SEDIBUD Test Sites: Fact Sheets

Edited by Lamoureux, S.F., Decaulne, A., and Beylich, A.A.
1st Edition, June 2008

Preface

Amplified climate change and ecological sensitivity of polar and cold regions has been highlighted as a key global environmental issue. Projected climate change in cold regions is expected to alter melt season duration and intensity, along with total precipitation and the balance between snowfall and rainfall. Similarly, changes to the reduced extent of permafrost and increase active layer depth are also expected. These effects will undoubtedly change surface water environments in cold regions and alter the flux of sediment, nutrients and solutes, but the absence of data and analysis to understand the sensitivity of the surface water environment are acute in cold environments.

A working group of the International Association of Geomorphologists (I.A.G / A.I.G.) has been formed to address this key knowledge gap through the SEDIBUD (Sediment Budgets in Cold Regions) program. The central research question of the working group is to assess the contemporary particulate and dissolved fluxes in cold climates. SEDIBUD, building on the SEDIFLUX project, has developed into a global group of researchers with field research sites located in polar and alpine regions in the northern and southern hemispheres. Research carried out at each site varies by program, logistics and available resources, but typically represent interdisciplinary collaborations of geomorphologists, hydrologists, ecologists, and permafrost scientists and glaciologists with different levels of detail. SEDIBUD has developed a key set of primary research data requirements intended incorporate results from these varied projects and allow analysis across the network. Sites will report annual climate conditions as well as total discharge and particulate and dissolved fluxes.

This volume is meant to consolidate and communicate key information about selected SEDIBUD key test sites in an accessible and visible manner. SEDIBUD currently has identified 38 Sites with a goal to extend the network to at least 40 – 45 sites that cover the widest range of cold environments possible. Additionally, it is expected that collaboration within the group will act to develop new sites in underrepresented regions. Collaboration with a number of International Polar Year (IPY) research programs including: International Tundra Experiment (ITEX), Circumpolar Active Layer Monitoring (CALM) and Arctic Coastal Dynamics (ACD/ACCO Net) will provide further opportunities for collaborative research to address broader polar research issues. We anticipate that as SEDIBUD evolves, this volume of fact sheets will expand to reflect an increased range of cold regions.

We would like to acknowledge the contributions of all of the SEDIBUD researchers and the editorial assistance of Anna Donevan, Queen's University.

June 25, 2008

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SEDIBUD Key Test Site Summary Sheet

AUSTDALUR
Iceland

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Site overview

In the Austdalur catchment, source-to-sink fluxes and the sediment budget have been analyzed by the integrated study and long-term monitoring of both the relevant denudative slope processes and the fluvial transport.
Main focus is on studying the absolute and relative importance of the different denudative processes as well as trends of Holocene relief development in this subarctic oceanic U-shaped valley.

The Austdalur catchment was instrumented with a number of slope test sites and measuring sites for runoff and fluvial transport in 1996.

Period of Observations

Measurements began in 1996, and have continued almost each year since that time.
Meteorological, hydrological and sediment delivery processes occur year-round in this subarctic oceanic environment.

Recent or Key Publications

Beylich, A.A. (2000): Geomorphology, sediment budget and relief development in Austdalur (Austfirðir, East Iceland). *Arctic, Antarctic and Alpine Research,* 32(4), 466-477.

Beylich, A.A. (2003): Present morphoclimates and morphodynamics of Latnjavagge, the northern Swedish Lapland and Austdalur, east Iceland. *Jökull*, 52, 33-54.

Site Summary:

Country: *Iceland*
Region: *Austfirðir*
Coordinates: 65°16'N, 13°48'W

Elevation: *0-1028 m asl*

Catchment size: *23 km²*

Larger drainage basin system: *No*

Climate: *subarctic oceanic*

Vegetation: lichens, mosses, meadows, bogs, dwarf shrubs

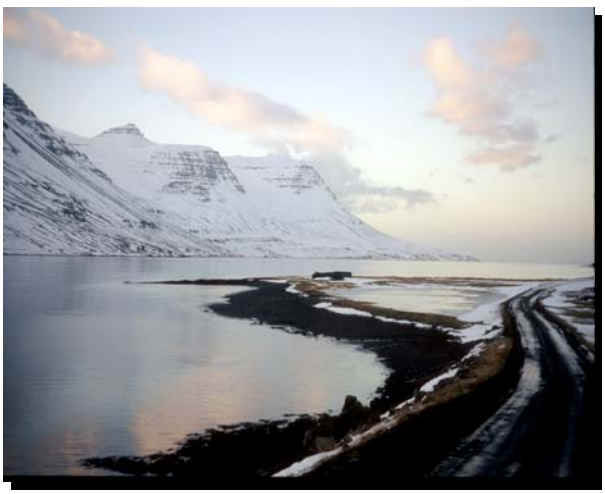
Topography: very *steep glacially sculptured valley, plateau areas at 900-1000 m asl, knickpoints in slope and valley longitudinal profiles*

Lithology: *Basalt*

Denudative geomorphic processes: *Fluvial, chemical denudation, rockfalls, boulder falls, creep, avalanches, debris flows and slides, deflation*

Storage/sink elements: *valley slopes with talus cones*

Human influence: *grazing*



SEDIBUD Key Test Site Summary Sheet

BØDALEN Norway

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Site overview
In Bødalen, research is focused on the quantitative analysis of storage elements and Holocene sedimentary fluxes and budgets, as well as on sub-recent and present-day sedimentary fluxes and budgets. A spectrum of methods is used including geophysical techniques, dating techniques and monitoring techniques for process analysis. The integration of Holocene, sub-recent and present-day process rates is expected to provide knowledge on how the inheritance of the landscape due to the influence of the Last Glacial Maximum has affected different geomorphologic processes, especially source-to-sink processes and process rates over time in a typical U-shaped valley system.

Period of Observations
Investigations on storage elements were started in 2004. Runoff occurs year-round, with high discharges occurring during spring snowmelt, summer glacier melt flow and extreme rainfall events. These periods are also the periods with the highest intensity / frequency of geomorphic processes. Monitoring of runoff and geomorphic processes will be started in 2008.

Recent or Key Publications

Fredin, O., Beylich, A.A., Nesje, A., Larsen, E., Jansson, P. V. Burki (2007): Recycling of glacial and non-glacial sediments during the `Little Ice Age` advance around Jostedalsbreen, south central Norway? *NGF Abstracts and Proceedings of the Geological Society of Norway*, **1**: 27-28.

Larsen, E., Beylich, A.A., Bonow, J., Derron, M.-H., Fredin, O., Hättestrand, C., Jansson, P., Kleman, J., Knies, J., Lidmar-Bergström, K., Stalsberg, K. & A. Stroeven (2006): Relief production in glaciated regions: a case study of the Norwegian Atlantic margin. *1st TOPO-NORGE Workshop, Trondheim, 6.-7. March 2006*: 22.

Site Summary:

Country: *Norway*

Region: *Sogn og Fjordane*

Coordinates: 61º48`N, 07º05`E

Elevation: *52-2082 m asl*

Catchment size: *approx. 61 km^2*

Larger drainage basin system: *N/A*

Climate: *subarctic oceanic*

Vegetation: *moss and lichen, grey alder (Alnus incana), meadows, bogs*

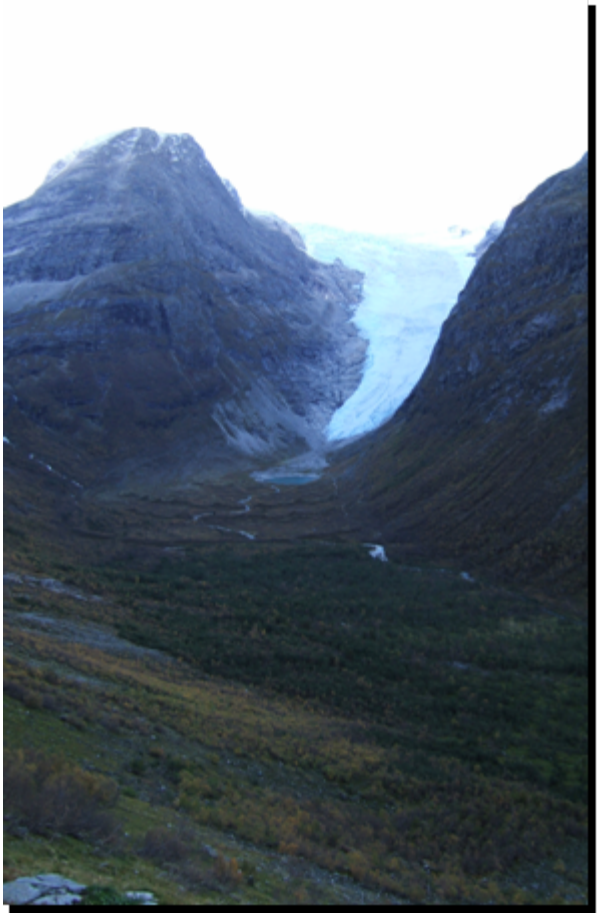
Topography: *U-shaped valley*

Lithology: *Granitic orthogneiss, intrusive Monzonite*

Denudative geomorphic processes: *Glacial, fluvial, slush flows, rock falls, boulder falls, avalanches, debris flows, creep*

Storage/sink elements: *valley filling, lake storage, talus cones*

Human influence: *grazing, some tourism*



SEDIBUD Key Test Site Summary Sheet

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Site overview

Botn í Dýrafjörður is a large glacial shaped valley, linked to a fjord system. Slope processes are active, supplying material to a large range of talus and cones. As remote, human influence is limited so the natural processes impacts are easily visible and long-lasting evidence of slope activity can be observed. The vegetation in the valley record the damages caused by the snow avalanches: trees provide the opportunity for dendrochronological studies, and the low vegetation reveals its dynamic to colonize devastated snow avalanche zones.

Period of Observations

Measurements began in October 1995, after a severe snow avalanche event, and have continued to determine the geomorphological impact of snow avalanches linked to dendrochronological studies.

Recent or Key Publications

Decaulne A. & Sæmundsson Þ. 2007. The role of geomorphological evidence for snow-avalanche hazard and mitigation research in northern Icelandic fjords. In V.R. Schaefer, R.L. Schuster & A.K. Turner (Eds.): *First North America Landslide Conference, Vail, Colorado,* AEG Publication No. 23, 583-592.

Sæmundsson Þ., 2005. Jarðfræðileg ummerki snjóflóða. NÍ-05010, 21 p.

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Université Blaise Pascal

Site Summary:

Country: *Westfjords, Iceland*

Region: *Subpolar environment*

Coordinates: 65°50 N, 23°10 W

Elevation: *0-750 m asl*

Catchment size: ca *11.0 km^2*

Larger drainage basin system: *N/A*

Climate: *subpolar maritime*

Vegetation: *bare, grass, dwarf trees*

Topography: *fjord*

Lithology: *basalt*

Denudative geomorphic processes:*Fluvial, slope (debris flows, snow avalanches, rockfall), nivation, weathering*

Storage/sink elements: *Slope, channel, sea*

Human influence: *limited*

SEDIBUD Key Test Site Summary Sheet

CAPE BOUNTY
Canada

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Site overview

Cape Bounty is the focus of a large number of interrelated watershed and landscape studies to quantify the linkages between meteorology, geomorphology, aquatic ecology, biogeochemistry and hydrology. A key dimension of this work is the use of paired and experimental watersheds that contain similar physiographic conditions and are subject to comparable weather conditions. The observatory has become one of the most comprehensive interdisciplinary terrestrial data sets available in the region to understand the impact of climate change and variability on water, vegetation and the land.

Period of Observations

Measurements began in June, 2003, and have continued each melt season since that time. Typically, meteorological, hydrological and sediment delivery processes occur during June to early August period.

Recent or Key Publications

Cockburn, J.M.H. and S.F. Lamoureux, 2007 in press. Hydroclimate controls over seasonal sediment yield in two adjacent high arctic watersheds, *Hydrological Processes*.

Lamoureux, S.F., D.M. McDonald, J.M.H. Cockburn, M. Lafrenière, D. Atkinson and P. Treitz, 2006. An incidence of multi-year sediment storage on channel snowpack in the Canadian High Arctic, *Arctic*, 59: 381-390.

Site Summary:

Country: *Nunavut, Canada*

Region: *High Arctic Islands*

Coordinates: 74°55'N, 109°35'W

Elevation: *5-125 m asl*

Catchment size: *7.9 and 11.0 km^2*

Larger drainage basin system: *N/A*

Climate: *Cold polar*

Vegetation: *Dwarf prostrate tundra*

Topography: *Rolling, Incised Plateau*

Lithology: *Sandstones and siltstones*

Denudative geomorphic processes: *Fluvial, freeze-thaw; land slides, aeolian*

Storage/sink elements: *channel storage; lake storage; valley slopes*

Human influence: *none*

SEDIBUD Key Test Site Summary Sheet

EAST DABKA INDIA

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Site overview

East Dabka Watershed is nested within the catchment of Dabka River in Kumaon Lesser Himalaya in India. It is situated in Lesser Himalayan Mountains and located with the close proximity of Main Boundary Thrust (MBT) – the major Himalayan Fault that makes tectonic boundary between Lesser Himalaya in the north and Siwalik (outer Himalaya) in the south. The entire area is therefore tectonically alive and ecologically fragile, and therefore prone to several kind of mass movement and slope failure processes, particularly, landslides, creeping and highly vulnerable to a variety of natural risks.

Period of Observations

The study started in July 2004 and shall complete in June 2008. The monitoring of water discharge, and observation of meteorological, hydrological and sediment delivery processes have been carried out during the period.

Recent or Key Publications

Tiwari, P. C. & Joshi, B. 2007, Rehabilitation and Management of Wasteland in the Himalayan Headwaters: An Experimental Study of Kosi Headwater in Kumaon Lesser Himalayas in India, Journal of WASWC, J2, 39-62

Tiwari, P. C. & Joshi, B. 2005, Environmental Changes and Status of Water Resources in Kumaon Himalaya, ustainable Management of Headwater Resources: Research from Africa and Asia, United Nations University, Tokyo, Japan, 109 – 123, 2005.

Department of Science & Technology Government of India

Site Summary:

Country: *Uttarakhand, India*

Region: Lesser *Himalaya*

Coordinates: 29°40'N, 79°42'W

Elevation: *700-2623 m asl*

Catchment size: *27.44 km^2*

Larger drainage basin system: *Dabka Catchment 68 sq km*
Climate: *Cold Temperate*

Vegetation: *Temperate*

Topography: *Mountainous*

Lithology: *quartzite, diamictite, siltstone, shale*

Denudative geomorphic processes: *Fluvial, land slides,*

Storage/sink elements: *channel storage; valley slopes*

Human influence: *Minimal*

SEDIBUD Key Test Site Summary Sheet

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Site overview

In Erdalen, research is focused on quantitative analysis of storage elements and Holocene sedimentary fluxes and budgets as well as on sub-recent and present-day sedimentary fluxes and budgets. A spectrum of methods is used including geophysical techniques, dating techniques and monitoring techniques for process analysis. The integration of Holocene, sub-recent and present-day process rates is expected to provide knowledge on how the inheritance of the landscape due to the influence of the Last Glacial Maximum has affected different geomorphologic processes, especially source-to-sink processes and process rates over time in a typical U-shaped valley system.

Period of Observations

Investigations were started in 2004. Runoff occurs year-round, with high discharges occurring during spring snowmelt, summer glacier melt flow and extreme rainfall events. These periods are also the periods with the highest intensity / frequency of geomorphic processes.

Recent or Key Publications

Hansen, L., Burki, V., Beylich, A.A., Eilertsen, R., Fredin, O., Larsen, E., Lysså, A., Nesje, A. & J.F. Tønnesen (in prep.): Stratigraphic architecture, infill history and controlling factors of a (de)glaciated bedrock-valley in Stryn, western Norway. *Sedimentology.*

Beylich, A.A., Lamoureux, S.F. & A. Decaulne (2007): Coordinated quantitative studies on sediment fluxes and sediment budgets in changing cold environments – examples from three SEDIBUD key test sites in Canada, Iceland and Norway. *Landform Analysis*, 5, 11-12.

Site Summary:

Country: *Norway*

Region: *Sogn og Fjordane*

Coordinates: N 6858832, E32403291

Elevation: *470-1749 m asl*

Catchment size: *approx. 50 km^2*

Larger drainage basin system: *N/A*
Climate: *subarctic oceanic*

Vegetation: *moss and lichen, grey alder (Alnus incana)*

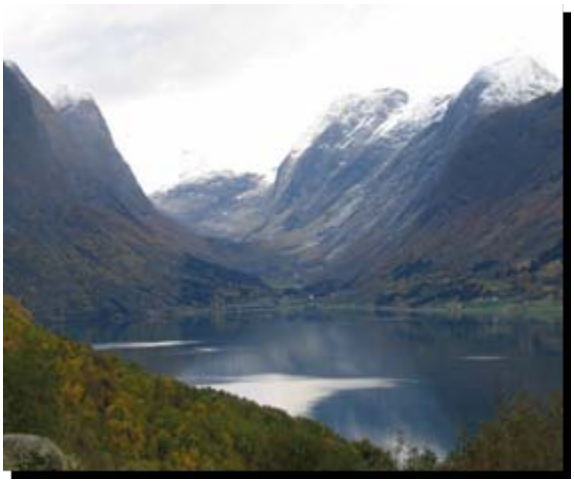
Topography: *U-shaped valley*

Lithology: *Northwestern Precambrian gneiss*

Denudative geomorphic processes: *Glacial, fluvial, slush flows, rock falls, boulder falls, avalanches, debris flows, creep*

Storage/sink elements: *valley filling, lake storage, talus cones*

Human influence: *grazing, some tourism*



SEDIBUD Key Test Site Summary Sheet

FNJÓSKADALUR - BLEIKSMÝRARDALUR ICELAND

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Site overview

The Fnjóskadakur and Bleiksmýrardalur valleys are two remote U-shape valleys in Northern Iceland. Snow avalanche activity is well-known in the valleys, leaving evidence such as scattered transported boulder at a long distance of the slope toes and boulder accumulation at the end of the avalanche path. Those boulders are both fresh and covered with vegetation (lichens, mosses), attesting a recurrent activity in the valleys and a regular debris transfer. The tree cover on some slopes enable an innovative dendrogeomorphologic approach of the snow avalanche activity in Northern Iceland.

Period of Observations

Measurements began in 1995 and are ongoing, investigating the snow avalanche impacts.

Recent or Key Publications

Decaulne A. & Sæmundsson Þ., 2008. Dendrogeomorphology as a tool to unravel snow-avalanche activity; preliminary results from th Fnjóskadalur test site, Northern Iceland. *Norsk Geografisk Tiddskrift*, *in press.*

Decaulne A. & Sæmundsson Þ. 2007. The role of geomorphological evidence for snow-avalanche hazard and mitigation research in northern Icelandic fjords. In V.R. Schaefer, R.L. Schuster & A.K. Turner (Eds.): *First North America Landslide Conference, Vail, Colorado,* AEG Publication No. 23, 583-592.

Site Summary:

Country: *Iceland*

Region: *Subpolar environment*

Coordinates: 65°20 N, 17°30 W

Elevation: *200-900 m asl*

Catchment size: *from less than 10 km² to more than 30 km²*

Larger drainage basin system: *yes*

Climate: *subpolar maritime*

Vegetation: *bare, grass, shrubs and tree cover*

Topography: *Slopes, from gentle to rockwall, valley*

Lithology: *basalt*

Denudative geomorphic processes: *Slope (debris flows, snow avalanches, rockfall), fluvial, nivation, weathering*

Storage/sink elements: *Slope, channel*

Human influence: *limited*

GEOMORPHOLOGY
GEOMORPHOLOGIE

SEDIBUD Key Test Site Summary Sheet

GODLEY VALLEY New Zealand

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Site overview
The Godley Valley is located in the Aoraki/Mt. Cook National Park. There are three glaciers at the head of the valley which have experienced significant retreat in the last two decades and have well defined proglacial areas and significant stores of sediment. All three glaciers terminate in proglacial lakes which provide a unique opportunity to assess the effect of these on sediment transfer patterns. The region is very dynamic as it is located on an active plate boundary and experiences orographically induced high precipitation. Equipment for year-round monitoring will be installed early 2008.

Period of Observations
Measurement of suspended sediment concentration, dissolved load and discharge will begin in early 2008 and will continue to 2011. Data will telemetered via radio onto the cell phone network and back to the University of Otago on a daily basis.

Recent or Key Publications

Orwin, JF and Smart, CC. 2004. Short-term spatial and temporal patterns of suspended sediment transfer in proglacial channels, Small River Glacier, Canada. *Hydrological Processes 18*: 1521-1542
Orwin, JF and Smart, CC. 2005. An inexpensive turbidimeter for monitoring suspended sediment. *Geomorphology 68:* 3-15

Site Summary:

Country: *New Zealand*

Region: *Central Southern Alps*

Coordinates: 43°28’41”S 170°30’28”E

Elevation: *1100-2900 asl*

Catchment size: *70 km²*

Larger drainage basin system: *N/A*

Climate: *Temperate*

Vegetation: *Minimal*

Topography: *Steep, mountainous*

Lithology: *Sandstones and siltstones, schist*

Denudative geomorphic processes: *glacial, snow and rock avalanche, debris flow, fluvial*

Storage/sink elements: *channel storage; lake storage; valley slopes*

Human influence: *none*

SEDIBUD Key Test Site Summary Sheet

HOFSJÖKULL FORELAND ICELAND

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Site overview

The site is close to the northern margin of the Hofsjökull glacier in Central Iceland, in an area of small hills or mountain ridges from 100 to 150 m high.
Since 1950, measurements on fluctuation of the northern margin of the Hofsjökull glacier show a glacier retreat over 600 m.
The mountainous environment presents solifluction slopes of different exposure.
The site provides a survey of contemporary permafrost environments in central Iceland at the fringe of permafrost existence.

Period of Observations

Measurements began in 2005 and are ongoing, investigating the permafrost evolution in the glacier surroundings.

Recent or Key Publications

Kneisel C., Sæmundsson Þ. & Beylich, A.A. 2007. Reconnaissance surveys of contemporary permafrost environments in central Iceland using geoelectrical methods: implicants for permafrost degradation and sediment fluxes. *Geografiska Annaler* 89 A, 41–50.

Kneisel C., Sæmundsson Þ. and Beylich A.A., 2006. Permafrost environments in central Iceland. *Geophysical Research Abstracts*, 8: 04226.

Site Summary:

Country: *Iceland*

Region: *Subpolar environment*

Coordinates: *64°58 N, 18°32 W*

Elevation: *900-1100 m asl*

Catchment size: ca *10 km²*

Larger drainage basin system: *yes*

Climate: *subpolar maritime*

Vegetation: *bare*

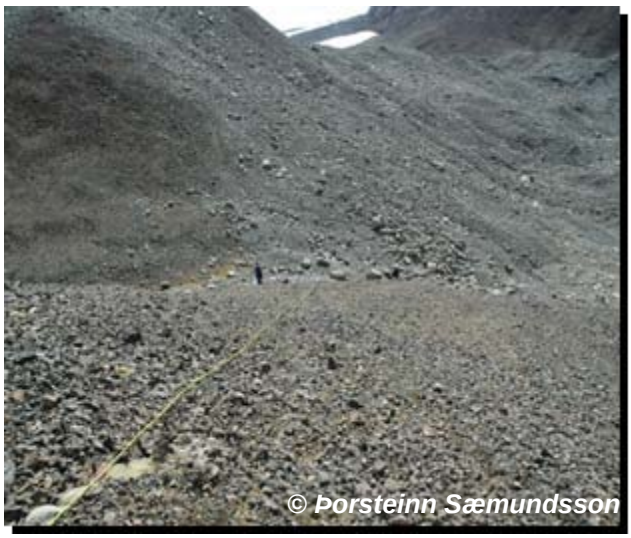
Topography: *Slopes, debris slopes, debris cones*

Lithology: *basalt and intermediate rocks*

Denudative geomorphic processes: *glacial erosion and sedimentation, fluvial erosion and sedimentation, runoff, slope processes*

Storage/sink elements: *flood plain, talus, small lakes*

Human influence: *none*



SEDIBUD Key Test Site Summary Sheet

HRAFNDALUR
Iceland

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Site overview

In the Hrafndalur catchment, source-to-sink fluxes and the sediment budget have been analyzed by the integrated study and long-term monitoring of both the relevant denudative slope processes and the fluvial transport.

Main focus is on studying the absolute and relative importance of the different denudative processes as well as trends of Holocene relief development in this subarctic oceanic environment.

The Hrafndalur catchment was instrumented with a number of slope test sites and measuring sites for runoff and fluvial transport in 2001.

Period of Observations

Measurements began in 2001, and have continued each year since that time.
Meteorological, hydrological and sediment delivery processes occur year-round in this subarctic oceanic environment.

Recent or Key Publications

Beylich, A.A. & C. Kneisel (in prep.): Sediment budget and relief development in Hrafndalur, subarctic Eastern Iceland. *Arctic, Antarctic and Alpine Research special issue*.
Beylich, A.A. (2007): Sediment transfers, sediment budgets and relief development in three catchments in different cold environments in sub-Arctic East Iceland and Arctic Swedish Lapland. *Geophysical Research Abstracts*, Vol. **9**, 02784, 2007.

DAAD Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Site Summary:

Country: *Iceland*

Region: *Austfirðir*

Coordinates: 65°28'N, 13°42'W

Elevation: *6-731 m asl*

Catchment size: *7 km^2*

Larger drainage basin system: *Fjarðara*

Climate: *subarctic oceanic*

Vegetation: lichens, mosses, meadows, bogs, dwarf shrubs

Topography: *steep glacially sculptured valley*

Lithology: *Rhyolite, some Basalt*

Denudative geomorphic processes: *Fluvial, chemical denudation, rockfalls, boulder falls, creep, avalanches, debris flows and slides, deflation*

Storage/sink elements: *valley slopes with talus cones*

Human influence: *grazing*

SEDIBUD Key Test Site Summary Sheet

Kangerlussuaq
West Greenland

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Site overview

The station is located at the outlet from Watson River into the Kangerlussuaq Fiord. The river drains about 6300 km^2 of the Greenland Ice Sheet. The solid rock threshold emerged from the sea about 8000 years BP and has been carved by the sediment-laden water so that beautiful bed forms appear. The present distance to the Ice Sheet is about 30-40 km. The river has two major tributaries; Ørkendalen (Desert valley) and Sandflugtsdalen (sand drift valley) where large sandurs appear. Glacial outburst have been recorded several times

Period of Observations

Previously water samples have been collected as part of scientific projects in the area. As part of the CRIK project recording stations have been established in April 2007. Hydrological, and sediment delivery processes occur during June to September period.

Recent or Key Publications

Russel, A.J. 2007 Controls on the sedimentology of an ice-contact jökulhlaup-dominated delta, Kangerlussuaq, West Greenland. Sedimentary Geology, 193: 131-148.

Hasholt,B.& Mernild, S.H.2005 Runoff and Sediment Transport Kangerlussuaq, West Greenland Abstract, poster ICARP Conference, Copenhagen 2005

INSTITUT FOR GEOGRAFI OG GEOLOGI
KØBENHAVNS UNIVERSITET

CRIK

Site Summary

Country: *Greenland, Denmark*

Region: Dry *Arctic*

Coordinates: 67°00'N, 50°50'W

Elevation: 0-*2000 m asl*

Catchment size: 6300 *km*^{2}

Larger drainage basin system: *N/A*

Climate: *Cold polar*

Vegetation: *Dwarf prostrate tundra*

Topography: *Rolling, Incised Plateau*

Lithology: *Granites*, *Sandstones*

Denudative geomorphic processes: *Fluvial, freeze-thaw; aeolian*

Storage/sink elements: *channel storage; lake storage; valley slopes*

Human influence: some

SEDIBUD Key Test Site Summary Sheet

KIDISJOKI Finland

Principal Investigator

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Site overview

In Kidisjoki, present-day sedimentary fluxes are studied. The goal is to analyze the absolute and relative importance of chemical and mechanical denudation in this low-relief (Precambrian Baltic Shield) catchment in subarctic Finnish Lapland.
Main focus is on studying the spatio-temporal variability and the controlling factors of runoff, water chemistry, solute and sediment fluxes by comparing different sub-systems as well as chemical and mechanical fluvial denudation rates of different sub-systems within the Kidisjoki catchment.

Period of Observations

Measurements began in 2002, and have continued each year since that time. Typically, meteorological, hydrological and sediment delivery processes occur during April to October period.

Recent or Key Publications

Beylich, A.A. (2007): The quantitative role of chemical weathering, solute fluxes and chemical denudation in four different catchments in Iceland, Swedish Lapland and Finnish Lapland. *Geophysical Research Abstracts*, Vol. **9**, 02742, 2007.
Beylich, A.A., Schmidt, K.-H., Neuvonen, S., Forbrich, I. & A. Schildt (2006): Solute fluxes in the Kidisjoki catchment, subarctic Finnish Lapland. *Géomorphologie: relief, processus, environment*, **3**, 205-212.

Site Summary:

Country: *Finland*

Region: *Finnish Lapland*

Coordinates: 69°47'N, 27°05'E

Elevation: 7*5-365 m asl*

Catchment size: *18 km^2*

Larger drainage basin system: *Tana river system*

Climate: *subarctic*

Vegetation: *Mountain birch woodland, Scots pine, Alpine heaths, bogs, mosses, lichens*

Topography: *Precambrian Baltic Shield, low relief*

Lithology: *gneisses and granulites*

Denudative geomorphic processes: *Fluvial, freeze-thaw*

Storage/sink elements: *delta at the outlet*

Human influence: extensive *grazing, gravel road through the valley*

SEDIBUD Key Test Site Summary Sheet

LATNJAVAGGE Sweden

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Site overview

In the Latnjavagge catchment, source-to-sink fluxes and the sediment budget have been analyzed by the integrated study and long-term monitoring of both the relevant denudative slope processes and the fluvial transport. Main focus is on studying the absolute and relative importance of the different denudative processes in this Arctic oceanic environment. The catchment was instrumented with a number of slope test sites and measuring sites for runoff and fluvial transport in 1999. Ongoing process geomorphologic research in Latnjavagge is integrated with a number of ecological projects and long-term monitoring programs.

Period of Observations

Measurements began in 1999, and have continued each summer season since that time.
Typically, meteorological, hydrological and sediment delivery processes occur during late May to October period.

Recent or Key Publications

Beylich, A.A. (2008): Mass transfers, sediment budget and relief development in the Latnjavagge catchment, Arctic-oceanic Swedish Lapland. *Zeitschrift für Geomorphologie N.F.*, ***52*** *(1): 149-197*

Beylich, A.A., Sandberg, O., Molau, U. & S. Wache (2006): Intensity and spatio-temporal variability of fluvial sediment transfers in an Arctic oceanic periglacial environment in northernmost Swedish Lapland (Latnjavagge catchment). *Geomorphology*, **80**, 114-130.

NGU 150
Deutsche Forschungsgemeinschaft DFG
GÖTEBORGS UNIVERSITET
DAAD Deutscher Akademischer Austausch Dienst German Academic Exchange Service

Site Summary:

Country: *Sweden*
Region: *Swedish Lapland*
Coordinates: 68°20'N, 18°30'E
Elevation: *950-1440 m asl*
Catchment size: *9 km²*
Larger drainage basin system: *Kårsavagge, Abiskojåkka valley system*
Climate: *Arctic oceanic*
Vegetation: *lichens, mosses*, *dwarf shrub heaths, Alpine meadows and bogs*

Topography: *glacially sculptured valley, plateau areas at 1300 m asl, flat valley floor at 1000 m asl*
Lithology: *Cambro-Silurian mica-garnet schists, inclusions of marble, intrusions of granites*

Denudative geomorphic processes: *Fluvial, slush flows, chemical denudation, rockfalls, boulder falls, ploughing boulders, solifluction, creep, avalanches, debris flows and slides, deflation*
Storage/sink elements: *delta and lake storage; valley slopes with talus cones*

Human influence: *reindeer husbandry (extensive grazing), some hiking tourism, field research*

SEDIBUD Key Test Site Summary Sheet

Mittivakkat
Sermilik,Greenland

Principal Investigator

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Site overview

The Mittivakkat Glacier was first monitored in 1933. Runoff was measured as part of the IGY programme in 1958. The focus was on glaciology. In 1970 a permanent field station, the Sermilik station was built. Sediment transport was measured in 1972. The focus shifted toward integrated landscape studies. In order to study effect of climate, two recording climate stations were installed in 1993 and 1998. The whole catchment is now studied as a model of a typical arctic landscape, representative of this climatic environment. Data are integrated into models.

Period of Observations

Continuous measurements began in August, 2004, and have continued each melt season since that time. Typically, meteorological, hydrological and sediment delivery processes occur during May to early October period.

Recent or Key Publications

Hasholt, B.1976. Hydrology and Transport of Material in the Sermilik Area 1972. Danish Journal of Geography, Vol 75:30-39.

Hasholt, B. & Mernild, S.H.2006 Glacial erosion and sediment transport in the Mittivakkat Glacier Catchment, Ammassalik Island, Southeast Greenland, 2005 IAHS publ.306:45-55.

Hasholt, B.1996 Sediment transport in Greenland IAHS publ. 236: 105-114

INSTITUT FOR GEOGRAFI OG GEOLOGI
KØBENHAVNS UNIVERSITET

Site Summary

Country:*Greenland, Denmark*

Region: *East Greenland*

Coordinates: *65°40'N, 38°10'W*

Elevation: *0-900 m asl*

Catchment size: *18.4 and 30.0 km2*

Larger drainage basin system: *N/A*

Climate: *Subarctic*

Vegetation: *Dwarf prostrate tundra*

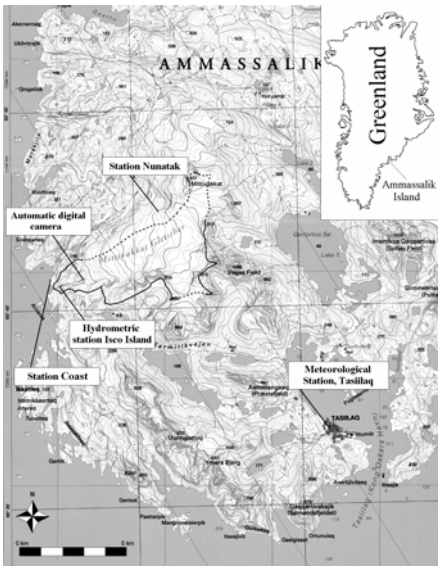
Topography: *Alpine, fissure valleys*

Lithology: *Gneiss, anorthosites*

Denudative geomorphic processes: *Glacial*, *Fluvial, freeze-thaw*

Storage/sink elements: *channel storage; lake storage; valley slopes, delta*

Human influence: *none*



SEDIBUD Key Test Site Summary Sheet

Moor House North Pennines UK

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Site overview

The site is England's highest and largest terrestrial National Nature Reserve (NNR), a UNESCO Biosphere Reserve and a European Special Protection Area. The Moor House NNR was first created in 1952. In the 1960s and 1970s the area was intensively studied as part of the International Biological Programme and in the 1990s as a flagship site of the Terrestrial Initiative in Global Environmental Research (TIGER). Since 1992 the site has been part of the UK Environ-mental Change Network (ECN) which is the UK's long-term environmental monitoring programme collecting information on the terrestrial and freshwater environment.
http://www.ecn.ac.uk/sites/moorh.html

Period of Observations

Measurements began as far back as the 1930s. The ECN collects a long-term data base of key physical, chemical and biological variables which drive and respond to environmental change. Sediment budget work began in earnest in 1998 and strategic studies have continued for the last decade. Work by Crisp (1960) provides a valuable early baseline of observations.

Recent or Key Publications

Evans, M. G. and Warburton, J. (2007) *Upland Peat Erosion – Form, Processes and Landscape Change.* Blackwells, Oxford, 262p.
Evans, M. and Warburton, J. (2005) Sediment budget for an eroding peat moorland catchment in northern England. Earth Surface Processes and Landforms, 30, 5, 557-577. Worrall, F., Reed, M., Warburton, J. and Burt, T.P. (2003) Carbon budget for a British upland peat catchment. *The Science of the Total Environment*, 312,133-146.
Warburton, J. (2003) Wind-splash erosion of bare peat on UK upland moorlands. Catena. 52:191-207.

Durham University
NATURAL ENVIRONMENT RESEARCH COUNCIL

Site Summary:

Country: *Northern England*

Region: *North Pennines*

Coordinates: 54°42'N, 2°22'W

Elevation: *530-850 m asl*

Catchment size: Trout Beck *11.5 km²*

Larger drainage basin system: *River Tees (1930 km²)*

Climate: *Annual precipitation 2000 mm; Mean annual air temperature 5.8 °C; 110 Frost days*

Vegetation: *Blanket peat bog and Calluna-Eriophorum*

Topography: *Extensive peat moorland, exposed plateau and incised river valleys*

Lithology: Interbedded s*andstones, shales and limestone*

Denudative geomorphic processes: *Fluvial, aeolian, freeze-thaw and chemical*

Storage/sink elements: slopes, floodplain, *channel, reservoir*

Human influence: *Managed moorland (shooting & grazing), historic mining*

SEDIBUD Key Test Site Summary Sheet

MUSALA AREA BULGARIA

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Site overview

This is the highest part of Bulgarian tallest mountain – Rila.
Consist of two adjacent catchments, parts of two separate larger basins – Maritsa catchment (12 km^2) belongs to Maritsa basin (larger basin area: down to 1400 m a. s. l. – 39,9 km^2, down to 850 m a. s. l. – 96,6 km^2), Bistrica catchment (10 km^2) belongs to Iskar basin (larger basin area: down to 1400 m a. s. l. – 20 km^2; down to 1000 m a. s. l. – 57 km^2; down to 950 m a. s. l. – ca. 450 km^2).
Here cryogenic and cryonival morphology and morphodynamics are mostly well expressed. The two separate catchments provide a nice basis for comparative analyses of processes in different conditions of aspect, slope tilts and altitude.

Period of Observations

Measurement collection began in the summer of 2005. Some test polygons defined in summer 2006. Still no regular observations of sediment transfer processes due to lack of funding. Usually field season is from June to November.

Recent or Key Publications

Gachev E. 2006. Starting a Pro-gramme for Research and Monitoring of Contempo-rary Sediment Transfer Processes in the Periglacial Zone of Bulgaria (Bulgarian Pe-riglacial Programme). 4th SEDIFLUX Sci. Meet., Trondheim, Norway. Gachev E. 2007. Relation between Slope Tilt and Land Cover in Mu-sala Cirque. Problems of Geo-graphy - Journal of the Institute of Geography. Gachev E. 2007. Land system units in Musala cirque and their relation to present geo-morphic processes. FP6 BEOBAL project conference, Giulecica, 2007 OM2 series, vol. 12 Stefanov P.,E. Gachev, P.Nojarov, 2007.Observ-ation of Terrestrial Processes in Model High mountain Geosystems around the peaks Musala (Rila Mountain) and Vihren (Pirin mountain). FP6 BEOBAL project conference, Giulecica, 2007. OM2 series, vol. 12

Site Summary:

Country: *Bulgaria*

Region: *Sofia region*, SW Bulgaria

Coordinates: 42°12'N, 23°35'E

Elevation: *1830-2925 m a s l*

Catchment size: *12.0 and 10.0 km²*
Larger drainage basin system: *Maritsa (Aegean sea), Iskar (Danube)*
Climate: *submediterranean – mountain modification*

Vegetation: *1830m-2100 m– Picea abies, Pinus silvestris, Pinus peuce, 2100m – 2600 m– dwarf pine (Pinus mugo), > 2600m – alpine grassland*

Topography: *Mountain ridges, relict cirques and U-shaped valleys*
Lithology: *Granitoides*

Denudative geomorphic processes: *Rockfalls, debris movement in talus, avalanches, creep, land slides.*

Storage/sink elements: *colluvial fans, slope hollows, lakes*
Human influence: *hiking tourism*

SEDIBUD Key Test Site Summary Sheet

ORRAVATNSRÚSTIR ICELAND

Principal Investigator

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Site overview

The Orravatnsrústir is a palsa site located north of the Hofsjökull ice cap. The palsas are located in a small valley like depression about 3 km², at 710-715 m a.s.l.
All the palsas in the area are well vegetated, with grasses, sedges and lichens. A small creek inundate the water system in the palsa site from the south and the system is drained by two streams, indicating that the main part of the water entering the system is a ground water.
All together ten palsas are under investigation to follow the evolution of the permafrost in the area.

Period of Observations

Measurements began in 2001 and are ongoing, investigating the active layer thickness on the palsas.

Recent or Key Publications

Kneisel C., Sæmundsson Þ. & Beylich, A.A. 2007. Reconnaissance surveys of contemporary permafrost environments in central Iceland using geoelectrical me-thods: implicants for permafrost degradation and sediment fluxes. *Geografiska Annaler* 89 A, 41–50.

Site Summary:

Country: *Iceland*

Region: *Subpolar environment*

Coordinates: *65°05 N, 18°32 W*

Elevation: *600-900 m asl*

Catchment size: *less than 10 km^2*

Larger drainage basin system: *yes*

Climate: *subpolar maritime*

Vegetation: *grasses, sedges and lichens*

Topography: *flat, wetland, palsas*

Lithology: *basalt and intermediate rocks, mostly detritic on the surface*

Denudative geomorphic processes: *permafrost, runoff, bank erosion, running water*

Storage/sink elements: *lakes, pounds*

Human influence: *none*

SEDIBUD Key Test Site Summary Sheet

PASTERZE Austria

Principal Investigator

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Site overview

The proposed key test site 'Pasterze' consists of the partly debris-covered Pasterze Glacier (Austria's largest glacier; 17.5 km^2) and the headwaters of the Möll River. This area is the focus of glaciological studies since many decades (University of Graz) and the focus for studies on distribution, characteristics, thermal regime and dynamics of supra- and proglacial sediments and solifluction monitoring since a few years (Universities of Graz and Salzburg). This site allows to study the linkage between meteorology, glaciology, permafrost, geomorphology and hydrology under the influence of climate change.

Period of Observations

LiDAR technique is applied for glacier, solifluction and slope process monitoring 1-3 times a year. Solifluction rates and measurements of suspended load and concentration of solutes is carried out at least once a year.

Recent or Key Publications

Kellerer-Pirklbauer A. (in press): The Supraglacial Debris System at the Pasterze Glacier, Austria: Spatial Distribution, Characteristics and Transport of Debris. *Zeitschrift für Geomorphologie.*

Kellerer-Pirklbauer A., Lieb G.K., Avian M. & Gspurning J. (in review): On the recent response of partially debris-covered valley glaciers to climate change: The example from the Pasterze Glacier, Austria. *Geografiska Annaler.*

FWF
Austrian Science Fund

Site Summary:

Country: *Carinthia, Austria*

Region: *Central Eastern Alps*

Coordinates: *47°05'N, 12°42'E*

Elevation: *2060-3798 m asl*

Catchment size: *34 km^2*

Larger drainage basin system: *yes*

Climate: *Cold alpine with relatively high precipitation*

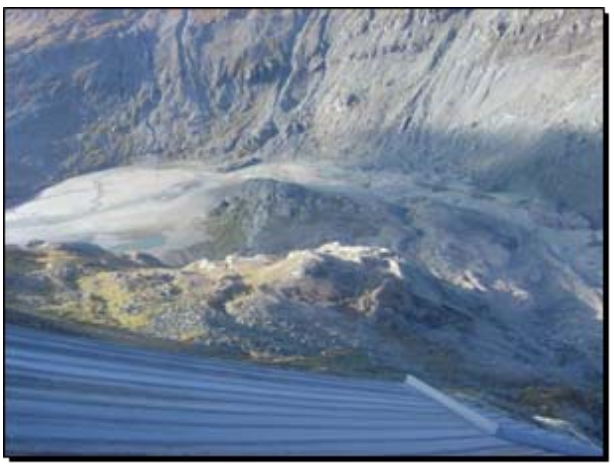
Vegetation: *between upper tree line to vegetation free areas*

Topography: *steep alpine relief with flat basins and plateaus*

Lithology: *metamorphic rocks (calc. mica schist and prasinite)*

Denudative geomorphic processes: *gravitational, peri-glacial, fluvio-glacial and glacial*

Storage/sink elements: *channel storage; basin storage; valley slopes*
Human influence: *little*



SEDIBUD Key Test Site Summary Sheet

PETUNIABUKTA Spitsbergen

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Period of Observations

Research are based on summer expeditions (July - mid-September), while denudation processes connected with glaciers ice and snow cover melt occur, were first done in 1985 and continued annually since 2001.

Site overview

In Petuniabukta (Petunia Bay) surrounding, glaciated in ca. 40%, several glaciated and non-glaciated catchments of various area are located. Main goals of the studies are to characterize denudation system and quantify mass fluxes rates in high Arctic catchments, describe main changes in the last 25 years and since the Little Ice Age and investigate the influence of various environmental factors on the dynamics and spatial variability of cryo-hydro-geomorpho-logical processes in catchment systems. This site is the only one within monitored on Spitsbrgen, which is located in the inner-fiord part.

Recent or Key Publications

Rachlewicz G., 2007. Geomor-phology outline of the vicinity of Petuniabukta, *Landf. Analys., 5:* 196-200.
Rachlewicz G., Szczuciński W. and Ewertowski M., 2007. Post−"Little Ice Age" retreat rates of glaciers around Billefjorden in central Spitsbergen, Svalbard, *Polish Polar Res., 28(3):* 159-186.

MINISTRY OF SCIENCE AND HIGHER EDUCATION

Site Summary:

Country: *Svalbard (Norway)*

Region: *Spitsbergen,*

Coordinates: 78°44'N, 16°35'W

Elevation: *0-1100 m asl*

Catchment size: *1.4; 70 & 75 km^2*

Larger drainage basin system: *N/A*

Climate: *Cold polar, semi-arid*

Vegetation: *High-Arctic dry tundra*

Topography: *Coastal mountains; steep walls; slopes; alluvial fans*

Lithology: *Metamorphic and clastic (carbonate and sulpate) rocks*

Denudative geomorphic processes: *Glaial; fluvial; freeze-thaw; slope; aeolian*

Storage/sink elements: *Glaciers; ice-cored marginal zones; channel storage; alluvial cones; valley slopes*

Human influence: *none*


Ebba valley


Hörbye valley


Dynamiskbkken catchment

SEDIBUD Key Test Site Summary Sheet

POTROK AIKE Argentina

Principal Investigator

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Period of Observations

Measurements began in February, 2002 and have continued since then. Meteorological and sediment delivery processes are monitored continuously, stable isotopes only during field seasons of the southern summer. Long sediment records are recovered for reconstruction of past conditions.

Site overview

At the site of Laguna Potrok Aike regionally consistent climatic, hydrological and environmental records have been developed with up to decadal resolution on a calendar-year timescale. The main goals are: 1. monitoring of modern processes to provide in-depth knowledge of forcing factors; 2. combination of process studies with a wide range of sedimentary proxy parameters for improved climatic interpretation; 3. comparison with global to regional climate model output. Overall, a better understanding of forcing factors on different parameters including sediment budgets are envisioned.

Recent or Key Publications

Ohlendorf, C., et al. (in prep.). A comparison of hydrological balance calculations with instrumental lake level data for Laguna Potrok Aike (Argentina). Climatic Change.
Mayr, C., et al. (2007): Precipitation origin and evaporation of lakes in semi-arid Patagonia (Argentina) inferred from stable isotopes ($\delta^{18}O$, $\delta^{2}H$). J. of Hydrology 334: 53-63.

Site Summary:

Country: *Santa Cruz, Argentina*

Region: southern Patagonia

Coordinates: 51°57´S, 70°23´W

Elevation: *100 m asl*

Catchment size: *200 km²*

Larger drainage basin system: *N/A*

Climate: *semi-arid and cool semi-dessert*

Vegetation: *Patagonian steppe*

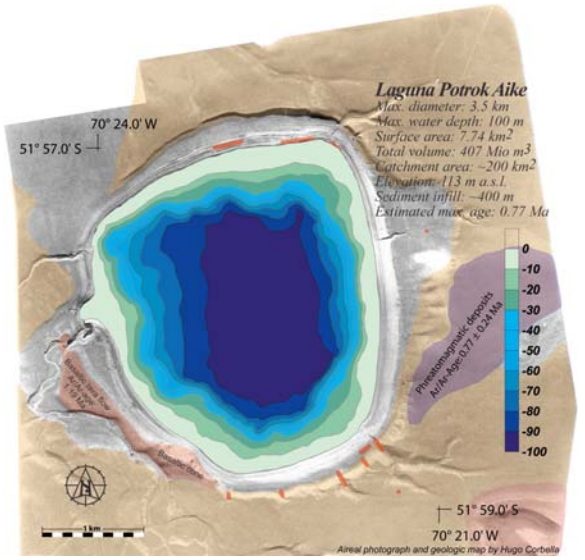
Topography: *Patagonian plains*

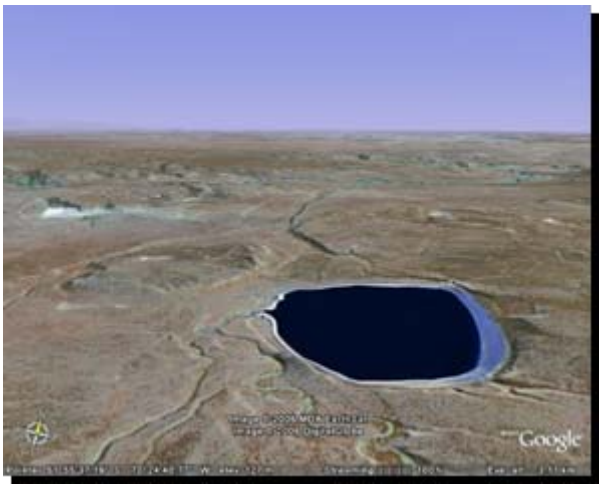
Lithology: *fluvioglacial and moraine deposits with occasional basaltic scatter cones and plateaus*

Denudative geomorphic processes: *Fluvial, aeolian*

Storage/sink elements: *alluvium*

Human influence: *sheep farming since the 1870's*





SEDIBUD Key Test Site Summary Sheet

SCOTTELVA
Svalbard/Norway

Principal Investigator

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Site overview

Scottelva represents a glaciated basin within which it is possible to examine correlations between atmosphere, cryosphere, hydrosphere and biosphere. The researches conducted within the basin are of an interdisciplinary nature and aim at a complex recording/registration of data which will make it possible to determine the functioning of the basin dependent upon local environmental conditions as well as on supraregional factors such as climate which, in turn, is tied to a mutual interaction of the following environments: marine, glacial and terrestrial.

Period of Observations

The observations started in 1986 and with few intervals they are carried out each polar summer. They include: meteorology, geomorphology, glaciology, hydrology and hydrochemistry.

Recent or Key Publications

Chmiel S., Bartoszewski S., Gluza A., Siwek K., Zagórski P., 2007: Physicochemical characteristics of land waters in the Bellsund region (Spitsbergen). Landform Analysis 5, 13-15.

Bartoszewski S., Gluza A., Siwek K., Zagórski P., 2007: The functioning of the Scott Glacier in conditions of climate global change. Landform Analysis 5, 5-8.

Site Summary

Country: *Norway*

Region: *Svalbard*

Coordinates: *77°34'N, 14°27'E*

Elevation: *0-780 m a.s.l.*

Catchment size: *10 km²*

Larger drainage basin system: *N/A*

Climate: *polar, semi-marine*

Vegetation: *Hight-Arctic dry tundra*

Topography: *Mountain ridge, steep wall and slope incision, ice-cored moraine ridges, sandur, raise marine terrace, alluvial fan*

Lithology: *grey to rusty to yellow quartzite−clast sandstone, sandstone and shale complex with coal-seams*

Denudative geomorphic processes: *nivation, glaciation, solifluction, mass movements, periodic outflow, littoral*

Storage/sink elements: *snow cover, coarse-grained alluvial fan, marine basin*

Human influence: *negligible*

SEDIBUD Key Test Site Summary Sheet

TINDASTÓLL-REYKARSTRÖND ICELAND

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Site overview

The Tindastóll Mountain located in the Skagafjörður fjord is orientated NNW–SSE and has relatively flat summits at 800–900 m a.s.l. Numerous deep gullies dissect the rock wall, leading material to large colluvial cones. Several cirques also develop within the rockwall. Most of the colluvial cones exhibit specific landforms related to debris-flow, snow-avalanche or landslide activity. The site is particularly adapted for Holocene cone development studies as several well known tephra layers can be recognised within the colluvial material. Also, sites where slope process are active are easily accessible for long term monitoring.

Period of Observations

Measurements began in July 2004 and are ongoing.

Recent or Key Publications

Decaulne A., Sæmundsson Þ. , Jónsson H.P. & Sandberg O., 2007. Changes in deposition on a colluvial fan during the Upper Holocene in the Tindastóll Mountain, Skagafjörður District, North Iceland - Preliminary results. *Geografiska Annaler,* 89A (1), 51-53.

Decaulne A. & Sæmundsson Þ. 2007. The role of geomorphological evidence for snow-avalanche hazard and mitigation research in northern Icelandic fjords. In V.R. Schaefer, R.L. Schuster & A.K. Turner (Eds.): *First North America Landslide Conference, Vail, Colorado,* AEG Publication No. 23, 583-592.

Site Summary:

Country: *Iceland*

Region: *Subpolar environment*

Coordinates: 65°49 N, 19°53 W

Elevation: *30-900 m asl*

Catchment size: *from less than 10 km² to more than 15 km²*

Larger drainage basin system: *n/a*

Climate: *subpolar maritime*

Vegetation: *bare, grass*

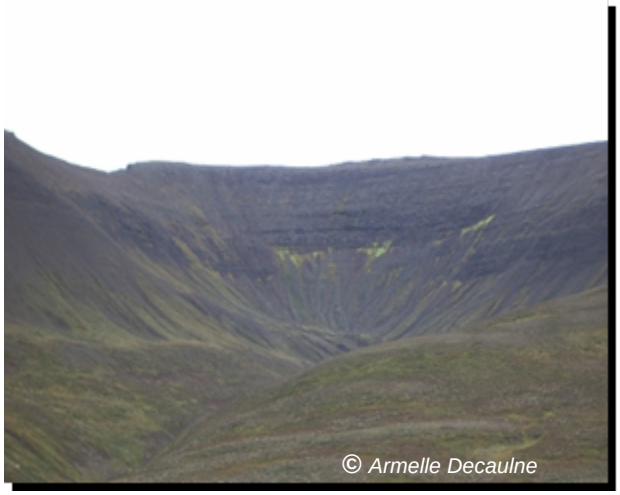
Topography: *Slopes, from gentle to rockwall*

Lithology: *basalt and rhyolite*

Denudative geomorphic processes: *Slope (debris flows, snow avalanches, rockfall), nivation, weathering*

Storage/sink elements: *Slope, channel*

Human influence: *limited*



GEOMORPHOLOGY
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SEDIBUD Key Test Site Summary Sheet

Zackenberg NE-Greenland

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Period of Observations
Measurements of sediment transport began in June, 1997, and have continued each melt season since that time. The Zackenberg river typically breaks up in late May/early June and freeze back in mid September.

Site overview
In Zackenberg a comprehensive monitoring programme 'Zackenberg Basic' has been running since 1995. The programme collects long term series of baseline data that describes the dynamics of the marine and terrestrial ecosystems in this High Arctic area. The sub-programme 'GeoBasis' provide data of seasonal and spatial variations in snow cover and microclimate in the area as well as water discharge, sediment- and solute transport in the Zackenberg river. GeoBasis is operated by the National Environmental Research Institute, Department for Arctic Environment in co-operation with Department of Geography and Geology, University of Copenhagen.
More details about Zackenberg Research Station and the monitoring programme are available from the Zackenberg homepage: www.zackenberg.dk

Recent or Key Publications

Hasholt, B., Mernild, S.H., Sigsgaard, C. Elberling, B., Petersen, Jakobsen, B.H., Hansen, B.U., Hinkler, J. and Sogaard, H. (in press). Hydrology and Transport of Sediment and Solutes at Zackenberg, Northeast Greenland In: Meltofte, H., Christensen, T.R., Elberling, B., Forchhammer, M.C. and Rasch, M. (eds.): High-Arctic Ecosystem Dynamics in a Changing Climate. - Advances in Ecological Research, Vol. 40, 2008, Elsevier, New York

Mernild, S.H., Sigsgaard, C., Rasch, M., Hasholt, B., Hansen, B.U., Stjernholm, M. and Dpetersen, D. (2007).Climate, river discharge and suspended sediment transport in Zackenberg River drainage basin and Young Sound/Tyrolerfjord, Northeast Greenland, 1995-2003. In Rysgaard, S. and Glud, R.N., Carbon cycling in Arctic marine Ecosystems: Case study Young Sound. Meddelelser om Grønland, Bioscience Vol 58. Copenhagen, the Commision for Scientific Research in Greenland, 2007.

Site Summary:
Country: *Greenland*

Region: *High Arctic*

Coordinates: *74°28'N, 20°34'W*

Elevation: *0-1,450 m asl*

Catchment size: *512 km2*

Larger drainage basin system:

Climate: *High-arctic*
Vegetation: *Well-drained heath, fen*

Topography: *valley system sorrounded by mountains up to 1,450 m*

Lithology: *Gneiss and granite, sedimentary rocks and basalt*

Denudative geomorphic processes: *Fluvial, freeze-thaw; land slides, aeolian*

Storage/sink elements: *channel storage; lake storage; valley slopes*

Human Influence: *none*