**Q: What are the expect changes in the cryosphere and riverine inputs and how does that alter BGC, food web structure and functioning, C storage processes, and the provisioning of ecosystem services (and feedbacks therein)?**

Why: We know that that water mass transports and connectivity among basins are changing, affecting trophic size structure, community composition and timing of ecological events, charismatic megafaunal distributions, etc. Management must respond to these changes.

Approach:

Measure cyrosphere / riverine input & their changes

Constrain transports, connectivity & freshwater inputs and their changes. Focus efforts at bottlenecks, gaps, etc.

Fieldwork to understand impacts of nutrient ratios and changes in food web structure on primary productivity, BGC, food web functioning, and timing of ecosystem events during the annual cycles, etc.

Assess how the human system is altered via fisheries (& other transportation, etc.) and how does it feedback to the coupled system.

Models to link these things.

Synthesize available monitoring (fish survey, etc.) and scientific data sets (CPR, OOI, etc.) and the address what expansions are needed.

Deploy an integrated observational system taking advantage of existing assets (time series, VOS lines, OOI, international participants) and new technological advances (autonomous assets).

The Labrador Sea and Irminger Sea both might be a good place to think about siting this investigation. Many assets are available at both of these sites.

**Q: How do mesopelagic food web processes control BGC and food web processes (which presumably will feedback to the global C cycle) and how does it respond to climate changes (& potentially emerging fisheries)?**

Why: The need should be obvious. Models use Martin’s “b” to describe these processes. Many unknowns and poorly (un)constrained rates – but a major impact on mesopelagic ecology and BGC and the global C cycle

Approach:

Process level understanding is needed

focus on linkages between euphotic and twilight zone

Distributed observational network looking at the base of food web

T, S, u, v, O2, NO3, particles, phytoplankton, PSD, etc.

Process studies to measure pathways of C exchanges in the mesopelagic

Address flux attenuation, changes in PSD and microbial activities vertically

DOC processing and net vertical transport

Zooplankton migration

need new tools to measure and system model for zoop do

Trophic transfers of C energy to higher trophic levels (fish!!)

Constrain with annual nutrient and BGC balances

Models to link these things and address impacts on C cycle prediction

Synthesize available monitoring (fish survey, etc.) and scientific data sets (JGOFS, NABE08, CPR, OOI, etc.).

Deploy an integrated observational system taking advantage of existing assets (time series, VOS lines, OOI, international participants) and new technological advances (autonomous assets).