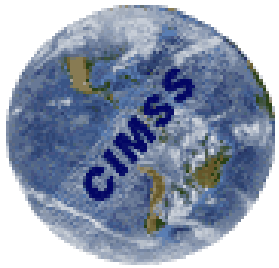
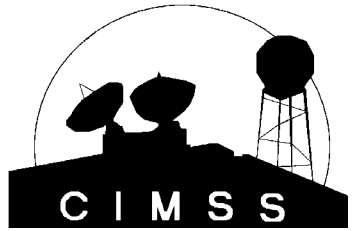



# Reflections on Twenty Five Years at CIMSS

Paul Menzel

NOAA/NESDIS/ORA
Cooperative Institute for Meteorological Satellite Studies (CIMSS)
Madison, Wisconsin

**July 2005**

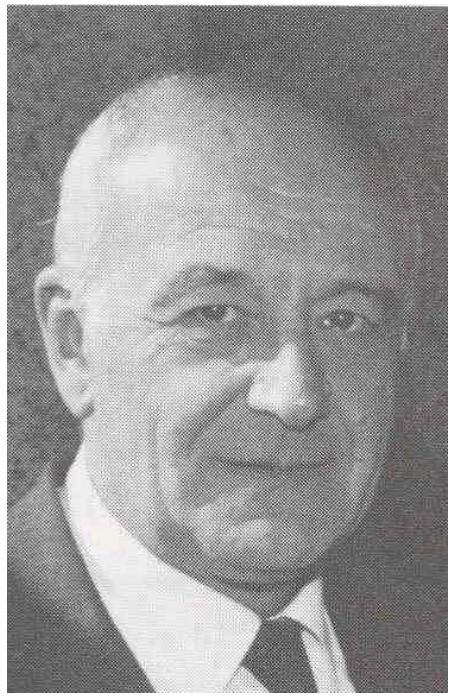


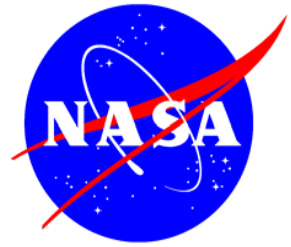
**CIMSS has flourished because of**

- **good leaders leading good people**
- **interesting science**
  - **instruments and cal/val**
  - **processing and visualization**
  - **algorithms and applications**
  - **multitudes of data**
- **steady sponsorship from NASA and NOAA**
  - **basic research**
  - **transfer to operations**
- **strong international partnerships**
  - **global observing system**

# Verner Suomi started it all

# He had some friends

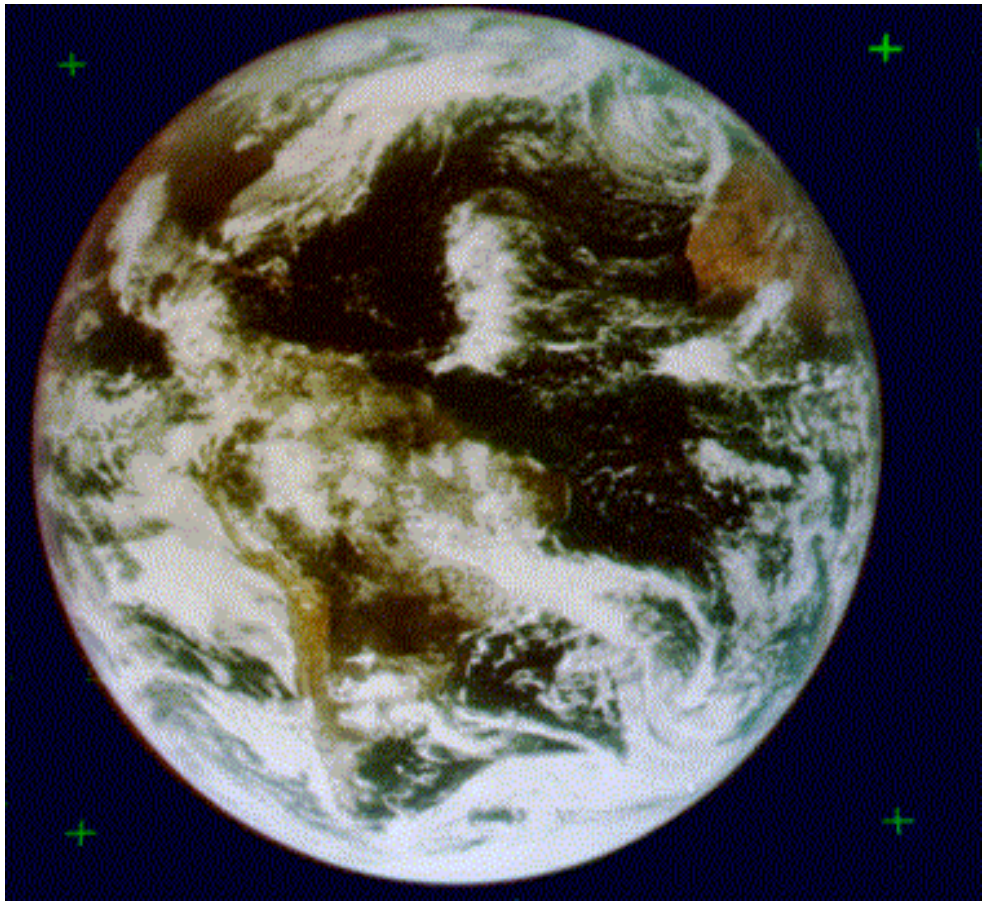



## UW - NOAA - NASA have been working together for many years

## Some early examples include:

* **first meteorological satellite experiment in 1959**
  - **Suomi's net flux radiometer on Pioneer VII**
* **first geostationary satellite in 1966**
  - **Suomi and Parent's spin scan cloud camera on ATS-1**
* **processing system to display, navigate, loop images**
  - **McIDAS**
* **archive of GOES data**
  - **videocassette synched to satellite spin**
* **first geostationary sounder**
  - **VAS in 1981**



**“the clouds moved - not the satellite”**

**Verner Suomi**

**In 1966, ATS-1's geostationary spin scan cloud camera provided full disk visible images of the earth and its cloud cover every 20 minutes**

## NOAA / NESS sends a small group to work with Suomi et al

* The NESS Development Lab locates at UW

  Dave Small starts in 1975

  Bill Smith & Kit Hayden bring their groups to SSEC

* First visiting scientist comes

## Soundings become NESS / UW project

* TIROS-N in 1978 became the operational polar sounder

  NESS DL developed the sounding software

* VISSR Atmospheric Sounder preparations intensify

  Larry Sromovsky & Hank Revercomb are UW leads

  first geostationary sounding is made in 1981

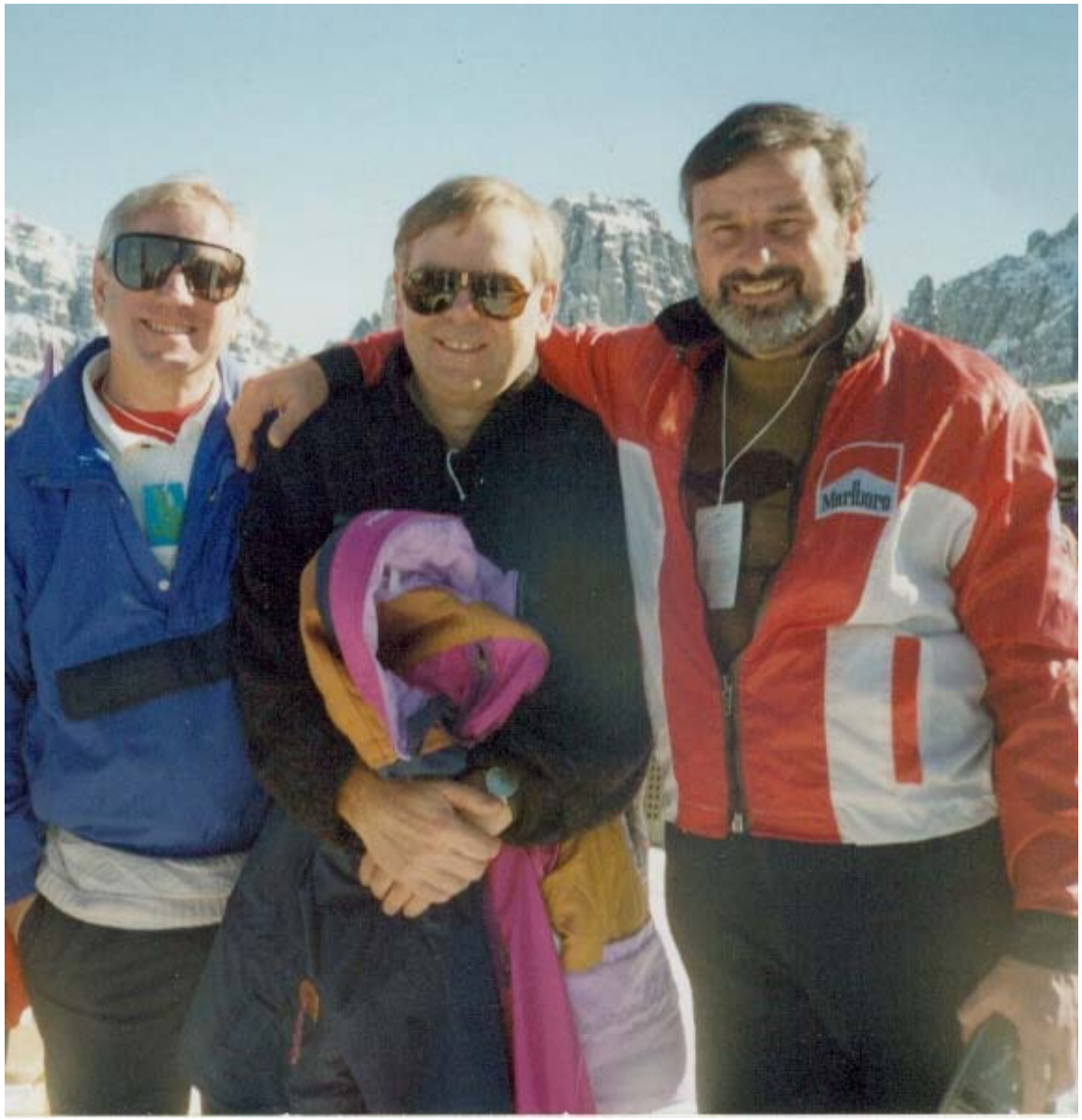
# Some of us looked different then








# Bill recruits CIMSS visiting fellows from Down Under



→ **FGGE produces the first global wind data sets**

* **First GARP Global Experiment in 1979**
* **Connections with European community strengthen**

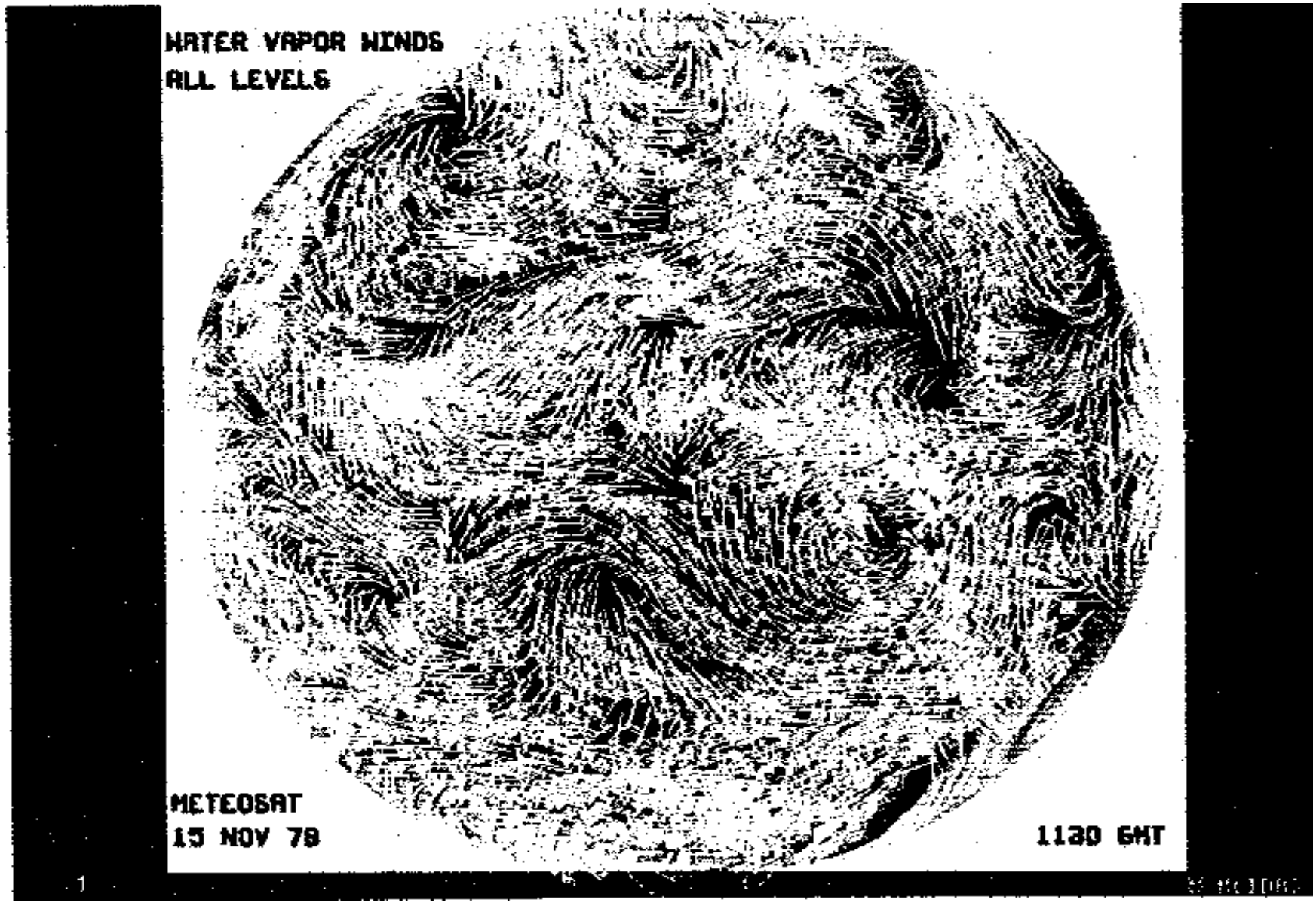
**CIMSS formalizes UW/NESDIS arrangement with MOU**

* **Vern Suomi is first Director in 1980**

  **SSEC maintains data rich environment for CIMSS**
* **Smith becomes 2nd CIMSS Director**
* **ASPP formed to do NOAA Operational VAS Assessment**

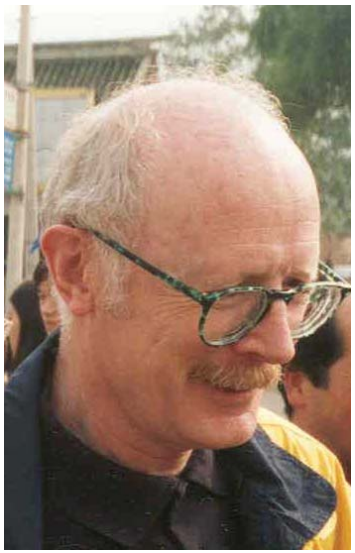
# Meteosat water vapor tracers supplemented FGGE winds

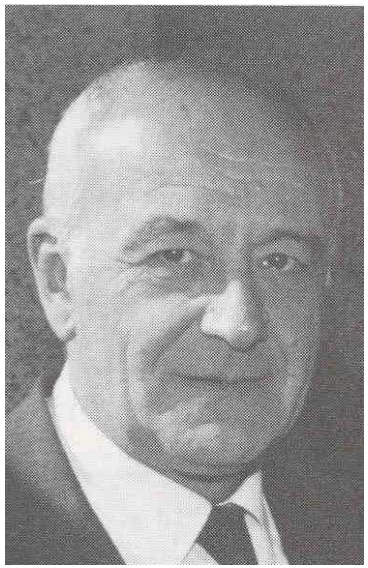
This picture was included in 1978 Christmas Greetings from Vern Suomi to Pierre Morel



# European-CIMSS connection starts early and stays strong

## Members of the Meteosat Family that have visited CIMSS





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The National Aeronautics and Space Administration

*Presents the*

# Group Achievement Award

*to the*

## VAS DEMONSTRATION TEAM

Goddard Space Flight Center

*In recognition of the implementation of a successful demonstration of the capabilities of a new atmospheric sounding system which is now being used as a baseline for the operational implementation of geosynchronous soundings.*

**Cooperative Intstitue for Meterological Satellite Studies(CIMSS)**
**University of Wisconsin**

*Signed and Sealed at Goddard Space Flight Center this fourth day of December, Nineteen hundred and eighty-one.*

Director, GSFC

## CIMSS gets praise from NESDIS Administrator

**William P. Bishop says in article on partnerships in remote sensing in (Nov 1986)**

**"…a cooperative institute (CIMSS) at the UW…has had an enormous on the geosynchronous satellites…in fact it may have had the largest impact on those satellites and their use of any single institution"**

**this one partnership…on three occasions (cloud winds, archive of images, and soundings from VAS)… demonstrated…the best ways in which government - academic partnerships work to enormous benefit"**

→ **CIMSS connects with international remote sensing family**

* **First international TOVS Study Conference in 1983**
* **China - CIMSS ties strengthen with visiting scientists**

**High spectral IR resolution takes off**

* **HIS is built and flown in 1980s**
* **Interferometer almost makes it onto GOES I/M**
* **NASA commits to AIRS for EOS**
* **EUMETSAT starts IASI efforts**

# ITSC-1 leads to ITSC-14 with record audience in Beijing

INTERNATIONAL ATOVS WORKING GROUP

## The 14th International TOVS Study Conference

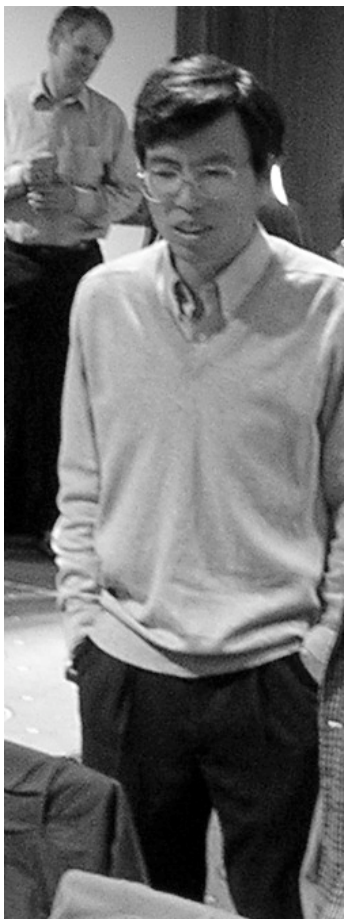
第 14 届国际泰罗斯业务垂直探测研讨会

(25–31 May, Beijing, China)

# CIMSS-China ties have grown over 25 years







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* **Field experiments demonstrate high spectral IR data**
* **Interferometer almost makes it onto GOES I/M**
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# Scanning HIS

## (HIS: High-resolution Interferometer Sounder, 1985-1998)

### Characteristics

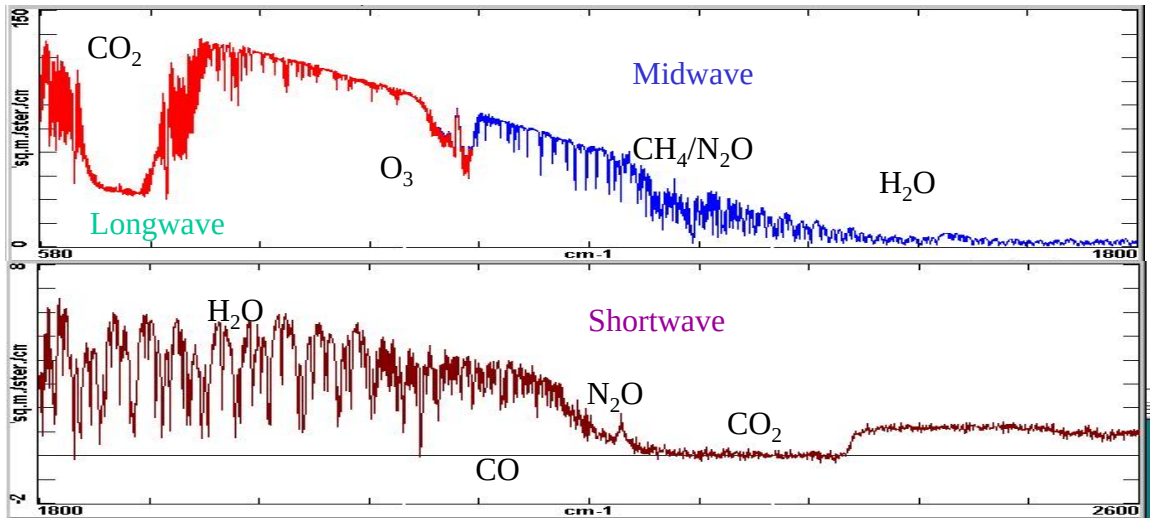
**Spectral Coverage:** 3-17 microns

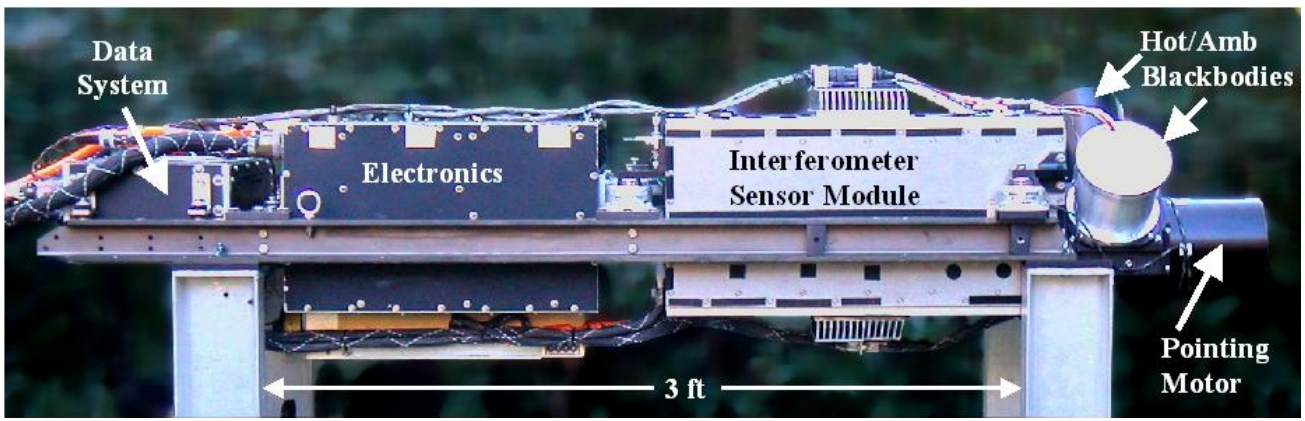
**Spectral Resolution:** 0.5 $cm^{-1}$

**Resolving power:** 1000-6000

**Footprint Diam:** 1.5 km @ 15 km

**Cross-Track Scan:** Programmable including uplooking zenith view




### Applications:

- Radiances for Radiative Transfer
- Temp & Water Vapor Retrievals
- Cloud Radiative Prop.
- Surface Emissivity & T
- Trace Gas Retrievals

→ **NASA joins UW and NOAA in MOU in 1989**

*** Smith, Tilford, and Pyke expand collaboration**

**Remote sensing and CIMSS continue to evolve**

*** GOES I/M replaces VAS in 1994**

*** Winds processing gets boost from Intl Winds Workshops**

*** AERIs and MAERIs prove their worth on land and sea**

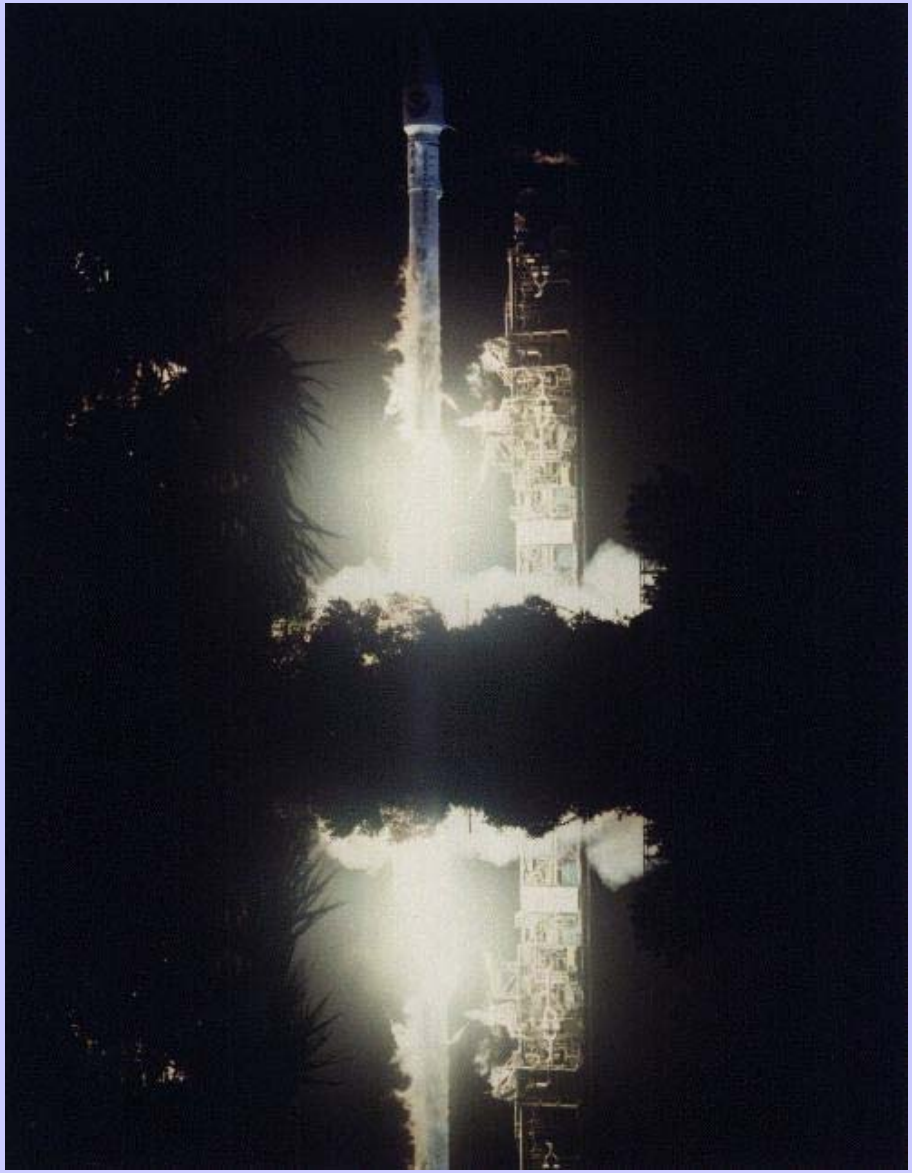
*** First operational soundings from geo**

*** Hayden retires and Smith departs in 1997**

**Don Johnson becomes Director**

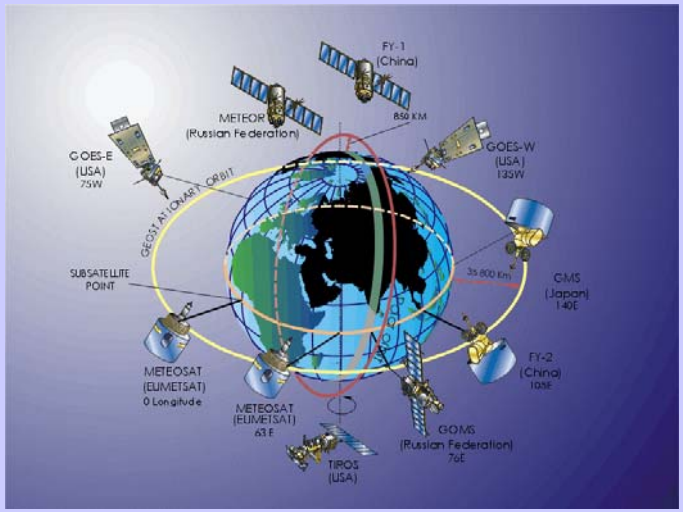
*** NOAA plans for interferometers in leo (CrIS)**

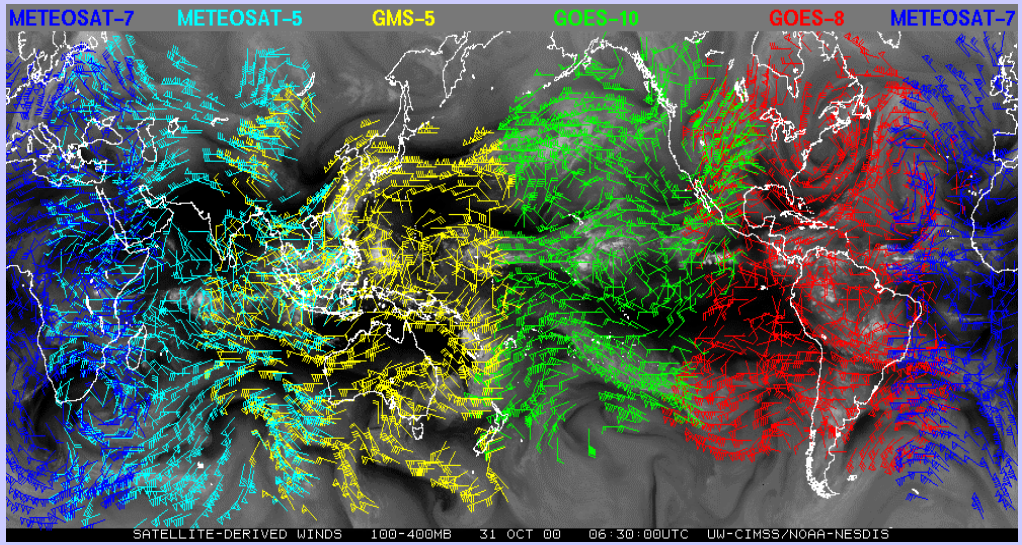
**and geo (GOES ABS)**



# GOES-I launch

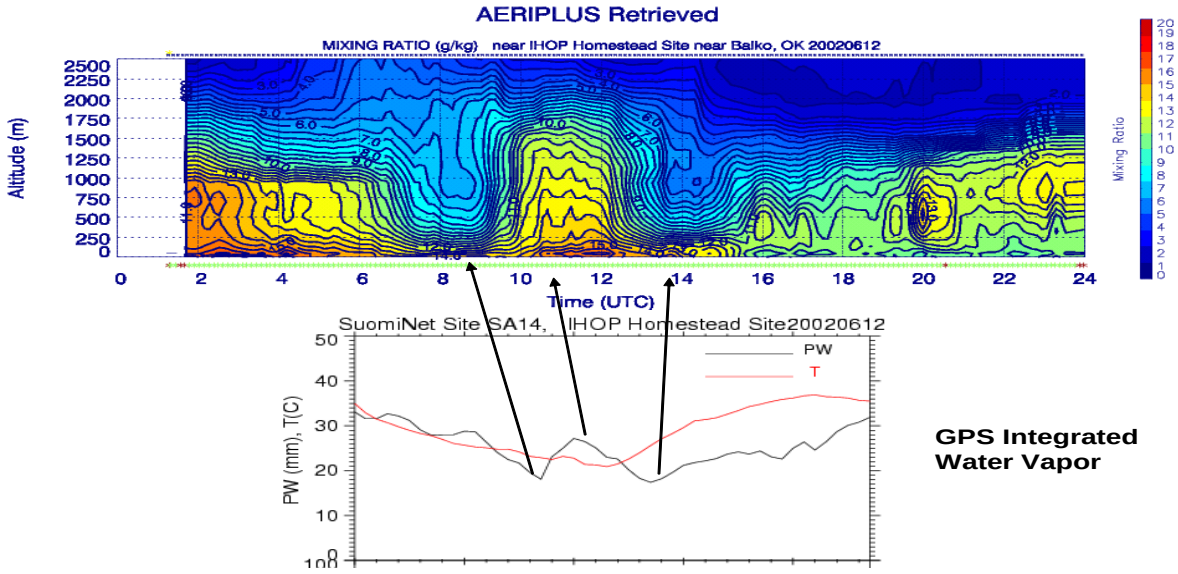
# Second International Winds Workshop is held in Tokyo Japan




Five geos providing global coverage for winds in tropics and mid-lats with comparable quality

**AERI Retrieved IHOP water vapor time height cross sections from 12 June 2002 indicating rapid water vapor oscillations also indicated by GPS retrieved integrated water vapor**



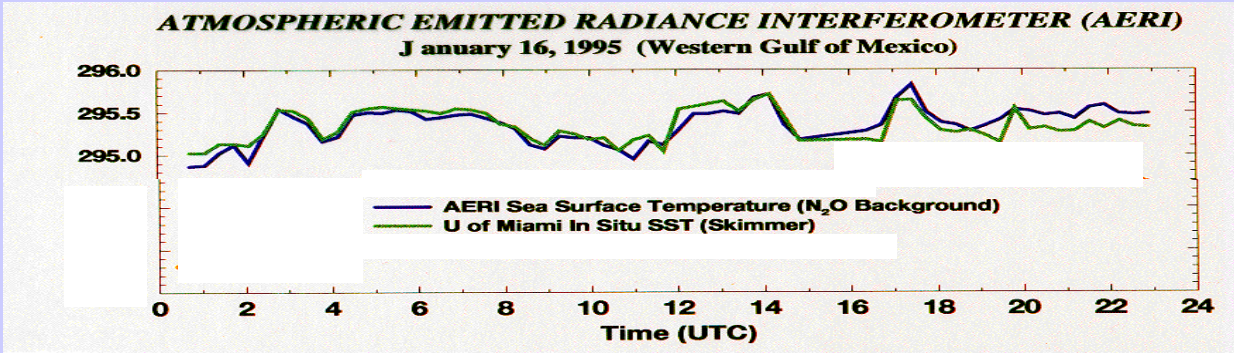

GPS Integrated Water Vapor

**AERI marks water vapor changes**

**MAERI high spectral resolution detects daytime surface skin heating in clear skies**

**Skimmer (green) warmer at night and cooler in day**

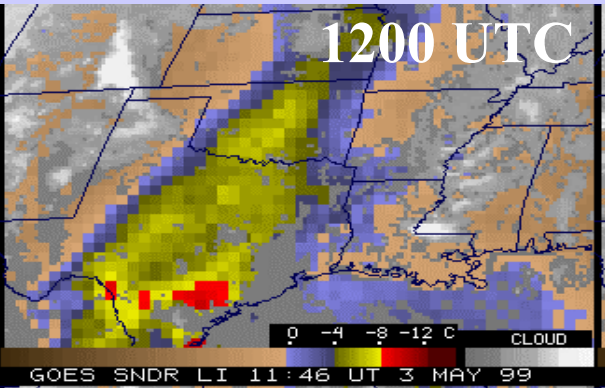
**MAERI marks solar heating of sea surface skin**

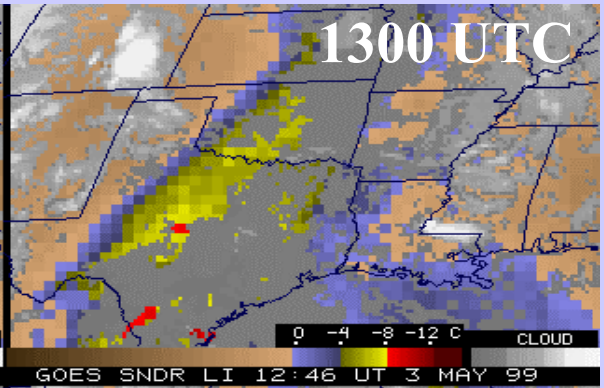


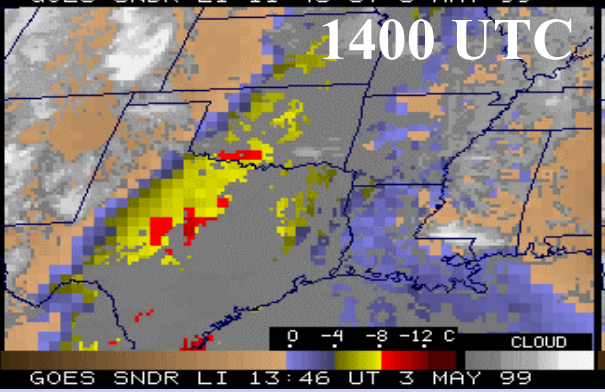

↑ solar heating showing up

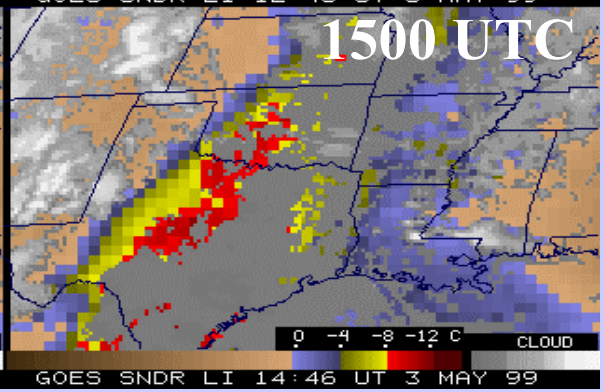
# Oklahoma City Tornado 3 May 99

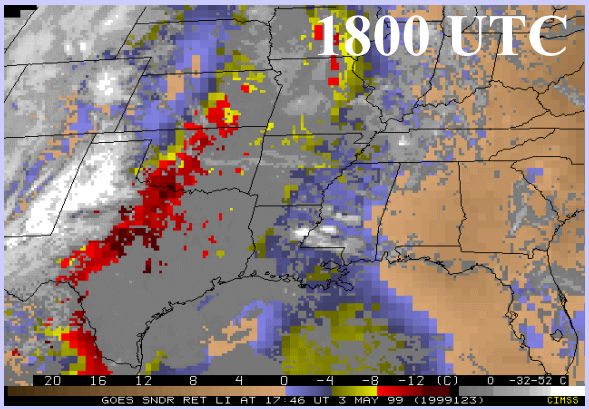
## View from space

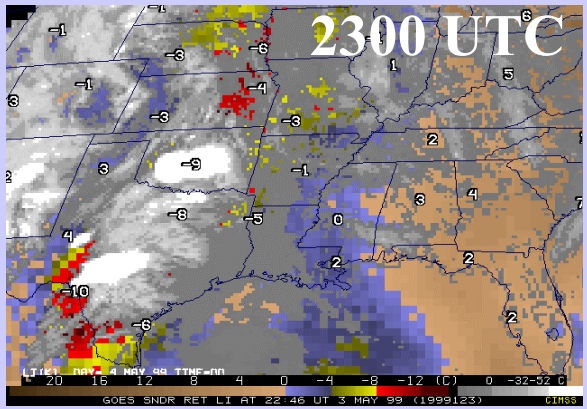


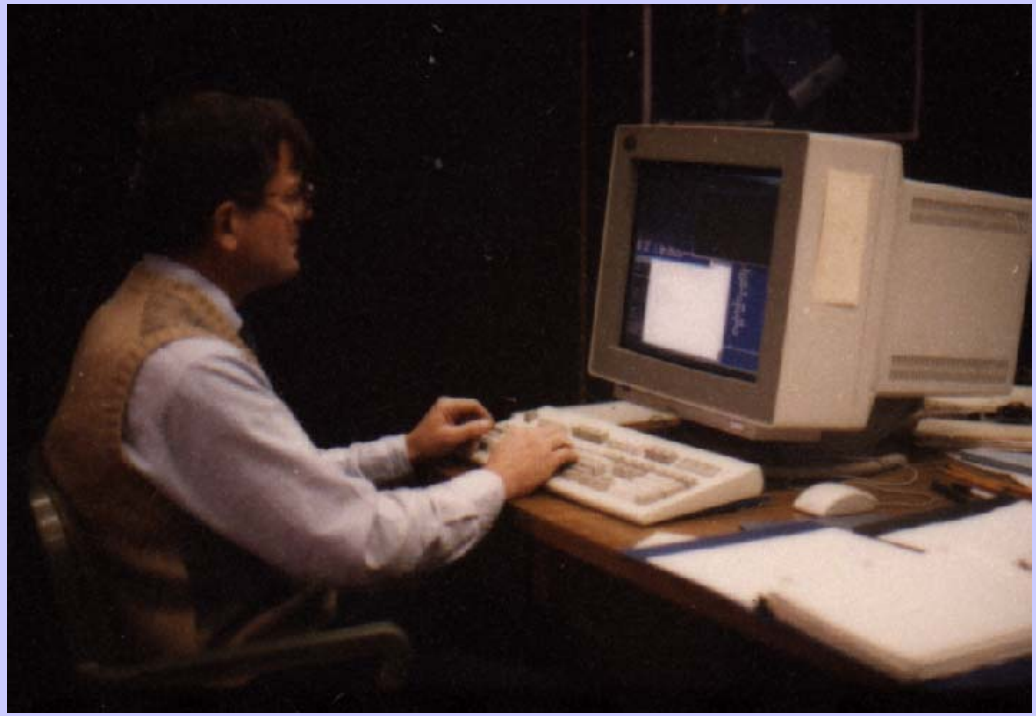





## View from ground

**Director**
**Don Johnson**

**Kit Hayden as we remember him**

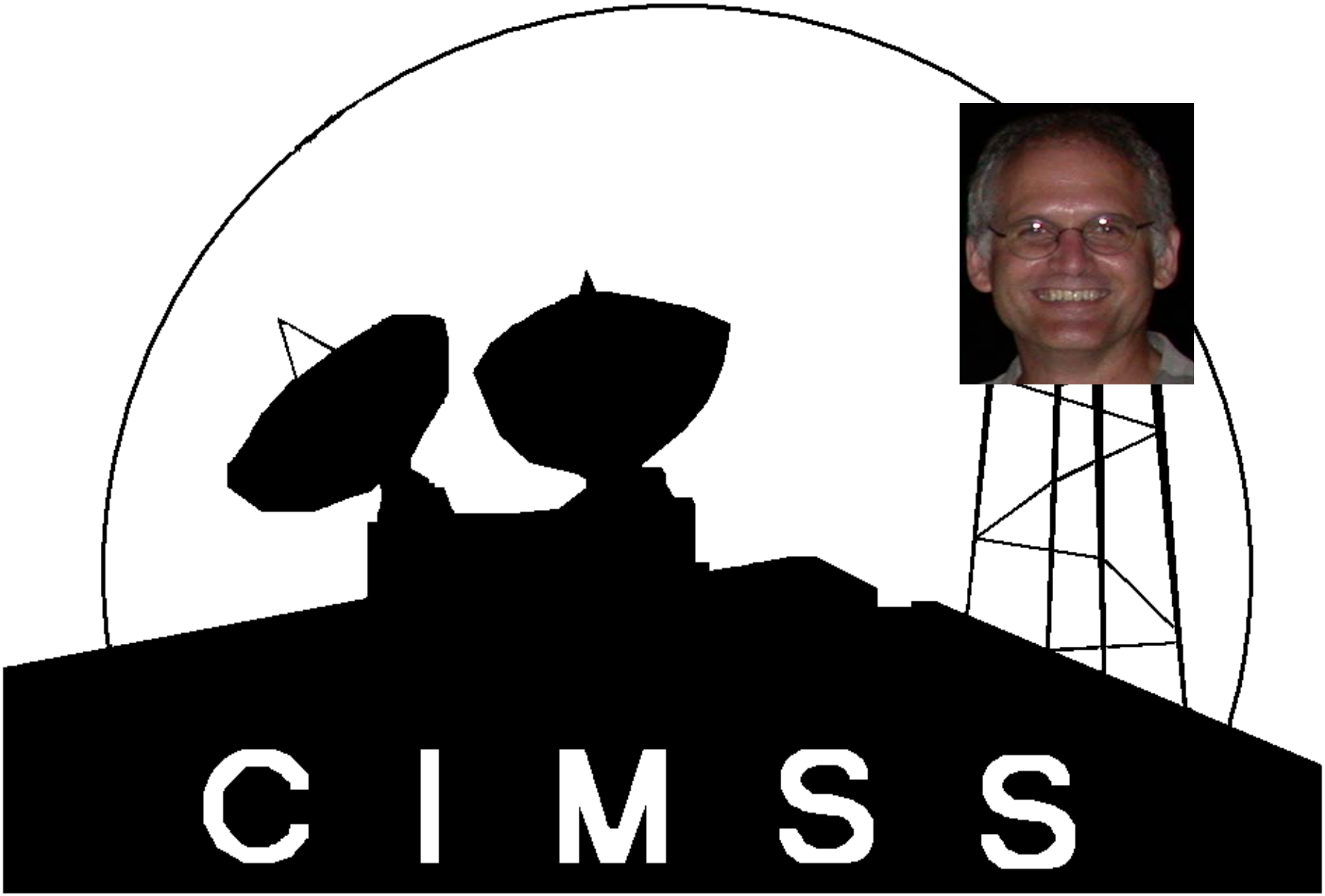


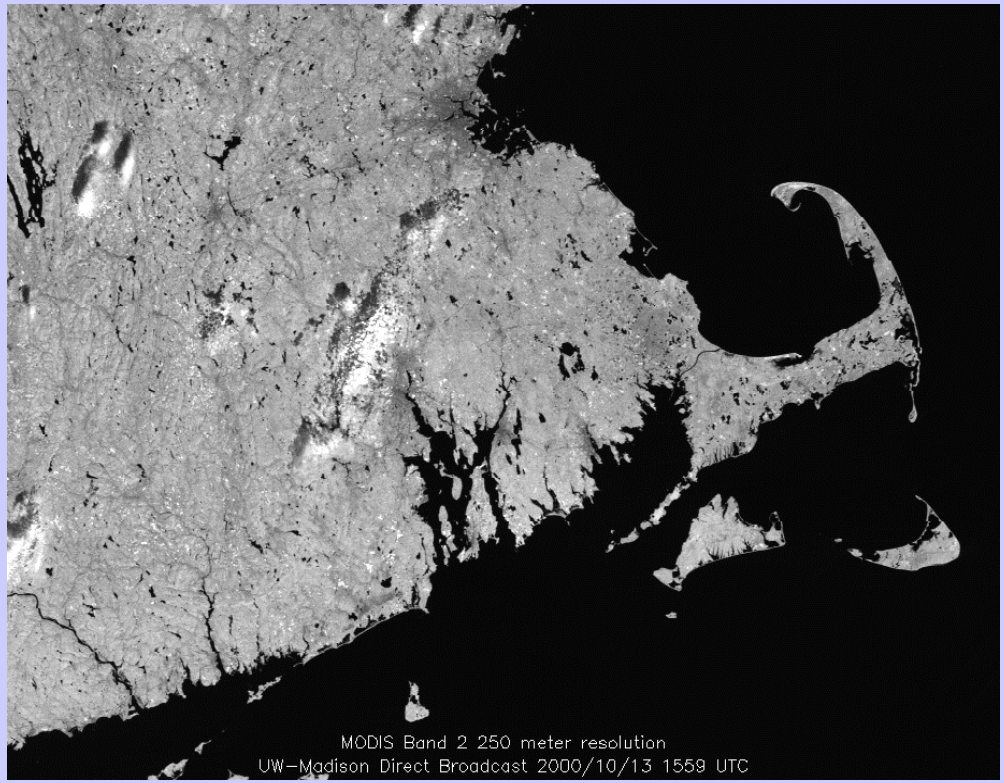
→ **CIMSS closes out the millennium**

* **Steve Ackerman becomes Director**
* **NASA commits to GIFTS but…**
* **EOS becomes a reality**
* **Madison skyline changes for direct reception of EOS**

**Since 2000**

* **MODIS polar winds fill observing system gap**
* **AIRS shows significant NWP impact**
* **Intercalibration of IR sensors becomes state of the art**
* **International community connecting through WMO**


C I M S S




*MODIS Band 2: 250 meter resolution*
*UW-Madison Direct Broadcast 2000/10/13 1559 UTC*

CIMSS

**Cooperative Institute for**
**Meteorological Satellite Studies**

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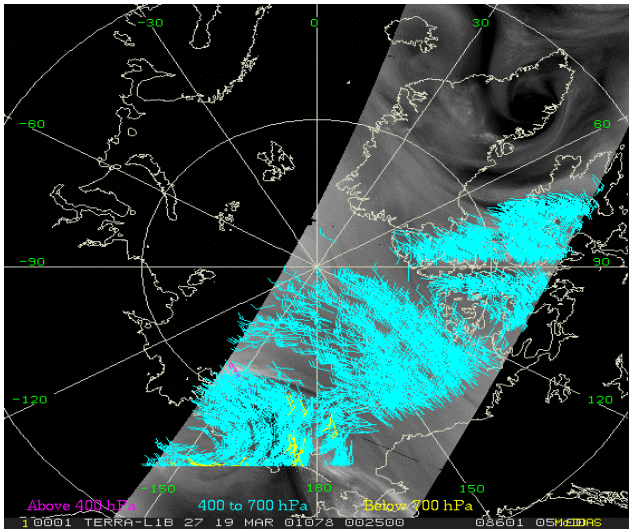
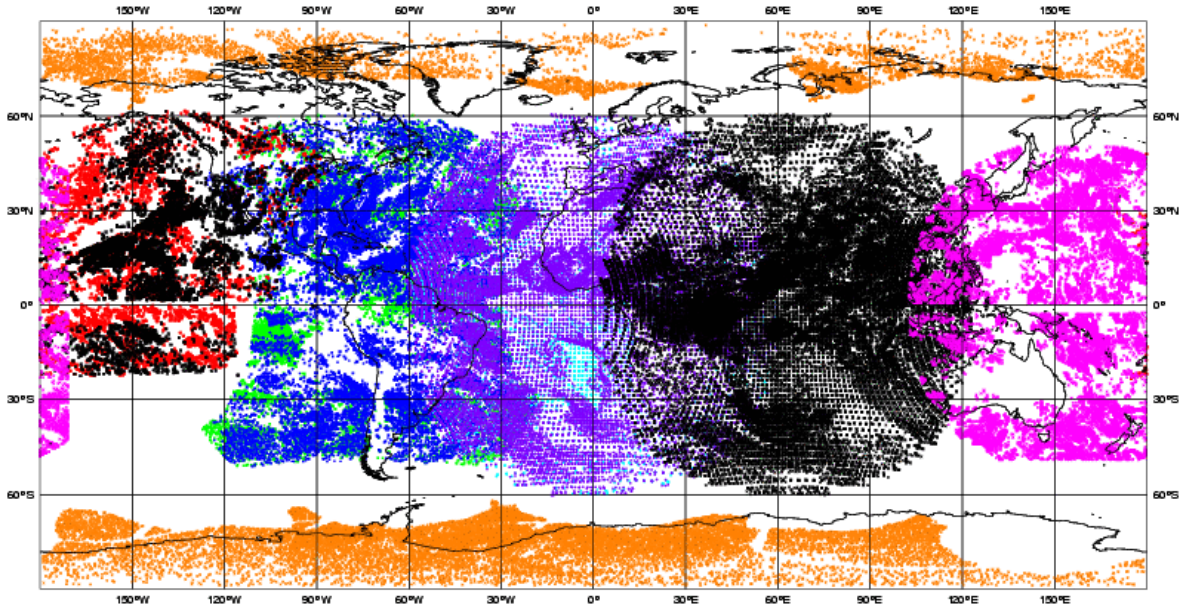
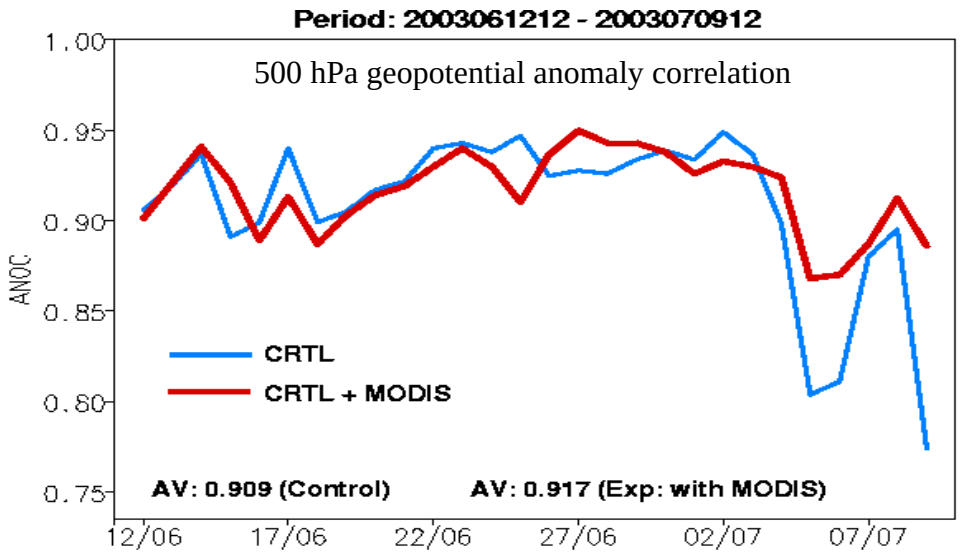
# MODIS fills polar gap in wind coverage

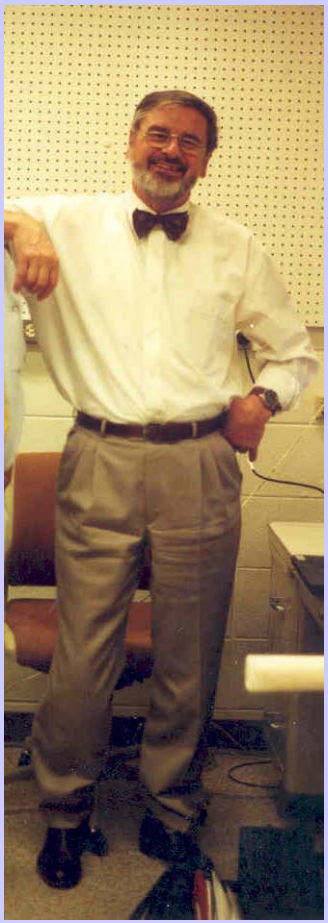


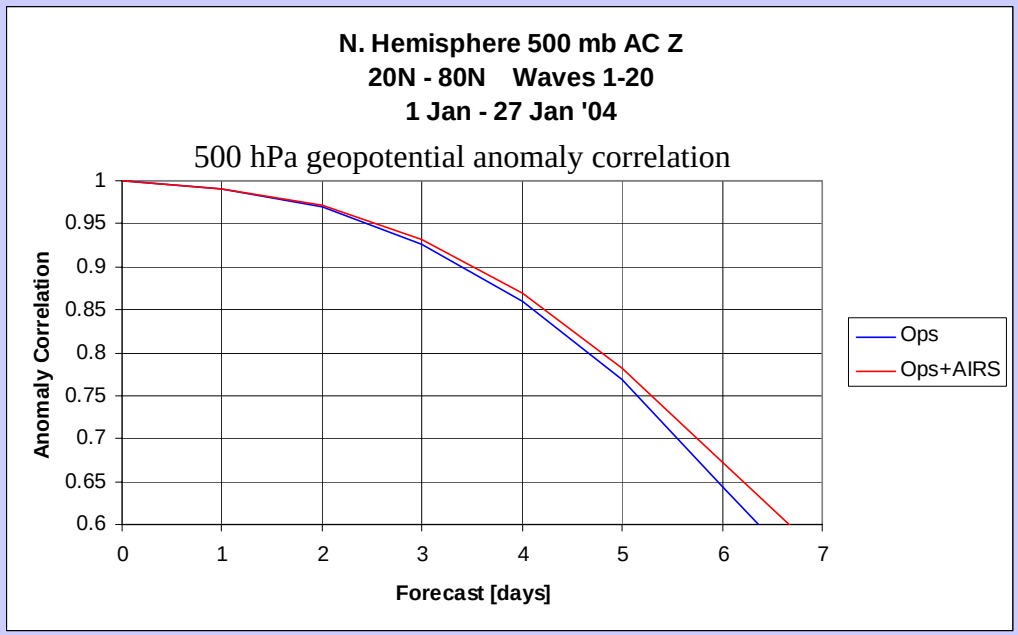



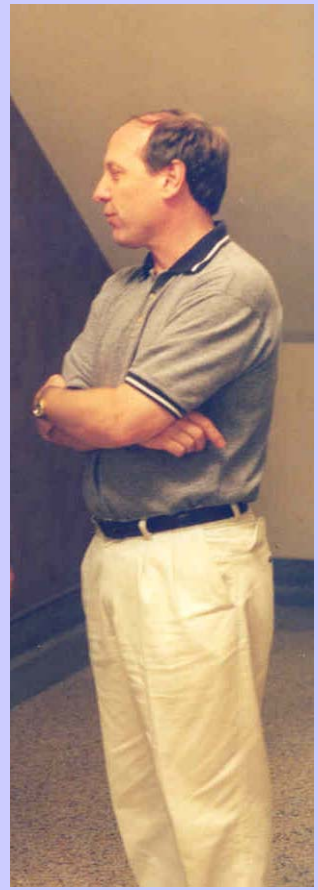
**forecast busts are mitigated**



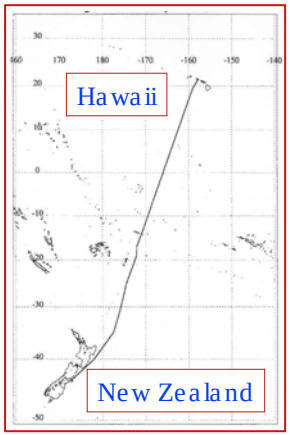
# AIRS adds to GOS & provides positive NWP impact at JCSDA





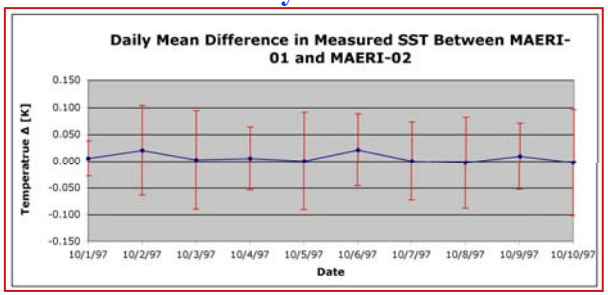



# Intercomparison of 2 Marine AERIs Measuring Sea Surface Temperature




Track of the R/V Roger Revelle
28 Sept. - 14 Oct. 1997

## 16 Day Cruise

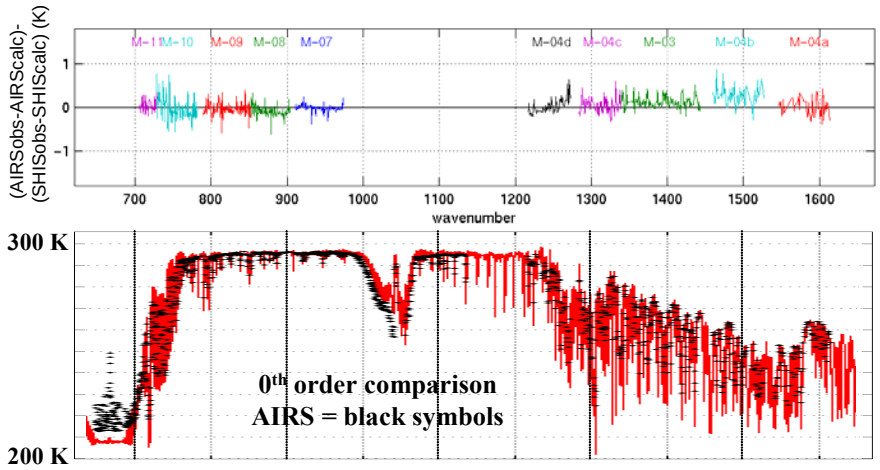



**Largest Daily Mean Difference: 0.020 K**
**Ten Day Mean Difference: 0.005 K**



# AIRS Validation with SHIS

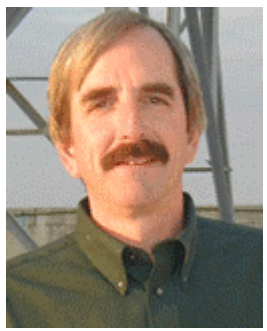
**Mean over AIRS modules (same color) generally <0.1 K!**




Excluding channels strongly affected by atmosphere above ER2

**Cal/val of IR obs is now concerned with tenths of K, not degrees of K**

**High spectral IR is an important part of the reason**

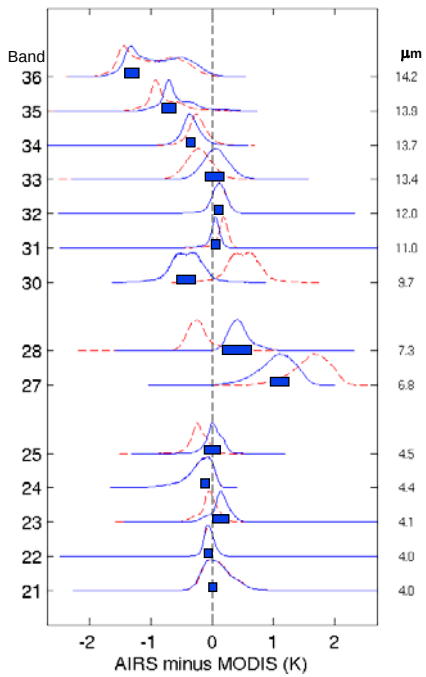


## Summary of AIRS-MODIS mean Tb differences

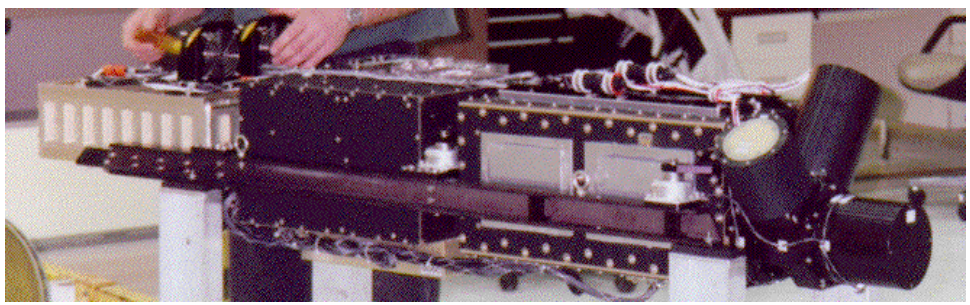
Red=without accounting for convolution error
Blue=accounting for convolution error with mean correction from standard atmospheres

p-p Convolution Error (CE) Estimate

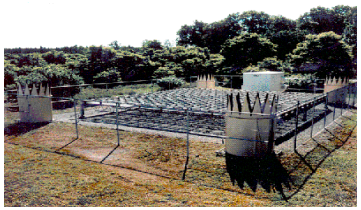
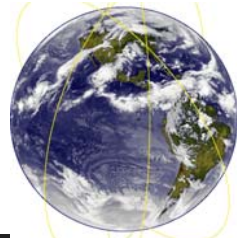
| Band | Diff | CE | Diff | Std | N |
|---|---|---|---|---|---|
| 21 | 0.10 | -0.01 | 0.09 | 0.23 | 187487 |
| 22 | -0.05 | -0.00 | -0.05 | 0.10 | 210762 |
| 23 | -0.05 | 0.19 | 0.14 | 0.16 | 244064 |
| 24 | -0.23 | 0.00 | -0.22 | 0.24 | 559547 |
| 25 | -0.22 | 0.25 | 0.03 | 0.13 | 453068 |
| 27 | 1.62 | -0.57 | 1.05 | 0.30 | 1044122 |
| 28 | -0.19 | 0.67 | 0.48 | 0.25 | 1149593 |
| 30 | 0.51 | -0.93 | -0.41 | 0.26 | 172064 |
| 31 | 0.16 | -0.13 | 0.03 | 0.12 | 322522 |
| 32 | 0.10 | 0.00 | 0.10 | 0.16 | 330994 |
| 33 | -0.21 | 0.28 | 0.07 | 0.21 | 716940 |
| 34 | -0.23 | -0.11 | -0.34 | 0.15 | 1089663 |
| 35 | -0.78 | 0.21 | -0.57 | 0.28 | 1318406 |
| 36 | -0.99 | 0.12 | -0.88 | 0.43 | 1980369 |

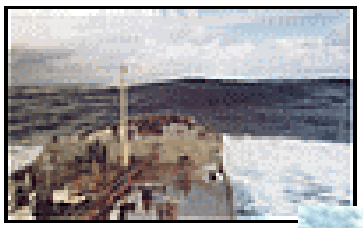


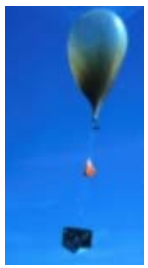
# SHIS Support comes from NASA Ames and the Mango Kings



# Evolving the Global Observing System



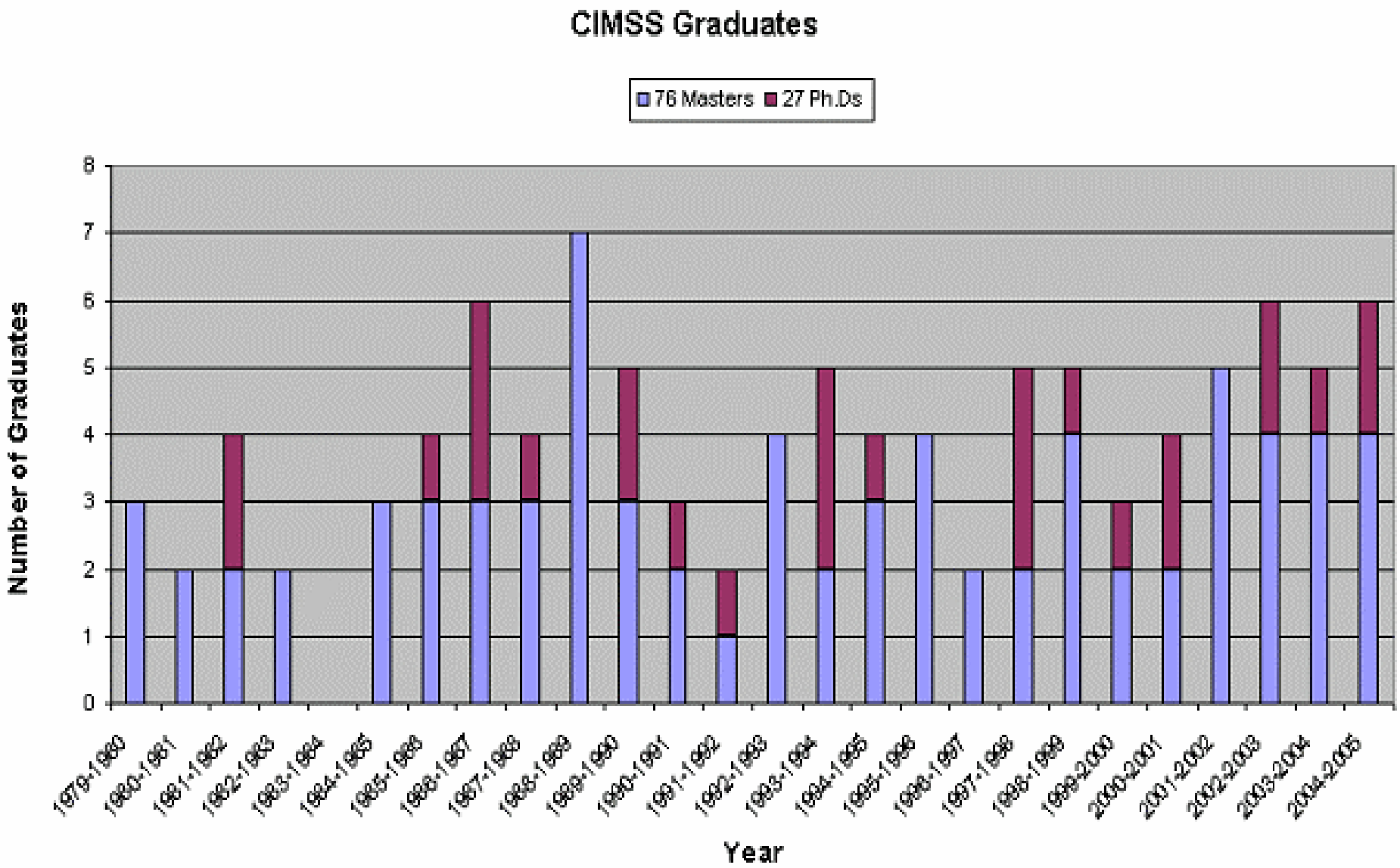



Working towards IGeoLab

WMO Team

→ **CIMSS education and outreach has touched many people**

* **103 students graduate from AOS with CIMSS advisors**
  **most take jobs in govt labs**
* **education and training**
  **in classrooms at UW**
  **in the virtual laboratory everywhere**
* **over 50 visiting scientists spend a sabbatical at CIMSS**
  **every continent participates**


CIMSS Graduates
76 Masters
27 Ph.Ds
Number of Graduates
0
1
2
3
4
5
6
7
8
1979-1980
1980-1981
1981-1982
1982-1983
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2001-2002
2002-2003
2003-2004
2004-2005
Year

# CIMSS Graduate Students

1979-1980

Michael Kalb MS (NASA Marshall)
Tony Siebers MS (NWS)
Jim Block MS (NWS)

1980-1981
Jim Zandlo MS (private sector)
Roberta Marshment MS (private sector)

1981-1982
George Diak PhD (CIMSS)
Roy Spencer PhD (NASA Marshall)
Chris Velden MS (CIMSS)
David Keller MS (Air Force)

1982-1983
John Bates MS (NOAA ERL)
Gin Rong Liu MS (Taiwan National U)

1984-1985
David Donahue MS (NESDIS)
Stacey Heikkinin MS
Martin Mlynczak MS (NASA Langley)

1985-1986
John Bates PhD (NOAA ERL)
Allen Huang MS (CIMSS)
Chris Moeller MS (CIMSS)
Craig Burfeind MS (private sector)

1986-1987
Louis Garand PhD (Environment Canada)
Gin-Rong Liu PhD (Taiwan National U)
Gary Jedlovec PhD (NASA Marshall)
Fred Wu MS (CIMSS)
Maria Perrone MS (Rutgers University)
Tim Schmit MS (CIMSS)

1987-1988

Nelson Ferreira PhD (INPE, Brazil)
Richard Frey MS (NASA Langley)
Arlindo Arriaga MS (EUMETSAT)
Grant Carlson MS (NASA Marshall)

1988-1989
Hyosang Chung MS (Korea Met Agency)
Laurie Rokke MS (PhD at Oxford)
Liam Gumley MS (GSFC and CIMSS)
Kurt Brueske MS (Air Force)
Murty Divakarla MS
Elaine Prins MS (CIMSS)
Chris Scheuer MS (NASA Langley)

1989-1990
Allen Huang PhD (CIMSS)
Fred Wu PhD (CIMSS)
Steve Nieman MS (CIMSS)
Walt McKeown MS (Navy)
Hai Yen Zhang MS (CSU)

1990-1991
Arlindo Arriaga PhD (EUMETSAT)
Peter Keehn MS (NASA Goddard)
Yanni Qu MS (NESDIS)

1991-1992
Robert Purser PhD (NCEP/EMC)
Kathy Strabala MS (CIMSS)

1992-1993
Daphne Zaras MS (NOAA/NSSL)
Chia Lee MS (CIMSS)
Rongrong Xie MS (NESDIS)
Jason Li MS (NASA Goddard)

1993-1994

Walt McKeown PhD (Navy)
Gilberto Vicente PhD (NASA GSFC)
Xiaohua Wu PhD (Univ. of Chicago)
Wayne Feltz MS (CIMSS)
Tim Olander MS (CIMSS)

1994-1995
Yanni Qu PhD (NESDIS)
Susan Faust MS (NWS)
Lan Ge MS (NESDIS)
Ben Ho MS (NASA Langley)

1995-1996
Jack Dostalek MS (CIRA)
Nick Nalli MS (NESDIS)
Brad Hoggatt MS (private sector)
Dan DeSlover MS (CIMSS)

1996-1997
Jay Heinzelman MS (SSEC)
Phil Politowicz MS (SSEC)

1997-1998
Ben Ho PhD (NASA Langley)
Bormin Huang PhD (CIMSS)
Paul van Delst PhD (CIMSS)
Gideon Kinyodah MS (Kenya Met Office)
Rose Shie MS (computer science)

1998-1999
Mike Friedman PhD (Oregon State)
William Badini MS (private sector)
Jason Dunion MS (NOAA AOML)
Rhett Grauman MS (NOAA/NWS)
Shaima Nasiri MS (CIMSS)

1999-2000
Erik Olson MS (CIMSS)
Chris Schmidt MS (CIMSS)
Nick Nalli PhD(CIRA)

2000-2001

Nick Bower PhD (from Curtin Univ)
Monica Harkey MS (UW)
Michael Pavlonis MS (CIMSS)
Kurt Brueske PhD (Air Force)

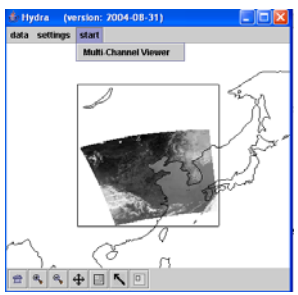
2001-2002
Hong Zhang MS (CIMSS)
Brian Kabat MS (Air Force)
Sarah Thomas MS (CIMSS)

2002-2003
Shaima Nasiri PhD (CIMSS)

2003-2004
Mark Gray MS (GSFC)
Giuklia Pannegrossi PhD (Italy)
Grag McGarragh MS (LaRC)

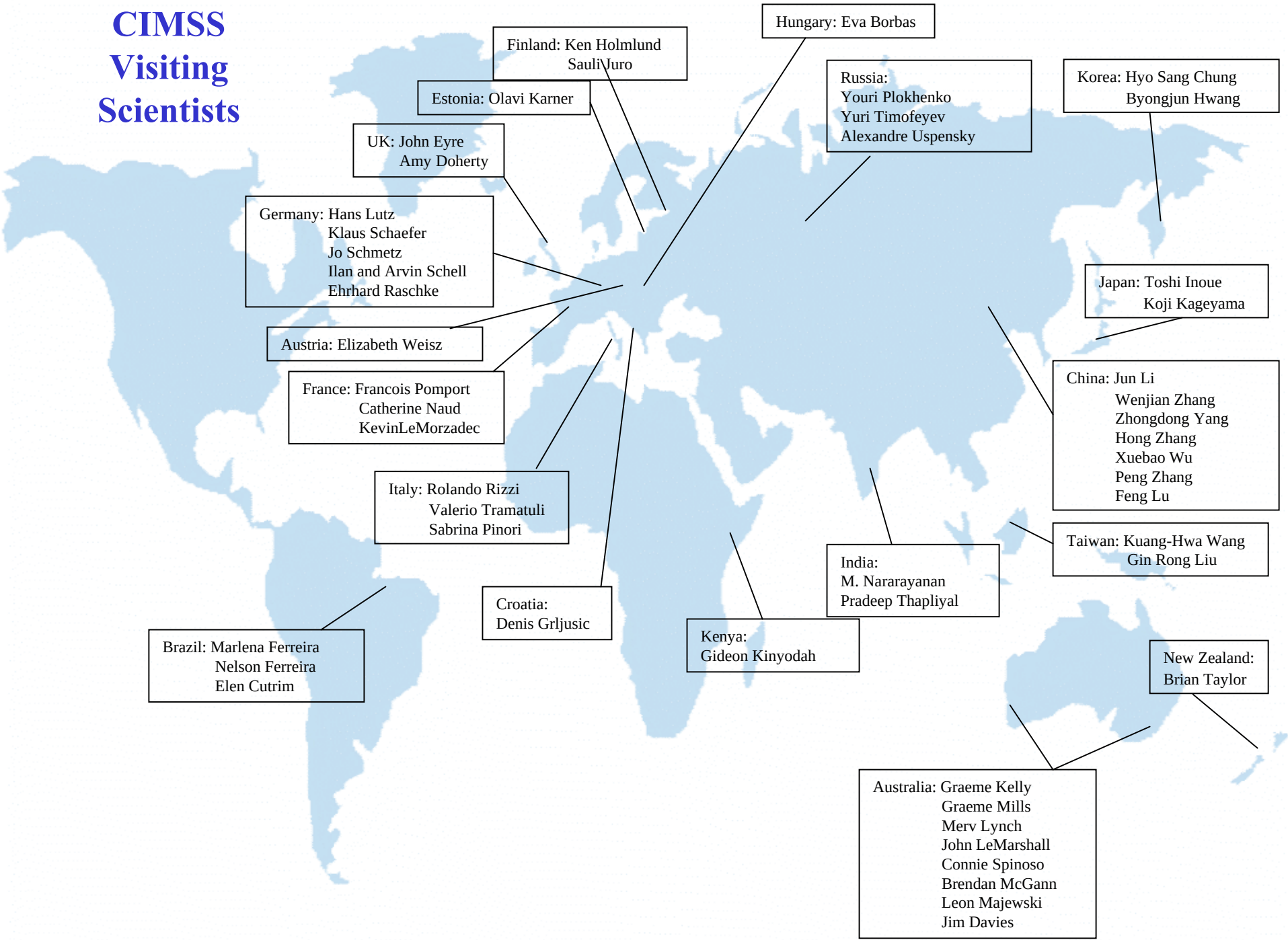

Hydra
used to analyze
the data



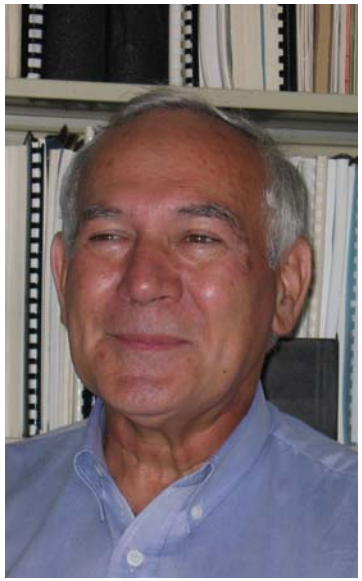




**Remote Sensing Schools catch on around the world**

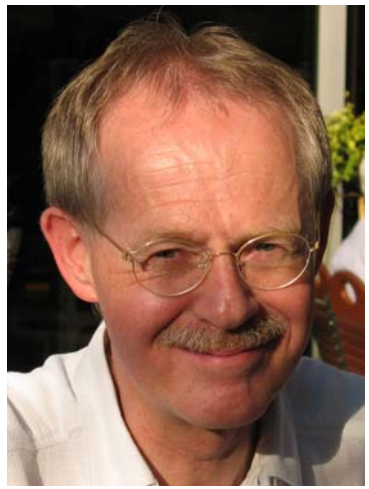
# CIMSS Visiting Scientists



# Friends from all over





→ **CIMSS in the next 25 years**

*** NWP maximizes benefit from remote sensing data**

*** spatial, temporal, and spectral resolution increases**

*** ocean studies forge ahead**

*** reference network establishes climate quality data**

**AERIs supplement in situ observations**

*** imaging and sounding functions merge**

**hyperspectral remote sensing matures**

*** active complements passive remote sensing**

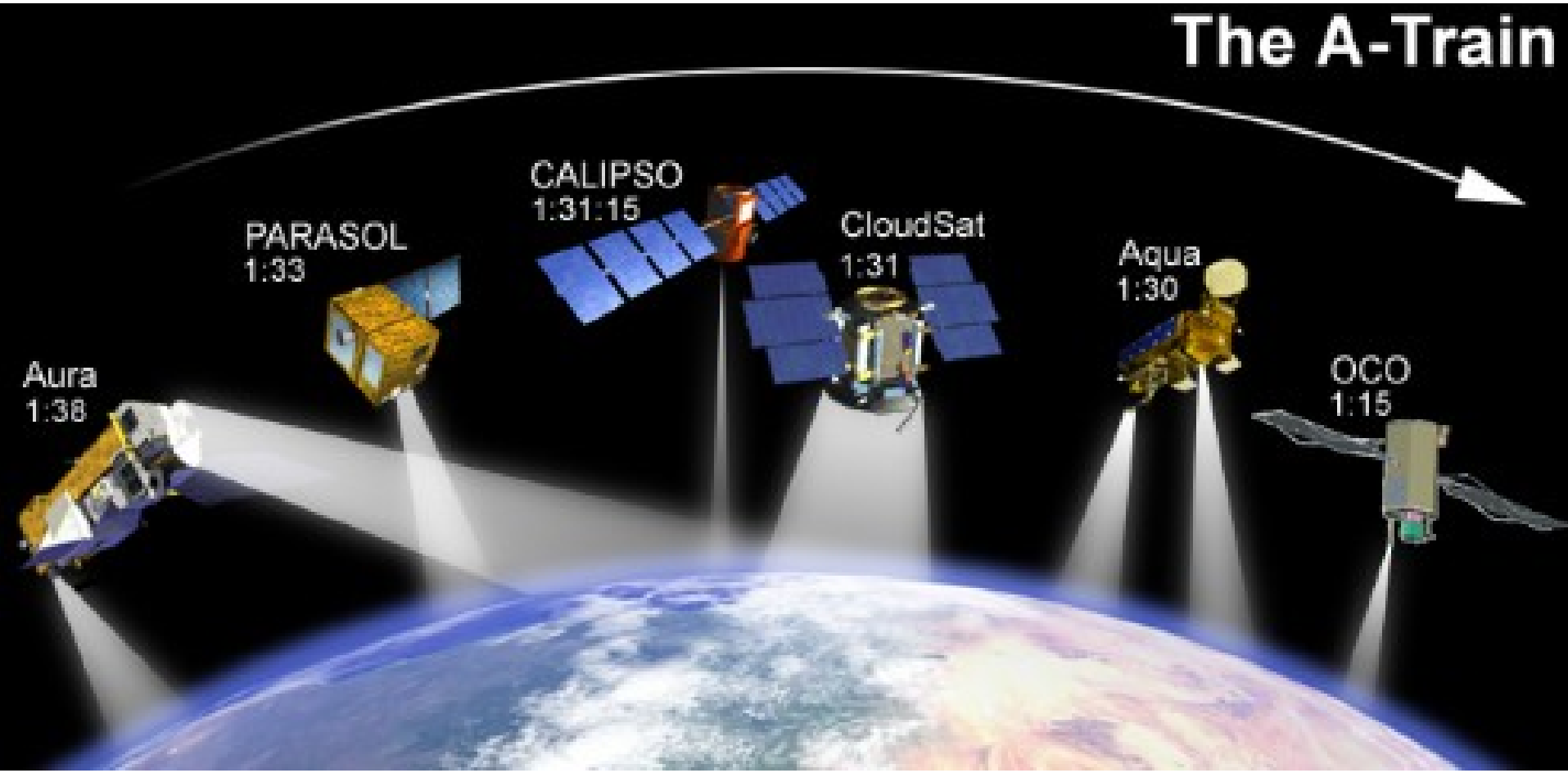
*** land, ocean, and atmosphere are studied**

**fingerprint of climate and climate change emerge**

*** global partnerships are forged within GEOSS**

**pulse of the planet is taken**

# Clouds will get a thorough look with the A-train



**The top opportunities for CIMSS with NOAA and NASA in the coming years?**

*** to help evolve NOAA remote sensing assets with NPOESS and GOES-R**
*** to help build a strong research to operations bridge from a revitalized NASA to a multi-applications oriented NOAA**
*** to help GEOSS realize its potential through open sharing of and strong support from the NOAA & NASA environmental remote sensing capabilities**
*** to help foster the opportunities for international partnering in the development and demonstration of new remote sensing capabilities (e.g. IGeoLab)**

**The top challenges for CIMSS with NOAA and NASA in the coming years?**

*** to maintain and increase the gains in environmental remote sensing demonstrated by EOS (e.g. AIRS soundings, MODIS polar winds)**
*** to sustain a strong viable partnership between government , industry, and university that takes advantages of the unique capabilities of each**
*** to assure adequate resources and capabilities are directed toward accomplishing the pending climate tasks**

**CIMSS has flourished because of**

- → **good leaders leading good people**
- → **interesting science**
  - **instruments and cal/val**
  - **processing and visualization**
  - **algorithms and applications**
  - **multitudes of data**
- → **steady sponsorship from NASA and NOAA**
  - **basic research**
  - **transfer to operations**
- → **strong international partnerships**
  - **global observing system**

# It has been a great ride – Thank you