Arctic Coastal Dynamics

Report of the 3rd International Workshop

University of Oslo, Oslo (Norway) 2-5 December 2002

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Preface

Arctic Coastal Dynamics (ACD) is a joint project of the International Arctic Sciences Committee (IASC) and the International Permafrost Association. Its overall objective is to improve our understanding of circum-Arctic coastal dynamics as a function of environmental forcing, coastal geology and cryology and morphodynamic behavior.

The third IASC-sponsored ACD workshop was held in Oslo, Norway, on December 2-5, 2002. Participants from Canada (3), Germany (3), Great Britain (1), the Netherlands (1), Norway (6), Russia (11), Switzerland (1) and the United States (2) attended. The objective of the workshop was to review the status of ACD according to the Science and Implementation Plan, with the main focus on the quantitative assessment of the sediment and organic carbon input to the Arctic Ocean through coastal erosion.

During the first part of the workshop, 29 papers dealing with regional and/or circum-Arctic coastal dynamics were presented. Based on the material presented, three regional working groups and two circum-Arctic working groups were organized. The main task of the regional working groups was to continue previous efforts to segment and classify the coast for their sectors. The coastal segmentation and classification is the basis for the assessment of the sediment and organic carbon input through coastal erosion. The circum-Arctic working groups focused on GIS development and extraction and presentation of environmental data, respectively. Finally, the results of the workshop and the next steps were discussed in the ACD Steering Committee meeting. The present report summarizes the program of the workshop and the main results.

Financial support from the International Arctic Sciences Committee (IASC) is highly appreciated and was essential for conducting the workshop. Additional support of ACD activities is provided by the International Permafrost Association (IPA), INTAS (International Association for the promotion of co-operation with scientists from the New Independent States of the former Soviet Union), the International Arctic Research Center (IARC), and the Canadian Department of Foreign Affairs and International Trade (DFAIT).

IASC

International Permafrost Association

Participants of the 3rd International Workshop on Arctic Coastal Dynamics (ACD), Oslo (Norway), 2-5 December 2002 (photo by Feliks Rivkin).

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1 History and Development of ACD

Complex land-ocean interactions in the Arctic coastal environment play an important role in the balance of sediments, organic carbon and nutrients of the Arctic Basin. In the past, contribution of coastal erosion to the material budget of the Arctic seas has been underestimated, but recent investigations have underlined its importance. Reimnitz et al. (1988) presented calculations for 344 km of Alaskan coast in the Colville River area and found that coastal erosion here supplied seven times more sediments to the Alaskan Beaufort Sea than rivers. Are (1999) suggested that the amount of sediment supplied to the Laptev Sea by rivers and shores is at least of the same order and that the coastal erosion input is probably even larger than the input of the rivers. This finding was supported by Rachold et al. (2000), who concluded that the sediment input to the Laptev Sea through coastal erosion is twice as large as the river input. In the Canadian Beaufort Sea on the other hand, the Mackenzie River input is the dominant source of sediments and coastal erosion is much less important (MacDonald et al. 1998). These pronounced regional differences in the riverine and coastal erosion sediment input have to be considered in any research related to the fluxes and budgets of the Arctic seas.

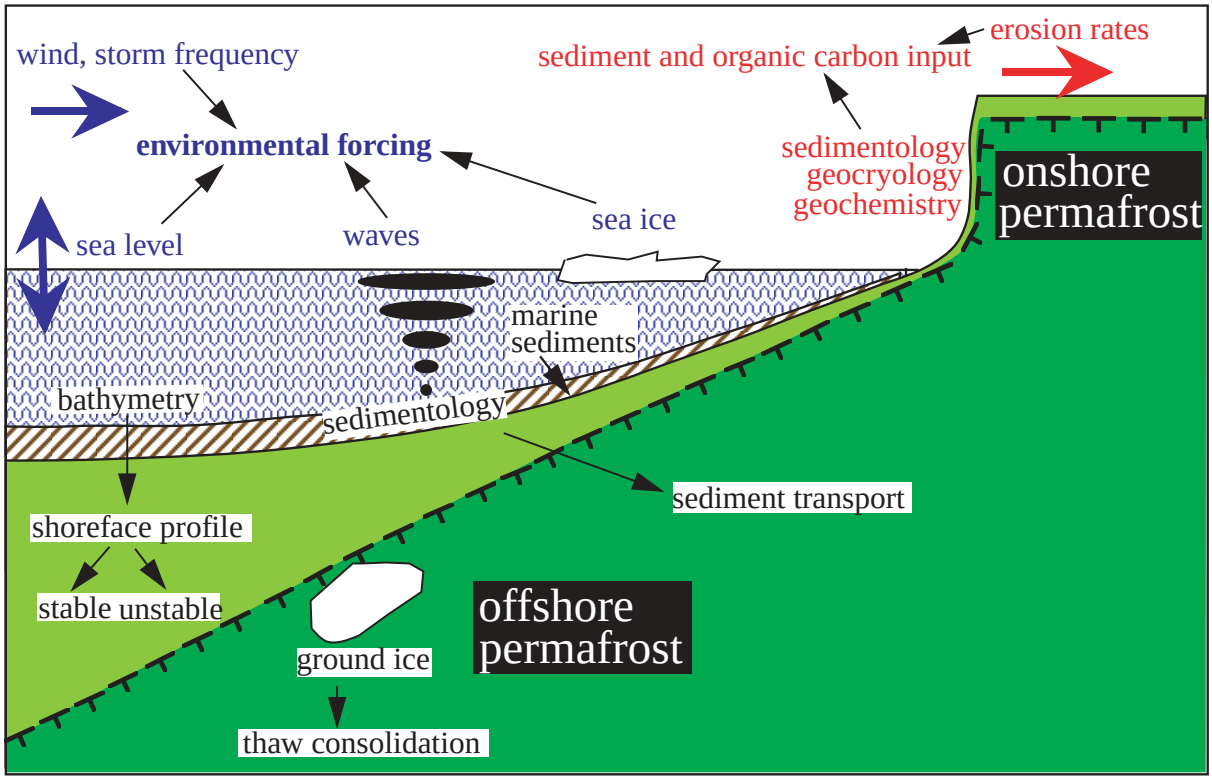

Figure 1. Coastal dynamics as a function of environmental forcing, coastal morphology, and onshore and offshore permafrost characteristics.

The Arctic Coastal Dynamics (ACD) program is a multi-disciplinary, multi-national forum to exchange ideas and information. The overall objective of ACD is to improve our understanding of circum-Arctic coastal dynamics as a function of environmental forcing, coastal geology and cryology and morphodynamic behavior. Figure 1 schematically summarizes the relevant parameters and processes. In particular, the ACD program proposed to:

- establish the rates and magnitudes of erosion and accumulation of Arctic coasts;
- develop a network of long-term monitoring sites including local community-based observational sites;
- identify and undertake focused research on critical processes;
- estimate the amount of sediments and organic carbon derived from coastal erosion;
- refine and apply an Arctic coastal classification (includes ground ice, permafrost, geology, etc.) in digital form (GIS format);
- compile, analyze and apply existing information on relevant environmental forcing parameters (e.g. wind speed, sea level, fetch, sea ice etc.);
- develop empirical models to assess the sensitivity of Arctic coasts to environmental variability and human impacts;
- produce a series of thematic and derived maps (e.g. coastal classification, ground-ice, sensitivity etc.);

The project elements were formulated at a workshop in Woods Hole in November 1999 carried out under the auspices of the International Permafrost Association (IPA), its working group on Coastal and Offshore Permafrost and its Coastal Erosion subgroup (Brown and Solomon 2000). As a result of the workshop a metadata form for the selection and establishment of key monitoring sites was developed. A consistent and generalized coastal classification scheme was established based on morphology and materials. Consensus was reached on direct and indirect methodologies for estimating ground-ice volumes and presentations of data on maps. Finally, a suite of standard tools and techniques for development of long-term coastal monitoring sites was recommended.

During the Arctic Science Summit Week in April 2000 in Cambridge, UK, and at the request of the IPA, the Council of the International Arctic Science Committee (IASC) approved funding for a follow up workshop to develop a Science and Implementation Plan for ACD. The resulting international workshop, held in Potsdam (Germany) on 18-20 October 2000, produced a phased, five-year Science and Implementation Plan (Figure 2).

The participants selected Volker Rachold to be the official IASC Project Leader. Hans Hubberten, Head of the AWI Potsdam Department, agreed to establish an ACD project office at AWI-Potsdam with a secretariat headed by Volker Rachold to maintain international communications including the web site (http://www.awi-potsdam.de/www-pot/geo/acd.html) and an electronic newsletter. The secretariat is assisted by the International Steering Committee (ISC) consisting of

- Felix Are, St. Petersburg State University of Means and Communication
- Jerry Brown, International Permafrost Association, Woods Hole
- George Cherkashov, VNIIOkeangeologia, St. Petersburg
- Mikhail Grigoriev, Permafrost Institute, Yakutsk
- Hans Hubberten, AWI, Potsdam
- Volker Rachold, AWI, Potsdam
- Johan Ludvig Sollid, Oslo University
- Steven Solomon, Geological Survey of Canada, Dartmouth

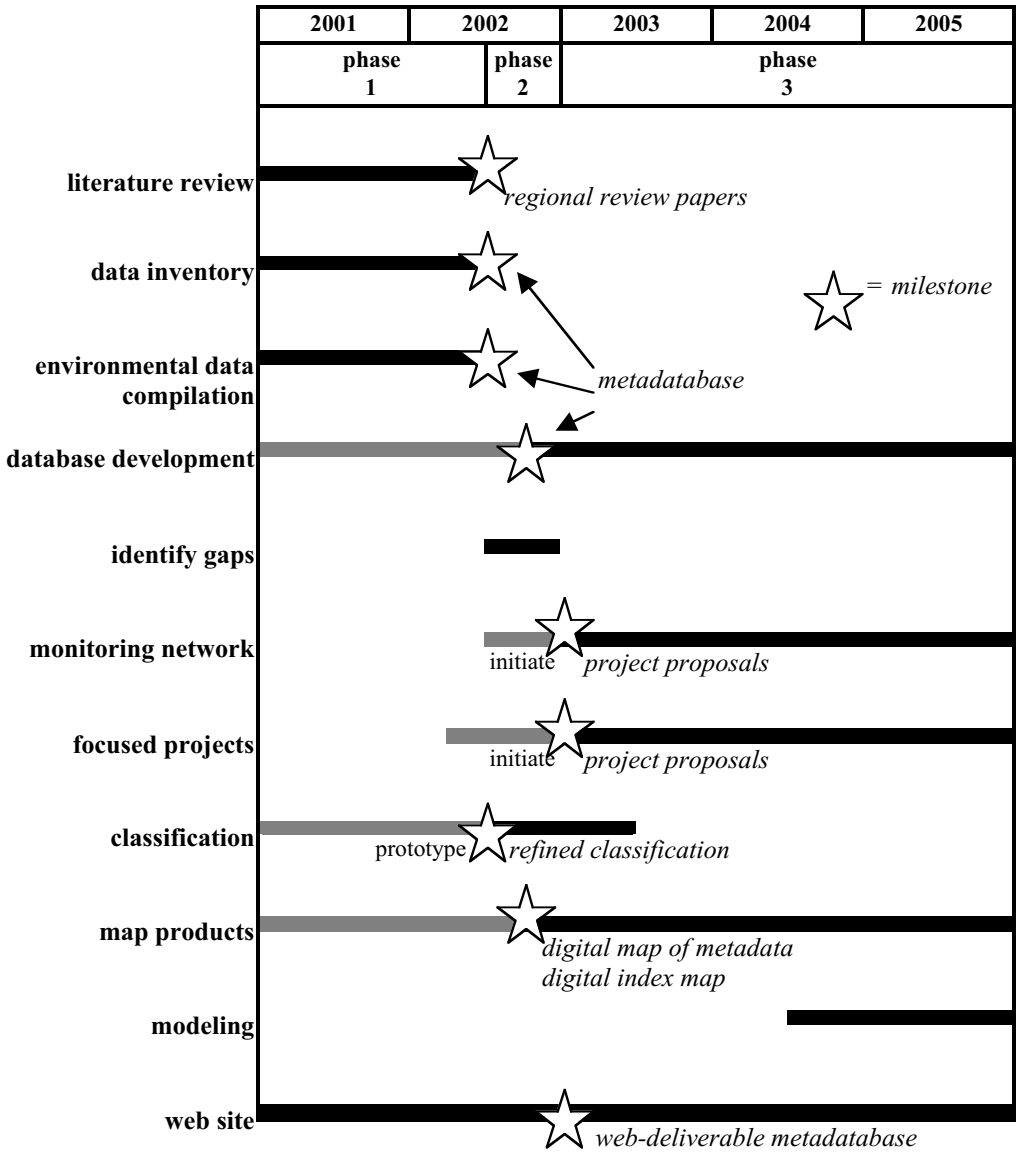

Figure 2. Main elements of the ACD Science and Implementation Plan, schedule and milestones.

The Science and Implementation Plan (IASC Arctic Coastal Dynamics, 2001) was made available at the ACD web page and submitted to the IASC Council for review, approval and advice on future directions. At the Council Meeting during the Arctic Science Summit Week in Iqaluit, Canada (April 22-28, 2001), IASC officially accepted the ACD project and approved funding for the 2nd ACD workshop in Potsdam, November 26-30, 2001. The main objective of the 2nd ACD workshop was to review the status of ACD according to phase 1 of the Science and Implementation Plan. During the first part of the workshop status reports of the ACD working groups and several papers dealing with different aspects of circum-Arctic coastal dynamics were presented. During the second part the workshop, progress of the ACD working groups was discussed and, based on these discussions, the next steps were identified in the ACD Steering Committee meeting. The results of the workshop including ca. 30 extended abstracts were published in the journal *Reports on Polar and Marine Research* (Rachold et al. 2002).

According to the results of the 2nd ACD workshop, emphasis is currently on developing a circum-Arctic estimate of sediment and organic input from coastal erosion to inner shelf.

Several papers on this topic have recently been completed (Brown et al., in press; Grigoriev and Rachold, in press; Jorgenson et al., in press; Rachold et al., in press [a]). The studies indicate that coastal erosion forms a major source not only of the sediment input but also of the total organic carbon (TOC) input to the Arctic seas. The comparison between riverine and coastal TOC input, based upon a combination of detailed field studies carried out in the Laptev and East Siberian Seas during the last several years (Grigoriev and Rachold, in press) and on a review of the existing literature, is shown in Figure 3 (Rachold et al., in press [a]). It has to be noted that the data given in Figure 3 are the best currently available estimates, but may include errors ranging from ca. 30 % for the Laptev and East Siberian Sea (Grigoriev and Rachold, in press) to one order of magnitude for the other seas.

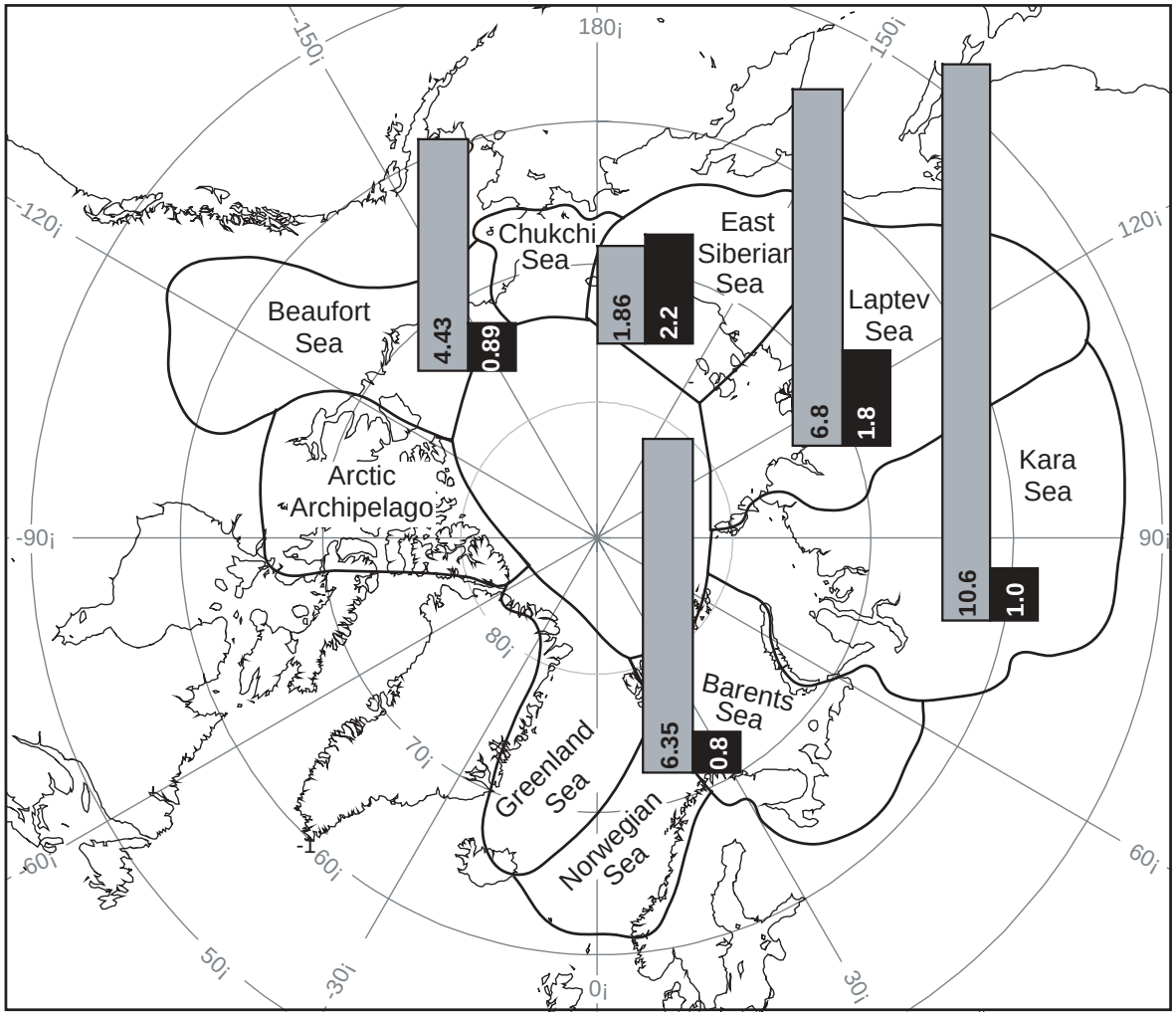

Figure 3. Riverine and coastal TOC input (10^6 t C yr^{-1}) to the Arctic Ocean (Rachold et al. in press [a]). Grey bars refer to river input and black bars to coastal input. Note that the sum is shown for Beaufort and Chukchi Sea and that Barents Sea input data include White Sea. The drainage systems are taken from http://www.R-ArcticNET.sr.unh.edu/.

The development of a reliable assessment of the sediment and organic input through coastal erosion involves classifying and segmenting the entire circum-Arctic coastline into common elements based primarily on morphology, ground-ice composition and erosion rates. Accordingly, a coastal mapping template (Table 1), which allows coastal scientists to record information about Arctic coasts, was developed during the 2nd ACD workshop in Potsdam,

and modified during a small working meeting[1] at the AWI in Bremerhaven in October 2002. The segmented data will be entered into the PANGAEA data system (http://www.pangaea.de). Regional expert teams to perform the segmentation for the major Arctic seas were identified during the Potsdam workshop. Figure 4 shows the areas by major seas, the length of their shorelines is given in Table 2. For the Laptev Sea a first version of the segmentation has already been completed (Rachold et al. in press [b]).

Table 1. ACD Coastal Classification Template.

field	***entry options***
primary_contact_person	provide name and email
regional_sea	Chukchi Sea=CS, East Siberian Sea=ESS, Laptev Sea=LS, Kara Sea=KS, Barents Sea=BS, Greenland Sea/Canadian Archipelago=GSCA, Beaufort Sea=BS
segment	
segment_name	text field
segment_no	number
segment_start_lat	decimal degrees (4 decimals)
segment_start_long	decimal degrees (4 decimals)
segment_end_lat	decimal degrees (4 decimals)
segment_end_long	decimal degrees (4 decimals)
segment_comment	yes=y or no=n (to be added if islands are included in the segment)
onshore (direction landward from the sea)	
onshore_form	delta=d, lowland(<10m)=l, upland(10-500m)=u, highland(>500m)=h, wetland=w
backshore (upper part of the active beach above the normal reach of the tides (high water), but affected by large waves occurring during a high water)	
backshore_form	cliff=c, slope=s, flat=f, ridged/terraced=r, anthropogenic=a, complicated=x
backshore_elevation	in meters
backshore_material_1	lithified=l, unlithified=u
backshore_material_2	mud-dominated=m, sand-dominated=s, gravel-dominated=g, diamict=d, organic=o, mixtures= e.g mg, sg
backshore_comment	text to be added if backshore_form=r or backshore_form=x
shore (strip of ground bordering the sea which is alternately exposed, or covered by tides and/or waves)	
shore_form	beach=b, shore terrace*=t, cliff=c, complicated=x
beach_form	fringing=f, barrier=b, spit=s (to be filled if shore_form=b)
shore_material_1	lithified=l, unlithified=u
shore_material_2	mud-dominated=m, sand-dominated=s, gravel-dominated=g, diamict=d, organic=o, mixtures= e.g mg, sg
shore_comment	text to be added if shore_form = x
offshore	
depth_closure**	in meters (if available)
distance_2m_isobath	in meters (if available)
distance_5m_isobath	in meters (if available)
distance_10m_isobath	in meters (if available)
distance_100m_isobath	in meters (if available)
offshore_material	mud-dominated=m, sand-dominated=s, gravel-dominated=g, diamict=d, organic=o, mixtures= e.g mg, sg

[1] M. Grigoriev, J. Brown, S. Solomon, W. Pollard (McGill University, Montreal, PQ, Canada) and V. Rachold participated in the October meeting which was funded in large part by the Canadian Department of Foreign Affairs and International Trade.

Table 1. continuation

field	*entry options*
general	
ground_ice_1	low(2-20)=l, medium(20-50)=m, high(>50)=h
ground_ice_2	in % total volume of shoreline (best guess!)
ground_ice_comment	text to be added if ground ice template was filled out
change_rate	in meter/year (erosion=minus, accumulation=plus)
change_rate_interval	in years (years of observation, e.g. 1956-1999)
dynamic_process	erosive=e, stable=s, accumulative=a (interpretation, only to be filled out if change rate is not available)
dry_bulk_density	in t/m3 (if no data available use: clay=1.3, silt=1.5, sand=2, or mixtures, e.g. silty sand=1.8)
organic_C	in weight % (best guess!)
soil_organic_C	in kg/m2 (if available)
environmental	
glacier_ice	floating=f or grounded=g
sea_level_change	in centimeters per hundred years (if available) (negative for submergence)
tidal_range	in meters (if available)
meteorol_tidal_range	in meters (if available) (positve and negative storm surge)
mean_freezeup_date	Julian day (if available)
mean_breakup	Julian day (if available)
open_water_length	days (if available)
landfast_ice_min	in km (if available)
landfast_ice_max	in km (if available)
open_water_max	in km (if available)
open_water_mean	in km (if available)
open_water_min	in km (if available)
data_sources	text (provide the sources or references(citation) of used information, i.e. published, unpublished observations or reports)
comments	text (space for additional comments)

*shore terrace = a terrace made along a coast by the action of waves and shore currents, it may become land by uplifting of shore or lowering of the water; **depth_closure = maximum storm wave base

Table 2: Shoreline lengths of the Arctic seas based on World Vector Shorelines (excluding islands).

	Sector	Shoreline length (km)
CS	Chukchi Sea	5,203
ES	East Siberian Sea	3,500
LS	Laptev Sea	7,931
KS	Kara Sea	10,790
BS	Barents Sea	6,176
GSCA	Greenland Sea/Canadian Archipelago	4,378
CBS	Canadian Beaufort Sea	3,787
USBS	US Beaufort Sea	1,958
	total	**43,723**

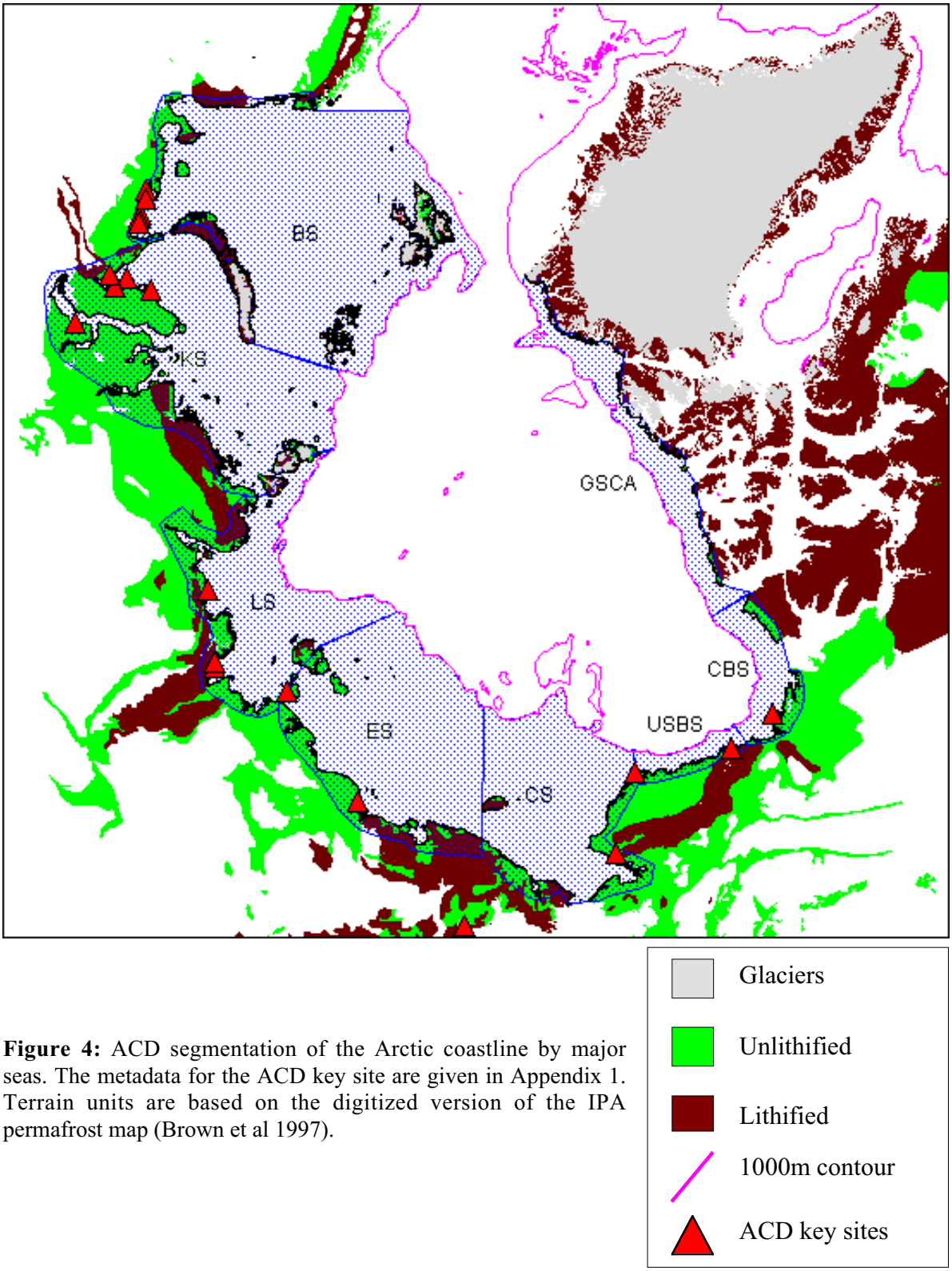

Figure 4: ACD segmentation of the Arctic coastline by major seas. The metadata for the ACD key site are given in Appendix 1. Terrain units are based on the digitized version of the IPA permafrost map (Brown et al 1997).

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2 Program and Main Results of the Workshop[2]

The third IASC-sponsored ACD workshop was held in Oslo, Norway, on December 2-5, 2002. Participants from Canada (3), Germany (3), Great Britain (1), the Netherlands (1), Norway (6), Russia (11), Switzerland (1) and the United States (2) attended. Of these five were young scientists supported by IASC. Two current INTAS projects provided support for six additional Russian participants. The Geography Department at the University of Oslo organized the local logistics for the workshop.

The objective of the workshop was to review the status of ACD according to the Science and Implementation Plan, with the main focus on the quantitative assessment of the sediment and organic carbon input to the Arctic Ocean through coastal erosion.

2.1 Program

During the first part of the workshop (Monday, December 2 and morning of Tuesday, December 3) 29 papers dealing with regional and/or circum-Arctic aspects of coastal dynamics were presented (the extended abstracts including several from those not attending are presented in Section 3):

- Beaufort and Chukcki Sea: 6 papers;
- Laptev and East Siberian Sea: 5 papers;
- Kara and Barents Sea: 9 papers;
- Norwegian and Greenland Sea: 3 papers;
- circum-Arctic processes, methods and techniques: 6 papers.

Based on the presentations and the regions and expertise represented at the workshop three regional working groups (WG) and two circum-Arctic WGs (focusing on GIS development and extraction and presentation of environmental data) were organized. The WGs met on Wednesday, December 4 and Thursday, December 5. Plenary meetings were held twice per day in order to discuss general questions and to exchange information on the progress of the working groups.

Western Russian Arctic (Barents and Kara Sea) WG

Leader: A. Vasiliev
Participants: D. Drozdov, A. Kizyakov, D. Pertednya, I. Streletskaya, S. Ogorodov, F. Rivkin and A. Vasiliev

Eastern Russian Arctic (Laptev, East Siberian and Chukchi Sea) WG

Leader: M. Grigoriev
Participants: F. Are, M. Grigoriev, H.-W. Hubberten, V. Ostroumov and V. Rachold

Canadian and Alaskan Beaufort Sea WG

Leader: S. Solomon
Participants: J. Brown, A. Mahoney, H. Lantuit and S. Solomon

[2] The complete program and the list of participants are given in Appendices 2 and 3.

Environmental WG

Leader: D. Atkinson[3]
Participants: D. Atkinson, J. Hölemann and A. Mahoney

GeoInformation System (GIS) WG

Leader: R. Ødegaard
Participants: D. Atkinson, D. Drozdov, B. Etzelmüller, H. Lantuit, I. May, V. Rachold, F. Rivkin, F. Steenhuisen and B. Wangensteen

A meeting of the teams involved in two ACD related INTAS projects was held in conjunction with the workshop on Sunday, December 1:

Arctic coasts of Eurasia: dynamics, sediment budget and carbon flux in connection with permafrost degradation. INTAS Open Call 2001-2329

Arctic coastal dynamics of Eurasia: classification, modern state and prediction of its development based on GIS technology. INTAS Open Call 2001-2332

participants: F. Are, G. Cherkashov, D. Drozdov, M. Grigoriev, A. Kizyakov, R. Ødegaard, V. Ostroumov, D. Perednya, V. Rachold, F. Rivkin, J.L. Sollid, I. Streletskaya, A. Vasiliev, B. Wangensteen

Finally, the results of the workshop and the next steps were discussed in the ACD Steering Committee meeting.

2.2 Main Results of the Working Group Meetings

The main task of the regional WGs was to continue the coastal segmentation and classification for their sectors. Additionally, representative photographs of coastal sites for each sector were selected for inclusion in a coastal photo library. These, and metadata forms for key sites will be incorporated into the IPA CAPS 2 CD ROM currently in preparation at the National Snow and Ice Data Center, Boulder, Colorado. The discussions of the two circum-Arctic WGs concentrated on the extraction and presentation of relevant environmental data and on technical aspects concerning the development of a circum-Arctic coastal GIS.

At the end of the workshop the WG leaders reported on the progress of their groups:

Western Russian Arctic (Barents and Kara Sea) WG

For the coast of the western Russian Arctic 40-45 photographs of typical shores were selected. The collection includes photographs of the ACD key sites in the Kara Sea and in the Barents Sea.

The segmentation of the coastline in the western Russian Arctic was almost completed during the workshop. However, the western segments of the Barents Sea have to be revised (responsible: D. Drozdov, S. Ogorodov for western Barents Sea and A. Vasiliev for Yamal

[3] David Atkinson, the leader of the Environmental WG, is financed through the IARC grant "Analysis of Coastal Meteorological and Oceanographic Forcing in the Arctic Basin".

Peninsula). White Sea and Kola Peninsula have not been classified yet. This region is located outside of the permafrost zone but should be included to calculate the sediment budget. The segmentation of the Taymyr Peninsula west coast is still in progress (50-60 % of the Kara Sea are completed) and will be finished by middle of 2003 (responsible: A. Vasiliev).

The final version of the segmentation and classification of the entire western Russian Arctic will be available at the next ACD workshop (November 2003, see below).

Eastern Russian Arctic (Laptev, East Siberian and Chukchi Sea) WG

For both Laptev and East Siberian seas ca. 15 coastal photographs and for the Chukchi Sea four photographs covering the ACD key sites in the eastern Russian Arctic and some additional sites were selected.

The segmentation of the Laptev Sea coast is practically finished, but the western segments (east coast of Taymyr Peninsula and Severnaya Zemlya Archipelago) have to be revised (responsible: H.-W. Hubberten, M. Grigoriev, deadline: May, 2003). For the East Siberian Sea 50-60 % of the coastline could be segmented, the segmentation of the remaining parts will be completed by middle of 2003 (responsible: M. Grigoriev, S. Razumov, S. Nikiforov, V. Ostroumov). A first approximation of the segmentation was performed for the coastline of the Chukchi. Literature sources and data of A. Kotov (Chukchi Scientific Center) will be used to perform the detailed segmentation and classification, which is anticipated no later than the next ACD workshop (responsible: M. Grigoriev, S. Razumov, D. Drozdov, A. Kotov).

Canadian Beaufort and U.S. Beaufort Sea and Chukchi WG

Much of the Canadian Beaufort Sea coastal segmentation and classification had been accomplished at the October meeting in Bremerhaven (see footnote on page 5). Discussions between Alaskan and Canadian scientists took place in order to maintain consistency across the border. Segmentation of the southern part of the Arctic Islands Archipelago (Banks Island) is underway as part of coastal vulnerability assessments in Canada and is expected to be completed by May 2003. The remainder of the Archipelago will be undertaken in conjunction with colleagues working on the Greenland coasts (Ole Humlum and Hanne Christiansen). The deadline for this segmentation was not set because key participants were not present. The working group also discussed recently initiated projects on the application of remote sensing to Arctic coastal mapping and process studies and ongoing work on landfast ice and ice/sediment interaction processes in the Barrow and Mackenzie regions.

The U.S sectors of the Beaufort and Chukchi seas have been divided initially into 45 and 15 segments, respectively, by Brown, and largely follows subdivisions made in earlier studies. The initial classification will be completed by July. Mahoney contributed a number of site photographs for the Barrow key sites and these will be added to for the other Alaskan sites.

Environmental WG[4]

The Environmental Working Group (EWG) discussed which environmental data should be included for output, how and in what time and spatial scales should the output be delivered, and what additional information is required to complete the output items. To become acquainted with what the field researchers consider of importance the EWG members met

[4] For additional details on environmental data extraction and presentation the reader is referred to the extended abstract of Atkinson, this volume p. xxx)

with the regional WGs. Additionally, the EWG output was discussed with the GIS WG to be consistent with the requirements and constraints of the final GIS structure.

The most important forcing elements considered by the regional WG members was the action of waves. Another important consideration identified was the impacts of meteorological or storm surges. The criticality of the presence of land-fast ice was also identified, as was the length of the open-water season. The importance of extreme events, and of specific sequences of events, was also identified. Based on such discussions the importance of moving beyond basic meteorological elements and into modelled elements became evident.

Various elements have been selected as relevant to the aims of the ACD project and will be output to the GIS. The first round will include basic meteorological elements as expressed in the form of various derived statistics. The second round will consist of process or temporal model results. To achieve this, various "modelling partners" have been identified either because they developed the relevant model or because they have specific knowledge that pertains to the issue under consideration. Element output layers and modelling partners (in parentheses) are listed in Table 3. Final output form will be in GIS layers, or in a format specified by the GIS technical personnel, delivered directly to the ACD secretariat. Issues that arise will be taken up with the GIS personnel there, or with members of the regional WGs.

The nature of this project includes a important exploratory aspect. Thus to accommodate unexpected results or observations, the EWG will continue to entertain suggestions for new environmental data layers until the deadline, as yet to be finalized, for the submission of new information to the ACD GIS database has been reached.

Table 3: Time line for delivery of environmental data. "Output" refers only to major element categories, and not specific data layers. Each category will consist of one or more specific data layers.

Date delivered by	Output (categorical only)
Jan 2003	Wind field
Jan 2003	Temperature
Jan 2003	Precipitation
Mar 2003	Open water season length
Mar 2003	Tidal ranges
Apr 2003	Surges (working with Proshutinsky)
May 2003	Land fast ice (working with Mahoney)
May 2003	Mean wave energy delivered to coast (working with Orogodov)

GeoInformation System (GIS) WG

It was decided that the ACD coastal segmentation database will be stored in the PANGAEA system (http://www.pangaea.de), which is the core database for "raw" data needed in the calculations of sediment and organic input. For analyses and other scientific purposes within the project the raw data will be exported from this system into different GIS and other processing software.

During the WG meetings Ian May (World Conservation Monitoring Centre) and Frits Steenhuisen (Arctic Center, the Netherlands) and new contributors to ACD, volunteered to produce a small web-based front-end to the PANGAEA system, which will be based on the ArcIMS software. This system will link the tabular data in PANGAEA to the World Vector Shoreline (WVS). The projection will be user defined and the segments will be allocated with

a unique identifier. A regional area code should be included in this unique identifier together with a segment number. Tools will be available in this web system to perform corrections (e.g. split and move) and to define a coastal segment based on a polygon (e.g. complicated coast with several islands or barrier coast).

Only one person (the defined regional expert) will have the permission to carry out the segmentation for a predefined sector of the coastline. After the work in this system is completed the data will be transferred to the PANGAEA system for final quality control and permanent storage for the use within the ACD project. Once the data are stored there will be no system to update or change to the content of the database. However, the database will be modifiable through interaction with the database administrator.

The main deliverables from the ACD project will be:

- PANGAEA database (raw field data linked to the WVS with a unique identifier)
- ACD homepage with maps and figures (mainly bitmaps)
- Final product with different derived GIS features on CD-ROM

In addition to the technical details, the members of the WG discussed the issue of estimating coastal lengths based on the WVS. It was decided to initiate a small workshop to address this question. As a first step a review of existing literature on this subject will be finished in July 2003. The next step will be to develop a methodology, probably a statistical model, to be tested in one key area. This work should also include detailed information about the scale of coastal erosion measurements available in the project. Detailed validation data will be needed in representative coastal areas (digital maps scale 1:10000, air photos, high resolution satellite imagery and CORONA images).

2.3 Next Steps

Based on the presentations and on the results of the WGs discussions, the following next steps were identified in the Steering Committee meeting:

ACD Input for the New CAPS CD-ROM

The second version of the CAPS-CD (Circumpolar Active-Layer Permafrost System) will be completed for distribution at the 8th International Conference on Permafrost in July 2003. It was decided that the following ACD products will be submitted:

- Russian bibliography of ACD related literature containing ca. 550 references
- ACD metadata for key sites
- library of circum-Arctic coastal photographs of the ACD key sites and additional coastal sites containing ca. 120 photographs

The products will be available at the ACD web site as well.

Fate and Type of Eroded Organic Carbon

Organic carbon is supplied to the Arctic shelves and basins by rivers and rapid erosion of unlithified coastal materials. This information is important in order to understand the role of the Arctic in the global carbon budget; whether it is a source or a sink for carbon. The

knowledge of the type of organic carbon (dissolved or particulate etc.) and its fate is essential to understand the role of coastal erosion in the carbon budget of the Arctic.

The participants agreed to study three key transects with regard of detailed organic carbon studies as a first step. The key transects, located in the Kara, Laptev and East Siberian seas, will be sampled during the summer activities in 2003. A sampling protocol will be developed.

U.S. Arctic Near-Shore Initiative

Planning of a new Land-Shelf Interactions program in the Arctic near shore is underway, and includes elements of the RAISE (Russian-American Initiative for Shelf-Land Environments) activities. In order to coordinate the effort with the ACD program, a summary of the ACD activities was provided to the planning group, headed by Lee Cooper.

Workshop Report

All participants and those unable to attend were invited to submit extended abstracts for the present workshop report.

ACD Publications

The presentations during the workshop documented that several studies are ready or almost ready for publication. Potential papers were identified and a preliminary table of contents for a special issue of a peer-reviewed coastal journal was proposed. The articles are expected to be ready for submission before the start of the summer field season. A series of ACD papers and extended abstracts will be published in the forthcoming publications of the 8th International Conference of Permafrost.

ACD Relevant Meetings in 2003

- ELOISE (European Land-Ocean Interaction Studies), Gdansk (Poland) 24-27 March 2003: ACD presentation by V. Rachold.
- Arctic Science Summit Week, Kiruna (Sweden), 31 March - 4 April 2003: ACD presentation at the IASC Council meeting by V. Rachold (and poster).
- Arctic Workshop, Tromsø (Norway), 3-5 April 2003: ACD poster.
- EGU/AGU (European Geophysical Union / American Geophysical Union), Nice (France), 6-11 April 2003: ACD poster.
- Annual geocryology conference, Pushchino (Russia), 19-21 May 2003: ACD presentation by V. Rachold, Meeting of the ACD INTAS teams.
- 8th International Conference on Permafrost, Zürich (Switzerland), 21-25 July 2003: special session on coastal permafrost, a number of ACD papers, and distribution of the present journal to conference participants.
- ICAM (Arctic Margins Meeting), Halifax (Canada), 30 September - 3 October 2003: special session on Arctic Margins: Coastal and Marine Environmental Geosciences in a Changing Climate; Implications for Development chaired by S. Solomon and L. Johnson (ACD poster and presentation).

Next ACD Workshop

It was decided to organize the 4th ACD Workshop in St. Petersburg (Russia), November 2003, ideally to take place at about the same time as the WCRP Arctic Climate System Study (ACSYS) Final Conference and the Climate and Cryosphere (CliC) meeting. George Cherkashov, VNIIOkeangeologia, has received permission to host the workshop. The status of ACD will be reviewed and the tasks for the next phase of the five-year plan will be developed. In particular, the Steering Committee decided to expand the scope of ACD to cover human aspects and the impact of coastal dynamics on habitats and species. Additional participants to cover these aspects including participants representing AMAP, CAFF, ACIA, LOIRA, LOICZ, WCMC and HARC will be considered based on IASC recommendations.

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