



The Earth Observer

An EOS Periodical of Timely News and Events

Vol. 2, No. 2

February 28, 1990

EDITOR'S CORNER

COMMUNICATIONS

Our great plan for communications is not yet purring along. A cross-section through the Project would look like a Rube Goldberg machine. Besides the usual memos, telephone calls, letters, notices, telemail messages, minutes of meetings, trip reports, viewgraphs, handwritten notes, and back-of-envelope calculations, we have all sorts of new methods. You would be surprised at what facts and "non-facts" you get from floppy disks, team meetings, Academy briefings, interviews with Congressional "staffers," TV interviews, videotapes, "insider contractor reports,"..... in the halls of Headquarters, the cafeteria at GSFC, or just plain rumors.

The problem is NOT too few or too many sources; the problem is trying to remember where you learned of something so that you can tie some element of credibility or urgency to it. Has anybody figured out how to do that? Maybe two completely different sources with the same information makes it "true." How about internal consistency, or who sent the memo.

One thing for sure, the Project is already feeling the weight of a terabyte/day of s.....(something). What happens when the real data arrives??

Jerry Soffen

Message from HQ

I have just returned from a fruitful trip to Japan where I met with the Joint Scientific Committee (JSC) of the World Climate Research Program (WCRP) of the World Meteorological Organization.

As most of you are aware, and as many of you are participating in the development of such, the JSC is in the process of defining a Global Energy and Water Cycle Experiment (GEWEX). Because of the great potential contributions of EOS, and especially LAWS, plus the contributions of ADEOS and TRMM to the objectives of GEWEX, both the Japanese and myself were invited to participate in this meeting. The Japanese continued to express strong support for Global Change, GEWEX, and Earth System Science remote sensing measurements.

As I have expressed in the past, for the Global Change Program to work on a global scale, we must develop working agreements and data exchange policies with our international partners. I was very impressed with the Japanese interest and proposed contributions, not only to the space segment, but also to the data and science elements of these proposed programs for the next decade.

Shelby Tilford

SEC Meets

The Science Executive Committee (SEC) met in Washington, DC, January 30, 1990. Topics of this meeting were updates from the Program and Project Offices, the IWG charter, SEC/IWG panel reports, and Level 0 requirements.

The Earth Observer

There is encouraging news about the administration's FY 1991 budgets for global change research and for EOS. NASA's budget for global change is \$661 M, and, the number is over \$100 M for EOS (aside from platform funding). Earth Probes is to have its new start this year, with \$25 M as start-up money.

The first EOS platform will be launched in FY 1998, and Len Fisk has said that development of EOSDIS will begin immediately. He believes that SAR is an absolutely necessary part of the program and will be seeking a new start for it in a year or two.

Jerry Soffen is considering the addition of science reviews to the instrument Concept Development and Cost Reviews (CDCRs), which are planned for this spring and summer. Interdisciplinary investigators and instrument investigators who do not have a conflict of interest would be invited to participate in these reviews.

The Payload Advisory Panel plans to have its final meeting during the week of August 27 in order to

NAS Committee on Global Change will conduct the second review, which was requested by the President's Science Advisor, Allan Bromley. This committee is to make its final report by July 1. Issues to be considered are simultaneity, big platforms, appropriateness of EOS science for global change, long-term costs, and whether, in general, EOS science can be accomplished on a smaller scale that would be faster and cheaper.

The current findings of the Payload Advisory Panel came in for considerable discussion. Berrien Moore called attention to two key payload issues: the proper disposition of ITIR and a possible extension of HIMSS capabilities by including AMSU channels. The ITIR question has to do with possible modifications that would allow it to fly on the A platform or whether to make it part of the B payload. If the HIMSS concept should be modified to include some of the AMSU channels, then the Japanese and ESA would be asked to consider modifying their AMSR and MIMR concepts. The Panel will request a study on the HIMSS/AMSU issues.



Vince Salomonson, Jerry Soffen and Jeff Dozier (back to camera) at the recent Payload Panel Meeting

The Payload Panel is drafting a letter of payload recommendations to Len Fisk. Some broad policy questions are under consideration: Does the "violet" A payload adequately address the questions of global change? Must all of the "violet" payload fly on one platform? Is flying all the payload on one platform the most cost-effective approach?

The Panel believes the total sounding capability of EOS A must be addressed. Also it intends to go on to a review of the science to be accomplished by EOSB, and to consider whether each of the B instruments needs to be on a single large platform.

have its final report ready in time to affect the Phase C/D selections.

Two National Academy of Sciences reviews of EOS have been scheduled. The first review by the NAS Committee on Earth Sciences, chaired by Byron Tapley, was held the day after the SEC meeting. The

JoBea Way presented her compilation of "silver bullets." (There are over 760 data product requirements that have been provided by the interdisciplinary investigators.) She reported that the document is now relatively complete. In the coming months, the data product requirements will be tied to the instrument output products.

Mous Chahine reported on the expected capabilities of AIRS/AMSU. AIRS offers the first opportunity to get both land surface emissivity and land surface temperature. Among a long list of products in addition to temperature profiles are total ozone, fractional cloud cover, cloud characteristics, precipitation index for convective clouds, relative humidity profiles, total precipitable water, sea surface temperature, surface albedo, snow and ice cover, and outgoing longwave radiation. Methane, carbon monoxide, and nitrous oxide will be mapped on a relative basis.

Vince Salomonson said that the Facility Instruments Panel will modify the products tables to show both horizontal and vertical resolutions. They will also attempt to standardize units and give a better indication of coverage capabilities. Comparison with the interdisciplinary requirements has shown some differences in terms of areas covered, accuracies, and time-averaging periods that need to be examined to see if there are any gaps between deliverable products and product requirements.

Jim Russell reported that the PI Instruments Panel had distributed its products table at the Payload Panel meeting the previous week. There is always one individual named for each product.

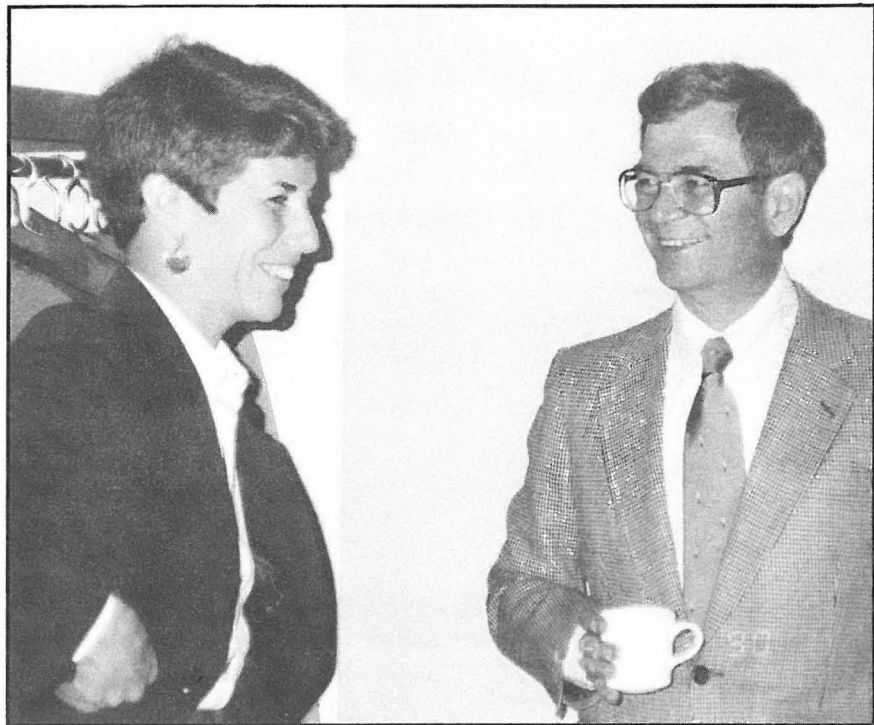
Berrien Moore, speaking for Piers Sellers, stated that the Land/Biosphere Panel had been particularly concerned with the role of HIRIS. They concluded that the 30-m HIRIS scale was important for land/biosphere process studies and for the determination of canopy chemistry. Now, field campaigns with AVIRIS are needed. (The Panel was to have a written report by February 7.)

The Modeling Panel was represented by Bob Dickinson who addressed the importance of models for 4-D data assimilation. He said that, if EOS were flying today, we would not be able to take advantage of sets of global data on humidity, clouds, soil moisture, and surface winds without first performing the assimilation process. At this time we

still need to learn how to assimilate the hydrological cycle elements into models.

Jeff Dozier, Data Panel, stated that EOSDIS is planned to have at least six nodes around the country operating semi-independently of each other. The Panel is recommending that EOSDIS go right into a prototyping operation. Jeff Dozier will present material about EOSDIS at the March IWG Meeting to advise users on what they can assume about EOSDIS in order to write their execution-phase proposals.

Dave Glover represented the Biogeochemical Panel. They have reviewed and now advocate HIRIS/MODIS synergisms, and urge that SCATT fly on the A platform with these instruments because they want surface winds. The 30-m HIRIS resolution meets their needs. Given a choice, they prefer simultaneity over observations six hours apart.



Miriam Baltuck and Frank Palluconi at the recent Payload Panel Meeting

Bryan Isacks reported on the Solid Earth Panel meeting that was held on January 8. Some Panel concerns are: What is the role of EOS in hazard mitigation and forecasting? How to coordinate solid earth science concerns with the ITIR team?

see SEC, page 5

GLOBAL CHANGE MASTER DIRECTORY AVAILABLE NOW

There is no doubt that the amount of data gathered in the EOS era will dwarf what had been previously available for the study of global change. Nonetheless, there is still an important role for the data collected prior to and in concurrence with the EOS project. In order for both non-EOS-related as well as EOS data to be of use to the general community, it must first be possible for researchers to know what data are available, where they are located, and how to access them. The Global Change Master Directory (GCMD), available now, is intended for this purpose.

The Global Change Master Directory is a free, online service to the research community. Methods of access through computer networks and dial-in lines are described in the accompanying box. Note also that a more comprehensive Master Directory for the space and earth sciences is available at the same location, and includes all the global change data information as well as information on data in astronomy and other space sciences.

The GCMD contains brief, overview information about data sets of potential use to the study of global change. This includes such items as a descriptive title, a brief summary/abstract, data center location and contact information, keywords descriptive of the content, time extent and spatial coverage, etc. It is intended primarily as a directory to the data holdings of U.S. Government agencies such as NASA, NOAA, USGS, NSF, EPA, etc., but it also has information about non-governmental data as well as data from the international sector.

There have been, and still are, many good directories to earth sciences data, but the GCMD differs from these in several ways. First, the directory allows a user to LINK to other data information systems where more details and services related to the data may be obtained. For example, if a user selects information about a NIMBUS data set contained within the NASA Climate Data System (NCDS), a LINK command is offered which, when invoked, automatically logs the user into the NCDS. Within NCDS a more detailed description of the NIMBUS data can be found, and an inventory of the data set

may be searched to determine whether data are available for a particular time or place of interest. Links to many other data information systems are also possible. Descriptions of these and other data centers not currently having links are also in the GCMD.

Entries in the GCMD are made via a data structure called the Directory Interchange Format or DIF file. The DIF file is an ASCII text file usually the equivalent of 2-3 typed pages in length. If data set information is described according to the DIF format, it is automatically loadable into the directory in a matter of minutes. Thus the GCMD can quickly reflect new data set information. The DIF is being promoted as an international standard which would allow directories throughout the world to share information quickly and conveniently via this medium. The EOSDIS is one of the data systems that has committed to the use of this standard.

Several other directories currently exist, and many others are planned, which will be interconnected via computer networks and share information via DIF files. Currently, copies of the GCMD software have been installed on computers at NOAA/NODC in Bethesda, MD and at ESA/ESRIN in Frascati, Italy. Other directories are planned for NASDA in Tokyo, Japan; UNEP/GRID in Geneva, Switzerland; EODC in the United Kingdom; CCRS in Canada, etc. A DIF file submitted to any of these nodes would be sent to the others as well so that all might be kept up-to-date with useful information. Distributed directories also provide more local service for researchers who may experience poor performance accessing directories over long distances. Future plans for the GCMD include increasing coverage of all useful global change data sets, a stand-alone PC version of the directory, and more efficient methods of getting to the detailed data set information of interest in the other data systems.

You can also shape the future of the directory. By using the system and providing feedback for evaluation purposes, you will help to assure a system which will serve the EOS community and blend well with the future EOSDIS.

Jim Thieman

ACCESS TO THE GLOBAL CHANGE MASTER DIRECTORY

The Global Change Master Directory is currently available for use. It is most easily accessed through the Space Physics Analysis Network (SPAN). From a computer connected to SPAN issue the command: SET HOST NSSDCA, then respond to the 'Username:' request with: NSSDC. You will then be asked for name and address information so that we may respond to your needs and keep track of usage. Next you will see a menu of NSSDC services, one of which will be the GCMD. The rest should be self-explanatory.

To access via INTERNET use the command: TELNET NSSDCA.GSFC.NASA.GOV or TELNET 128.183.10.4. You will then receive a 'Username:' prompt and can proceed as stated above.

If you belong to OMNET, you may use the "GOTO NSSDC" command which will do the login procedure for you, bypassing the Username: prompt.

Access may also be made through dial-in lines. The number to call is (301) 286-9000 or FTS 888-9000. At the 'Enter Number:' prompt enter MD. After seeing the CALL COMPLETE message, enter a few carriage returns and the 'Username:' prompt will appear. Then proceed as above.

The Master Directory is intended to be usable without prior training, but if you wish to have a user's guide, or if you have any questions or problems, contact Janice Shipe at (301) 794-52186 or Joy Beier at (301) 794-5289. Those who hold useful data sets and are interested in submitting information about them, or wish to have more information on the DIF, should request the Directory Interchange Format Manual, NSSDC publication number 89-24, from the author. He may be reached at NASA/GSFC, Code 633, Greenbelt, MD 20771, (301) 286-9790, or SPAN - NSSDCA::THIEMAN; TELEMAIL - (C:USA, A:, O:, UN:JTHIEMAN); or OMNET - J.THIEMAN.

Jim Thieman

SEC continued from page 3

Rod Heelis, Particles and Fields Panel, said that they need to coordinate their activities with the atmospheric chemistry and dynamics instrument investigations. For instance, XIE will contribute to the understanding of NO_x production. The Panel believes that SOLSTICE should be part of the "A" package to maintain continuity with UARS.

Byron Tapley, Precision Orbit Determination, Mission Design Panel, said that they see problems with

the crossing-time and pointing-control statements in the EOS Program Level Technical Requirements (PLTR) document. They question the choice of the 705-km altitude—824 km would give better coverage for surface imagers. They will run a multiplicity of orbit scenarios with the JPL software package.

Ray Roberts was introduced as the new EOS Program Manager—Alex Tuyahov will be his deputy.

Renny Greenstone and Dot Zukor

Panel Reports

Facilities Instruments Panel

The Facilities Instrument Panel has revised the tables of data products that can be expected to be produced at or near the launch of the appropriate EOS platform carrying the relevant facility instrument. These inputs have also been compiled in a table containing all the products to be expected from the facility instruments. Where the same or a very similar geophysical parameter is being observed, this table readily permits comparisons of the accuracies, frequency and extent of coverage for the data product. The results of this effort have been reported and distributed to the EOS SEC and the EOS Payloads Panel. The SEC has instructed the Facility Instruments Panel to update the tables so as to provide columns in the tables showing spatial and vertical resolutions separately. In addition, it was asked that the units be the same where the same geophysical parameter is being listed for two or more instruments. The present efforts focus on incorporating these requests into updated tables for presentation and distribution at the next IWG meeting March 20-23.

Vince Salomonson, Chairperson

Oceans Panel

The EOS Oceans Panel met in New Orleans LA, February 15, 1990, with the following people in attendance: Mark Abbott (chairperson), Joey Comiso, Curt Davis, Bill Emery, Lee-Leung Fu, David Glover, Ben Holt, Gary Lagerloef, Drew Rothrock, Barry Shipper, C.K. Shum, JoBea Way, Diane Wickland, and Stan Wilson.

The meeting began with a discussion of the oceans science plan. This document is basically a reorganization of the material discussed at the October panel meeting. The audience for this science plan will be the IWG and the EOS Program and Project. The purpose of the plan is to describe a consistent approach to ocean research using EOS data, primarily to address the scientific issues raised by the Committee on Earth Sciences (CES). This plan will not be either complete or static; rather, it will evolve over time as our understanding of the ocean and its role in

the Earth system becomes more complete. Thus, the first version of this plan will describe a structure for the development of the science plan as well as the science plan itself.

An initial outline of the science plan is included later in this report. A relatively complete, detailed outline should be distributed before the next IWG meeting in March. We will deliver a complete draft to NASA HQ by June 1. It was noted that part of this science plan will require summaries of the facility team member proposals as each team member expects to conduct research as well as develop data products. Given the size of this task, it was suggested that the Oceans Panel pursue the offer made by Tony Busalacchi concerning the hiring of a person to assist the EOS Project office with ocean-related issues. One task for this person would be the compilation of existing EOS ocean science proposals.

As part of the development of the science plan, we will need to develop a list of consensus or baseline data products that will need to be available from EOS. As part of this exercise, JoBea Way presented the latest version of the data product requirements list which was compiled from inputs provided by the EOS interdisciplinary investigators. Similar lists will be provided by Jim Russell for the PI instruments and by Vince Salomonson for the facility instruments products.

A number of concerns were raised concerning this approach. First, how do team member needs and plans get folded into this process? For example, a MODIS team member may need a specific data set from another sensor, yet there is no mechanism for ensuring that this requirement is even described in the present exercise. Second, there are a number of multiple requests for essentially the same product (there are 15 different SST products). How do we collapse these lists into a reasonable set? Third, some of the products cannot be derived using present sensor technology. Fourth, there may be valuable products produced by a particular sensor yet they do not appear on the interdisciplinary lists. Fifth, this approach makes no provision for the creation of more sophisticated (and potentially more robust) products formed from the combination of sensors. For example, one might be able to derive a more accurate SST using a combination of atmospheric sounder,

aerosol, and infrared radiometer data.

Some of these problems will be solved by the development of the baseline products list. The following assignments were made, based on the organization described by JoBea Way:

Ocean Winds	Freilich
Waves	Fu
Elevation	Fu
Temperature	Abbott (Liu)
Ice	Rothrock
Biology	Abbott (Glover)
Radiation	Liu
Water flux	Liu
Heat	Liu
Optics	Abbott

When similar forms are available from the PI and facility instruments, we will begin the development of the baseline products list. This list will be distributed to the interdisciplinary investigators for concurrence. It was noted that this activity will serve as a focal point for the interaction between the interdisciplinary investigators and the instrument investigators. It will also ensure that the science needs of the facility team members are incorporated into the process as well as creating realistic expectations on the part of the interdisciplinary investigators in terms of instrument capabilities. As far as the creation of "synergistic" products, we feel that this is an activity that needs to be encouraged strongly by the EOS Program office.

A brief review of the activities of the EOS Payload Panel was made. The inclusion of STIKSCAT and ALT on EOS-A was strongly recommended as part of critical studies of air/sea flux, CO₂ uptake, and heat flux. The Oceans Panel also supported the notion of science "CDCR's" as part of the development of the EOS payload. Panel members will develop nominations for service on specific instrument science CDCR's. The list of potential nominees will not be restricted to EOS-associated scientists.

The issue of the ALT repeat-track requirement was discussed extensively. There is considerable reservation concerning the analysis presented by the EOS Project on the orbit maneuver frequency. C. K. Shum

presented an analysis showing that the Project analysis was too conservative, and that the +/- 1 km repeat-track requirement during the solar maximum period (2001) will probably impose an orbit maneuver of every 6-10 days instead of 3-4 days as the Project analysis indicated. However, this maneuver frequency is expected only for 3-4 months during solar maximum every 11 years. EOS-A, which will be launched during a solar minimum period (1996-97), will only require a maneuver frequency of 30-40 days to keep +/- 1 km repeat orbit accuracy. Also, adjusting the orbit height to 824km would decrease this frequency substantially. The +/- 1km repeat-track requirement is still being investigated and will be reported later. Lastly, EOS will need to develop an orbit maneuver strategy no matter what the repeat-track requirement eventually becomes. It was recommended that the EOS Project begin this effort immediately.

Another issue concerned GLRS for ice sheet and sea level studies. Although the scientific importance of these measurements is recognized, they are considered to be of lesser importance than other issues within ocean sciences. Recent work by Edward Christiansen (JPL) on the use of transponders in conjunction with radar altimeters to address similar scientific issues was briefly discussed. It was suggested that this research be given higher visibility within the EOS Program. Questions remain concerning the accuracy of the method, but its potential contributions to Earth science appear to be great.

The final issue concerned the "hot spares" described in a recent letter by Stan Wilson to the Payload Panel. The Oceans Panel recommended strongly that this concept not be pursued; the potential advantages of a short gap in a critical time series was far outweighed by the risks of losing the ability to collect a 15-year time series (because of substantially higher costs) as well as the availability of "surrogate" data for almost every critical sensor.

Oceans Science Plan Outline

I. Science Goals

- A. • Role of the ocean in the carbon cycle
(Glover coordinate with Lewis)

The Earth Observer

- Role of the ocean in vertical and lateral heat transport (Liu coordinate with Lagerloef)
- Role of the ocean in the hydrologic cycle (Rothrock coordinate with Thomas)
- B. Key processes and variables, e.g. air/sea flux of CO₂, deep water formation, etc.
- C. EOS data sets
 - consensus data products
 - relationship to EOS sensors

II. Science Plan

- A. Planned EOS science
 - summary of IDS and TM science
- B. "Early EOS" missions related to ocean studies
 - ERS-1
 - TOPEX/Poseidon
 - ADEOS, NSCAT, and OCTS
 - Radarsat
 - SSM/I
 - etc.
- C. Relationship to other global studies
 - WOCE
 - JGOFS
 - IGBP
 - etc.
- D. A "schedule" of EOS Oceans science
 - a discussion of priorities
- E. What's missing
 - coastal interactions
 - ice sheet studies
 - etc.
- F. Reference data sets required
 - climatologies
 - atlases
 - etc.

Mark Abbott, Chairperson

Particles and Fields Panel _____

Representatives of the Particles and Fields Panel have met informally on various occasions and have communicated by telephone. The role of the panel is becoming clearer as those scientific objectives most closely associated with Earth sciences and EOS are identified. Initial discussions have identified the following major topics that do not seem to be well represented in other panels or by IDS investigations:

1. Global electric circuit
2. Global external energy input
3. Effect of energy transport on lower mesosphere chemistry and dynamics
4. Lightning, energetic particle and energy transport effects on NO_x and ozone

Brief discussions of the science goals in these areas has pointed to the need for particles and fields measurements in conjunction with measurements of cloud cover, lightning rate, lower mesosphere gas composition, temperature and dynamics and stratosphere gas composition, temperature and dynamics.

Specific issues to be discussed at future meetings include the detailed scientific objectives, the optimal instrument configuration on each platform for performing the required measurements, the identification of IDS representatives for the science goals and the ease with which data from different disciplines can be used and interpreted by non-specialists.

Rod Heelis, Chairperson

The Earth Observer is a monthly publication of the EOS Project Science Office, Code 600, NASA/Goddard Space Flight Center, Greenbelt, MD 20771, telephone (301) 286-8228, FAX (301) 286-3884. Correspondence may be directed to the above address. Articles, contributions to the meeting calendar, and suggestions are welcomed. Contributions to the meeting calendar should contain location, person to contact, and telephone number. Deadline for all entries is the 20th of each month.

Team Meetings

MODIS Team

The MODIS Science Team (MST) Meeting, chaired by Vince Salomonson, Science Team Leader, was held at NASA/GSFC January 31-February 2, 1990. About 90 persons including 23 MST members attended the meeting.

In opening the plenary session, Vince Salomonson offered his perception to those attending that the principal and most unique contributions of MODIS to EOS studies of Global Change appear to be: global observations of (1) ocean color and surface temperature leading to improved understanding of photosynthetic activity, related processes, and primary production; (2) land cover type and condition related to climate change and anthropogenic activity; (3) cloud cover and cloud properties leading to improved description of cloud climatology as it relates to global change. MODIS will also provide many other observations that contribute very significantly in a great many other areas, and complement other instruments in delivering products needed for interdisciplinary studies of global change.

Other topics covered in the plenary session included status reports on MODIS-N and MODIS-T. MODIS-N is in the Source Evaluation process (SEB) progressing toward the release of the RFP in the Spring for the beginning of Phase C/D efforts in early 1991. MODIS-T is in an extended Phase-B study period leading to Phase C/D efforts in 1991. The major discussion and decision involved with MODIS-T is whether to use a "dual mode" of operation where a different gain is used over the ocean versus observations over land, or to use a "combination mode" that permits the instrument to adapt to varying land, ocean or cloud conditions with the field-of-view. The problem is that, at present, the combination mode does not meet ocean signal-to-noise specifications in the longer wavelengths. Unless these specifications can be met, the dual mode will be adopted. Further study of this area is underway by the Goddard MODIS-T engineering team.

Most of the rest of the Science Team meeting was spent on determining the output products from MODIS, and which team members would take primary responsibility for producing the algorithms involved in the production of the products. The presently perceived steps involved in producing the products were outlined by Al Fleig. The various subsets of the MODIS Science Team (land, oceans, atmospheres, and instrument characterization groups) met in individual sessions and compared results in plenary session on these matters. The Team meeting ended with considerable progress having been made in understanding and coordinating the algorithm and data product production of the various members so that an appropriate set of proposals could be prepared by the April 30 deadline.

The Science Team will not meet again until after the resubmitted proposals have been submitted. It was estimated that this meant that a meeting would be held in late September. In the meantime, coordination and other actions will take place by electronic mail, etc.

Vince Salomonson, Chairperson

Note:

The Fall IWG Meeting is planned for October 23-25, 1990, at Langley Research Center, Hampton, VA. If you know of any major conflicts, please call Charlotte Griner at (301) 286-5876, FTS 888-5876, or write her at the EOS Project Science Office, Code 600, NASA/Goddard Space Flight Center, Greenbelt, MD 20771.

The Earth Observer

Global Change Meetings

- Mar. 19-23 Global Biomass Burning: Atmospheric, Climatic and Biospheric Implications, Williamsburg, VA
- Mar. 28-30 3rd CERES Science Team Meeting, Langley Research Center, Hampton, VA. Contact Jim Youngblood (804) 864-4509.
- Apr. 2-4 SAGE III Science Team Meeting, Newport News, VA. Contact Len McMaster, (804) 864-2669.
- Apr. 10-12 Global Warming - A Call for International Coordination, Chicago. Contact Sinyan Shen, SUPCON International, Woodbridge, IL
- April 16-20 SPIE Symposium, Orlando, FL. Contact Dixon Butler (202) 453-1681.
- Apr. 24-27 International Conference on the Climate Impact of Solar Variability, GSFC. Contact Kenneth Schatten (301) 286-3831.
- May 7-11 22nd International Liege Colloquium on Ocean Hydrodynamics, Liege, Belgium. Contact Jacques C. J. Nihoul, Modelenvironment, University of Liege, B5, Sart Tilan, B-4000, Liege, Belgium.
- May 20-24 10th IEEE-GRS/URSI International Geoscience and Remote Sensing Symposium (IGARSS), "Technologies for the 90's," University of Maryland. Contact James A. Smith, (301) 286-7282.
- May 28-June 1 Climate Variability: Causes and Consequences, Victoria, B.C. Contact Rick Marsden (604) 380 4333.
- May 29-June 1 AGU Spring Meeting, Baltimore.
- June 4-8 Nonlinear Phenomena in Atmospheric and Oceanic Sciences, Minneapolis, Minn. Call (612) 624-6066.
- June 11-15 International Conference on the Role of the Polar Regions in Global Change, Fairbanks, Alaska. Contact Gunter Weller (907) 474-7954.
- June 12-14 AGU Chapman Conference on Hydrologic Aspects of Global Climate Change, Lake Chelan, Wash. Call (202) 462-6900.
- June 18-21 Global Environmental Hydrology and Hydrogeology, Leningrad, Russia. Call (612) 379-1030.
- July 9-13 International Symposium on Assimilation of Observations in Meteorology and Oceanography, Clermont-Ferrand, France. Call (1) 45 29 12 25.
- June 19-23 4th CERES Science Team Meeting (tentative). Contact Jim Youngblood (804) 864-4509.
- July 16-20 Earth System Science Center Workshop on Atmospheric Oxygen Variation Through Geologic Time, Penn State University. Contact Eric Barron (814) 865-1073.
- Sept. 5-11 7th International Symposium of the Commission on Atmospheric Chemistry and Global Pollution, Chamrousse, France. Fax 76 51 32 48.

Future EOS Science Meetings:

Week of Aug. 27 Payload Panel Meeting

Sept. 12 Calibration Advisory Panel Meeting, University of Arizona, Tucson, AZ.

The Earth Observer

EOS Science Meetings - 1990

	Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
				1	2	3 4
MARCH	5	6	7	8	9	10 11
	12	13	14	15	16	17 18
	19 See Below	20 See Below	21 IWG Meeting-New Carrollton, MD See Below	22	23	24 25
	26	27	28	29	30	31 1
APRIL	2	3	4	5	6	7 8
	9	10	11	12	13	14 15
	16	17	18	19	20	21 22
	23	24	25	26	27	28 29
	30	1	2	3	4	5 6
MAY	7	8	9	10	11	12 13
	14	15	16	17	18	19 20
	21	22	23	24	25	26 27
	28	29	30			

Monday, March 19:

Atmospheres, Land Biosphere, and Facility Instruments Panel Meetings

Tuesday, March 20:

AIRS and Altimeter Team Meetings; Particles and Fields, Data, Solid Earth, and Modeling Panel Meetings

Wednesday, March 21:

Payload, PI Instrument, and Physical Climatology and Hydrology Panel Meetings

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