



*8<sup>th</sup> Circumpolar Symposium on Remote Sensing of Polar Environments*  
June 8 -12, 2004, Chamonix, France



Abstract book





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### Oral Presentation:

## EVALUATION OF ALGORITHMS FOR THE RETRIEVAL OF SNOW SURFACE TEMPERATURE FROM MEDIUM RESOLUTION SATELLITE DATA

Jostein Amlien & Rune Solberg

Norsk Regnesentral (Norwegian Computing Center)  
Postboks 114 Blindern, N-0314 Oslo, Norway  
Phone : +47 2285 2680  
Email: jostein.amlien@nr.no

The surface temperature of snow (STS) is a geophysical parameter that is relevant for hydrological modelling of the snow melting as well as for climatic monitoring. In our paper we evaluate methods for retrieving STS from thermal EO data and compare with results from field observations. Retrieval of STS by means of satellite remote sensing is undertaken in the thermal part of the spectrum. Snow surfaces are close to blackbodies, but because of the atmosphere, the brightness temperature observed from the satellite will typically differ from the real surface temperature of the snow cover. The atmospheric attenuation will depend on the wavelength of the observed radiation, the length of the atmospheric path between the surface and the satellite, and the chemical composition of the atmosphere. Methods for retrieving STS from EO data will typically combine observations in different spectral bands and/or from different view angles. In a pilot study we identified Key's algorithm as one of the best single-view techniques method for polar atmospheres, and it can be applied on MODIS as well as AVHRR data. Dual-view techniques will require dual-viewing sensors, like AATSR. They are considered as the most promising ones with respect to accuracy, but may not be suitable in an operational setting, due to narrow swaths and long repetition cycles of current available sensors. The main analysis is undertaken on data from single-view and dual-view EO sensors acquired the winter 2004, and the results are compared with simultaneous field observations from field campaigns and field stations.



## Oral Presentation:

### CHANGES IN GLACIER EXTENT IN THE CENTRAL TIEN SHAN, 1943-2001

Roger G. Barry<sup>3</sup> T.E. Khromova<sup>1</sup>, M .B. Dyurgerov<sup>2</sup>

<sup>1</sup>Institute of Geography, Russian Academy of Sciences, Moscow.

<sup>2</sup>Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO  
80309-0450

<sup>3</sup>National Snow and Ice Data Center, University of Colorado, Boulder CO 80309-0449.  
rbarry@kryos.colorado.edu

Mountain glaciers worldwide show widespread wastage starting in the late 1970s and accelerating in the late 1980s. We investigated changes in the Ak-shirak Range, central Tien Shan plateau (43° N, 75°E) using air-photo mapping surveys prepared by V.A. Kuzmichenok for 1943 and 1977, an ASTER image (2001), and long term glaciological and meteorological observations. The "Tien Shan" hydrometeorological station (3614m) operated from 1930-98. The Ak-shirak Range rises to 5000 m a.s.l., about 1500 m above the plateau and has more than 170 glaciers with an aggregate area of 436 km<sup>2</sup>. Wasting of the Ak-shirak glacier system includes a decrease in average glacier size, an increase in the area of outcrops, and in the perimeters of water divides between individual glaciers. A small shrinkage during 1943-1977 was followed by a 23 % reduction during 1977-2001 in response to increases in summer and annual air temperature and decreases in annual precipitation. Our results match reported glacier recession rates in the Zailisky Alatau of the western Tien Shan and in the Pamir.

Cold, high-mountain glaciers have been considered very stable in their response to small changes in climate. Our study shows that this may no be longer true. While most ice in the Tien Shan is concentrated in four compact glacier systems, individual glaciers and ice areas outside these systems can rapidly diminish.

Acknowledgment: Work supported through a Fulbright Fellowship at the NSIDC (TEK); NASA NAG5-0772 (RGB); and NSF/ATM-0118384 (MBD).

A published version of this presentation appears in:  
*Geophysical Research Letters*, 2003, vol. 30(16)1863, doi: 10.1029/2003GLO17233.



### Oral Presentation:

## PREDICTIVE HABITAT DISTRIBUTION MODELLING FOR PLANT SPECIES IN AN ARCTIC TUNDRA ENVIRONMENT, A CASE STUDY

Pieter Beck<sup>1</sup>, Lennart Nilsen<sup>1</sup>, Daniel Joly<sup>2</sup>

<sup>1</sup>Department of Biology, University of Tromsø, N-9037 Tromsø, Norway  
Tel : +47 77 64 44 44  
Email: pieter.beck@stud.ibg.uit.no ; lennart@ibg.uit.no

<sup>2</sup> ThéMA, CNRS, Université de Franche-Comté, 30, rue Mégevand, 25030 Besançon, France  
Email: daniel.joly@univ-fcomte.fr

With most current global circulation models predicting a greater climate change for the Arctic than for the rest of the globe, and the physical environment controlling plant growth and establishment in the Arctic, dramatic effects on plant life in the arctic tundra can be expected.

In recent years, many studies have been performed to assess the impact of climate change on arctic plant species, most of them measuring vegetative and sexual responses at the organismic level. So far, few studies have allowed for quantitative estimates of species distribution in an altered arctic environment. Predictive habitat distribution models are an essential tool to assess the factors that influence the geographical distribution of species and to estimate how populations respond to changes in these factors. We used *Generalized Linear Models* to predictively model the distribution of *Dryas octopetala*, a dwarf shrub with a much studied ecology, around Kongsfjorden on Svalbard. Validation of the models and the resulting habitat distribution maps show that the method, using a GIS database containing topographical, geological, and temperature data with a spatial resolution of 20 m, is useful. There is a need for elevation models with a higher resolution if less prevalent species are to be modelled however and for snow distribution models if the impact of climate change on species distribution is to be incorporated in the predictive habitat distribution models.



## Oral Presentation:

### FOURTEEN YEARS OF MONITORING SUB-ARCTIC VOLCANOES USING SATELLITE DATA: WHAT WE HAVE LEARNED

Ken Dean, J. Dehn, R. Peterson, L. Bickmeier, A. Stefke, C. Kearney, S. Smith, P. Izbekov,  
K. Papp and A. Tranbenkova

Geophysical Institute (Alaska Volcano Observatory)  
University of Alaska Fairbanks  
P.O. Box 757320  
Fairbanks, Alaska 99775-7320  
Tel: (907) 474-7364,  
Email: [ken.dean@gi.alaska.edu](mailto:ken.dean@gi.alaska.edu)

This presentation will demonstrate how satellite-based volcano monitoring in the Arctic/Sub-Arctic, North Pacific Region has evolved over a fourteen-year period, since its implementation at the Alaska Volcano Observatory (AVO). In 1989 the AVO began satellite-based monitoring of approximately 50 active volcanoes in Alaska primarily focused on volcanic plumes and in a reactive mode. During this period plumes were detected every few months. As computing systems and satellite coverage improved, and analytical techniques became more sophisticated, our capability to detect and analyze eruptions also improved. After an AVHRR receiving station was acquired (1993) volcano monitoring became proactive and eruption warnings were issued via the AVO alert network. The realization that east-blowing winds transported volcanic ash emitted by Kamchatkan Volcanoes towards North America resulted in the expansion of the monitored region to include all of the North Pacific. A few years later a source of GOES data was developed. The improved capabilities resulted in a significant increase in detected activity, such as plumes, drifting ash clouds and thermal anomalies, which were now observed almost daily. The addition of high spectral-resolution MODIS data (ground station acquired in 2001) permitted the compositional analysis of plumes and clouds, and the detection of subtle thermal anomalies as precursor signals to eruptions. Finally, high-resolution (ASTER, Landsat and SAR) data, field observations and measurements (e.g. Forward Looking Infrared Radiometer - FLIR) provided insight into volcanic processes that resulted in thermal anomalies and emission of  $SO_2$ .



### Oral and Poster Presentation:

## VOLCANIC ERUPTIONS OF THE NORTHERN PACIFIC: AN ATLAS OF SPACE-BORNE IMAGES

Ken Dean & Jonathan Dehn

Geophysical Institute (Alaska Volcano Observatory)  
University of Alaska Fairbanks  
P.O. Box 757320 Fairbanks, Alaska 99775-7320  
Tel: (907) 474-7364,  
Email: [ken.dean@gi.alaska.edu](mailto:ken.dean@gi.alaska.edu)

A book entitled, " Volcanic Eruptions of the Northern Pacific: An Atlas of Space-borne Images," will be published next year by Springer Praxis Press. The book will discuss how satellite data are used to monitor volcanoes and provide a consolidated but informative review of types and styles of eruptions and landforms as seen from space in the sub-Arctic region of the north Pacific. Volcanic clouds erupted from these volcanoes often circulates throughout the north polar region. Data from GOES, AVHRR, MODIS, Landsat, ASTER, and various SAR systems will be included. The book will consist of two parts. The first part will describe the state of the art of real-time volcano monitoring from space. Each chapter in this section is written by a variety of specialists who work in this field and will describe how the data are acquired and analyzed, the types of information derived from the images to support hazard mitigation and the transfer of this information to people most affected by eruptions. The second part will be an atlas of images showing eruptions and volcanoes with a description of the activity or features observed. The intent of the book is to provide a pleasing overview of data and past experiences that can be used as a learning tool by students and specialists. The manuscript will consist of approximately 800 pages including 300 black and white and color satellite images. A DVD with images and animations to show the dynamics of eruptions will be included with the book. The book should be completed in late 2004.



## Oral Presentation:

### A METHOD FOR MONITORING GLACIER MASS BALANCE USING REMOTE SENSING IN THE FRENCH ALPS : COMPARISON WITH GROUND MEASUREMENTS (1985-2003)

Jean-Pierre Dedieu<sup>1</sup>, Antoine Rabatel<sup>1&2</sup>, Christian Vincent<sup>1</sup>, Alvaro Soruco<sup>1&3</sup>

<sup>1</sup>LGGE/CNRS, 54, rue Molière. Domaine Universitaire, BP.96, 38402 Saint Martin d'Hères cedex, France.

Tel : +33 4 76 82 42 73, Fax : +33 4 76 82 42 01, Email : [dedieu@lgge.obs.ujf-grenoble.fr](mailto:dedieu@lgge.obs.ujf-grenoble.fr)

<sup>2</sup>IRD-UR 032 Great-Ice, CP 9214, La Paz, Bolivia

<sup>3</sup> Université Joseph Fourier, 38402, Grenoble, France

An indirect methodology for determining the reconstruction of alpine glaciers mass balance is presented by using Remote Sensing optical and SAR imagery. Direct measurements of mass balance (winter and summer data) provide highly sensitive indicators from well monitored glaciers, as in the Alps since 1945, but not enough time series measurements exist over a large number of samples at the mountain range scale. In this context, Remote Sensing data available since the 80's offer a good description of the glaciers retreat in the Alps, but other additional indicators may be used for snow line positioning at the end of the ablation season. The objective is to set a correlation between the snow line position on the image as a proxy of the Equilibrium Line Altitude (ELA) and the annual net mass balance. The core of the methodology is to calculate the ELA variations from the steady state of the glacier over the referenced time period, the key of the transfer to mass balance is the annual activity coefficient  $db/dz$ . A reliable use of Remote Sensing data requires strong validation of the method. In this objective, a comparison between the computed mass balance reconstruction and the direct ground annual mass balance calculation is set for 3 French glaciers well suited and included in a national Observation Program inventory (Argentière, Gebroulaz, St. Sorlin). The outlet glaciers are located between latitude of 45°7'N and 44°56'N along longitude of 06°30', with ice field elevation ranging from 3600 to 1700 m and flowing out in all directions. A continuous time series of images is used for the period between 1985-2003. The data obtained are given before and after meteorological J.D.D. corrections. The final computed results are well correlated with the direct ground mass balance cumulative values.



## Oral Presentation:

### HIGH RESOLUTION SATELLITE DATA FOR COMMUNITY DEVELOPMENT AND MONITORING IN THE CANADIAN ARCTIC

Helmut Epp<sup>1</sup>, Donna Schreiner<sup>2</sup>, Norm Mair<sup>1</sup>

<sup>1</sup>NWT Centre for Geomatics Government of the Northwest Territories 600, 5102 - 50 Ave.,  
Yellowknife, NT, X1A 3S8, Canada  
Tel : (867)920-3329, Fax : (867)873-0221, Email : [helmut\\_epp@gov.nt.ca](mailto:helmut_epp@gov.nt.ca)

<sup>2</sup>C.S. Lord Northern Geoscience Centre Box 1500, 4601-B 52nd Ave, Yellowknife, NT, X1A 2R3,  
Canada

Most communities in the Canadian Arctic are isolated and can only be accessed by air, some are accessible by winter road for a few months of the year. The use of aerial photography has therefore been a standard method of mapping and monitoring the communities. In some cases it has been difficult and costly to obtain photography due to cloud cover problems. Within the past year IKONOS high resolution satellite imagery was obtained on a test basis for the community of Holman on Victoria Island. The imagery was geocorrected using the cadastral base which had been developed through aerial photography in the past. The 1m satellite data was pan sharpened and fused with the 4m multispectral data. Several enhancements were created to bring out any vegetation as well as geological features around the community. A Digital Terrain Model (DTM) was developed from the 1m cadastral data and then converted into a Triangulated Irregular Network (TIN). The satellite imagery was then draped over the TIN to create a three dimensional image. Both the 2 and 3 dimensional images were used to identify infrastructure changes within the community. The imagery was also used as part of a Community Outreach Program to involve residents to assist in identifying land forms, historic sites of interest, and local geology. High resolution satellite imagery is providing information which is more cost effective and efficient in community mapping and monitoring.



### Oral Presentation:

## REMOTE SENSING MONITORING SYSTEM OF SEASONAL HYDROLOGICAL PROCESSES IN THE POLAR RIVER DELTAS

Olga Gorelits & Igor Zemlianov

State Oceanographic Institute (SOI)  
Kropotkinsky per., 6, Moscow, Russia, 119034  
Tel/Fax: +7(095) 246 6448  
Email: gorelits@mail.ru, ivz@mail15.com

Nowadays remote sensing data (RSD) become one of the most significant source of information on the environment. Recently, researches obtained access to RSD, featuring high temporal (once a day) and medium spatial (250 m/pixel) resolution sufficient for investigation into seasonal hydrological processes in the river deltas.

Remote Sensing Monitoring System (RSMS) was design in SOI in 2002-2003 on the basis of medium resolution RSD, received from satellite platform TERRA-MODIS. SOI operated in a close contact with European Russia (ER) Regional Centers for Hydrometeorology. To link RSD to real natural situation during experiment these Centers operatively transmitted to SOI the daily hydrological and meteorological data and synoptic maps covered studied regions.

The novelty of experiment lied in combined analysis in real time mode of daily RSD and daily hydrometeorological data. Experiment covered seasonal hydrological processes, such as spring breaking up and melting of ice, ice dams formation and summer flooding in the deltas of ER rivers: Northern Dvina, Onega, Mezen, Pechora.

Results from experiment showed that developed RSMS provided a means to monitor seasonal hydrological processes in the river deltas and to indicate short term local processes in real time mode in the local parts of the deltas. Technical, technological and software capabilities, available in SOI nowadays, offer a means to develop and operate RSMS, which provide to the full extent the solution of the tasks of monitoring of seasonal hydrological processes with application of medium resolution RSD, received from satellite platform TERRA-MODIS.



### Oral Presentation:

## REMOTE SENSING FROM THE GROUND IN THE ARCTIC : A COMPLEMENTARY TOOL OF THE SATELLITE IMAGERY TO FOLLOW THE EVOLUTION OF THE ENVIRONMENT AND THE PROCESSES (ZEPPELIN FJELLET'S WEBCAM, NY AALESUND, SVALBARD)

Madeleine Griselin<sup>1</sup>, Kim Holmen<sup>2</sup>, Serge Ormaux<sup>1</sup>

<sup>1</sup>ThéMA CNRS, Université de Franche-Comté, 30, rue Mégevand 25030 Besançon-Cedex , France  
Email : [Madeleine.griselin@univ-fcomte.fr](mailto:Madeleine.griselin@univ-fcomte.fr) ; [Serge.ormaux@univ-fcomte.fr](mailto:Serge.ormaux@univ-fcomte.fr)

<sup>2</sup> MISU (Meteorological Institute in Stockholm), University of Stockholm

To survey the Arctic environment, there is a complementary tool of the satellite imagery : photographs taken from the ground with cameras or webcams permit to follow the evolution of processes which are difficult to approach with other methods.

Since 2000, a webcam equips the Zeppelin Station for Air Monitoring and Research. From the top of the Zeppelin Fjellet (79°North, altitude 475 m), it provides 24 pictures a day for more than three years, offering a panoramic vision of the Kongsfjord.

After presenting the technical aspects of such an instrumentation, the authors will overview the data collection in order to explore the different possibilities of scientific approaches offered by this image bank, and that at different time scales.



## Poster Presentation

### ACHIEVING A CLIMATIC DATA BASE (WIND AND TEMPERATURE) WITH THE HELP OF REMOTE SENSED DATA AT DIFFERENT SCALES IN THE KONGSFJORD AREA (SVALBARD)

Daniel Joly & Thierry Brossard

ThéMA CNRS, Université de Franche-Comté, 30, rue Mégevand 25030 Besançon-Cedex , France  
 Tel : 33-(0)3.81.66.54.02  
 Email : [daniel.joly@univ-fcomte.fr](mailto:daniel.joly@univ-fcomte.fr) ; [thierry.brossard@univ-fcomte.fr](mailto:thierry.brossard@univ-fcomte.fr)

At fine grain resolution, temperature and wind are highly correlated : sea-land or slope breeze appears correlatively with temperature variation between two thermically contrasted areas. This process depends on many factors. First of them, the weather conditions have a large influence on the winds: by cyclonic weather, synoptic winds blow whereas by sunshine conditions, local winds dominate when thermic contrasts are maximum.

The components of environment also act on wind and temperatures:

- the wind generally increases when running through a narrow gully between two hills, and generally decreases in the middle of a chaotic topography due to the frictions;
- temperature distribution can be related to land cover and topography. The temperature is low close to fjords and glaciers and higher above dry mineral soils or sun facing slopes

All these interactions were studied on a small area located on two glacier forefields on the northern part of Brøggerhalvøya (Svalbard). The method we used is based on remote sensed data and a digital elevation model (DEM) at a 2\*2 m resolution. By an appropriate calculation, 3 information layers are provided from an infrared aerial photograph ; they concern the probability that each pixel must belong to a dry, a wet mineral and a vegetated surface. Different sub-layers are processed from the DEM and from the satellite images. They are first stored into a GIS and then taken as predictors for explaining and interpolating the wind and temperature values such as they are given by field observations and measurements (ground truth).

The GIS approach allows us to generate maps showing (a) the frequency for eight wind quadrats and for windless situations and (b) the potential distribution of temperature. The highest temperatures are exactly located close to the central part of the strandflat, where the windless frequency is highest. The northern and southern parts of the study area are highly windy. The north winds spread cold air from the fjord wide over large open areas, whereas permanent south catabatic winds drastically refresh the air on the front of the glaciers.



## Poster Presentation

### ONSET OF GROWING SEASON IN 2003, AS MEASURED FROM MODIS NDVI DATA AND A PHENOLOGICAL GROUND NETWORK IN NORWAY

Stein Rune Karlsen<sup>1</sup>, K. A. Høgda<sup>1</sup>, S. Ahmed<sup>1</sup>, B. Johansen<sup>1</sup>, I. Solheim<sup>1</sup>, and N. Brattenborg<sup>2</sup>

<sup>1</sup>Norut IT, P.O.Box 6434, N-9294 Tromsø, Norway  
Phone:+47 77629441  
Email: [stein-rune.karlsen@itek.norut.no](mailto:stein-rune.karlsen@itek.norut.no)

<sup>2</sup> University of Bergen, Department of Zoology, Allegaten 41, N-5007 Bergen, Norway

Norway is characterized by high climatic diversity, and comprises the nemoral zone in south to the southern arctic zone in north, and the highly oceanic section in west to continental sections in east and northeast.

Since spring 2003 more than 100 schools across Norway are recording phenological events. The Norwegian Environmental Education Network is organizing the work. In addition, five research units belonging to The Norwegian Crop Research Institute, are recording comparable phenological events.

MODIS NDVI satellite data is also used to measure the onset of the spring for the whole area. To determine the onset of spring, a method with a threshold value individually for each pixel was used on a time series of the MODIS Level 3 16-day composite 250 meter NDVI data. This method showed high agreement with the in-situ recordings of onset of leafing of birch for areas where we had in-situ measurements. However, a phenological description of the measured spring event in alpine areas is missing, and is due to lack of phenological stations at high altitudes.

The MODIS based measurements indicate more than three months differences within Norway in onset of spring in 2003, from late March to early July. The start of spring was unusual early in most of Norway in 2003, and is probably mostly related to spring temperature. The mean spring temperature (March to April) in Norway in 2003 was 1.6 °C above the temperature normal, 1961-90. Temperatures of 2.5-3.5 °C above the normal were recorded in large parts of N Norway.



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### Oral Presentation:

## EVALUATION OF ALGORITHMS FOR THE RETRIEVAL OF SNOW GRAIN SIZE FROM OPTICAL SATELLITE DATA

Hans Koren, Rune Solberg, Jostein Amlien

Norsk Regnesentral (Norwegian Computing Center)  
Postboks 114 Blindern, N-0314 Oslo, Norway  
Tel: +47 2285 2693  
Email: [hans.koren@nr.no](mailto:hans.koren@nr.no) ; [jostein.amlie@nr.no](mailto:jostein.amlie@nr.no)

The size and shape of the snow grains will vary through the winter season. The metamorphosis of the snow makes the individual grains larger and more rounded, and they will also grow together. The process will accelerate with increasing temperatures. The snow grain size development may thus be an indicator of forthcoming snowmelt, in particular if it is combined with observations of snow temperature. The snow grain size can be observed from satellite remote sensing in the optical part of the spectrum. Increasing snow grain size will reduce the snow reflectance and increase the anisotropy of the reflectance. These effects will be most prominent in the infrared parts of the spectrum. Due to local topographic variations, it is difficult to retrieve the reflectances directly, but various indices, like the normalized difference of some channels, will reduce this uncertainty. Techniques for retrieving snow grain size from remote sensing are evaluated for implementation in our system for observing snow parameters from satellite. The evaluation is based on literature reviews, field measurements of spectral reflectance and model simulations. The field measurements have been undertaken the winter 2003 and will continue the winter 2004.



## Oral Presentation:

# QUICKBIRD-2 DATA IN REINDEER PASTURE CLASSIFICATION ON ARCTIC TUNDRA

Timo Kumpula

Department of Geography, University of Oulu  
Box 3000, 90014 Oulu, Finland  
Tel: +358-(0)8-5531726  
Email: [timo.kumpula@oulu.fi](mailto:timo.kumpula@oulu.fi)

Aim of the research was to test new Very High Resolution (VHR) remote sensing data suitability to vegetation classification of the reindeer pastures. Remote sensing data used was multispectral Quickbird-2 image acquired summer 2002.

Study area (Jauristunturit) is located partly in Finnish Näkkälä herding district and partly in Norway. Jauristunturit is treeless tundra dominated by the dwarf shrub (*Betula nana*)-lichen heaths (*Cladina sp.*).

About 200 test sites for classification were made. Each test site selected and inventoried represents a homogenous vegetation or land use type. The test sites were selected randomly. Then from each site 5-10 vegetation quadrates (50 \* 50 cm) were inventoried. The locations of test sites were measured with GPS. Digital image processing was done with ERMapper 6.3 and ERDAS imagine 8.6 software.

Preliminary results of Quickbird-2 image classifications indicate that in the Jauristunturit area, it is possible to distinguish 4 - 5 classes of different grazing intensities of reindeer lichens. Especially in the Norwegian side the gradient from ungrazed to grazed was clear. In the depressions where snow accumulates (over 1m) lichen cover is almost totally ungrazed. Where snow cover is thinner the grazing pressure is higher.

VHR images allow detailed study of vegetation types. Small areal coverage is the main limiting factor in the usability of VHR images. For small study areas they are very potential. However VHR images can also be used in the study of larger areas. They can be used as reference material when classifying larger scale images for example Landsat TM.



### Oral Presentation:

## LANDCOVER MAPPING IN THE ARCTIC BY THE U.S. GEOLOGICAL SURVEY

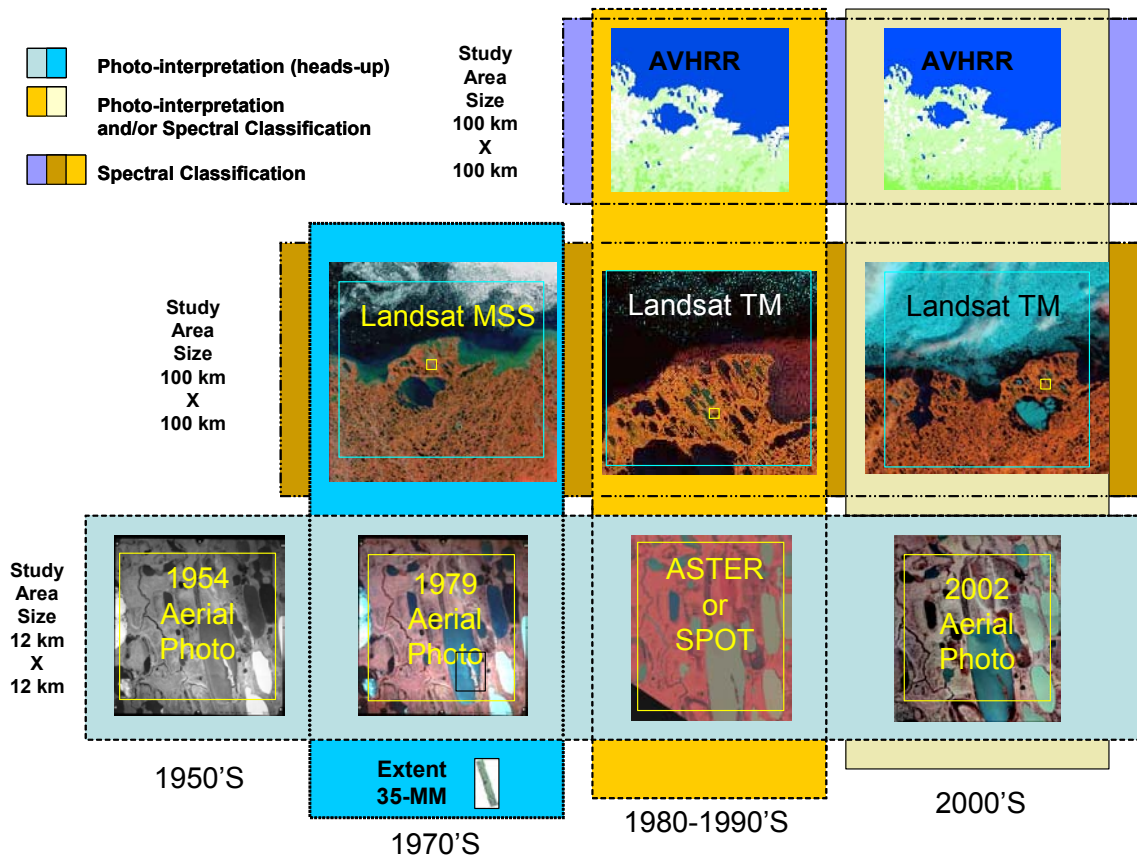
Carl J. Markon

USGS/Alaska Geographic Science Office,  
4230 University Dr., Anchorage, Alaska 99508-4664  
Tel: 1.907.786.7023  
Email: markon@usgs.gov

The U. S. Geological Survey has performed a number of different remotely sensed based land cover mapping projects in the Arctic, particularly in Arctic Alaska. Aerial photographs have been used to collect detailed information over small to medium sized areas. They are utilized as a standard management tool and are attainable using equipment ranging from hand held 35-mm cameras to precision metric mapping cameras. More recently, satellite data have become equally, if not more important, offering synoptic views of landscape at a wide variety of scales, digitally or manually interpreted, and are easily merged with other digital data bases. They include sensors that range from moderately high resolution (ASTER [15-m], SPOT [20-m]), medium resolution (Landsat MSS [50-m] and Landsat TM [30-m]), to low resolution (AVHRR [1 km]). Information from both types of sensors have provided and will continue to provide baseline land cover and land use data for research, conservation, management, and planning of U. S. Geological Survey activities in the Arctic. Currently, these data are being used to perform a multi-temporal/multi-resolution land cover mapping project in the Teshekpuk Lake area of the Alaskan Arctic coastal plain.



Use of multiple temporal periods, data types, and scales to study the effects of time and scale on mapping arctic tundra types.





### Oral Presentation:

## GIS AND PROBABILITY MODELIZATION OF PLANT COLONIZATION SINCE THE END OF THE LITTLE ICE AGE : EXEMPLE ON THE FOREFIELD OF MIDDRE LOVÉNBREEN, SPITSBERGEN (79°N).

Myrtille Moreau<sup>1</sup> & Dominique Laffly<sup>2</sup>, Daniel Joly<sup>3</sup>, Thierry Brossard<sup>3</sup>

<sup>1</sup> GEOLAB UMR 6042 CNRS - 4 rue Ledru - 63 000 Clermont-Ferrand

Email: [myrtille.moreau@free.fr](mailto:myrtille.moreau@free.fr)

<sup>2</sup> SET UMR 5 603 CNRS - Av. doyen Poplawski - 64 000 Pau

Email: [dominique.laffly@univ-pau.fr](mailto:dominique.laffly@univ-pau.fr)

<sup>3</sup> ThéMA CNRS, Université de Franche-Comté, 30, rue Mégevand 25030 Besançon-Cedex , France

Tel : 33-(0)3.81.66.54.02 Email : [daniel.joly@univ-fcomte.fr](mailto:daniel.joly@univ-fcomte.fr) ; [thierry.brossard@univ-fcomte.fr](mailto:thierry.brossard@univ-fcomte.fr)

Recognizing and characterizing the different plant colonization stages on recent moraines by means of remote sensed data are difficult to operate through a direct approach because the most significant part of the information is related to mineral landscape components. Therefore, the authors suggest an indirect approach which consists in the following steps.

1 - An optimized sampling procedure is established in order to collect georeferenced vegetation data from the field. A multivariate analysis is used to define 12 vegetation types which can be related both to different colonization stages and environment contexts.

2 - Remote sensed data sources (GPS and IR air photos) provide means to process a complete data base integrating various environment factors able to control the plant colonization process. These factors concern climate (wind, temperature), physical landscape components (habitat characteristics) and morphodynamic processes (runoff).

3 - A modelling approach laying on Bayesian conditional probabilities is achieved in order to recognize automatically the habitats corresponding to the different vegetation types and, thus, showing the spatial distribution of plant colonization stages. Such a time-space correspondence is designed by means of a synthetic map.

This protocol was tested on the forefield of the Middre Lovénbreen (Spitsbergen) glacier where several belts correspond to well defined deglaciation stages. It is shown how the plant colonization process is controlled, at a general scale, by time effect but also depends on local conditions such as microtopography, microclimate or runoff dynamics.



### Oral and Poster Presentation:

## THE CIRCUMPOLAR ARCTIC VEGETATION MAP: ANALYSIS OF DISTRIBUTION AND NDVI OF VEGETATION TYPES

Martha K. Reynolds and D.A. Walker

Alaska Geobotany Center, Institute of Arctic Biology,  
University of Alaska Fairbanks  
311 Irving, P.O. Box 757000, Fairbanks, AK 99775, USA  
Email: fnmkr@uaf.edu

The Circumpolar Arctic Vegetation Map (CAVM) shows the distribution of fifteen physiognomic vegetation units at 1:7.5 million scale. The map was created using a 1:4 million-scale false color infra-red AVHRR-derived base map. Experts from different regions drew polygons on this image based on existing vegetation maps, ground studies, and data from geology, soils, topography and climate maps. The CAVM uses a physiognomic approach for the legend, uniting previously disparate approaches to describing arctic vegetation in North America and Eurasia. The distribution of cover types was analyzed by country, bioclimate subzone, substrate pH, and elevation. The average normalized difference vegetation index (NDVI) values of the polygons were analyzed by these same factors. One interesting result was the location and size of the area with cryptogam, herb, barren vegetation. It is found in the coldest bioclimate subzones, has the lowest NDVI of any cover type, and is predominantly (>90%) located on the Canadian Arctic Islands. It covers a relatively small area (225,000 km<sup>2</sup>) and is the type most at risk due to climate warming. The dominant trend in arctic NDVI is an increase from colder to warmer areas, as shown by bioclimate subzones and vegetation types. There are also strong correlations with elevation, substrate pH, and glacial history (lower NDVI with higher elevations, higher pH, and more recent glaciation). NDVI was also used to estimate circumpolar plant biomass and its distribution, using a relationship derived from ground clip-harvest data. Total above-ground plant biomass for Arctic is estimated at 2524 g x 10<sup>12</sup>.



### Oral Presentation:

## LONG-TERM MONITORING OF THE TROPOSPHERIC AEROSOL VERTICAL STRUCTURE AND OPTICAL PROPERTIES BY ACTIVE AND PASSIVE REMOTE-SENSING AT NY-AALESUND, SVALBARD

M. Shiobara<sup>1</sup>, M. Yabuki<sup>1</sup>, R. Neuber<sup>2</sup>, E.J. Welton<sup>3</sup>, T.A. Berkoff<sup>3</sup>, J.R. Campbell<sup>3</sup>, and J.D. Spinhirne<sup>3</sup>

<sup>1</sup> National Institute of Polar Research, Tokyo,  
Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan  
Tel: +81 3-3962-4740  
Email: [shio@nipr.ac.jp](mailto:shio@nipr.ac.jp)

<sup>2</sup> Alfred-Wegener-Institute for Polar and Marine Research, Potsdam, Germany

<sup>3</sup> NASA Goddard Space Flight Center, Greenbelt, MD, USA

Tropospheric aerosol has a potential to change the global climate by the direct and indirect effects to the radiation balance in the atmosphere. The aerosol optical properties are essential for the direct effect of aerosols. The indirect effect by the aerosol-cloud interaction may vary with the aerosol vertical structure in the cloud formation process. In order to monitor the vertical structure and optical properties of aerosols in the Arctic troposphere, we are operating remote-sensing measurements at Ny-Aalesund, Svalbard. A micro-pulse lidar has been placed at Koldewey Station, and measures the backscatter signal from aerosols as an active sensor. A sky-radiometer has been placed at the Rabben Station and measures the direct solar beam and the sky radiance distribution. Combined measurements with MPL and sky-radiometer provide the aerosol vertical structure and optical properties, such as the single scattering albedo and phase function, and their temporal variations. Preliminary results from the Arctic measurements will be shown and discussed in this paper.



### Oral Presentation:

## PINRO COMPLEX AIRBORNE RESEARCH BIOLOGICAL OBJECTS AND ENVIRONMENT CONDITIONS STUDY IN THE NORTH PART OF THE BARENTS SEA IN 2002-2003

Vladimir B. Zabavnikov, Vladimir I. Chernook

Polar Research Institute of Marine Fisheries and Oceanography (PINRO)  
6, Knipovich Street, Murmansk, 183763, Russia,  
Tel: (+7)- 815-2-47-25-72, (+7)-815-2-47-36-66, (+47)-789-10-518  
Email: [ltei@pinro.ru](mailto:ltei@pinro.ru), [chernook@pinro.ru](mailto:chernook@pinro.ru)

PINRO is carried out regular research in the Barents Sea with use of airborne remote sensing methods in the interests of study marine biological resources and accompanying of environment conditions during many years. At present this research carry out on base of complex technologies with separate accessible for airborne surveys ecosystem elements. For this purpose uses aircraft-laboratory Antonov-26 (An-26), named "Arktika" during several last years.

In planning and organizing of each research flight uses difference satellite information, including RADAR images (SAR) of ERS-2, ENVISAT and RADARSAT. Also use many kind information about meteorological conditions in the area of air surveys as well as forecast data. These principles allow to increase efficiency of air surveys. Under our estimation it is about 30%% in compare with traditional air surveys.

Therefore, in September-October 2002 and 2003 was carried out special complex airborne remote sensing research for study of biological objects and environment conditions distribution in the north part of the Barents Sea with separate accessible for airborne surveys ecosystem elements. In 2002 research was joint with participation of Russian and Norwegian scientists. This research were carried out simultaneously with annual Norwegian-Russian capelin vessels research surveys in the Barents Sea.

The Russian research aircraft "Arktika" was used to carry out air surveys. During indicated airborne research were used methods and principles above-stated, and which were used in the last time. Results, which were got during air surveys showed possibility overlap in distribution of harp seals, other marine mammals, seabirds, capelin, and current marine environment conditions. We think that air research for this purpose is necessity to carry out in the future every year as joint of Norwegian-Russian research.



### Oral Presentation:

## PINRO AIR MULTIFREQUENCIES SURVEYS FOR ASSESSMENT OF HARP SEALS DISTRIBUTION AND NUMBERS

Vladimir B. Zabavnikov, Vladimir I. Chernook

Polar Research Institute of Marine Fisheries and Oceanography (PINRO)  
6, Knipovich Street, Murmansk, 183763, Russia,  
Tel: (+7)- 815-2-47-25-72, (+7)-815-2-47-36-66, (+47)-789-10-518  
Email: [ltei@pinro.ru](mailto:ltei@pinro.ru), [chernook@pinro.ru](mailto:chernook@pinro.ru)

PINRO has about many years experience of air surveys for assessment of harp seals distribution and number. First air surveys were begun in 1922. For this time was carried out the way from simple visual air surveys to complex technologies based on using of multifrequencies equipments and modern onboard computer systems (PC's...). At present we are carried out air surveys under above-stated purpose with use of infra-red (IR), photo and video equipments. All these instruments are installed on board of research aircraft (so named aircraft-laboratory) Antonov-26 (An-26) "Arktika". All information about air surveys results are presented in the real geographical co-ordinates and time with use of GPS.

In calculation of harp seals number uses special software, which was devised at PINRO. With such IR-images are used for identification and detection of adults and whelps of harp seals (white coat). Also these images are used for assessment of total harp seals number (adults+whelps). Video-images and photo-images are used for reliable of adults and whelps detection on color and size of them.

PINRO air surveys, which are carried out with purpose indicated above-stated can be divided in following stages:

- identification of current ice condition with using of difference satellite information, including ERS-2 and RADARSAT synthetic aperture radar (SAR) images
- tuning, test and calibration of air survey equipment;
- air surveys with purpose of ice reconnaissance and assessment of harp seals distribution and number;
- air surveys data processing and presentation.

Air surveys of harp seals are carried out in the beginning of March at White Sea. During each air surveys flight makes multifrequencies surveys (with use of photo, video, and IR equipments) tacks. Distance between these tacks is about 7.4 km. Air surveys tacks grid are made PINRO experts. The principal advantage of this grid is re-covering of all air surveyed areas with harp seals concentration with sufficient stock. During these air surveys the flight of height is from 140 m to 210 m and aircraft speed is 250-300 km/h.



### Oral Presentation:

## ELECTRONIC REMOTE SENSING IMAGES ATLAS OF THE NORTHERN EURASIA RIVER DELTAS

Igor Zemlianov, Olga Gorelits

State Oceanographic Institute (SOI)  
Kropotkinsky per., 6, Moscow, Russia, 119034  
Tel/Fax: +7(095) 246 6448  
Email: [ivz@mail15.com](mailto:ivz@mail15.com), [gorelits@mail.ru](mailto:gorelits@mail.ru)

Authors have suggested the project of the electronic scientific and educational atlas of the Northern Eurasia river deltas. River deltas are under constant interference of river and marine factors during the whole period of evolution, this interaction determines existence of unique natural environments. Since ancient times all large river deltas have been actively used by humans due to convenient arrangement and favorable natural conditions.

The basic requirements to the atlas are an urgency and accessibility of the information as well as simplicity of use, therefore the Internet technologies were chosen for creation of the atlas. To ensure a broad geographical scope and further capability of continuous actualization of the Internet-Atlas contents, geoimages developed on the basis of remote sensing data on the Earth were chosen as an information database. In the test version of the Internet-Atlas the deltas of the Northern Dvina, Ob and Enisey rivers are presented. For development of the entire version the total amount of information base includes 335 geoimages of various spatial resolution for large river deltas of Eurasia.

At the present stage of the Internet-Atlas development it is possible to solve the following problems with its help:

1. Acquaintance of the main types of the river deltas.
2. Study of the initial bases of the analysis of structure of the river deltas and hydrological and morphological processes.
3. Study of the features of a structure and characteristic attributes of the river deltas of various types applying examples of synthesized multispectral remote sensing geoimages.