



# University of Wisconsin SSEC

## Satellite Data Services Archive

2016 McIDAS Users Meeting

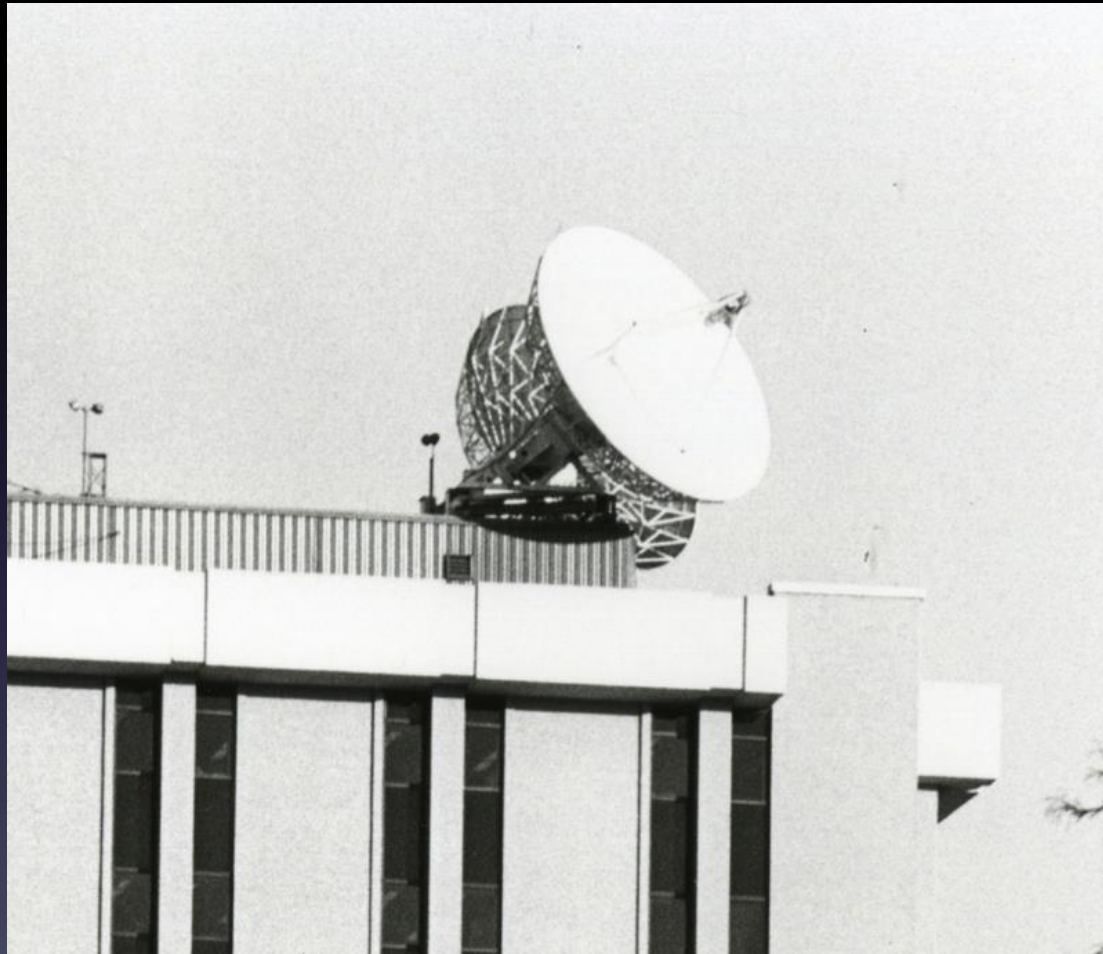
November 17, 2016



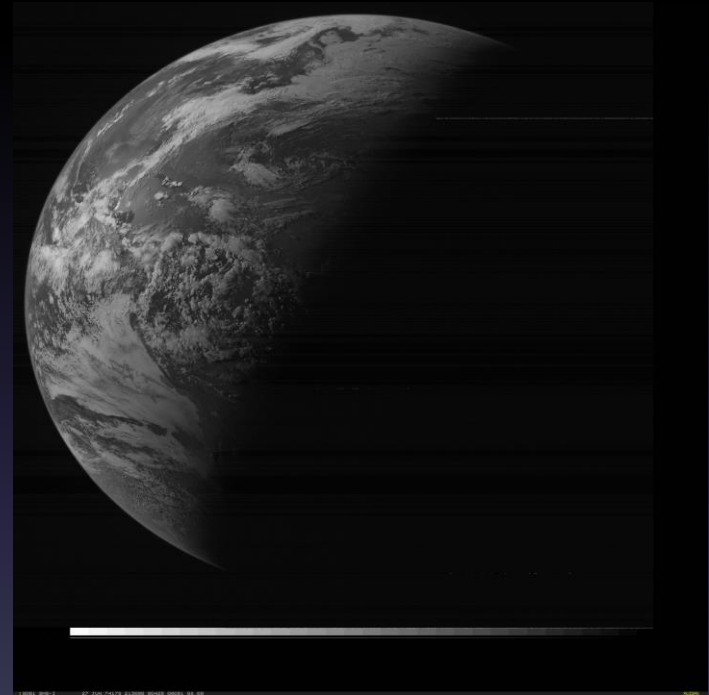
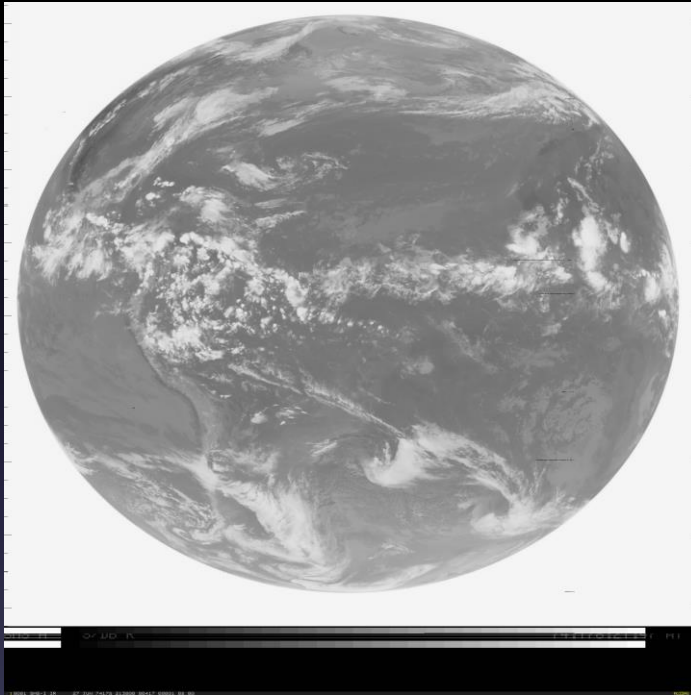
# History



# First antennas 1974



# First Satellite Imagery in the online archive



1974 day 178





# Dr. Verner Suomi



# U-matic (1978-1996)





# U-matic (1978-1996)





# National Archive (1979-2004)

- SSEC became the National Archive of GOES data in 1979
- Tried to send the archiving activity to NOAA over the next 25 years
- Finally Moved to NCDC in 2004 (Now called NCEI)



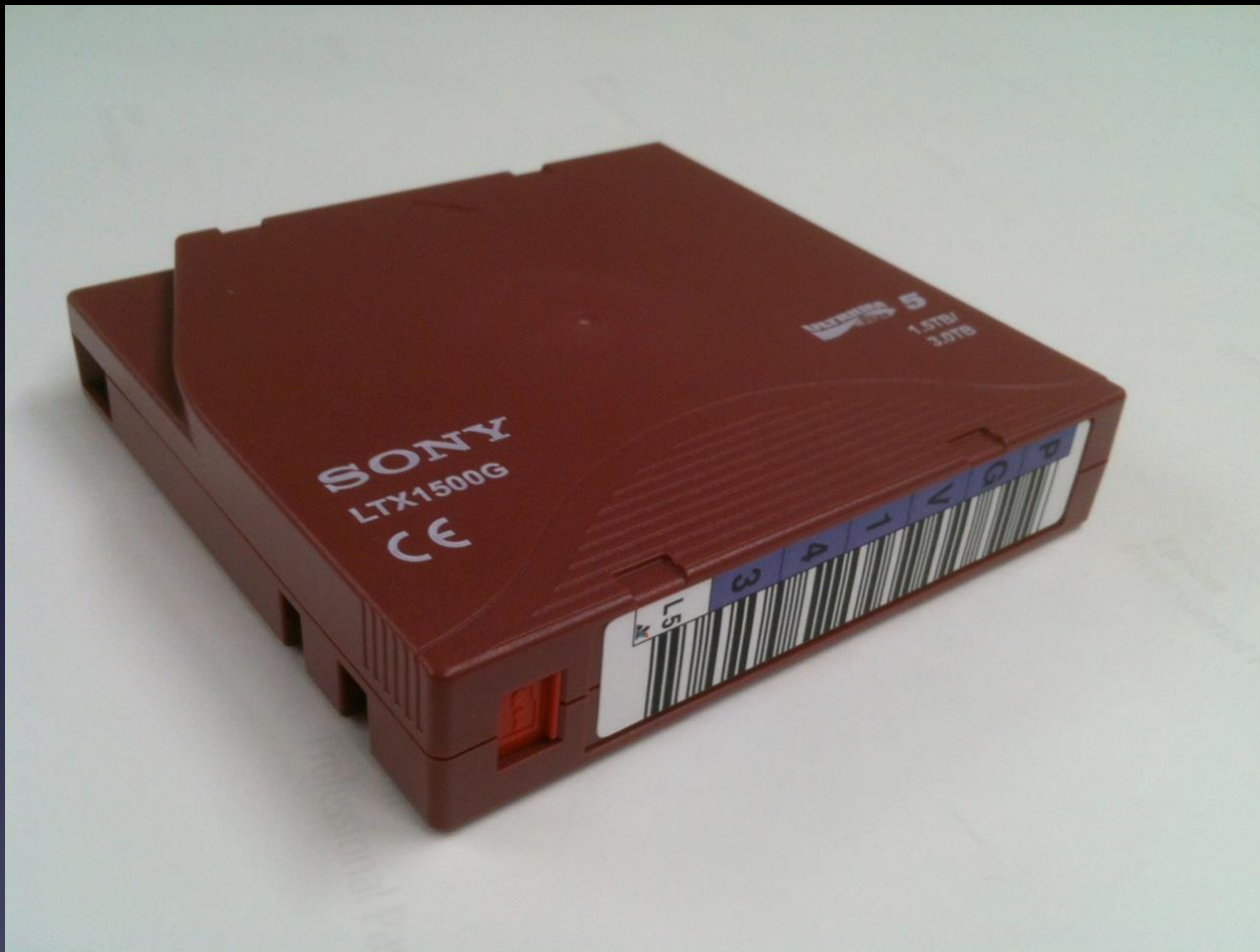
# 3590 tapes (1996-2005)



# Online Archive (2005- Present)



# LTO-5



Source	Satellites	Years	sensors	Formats	Servers
US Geo	SMS1&2 GOES1-7	1974, 1978-1996	imager and sounder	Mode A,AA,AAA AREA	ADDE
US Geo	GOES8-15	1993-Present	imager and sounder	GVAR and AREA for sounder	ADDE
Eumetsat	Met-1, Met-3, Met5- 7	1978-1979 1992-1995 1998-Present	imager	Native, AREA OMTP pdus	ADDE
Eumetsat	Met8-11	2004-Present	SEVERI	HRIT	ADDE
Japan (JMA)	GMS-1 GMS-5	1978-1979 1998-Present	Imager	AREA	ADDE
Japan (JMA)	MTSAT1R,2	2005-Present	Imager	HiRID,HRIT	ADDE
Japan (JMA)	Himawari-8	2015-Present	Imager	HSD	ADDE
China	FY2,C,D,E,G	2005-Present	Imager	AREA	ADDE
India (ISRO)	Kalpana Insat-3D	2004-Present 2014-Present	VHRR Imager, Sounder	HDF4,5	ADDE
South Korea (KMA)	COMS	2012-Present	CMOS	HRIT	ADDE



Source	Years	Formats	Servers
Insitu Point	1976-Present	McIDAS MD	ADDE
Noaaport Model Output	1996-Present	McIDAS GRID, GRIB <sub>1</sub> , GRIB <sub>2</sub>	ADDE, THREDDS
Noaaport Text	1996-Present	Original text, concatenated binary file	ADDE
Global Satellite Composite	2001-Present	AREA	ADDE
Cloud top height global composites	2003-Present	AREA	ADDE
Lots of others misc, sst composites, SSMI, modis winds	Early 2000-Present	AREA, l1b,	ADDE, THREDDS





# Statistics

- 210 TB of data via ADDE in first 10 months of 2016
- 12 million transaction in 2016
- Averaged 2.5 TB transferred via ADDE per day in October 2016
- As of Dec 2015, over 975 TBs online.
- (closer to 1.5 PB when redundant data are included)
- Grows approximately about ~150 TB/year



# Backend Hardware

- 6-Dell PowerEdge R430 servers
- 2 Dell PowerEdge R730 servers
- 3 Dell PowerVault MD3460 storage arrays
- 2 Dell PowerVault MD3060e storage arrays
- Lustre 2 on zfs



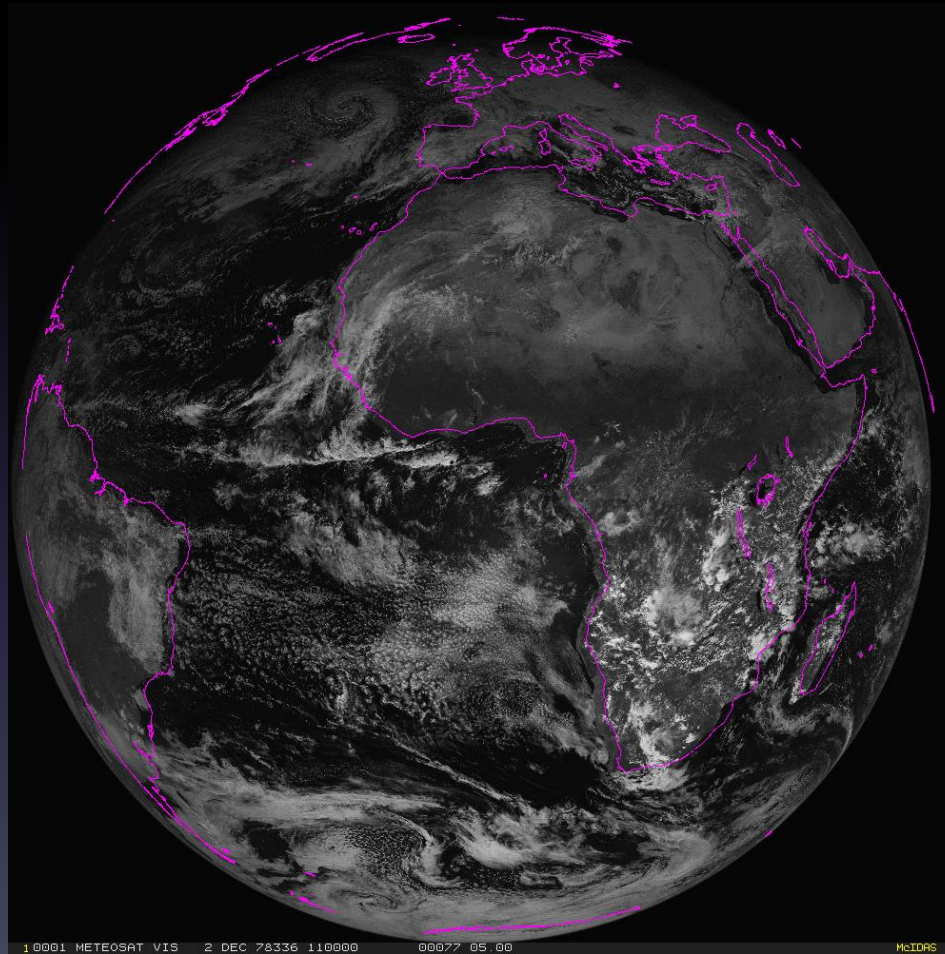
# Recent Performance Enhancements

Modifications to Lustre server data prefetch:

- Himawari-8 entire Day List
  - Before enhancements 200+ seconds
  - After Enhancements ~13 seconds
- COMS
  - Before enhancements ~17 seconds
  - After Enhancements ~2.5 seconds



# Meteosat-1



# Meteosat-1

- Originally pulled from 9-track tape in early 2000s, but not decoded.
- Covers time period of December 1, 1978 – November 24, 1979
- Rediscovered in summer 2016 due to an inquiry by Paul Menzel
- Decoded, Navigated, and Calibrated by Dan Forrest and Dave Santek
- Provided to Eumetsat in November 2016



# Eumetsat article

The screenshot shows a web browser window with the URL [www.eumetsat.int/website/home/News/DAT\\_3253427.html](http://www.eumetsat.int/website/home/News/DAT_3253427.html). The page features the EUMETSAT logo and tagline "MONITORING WEATHER AND CLIMATE FROM SPACE". A navigation menu includes "HOME", "IMAGES", "ABOUT US", "SATELLITES", "DATA", "NEWS", and "QUICK LINKS". The main article title is "DISCOVERY OF 'LOST' EARLY SATELLITE DATA TO AID UNDERSTANDING OF THE EARTH'S CLIMATE".

**NEWS**

- 2016
- NOVEMBER
- OCTOBER**
- SEPTEMBER
- AUGUST
- JULY
- JUNE
- MAY
- APRIL
- MARCH
- FEBRUARY
- JANUARY

2015

- 2014
- 2013
- 2012
- 2011
- 2010
- 2009

**TECHNICAL BULLETINS**

**CONFERENCES AND EVENTS**

**VISITING SCIENTISTS**

**RSS FEEDS**


**Serendipity, expertise, foresight and the equivalent of an Earth observation data archaeological dig have led to recovery of almost-40-year-old satellite imagery - thought lost forever - which will significantly add to understanding of our planet's climate.**

**THURSDAY, 27 OCTOBER 2016**

The data, from the European Space Agency's prototype Meteosat-1 geostationary meteorological satellite, was found at the University of Wisconsin-Madison's Space Science and Engineering Center (SSEC) in the United States.

It has now been provided to EUMETSAT, which operates and disseminates data from Meteosat-1's "descendants" and, crucially, has an uninterrupted record of climate data from these satellites stretching back more than 30 years. That record, although with a small gap, now extends even further back in time.


To say that the discovery of this lost data was greeted with enthusiasm would be an understatement, with climate scientists describing it as "like finding a lost child" – "the first born!"



**THE DATA**

Meteosat-1 was launched on 23 November 1977, and was positioned in a geostationary orbit at 0° degrees longitude, with a constant view of most of Europe, all of Africa, the Middle East and part of South America.

From that position, this view of the "full-disk" was scanned every 30 minutes, with the data being provided in near-real time to users. The satellite's mission lasted until 25 November 1979.



One day in 1979





# One Day in 1979



# SMS 1974-1980

- Doug Ratcliff, Dan Forrest, Nancy Troxel-Hoehn, Jerrold Robaidek



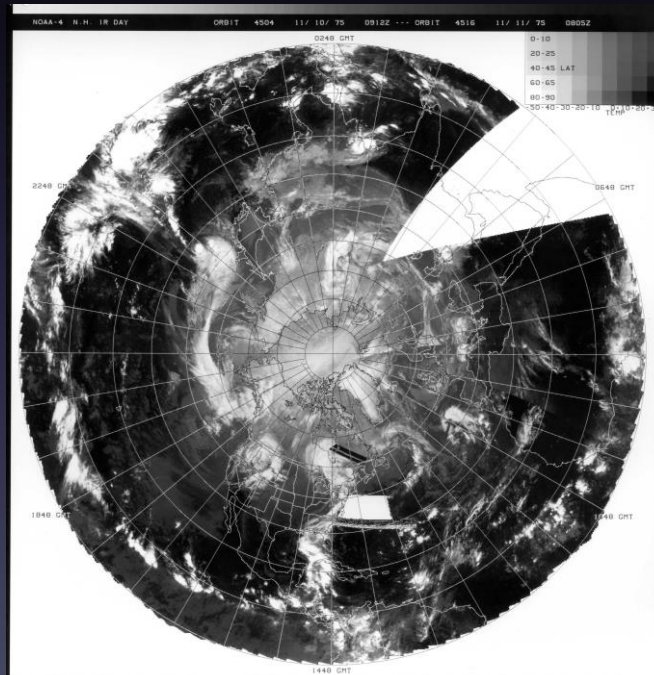
# SMS 1974-1980

- ~1,300 9-track tapes scheduled for destruction by NASA Goddard
- Reading was complete in the past week
- Processing and decoding now
- Tapes covered a period of 1974 – 1980, but most were from July 1974 and Fall 1975 time period



# Edmund Fitzgerald

- November 10, 1975



# Edmund Fitzgerald



- “Superior, they said, never gives up her dead”
- The tapes did not contain this data.
- But almost an entire year of GOES data has now recovered that had previously been lost.



# SMS 1974-1980

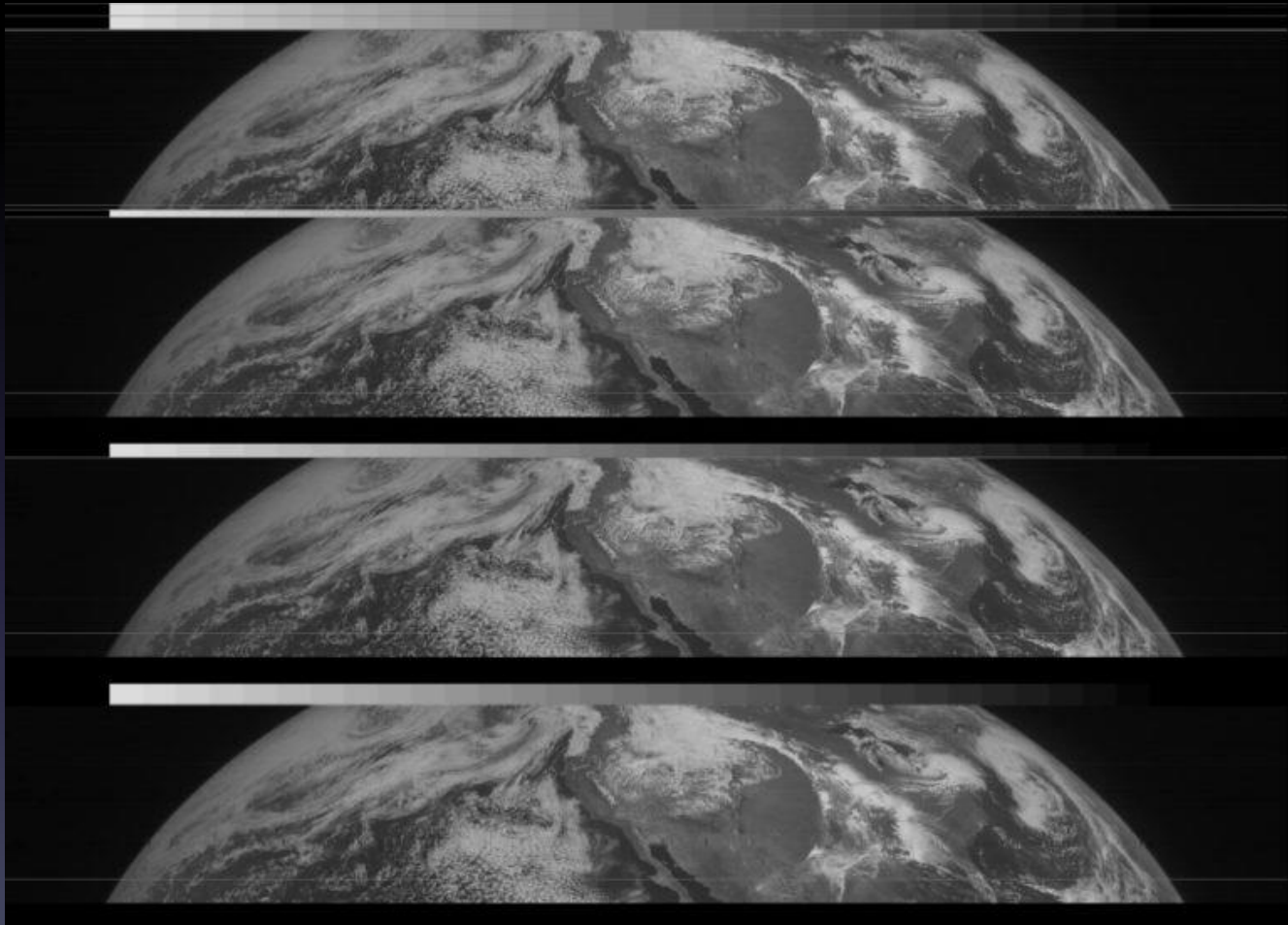
An interesting case:

- Major tornado outbreak swept across Omaha, Nebraska, killing three people and injuring more than 100
- Five-minute imagery created from 6 May 1975





# SMS-1 1974-1975 +



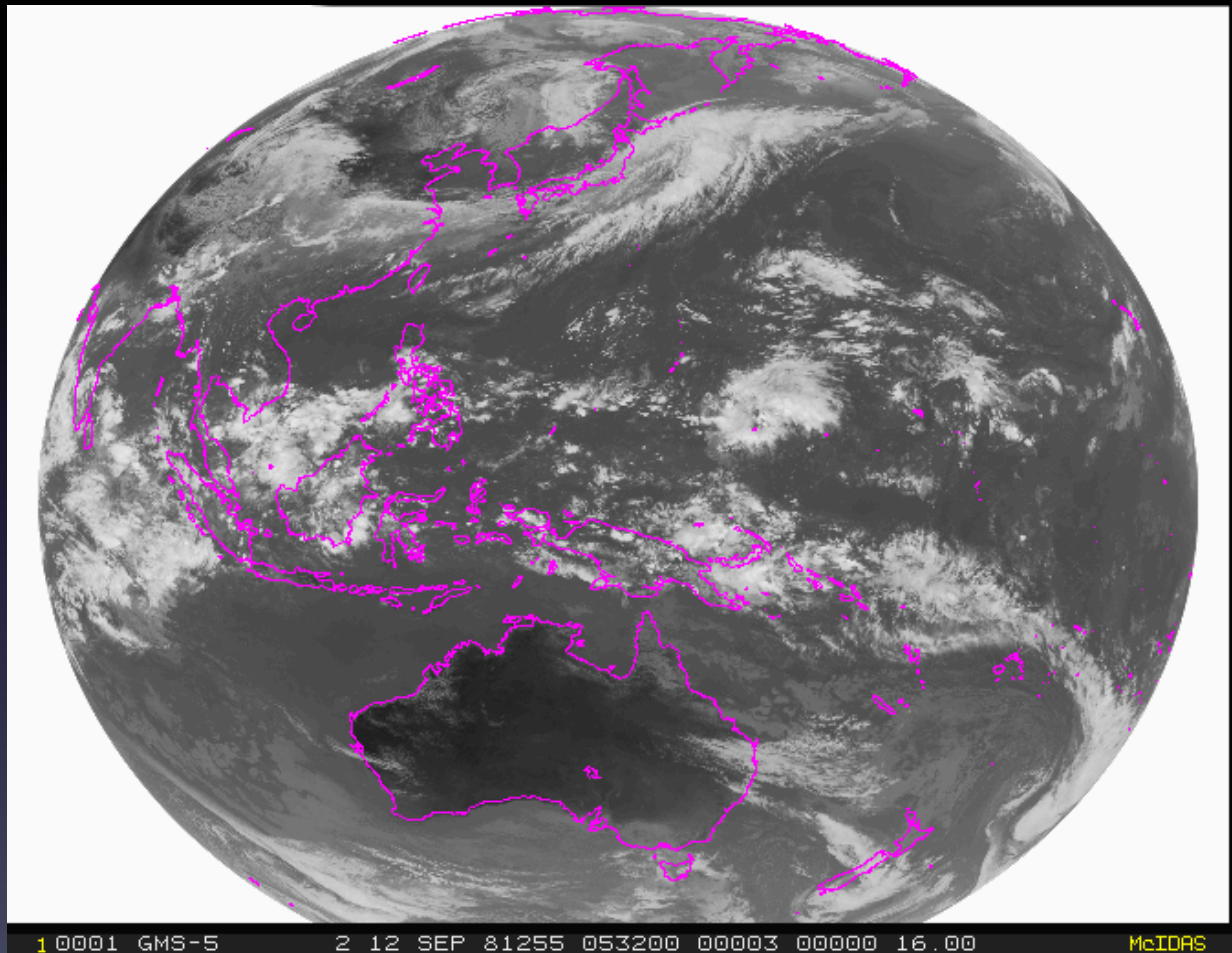


WISCONSIN  
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2016 MUG Meeting

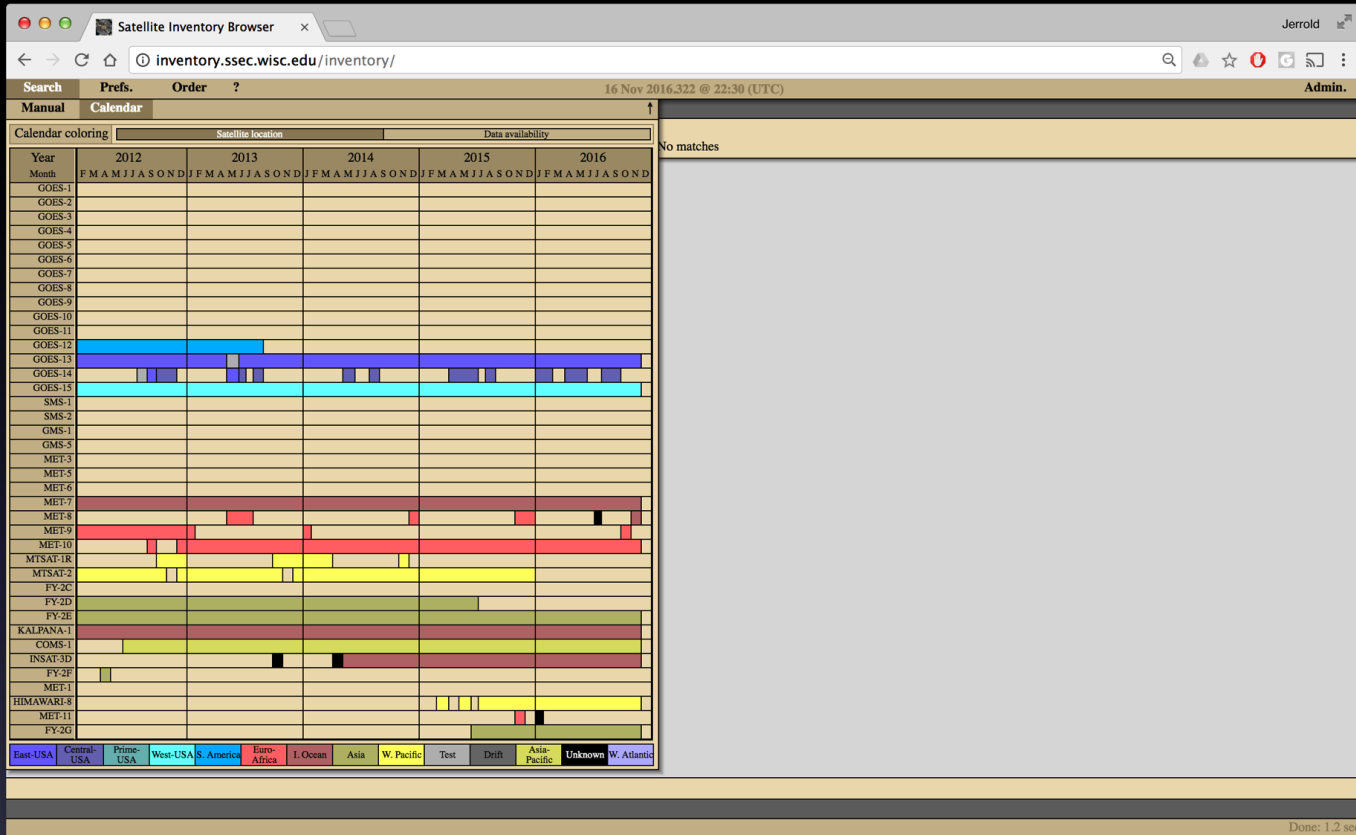


# GMS IR (1981-1998)



# Inventory

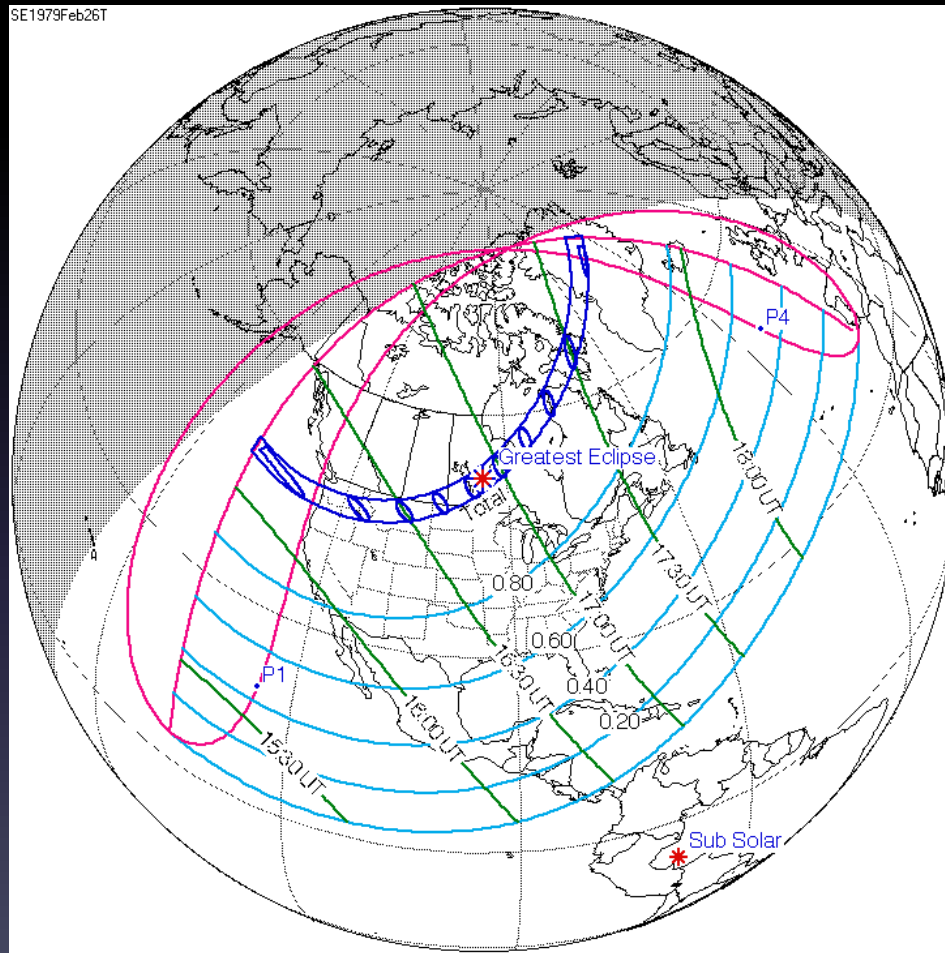
<http://inventory.ssec.wisc.edu/inventory/>



# Fact Check



# Total Eclipse of February 26, 1979



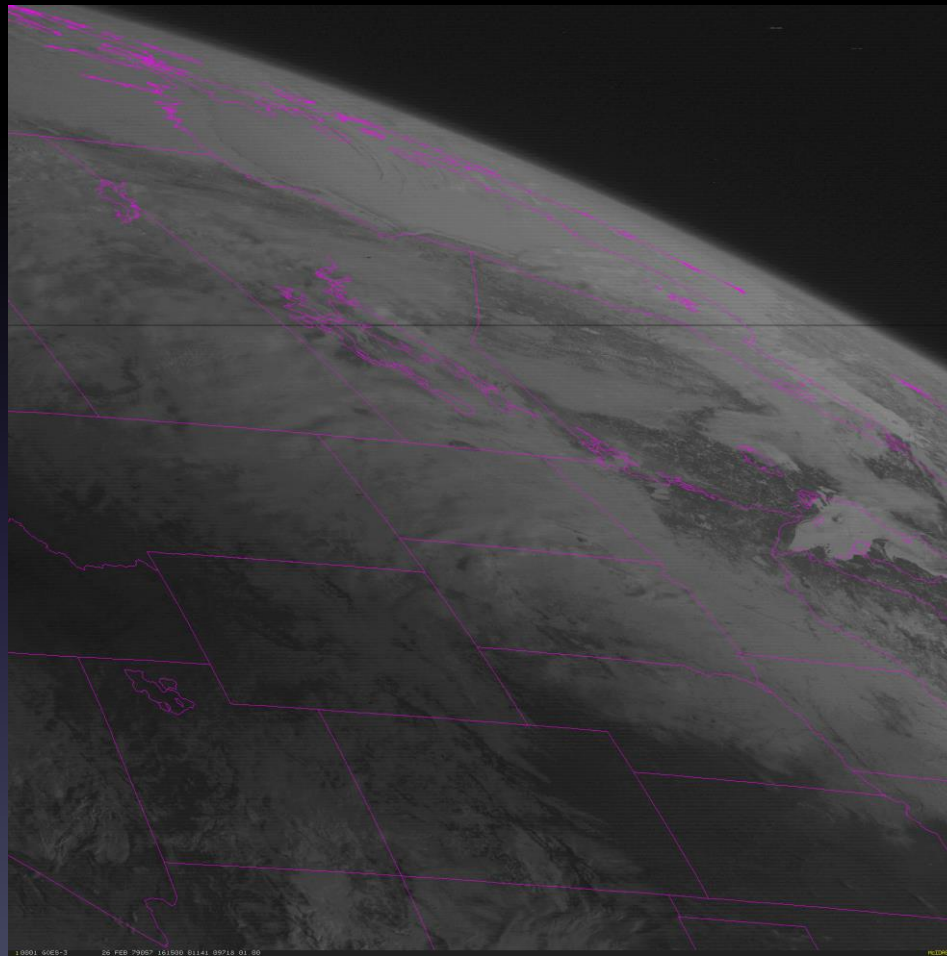


# McFETCH

- [http://mcfetch.ssec.wisc.edu/cgi-bin/mcfetch?dkey=\\*\\*\\*\\*\\*&output=gif&GROUP=AGOE5o3&DESCRIPTOR=A-VIS&SERVER=geoarc.SSEC.WISC.EDU&date=February+26,+1979&band=1&mag=1+-1&map=yes&lat=48+100&USER=\\*\\*\\*\\*&PROJ=\\*\\*\\*\\*&TIME=16:15&size=2000+2000](http://mcfetch.ssec.wisc.edu/cgi-bin/mcfetch?dkey=*****&output=gif&GROUP=AGOE5o3&DESCRIPTOR=A-VIS&SERVER=geoarc.SSEC.WISC.EDU&date=February+26,+1979&band=1&mag=1+-1&map=yes&lat=48+100&USER=****&PROJ=****&TIME=16:15&size=2000+2000)
- [http://mcfetch.ssec.wisc.edu/cgi-bin/mcfetch?dkey=\\*\\*\\*\\*\\*&output=gif&GROUP=AGOE5o3&DESCRIPTOR=A-VIS&SERVER=geoarc.SSEC.WISC.EDU&date=February+26,+1979&band=1&mag=1+-1&map=yes&lat=48+100&USER=\\*\\*\\*\\*&PROJ=\\*\\*\\*\\*&TIME=16:45&size=2000+2000](http://mcfetch.ssec.wisc.edu/cgi-bin/mcfetch?dkey=*****&output=gif&GROUP=AGOE5o3&DESCRIPTOR=A-VIS&SERVER=geoarc.SSEC.WISC.EDU&date=February+26,+1979&band=1&mag=1+-1&map=yes&lat=48+100&USER=****&PROJ=****&TIME=16:45&size=2000+2000)

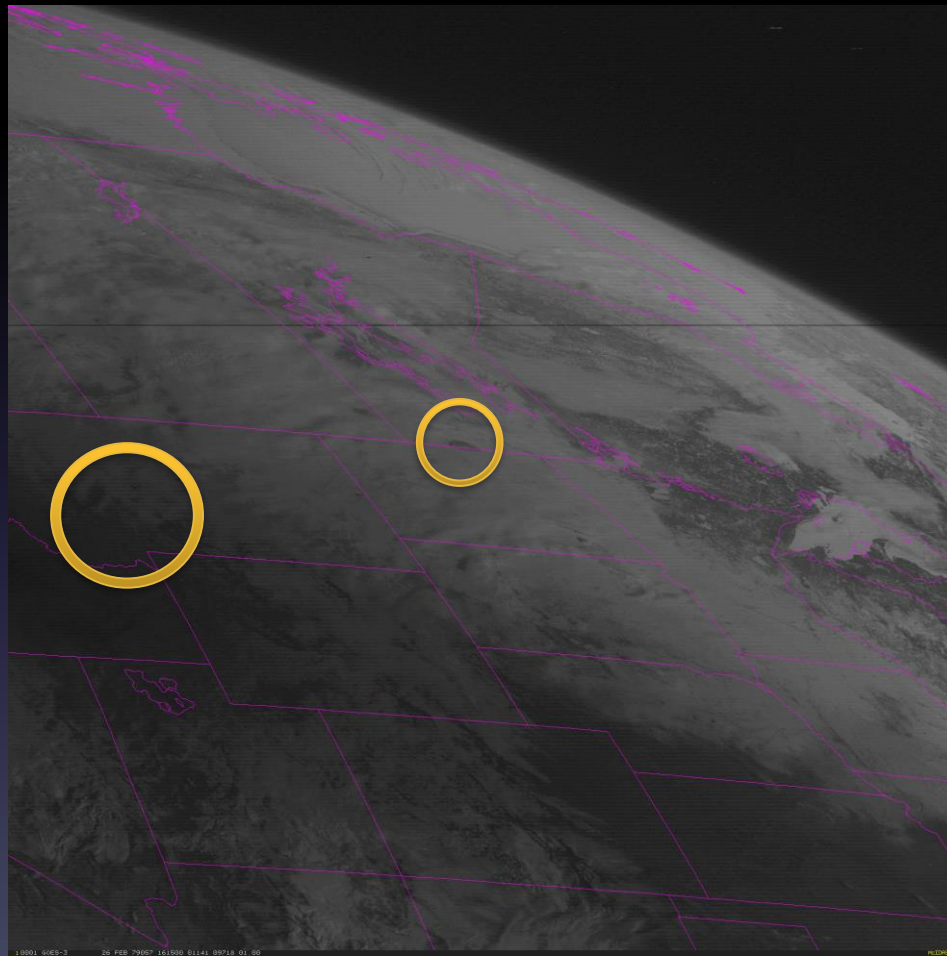


# February 26, 1979





# February 26, 1979



# February 26, 1979

- Story checks out!



End

