

# The History of Winter: A Professional Development 'Teacher as Scientist' Experiential Learning Field Experience

Dr. Robert Gabrys, NASA GSFC; Dr. Peter Wasilewski, NASA GSFC; Katherine Bender, SGT, Inc

## Introduction

Each year since 2000, the NASA Goddard History of Winter (HOW) program has allowed teachers to develop an understanding of the consequences of one segment of the orbit of the tilted Earth in its path around the sun. Scientists from NASA, CRREL, and Michigan Tech, supported by the Whiteface Observatory, and the science program at Northwood School in Lake Placid, New York, use the weather and the stratigraphy in the ice and snow, consequences of the weather changes, as "teachers" in a team study of the winter record. Snow in the air and on the ground, ice, its crystal structure and axial orientation, and the ecosystem consequences of snow and ice constitute the weeklong content package. Teacher Professional Development Standards A, B, C, and D were the guiding principles in developing HOW with a content structure formulated as protocols to serve as inserts into lesson plans and inquiry guides. The concept of HOW within NASA is to provide understanding of the WHY? and WHAT? of satellite remote sensing. The content is appropriate ground validation in that techniques presented in protocols are identical to those used by professionals who study snow pits, evaluate features in snow metamorphism, and study thin sections of ice cores drilled in ice caps and glaciers.



Figure 1. Ice climbing is a part of the team building effort at HOW.

## Methodology

**HISTORY OF WINTER 2008: AN IMMERSIVE CRYOSPHERE SCIENCE TRAINING CAMP**  
 Lake Placid, NY  
 February 10-16, 2008

Recognized by the Joint Committee for the International Polar Year 2007-2008 as an activity with strong science, education and outreach components  
 Your cost: You are responsible for transportation fees and travel fees. All expenses are paid once you reach Lake Placid, NY.

NASA GSFC encourages you to create a team of educators to participate in the 2008 History of Winter training. A training team includes a university educator involved in pre-service science education, pre-service teacher and in-service teacher. Informal educators are also welcomed as members of the team.

Participate in authentic Teacher-as-Scientist Cryosphere Research in the Field

An IPY Legacy program building an interactive online data resource for science and education

Inquiry, research, and technology integration with a focus on temperature records

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## Implementation

How participants come in teams consisting of a higher education faculty member, a pre-service science education student, an in-service science teacher, and optionally an informal education partner. The concept behind this configuration is to study the integration of HOW content, skills, and processes into all three (four) learning strata. The team model implies a framework for sustainability and the program offers opportunities for follow-on support.

In addition to the training that participants receive while attending the weeklong Lake Placid workshop, there are pre-HOW and post-HOW program components to support their learning experience. Online multimedia resources are available on the History of Winter website and are used both synchronously and asynchronously by the workshop and participants.

Figure 2.

An offshoot of the NASA Goddard Center History of Winter (HOW) Program, the Global Snowflake Network (GSN) launched in the winter of 2006 engages an international audience including both formal and informal education groups. The goal is to provide an interactive online data resource in science and education for the characterization of snowfall and related weather systems. The Global Snowflake Network has been accepted as an education outreach proposal for the International Polar Year. Collaborations with other agencies and universities also with IPY-accepted proposals are now underway. HOW and the GSN are endorsed by the NASA Goddard Education Office and many of the Goddard Snow and Ice Team scientists. Together these programs offer a unique, sustainable, and proven outreach for the Cryosphere research program. Snowflakes are like frozen data points, their shape is a record of atmospheric conditions at the time of their formation. The shapes of snowflakes vary over the winter season, with the source of a weather system and over the course of a given snowfall. The objective of the Global Snowflake Network (GSN) is to create a global ground team of teachers, students, families, and researchers worldwide to identify snowflake types during the progress of snowfalls. The result is a unique and scientifically valid resource useful to meteorology and scientific modeling of Earth's Hydrosphere. The Global Snowflake Network (GSN), simultaneously a science program and an education program is presented as a simple, scientifically valid project that has the potential to spread the IPY message and produce a lasting resource to further scientific understanding of Earth's hydrology through the study of snow.

Figure 2. HOW offers participants the opportunity to work alongside of cryosphere scientists and learn firsthand how research is carried out in the field.



## Field Results

How participants collect snow pit data including snow depth, temperature profiles, crystal grain size, hardness, and density. Ice core samples of the local lakes are analyzed through thin-section sampling.

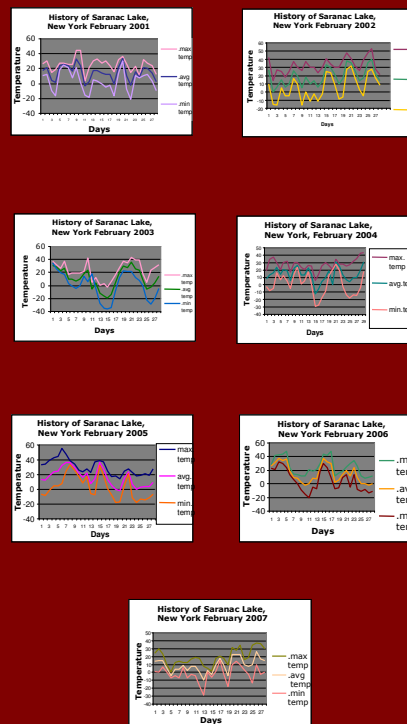


Figure 3. In addition to daily temperature data, HOW participants collect snow pit and ice depth data to develop a long term record of winters in the Lake Placid region.

## Summary

The HOW Teacher as scientist (TAS) model is a flexible model. HOW enables teachers who are required to use inquiry-based facilitation in the classroom to experience inquiry themselves. Teachers with little science content background as well as those with Science degrees have participated in HOW working alongside of the science team. Accommodations are made through differentiation of instruction so that each group leaves with a mastery of the content that is appropriate for the transition to presentation in the classroom. Each year builds on the previous year ensuring a time series record of the history of winter-by itself a learning experience.

NASA HISTORY OF WINTER		
HOW at Lake Placid	Global Snowflake Network	A Goddard Education Program ThermoChron Quest
<ul style="list-style-type: none"> <li>*"Teacher as Scientist" Cryosphere Science Field Research</li> <li>*Long Duration Experiential Learning Professional Development</li> <li>*Supportive web and distance learning resources</li> <li>*Teams consist of Higher Education Faculty Pre-service Teacher In-service Teacher Informal Educator</li> <li>*Traditions to use of inquiry in classroom</li> </ul>	<ul style="list-style-type: none"> <li>*Science and Education Field as "Validation Effort"</li> <li>*Opportunity for committed participation in science research</li> <li>*Facilitated by the Joint Committee for the International Polar Year</li> <li>*Snowflake Collection and Identification Protocol</li> <li>*Valid database on science and education research</li> <li>*Understanding of climate and weather through observation and analysis</li> </ul>	<ul style="list-style-type: none"> <li>*Integration of 1-12 science inquiry</li> <li>*HOW at Lake Placid participants utilize ThermoChron in the field</li> <li>*Partnered with Arctic traverse teams</li> <li>*Supportive Online resources</li> <li>*Additional distance learning opportunities with both ThermoChron and ThermoChron components</li> <li>*Pre-encore'd research project development</li> </ul>

## Project Website



<http://education.gsfc.nasa.gov/how>

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## For further information

Please contact [Katherine J. Bender@nasa.gov](mailto:Katherine.J.Bender@nasa.gov) or [Peter J. Wasilewski@nasa.gov](mailto:Peter.J.Wasilewski@nasa.gov). More information on this and related projects can be obtained at <http://education.gsfc.nasa.gov/how>