



National Snow and Ice Data Center  
Advancing knowledge of Earth's frozen regions



## *Semantics & the SSIUI Project*

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Cassidy Thompson,*

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Raymondino Yan*





# *The Semantic Sea Ice Interoperability Initiative*



Image courtesy Andy Mahoney, NSIDC



*SSIII works to make Arctic data more useful to more people.*

*Extend a network of Arctic data and systems and harmonize metadata.  
Create integrative sea ice ontologies and encourage their use.  
Improve the discovery, understanding, and use of sea ice data.*



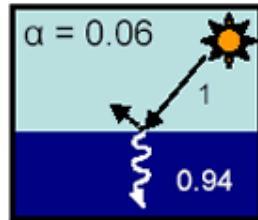
photo courtesy *The Inquisitr*

## *Operational Perspective*

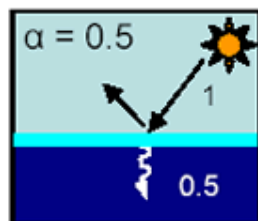
A Coast Guard Icebreaker cutting a path for a tanker to get fuel to the iced in city of Nome, Alaska.



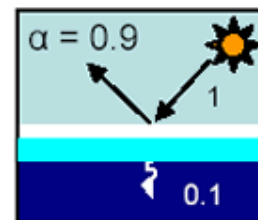
I. Open ocean



II. Bare ice



III. Ice with snow



© Karen Frey, The Polaris Project

## *Research Perspective*

How is the changing sea ice affecting the ice-albedo feedback?



Image courtesy NASA Earth Observatory

## *Modeling Perspective*

What data should be used to  
validate/drive my model?



## The Local Indigenous Perspective

- earlier break up / later freeze up (2-3 weeks each)
- increased weather variability / traditional forecasts no longer work
- sea ice thinner; poorly formed (poor strength/integrity)
- seasonal calendar off; some names no longer apply
- etc. etc.

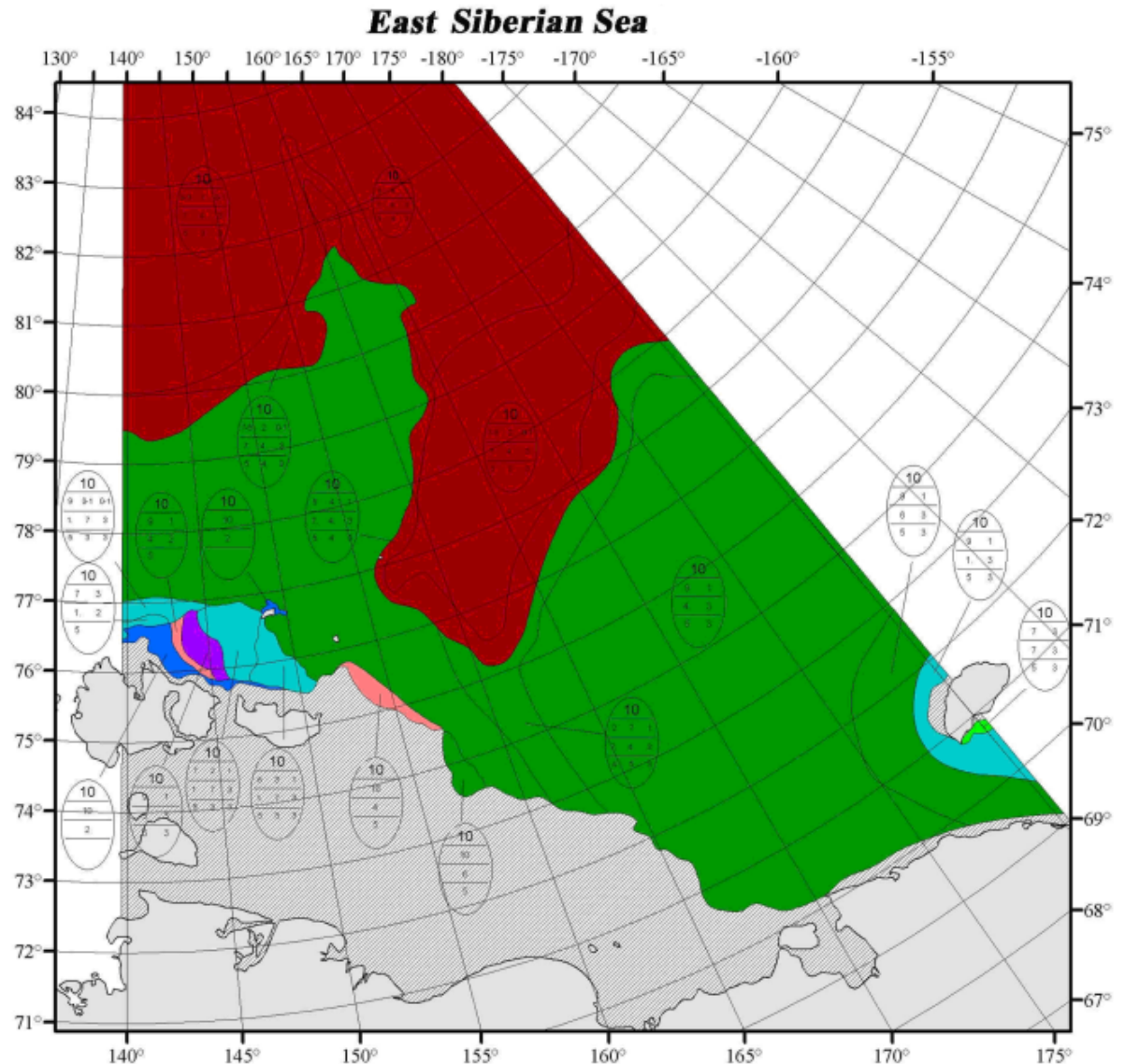
# Example sea ice chart with egg codes

Арктический и Антарктический  
научно-исследовательский  
институт Росгидромета

Arctic and Antarctic Research  
Institute of Roshydromet

**Feb. 28 - March. 02 2005**

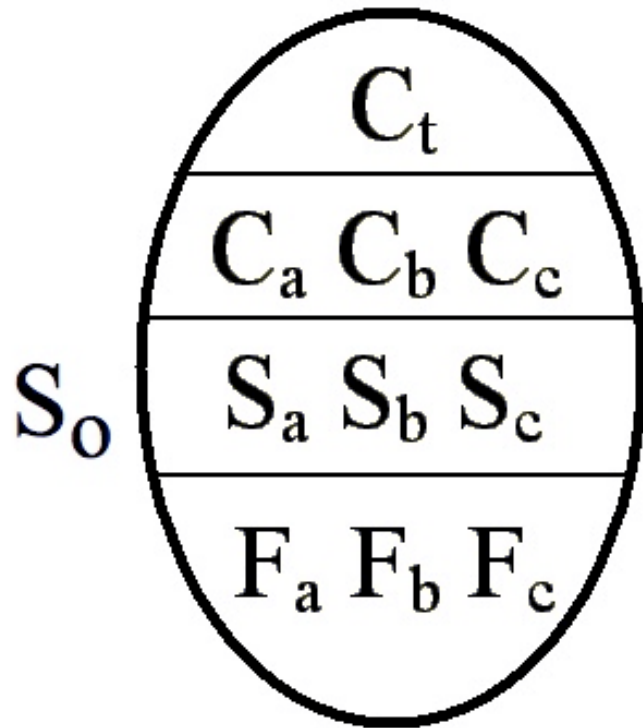
- free
- New ice
- Nilas
- Grey ice
- Grey-white ice
- Thin first-year ice
- Medium-year ice
- Thick first-year ice
- Old ice
- 
- Fast ice





# The WMO “Egg Code”

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**Total Concentration** (in tenths or a range)

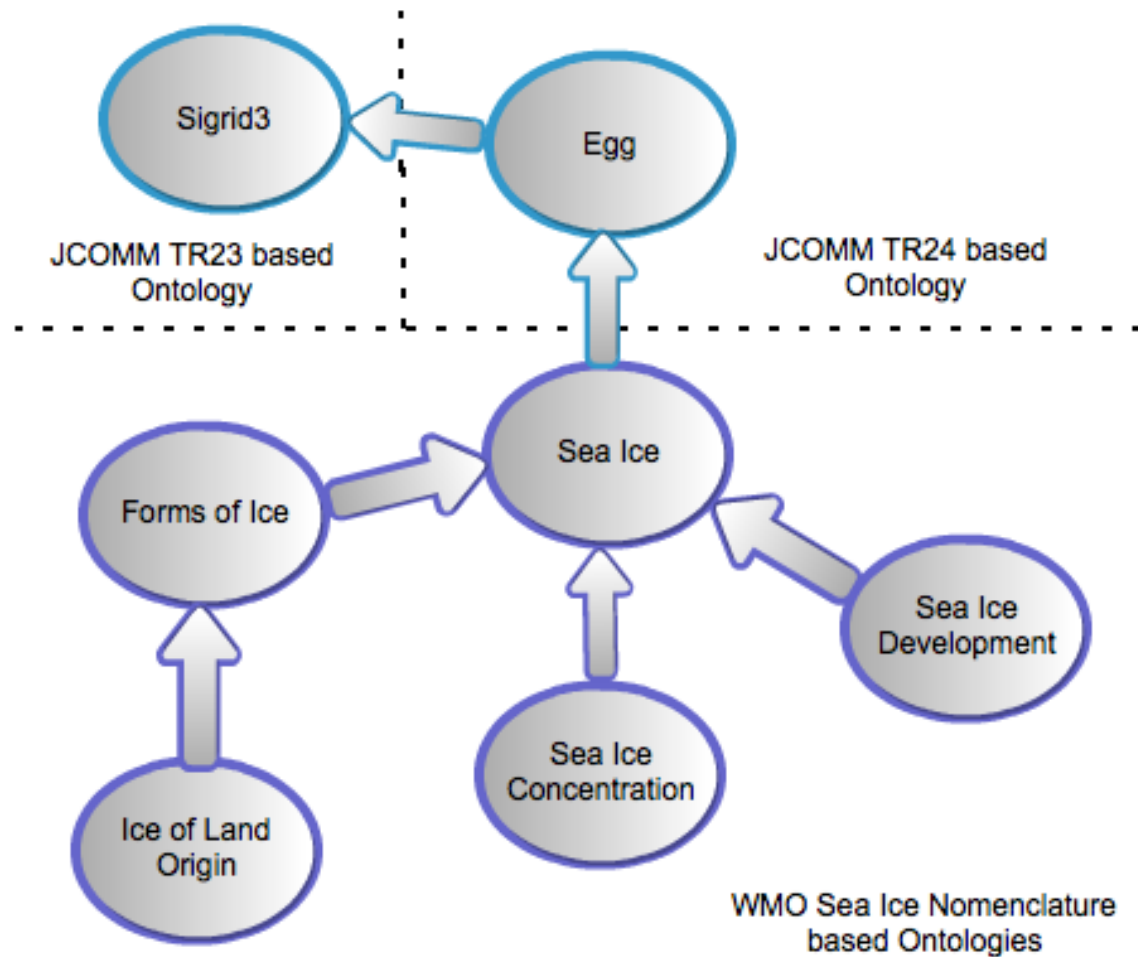
**Partial Concentration** for different thicknesses (in tenths)

**Stage of Development** for different thicknesses  
(codes for defined terms partially based on thickness, e.g. “nilas”, “first year”, “multi-year”)

**Form** of ice (codes for defined terms largely based on floe size, e.g. “pancake”, “vast ice floe”)

Relates to the “WMO Sea Ice Nomenclature”

# SSIII Sea Ice Ontologies





# SSIII

## Semantic Sea Ice Interoperability Initiative



[Home](#) | [Feedback](#)

### Ontology Browser

Load an Ontology: [Sea Ice](#) | [Seaiice Concentration](#) | [Seaiice Development](#) | [Seaiice Form](#) | [Ice of Land Origin](#) | [Sigrid-3](#) | [Egg Code](#)

Ontology Browser V1.4.2 Help

All ontologies

Ontologies | Classes | Object Properties | Data Properties | Annotation Properties | Individuals | Datatypes | DL Query Options | Render labels

#### Ontologies

- + All ontologies
- sigrid3
- annotations
- + seaiice
  - development
  - form
- development
- form

#### sigrid3 permalink

<http://purl.org/nsidc/jcomm/sigrid3#>

##### Annotations (17)

- creator "Ruth Duerr, Jim McCusker and the SSIII Project Team" @en
- date "May 1, 2013" @en
- language "english" @en
- rights "To the extent possible under law, the Ruth Duerr, Jim McCusker and the SSIII Project Team has waived all copyright and related or neighboring rights to "Terminology for the contents of a Sigrid-3 formatted ice chart". The authors expect that users will follow the Polar Information Commons Ethics and Norms of Data Sharing found at <http://polarcommons.org/ethics-and-norms-of-data-sharing.php>. This work is published from the United States." @en
- source <http://purl.org/nsidc/jcomm/sigrid3#www.aari.nw.ru/gdsidb/docs/wmo/JCOMM%20TR23%20SIGRID3.doc>
- subject [http://dataportal.ucar.edu/schemas/gcmd.ow/#cryosphere\\_sea\\_ice\\_ice\\_types](http://dataportal.ucar.edu/schemas/gcmd.ow/#cryosphere_sea_ice_ice_types)
- subject [http://dataportal.ucar.edu/schemas/gcmd.ow/#cryosphere\\_sea\\_ice\\_sea\\_ice\\_age](http://dataportal.ucar.edu/schemas/gcmd.ow/#cryosphere_sea_ice_sea_ice_age)
- subject [http://dataportal.ucar.edu/schemas/gcmd.ow/#cryosphere\\_sea\\_ice\\_sea\\_ice\\_concentration](http://dataportal.ucar.edu/schemas/gcmd.ow/#cryosphere_sea_ice_sea_ice_concentration)
- subject [http://dataportal.ucar.edu/schemas/gcmd.ow/#oceans\\_sea\\_ice\\_ice\\_types](http://dataportal.ucar.edu/schemas/gcmd.ow/#oceans_sea_ice_ice_types)
- subject [http://dataportal.ucar.edu/schemas/gcmd.ow/#oceans\\_sea\\_ice\\_sea\\_ice\\_age](http://dataportal.ucar.edu/schemas/gcmd.ow/#oceans_sea_ice_sea_ice_age)
- subject [http://dataportal.ucar.edu/schemas/gcmd.ow/#oceans\\_sea\\_ice\\_sea\\_ice\\_concentration](http://dataportal.ucar.edu/schemas/gcmd.ow/#oceans_sea_ice_sea_ice_concentration)
- title "Terminology for the contents of a Sigrid-3 formatted ice chart" @en
- license <http://creativecommons.org/publicdomain/zero/1.0/>
- comment "This ontology models the contents of a SIGRID-3 formatted digital ice chart. This version does not yet include the complete content of the metadata component of the SIGRID-3 specification." @en
- label "Sigrid-3 formatted ice chart file contents" @en
- priorVersion "1.0" @en
- versionInfo "2.0"

##### References

- Classes (62)
- Object Properties (7)
- Data Properties (14)
- Annotation Properties (12)
- Datatypes (5)

##### Imports (1)

- <http://purl.org/nsidc/jcomm/egg#>

ASK US

## *Operations to Research: Next Steps (1 of 2)*

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- Load NSIDC Sigrid 3 data into Virtuoso - done
- Create simple prototype query interface – in progress
- Sample queries for the prototype:
  - Give me a list of areas where the sea ice was thicker than X between the dates A and B?
  - On date X where were the ice floes bigger than 10 km?
  - What is the average age of the sea ice in the Beaufort sea?

## *Operations to Research: Next Steps (2 of 2)*

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- Create simple map-based query interface – experiments in progress
  - Show me where the 3+ m thick ice was between these two dates
- Feed the shapes output from these queries into subsetting services for other NSIDC data – not this grant...
  - MODIS sea ice products (what's the average albedo when the sea ice is more than 3 meters thick?)
  - AVHRR data
  - Passive microwave

# *Modeling Perspective: The Semantics of CICE*

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- Semantic framework for describing the physics and computational methods in the Community Ice Code (CICE)
  - Sea Ice component of NCAR's Community Earth System Model (CESM4)
- Will help others understand
  - how model subcomponents interact
  - which processes are parameterized and which are directly simulated
  - how observations can be used to set model parameters or validate model outputs

# *Solar Radiation and Sea Ice*

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- We focus on the disposition of solar radiation
  - Important determinant of surface energy balance and subsequent changes in sea ice state and ocean primary productivity
  - Building an ontology using Event Calculus to highlight different treatments of ice surface reflectance
    - Parameterize as function of other state variables (air temperature), vs.
    - Modeling the physical interaction of ice with light
- Hope to serve as bridge between research, operational and modeling communities

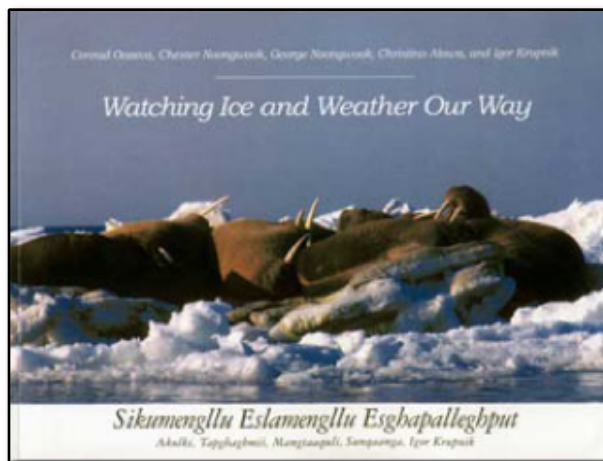
# *Indigenous Perspective: Background*

---

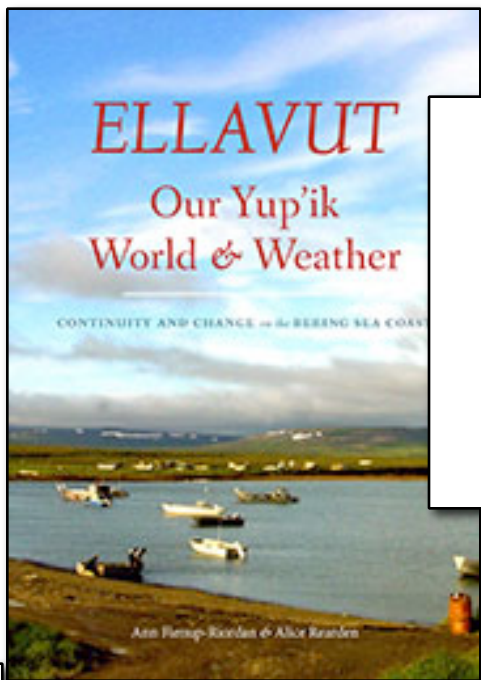
- SSIII is exploring the use of semantics theory, methods and tools to assist with linking Indigenous knowledge, concepts and terminology with scientific knowledge
- Indigenous knowledge is long-standing knowledge passed from generation to generation, yet is constantly evolving based on the synthesis of new observations and experiences
- In this sub-project, we are working with communities to model Indigenous knowledge of sea ice of Alaska (Barrow, Yukon River Delta) and evaluate the potential to link with scientific/operational terminology (WMO)
- The challenges lie in understanding the nuance of Indigenous knowledge and terminology, local specificity, different understandings due to different experiences, and the historical and political context of using Indigenous knowledge



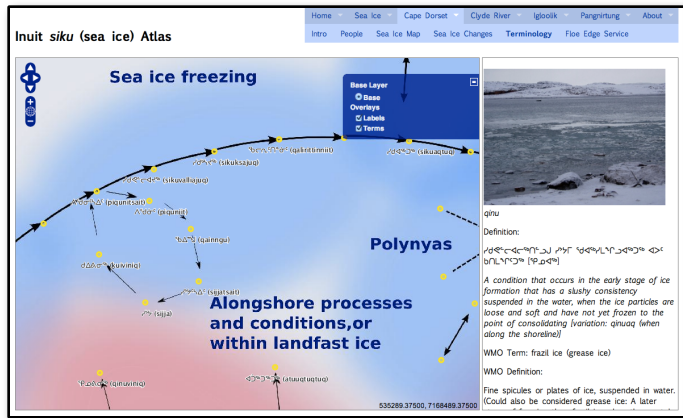
# Sources - interviews + books



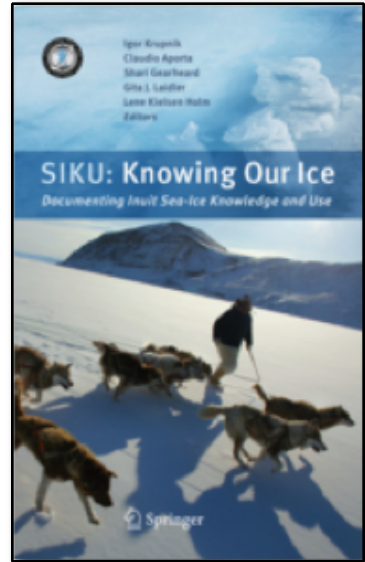
<http://www.arcus.org/publications/wiwow/>



Barrow Iñupiaq Sea Ice Terminology	
Alphabetical List, with English Explanations	
Compiled by Ronald H. Brower, Sr. ANLC; shared February 2008	
Aayuagaq	Crack in sea or lake ice kept open by shifting currents so that it never freezes solid.
Agiuppak	Wall of shared ice along the edge of the open lead that has been formed by the grinding action of the free ice against the shore-locked ice
Aisitaq	Cracked ice made by force of moving ice that attaches to ayuksraq (see below) and moves with it.
Alliviñiq	Ice that is under other ice that could at any moment come out from under, due to current or boat wake
Aluksraq	Young ice punched by seals forming a seal blowhole



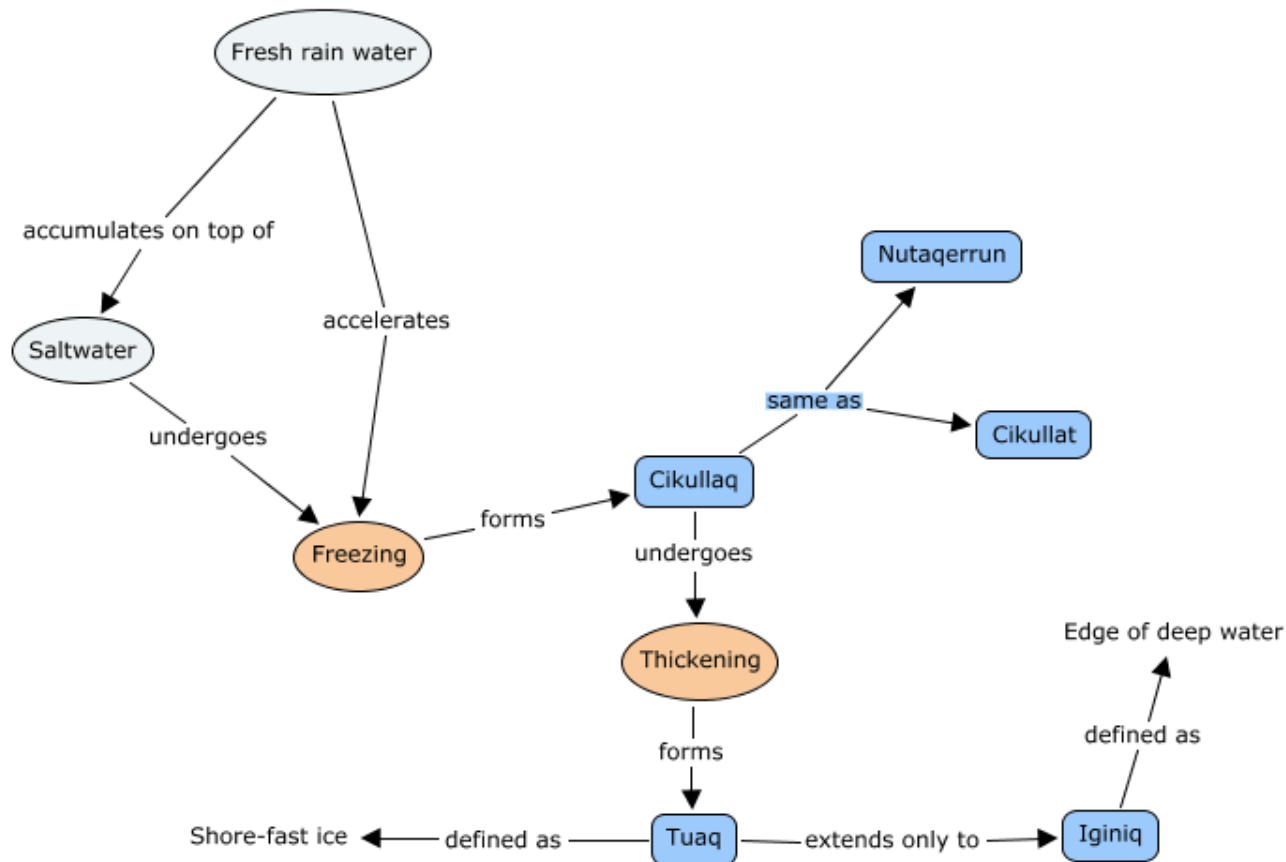
These sources only as good as reader's interpretation - experts still needed



<http://www.springer.com/>

# Models being developed and validated

Concept Map based on interpretation of  
"Ellavut: Our Yup'ik World and Weather"  
Anne Fienup-Riordan & Alice Rearden, 2012



# Several applications being considered

The screenshot displays the SIZONet website interface. At the top left is the SIZONet logo, and to its right is the text "Local Observations Seasonal Ice Zone Observing Network (SIZONet)". Further right is the ELOKA logo with the text "Exchange for Local Observations and Knowledge of the Arctic". A navigation bar contains links for Home, About, Research methods, Public information, Data, Add observation, and Contacts. The user is logged in as "ELOKA Team".

The main content area shows a search results page for the keyword "Frazil". The search parameters are: Keyword(s): Frazil, Date(s): 2006-04-01 - 2010-12-04, Village(s): All, Observer(s): All. The search results table has columns for Date, Observer, Village, and Additional elements noted (legend). The first row shows an observation from 2007-12-20 at 01:45 PM by Winton Weyapuk Jr. in Wales. A dialog box is overlaid on the table, displaying a question mark icon and the text: "Related terms found: You are searching for the term 'frazil'. Related terms 'Siquelouk' and 'Frazile' have been found. Do you want to include them in your results? (Cancel for no)". The dialog box has "Cancel" and "OK" buttons.

Date	Observer	Village	Additional elements noted (legend)
2007-12-20 01:45 PM	Winton Weyapuk Jr.	Wales	Transcript All details Edit
2007-12-09 0:			Transcript All details Edit
2007-12-05 0:			Skies are mostly cloudy, winds SE at 25, temp about 40
2007-12-04 1:			
2007-12-03 1:			
2007-12-01 03:00			
2007-11-06 01:30			
2007-11-01 11:40			

# Teaching and continued use of language



**Local Observations**  
Seasonal Ice Zone Observing Network  
(SIZONet)

Exchange for Local Observations and Knowledge  
of the Arctic



Home About Research methods Public information Data Add observation Contacts Logged in as ELOKA Team Log out

**CURRENT SEARCH**  
Keyword(s): Slush  
Date(s): 2006-04-01 - 2010-12-04  
Village(s): Barrow  
Observer(s): Joe Leavitt  
Refine Search

**Search Results**  
20 per page Go to Page: 1 Go

Sort by: Date (Late)

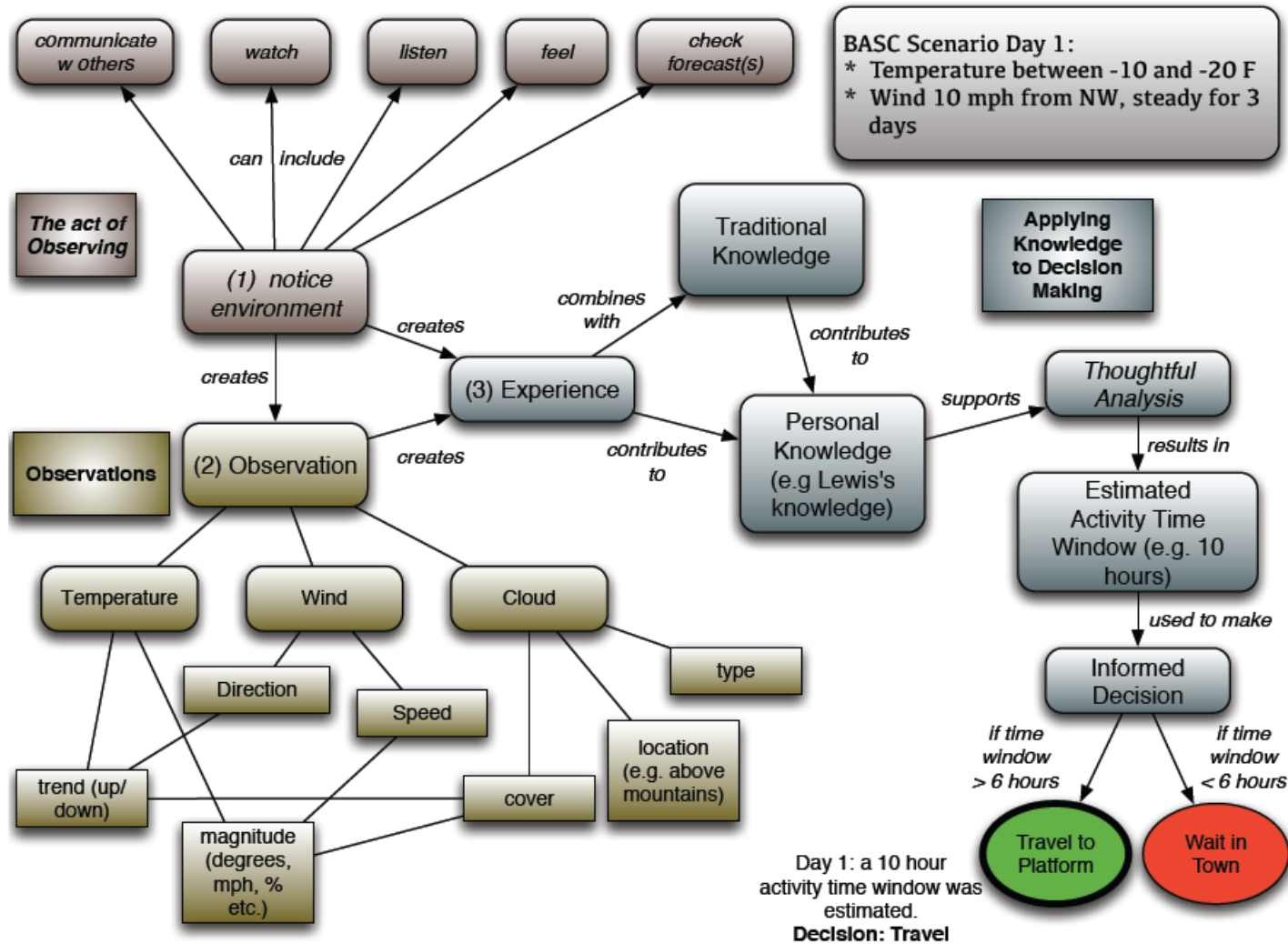
Date	Observations	Comments noted (legend)
2008-10-14	Slush ice moving along shore fast ice. Hard on boat's to oar through the slush Most boat moved up One whale taken Current going to the NE Lot's of whale going by.	Transcript Edit All details
2008-01-11		Transcript Edit All details
2007-05-06		Transcript Edit All details

Close

[Scroll to Top]

The SIZONet Observation Database is a collaboration between [SIZONet](#) and [ELOKA](#). This Web site is hosted by the [National Snow and Ice Data Center](#).

# Focus on sea ice safety training using Indigenous knowledge




# *Tradition and Technology*

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- New technology cannot replace the traditional passing of wisdom and instruction by Elders and experts
- Books and other established forms of documentation will always have a place
- New technologies may complement existing ways of documenting, teaching and learning and may help to engage youth
- Ultimately, selecting appropriate technology is key

*“I believe it is time for the harpoon and the computer to work together”*     -- Peter Kattuk, Sanikiluaq, Nunavut

A team of sled dogs is pulling a sled across a snowy landscape at sunset. The dogs are running in a line, pulling the sled. The sky is a mix of orange and blue, and the snow is white. The sled is in the foreground, and the dogs are in the middle ground. The background shows a range of mountains under a clear sky.

## Possible benefits

Documenting and representing concepts in new ways:

- May help in passing knowledge from Elders and experts to youth.
- May increase the prominence of Indigenous knowledge in science and policy making.
- May be used to link knowledge across languages, and help in continuing use of Indigenous languages.
- May help us to make the most useful observations and models of environmental impacts.
- May allow us to compare how different processes work across locations.

## *What is Schema.org?*

---

“a collection of schemas, i.e., html tags, that webmasters can use to markup their pages in ways recognized by major search providers.”

“Search engines including **Bing, Google, Yahoo! and Yandex** rely on this markup to improve the display of search results, making it easier for people to find the right web pages.”



# *The Schema.org dataset schema*

---

- [Thing](#) > [CreativeWork](#) > [Dataset](#): a body of structured information describing some topic(s) of interest
  - **catalog**([DataCatalog](#)): the data catalog which contains a dataset
  - **distribution**([DataDownload](#)): a downloadable form of this dataset, at a specific location, in a specific format
  - **spatial**([Place](#)): the range of spatial applicability of a dataset, e.g. for a dataset of New York weather, the state of New York
  - **temporal**([DateTime](#)): the range of temporal applicability of a dataset, e.g. for a 2011 census dataset, the year 2011 (in [ISO 8601](#) time interval format)
- [Thing](#) > [CreativeWork](#) > [DataCatalog](#): a collection of datasets
  - **dataset**([Dataset](#)): a dataset contained in a catalog
- [Thing](#) > [CreativeWork](#) > [MediaObject](#) > [DataDownload](#): a dataset in downloadable form

# NSIDC Catalog Pages

The screenshot shows a web browser window with the URL [nsidc.org/data/ggd323](http://nsidc.org/data/ggd323). The browser's address bar and tabs are visible at the top. The website's navigation menu includes links for HOME, DATA, PROGRAMS, RESEARCH, NEWS, ABOUT THE CRYOSPHERE, and ABOUT US. The main content area displays the title of the data set and provides information on how to access it, including a citation and a list of contributors and parameters. A sidebar on the right contains an 'ASK US' button and a 'Frozen Ground Data Center' logo.

nsidc.org/data/ggd323

Most Visited Getting Started GSLIS NSIDC VPN Outlook Web App DC wiki dcs-ui DC Contour DC Jira Research Data S...

Jobs | Contact Us Search NSIDC...

NSIDC National Snow & Ice Data Center

HOME DATA PROGRAMS RESEARCH NEWS ABOUT THE CRYOSPHERE ABOUT US

## Soil and Air Temperature at Forest and Tundra sites, Petite-Riviere-de-la-Baleine, Quebec, Canada

[Get External Data](#)

This data set includes meteorological measurements from two climatological stations (one forest, one tundra) at PBA Campus, Petite Riviere de la Baleine in Quebec, Canada. Parameters include ground temperature, air temperature, pressure, relative humidity, wind speed and direction, and snow depth. Measurements were taken every minute, with a storage interval of 60 minutes for air data and 1440 minutes for ground data.

[View Metadata Record](#)

### Data Citation

The following example shows how to cite the use of this data set in a publication. For more information, see our [Use and Copyright](#) Web page.

Yves Michaud and Denis Sarrazin. 2003. *Soil and Air Temperature at Forest and Tundra sites, Petite-Riviere-de-la-Baleine, Quebec, Canada*. [indicate subset used]. Boulder, Colorado USA: National Snow and Ice Data Center.

### See Also

- [Contact User Services](#)

**Externally Distributed Data Set**  
NSIDC does not archive this data set. Please contact the investigator or data compiler to acquire these data.

**ASK US**

**Frozen Ground Data Center**  
FGDC catalog

### Data Contributors

- MICHAUD, YVES

### Parameters

- ATMOSPHERIC RADIATION > ALBEDO
- ATMOSPHERIC TEMPERATURE > AIR TEMPERATURE
- ATMOSPHERIC TEMPERATURE > SURFACE AIR TEMPERATURE
- ATMOSPHERIC WATER VAPOR > HUMIDITY
- ATMOSPHERIC WINDS > SURFACE WINDS
- FROZEN GROUND > SOIL TEMPERATURE
- SOILS > SOIL TEMPERATURE
- SURFACE RADIATIVE PROPERTIES > ALBEDO

# Tags used by NSIDC

## First set of fields embedded:

- [Thing](#) > Name
- [Thing](#) > Description
- [Thing](#) > [CreativeWork](#) > Contributor
- [Thing](#) > [CreativeWork](#) > Citation
- [Thing](#) > [CreativeWork](#) > Keyword  
(parameter)

These fields were already on the catalog pages

These fields aren't but are likely to be later  
this year

## Up next:

- From Thing
  - sameAs
  - url
- From Thing > CreativeWork
  - Author
  - dateCreated
  - dateModified
  - datePublished
  - Editor
  - inLanguage
  - Provider
  - Publisher
  - Version
- From Thing > CreativeWork > Dataset
  - Distribution
  - Spatial
  - Temporal

## *How? In theory*

---

Add the markup to your pages and republish them

## *It wasn't really that easy*

---

### Issues:

- Google tools vs. development environments
- Google webmaster and structured testing tools don't work with dynamic web pages
- It can take forever for Google to completely re-crawl a site



Webmaster Tools

- Site Dashboard
- Site Messages (12)
- Search Appearance (1)
  - Structured Data
  - Data Highlighter
  - HTML Improvements
  - Sitelinks
- Search Traffic
- Google Index
- Crawl
- Security Issues
- Other Resources
- Labs

Structured Data > Dataset (markup: schema.org)

Status: 2/7/14

18 Items on 18 pages

Items

20

15

10

5

Showing all pages

Download

Page URL

/data/g02180

/data/myd29p1n

/data/aa\_12a

/data/ggd611

/data/NSIDC-034

/data/ae\_land?\_e

/data/G10007

/data/ggd257\_es

/data/ggd323

/data/nsidc-0119

/data/nsidc-0064

/data/iputn1b

/data/nsidc-0381

/data/nsidc-0388?\_escaped\_fragment\_

/data/nsidc-0108?\_escaped\_fragment\_ =

/data/mod29p1d

/data/g01938

/data/ghah14

1

-

1/29/14

-

1

-

1/29/14

-

1

-

1/29/14

-

1

-

1/29/14

-

Dataset (markup: schema.org) > Page details

<http://nsidc.org/data/ggd323>

**Crawled:** 1/30/14  
Data only shows detected fields and may be different than live data.

Dataset

**itemtype:** http://schema.org/Dataset  
**name:** Soil and Air Temperature at Forest and Tundra sites, Petite-Riviere-de-la-Baleine, Quebec, Canada  
**contributor:** MICHAUD, YVES  
**name:** MICHAUD, YVES  
**keywords:** ATMOSPHERIC RADIATION > ALBEDO  
**keywords:** ATMOSPHERIC TEMPERATURE > AIR TEMPERATURE  
**keywords:** ATMOSPHERIC TEMPERATURE > SURFACE AIR TEMPERATURE  
**keywords:** ATMOSPHERIC WATER VAPOR > HUMIDITY  
**keywords:** ATMOSPHERIC WINDS > SURFACE WINDS  
**keywords:** FROZEN GROUND > SOIL TEMPERATURE  
**keywords:** SOILS > SOIL TEMPERATURE  
**keywords:** SURFACE RADIATIVE PROPERTIES > ALBEDO  
**description:** This data set includes meteorological measurements from two climatological stations (one forest, one tundra) at PBA Campus, Petite Riviere de la Baleine in Quebec, Canada. Parameters include ground...

Use the Structured Data Testing Tool to check live data for errors and preview how your rich snippets will appear on Google Search with the next crawl of the page.

[Test live data](#) [Close](#)

2/7/14

Show 25 rows 1-18 of 18

Errors





Thank You  
[rduerr@nsidc.org](mailto:rduerr@nsidc.org)  
[nsidc.org/ssiii](https://nsidc.org/ssiii)