POLAR RESEARCH IN THE CLASSROOM, AFTER THE IPY

Birgit Strømsholm, birgit@rocketrange.no
Norwegian Centre for Space-related Education (NAROM)
postbox 54, 8483 Andenes, Norway

NAROM, The Norwegian Centre for Space-related Education, was responsible for an educational IPY (International Polar Year) project related to Arctic satellite applications as part of its activities in 2007-2008.
The focus on the project has been on accepted Norwegian IPY research projects that use satellite data as a tool in their research, and projects for which satellite data from our educational project (PolarEduSpace) could be a useful supplement to scientific results. Within an educational network, NAROM has developed new educational resources and activities based on experience, knowledge and data from the PolarEduSpace project.

1. INTRODUCTION

NAROM (Norwegian Centre for Space-related Education), offers educational programmes for teachers and students at many different levels to promote appreciation for the benefits of space activities, to facilitate recruitment in the space industry, and to stimulate an interest in science in general. NAROM is located at Andøya Rocket Range (ARR), and uses the unique technical facilities at ARR to provide an exciting educational experience.

In addition NAROM concentrates on being an important contributor in the provision of space-related resources for the classroom. The website SAREPTA, www.sarepta.org, was established to exploit the exciting, visible aspects of space activities to stimulate interest in science and technology and thereby ensure recruitment to space-related disciplines. Through the website sarepta.org, NAROM also aims to show young people how space activities can be used as a tool in the development of society and to appreciate and understand the benefits, challenges and importance of space for everybody.

2. POLAREDUSPACE

The PolarEduSpace project was implemented through funding from the Norwegian Research Council and with support from the Norwegian Directorate for Education and Training, the Norwegian Space Centre and ESA. The project wanted to encourage the youth, students and teachers to join in IPY events and share the global enthusiasm during this extraordinary opportunity. The overall aim was to inspire and stimulate an increased interest and understanding in polar research among young people aged 13-18.

The PolarEduSpace has provided opportunities for classroom teachers and young students to attend on-line activities presented at the website sarepta.org. The participants have been provided with content knowledge and ideas for activities related to current curricula and focusing on polar science. Example of these has been IPY research projects in the area of sea ice, glacier monitoring, ocean currents, permafrost, Arctic weather situation and Sun-Earth interaction.

Remote sensing, use of fresh satellite images and thematic data have been integrated tools. On-line classroom resources and activities (Norwegian and English version) related to the IPY have been prepared in the space educational website sarepta.org.

Figure 1. Researches and teachers involved in PolarEduSpace visiting the Longyearbyen glacier.

Based on reports from classroom activities, we selected a group of teachers who we invited for one week field based training course at Svalbard in August 2008.

3. AFTER THE IPY

3.1 Space Science Suitcase

In cooperation with the University in Bergen, we have developed four “Space Science Suitcases” filled with instruments. Among these are a simple solar telescope (Sunspotter) for white light for observing sunspots, a

Proc. ‘20th ESA Symposium on European Rocket and Balloon Programmes and Related Research’
Hyère, France, 22–26 May 2011 (ESA SP-700, October 2011)

narrow-filter telescope for the H-alpha line (656.3 nm) and magnetometer to measure the magnetic disturbances due to electrical currents in the Aurora.
The Aurora and other phenomena in near Earth space are becoming a considerable part of the science curriculum in upper secondary school (high school) in Norway. Introducing scientific methods to the young students is an important objective of the education.

Figure 2. The astronaut Christer Fuglesang express interest in the Space Science Suitcase.

The Space Science Suitcase is developed with a set of simple versions of instruments for monitoring solar and geophysical activity in near Earth space.The schools have the possibility to borrow the Suitcase to do some exciting field research in the classroom combined with on-line space weather observations.

Background information /facts relating the observed parameters to phenomena in the solar wind and near-Earth space are prepared in the space resource website sarepta.org.

Figure 3. Northern lights

We also offer teacher traing courses where these instruments are parts of the hands-on activities in the field course.
Use of the Space Science Suitcase have been highly focused in the International Year of Astronomy 2009.

3.2 Training courses, Polar research in the classroom
In spring 2008 NAROM applied the Nordplus horizontal progrogramme announced by the Nordic Council of Ministers. We wanted to develop "Polar research in the classroom" at Nordic level based on experience, knowledge and data from the PolarEduSpace project. The proposal was accepted in October 2008 and will last up to July 2011.

In a Nordic educational network and cooperation we have within the "Polar research in the classroom" started to develop teacher training courses. The participants in the network are educators from secondary level, University College and Universities in Denmark, Iceland and Norway. Since spring 2009 we have had workshops at southern part of Iceland, in Copenhagen, at Andøya Rocketrange and Svalbard.

Figure 4. Some of the the Nordic participants in the field in southern part of Iceland March 2009.

We offer three different web based and field based teacher training courses (10 credits) at Nordic level with the titles "Climate research in Polar landscape" (2010, field course at Svalbard), "Below the Polar sky" (2011, field couse at Andøya Rocket Range) and "Environmental changes in the sub-polar regions" (2011, field couse at Iceland). The training courses were fullbooked a year before they start.

The training course "Climate research in Polar landscape " started with on-line activities in March 2010 and a week field work with 30 science and geography teachers at Svalbard in August.

Themes at the course include changes in the Arctic weather and climate, permafrost, ocean currents and sea ice, glaciers, vegetation, landforms and landscapes. LEOWorks, image processing software for education use provided by ESA and Geographic Information System (GIS), were importent tools at the course. Out in the field both GPS and data logger with different probes were used for different measurements and registrations.

A new glacier module was presented as a classroom resource. One part we focused on was glacier mapping and change detection. Satellite remote sensing is the only mean to map glacier areas and detect their changes over time in a practical and fast way over large areas. Detecting and quantifying glacier retreat and advance, and glacier area changes, is one of the most important contributions of satellite technology to investigate and better understand climatic change.

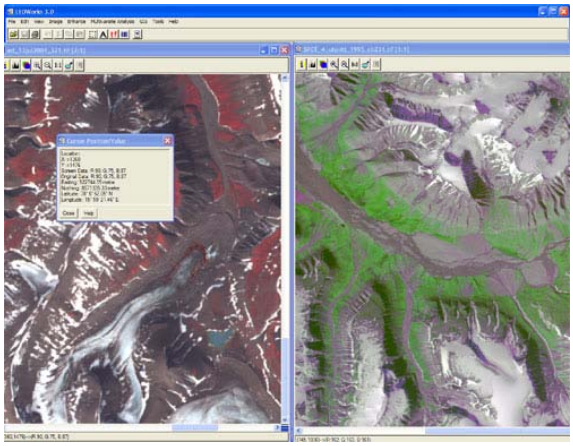

Figure 5. SPOT image, August 1995

With use of LEOWorks, image processing software and ASTER satellite images from 2004, SPOT image from 1995, an infrared airphoto from 1990 and a topographic map based on airphotos of 1936, the teachers worked with an exercise to digitize the glacier outlines the different years. The outlines were overlain and compared to each other in order to visualize and quantify changes in glacier extent. In the field the outline 2010 was measured using GPS.

Figure 6. Teachers measure the temperature and the outline at the Scott Turner glacier.

Most glaciers on Svalbard and around Longyearbyen are polythermal with parts of the glacier at the pressure melting point, that is close to 0 °C. This ice is among scientists called “temperate ice” or “warm ice”.
To confirm this the teachers used data logger with temperature probes to measure the temperature at different parts of the Scott Turner glacier.

Out in the field the participants visited some of the permafrost observatory in Svalbard made up of several ground-based instruments that measure ground thermal conditions in Advemtdalen.

Figure 7. Professor Hanne Christiansen demonstrates some of the ground-based permafrost instruments.

Professor Hanne Christiansen presented the PERMASAR project in a lecture. For the first time satellite technology has been incorporated in monitoring of changes in different landforms.

The PERMASAR project can give additional valuable information about the rate of permafrost landscape in Svalbard. Images from the radar satellites TeraSAR-X and Radardsat-2 produce images from the study areas in Svalbard with an interval of 11 and 24 days, respectively.

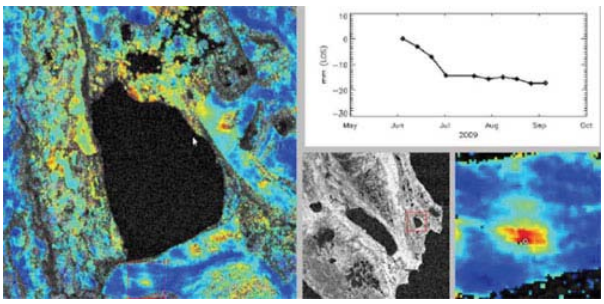

Figure 8. Mapping of permafrost= Earth < 0 °C for • 2 years

The training course “ Below the Polar sky” started with on-line activities in February 2011 and a week field work

with 20 science teachers at Andøya Rocket Range in March. Themes on the course are monitoring of solar activity, space weather and research, the sun and northern lights, instrumentations and observation.

Figure 9. Northern Lights, Andøya Rocket Range 11. March 2011

The training course "Environmental changes in the sub-polar regions" started with on-line activities in February 2011 and a week field work with 23 science and geography teachers at Southern part of Iceland in April. Themes at the course include geology, glaciers, past climate, landforms and landscape development. We use glacial and climate changes on Sólheimajökull – long glacier coming from Mýrdalsjökull glacier in southern Iceland as an example.

Figure 10. Out in the field.

In an oral feedback the 31 participants expressed a great enthusiasm for the field course. Before the outdoor activities the participants went through a professional preparation with study of old maps, aerial photographs and satellite images to detect changes in the extent of glaciers and environmental changes associated with floods and volcanic eruptions.

Out in the field there were observations using GPS and data loggers. The participants expressed that there were many spectacular nature experiences during the field gathering, with a hurricane, spring floods and walking on glaciers.

Figure 11. Walking at Sólheimajökull glacier using GPS and datalogger.

In 2010 it was decided that the teacher training courses will be provided through the ESERO (European Space Education Resource Office) Norway, an educational project within ESA, to Norwegian teachers and from 2012 also include teachers on Nordic level.