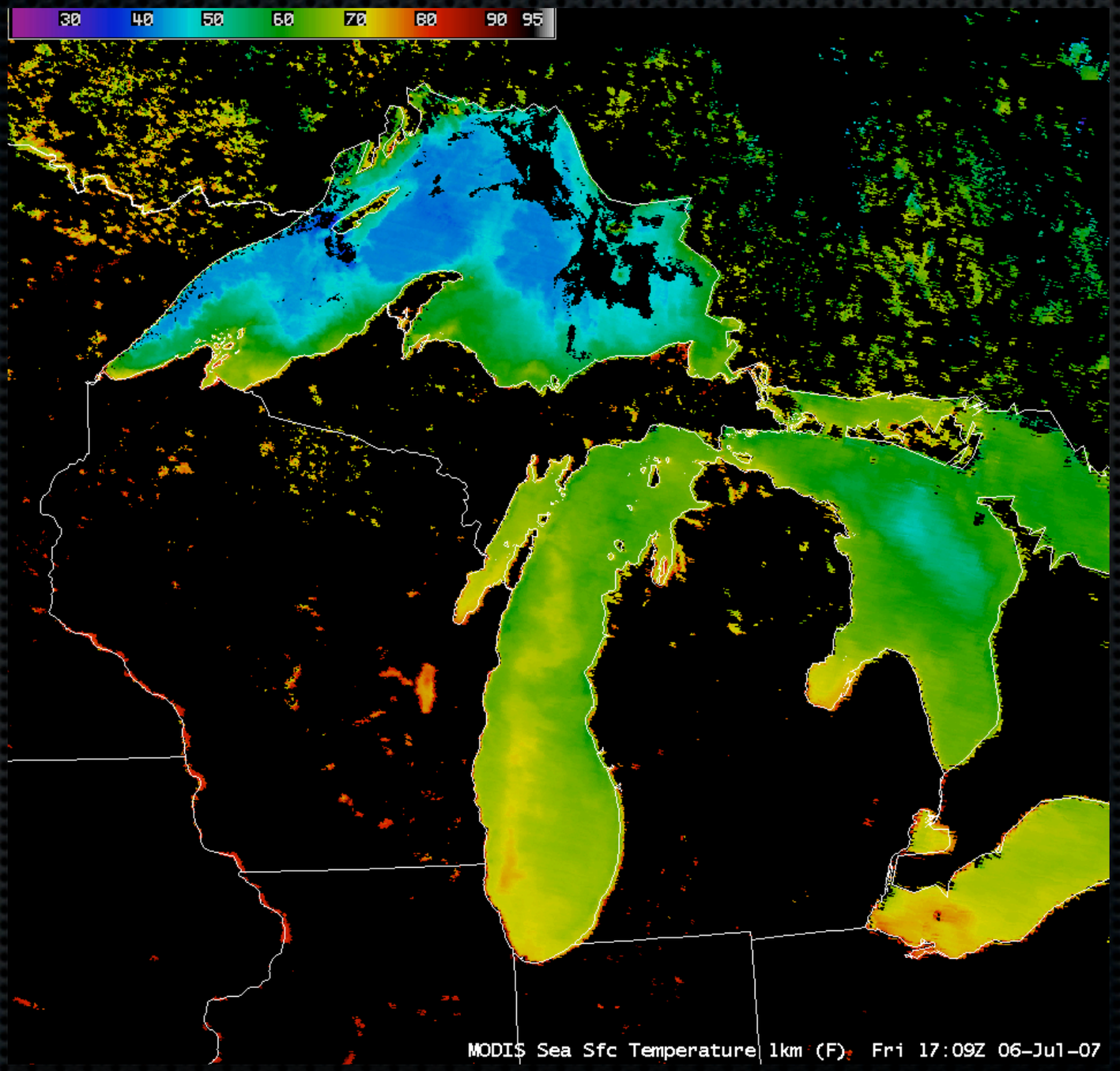
MODIS Products in AWIPS:
Using Research Satellites in Operations



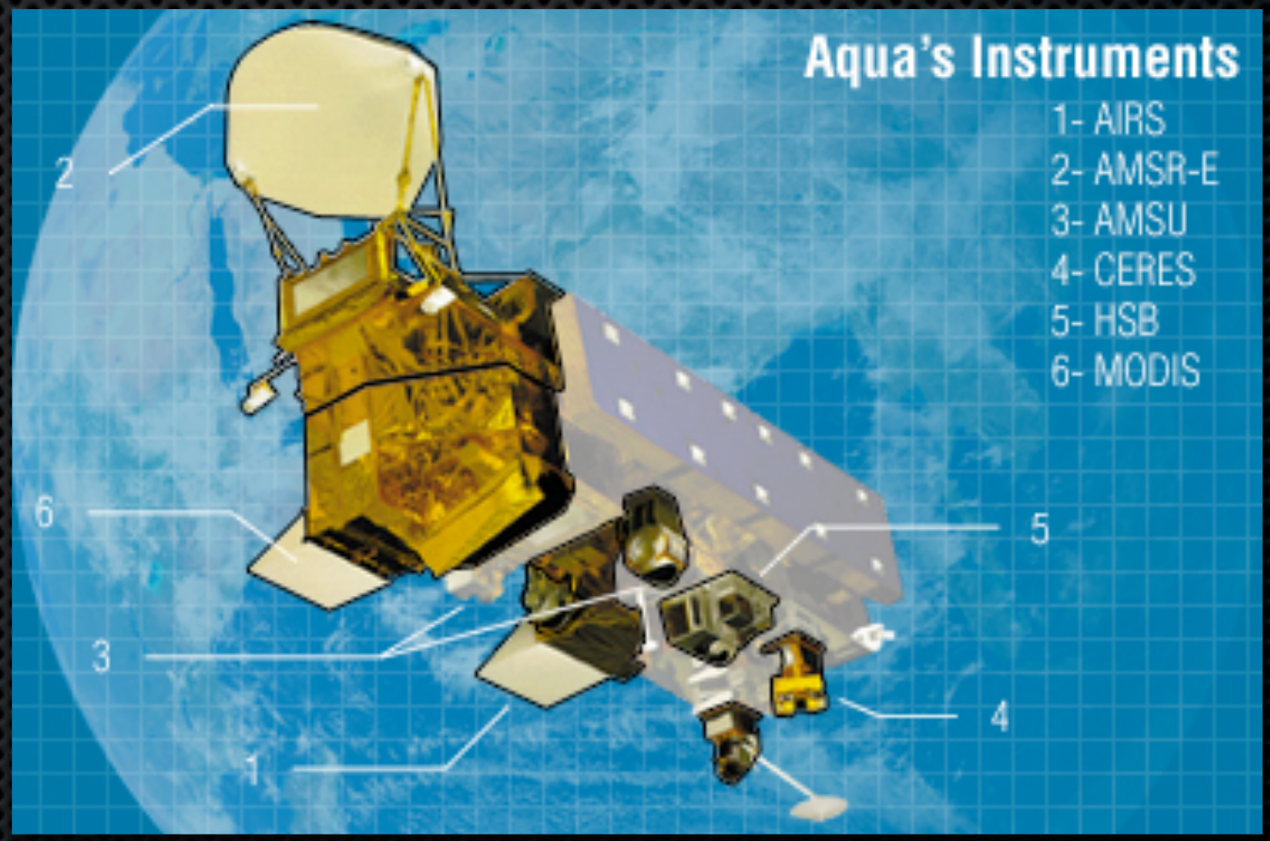
Scott Bachmeier, Jordan Gerth, Kathleen Strabala
Cooperative Institute for Meteorological Satellite Studies (CIMSS) • University of Wisconsin - Madison

16th US-Canadian Great Lakes Operational Meteorology Workshop • September 2007

MODIS

MODerate resolution Imaging Spectroradiometer

- Terra/Aqua satellites
- 36 spectral bands
- Visible and InfraRed
- 250 / 500 / 1000 m spatial resolution



MODIS

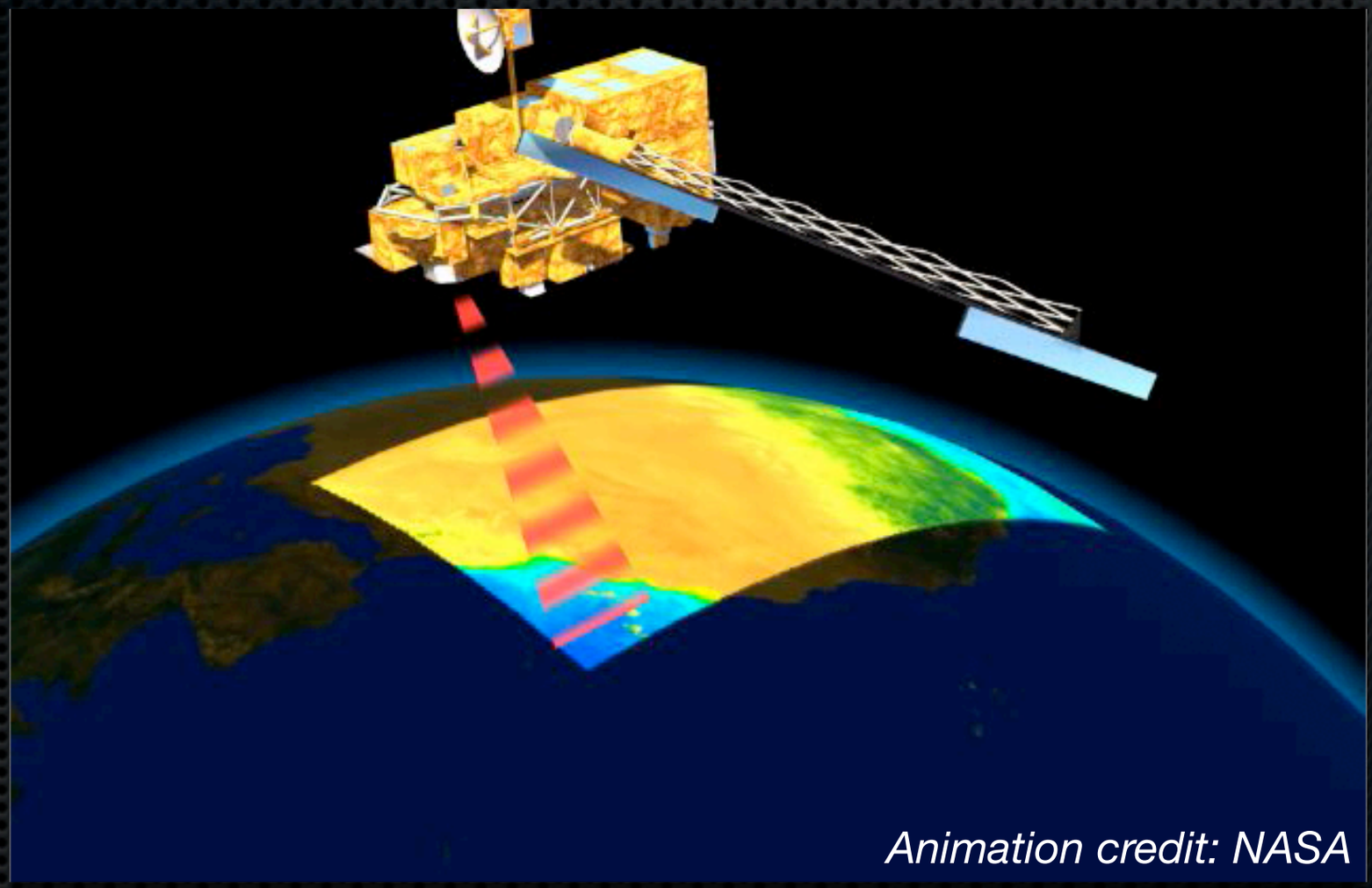
MODerate resolution Imaging Spectroradiometer

Primary Use	Band	Bandwidth[1]
Land/Cloud/Aerosols Boundaries	1	620 - 670
	2	841 - 876
Land/Cloud/Aerosols Properties	3	459 - 479
	4	545 - 565
	5	1230 - 1250
	6	1628 - 1652
	7	2105 - 2155
Ocean Color/ Phytoplankton/ Biogeochemistry	8	405 - 420
	9	438 - 448
	10	483 - 493
	11	526 - 536
	12	546 - 556
	13	662 - 672
	14	673 - 683
	15	743 - 753
	16	862 - 877
Atmospheric Water Vapor	17	890 - 920
	18	931 - 941
	19	915 - 965

Primary Use	Band	Bandwidth[1]
Surface/Cloud Temperature	20	3.660 - 3.840
	21	3.929 - 3.989
	22	3.929 - 3.989
	23	4.020 - 4.080
Atmospheric Temperature	24	4.433 - 4.498
	25	4.482 - 4.549
Cirrus Clouds Water Vapor	26	1.360 - 1.390
	27	6.535 - 6.895
	28	7.175 - 7.475
Cloud Properties	29	8.400 - 8.700
Ozone	30	9.580 - 9.880
Surface/Cloud Temperature	31	10.780 - 11.280
	32	11.770 - 12.270
Cloud Top Altitude	33	13.185 - 13.485
	34	13.485 - 13.785
	35	13.785 - 14.085
	36	14.085 - 14.385

Terra and Aqua Satellites

NASA Earth Observation System (EOS) Satellites



Animation credit: NASA

- Polar-orbit (702 km orbit altitude)
- 4 orbits per day over the Great Lakes
- 2330 km wide swath

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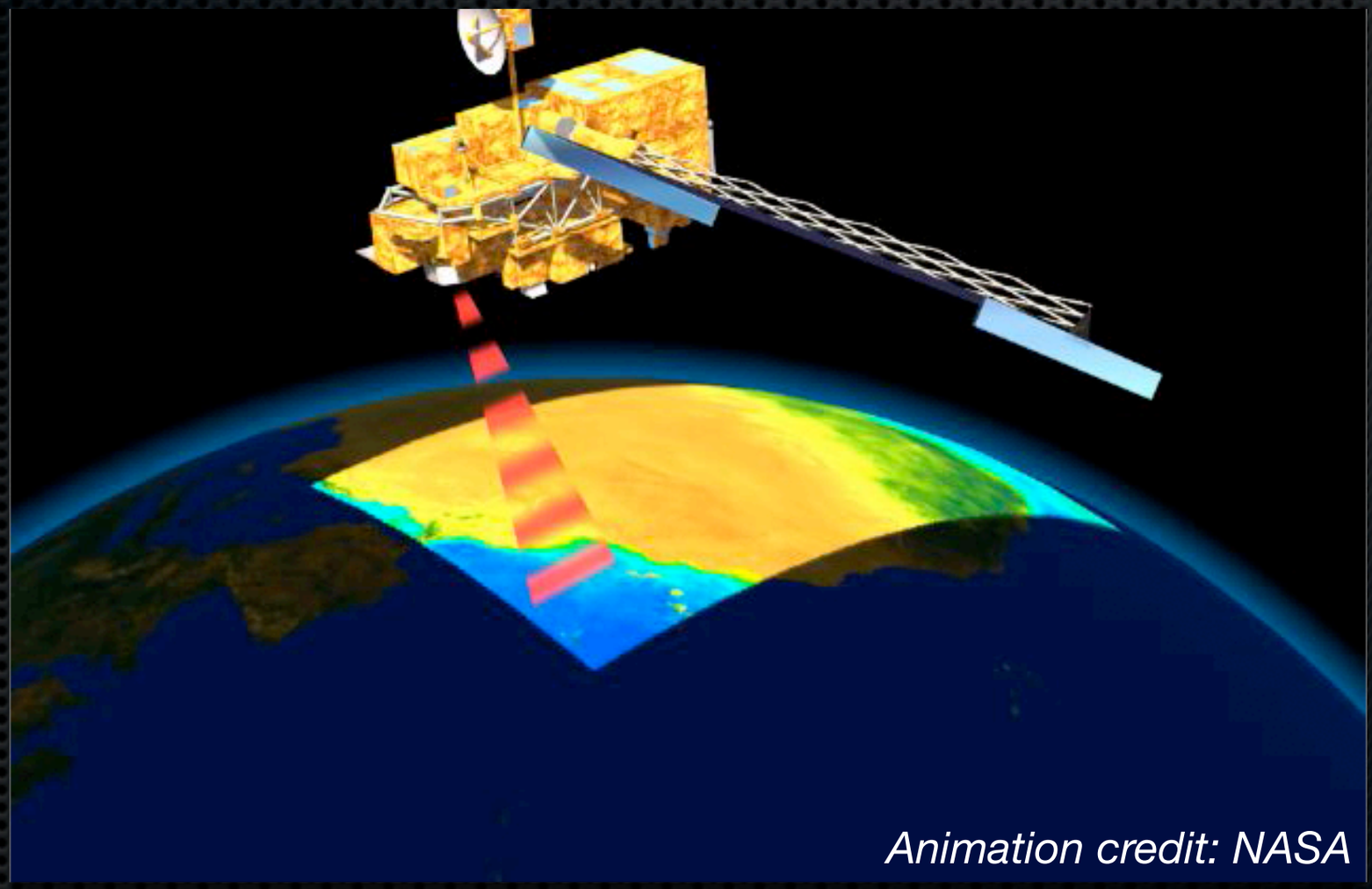

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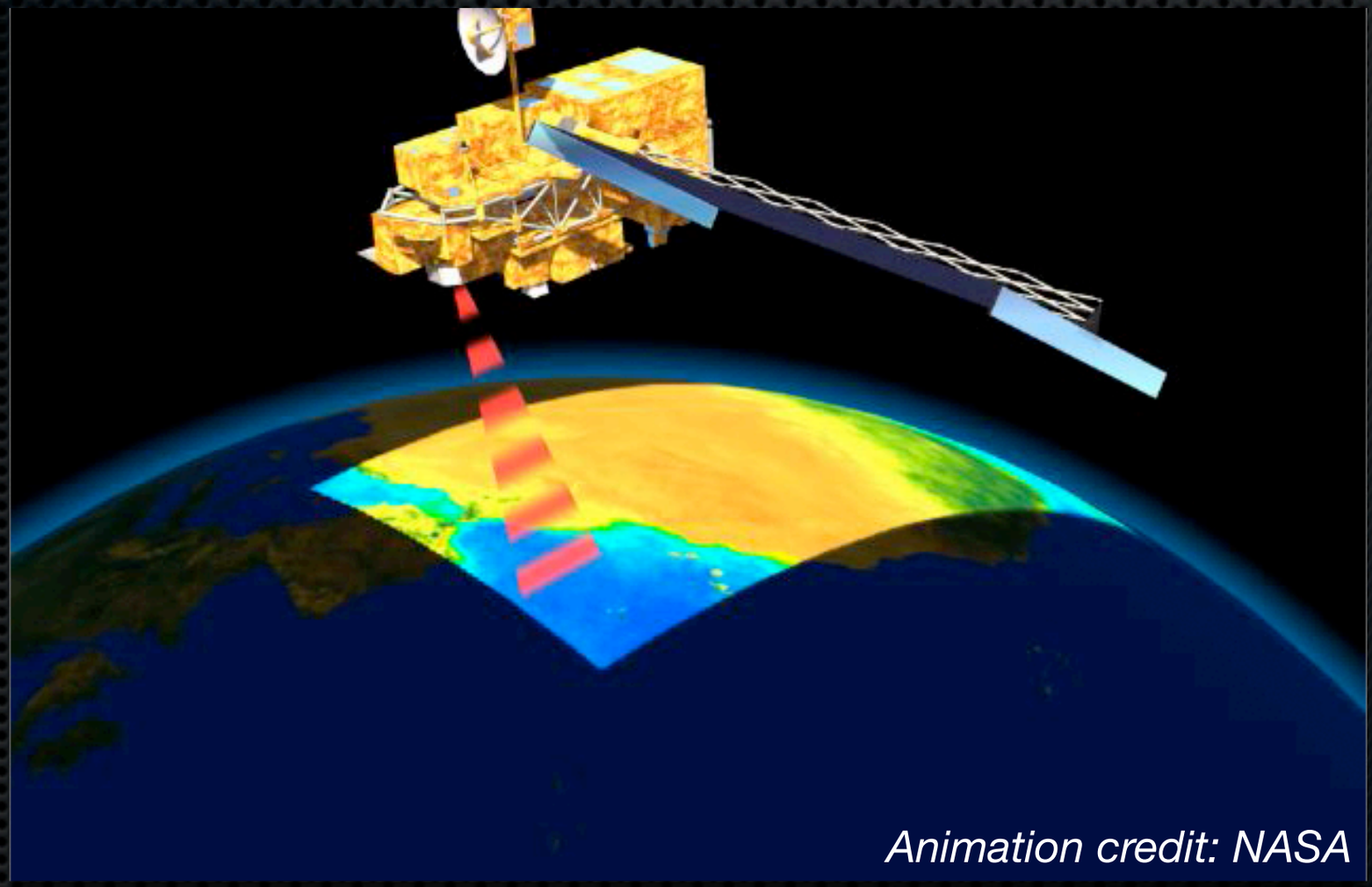

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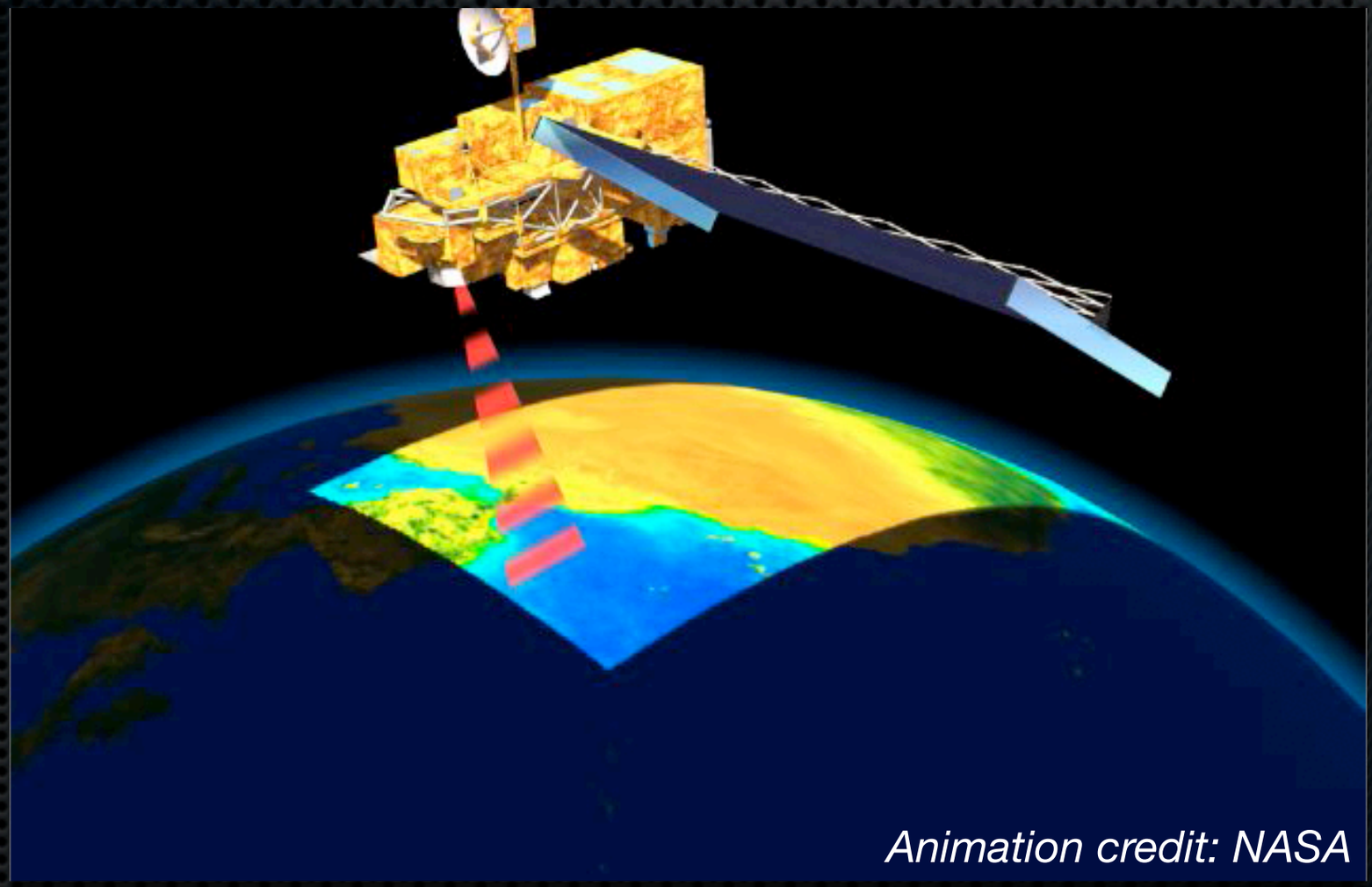

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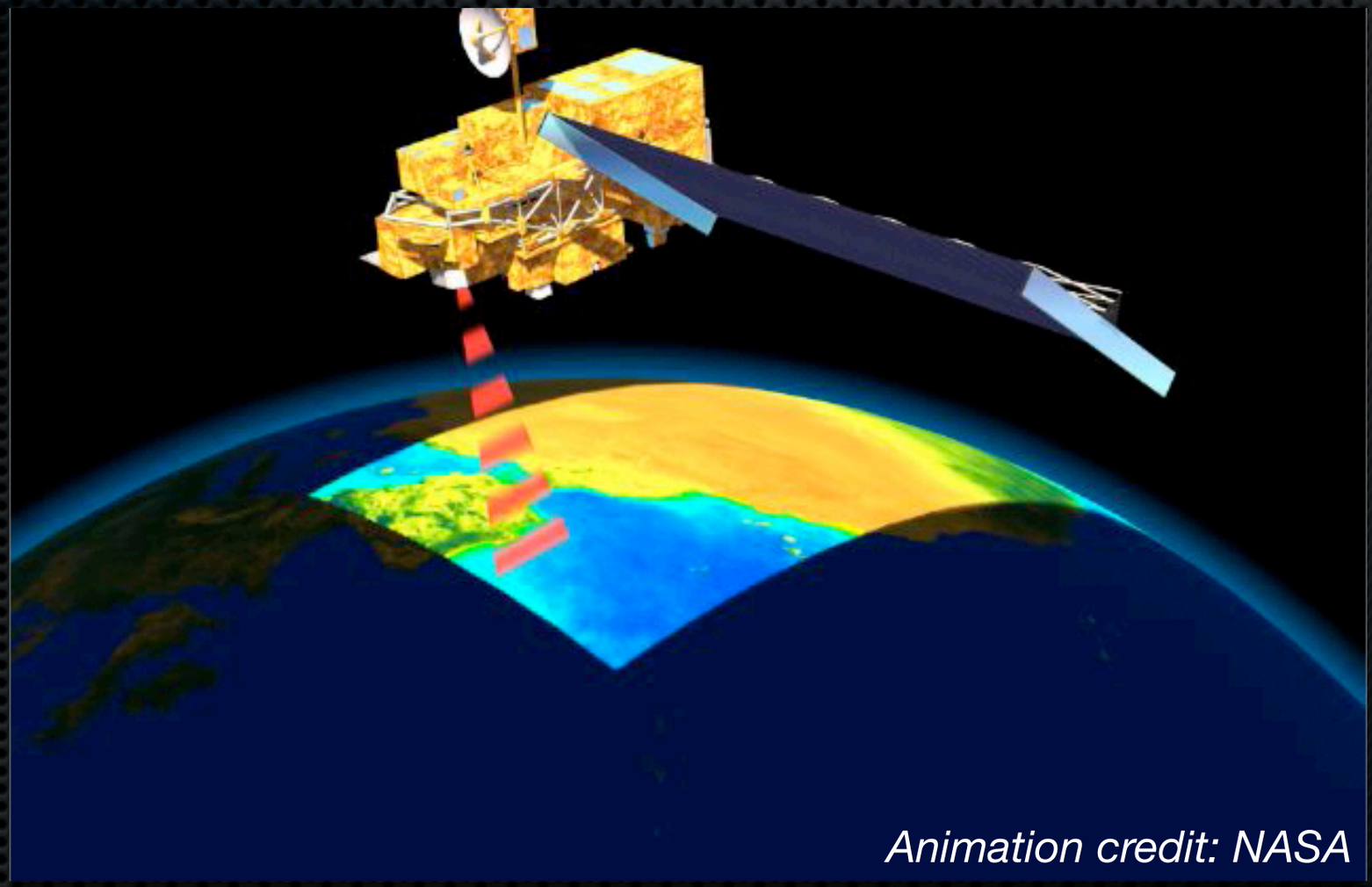

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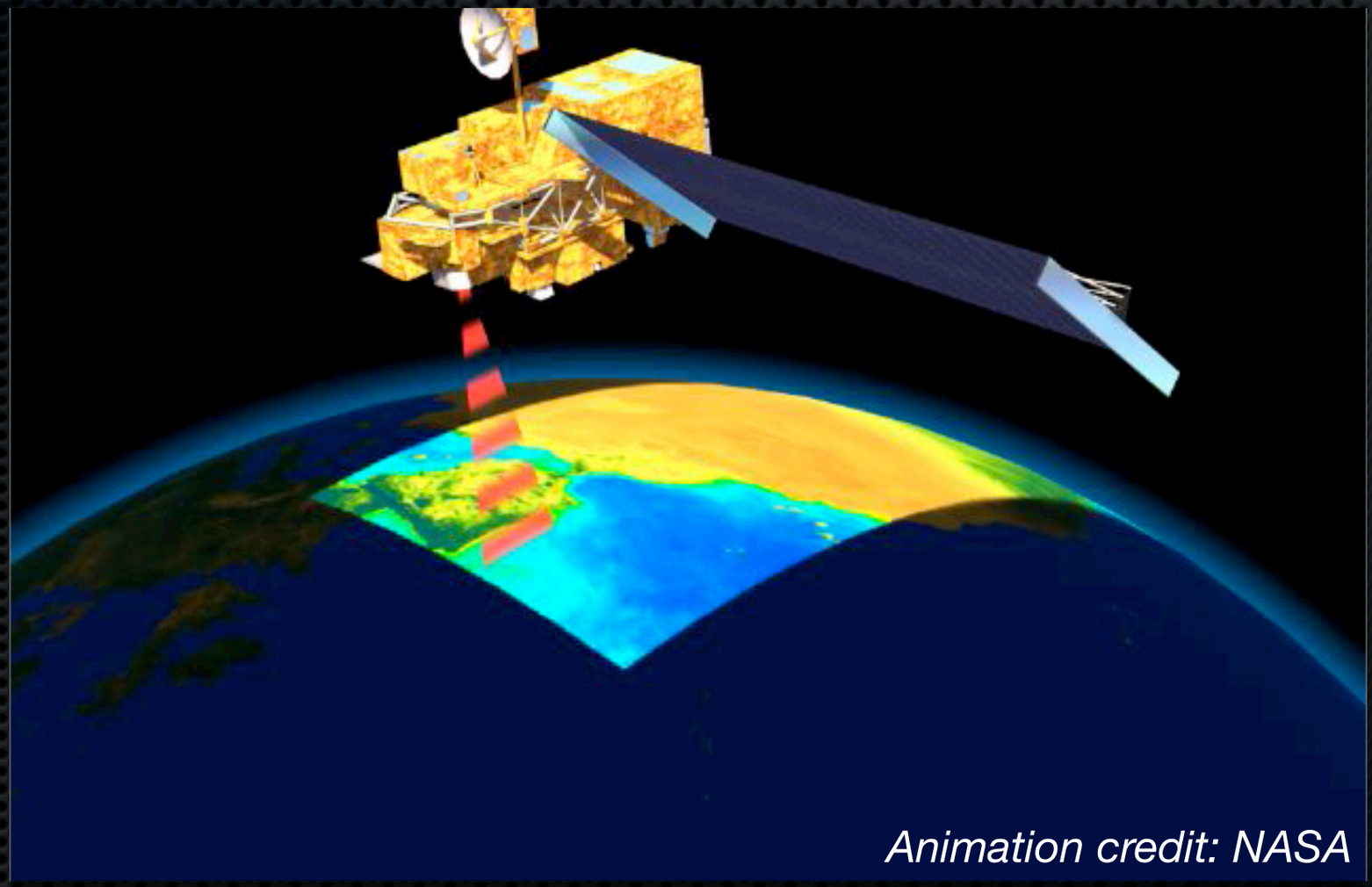

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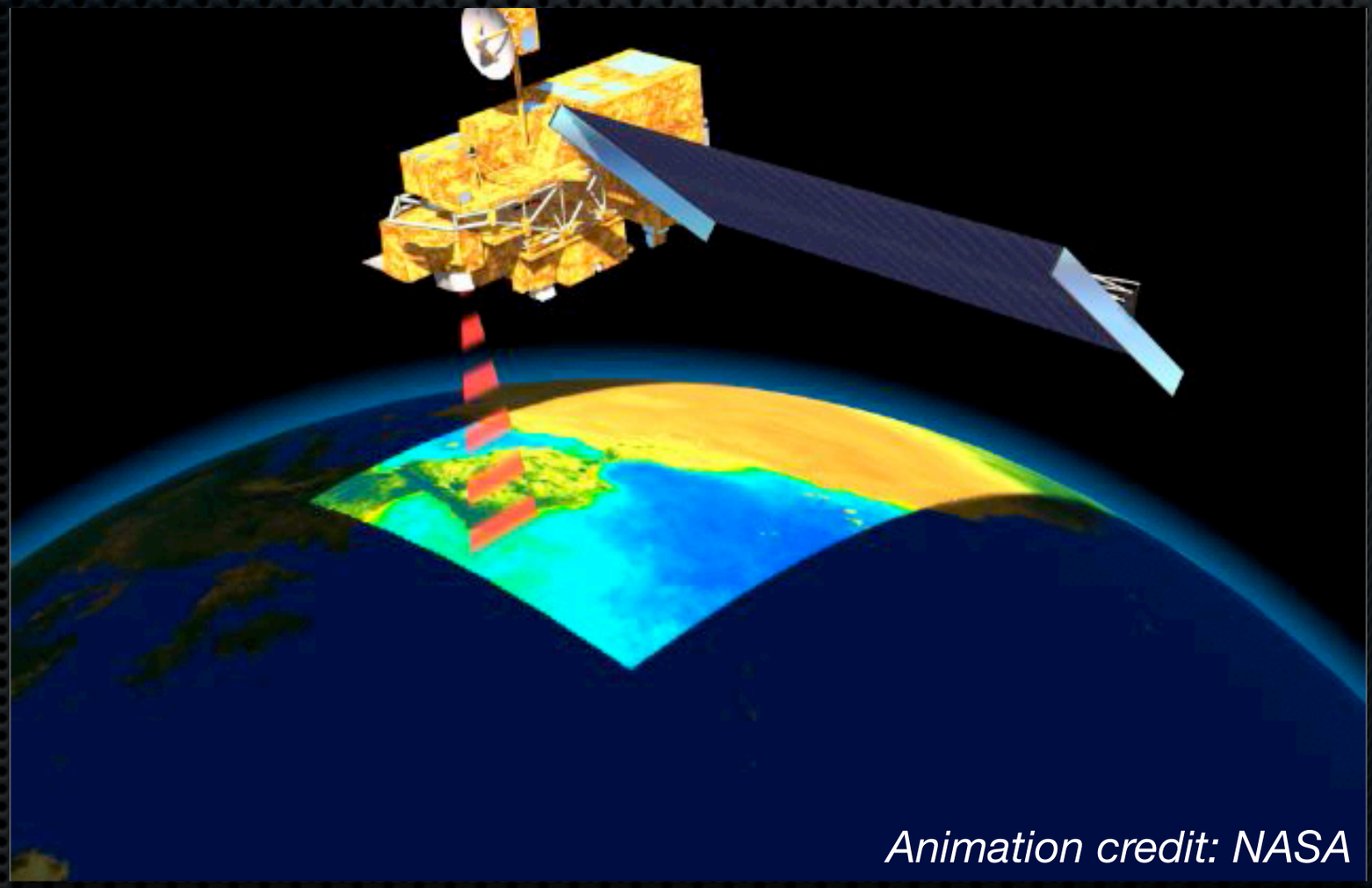

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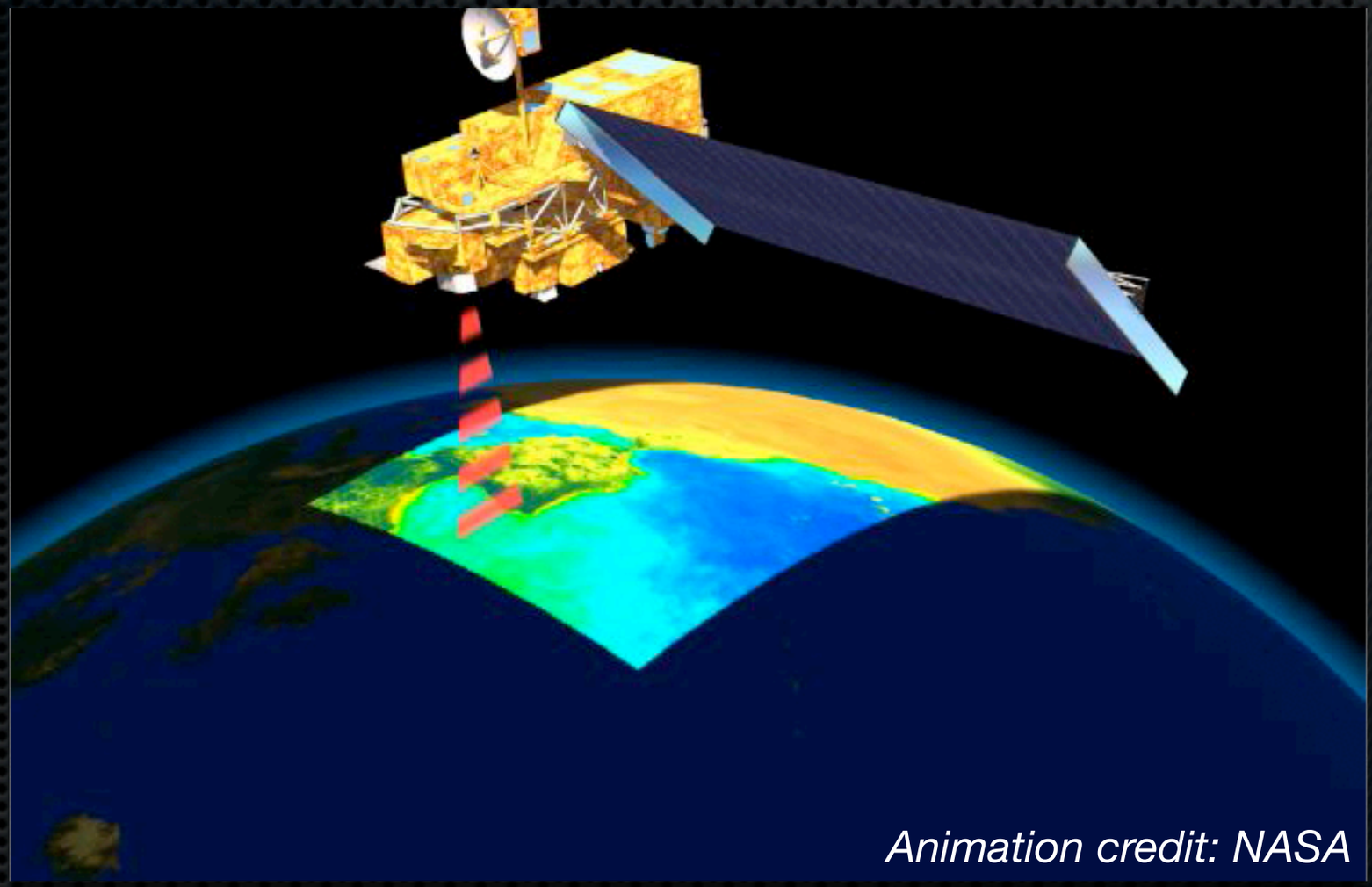

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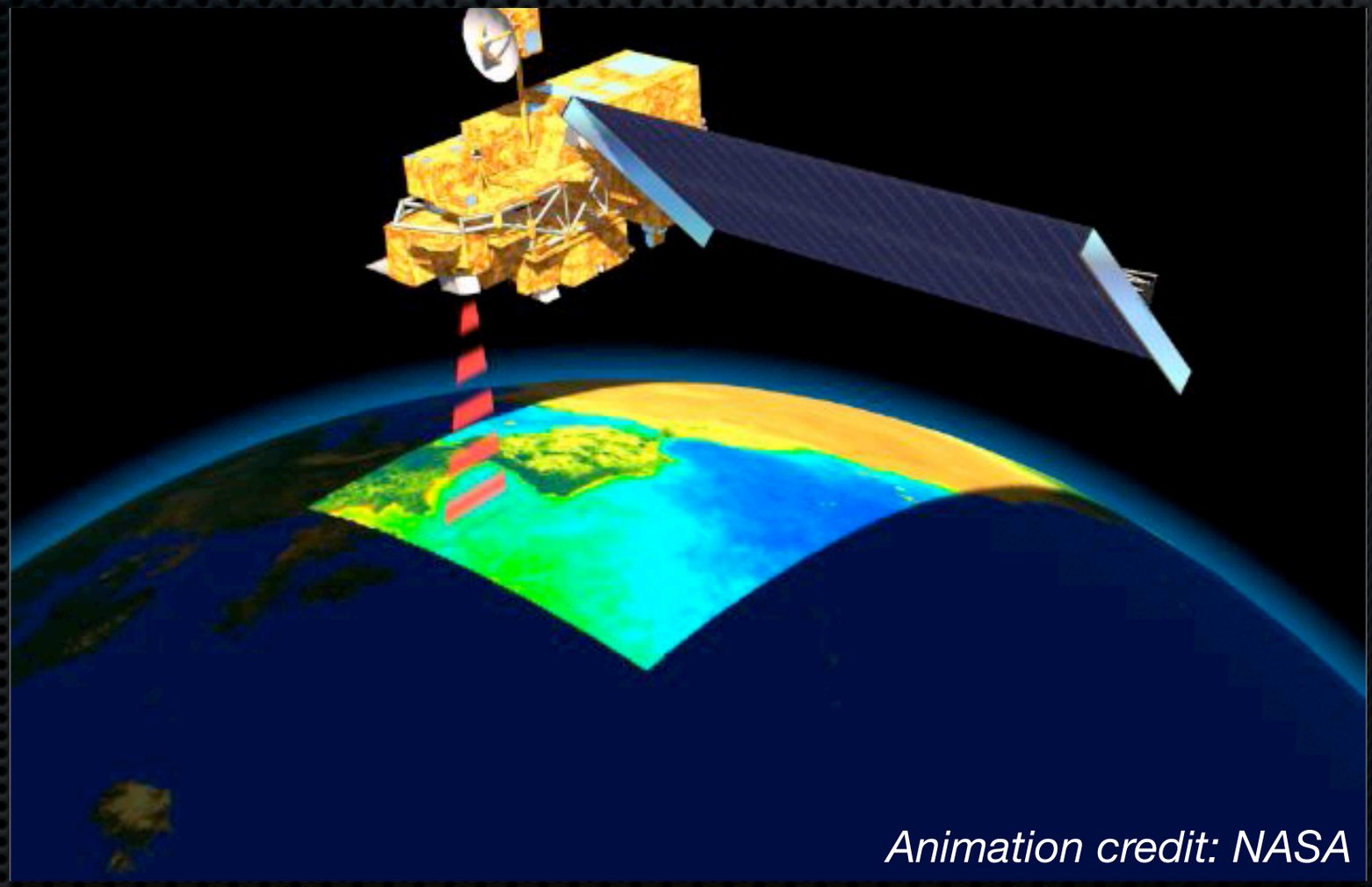

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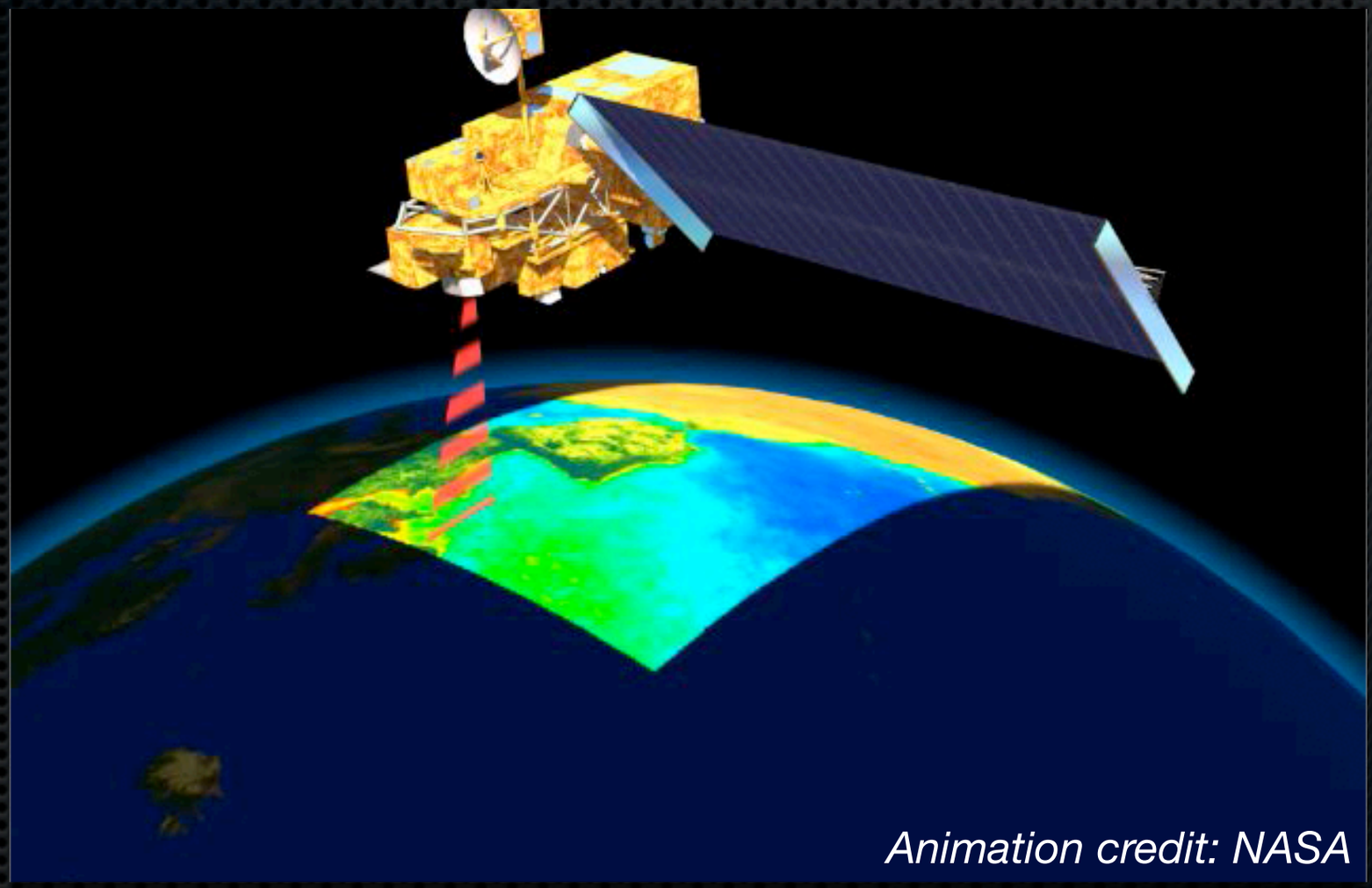

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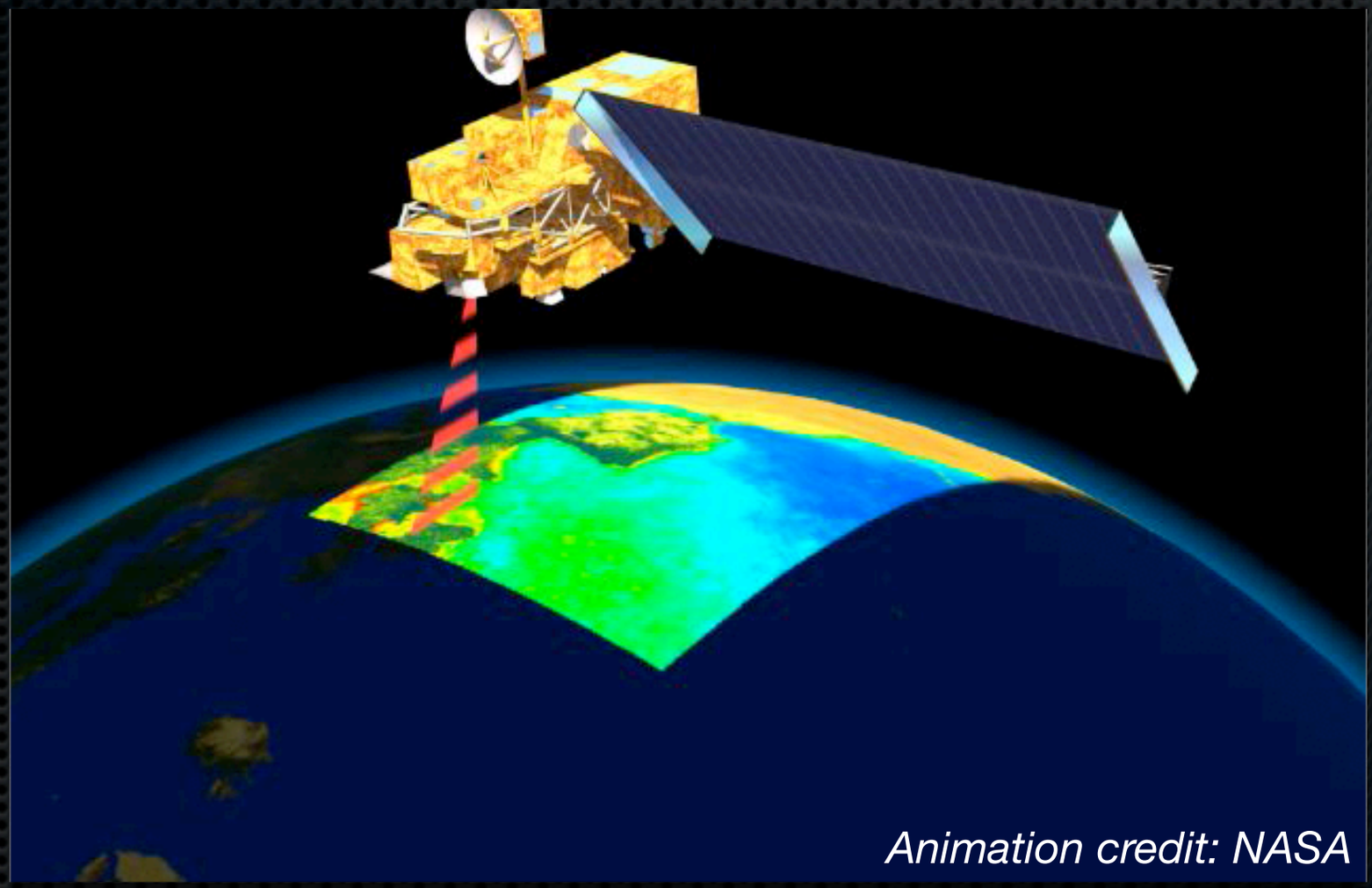

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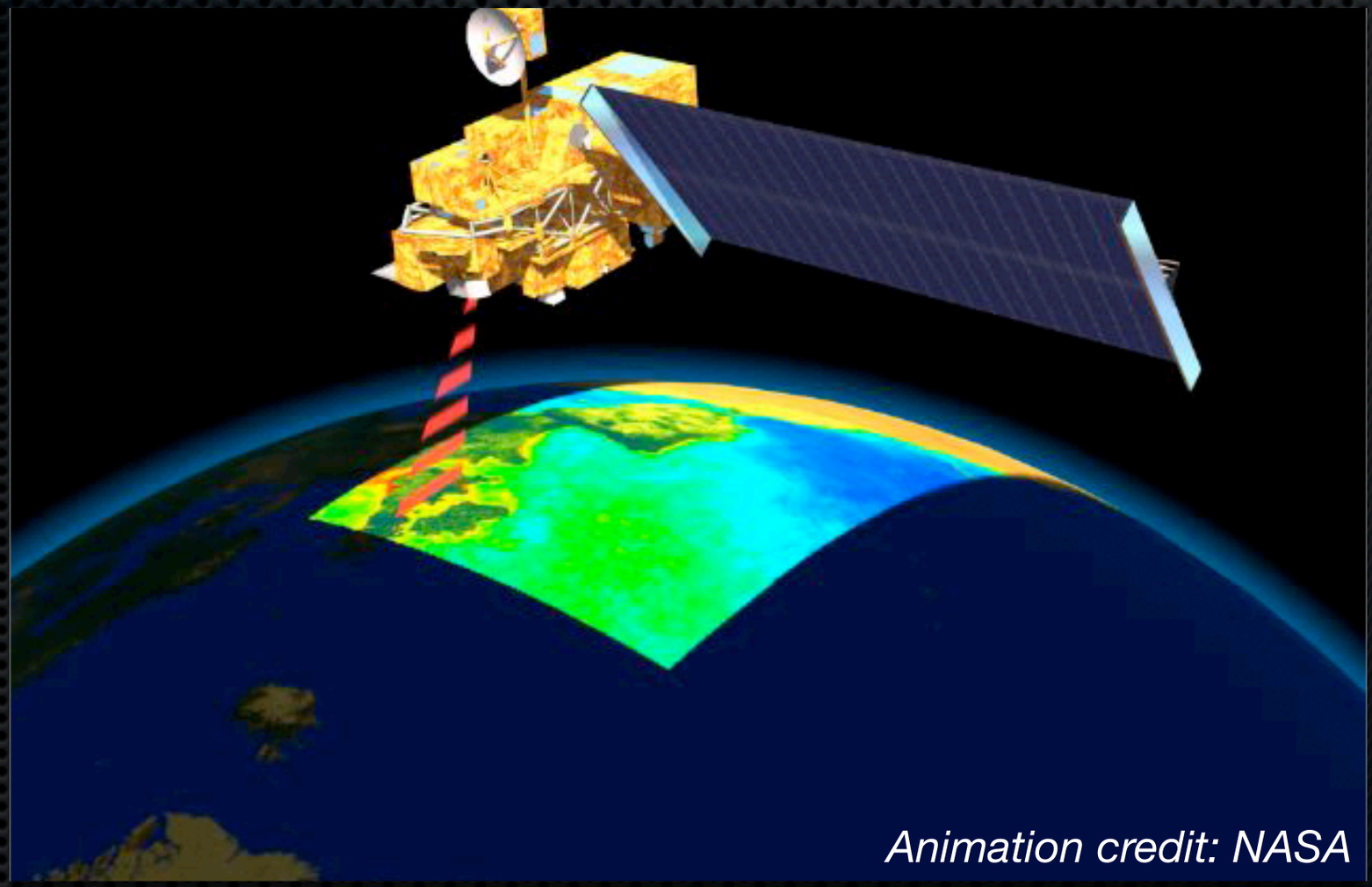

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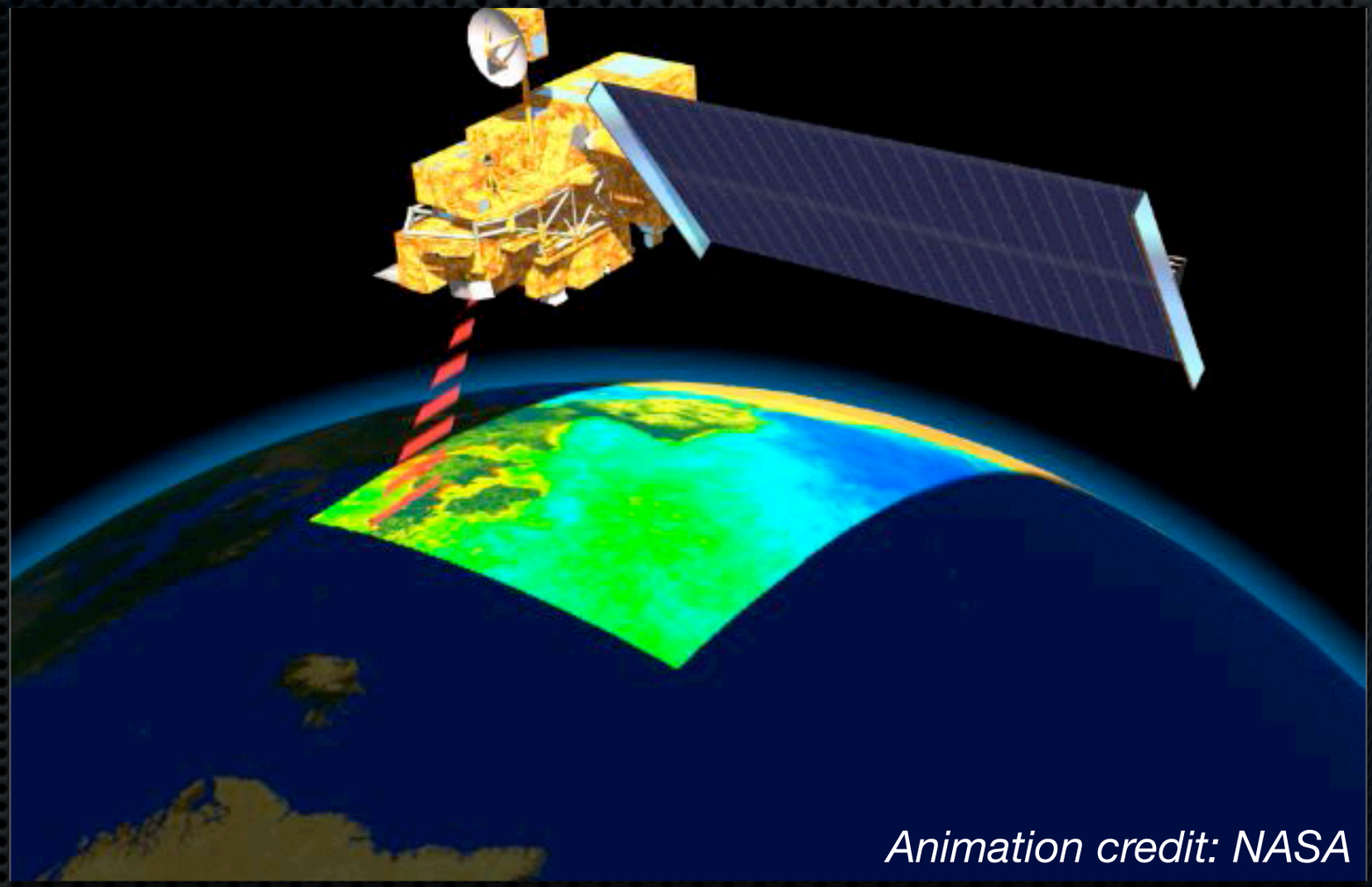

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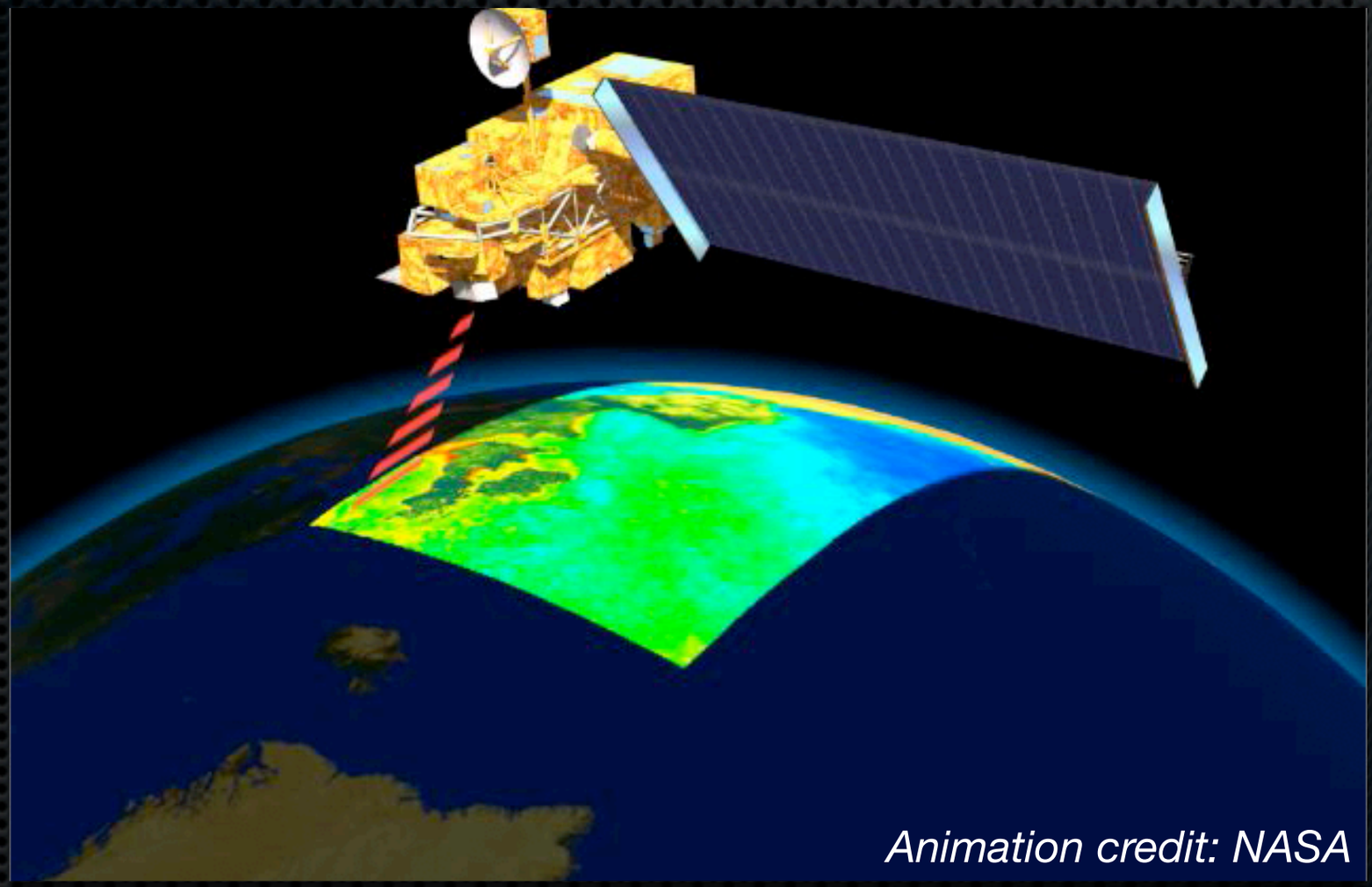

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MODIS Direct Broadcast Ground Station

Space Science and Engineering Center (SSEC), UW-Madison

SSEC → NWS Regional Headquarters → LDM subscription at WFO

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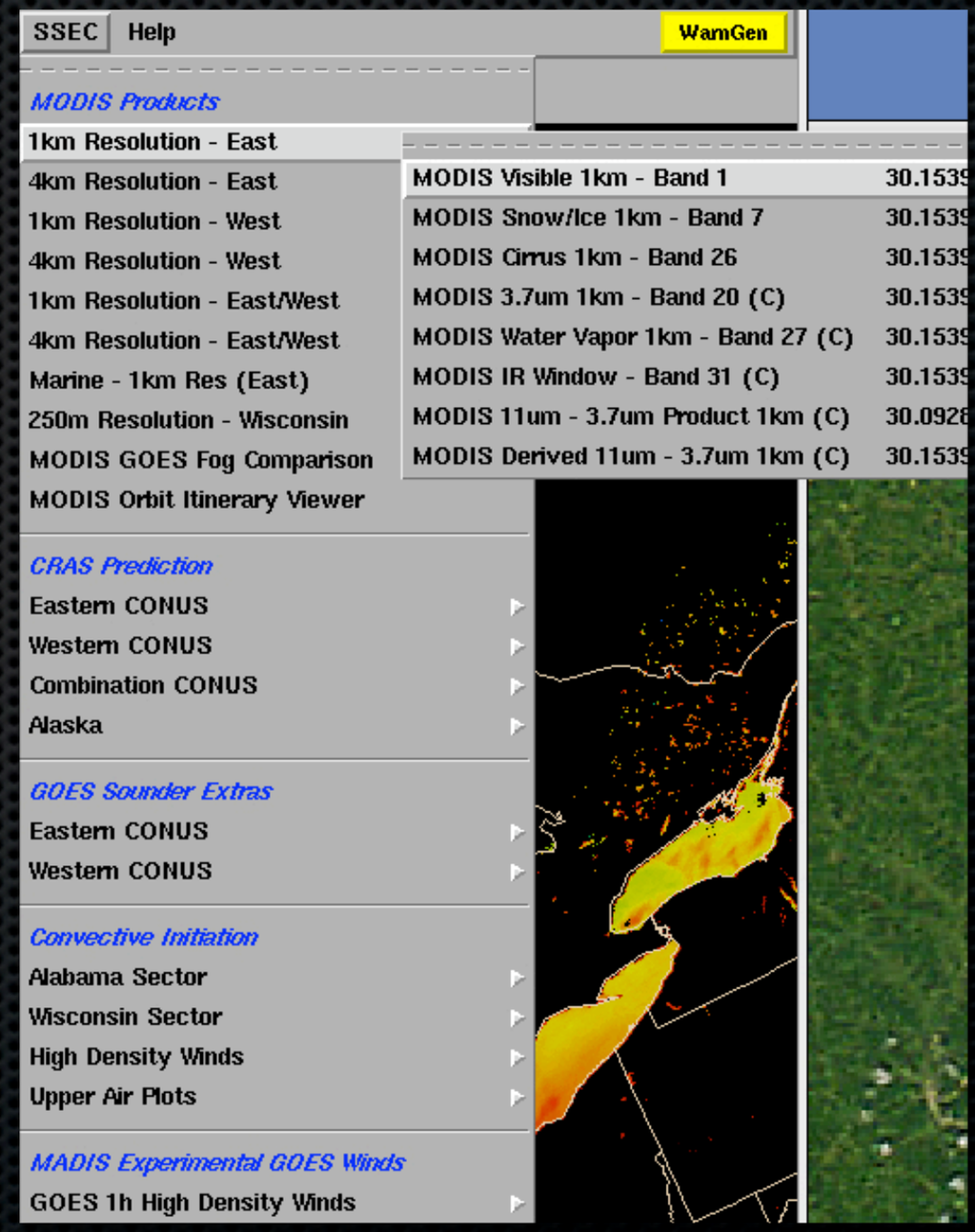
MODIS 1km Imagery and 4km Products in AWIPS

- Band 1 - (0.6µm) - Visible
- Band 7 - (2.1µm) - Snow/ice detection
- Band 20 - (3.7µm) - Shortwave IR
- Band 26 - (1.3µm) - Cirrus detection
- Band 27 - (6.7µm) - Water vapor
- Band 31 - (11.0µm) - IR window
- 11µm - 3.7µm - Fog/stratus product
- Total precipitable water (TPW)
- Cloud phase
- Cloud top temperature
- Sea surface temperature (SST)



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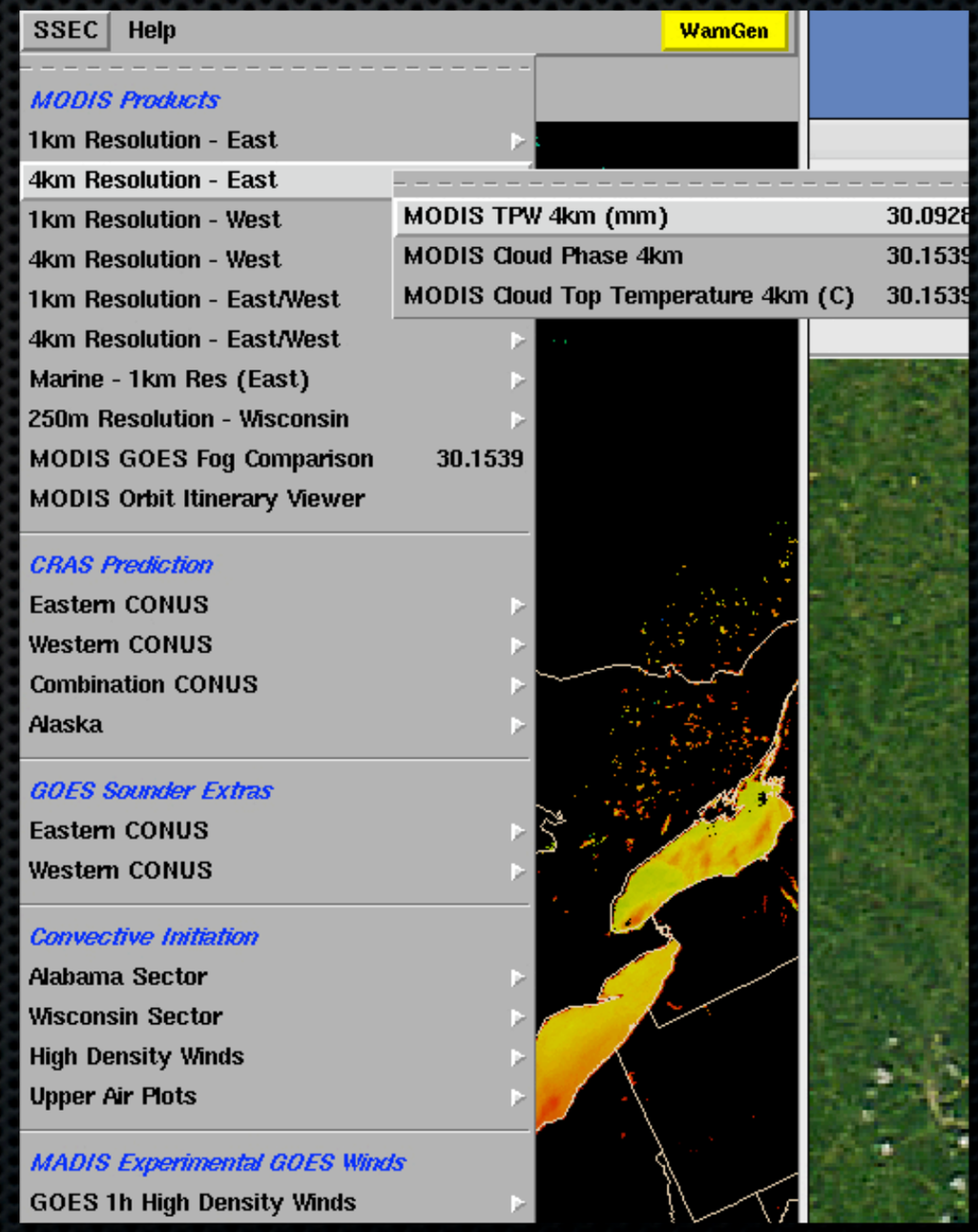

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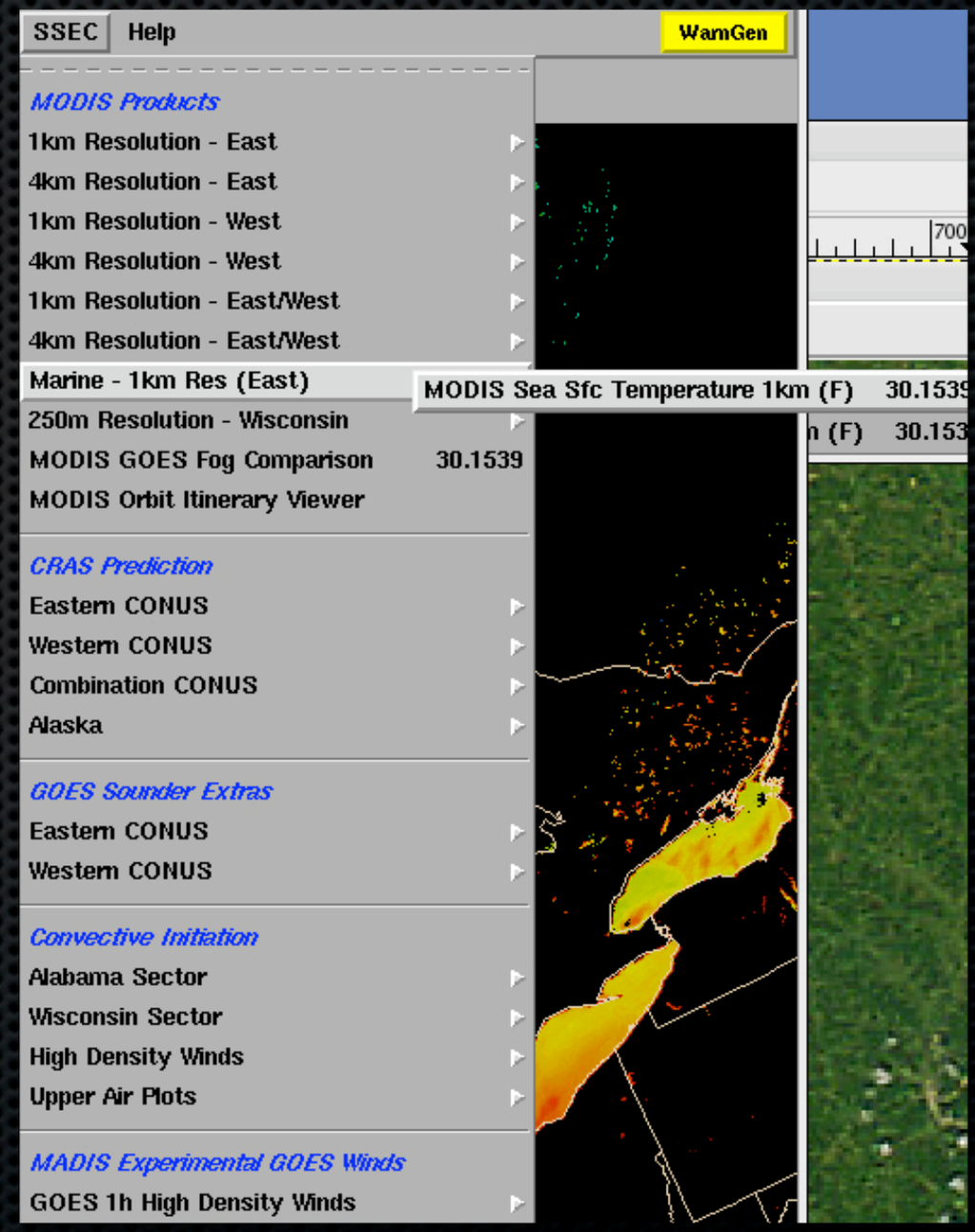
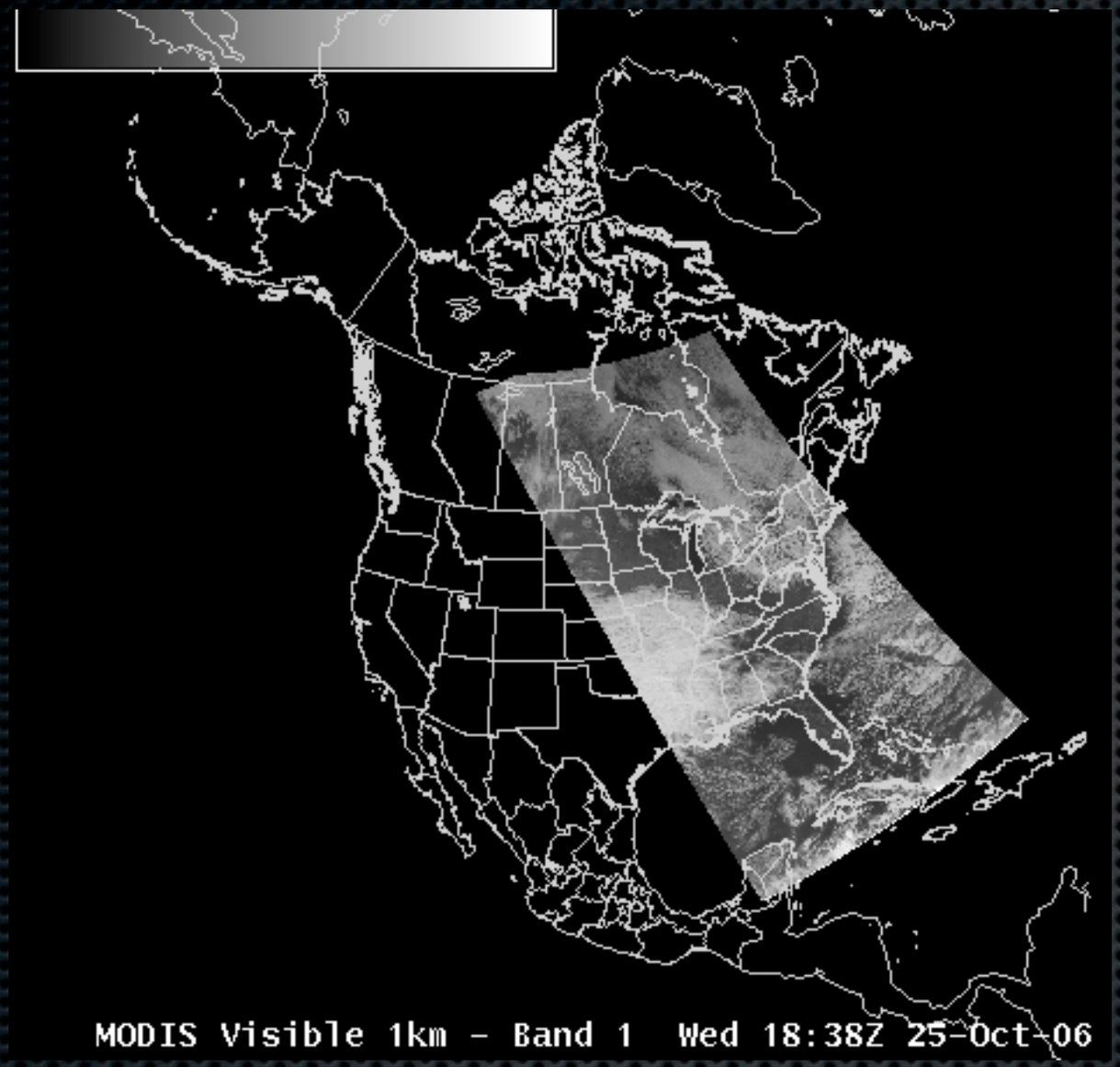
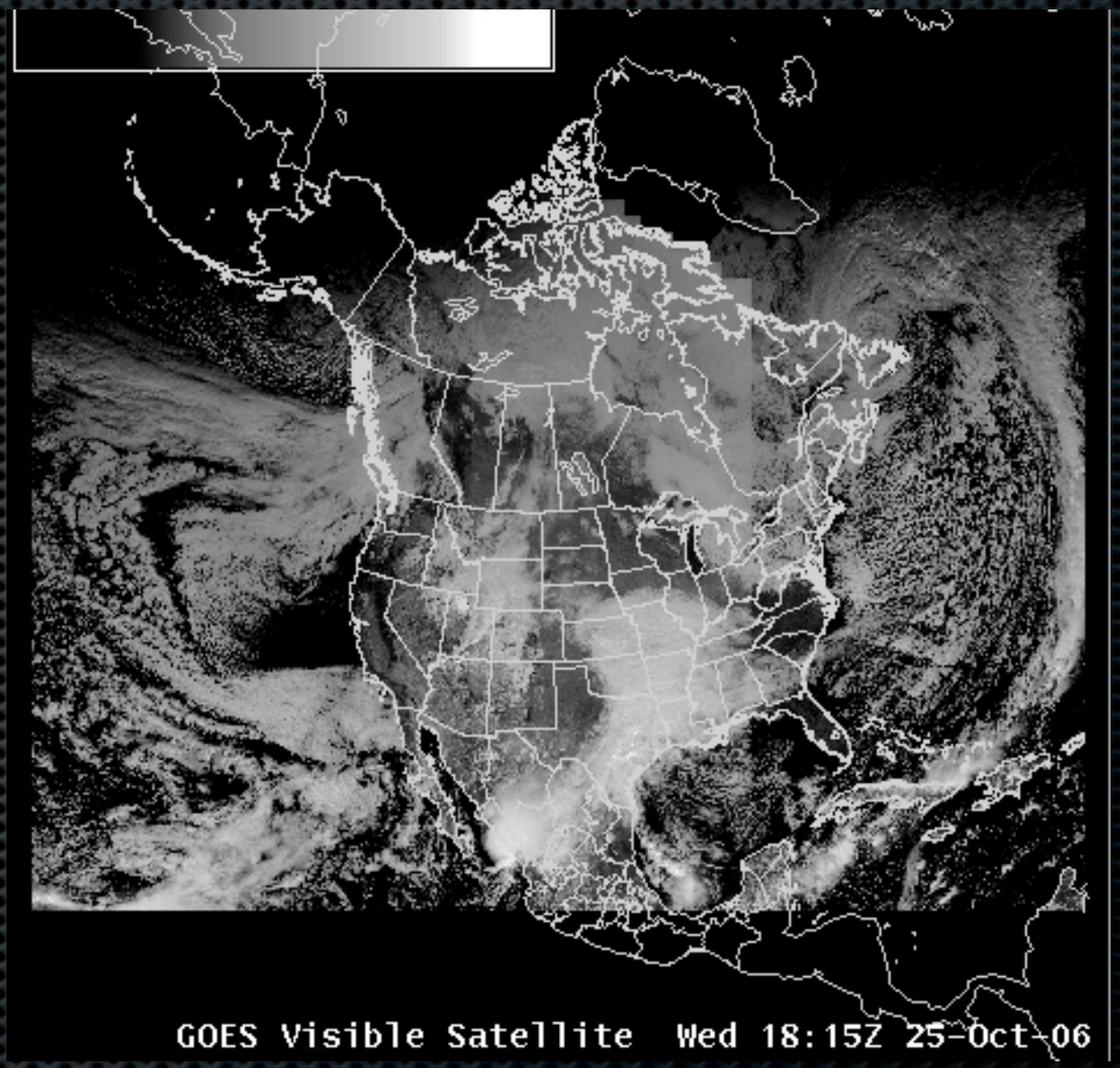


MODIS Imagery in AWIPS

Band 1: Visible channel (0.6µm)



MODIS visible channel



GOES visible channel

MODIS Imagery in AWIPS

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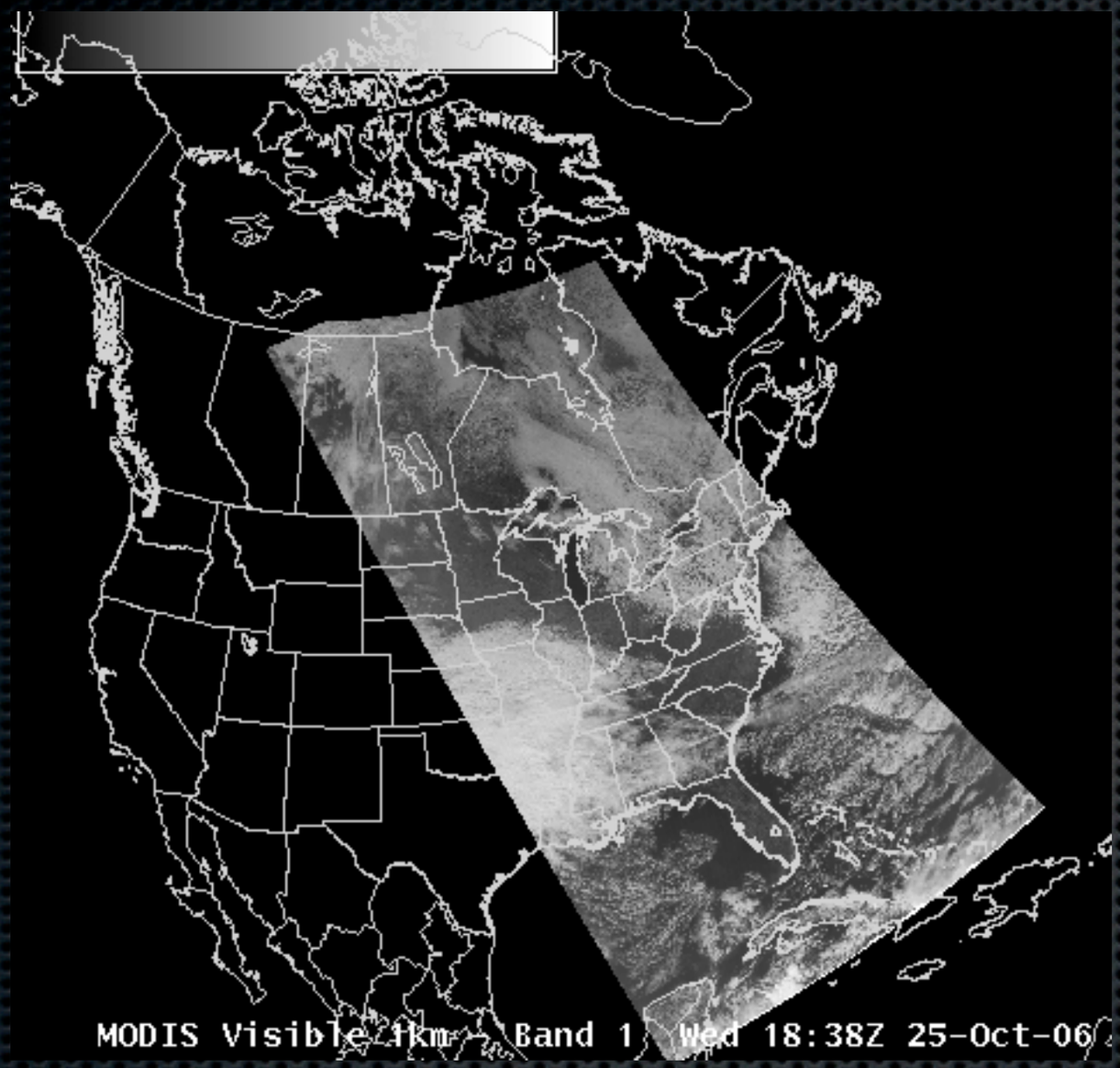

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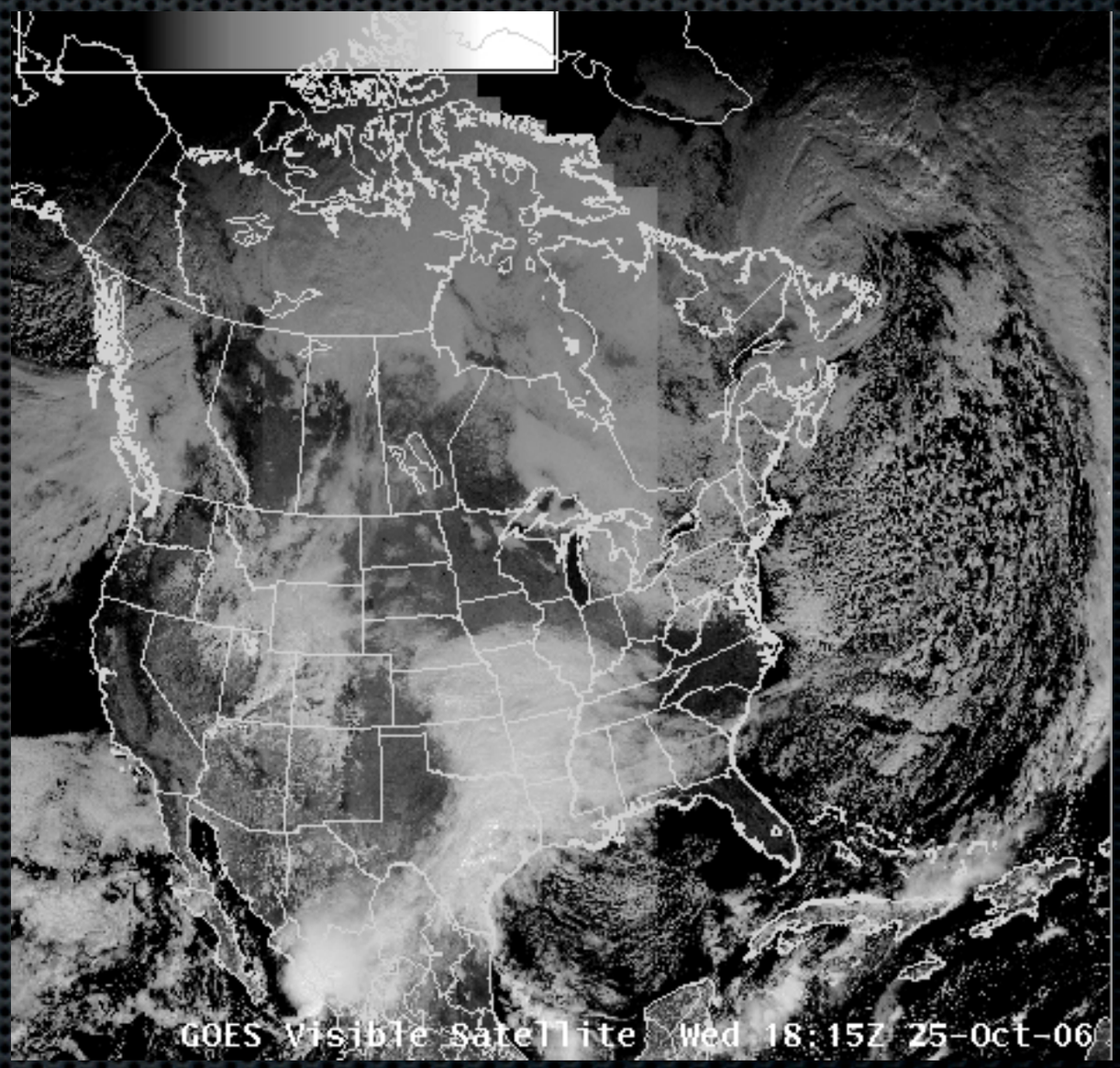

GOES visible channel

MODIS Imagery in AWIPS

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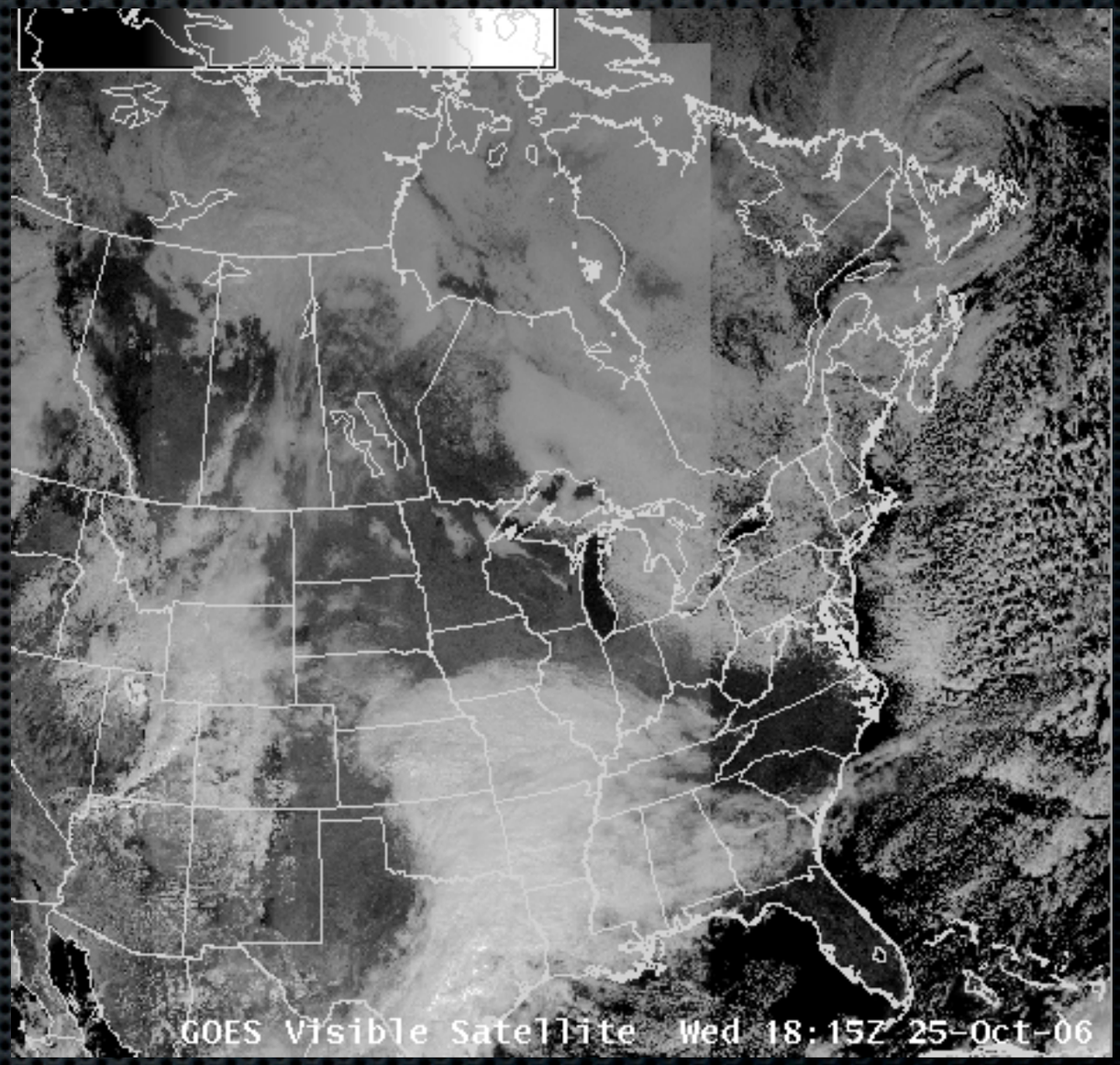
MODIS visible channel



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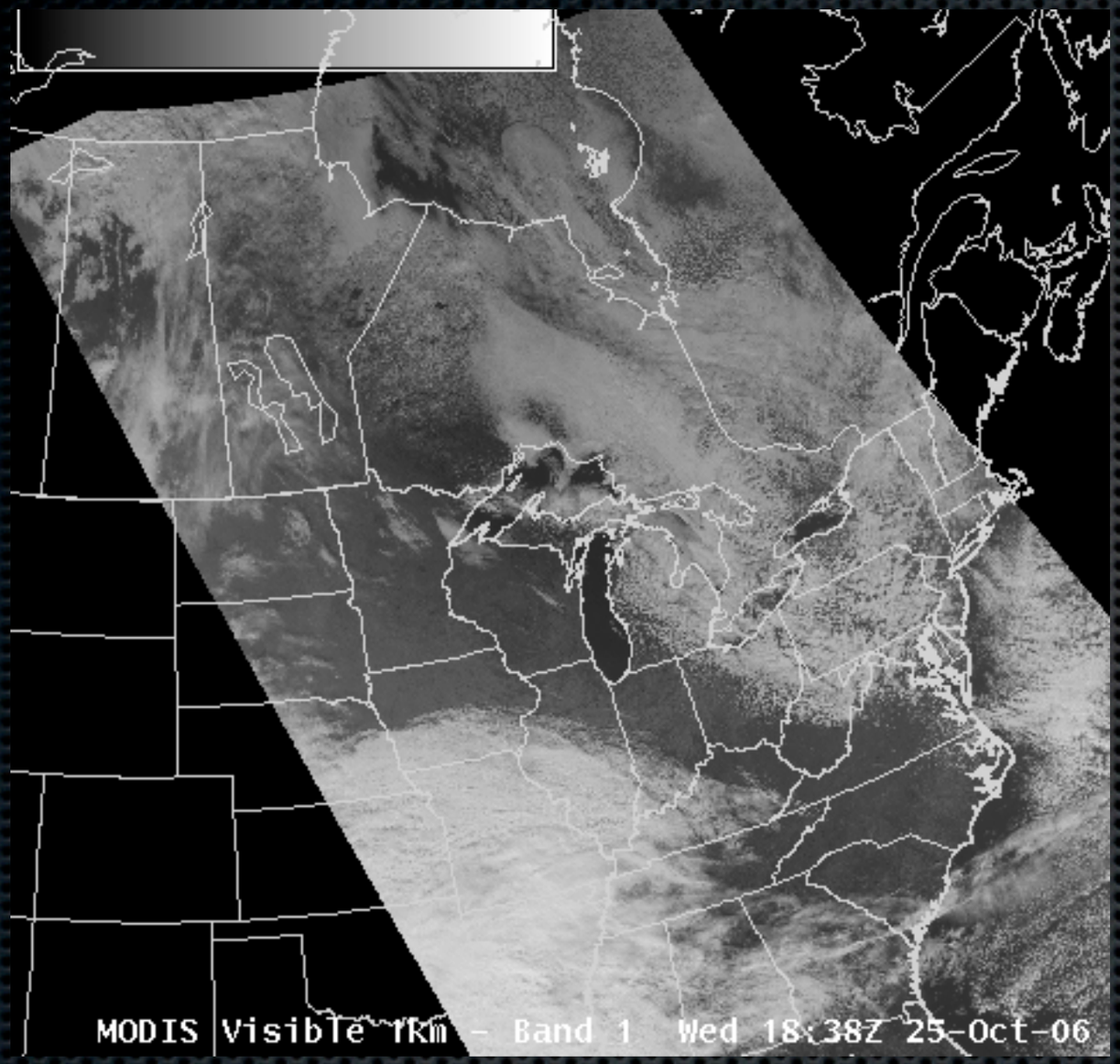

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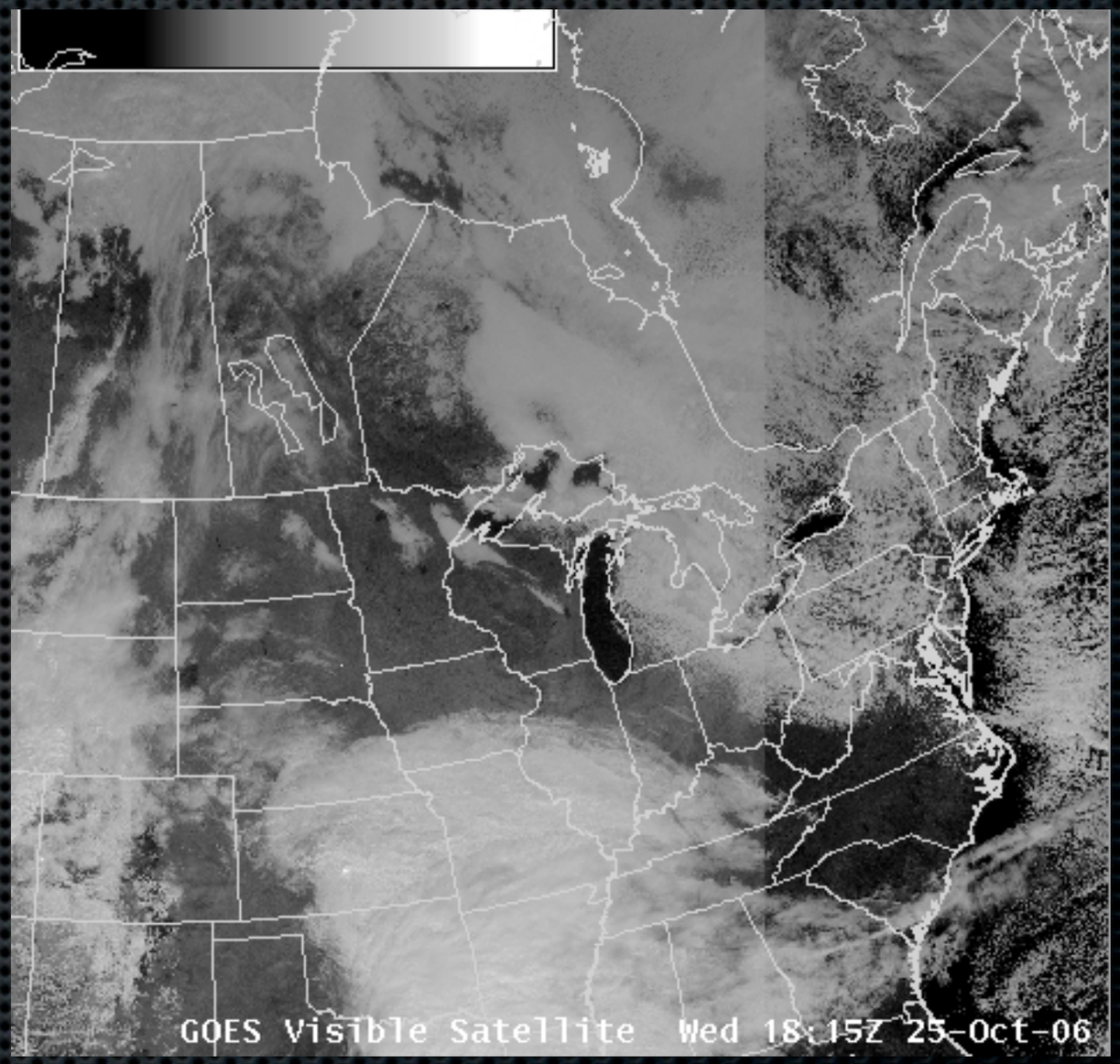

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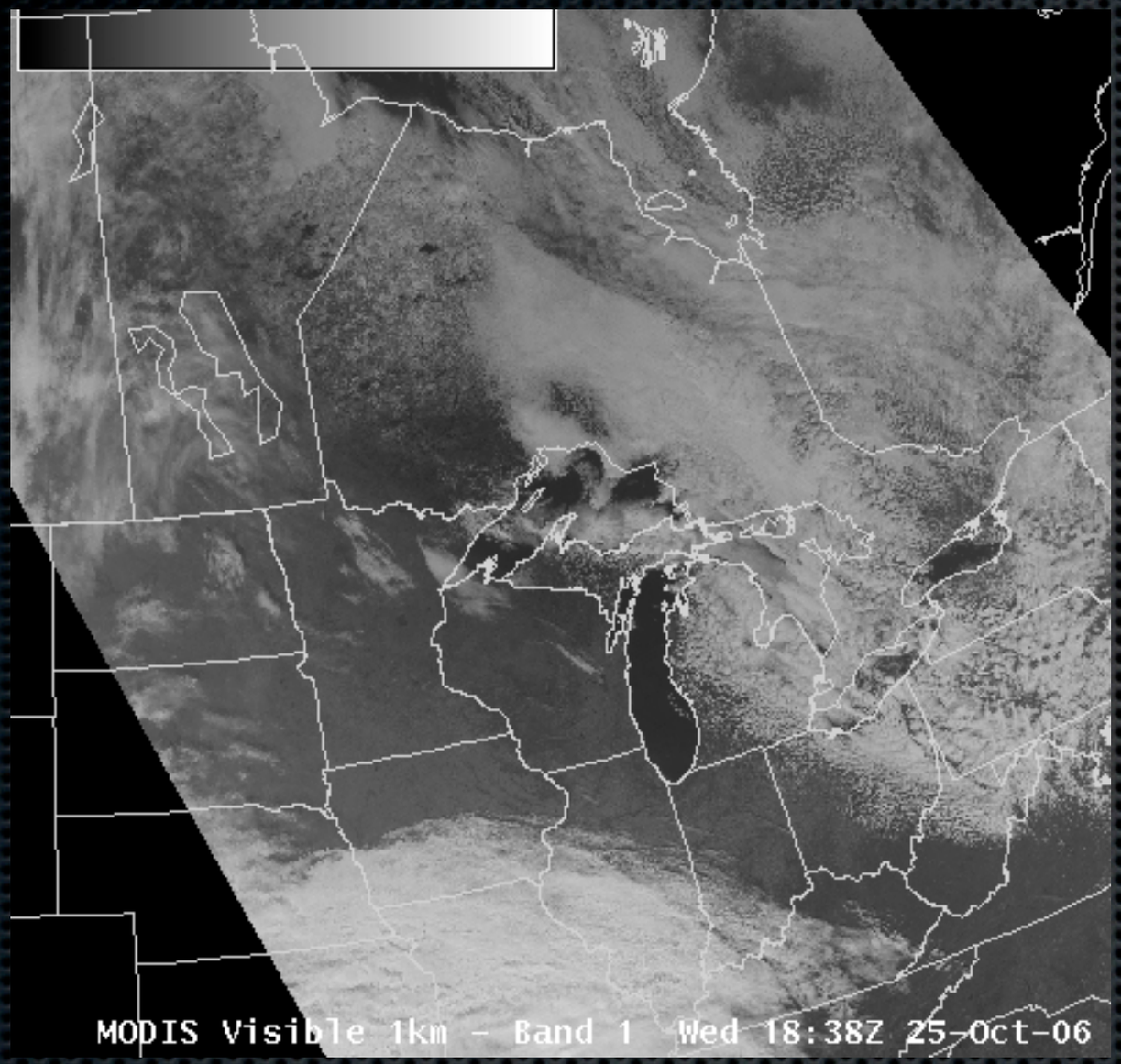

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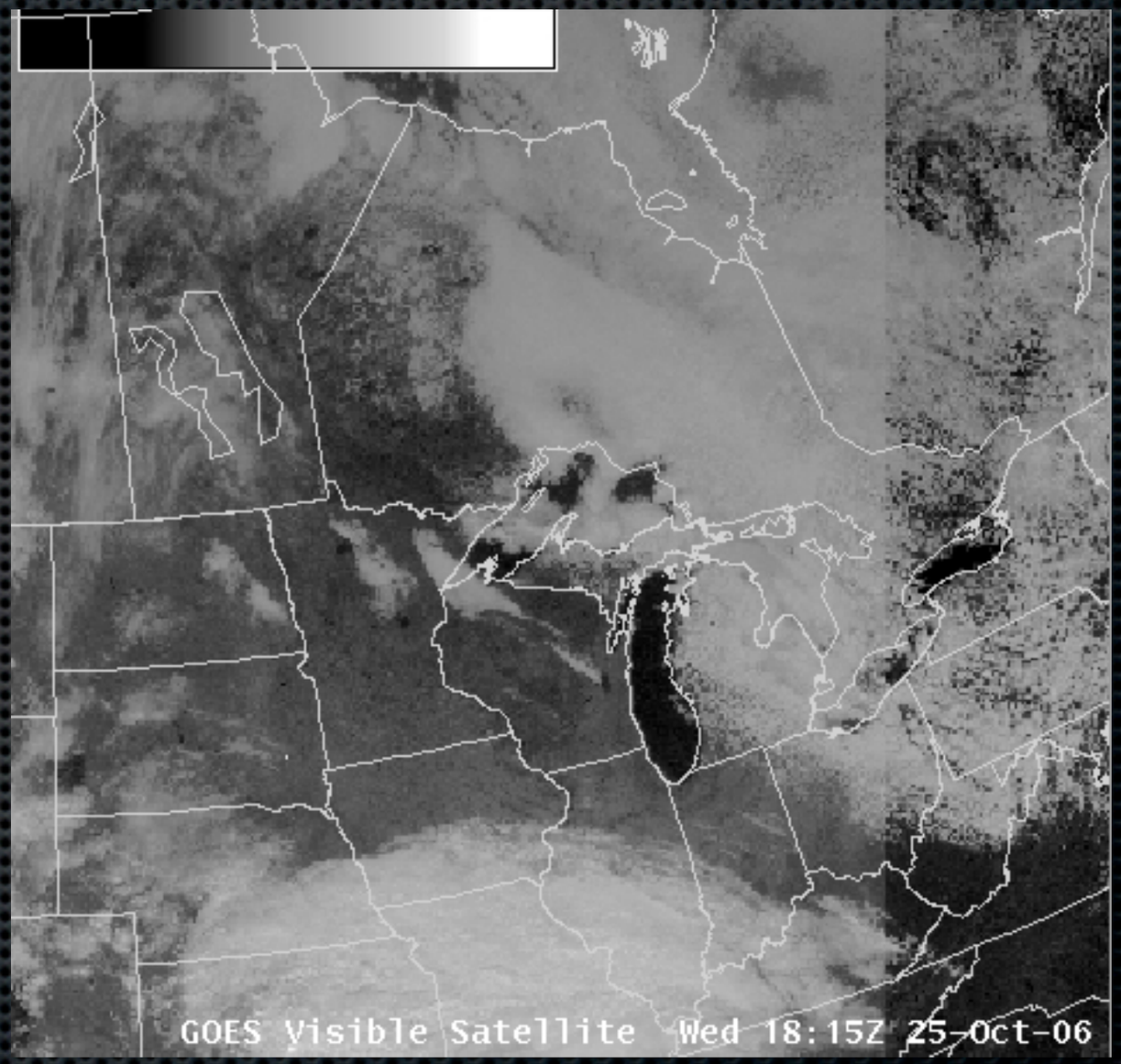

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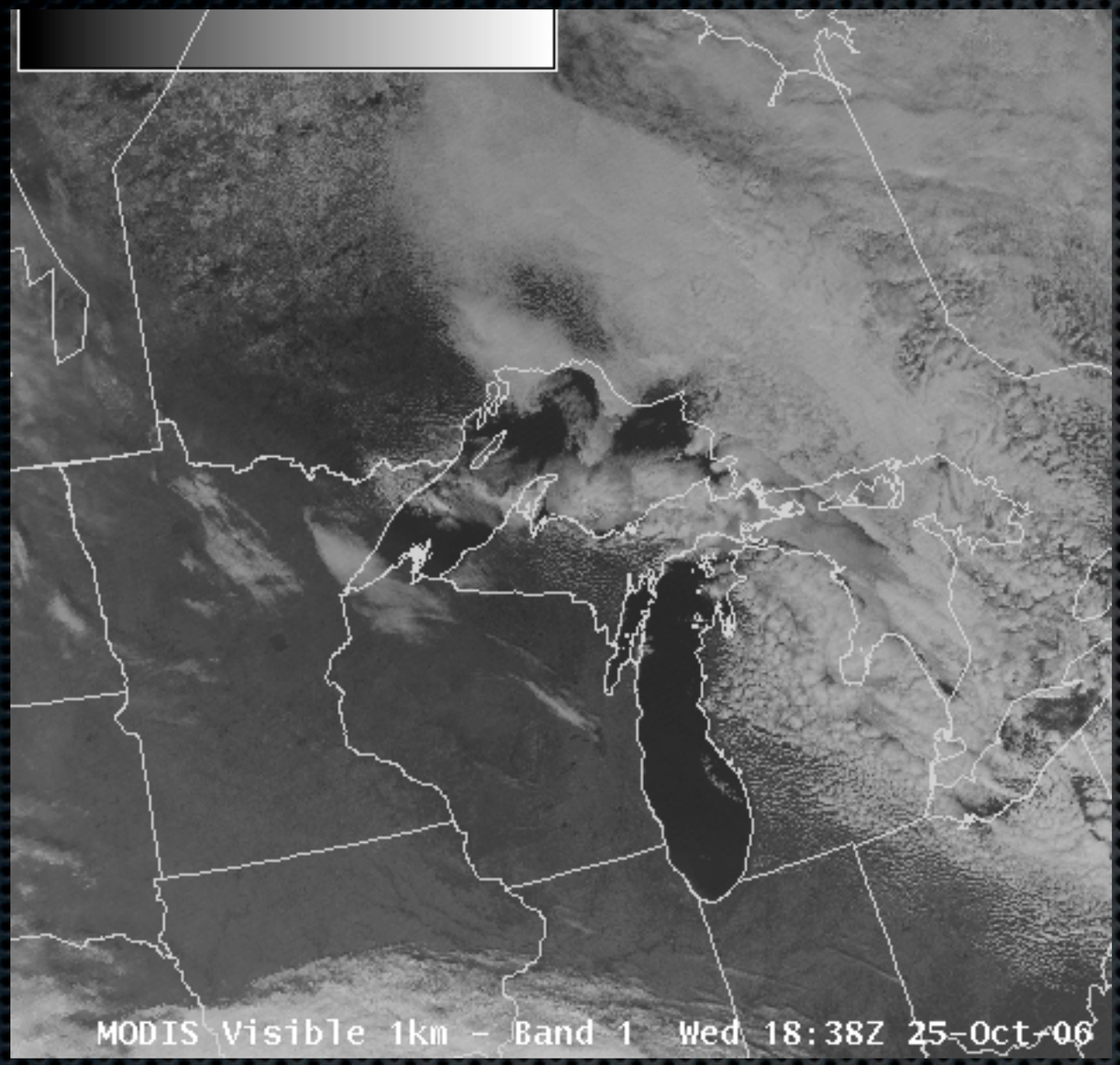
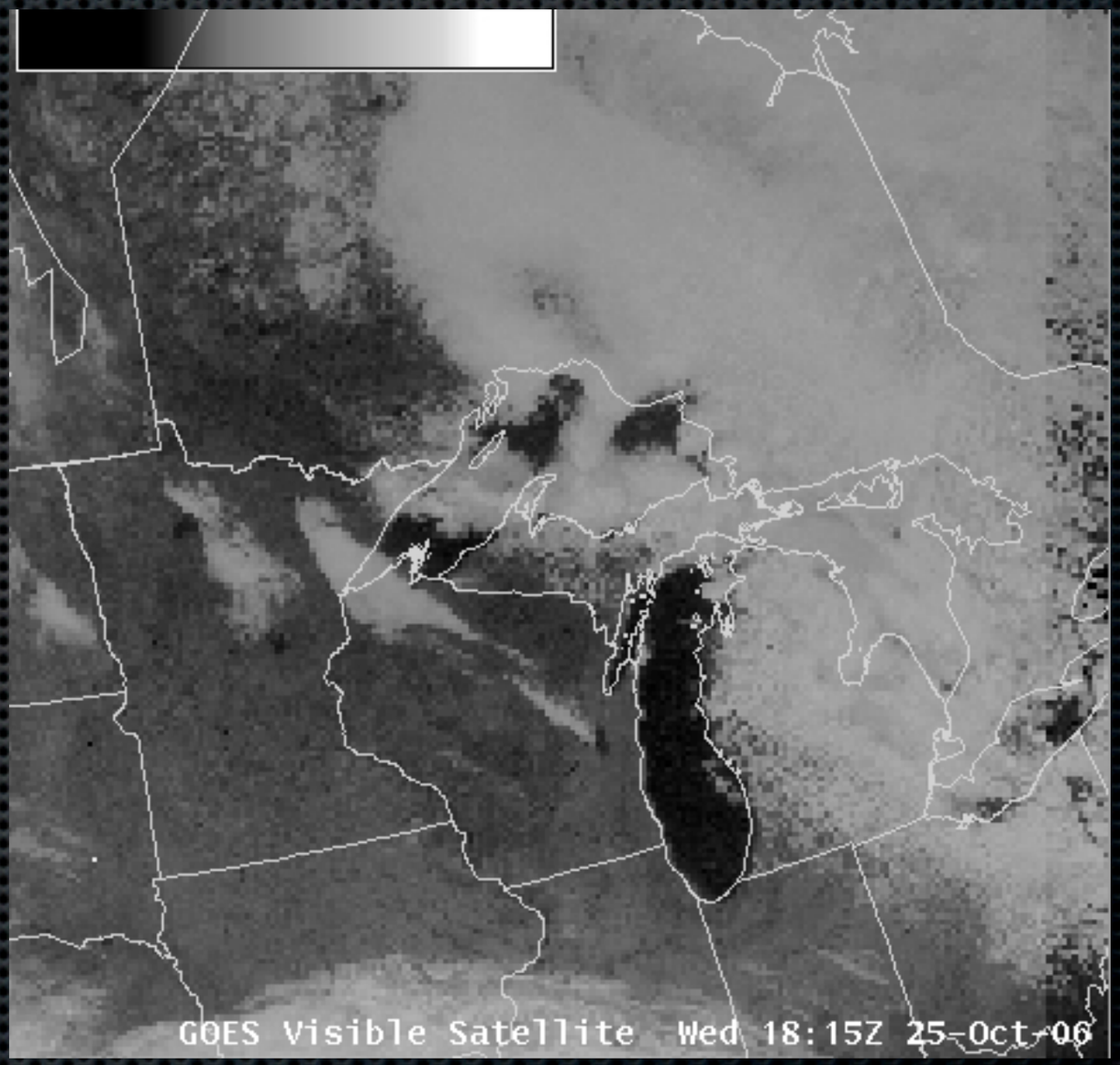


MODIS visible channel



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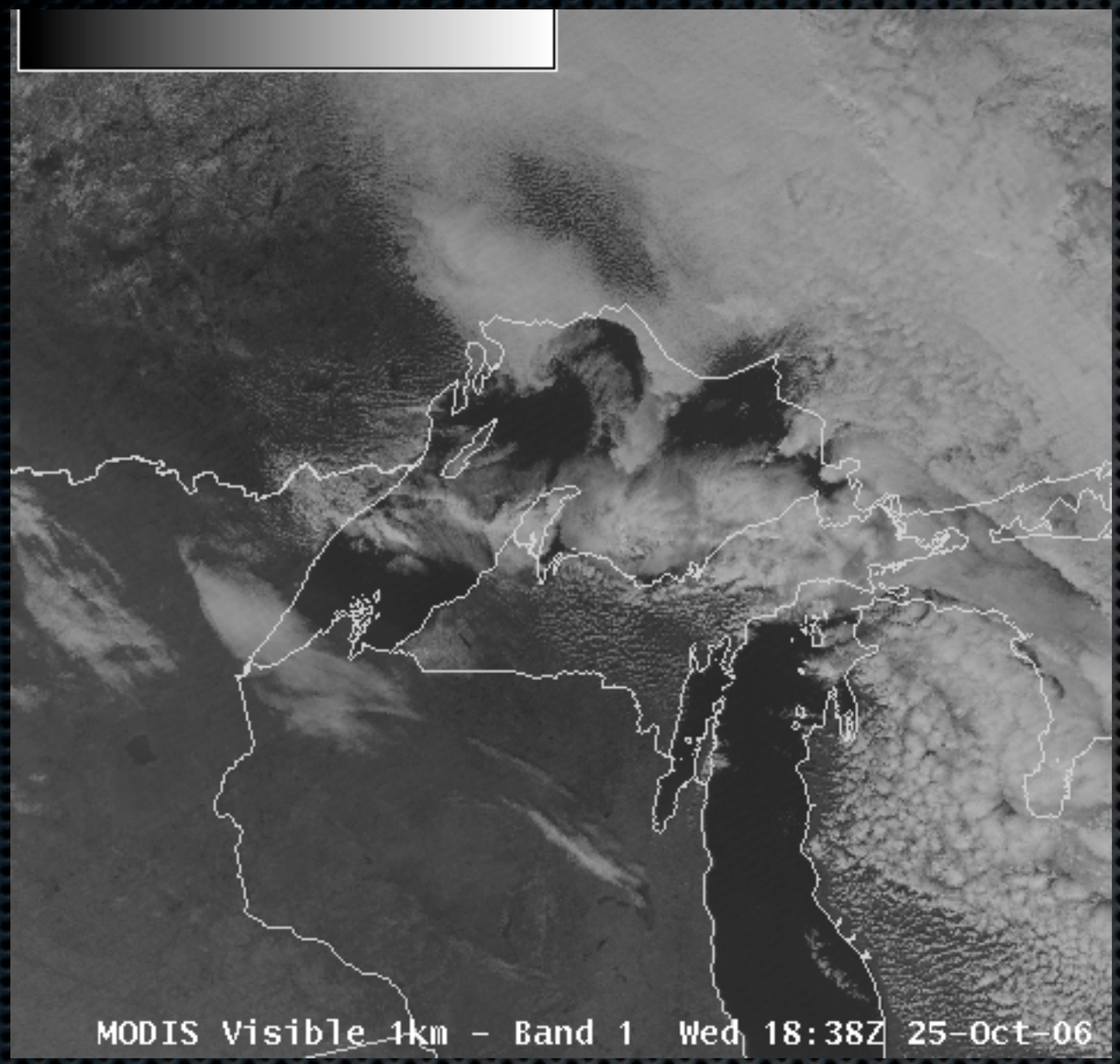

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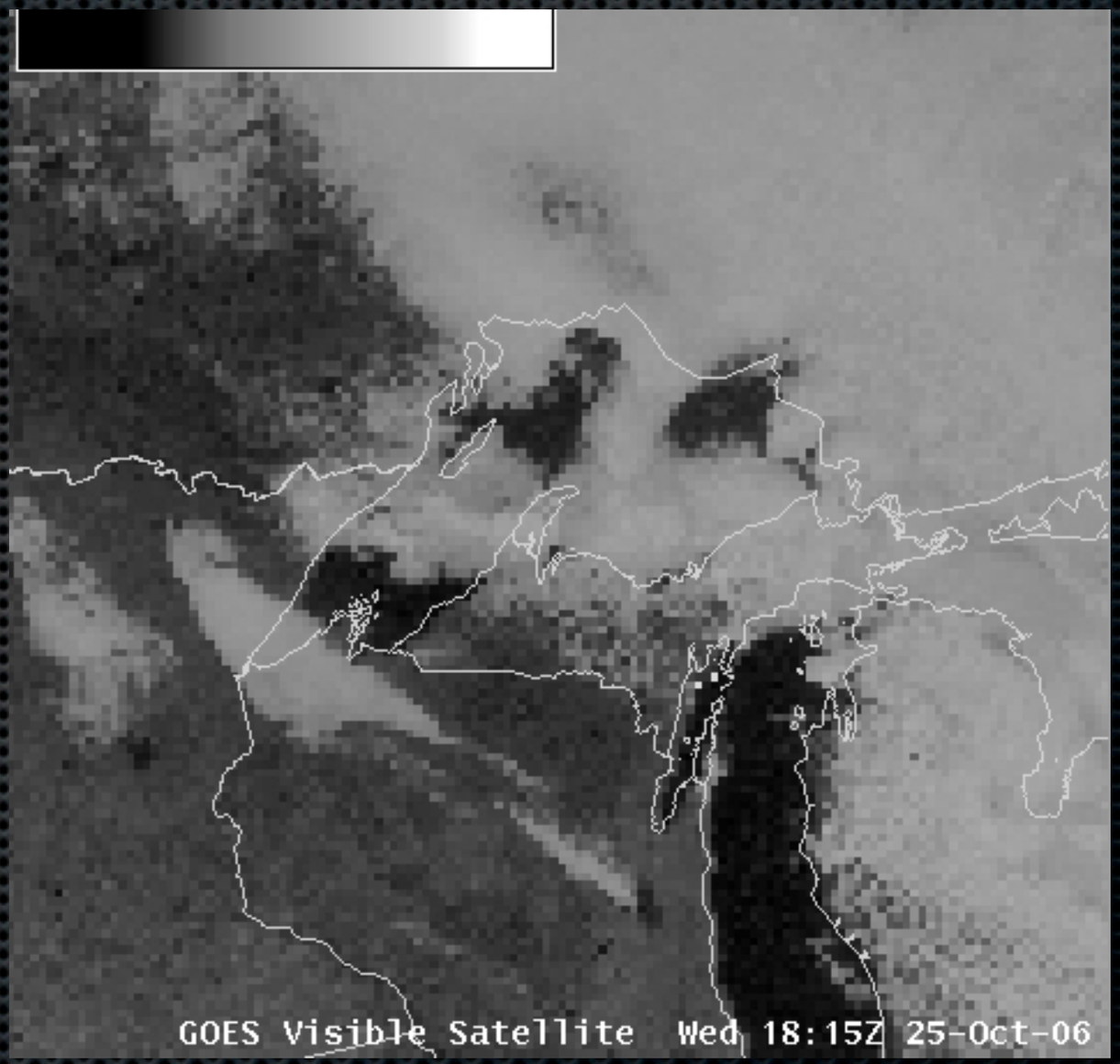

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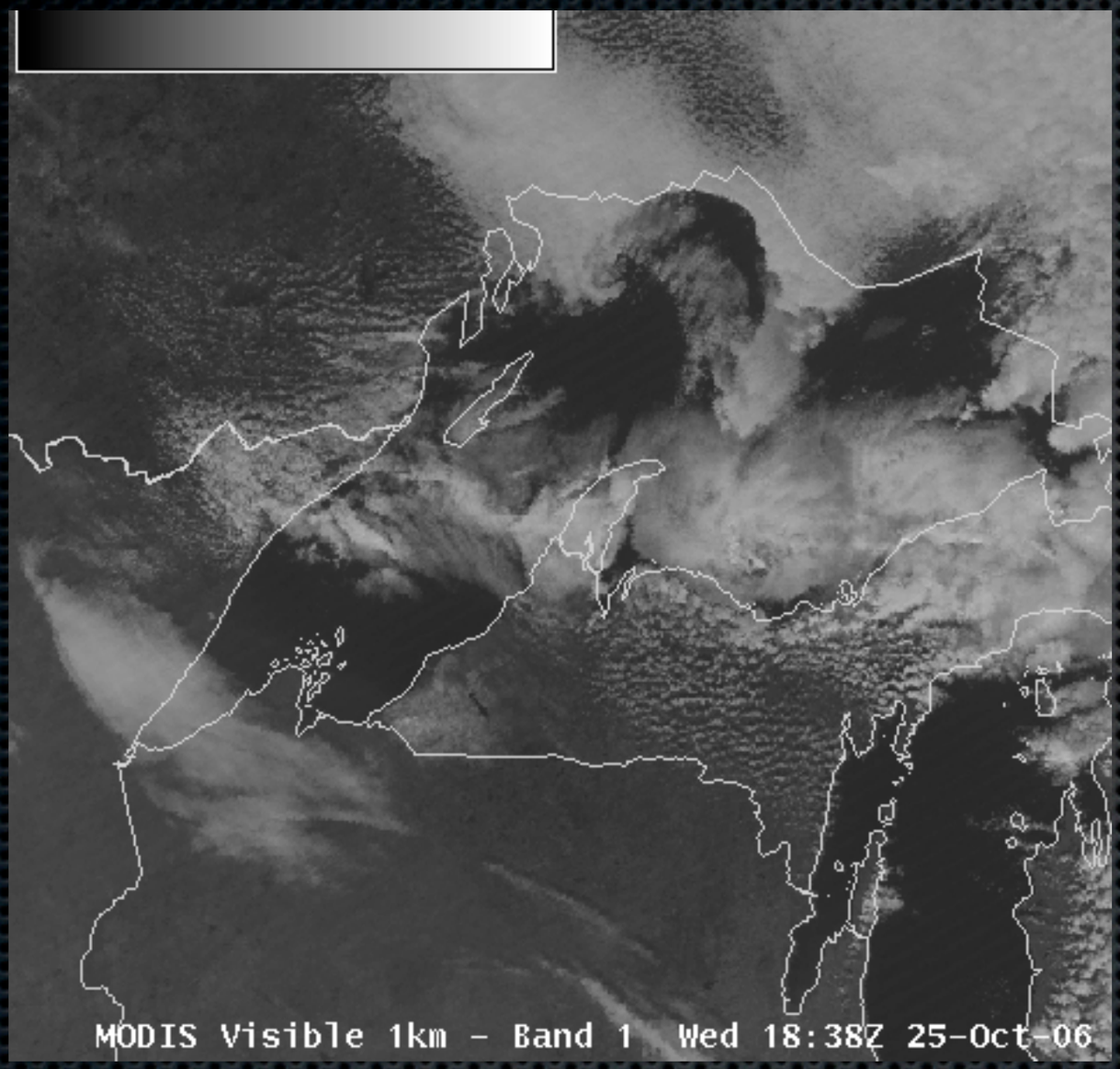

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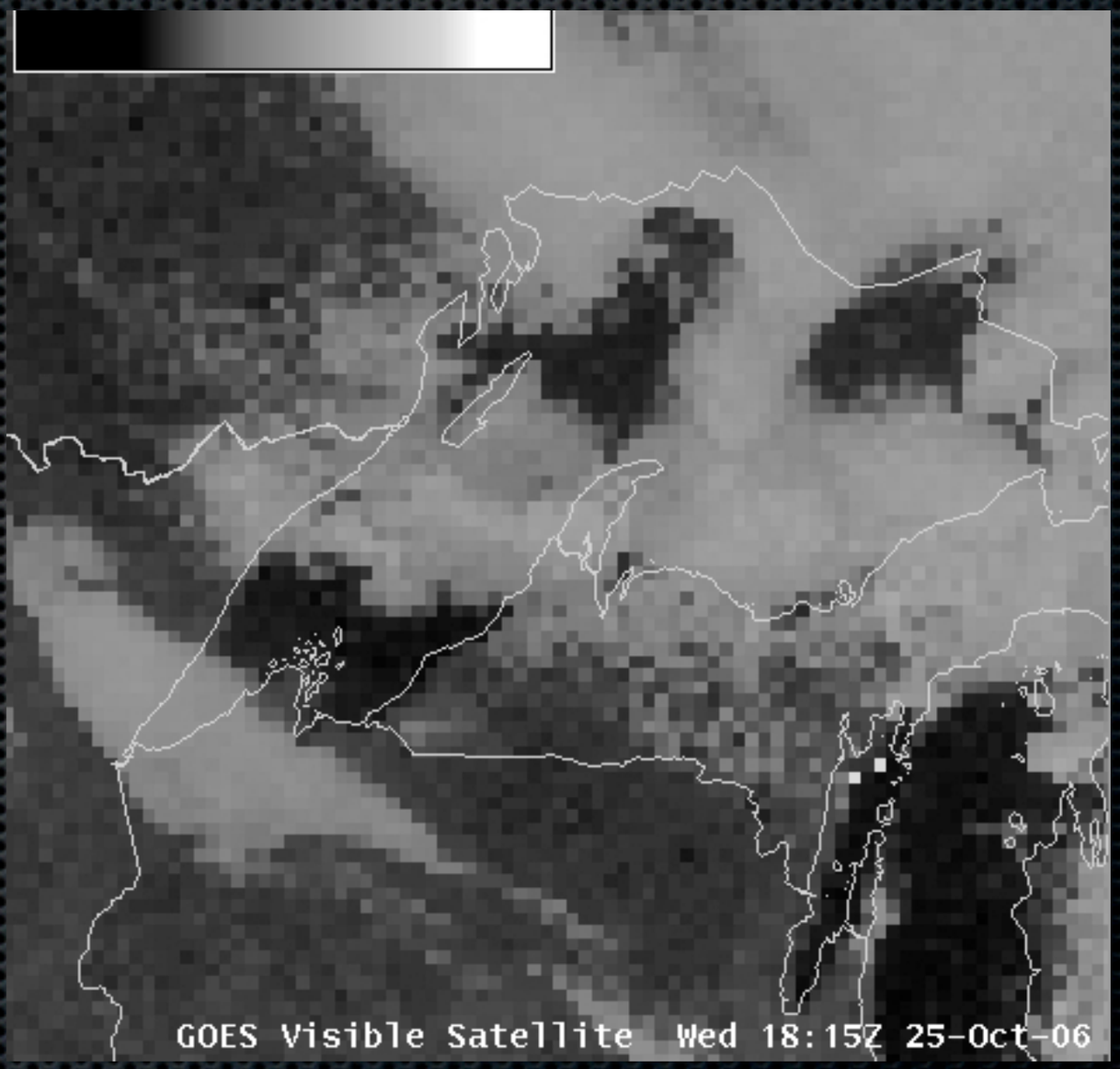


GOES visible channel

MODIS Imagery in AWIPS

Band 1: Visible channel (0.6µm)

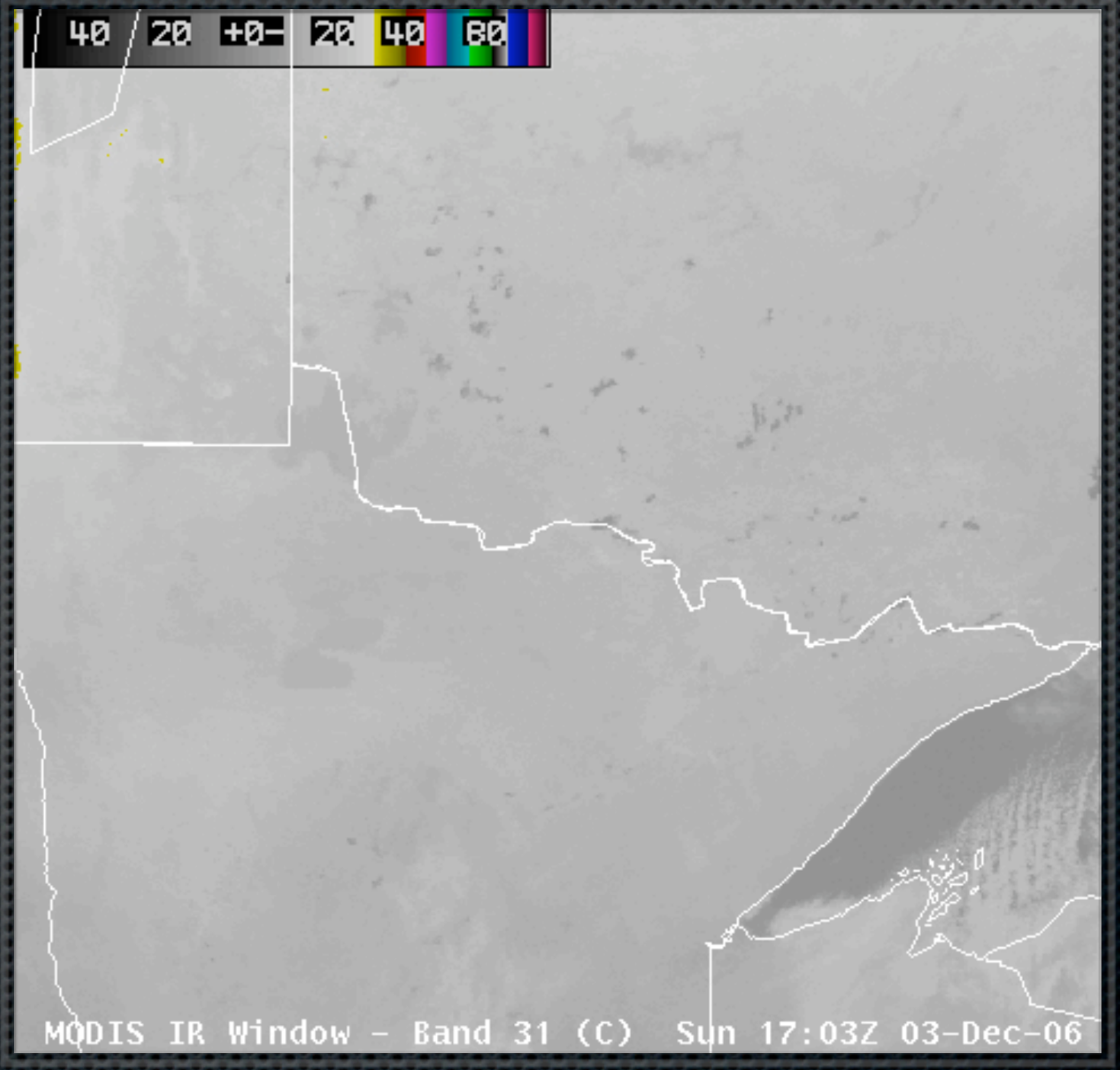
MODIS Imagery in AWIPS

Band 7: Snow/Ice channel (2.1μm)

Snow/ice vs. supercooled water cloud discrimination

MODIS Imagery in AWIPS

Band 7: Snow/Ice channel (2.1μm)



Snow/ice vs. supercooled water cloud discrimination

MODIS Imagery in AWIPS

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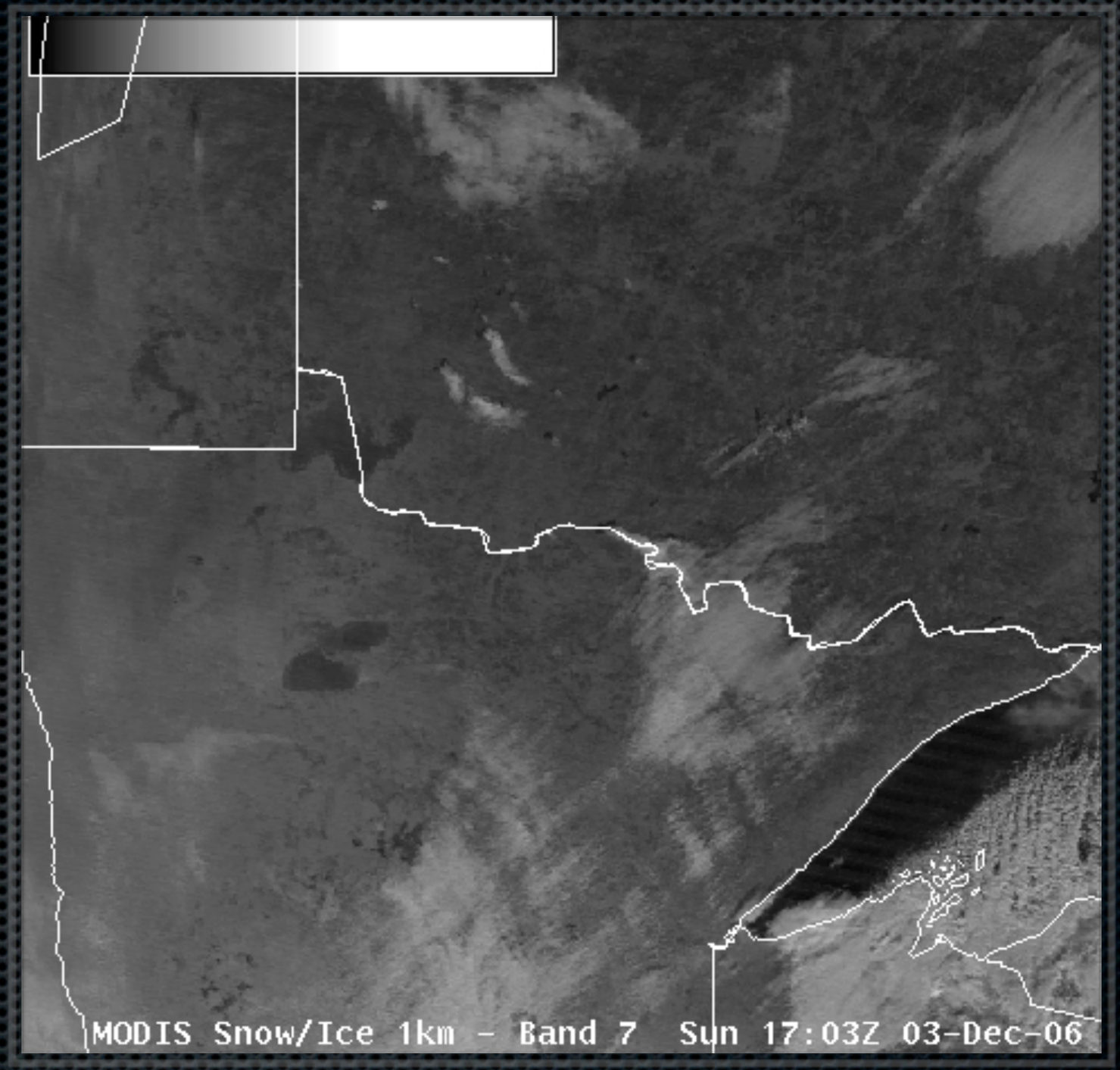

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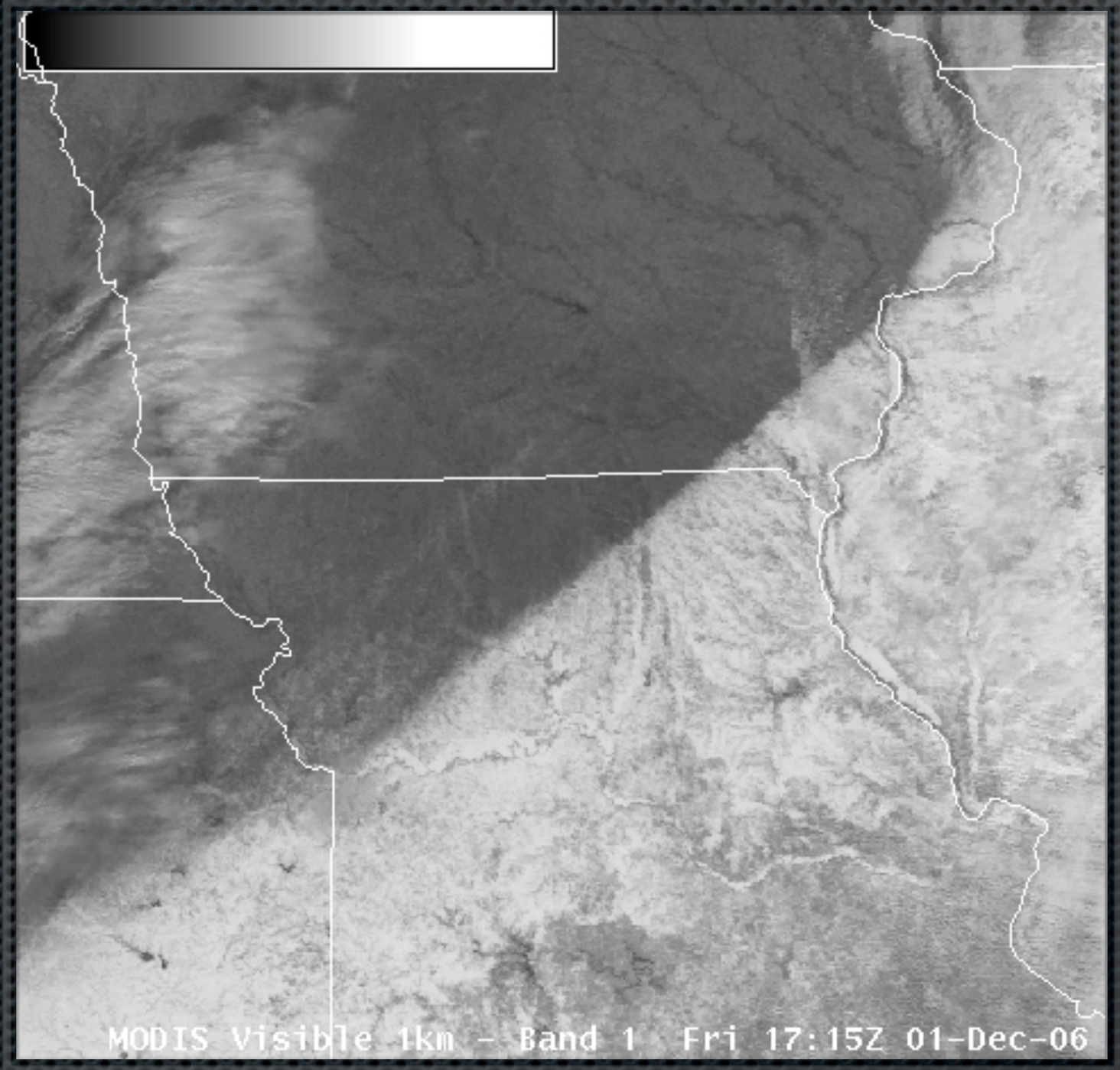

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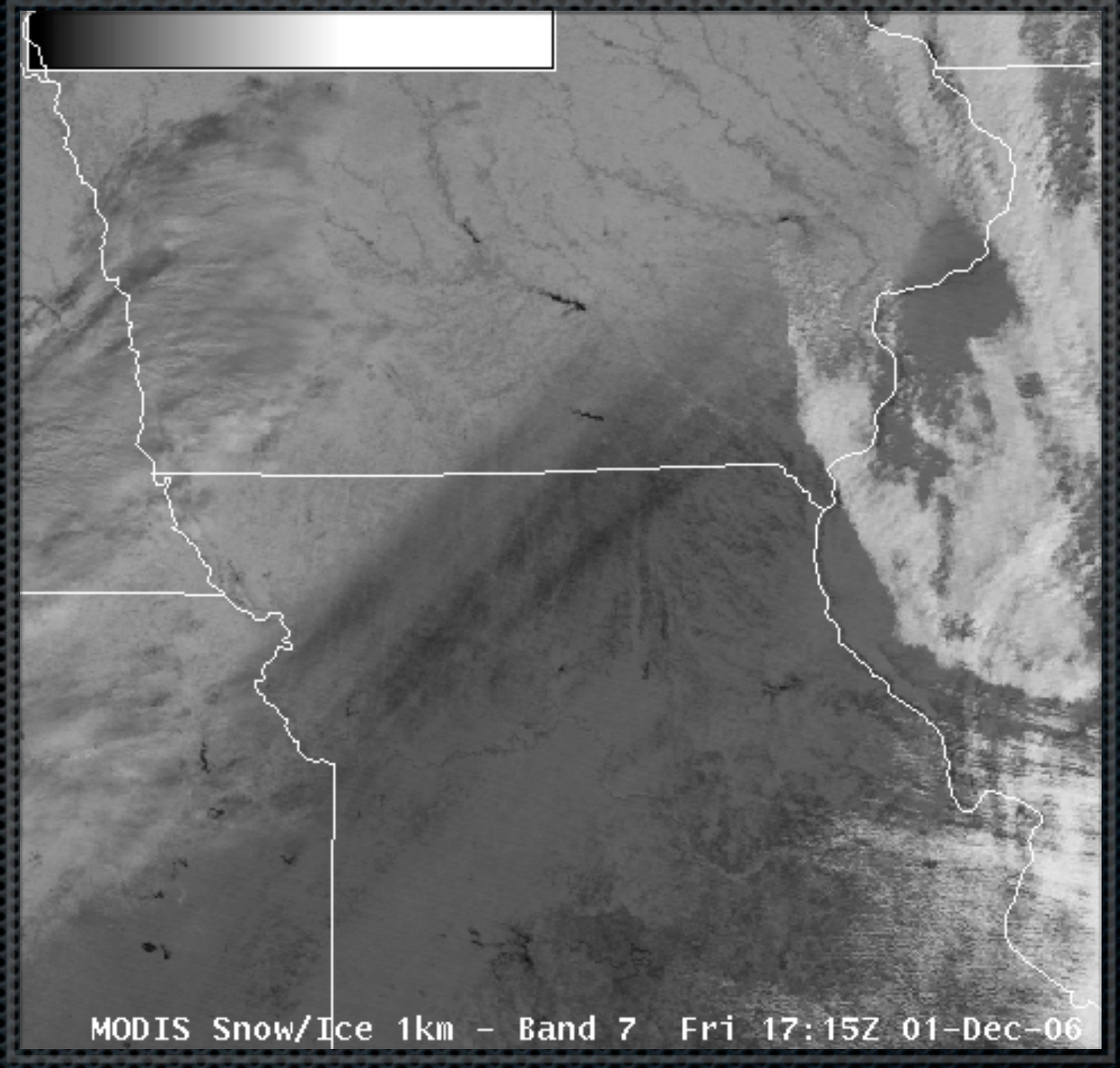
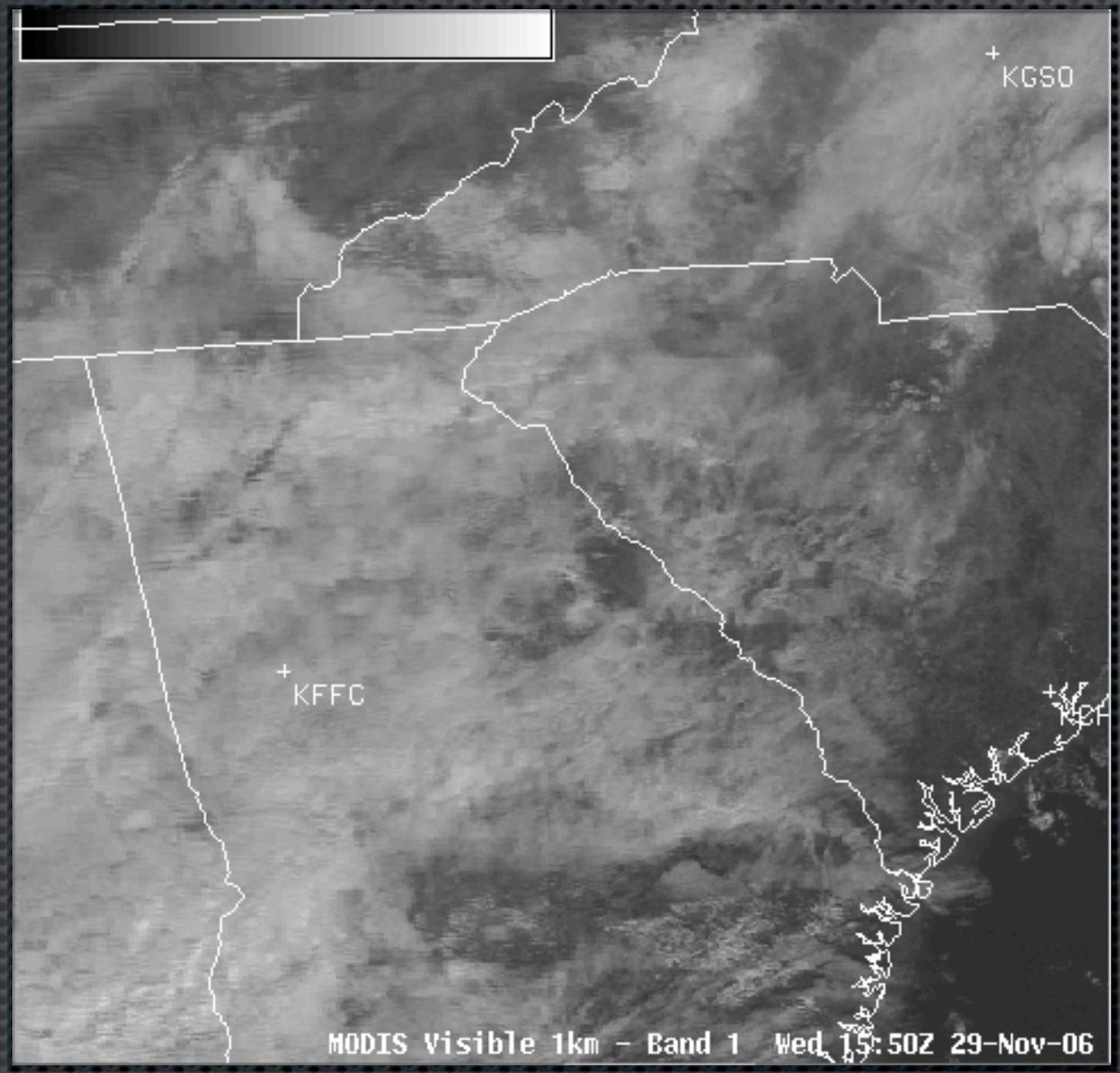


Snow/ice vs. supercooled water cloud discrimination

MODIS Imagery in AWIPS

Band 26: Cirrus detection (1.3μm)



MODIS Imagery in AWIPS

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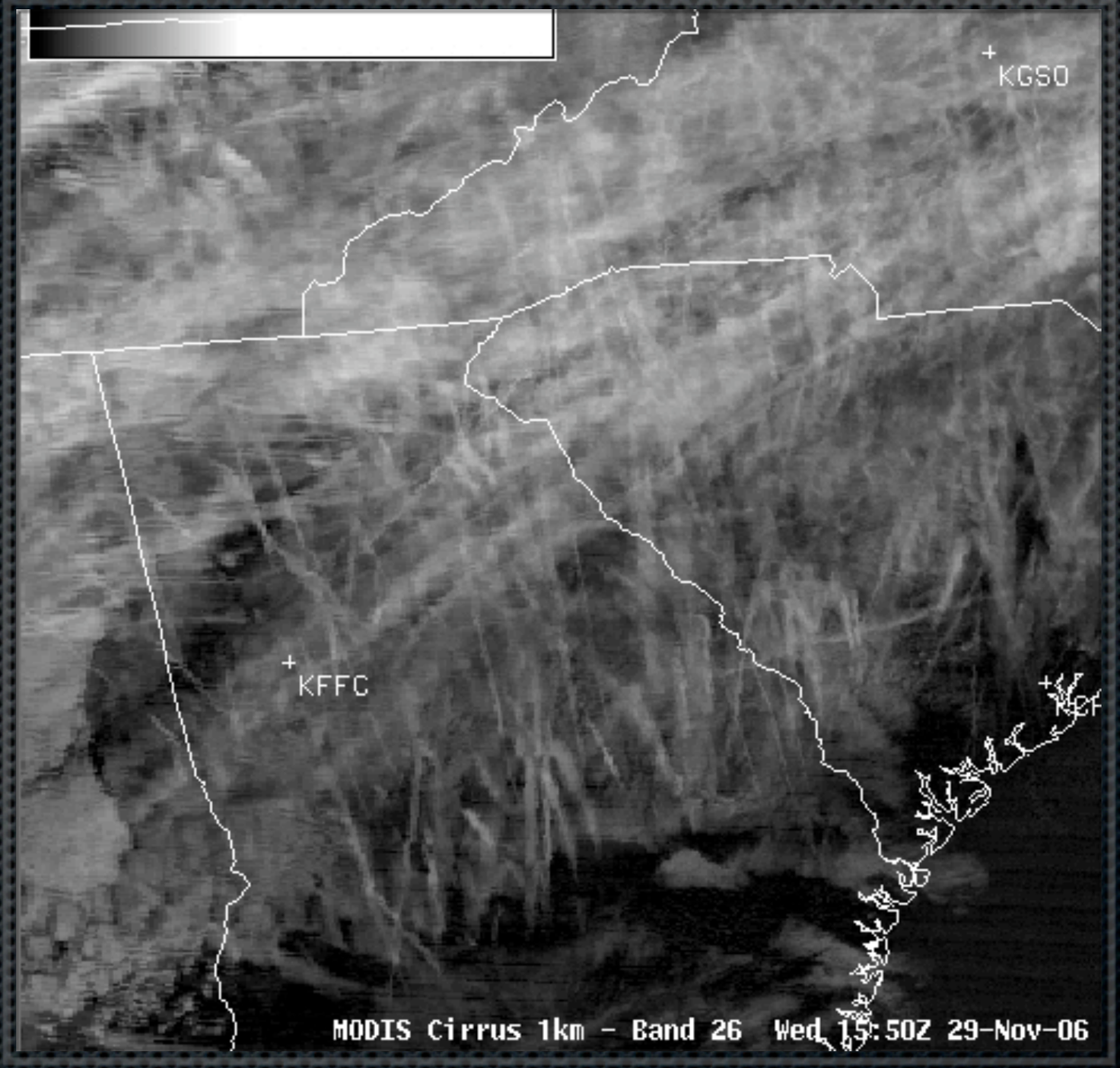
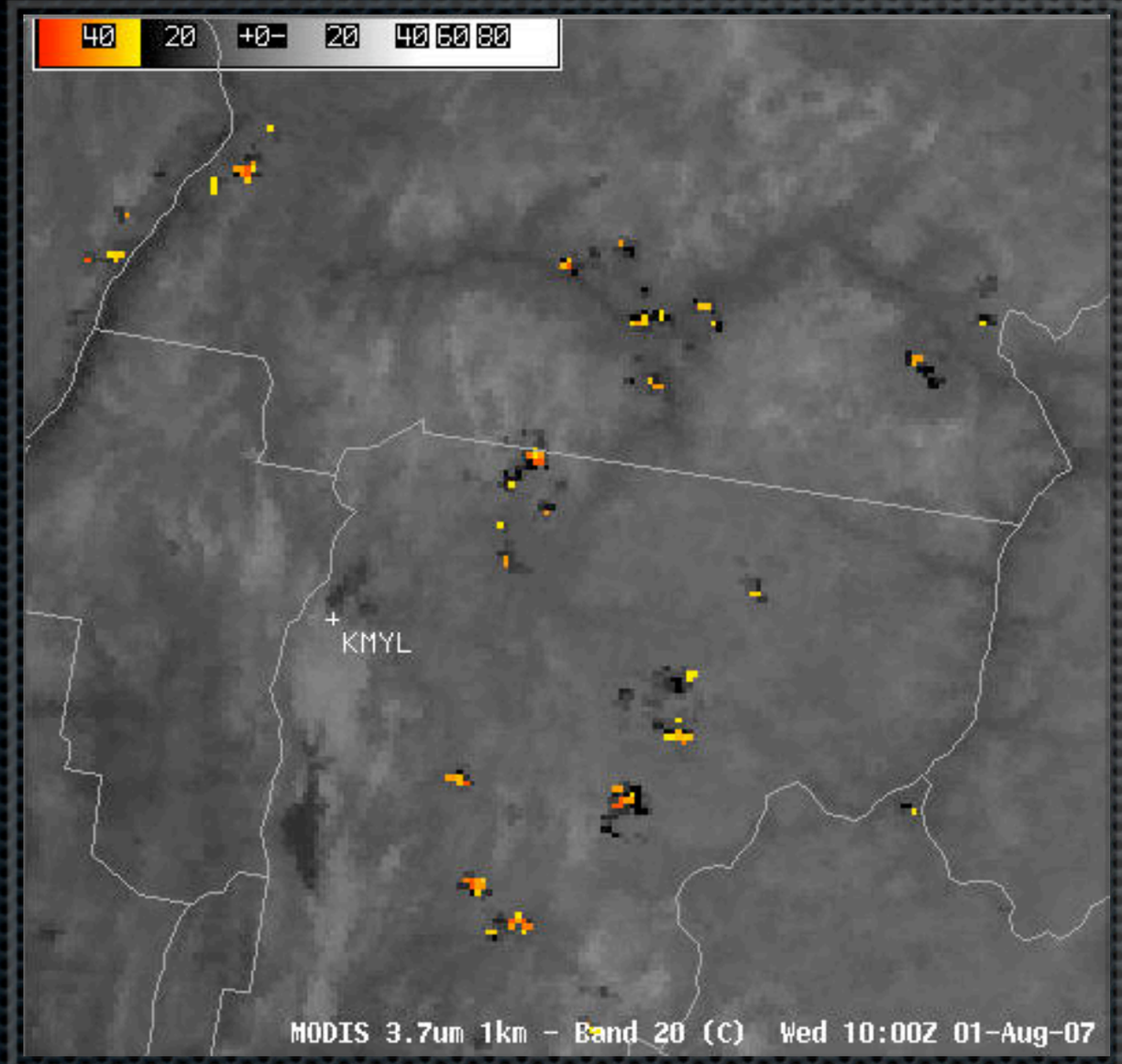
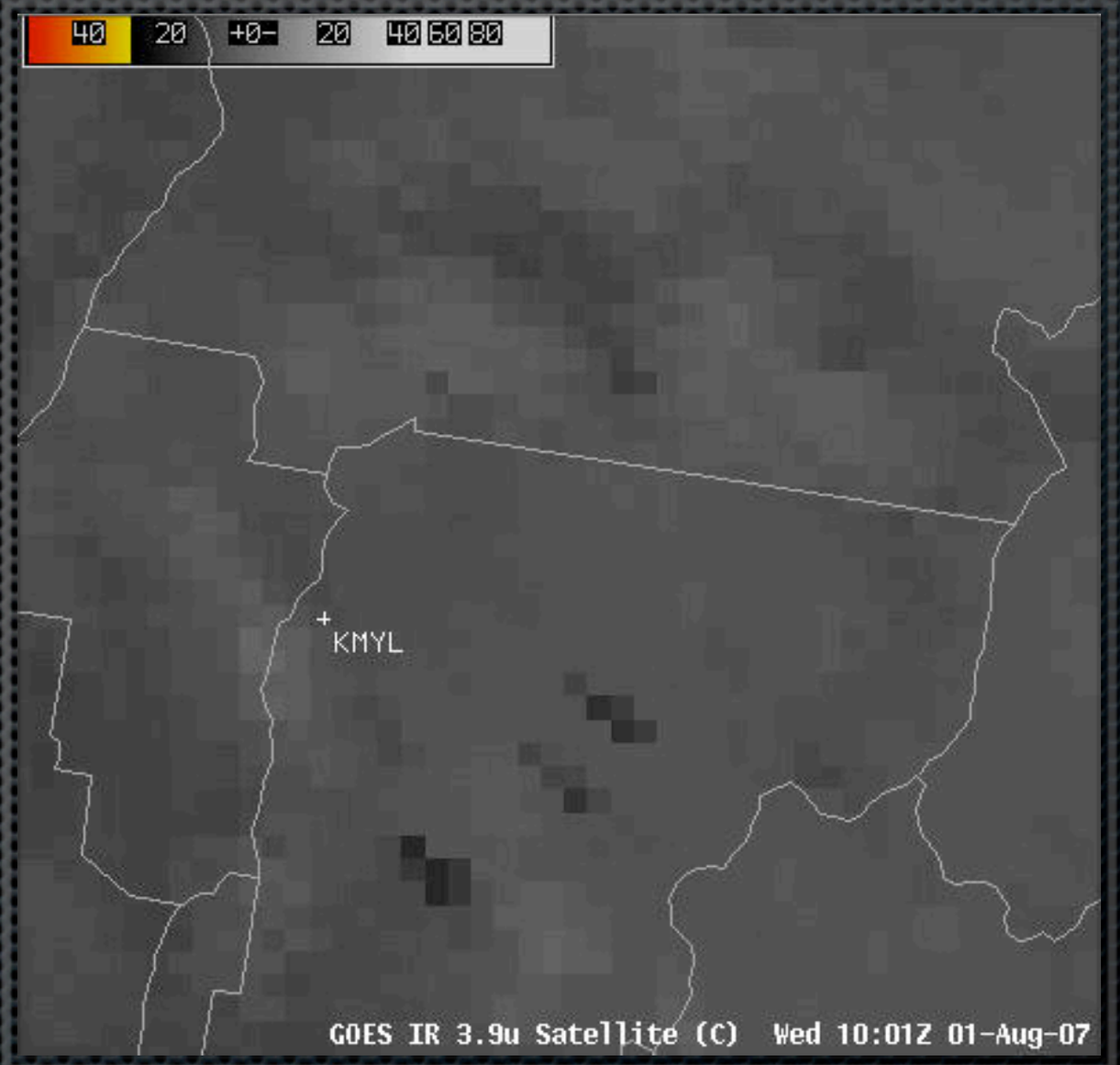


MODIS Imagery in AWIPS

Band 20: Shortwave IR (3.7μm)



1-km MODIS

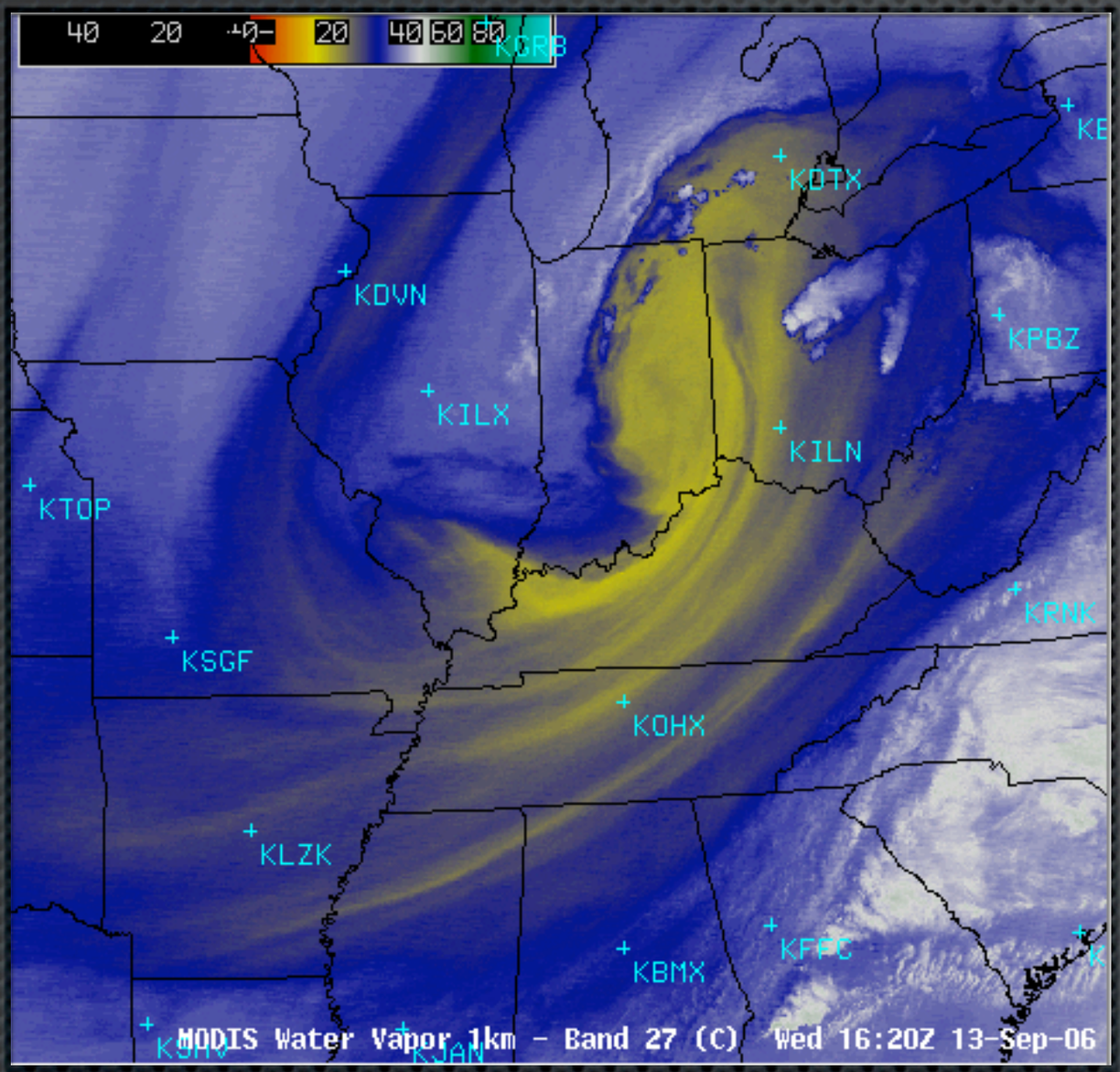


4-km GOES

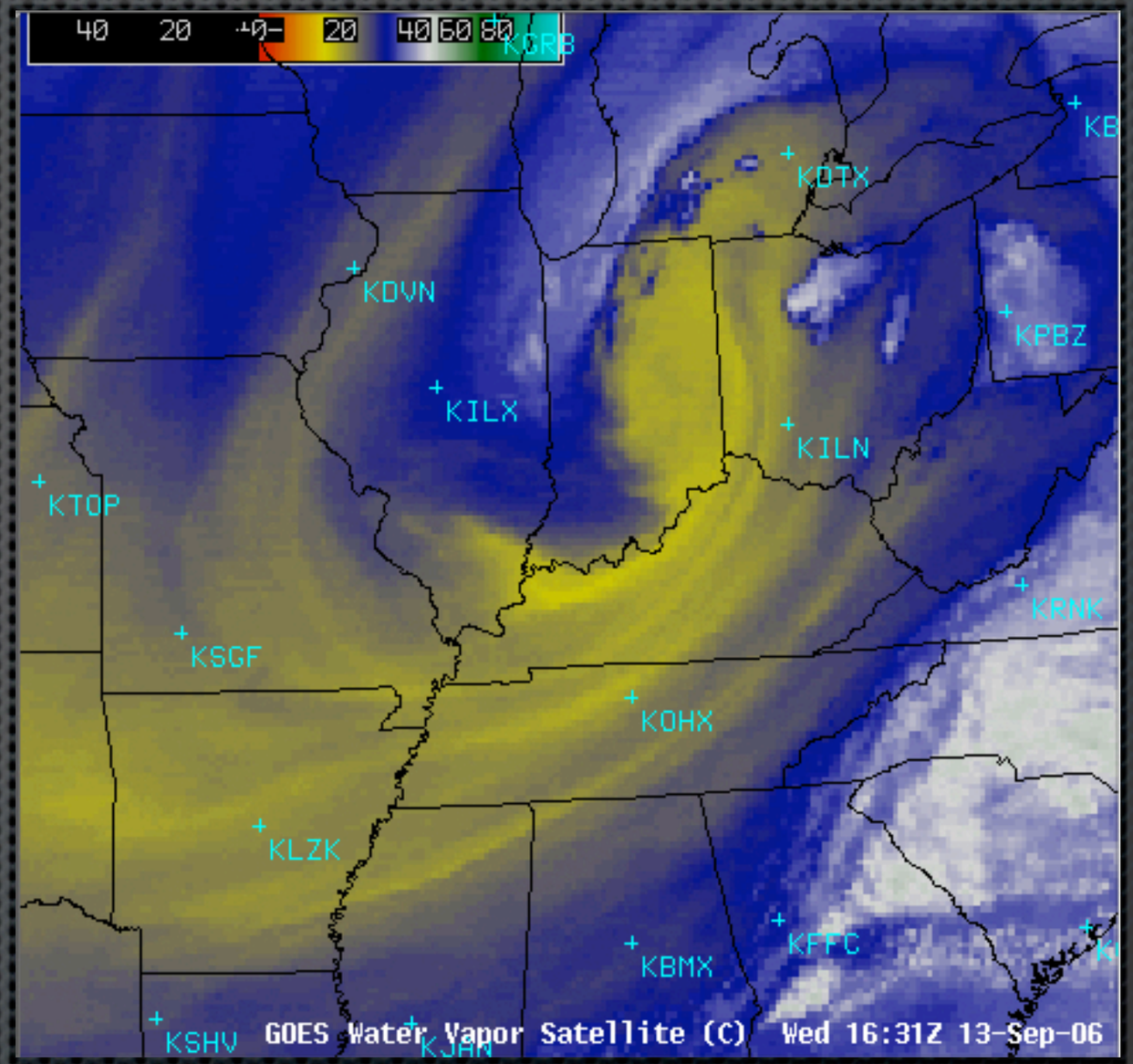
Improved fire detection capability

MODIS Imagery in AWIPS

Band 27: Water vapor (6.7μm)



1-km MODIS

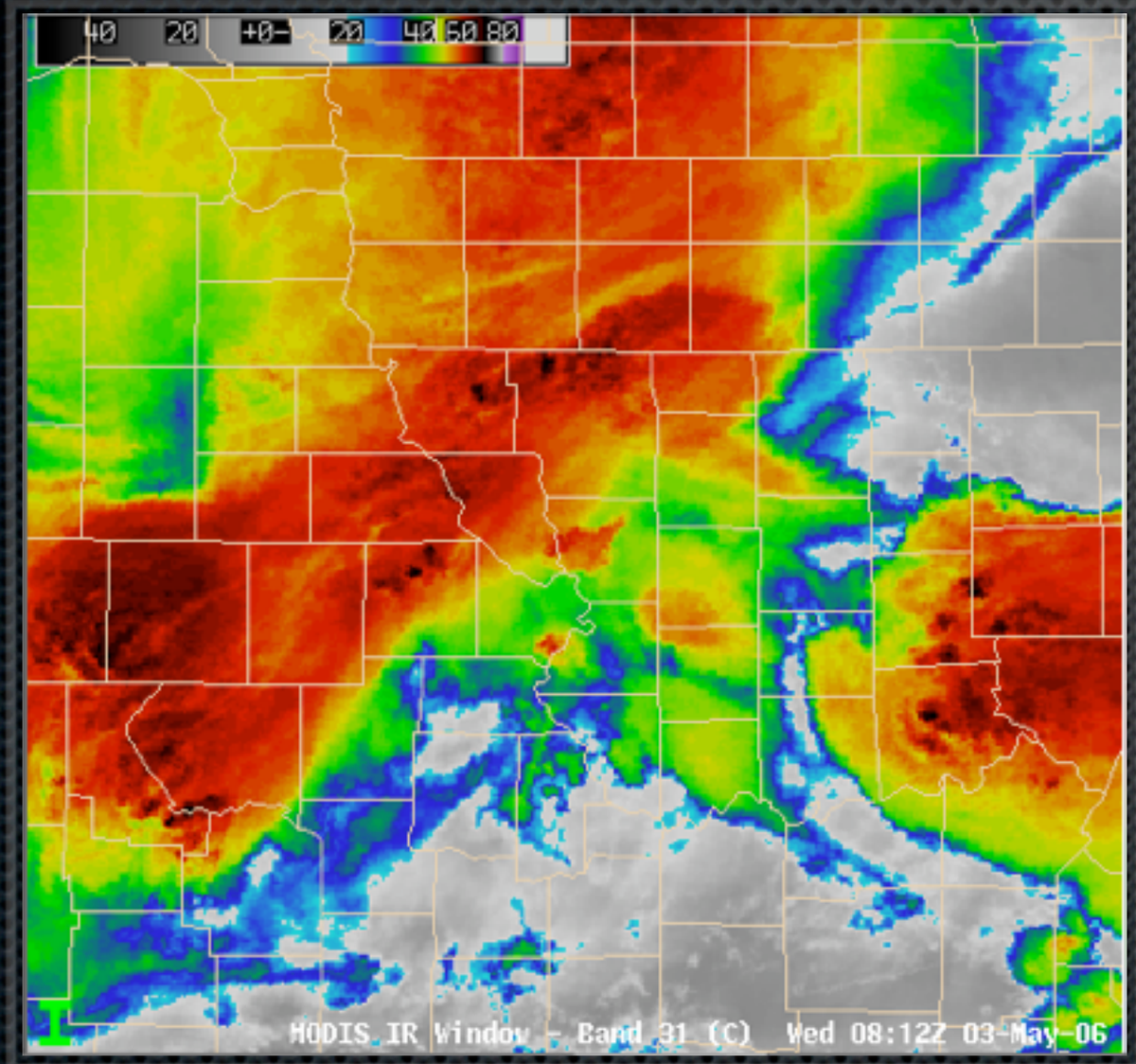


4-km GOES

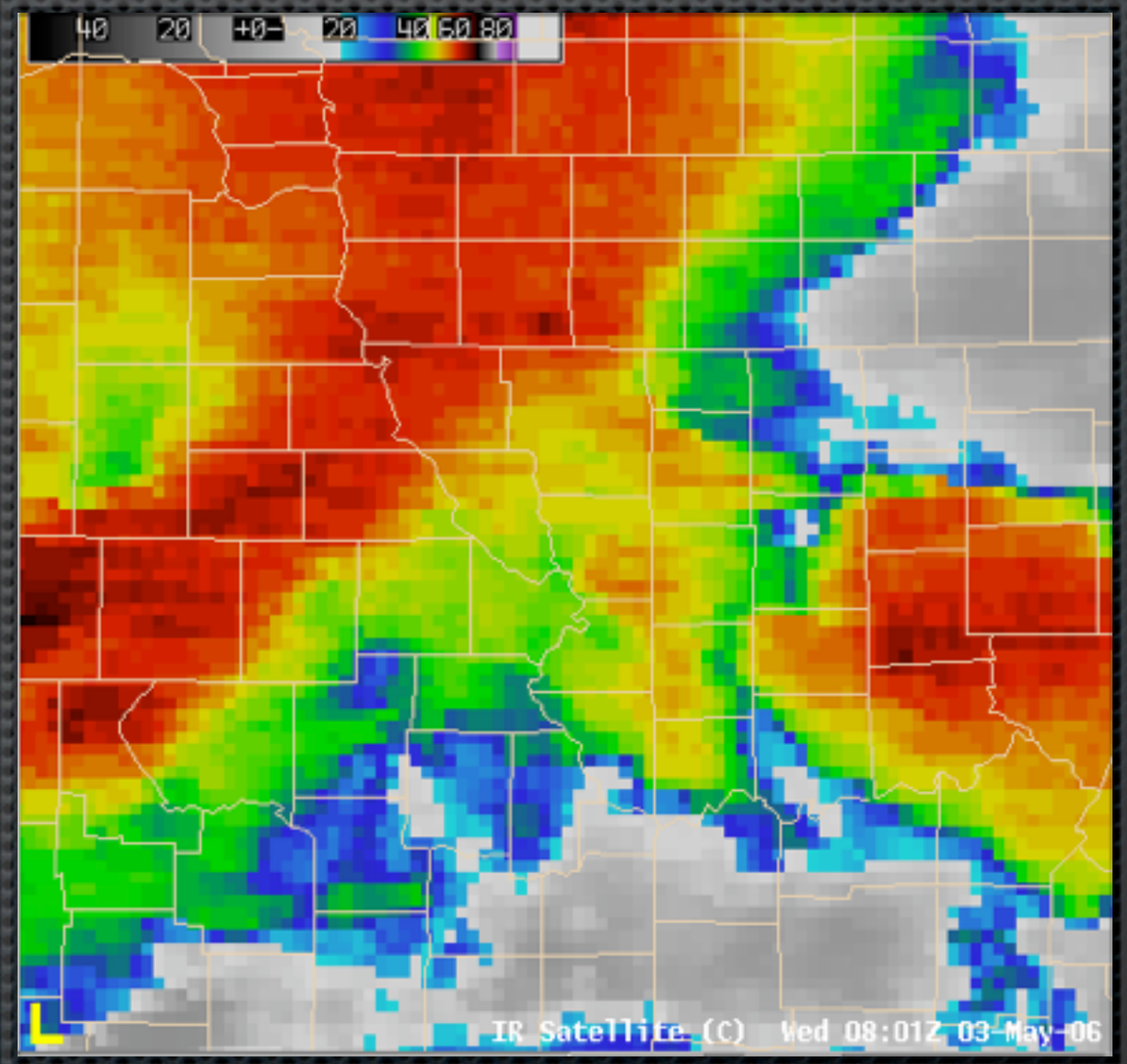
Improved feature identification (jet streaks, turbulence, etc)

MODIS Imagery in AWIPS

Band 31: IR window (11.0μm)



1-km MODIS

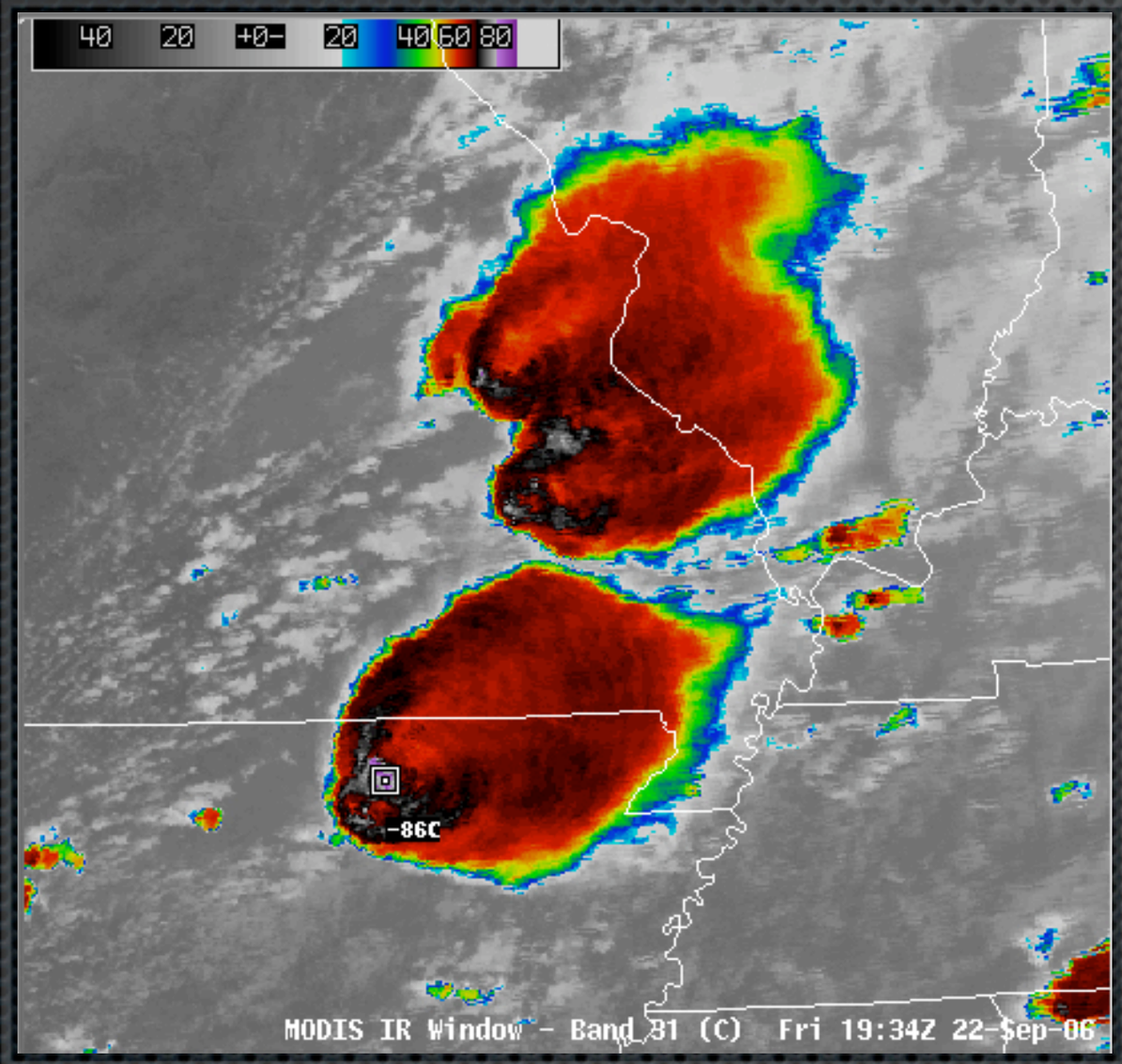


4-km GOES

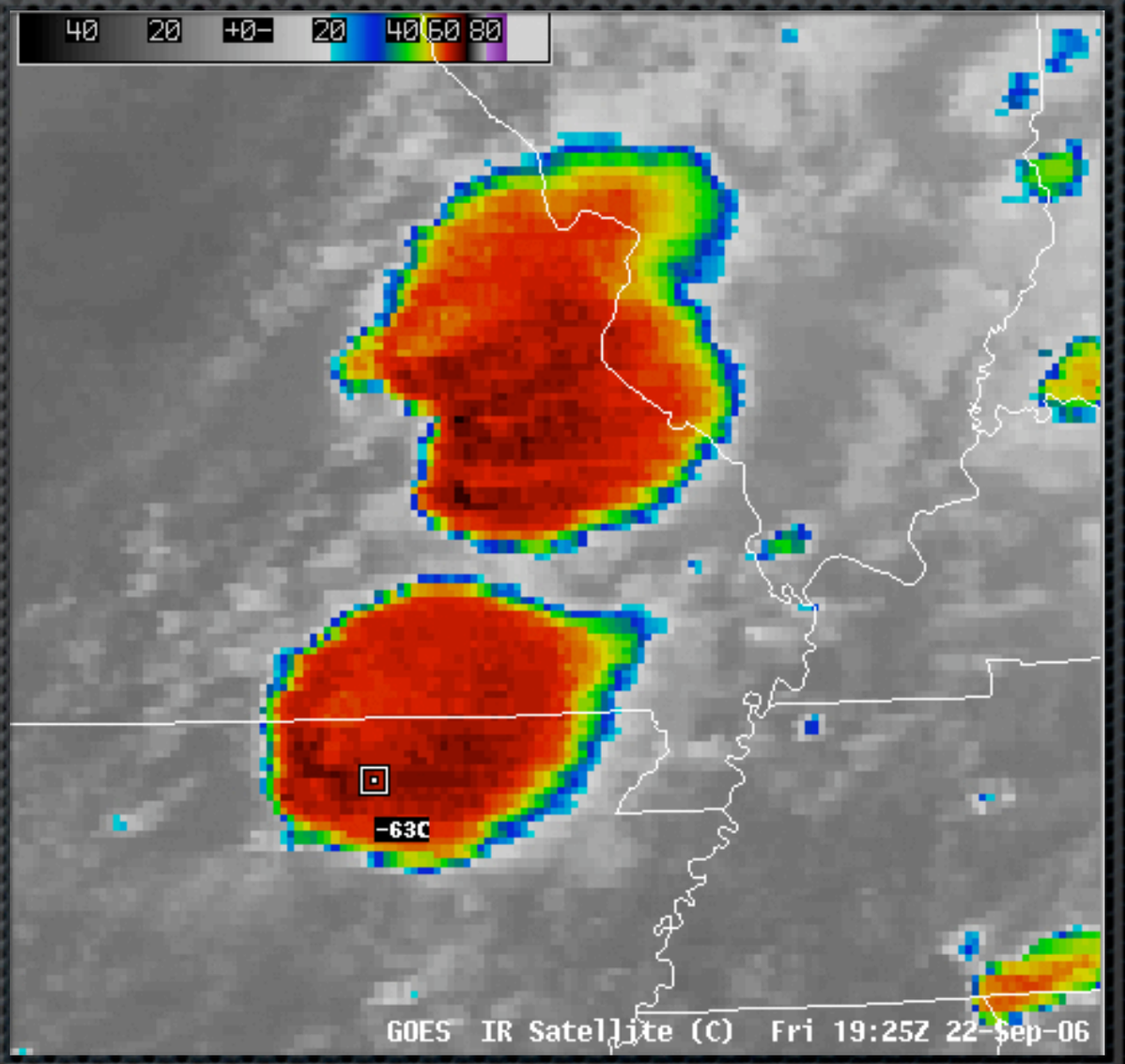
Improved feature identification (overshooting tops, enhanced-v)

MODIS Imagery in AWIPS

Band 31: IR window (11.0μm)



1-km MODIS

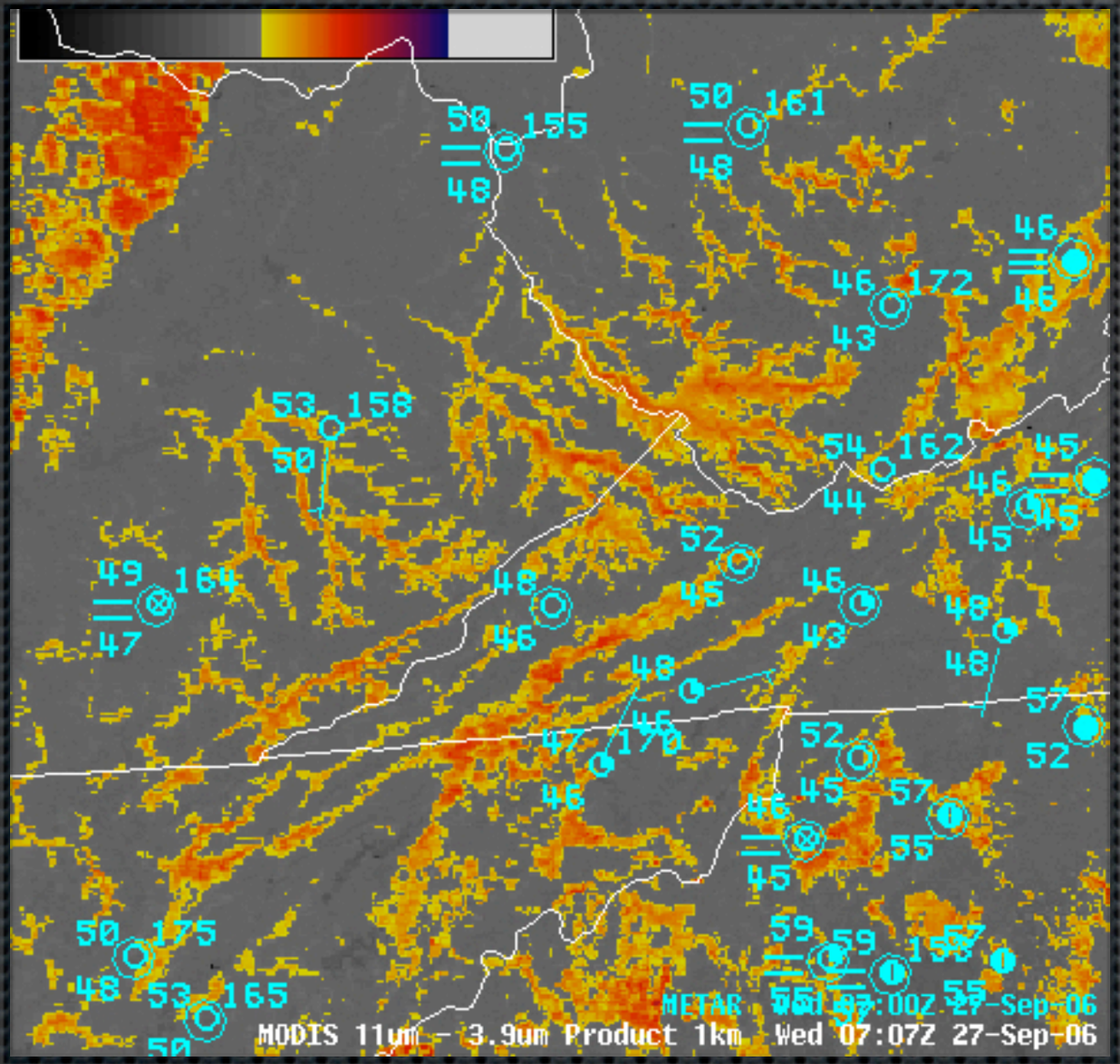


4-km GOES

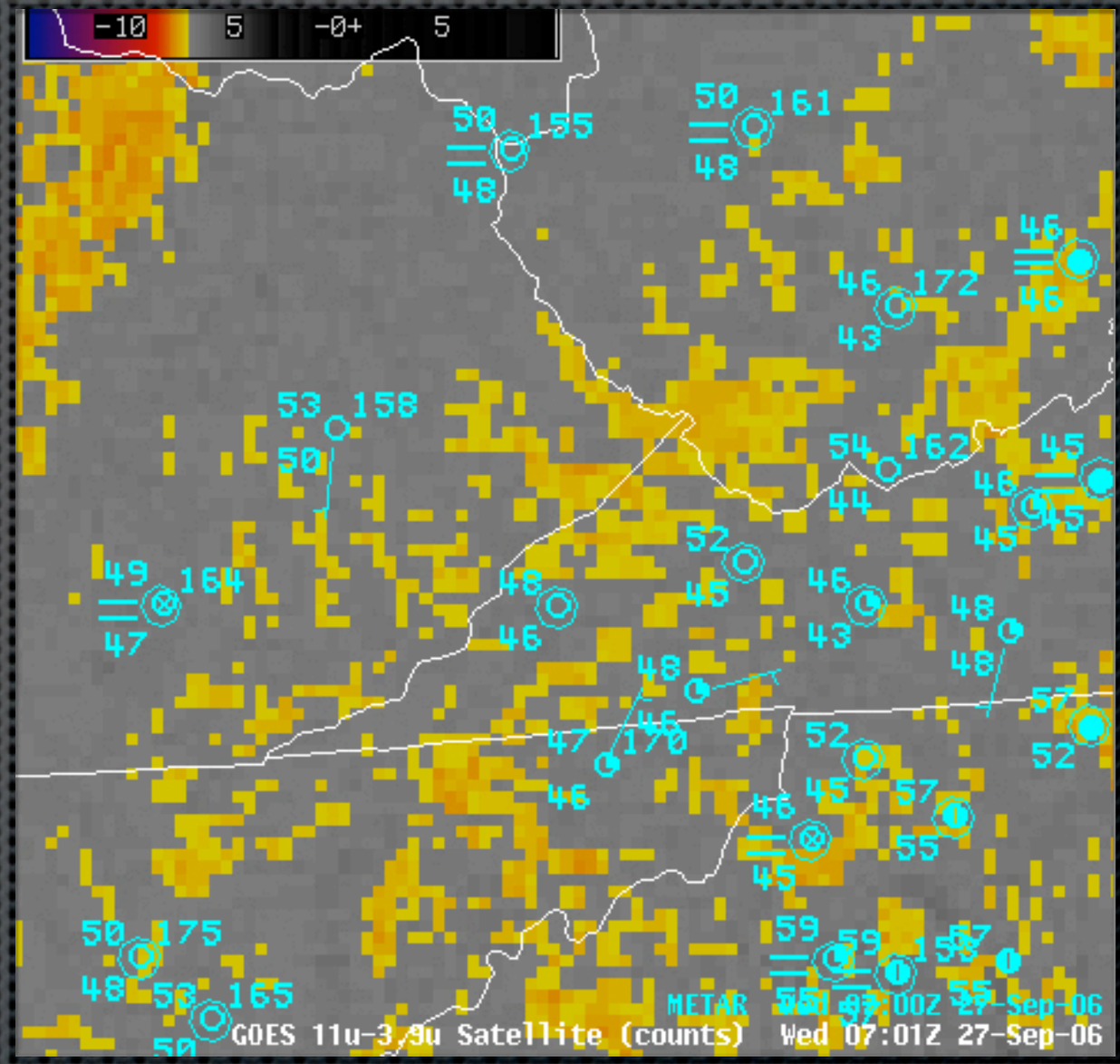
Improved feature identification (overshooting tops, enhanced-v)

MODIS Imagery in AWIPS

Fog/stratus product (11.0μm - 3.7μm)



1-km MODIS

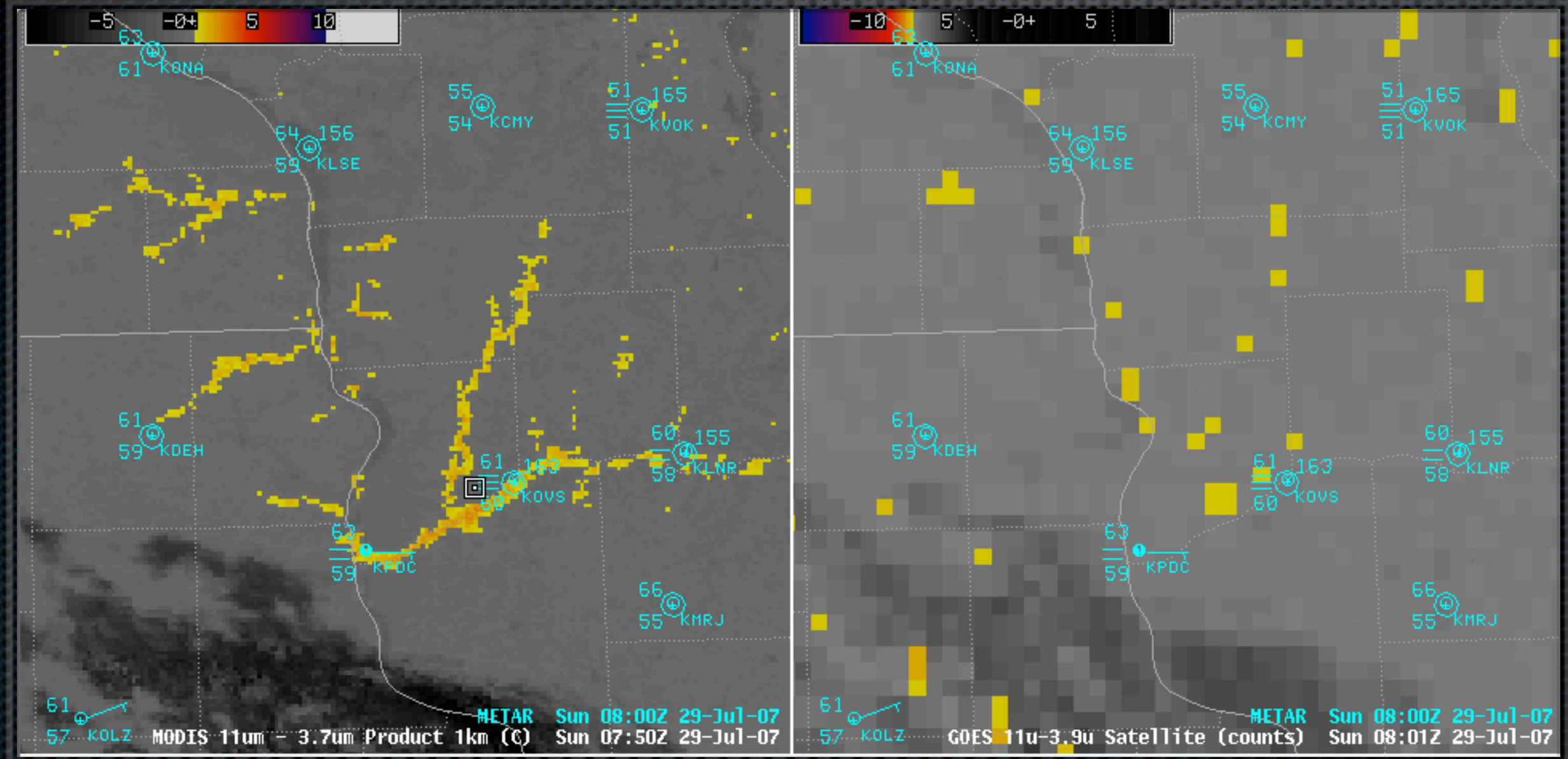


4-km GOES

Improved fog/stratus detection capability

MODIS Imagery in AWIPS

Fog/stratus product (11.0μm - 3.7μm)



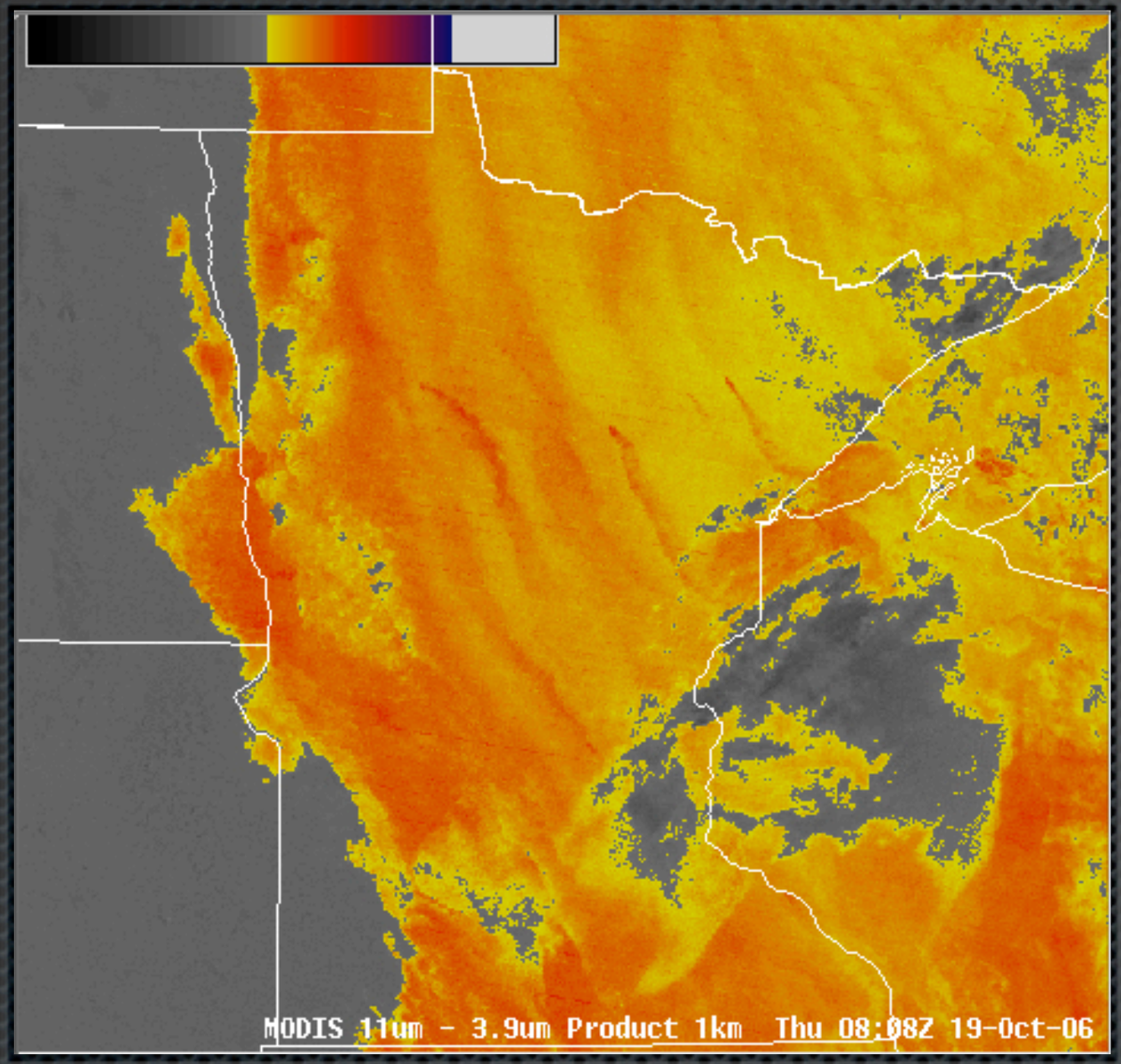
1-km MODIS

4-km GOES

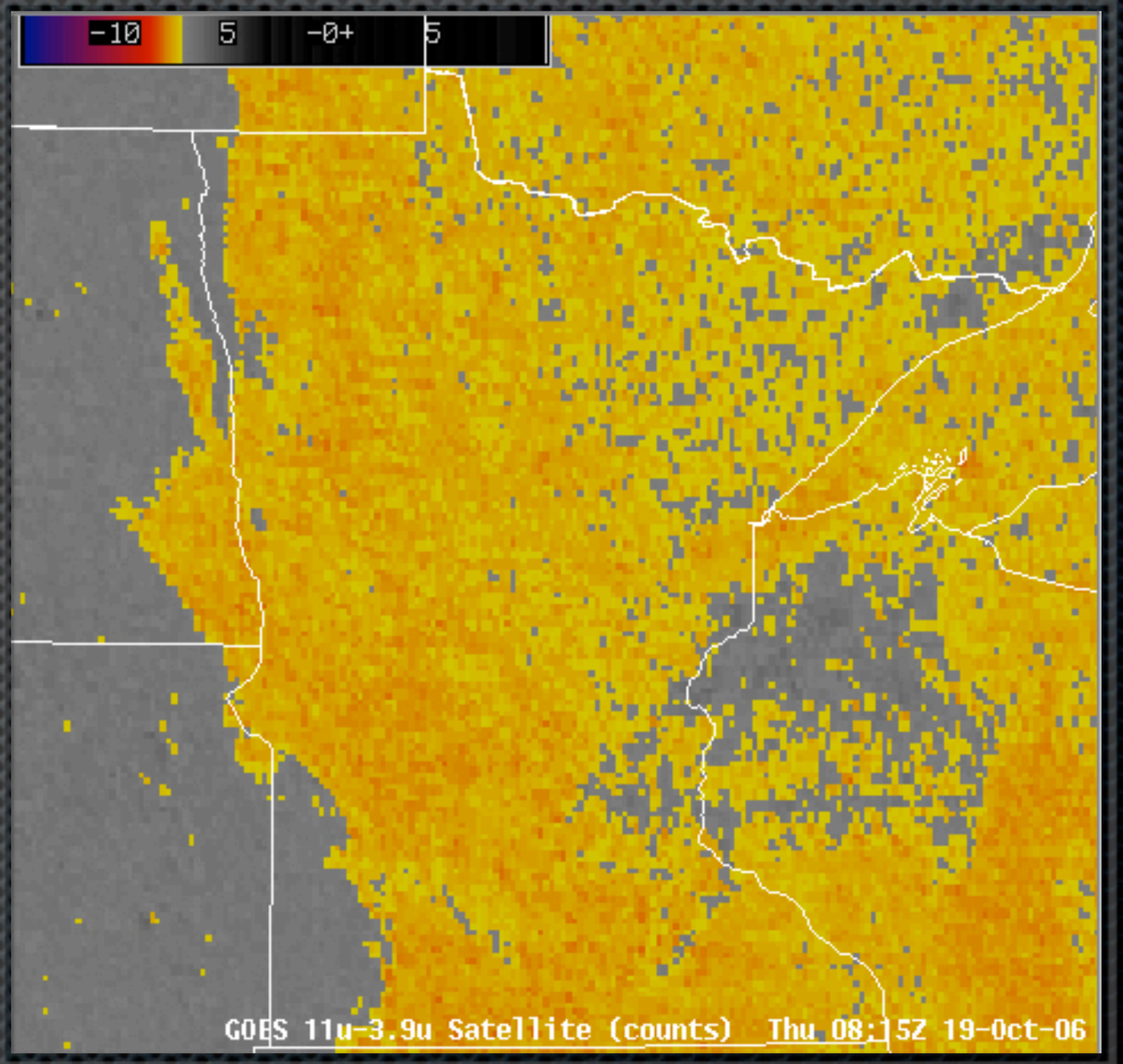
Improved fog/stratus detection capability

MODIS Imagery in AWIPS

Fog/stratus product (11.0μm - 3.7μm)



1-km MODIS

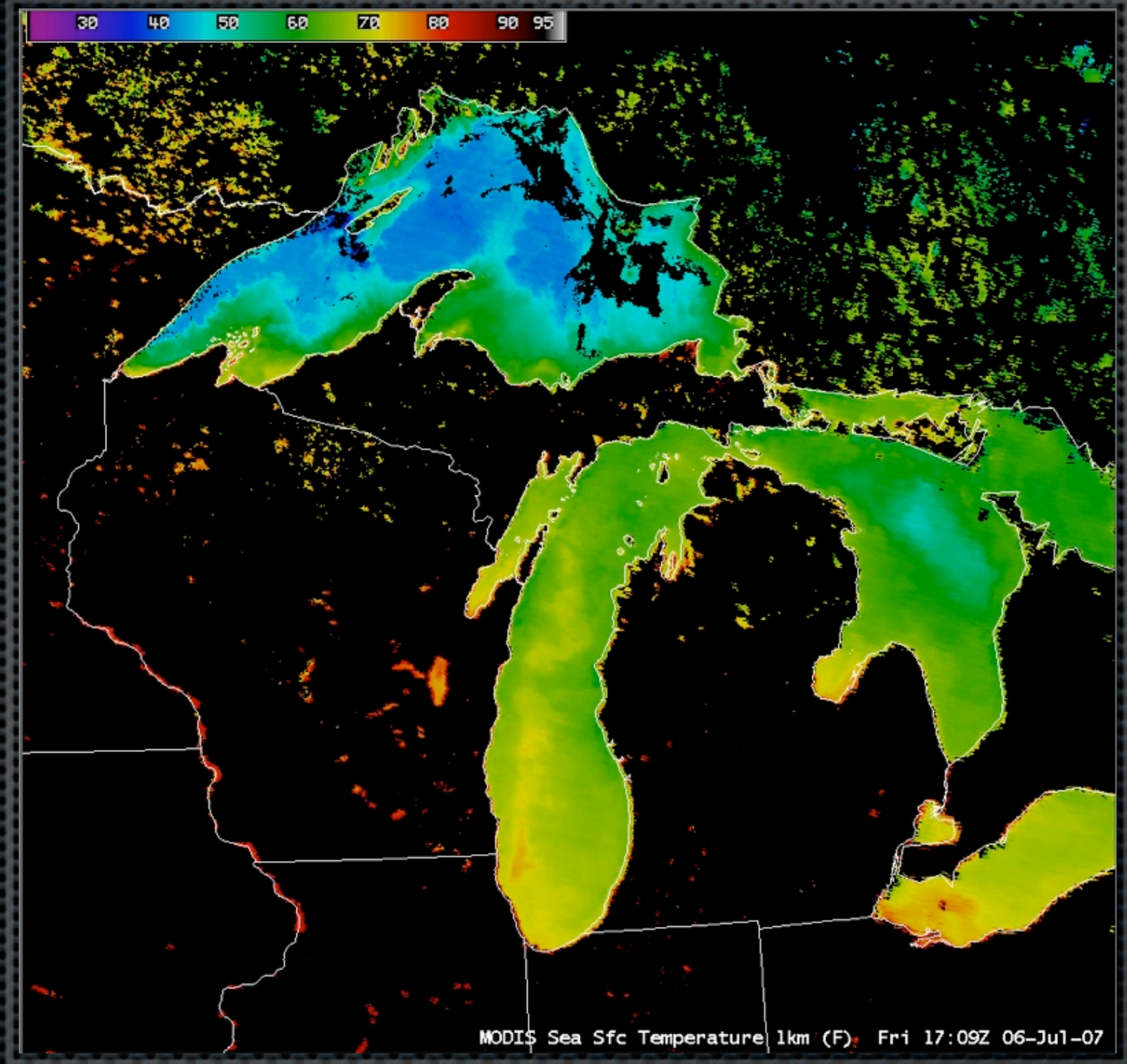


4-km GOES

Improved fog/stratus detection capability

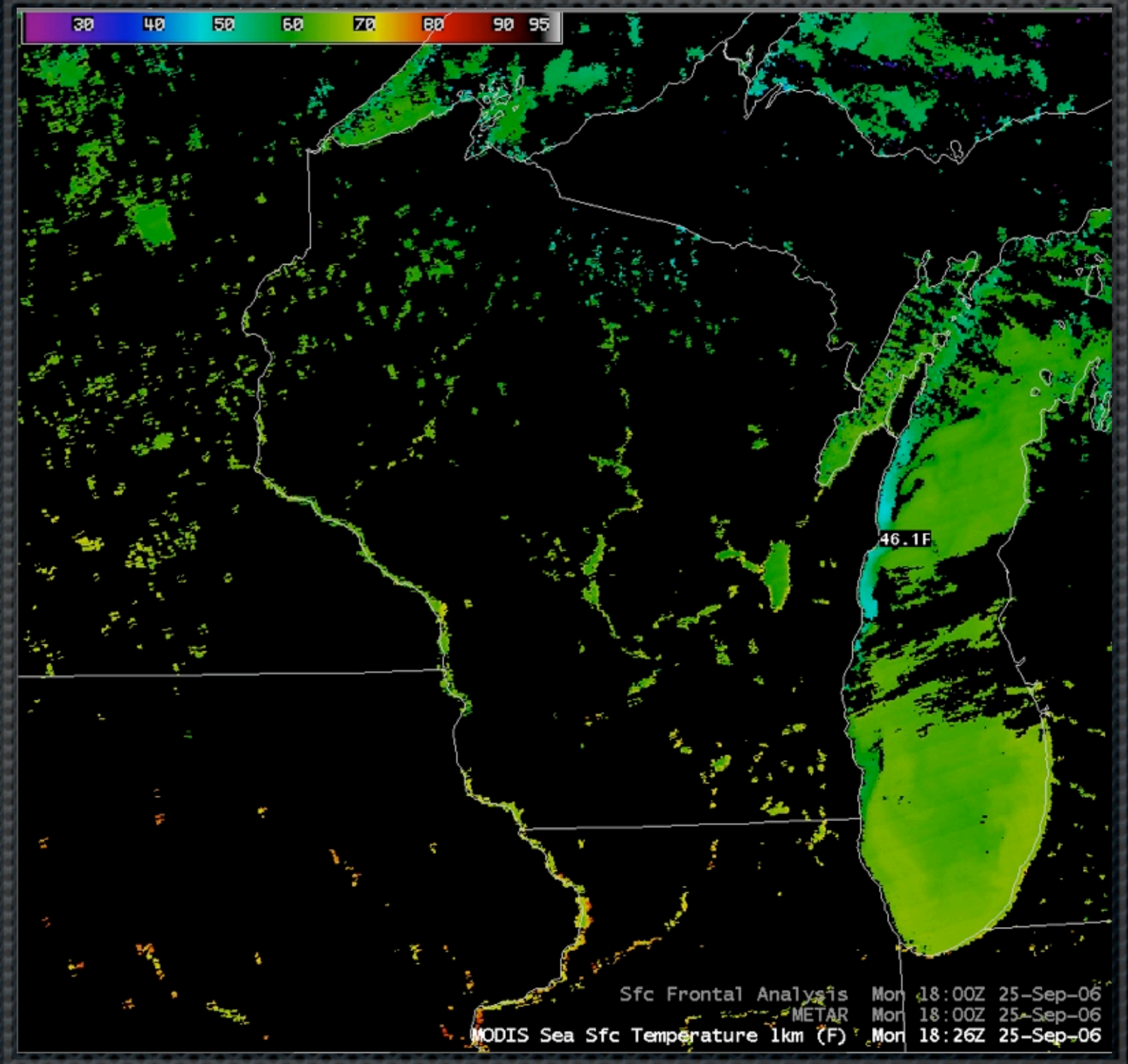
MODIS Imagery in AWIPS

Sea surface temperature



MODIS Imagery in AWIPS

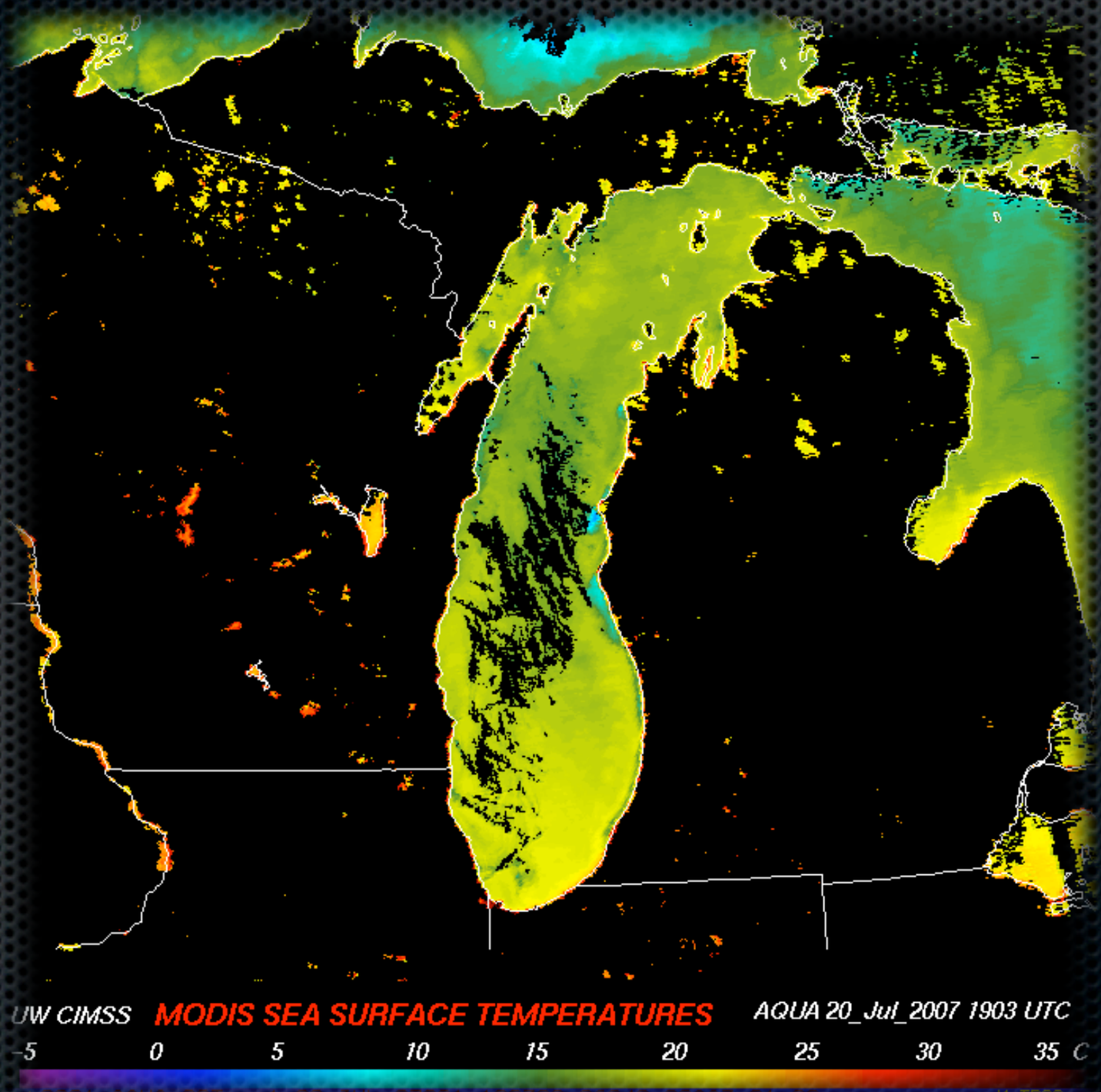
Sea surface temperature



Identify areas of upwelling

MODIS Imagery in AWIPS

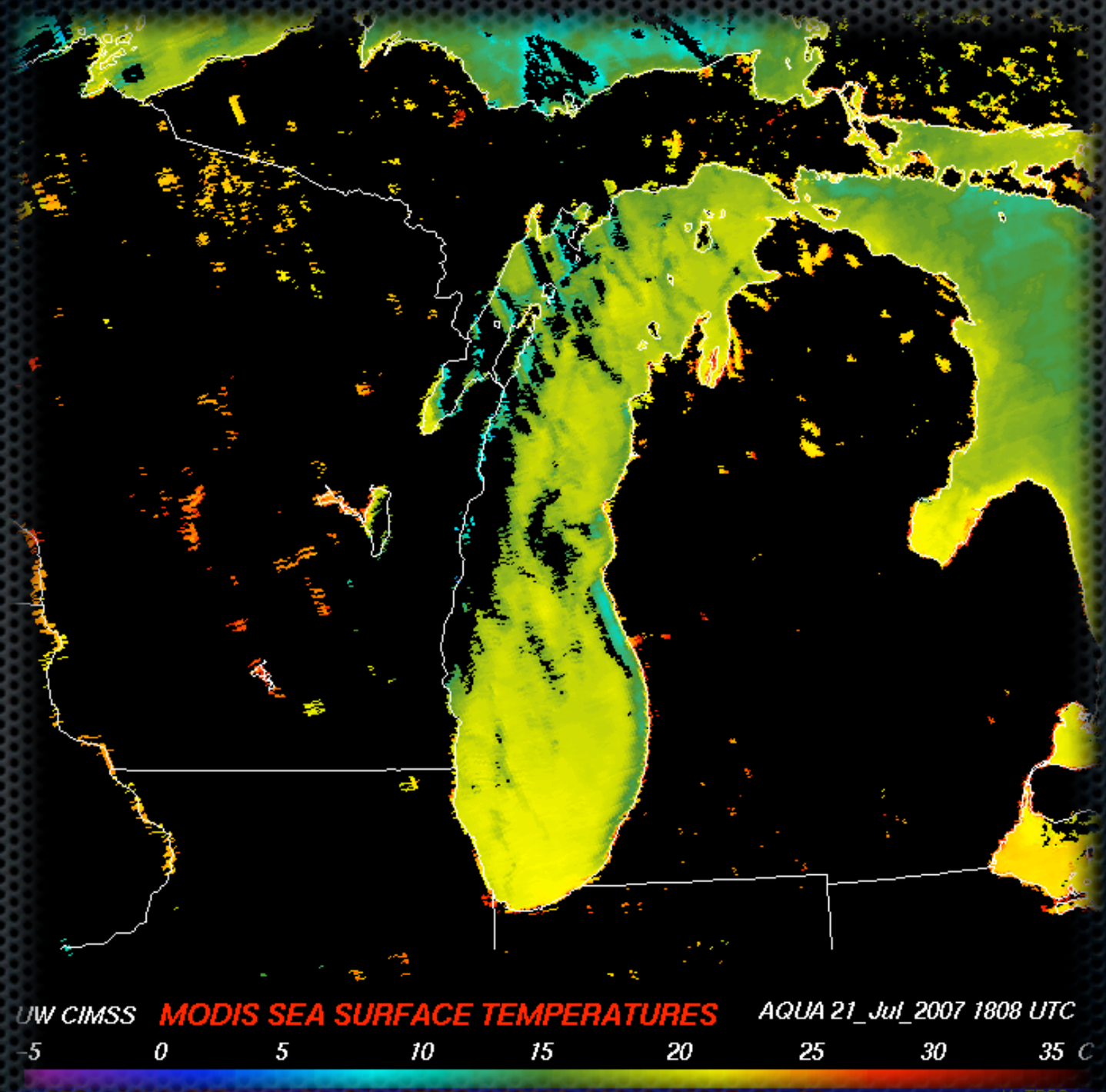
Sea surface temperature



Identify areas of rapid SST increase

MODIS Imagery in AWIPS

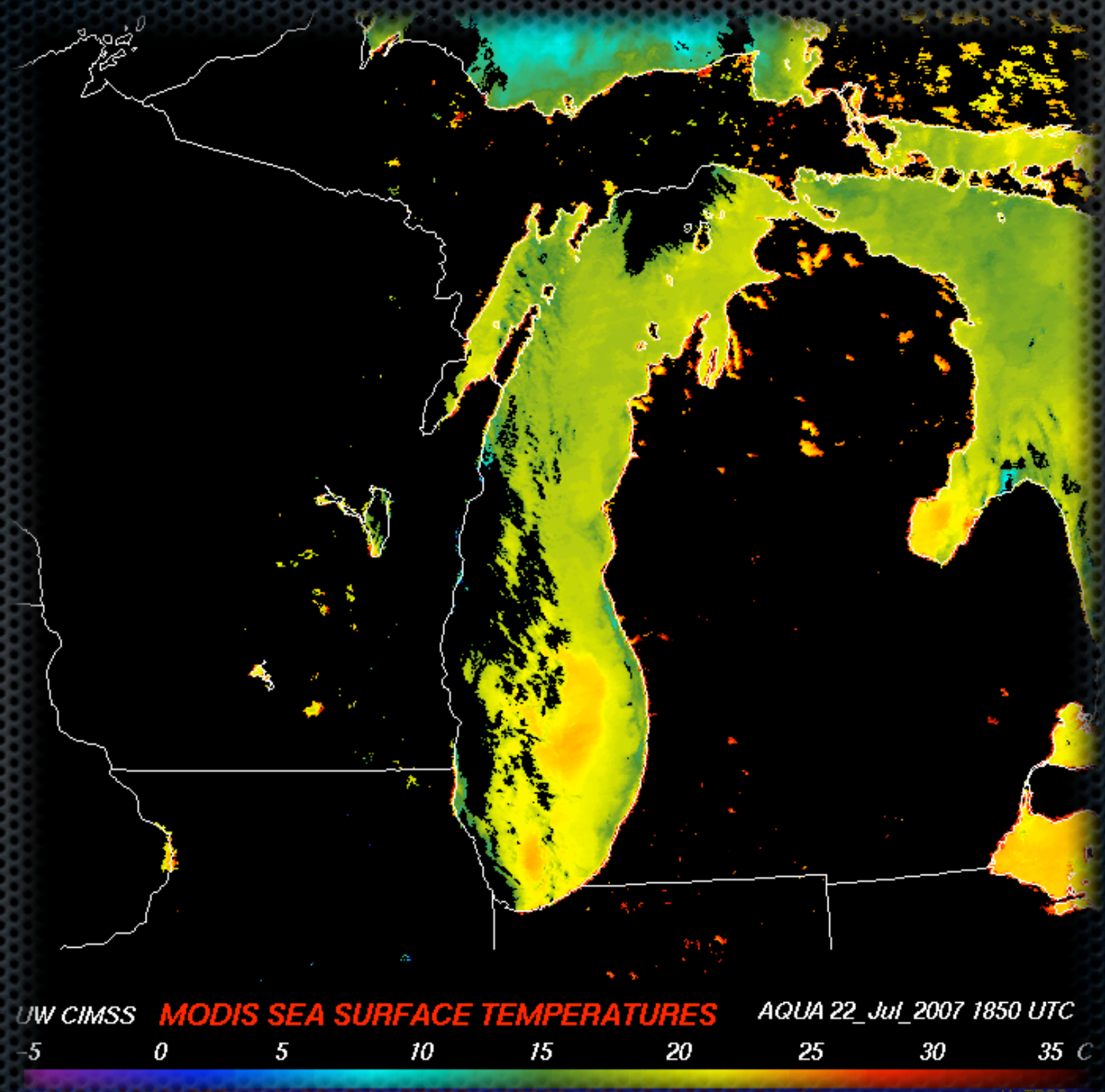
Sea surface temperature



Identify areas of rapid SST increase

MODIS Imagery in AWIPS

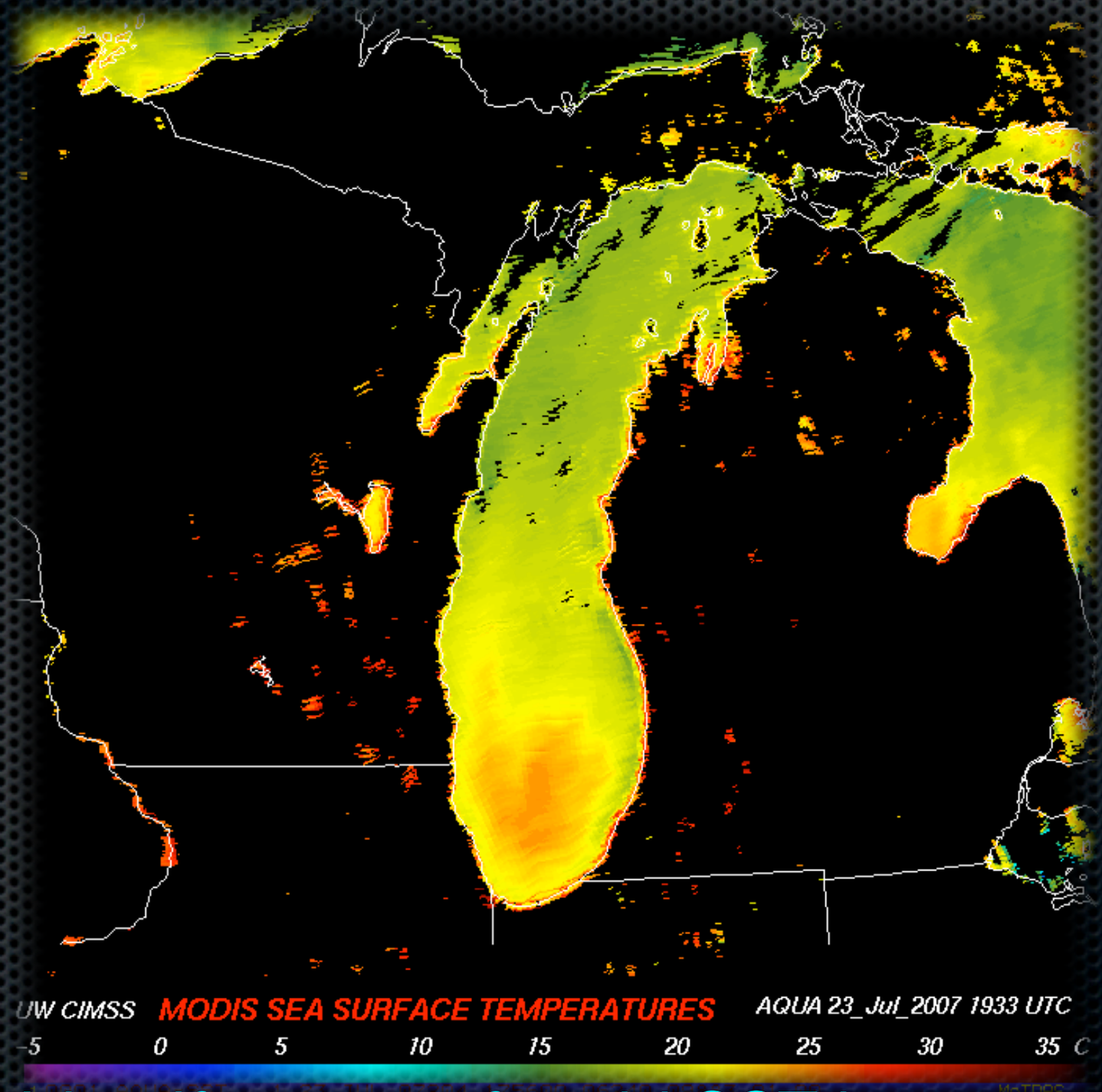
Sea surface temperature



Identify areas of rapid SST increase

MODIS Imagery in AWIPS

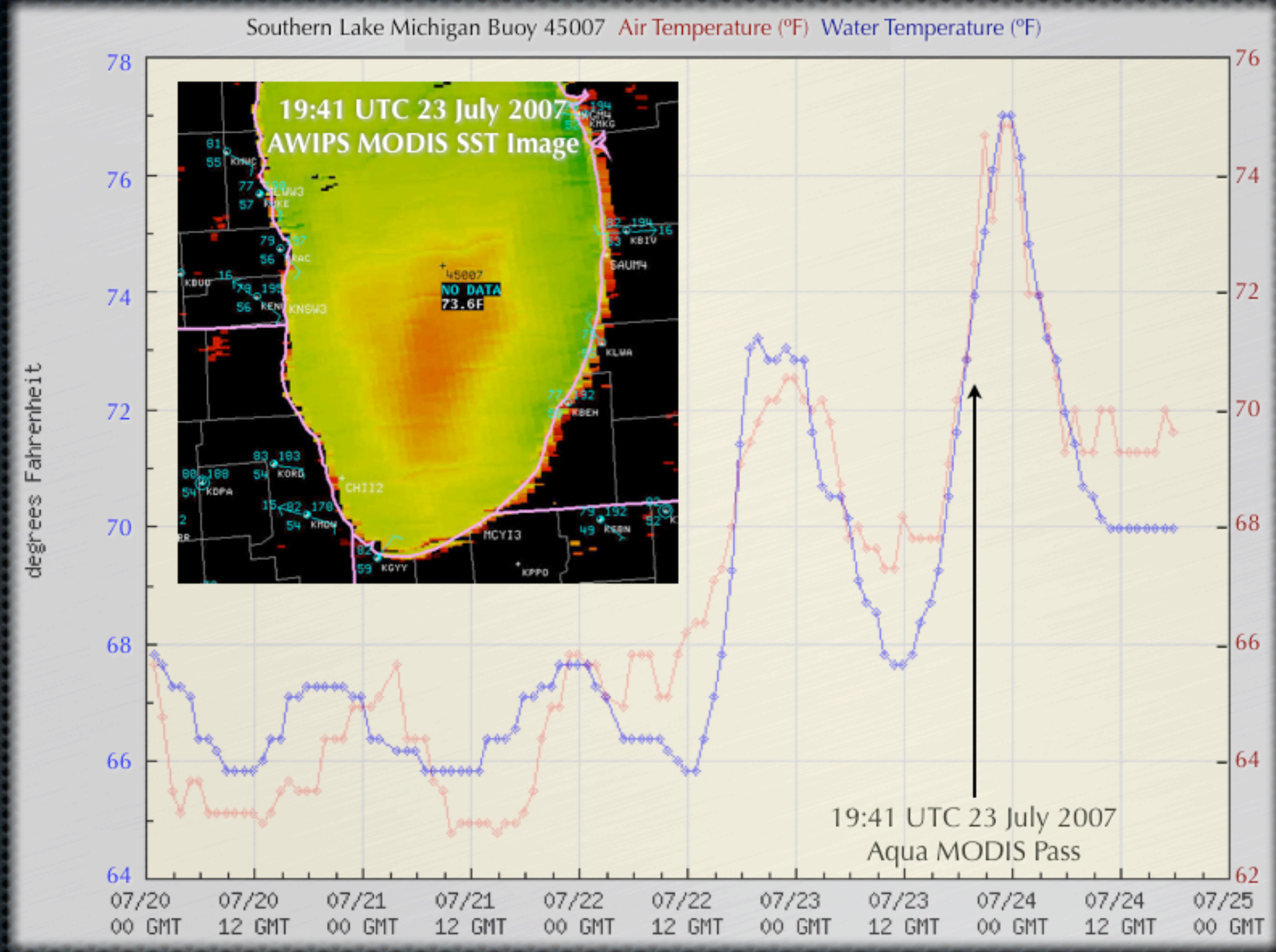
Sea surface temperature



Identify areas of rapid SST increase

MODIS Imagery in AWIPS

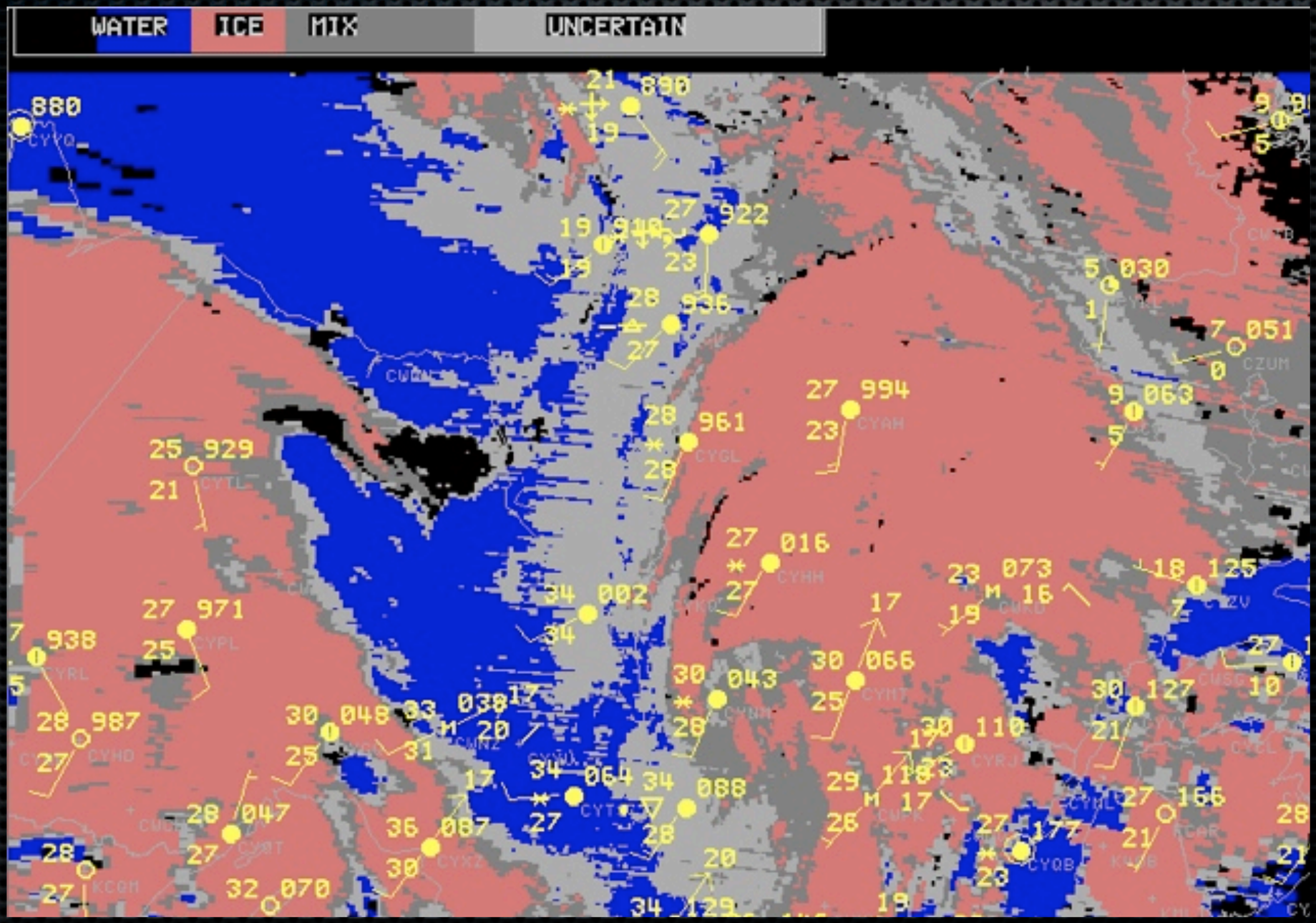
Sea surface temperature



Identify areas of rapid SST increase

MODIS Imagery in AWIPS

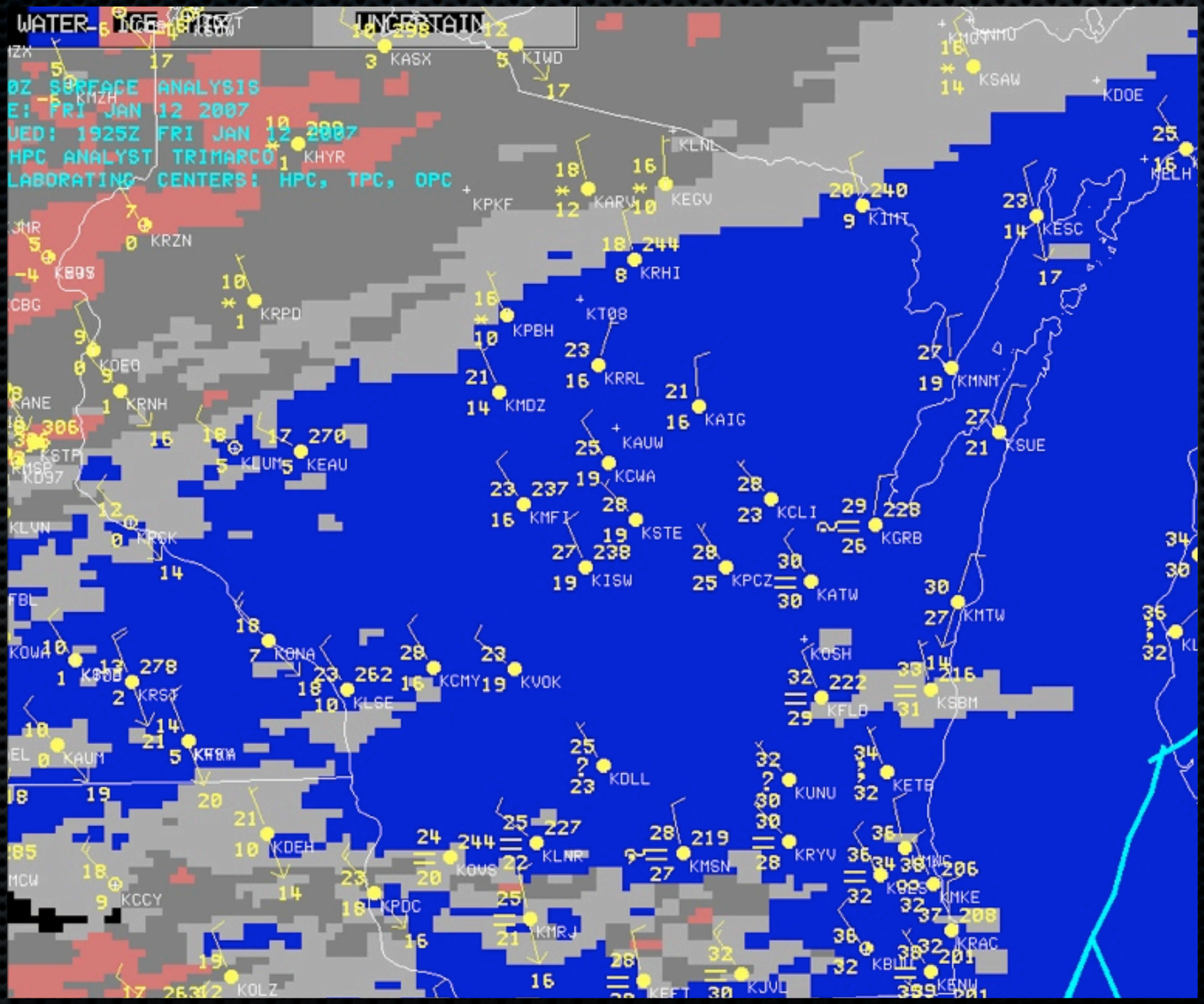
Cloud phase product



Can aid in the *precipitation type* forecast problem

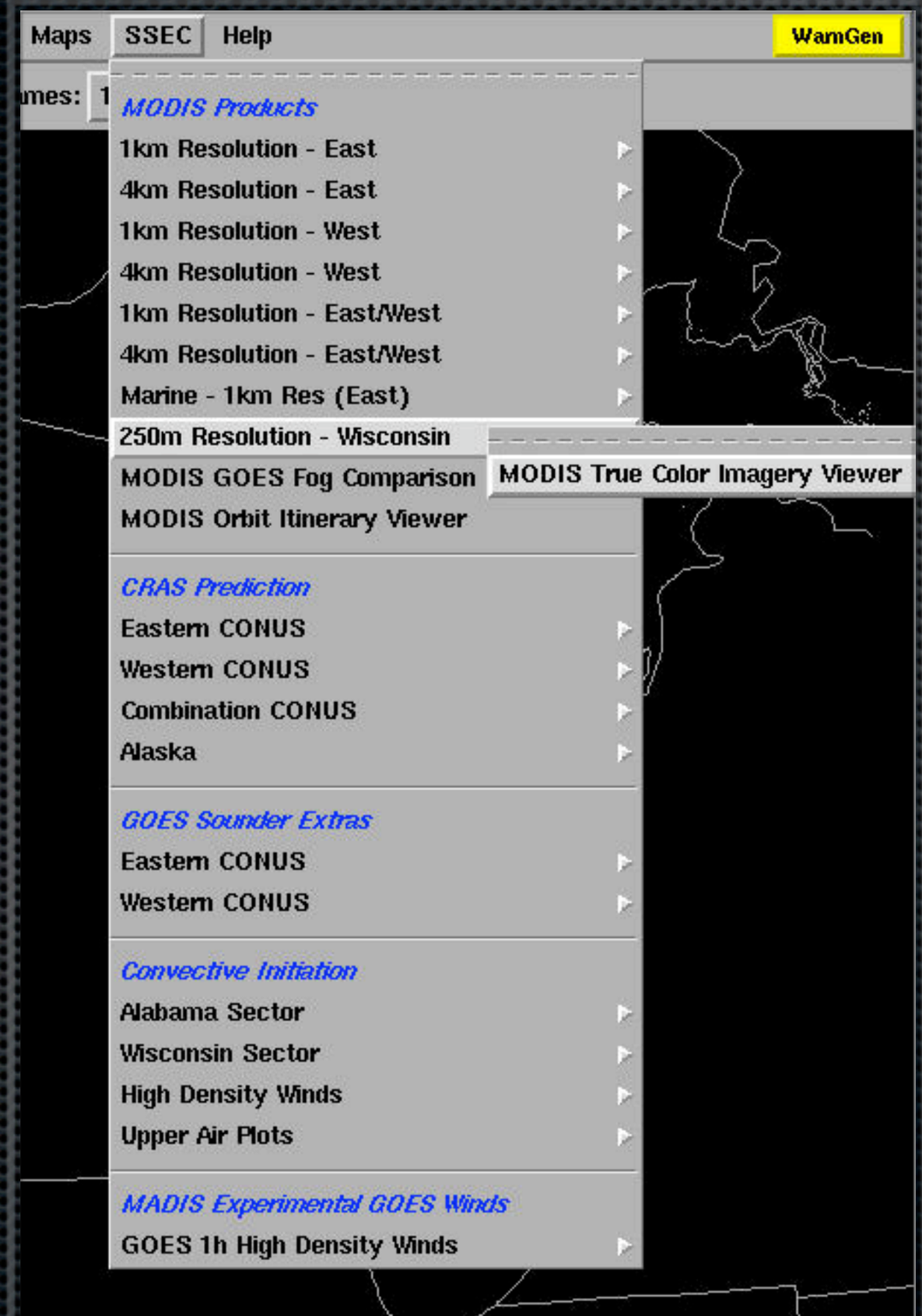
MODIS Imagery in AWIPS

Cloud phase product

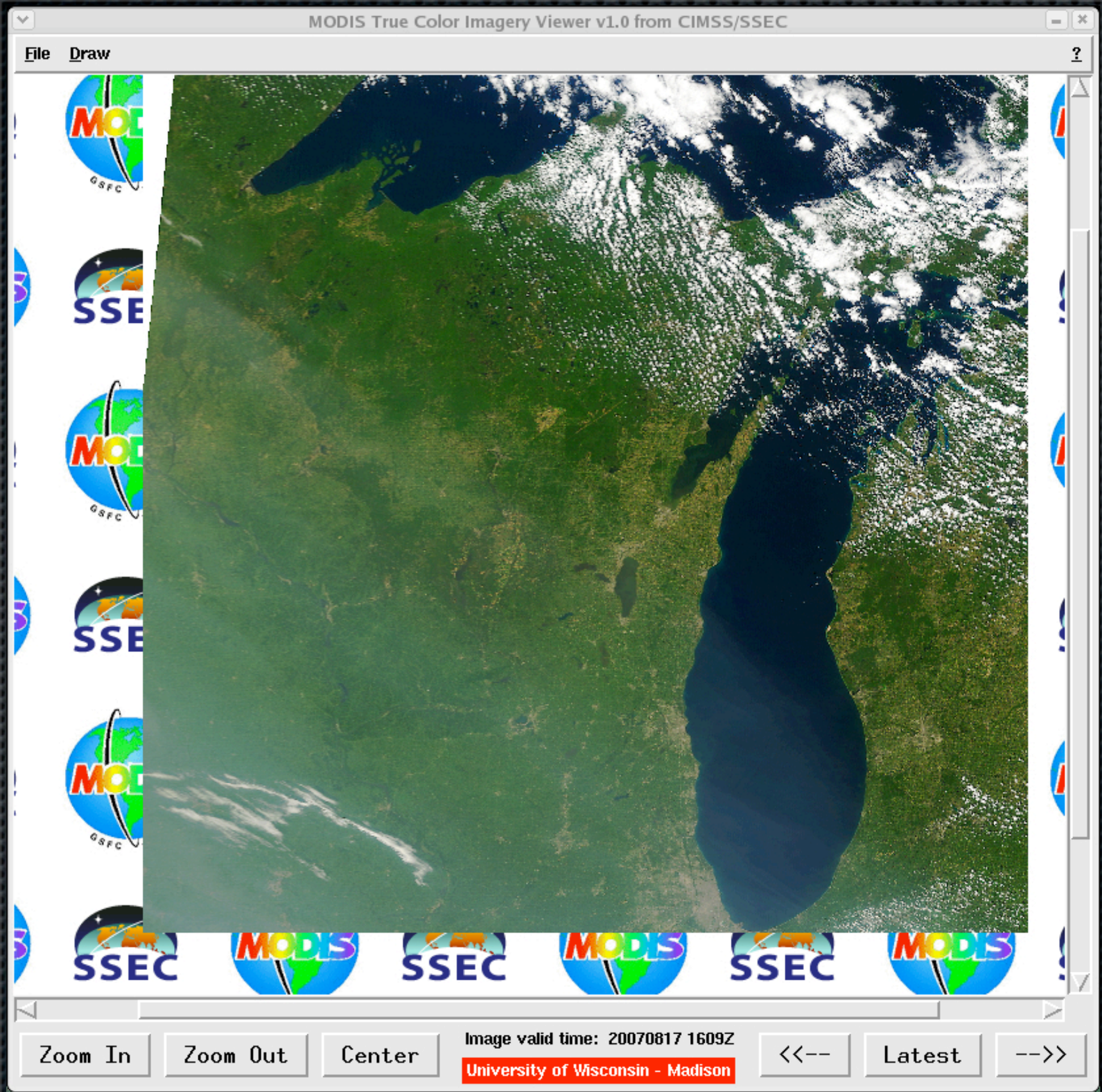


Can aid in the *precipitation type* forecast problem

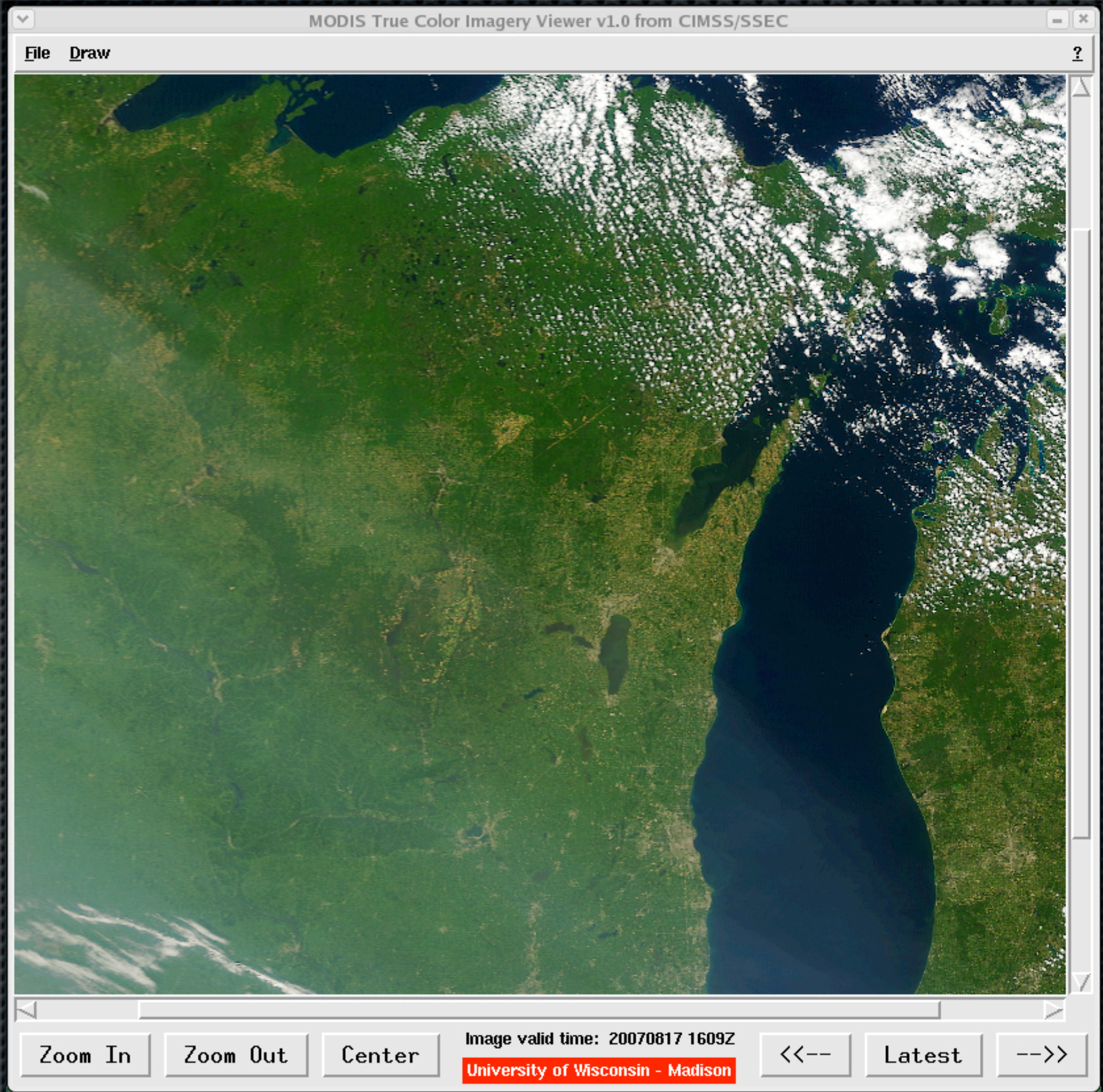
MODIS True Color Imagery Viewer



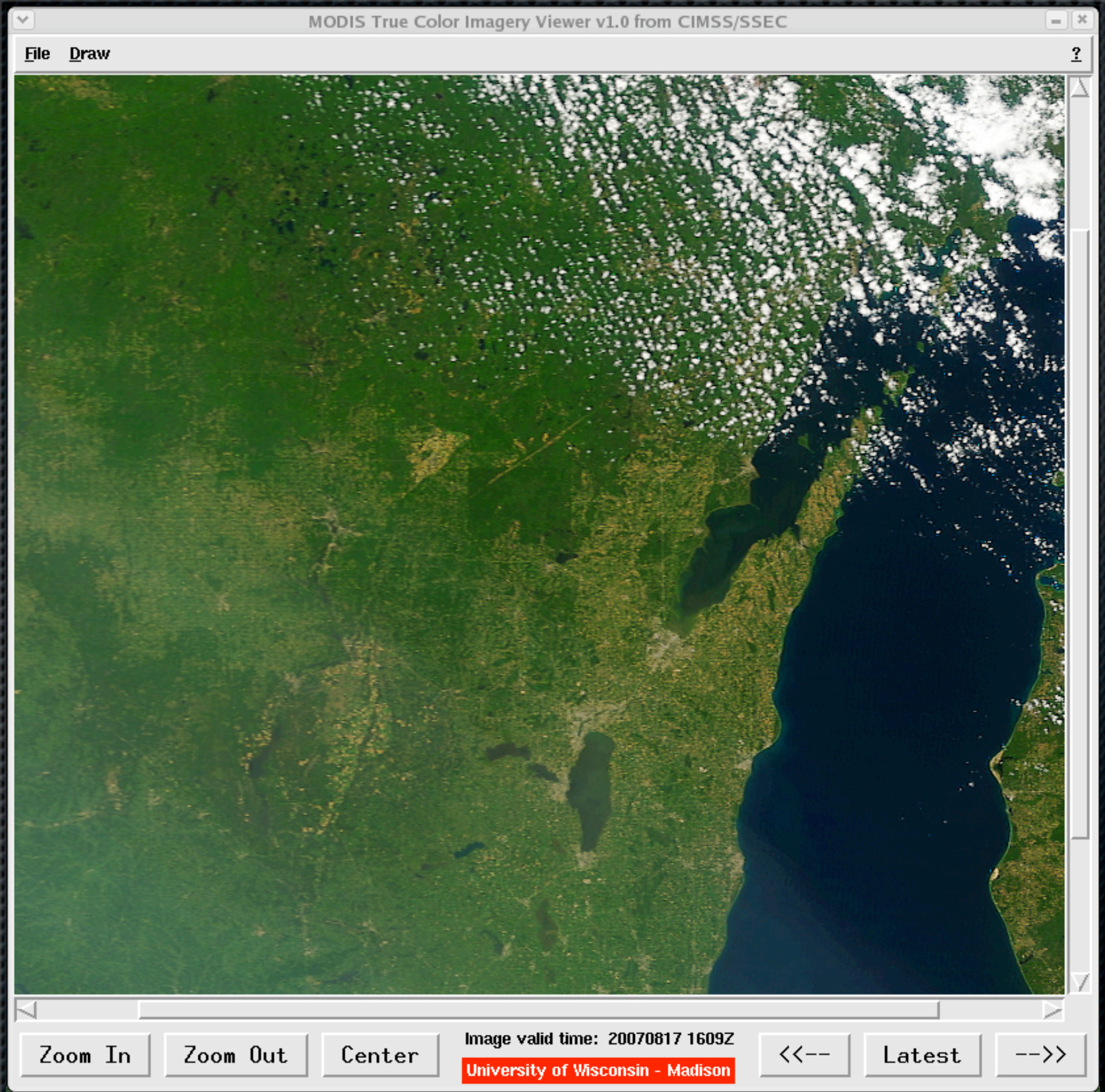
MODIS True Color Imagery Viewer



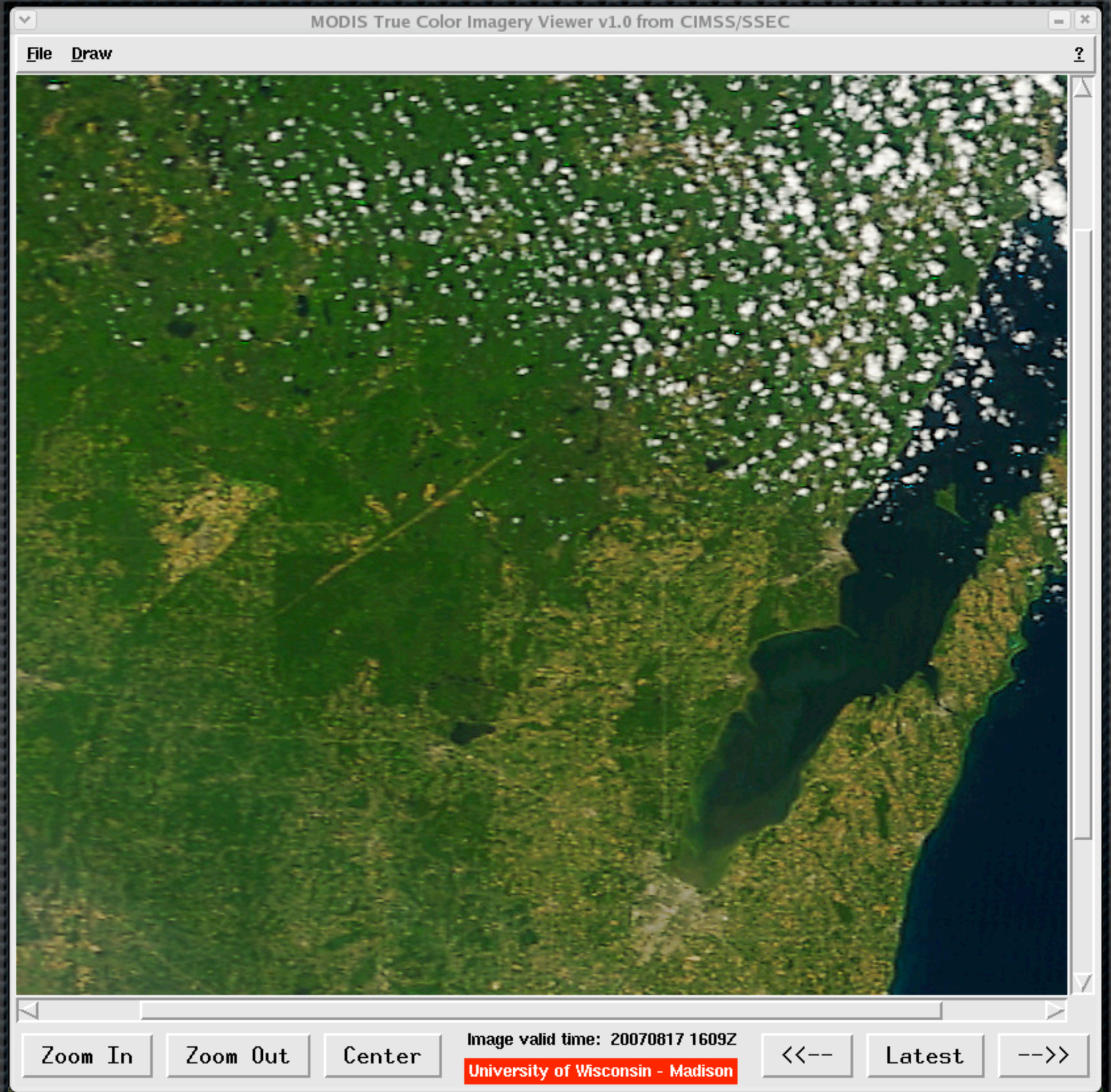
MODIS True Color Imagery Viewer



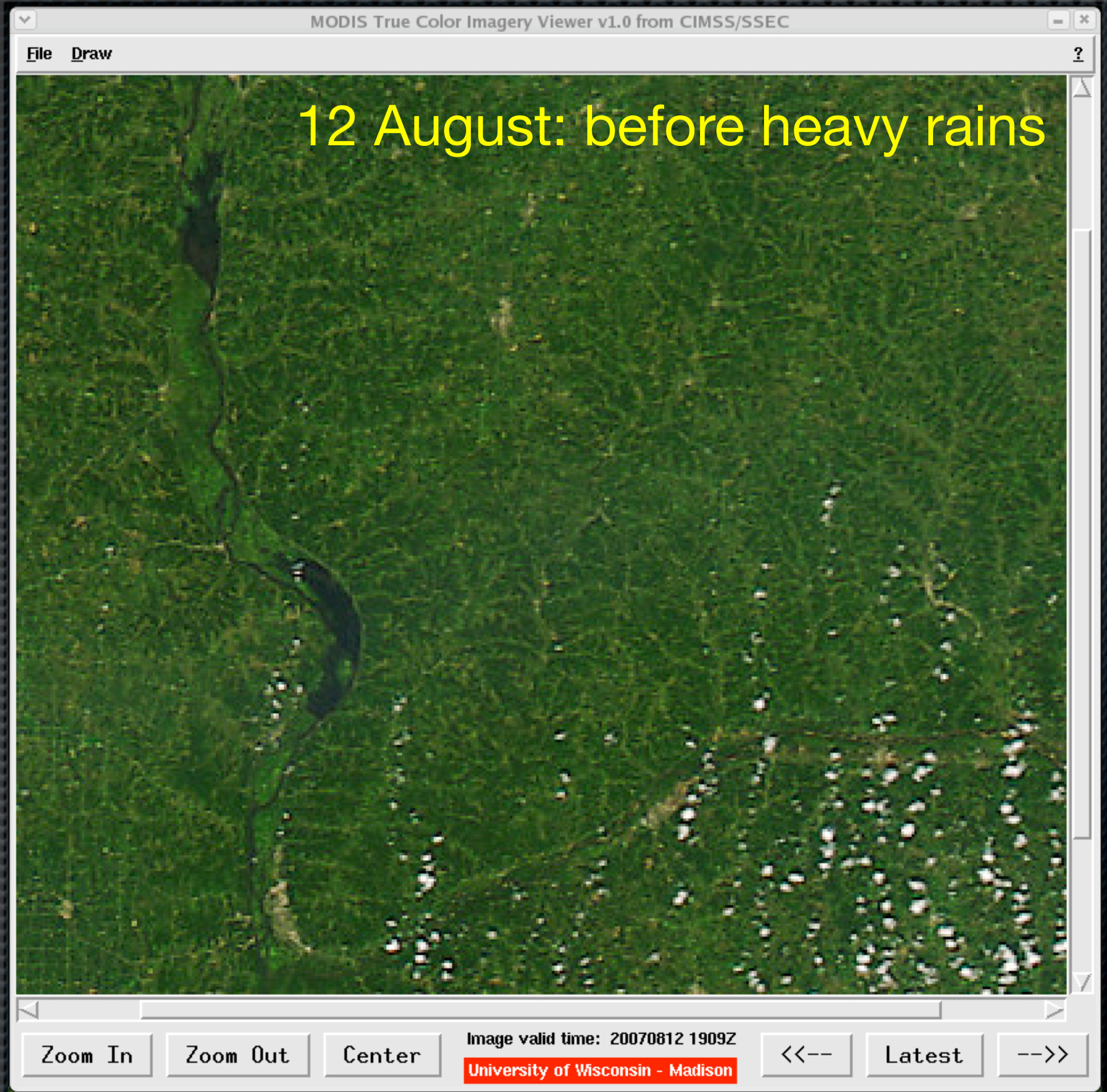
MODIS True Color Imagery Viewer



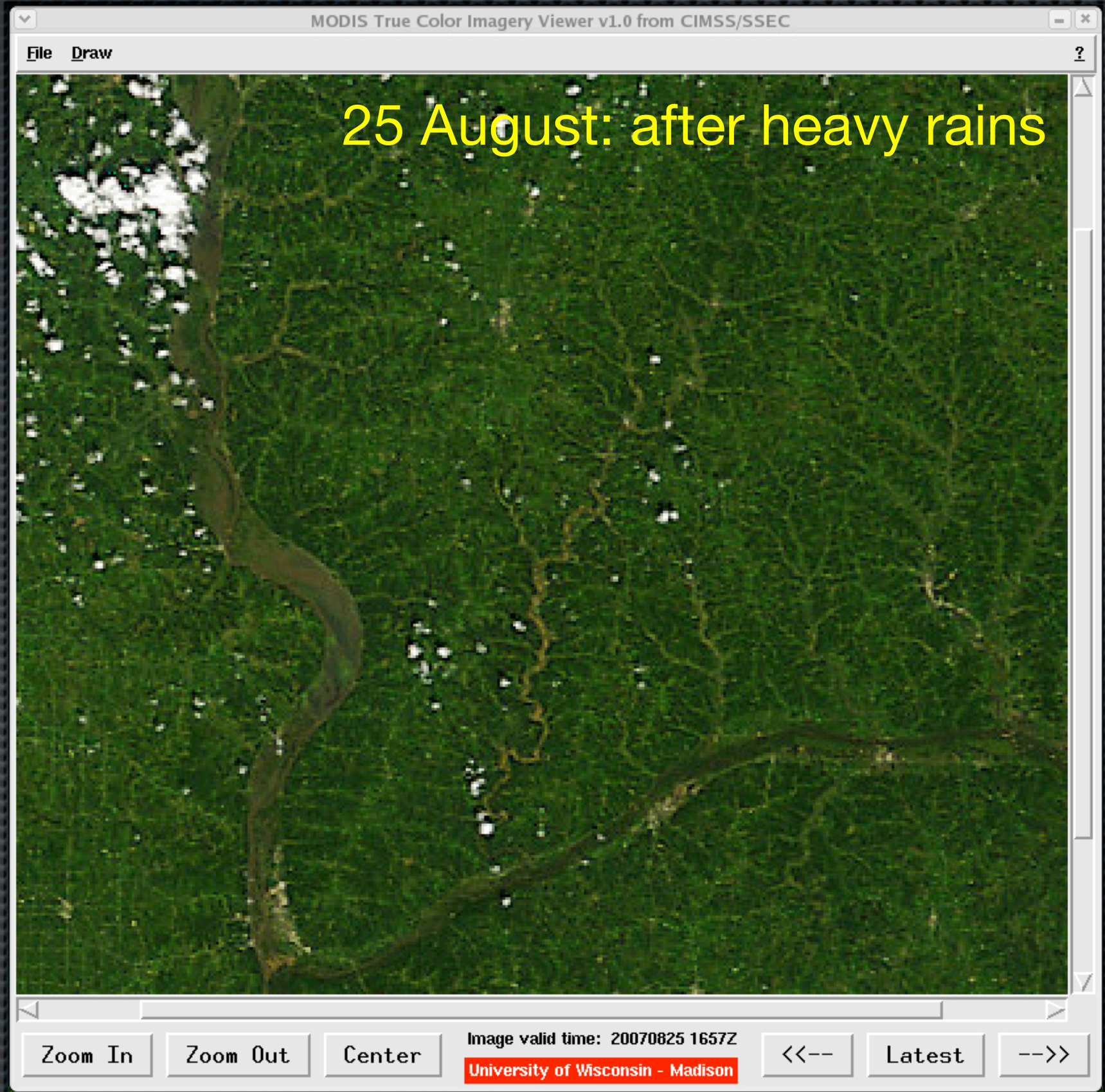
MODIS True Color Imagery Viewer



MODIS True Color Imagery Viewer



MODIS True Color Imagery Viewer

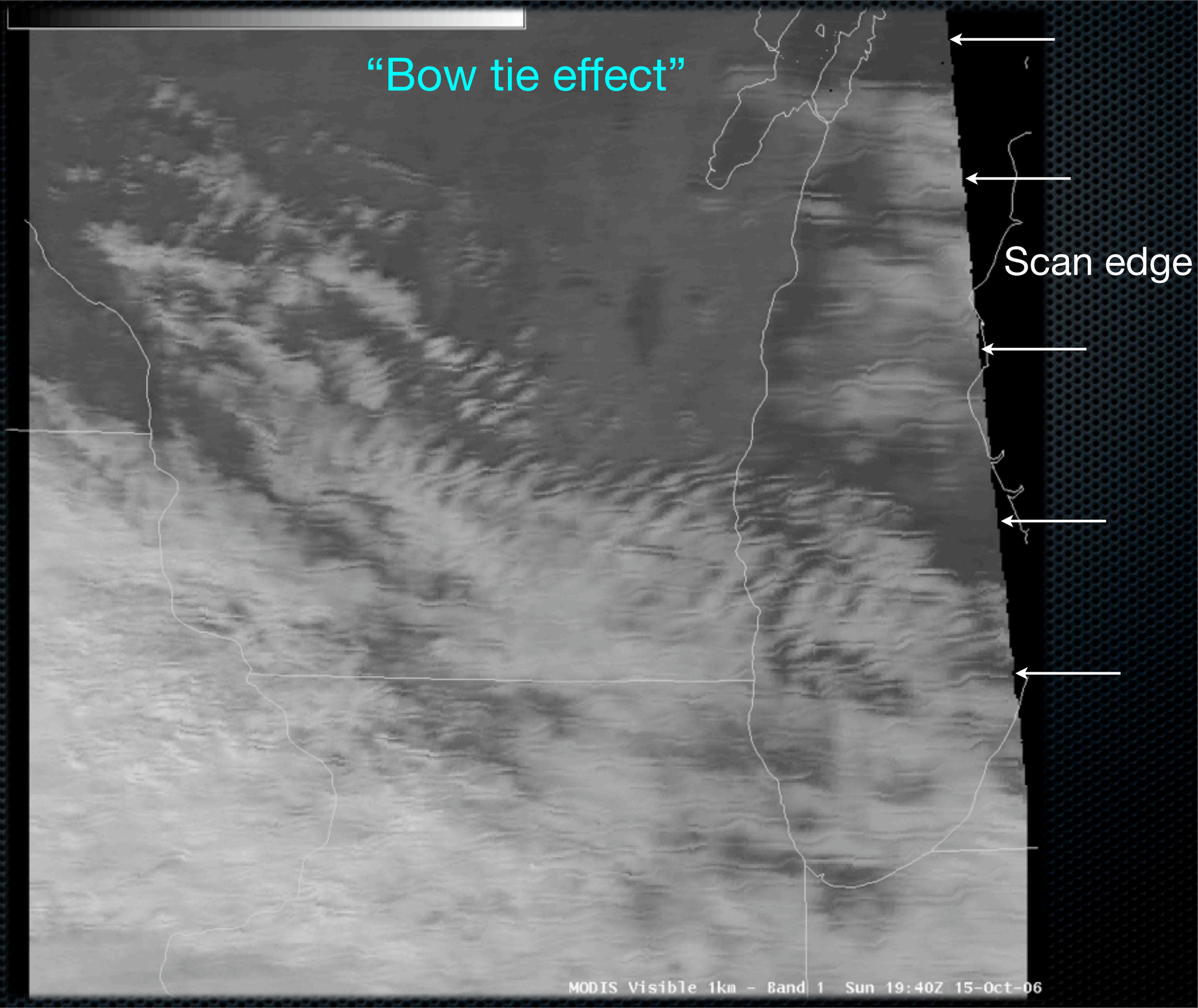


MODIS Products in AWIPS: Pros

- New satellite channels and products not yet available on GOES; prepares forecasters for what will be available in the GOES-R era
- Better spatial resolution than comparable GOES channels
- MODIS imagery does not suffer resolution degradation when viewed at large scales (N. Hemisphere, North American, CONUS)
- Minimal parallax error

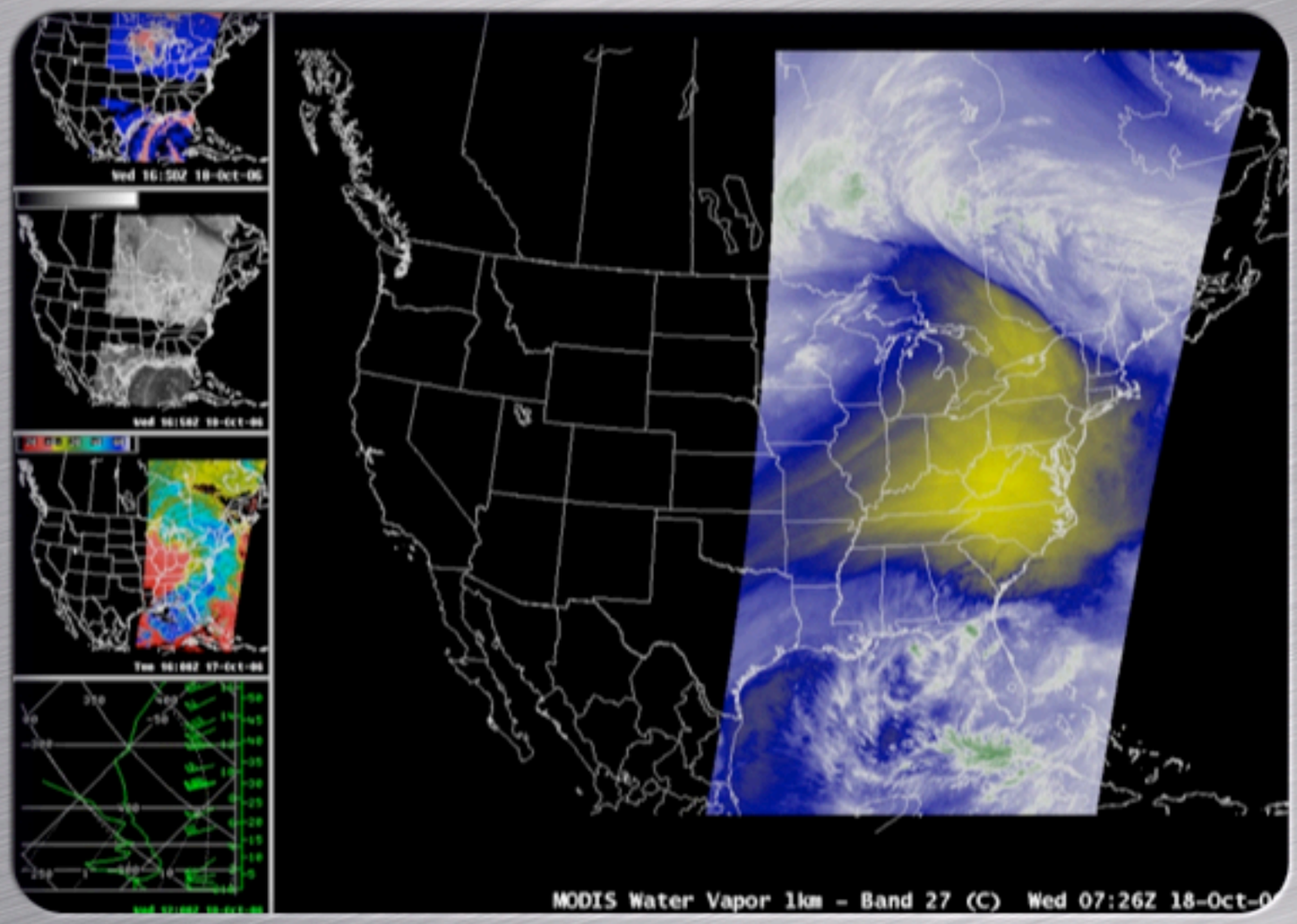
MODIS Products in AWIPS: Cons

- Polar orbit: inconsistent coverage (overpass time and geometry)
- Data latency: 15-45 minutes for individual 1km channels, 30-75 minutes for 4km products
- “Bow tie effect” along scan edges


“Bow tie effect”
Scan edge
MODIS Visible 1km - Band 1 Sun 19:40Z 15-Oct-06

For more Information, see the VISIT lesson...

MODIS Products in AWIPS

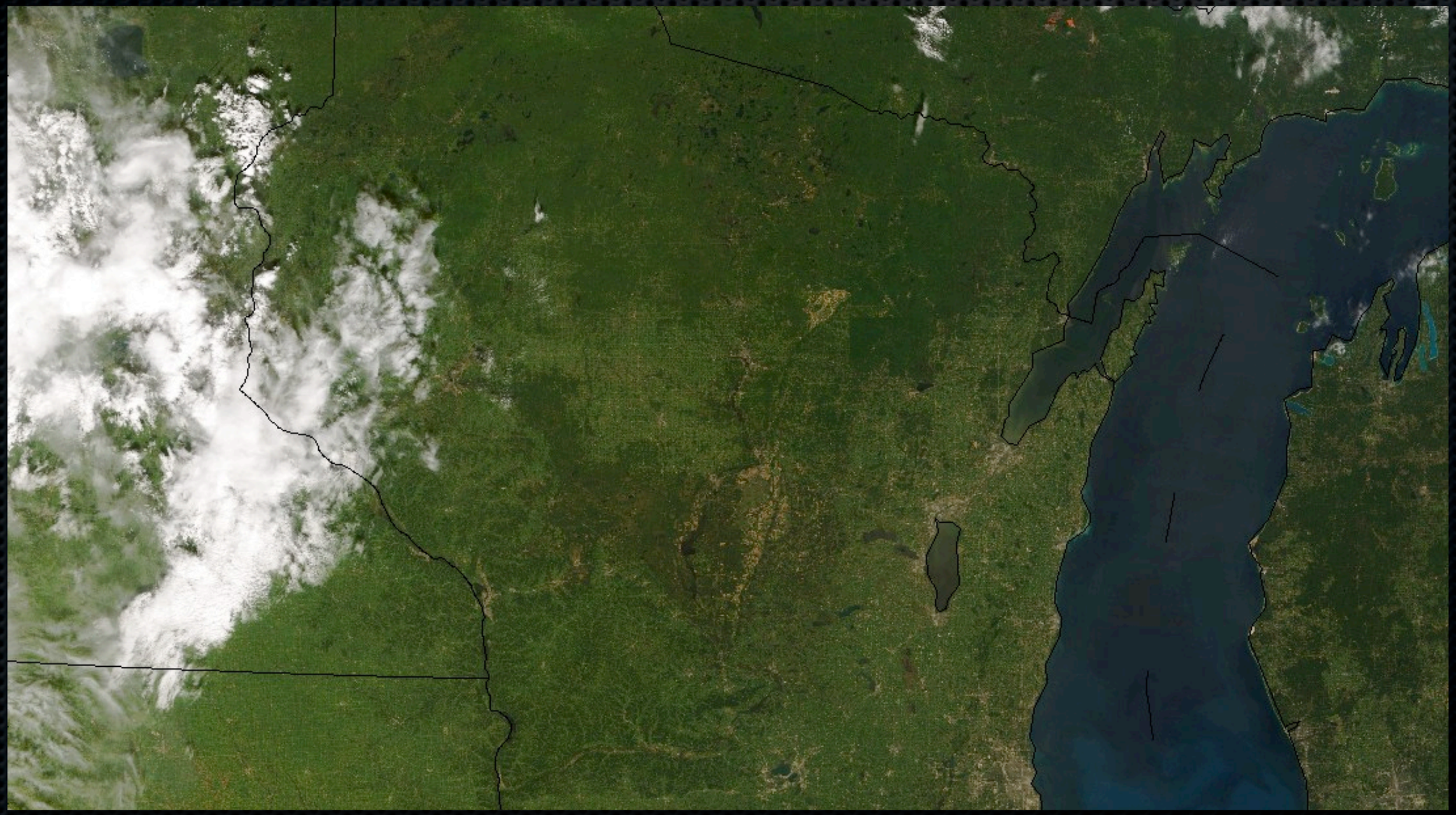


National Weather Service • Integrated Sensor Training Professional Development Series
Virtual Institute for Satellite Integration Training

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

Questions?

scott.bachmeier@noaa.gov



MODIS true color images - 10 September to 10 October 2004

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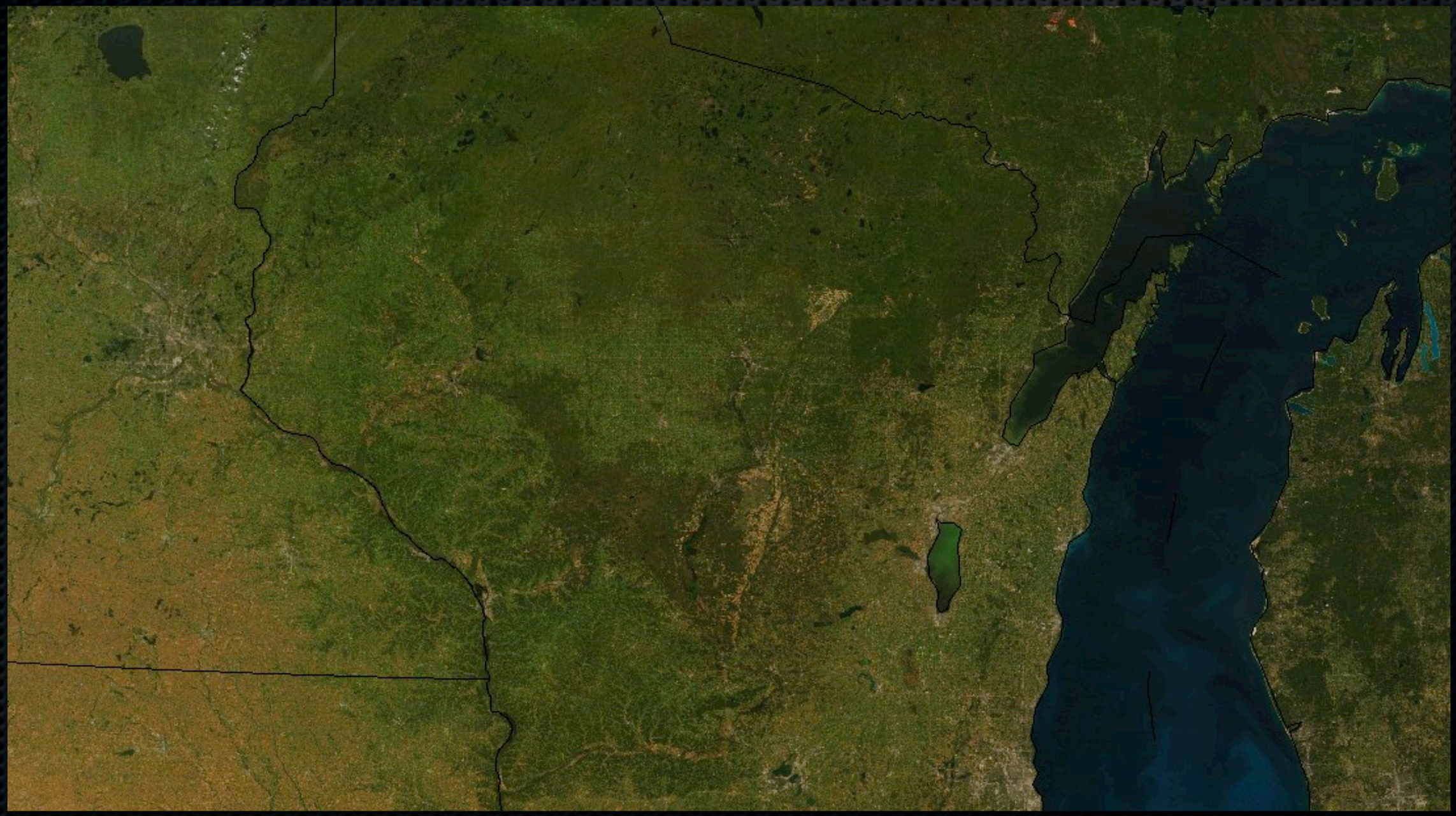

MODIS true color images - 10 September to 10 October 2004

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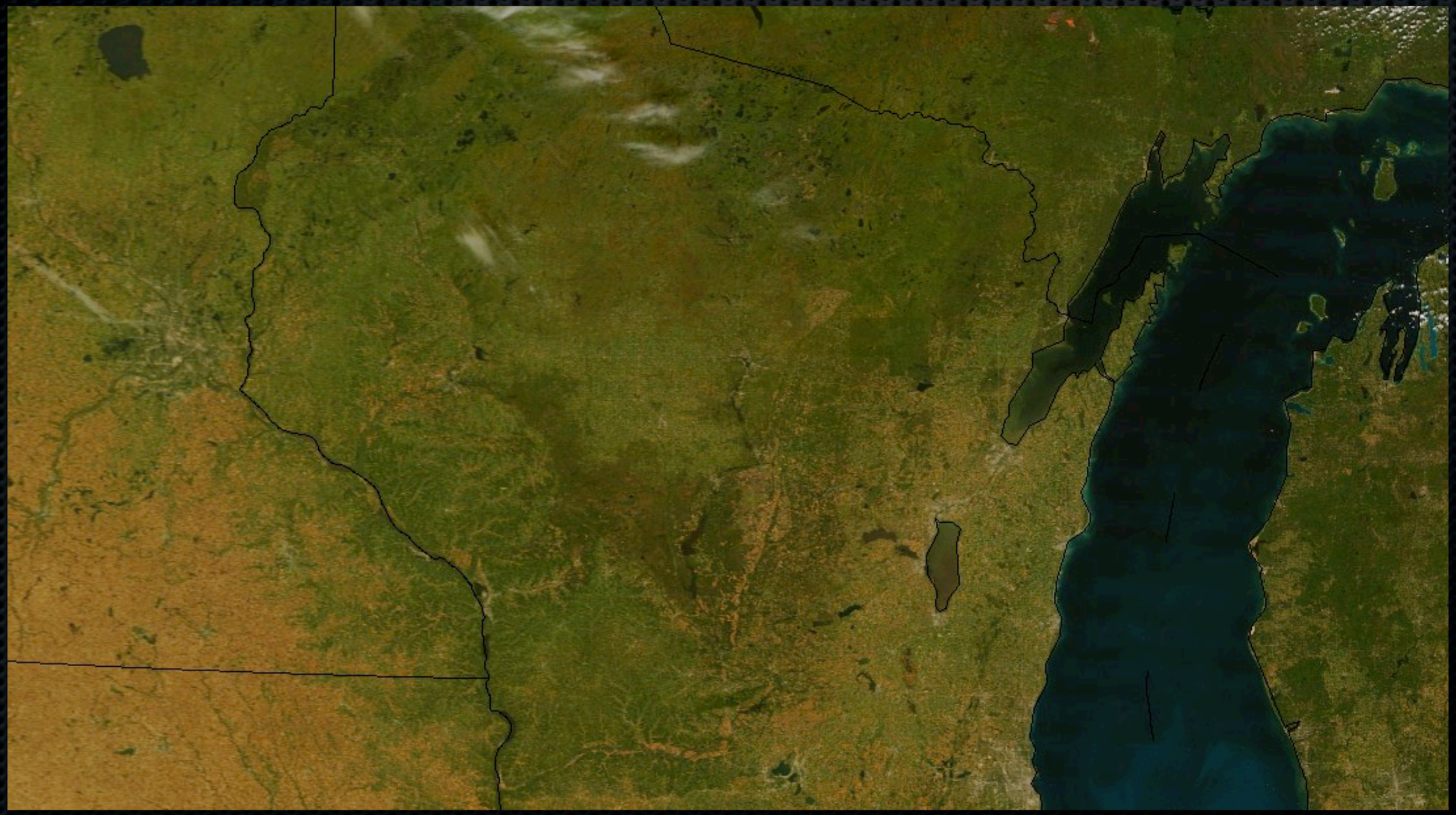

MODIS true color images - 10 September to 10 October 2004

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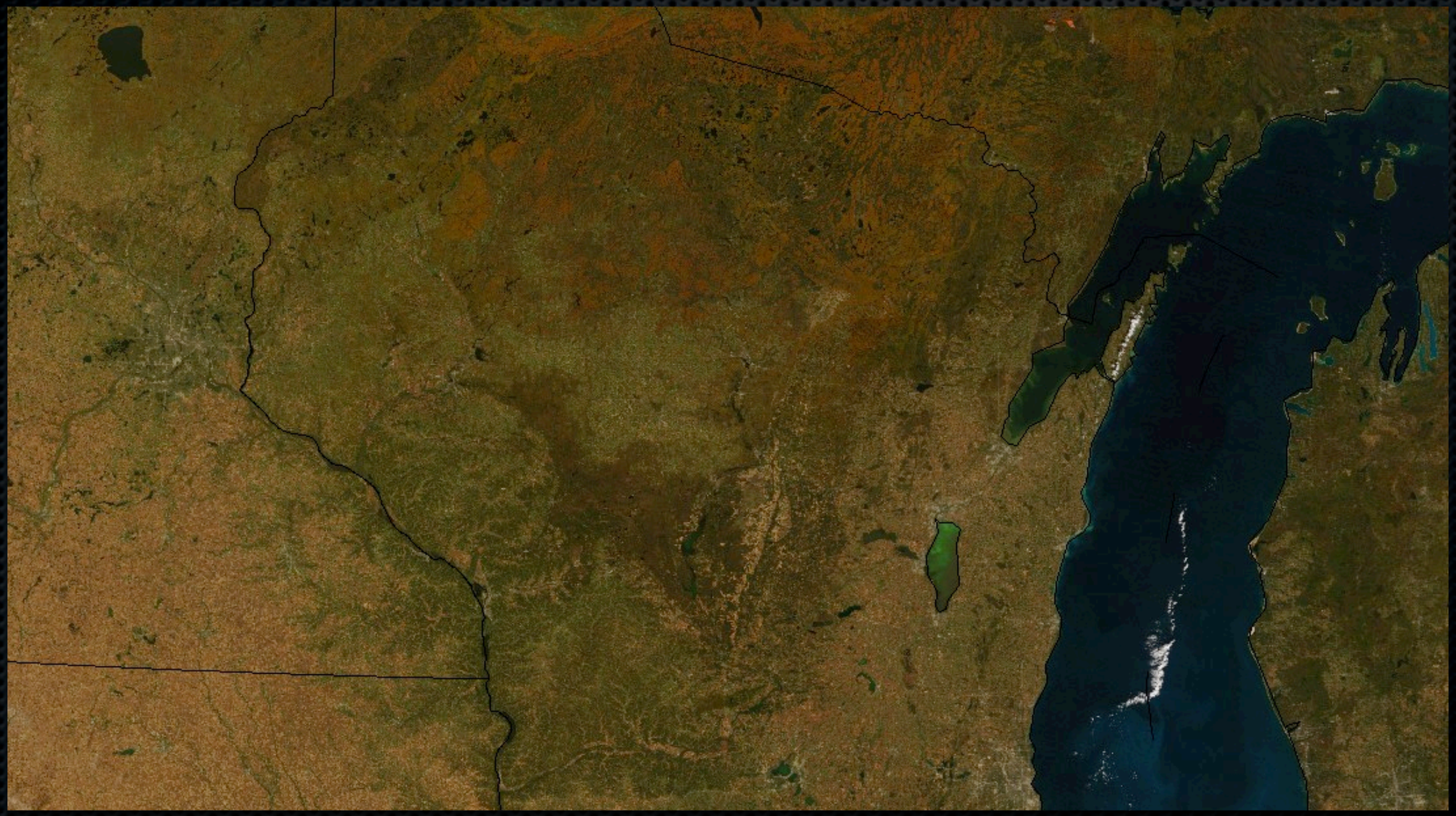

MODIS true color images - 10 September to 10 October 2004