EOS Direct Broadcast Real-Time Products for the US National Weather Service

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16th International TOVS Study Conference
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EOS Direct Broadcast Activities at SSEC, UW-Madison

Objectives:

- Acquisition and processing of EOS Terra and Aqua direct broadcast (DB) data.
- Distribution of data to customers in real-time.
- Development of software for data processing.

Accomplishments:

- Have acquired more than 20,000 Terra and Aqua passes.
- MODIS, AIRS, and AMSR-E Level 1B data, browse images, and Level 2 products are produced automatically and made available via anonymous FTP and the Web.
- IMAPP MODIS/AIRS/AMSR-E software now in use in on every continent.

Funding: NASA, NOAA IPO

Major Customers for EOS Direct Broadcast Data from SSEC

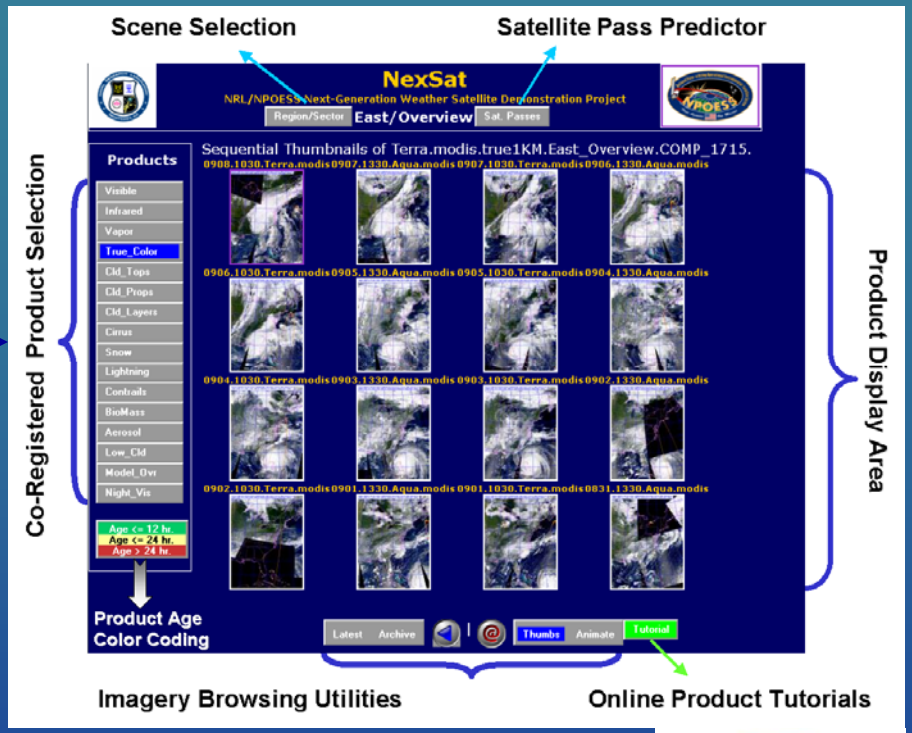
National Weather Service

Imagery for Forecasters

Naval Research Lab Monterey

NexSat Website

Product Development



Canadian Ice Service

Ice Analyses

NOAA Great Lakes Environmental Research Lab

JPEG and GeoTIFF images for Great Lakes

NASA/Environmental Protection Agency IDEA Project

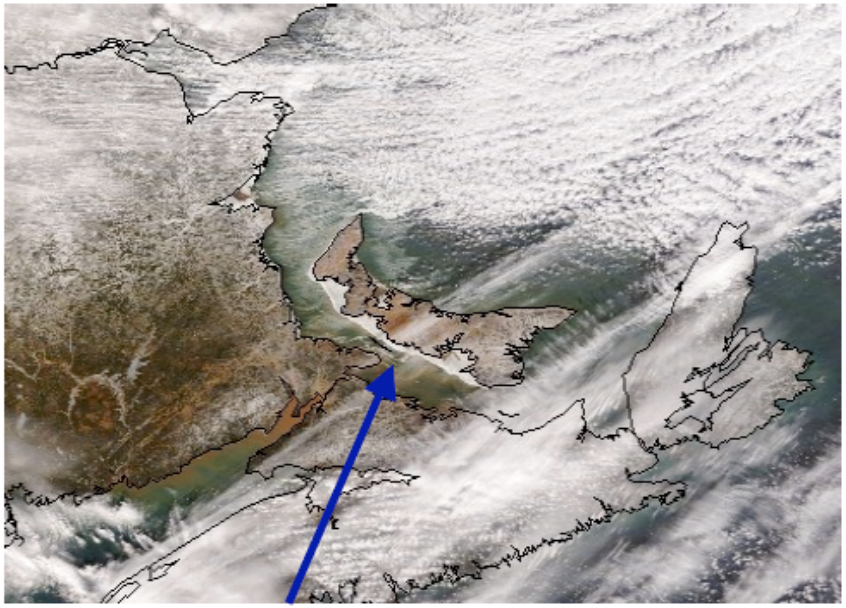
L1B data and images for air quality forecasts

Canadian Ice Service integrates MODIS into operational data stream for ice monitoring

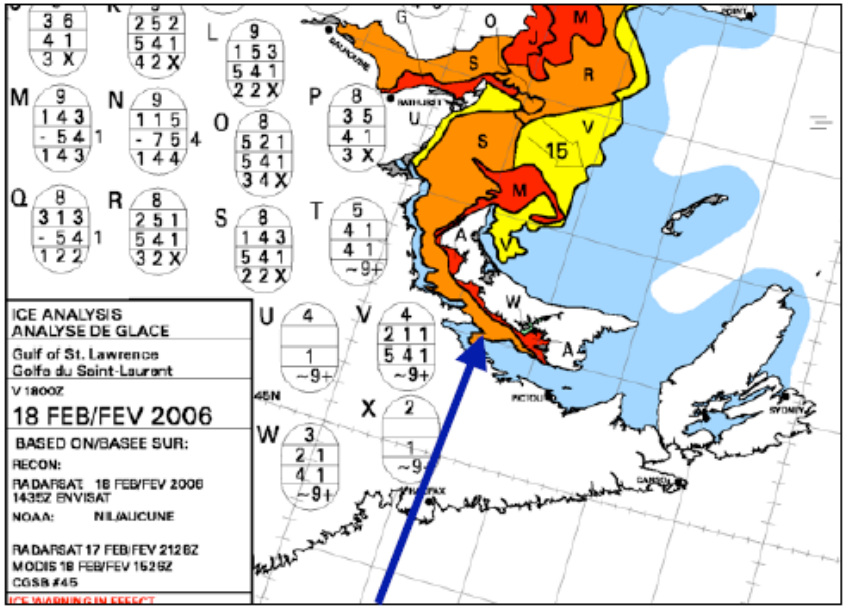
CIS data suite includes RadarSat and Envisat (SAR); AMSR, QuikScat and SSM/I (microwave); MODIS, OLS, NOAA and GOES (visible images).

- MODIS supplements SAR data in clear sky conditions.
- 250 meter resolution true color GeoTIFF images are obtained daily from SSEC for Great Lakes, Hudson Bay, Labrador coast, and Gulf of St. Lawrence.

MODIS helps to define ice boundary along southern Prince Edward Island



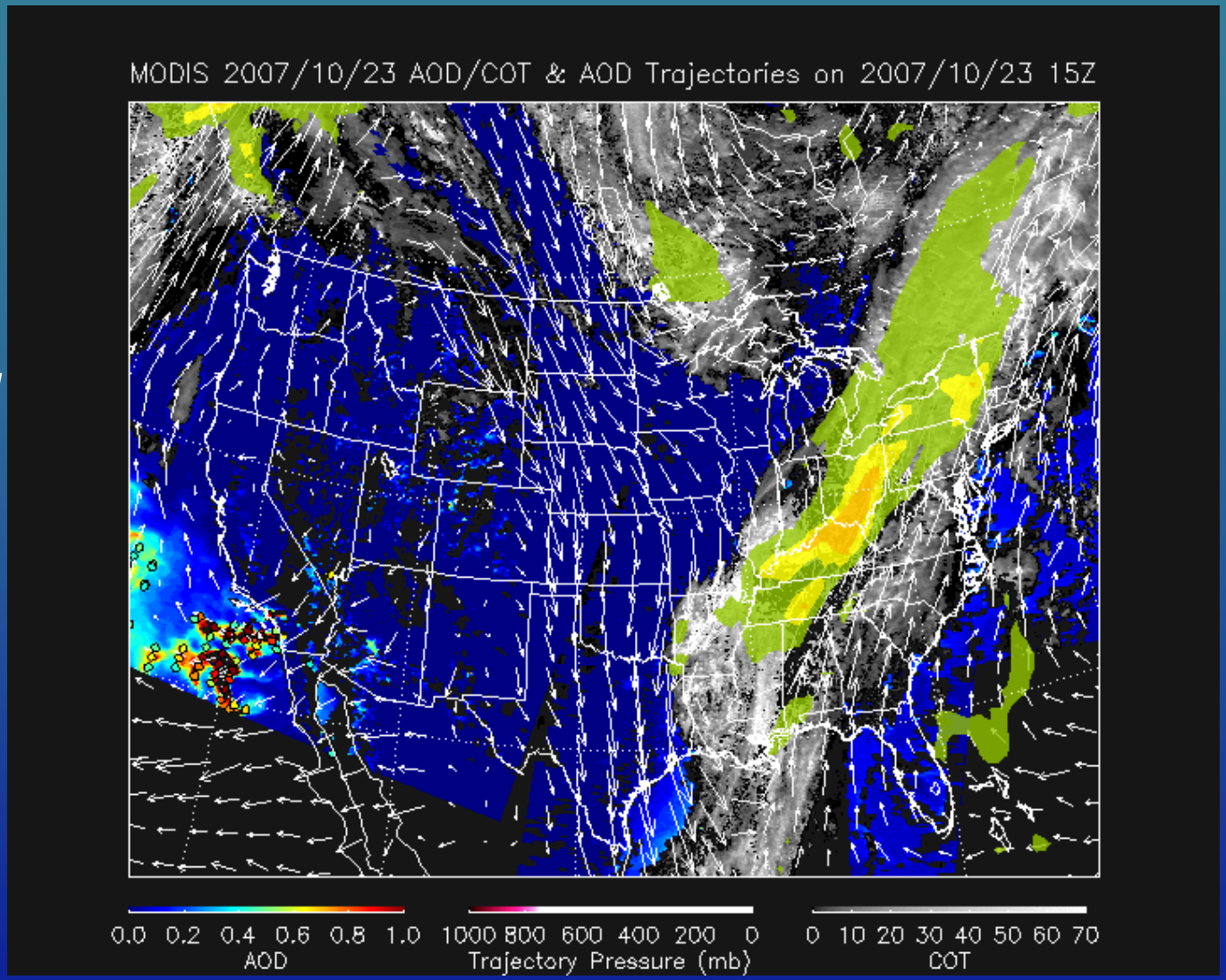
MODIS DB image 2006/02/18 15:26 UTC



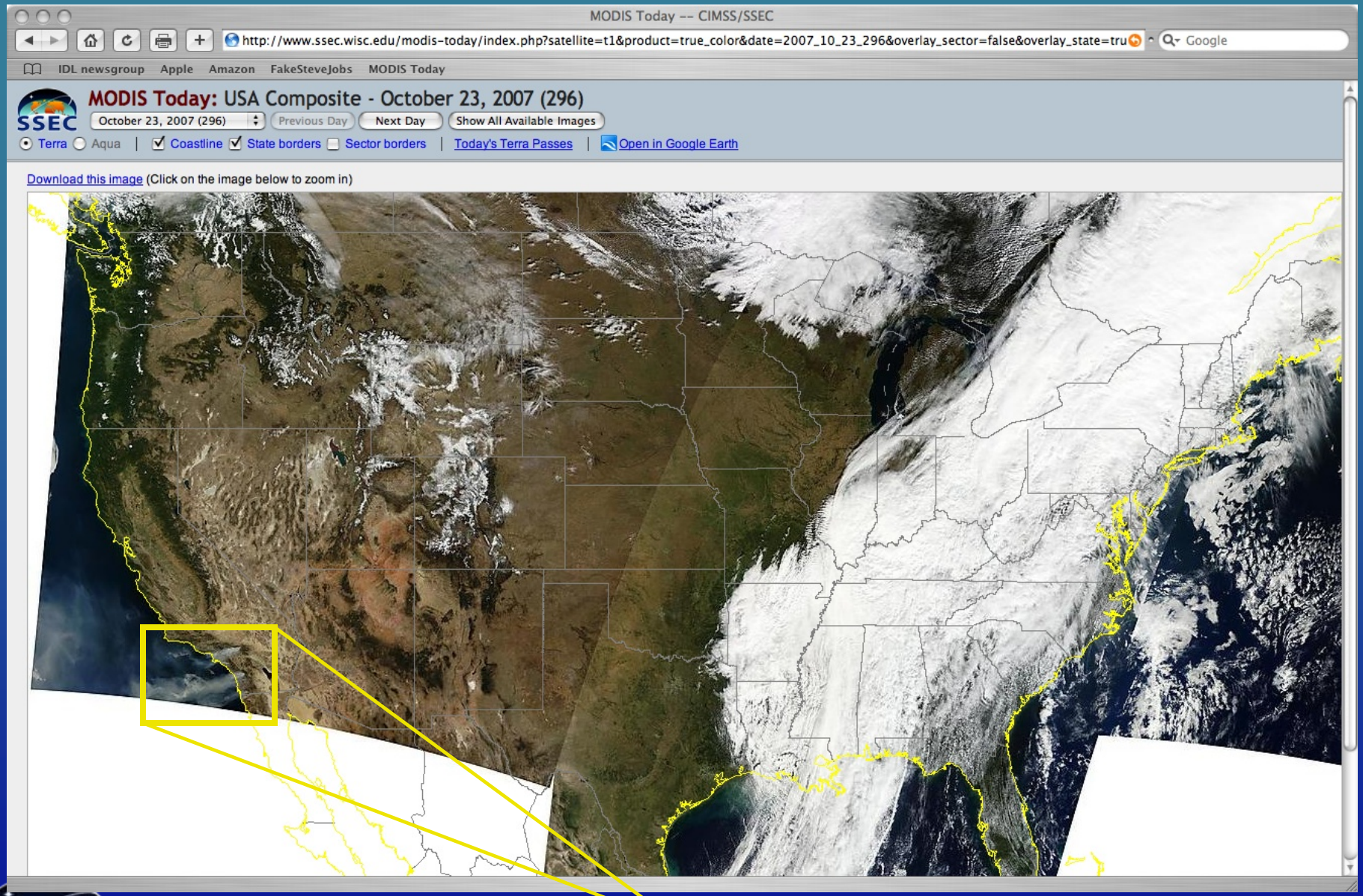
CIS Ice Analysis 2006/02/18

NASA/EPA Air Quality Monitoring and Forecasting

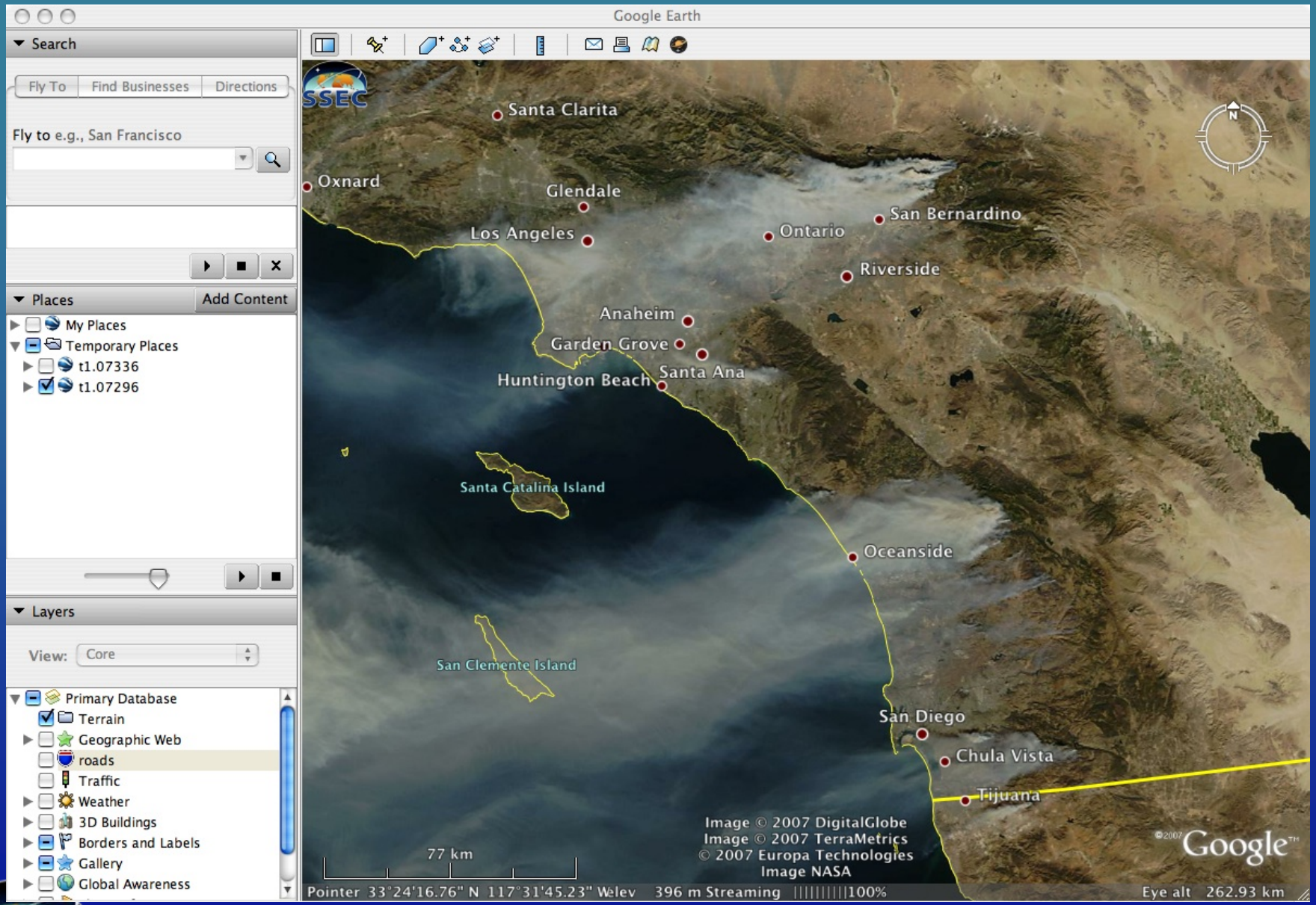
MODIS Aerosol Optical Depth and Surface PM2.5 integrated with Trajectory Model



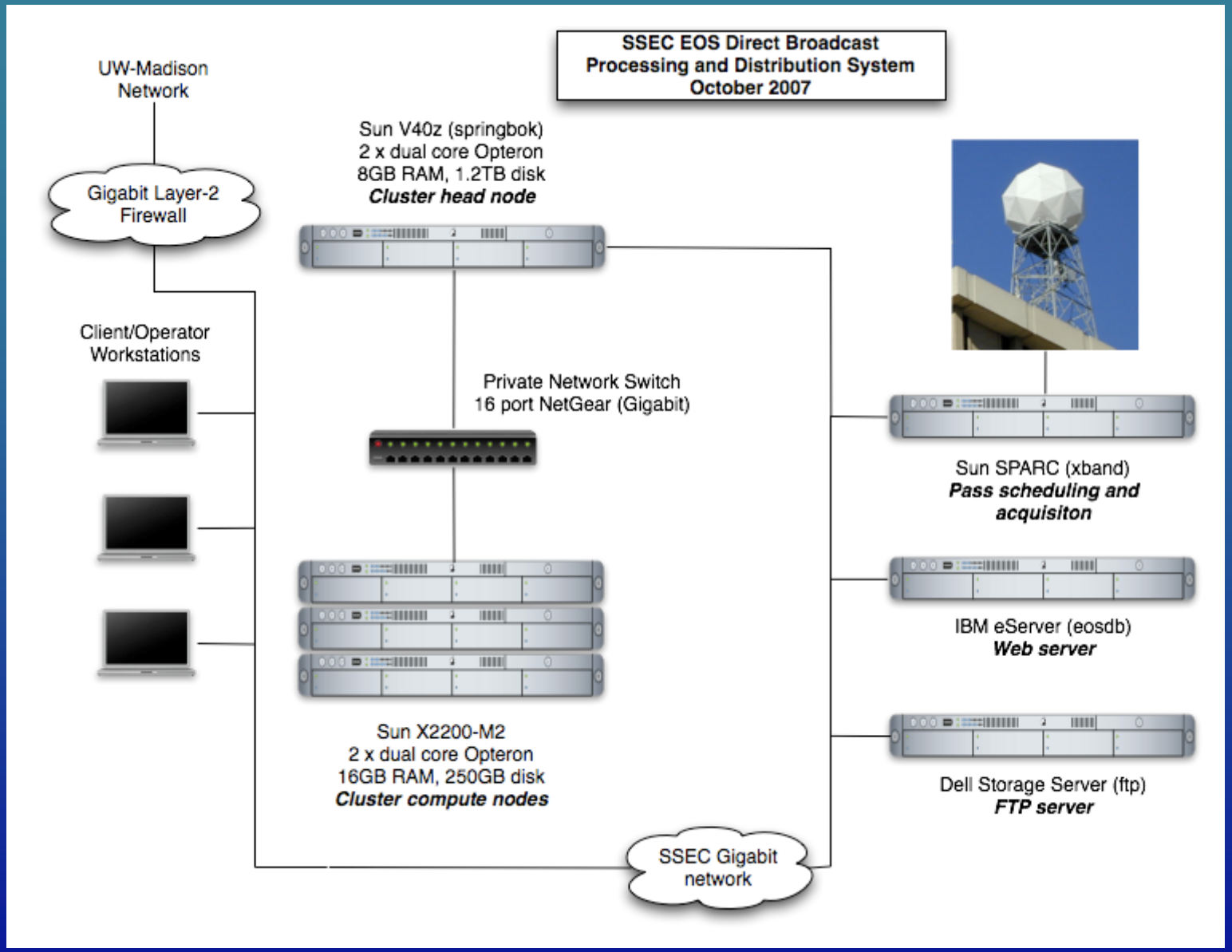
MODIS Today: *http://www.ssec.wisc.edu/modis-today/*



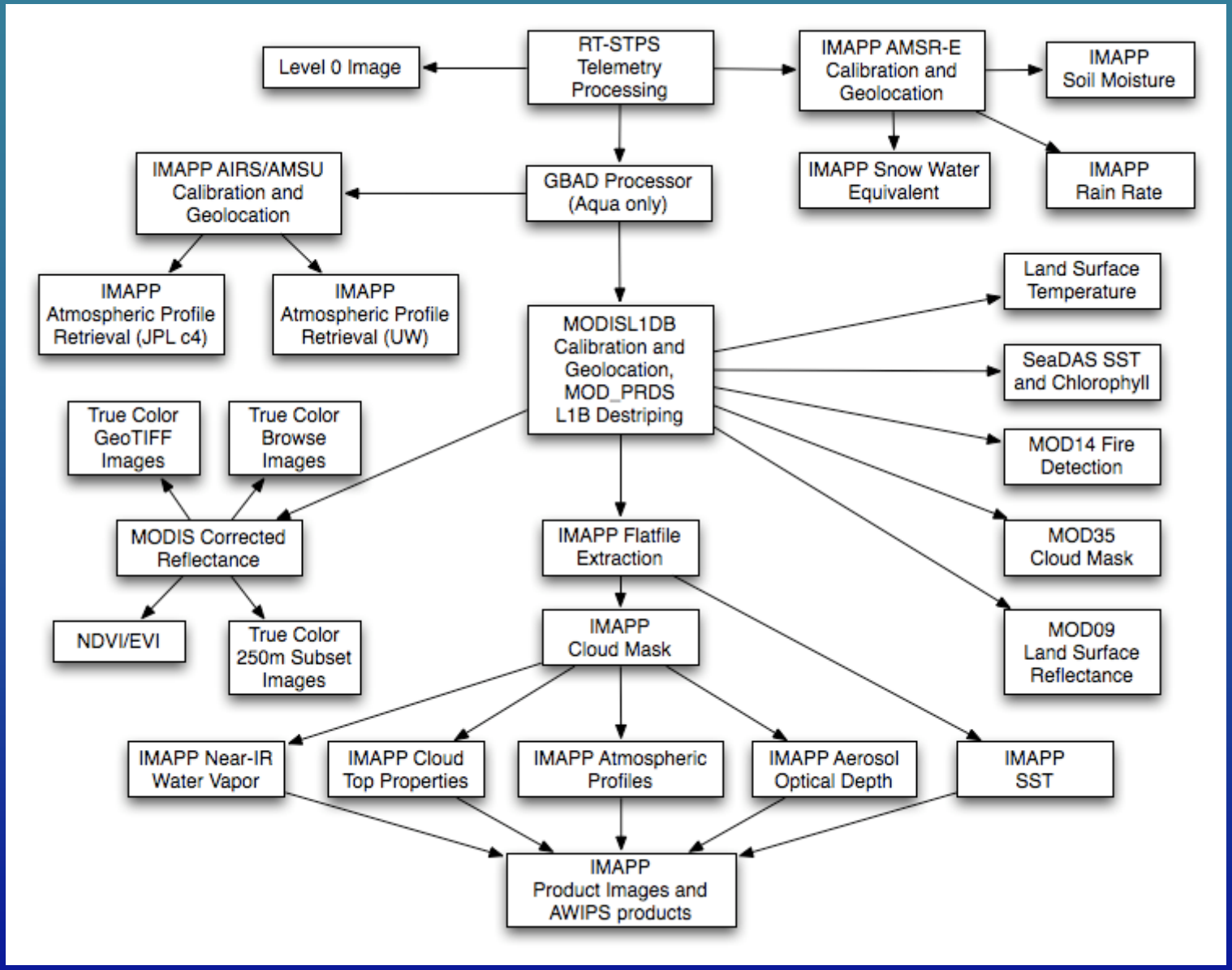
MODIS Today: Google Earth Integration



SSEC Direct Broadcast Processing System: Schematic



SSEC Direct Broadcast Processing System: Data Flow



MODIS Products for the US National Weather Service

SSEC began routine insertion into NWS Central Region data feed on 30 June 2006.

Current feed consists of:

- MODIS L1B Bands 1 (.86 micron), 7 (2.1 micron), 26 (1.38 micron), 20 (4.0 micron), 27 (6.7 micron) and 31 (11 micron)
- Cloud Phase, TPW, Cloud Top Temperatures, Fog, SST, NDVI, LST

Keys to success:

- Provide something better or new to forecasters (e.g., higher resolution)
- Must be delivered in a format that can be accepted by AWIPS
- Must have a person at the forecast offices to champion the data

Steve Hentz, Lead Forecaster, NWSFO MKE

AWIPS: The NWS Display System

AWIPS

*A*dvanced

*W*eather

*I*nteractive

*P*rocessing

*S*ystem

Main AWIPS display tool is known as *D2D*

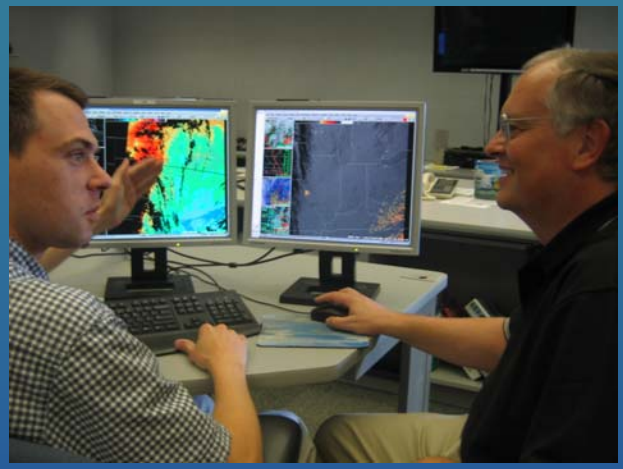
*D*isplay

2 (Two)

*D*imensions

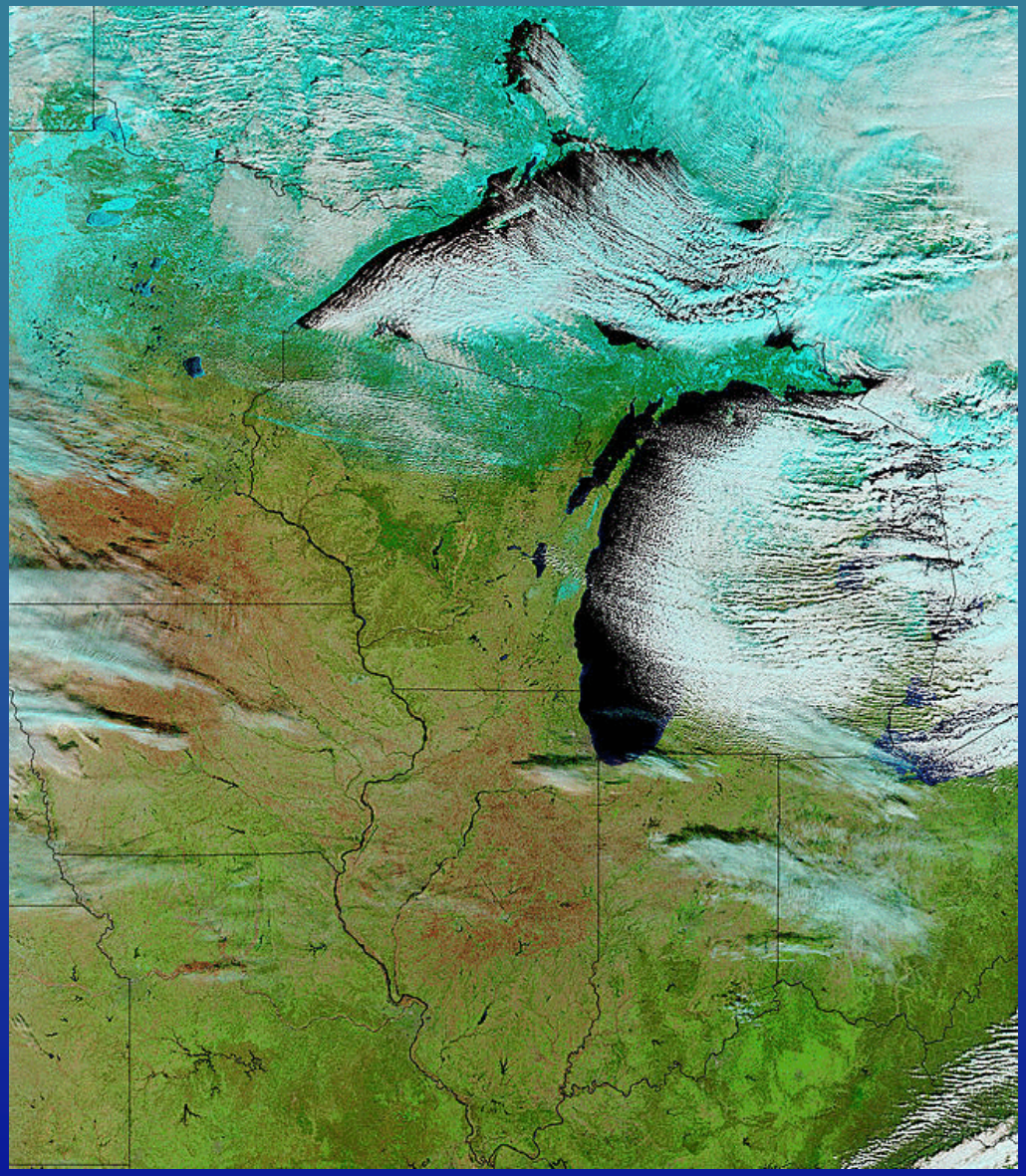
SSEC Real-time Products: Value to NWS Forecasters

- Near-term (less than 12 hours) forecasts
  - Diagnosing heavy precipitation potential
    - Total Precipitable Water (TPW)
  - Determining precipitation type
    - Snow or freezing drizzle?
- Short-term (12 to 36 hours) forecasts
  - Areas of fog formation
  - Temperatures in lakeshore areas
- Post-event analysis
  - Temperature of significant convective cells
- Aviation
  - Small-scale orographic turbulence
- Climatology
  - Diagnosing areas of accumulated snow
  - Formation of ice on sizeable lakes and other waterways
- Marine
  - Wind shift on Great Lakes



CIMSS/SSEC AWIPS Imagery Distribution Network

- Davenport, Iowa
- La Crosse, Wisconsin
- Milwaukee, Wisconsin
- Riverton, Wyoming
- Reno, Nevado
- Indianapolis, Indiana
- Billings, Montana
- Springfield, Missouri
- Aberdeen, South Dakota
- Wichita, Kansas
- Green Bay, Wisconsin
- Duluth, Minnesota
- Minneapolis, Minnesota
- Spokane, Washington
- Des Moines, Iowa
- Kennedy Space Center

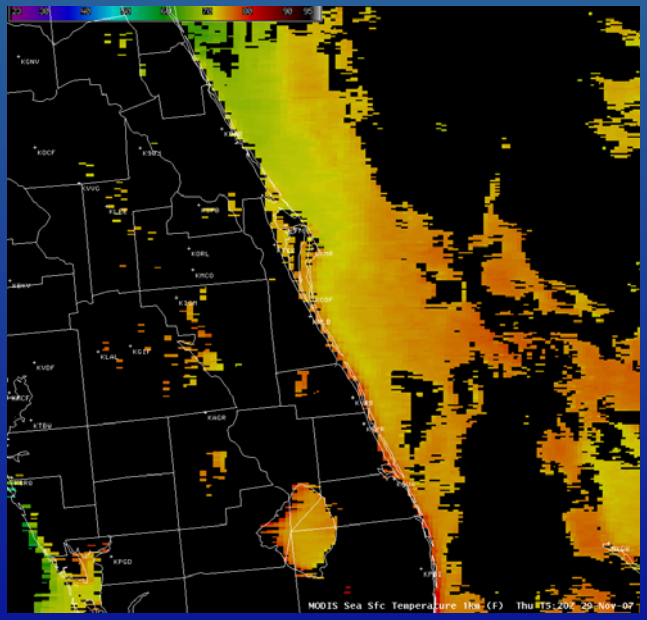


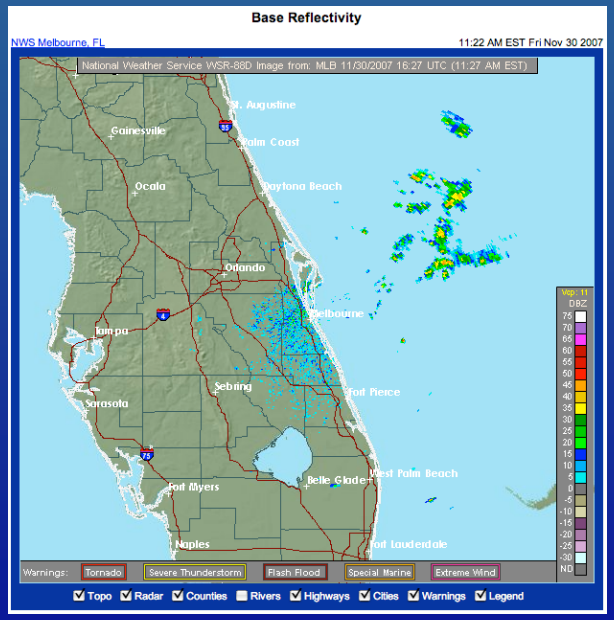
National Weather Service: Kennedy Space Center

NWS at KSC began using MODIS real-time products from SSEC in Nov. 2007 to support NASA Space Shuttle launch and landing forecasts.

MODIS Sea Surface Temperature (SST) near to shore helps to forecast duration of rain showers at the Cape.

MODIS SST in AWIPS

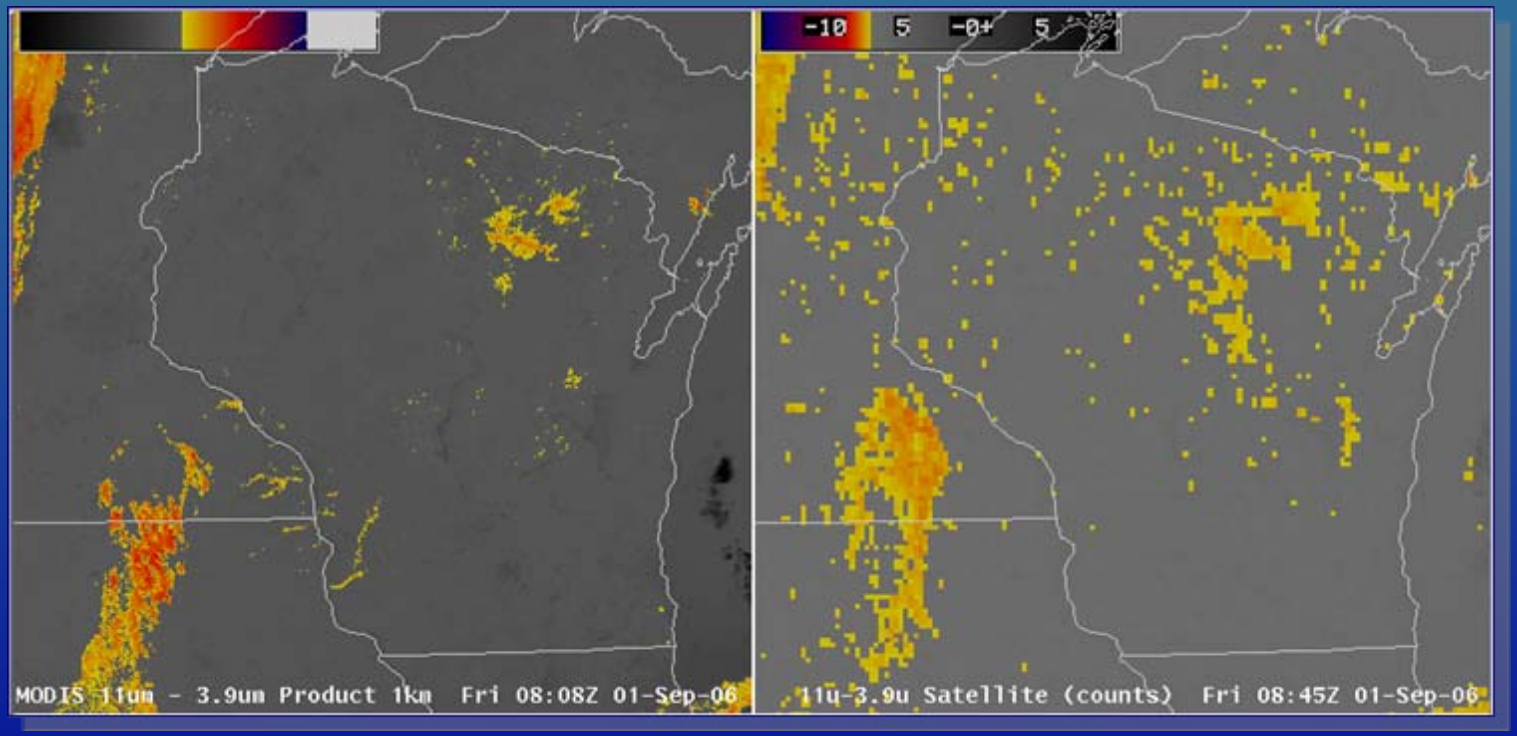




NWS Radar

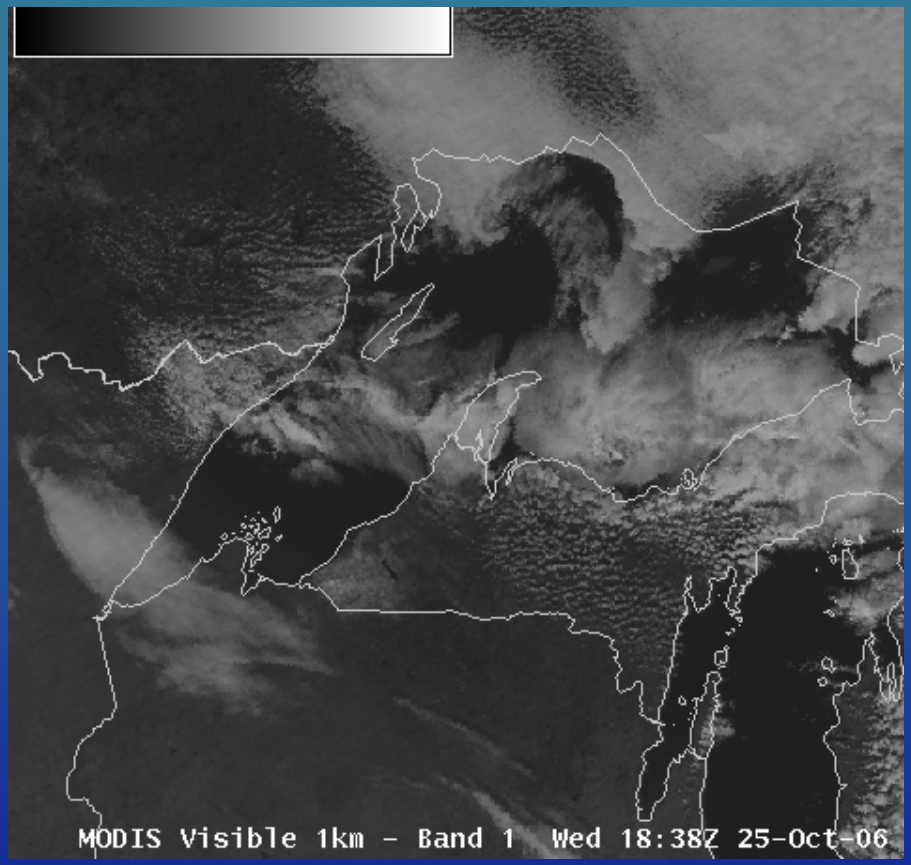
Milwaukee Area Forecast Discussion

MAIN SHORT TERM FORECAST PROBLEM IS EAST FLOW AND MARINE LAYER INFLUENCE OVER EASTERN WISCONSIN..AND DENSE FOG POTENTIAL IN THE WEST. THINK MOST OF THE DENSE FOG WOULD BE IN THE RIVER VALLEYS...WITH A TENDENCY FOR PATCHY FOG AND SOME STRATUS AGAIN IN THE EAST WITH MORE OF A GRADIENT. MODIS 1 KM IMAGERY LAST NIGHT SHOWED THE DENSE FOG IN LONE ROCK AND BOSCOBEL WAS CONFINED TO THE IMMEDIATE WISCONSIN RIVER VALLEY...IMPORTANT INFORMATION. THE LOCAL RIVER VALLEY DENSE FOG IS NOT SEEN IN THE NORMAL 2 KM GOES. (HENTZ/MKX)

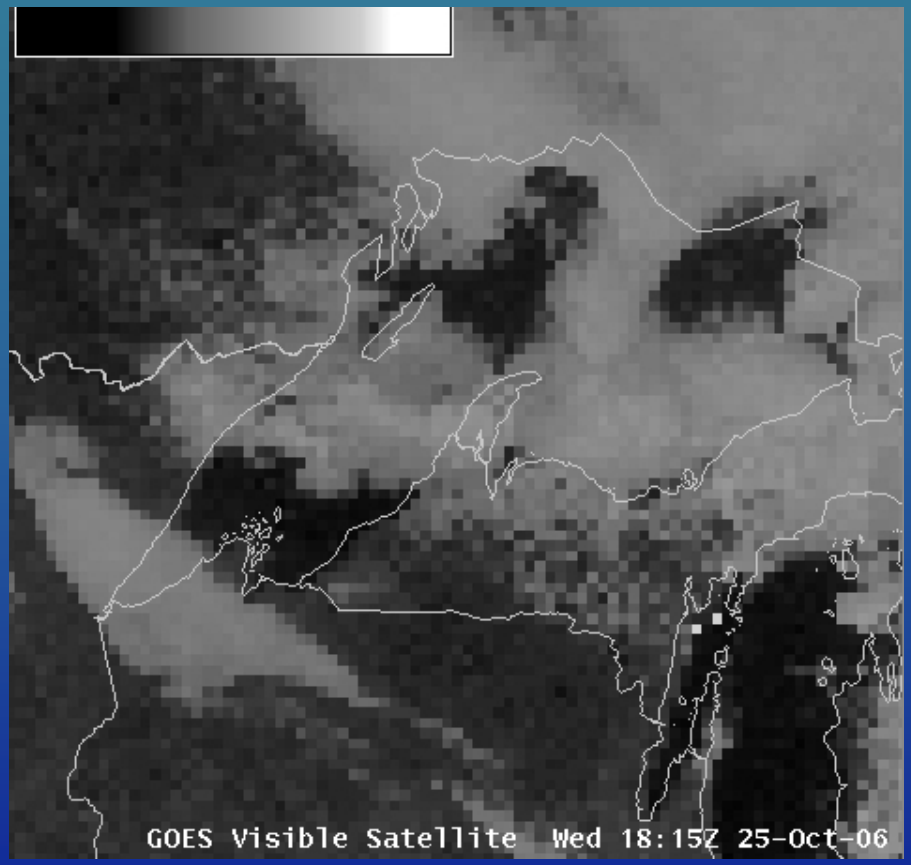


MODIS Imagery in AWIPS

Band 1: Visible channel (0.6µm)



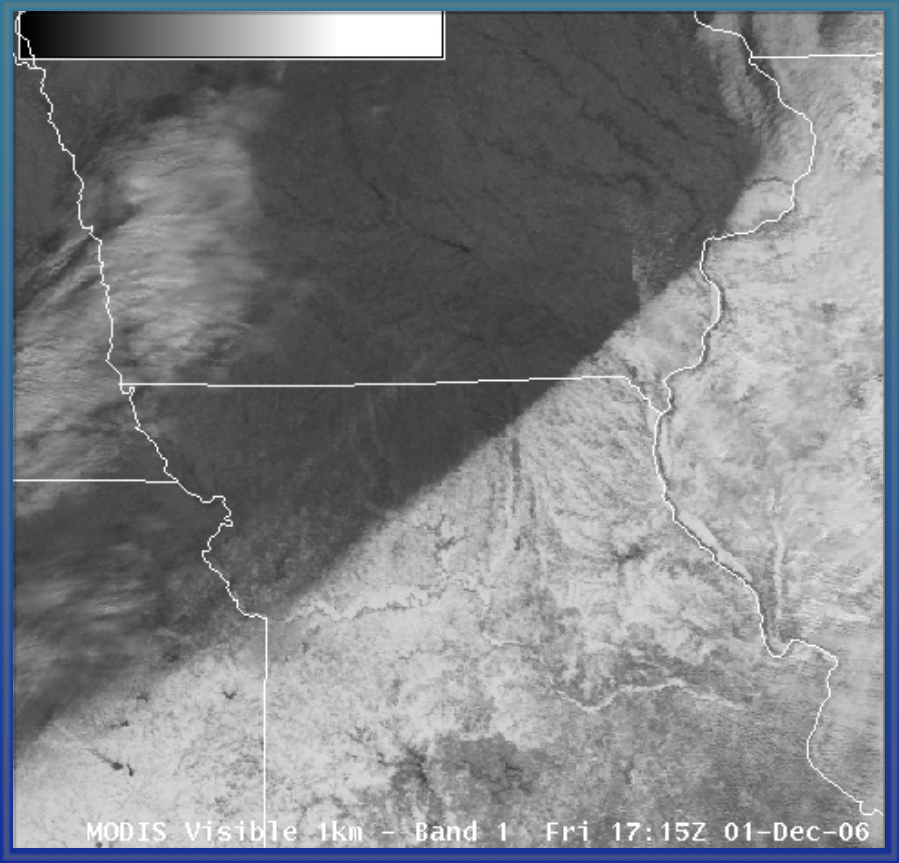
MODIS visible channel



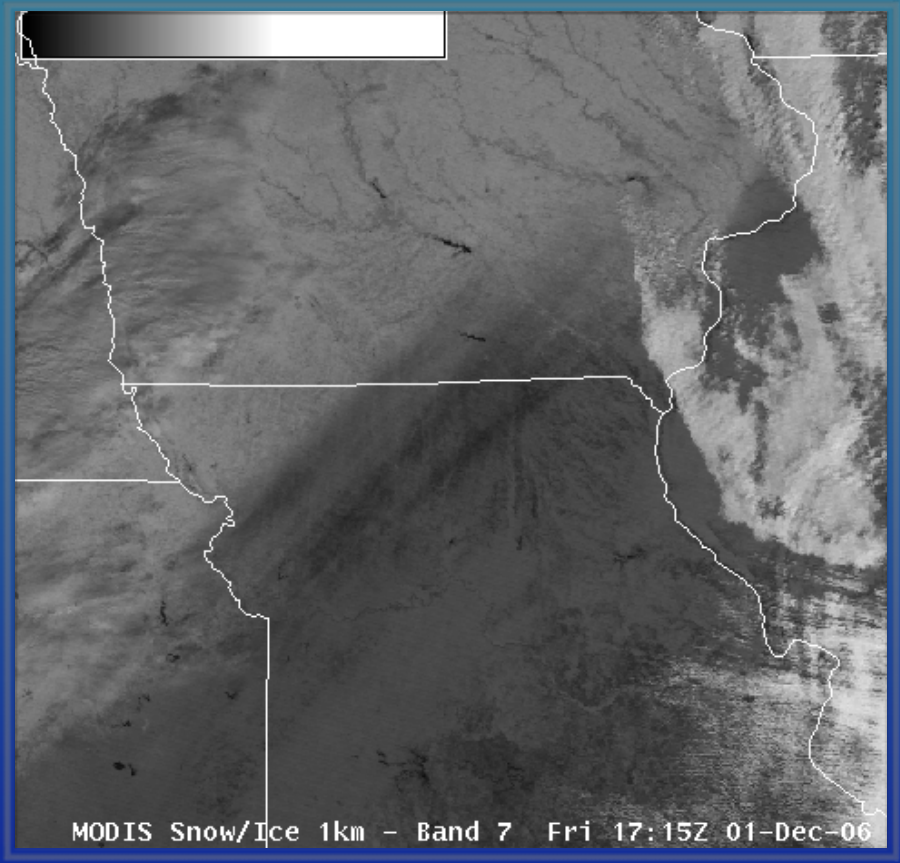
GOES visible channel

MODIS Imagery in AWIPS

Band 7: Snow/Ice channel (2.1µm)



0.66 µm channel

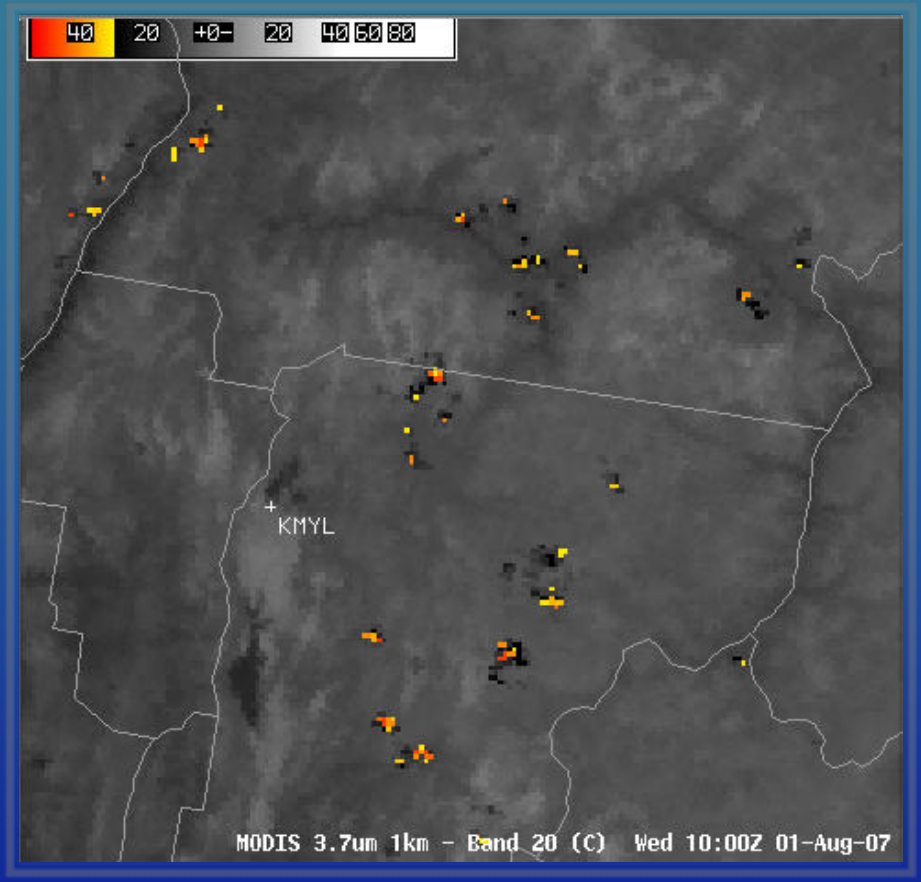


2.1 µm channel

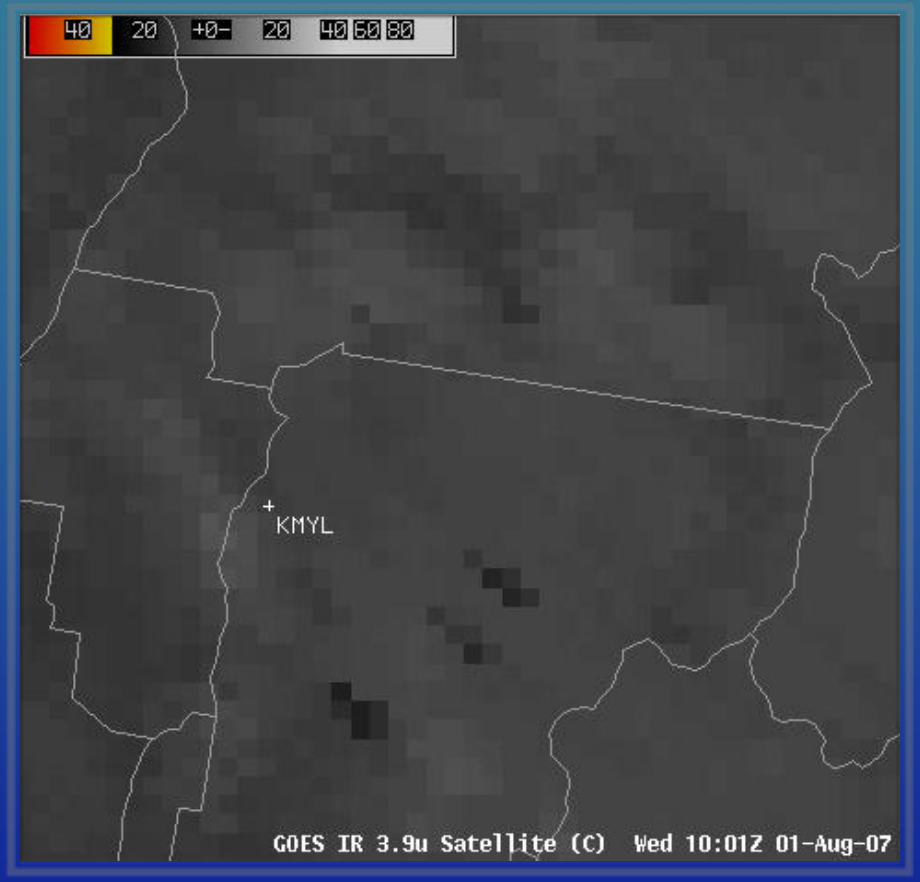
Snow/ice vs. supercooled water cloud discrimination

MODIS Imagery in AWIPS

Band 20: Shortwave Infrared (3.7µm)



1-km MODIS

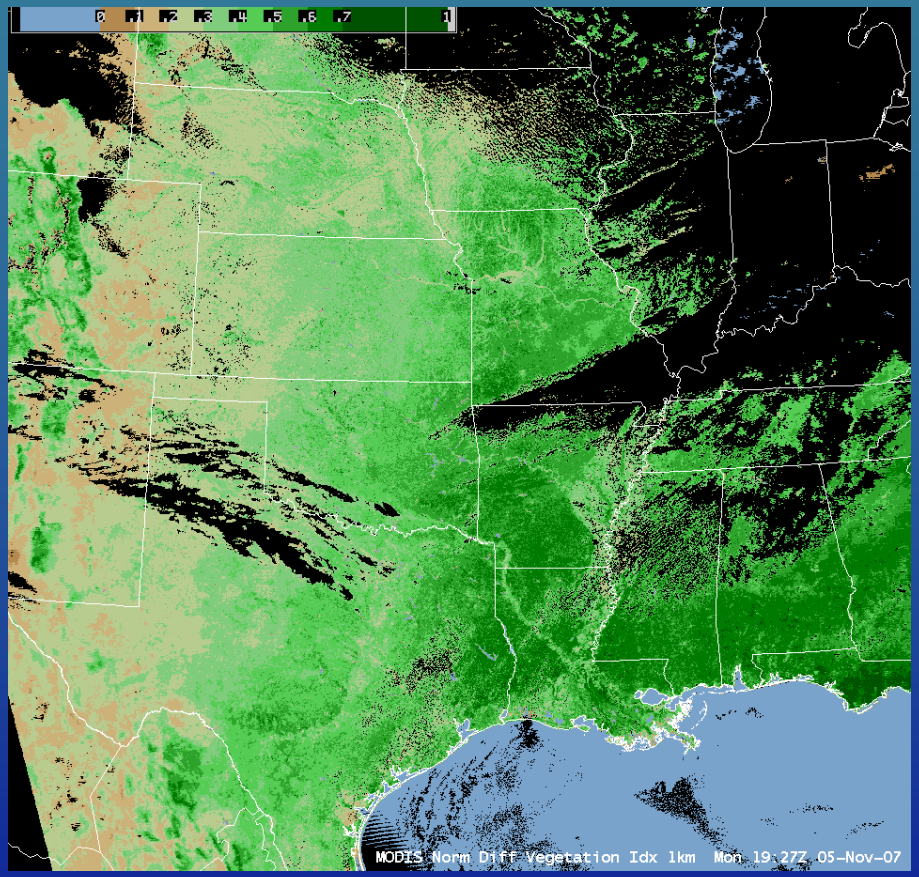


4-km GOES

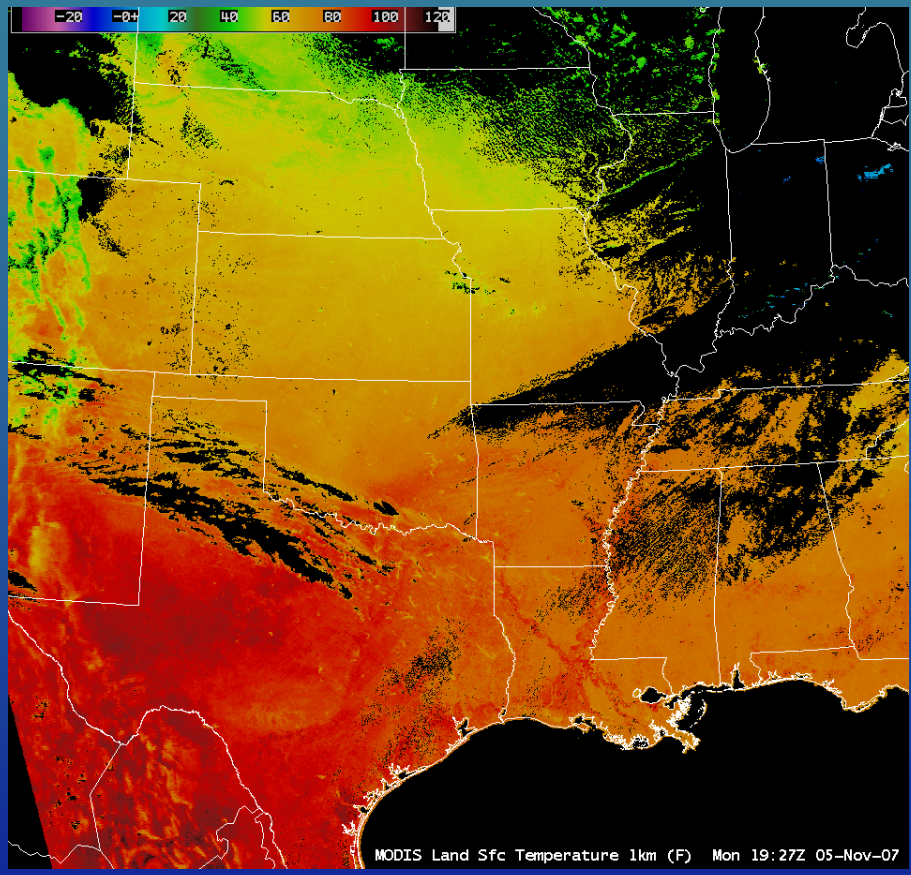
Improved fire detection capability

MODIS Imagery in AWIPS

Vegetation Index and Land Surface Temperature



Vegetation Index (NDVI)

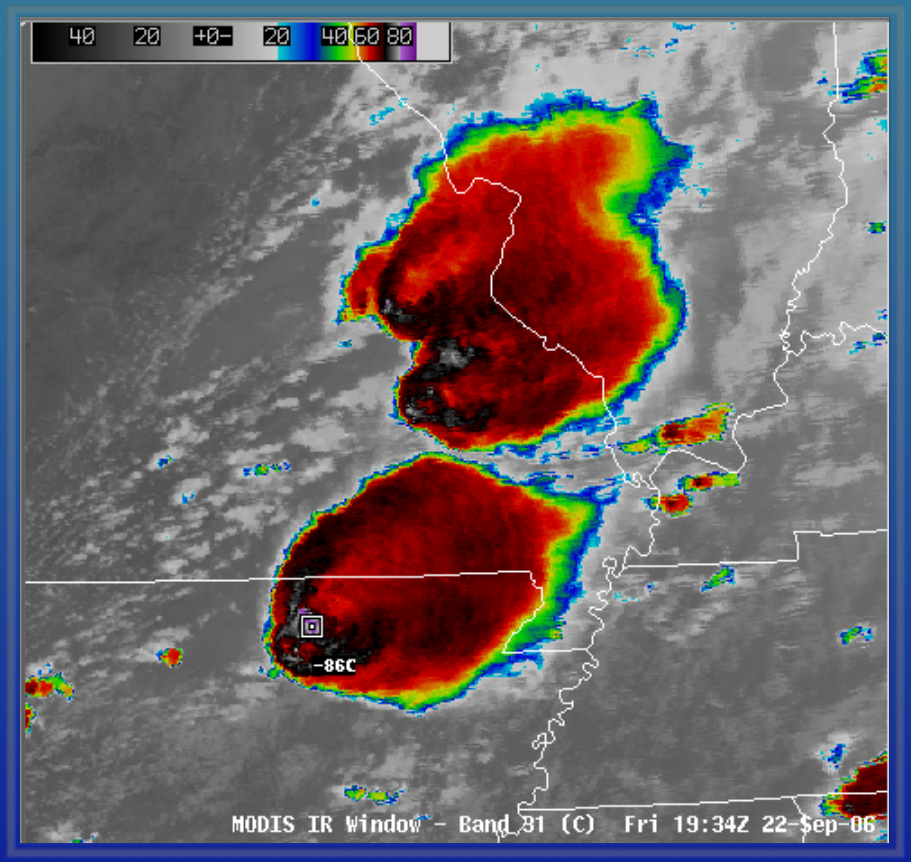


Land Surface Temperature

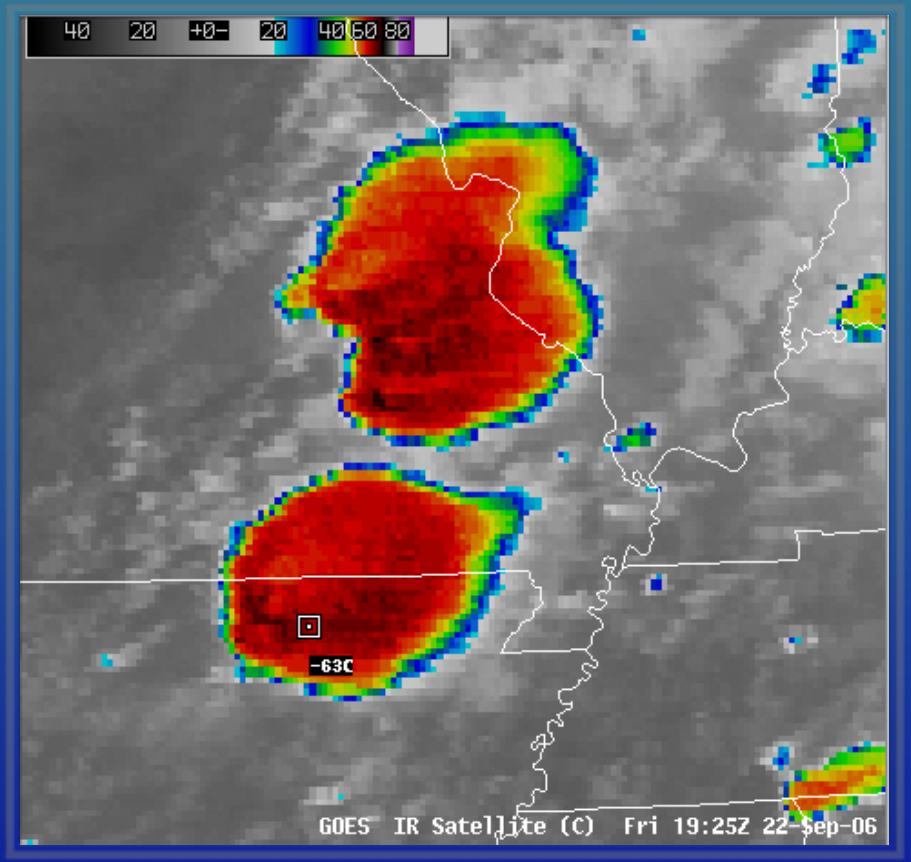
Helps with Fire Weather Forecasting

MODIS Imagery in AWIPS

Band 31: Infrared window (11.0µm)



1-km MODIS

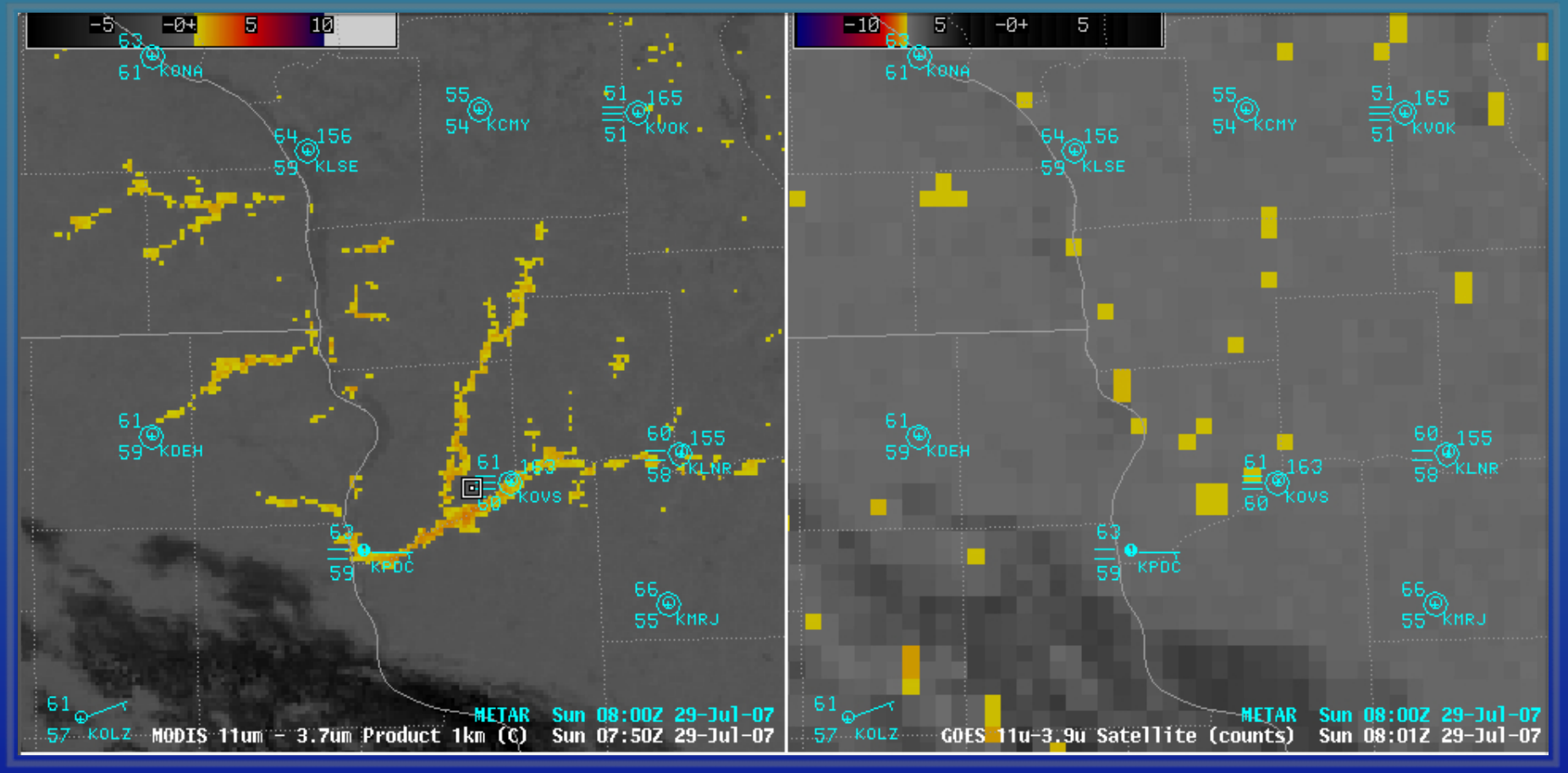


4-km GOES

Improved feature identification (overshooting tops, enhanced-v)

MODIS Imagery in AWIPS

Fog/stratus product (11.0µm - 3.7µm)



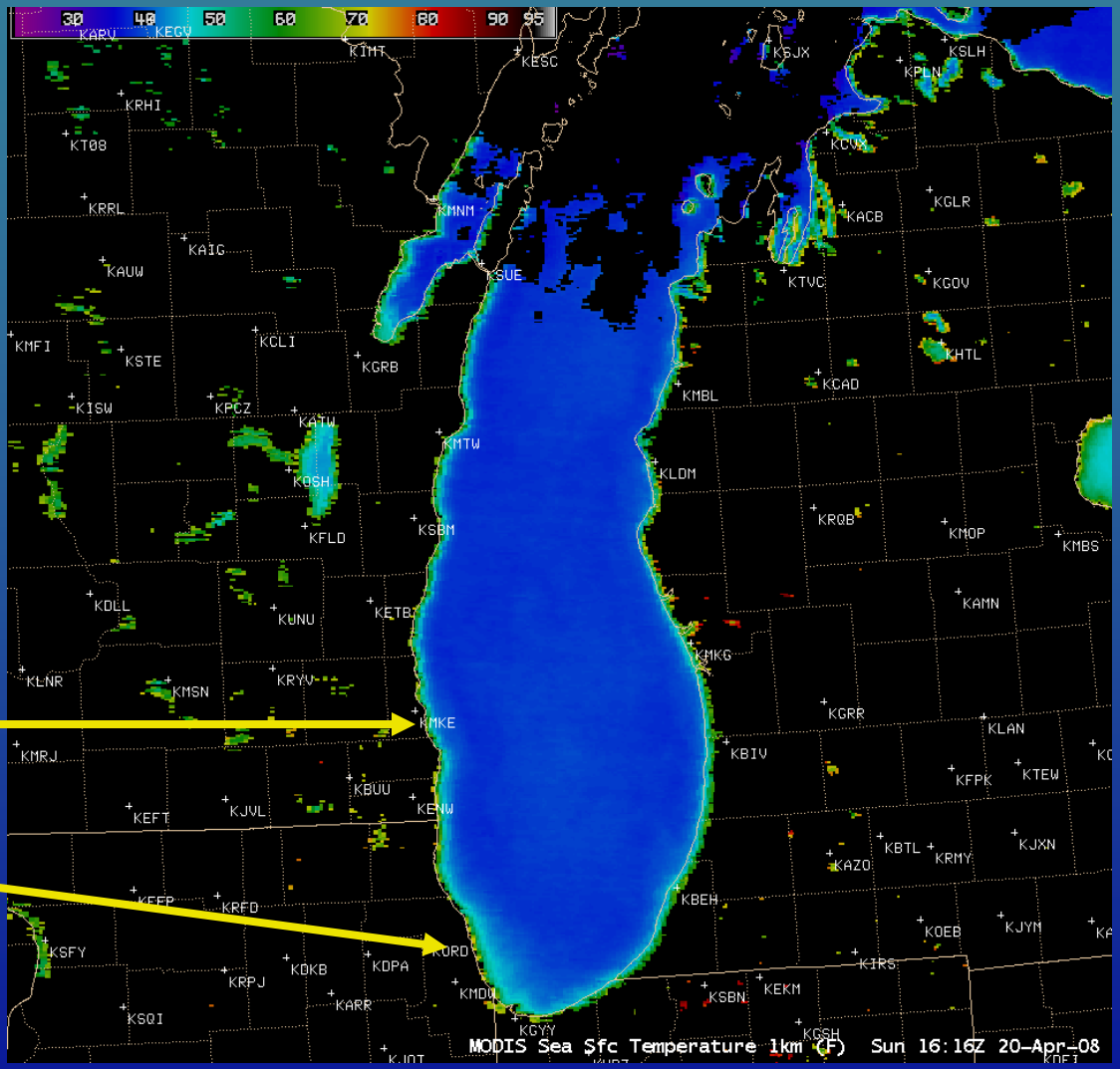
1-km MODIS

4-km GOES

Improved fog/stratus detection capability

MODIS Imagery in AWIPS

Sea surface temperature



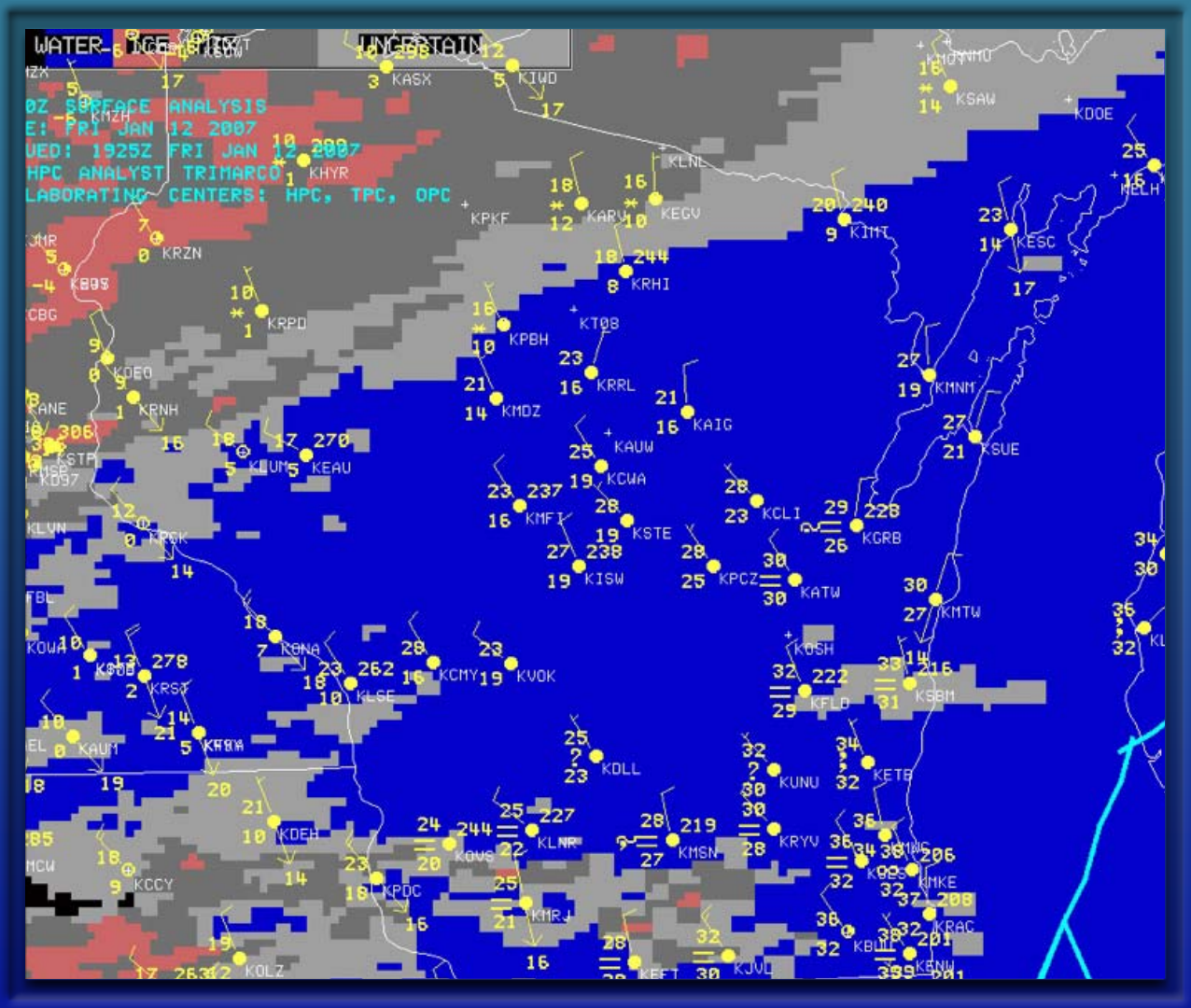
Milwaukee

Chicago

Identify areas of upwelling ⇒ Maximum temperature forecast

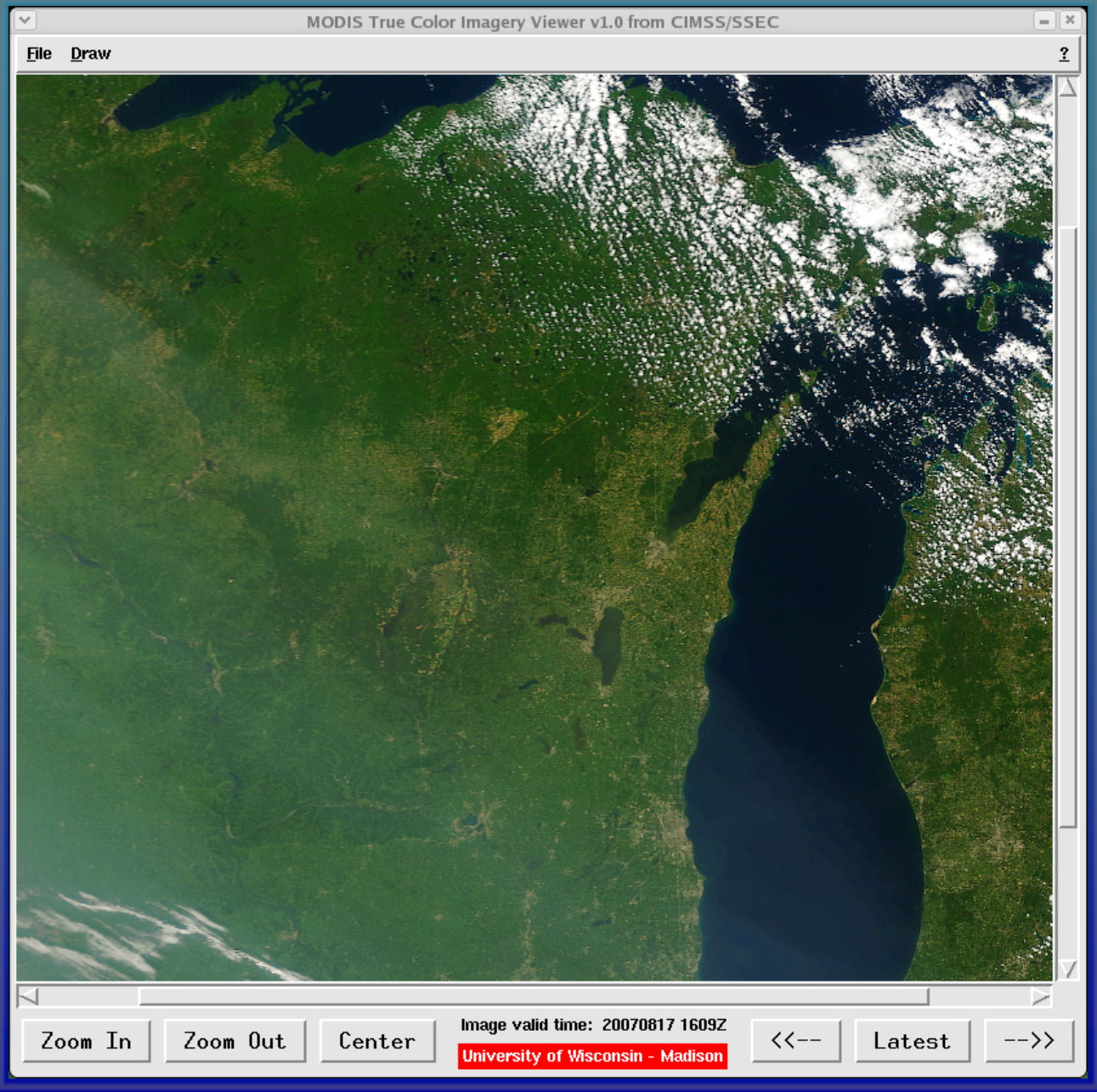
MODIS Imagery in AWIPS

Cloud phase product

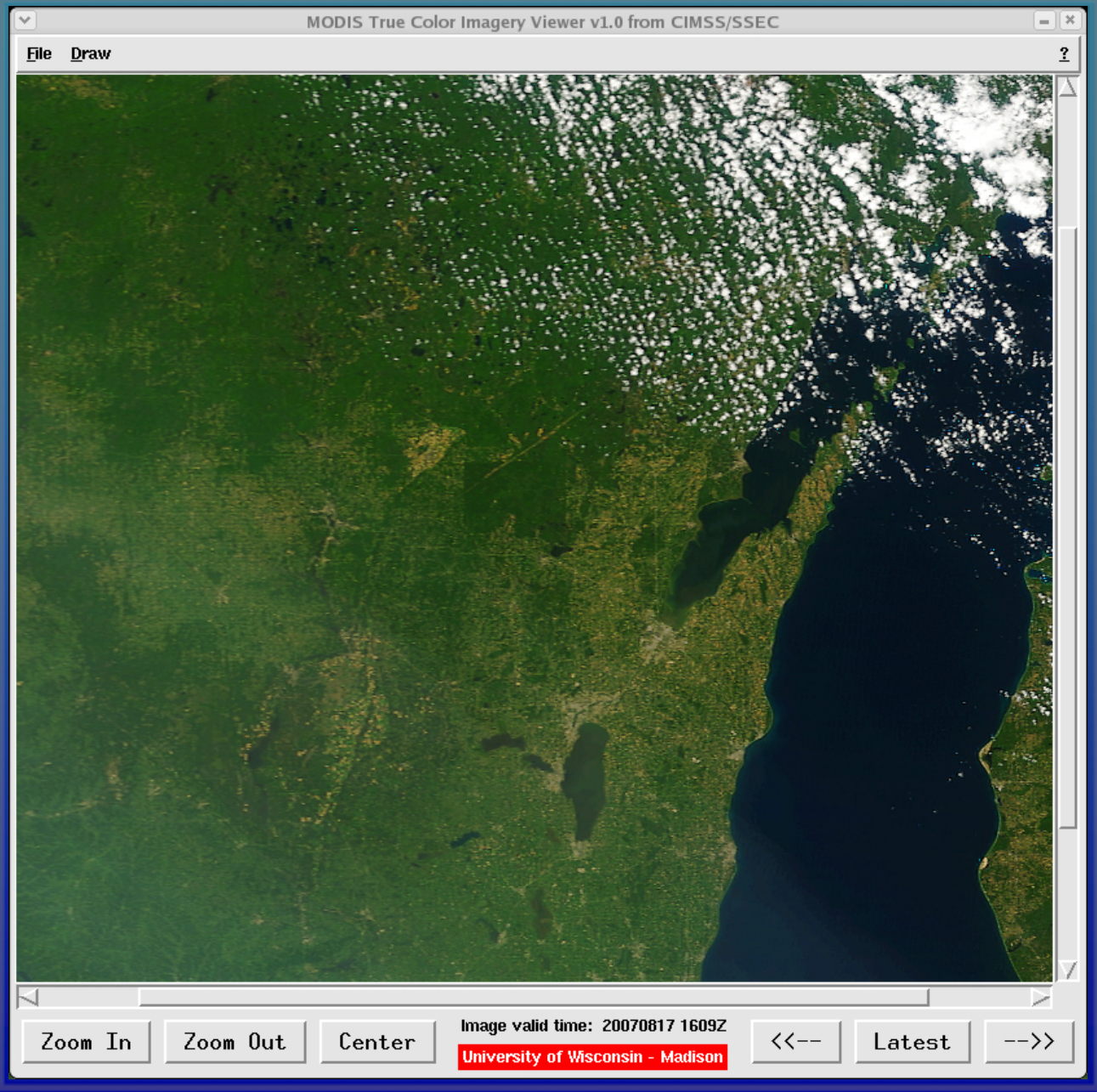


Can aid in the *precipitation type* forecast problem

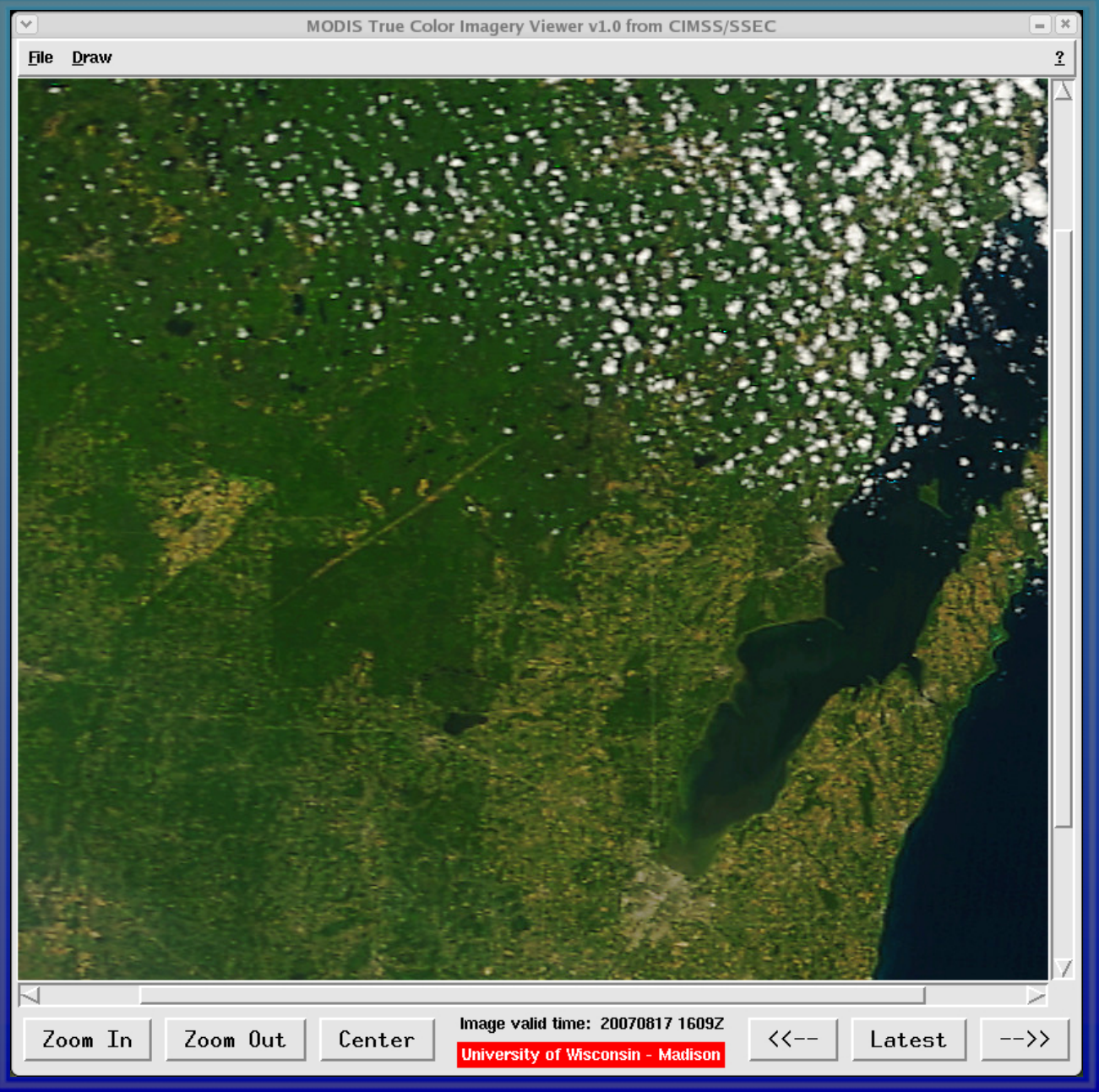
MODIS True Color Imagery Viewer



MODIS True Color Imagery Viewer



MODIS True Color Imagery Viewer



MODIS Images in Google Earth

Dust vs. Smoke can be Discriminated in True Color Imagery

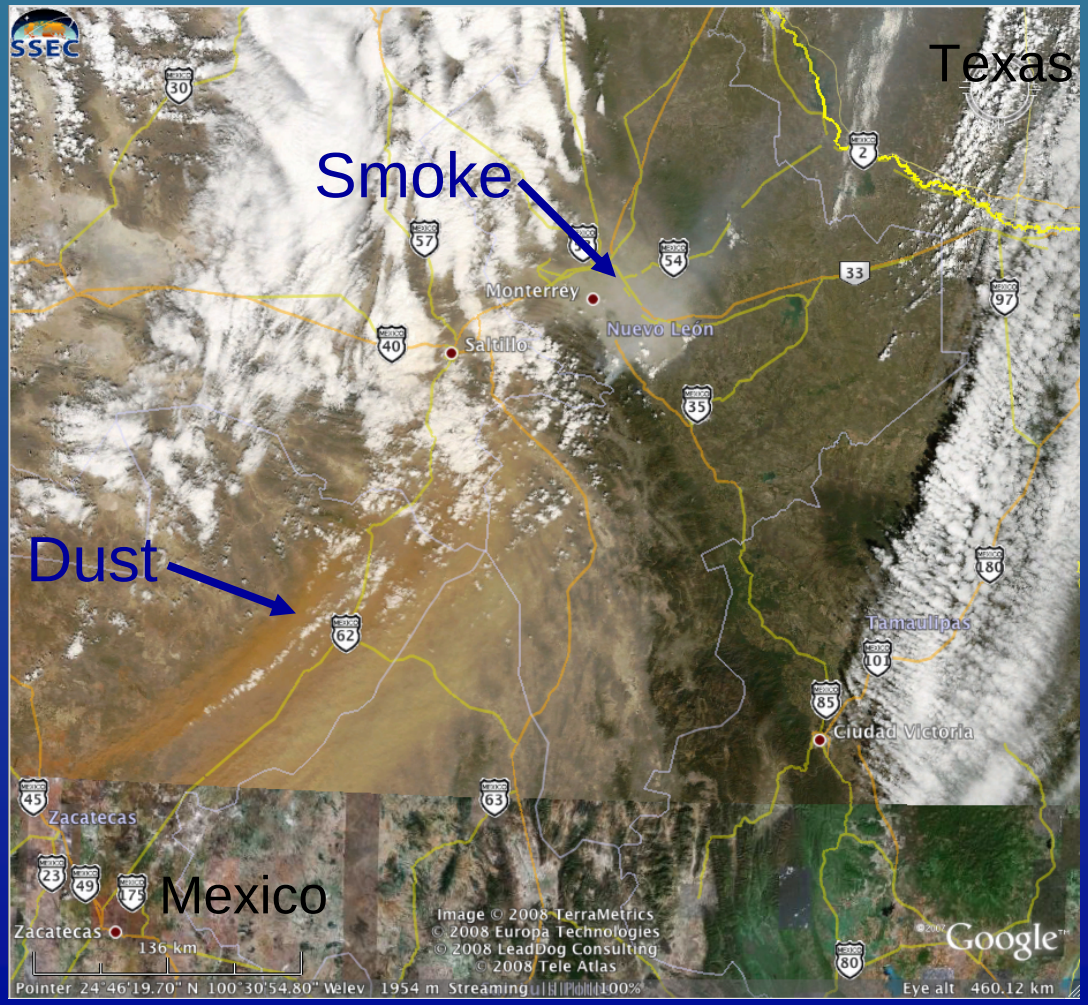
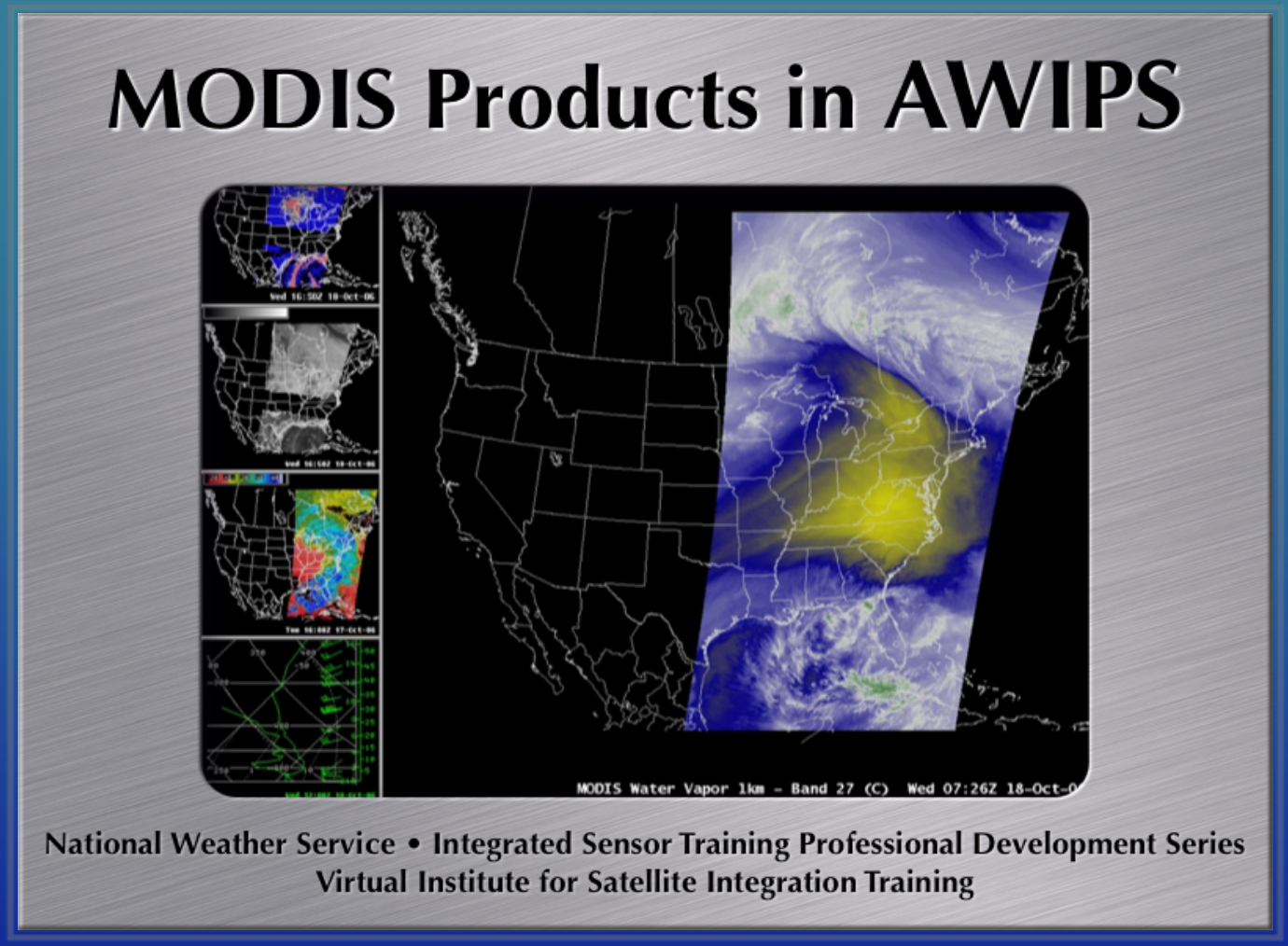


Image courtesy of
J. Zeitler, NWS Austin TX

18 March 2008

For more information, see the online lesson



http://cimss.ssec.wisc.edu/goes/visit/modis.html