Arctic Nearshore Processes All-Hands Discussions Feb. 21 2002







OVERARCHING GOAL

To improve our understanding of the biogeochemical, physical, and hydrological processes that occur in the nearshore zone of the arctic shelf with respect to changes in global climate system and alteration of marine ecosystems and societal resources. Definition of coastal zone:

Area where surface and bottom boundary layers interact

Horizontally the transition of terrestrial to oceanic processes

Need time scale since the above are variable Seasonal changes are important Landward – area of human settlement Delta and connections to terrestrial environment

Linkages to Climate and Global Change

Vertical stratification – advection and atmospheric forcing

Organism responses – physiology, adaptation Biogeochemical processes and transformation of materials – Different sources of organic matter Important to review international programs looking at coastal zone Linkages to other initiatives (national) – river discharge tied to global carbon cycling Human interaction – discrete pockets of human activity

Importance of ice to human activity

Fast ice separates Arctic from other land margins Estuarine waters are important and different – organisms differ in physiology, responses Permafrost should be looked at both submarine and terrestrial Wind forcing and influence on polynyas The region is the most "shaken" – dynamic variability Define importance of Arctic coastal zone Largest over historic time scales

Carbon sources and sinks

Only coast with close human linkage

As a percentage of the population

Numerically more important in lower 48

Populations have been living in area for 1000s of years in subsistence mode – may face rapid change in way of life

Populations have impact on land-use change which can be dramatic - testable

Climate connection – not found in mid latitudes

AO influence and feedbacks in coastal zone not well understood

Facing dramatic and rapid change in open water Gas hydrates very near surface

Warming of nearshore influence greenhouse gas fluxes

Fast ice, anchor ice

Water content of soils may be 80%, but state is very different from other coasts – phase boundary

From a modeling perspective – boundary condition, so a major driving force

Ice causes major increases in erosional rates and can cause morphological changes in stream and terrestrial systems

Important to efflux of ice from Arctic

Air-sea fluxes are very important

CO2/methane fluxes

Shelf history, transgressions, sea level changes

Permafrost may take long interglacial cycles to thaw – rate of change may not be fast

Ancient river valleys may be preferred pathways for material transport across shelves

Nutrient cycling – changes in rate processes Elemental ratios

QUESTIONS

• Need to distinguish 3 coastal zone systems (across seasons)

Coastal zone permafrost, ice scour Coastal zone river discharge Coastal zone tidal influence

• Shallow shelf (~ 20 m)

How do freshwater and wind forcing interact to distribute material in the nearshore zone?

What is the physical and biogeochemical response on the shelf to the high temporal and spatial variability of river discharge? • How do changes in atmospheric circulation and meteorological events affect runoff, erosion, biogeochemistry, dispersal of contaminants, and societies in the coastal zone?

What is the role of light in the Arctic?

• How does ice mediate the transport of material in and through the coastal the zone?

Feedbacks

- How will change in the open water season change the distributions of inorganic and organic materials in the nearshore environment?
- What is the feedback of erosion of the permafrost to the climate system, with respect to CO2/methane?

Transformations and Internal Processes

• How does ice dominated coastal zone mediate the transport of materials from a physical, biological and chemical perspective?

- How is the advancing and retreating of the ice edge interacting with the river plume?
- How does functional heterogeneity contribute to resilience in face of change?
- How does transformation and fate of ancient organics affect nearshore food webs?
- How do changes in sealevel affect erosion rates across micro- and macrotidal shoreline systems?
- How do changes in forcing processes affect growth, migration, seasonality, distribution, species composition of nearshore-dependent species.
- What processes affect biogeochemical cycling on the shelves and lead to ventilation of the interior Arctic?

Impacts

- How are the changes in the processes affecting ice formation or ice loss altering marine ecosystems and societal resources?
- How will changes in the Arctic coastal zone affect the infrastructure (on a global scale) of societies.
- How do we quantify the effect of National economic and development policies, National security, and National environmental response capability on integrated coastal zone management?
- What kinds of information will coastal communities need in order to prepare to adapt to rapid change?