Sky Cover during the 2017 Solar Eclipse

Jordan J. Gerth @jjgerth

Cooperative Institute for Meteorological Satellite Studies
Space Science and Engineering Center
University of Wisconsin – Madison

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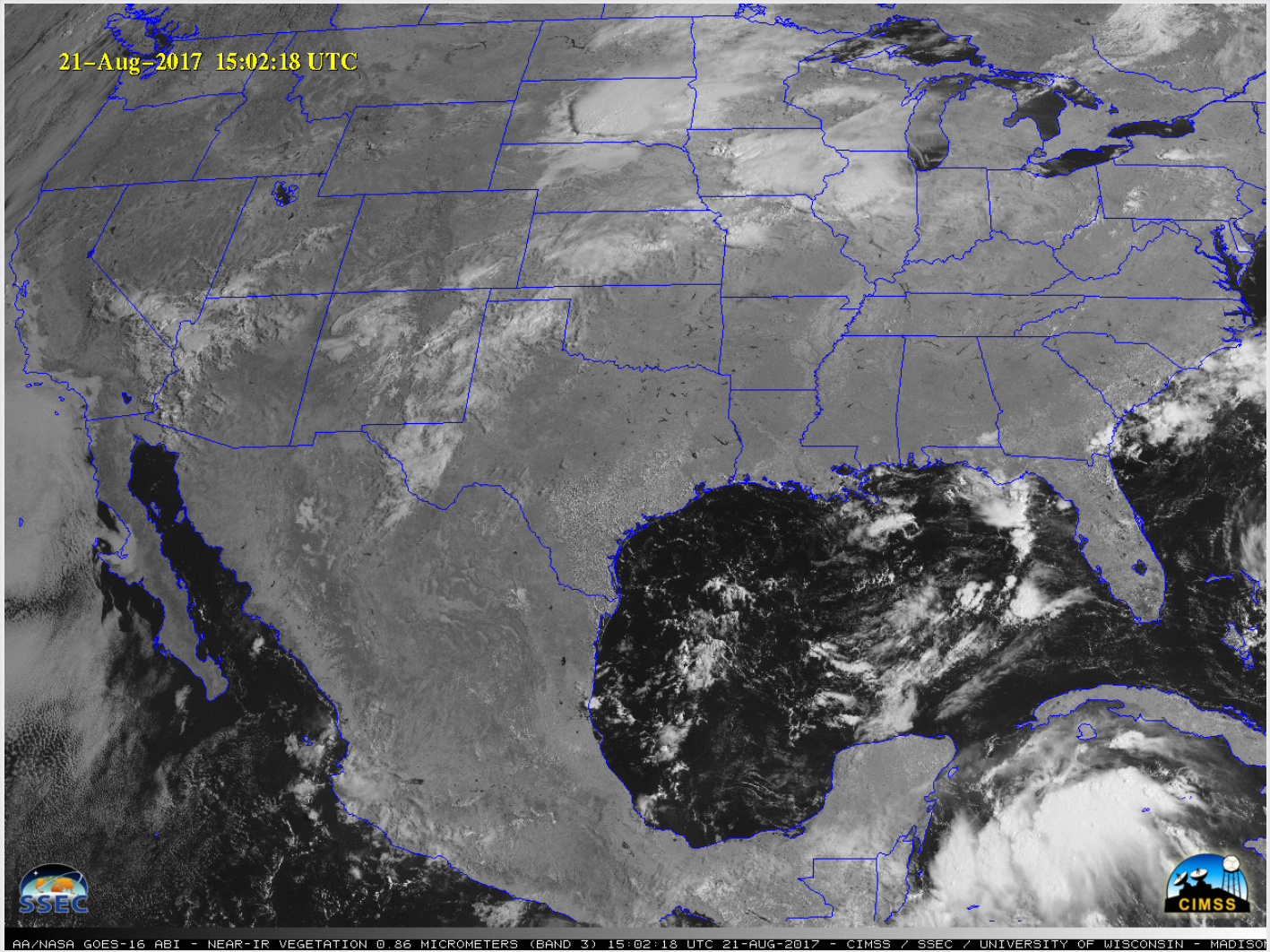
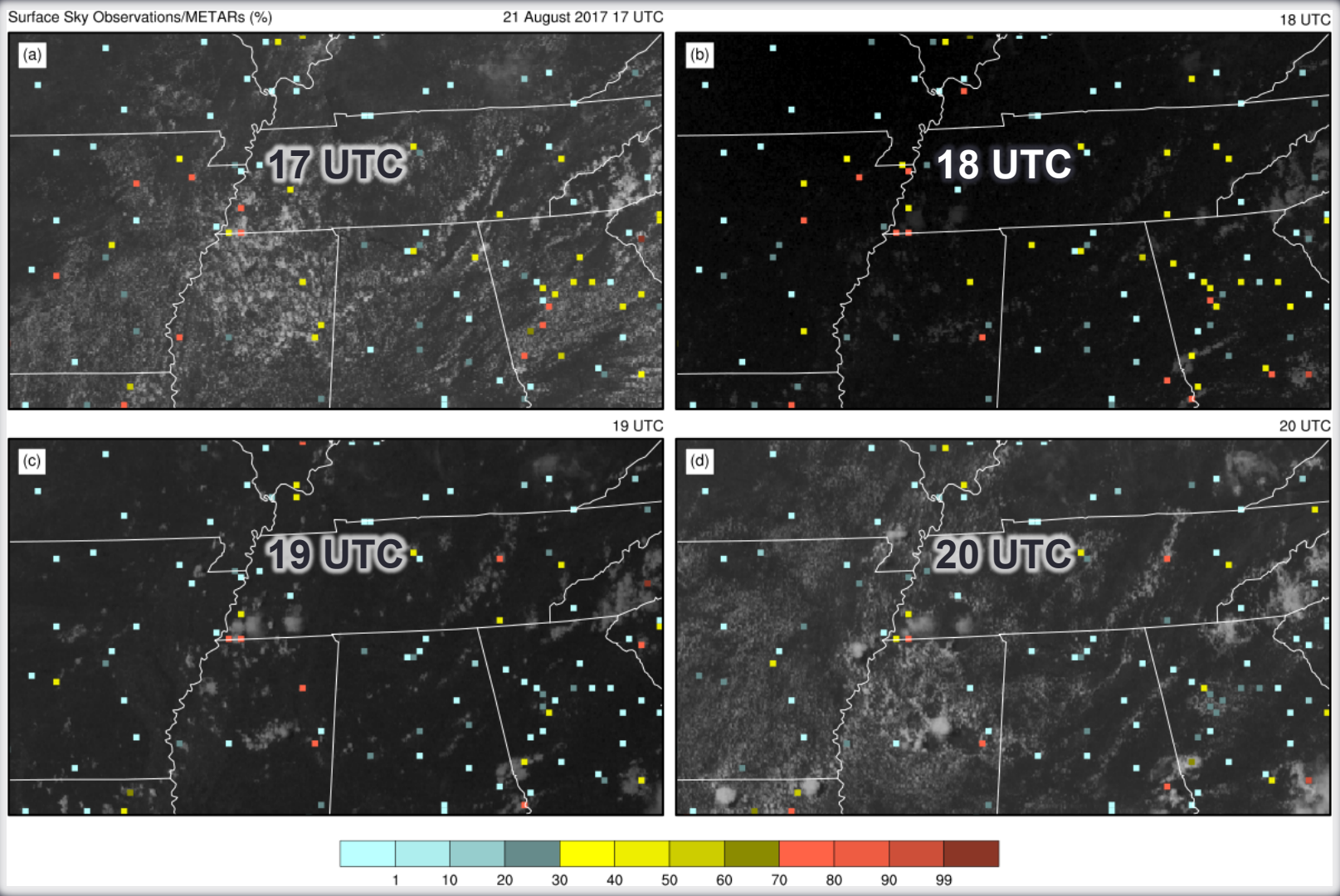
21 August 2017 Solar Eclipse

- Question: Were the National Weather Service (NWS) forecasts adequate in assessing the trend in sky cover during the course of the solar eclipse?
  - Totality in Nashville, TN, was around 18:30 UTC.
  - The NWS defines sky cover as “the expected amount of opaque clouds (in percent) covering the sky valid for the indicated hour.”


21-Aug-2017 15:02:18 UTC
SSEC
CIMSS
AA/NASA GOES-16 ABI - NEAR-IR VEGETATION 0.86 MICROMETERS (BAND 3) 15:02:18 UTC 21-AUG-2017 - CIMSS / SSEC / UNIVERSITY OF WISCONSIN - MADISO


Surface Sky Observations/METARs (%)
21 August 2017 17 UTC
(a)
17 UTC
18 UTC
(b)
18 UTC
19 UTC
(c)
19 UTC
20 UTC
(d)
20 UTC
1
10
20
30
40
50
60
70
80
90
99

Source: Wikimedia

Imager SCP

GOES-13 Imager Sky Cover Product

The GOES-13 Imager Sky Cover Product is a time-average of the celestial dome effective cloud amount (emissivity) within a one-hour window. The valid time begins at the indicated time. The average is all scans after the valid time, within one hour.

RTMA

NCEP Real-Time Mesoscale Analysis

The RTMA is an assimilation system for near-surface weather observations that produces an hourly analysis with a spatial resolution of approximately 2.5 km. The GOES imager SCP is used in the RTMA as data of opportunity for sky cover.

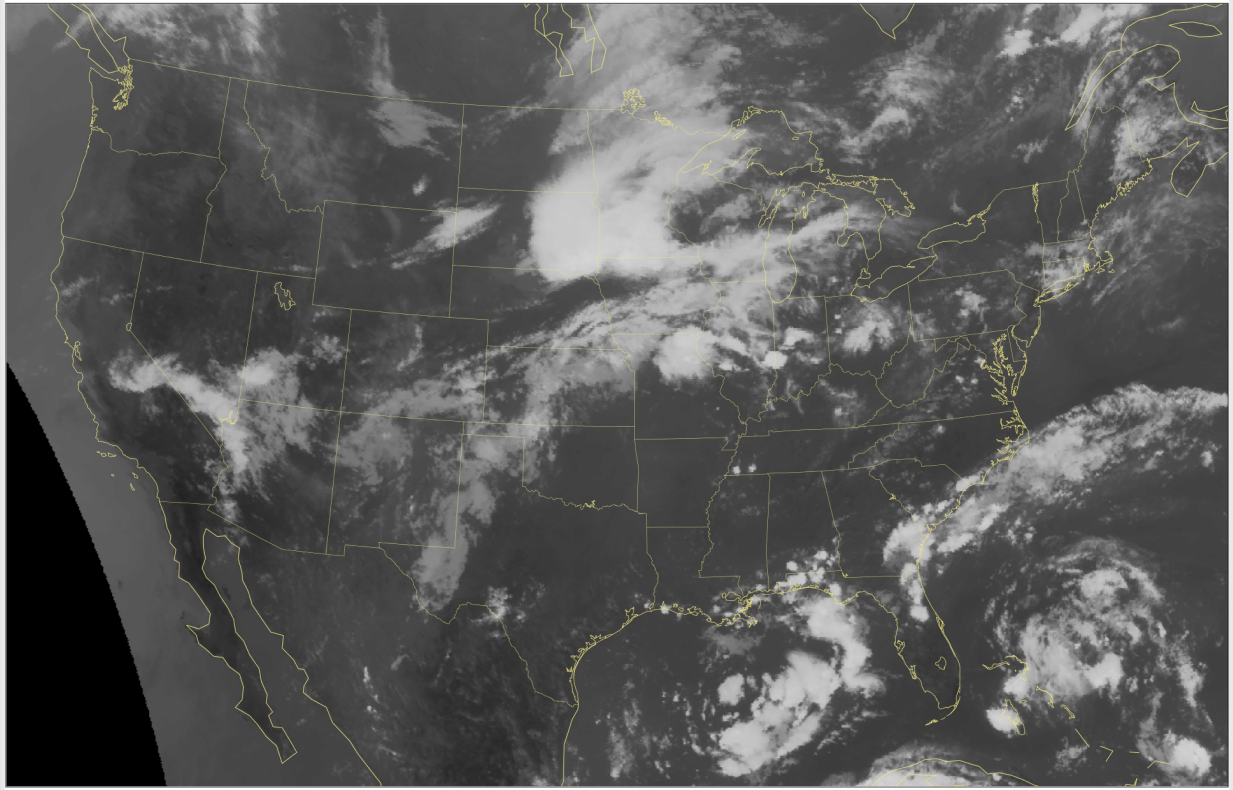
NDFD

NWS National Digital Forecast Database

The NDFD Total Cloud Cover is the human-produced one-hour cloud forecast valid for one hour beginning at the indicated time, usually with input from numerical weather prediction fields. This is an official NWS product and converted to text forecasts.

Sky Cover Comparison

GOES-East CONUS IR Window Image

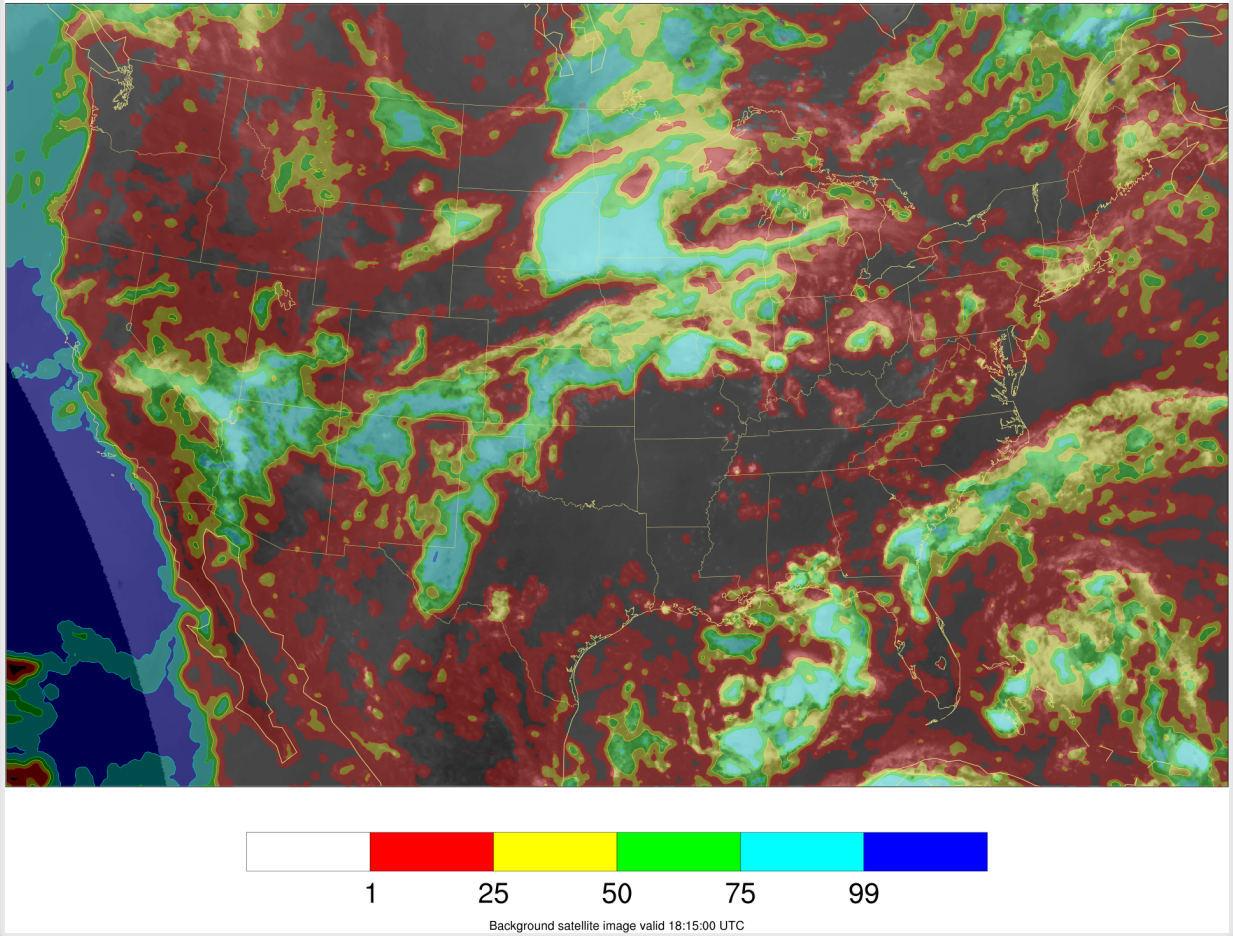


Background satellite image valid Mon Aug 21 18:15:00 UTC 2017

Sky Cover Comparison

Mon Aug 21 18:00:00 UTC 2017

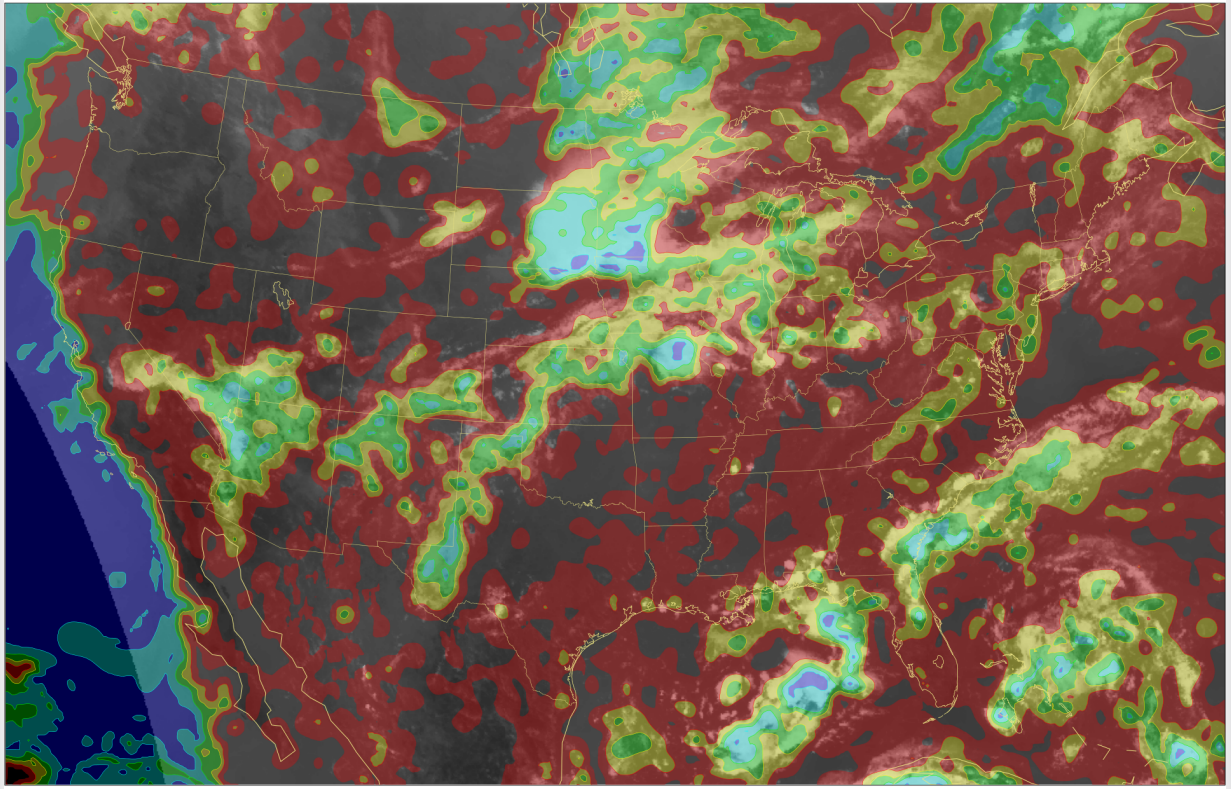
GOES Imager Sky Cover Product (%)



Sky Cover Comparison

Mon Aug 21 18:00:00 UTC 2017

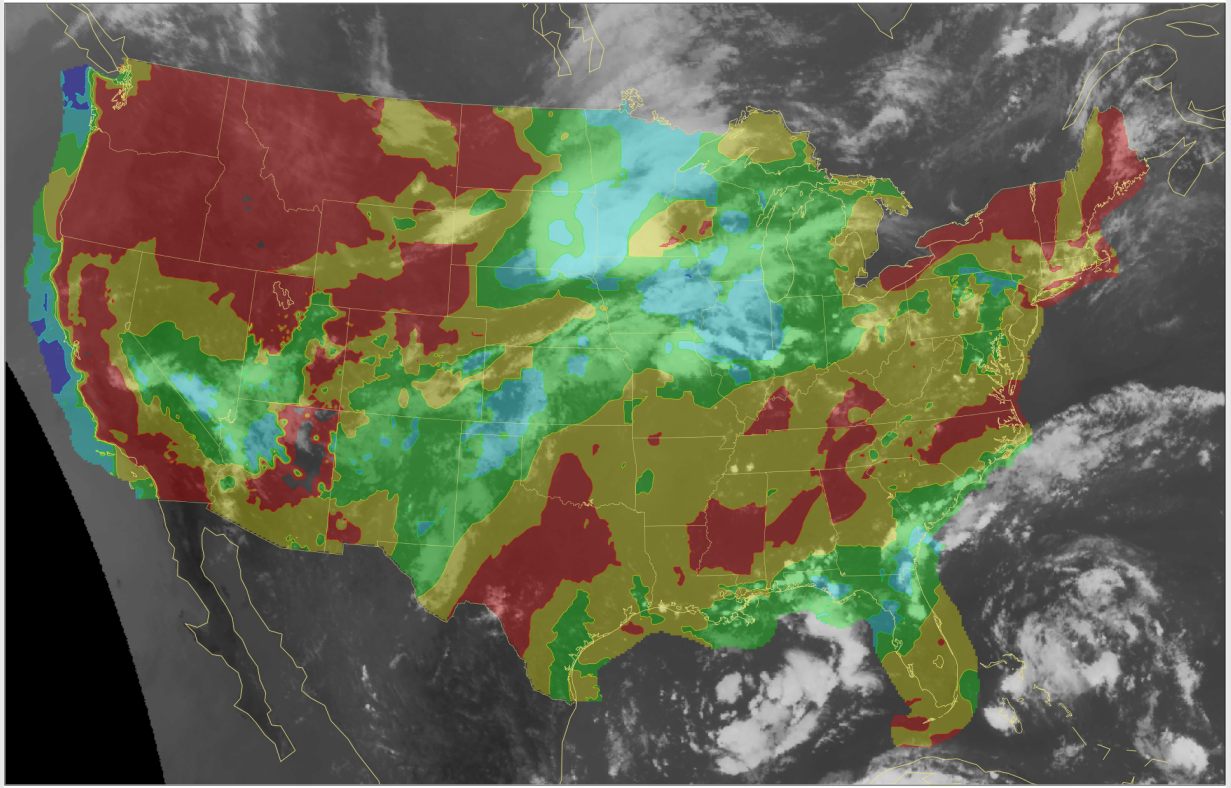
RTMA Total Cloud Cover (%)

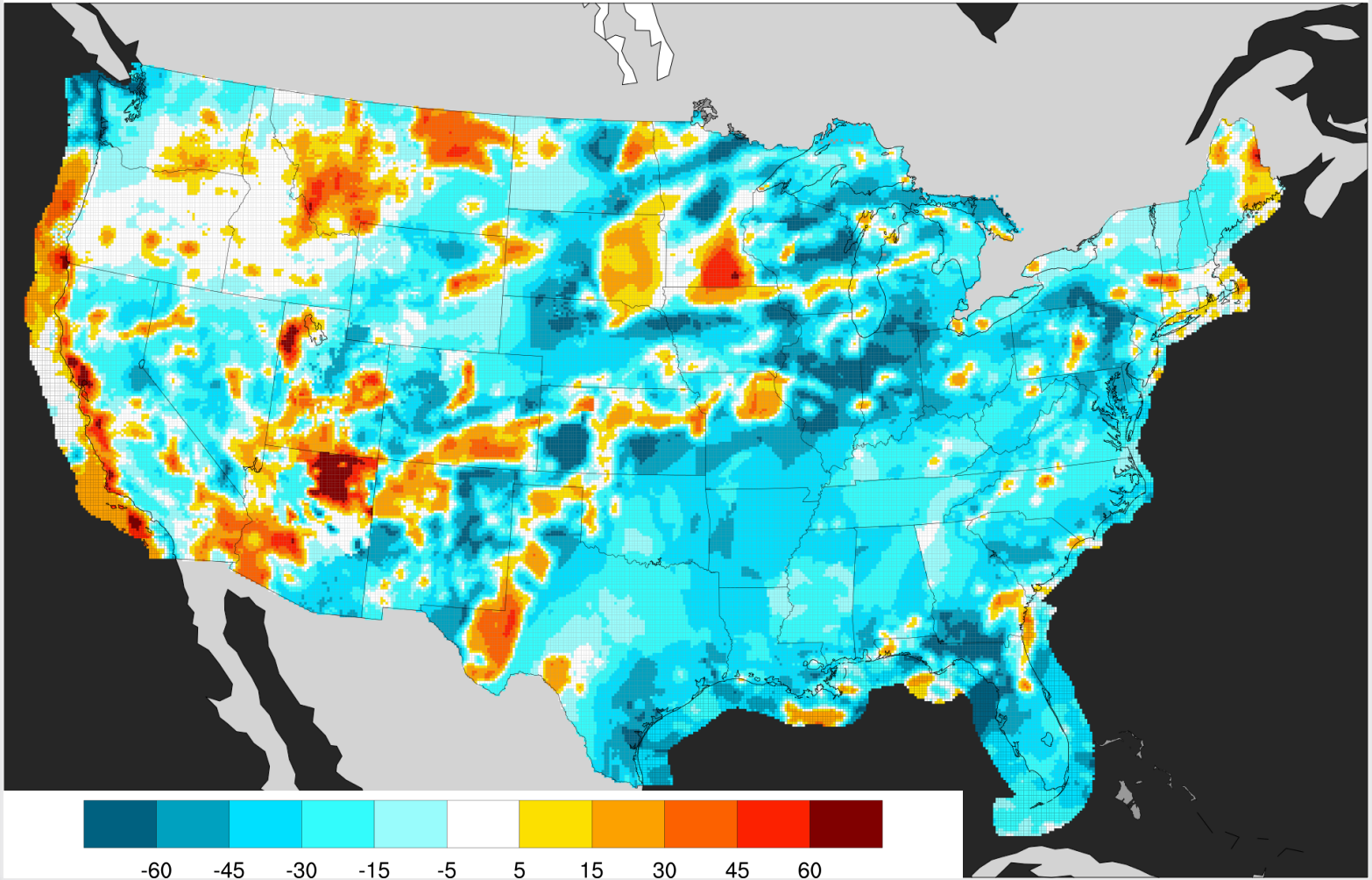


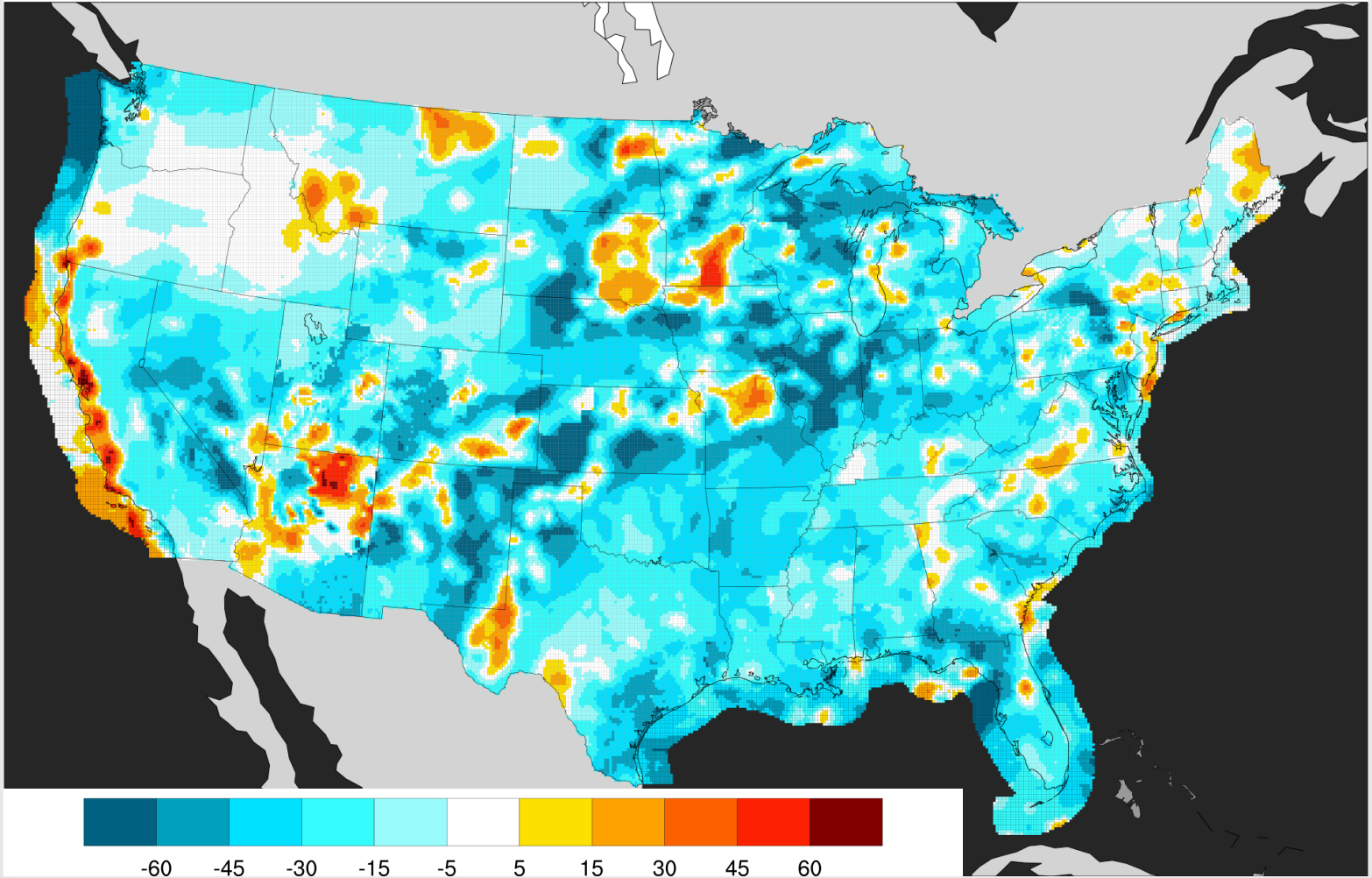
Sky Cover Comparison

Mon Aug 21 18:00:00 UTC 2017

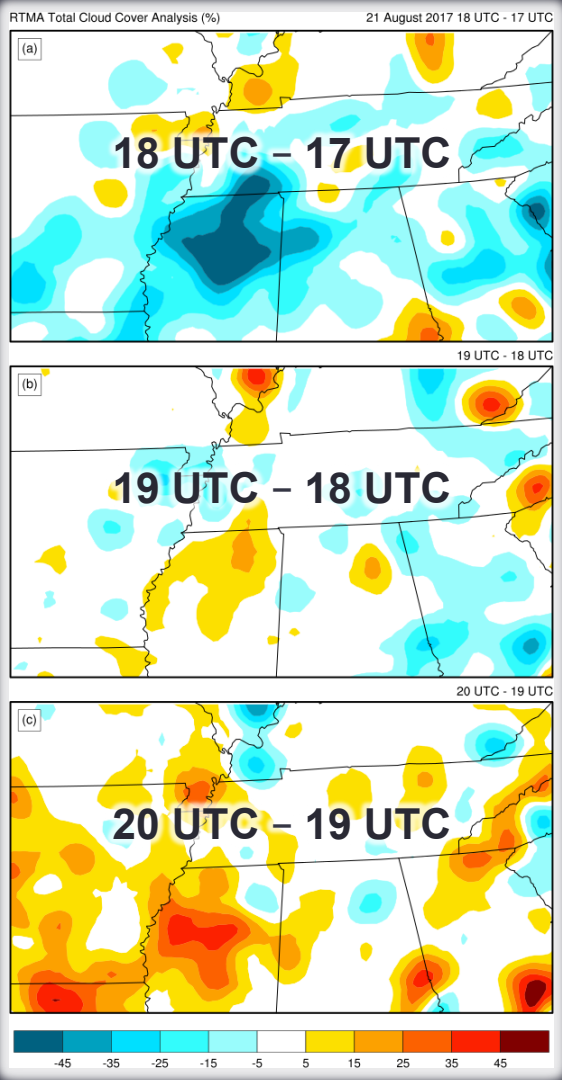
NDFD Total Cloud Cover (%)



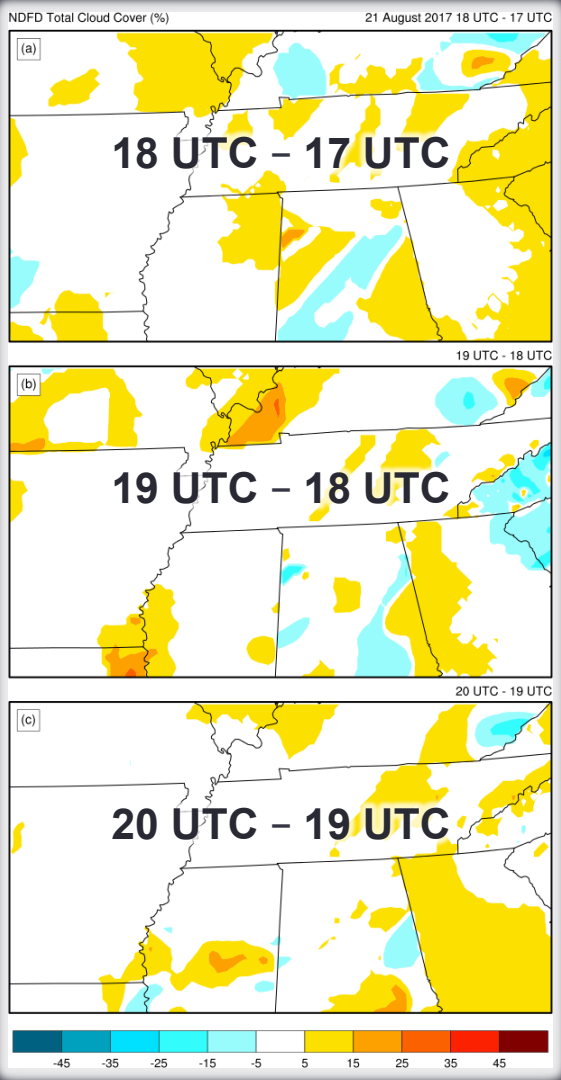

Mon Aug 21 18:00:00 UTC 2017
GOES Imager Sky Cover Product (%) - NDFD Total Cloud Cover (%)
-60
-45
-30
-15
-5
5
15
30
45
60


Mon Aug 21 18:00:00 UTC 2017
RTMA Total Cloud Cover (%) - NDFD Total Cloud Cover (%)
-60
-45
-30
-15
-5
5
15
30
45
60

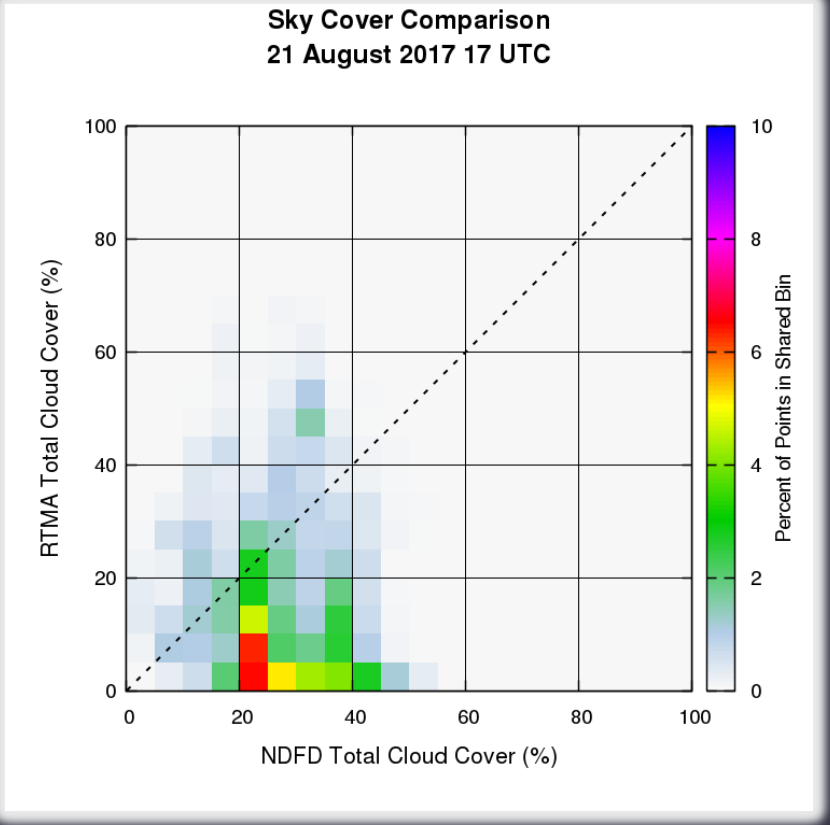
RTMA Total Cloud Cover Analysis (%)

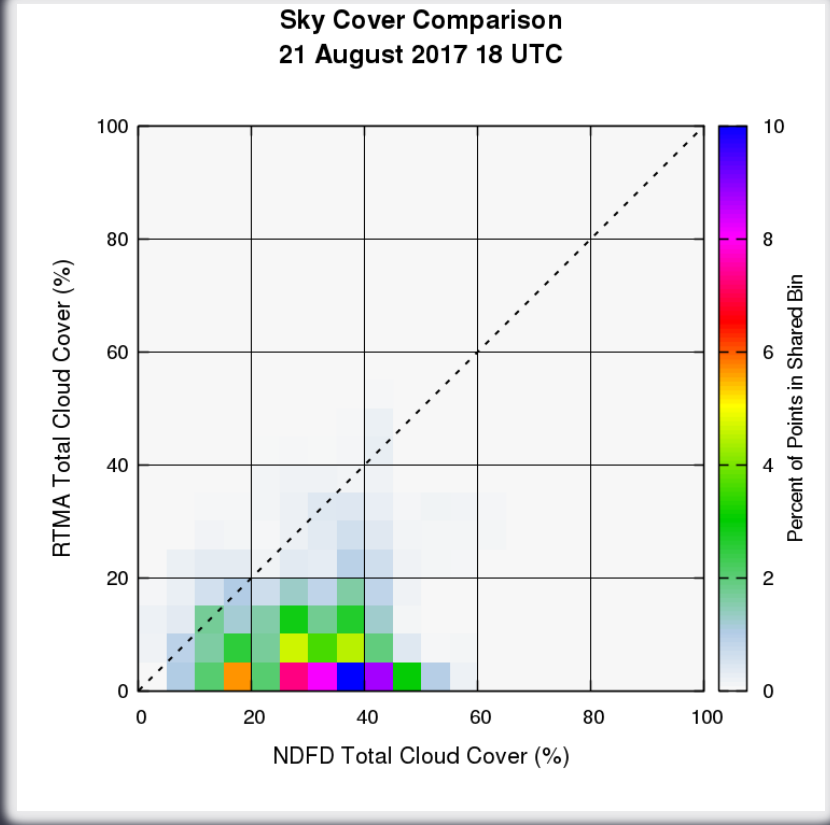


NDFD Total Cloud Cover (%)



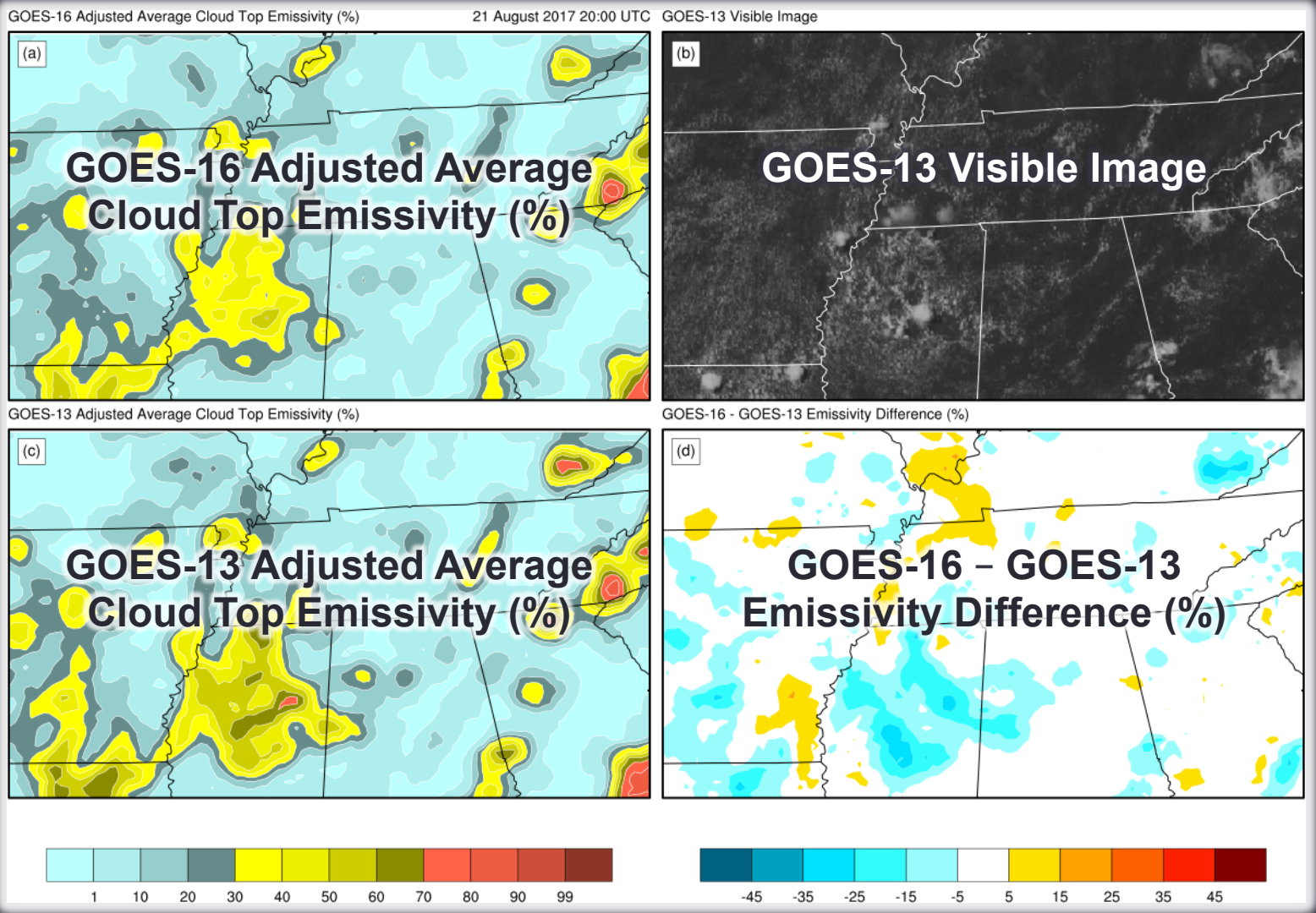
RTMA vs. NDFD, 17 ➔ 18 UTC





21 August 2017 Solar Eclipse

- Conclusion: The cloudiness decreased ahead of totality, but NWS forecasts of sky cover for the Tennessee Valley did not predict it, even as solar eclipse totality was approaching.
  - Subsequent question: Does using imagery from GOES-16 change the calculation of the satellite-observed adjusted average cloud top emissivity?


GOES-16 Adjusted Average Cloud Top Emissivity (%)
21 August 2017 20:00 UTC
GOES-13 Visible Image
(a)
GOES-16 Adjusted Average Cloud Top Emissivity (%)
(b)
GOES-13 Visible Image
GOES-13 Adjusted Average Cloud Top Emissivity (%)
GOES-16 - GOES-13 Emissivity Difference (%)
(c)
GOES-13 Adjusted Average Cloud Top Emissivity (%)
(d)
GOES-16 – GOES-13 Emissivity Difference (%)
1 10 20 30 40 50 60 70 80 90 99
-45 -35 -25 -15 -5 5 15 25 35 45

21 August 2017 Solar Eclipse

- Conclusion: There were minor changes in the magnitude of maxima and minima due to different the spectral and spatial resolutions of the GOES imagers.
- Full article available online:
  - Jordan J. Gerth, “Shining light on sky cover during a total solar eclipse,” *Journal of Applied Remote Sensing* 12(2), 020501 (29 June 2018). https://doi.org/10.1117/1.JRS.12.020501.

QUESTIONS?

jordan.gerth@ssec.wisc.edu

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