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

A REPORT from the

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

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# REPORT TO THE BOARD OF DIRECTORS

**COOPERATIVE INSTITUTE FOR METEOROLOGICAL SATELLITE STUDIES**

**JUNE 1992**

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CIMSS BOARD OF DIRECTORS

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CIMSS PERSONNEL

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

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

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

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

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

POST DOCTORS:
Purser
Research Assoc.

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

3
CIMSS Program Funding: FY92

- NASA (47%)
- NOAA (28%)
- DOD (9%)
- DOE (11%)
- IR&D (1%)
- NSF (4%)
NASA Programs: FY92 ($1,357K)

- NASA BASE
- ERBE
- SFC ENERGY
- MSFC/MODELLING
- FIRE II
- TRACE GAS
- EOS/MODIS
- EOS/AIRS
- BIOMASS BURN
- GEOMORPHOLOGY
- CaPE
- PRECIP MODEL
- HIS AC STORM-FEST
- WINDS
NOAA Programs: FY92 ($811K)

SVR WX - STRM-FST

GUUFMEX
CLIM & GBL CHG
METEOSAT
GOES I-M
CIMSS BASE
ASOS I
DOE/DOD/NSF Programs: FY92
($307K/$248K/$119K)

DOE Programs

ARM INSTRUMENT

DOD Programs

SPECTRE

AFGL HIS

NAVY-GBHIS

DOE ALGORITHM

TYPHOOON

NONLOCAL MX

TYPHOOON VORTICITY

NSF Programs
CIMSS RESEARCH PROGRAM SUMMARY: FY91-92

1. INSTITUTIONAL SUPPORT

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

2. OPERATIONAL SUPPORT

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

INVESTIGATION TITLE

GUfMEX

AGENCY        PRINCIPAL SCIENTISTS

NOAA          MERRILL, WADE

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

WISP

DOE           SMITH, KNUTESON

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

CaPE

NASA          SMITH, REVERCOMB, KNUTESON

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 (SERO)

FIRE II

NASA          SMITH, ACKERMAN

Participation in Nov.-Dec. 1991 field experiment in KS
ER/2 HIS observations to study cirrus cloud radiative properties and develop parameterizations

SPECTRE

DOE           (see Section 4)

Collect GB-HIS data from Coffeenville, KS in Nov.-Dec. 1991 (4 weeks)

STORM-FEST - HIS AIRCRAFT

NASA          SMITH, REVERCOMB

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

STORM-FEST - GB HIS

NOAA          (see Section 2)

Collect GB-HIS data from Seneca, KS in Feb.-Mar. 1992 (6 wks)

STORM-FEST - McIDAS

SSEC          (SSEC overhead)

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

MARINE - GB HIS

NOARL         SMITH, KNUTESON

Research cruise to collect GB-HIS measurements in marine environment
Develop algorithms for detection of radar ducting conditions

(TOGA-COARE McIDAS

NSF           YOUNG, WYLIE, VELDEN)

SSEC system support for 4 month field program (Nov. 92 - Feb. 93)
McIDAS workstations at Townsville, Australia and Guadalcanal (as required)
Scientific staff support for McIDAS operations
4. WEATHER AND CLIMATE APPLICATIONS

INVESTIGATION TITLE
TROPICAL CYCLONE
TYPHOON POTENTIAL VORTICITY
ERBE
BIOMASS BURNING
SPECTRE
GEOMORPHOLOGY
AVHRR/HIRS CLIMATE MONITORING

AGENCY
AFGL
NSF
NASA
NASA
DOE
NASA
NOAA

PRINCIPAL SCIENTISTS
MERRILL, VELDEN
MERRILL, VELDEN
SMITH, ACKERMAN
SMITH, ACKERMAN
SMITH, REVERCOMB, KNUTESON
MENZEL, MOELLER & LSU
ACKERMAN, SMITH

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
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)
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
Investigate the extent of burning in Amazonia from 1988 through 1992 using GOES/VAS multispectral radiance measurements
U. of MD subcontract to collect ground-based data set of accurate radiances with extensive in situ measurement of atmospheric state parameters for validation of atmospheric transmittance models
GB-HIS instrument development support (year 1); field experiment in Coffeetville, KS in Nov.-Dec. 1991 (year 2); calibration and final data set preparation (year 3)
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
Develop operational algorithm for global climate parameters over oceans from co-located AVHRR / HIRS2 data
## 5. REMOTE SENSING TECHNIQUES / ALGORITHM DEVELOPMENT

<table>
<thead>
<tr>
<th>INVESTIGATION TITLE</th>
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<th>PRINCIPAL SCIENTISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EOS/MODIS</strong></td>
<td>NASA</td>
<td>MENZEL, MOELLER, STRABALA</td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EOS/AIRS</strong></td>
<td>NASA</td>
<td>SMITH, HUANG</td>
</tr>
<tr>
<td>Algorithm development for AIRS temperature/moisture retrieval Use ER/2 HIS data for algorithm development and testing</td>
<td></td>
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</tr>
<tr>
<td><strong>EOS/AIRS (CLIMATE APPL.)</strong></td>
<td>NASA</td>
<td>REVERCOMB, KNUTESON</td>
</tr>
<tr>
<td>Technique development for trace gas and surface property retrievals Instrument studies emphasizing spectral calibration and verification</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DOE ALGORITHM DEVELOPMENT</strong></td>
<td>DOE</td>
<td>SMITH, ACKERMAN, KNUTESON</td>
</tr>
<tr>
<td>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</td>
<td></td>
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</tr>
<tr>
<td><strong>TRACE GAS</strong></td>
<td>NASA</td>
<td>REVERCOMB, KNUTESON</td>
</tr>
<tr>
<td>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)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AFGL HIS</strong></td>
<td>AFGL</td>
<td>SMITH, KNUTESON</td>
</tr>
<tr>
<td>Cooperative program to exchange ideas, techniques and personnel to study sounding technology and atmospheric modeling issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOVS UPGRADE</strong></td>
<td>INT R&amp;D</td>
<td>ACHTOR</td>
</tr>
<tr>
<td>Continued studies to provide improvements to International TOVS Processing Package (ITPP) for generating temperature and moisture profiles from POES radiance measurements Funds derived from IPP licensing</td>
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6. **MODELING**

<table>
<thead>
<tr>
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<th>PRINCIPAL SCIENTISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRECIPITATION MODELING</td>
<td>NASA</td>
<td>RAYMOND, OLSON</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NON-LOCAL MIXING</td>
<td>NSF</td>
<td>RAYMOND</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MODELING/MSFC</td>
<td>NASA</td>
<td>DIAK, HUANG</td>
</tr>
<tr>
<td>Simulation of AMSU retrievals, including cloud liquid water. Observing system simulation experiments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURFACE ENERGY BALANCE</td>
<td>NASA</td>
<td>DIAK, WHIPPLE</td>
</tr>
<tr>
<td>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.</td>
<td></td>
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</tbody>
</table>

7. **HARDWARE / FEASIBILITY STUDIES**

<table>
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<tr>
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<th>AGENCY</th>
<th>PRINCIPAL SCIENTISTS</th>
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</thead>
<tbody>
<tr>
<td>ARM/DOE</td>
<td>DOE</td>
<td>REVERCOMB, KNUTESON</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIS GEOPLATFORM</td>
<td>NASA</td>
<td>SMITH, REVERCOMB, BEST</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITS</td>
<td>EUMETSAT</td>
<td>SMITH, REVERCOMB, BEST</td>
</tr>
</tbody>
</table>

8. **EDUCATION/OUTREACH**

<table>
<thead>
<tr>
<th>INVESTIGATION TITLE</th>
<th>AGENCY</th>
<th>PRINCIPAL SCIENTISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPACE GRANT CONSORTIUM</td>
<td>NASA</td>
<td>SMITH, ACHTOR</td>
</tr>
<tr>
<td>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.</td>
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</tbody>
</table>
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. FUNDDED (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. FUNDDED 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. FUNDDED (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)


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.


1991-1992 CONFERENCE PAPERS AND REPORTS


**Ackerman, S. A., S. Limaye, G. S. Wade and P. Fry, 1992:** Spectral signatures of dust, smoke, forest fire and volcanic aerosols from satellite observations. Sixth Conference on Satellite Meteorology and Oceanography, Atlanta, GA, January 5-10, 1992.


**Ackerman, S. A., 1991:** The effects of dust on tropospheric and stratospheric radiative heating rates. IAMAP Symposium on Aerosol-Cloud-Climate Interactions, Vienna, Austria, August, 1991.


