

# **Satellite Meteorology – the last 25 years – and the role of CIMSS**

**by**

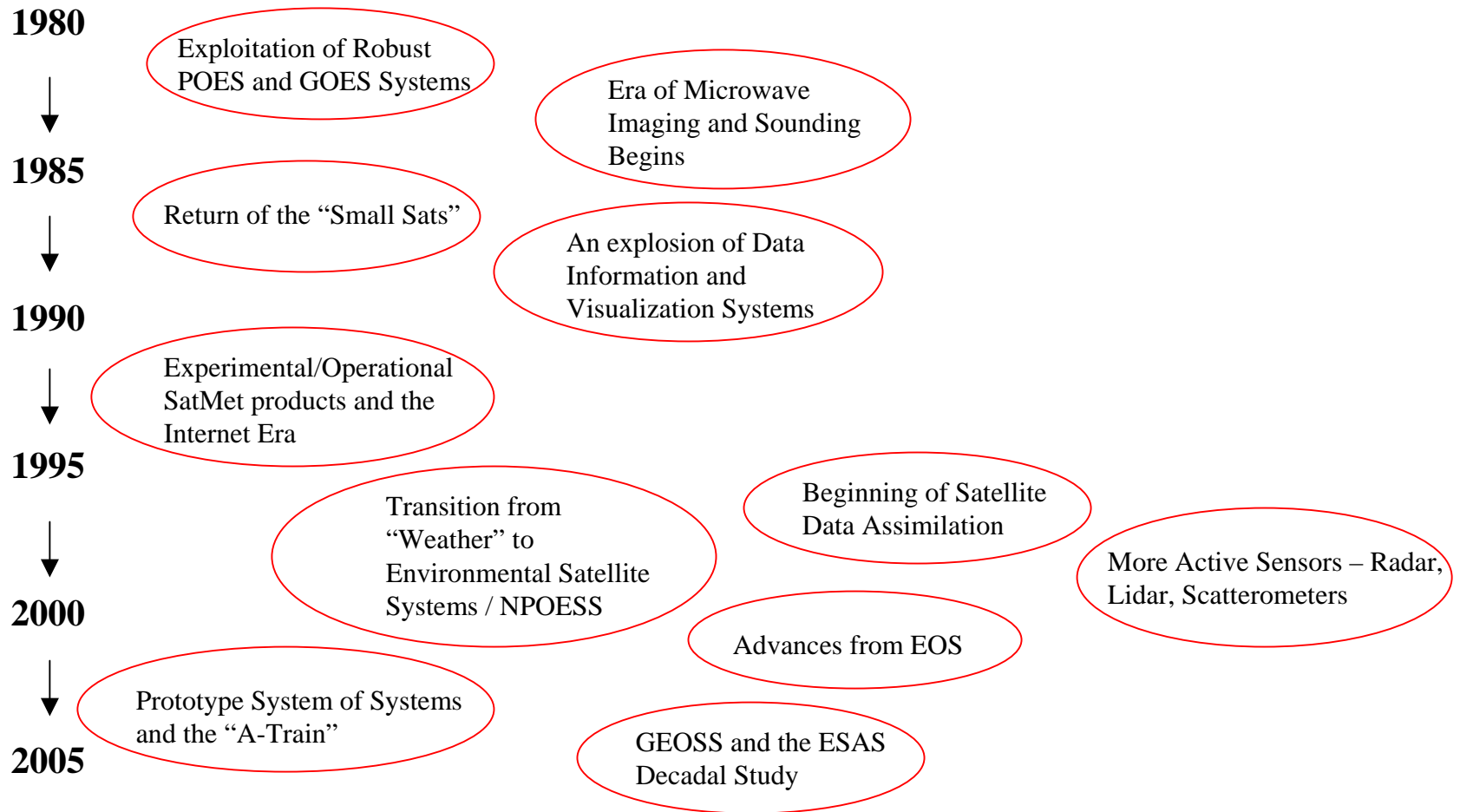
**Professor Tom Vonder Haar  
Colorado State University**

**Invited presentation at the Symposium on  
Satellite Meteorology: Past, Present and Future**

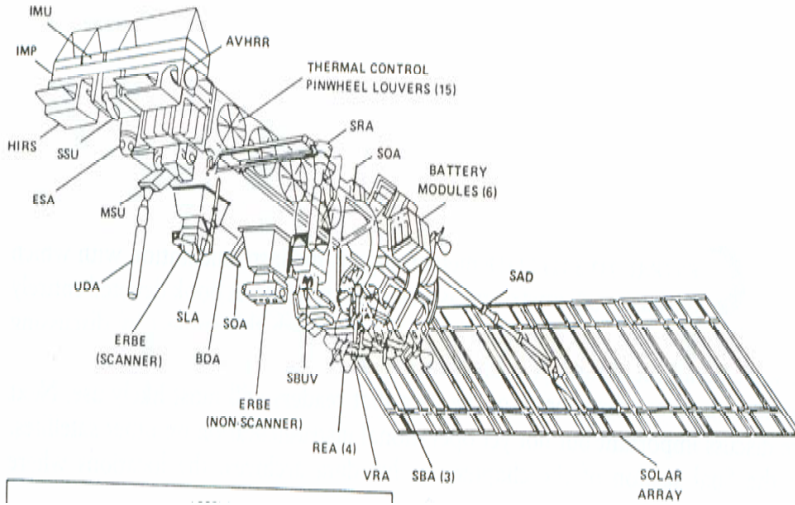
**CIMSS 25<sup>th</sup> Anniversary  
Madison, Wisconsin  
July 11-13, 2005**



# The US SatMet Program 1980-2005

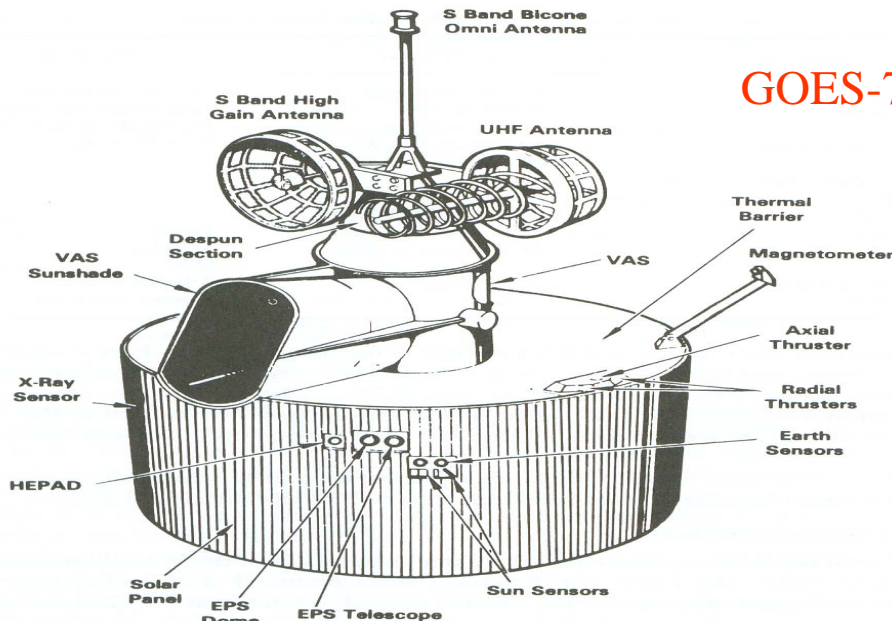


# Exploitation of Robust POES and GOES Systems



## Advanced TIROS-N

- TIROS-N/NOAA series developed from Nimbus and ESSA
- GOES 4-7 from ATS and SMS
- POES now measures clouds, SST, T, q, Ozone, ERB and more



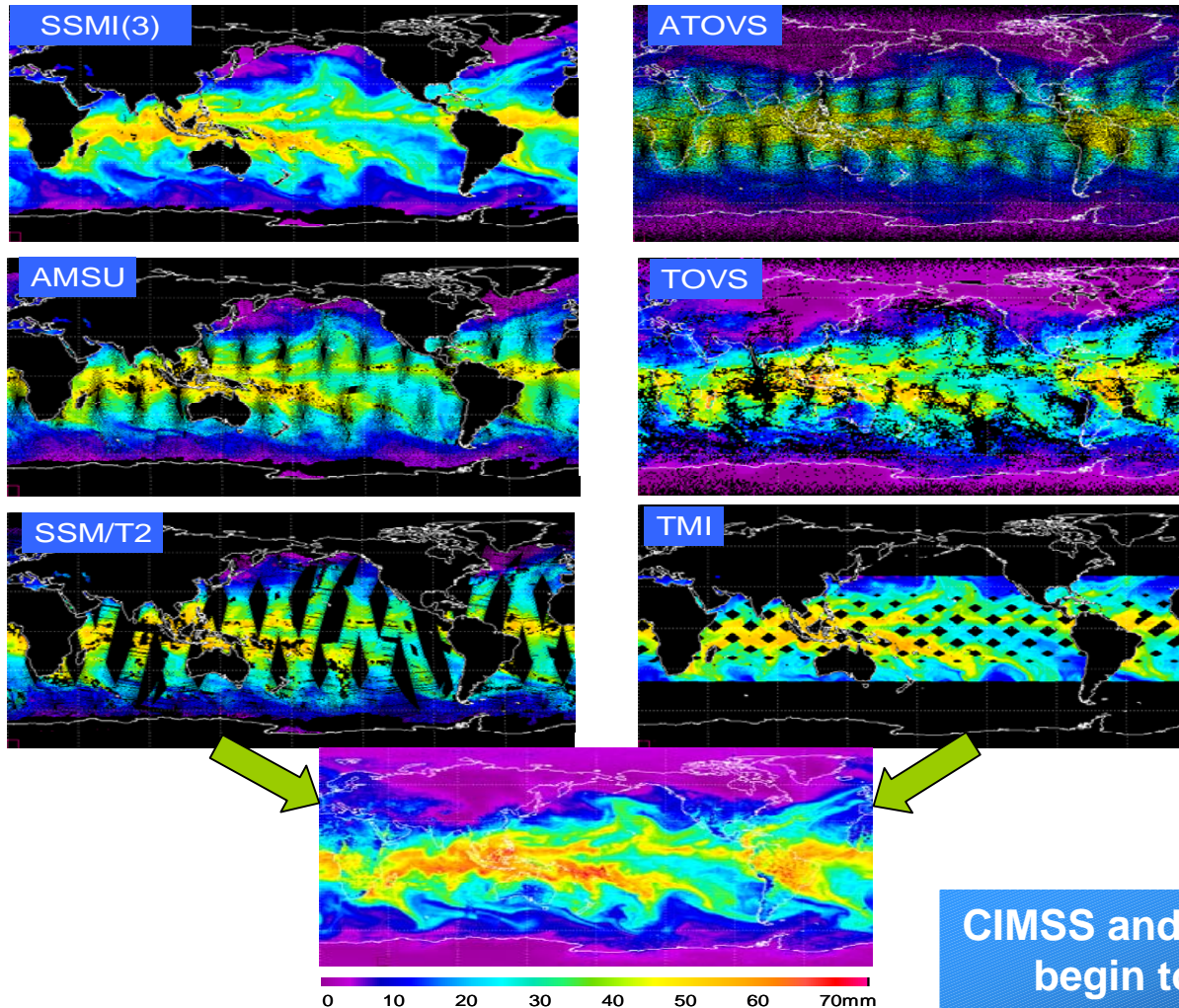
## GOES-7

FIGURE 4.22. Sketch of GOES 7. [After Vaughan (1982).]

CIMSS leads in product development for the GOES program



# Era of Microwave Imaging and Sounding



• Multiple satellite products are blended to create the NVAP dataset.

• January 1, 2000 Total Precipitable Water (TPW) shown here.

CIMSS and other groups begin to combine microwave, visible and infrared data

(Vonder Haar et al. 2005)



# Return of the “Small Sats”-1984

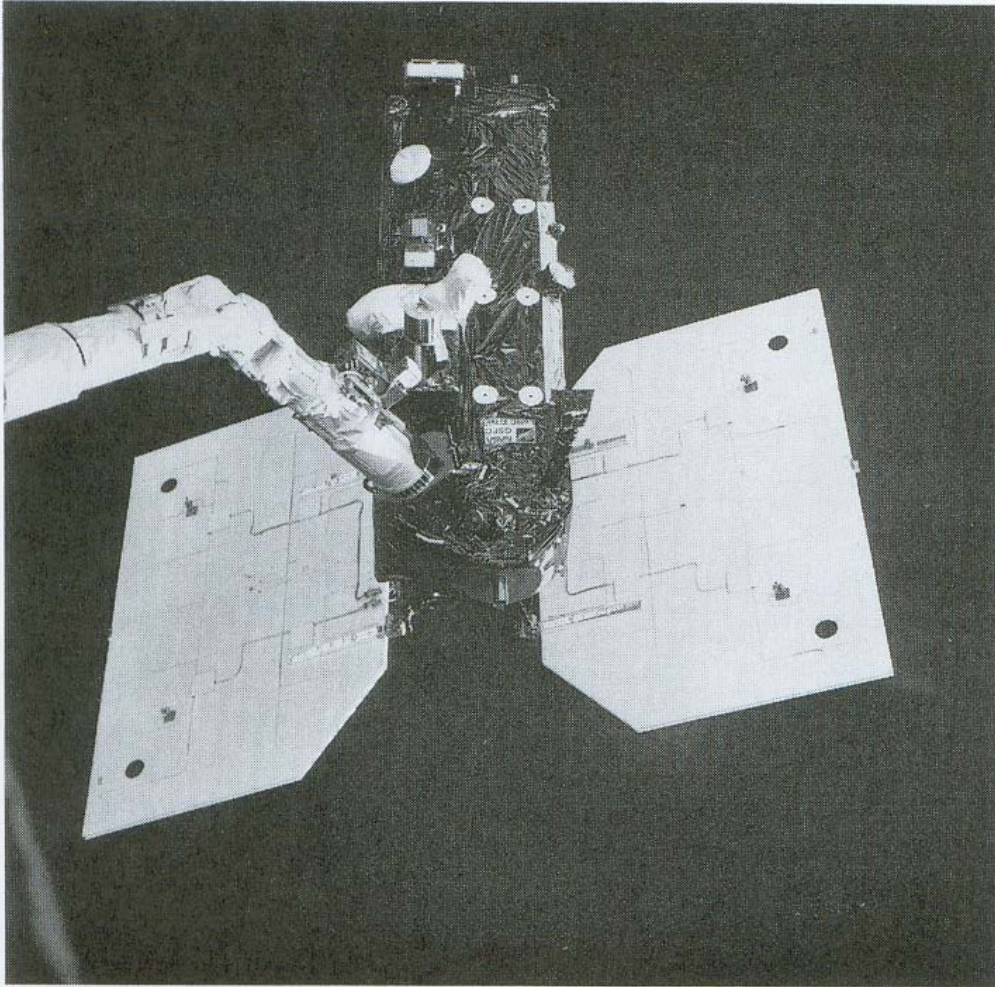


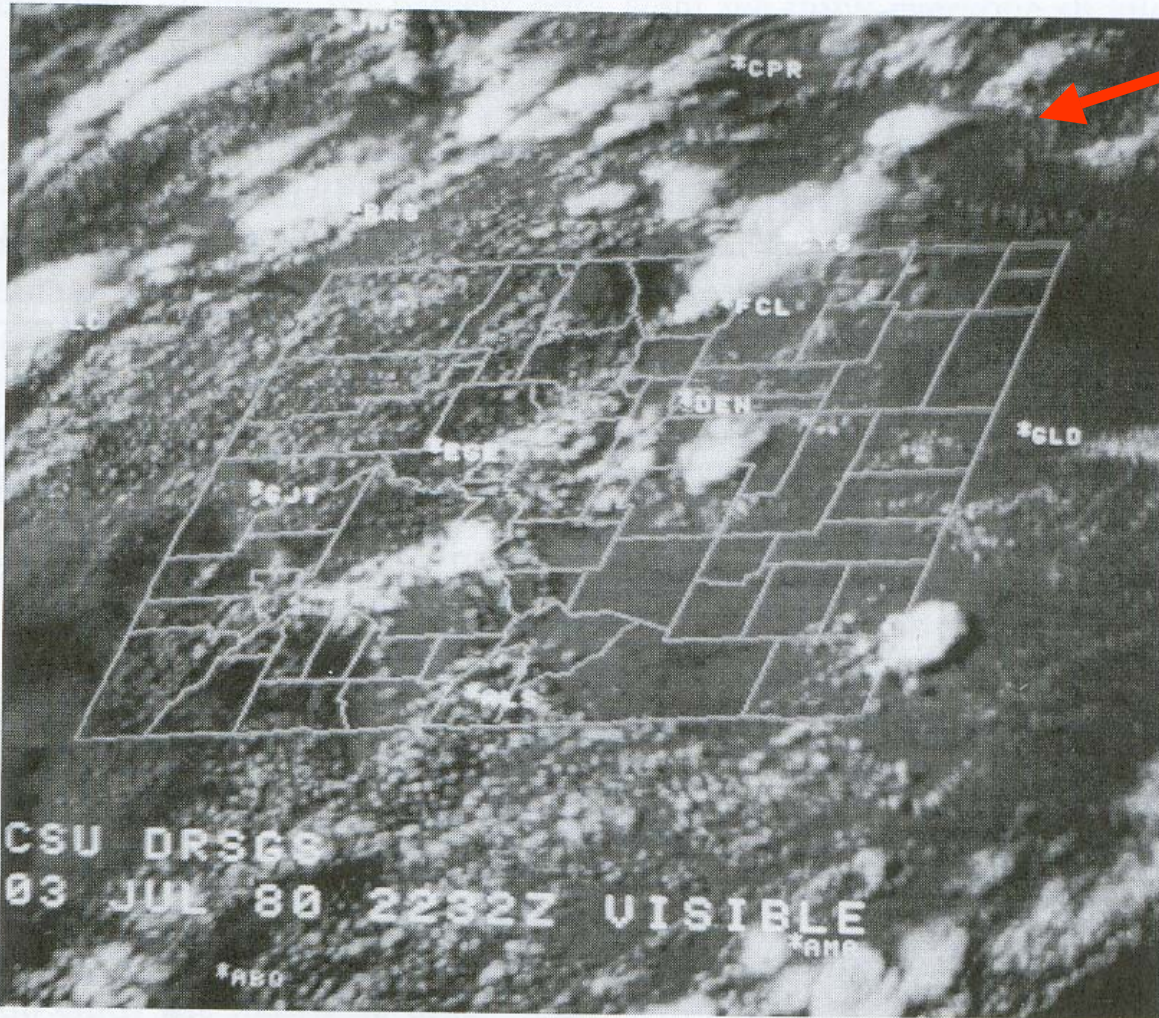
FIGURE 1.8. ERBS being launched from the Space Shuttle. [Courtesy of NASA.]

- This NASA/CSU/BALL/TRW Mission joins SAGE, TRMM, QuikScat and others to add to US Environmental Satellite research and operations

**CIMSS and many other scientists join science teams for the small satellite missions**



# An Explosion of Data Information and Visualization Systems



CIRA, CSU real time GOES image transmitted to NWS, DEN, July, 1980

- McIDAS, ADVISAR, RAMSDIS, AWIPS et al. bring SatMet products to many users

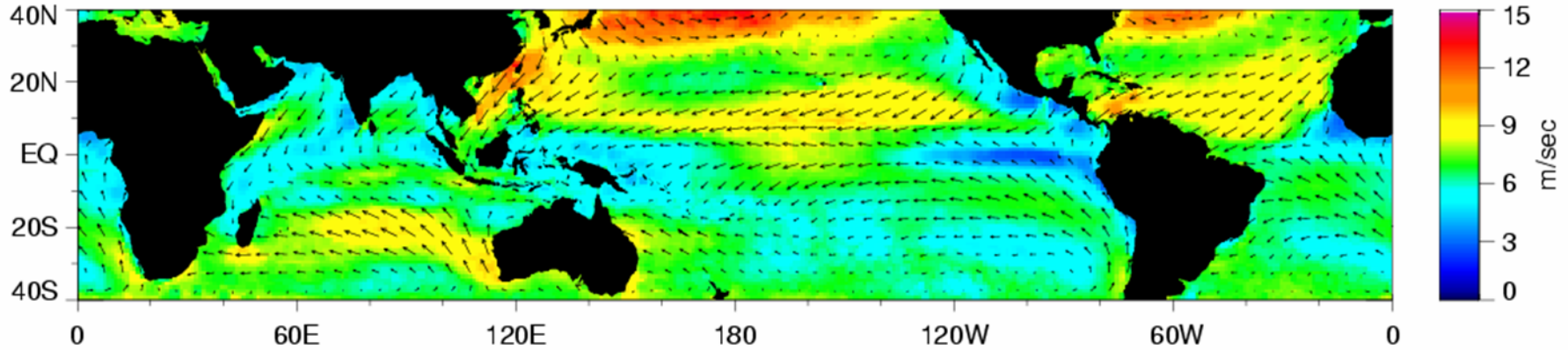
CIMSS, SSEC develops real time products for Miami, Kansas City and more



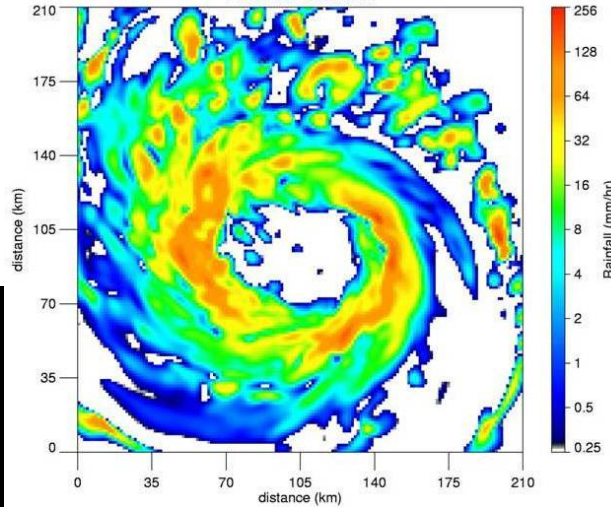
FIGURE 1.9. GOES image transmitted in near-realtime to a remote site.

# More Active Sensors: RADAR, LIDAR, Scatterometer

DJF 99/00 QuikScat Mean Winds



Surface Rainfall



TRMM RADAR

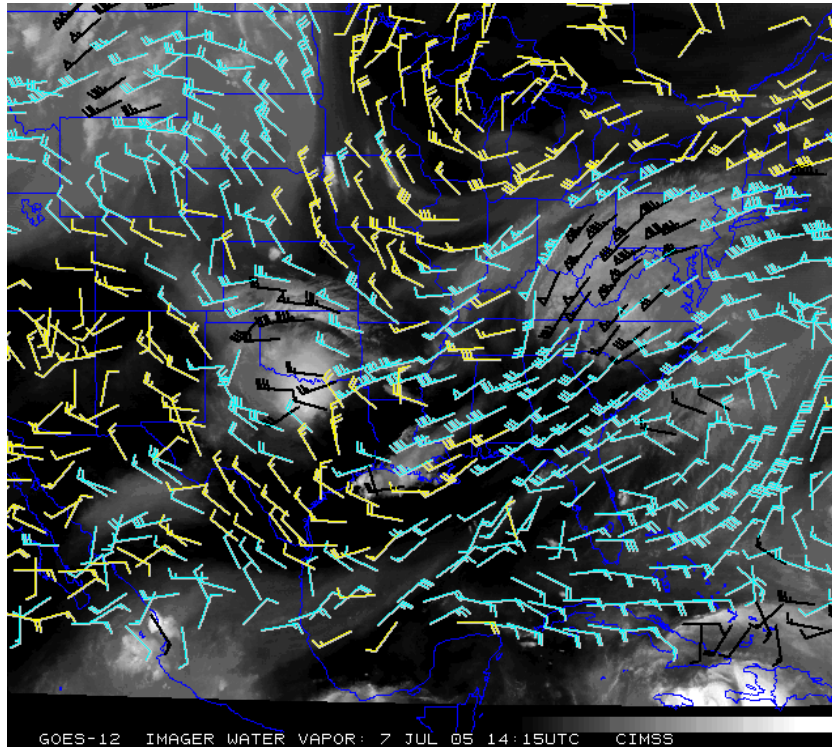


CIMSS, CIRA and others develop cross-sensor forecast products



# Experimental/Operational SatMet Products and the Internet Era

- Many research-to-operations groups place new SatMet products on the web – to the forecasters delight!

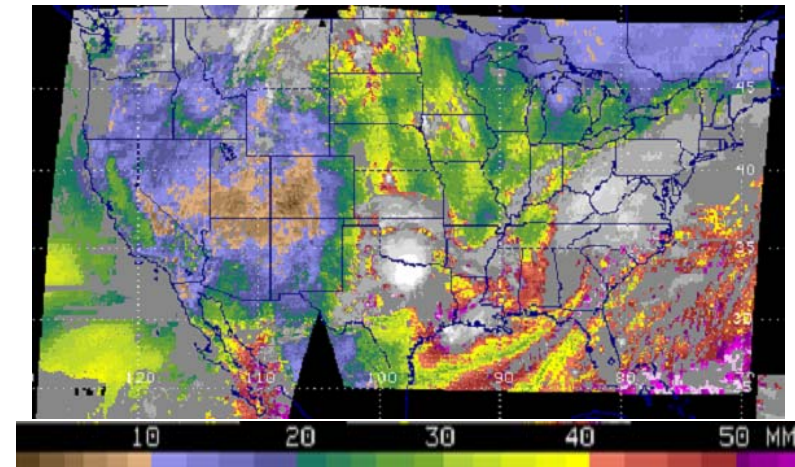


**Black:** 100-250 mb

**Cyan:** 251-350 mb

**Yellow** 351-500 mb

**GOES-12 water vapor  
winds from CIMSS July  
7, 14:15 UTC**



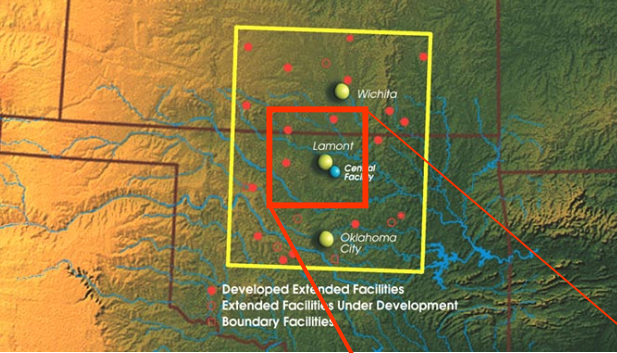
**GOES Sounder Total  
Precipitable Water July  
7, 14:00 UTC from  
CIMSS**



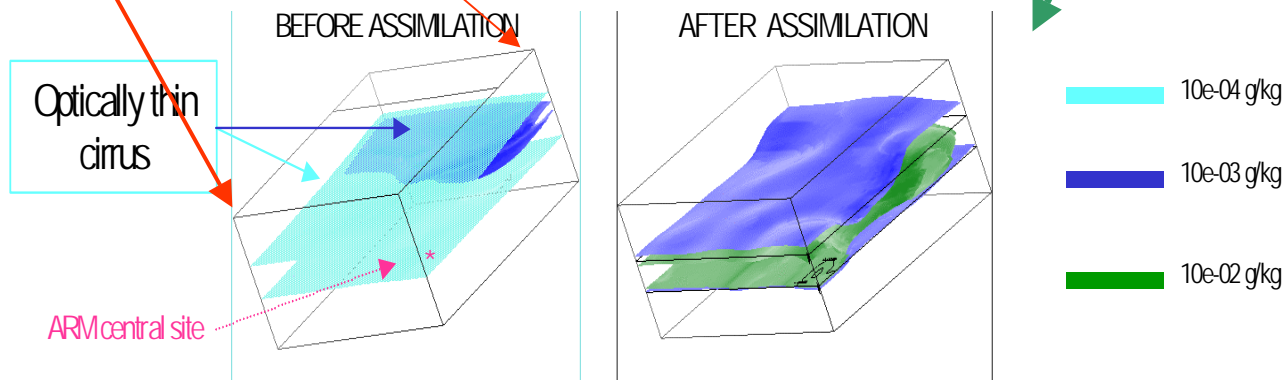


# Era of Satellite Data Assimilation

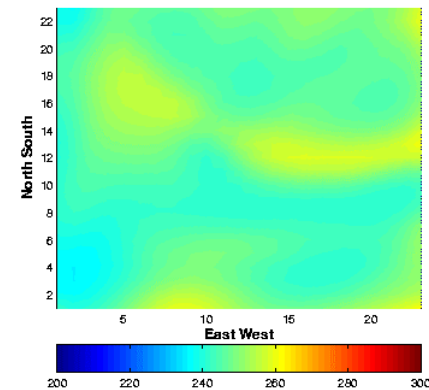
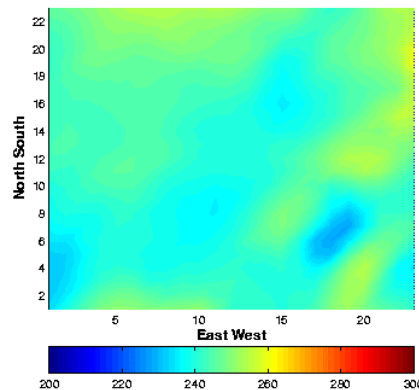
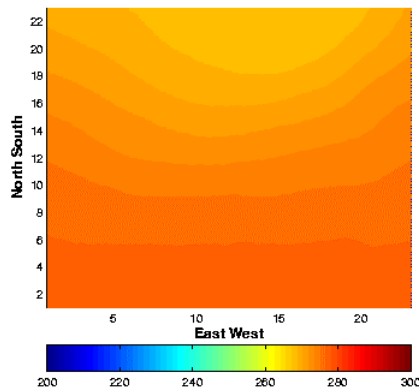
- From 1995 onward global assimilation of cloud-free satellite radiances shows positive impact
- Today we focus on global and regional DA in cloudy cases (4D assimilation of GOES imager IR multi-layered non-convective case)



Model  
3D  
cloud



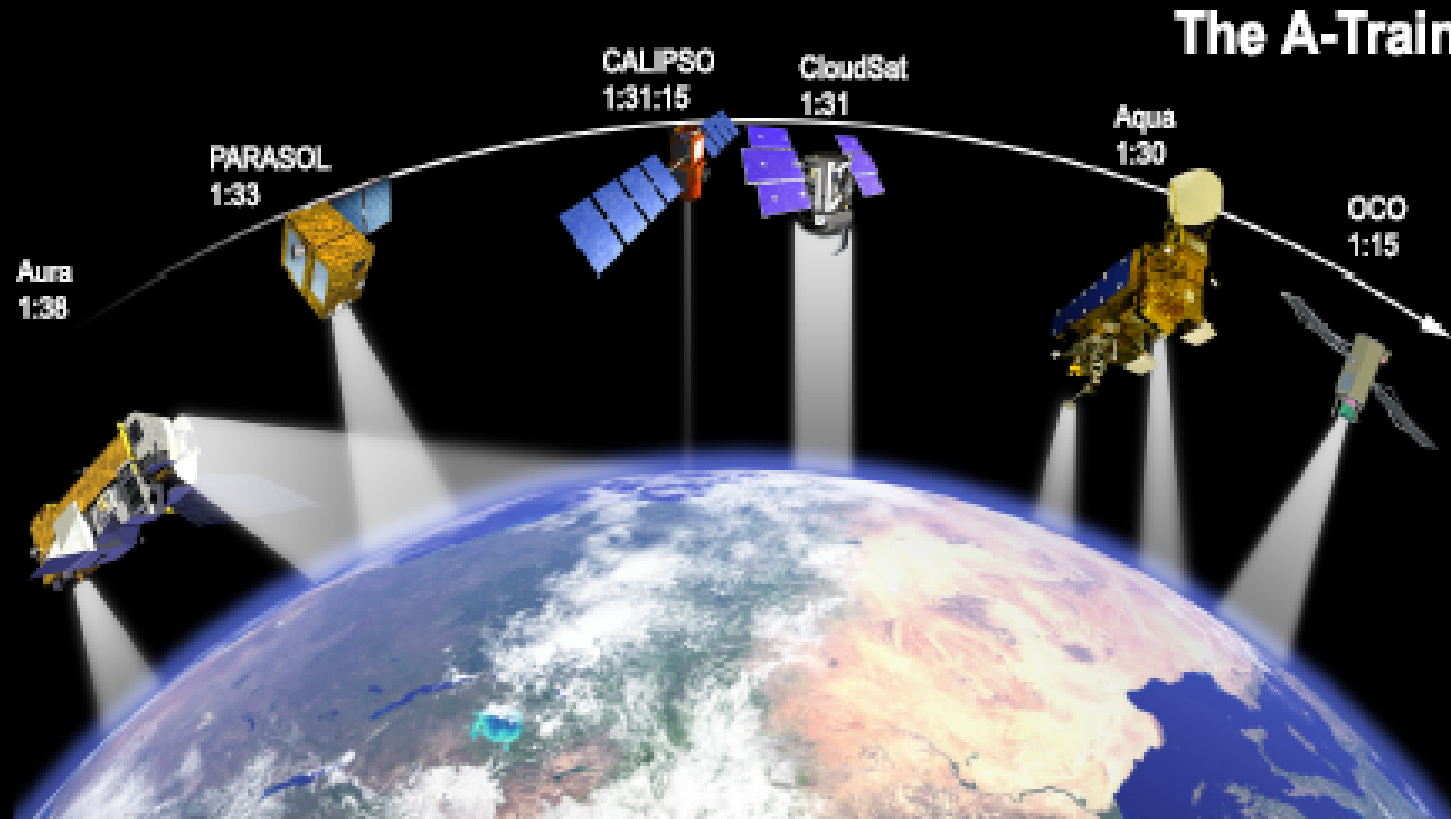
2D  
Tb



(Vukicevic et al. 2004)



# Prototype System of Systems and the “A-Train”



By mid 2005, we expect to have a wide range of different sensors, active and passive, optical, infrared and microwave, hyper-spectral to coarse band, all approximately viewing Earth at the same time.

We are left to pose a strategy that optimally combines these measurements, converting them to meaningful information with verified uncertainties. (G. Stephens, 2005)

# CSU Graduate Class with early CloudSat in the background



CIMSS, CIRA, CICS and others have assisted the education of many in our field

**Are we training and entraining enough young scientists and engineers?**



# More background on the last 25 years

## For 1960-1995

**Kidder, Stan and Tom Vonder Haar, 1995: Satellite Meteorology: An Introduction, Academic Press, 466pp. (First Ed.)**

## For 1995-2005

**(2<sup>nd</sup> Ed. of above, 20xx)**



To the Scientists  
& Staff of CIMSS,  
SSEC, UW,

In Appreciation for your  
many contributions to - and fine  
collaborations within - the field  
of Satellite Meteorology!

On the occasion of your  
25<sup>th</sup> Anniversary, July, 2005.

Stan Kidder  
Tom Vonderhaar

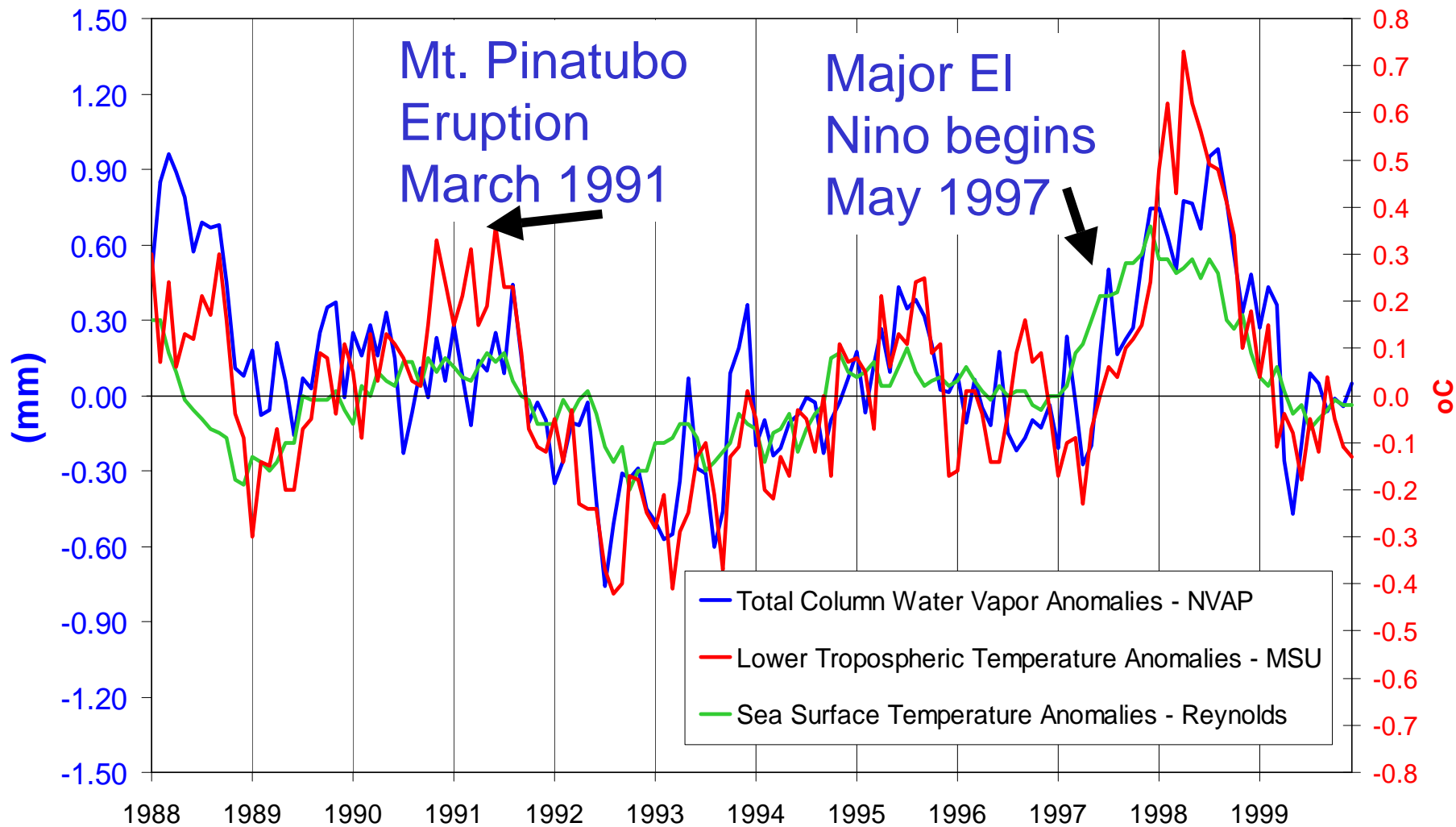


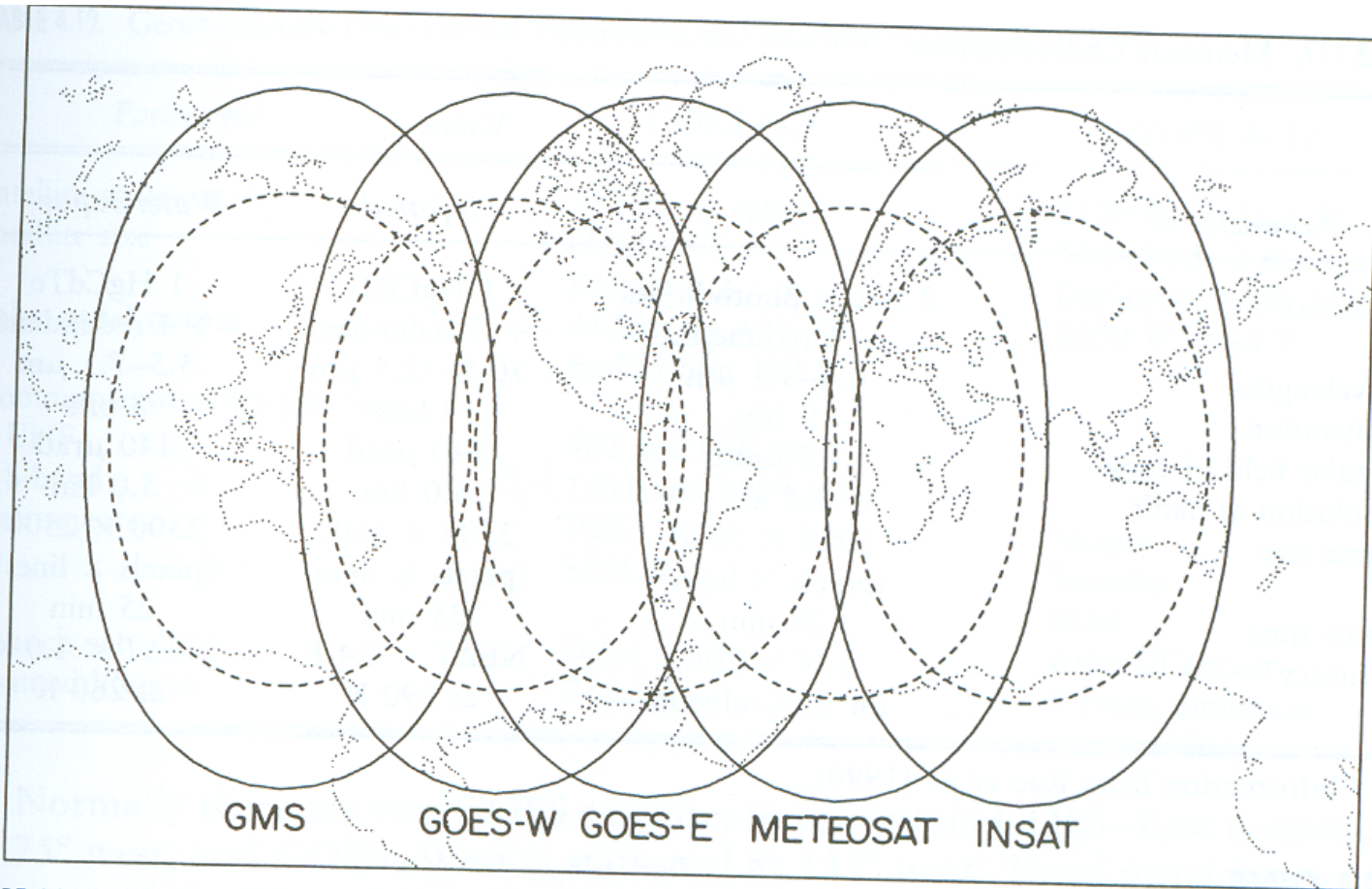
# Back up slides



# Comparison of the Total Column Water Vapor, Sea Surface Temperature, and Lower Tropospheric Temperature Anomalies - Global Means

Three Independent Satellite Measurements – Highly Coupled





**FIGURE 4.21.** Areas viewed by geostationary meteorological satellites. The solid line shows the limb; a satellite sees nothing outside this area. The dashed line encloses the area of useful data where the satellite is at least  $10^\circ$  above the horizon.