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**REPORT TO THE BOARD OF DIRECTORS  
COOPERATIVE INSTITUTE FOR METEOROLOGICAL  
SATELLITE STUDIES  
JUNE 1992**

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# A REPORT from the

COOPERATIVE  
INSTITUTE FOR  
METEOROLOGICAL  
SATELLITE  
STUDIES



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SATELLITE STUDIES**

**JUNE 1992**

1.	PERSONNEL .....	1
2.	FINANCIAL SUMMARY .....	4
3.	RESEARCH PROGRAMS .....	10
4.	PROPOSAL SUMMARY .....	15
5.	PUBLICATIONS AND CONFERENCE REPORTS: 1991-1992.....	17

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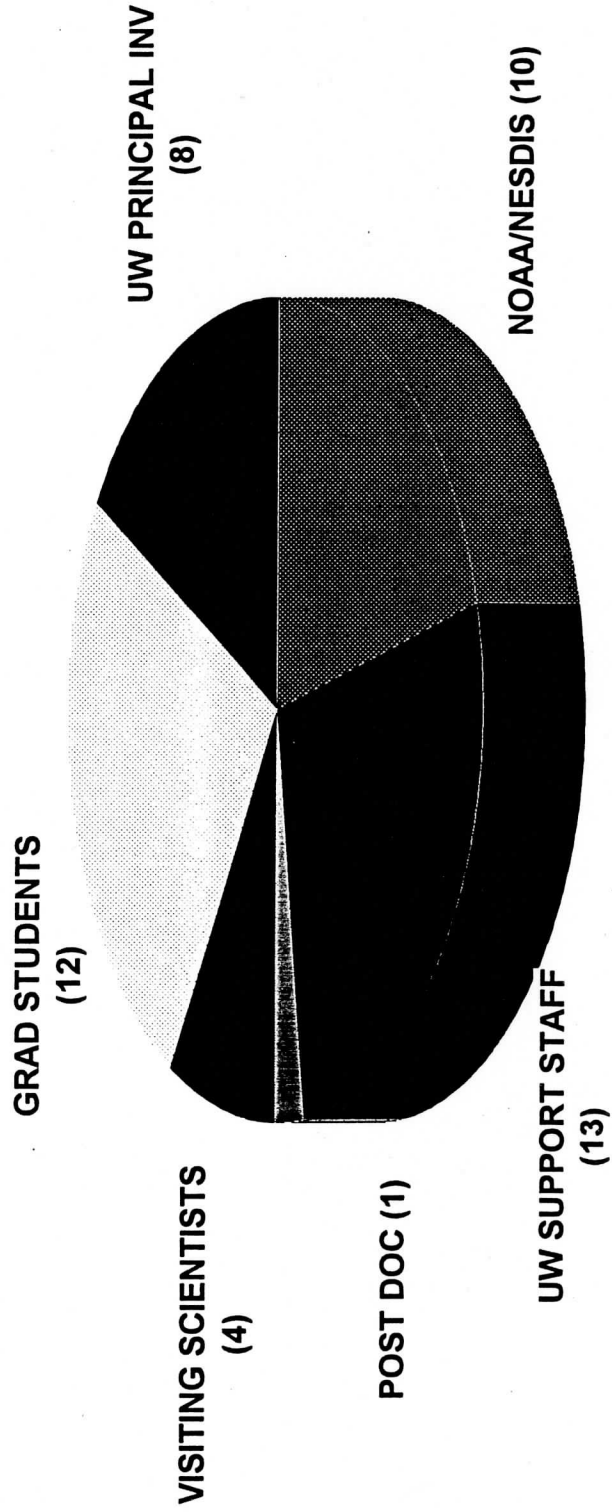
John Anderson, Department of Atmospheric and Oceanic Sciences, UW

Roland Stull, Department of Atmospheric and Oceanic Sciences, UW

Henry Revercomb, SSEC/CIMSS, UW



**CIMSS Personnel: 1992**  
Total of 48 Associates



**CIMSS ADMINISTRATION:** Smith Assoc Acad Prog Dir  
 Achtor Res Prog Mgr III  
 Pertzborn Program Asst. II

**VISITING SCIENTISTS:**  
 Rabin NOAA/NSSL  
 Ma P. R. China  
 Soden U Chicago  
 Van Delst Australia

**UNIVERSITY PRINCIPAL INVESTIGATORS:**  
 Ackerman Asst Scientist  
 Diak Assoc Scientist  
 Huang Asst Scientist  
 Knuteson Asst Scientist  
 Merrill Asst Scientist  
 Olson Asst Scientist  
 Raymond Assoc Scientist  
 Revercomb Senior Scientist

**NOAA SAB PERSONNEL:**  
 Aune  
 Callan  
 Hayden PI  
 Herman  
 Howell  
 Menzel PI  
 Nagle  
 Paris  
 Wade  
 Woolf

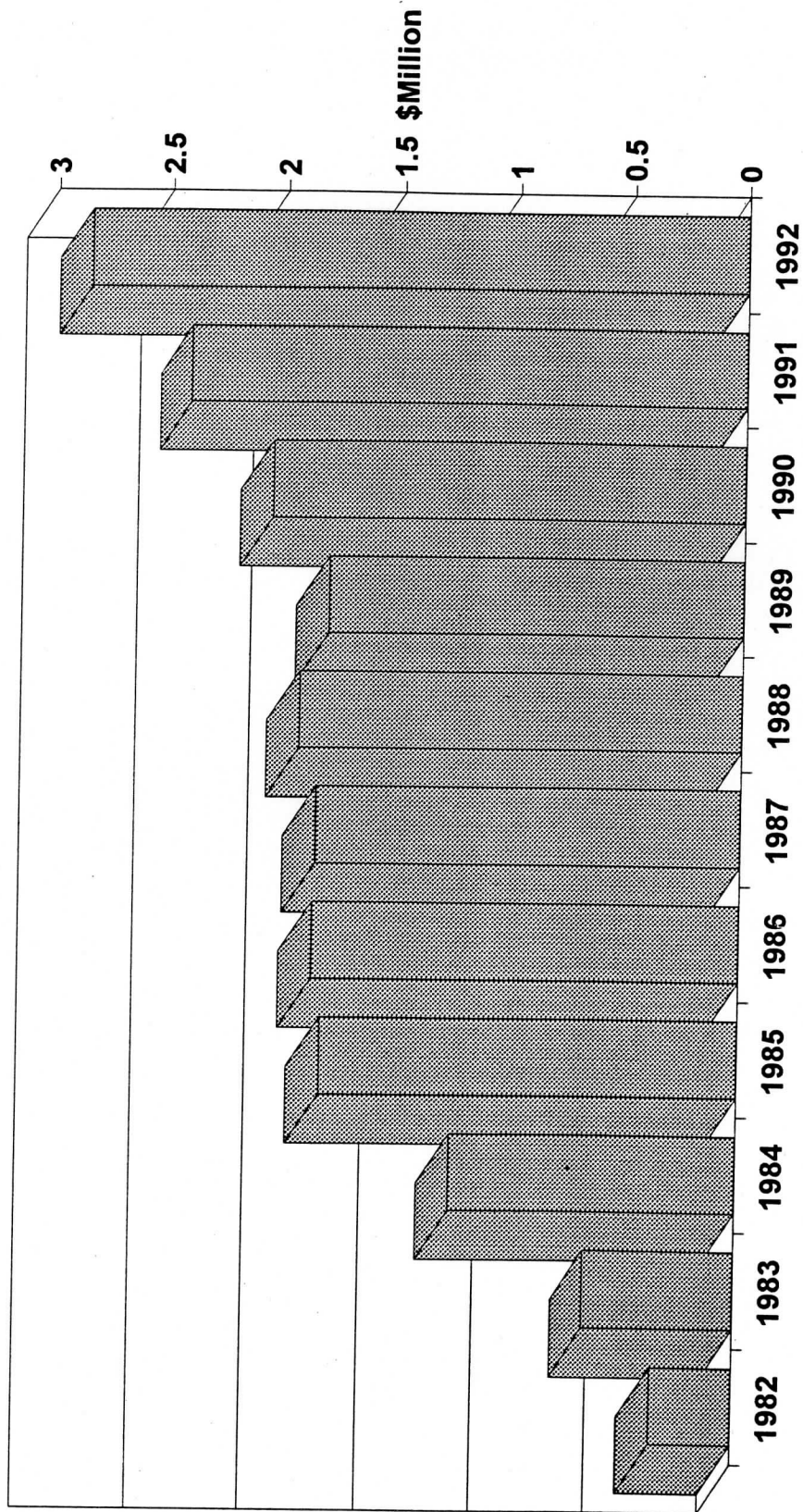
**SCIENTIFIC AND PROGRAMMING STAFF:**  
 Collimore Res. Specialist  
 Dedecker Instrument Tech  
 Garcia Student hourly  
 Frey Sen Res Specialist  
 Moeller Sen Res Specialist  
 Nieman Sen Res Specialist  
 Prins Res. Specialist  
 Rowe Assoc Inst Tech  
 Schmit Sen Res Specialist  
 Schreiner Assoc Researcher  
 Strabala Res. Specialist  
 Velden Assoc Researcher  
 Whipple Sen Res Specialist

**POST DOCTORS:**  
 Purser Research Assoc.

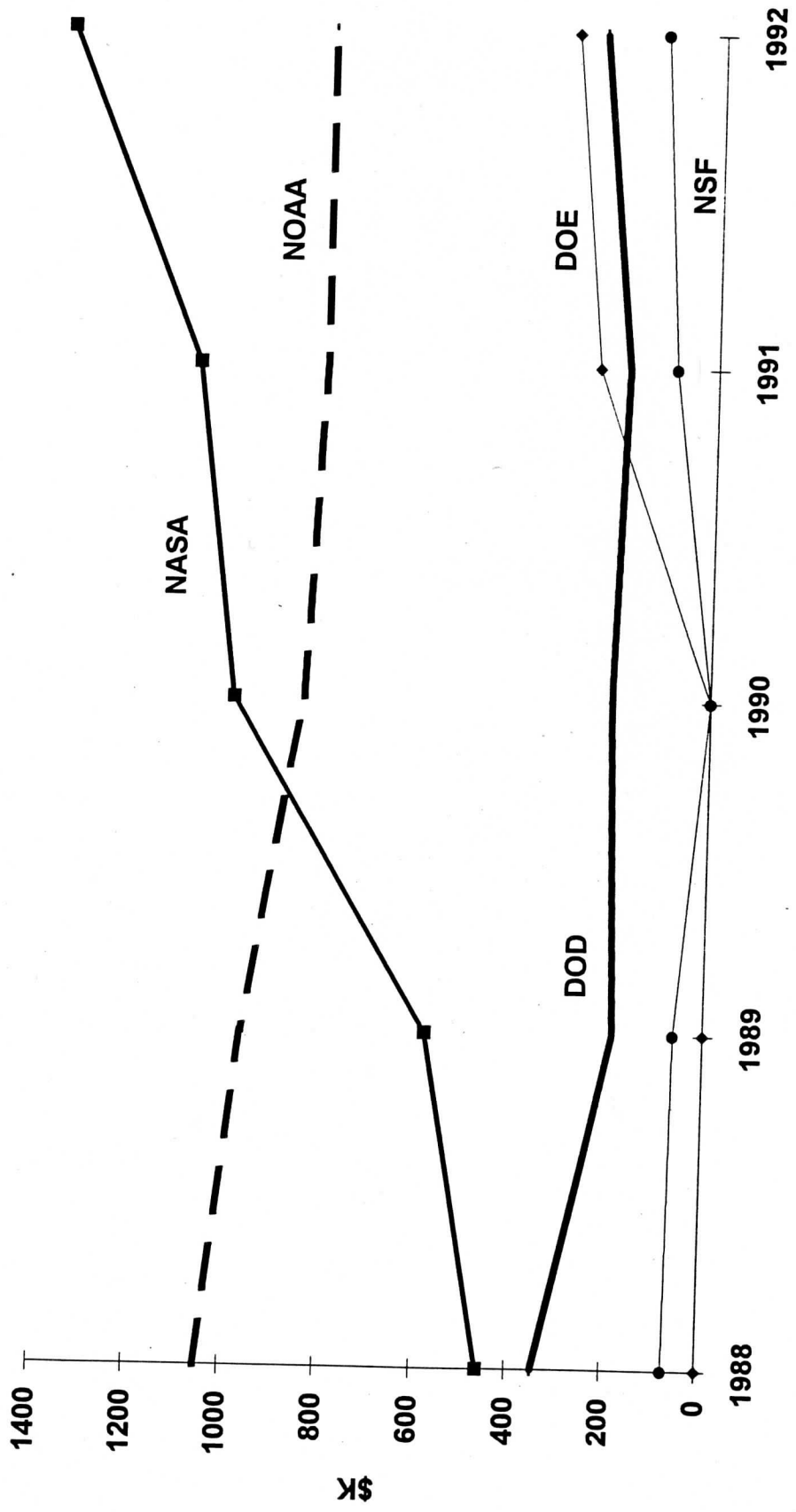
**GRADUATE STUDENTS:**

McKeown	PhD	Faust	MS	Olander	MS
Qu	PhD	Feltz	MS	Xie	MS
Wu	PhD	Li	MS	Zaras	MS
Ding	MS	Lee	MS		

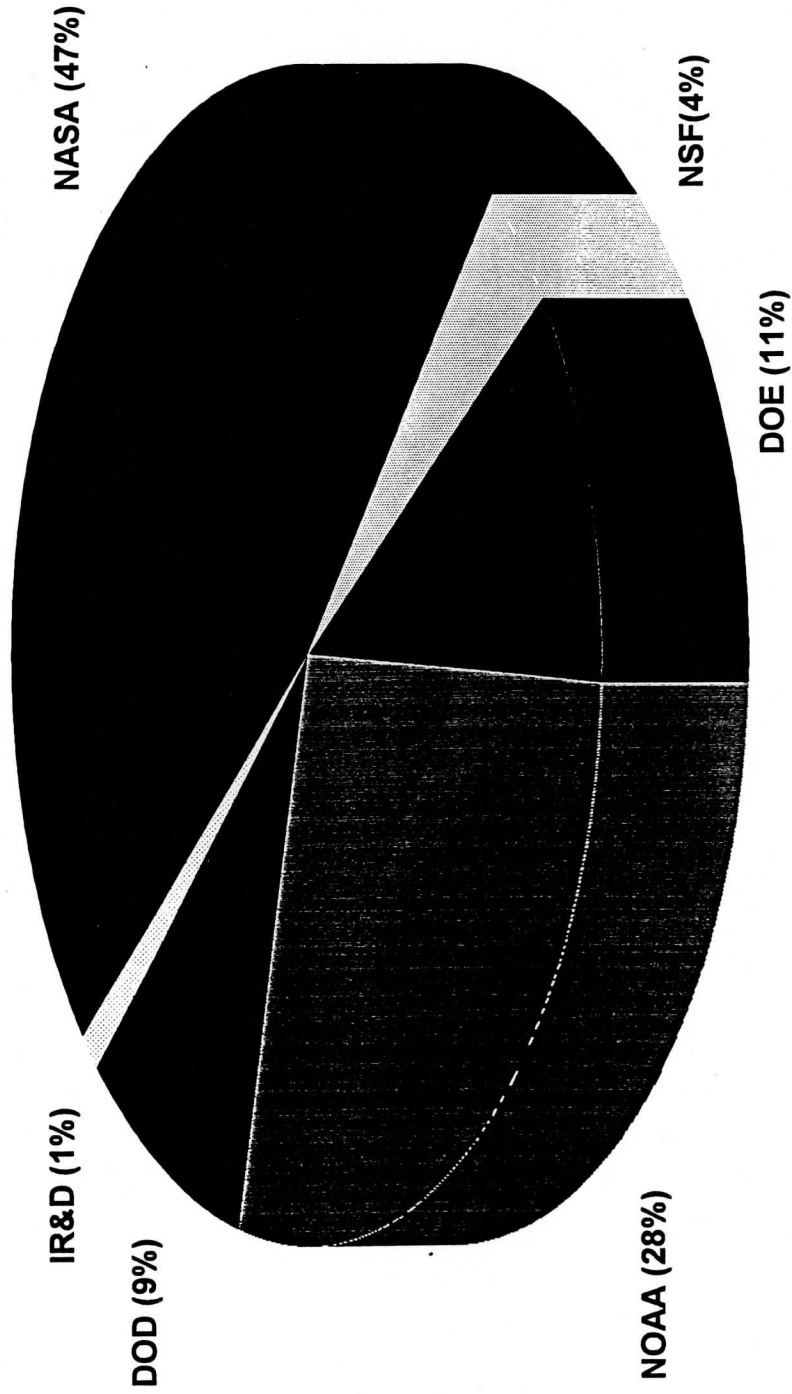
# CIMSS Annual Revenue: 1982-1992



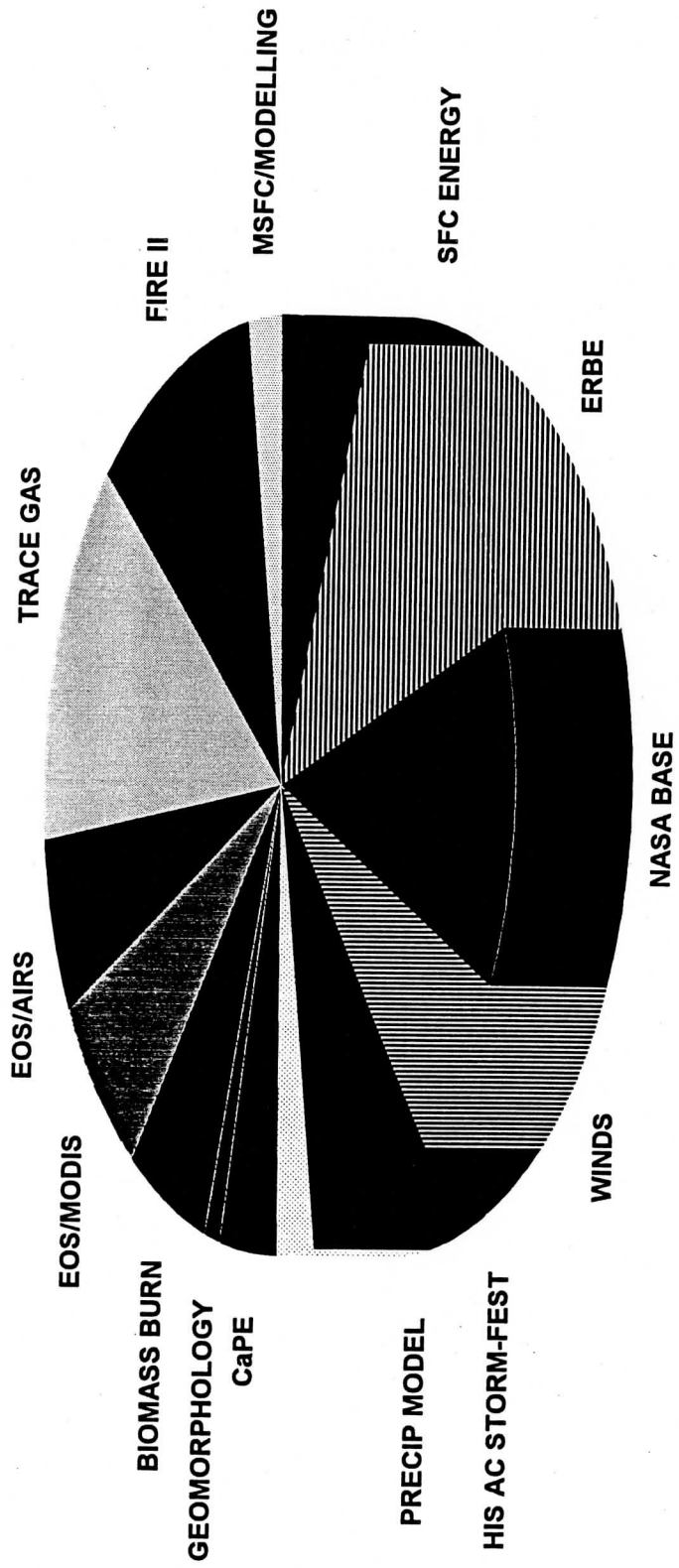
# Support by Agency: 1988-1992



**CIMSS Program Funding: FY92**

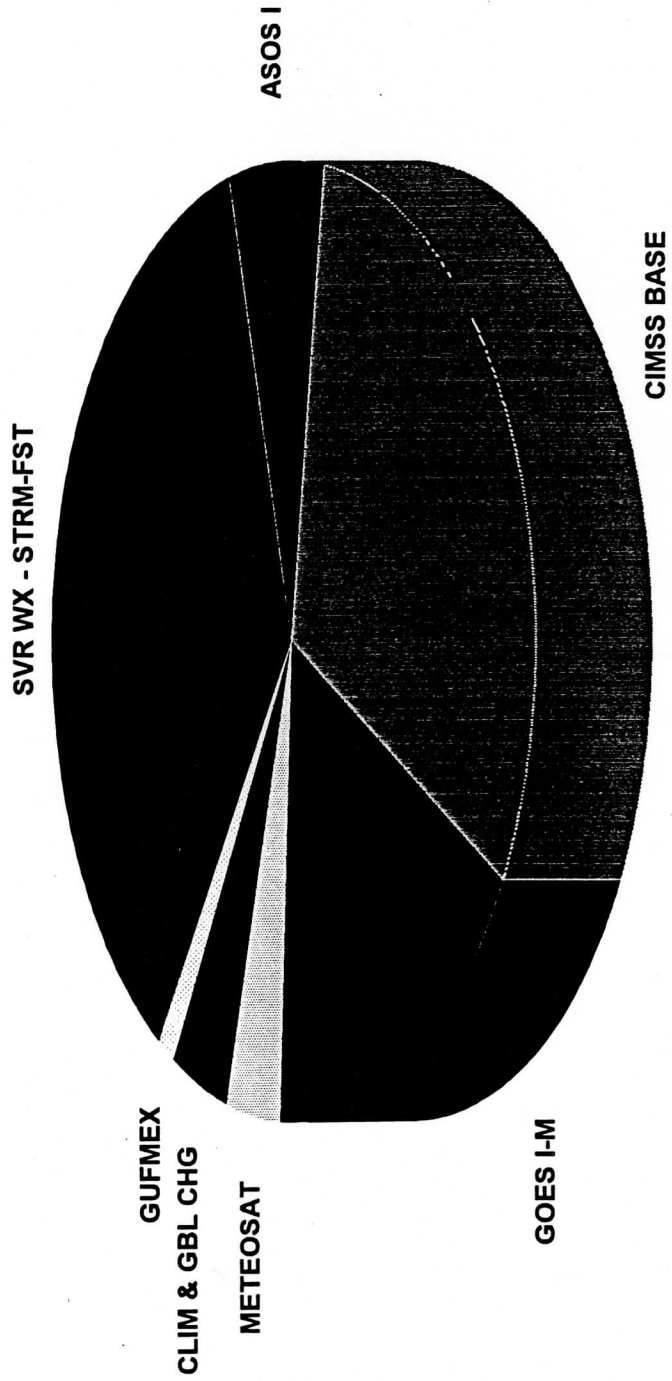


**NASA Programs: FY92 (\$1,357K)**

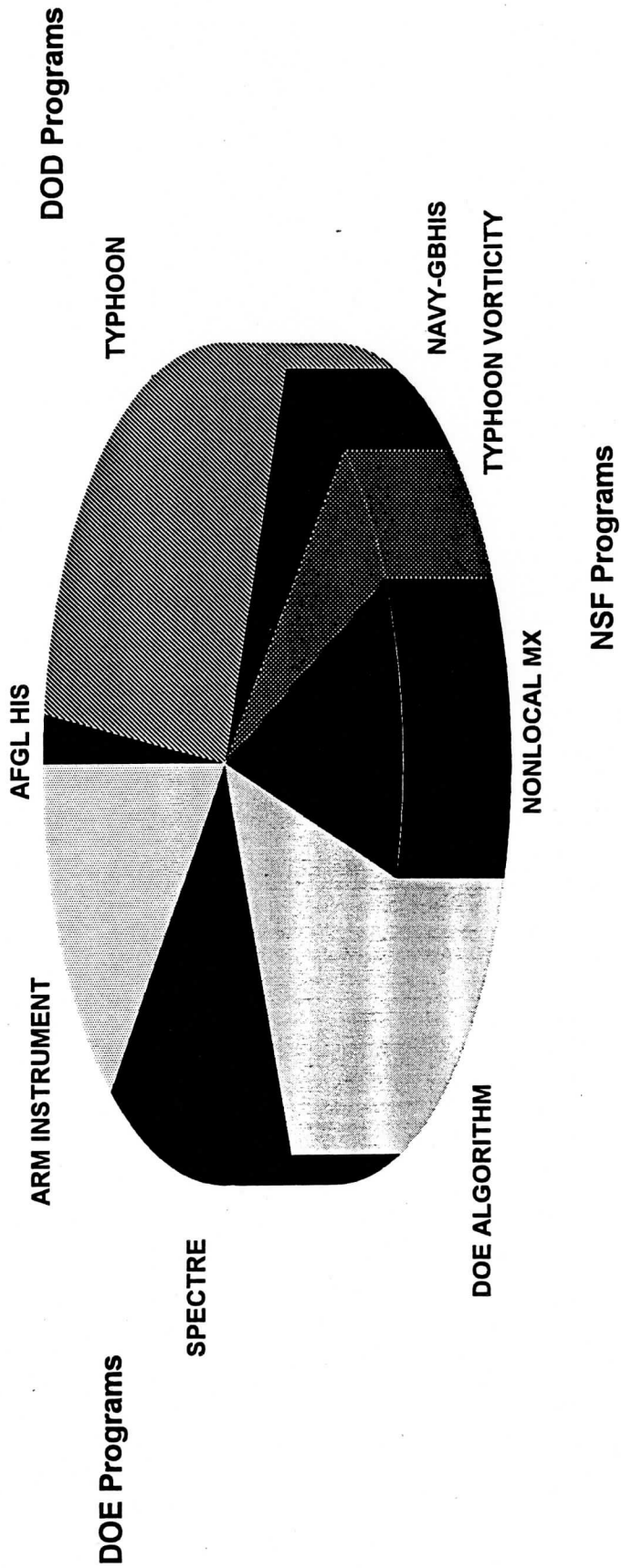




# NOAA Programs: FY92 (\$811K)



**DOE/DOD/NSF Programs: FY92**  
(\$307K/\$248K/\$119K)



# CIMSS RESEARCH PROGRAM SUMMARY: FY91-92

## 1. INSTITUTIONAL SUPPORT

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>NOAA BASE</b>		<b>NOAA/NESDIS SMITH, ACHTOR</b>
Institutional support for seed programs, graduate students, post doctoral positions, visiting scientists and seminars		
GOES cloud height feasibility study		
POES cloud drift winds at high latitudes		
Microwave signature of upper tropospheric warming in mid latitude cyclones		
<b>NASA BASE</b>	<b>NASA</b>	<b>SMITH, ACHTOR</b>
Institutional support for seed programs, graduate students, post doctoral positions, visiting scientists and seminars		
Performance requirement study for future satellite instrumentation		
Heat flux measurement from water to air using downward looking interferometer		
RISC computer facility		

## 2. OPERATIONAL SUPPORT

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>SEVERE WEATHER</b>	<b>NOAA</b>	<b>SMITH, HAYDEN, SCHREINER</b>
Satellite data assimilation studies		
Support GB-HIS in STORM-FEST, emphasizing the demonstration of continuous thermodynamic sounding of the lower atmosphere and display of high spatial and temporal resolution results in near-real time		
Continued study of return flow over Gulf of Mexico (GUFMEX)		
<b>CLOUD HEIGHT: ASOS</b>	<b>NOAA/NWS</b>	<b>MENZEL, SCHREINER</b>
Implementation of ASOS software on VDUC at WWB		
Refining the definition of satellite derived cloud cover and amount		
<b>GOES-NEXT</b>	<b>NOAA</b>	<b>SMITH, HAYDEN, SCHMIT</b>
Development of Day-1 GOES I products; provide information for waver requests during instrument development and testing		
Generate derived product images from simulated imager radiance fields for several instrument noise scenarios		
Attend (and host) meetings of the Calibration Task Force; participate in imager and sounder data reviews		
Generate new sounder radiances and retrievals for the simulation case of March 6th, 1992		
Support for VDUC/VAS operational product development		
<b>CLOUD MOTION VECTORS</b>	<b>NASA</b>	<b>SUOMI, MENZEL, NIEMAN</b>
Conduct studies to improve cloud and water vapor wind vector derivation from GOES/VAS radiances		
Investigations using various water vapor bands		
Improvements to automated target selection techniques and quality control		

### 3. FIELD PROGRAM SUPPORT

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>GUFMEX</b> Synoptic analysis of 3-dimensional moisture structure of return flow event Continued work on conceptual model of the interaction of boundary layer and convective processes in return flow and pre-severe weather events	<b>NOAA</b>	<b>MERRILL, WADE</b>
<b>WISP</b> Field program in support of development of GB-HIS for ARM in Platteville, CO in Mar. 1991 Develop calibration software and deliver final data set	<b>DOE</b>	<b>SMITH, KNUTESON</b>
<b>CaPE</b> ER/2 HIS flights from Wallops Is, VA in July-Aug. 1991 for combined field program of Convection and Precipitation/Electrification Experiment (CaPE) and Southeast Regional Oxidant Network (SERON)	<b>NASA</b>	<b>SMITH, REVERCOMB, KNUTESON</b>
<b>FIRE II</b> Participation in Nov.-Dec. 1991 field experiment in KS ER/2 HIS observations to study cirrus cloud radiative properties and develop parameterizations	<b>NASA</b>	<b>SMITH, ACKERMAN</b>
<b>SPECTRE</b> Collect GB-HIS data from Coffeerville, KS in Nov.-Dec. 1991 (4 weeks)	<b>DOE</b>	<b>(see Section 4)</b>
<b>STORM-FEST - HIS AIRCRAFT</b> Collect aircraft-HIS data from Houston, TX base in Feb.-Mar. 1992 (4 wks) Demonstrate vertical sounding capabilities for numerical model/data assimilation studies from prototype advanced satellite sounder	<b>NASA</b>	<b>SMITH, REVERCOMB</b>
<b>STORM-FEST - GB HIS</b> Collect GB-HIS data from Seneca, KS in Feb.-Mar. 1992 (6 wks)	<b>NOAA</b>	<b>(see Section 2)</b>
<b>STORM-FEST - McIDAS</b> McIDAS computer and scientific staff support to STORM-FEST headquarters in Kansas City, KS for duration of 6 week program Staff from UW and NOAA/NESDIS	<b>SSEC</b>	<b>(SSEC overhead)</b>
<b>MARINE - GB HIS</b> Research cruise to collect GB-HIS measurements in marine environment Develop algorithms for detection of radar ducting conditions	<b>NOARL</b>	<b>SMITH, KNUTESON</b>
<b>(TOGA-COARE McIDAS</b> SSEC system support for 4 month field program (Nov. 92 - Feb. 93) McIDAS workstations at Townsville, Australia and Guadalcanel (as required) Scientific staff support for McIDAS operations	<b>NSF</b>	<b>YOUNG, WYLIE, VELDEN)</b>

#### 4. WEATHER AND CLIMATE APPLICATIONS

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>TROPICAL CYCLONE</b> Intensity and structure monitoring using passive microwave measurements Develop physical model to retrieve the horizontal structure of the warm core anomaly, including correction for different horizontal resolutions of current and planned satellite microwave radiometers	AFGL	MERRILL, VELDEN
<b>TYPHOON POTENTIAL VORTICITY</b> Analysis of 3-dimensional structure of outflow layer of intense typhoon Support TCM-90 with satellite data set collection and archive (ONR support) Create satellite derived cloud motion winds for TCM-90 (ONR support)	NSF	MERRILL, VELDEN
<b>ERBE</b> Studies with Earth Radiation Budget data sets Regional energy budget studies of deserts and the impact of dust Combined ERBE/AVHRR/HIRS2 observations to study impact of cloud type and cloud amount on energy budgets, and the coupling between greenhouse effect, SST, and vertical distribution of water vapor Field program in Bahrain to assess radiative properties of smoke and dust	NASA	SMITH, ACKERMAN
<b>BIOMASS BURNING</b> Investigate the extent of burning in Amazonia from 1988 through 1992 using GOES/VAS multispectral radiance measurements	NASA	MENZEL, PRINS
<b>SPECTRE</b> U. of MD subcontract to collect ground-based data set of accurate radiances with extensive <i>in situ</i> measurement of atmospheric state parameters for validation of atmospheric transmittance models GB-HIS instrument development support (year 1); field experiment in Coffeerville, KS in Nov.-Dec. 1991 (year 2); calibration and final data set preparation (year 3)	DOE	SMITH, REVERCOMB, KNUTESON
<b>GEOMORPHOLOGY</b> Study of the impact of cold front weather systems on the geomorphology of the Louisiana coastal zone using ER/2 MAMS Identify response of suspended sediment, SST, coastal circulation and water type distribution to individual cold front forcing Apply AVHRR, MAMS and ancillary meteorological, oceanographic and geological measurements to study cumulative impact of cold fronts on seasonal basis	NASA	MENZEL, MOELLER & LSU
<b>AVHRR/HIRS CLIMATE MONITORING</b> Develop operational algorithm for global climate parameters over oceans from co-located AVHRR / HIRS2 data	NOAA	ACKERMAN, SMITH

## 5. REMOTE SENSING TECHNIQUES / ALGORITHM DEVELOPMENT

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>EOS/MODIS</b> Development of algorithms and applications for EOS/MODIS high spatial resolution visible and infrared spectrometer Use ER/2 MAS (MODIS Airborne Simulator) data to investigate cloud microphysics and cloud heights	NASA	MENZEL, MOELLER, STRABALA
<b>EOS/AIRS</b> Algorithm development for AIRS temperature/moisture retrieval Use ER/2 HIS data for algorithm development and testing	NASA	SMITH, HUANG
<b>EOS/AIRS (CLIMATE APPL.)</b> Technique development for trace gas and surface property retrievals Instrument studies emphasizing spectral calibration and verification	NASA	REVERCOMB, KNUTESON
<b>DOE ALGORITHM DEVELOPMENT</b> Develop algorithms in support of Atmospheric Radiation Measurement (ARM) program to retrieve atmospheric temperature and moisture profiles from GB-HIS measurements Detect cloud presence and derive cloud emittance Improve atmospheric line-by-line models through detailed comparison of downwelling radiance spectra with model calculations	DOE	SMITH, ACKERMAN, KNUTESON
<b>TRACE GAS</b> Development of algorithms for retrieval of Ozone and other atmospheric trace gases from high altitude infrared observations Theoretical development (year 1), field program (year 2) and algorithm validation (year 3)	NASA	REVERCOMB, KNUTESON
<b>AFGL HIS</b> Cooperative program to exchange ideas, techniques and personnel to study sounding technology and atmospheric modeling issues	AFGL	SMITH, KNUTESON
<b>TOVS UPGRADE</b> Continued studies to provide improvements to International TOVS Processing Package (ITPP) for generating temperature and moisture profiles from POES radiance measurements Funds derived from ITPP licensing	INT R&D	ACHTOR



## 6. MODELING

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>PRECIPITATION MODELING</b> Evaluate techniques to incorporate SSM/I precipitation rate data to initialize numerical model forecasts Theoretical examination of the role of mesoscale circulation in convective processes	NASA	RAYMOND, OLSON
<b>NON-LOCAL MIXING</b> Theoretical investigation of mixing in the boundary layer and in convective zones over large distances Application of mathematical techniques to approximate mixing for incorporation into CIMSS model	NSF	RAYMOND
<b>MODELING/MSFC</b> Simulation of AMSU retrievals, including cloud liquid water Observing system simulation experiments	NASA	DIAK, HUANG
<b>SURFACE ENERGY BALANCE</b> Refine methods to determine surface energy balance using raob and satellite surface skin temp Simulate time changes of HIS/AIRS radiances for surface energy balance evaluation	NASA	DIAK, WHIPPLE

## 7. HARDWARE / FEASIBILITY STUDIES

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>ARM/DOE</b> Program with U of Denver, including development of a ground-based atmospheric emitted radiance interferometer (AERI), higher resolution emitted radiance interferometer (AERI-X), and solar absorption interferometer (SORTI) Instruments will provide accurate measurement of downwelling radiance and atmospheric transmittance in support of Atmospheric Radiation Measurement (ARM) program Goal to improve parameterization of cloud radiative properties in global climate models	DOE	REVERCOMB, KNUTESON
<b>HIS GEOPLATFOM</b> Geostationary Atmospheric Profiler (GAP) for advanced thermodynamic sounding and trace gas retrieval, emphasizing regional mesoscale applications Phase A instrument design study final report submitted 1990; revised 1992	NASA	SMITH, REVERCOMB, BEST
<b>ITS</b> Interferometer Thermal Sounder (ITS) compatible with ESA and NOAA operational platforms Phase A instrument design study final report submitted 1991 Design resulting from optimized performance requirements fits within HIRS/3 size envelope	EUMETSAT	SMITH, REVERCOMB, BEST

## 8. EDUCATION/OUTREACH

INVESTIGATION TITLE	AGENCY	PRINCIPAL SCIENTISTS
<b>SPACE GRANT CONSORTIUM</b> Programs to attract talented students into science and engineering fields Education, Outreach and Research branches provide support for students at all levels Research branch (at CIMSS) funds undergraduate student research proposals and conducts summer workshop in Earth System Science for high school students and teachers	NASA	SMITH, ACHTOR

## **PROPOSAL SUMMARY**

### **ATMOSPHERIC SOUNDINGS AND CLOUD AND RAIN WATER AMOUNTS FROM PLANNED SATELLITE INSTRUMENTATION**

\$270K for 3 years / NASA MSFC/ Diak, Huang  
Evaluate information content of AMSU  
Submitted to NASA in May 1991. **FUNDED** (start in August)

### **FIRE PHASE II DATA ANALYSIS**

\$124K for 1 year / NASA / Smith, Ackerman  
HIS data analysis for cirrus cloud microphysical and radiative properties  
Submitted to NASA in August 1991. **FUNDED** at \$100K

### **GEOMORPHIC EVOLUTION AND HYDROGRAPHIC CHANGES INDUCED BY WINTER STORMS ALONG THE LOUISIANA COAST**

\$685K for 3 years / NASA / Menzel, Moeller with LSU  
Investigate processes driving coastal environments under cold frontal passages  
Submitted to NASA in November 1991. **FUNDED** (lower start year 1)

### **CONTINGENCY CLOUD DEFINITION IN SUPPORT OF THE ASOS**

\$150K for 2 years / NOAA / Menzel  
Phase II of upper level cloud determination from GOES  
Submitted to NOAA in November 1991. **PENDING**

### **A COMPREHENSIVE MODELING, SATELLITE AND IN-SITU DATA BASE APPLIED TO INVESTIGATIONS OF CLOUD MICROPHYSICAL AND RADIATION PROCESSES**

\$428K for 3 years / NASA / Diak, Raymond, Ackerman, Wylie  
Investigate cloud microphysical properties to improve model parameterization  
Submitted to NASA in March 1992. **PENDING**

### **CONTINUED SUPPORT OF THE STORM RESEARCH PROGRAM**

\$273.5K for 1 year / NOAA-NESDIS / Smith  
Multi-faceted program supporting data assimilation / nwp, field programs, data analysis and hardware  
Submitted to NOAA in April 1992. **PENDING**

### **SPECTRAL RADIANCE MEASUREMENTS IN THE BOREAL ECOSYSTEM:**

\$465K for 3 years / NASA / Smith, Revercomb, Knuteson  
GB-HIS participation in BOREAS  
Submitted to NASA in April 1992. **PENDING**

**SATELLITE OBSERVATIONS IN SUPPORT OF BOREAS**

\$464K for 4 years / NASA / Ackerman, Smith  
POES Satellite data collection and analysis for BOREAS  
Submitted to NASA in April 1992. PENDING

**A STUDY OF THE CLIMATIC INTERACTIONS AMONG HIGH LATITUDE BIOTA, BOUNDARY LAYER CLOUDS AND ALBEDO**

\$279K for 3 years / NASA / Raymond, Hinton, Rabin, Wade  
Climate relationship between flora and atmosphere for BOREAS  
Submitted to NASA in April 1992. PENDING

**INVESTIGATIONS OF CLOUDS WITH GOES/VAS AND NOAA/HIRS**

\$108K for 2 years / NOAA Global Change / Menzel, Wylie  
Continue cloud property climatology from HIRS  
Submitted to NOAA in June 1992. PENDING

**AN OPERATIONAL UPPER TROPOSPHERIC HUMIDITY PRODUCT FOR CLIMATE APPLICATIONS OF GOES**

\$72K for 1 year / NOAA Global Change / Hayden  
Create operational upper tropospheric humidity product from GOES  
Submitted to NOAA in June 1992. PENDING

**DEVELOPMENT OF UNIFIED PRECIPITATION AND ATMOSPHERIC PHYSICAL RETRIEVAL METHODOLOGIES USING AMSU (AND OTHER ) DATA**

\$182K for 2 years / NOAA Global Change / Diak, Olson  
Use of current and future POES radiances to provide quantitative precipitation information  
Submitted to NOAA in June 1992. PENDING

**ADAPTATION OF POSITIVE DEFINITE ALGORITHMS FOR PARALLEL COMPUTERS**

\$90K for 3 years / NSF / Raymond  
Parallel processing experiments using Fourier transform procedures  
Submitted to NSF in June 1992. PENDING

## 1991-1992 REVIEWED LITERATURE

(CIMSS authors in italics)

- Ackerman, S. A.* and H. Chung, 1992: Radiative effects of airborne dust on regional energy at the top of the atmosphere. Jour. Appl. Meteor., Vol. 31, 223 - 233.
- Ackerman, S. A.*, *R. A. Frey*, and *W. L. Smith*, 1992: Radiation budget studies using collocated observations from AVHRR, HIRS/2 and ERBE instruments. Accepted for publication in Jour. Geo. Res.
- Chang Song, Jung-Sing Jwo, S. Lakshmivarahan, S.K. Dhall, J. Lewis and *C.S. Velden*, 1992: Wind Field Decomposition algorithms for use in a computationally demanding *Diak*, *G. R.*, D. Kim, and *H. L. Huang*, 1991 Preparing for the AMSU. Accepted by Bull. Amer. Meteor. Soc.
- Diak, G. R.*, and *M. A. Whipple*, 1992: Improvements to models and methods for evaluating the land-surface energy balance and "effective" roughness using radiosonde reports and satellite-measured "skin" temperatures. Submitted to Jour. Ag. For. Meteor.
- Goodman, B., *W. P. Menzel*, E. C. Cutrim, and D. W. Martin, 1992: A Non-linear Algorithm for Estimating 3-Hourly Rainrates over Amazonia from GOES/VISSR Observations. Submitted to Mon. Wea. Rev.
- Hayden, C. M.*, and *T. J. Schmit*, 1991: The anticipated sounding capabilities of GOES I/M and beyond. Bull. Amer. Meteor. Soc., Vol. 72, No. 12, 1835 - 1846.
- Huang, H.-L.*, *W. L. Smith*, and *H. M. Woolf*, 1992: Vertical resolution and accuracy of atmospheric infrared sounding spectrometers. Jour. Appl. Meteor. 31, 265-274.
- Huang, H-L.* and *G.R. Diak*, 1992: Retrieval of non-precipitating liquid water cloud parameters from microwave data: A simulation study. Accepted by Jour. of Atmospheric and Oceanic Technology.
- Jascourt, S. D., and *W. H. Raymond*, 1991: Comments on "Chaos in daisyworld". To appear in Tellus-B.
- Kaufman, Y. J., A. Setzer, D. Ward, D. Tanre, B. N. Holben, V. W. J. H. Kirchhoff, *W. P. Menzel*, M. C. Pereira, and R. Rasmussen, 1992: Biomass burning airborne and spaceborne experiment in the Amazonas (BASE-A). Submitted to IEEE Trans. and Geoscience and Remote Sensing.
- King, M. D., Y. J. Kaufman, *W. P. Menzel*, and D. Tanre, 1992: Remote sensing of cloud, aerosol and water vapor properties from the Moderate Resolution Imaging Spectrometer (MODIS). IEEE Trans. and Geoscience and Remote Sensing, 30, 2-27.
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- Menzel, W. P., D. P. Wylie, and K. I. Strabala, 1992: Seasonal and diurnal changes in cirrus clouds as seen in four years of observations with the VAS. Jour. Appl. Meteor. Vol. 31, No. 4, 370-385.*
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- Merrill, R. T., W. P. Menzel, W. Baker, J. Lynch, E. Legg, 1991: A report on the recent demonstration of NOAA's upgraded capability to derive satellite cloud motion winds. Bull. Amer. Meteor. Soc., Vol. 72, 372-376.*
- Merrill, R. T. 1992: Synoptic analysis of the GUFMEX return flow event of 10-12 March 1988. Accepted by Jour. Appl. Meteor., August 1992.*
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- Prins, E. M. and W. P. Menzel, 1992: Geostationary satellite estimation of biomass burning in South America. Accepted by Int. Jour. of Remote Sensing.*
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- Smith, W. L.* 1990: Atmospheric soundings from satellite - false expectation or the key to improved weather prediction? Royal Meteorological Society, Symons Memorial Lecture, London, UK May 16. Jour. Roy. Meteor. Soc., Vol. 117, No. 498, Jan. 1991.
- Smith, W. L., H. M. Woolf and H. E. Revercomb*, 1991: Linear simultaneous solution for temperature and absorbing constituent profiles from radiance spectra. App. Optics, Vol. 30, No. 9.
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