Visions of the Next 25 Years of Satellite Meteorology

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CIMSS Silver Anniversary (jubilee)

It would be easy to say

- Hyperspectral imaging and sounding
- Active radar and lidar
- Multi-disciplinary studies
- Global Utilization, NWP
- Multiple orbits, constellations
- Satellite System Synergy
- GEOSS
- Government, Private Sector, University Partnerships

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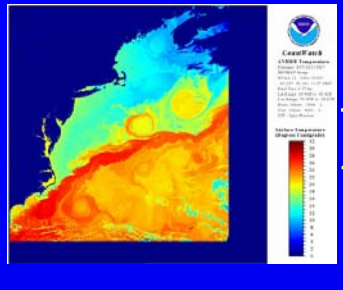
But I won't

What Led To Success?

- How did we get to where we are today?
  - We'll look at the positives
- How can this lead us into tomorrow?

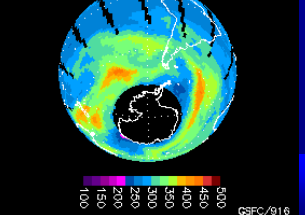
Pioneers in modern atmospheric science helped pave the way

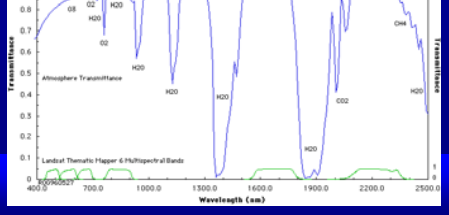
- V2 Rocket photographic montage
- J. Bjerknes performed synoptic analyses using pictures such as this in 1948: likely the first serious attempt to analyze the atmosphere from “space”

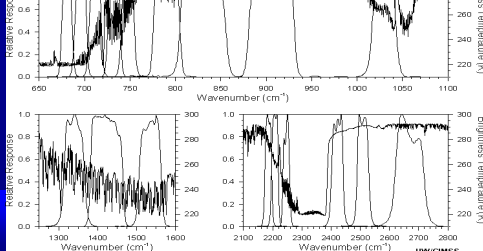


Reflections on Today

- Meteorological satellites provide **essential data** for weather forecasting to national weather services across the globe
- **APT -** the best good will ambassador ever
  - sharing of data and science
- Satellite data are **high resolution digital renderings** from a variety of spectral bands whereby both qualitative and quantitative information about the atmosphere, clouds, and land and sea surface properties are deduced – **NWP Revolution**







What was significant?

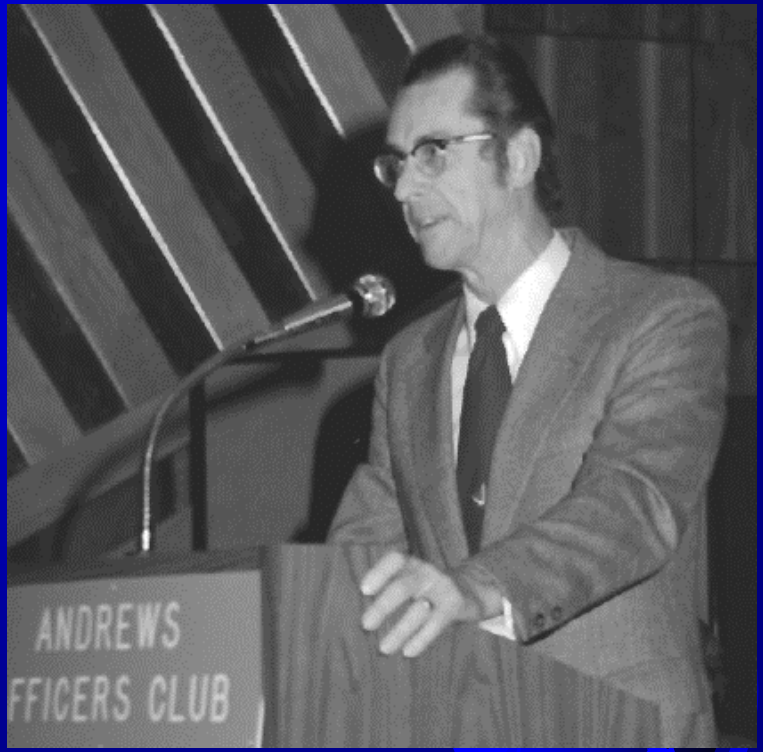
- Leadership
- Vision
- Understanding
- Utilization

True Giants Led The Way:

Let's look at four that embody the characteristics listed above

In 1985 at the 25th anniversary of weather satellites, Dave was recognized for his leadership

Dave was cited for exceptional accomplishments … while directing the U.S. Civil Operational Environmental Satellite Program. During his tenure, the United States established its preeminent position in the monitoring of the global environment and never suffered a break in operational weather service.

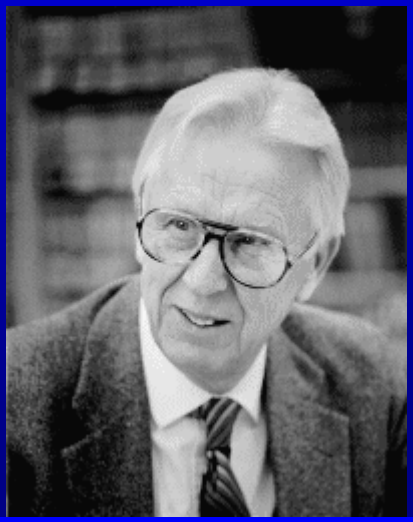


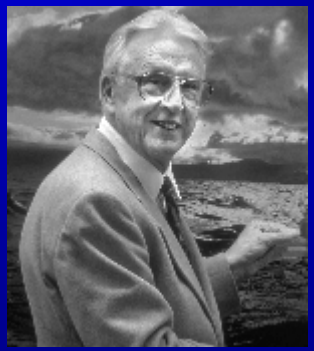
Leadership


METEOR 3M
(Russian Federation)
FY-1
(China)
850 KM
High-resolution
Land use
Missions
Oceanographic
Missions
GOES-E
(USA)
75W
GOES-W
(USA)
135W
GEOSTATIONARY ORBIT
R&D orbit
Polar orbit
35 800 Km
SUBSATELLITE
POINT
MTSAT
(Japan)
140E
Atmospheric
Chemistry
Missions
MSG
(EUMETSAT)
0 Longitude
FY-2
(China)
105E
Hydrological
Missions
METEOSAT
(EUMETSAT)
63 E
GOMS
(Russian Federation)
76E
NPOESS
(USA)
Metop
(EUMETSAT)

In 1985 at the 25th anniversary of weather satellites, Vern was recognized for his vision

Vern was cited for unparalleled scientific leadership and innovative engineering design and development in conceiving new sensors and applications from the first TIROS satellite through the GOES series.

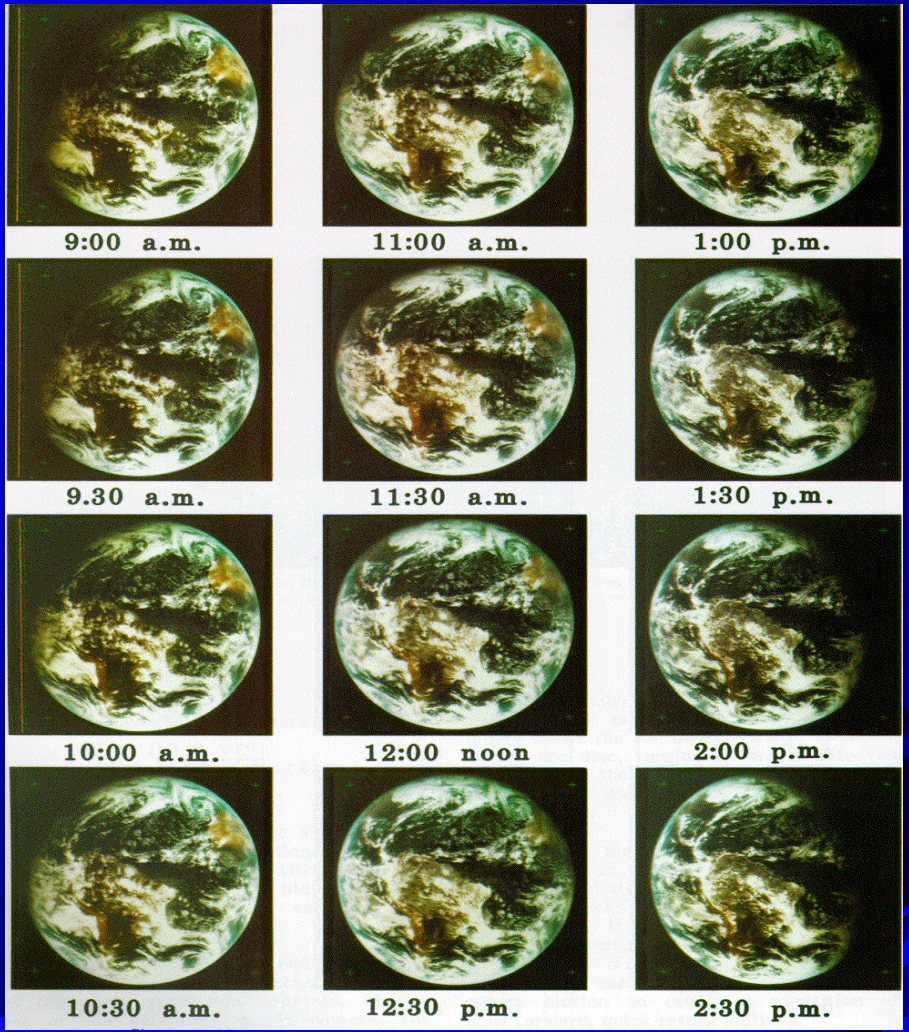




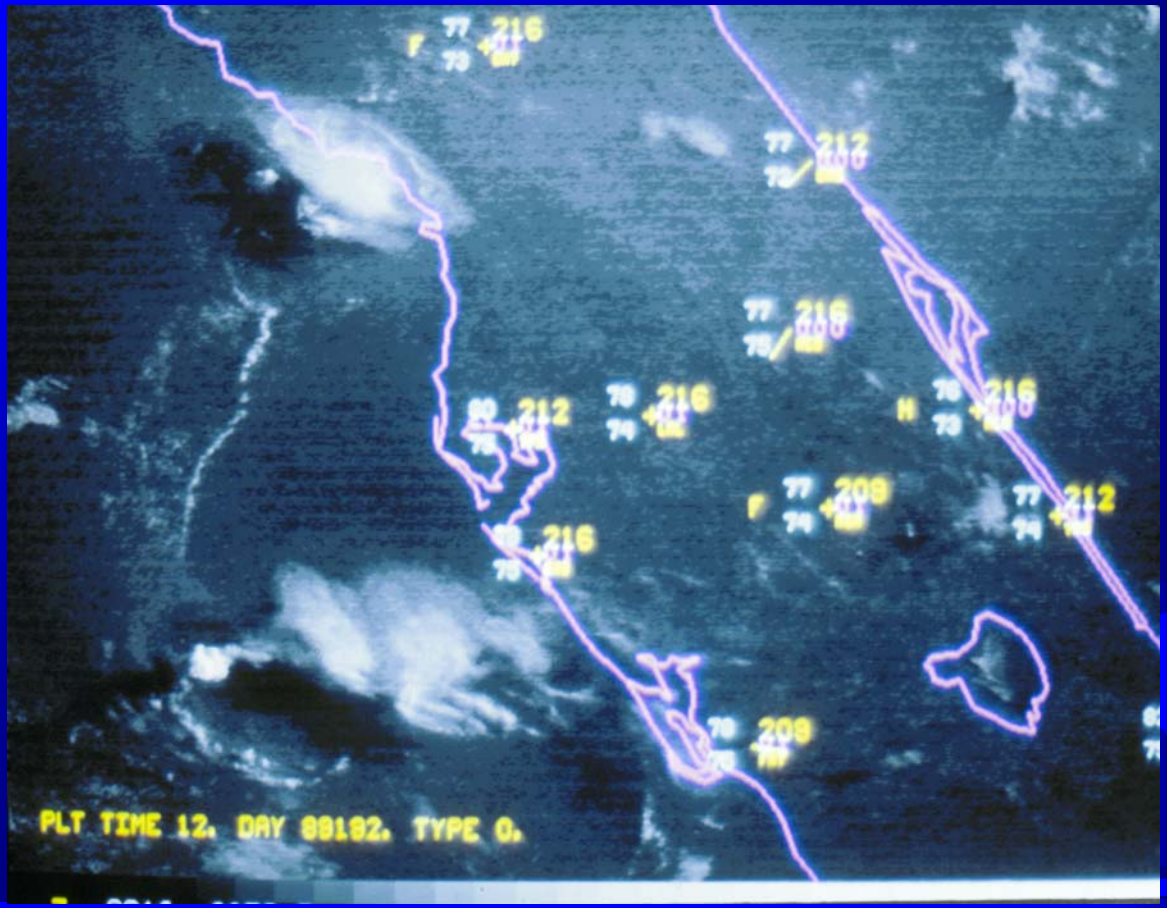
Vision

Suomi, Parent, and Fujita

create first color movie of planet Earth with ATS-III pictures on 19 Nov 1967

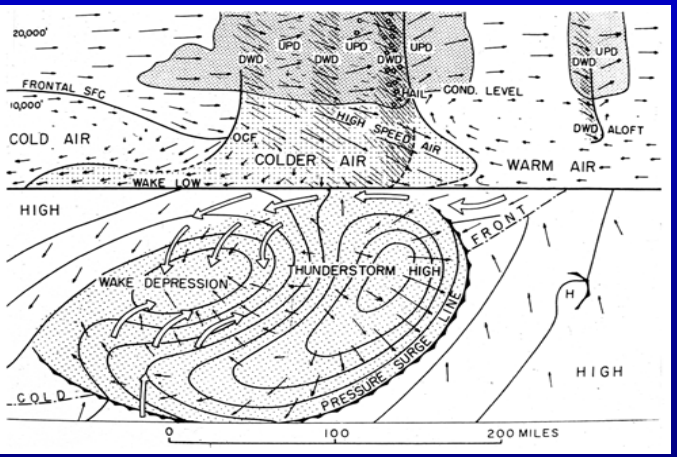


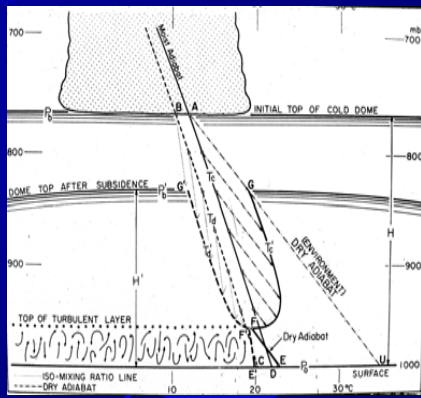
Assimilation



In 1985 at the 25th anniversary of weather satellites, Ted was recognized for his understanding

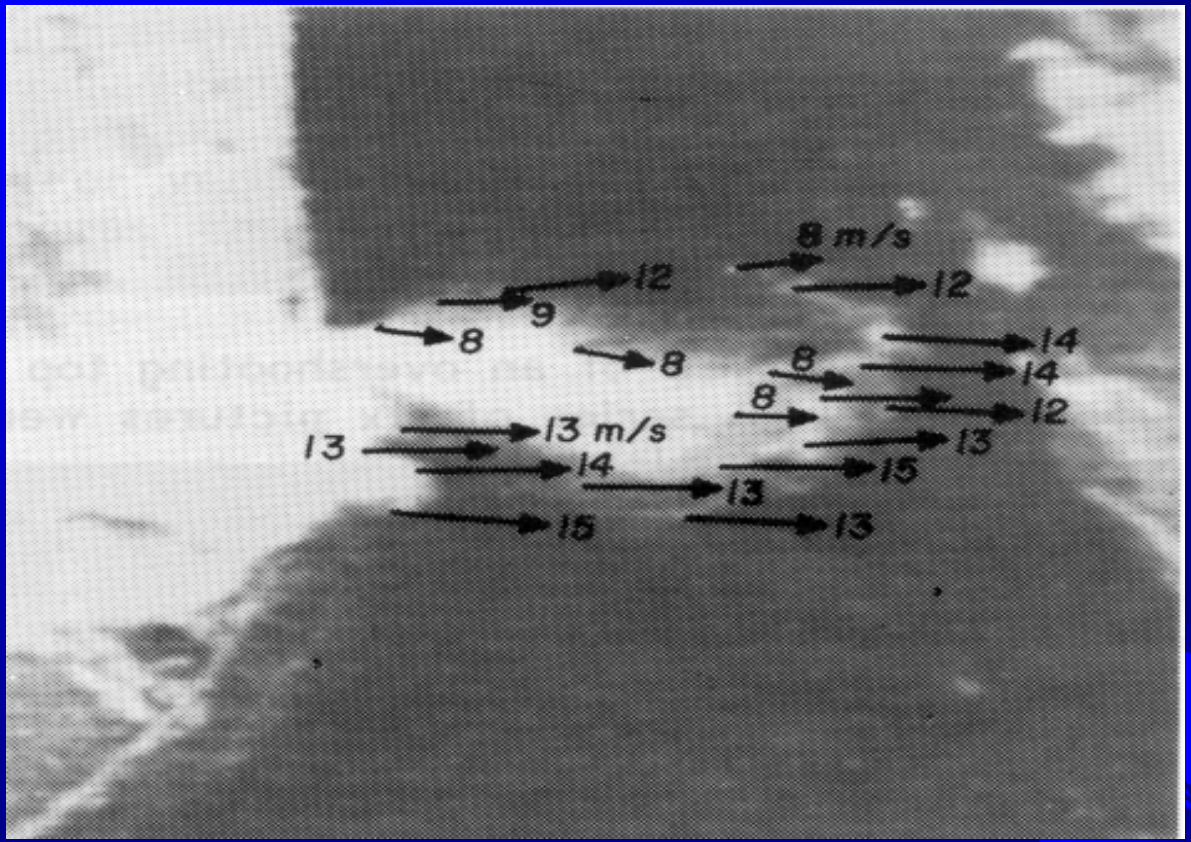
Ted was cited for 'creative scientific leadership as an enthusiastic pioneer in the use of satellite imagery to analyze and predict mesoscale weather phenomena and to understand severe thunderstorms, tornadoes, and hurricanes.'





Understanding

1242 EST
1244
1248
1250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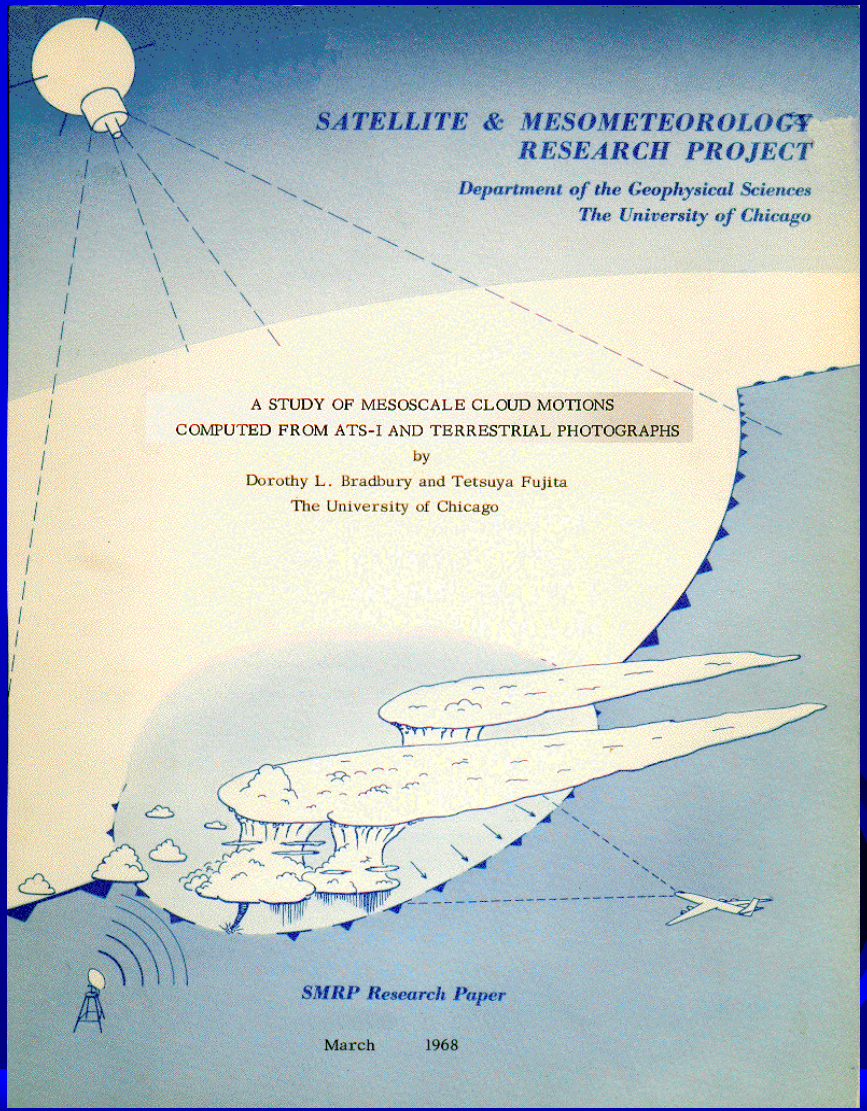
Fujita developed the necessary rectification and analysis techniques to make those TIROS satellite photographs useful for weather system analysis.

In the study of a 1960 south Pacific tropical storm, Fujita analyzed clouds to provide information about the direction of low level winds and the vertical wind shear between 700 and 200 hPa.

Fujita also showed how cloud shadows in these early satellite pictures could be used to quantitatively determine cloud top height.

The Mesometeorology Research Project added satellites and the SMRP papers from Ted and his U of Chicago colleagues became classics in atmospheric research

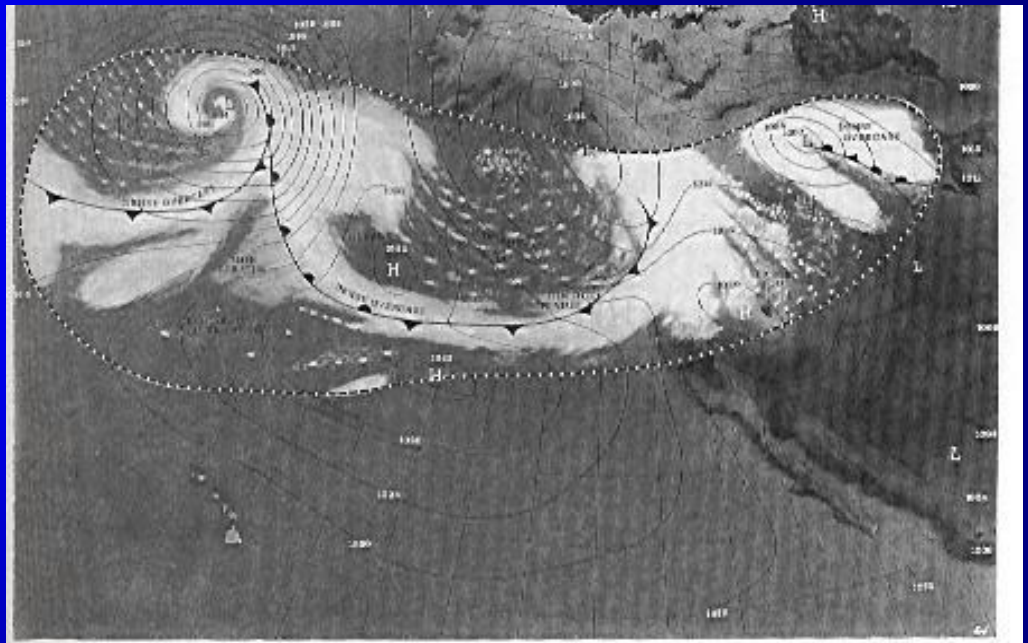


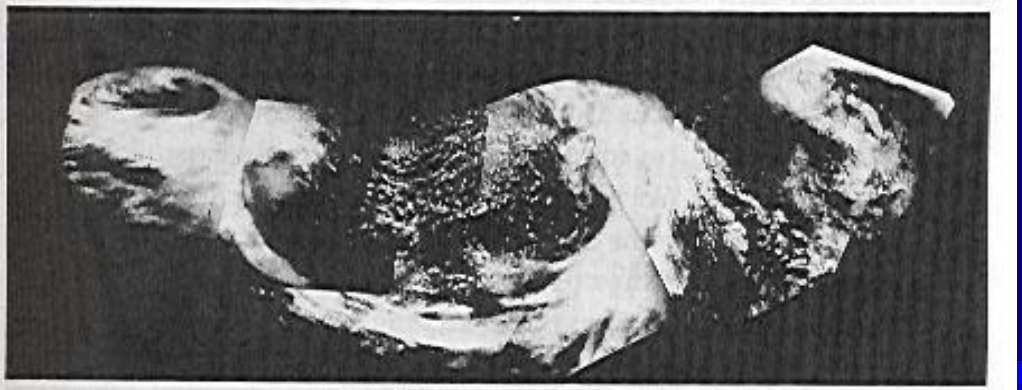
In 1985 at the 25th anniversary of weather satellites, Vince was recognized for utilization

Vince was innovative, outstanding scientific leadership…that developed many of the techniques used in daily weather forecasting operations in the United States and throughout the world. He developed techniques to determine [a variety] of weather related phenomena from satellite images

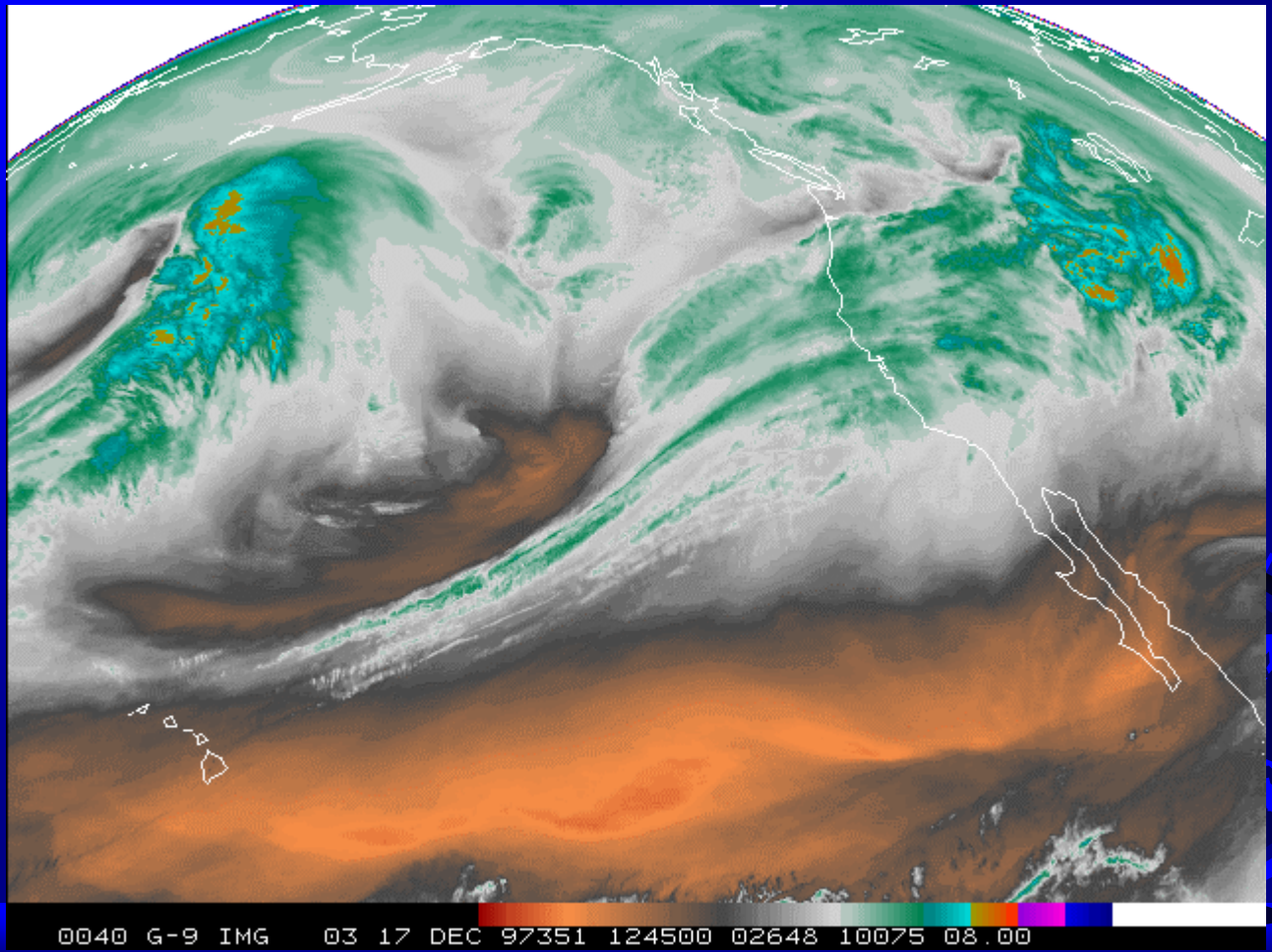
Utilization

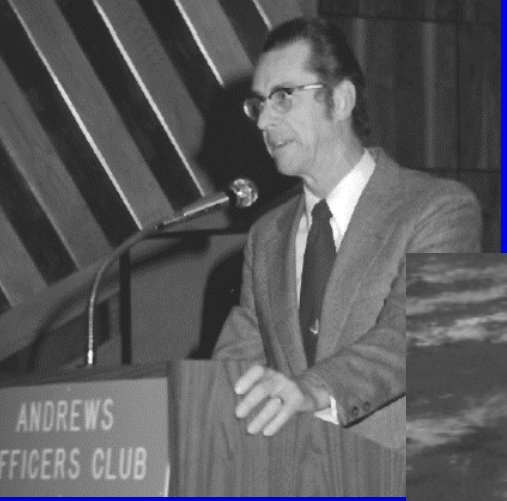
- **Weather map from May 20, 1960 (top) with artist rendering of clouds from the TIROS-1 photographic-mosaic taken that same day (bottom)**





Synoptic Weather Analysis




ANDREWS
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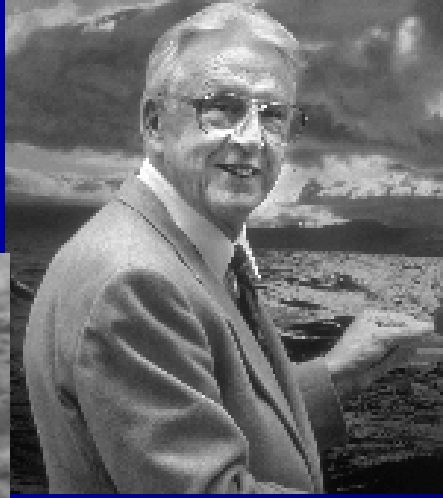

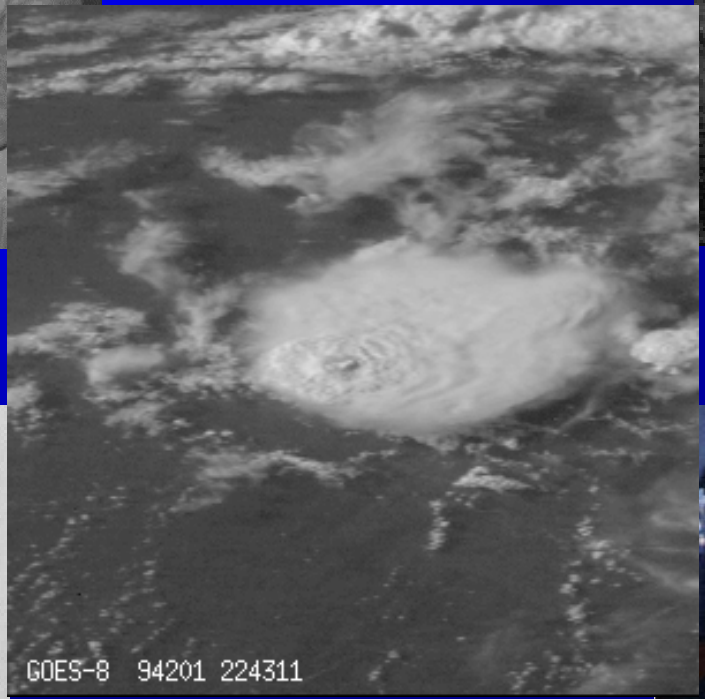
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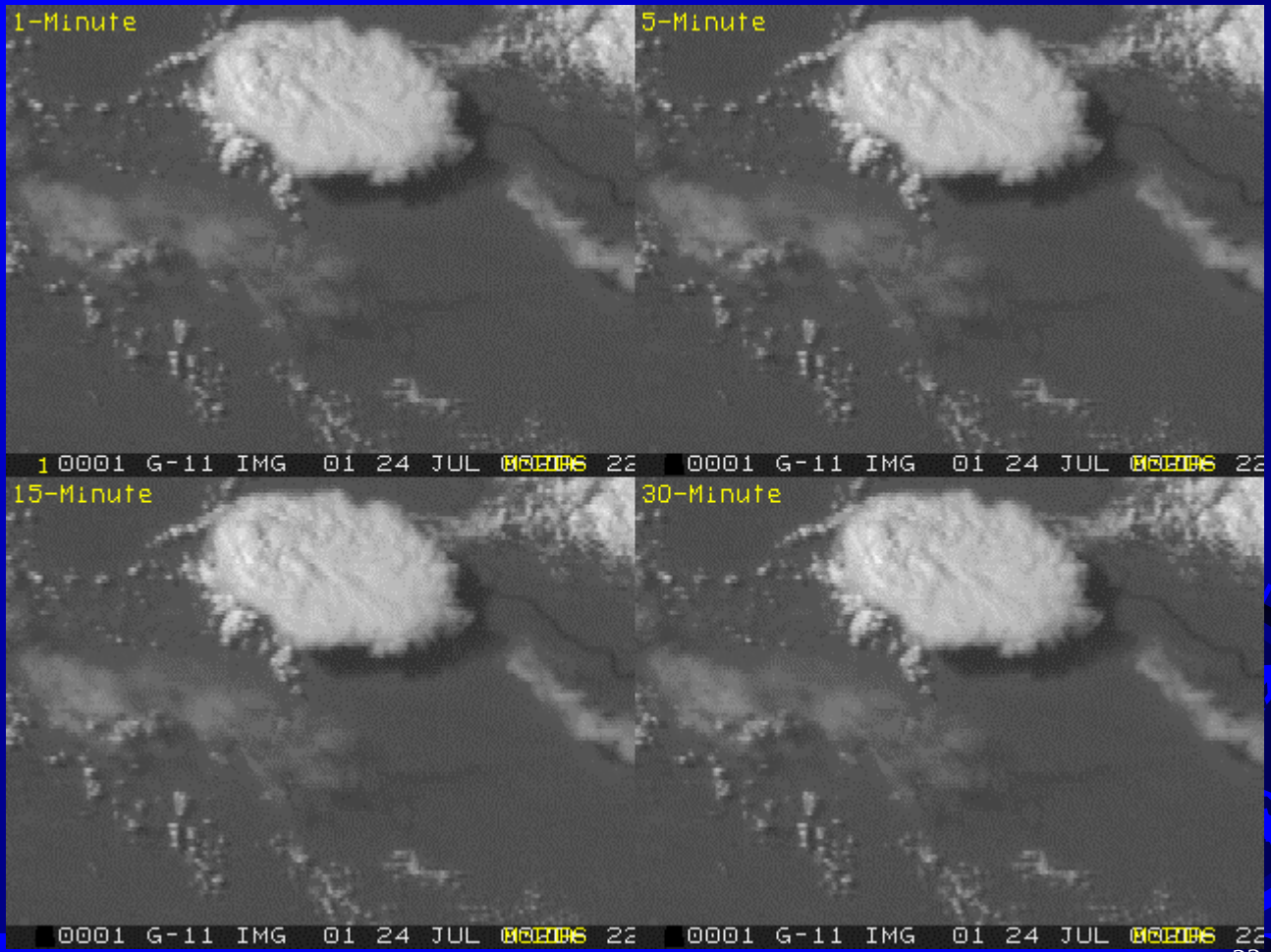
Rapid Scan


1-Minute
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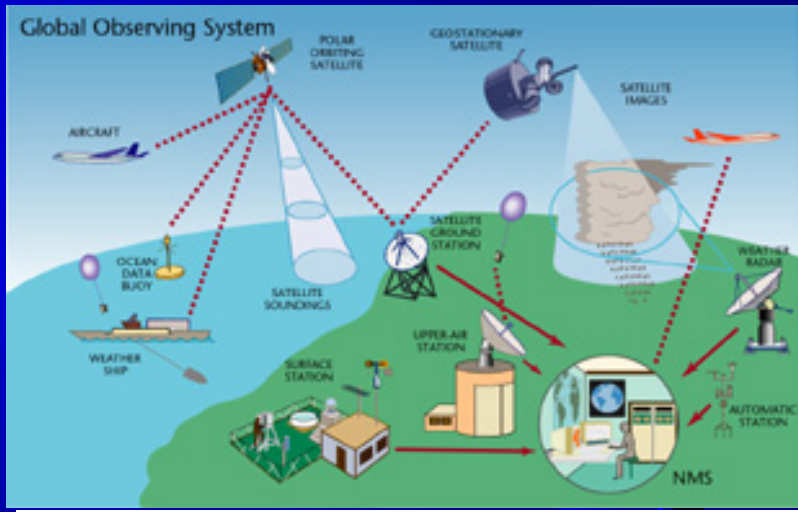
5-Minute
0001 G-11 IMG 01 24 JUL
15-Minute
0001 G-11 IMG 01 24 JUL
30-Minute
0001 G-11 IMG 01 24 JUL

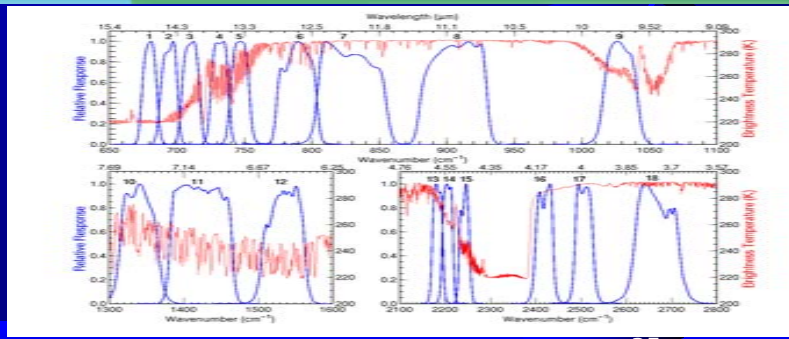
Observational data requirements and redesign of the Global Observing System

Chair: W.P. Menzel

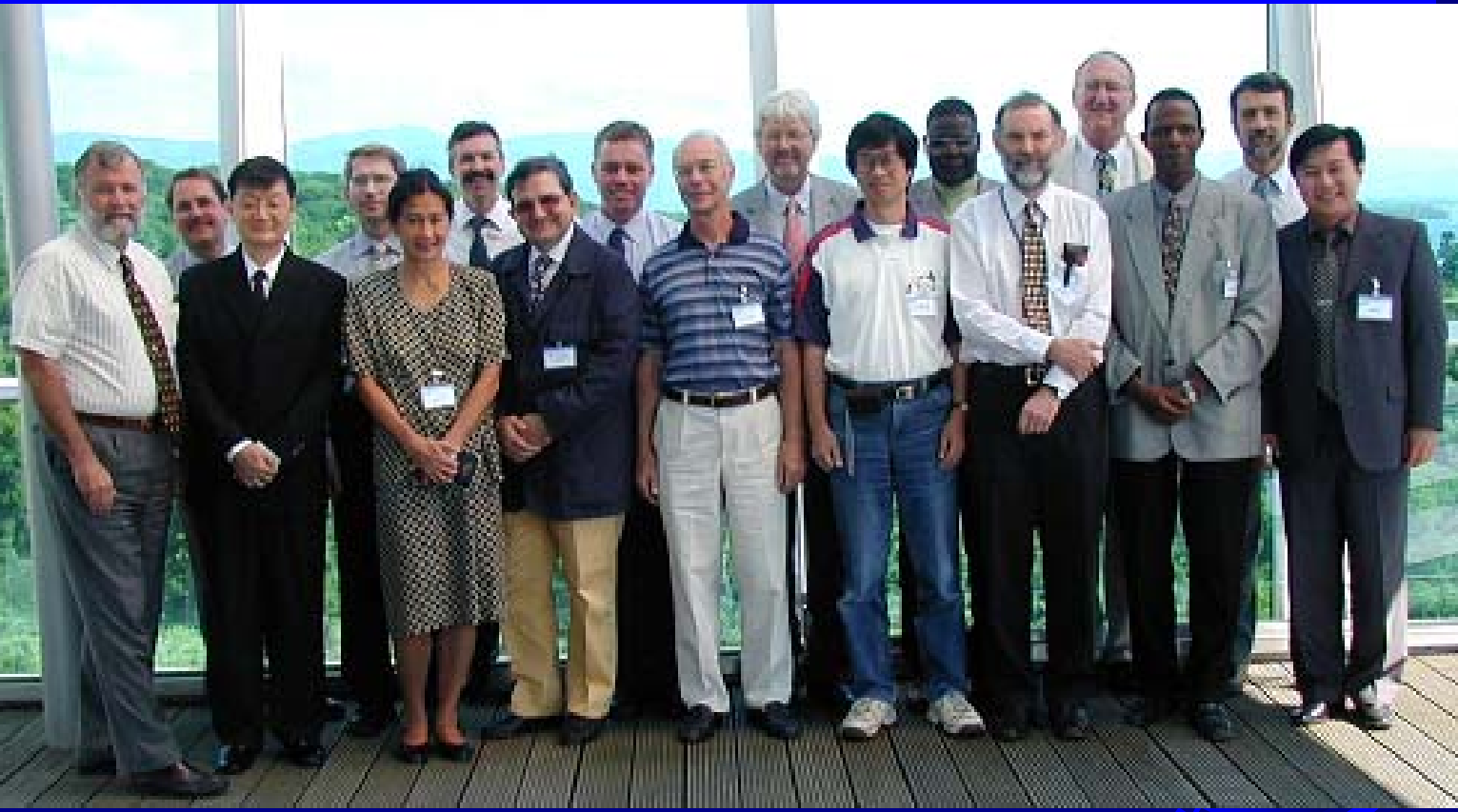
Implementation Plan for the Evolution of the Space- and Surface-Based Sub-Systems of the GOS – WMO TD 1267

- **Space based sub-system – 20 recommendations**
- Surface-based sub-system – 22 recommendations
- Interactions between NWP centers, data providers and users – 5 recommendations



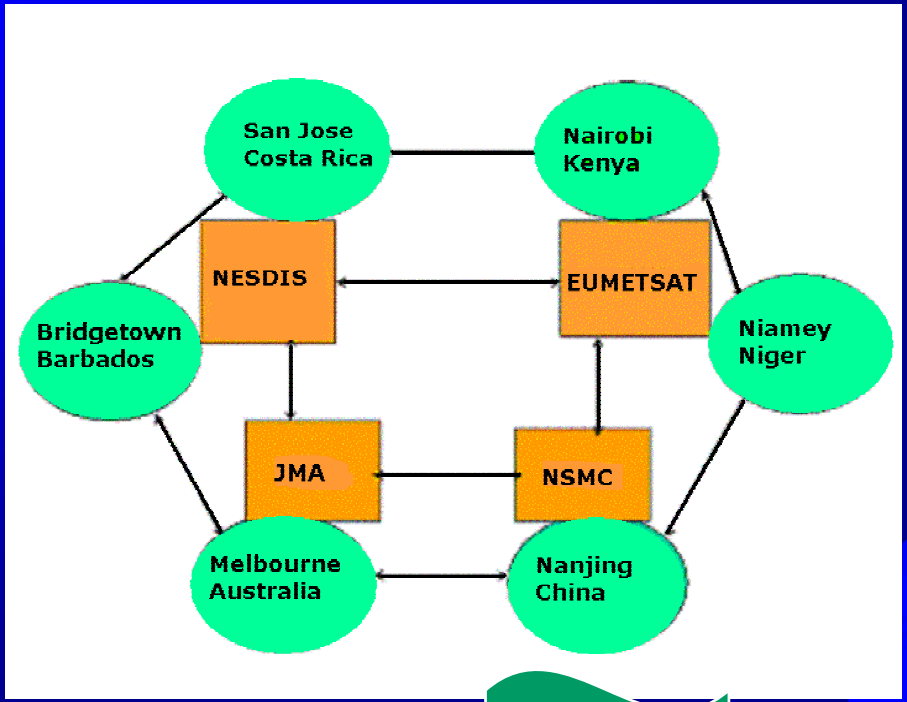


Expert Team on Satellite System Utilization and Products



Chair: H.P. Roesli

Virtual Laboratory for Education and Training in Satellite Meteorology (VL)



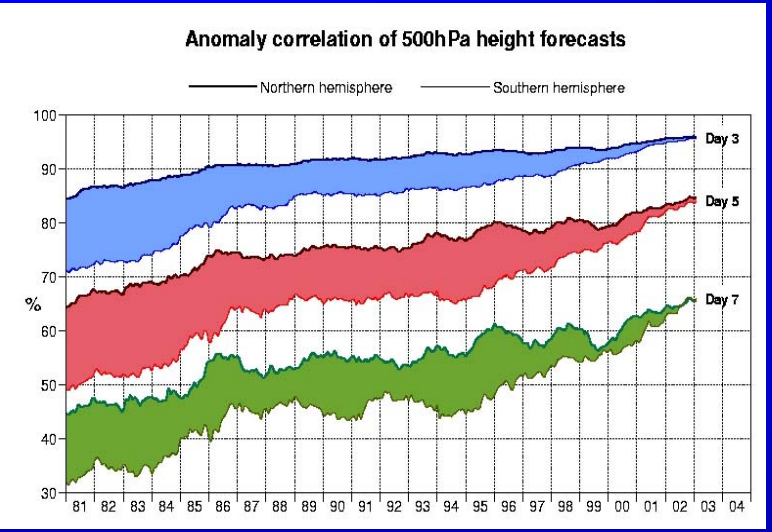
opportunity

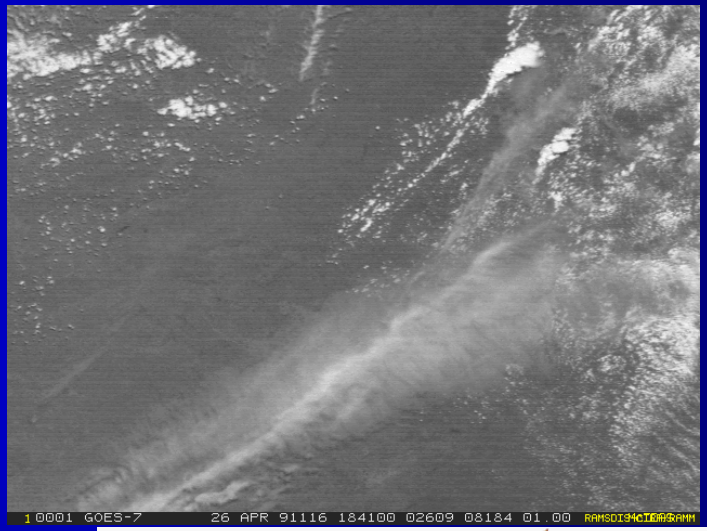
Virtual Laboratory for Education and Training in Satellite Meteorology (VL)

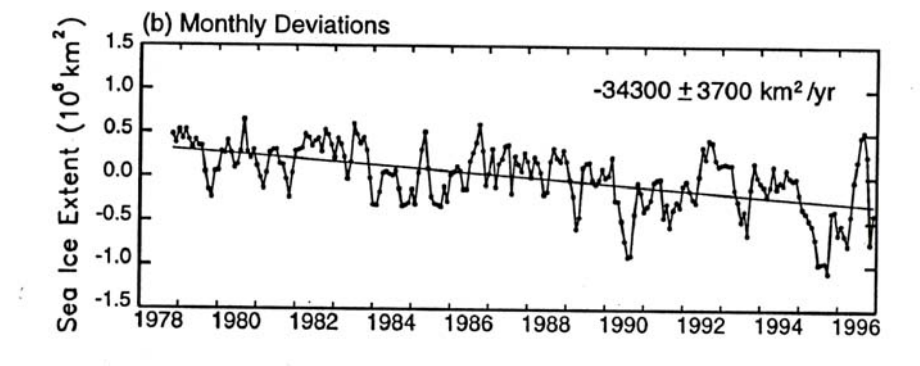
- **Revolutionize training through the use of electronic notebooks**

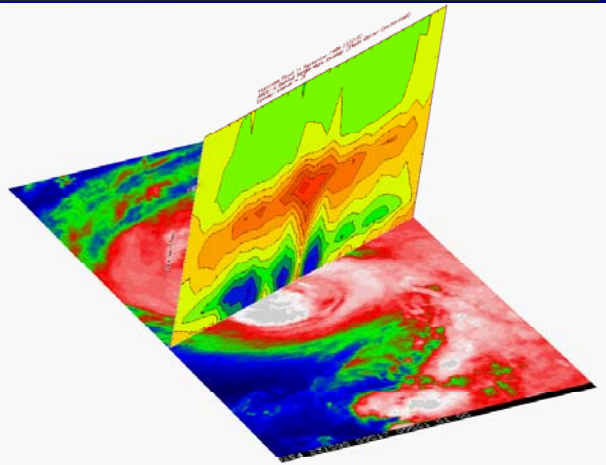
Above: Newly established Caribbean Focus Group to perpetuate and build a stronger dialogue amongst trainers and forecasters in the region (Barbados 2004)

Success – with room to grow

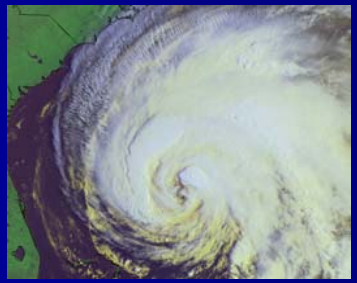




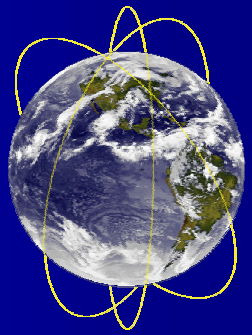


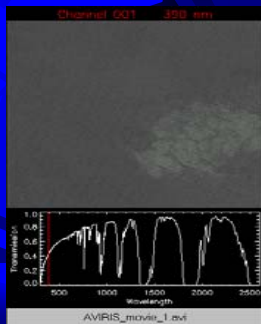


Conclusion

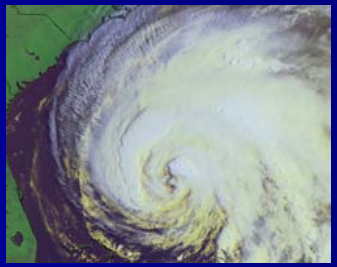


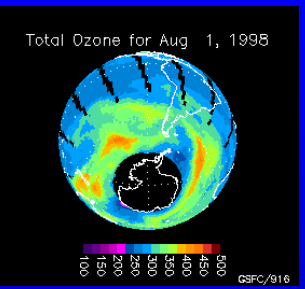
The advancement to improved microwave sensors, space-based lidar, radar, and hyper-spectral imaging and sounding is a *natural progression*, and will provide exciting new opportunities and challenges with truly adaptive observing systems



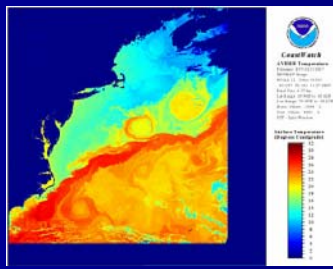


Meteorological Applications

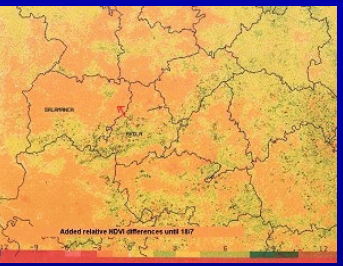




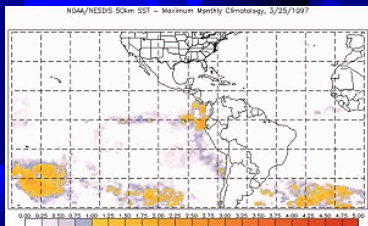
Climate Applications



Ocean Applications



Land Applications



Ecological Applications

What will be significant over the next 25 years?

What will be significant?

- Leadership
- Vision
- Understanding
- Utilization

What will be significant?

- Leadership
- Vision
- Understanding
- Utilization

We Need New Giants

Giants Still Exists

They Do What's Right