Writeup from Breakout Session 1, Group 2:

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We suggested small changes to the wording of the question and spent most of our time fleshing out a few subquestions that we found particularly compelling.

*Reworded Question: How will biogeochemistry of shelf and open ocean waters of the North Atlantic and Arctic respond to climate variability and increasing human pressures?*

The most notable changes are: (1) we changed “deep” to “open water” since all depths are important and (2) we changed “climate change” to “climate variability” since the program may not be long enough to assess effects of change.

One issue discussed by the group is that whereas the effects of increased atmospheric CO2 (e.g. atmospheric warming, reduced ice cover, changing precipitation and wind patterns, etc.) will be critical in both the open ocean and the shelf, the smaller scale effects of other increasing human pressures (e.g. increased riverine nutrient inputs, atmospheric deposition, energy exploration, offshore drilling, plastics/toxics, aquaculture etc.) will likely be felt primarily on continental shelves and shallow seas.

We then spent the rest of our time discussing a few research foci/subquestions that we thought would align well with this major question. The topic that garnered the most interest was the connection between the subplolar N Atlantic and the Arctic and how changes in one basin may be affecting another. How are changes in the Arctic affecting the subpolar N Atlantic? For example, melting ice in the Arctic may lead to increased Arctic productivity, which in turn could reduce the nutrients downstream that enter the North Atlantic. What effect would that have? The “flip” question was also deemed important – How are changes in the North Atlantic (e.g. warming) affecting the Arctic? We also discussed that studying biogeochemistry at all depths is important and in particular, linking the surface processes to deep processes is necessary. For example, the depth at which remineralization occurs affects how nutrients, carbon and oxygen are transported in the deep ocean, and how those biogeochemical species are transported in turn affects where they return to the surface and thus impacts global productivity patterns.

The third main topic we discussed was the linkage between physics and biogeochemistry. How do changes in circulation and stratification affect fluxes of nutrient, oxygen and carbon fluxes? In particular, we discussed that for the water budget, the overturning flux is different than transport flux. What about for carbon, oxygen and nutrients – does the overturning flux equal the transport flux of those biogeochemical species? We discussed the need for more biogeochemical observations made at the same time as physical assessments of the MOC – for example, biogeochemical sensors in RAPID (we were told some sensors exist in RAPID but only to a limited extent) and on OSNAP (which are not yet there but would be welcomed) or on a line further North.

We spent only a little time discussing the shelf, mostly because of the composition of scientists within the room. We did, however, highlight (1) the importance of the connection between the shelf/shallow seas and the open ocean and (2) the issue raised above, regarding the fact that the shelf appears to be a critical place for understanding the effects of human impacts. In response to the plenary breakout presentation, it was also pointed out that continental shelf pumping is a very important issue that should be addressed within this question.