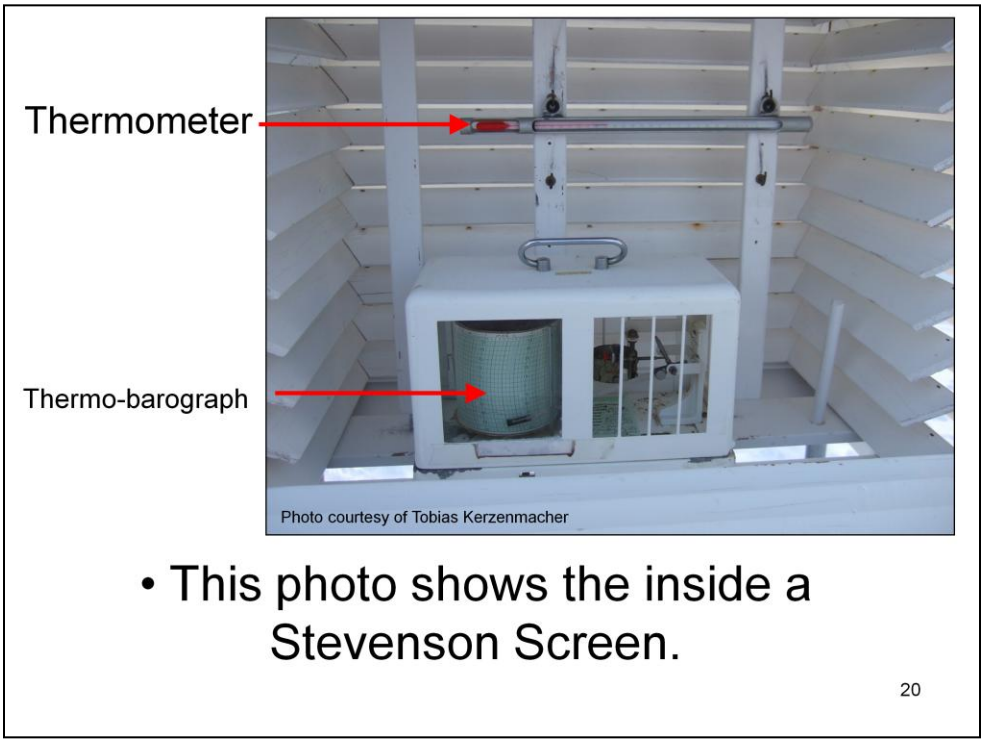
Teacher: Raise your hand if you know what instrument is used to measure temperature. If no student knows the answer, tell them that they will learn about it on the next slide.

Response: A thermometer

Teacher: Yes! When the temperature is warm, the liquid inside the thermometer expands and the liquid moves upwards. When the temperature is cold, the liquid inside the thermometer contracts (takes up less space). Why do you think these instruments are placed inside a box?

Response: The box protects the temperature sensors from being influenced by direct or reflected sunlight.

Additional information: “Stevenson screens are always painted white to better reflect the sun's rays. The louvered sides allow outside air to flow around the thermometers. In the picture above, two hinges can be seen at the bottom of the door, with a latch at the top. The door swings down rather than to one side so that the wind won't catch it on windy days and rip it off the hinges. Stevenson screens are always installed so that the door opens facing north, to keep the sun from shining directly on the thermometers and affecting the readings” (http://www.on.ec.gc.ca/skywatchers/ontario/wx_office_tour/compound/screen_e.html).



Teacher: This is a picture taken of inside one of the Stevenson screens. The thermometer at the top measures temperature. The thermo-hydrograph measures both temperature and air pressure. The thermo-barograph keeps a record of the temperature and air pressure over time. Some Stevenson Screens also house hydrometers, which measure humidity.

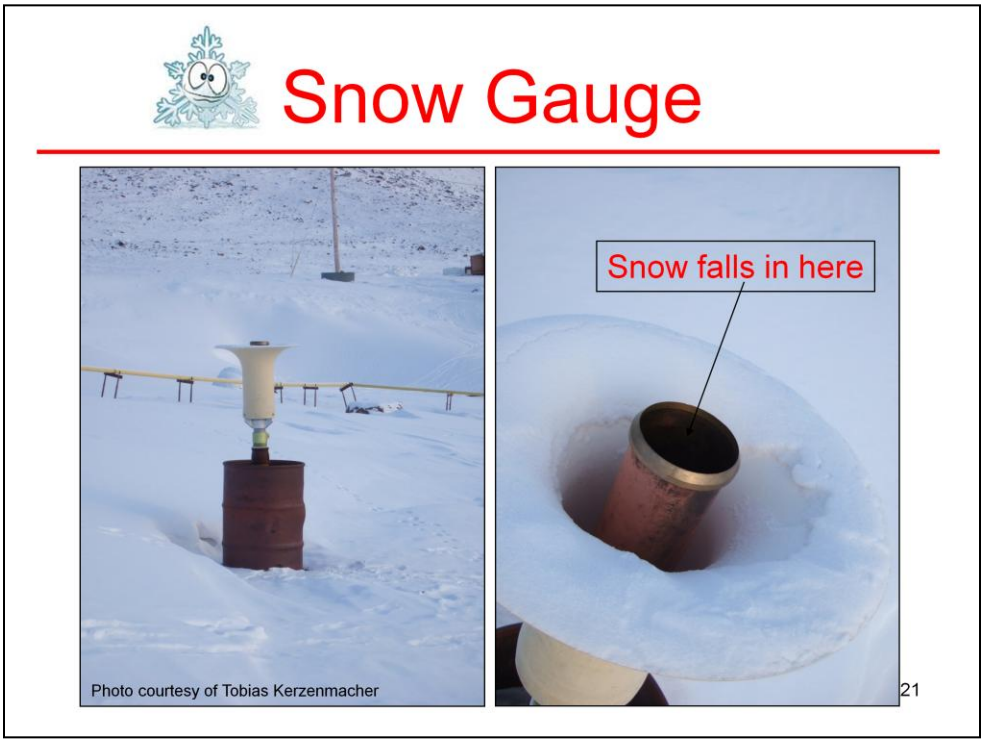
Note: If you have access to a thermometer, bring one in to show the students. You can use hot and cold water to demonstrate how a thermometer works.

Teacher: You may have heard people use the word humidity or humid before. Does anyone know what humidity means?

Response: The amount of water vapor in the air. So if a region is experiencing high humidity, the air will fell muggy and thick. The air temperature also feels hot. If a region is experiencing low humidity, the air will feel dry. The air temperature may feel hot, warm or cool.

Teacher: Although sunlight is important for the body to make vitamin D, too much heat and humidity can also be dangerous to one's health. In extreme heat, high humidity, or vigorous physical exercise under the sun, the body may not be able to get rid of enough heat, causing body temperature to rise and the person to experience heat stroke. This can cause symptoms like nausea, vomiting, weakness, headaches and muscle cramps. Infants, elderly people and people working outdoors are especially susceptible to heat stroke.

Information courtesy of: http://www.weatheroffice.gc.ca/mainmenu/faq_e.html#weather4 and http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/heat-chaleur-eng.php



A snow gauge measures how much snow has fallen. The snow falls inside the inner tube as shown. It is then taken inside where it melts, and the volume of the water is measured to determine the amount of snowfall.

Information courtesy of:
http://www.theweathernetwork.com/index.php?product=help&pagecontent=formulae#Q1

Rain Gauge

www.campbellsci.ca/Museum_Precipitation_1.html

Model CS700 (c) 2002 Campbell Scientific (Canada) Corp.

http://www.campbellsci.ca/Catalogue/prfull/cs700.jpg

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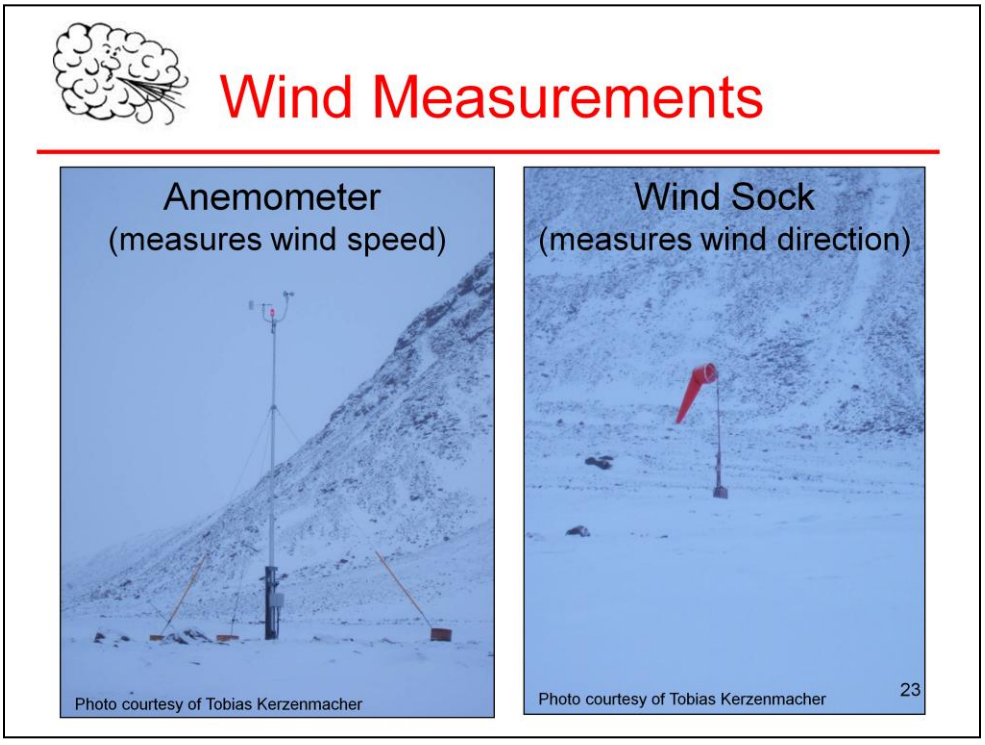
Additional Information: A rain gauge is used to measure the amount of precipitation (rain) that has fallen. Precipitation comes in many forms: rain, drizzle, freezing rain, freezing drizzle and hail. Some rain gauges have a measuring device inside the collection container, while others need to be transferred into graduated cylinders (similar to measuring cups) to be measured. Precipitation is usually measured in millimeters.

Information courtesy of:
http://www.weatheroffice.gc.ca/mainmenu/faq_e.html#weather1ba



Teacher: Both anemometers and wind socks are used to measure the wind. Wind socks show the direction of the wind. The sock turns to point in the direction in which the wind is blowing. Anemometers measure how fast the wind is blowing. Both of these instruments are commonly seen at airports.

Information courtesy of:
http://www.on.ec.gc.ca/skywatchers/ontario/wx_office_tour/compound/anemometer_e.html

Additional activity: Using a wind sock (homemade wind socks can be make with ribbon or light paper attached to a ruler), a fan and a paper with a compass rose drawn, you can demonstrate how a wind sock works. Have one student hold the fan on any side of the wind sock while the remaining students determine which way the wind is blowing.

Ice Thickness Measurements

Chris Polashenski of Dartmouth College (left) and Benny Hopson from the Barrow (Alaska) Arctic Science Consortium bore a hole through sea ice in the Chukchi Sea on July 4.
Caption courtesy of http://www.nasa.gov/topics/earth/features/icescape2010_arctic_ice.html
Photo courtesy of NASA/Kathryn Hansen

- Ice thickness can be determined using drill-hole measurements.
- A hole is drilled in the ice using an ice auger.
- Ice thickness is measured using a measuring tape equipped with a hinged weight at the end.
- The tape and weight are lowered through the hole and then pulled upward until the weight catches on the bottom of the ice.
- The tape is then read to determine the thickness of the ice.

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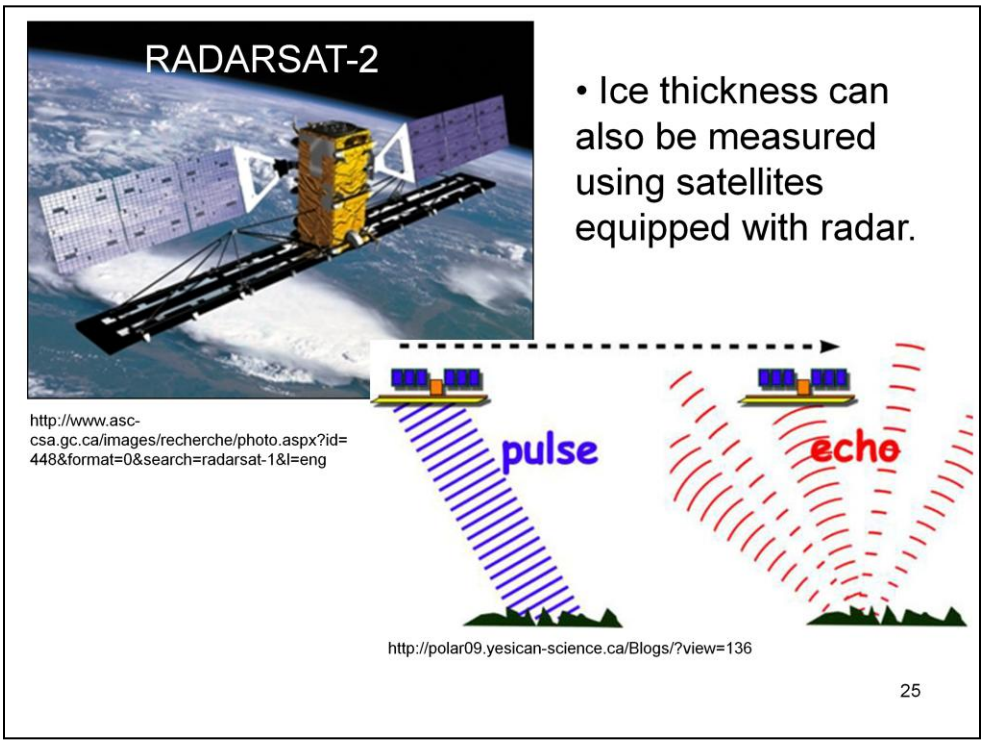
Additional information:

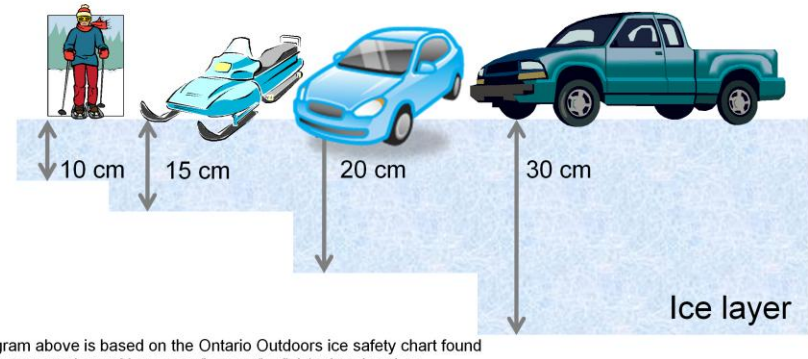
"Many things contribute to how thick the ice can be; such as the depth of the water, if the ice is exposed to the air and/or sun, as well as how much snow is on top of the ice. Think of the snow as a blanket. When snow if on ice it insulating it, preventing it from becoming thicker and stronger" (http://www.taiga.net/nce/schools/lessonplans/seaice.html).



Additional Information: Remote-sensing technology used to measure ice thickness from space was developed in Canada. RADARSAT is an Earth observation satellite developed to monitor environmental changes and the planet's natural resources. RADARSAT transmits pulses of radio waves towards the Earth, which then bounce off snow and ice as an echo. The strength of the echo is used to determine the thickness of the ice. If the echo is loud, the ice is hard and thick. If the echo is dull, the ice is soft and thin.

Information courtesy of:
http://www.thecanadianencyclopedia.com/index.cfm?PgNm=TCE&Params=A1ARTA0006639

- Thicker ice can usually support more weight than thinner ice, but the quality of the ice and the way it formed is also important.
- In order to be safe, people planning to travel or play on ice should know the thickness and approximate weight it is able to support.



The diagram above is based on the Ontario Outdoors ice safety chart found at http://www.ontariooutofdoors.com/images/icefish/safetychart.jpg.

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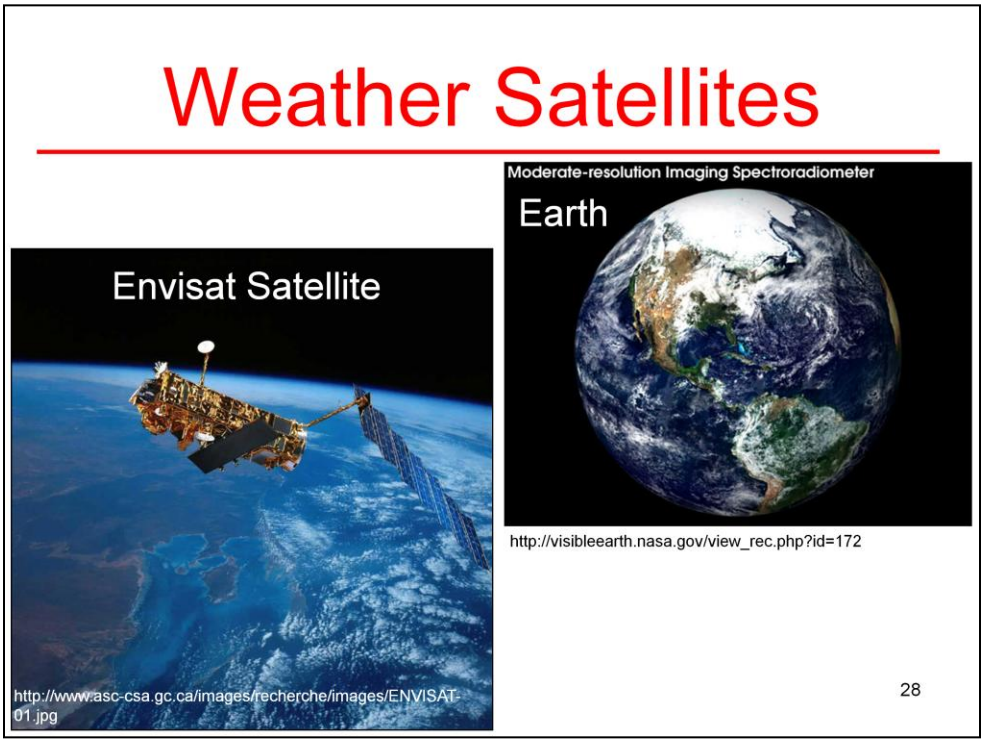
Additional Information: The diagram above shows the approximate ice thickness required to support various loads. Environment Canada has different safety requirements based on fresh and sea ice conditions. These can be viewed at http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=10167&Lang=eng.

Additional information: Each station collects data primarily from radiosonde instruments attached to hydrogen-gas weather balloons, which are launched every 12 hours. Radiosondes transmit temperature, pressure and humidity information from ground to 30 km; wind velocity and the direction the balloon travels is also tracked electronically. In addition to addressing issues of climate change, global warming and long-range transport of pollutants, researchers maintain that this data is important for generating extended weather forecasts.

Information courtesy of:
http://thecanadianencyclopedia.com/index.cfm?PgNm=TCE&Params=A1ARTA0003751



Teacher: Weather can also be monitored using satellites. What is shown in the picture on the right? (Point to the Earth.)

Response: The Earth

Teacher: Yes, this picture was taken by the Moderate Resolution Imaging Spectro-radiometer, MODIS, which is on the Terra Satellite. MODIS will help us understand global dynamics and processes taking place on the land, in the oceans, and in the lower atmosphere in order to accurately predict global changes. What do you think is shown in the picture on the left? (Point to the satellite.)

Response: A satellite

Teacher: Yes! This is a picture of the Envisat Satellite.

Additional Information: "By observing the Earth from space, satellites provide essential information on ocean, ice, land environments, and the atmosphere. Earth-observation satellites help us monitor and protect our environment, manage our resources, and ensure the safety and security of Canadians. Satellite imagery and expertise is also used to support global humanitarian efforts and sustainable development" (http://www.asc-csa.gc.ca/eng/satellites/default.asp).

Weather Puppets

1. Using half a sheet of construction paper, draw and cut out a weather shape (sun, raindrop, cloud, rainbow, snowflake).
2. Add accessories/decorate using additional construction paper, markers.
3. Add arms/legs with pipe cleaners and googly eyes.
4. Attach weather shape to popsicle stick (handle) with scotch tape.

Photos courtesy of Tara Cunningham

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You may also choose to provide printed images for students who find drawing challenging.

Weather Mobiles

1. Glue two popsicle sticks in an “x” shape to form mobile base.
2. Using scrap paper, draw small pictures of seasonal weather (snow for winter, rain for summer). The teacher may also choose to provide printed images for students who find drawing very challenging.
3. Using string, attach pictures to the mobile and decorate.


Photo courtesy of Niall Ryan

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