



*Advanced Satellite Aviation-weather Products*

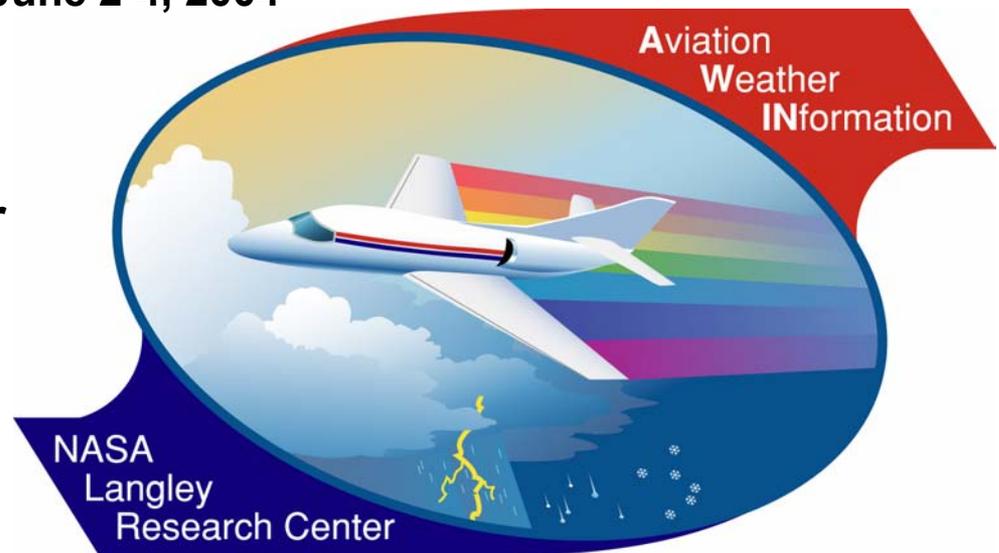
# Advanced Satellite Aviation-weather Products (ASAP)

**NASA Aviation Safety and Security Program**

**Weather Accident Prevention Project Review**

**June 2-4, 2004**

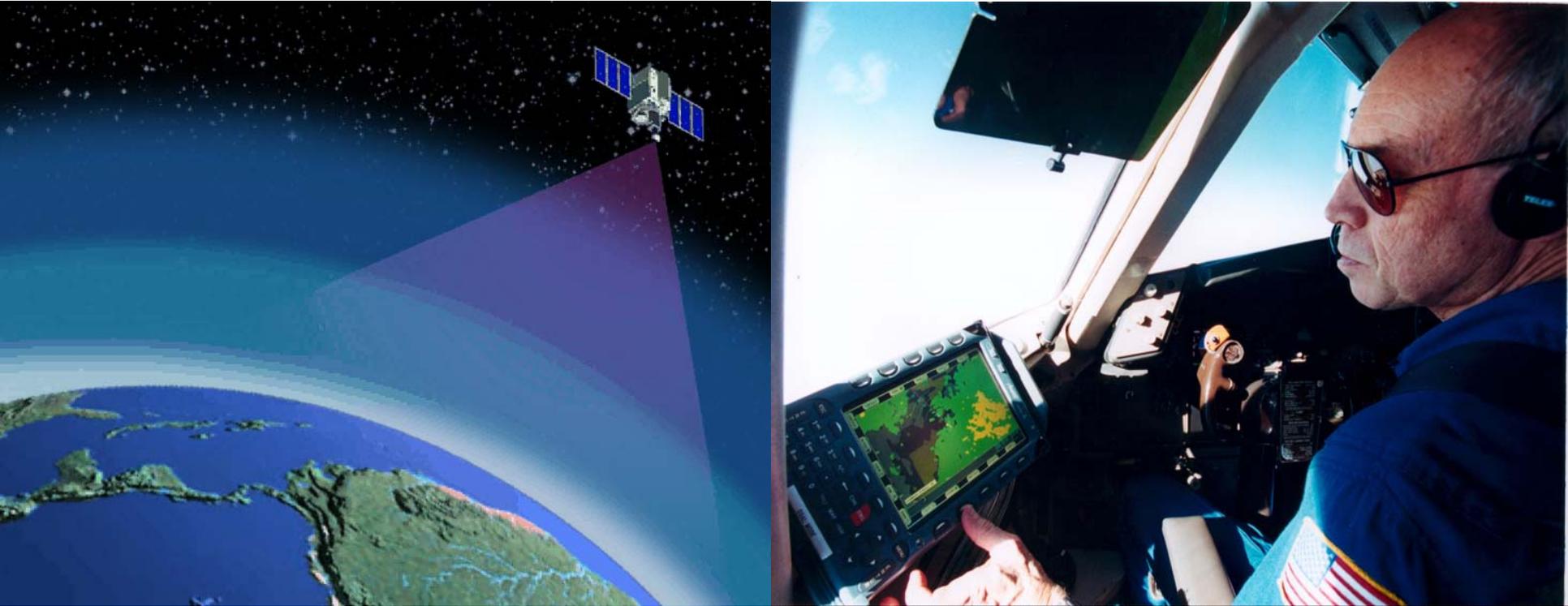
**John Murray  
NASA Langley Research Center  
Hampton, VA**





# Advanced Satellite Aviation-weather Products

*Advanced Satellite Aviation-weather Products*



**A partnership between NASA, the FAA and their research partners to infuse current and future satellite data into FAA Aviation Weather Research Program products.**

# The Interagency Team



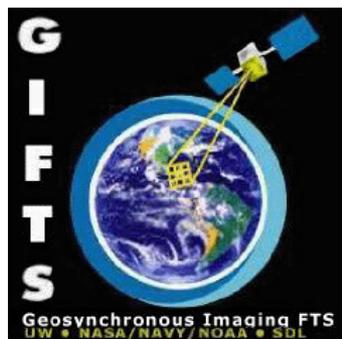
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NCAR



FORECAST  
SYSTEMS  
LABORATORY  
BOULDER, COLORADO



Cooperative Institute for  
Meteorological Satellite Studies



# ASAP Project Structure

Advanced Satellite Aviation-weather Products

NASA

FAA

ASAP

Oceanic Weather

In-Flight Icing

Ceiling & Visibility

Aviation Weather Research Program Product Development Teams

- In-Flight Icing
- Convective Weather
- Turbulence
- Oceanic Weather
- National Ceiling and Visibility
- Terminal Ceiling and Visibility
- Winter Weather
- Model Development and Enhancement
- Aviation Forecasts
- Quality Assessments
- NEXRAD Algorithms

Field Campaigns

Volcanic Ash

Convection

Turbulence

FL Winds

Typical Product Development Processes

In-Flight Icing

- Research
- Validation
- Integration

Field Campaigns

- Planning
- Execution
- Reporting

# FAA AWRP Target Products



## *Advanced Satellite Aviation-weather Products*

- In-Flight Icing:
  - Current Icing Potential (CIP),
  - Forecast Icing Potential FIP
- Turbulence:
  - Graphical Turbulence Guidance (GTG)
- Oceanic Weather:
  - Integrated Volcanic Ash,
  - FL Winds,
  - Oceanic Convective Weather Forecast (OCWF)
- Convective Weather:
  - Oceanic Convective Weather Forecast (OCWF)
  - National Convective Weather Forecast (NCWF)
- National Ceiling and Visibility:
  - National Ceiling and Visibility Forecast NCVF
- Model Development & Enhancement:
  - Rapid Update Cycle
  - Wx Research & Forecast (WRF) Rapid Refresh Cycle (RRC)

# A-Train Observations



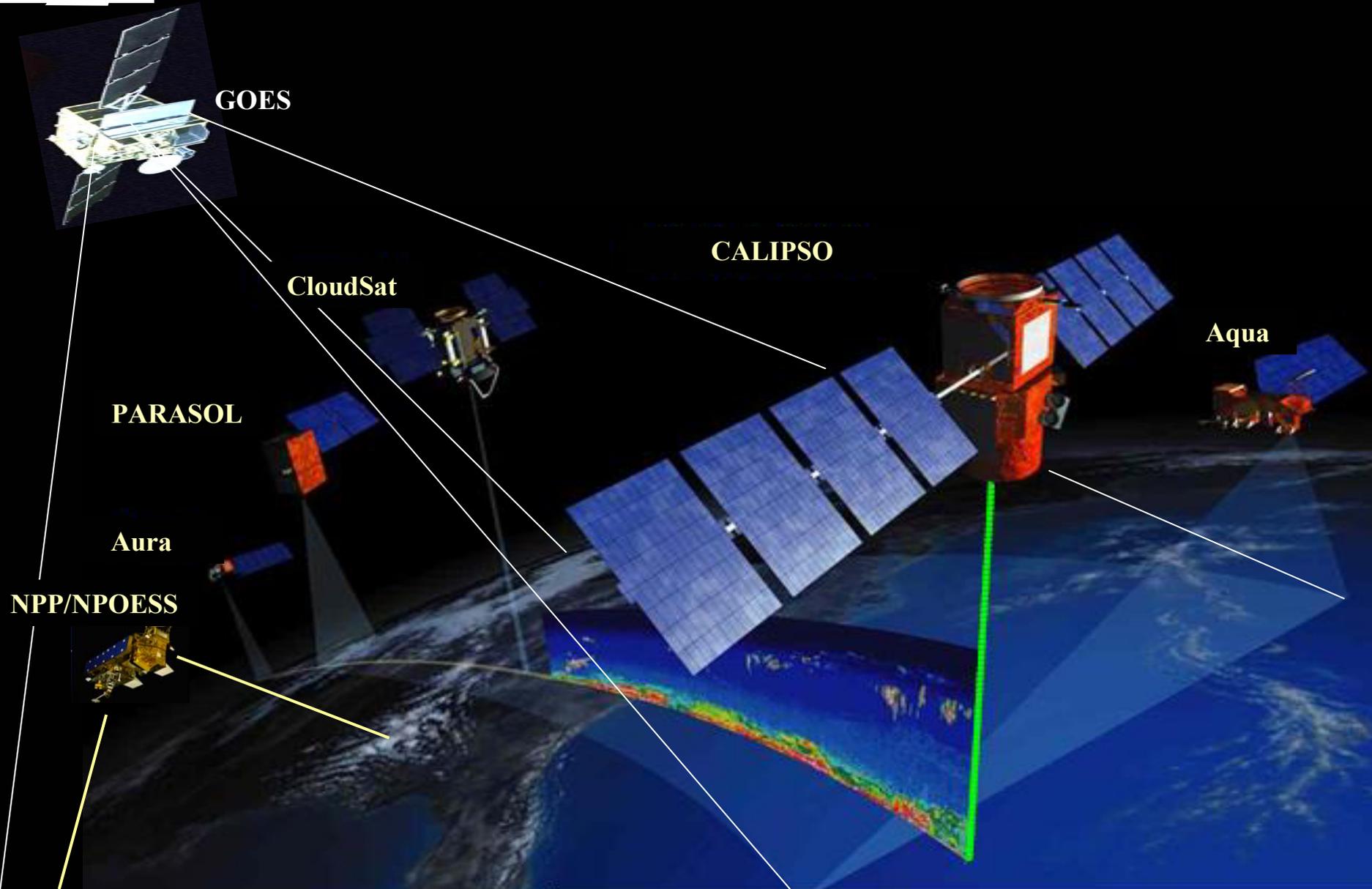
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# ASAP Data Sources



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**GOES**

**CloudSat**

**PARASOL**

**Aura**

**NPP/NPOESS**

**CALIPSO**

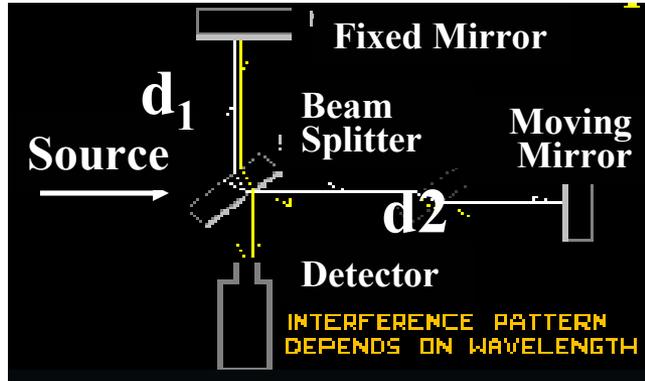
**Aqua**

# High Spectral Resolution Sounding

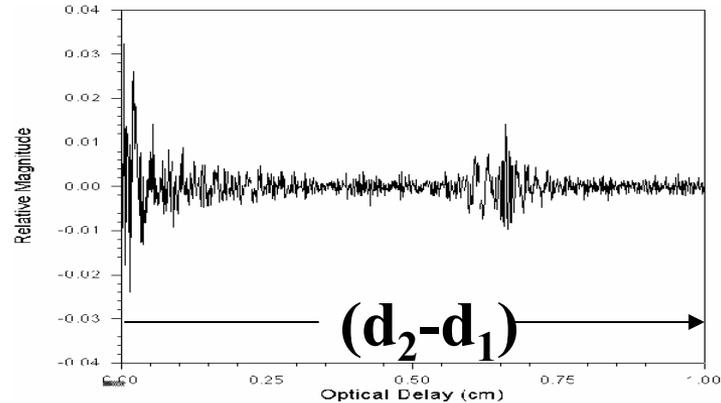


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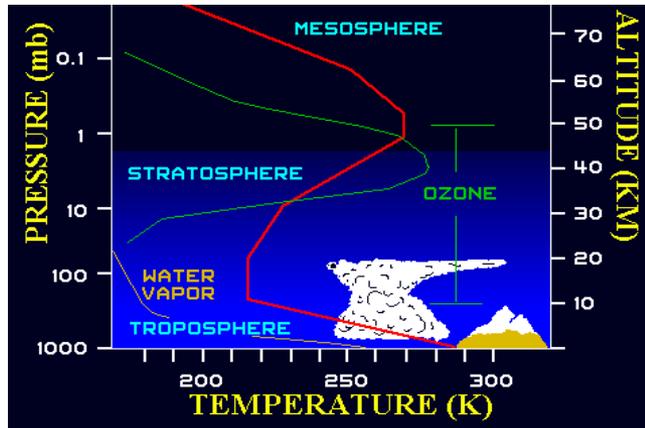
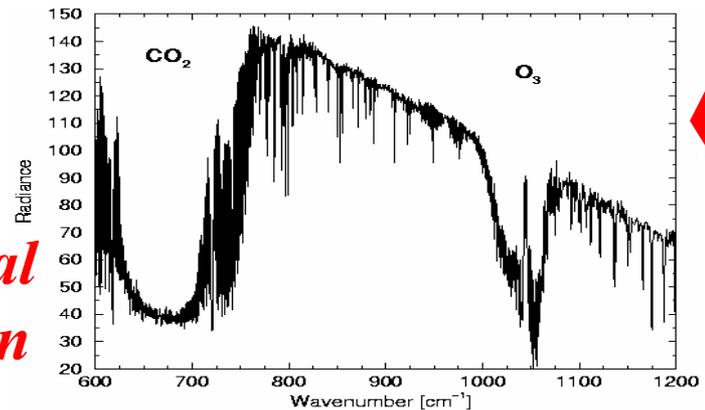
## Michelson Interferometer (FTS)



## Interferogram



## Fourier Transformation



## Vertical Sounding

## Radiance Spectrum

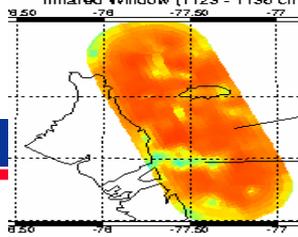
*Numerical Inversion*

**Fourier Transform Spectrometer - The Preferred Approach**



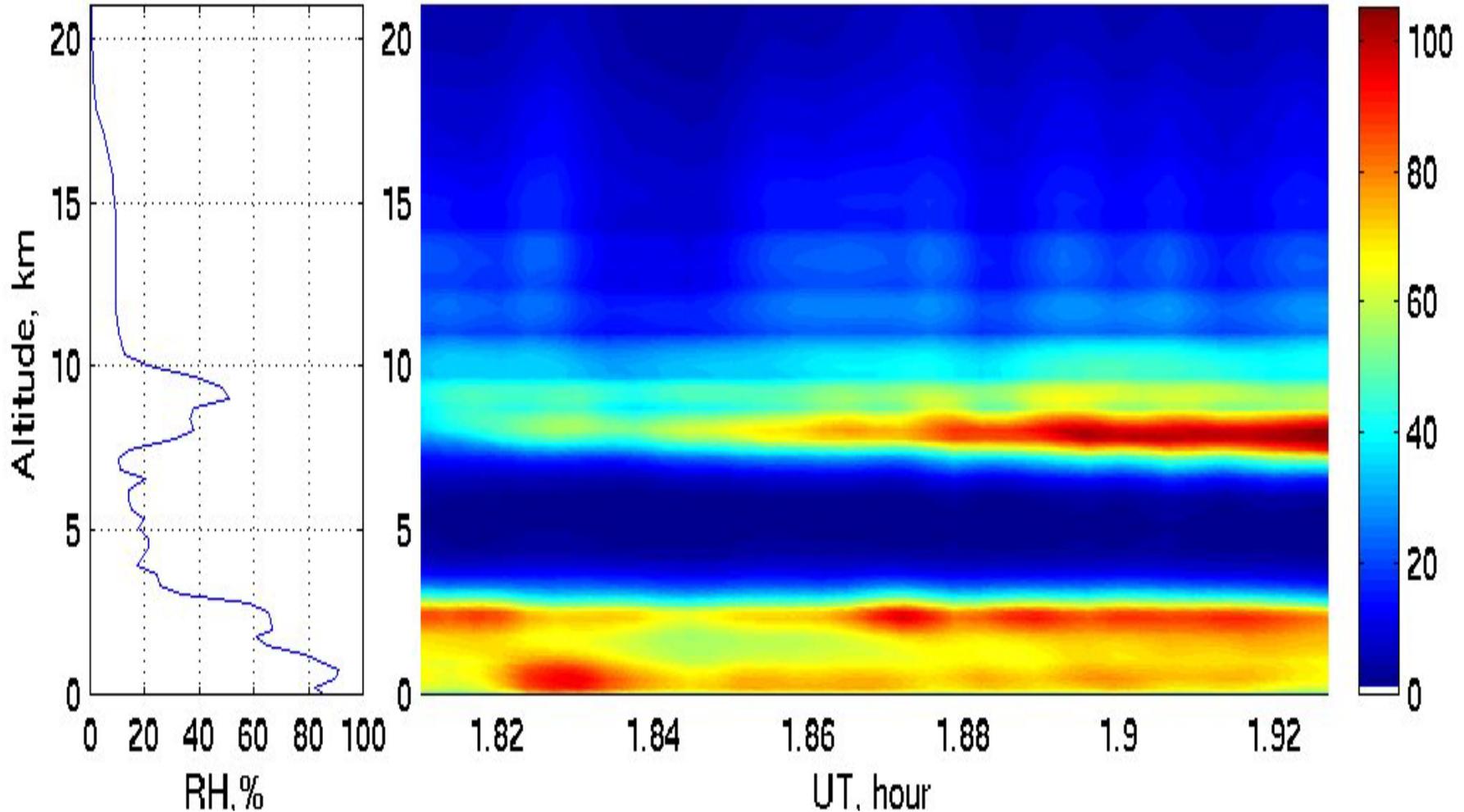
# High Resolution Water Vapor Profiling

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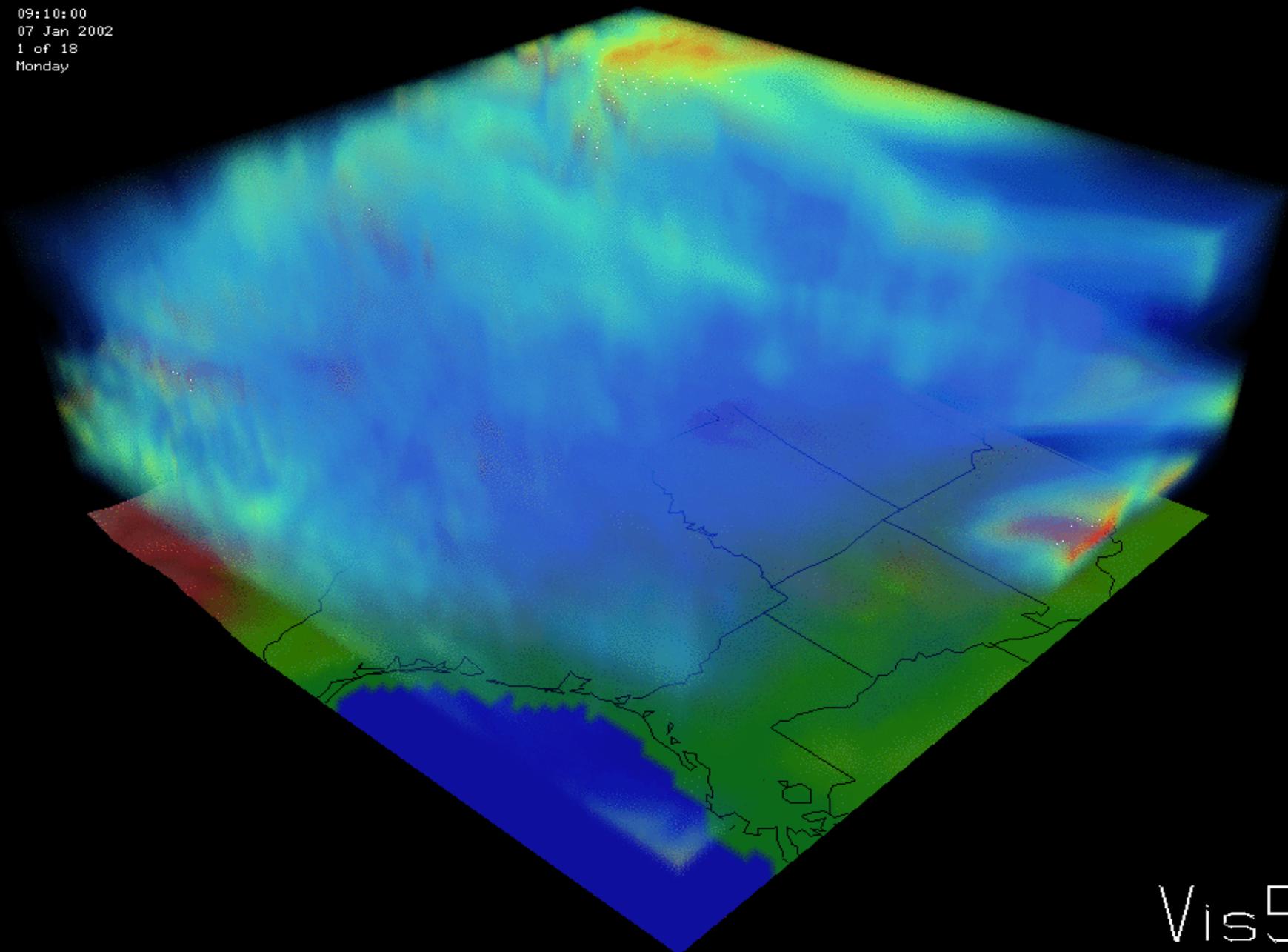
## Andros Is. Bahamas (Sept. 14, 1998)

Raob Mean



# High Resolution Water Vapor Flux

09:10:00  
07 Jan 2002  
1 of 18  
Monday



Vis5D



# FY 2003 Accomplishments

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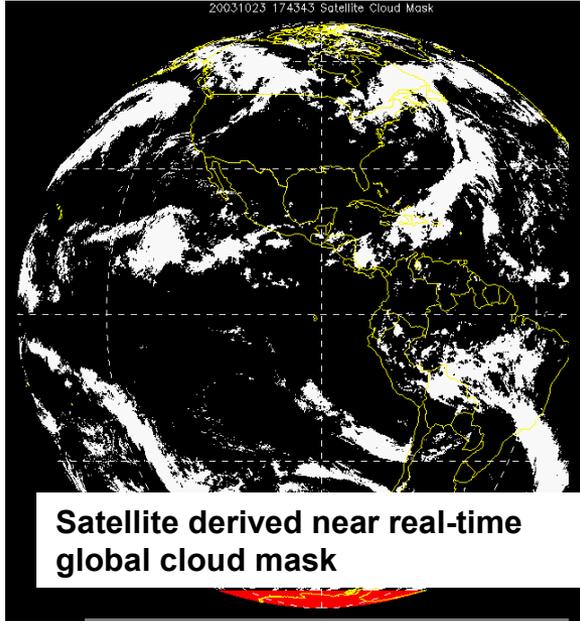
- ✓ **Completed ASAP Study Report**
- ✓ **Teamed with FAA Aviation Weather Research Program**
- ✓ **Completed cost/benefits analysis for candidate products**
- ✓ **Conducted Pacific THORPEX Observing System Test**
- ✓ **Completed UW Satellite Data Web Access for AWRP**
- ✓ **Completed Icing Domain Expansion**



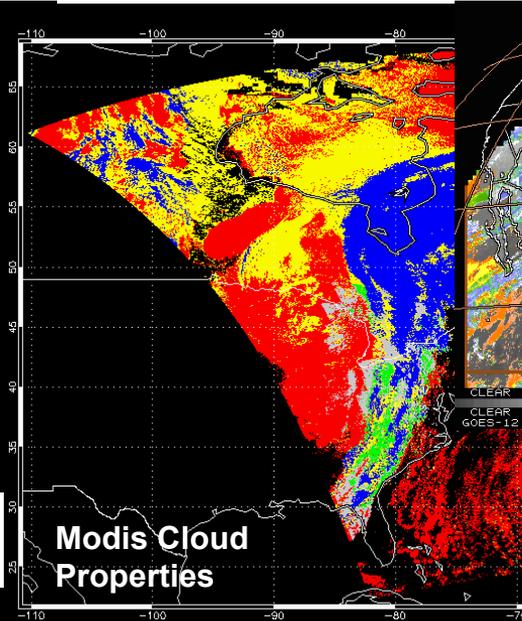
# UW CIMSS Satellite Data Web Access

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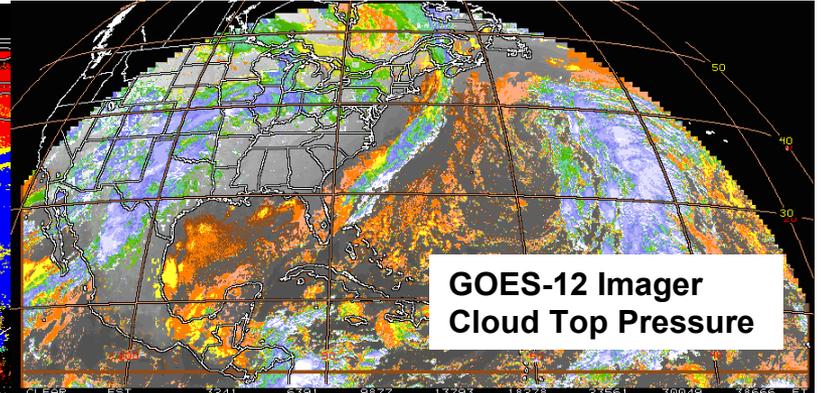
Access to ASAP Satellite Weather Data for FAA AWRP PDTs



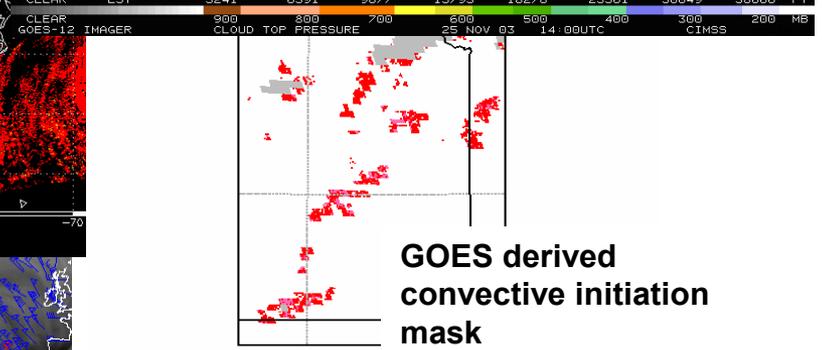
Satellite derived near real-time global cloud mask



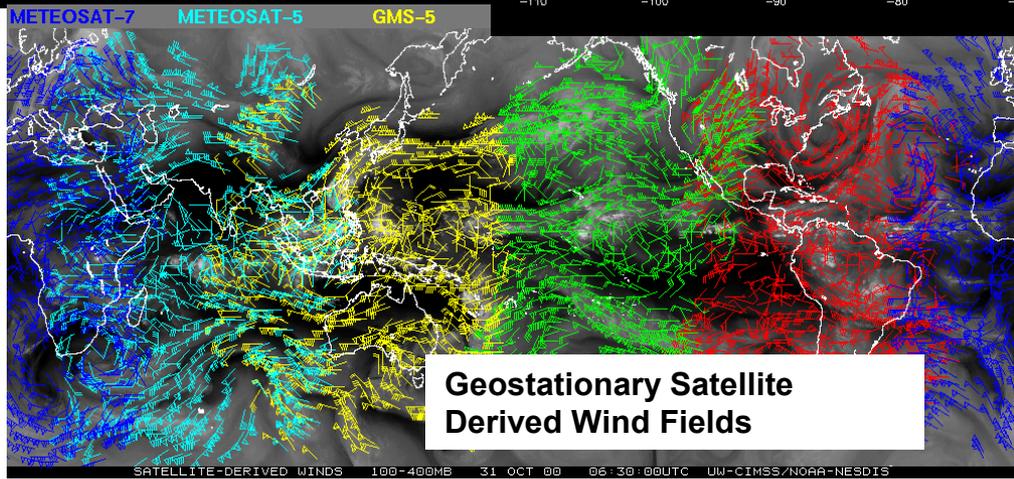
Modis Cloud Properties



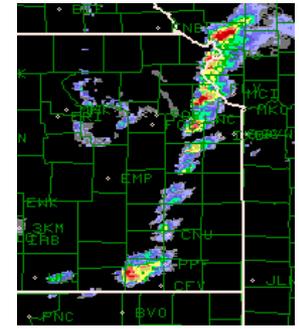
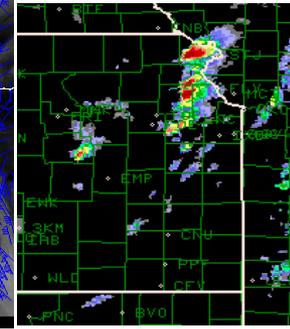
GOES-12 Imager Cloud Top Pressure



GOES derived convective initiation mask



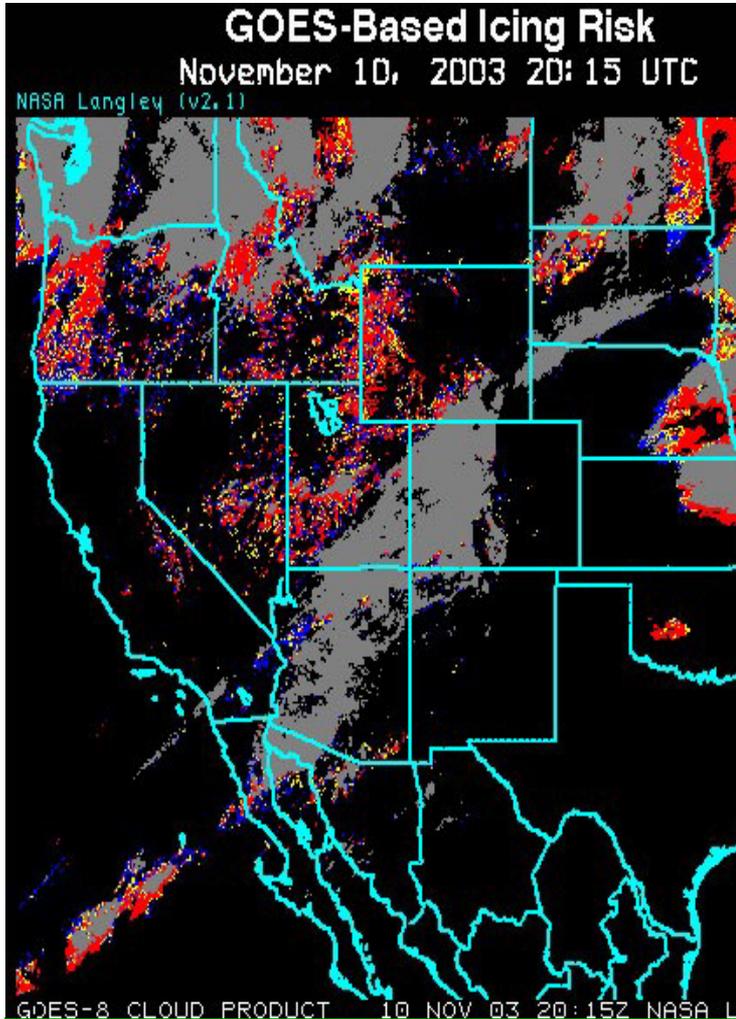
Geostationary Satellite Derived Wind Fields



# NASA LaRC Icing Domain Expansion

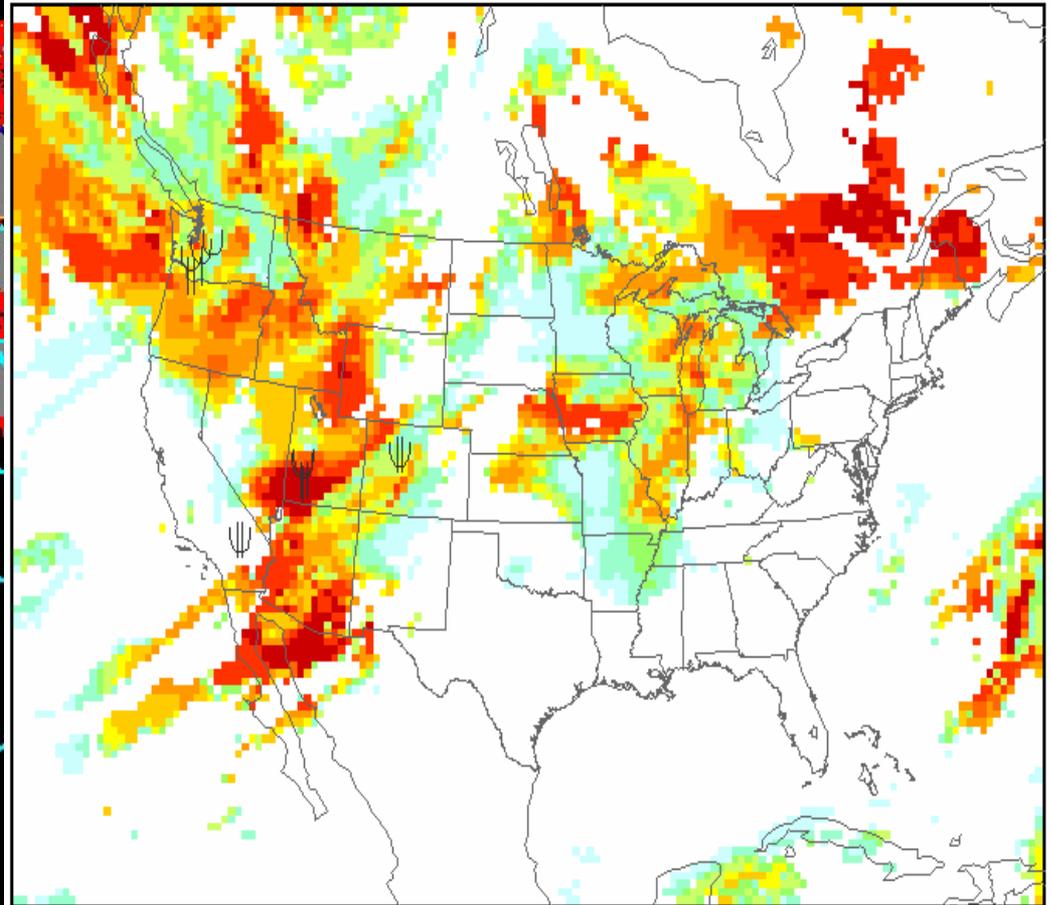


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Maximum Icing potential (FL010-FL300)

Analysis valid 2000 UTC Mon 10 Nov 2003



**Expansion of NASA Cloud Microphysical Product to Full CONUS Domain –  
NASA ASAP Cloud Product targeted for FAA AWRP Current Icing Potential Product**



# FY 2004 Activities

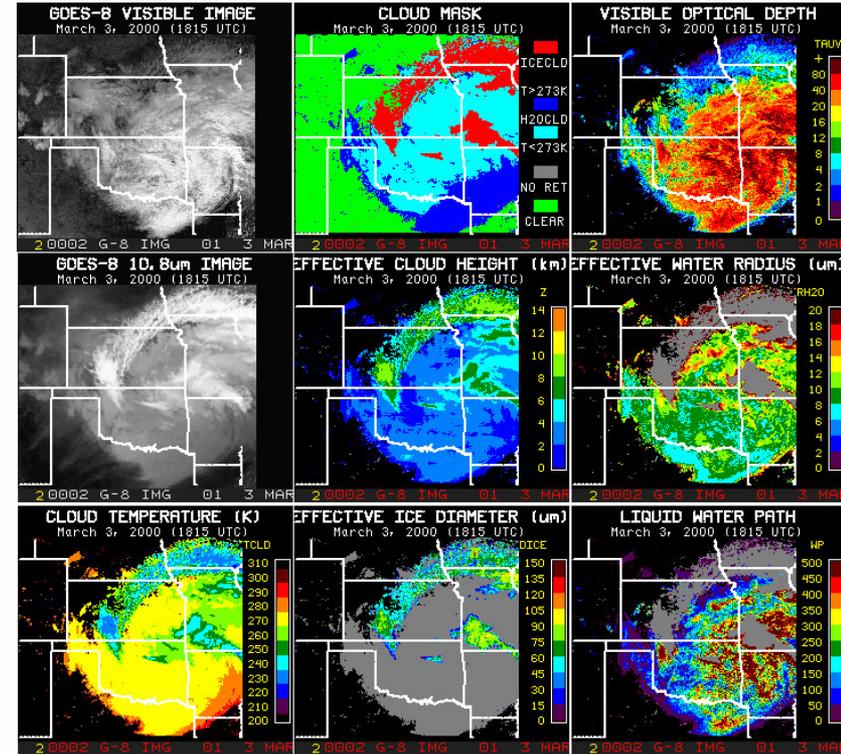
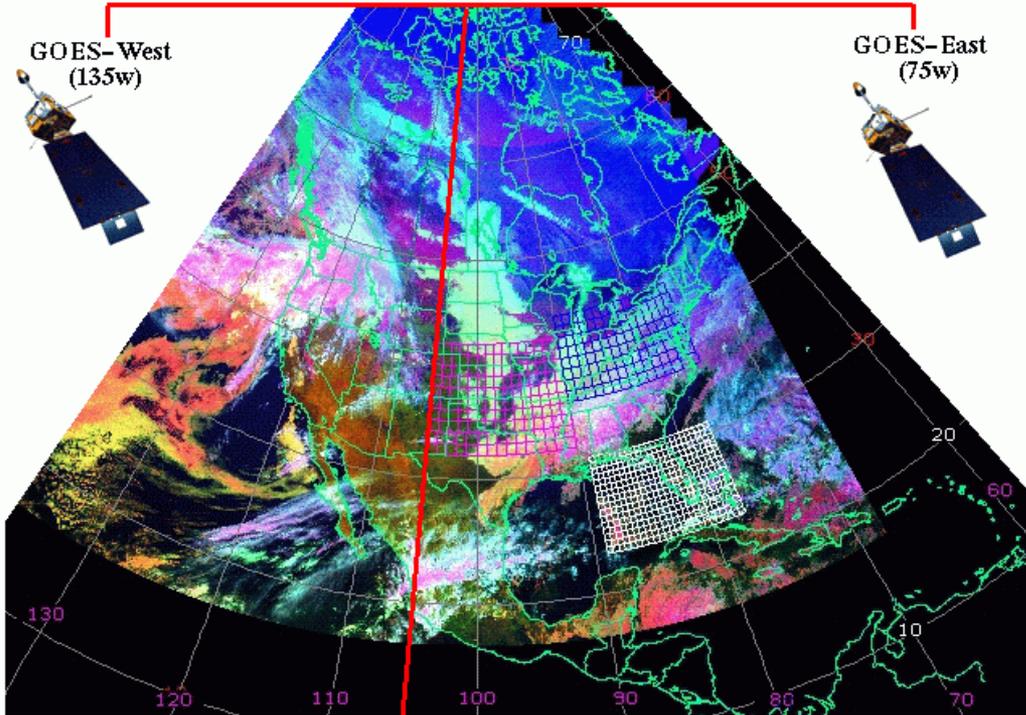
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- **Atlantic THORPEX Regional Campaign and AIRS II**
- **Benchmark ASAP In-Flight Icing algorithms against CIP**
- **Develop Volash, Turbulence, Oceanic Convection and Winds Tools**
- **Co-Sponsor 2<sup>nd</sup> Int'l Conference on Volcanic Ash & Aviation Safety**
- **Conference Papers for :**
  - ❖ **2<sup>nd</sup> International Volcanic Ash and Aviation Safety Conference**
  - ❖ **AMS Satellite Conference**
  - ❖ **AMS Aviation Range and Aerospace Meteorology Meeting**
  - ❖ **AIAA Annual Meeting**
- **AMS ARAM and AIAA Conference Papers on TAMDAR Icing data validation and ASAP collaboration**
- **AMS ARAM and AIAA Conference Papers on UAV Aviation Weather Observations**

# Satellite-derived Icing Product Benchmark



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**NASA Integrated Budget Performance Document (IBPD) Benchmark – NASA LaRC Cloud Microphysical Properties formally evaluated by FAA AWRP In-flight Icing Product Development Team for enhancement of Current Icing Potential Product**



# Planned FY 2005 Activities

*Advanced Satellite Aviation-weather Products*

- **CIP Enhancement**
- **Gravity Wave Cloud Mask Evaluation for GTG**
- **Integrated Volcanic Ash Detection Tools**
  - ❖ **AURA Aerosol**
  - ❖ **MODIS Multispectral Imagery**
  - ❖ **DSP Bulk Radiance**
- **Oceanic Convective Weather Forecast Tools**
- **Cloud Top and Ceiling Tools**