27 Minutes -- 10-12 September 1996

U.S. JGOFS Scientific Steering Committee Meeting

East-West Center, University of Hawaii, Honolulu, HI

Attendees

SSC members: M. Abbott, D. Archer, R. Bidigare, A. Dickson, S. Doney, H. Ducklow (Chairman), S. Emerson, R. Feely, W. Gardner, M. Landry, C. Lee, J. McCarthy, J. Murray, B. Prezelin, P. Quay, J. Sarmiento, D. Siegel, W. Smith

Time-series programs: D. Karl, A. Knap, A. Michaels, L. Tupas

Planning Office: M. Bowles, H. Livingston, M. Zawoysky

NSF: D. Rice, P. Taylor

Guests: J. Alberts, ASA; R. Lukas, U. Hawaii

27.1 Introduction

Chairman Hugh Ducklow opened the U.S. JGOFS Scientific Steering Committee (SSC) meeting, held at the East-West Center, University of Hawaii, with a welcome to new members and introductions around the room. He also complimented David Karl and his colleagues in the Hawaii Ocean Time-series (HOT) program on the HOT-75 Symposium, held the day before in the same location. Dave gave a brief introduction to the East-West Center and various facilities of the University of Hawaii and invited attendees to a reception to be held the following evening at the Aloha Towers on the Honolulu waterfront.

27.2 Synthesis and Modeling Project

Jorge Sarmiento gave a progress report on the U.S. JGOFS Synthesis and Modeling Project (SMP) and a presentation on the SMP workshop, held Aug. 13-19 at The New England Center in Durham, NH. The workshop, attended by 52 field researchers and modelers, was organized by the committee that is responsible for directing the SMP. Jorge serves as Chairman of the SMP committee, and Robert Armstrong (Princeton University), as Project Scientist. Other committee members are Richard Barber, Eileen Hofmann, Marlon Lewis, Dennis McGillicuddy, Anthony Michaels and James Murray.

Jorge listed the charges to the SMP. They are, in brief:

* To plan and direct synthesis and modeling activities that apply the knowledge gained from field programs and satellite observations to the pursuit of the goals of JGOFS;

* To advise the SSC on potential field studies that would explore new ideas or fill important gaps in knowledge;

* To work with the SSC to encourage the cross-fertilization of ideas and the dissemination of knowledge from synthesis and modeling activities through workshops and publications;

* To serve as a counterpart and liaison to the Global Synthesis and Modeling Task Team of the JGOFS program and to other relevant international programs.

Jorge said that the committee hopes to complete the first draft of the SMP Implementation Plan this fall. He hopes to see a first National Science Foundation Announcement of Opportunity for synthesis and modeling proposals by Jan. 1, 1997, a proposal deadline of April 1, reviews in by October and funding decisions by January 1998. To meet this schedule, the SMP implementation plan will have to be completed this fall. He also presented a resource summary that showed a rise in projected SMP funding from $1-2 million in FY 1998 to $5 million in FY 2002.

The SMP workshop had the following objectives:

* To present and discuss critical knowledge gained from JGOFS field programs, focusing on how this and related knowledge will allow development of regional and global syntheses and models;

* To determine the nature of the syntheses that must be achieved within each U.S. JGOFS study area to enable results from these areas to be scaled globally;

* To develop and endorse a set of specific objectives that can be attained within the time frame of the SMP;

* To write an implementation plan that will guide future SMP activities.

The workshop began with a series of overview presentations on the various U.S. JGOFS field programs and continued with discussions of preliminary carbon budgets and the mechanistic controls on these budgets for each study area. Discussion of critical knowledge gaps, listed in the agenda, was eliminated in favor of allowing attendees to break up into small groups at the end of the workshop to discuss extrapolation (scaling up) and to develop objectives to be attained by the SMP.

Jorge described the workshop as a great success, with good cross-disciplinary discussions and serious efforts at writing parts of the implementation plan. Cindy Lee agreed with his assessment and noted her surprise at the differences in terminology and outlook between modelers and field researchers.

Dave Siegel asked what resolution was needed to provide accurate predictions for policymakers of the ocean's response to changes in atmospheric CO2. Jorge noted that the question of setting numerical goals for predicting the air-sea flux of CO2 had come up for discussion. Steve Emerson pointed out that the time scale makes a great difference in budget making; carbon budgets are more likely to balance over the long term than in the short term.

In response to an observation about the impact of critical gaps in knowledge on budget making, Jorge asserted that identifying knowledge gaps would be an important contribution of the SMP. Jim McCarthy observed that U.S. JGOFS was breaking new ground by designing a "process study that is not going to sea" at a time when huge changes were beginning to take place in the anthropogenic carbon inventory.

Jorge continued with a description of the Intergovernmental Panel of Climate Change (IPCC) 1994 scenarios on changes in atmospheric CO2 concentrations up to 2300. IPCC provides advice to policymakers working on framework conventions on atmospheric gases; its scenarios attempt to show how much carbon the ocean and the terrestrial biosphere will take up under given climate conditions.

The IPCC calculations of ocean uptake are based on a simple model of CO2 invading the ocean that assumes no changes in ocean circulation. This assumption is not reasonable, Jorge said, showing evidence from modeling runs that deepwater circulation in the ocean collapses sooner or later under various climate change scenarios. Results from modeling exercises conducted by his research team suggest, however, that biological processes mitigate considerably the effects of greenhouse warming on the capacity of the ocean to take up CO2. The sensitivity of the air-sea flux to biological processes in the ocean increases as time passes and atmospheric CO2 levels increase; the reason is the drop in buffering capacity with the decrease in availability of carbonate ions in the ocean.

If biology really does matter, where does it matter most? Modeling results for various regions point to the Southern Ocean, Jorge said. He reminded the SSC of the disagreements between modelers over whether the sink for atmospheric CO2 in the northern hemisphere was terrestrial or oceanic and stressed the importance of developing a better understanding of the spatial distribution of sources and sinks. He went on to describe the ways in which the biological and solubility pumps and the mechanisms for partitioning carbon between the atmosphere and various layers of the ocean are represented in his model.

Returning to the draft SMP Implementation Plan, SSC members engaged in a lengthy discussion of goals and language, focusing in part on the definition of "prediction" and its merits as an SMP goal. Members also discussed the organization of the plan and made suggestions for improving it. Andrew Dickson asked how one would assess the success of the program and suggested that it be spelled out in the plan. Jorge pointed out the SMP goals and program elements as they were currently stated.

Noting that the document was a combination of science and implementation plans, Hugh Ducklow suggested a revision in the organization of the plan:

I. Introduction

II. Synthesis of JGOFS results

a. carbon stocks

b. balance of fluxes

c. mechanisms and controls

III. Extrapolation and prediction

a. local to regional

b. regional to global

c. parameterization

d. other issues

IV. Implementation

a. JGOFS results

b. extrapolation and prediction

Jorge expressed his willingness to reorganize the plan along these lines if that was what SSC members wanted. Steve urged that the document bring out discoveries made and problems identified. But Mike Landry cautioned against stressing what we don't know with regard to the Southern Ocean, since the study has not been done yet. Jim McCarthy noted that what we don't know can be divided into three classes: things solvable with more work along current lines, things needing new approaches, and things beyond our scope. The plan needs to reflect the iterative nature of the relationship between what we have learned and what we don't know.

Jorge said that the whole document will be available in a document work room via the resuscitated OMNET and via the U.S. JGOFS Home Page. He and other committee members will be working on it and will welcome comments.

Hugh Ducklow stressed that the SSC must approve and ratify the SMP plan before the first announcement of opportunity for proposals goes out. The SMP is a managed project like a process study, he pointed out. It has a committee created by the SSC, a coordinator, and a set of goals against which proposals will be measured, at least in part. New announcements of opportunity may be issued

from time to time. He also suggested that the SSC would have to keep an eye on the progress of this project and perhaps appoint an oversight committee with some outside members, similar to that of the time-series programs.

Noting the value of the recently completed workshop, Cindy Lee asked whether there could be more synthetic workshops. Hugh Livingston said that there were funds in the planning office budgets to support such efforts. Andrew Dickson asked whether these workshops could be regarded as the "cruises" of the study; Cindy agreed.

Mark Abbott suggested that the goals outlined in the SMP Implementation Plan be made more quantitative and that the importance of continued interaction between field researchers and modelers be emphasized.

Barbara Prezelin asked whether the NSF budget would affect the implementation time line. Don Rice said that the amounts projected were not set in concrete; they could be nudged upward. Phil Taylor pointed out that the first awards for proposals would be made in FY 1998. Dick Feely urged the SMP planners to seek support from agencies other than NSF, especially NOAA.

Hugh Ducklow pointed out that the plan does not belong to NSF; the agency does not review it. It will be issued as a planning office document in the same style as the implementation plans for the Arabian Sea and Southern Ocean process studies. Jorge expressed his expectation that the document would be modified considerably before it was finished and his hope that people would comment quickly so that a redrafted plan could go onto the Web via the U.S. JGOFS Home Page. Duck noted further that everything would be reviewed and approved by the SSC before the plan was published.

27.3 Time-Series Oversight Committee Report

Jim McCarthy, chairman of the U.S. JGOFS Time-Series Oversight Committee, reported on meetings held this year at the HOT and BATS sites as part of the periodic review of these programs. The accomplishments of these programs have accelerated in recent years, he said, noting that it is hard to imagine teaching a course in biological oceanography without reference to HOT and/or BATS. He also complimented the leaders of the time-series programs, Dave Karl and Tony Knap, for amply justifying the faith put in them.

The oversight committee, composed of Dave Archer, Jim Bishop, Francisco Chavez, Scott Doney and Jon Sharp as well as Jim McCarthy, has submitted a report, included in the SSC briefing book. The committee is very pleased with the time-series programs overall, Jim said. It recommends one final review in 1998-99.

Among the committee's recommendations are continued progress toward comparability of measurements and careful documentation and justification of differences in methods. Findings and recommendations for five kinds of parameters are detailed in the report. The ongoing difficulty of

securing a suitable vessel for the HOT program continues to concern the committee.

Jim noted improvements in the creation and distribution of data products. He also pointed out that ancillary investigators at HOT and BATS have not contributed their data to the U.S. JGOFS Data Management Office and recommended that they be asked to do so.

Following Jim's report, SSC members discussed the pros and cons of exchanging samples between the sites as a means of achieving comparable measurements. Bob Bidigare reviewed the exchange of pigment samples and the whole approach to intercalibration. Dick Feely raised a number of concerns about measurements of carbon system parameters.

27.4 Response To Time-Series Report

Tony Knap responded to the report of the time-series oversight committee on behalf of both BATS and HOT, expressing appreciation of the committee's efforts. A written response will follow. He agreed that a common manual for both sites was a good idea and noted that many other recommendations contained in the report were already being implemented. A better statement of what measurements were core and what were not was reasonable, he added.

Efforts were underway to reach agreement on a common approach to microbial measurements, he continued. Method changes were not undertaken lightly; a year's overlap was necessary when changes were made.

Tony acknowledged the value of written data reports but pointed out that they were a lot of work. Electronic reporting of data within six months was reasonable, he said. He and Dave Karl agreed to pursue the collection of data from ancillary investigators.

Ship time remains a problem. The Bermuda program has its own ship, but demands for time are rising. Tony commended Dave for his continuous effort to obtain ship time for the Hawaii program. He also mentioned the value of having moorings at each site and the need for more funding for moored instruments.

The value and reliability of floating sediment trap measurements continue to be much debated issues. SSC members discussed at length both the methodological problems associated with traps in general and the merits of using them at the time-series sites. Wilf Gardner pointed out that neither HOT nor BATS have followed the recommendations of the trap review session conducted at the JGOFS meeting in Villefranche two years ago.

Hugh Ducklow noted the ongoing need for some way of measuring short-term carbon export. Steve Emerson argued for the use of oxygen and carbon-13 mass-balance approaches but acknowledged problems in using them on a short time scale. With regard to the use of thorium measurements for this purpose, Tony Michaels pointed out the problem of conversion to carbon. Jim Murray noted that

thorium measurements had been used with sediment trap measurements in the Equatorial Pacific Process Study.

Observing that methods have improved over the years of JGOFS, Paul Quay pointed out that we have more ways now of evaluating the validity of measurements and that solving this problem could be part of the SMP effort. Duck noted that the report recommended that such questions be addressed in the SMP and drew attention to a particular recommendation that moderate-scale regional process studies for the time-series be considered as a component of the SMP phase of U.S. JGOFS. Dave Karl raised the problem of the expense of such an experiment and suggested that it should perhaps be a post-JGOFS effort.

SSC members agreed that they would have to speak up on the subject of HOT's ship problem. R/V Moana Wave is scheduled to be retired from the UNOLS fleet and may not be scheduled at all next year. Cindy Lee urged the SSC to send a letter before the UNOLS ship meeting in a week or so. Duck, Tony and Dave agreed to do so.

27.5 Future Home for Time-series Programs

Hugh Ducklow and Dave Karl reported on a meeting held in July in Madison, Wisconsin, to consider the merits of a common future for the NSF-supported LTER, LMER and U.S. JGOFS time-series programs. The meeting, organized by Bruce Hayden of the University of Virginia and supported by NSF, recommended that NSF expand the LTER program through open competitions for sites representing land-margin, oceanic and other marine systems. Dave said that he and Tony Knap had been pursuing this possibility for several years. Duck, Tony and Dave attended the meeting, as did Barbara Prezelin and Tony Michaels. NSF participants in the meeting included Phil Taylor and Mike Purdy from OCE and Polly Penhale from OPP.

Phil noted that he had circulated a white paper at NSF on this subject some two years ago and got a response after 18 months from the LTER program. OCE is very much in favor of this solution, he said. The time-series programs have new proposals in now for the next three years, leaving plenty of time to explore the possibility, he added. Funding would still come from OCE if the U.S. JGOFS time-series programs went into the LTER network.

Tony Knap mentioned the ecological focus of the LTER and suggested that some of the physical measurements made at BATS and HOT could be split off and made part of GOOS (Global Ocean Observing System). Tony Michaels pointed out the "leverage" associated with status as an LTER site. They attract lots of other proposals and funding, he said. Mark Abbott asked whether the LTER was the best home for the time-series programs, noting that agencies like EPA have little interest in ocean studies.

Duck noted several preliminary moves. Chris Hammond has been contacted about data management matters. She and others may attend some LTER meetings.

27.6 Updates from BATS and HOT

Tony Knap began his presentation by reporting that BATS executive scientist Tony Michaels was leaving Bermuda for a new position on the west coast. Craig Carlson will take over responsibility for core measurements; Nick Bates, for carbonate system measurements; Debbie Steinberg, for biological measurements; and Rod Johnson, physical measurements and

technical matters.

Tony outlined the 1998 renewal proposal to NSF. He described activities associated with the new testbed mooring located near the BATS site and listed participants in the testbed program and their projects. He also mentioned Dave Siegel's optical research.

Dave Karl reviewed 1996 field operations and plans for the next year as well as the HOT symposium held at the East-West Center the day before the SSC meeting. HOT has had R/V Moana Wave all year and will have her through June 1997; nothing is set past that date. He described the new mooring, aptly named Hale Aloha, and listed the various instruments and researchers associated with it.

The HOT renewal proposal is for three rather than five years (1998-99, 1999-2000, 2000-01). Budgeted totals average around 900,000 per year.

Dave also described an upcoming international time-series workshop in Dichato, Chile, supported by the Inter-American Institute for Global Change (IAI). Mark Abbott, Ricardo Letelier and Dave are the organizers, along with several Chilean colleagues. Some 14 North American scientists are expected to attend.

27.7 Forward Planning

Steve Emerson introduced and led a discussion on the present status of planning for ocean science programs after the present suite of Global Change focussed programs such as JGOFS finish. The idea was to review the various issues involved to see if any input or action from the U.S. JGOFS Steering Committee was appropriate and useful.

To start off the discussion, Roger Lukas presented an in depth review of the evolution of CLIVAR - as an example of a new large climate program growing out of the efforts of past and present large programs - such as WOCE, TOGA and GEWEX. He reviewed the national and international aspects of the planning for CLIVAR, noting the considerable U.S. involvement in the planning process. Through interaction at international levels and feedback with national activities in the U.S., such as the National Research Council, a set of goals was articulated. Timing of the end of present programs and startup of CLIVAR had the potential to create a funding crunch. He recounted the series of meetings which led to an Implementation Plan for CLIVAR. He noted that it is viewed in the US as a 5 year program, but that

it was expected to adapt throughout its life. The key need was the setting of the principles upon which the program lay. The whole process was characterized as an iterative one in respect of U.S. and international activities. Roger's general recommendation was to go ahead with a definition of what science was needed to underpin the general principles and to seek linkages wherever possible with NRC panels. Following the presentation there was a general discussion of planning strategy. Roger noted that U.S. initiative was no longer a critical driving force behind program evolution and noted the role of the European Union and Japan. Finally the question was raised of whether a biogeochemical component could be included, but it was recognized that this might be beyond the program's scope, and that clear lines of program limits were usually required.

Following the CLIVAR presentation, Don Rice gave his perspective of the view from NSF of long term planning issues. He noted the two driving mechanisms - the political process and input from science. He noted that the $10M budget from NSF/OCE for JGOFS was part of the Global Change Research Initiative and, while future funding was a matter for the Congress, there was an implicit assumption that there would be some support available for a large program after JGOFS ended. The situation was under discussion at present and the outcome was not yet clear. He noted that the U.S. JGOFS group could provide useful input to the formulation of a future science program, if appropriately directed through the National Academy of Science. Phil Taylor added some remarks that also noted little progress on this matter at NSF so far and said that JGOFS should complete program synthesis while becoming involved in discussions about future programs. Following this account of the view from NSF some questions to Phil and Don confirmed that there was as yet no forward planning document such as a Long Range Plan although this is up for discussion. Steve Emerson asked if there was community consensus against a large program, would NSF listen. Noting that such consensus was unlikely, the question was academic and Don Rice gave a hypothetical positive answer.

Following these introductions to the topic of forward planning, opinions, questions and comments were solicited from the Steering Committee. Jorge Sarmiento started by noting the driving force represented by the U.S. signature at the convention on CO2 emission controls. This seemed to him to point to a need for basic research to understand the fate of future CO2 levels. He noted the need for new techniques to cover the issue of gaining adequate temporal and spatial coverage.

The issue of small group science was discussed at length, with several people noting the efficiency and quality offered by this approach in the past. Jim McCarthy asked Don Rice and Phil Taylor whether they would funnel unexpected additional dollars into tightly focussed group efforts or individual ones. In response, Don noted that $2M more per year would allow funding of all quality JGOFS proposals but twice that amount would be needed to support good quality core proposals. Phil noted that the imbalance between JGOFS and core was worse in Biological Oceanography.

Other topics raised as important in the forward planning process were paleo-oceanography and ocean margins. It was noted that the latter were being addressed though an International JGOFS element and that margin physics was being done in the U.S. by several programs. Several people noted the need for focussed goal definition, e.g., Jim Murray mentioned that we are at the start of a decade which will see a major increase in atmospheric/ocean CO2 and the effects of required study. The Synthesis and Modeling

Project might provide a framework to address this issue. The discussion on the issue of small group/ large group science ended with Steve Emerson noting that he heard that the small or individual approach to these large questions, while worthwhile in and of themselves, took a significant risk of falling short of answering all questions that a tightly focussed larger effort could address.

Jim McCarthy then reviewed the evolution of JGOFS, from its early origins in discussions in workshops in the late 70's, through growth in 81/82 as new technology (satellites/computers) became available, to the critical National Academy 1984 workshop where the community signed on to the concept of, then, GOFS. He noted the important role of the NRC and that thereafter, with help from IGBP, a high level effort to double the NSF budget, in respect of Global Change research, came about. This lead to a large scale migration of P.I.'s from NSF core into the large programs. He argued that involvement of NRC committee influence and work through agencies and advisory committees could bring about the new directions required - and that the Synthesis and Modeling Project could help bring out these new directions.

Finally, the question was raised of whether it was appropriate for JGOFS to find a means to communicate its views on these matters to NRC groups looking to future ocean science directions. Don Rice noted no problem from his perspective in this. That being the case, it was proposed that a group be formed, perhaps as part of the SMP, to formulate forward planning views. Hugh Ducklow proposed that this be on the agenda for the next meeting of the Steering Committee.

27.8 Arabian Sea

As Sharon Smith was unable to attend this meeting, Cindy Lee presented an account of the highly successful Data Workshop which had been held one month earlier. The flavor of the meeting was the initial excitement as P.I.'s first began to see how their early results fitted with those of others. She chose to highlight several observations and surprises, e.g., that the monsoon was climatologically about average, that primary production in the two monsoons was remarkably high and widespread, did not vary as much as expected in space and time, and that sediment traps collected record fluxes in the NE monsoon. One key process noted as affecting the difference in levels of particle flux between areas of similar primary productivity was the role of microzooplankton grazing. The SW monsoon trap samples were noted to contain high levels of diatoms. Cindy concluded the presentation with some observations of carbon export and summarized the main conclusions of the workshop (Appendix 1). The workshop participants found the setting for the meeting to be ideal and as a result the next Data Workshop has been scheduled at the New England Center for July 1997.

27.9 Southern Ocean Process Study (AESOPS)

Walker Smith brought the Steering Committee up to date with news of the start of the field program in the Southern Ocean. He reviewed a) ship operations b) ship schedule and c) initial successes and problems.

Due to bad ice conditions, the 64°S survey area had to be abandoned, however data were being collected and he showed some of the underway pCO2, nitrate and silicate data. He noted that there was considerable mesoscale variability in the Polar Front region.

Some changes to the schedule were noted and the next cruise planning meeting will be March 17-21, 1997. Also it had just been announced that the R/V Thompson will indeed be the UNOLS vessel in the second field summer cruises.

Amongst the successes noted were: collection of cores in the Polar Front region, transfer of the CTD/ nutrient data processing system from the Thompson to the Palmer and deployment of 3 drifters. Problems included: abandonment of the 64°S survey, instabilities in the O2 and salinity instruments and problems with ADCP, SEABEAM and PAR sensors. He was optimistic that most of these problems would be overcome.

Although it actually took place in the SMP discussion, Don Rice was asked to address the question of resources from the perspective of projected NSF budgets. He noted, first of all, that the Southern Ocean study (AESOPS) would definitely have R/V Thomas G. Thompson as the UNOLS ship for the study. According to current plans, AESOPS will cost roughly $23.5 million over four years (FY 96, 97, 98, 99). NSF's Ocean Sciences Division (OCE) and Office of Polar Programs (OPP) have agreed to split the cost of AESOPS evenly, although OPP will spend more during the first two years, and OCE, more during the second two years. AESOPS is expected to cost slightly more than the recently completed Arabian Sea process study.

Don showed an overhead with figures covering all elements of U.S. JGOFS over the next four fiscal years but cautioned against regarding these amounts as certain. If OCE has a flat JGOFS budget, all will be well, he said, but there are no guarantees that the budget won't be cut. His figures for support for the SMP from FY 1998 through FY 2000 were similar to the ones mentioned by Jorge at the beginning of his presentation.

Jon Alberts (ASA) then gave a presentation on ASA's support role of operations in the Antarctic including details of their operating procedures. He concluded by showing an interesting video of the R/V Nathaniel B. Palmer in operation in the Antarctic ice.

27.10 Equatorial Pacific Process Study

Jim Murray gave an update of activities emanating from the Equatorial Pacific Study - noting that it was now a mature program well into its synthesis phase. A second Deep-Sea Research volume is about to be released and the third is well underway (this latter being a mix of synthesis and multi-authored papers - several being second generation). It will also include papers from the international EqPac meeting held last year in Noumea.

He also described a zonal flux cruise he had been involved in last April along the Equator. All the

JGOFS core measurements were included and the cruise provides a link between U.S. and French work in the region. The results, in cold tongue conditions, permit an El Niño/La Niña comparison and will be featured at the TOS meeting next April.

Dick Feely then provided an update on the continuing NOAA work in the the region, showing CO2 and pCO2 fluxes along a zonal section, and sea surface temperatures in an area bounded by 2°N and 2°S. The data show dramatic interannual variability and provide estimates of CO2 evasion under both El Niño and La Niña conditions. Careful analyses of data since 1960 in non-El Niño periods show a rise in pCO2 averaging 1.5 microatmospheres/year. Dave Karl asked if the NOAA ship could run pCO2 as it passed the HOT Kahe Point station and hence allow a tie-in of the NOAA and HOT data. Dick said this could be done and was a good idea.

The EqPac session concluded with Paul Quay presenting a repeat of the talk he had given at the August SMP meeting on carbon balance in the Equatorial Pacific region. Some conclusions were: 1. that closure of the DIC budget was possible in spring but not fall, 2. there were substantial differences between carbon fluxes (from new production) in spring/fall, 3. in the non-El Niño situation, DIC supply was balanced by organic carbon export, 4. DIC export was significantly less then POC export, 5. GCM derived carbon fluxes produce overestimates of DOC production rates.

The mix of estimates and data stimulated a spirited discussion of problems and disagreements - in particular, bringing up, inevitably, issues associated with sediment traps. Wilf Gardner went on to summarize the State of the Traps as articulated at the JGOFS meeting in Villefranche. He noted the recommendation that there be a 3D experiment at BATS, which has not taken place due to difficulties in support. The validity and usefulness of floating traps was discussed again, noting questions associated with swimmers and the use of brine. And finally the issue of trap calibration using Th was mentioned. Dave Karl noted that he was amenable to comparisons between different methods and Tony Knap said the Th work should be tied to this. He said that, if there was a Time-Series Plus recommendation for a Science Plan to address these problems, it could perhaps be proposed as part of the SMP program. Noting the time and effort spent on floating trap work, both in the past and in the future as part of the continuation of the TS stations, Hugh Ducklow suggested it be made a part of the Time-Series Oversight Report. It was suggested that Wilf work with Jim McCarthy, Cindy Lee, Tony Knap and Dave Karl on this matter and to report back to the SC via e-mail.

27.11 CO2

Andrew Dickson provided the SC with an account of the August 1996 DOE Science Team meeting (though not present there himself). He went on to review recent activities in the CO2 standards project, discussing possible commercial suppliers, methodology documentation etc. For the latter, it was agreed that a link from the US JGOFS Web Page be made to the CO2 Handbook which Andrew maintains on his Web Site. There was also a brief discussion about other standard needs such as nutrients, but it was apparent that the CO2 standards would be unsuitable for nutrients (especially silica).

Dick Feely then gave an account of the Indian Ocean CO2 data sets. He noted excellent agreement between measured and calculated results. He also noted an EOS article which summarizes the results. He continued by giving a comprehensive account of methods used for CO2 data set reporting, evaluation and synthesis. The evaluation was being done on a cruise by cruise basis and included shorebased measurements. Four Working Groups have been established to this end. Plans are to synthesize the global data sets over the next year. Taro Takahashi is leading the effort to combine all new data sets. The 15 year data set total comprises an amazing 225,000 data points. He showed some beautiful seasonally resolved global CO2 maps made from these data sets. This effort will contribute in a major way to JGOFS synthesis and will permit the next generation of comparisons with GCM estimates. He also discussed methods of calculating excess CO2 and estimates of anthropogenic CO2 profiles - which agreed well with freon data. He concluded with positive news about the North Atlantic survey. It looks like it will take place finally, and he showed some of the cruises/sections planned - both U.S. and international.

27.12 NASA Primary Productivity Symposium

Bob Bidigare reported on this meeting - held at Goddard SFC last June. A major component of work in this area is based on a Science Plan which he described. This included a summary, table comparing marine and terrestrial productivity, a series of questions to be answered, definitions of various kinds, relevant models and model comparisons and a final set of recommendations. He mentioned that SeaWiFS is currently scheduled for launch in February 1997.

27.13 Ocean Color Temperature Sensor (OCTS)

Mark Abbott informed the committee about this new Japanese color sensor - launched on ADEOS-1 in August. He noted the sensors aboard, which include the NASA scatterometer (vector winds). He described details of OCTS and note that they may be accessed in full via the National Space Development Agency of Japan (NASDA) Home Page, (www.eoc.nasda.go.jp).

27.14 Committee Rotation

Hugh Livingston reported on the results of the 1996 Steering Committee rotation process. The six people who had topped the list in the final vote tally were: Scott Doney, Dennis Hansell, Tony Michaels, Paul Quay, Doug Wallace and Rik Wanninkhof. The committee was invited to comment on the process and its result. The committee was satisfied with both the process and outcome. After a unanimous vote, the rotation recommendations were quickly adopted.

27.15 Archiving

Sharon Smith had asked that the issue of program archiving be addressed and had put a paragraph on issues in the briefing book. It was quickly apparent that the SC agreed with the need and there followed discussion of how this might be done. Andrew Dickson gave one view of the need. As to data, it

appeared that archiving issues were on track (CD ROM's, NODC etc). The various reports and the Newsletters were obvious archival candidates and records of budget profiles would be of value to future program planners. Also, students of the History of Science would have interest in such an archive. He proposed that the U.S. JGOFS Office be asked to collect materials suitable for archiving and that the SC, or a sub-set of the JGOFS community select the materials for archival. Others agreed and it was felt that a site at a major oceanographic institution should be selected. The Marine Biological Library in Woods Hole was suggested as a good candidate site - noting that it already received and held materials distributed by the Planning Office. It was even mentioned that it was not impossible that a professional archivist might be found with support to take on the task.

27.16 1997 Synthesis and Modeling Process Workshop

Jorge Sarmiento invited discussion on the second SMP meeting - in 1997. He suggested that there be discussion on this on e-mail: size, focus, place, invitees, etc. On the invitations, there was concern that these meeting be broadly represented (i.e., no closed shop). Several methods of publicizing this were mentioned - newsletter, Web site, etc. Another idea was an article in EOS and it was suggested that Jorge put one together. In response to questions, Don Rice thought that several target dates for Announcement of Opportunities in Synthesis/Modeling would almost certainly take place. Several issues which might need stated as objectives included: mesoscale variability around HOT and BATS, sediment trap questions, etc. Funding for these was noted to be very dependent on the scale of the SMP project. The role of physics in assessing variability was recognized, e.g. SEASOAR, but to involve this in the SMP seemed unlikely and more probably should be dealt with under Forward Planning.

27.17 Steering Committee Meeting Format

Barbara Prezelin asked that this matter be added to the agenda. She had three points in mind. Noting that the meetings are 8 months apart and 1/3 of the committee rotates each year:

1. She suggested that an hour be set aside on the first morning for the committee to get acquainted and to go over its formal charges.

2. At, say, the end of the second day, hold a discussion on what issues had been brought to conclusion, state what had been achieved and what was to happen next.

3. Present a list of recommendations on the last morning.

The committee discussed this and there was broad agreement with Barbara's suggestions. It was noted that the Exec. had been active over the year and it took some time to consider their reports/questions/ recommendations. One example given was how action would be taken on the issue of C/Th calibration of traps. What would be the course of action? The answer given was that after HOT and BATS had time to respond to the Time-series Oversight Committee report that the SC would vote on whether to accept or modify the recommendations.

Following this discussion, Hugh Ducklow noted that there was a genuine need to formalize and communicate the conclusions and actions planned out of the committee meetings. He planned to make sure that changes in the meeting organization would be made to ensure that the committee understood at the end of each meeting just what had been decided.

One other point which came up was that it was argued that the Executive Committee should also vote. This was generally agreed upon and after a unanimous vote was adopted for future committee actions requiring votes.

27.19 Next Meeting

A locale and focus were discussed. Williamsburg, next June 18/20, ended up as the choice. The format will include science elements throughout the agenda - rather than a Day of Science, which was also suggested.

27.20 Other Business

Hugh Ducklow closed the meeting with several remarks of thanks. He began by thanking retiring members of the SC, Bob Bidigare, Dick Feely, Wilf Gardner, and Barbara Prezelin for their valuable contributions to U.S. JGOFS during their terms of office. Dick Feely was moved to respond and noted how much he had been pleased to work on the committee and expressed his thanks in turn. Hugh Ducklow then thanked Jon Alberts of ASA for attending the meeting, Dave Karl and his HOT colleagues for the wonderful way in which they had acted as local hosts, and the Planning Office staff for their work in organizing it all.

Appendix 1.

Preliminary Conclusions

1) Southwest monsoon average (climatologically) in timing and intensity

2) On an annual basis, the Arabian Sea is a net source of carbon dioxide to the atmosphere (27 ppm)

3) Primary productivity much higher than previously measured; 2x in southwest monsoon, 5x in northeast monsoon

4) Contrast in primary productivity between monsoons less pronounced than previously reported

5) Primary productivity was "same" as EqPac, but mesozooplankton biomass greater by 3 or 4x

6) Microzooplankton loop unbalanced in southwest monsoon, balanced in northeast monsoon

7) Bacterial growth pattern different than anywhere else; high at depth

8) Highest trap flux ever measured by Honjo in southwest monsoon when diatoms were blooming

9) Mesoscale physics drive biology and chemistry in the southwest monsoon