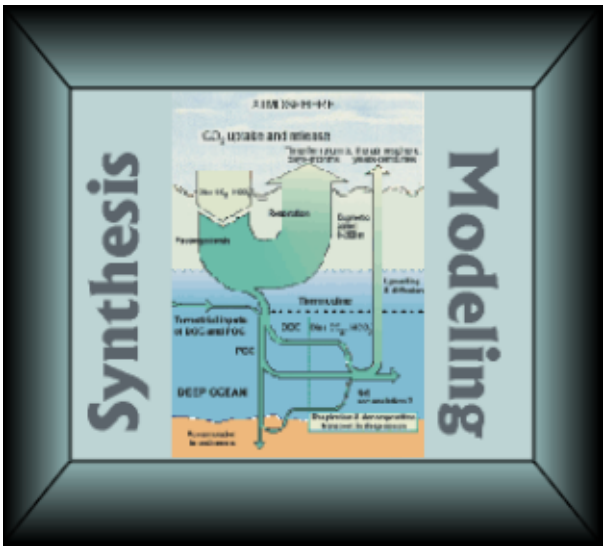

JGOFS developed a plan for synthesising the observations into a picture of large-scale fluxes with the help of mathematical techniques already existing or that must be developed. Two kinds of activity are involved here, although the boundaries between them are not clear-cut. Firstly, interpolation between all the data that are collected will provide a simple assessment of fluxes. Secondly, understanding and prediction will be obtained from the development and application of "hybrid biogeochemical process/general circulation models that can define the current biogeochemical state of the ocean and predict its future evolution in response to global warming and other externally-imposed changes"

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JGOFS Synthesis Plan 1998-2003

Introduction

The Joint Global Ocean Flux Study has been, without doubt, the most successful interdisciplinary biogeochemical ocean project yet undertaken. It transcended cultures, politics and economic boundaries to bring together oceanographic talent, research ships and other resources from all parts of the world. The research elements of regional Process Studies and Time Series Studies are perhaps the most often associated with JGOFS. No less critical

elements of the JGOFS strategy are the surface ocean surveys and the synoptic view of ocean colour made from satellites. The recent satellite data, in fact, promise to revolutionise our knowledge of ocean biological variability. With a successful completion of its observation phase, JGOFS promises to provide an unique data set on the status of the global ocean during 1990s. Along with the observations, significant advances in biogeochemical modelling have found important application in studies of carbon cycling and transport on regional and global scales.

The Joint Global Ocean Flux Study project is now rapidly approaching a closure of its intensive field observations, but the project will not end there. A continuing effort is needed to ensure that the observations are fully exploited to achieve JGOFS scientific goals. One of the many legacies that JGOFS bequeaths to future generations will be extensive biogeochemical and physical data sets collected during its high profile and successful 10-year field campaign that began in 1989. However, future generations will not judge JGOFS on its data sets and its interdisciplinary research alone. The real measure of success will rest entirely on its ability to synthesise its data sets in order to improve ocean carbon models and to be able to predict future ocean carbon cycling scenarios accurately.

Background

The 12th Scientific Steering Committee began restructuring discussions for a global synthesis-modelling phase, which is expected to continue well past the end of its last field campaign. The SSC envisions that the final phase will require 5 to 6 years to successfully complete its two scientific goals and objectives. This phase intends to provide national researchers with the time and resources needed to complete the best possible descriptions and interpretations of JGOFS data sets. The cost of which is expected to be on part of a Process Study. The target date for completion is early 2004.

With the shift from fieldwork towards synthesis, the Thirteenth Scientific Steering Committee restructured the Planning Groups for synthesis, which includes modelling and data products and renamed them Synthesis Groups. In part, they are responsible for the international perspective of national activities over the respective regions. Their goals are (1) to enhance national synthesis efforts, (2) to identify JGOFS biogeochemical data and related data sets in the regions, (3) to assist the development and validation of regional models of ocean biogeochemistry, and (4) to report their efforts internationally. Regional synthesis will provide snap shots of the temporal and spatial scales of the ocean's biogeochemical regimes and boundaries. Rigorous time and space descriptions of the biogeochemical regimes and their boundaries are needed to develop present one-dimensional models into three-dimensional models that can describe the biogeochemical state of the global ocean as it varies in time and space. Biogeochemical data from the fieldwork are being released to the community and appearing at national ocean data centres, on CD-ROMs and/or distributed data systems.

Restructuring the Scientific Steering Committee. The Thirteenth SSC decided that the SSC must participate directly in the integration of the Synthesis Groups and as such agreed to accept additional tasks. The efficacy of the restructure process ensures global integration of regional regimes. The restructured Fourteenth SSC will include ocean carbon and ecosystem modellers, and representatives from the Ocean Carbon Modelling Intercomparison Project (OCMIP) and International Ocean Colour Co-ordination Group (IOCCG).

The Thirteenth SSC also modified Point 2 of its Terms of Reference, to include: (1) Oversee the integration and modelling activities of the four regional Groups and all task teams with similar activities, such as Data Management, CO2 Advisory Panel, etc.; (2) Liase with IGBP Program

Elements and Framework Activities as well as with international ocean programs with extensive ocean data sets and global ocean-climate observing systems; (3) Identify critical scientific gaps in our knowledge of ocean biogeochemistry that may significantly compromise carbon monitoring and modelling carbon in Earth's oceans; (4) Organise synthesis, modelling and training workshops; and (5) Publish international book(s), glossy brochure(s) and other data products.

Synthesis Plan

With these new efforts, the 13th SSC produced a Synthesis Plan with an overarching goal and specific objectives for synthesis that provides a practical guide for assessing success.

Goal

To develop an integrated, quantitative view of the biogeochemical cycle of carbon in the ocean, indicating the roles of biota, physical transport, air-sea exchange and particle settling and remineralisation, and including estimates of uncertainties.

This goal will be achieved through the following products that serve as JGOFS synthesis objectives:

Objectives

1. Ensure that all JGOFS observations are lodged with organisations, which can guarantee long-term stewardship. Provide web-based information on the availability and access mechanisms to all JGOFS data. Encourage the development of Web-based data delivery systems.
2. Create a new synthesis of ocean biogeochemical regimes from the major JGOFS Regional Process, Time Series and Global Survey studies, with special emphasis on biogeochemical processes and ecological community structure, and including the mechanisms controlling primary production, carbon, macro- and micronutrient cycling, and carbon export from the upper ocean
3. Develop a hierarchy of coupled, biogeochemical-physical circulation models of varying ecosystem complexity, and use them to enhance understanding of natural variability and anthropogenic changes in the carbon cycle over dec-cen time scales.
4. Building on Objective 3, assess the capability of 3-dimensional ocean carbon cycle models with biogeochemistry to simulate observed global inventories, seasonal cycles and fluxes of carbon, nutrients and functional groups, and to evaluate current rates of carbon remineralisation and ocean forcing over time scales. The models will be constrained, calibrated and validated using JGOFS and other pertinent global and regional data sets (e.g., JGOFS/WOCE global survey of CO2 and tracers, pCO2, ocean colour, particle fluxes and deep ocean cores)
5. Assess the contribution of continental margins and seas to CO2 sequestration and the horizontal flux of carbon across the ocean - continental margin boundary.
6. Utilise ocean colour observations from satellites, aircraft, moorings, and towed vehicles to provide a global picture of the seasonal cycles of phytoplankton biomass, primary and new production
7. Make recommendations on the development and implementation of future global ocean observing systems for detection of changes in the ocean carbon cycle and impacts on marine ecosystems, as one aspect of global change

At the 10th IGBP meeting, the Officers recommended that mature Core Projects launch a concerted effort towards synthesis of scientific knowledge. To encourage IGBP-wide synthesis, they also invited specific projects to bid for Secretariat funds up to $40,000 per project to aid in the task. Products should be specifically targeted towards the Second IGBP Congress, the IGBP Book Series, the IGBP Science Series, and that culminate at the IGBP Millennium. Within JGOFS, such efforts have started:

(1) SSC and Planning Groups restructured,

(2) Synthesis Plan written, and

(3) Workplan and Timeline tentatively approved (see below)

JGOFS Workplan and Timeline

1998

April	• Thirteenth JGOFS SSC, Cape Town, South Africa. Discuss, develop and approve JGOFS synthesis plan
May	• First Meeting of the North Atlantic Synthesis Group, Southampton, UK. Plan chapter(s) for synthesis and presentation for IGBP congress
September	• First Meeting of the Southern Ocean Synthesis Group, AWI, Bremerhaven, Germany. Discuss/define all Southern Ocean biogeochemical regimes, plan chapter(s) for synthesis and presentations • First Meeting of the Equatorial Pacific Synthesis Group, Seattle, USA. Plan chapter(s) for synthesis book and presentation for IGBP congress • JGOFS Data Management & Synthesis Workshop, Bergen. Review data requirements for JGOFS synthesis and plan development of web-based data archive
October	• JGOFS Executives, General Business Meeting, Southampton, UK • First JGOFS SSC Synthesis Workshop, Southampton, UK. Develop implementation of JGOFS synthesis plan. Produce a synthesis Brochure (1999), draft book (2001), plan presentations for IGBP congress and future meetings.

1999

January	• Jan 18-20 First Meeting of Indian Ocean Synthesis Group, Bangalore, India. Plan chapter(s) for synthesis book and future presentations • Symposium on the Biogeochemistry of the Arabian Sea: Synthesis and Modelling, Bangalore, India • Training Course of Biogeochemical Modelling of the Ocean. Bangalore, India.
May	• Second IGBP Congress/JGOFS SSC meeting, Yokohama, Japan. JGOFS will present papers on overall synthesis and progress reports on North Atlantic, Equatorial Pacific and Indian Ocean syntheses
TBA	• Meetings of the Continental Margins, Deep Sea Flux, and North Pacific Task Teams. Plan chapters for synthesis and presentations at future meetings • Second JGOFS SSC Synthesis Workshop

2000

April	• Second JGOFS Science Conference, Bergen, Norway. Theme: Ocean Biogeochemistry and Climate Change: Synthesis. Presentations on synthesis progress; JGOFS SSC Annual Meeting

2001

TBA	• IGBP Millennium Conference. Keynote talks on JGOFS synthesis. Distribute Brochure. • Summer Publication of JGOFS Synthesis in IGBP Book Series (CUP Press) • Fall Publication of JGOFS Synthesis in IGBP Science Series

Synthesis Workshops

In June, IGBP Secretariat approved funds for JGOFS Synthesis Workshops. The two workshops are dedicated to JGOFS synthesis and related research. The First Workshop took place 25-29 October 1998 in Southampton, UK. The two goals are to produce a glossy JGOFS Brochure (tentative title: Ocean Biogeochemistry and Climate Change), and draft chapters for a Cambridge University Press book (tentative titled: JGOFS Synthesis and Related Research) as part of the IGBP Book Series. This workshop involved most SSC members and invited contributors. Workshop participants contributed with "white papers", figures and illustrations for the brochure and book as follows:

- Ocean biogeochemical regimes
    - Regional primary and new production,
    - Role of community structure and function
    - Water column remineralisation,
    - Air-sea carbon dioxide exchange,
    - Feedback processes in regulating production and exchange,
    - Role of continental margins
    - Role of deep-ocean fluxes,
    - Ocean biogeochemical models,
    - Future ocean biogeochemistry challenges,
- Integrated understanding of carbon cycling in the ocean