

# Ice Seasonality Investigation

## Ice Seasonality Protocol

### ***Purpose***

To monitor the freeze-up and break-up processes on a selected pond/lake or large creek/river to determine the duration of the annual ice cover.

### ***Overview***

Students will select an easily accessible pond/lake or large creek/river close to their school that is known to develop an ice cover in the winter and observe and document its freeze-up and break-up.

### ***Student Outcomes***

Students will be able to:

- Observe when the water body freezes up at the beginning of the ice growth and decay season;
- Observe when the water body breaks up at the end of the ice growth and decay season;
- Examine relationships between the freeze-up and break-up processes and climate;
- Communicate with other GLOBE schools (within your country and other countries);
- Share observations by submitting data to the GLOBE database;
- Compare the freeze-up and break-up processes among various GLOBE sites;
- Predict the timing of freeze-up and break-up for upcoming seasons (advanced).

### ***Science Concepts***

#### ***Earth and Space Sciences***

- The sun is the major source of energy for Earth surface processes.
- Weather changes from day to day and over the seasons.
- Water circulates through the land, ocean and atmosphere.

#### ***Physical Science***

- The sun is the major source of energy at the Earth's surface.
- Materials exist in different states – solid, liquid and gas.
- Substances expand and contract as they are heated and cooled.
- Heat only moves from warm to cooler or colder objects.

#### ***Geography***

- Physical processes shape the patterns of the Earth's surface.

***Scientific Inquiry Abilities***

- Estimate the ice cover
- Identify ice types
- Identify answerable questions
- Design and conduct scientific investigations
- Use appropriate mathematics to analyze data
- Recognize and analyze alternative explanations
- Communicate procedures, descriptions and predictions

***Time***

Selection and preparation of site (not including times to and from the site): up to several hours.

Observation visits (not including times to and from the site): about 15-20 minutes.

***Level***

Upper elementary grades, middle school and high school.

***Frequency***

This is highly dependent on the nature of the water body. For small ponds and shallow and/or slow moving rivers and creeks, observations will be made daily at the same time of day  $\pm$  1 hour during the freeze-up. The recommended time of day is solar noon as this is the time of the maximum of sunlight even as the length of the day decreases. Initially, for large lakes and fast moving rivers, freeze-up observations can be made 2-4 times a week. Once the border ice is well established and the only open water left on the river takes the form of "leads", observations will be made every day.

In the event of a "warm" freeze-up period (daily mean temperatures are  $< 0^{\circ}\text{C}$  but not very cold), freeze-up observations can be made every other day on small ponds and shallow and/or slow moving rivers and 2-3 times a week on large lakes and fast moving rivers.

Once the snow has completely melted from the ice cover, break-up observations should be made every day because break-up is a rapid (and possibly dynamic) process. Break-up can be due to melting (thermal process) and the physical breaking of ice into smaller pieces (mechanical process) that may then move due to environmental forcing (winds and currents).

***Material and Tools******For Site Definition (once only)***

GPS receiver

Pencil and Pen

Survey stakes/tape or other markers to identify the photo sites and viewing points

Digital camera (with cables and software)

Computer with Internet connection  
*Ice Seasonality Site Definition Field Guide*  
*Ice Seasonality Site Definition Sheet*  
*Basic GPS Protocol Field Guide*  
*Basic GPS Protocol Data Sheet*

***For Ice Observations***

Pencil or pen  
Digital camera (with cables and software)  
*Ice Seasonality Field Guide*  
A completed copy (including photographs and map/diagram) of the *Ice Seasonality Site Definition Sheet* in a plastic sleeve (or laminated)

One of the following:

*Ice Seasonality Investigation River Freeze-Up Data Sheet*  
*Ice Seasonality Investigation River Break-Up Data Sheet*  
*Ice Seasonality Investigation Lake Freeze-Up Data Sheet*  
*Ice Seasonality Investigation Lake Break-Up Data Sheet*

One of the following:

*Ice Seasonality Investigation River Ice Glossary*  
*Ice Seasonality Investigation Lake Ice Glossary*

*For Meteorological Observations (only for GLOBE Atmosphere sites)*

Pencil or pen  
Field note book/paper  
*Max, Min and Current Temperature Protocol Field Guide*  
*Solid Precipitation Protocol Field Guide*  
One of the GLOBE Atmosphere Data Sheets on which to record the Max, Min and Current Temperature and Solid Precipitation data, e.g. *Integrated 1-Day Data Sheet* or *Integrated 7-Day Data Sheet*.

***Preparation***

Select and mark the observation site and complete the Site Definition Sheet.

Locate a source of local weather data (GLOBE Atmosphere site, NWS meteorological station, local airstrip observations or newspaper)

Begin observations to complete the Annual Summary Data Sheet

Familiarize the students with GPS or map use

Familiarize students with the ice types in the Ice Glossary.

***Prerequisites***

None

# Ice Seasonality Investigation

## Introduction

Ice and snow are important components of the Earth's climate system and are particularly sensitive to global warming. Over the last few decades, the amount of ice and snow, especially in the Northern Hemisphere, has decreased substantially. Changes in volumes and extents of ice and snow have both global and local impacts on climate, ecosystems and human well-being. River and lake ice, with their smaller areas and volumes, react relatively quickly to climate effects, influencing ecosystems and human activities on a local scale. Therefore, they are good indicators of climate change.

Rising air temperatures are affecting river and lake ice. This is mainly seen as earlier spring break-up and, to a lesser extent, later autumn freeze-up. The trend to longer ice-free periods is projected to continue. Details are uncertain but strong regional variation is expected, with the amount of change depending on the degree of warming.

In remote areas, frozen rivers and lakes are used as transportation corridors and longer ice-free periods mean reduced or more expensive access to communities and industrial developments. Many northern indigenous people depend on frozen lakes and rivers for access to traditional hunting, fishing, reindeer herding or trapping.

Ice formation on rivers and lakes is a key factor controlling biological production. Consequently, changes in the length and timing of ice cover have ecosystem effects. Spring break-up often causes ice damming on the river, resulting in costly flooding. Lowered temperature gradients along north-flowing rivers in the Northern Hemisphere may lead to reductions in ice-jam flooding. This has potential negative ecological consequences for deltas where annual flooding is needed to maintain ponds and wetlands.

The seasonality of an ice cover is summarized by the freeze-up date, break-up date and ice cover duration. Freeze-up (FrzUp) defines the period between initial ice formation and the establishment of a complete ice cover. The FrzUp date is the day that the lake or river is completely ice covered (100%). Break-up (BrkUp) defines the period between the onset of snowmelt and the complete disappearance of the ice. The BrkUp date is the day when the lake or river is completely ice-free (0%). Taken together, the FrzUp date and BrkUp date denote the endpoints of the ice cover duration.

## Teacher Support

### *Timing of Observations*

For the purposes of this protocol, freeze-up is the period when the water body goes from having no ice cover to a permanent 100% ice cover, i.e., it does not melt out until the end of the ice season: the freeze-up date is the first day of “permanent” 100% ice cover. Break-up is the period when the water body goes from having a 100% ice cover to no ice: the break-up date is the first day of no ice. Teachers/students will determine the ice cover duration by counting the number of days from the permanent freeze-up date to the break-up date.

Monitor freeze-up from the day when ice first appears until the water body is covered by 100% ice. Observations should begin when overnight air temperatures fall below 0°C in order to catch the first incidence of ice formation. Observations should extend beyond the 100% ice cover date (less frequent observations) for about a week in order to make sure that the ice cover is “permanent”. It is not uncommon for an ice-cover the melt back before becoming established for the winter. Daytime air temperatures (>0°C) will be a clue as to possible ice melting.

Monitor break-up from the day when the ice is bare because the snow cover on it has completely melted, determined by snow no longer being seen, until there is 0% ice cover. Preliminary observations should be made when daytime air temperatures rise above 0°C so that melt features induced by the snow melt can be documented (i.e., melt ponds and cracks).

Complete the **Annual Summary Data Sheet** during the freeze-up and break-up periods. Note that some of the information recorded on this form is also found on the **Site Definition Sheet** (General Site Description and Standard Photograph Set).

### *Measurement Procedure*

It is ***highly desirable*** that these observations be done by a minimum of two people per visit. The observers ***never*** go on the ice.

Complete the appropriate data sheet (**River Freeze-Up Data Sheet, River Break-Up Data Sheet, Lake Freeze-Up Data Sheet or Lake Break-Up Data Sheet**) during each visit. This will involve:

1. Characterizing the ice cover in terms of % cover, ice type and changes in the ice.
2. Making Environmental observations.
3. Documenting the site with photographs and comments.

See the **Ice Seasonality Field Guide** for details.

## Site Selection and Set-Up

Choose a water body to be studied well in advance of the freeze-up or break-up season. It should be as close to the school as possible for easy access in the minimum amount of time. It should have a history of freezing up during the winter.

The photos are taken from the shore. The observers ***never*** go on the ice. Choose a study site that has at least one point of easy access (vantage point) from which there is a clear view of all of the water to be documented. In some cases, it may be necessary to identify several points of access in order to adequately document the water body (see figures 1-5 below).

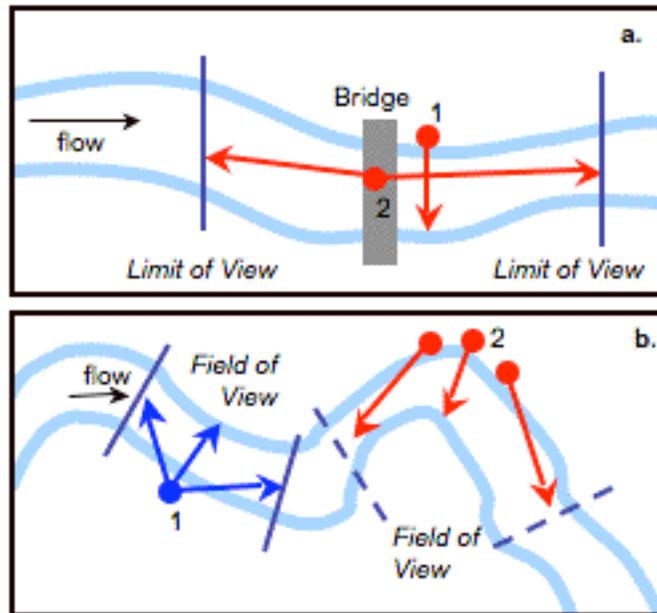
During the site selection and set-up visit, complete the **Site Definition** Sheet. See the **Site Definition Field Guide** for details.

### *Choosing a river ice site*

For River sites, the standard photo set has three photos: "Across", "Upstream", and "Downstream". The ideal River site would be a bridge across the river (Fig. 1a). In this case, the "Across" stream image should be taken adjacent to the bridge from one of the banks (Fig. 1a – Point 1) and the Upstream and Downstream photos should be taken from approximately the same vantage point but in opposite directions (Fig. 1a – Point 2). A gravel bar may also serve this purpose as long as it is easily accessible.

It is possible that a bridge does not span the river/creek of interest. In that case, a single vantage zone on one or the other bank may be used (Fig. 1b – Point 1). This will be a high point that offers views up and down the river as well as across it. In some instances, it may be necessary to move along the bank in either direction to take the Upstream and Downstream photos (Fig1b – Point 2).

An example of a River Ice standard photo set is seen in Figure 1.



**Figure 1. Examples of river photo acquisition scenarios.** Numbers indicate vantage points from which photos are taken. Arrows indicate lines of sight. A bridge can be used as a vantage point to take the upstream and downstream views on a river **(a)** (between the two solid lines). The across stream view can be taken adjacent to the bridge or at the end of the bridge. If no bridge is available, another kind of vantage point must be found to provide upstream and downstream views **(b)**. For the site shown in (b), you could choose either 1 or 2 as your vantage point. In this case the upstream/downstream views will not be perpendicular to the across view.

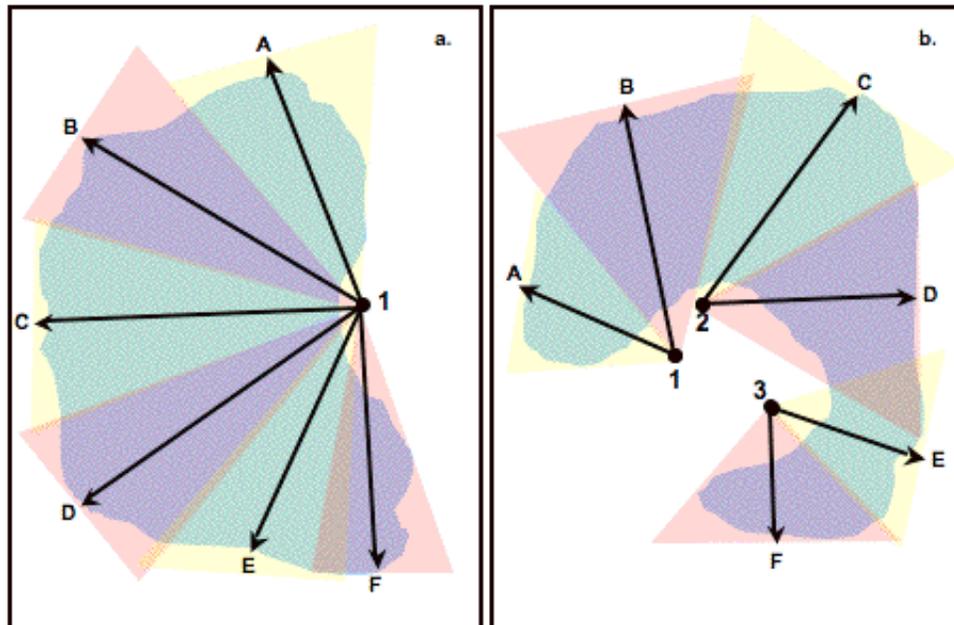


**Figure 2. An example of a standard set of river ice photographs:** across river (top left), downstream (right), and upstream (bottom left). The above photographs of the Chena River in Fairbanks, AK, were taken on 7 November 2006 by Martin Jeffries. See the Site Definition Field Guide for a description of the photograph naming convention.

### Choosing a lake ice site

For Lake sites, the appropriate number of photos in the standard set will have to be determined by the observers (maximum of six). The number and direction of the images will depend on the shape of the lake/pond and the area of the lake that is to be documented (all or part of the water body). Your standard set may have from three to six photos (see Figs. 3 and 4). The vantage point(s) and photo “targets” of the observation site should be marked by survey stakes/tape or other obvious markers to ensure the necessary repeatability of the observational field of view of the photo time series (see Figs 3 and 4).

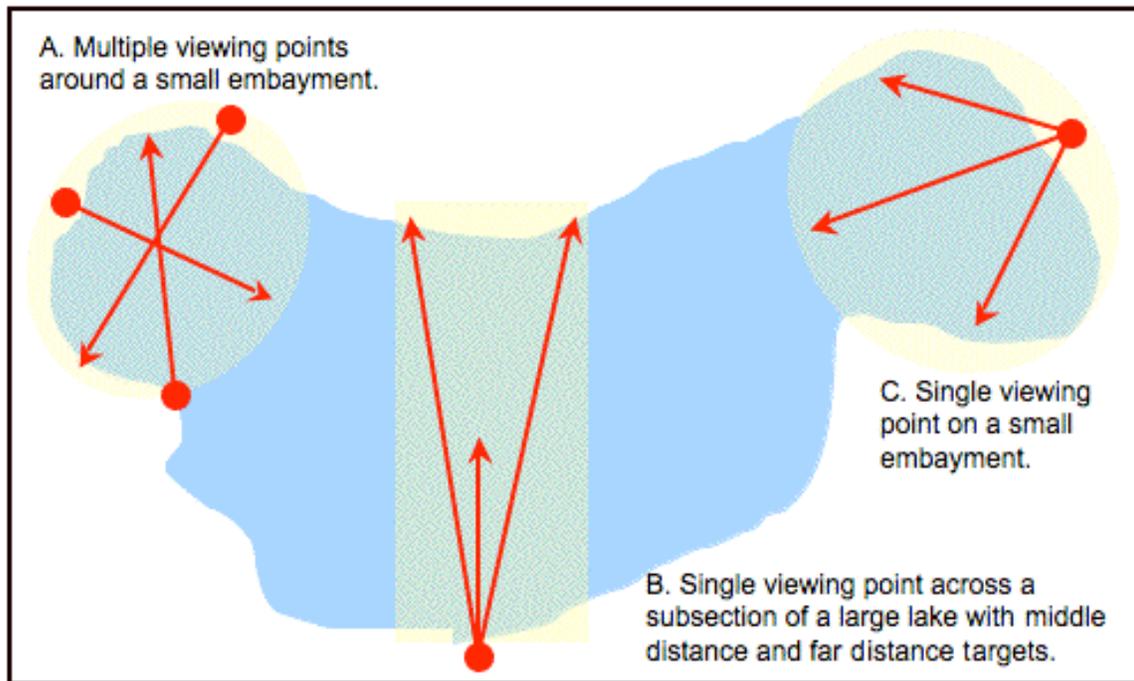
For a small pond, it is possible to document the entire water body (Figure 3). A single vantage point strategy may not be possible in all cases. Keep in mind that the goal is to document the entire water body if it is small (100’s meters long and wide). Teacher/students will have to devise their own standard photo set in order to achieve this goal (see Figure 3b). Setting up your site, including determining the data acquisition strategy, is part of the problem solving required by the protocol. To keep the scope of the problem manageable, you need to define a standard photo set of up to six photos. They can be taken from a single vantage point or from different vantage points.



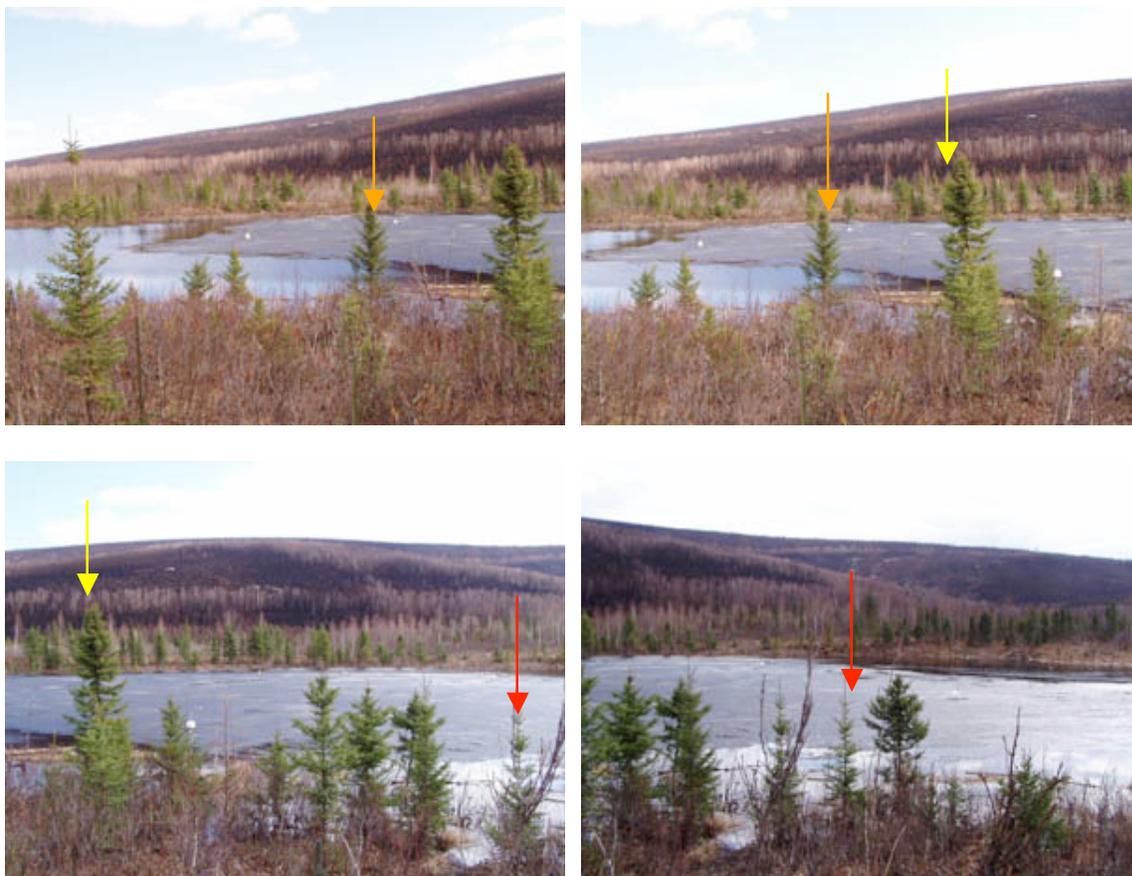
**Figure 3. Examples of photo acquisition scenarios for a small pond/lake.** Numbers indicate vantage points. Capital letters indicate across-the-water-body targets. Arrows indicate lines of sight. For small ponds and lakes (irregularly-shaped solid objects above), it is more difficult to cover the area of interest in only three photos. If possible, select one vantage point and make multiple, overlapping images of the pond (a). The shaded triangles approximate the field of view for the acquired image. Otherwise, select several vantage points and take photos at each point that will produce overlapping images of the entire pond (b).

For a large lake (kilometers long and wide), focus on a portion of the lake (Figure 4). Natural inlets or embayments are easiest as they have obvious boundaries. However, with careful placement of marking stakes it is possible to document the ice cover over a central portion of the lake (Figure 4).

An example of a Lake Ice standard photo set is seen in Figure 5.



**Figure 4. Examples of photo acquisition scenarios for a large lake.** In the case of a large lake, only a portion of the water body is documented. An embayment or inlet on the lake is the easiest to photograph and scenarios similar to those on a small pond can be used (A or C). Alternately, a zone in the middle of the lake can be delineated and photo targets can be across the lake, to capture the ice conditions on the far shore, and mid-lake to capture ice conditions at the near shore (B).



**Figure 4. Example of a standard set of lake ice photographs.** These photographs are of site 01 at MST Pond at Poker Flat, AK; they were taken on **2 May 2005** by Martin Jeffries. These images were taken using the data acquisition scenario shown in Figure 3a, i.e., from a single vantage point and were taken looking south from west (upper left) to east (lower right). Notice that the tree indicated by the orange arrow in the upper left image appears again in the adjacent image and the tree indicated by the yellow arrow in the upper right image appears again in the lower left image, etc.

See the Site Definition Field Guide for a description of the photograph naming convention.

# Ice Seasonality Investigation

## Site Definition Field Guide

### Task

To set-up, draw, describe, take photographs and locate the latitude, longitude and elevation of your Ice Seasonality site.

### What You Need

- GPS receiver
- Basic GPS Field Guide*
- GPS Data Sheet*
- Topographic map of the area
- Air photo or satellite image of the area (optional)
- Ice Seasonality Investigation Site Definition Sheet*
- Surveyor's stakes and/or tape
- Pencil or Pen
- Digital camera (with extra batteries)

### In the Classroom

1. Determine the source of the meteorological data (air temperature and snow events) you will use for the Ice Seasonality Investigation. Please keep in mind that none of these data sources give you an exact description of the daily air temperatures and snow events since none of them are located on the Ice Seasonality study site.

Meteorological data sources include:

a. A school sponsored, site specific, GLOBE weather station at a GLOBE Atmosphere site (located not more than 100 meters from your Ice Phenology site - see the GLOBE Teacher's Guide – Atmosphere Chapter). It is recommended that the GLOBE Maximum, Minimum and Current Temperature Protocol be implemented. You will have to compile these data on a daily basis in order to create a useful data set. This data source will produce the most relevant meteorological data for your Ice Seasonality study site because they are acquired closest to your site although there may be a difference in elevation. This difference in elevation may result in a slight difference in the daily minimum temperature as cold air pools in low-lying areas at night.

b. The government operated weather station in your local area or region. The monthly summaries of these data may not available for several months after the fact. However, the relevant agency may have a web site or other data distribution venue where daily data are available. You will have to compile these data on a daily basis in order to create a useful data set. These data may only give a general idea of the temperature conditions at your Ice Seasonality study site, since the source is not at the same location as your site and may be in a different environment or at a different elevation.

c. The local airstrip weather data. This may be available on the Weather Underground web site at <http://www.wunderground.com/>. To determine the data sources near the observation site:

- Enter the appropriate information in the search cell at the top of the web page.
- Scroll down to the “Nearby Airports” area (highlighted in light blue) and select the correct location (the window will refresh itself if you choose another location from the current window).
- Scroll down to the “History & Almanac” area (highlighted in light blue) and in the “Detailed History and Climate” section click on the “Calendar View”. This will take you to a summary of the current month’s data.
- Scroll down to the bottom of the page where the data are tabulated. Either read the information needed directly off the web page or download the data as a Comma Delimited File.

You will have to compile these data on a daily basis in order to create a useful data set. These data may only give a general idea of the temperature conditions at your Ice Seasonality study site, since the source is not at the same location as your site and may be in a different environment or at a different elevation.

d. The local television and radio broadcasters and newspaper. These information outlets report the daily meteorological data (the daily maximum, minimum, and mean daily temperatures and amount of precipitation). It is a good idea to contact these information outlets to find out what the sources of their data are. You will have to compile these data on a daily basis in order to create a useful data set. These data may only give a general idea of the temperature conditions at your Ice Seasonality study site, since the source is not at the same location as your site and may be in a different environment or at a different elevation.

2. Fill out as much of the “Source of Meteorological Data” section. If you are **NOT** using a GLOBE Atmosphere Site, you should be able to complete this section before going in the field.
3. Locate the map or image (airphoto (<http://terraserver-usa.com/> - USA sites) or satellite image from Google Earth) that will describe the general area of your site and make or print out a copy to take in the field.

#### *In the Field*

4. Fill out the top part of the Site Definition Sheet (lines 1-5).
5. Identify and set up the Ice Seasonality site as described in the Ice Seasonality Protocol – Site Set Up. Remember to identify the vantage points (positions

from which the photos are taken) and the targets. It is highly recommended that the vantage points be marked with a surveyor's stake or tape.

6. Identify the latitude, longitude and elevation of the observation site following the *Basic GPS Measurement Protocol* **OR** use a topographic map to determine this information.
7. If you have a GLOBE Atmosphere siteweather station adjacent to your Ice Seasonality observation site then: record its name (ATM-99) and measure:
  - Its name (ATM-XXX)
  - Distance to Atmosphere site from Ice Seasonality site
  - Direction to Atmosphere site from Ice Seasonality site
8. Provide an adequate description of how to get to the site. This should include the best route to drive from a well-known landmark (the school, major cross roads) to the parking area. Then describe the walking route from the parking site to the spot where the Standard Photograph Set is acquired.
9. Determine the **biome** of the site:
  - a. Determine the NATURAL biome of the site. This is what the site would be classified as if there were no human activity in the area. You may need to make some notes on the general vegetation and then go to the GLOBE Seasons and Biomes website for descriptions and pictures of the major biomes once you return to the classroom.
  - b. Describe what kind of human modification has occurred at the site (urban, suburban, rural, industrial, agricultural or no alteration).
10. Document the general configuration of the study site using a sketch, map or image. Annotate your sketch, map or image, labeling important natural and cultural landmarks. Provide a north arrow and scale (if possible).
11. Describe the water body to be studied (i.e., estimated length, width and depth of lake, estimated depth and width of river, velocity of river water at the observation site (slow to fast, including rapids), general topography, dominant vegetation, etc.
12. Take a standard set of photographs. These "views" will be used for the entire freeze-up and break-up of the water body. It is best to select targets that are either at the center of the image (horizontal or vertical) or that define the edges of the image.

Photographs will be stored in the database at a size of not more than 1000 pixels wide, so they should be taken at the closest resolution of your camera to this size. (Always choose the slightly larger image if a 1000 pixel wide image is not one of the camera's standard options.) These images should all

be taken on the same photo setting (i.e., the default setting, NOT Zoom) in landscape format.

A River Ice Standard Photograph Set includes three photos: Across, Upstream, and Downstream.

A Lake/Pond Ice Standard Photograph Set includes as many photographs as necessary to fully document the site. (It is best not to exceed 6 images – this ensures repeatability and data acquisition in a timely fashion.)

13. Use the comment space for each photograph to describe the landmarks that define the image (objects that appear at the edges or at specific places within the image). Also describe the exact relationship between the stake marking the vantage point and the photographer when the photo is taken (stand in front, behind, to the left, etc.).

### ***In the Classroom***

14. Confirm your biome selection by going to the GLOBE Seasons and Biomes website.
15. Download your images and rename them according to the following convention: ***ICE-99\_YYMMDD\_XXXXXX*** where:
  - ICE-99*** is the site ID created by the GLOBE database when you create your site. (For your site definition photos, you can use the ID ***ICE-01*** in your photo names and if a different ID ends up being used, your photos will be automatically renamed with the correct ID.)
  - YYMMDD*** is the date of data acquisition
  - XXXXXX*** is the photo view (i.e., *Up*, *Down*, or *Across* for River Ice sites; or the names you selected for Lake/Pond Ice sites)

For example: ICE-01\_091028\_Down is an image acquired at the first ICE site on 28 October 2008 looking downstream.
16. Put the annotated sketch, map or image of the Ice Seasonality observation site on the computer. This can be done by scanning or photographing the document. In the case of digital images (air photos or satellite images), the field annotations can be transferred to the image in a computer application such as Photoshop and saved as a jpeg file.
17. Complete the *Ice Seasonality Investigation Site Definition Sheet* and submit all of your data to GLOBE.

18. Print out, name and annotate the standard photo set on a single sheet of paper. Important targets in the images should be marked either digitally in a computer drawing application (such as Photoshop) or by hand on the printout.
19. Place this annotated data sheet in a plastic sleeve and take it out into the field on every subsequent visit to the observation site. Use it as a guide to take all of the freeze-up and break-up observation images.

# Ice Seasonality Investigation

## Site Definition Sheet - *Example*

School Name: **Tri-Valley School**

Observer Names: **M. Martin and his class**

Date: **7 October 2007**

Check one:  New Site  Metadata Update

Study Site name (give your site a unique name): **Nenana River at the power plant at Healy**

Type of Site: Check one:  River/Creek  Lake/Pond

Coordinates: Latitude: **63.85**  N or  S (check one)  
 Longitude: **148.96**  E or  W (check one)  
 Elevation: **393.2** meters

Source of Location Data (check one):  GPS  Other

If other, describe: \_\_\_\_\_

### Source of Meteorological Data:

Temperature data:  GLOBE Atmospheric Site  National Weather Service  
 Airstrip data  Newspaper/local media reports

Snow data:  GLOBE Atmospheric Site  National Weather Service  
 Airstrip data  Newspaper/local media reports  Observation

If possible, provide some location information about the source of your meteorological data:

Distance to Ice Site: \_\_\_\_\_ kilometers;

Direction to Ice Site:  N  NE  E  SE  S  SW  W  NW

### OR

Latitude: **63.87**  N or  S (check one)  
 Longitude: **148.97**  E or  W (check one)

If a GLOBE Atmosphere Site is being used as the source of meteorological data for your Ice Seasonality Site, please complete the following:

**Atmosphere Site:** ATM-\_\_\_\_\_

Distance to Ice Site: \_\_\_\_\_ meters;

Direction to Ice Site:  N  NE  E  SE  S  SW  W  NW

**Driving and/or walking directions:** Provide directions to the site from some well-known landmark (school, cross roads, etc.). If appropriate, include walking directions from where your vehicle is parked to the Ice Site access/photo vantage point(s).

**From Tri-Valley School – drive back to the Parks Highway. Turn left onto the highway and drive down to the Healy Spur Road. Turn left onto the Healy Spur Road and drive until you arrive at the bridge that crosses the Nenana River (railway bridge is parallel to the traffic bridge and power plant is directly opposite). Park either at the end of the bridge or on it. NOTE: The name of the airstrip that we get our temperature data from is PAHV (elevation 394.5 m)**

**Site Biome:**

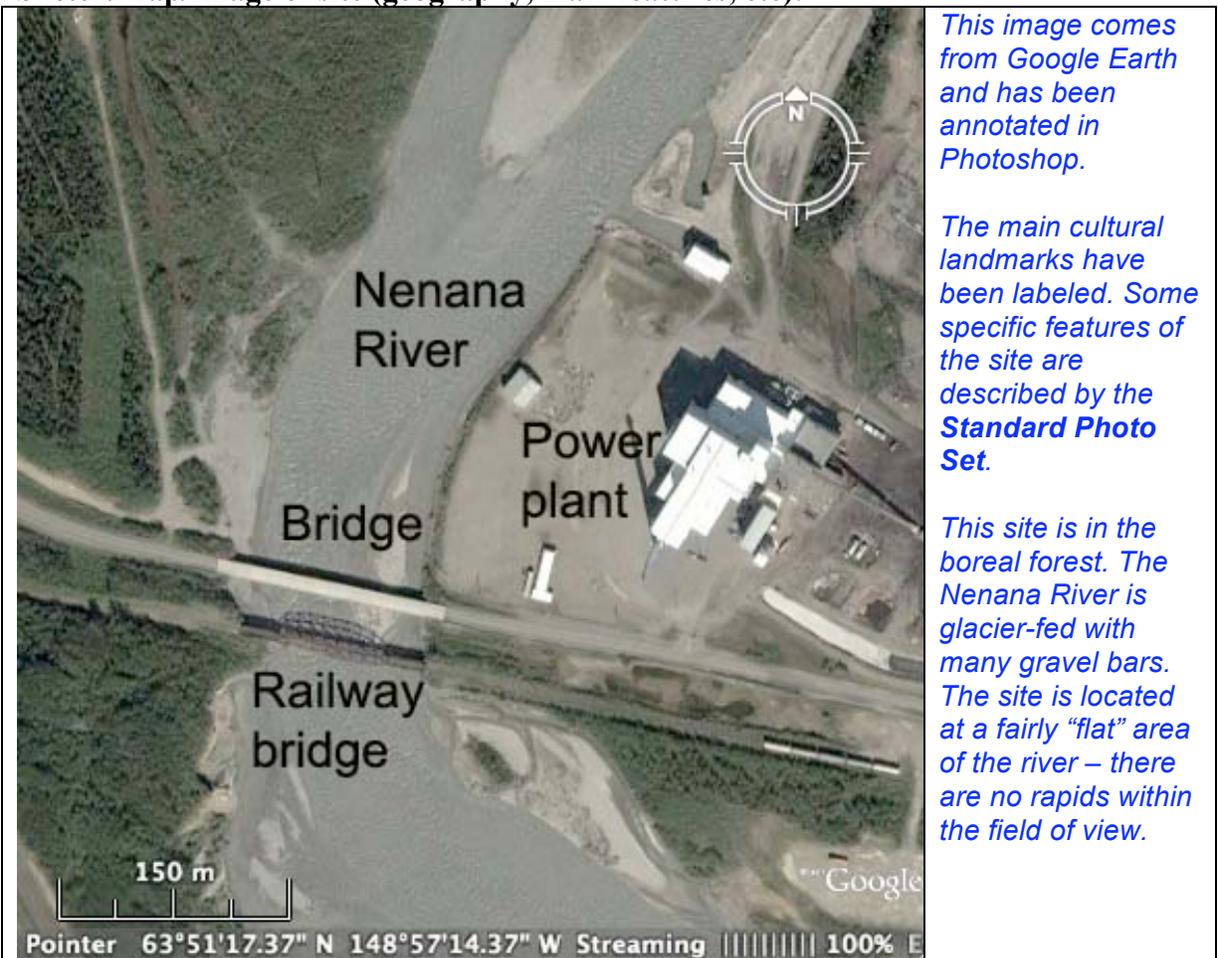
The site is in the following natural biome (check one – definitions are found on the GLOBE Seasons and Biomes website):

- Tundra                       Taiga/Boreal Forest                       Montane
- Temperate Conifer Forest
- Temperate Deciduous/Mixed Forest
- Tropical/Subtropical Moist Deciduous Forest
- Tropical/Subtropical Dry Deciduous Forest
- Tropical/Subtropical Coniferous Forest
- Mediterranean                       Tropical Grasslands                       Temperate Grasslands
- Desert/Xeric                       Flooded Grasslands                       Mangroves

The natural condition of the site has been modified by human activity in the following way (check one):

- Urban (dense settlement)                       Rural (villages)
- Croplands/Agriculture                       Rangeland/Grazing                       Forestry
- Little Human Influence                       No Human Influence

**Sketch/Map/Image of site (geography, main features, etc):**



*This image comes from Google Earth and has been annotated in Photoshop.*

*The main cultural landmarks have been labeled. Some specific features of the site are described by the **Standard Photo Set**.*

*This site is in the boreal forest. The Nenana River is glacier-fed with many gravel bars. The site is located at a fairly “flat” area of the river – there are no rapids within the field of view.*

**Standard Photograph Set of River Ice/Lake Ice Observation Site:**

For a **River Ice site**, the Standard Photograph Set includes three photos: Across, Upstream, and Downstream.

For a **Lake/Pond Ice site**, the Standard Photograph Set needs to be defined by you and can include up to 6 photos. If this is a **Lake/Pond site**, provide names for the *photo views* in your standard photo set:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_

Your Site Definition includes taking one Standard Photograph Set. When you download the photos from your camera, rename them to follow the convention *study site ID\_ date\_ photo view* (so the format would be: *ICE-99\_YYMMDD\_XXXXXX* where *XXXXXX* is *Up, Down, or Across* for River Ice sites; or the names you chose above for Lake/Pond Ice sites).

**Enter the filename and annotation comments for each photo here:**

<p><b>Photo 1: ICE-01_071007_Across</b></p>	<p>Comments: <b>The bridge forms the right-hand boundary of the image. The building on the far bank, next to the power plant, appears at the left-hand boundary of the image. The power plant appears in the top third of the image.</b></p>
<p><b>Photo 2: ICE-01_071007_Down</b></p>	<p>Comments: <b>The small building appears at the right-hand boundary of the image. The two vertical poles and the peak-like structure appear at the left-hand boundary.</b></p>
<p><b>Photo 3: ICE-01_071007_Up</b></p>	<p>Comments: <b>The railroad bridge appears in te top half of the image. Use the bridge structure to locate the image (i.e., the bridge pier appears at the right-hand boundary of the image).</b></p>

# Ice Seasonality Investigation

## Field Guide

### Task

To photograph and describe the changes in the ice cover on the Ice Seasonality observation site (since the last visit) during freeze-up and break-up.

**NOTE: It is highly desirable that these observations be done by a minimum of two people per visit. The observers never go on the ice.**

### What You Need

- Pencil or Pen
- Digital camera
- A completed copy (including photographs and map/diagram) of the *Ice Seasonality Site Definition Sheet* in a plastic sleeve (or laminated)

If your site is a **River Ice** site, then:

- Ice Seasonality Investigation River Freeze-Up Data Sheet* **OR**  
*Ice Seasonality Investigation River Break-Up Data Sheet*
- Ice Seasonality Investigation River Ice Glossary*

If your site is a **Lake/Pond Ice** site, then:

- Ice Seasonality Investigation Lake Freeze-Up Data Sheet* **OR**  
*Ice Seasonality Investigation Lake Break-Up Data Sheet*
- Ice Seasonality Investigation Lake Ice Glossary*

### In the Field

1. Estimate the ice cover, ice types and ice changes at the Ice Seasonality observation site. (see the appropriate figure below). Note that the ice cover is estimated to the nearest 5%. The only exceptions are when there is only a trace of ice or when there is only a minimum amount of open water. In these instances the ice cover is 1% and 99% respectively. This indicates that ice/water is present in a very small amount.
20. Complete the Environmental Observations.
 

**NOTE:** The “Wind” observations are based on the Beaufort Wind Force Scale (Table 1).

  - a. The **Calm** designation covers the Beaufort number 0 (calm) or <0.3 m/s.
  - b. The **Light Wind** designation covers the Beaufort numbers 1 (light air) through 3 (gentle breeze) or 0.3 – 5.5 m/s.
  - c. The **Windy** designation covers the Beaufort numbers 4 (Moderate breeze) and higher or >5.5 m/s.

If conditions are at number 8 (17.2 – 20.7 m/s - twigs broken from trees; cars veer on road) or higher, you should probably not be out making observations.

Table 1. Beaufort Wind Force Scale

Beaufort Number	Wind Speed m/s	Description	Land conditions
0	< 0.3	Calm	Calm. Smoke rises vertically.
1	0.3 – 1.5	Light air	Wind motion visible in smoke.
2	1.5 – 3.3	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	3.3 – 5.5	Gentle breeze	Leaves and smaller twigs in constant motion.
4	5.5 – 8.0	Moderate breeze	Dust and loose paper rise. Small branches begin to move.
5	8.0 – 10.8	Fresh breeze	Branches of a moderate size move. Small trees begin to sway.
6	10.8 – 13.9	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	13.9 – 17.2	High wind, moderate gale, near gale	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.

Source: [http://en.wikipedia.org/wiki/Beaufort\\_scale](http://en.wikipedia.org/wiki/Beaufort_scale)

Figure 1. Estimating the border ice on a river (looking upstream and downstream)

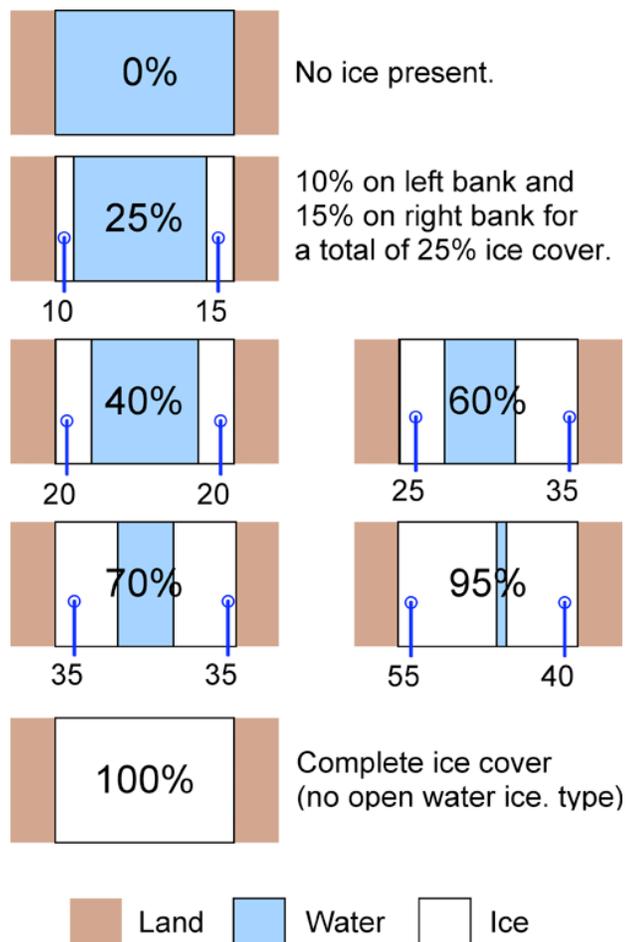
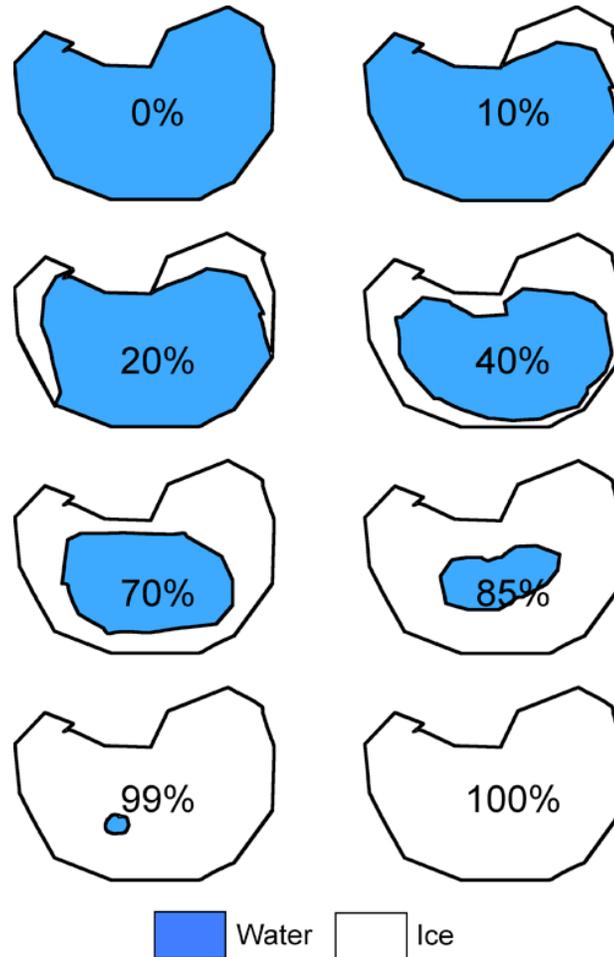


Figure 2. Estimating the TOTAL ice cover on a pond or lake.



2. Record any additional Environmental comments not covered on the data sheet.
3. Take a standard set of photographs. Refer to the *Ice Seasonality Site Definition Sheet* for guidance.
4. Record any comments that you would like to make on these photographs.
5. Take any additional photographs of interesting or unusual phenomena. You may use the Zoom camera function for these images but do not exceed an image width of 1000 pixels.
6. Record any comments that you would like to make on these photographs.
7. Record any additional comments on anything else that is relevant or of interest.

***In the Classroom***

8. Download your images and rename them according to the following convention: ***ICE-99\_YYMMDD\_XXXXXX*** where:  
*ICE-99* is the site ID created by the GLOBE database when you created your site  
*YYMMDD* is the date of data acquisition  
*XXXXXX* is the photo view (i.e., *Up*, *Down*, or *Across* for River Ice sites; or the names you selected for Lake/Pond Ice sites)

Use the following convention for naming the optional additional photos:

***ICE-99\_YYMMDD\_XXXXXX*** where:

- ICE-99* is the site ID  
*YYMMDD* is the date of data acquisition  
*XXXXXX* is a name that you choose for the additional photo and includes a number (start at 1)

For example: ICE-01\_091028\_Down is an image acquired at the first ICE site on 28 October 2008 looking downstream.

9. Submit all of your data to GLOBE.

# Ice Seasonality Investigation

## River Freeze-Up Data Sheet - *Example*

School Name: **Tri-Valley School**

Study Site: ICE- **01**

Observer Names: **M. Martin and his class**

Date: Year: **2007** Month: **October** Day: **23**

Local Time (hour:min): **11:00** Universal Time (hour:min): **20:00**

### General Freeze-Up Ice Observations:

<b>Upstream (border ice only):</b>	
Estimate fraction of width covered by border ice:	<b>25</b> %
Changes in border ice:	<input type="checkbox"/> None <input checked="" type="checkbox"/> Fractured <input type="checkbox"/> Flooding <input type="checkbox"/> Movement
<b>Downstream (border ice only):</b>	
Estimate fraction of width covered by border ice:	<b>40</b> %
Changes in border ice:	<input type="checkbox"/> None <input checked="" type="checkbox"/> Fractured <input type="checkbox"/> Flooding <input type="checkbox"/> Movement
<b>Across stream (ice in open water only):</b>	
Ice types:	<input type="checkbox"/> None <input checked="" type="checkbox"/> Frazil <input type="checkbox"/> Pancakes (< 3 m across) <input type="checkbox"/> Floes (> 3 m across)
Frost smoke?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

<b>Ice surface:</b>	<input type="checkbox"/> Smooth <input checked="" type="checkbox"/> Rough <input checked="" type="checkbox"/> Blocky/Broken/Jumbled <input type="checkbox"/> Wet/Flooded
<b>(may choose more than 1)</b>	<input type="checkbox"/> Holes/Leads <input type="checkbox"/> Bare (melting) <input type="checkbox"/> Ice jam
<b>Snow on ice:</b>	<input type="checkbox"/> None (cold) <input checked="" type="checkbox"/> New, patchy <input type="checkbox"/> New, continuous <input type="checkbox"/> Stable with new snow layer <input type="checkbox"/> Stable/No change <input type="checkbox"/> Wind redistributed <input type="checkbox"/> Icy crust <input type="checkbox"/> Melting/Wet <input type="checkbox"/> None (warm)
<b>Snow on bank/shore:</b>	<input type="checkbox"/> None <input type="checkbox"/> New, patchy <input type="checkbox"/> New, continuous <input type="checkbox"/> Stable with new snow layer <input checked="" type="checkbox"/> Stable/No change <input type="checkbox"/> Wind redistributed <input type="checkbox"/> Icy crust <input type="checkbox"/> Melting/Wet

### Environmental Observations:

<b>Cloud Cover:</b>	<ul style="list-style-type: none"> <li><i>If Three-quarters or More of the Sky is Visible: (Check one)</i></li> </ul> <table style="width: 100%; text-align: center;"> <tr> <td><i>No Clouds</i></td> <td><i>Clear</i></td> <td><i>Isolated</i></td> <td><i>Scattered</i></td> </tr> <tr> <td><input type="checkbox"/> 0%-No Clouds</td> <td><input type="checkbox"/> &lt;10% Clouds</td> <td><input type="checkbox"/> 10-25% Clouds</td> <td><input type="checkbox"/> 25-50% Clouds</td> </tr> </table> <table style="width: 100%; text-align: center;"> <tr> <td><i>Broken</i></td> <td><i>Overcast</i></td> </tr> <tr> <td><input type="checkbox"/> 50-90% Clouds</td> <td><input checked="" type="checkbox"/> &gt;90% Clouds</td> </tr> </table> <ul style="list-style-type: none"> <li><i>If View of More than One-quarter of the Sky is Blocked:</i> <b>Obscured</b> <input type="checkbox"/> Check here</li> </ul> <p><i>Why is the view of the sky blocked? (Check all that apply)</i></p> <p><input type="checkbox"/> Blowing Snow <input type="checkbox"/> Heavy Snow <input type="checkbox"/> Heavy Rain <input type="checkbox"/> Fog <input type="checkbox"/> Spray <input type="checkbox"/> Volcanic Ash <input type="checkbox"/> Smoke <input type="checkbox"/> Dust <input type="checkbox"/> Sand <input type="checkbox"/> Haze  </p>	<i>No Clouds</i>	<i>Clear</i>	<i>Isolated</i>	<i>Scattered</i>	<input type="checkbox"/> 0%-No Clouds	<input type="checkbox"/> <10% Clouds	<input type="checkbox"/> 10-25% Clouds	<input type="checkbox"/> 25-50% Clouds	<i>Broken</i>	<i>Overcast</i>	<input type="checkbox"/> 50-90% Clouds	<input checked="" type="checkbox"/> >90% Clouds
<i>No Clouds</i>	<i>Clear</i>	<i>Isolated</i>	<i>Scattered</i>										
<input type="checkbox"/> 0%-No Clouds	<input type="checkbox"/> <10% Clouds	<input type="checkbox"/> 10-25% Clouds	<input type="checkbox"/> 25-50% Clouds										
<i>Broken</i>	<i>Overcast</i>												
<input type="checkbox"/> 50-90% Clouds	<input checked="" type="checkbox"/> >90% Clouds												
<b>Wind*:</b>	<input type="checkbox"/> Calm (<0.3 m/s) <input checked="" type="checkbox"/> Light wind (0.3-5.5 m/s) <input type="checkbox"/> Windy (>5.5 m/s)												
<b>Precipitation type:</b>	<input checked="" type="checkbox"/> None <input type="checkbox"/> Snow flurries <input type="checkbox"/> Snowing <input type="checkbox"/> Fog/Drizzle <input type="checkbox"/> Rain <input type="checkbox"/> Freezing rain												

\*See *Ice Seasonality Investigation Field Guide* for definitions.

**Environmental Observation Comments:**

---

---

**Standard Photograph Set of River Ice Freeze-Up:**

When you download the photos from your camera, rename them to follow the convention *study site ID\_date\_photo view* (so the format would be: *ICE-99\_YYMMDD\_XXXXXX* where *XXXXXX* is *Up, Down, or Across*).

Enter the filename, and optional comments, for each photo here:

**Across photo:** [ICE-01\\_071023\\_Across](#)

Comments: [None](#)



**Upstream photo:** [ICE-01\\_071023\\_Up](#)

Comments: [None](#)



**Downstream photo:** [ICE-01\\_071023\\_Down](#)

Comments: [None](#)



**Optional Additional Photographs of River Ice Freeze-Up:**

Enter the filename of each photo and accompanying comments here:

<b>Additional photo 1:</b>	ICE- _____
Comments:	_____
<b>Additional photo 2:</b>	ICE- _____
Comments:	_____
<b>Additional photo 3:</b>	ICE- _____
Comments:	_____

***Other Comments:***

---

---

---

# Ice Seasonality Investigation

## River Break-Up Data Sheet - *Example*

School Name: **Tri-Valley School**

Study Site: ICE- **01**

Observer Names: **M. Martin and his class**

Date: Year: **2008** Month: **May** Day: **04**

Local Time (hour:min): **18:00** Universal Time (hour:min): **4:00**

### General Break-Up Ice Observations:

<b>Ice present?</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Static Ice:</b>	
<b>Upstream:</b>	
Ice fractured:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Water on ice:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Holes in ice:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Channel through ice:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Downstream:</b>	
Ice fractured:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Water on ice:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Holes in ice:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Channel through ice:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Moving ice:</b>	
Upstream:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Downstream:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Ice surface:</b> (may choose more than one)	<input checked="" type="checkbox"/> Smooth <input type="checkbox"/> Rough <input type="checkbox"/> Blocky/Broken/Jumbled <input type="checkbox"/> Melt ponds <input type="checkbox"/> Wet/Flooded <input type="checkbox"/> Ice jam

### Environmental Observations:

<b>Cloud Cover:</b>	<ul style="list-style-type: none"> <li><i>If Three-quarters or More of the Sky is Visible: (Check one)</i></li> </ul> <p> <i>No Clouds</i>      <i>Clear</i>      <i>Isolated</i>      <i>Scattered</i>  <input type="checkbox"/> 0%-No Clouds    <input type="checkbox"/> &lt;10% Clouds    <input type="checkbox"/> 10-25% Clouds    <input checked="" type="checkbox"/> 25-50% Clouds         </p> <p> <i>Broken</i>      <i>Overcast</i>  <input type="checkbox"/> 50-90% Clouds    <input type="checkbox"/> &gt;90% Clouds         </p> <ul style="list-style-type: none"> <li><i>If View of More than One-quarter of the Sky is Blocked:</i> <b>Obscured</b> <input type="checkbox"/> Check here</li> </ul> <p><i>Why is the view of the sky blocked? (Check all that apply)</i></p> <p> <input type="checkbox"/> Blowing Snow    <input type="checkbox"/> Heavy Snow    <input type="checkbox"/> Heavy Rain    <input type="checkbox"/> Fog    <input type="checkbox"/> Spray  <input type="checkbox"/> Volcanic Ash    <input type="checkbox"/> Smoke    <input type="checkbox"/> Dust    <input type="checkbox"/> Sand    <input type="checkbox"/> Haze         </p>
<b>Wind*:</b>	<input checked="" type="checkbox"/> Calm (<0.3 m/s) <input type="checkbox"/> Light wind (0.3-5.5 m/s) <input type="checkbox"/> Windy (>5.5 m/s)
<b>Precipitation type:</b>	<input checked="" type="checkbox"/> None <input type="checkbox"/> Snow flurries <input type="checkbox"/> Snowing <input type="checkbox"/> Fog/Drizzle <input type="checkbox"/> Rain <input type="checkbox"/> Freezing rain

\*See *Ice Seasonality Investigation Field Guide* for definitions.

**Environmental Observation Comments:**

---

---

**Standard Photograph Set of River Ice Break-Up:**

When you download the photos from your camera, rename them to follow the convention *study site ID\_date\_photo view* (so the format would be: *ICE-99\_YMMMDD\_XXXXXX* where *XXXXXX* is *Up, Down, or Across*).

Enter the filename, and optional comments, for each photo here:

**Across photo:** [ICE-01\\_071023\\_Across](#)

Comments: [None](#)



**Upstream photo:** [ICE-01\\_071023\\_Up](#)

Comments: [None](#)



**Downstream photo:** [ICE-01\\_071023\\_Down](#)

Comments: [None](#)



**Optional Additional Photographs of River Ice Break-Up:**

Enter the filename of each photo and accompanying comments here:

<b>Additional photo 1:</b>	ICE- _____
Comments:	_____
<b>Additional photo 2:</b>	ICE- _____
Comments:	_____
<b>Additional photo 3:</b>	ICE- _____
Comments:	_____

***Other Comments:***

---

---

---

# Ice Seasonality Investigation

## Lake/Pond Freeze-Up Data Sheet - *Example*

School Name: **Randolph School** Study Site: **ICE-01**  
 Observer Names: **G. Lopatka and students**  
 Date: Year: **2008** Month: **December** Day: **31**  
 Local Time (hour:min): **12:15** Universal Time (hour:min): **18:15**

### General Freeze-Up Ice Observations:

<b>Ice Cover:</b>	Estimate fraction of area covered by ice: <b>60 %</b>
<b>Ice Cover Change:</b>	Changes in ice: <input checked="" type="checkbox"/> None <input type="checkbox"/> Fractured <input type="checkbox"/> Flooding <input type="checkbox"/> Movement
Frost smoke?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

<b>Ice surface:</b> (may choose more than one)	<input type="checkbox"/> Smooth <input type="checkbox"/> Rough <input checked="" type="checkbox"/> Blocky/Broken/Jumbled <input type="checkbox"/> Wet/Flooded <input type="checkbox"/> Holes/Leads <input type="checkbox"/> Bare (melting) <input type="checkbox"/> Ice jam
<b>Snow on ice:</b>	<input type="checkbox"/> None (cold) <input checked="" type="checkbox"/> New, patchy <input type="checkbox"/> New, continuous <input type="checkbox"/> Stable with new snow layer <input type="checkbox"/> Stable/No change <input type="checkbox"/> Wind redistributed <input type="checkbox"/> Icy crust <input type="checkbox"/> Melting/Wet <input type="checkbox"/> None (warm)
<b>Snow on bank/shore:</b>	<input checked="" type="checkbox"/> None <input type="checkbox"/> New, patchy <input type="checkbox"/> New, continuous <input type="checkbox"/> Stable with new snow layer <input type="checkbox"/> Stable/No change <input type="checkbox"/> Wind redistributed <input type="checkbox"/> Icy crust <input type="checkbox"/> Melting/Wet

### Environmental Observations:

<b>Cloud Cover:</b>	<ul style="list-style-type: none"> <li><i>If Three-quarters or More of the Sky is Visible: (Check one)</i></li> </ul> <p><i>No Clouds</i>      <i>Clear</i>      <i>Isolated</i>      <i>Scattered</i>  <input checked="" type="checkbox"/> 0%-No Clouds    <input type="checkbox"/> &lt;10% Clouds    <input type="checkbox"/> 10-25% Clouds    <input type="checkbox"/> 25-50% Clouds</p> <p><i>Broken</i>      <i>Overcast</i>  <input type="checkbox"/> 50-90% Clouds    <input type="checkbox"/> &gt;90% Clouds</p> <ul style="list-style-type: none"> <li><i>If View of More than One-quarter of the Sky is Blocked:</i> <b>Obscured</b> <input type="checkbox"/> Check here</li> </ul> <p><i>Why is the view of the sky blocked? (Check all that apply)</i>  <input type="checkbox"/> Blowing Snow <input type="checkbox"/> Heavy Snow <input type="checkbox"/> Heavy Rain <input type="checkbox"/> Fog <input type="checkbox"/> Spray  <input type="checkbox"/> Volcanic Ash <input type="checkbox"/> Smoke <input type="checkbox"/> Dust <input type="checkbox"/> Sand <input type="checkbox"/> Haze</p>
<b>Wind*:</b>	<input type="checkbox"/> Calm (<0.3 m/s) <input checked="" type="checkbox"/> Light wind (0.3-5.5 m/s) <input type="checkbox"/> Windy (>5.5 m/s)
<b>Precipitation type:</b>	<input checked="" type="checkbox"/> None <input type="checkbox"/> Snow flurries <input type="checkbox"/> Snowing <input type="checkbox"/> Fog/Drizzle <input type="checkbox"/> Rain <input type="checkbox"/> Freezing rain

\*See *Ice Seasonality Investigation Field Guide* for definitions.

**Environmental Observation Comments:**

Lake was frozen until 27 December 2008. Temperature went to 15.1°C. Temperature today was -6.3°C/yesterday was 8.2°C.

**Standard Photograph Set of Lake Ice Freeze-Up:**

When you download the photos from your camera, rename them to follow the convention *study site ID\_date\_photo view* (so the format would be: *ICE-99\_YMMMDD\_XXXXXX* where *XXXXXX* is the name you chose for the photo view when you defined the site).

Enter the filename, and optional comments, for each photo here:

**Photo 1: ICE-01\_081231\_A**

Comments: **Lake Marmo, IL**



**Photo 2: ICE-01\_081231\_B**

Comments: **None**



**Photo 3: ICE-01\_081231\_C**

Comments: **None**



**Photo 4: ICE-01\_081231\_D**

Comments: **None**



**Photo 5: ICE-01\_081231\_E**

Comments: **None**



**Photo 6: ICE-01\_081231\_F**

Comments: **None**



**Optional Photographs of Lake Ice Freeze-Up:**

Enter the filename of each photo and accompanying comments here:

<b>Additional photo 1:</b>	ICE- _____
Comments:	_____
<b>Additional photo 2:</b>	ICE- _____
Comments:	_____
<b>Additional photo 3:</b>	ICE- _____
Comments:	_____

***Other Comments:***

---

---

---

---

# Ice Seasonality Investigation

## Lake/Pond Break-Up Data Sheet - *Example*

School Name: **Randolph School** Study Site: **ICE-01**  
 Observer Names: **G. Lopatka and students**  
 Date: Year: **2009** Month: **March** Day: **07**  
 Local Time (hour:min): **12:15** Universal Time (hour:min): **18:15**

### General Break-Up Ice Observations:

<b>Ice present?</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Ice Cover:</b> Estimate fraction of area covered by ice:	<b>3</b> %
<b>Ice Cover Appearance:</b>	
Ice fractured:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Water on ice:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Holes in ice:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Ice broken into pieces	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Ice blocks movement	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>Ice surface:</b> (may choose more than one)	<input type="checkbox"/> Smooth <input checked="" type="checkbox"/> Rough <input type="checkbox"/> Blocky/Broken/Jumbled <input type="checkbox"/> Ice jam <input type="checkbox"/> Holes/Leads <input type="checkbox"/> Melt ponds <input type="checkbox"/> Wet/Flooded <input type="checkbox"/> Moat

### Environmental Observations:

<b>Cloud Cover:</b>	<ul style="list-style-type: none"> <li><i>If Three-quarters or More of the Sky is Visible:</i> (Check one)                     <table style="width:100%; border:none;"> <tr> <td><i>No Clouds</i></td> <td><i>Clear</i></td> <td><i>Isolated</i></td> <td><i>Scattered</i></td> </tr> <tr> <td><input type="checkbox"/> 0%-No Clouds</td> <td><input type="checkbox"/> &lt;10% Clouds</td> <td><input type="checkbox"/> 10-25% Clouds</td> <td><input type="checkbox"/> 25-50% Clouds</td> </tr> <tr> <td><i>Broken</i></td> <td><i>Overcast</i></td> <td colspan="2"></td> </tr> <tr> <td><input type="checkbox"/> 50-90% Clouds</td> <td><input checked="" type="checkbox"/> &gt;90% Clouds</td> <td colspan="2"></td> </tr> </table> </li> <li><i>If View of More than One-quarter of the Sky is Blocked:</i>  <b>Obscured</b> <input type="checkbox"/> Check here   <i>Why is the view of the sky blocked?</i> (Check all that apply)                     <table style="width:100%; border:none;"> <tr> <td><input type="checkbox"/> Blowing Snow</td> <td><input type="checkbox"/> Heavy Snow</td> <td><input type="checkbox"/> Heavy Rain</td> <td><input type="checkbox"/> Fog</td> <td><input type="checkbox"/> Spray</td> </tr> <tr> <td><input type="checkbox"/> Volcanic Ash</td> <td><input type="checkbox"/> Smoke</td> <td><input type="checkbox"/> Dust</td> <td><input type="checkbox"/> Sand</td> <td><input type="checkbox"/> Haze</td> </tr> </table> </li> </ul>	<i>No Clouds</i>	<i>Clear</i>	<i>Isolated</i>	<i>Scattered</i>	<input type="checkbox"/> 0%-No Clouds	<input type="checkbox"/> <10% Clouds	<input type="checkbox"/> 10-25% Clouds	<input type="checkbox"/> 25-50% Clouds	<i>Broken</i>	<i>Overcast</i>			<input type="checkbox"/> 50-90% Clouds	<input checked="" type="checkbox"/> >90% Clouds			<input type="checkbox"/> Blowing Snow	<input type="checkbox"/> Heavy Snow	<input type="checkbox"/> Heavy Rain	<input type="checkbox"/> Fog	<input type="checkbox"/> Spray	<input type="checkbox"/> Volcanic Ash	<input type="checkbox"/> Smoke	<input type="checkbox"/> Dust	<input type="checkbox"/> Sand	<input type="checkbox"/> Haze
<i>No Clouds</i>	<i>Clear</i>	<i>Isolated</i>	<i>Scattered</i>																								
<input type="checkbox"/> 0%-No Clouds	<input type="checkbox"/> <10% Clouds	<input type="checkbox"/> 10-25% Clouds	<input type="checkbox"/> 25-50% Clouds																								
<i>Broken</i>	<i>Overcast</i>																										
<input type="checkbox"/> 50-90% Clouds	<input checked="" type="checkbox"/> >90% Clouds																										
<input type="checkbox"/> Blowing Snow	<input type="checkbox"/> Heavy Snow	<input type="checkbox"/> Heavy Rain	<input type="checkbox"/> Fog	<input type="checkbox"/> Spray																							
<input type="checkbox"/> Volcanic Ash	<input type="checkbox"/> Smoke	<input type="checkbox"/> Dust	<input type="checkbox"/> Sand	<input type="checkbox"/> Haze																							
<b>Wind*:</b>	<input type="checkbox"/> Calm (<0.3 m/s) <input checked="" type="checkbox"/> Light wind (0.3-5.5 m/s) <input type="checkbox"/> Windy (>5.5 m/s)																										
<b>Precipitation type:</b>	<input checked="" type="checkbox"/> None <input type="checkbox"/> Snow flurries <input type="checkbox"/> Snowing <input type="checkbox"/> Fog/Drizzle <input type="checkbox"/> Rain <input type="checkbox"/> Freezing rain																										

\*See *Ice Seasonality Investigation Field Guide* for definitions.

### Environmental Observation Comments:

**Temperature was +2.5°C today. We had 50cm of rain on 6 March 2009. This resulted in a significant reduction in the ice cover.**

### Standard Photograph Set of Lake Ice Break-Up:

When you download the photos from your camera, rename them to follow the convention *study site ID\_date\_photo view* (so the format would be: *ICE-99\_YMMMDD\_XXXXXX* where *XXXXXX* is the name you chose for the photo view when you defined the site).

**Enter the filename, and optional comments, for each photo here:**

<p><b>Photo 1: ICE-01_090307_A</b> Comments: <b>Lake Marmo, IL</b></p>  <p>03/07/2009</p>	<p><b>Photo 4: ICE-01_090307_D</b> Comments: <b>None</b></p>  <p>03/07/2009</p>
<p><b>Photo 2: ICE-01_090307_B</b> Comments: <b>None</b></p>  <p>03/07/2009</p>	<p><b>Photo 5: ICE-01_090307_E</b> Comments: <b>None</b></p>  <p>03/07/2009</p>
<p><b>Photo 3: ICE-01_090307_C</b> Comments: <b>None</b></p>  <p>03/07/2009</p>	<p><b>Photo 6: ICE-01_090307_F</b> Comments: <b>None</b></p>  <p>03/07/2009</p>

**Optional Additional Photographs of Lake Ice Break-Up:**

Enter the filename of each photo and accompanying comments here:

<p><b>Additional photo 1:</b> ICE- _____</p> <p>Comments: _____</p> <p><b>Additional photo 2:</b> ICE- _____</p> <p>Comments: _____</p> <p><b>Additional photo 3:</b> ICE- _____</p> <p>Comments: _____</p>
---

***Other Comments:***

---

---

---

---

# Ice Seasonality Investigation

## Annual Summary Guide

### **Task**

To document the important meteorological milestones which precede the freeze-up and break-up of the Ice Seasonality observation site.

### **What You Need**

- Pencil or Pen
- Daily meteorological data
- Ice Seasonality Investigation Annual Summary Data Sheet*

If you are using a GLOBE Atmosphere site:

- Pencil or pen
- Field note book/paper
- Max, Min and Current Temperature Protocol Field Guide*
- Solid Precipitation Protocol Field Guide*

### **In the Classroom**

1. Make observations to determine the dates of the appearance and disappearance of ice and snow at the Ice Seasonality observation site and complete the *Annual Summary Data Sheet*.

*Freeze-Up:* The onset of winter is usually characterized by several below/above freezing temperature episodes. In the Freeze-Up section on the *Annual Summary Data Sheet* there is a place to record the first occurrence of  $< 0^{\circ}\text{C}$  as the daily maximum, mean and minimum air temperature (solid blue boxes in Table 1).

There is also a place to record the first day of (near) **continuous**  $< 0^{\circ}\text{C}$  temperatures in each category (open blue boxes). Note that in some instances, the first day of  $< 0^{\circ}\text{C}$  and first day of continuous  $< 0^{\circ}\text{C}$  may be the same day (i.e., mean temperature at right).

Please note that the 100% ice cover refers to a total ice cover that lasts for the entire season. It may be possible that the ice cover reaches 100% ice cover that then melts back during a few days of warmer temperatures or a rain episode.

*Break-Up:* The onset of spring can be characterized by several above/below freezing temperature episodes. In the Break-Up section on the *Annual Summary Data Sheet* there is a place to record the first occurrence of  $> 0^{\circ}\text{C}$  as the daily maximum, mean and minimum air temperature (uppermost open red boxes (~ 3/31/08) in Table 2).

Table 1. Temperature data from the Healy airstrip (PAHV) for autumn 2007.

Healy - PAHV Airstrip Weather Data				
AKDT	Temperature (°C)			Precip. Events
	Max	Mean	Min	
09/15/07	6.7	5.6	3.9	Rain
09/16/07	5.6	4.4	2.8	Rain
09/17/07	10.6	6.1	-1.1	
09/18/07	10.0	5.6	1.7	
09/19/07	8.9	6.7	3.9	
09/20/07	10.6	7.8	5.6	
09/21/07	2.8	2.2	1.7	Rain
09/22/07	5.0	0.0	-4.4	Fog
09/23/07	10.6	7.2	3.9	
09/24/07	5.6	0.6	-4.4	
09/25/07	1.7	1.1	0.0	Fog-Rain-Snow
09/26/07	5.6	2.2	-1.1	Rain-Thunderstorm
09/27/07	8.9	4.4	0.0	
09/28/07	6.7	5.6	5.0	
09/29/07	5.6	5.6	0.0	
09/30/07	6.7	5.6	0.6	
10/01/07	2.8	0.0	-2.2	Rain
10/02/07	1.7	1.1	0.0	Fog-Rain
10/03/07	-1.1	-2.8	-4.4	Snow
10/04/07	3.9	-1.1	-6.1	
10/05/07	-5.0	-6.1	-8.3	Snow
10/06/07	-6.1	-7.8	-9.4	
10/07/07	-6.1	-7.8	-9.4	Snow
10/08/07	-6.1	-7.8	-11.1	
10/09/07	-1.1	-7.2	-13.3	
10/10/07	-7.2	-11.1	-15.0	Snow
10/11/07	-12.2	-13.9	-14.4	
10/12/07				
10/13/07	-3.3	-7.2	-11.1	
10/14/07	-2.2	-4.4	-6.1	Snow
10/15/07	-5.0	-6.1	-8.3	

http://www.wunderground.com/

Table 2. Temperature data from the Healy airstrip (PAHV) for spring 2008.

Healy - PAHV Airstrip Weather Data				
AKDT	Temperature (°C)			Precip. Events
	Max	Mean	Min	
03/15/08	-4.4	-5.6	-6.1	
03/16/08	-7.2	-11.1	-15.0	
03/17/08	-14.4	-17.2	-20.0	
03/18/08	-17.2	-21.1	-25.0	Snow
03/19/08	-17.8	-22.2	-25.0	Snow
03/20/08	-10.0	-13.3	-18.9	
03/21/08	-10.0	-16.7	-22.8	
03/22/08	-9.4	-17.2	-25.0	
03/23/08	-10.0	-13.9	-17.8	Snow
03/24/08	-4.4	-10.0	-16.1	
03/25/08	-6.1	-13.3	-20.6	
03/26/08	-7.2	-13.3	-20.0	
03/27/08	-6.1	-12.2	-17.8	
03/28/08	-4.4	-11.1	-17.2	
03/29/08	-1.1	-6.1	-11.1	
03/30/08	0.0	-1.7	-3.3	
03/31/08	2.8	1.1	0.0	
04/01/08	5.6	4.4	2.8	
04/02/08	5.0	3.3	1.7	
04/03/08	2.8	1.7	1.7	
04/04/08				
04/05/08				
04/06/08				
04/07/08				
04/08/08	-2.2	-2.8	-6.1	
04/09/08	-3.3	-8.3	-13.3	Snow
04/10/08	-6.1	-7.8	-10.0	Snow
04/11/08	-6.1	-10.0	-14.4	Snow
04/12/08	-6.1	-12.2	-17.8	Snow
04/13/08	-5.0	-11.1	-11.1	
04/14/08	-1.1	-2.8	-5.0	Snow
04/15/08	-8.3	-10.0	-11.1	Snow
04/16/08	-11.1	-14.4	-17.2	Snow
04/17/08	-4.4	-7.8	-11.1	Snow
04/18/08	0.6	-2.2	-5.0	
04/19/08	6.7	2.2	-2.2	
04/20/08	10.0	5.6	1.7	
04/21/08	12.8	8.3	3.9	
04/22/08	1.7	0.0	0.0	
04/23/08	13.9	12.2	6.7	
04/24/08	8.9	5.6	0.6	Snow
04/25/08	-4.4	-5.6	-7.2	Snow
04/26/08	-3.3			Snow
04/27/08	3.9	-0.6	-5.0	
04/28/08	0.6	0.0	-1.1	Snow
04/29/08	1.7	-1.1	-3.3	
04/30/08	0.6	-1.7	-3.3	Snow
05/01/08	5.0	4.4	2.8	

There is also a place to record the first day of (near) **continuous** > 0°C temperatures in each category (solid red boxes). In this case, there are a few < 0°C days after the ~4/18/08, but this minor cooling period only slows the melting process but do not reverse it.

In the spring, it is possible for ice to be stranded above the water level after the main water body is completely melted out. This occurs when ice is either stranded on a gravel bar, beach or high point in the river or lake bottom or when thick ice (aufeis) remains attached to the river or lake bank. Please note that only the ice cover in the river channel or in the body of the lake is being estimated. When these are clear of ice the ice cover is 0%.

2. Submit your data to GLOBE as you acquire it. Remember other schools may be comparing their freeze-up and/or break-up with yours in real time.

# Ice Seasonality Investigation

## Annual Summary Data Sheet

School Name:

Study Site:

Observer Names:

Period of Observation (YYMMDD):

### Ice Seasonality Milestones:

<b>FREEZE-UP</b>	<b>Date observed</b> (format: <i>YYMMDD</i> )
Date of first* minimum air temperature < 0°C:	
Date of continuous** minimum air temperature < 0°C:	
Date of first mean daily air temperature < 0°C:	
Date of continuous mean daily air temperature < 0°C:	
Date of first maximum air temperature < 0°C:	
Date of continuous first maximum air temperature < 0°C:	
Date of first snow:	
Date of continuous snow on the ground:	
Date of first appearance of ice on the site:	
Date of 100% ice cover on the site:	
<hr/>	
<b>BREAK-UP</b>	
Date of first maximum air temperature > 0°C:	
Date of continuous maximum air temperature > 0°C:	
Date of first mean daily air temperature > 0°C:	
Date of continuous mean daily air temperature > 0°C:	
Date of first minimum air temperature > 0°C:	
Date of continuous minimum air temperature > 0°C:	
Date of complete disappearance of snow on the ice:	
Date of 0% ice cover on the site:	

\* first day when this phenomenon occurs

\*\* first day this phenomenon becomes continuous (may be same as \*)

See the **Annual Summary Guide** for a complete description of how to determine milestone dates.