

U.S. GLOBEC SCS Meeting

Westin Arlington Gateway Hotel
Ernest Hemingway 3 Salon
801 North Glebe Road, Arlington, VA 22203

Friday Harbor Workshop - Enrique Curchitser

Chuck Greene organized a GLOBEC-sponsored workshop at Friday Harbor in August of this year. The focus of the meeting was predictability in both the physics of ecosystems in marine systems. Discussions addressed potential changes in the structure of ecosystems and climate change versus biogeographic shifts. Decadal predictability and remote force was also discussed. There will be a workshop report and a follow-up workshop that will review these discussions; the report will be available on the US GLOBEC website. Whatever is distilled from this report should be presented at the final symposium.

NCAR Connections - Enrique Curchitser

Work has been advanced on embedding a high-resolution regional ocean model into a two-way coupling climate model. We have produced a 150-year coupled simulation in the Northeast Pacific. Statistically significant effects from the two-way coupling are found, not only on the regionalscale but also globally. For example, capturing the upwelling with better resolution leads to cooler temperatures over the North American continent by 2 degrees Celsius.

Physics to Fish to Fishers - Ken Rose

Historically an outgrowth of PISES project involves quite a few people and high performance computing center money (HPCC) from NOAA. Basically, the model works; it is the California current model, which is ROMS with Nemeru doing nitrogen protoplankton/zooplankton and an individual based model for sardine and anchovy. They run around in a 3 dimensional grid, we have since added a predator that chases the around. There is also a fishing fleet model that has been added which tries to catch the sardines. This is ROMS to MPZ, which is Nemeru to the multispecies IDN to the fishing fleet model. We are running this from 1950 to 2005, roughly. This will be presented in Barcelona in the next week. (Note: a short movie was presented tot he group that illustrated species A and B, predators, fishing fleets and the catch by port and by where the fish were caught.) The next step is to put this into CCSM (the earth system model that Enrique is doing with two way downscaling); we would be modeling the earth, atmosphere and the ocean and then zoom in on the California current and run it all simultaneously. We hope to have some manuscripts early next year.

CURRENT - Dale Haidvogel for Dave Mountain

David is taking the lead on putting together an issue of CURRENT, the marine educators' journal. This issue will be entirely dedicated to U.S. GLOBEC with the following sections: Introduction, Regional Projects, Technology, Modeling, Data Management, U.S. GLOBEC Personalities, Education Activities and Epilogue. All sections are in draft form, and are to be reviewed and returned with comments to the authors of each section. Revisions are due in mid-December. Most of the drafts need to be "cut down". The target issue is scheduled for the second issue of 2011, in time for the Final Symposium. There are precedents for having a website for material (movies, classroom exercises, etc.) to accompany the actual issue.

Web Page Updates and Projects Underway - Dale Haidvogel and David Robertson

There was a successful seminar series that was held in Spring 2009; these series were videotaped and audio taped. We plan on having these seminars in some archival form on the U.S. GLOBEC website. It has been determined that the audio tapes should be synced with the PowerPoint presentations that are being displayed. This is a time consuming process, but progress is being made.

Work is continuing on web tools for collecting information on all personnel involved on all levels in U.S. GLOBEC (past and present) to present at the Final Symposium. This will highlight the great impact that U.S. GLOBEC has had on all levels of training personnel including students, post docs, junior scientists, etc.

Fourth Pan-Regional Synthesis Workshop - Dale Haidvogel

The Fourth Pan-Regional Synthesis Workshop was held in April 2010 at NCAR with approximately 50 people in attendance. Following brief reports, most of the meeting was devoted to trying to find synergistic activities that cut across funded Pan-Regional projects which might lead to additional products in the remaining year or two of U.S. GLOBEC. The working groups came together and found common ground for mutual activities to take forward from the workshop, which can be followed up on by smaller groups. The working groups were in five topic areas:

Indicators

A recommendation from this group was to identify a short list of potential targets from different U.S. GLOBEC regions and to develop or generate simpler models to capture the key variability and provide a model based index. Funding has been promised from the National Office to hold a small workshop to push this indicator idea forward.

Legacies

Looking broadly at the kinds of legacies that the U.S. GLOBEC program might be prepared to leave behind. Discussed was a networking group involving archiving the remaining and presently missing U.S. GLOBEC datasets, development and deployment of the model metadata site, clean up, migrate and integrate the US North Pacific, North Atlantic and Southern Ocean websites.

Model Metadata

The concept is to have general and specific information on the web about links for accessing the model generated products that are coming out of our collective U.S. GLOBEC programs. This web tool could take many forms; people could search it either for regions or types of models and or model output and learn more about the models and methods used to obtain or generate the simulated data and links to where they might get subsets of that data to use in investigations. Conference calls have been held to look into what form this tool could take (content, organization, etc.).

Model Intercomparison

Progress has been made in terms of reference for such a model. This is a very large undertaking and would require someone with a great desire to "push it forward".

Marine Protected Areas

The participants felt that there was enough collective and important results that warranted a small meeting among the participants culminating in a written document or review paper. Al Hastings is leading this effort and has also agreed to organize a small group of people to meet and work on the composition and details of said publication.

IMBER - Eileen Hofmann

(Integrated Marine Biogeochemistry and Ecosystem Research, co-sponsored by CORE and IGBP)
The purpose of IMBER is to look at the whole earth system (including human impacts) and the consequences of climate change. There are three primary research themes; the interaction between biogeochemistry and food webs, the holistic theme of biogeochemical cycling of food webs, merging JGOFS and U.S. GLOBEC science, and the response from society. The structure of IMBER includes an international project office in Brest, France, a science steering committee and working groups. IMBER has a large international network, more in Europe than anywhere else, although China is becoming a major player in the program having just set up a regional project office in Shanghai. This project office is under the IMBER IPO and is moving forward a host of recent IMBER science programs in Asian countries. There is also a large IMBER activity in the Mediterranean. Some results from IMBER meetings in 2008 and workshops is a special issue from a meeting in Miami focusing on the mesopelagic ocean. There have been some papers on feedback between biogeochemical food webs as well. IMBER has hosted these meetings to explore the issues and important science topics, to try to develop models and to set that as a basis for moving forward. Part of these synthesis activities has been to support international assessments; there is an ongoing one currently on ocean acidification, looking at the role of deep ocean as a reservoir for storage and the transportation of material and the effects of modifications to the Southern Ocean ecosystem, structure and function. Two years ago there was a transition task team put together charged with looking into what would happen to the U.S. GLOBEC programs such as ICED. This task team put together a report to offer guidance on how the U.S. GLOBEC programs that are not ready to end would be merged into IMBER. This report was published at the end of last year as a supplement to the IMBER Science Plan. IMBER currently has four programs, ICED (Southern Ocean), SIBER (Indian Ocean), CLIOTOP (Climate and Top Predators Program), ESSAS (Ecological Studies of Subarctic Seas), and SPACC (Small Pelagics and Climate Change). These programs are re-evaluating their science questions to align with IMBER.

Comparative Ecology of Krill - Hal Batchelder

Bill Peterson is chair of a working group at PICES looking at Pan Pacific euphausiid activities. Dr. Batchelder presented slides covering the following:

- Two cruises in the Yellow Sea (spring and summer) showing distribution of life stages and where individuals were found (on acoustic record)
- Brut size in E-Pacifica (Peterson/Fineberg)
- Average brut size over seven domains (from 66-153)
- An experiment was discussed where water was collected at the Newport line, was incubated at Newport lab at 10.5 degrees and six hour feeding experiments were performed
- Nine experiments on down welling conditions to upwelling conditions, filtration rates on seven of the nine
- Daily ration (increasing from 1% per day to 9%)
- Feeding summary (feeding rates strongly depend on the food biomass available)

Also discussed was the results of three simulations; a basic Nemero, Nemero plus krill with some fraction of the biomass (a stage structured model) and Nemero plus krill plus the correction for mean age.

Pacific Ocean Boundary Ecosystems - Manu DiLorenzo

The goals for this project are to understand, quantify and compare large-scale climate variability and to explore the range of uncertainty in responses of ecosystems and climate change. The ROMS model was used to understand the transport pathways of zooplankton and phytoplankton. A regional model with active tracers was used to define indexes of transport and upwelling statistics. There is growing evidence that the lower tropic levels are sensitive to changes in transport. The hypothesis is if the large-scale climate variability and climate change effect boundaries of the Pacific Ocean, in particular upwelling, mega-scale structures and the transport dynamic.

IPCC Climate Models - Nick Bond

Using high-resolution ROMS driven by the climate models, most of the work is in the North Pacific; there is a link between the big models and what ROMS is showing and using those relationships that are derived from other climate runs to anticipate what the mesoscale distributions are going to be. This work is very much in progress. There seems to be not enough interannual variability compared to the observations, one explanation for this is there is artificially too much diffusion.

Population Dynamics - Loo Botsford

A recent result to variability of generational time scales is there is an increase to sensitivity to variability at low frequencies. An age-structured model was formulated to plot the sensitivity of a cope salmon population to various frequencies of variability in the environment. Salmon population and cod population is being driven with white noise at various fishing levels over a period of four years. As the population is fished harder and harder the cohort resonance starts to show up in cod. The cod population spawns over a narrower and narrower span of ages. The second important characteristic of this is the mean of both seems to be variant with time from heightened sensitivity to low frequency variability. This is white noise forcing, no real decadal signal other than what is randomly occurring.

Copepods in a Warming Climate - e-Davis

Copepods in the Arctic climate on the North Atlantic systems. The Arctic model was coupled with the regional model through the North Atlantic model. The goal is to better understand the biological mechanisms that determine how global warming effects population of the copepod species in the Arctic and North Atlantic region. An example of *centropages typicus* was shown for 1999. In order to get the model to match the data, cannibalism needed to be invoked on the eggs. Vertical migration behavior was also invoked to match the data. Another slide showed a projection of the population based on the static population growth given IBCC scenarios from climate change, warming and also the effect of that warming on patterns using Richardson's CPR data. This is a new paper in progress for an article in Oceanography, the lead author is Christoph Steger. Projected population increase from present to 2060, pseudocalanus in the Gulf of Maine and Georges Bank area and in the North Sea, you get wither little change or decrease in pseudocalanus population growth whereas *centropages* in 2060 relative to present is going to increase in both regions. We are modeling the different population dynamics of *centropages typicus* in two northern regions, Gulf of Main and the North Sea and two southern regions, Mid Atlantic and Mediterranean. Models for the Gulf of Maine and the North Sea are already done; a collaboration with Carlotti is being established to create a 3D model.

End to End Energy Budgets

In a comparison between the Southern Ocean, Georges Bank, Coastal Gulf of Alaska and California Current System, each of these regions' food web models have been developed for all four regions. A meeting was held this past May where column metrics were developed where information can be extracted from the data for all four regions and a comparison can be made across all four regions. Another meeting is scheduled for early next year where cross-regional comparisons will be discussed. A CAMEO proposal provided funding for a workshop that was held this past April at Woods Hole looking at issues related to end to end models. The report from that workshop has been put on the CAMEO website and there will be a special issue in Oceanography.

Climate Forcing of *Calanus Finmarchicus* - Dennis McGillicuddy

What sustains the mean distribution of *calanus finmarchicus* in the North Atlantic? There are three self sustaining populations of *calanus* in the North Atlantic, Western North Atlantic gyre, Northern North Atlantic gyre and the Norwegian Sea gyre. There is evidence of these three populations from the CPR data, especially in the summer months. The first phase of the project is asking the question how do these population centers maintain themselves via a formal mathematical inversion on the CPR data together with the ROMS circulation model of the North Atlantic. We are in the process of going back and conducting a detailed flux diagnosis to look at the actual flux between the population centers and in particular looking at An Bucklin's genetic data to compare the model solutions and quantify the flux from a genetic point of view. The next steps are to examine the inverse solutions of the parameters of the estimation procedure, skill assessment and begin to assess mechanisms of immersion from diapause and entry into diapause.

Estimating Ecosystem Model Uncertainties - Zack Powell

We are attempting to use Bayesian techniques to try and estimate what the uncertainties are in the ecosystem model results that many of us calculate. Most of the effort right now is in the coastal Gulf of Alaska. Where the Bayesian hierarchical model learns in various parts of the coastal gulf we now have good notions of what the actual probability should be for those models. Seven of the thirteen model perimeters were presented on a slide presented showing the probabilities compared to the actual data. We are in the last stages in the coastal gulf and the California Current and we look forward to looking at the data for perimeters in models that we have worked with as well as those in other presentations.

The Effect of Varying Freshwater Inputs in the North Atlantic - Dale Haidvogel for Avijit Gangopadhyay

This piece is somewhat of a companion piece to Dennis McGillicuddy's presentation earlier. The focus is on the North Atlantic Arctic system and specifically on effects of varying freshwater inputs, hydrologic cycles and it's likely changes in the future and the ecosystem changes from that. The freshwater budget in the Arctic North Atlantic combined systems is not an easy problem. Getting components of salinity and freshwater cycle right in almost any ocean setting is very difficult. It is standard practice in climate simulations to include weak restoring terms to temperatures and salinity and tie them down to known climatologies. We are looking at non restoring models of the Arctic North Atlantic and beginning to look at how well we can see the freshwater cycle. We are also looking at the proposed three gyres of *calanus*, the North Atlantic and projected trends in variations in ecosystem expectations based on IPCC projections. We are using a high resolution version of the North Atlantic model that Dr. McGillicuddy's project is using. Hindcasts for the decade of the 90s using ROMS model with various hydrologic components (active sea ice, river inputs, etc.). We are collecting various graphic and other datasets for extensive validations of that decadal simulation. This is an extensive calculation we have been running at NCAR on their system, we have seven years of simulation that has been completed on the physical simulation side. Three years have been validated. We have been looking at a lot of different measures of success and we are very much interested in hydrologic properties and the evolution of those properties over time.

Calanus in the North Atlantic and North Pacific - Dale Haidvogel for Jeff Runge

This project has been looking at life histories and models for calanus species of the North Atlantic and the North Pacific and their responses to climate forcing. There has been a great deal of involvement in symposia and ocean sciences workshops, four journal articles and three book chapters either published or accepted. They are beginning to look at scenarios of climate change and impacts of production of subarctic copepods, calanus finmarchicus in the Gulf of Maine and regional scale climatological forcing of calanus finmarchicus. We are doing this with individual based modeling of calanus finmarchicus and calanus pacificus and are very much interested in the queues that lead to dormancy decisions and in particular hypothesis that decisions to enter dormancy are queued by the level of lipid in calanus. There is a stage specific model in which the developing calanus have reached a certain threshold of lipid.

Final Symposium

The document "U.S.GLOBEC Final Symposium and Celebrations was reviewed by all in attendance. The Symposium will be held at the AAAS facility on October 4 and 5 2011.

Dale Haidvogel will develop a few general sentences for the invitations to speakers. Once the verbiage is agreed upon, the invitations should be tailored to each invitee.