2002 -2003 Annual Report
Institute for Geophysics and Planetary Physics
University of California Irvine Branch

Susan Trumbore, Director
Elizabeth J. Ford, Administrator

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Statement of UCI IGPP Branch Goals

The Institute for Geophysics and Planetary Physics is a Multi-Campus Research Unit (MRU) of the University of California established in 1946, with existing branches at the UCLA, UCSD, UC Santa Cruz, and UC Riverside campuses, and the Los Alamos and Livermore National Laboratories. The IGPP charter defines its mission: to promote and coordinate basic research on the understanding of the origin, structure, and evolution of the Earth, the Solar System and the Universe, and on the prediction of future changes, as they affect human life.

Research at the UCI IGPP branch addresses fundamental questions of global environmental change affecting the coupled system of atmosphere, ocean, and land, and occurring on the time scale of a human life.

Global environmental problems such as climate change and stratospheric ozone depletion involve complex interactions between atmosphere, ocean and land systems. UCI’s IGPP branch includes members of the Departments of Earth System Science, Chemistry, and Mathematics in the School of Physical Sciences and the Department of Mechanical and Aerospace Engineering in the School of Engineering. As a group, we take an integrated approach that combines field and laboratory measurements with modeling and theoretical studies. Understanding of the Earth as a coupled system of atmosphere, land and ocean is required to plausibly predict future changes in the Earth System.

The IGPP branch at UCI has three major goals:
(1) promoting fundamental research on the workings of the earth as a coupled and complex system;
(2) providing contributions to formal assessments needed by policy makers;
(3) educating students and the public about scientific research in global environmental change.
Director’s Foreword: The Role of the IGPP at UC Irvine

The goal of the UCI Branch of the Institute for Geophysics and Planetary Physics is to enhance research in global environmental change at UCI and throughout the UC system. The UCI IGPP Branch, now in its third year, is attaining this goal in three ways. Support given to existing and new analytical facilities has fostered collaborations with UC and other campuses, and matching funds from IGPP for facility support are helping efforts to increase the multi-PI facilities on campus. Support given to UCI graduate students to begin their first major research projects helps foster research in Global Environmental Change and educates the next generation of scientists who study the Earth System. Support given for seminars and workshops fosters better communication and ultimately will lead to enhanced visibility for UCI IGPP.

The existence of world class research facilities at UC Irvine has clearly stimulated collaborative research with other UC campuses as well as internationally. These facilities have also helped UCI in its faculty recruiting efforts: three recent hires in Earth System Science (two of these joint appointments with Ecology and Evolutionary Biology in the School of Biological Sciences) will be collaborators in the W.M. Keck AMS facility and in the stable isotope laboratories. We anticipate the Earth System Modeling Facility to similarly be a tool to recruit top researchers to UCI in the future.

The UCI IGPP branch has made its administrative home within the School of Physical Sciences. This position means that there is little incentive to submit proposals through the IGPP rather than through the principal investigators’ academic Departments. A case in point was the successful NSF MRI proposal to bring a supercomputer facility for Earth System Modeling to UCI. We decided against submitting that proposal through IGPP when it became clear that in doing so we would lose additional matching funds and support from the School of Physical Sciences. IGPP is nonetheless, supporting this new facility by supplying partial salary for a system administrator. I am happy to see that IGPP matching support is facilitating the funding and operation of major research facilities that add tremendous value to research at UCI.

Respectfully submitted

Susan Trumbore
Director UCI IGPP branch
UC Irvine IGPP Participants

Donald R. Blake (measurement of trace gases in the atmosphere)
Ralph J. Cicerone (atmospheric chemistry; biosphere-atmosphere exchange of trace gases)
Donald Dabdub (mathematical modeling of air pollution dynamics)
Ellen R. M. Druffel (chemical oceanography and ocean carbon cycle dynamics)
Barbara J. Finlayson-Pitts (atmospheric chemistry - kinetics of gas phase and heterogeneous chemical reactions)
Carl Friehe (Turbulence and energy exchange between land and ocean surface and the atmosphere)
Jay Famiglietti (land surface hydrology and climate)
Michael Goulden (ecosystem ecology and exchange of energy, nutrients and water between land surface and atmosphere)
Gudrun Magnusdottir (atmospheric dynamics and global climate modeling)
J. Keith Moore (biogeochemistry of oceans)
Diane Pataki (plant physiology and isotope biogeochemistry); to join July 2004
Michael J. Prather (atmospheric chemistry; 3D atmospheric tracer transport models)
Francois Primeau (ocean circulation and climate)
James T. Randerson (biogeochemistry and the carbon cycle)
William S. Reeburgh (biogeochemistry, including methane)
F. Sherwood Rowland (trace gas chemistry of the atmosphere and stratospheric ozone depletion)
Edriss Titi (geophysical fluid dynamics)
John R. Southon (radiocarbon as a tracer for the global carbon cycle)
Kathleen Treseder (microbial ecology; global change biological)
Stanley C. Tyler (isotope biogeochemistry - stable isotope analyses of atmospheric trace gases and their sources)
Susan Trumbore (isotope biogeochemistry and global carbon cycle dynamics)
Jin-Yi Yu (coupled ocean-atmosphere climate modeling)
Charles S. Zender (atmospheric radiative transfer and global climate modeling)
Support for Major Research Facilities

I. W.M. Keck Carbon Cycle Accelerator Mass Spectrometry Facility

The W. M. Keck Carbon Cycle Accelerator Mass Spectrometer (hereafter Keck CCAMS) was established as a facility to use radiocarbon measurements in support of research on the global carbon cycle. The facility was built with a $2 million grant from the W.M. Keck Foundation, matched by funds from UC Irvine’s Office of Research and Graduate Studies, the School of Physical Sciences, the Institute for Geophysics and Planetary Physics, and the A. W. Mellon Foundation. IGPP grants continuing facilities support of $25,000 per year to the facility, which is used to partially pay salaries of John Southon (Researcher in ESS/IGPP) and Guaciara Macedo dos Santos (Associate Specialist, ESS/IGPP).

The KCCAMS is one of only five facilities in the US capable of measuring several thousand radiocarbon unknowns per year, and the only one dedicated to research in the carbon cycle. One of the existing facilities (LLNL Center for Accelerator Mass Spectrometry; CAMS) is also associated with IGPP, and Dr. John Southon left LLNL to join UCI’s effort. The two labs have cooperated on a number of levels, from technical (software support for data analysis at KCCAMS from CAMS/LLNL, and source comparison testing) to measurements (UCI collaborates on a multi-DOE lab project based at ORNL and LLNL).

The core of the KCCAMS facility is a 0.5 MV tandem accelerator system purchased from National Electrostatics Corporation. The AMS instrument was installed in July, 2002, and has been working on a reliable and routine basis since it passed acceptance tests in October, 2002. Over the past year, six major technical milestones have been accomplished:

(1) Attainment of high precision radiocarbon measurements, which enable the KCCAMS facility to explore aspects of the carbon cycle beyond what we had expected given the specifications of the instrument as purchased. Precision has reached 2‰ or better on several occasions.

(2) The instrumental blank was lowered by 80% by adjustment of the beam transport system to reduce a previously unrecognized nitrogen-14 background, so that it rivals the backgrounds obtained in AMS labs with much larger accelerators (roughly 55,000 years).

(3) Sample throughput (including sample preparation) has reached the system’s present capacity, reaching 500 samples per month. A funded NSF proposal for ion source improvements should allow increased throughput over the next 1-2 years.

(4) Movement of the AMS to its final home in John V. Croul Hall: The AMS was delivered roughly a year before completion of John V. Croul Hall and was installed in temporary facilities. Although moving an AMS facility is a non-trivial exercise, the move was completed with only 19 days of down-time for the instrument and the AMS.
has been in full operation in its new and more spacious quarters since mid-July 2003.

(5) Initiation of a recharge facility for sample fees from collaborators and outside users. There is now a pricing system and an approved recharge facility so that we can begin fee-for-service work in support of carbon cycle research. Prices are discounted for UC investigators in our pricing scheme to reflect the support of the facility from UC. Ultimately, it is anticipated that about half of the operating budget for the facility come from sample recharge fees to investigators outside UCI.

(6) Stable Isotope Facility: A Finnegan Delta Plus isotope ratio mass spectrometer purchased with Keck funds has been operating routinely since April 2002. Although the major use of this instrument is to obtain more precise (to 0.1 to 0.2 per mil in $^{13}$C) measurements than are available from the AMS (1 per mil at best), the Delta Plus instrument is running almost continuously and also providing measurements of $^{15}$N and $^{18}$O on samples for students and researchers at UCI. This facility also moved to new quarters in John V. Croul Hall in October, 2003.

The W. M. Keck Carbon Cycle AMS in a very short time has become a premier facility for measurement of radiocarbon at low cost to carbon cycle investigators. It has already become a magnet for collaborative research – a few of those projects are highlighted here, more detail in funding of samples run by the facility is given below.

**The Enriched Background Isotope Study (EBIS)** is a collaborative effort between UC Irvine, Oak Ridge National Laboratory, CAMS/LLNL, Argonne National Laboratory, and Lawrence Berkeley Laboratory, and UC Santa Cruz. It follows an inadvertent release of radiocarbon tracer that labeled vegetation on the Oak Ridge Reserve in the summer of 1999 in order to understand the decadal and short timescale C cycling in this ecosystem.

**Sources of soil respiration.** A collaborative NSF proposal to Trumbore, Randerson, E. A. G. Schuur (University of Florida), and E. A. Davidson (Woods Hole Research Center).

**Variations of radiocarbon in the past – links to solar and carbon cycle variations.** John Southon actively collaborates with several investigators, including Konrad Hughen at Woods Hole Oceanographic Institution,

**W. M. Keck Carbon Cycle AMS Facility Personnel**

Dr. John R. Southon (Researcher ESS/IGPP)

Dr. Susan Trumbore (Professor, ESS)

Dr. Ellen R. M. Druffel (Professor, ESS)

Dr. Guaciara Macedo dos Santos (Associate Specialist, ESS/IGPP)

Dr. Xiaomei Xu (Specialist, ESS/IGPP)

Maya Mazon (hired June, 2003) (Junior Specialist)

Shahla Ali (UCI undergraduate majoring in Physics and Chemistry)
Associated Faculty:  Dr. Kathleen Treseder (joint appointment in ESS and Ecology and Evolutionary Biology), Dr. Diane Pataki ((joint appointment in ESS and Ecology and Evolutionary Biology), Dr. James T. Randerson (ESS), Dr. William Reeburgh (ESS)

Postdocs (ESS):  Dr. Claudia Czimczik, Dr. Tomoko Komada, Dr. Jeffrey Q. Chambers

Graduate students.  UCI: Jeomshik Hwang, Steve Beaupré; John Kessler, Luz Maria Cisneros Dozal, Mariah Carbone, Andrew McMillan, and Nichole Nowinski.  UC Berkeley: Christina Castanha. Caltech: Lisa XXX.

Current collaborators:
Dr. Konrad Hughen (MIT/Woods Hole), Dr. Darren Sandquist (Cal State Fullerton), Dr. Edward A. G. Schuur (Florida State University),Dr. Jennifer Harden (USGS Menlo Park), Dr. Erving Taylor (UC Riverside).

Education/Outreach

We are developing a course in Radiocarbon and the Carbon Cycle to be offered annually starting in July 2004. Collaborator Edward Schuur (University of Florida) has received a NASA Young Investigator Award and will use part of that funding to help develop course materials, and an NSF Carbon Cycle Grant (to Trumbore, Randerson, and Schuur) has some funds for student travel and living expenses for the first year’s course.  We anticipate that this course will lead to greater numbers of student participants in the W. M. Keck facility, and increased levels of future collaboration on carbon cycle related research.

New Grants

Trumbore’s continuing support includes grants to study carbon cycling on land ecosystems from NSF, NASA, DoE, the Kearney Foundation, and a cooperative agreement from the US Geological Survey. Druffel has continuing funding from NSF and has solicited new funds. Four new awards were made in the past year. The recharge account has taken in ~$40,000 to support sample run at W.M. Keck CCAMS, for a number of researchers and institutions (including, the US Geological Survey, the University of British Columbia, the South Florida Water Management District, and the University of Florida Gainesville).

John Southon and Guaciara dos Santos were lead investigators on a multi-institution proposal awarded by NSF’s Instrumentation and Facilities ($75,000 will be UCI’s portion) to improve the NEC ion sources presently in use at several AMS institutions.

Graduate student Luz Maria Cisneros Dozal (working with Trumbore) was awarded a NASA Global Change Fellowship for her research using radiocarbon to distinguish different sources of soil respiration ($24,000, renewable for an additional year if needed).
Postdoctoral Researcher Claudia Czimczik (working with Trumbore) was awarded a Gary Comer Postdoctoral Fellowship. This fellowship (in the amount of $50,000 per year) is for the study of rapid climate change and its consequences in high latitude environments.

Ellen Druffel received a grant from the American Chemical Society Petroleum Research Fund in the amount of $80,000 for 2 years to support radiocarbon measurements in marine particulate and dissolved organic matter.

**Publications.**

Publications:


Effect of Drying on Soil Respiration at the Harvard Forest, MA. W. Borken, E.A. Davidson, K. Savage, S. Trumbore (*Global Change Biology*)

**Presentations at Meetings**

*AMS Conference (Nagoya, Japan, September 2002)*

Initial Operation of the W. M. Keck Carbon Cycle AMS Laboratory, University of California, Irvine. J. Southon, G. Dos Santos, E. Druffel, S. Trumbore, and X. Xu

*American Geophysical Union (San Francisco, USA, December 2002)*


*Ecological Society of America (Savannah, GA, USA, August 2003)*

Using radiocarbon to partition autotrophic and heterotrophic soil respiration sources, S. Trumbore, LM Cisneros Dozal, X Xu, E A Schuur, J Chambers.

*International Radiocarbon Conference (Wellington, New Zealand, September 2003 (for publication in Radiocarbon)*

1. A radiocarbon dater's view of Greenland ice core chronologies. J. Southon


5. Radiocarbon in atmospheric CO₂ along a latitudinal transect of the Pacific Ocean in 2002, X. Xu, S. Trumbore, S. Tyler, H Agie
**Honors**

Graduate student Jeom-Shik Hwang was awarded the Earth System Science Outstanding Graduate student award in 2003.

Kevin Druffel-Rodriguez used results from an experiment in graphite preparation methods at Keck CCAMS for an award-winning poster at the Orange County Science Fair.
II. Stable Isotope Facility for Measurement of Atmospheric Trace Gases

Personnel: Stanley C. Tyler (Researcher, ESS)
Henry O. Ajie (Specialist, ESS)

Graduate Students: Andrew McMillan, Allison Gotoh, Andrew Rice
Undergraduate Students: Ezekial Tostado, Tracy Tran

Collaborators: UCI: Dr. Donald R. Blake, Dr. Michael Goulden, Dr. Susan Trumbore
UC Berkeley: Dr. Kristie Boering, UC Davis: Dr. Mike Hare, IVIC, Venezuela: Dr. Tibisay Perez, King Mongut’s University of Technology Thonbury (Thailand) Dr. Amnat Chidthaisong

With partial support from the IGPP, the stable isotope research lab (headed by Stanley Tyler) has designed and built two trace gas preconcentrators (TGPs) for use with two Finnegan MAT isotope ratio mass spectrometers and their continuous flow gas chromatography systems. These gas preconcentrators provide us the maximum possible level of precision on ambient concentrations of CH$_4$ and N$_2$O in air. Several UCI graduate students took active roles in this development (Allison Gotoh, Tibisay Pérez, and Andrew Rice). When coupled to a TGP, the IRMS instrument greatly improves both the speed and sensitivity of C and H isotope analyses on ambient CH$_4$ in air (equal measurement precision to our old methods on much smaller air sample sizes) and makes possible for the first time N and O isotope sample analyses on ambient levels of N$_2$O in air and subambient levels of N$_2$O in soils.

The Tyler laboratory's ability to make high precision isotopic measurements on very small gas samples allows them to pose scientific questions involving the interannual and season variations of sources and sinks of trace gases which very few other labs can attempt to answer. Their studies of tropospheric CH$_4$ and CO include bi-monthly sampling of three fixed land surface sites, upper air samples (free troposphere to lower stratosphere) taken from aircraft over the Pacific during NASA sponsored flights (in collaboration with Don Blake at UC Irvine Department of Chemistry), and quarterly shipboard transects of the Pacific Ocean between Los Angeles, CA and Auckland, New Zealand. The most recent isotopic C and H data and interpretations of 1) changes in CH$_4$ mixing ratio and its accumulation in the atmosphere, 2) how CH$_4$ concentration affects the oxidizing power of the atmosphere, and 3) the seasonality of global CH$_4$ sources are being reported on in two upcoming publications.

The high precision isotope measurements, achievable even the smallest of samples, also allows them to take part in collaborative research with other scientists whose laboratory resources lack this capability. One example is the Tyler lab collaboration with UC Berkeley scientists (Dr. Kristie Boering and co-workers) to analyze atmospheric CH$_4$ from several recent high altitude (stratospheric) aircraft campaigns. We made both $^{13}$C/$^{12}$C and D/H measurements of subambient (below background) CH$_4$ in air with both the required precision and accuracy necessary to use
isotope measurements to interpret the vertical structure of CH₄ concentration and its chemical loss processes. This work initially resulted in two papers, one dealing with Rayleigh fractionation in chemical loss processes of CH₄ (Rice et al., 2003) and another modeling stratospheric transport of CH₄ and model testing of CH₄ chemical sinks (McCarthy et al., 2003a). The data has since contributed to two other studies. Our CH₄ data was combined with H₂ data from scientists at Los Alamos National Laboratory (Tom Rahn) and Cal Tech (John Eiler) to study the stratospheric H₂ budget (Rahn et al., 2003) and with water vapor and H₂ data to study stratospheric water vapor budget and tropospheric-stratospheric exchange (McCarthy et al, 2003b).

Collaboration with Dr. David Valentine in the Dept. of Geosciences at UC Santa Barbara on the isotope fractionation of bacteria under different conditions has led to a successful NSF Biocomplexity proposal by Dr. Valentine, which will provide funds for continued collaboration.

In collaboration with the Keck CCAMS laboratory, and Dr. James Randerson, samples collected for Tyler’s studies of methane and CO isotopes are also being used to start a monitoring program of radiocarbon in atmospheric CO₂. This monitoring is largely lacking in the Americas, and is critical for testing the distribution of fossil fuel inputs globally.

Tyler’s lab collaborated with Sue Trumbore and co-workers to make some of the very first N and O isotope sample analyses on ambient levels of N₂O in air and subambient levels of N₂O in soils. The isotopic measurements were initially performed with IRMS machines in the Tyler lab without continuous flow capability to study nitrification and denitrification in wet and dry tropical soils (Pérez et al., 2000 and 2001). With the N₂O gas preconcentrator added on and additional changes in instrumentation and data retrieval and analysis, Pérez (now a professor at IVIC, the Venezuelan Institute for Scientific Investigation), Trumbore and Tyler are currently studying 1) the position of isotopic N within the N₂O to obtain more information differentiating nitrification and denitrification, and 2) the isotopic enrichments of N and O in the two N₂O forming processes and their potential changes with time in a biological (soil) system with varying nitrogen inputs. This work was recently funded by a grant from the NSF Biogeosciences Program.

Publications resulting from collaborative work


III. The Earth System Modeling Facility

Dr. Charles Zender (Director)
Dr. James Famiglietti
Dr. J. Keith Moore
Dr. Gudrun Magnusdottir
Dr. Michael Prather
Dr. Francois Primeau
Dr. James T. Randerson
Dr. Jin-Yi Yu

Post-Docs: H. Bian, J. Hsu
Undergraduates: S. Bamattre and others unnamed

This year a group of UCI researchers submitted a successful major equipment grant to the National Science Foundation to acquire a supercomputer dedicated to modeling of the Earth System. This new facility receives $25,000 per year as matching from IGPP, which is used for salary support, mostly for a system analyst. The IBM supercomputer will be delivered to UCI in early January, and will form a center for collaboration on models coupling land, ocean, atmosphere, and climate.

The UCI ESMF will be devoted to the integration, synthesis, and analysis of large models and datasets required to advance fundamental understanding of the coupled physical climate, chemistry, and biogeochemical cycles of the Earth system. The ESMF represents a major enhancement in computational capability over the workstation-based and older shared-memory resources currently in use at UCI. It is tailored for the merging of ESM components (e.g., atmospheric chemistry, ocean biology, land hydrology) that normally consume the available computing resources of individual research projects. Although primarily a development facility for faculty and graduate researchers, the ESMF will produce the decade-long simulations of the coupled system that are needed for basic scientific studies.

The process of coupling existing ESM components will identify some of the more important feedbacks and help identify aspects of the models that need attention or further development. The ESMF will also be used operationally (i.e., 100-year simulations) with component subsets of the full ESM, to address some outstanding questions about feedbacks anticipated with global change in the 21st century.

Other faculty anticipate using the ESMF in support of their research activities in the near future. These include Professors Blake (Chemistry, Using ESMF simulations to evaluate aircraft-measured trace gases in support of field programs), Dabdub (Mechanical & Aerospace Engineering, Using ESMF to provide boundary conditions for nested regional air quality modeling), Druffel (ESS, Comparing ESMF simulations with long term coral 1
\(^{14}\)C measurements), Frihe (MAE, Comparing and ESMF-modeled air sea exchange), Smecker-Hane (Physics and Astronomy), and Smyth (Information and Computer Science, Fitting hidden Markov models to observations and ESMF simulations of precipitation and storm tracks), and Trumbore (ESS, Understanding terrestrial C cycling using ESMF-simulations and soil \(^{14}\)C measurements). The ESMF will be maintained as a multi-user resource.
Graduate Student Summer Research Program

A major initiative of the IGPP has been to encourage first-year graduate student involvement in summer research projects. Students are required to do research related to global environmental change, and to obtain funding must submit a written proposal together with their research mentor. Students present their results in a public forum in October. In this, the first year of the program, summer research results were presented in conjunction with the dedication celebrations for John V. Croul Hall. Not all students have chosen to continue these projects as their thesis research – though for most, it provides exposure to field, lab, or computation work that helps them make their decision. In summer of 2003, a total of 8 students received full or partial support from IGPP – their names and the titles of their projects are listed below.

Sarah Bortz (Mentor: Prather) “Modeling the trace gas emissions from biomass burning plumes”

Mariah Carbone (Mentor: Trumbore) “Sources and strengths of soil respiration in Canadian boreal forest”

Mark Flanner (Mentor: Zender) “Links between Vegetation and Dust Inputs in the Last Glacial Maximum”

Brett Greene (Mentor: Tyler) “Fossil fuel contributions to atmospheric CO₂ levels in the LA Basin airshed”

Syed Hassan (Mentor: Famiglietti) “Analysis of modes of interannual variability and spatio-temporal scales in simulated soil moisture”

Eun Young Kwon (Mentor: Zender) “Observational study of the relationship between extremes in precipitation and atmospheric dust concentrations”

Guozhong Sun (Mentor: Salzman) “Propane and butane in polar ice cores”

Yuqiong Hu (Mentor: Cicerone/Trumbore) “Modeling soil gas diffusion and sources of trace gases in soils”

We plan to continue this program in the coming year.
Other support

IGPP has paid to invite seminar speakers who give joint IGPP/ESS seminars (ESS itself has no funds to invite seminar speakers). While relatively few speakers were invited in 2002-2003, the number will increase in 2003-2004.

Budget Summary
Explanation of FY 2002-2003 Expenditures

Major expenditures in FY2002-2003 were for the W.M. Keck AMS facility, the Stable Isotope Facility, and administrative support.

**W.M. Keck Carbon Cycle Accelerator Mass Spectrometry facility.**
Funds granted to the AMS facility are counted as matching commitments toward the award from Keck; to help meet that matching commitment, we have spent a bit over the nominal $25,000 per year allotted per facility. This year IGPP gave partial salary support to Dr. John Southon (Researcher) and Dr. Guaciara dos Santos (Associate Specialist). The Keck AMS facility has just completed its first year of operation, and has been highly successful – it is already measuring unknown radiocarbon samples at the rate of the NSF supported AMS facilities, and has improved background and accuracy over the delivery specifications. Dr. Southon and Dr. dos Santos led a successful collaborative NSF proposal to improve the ion source for the AMS.

**Earth System Science Stable Isotope Facility**
The stable isotope facility received funds this year in the form of three months of salary for Dr. Stanley Tyler, Researcher. Dr. Tyler used this time to continue a successful collaboration with researchers at UC Berkeley to measure stable hydrogen isotopes in methane, and to measure isotopomers of nitrous oxide.

**Administrative Support**
Trumbore received summer salary support as Director, and partial salary was provided for selected administrative personnel in the Department of Earth System Science for continued support of IGPP payroll and accounting activities. Partial summer salary support was given to Zender to cover time spent preparing the Earth System Modeling Facility grant.

**Graduate Student Support.** A major portion of IGPP’s annual budget is to be used to support research projects undertaken by first year graduate students on global change topics. That program began this year (and is currently supporting 11 students). However, only two weeks of that support shows up in FY2002-03.

Other expenditures were in the form of travel reimbursements and associated expenses for visiting seminar speakers, and to purchase furniture for an IGPP office.
Explanation of carry-over funds and predicted budget expenditures for FY2003-2004

IGPP is still a young and growing initiative; spending will increase rapidly in the coming year. While IGPP does have a relatively large carry-forward this fiscal year, much of it is committed as the first student summer research support program expenditures mostly fall in FY03-04, and we expect a growth in facilities spending, as well as a reduction in income from UCOP this year.

**Student Support.** We do have a large carry-over from FY2002-2003, though a large portion of that is committed to be spent during summer 2003 by continued support of 11 graduate students this summer. Those costs are projected at $85,000 to finish the summer, and come to ~$100,000, if we include the start of a new summer research program in summer 2004.

**Facility Support.** In FY 2003-2004, we plan to continue supporting the two continuing facilities (UCI Stable Isotope Facility and W. M. Keck Carbon Cycle AMS Facility) in the amount of ~$25,000 each. Expenditures will increase next year because of the addition of a new supercomputer facility to IGPP (the Earth System Modeling Facility). IGPP proposed $25,000 per year in salary support of a systems administrator or scientific programmer. Total expected facilities costs: $80,000.

**Administrative Support** will continue in the amount of $26,000/year. ($6,000 for Director support, $20,000 for administration)

**Seminar Support** is expected to increase to ~$10,000 next year.

**New Programs.** We will initiate a new program in 2003-2004 to support mini-workshops that gather together people from other IGPP branches/UC campuses to discuss initiatives in (1) use of radiocarbon measurements; (2) climate modeling that takes advantage of the new Earth System Modeling Facility; (3) stable isotopes in atmospheric trace gases; (4) other topics, including additional support for funded workshop activities. $30,000 will be set aside for this; the call for proposals will come out in late August.

Total commitments in FY2003-2004 are thus estimated to be ~246,000, which is greater than our income is likely to be and will thus require the carry-forward funds from 2002-2003 to see us through. To date, we have heard nothing from UCOP concerning this years’ funding.