Total Solar Irradiance Data for the CERES Climate Record

David P. Kratz[1], Shashi K. Gupta[2],
Anne C. Wilber[2], Victor E. Sothcott[2]

[1]NASA Langley Research Center
[2]Science Systems and Applications, Inc.

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Edition 4 Improvements to the Surface-Only Flux Algorithms

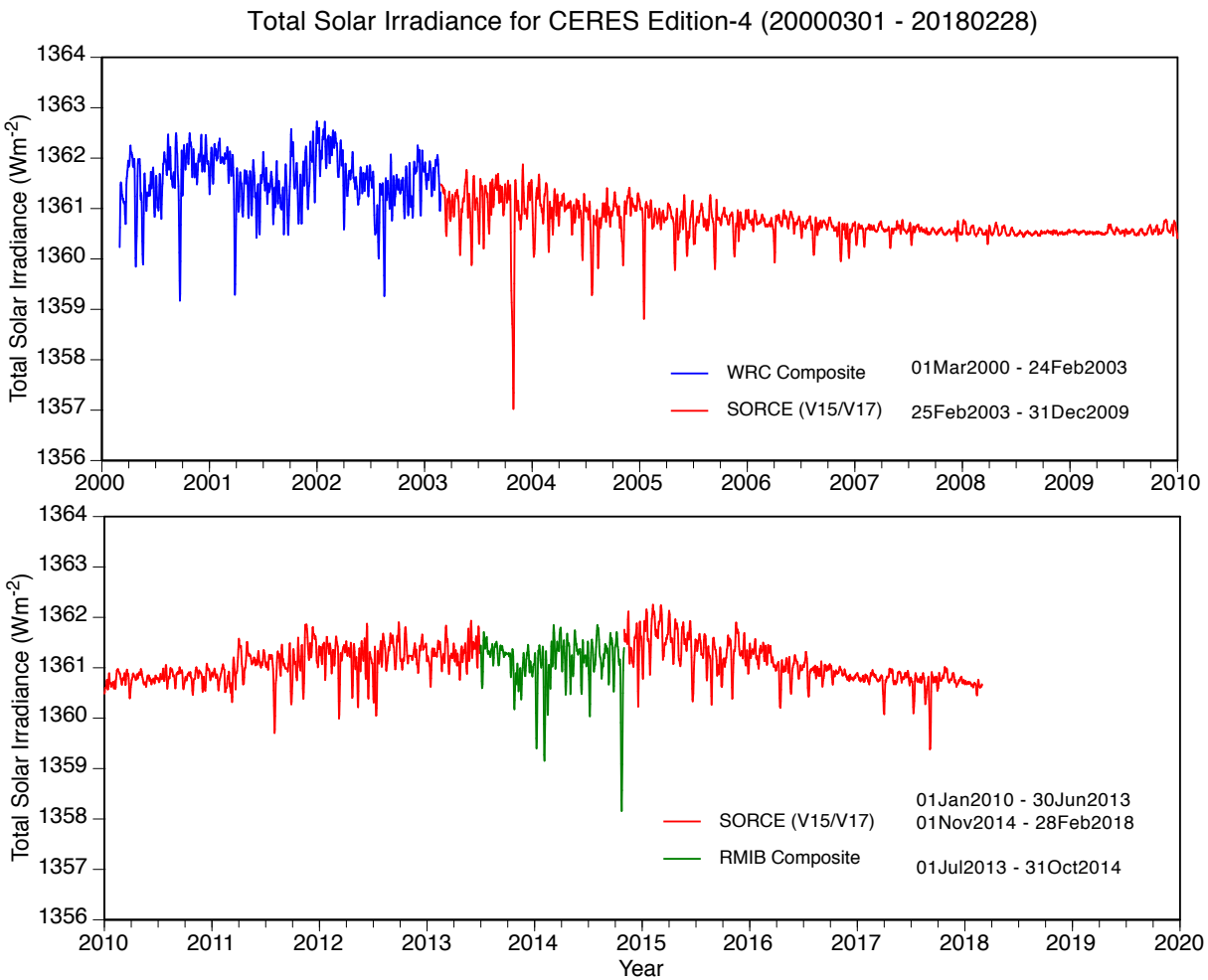
SW Model Improvements: 1) Replacing the ERBE albedo maps with the Terra maps greatly improved the SW retrievals, most notably for polar regions. 2) Replacing the original WCP-55 aerosols properties with monthly MATCH/OPAC datasets while also replacing the original Rayleigh molecular scattering formulation with the Bodhaine et al., (1999) model significantly improved SW surface fluxes for clear conditions. 3) To account for the short term aerosol variability we have incorporated daily MATCH aerosol data into Edition 4A. 4) Using a revised empirical coefficient in the cloud transmission formula improved the SW surface fluxes for partly cloudy conditions. 5) Work continues on the improvement of the cloud transmission method for Edition 4+ clouds.

LW Model Improvements: 1) Constraining the lapse rate to 10K/100hPa (roughly the dry adiabatic lapse rate) improved the derivation of surface fluxes for conditions involving surface temperatures that greatly exceeded the overlying air temperatures, see Gupta et al. (2010). 2) Limiting the inversion strength to −10K/100hPa for the downward flux retrievals provided the best results for cases involving surface temperatures that were much below the overlying air temperatures (strong inversions).

Parameterized models for fast computation of surface fluxes for both CERES and FLASHFlux

Dataset	CERES 2B	CERES 4A
Clear-Sky TOA albedo Terra	48 month ERBE	70 month Terra
Clear-Sky TOA albedo Aqua	46 month Terra	70 month Terra
Clear-Sky Surf. albedo	46 month Terra	70 month Terra
TOA to Surface albedo transfer	Instantaneous	Monthly average
Spec. Corr. Coef.	CERES 2B	CERES 4A
Cos (sza) dependence of Surface Flux	LPSA	Briegleb-type
Cloud Algorithm Terra	Terra Ed2	Terra/Aqua Ed4
Cloud Algorithm Aqua	Aqua Ed2	Terra/Aqua Ed4
SW aerosol dataset	WCP-55	MATCH/OPAC
Rayleigh Treatment	Original LPSA	Bodhaine et al (1999), JAOT.
Ozone Range Check	0 to 500 DU	0 to 800 DU
Twilight cutoff		New
Cloud transmission empirical coefficient	0.80	0.75
LW high temperature surface correction	No	Maximum Lapse Rate 10K/100hPa
LW Inversion correction	No	Maximum Inversion Strength -10K/100hPa

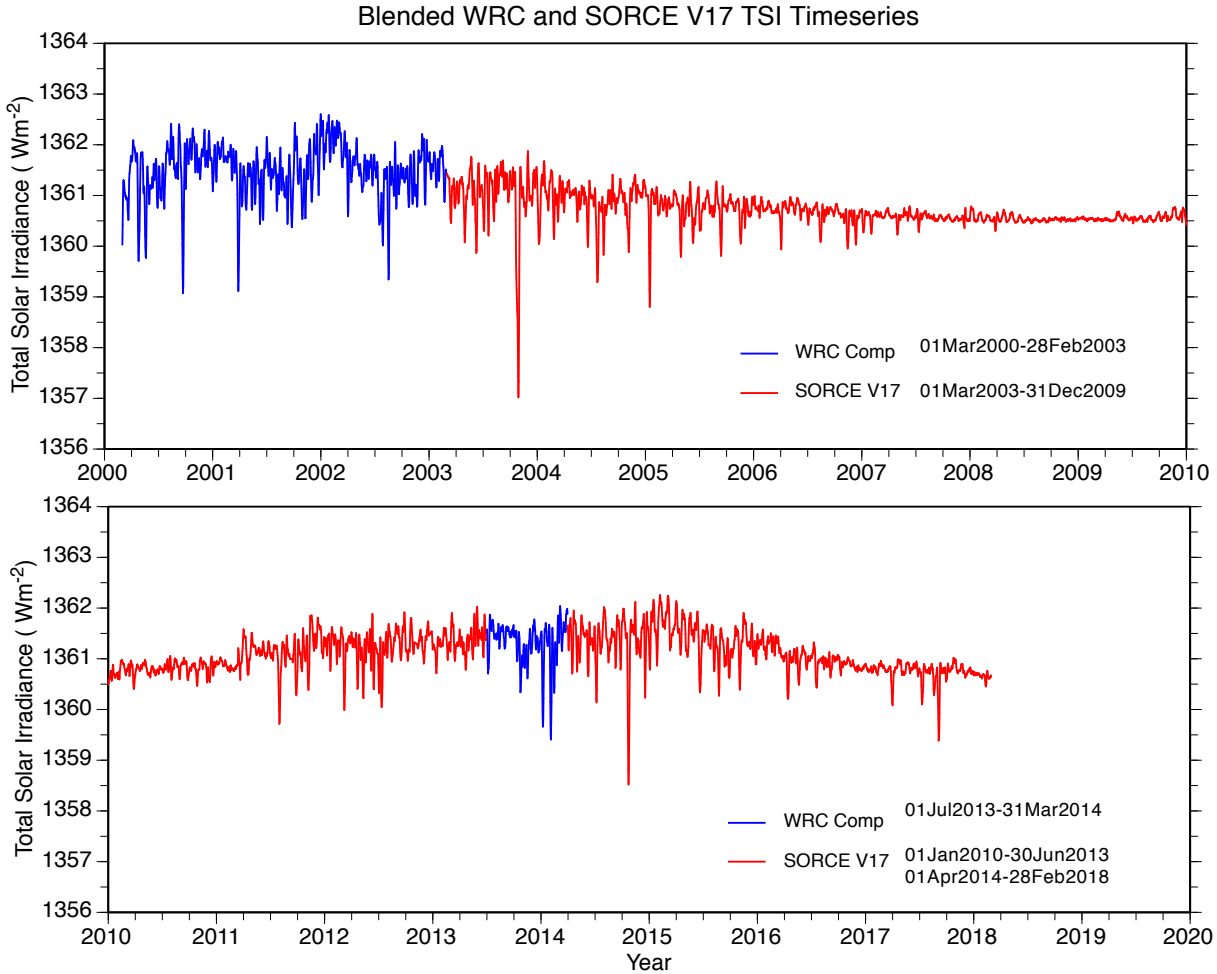
TSI data from composite WRC and RMIB datasets, and the SORCE(V15) for Timeframe of CERES Terra, Aqua & NPP



CERES Edition 4

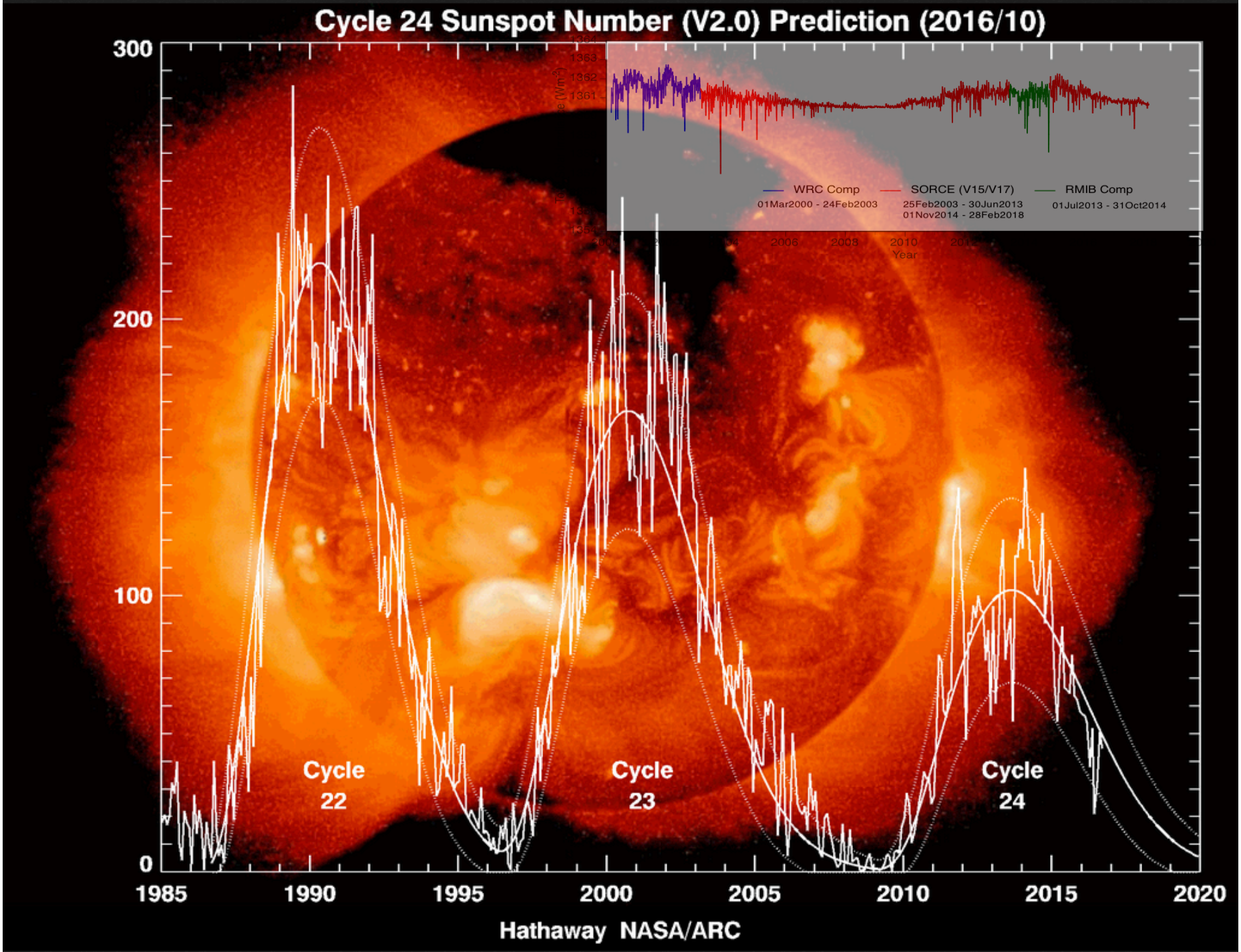
For CERES Ed 4A, all TSI data are offset to match SORCE TSI Version 15

TSI data from composite WRC dataset, and SORCE(V17) for the Timeframe of CERES Terra, Aqua & NPP



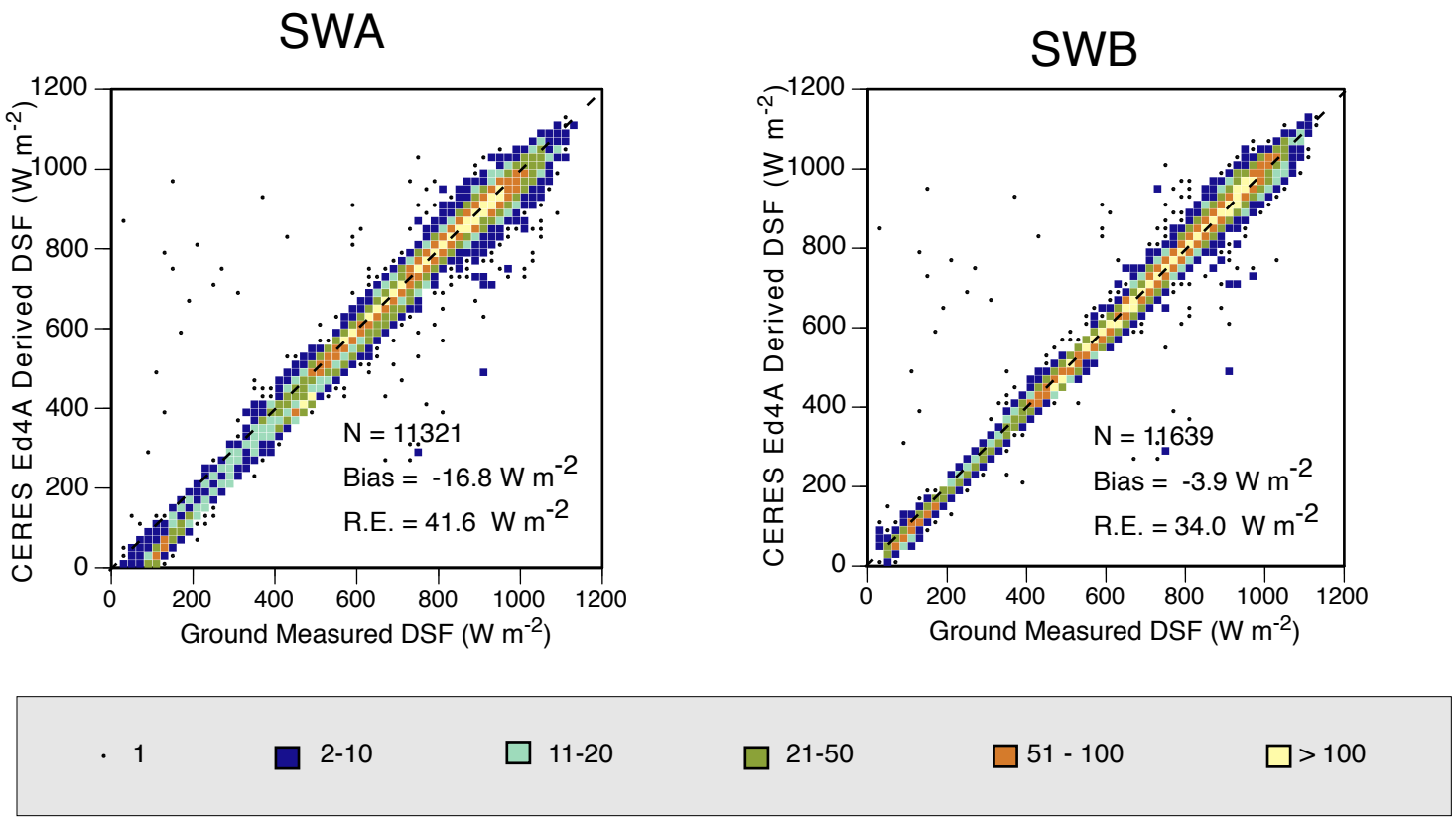
Future CERES Edition

For Future CERES, all TSI data are offset to match SORCE TSI Version 17


Cycle 24 Sunspot Number (V2.0) Prediction (2016/10)
300
200
100
0
1985
1990
1995
2000
2005
2010
2015
2020
Cycle 22
Cycle 23
Cycle 24
Hathaway NASA/ARC
WRC Comp
01Mar2000 - 24Feb2003
SORCE (V15/V17)
25Feb2003 - 30Jun2013
01Nov2014 - 28Feb2018
RMIB Comp
01Jul2013 - 31Oct2014
Year

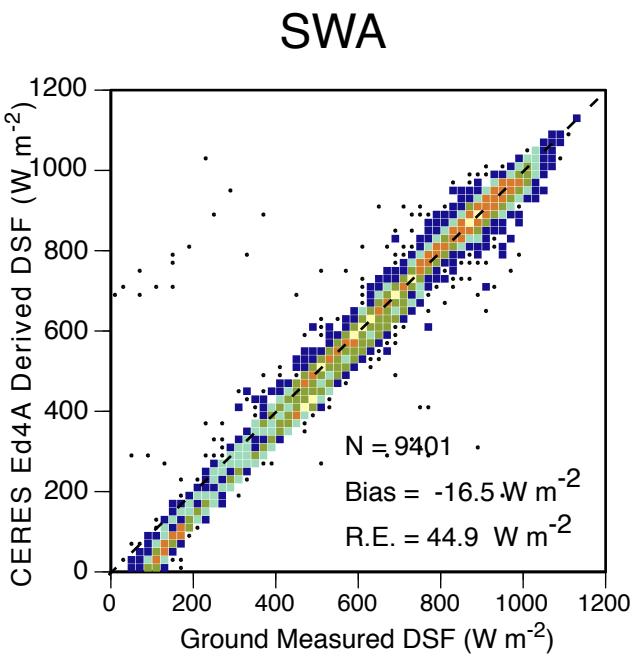
CERES Terra Edition 4A SW Ground Validation (Global)

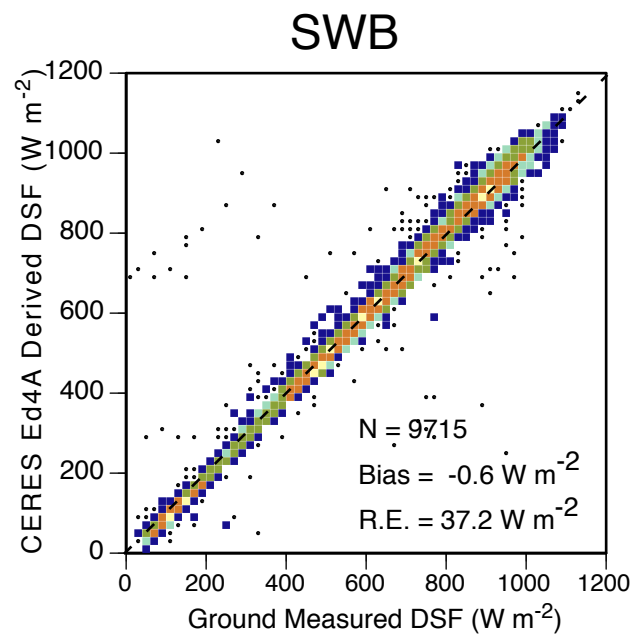
Clear-Sky

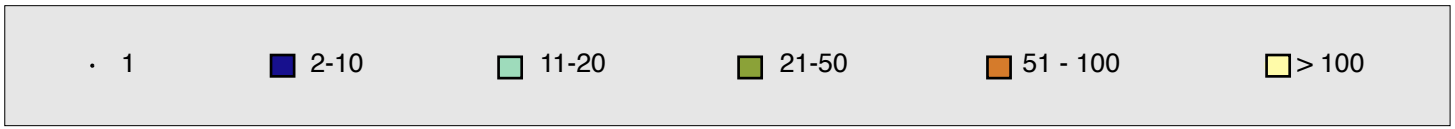


CERES Aqua Edition 4A SW Ground Validation (Global)

Clear-Sky

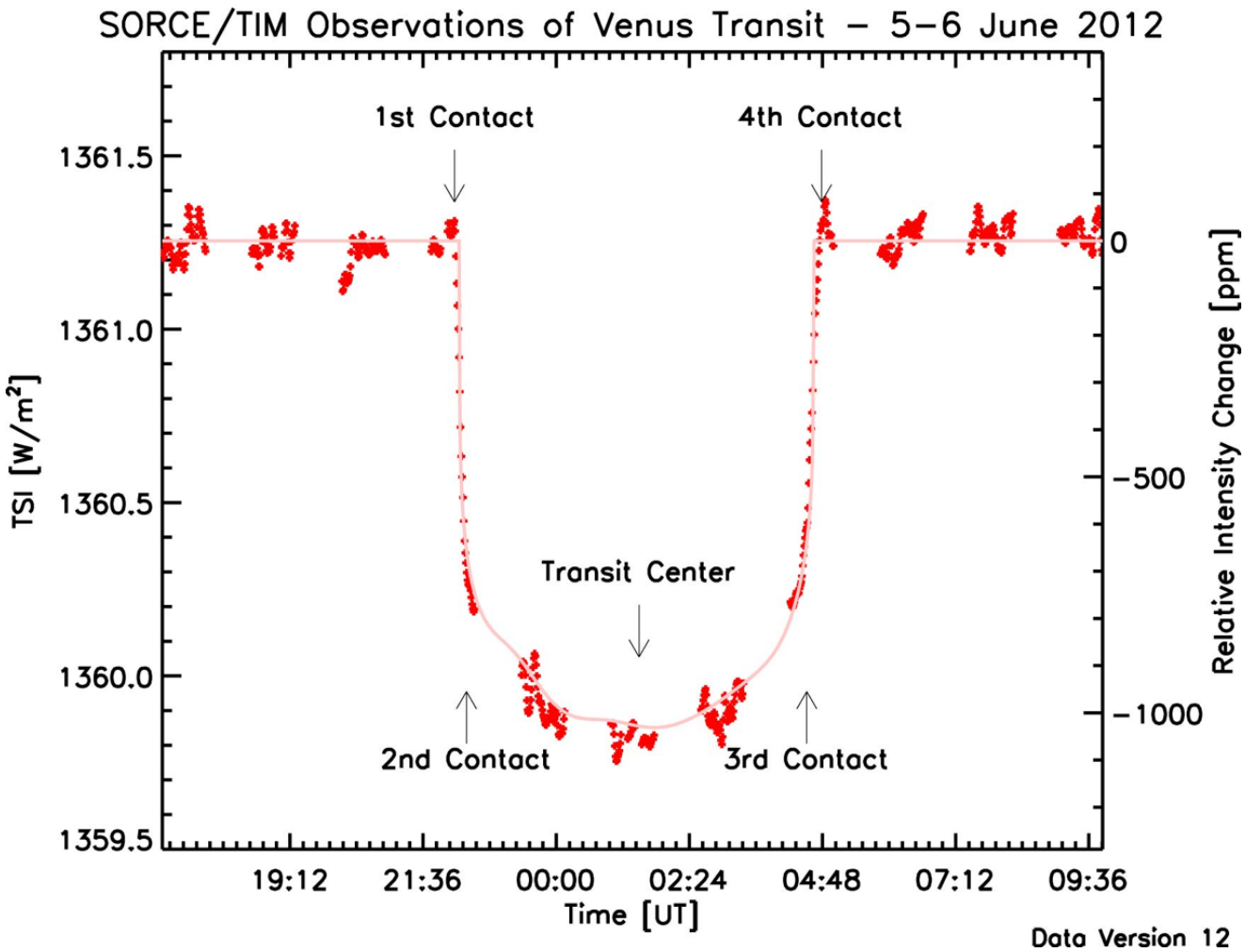






Transit of Venus June 5-6, 2012

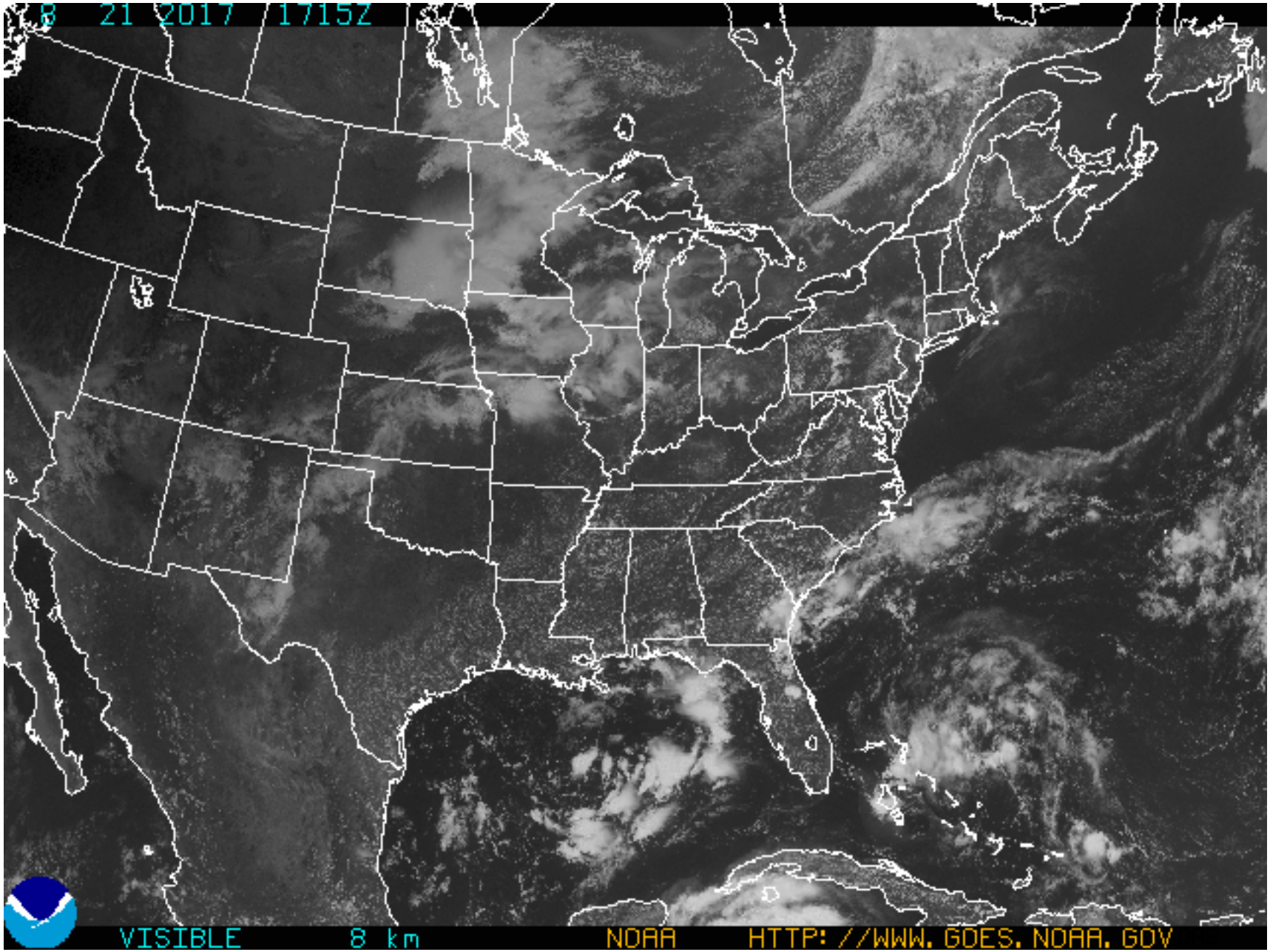
Image available from Greg Kopp's page: spot.colorado.edu/~koppg/TSI



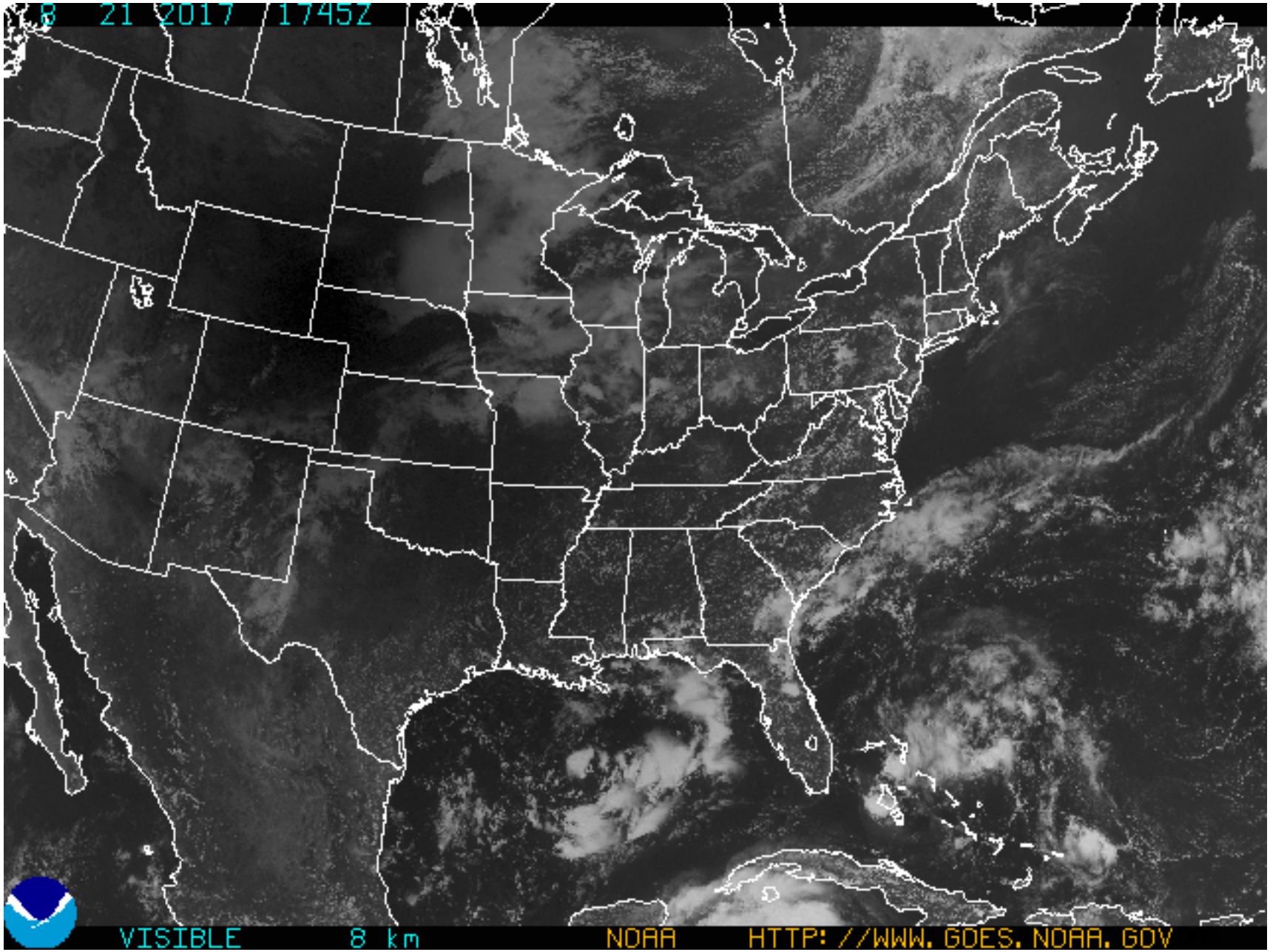
Impact of 8/21/2017 Total Solar Eclipse on CERES data

17:15 UT (11:15 CDT)
17:45 UT (11:45 CDT)
18:15 UT (12:15 CDT)
18:15 UT (12:45 CDT)

See: http://cimss.ssec.wisc.edu/goes/blog/wp-content/uploads/2017/08/170821_g16_vegetation_b3_conus_anim.gif



Climate Science Branch, NASA Langley Research Center



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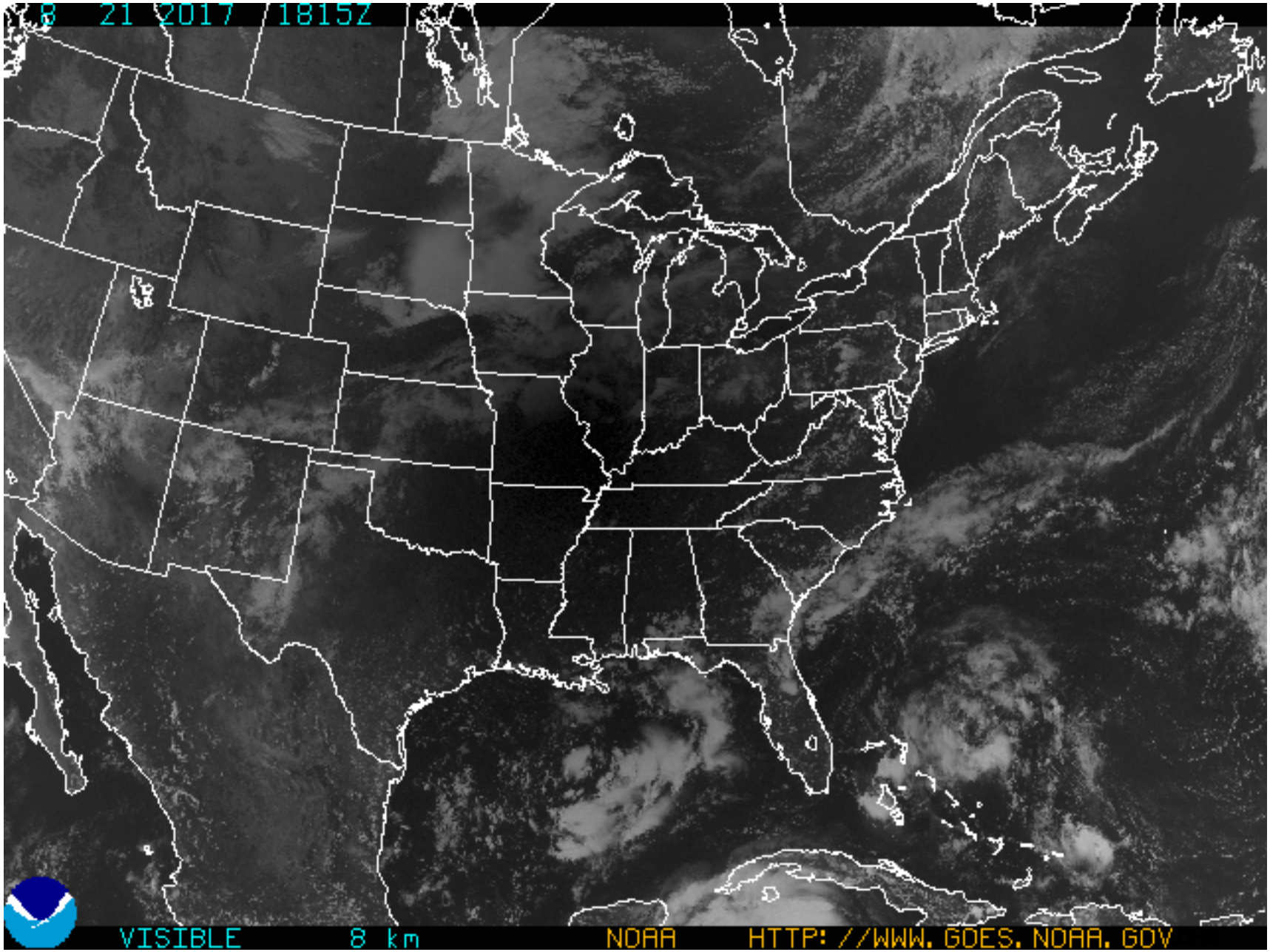

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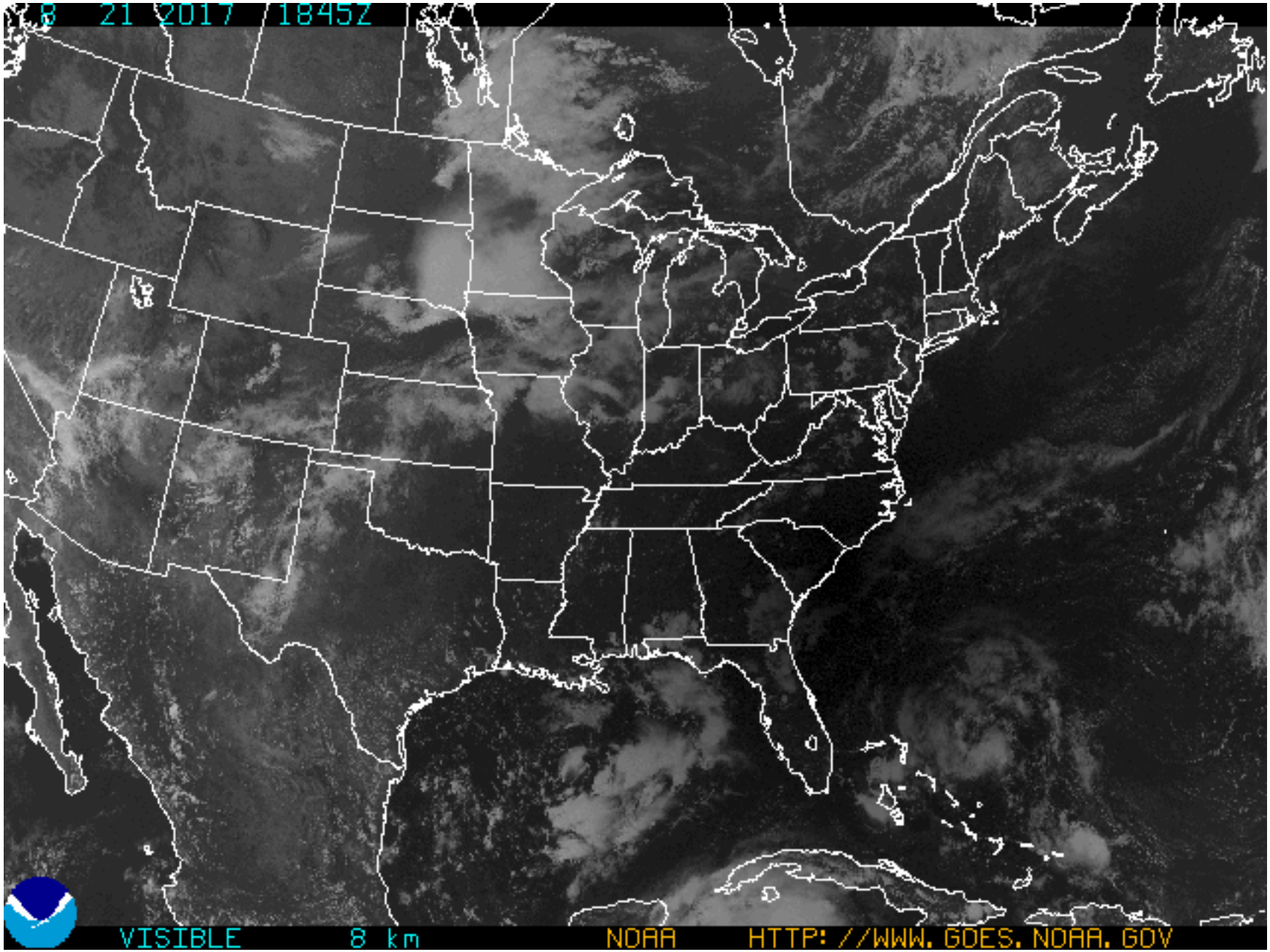

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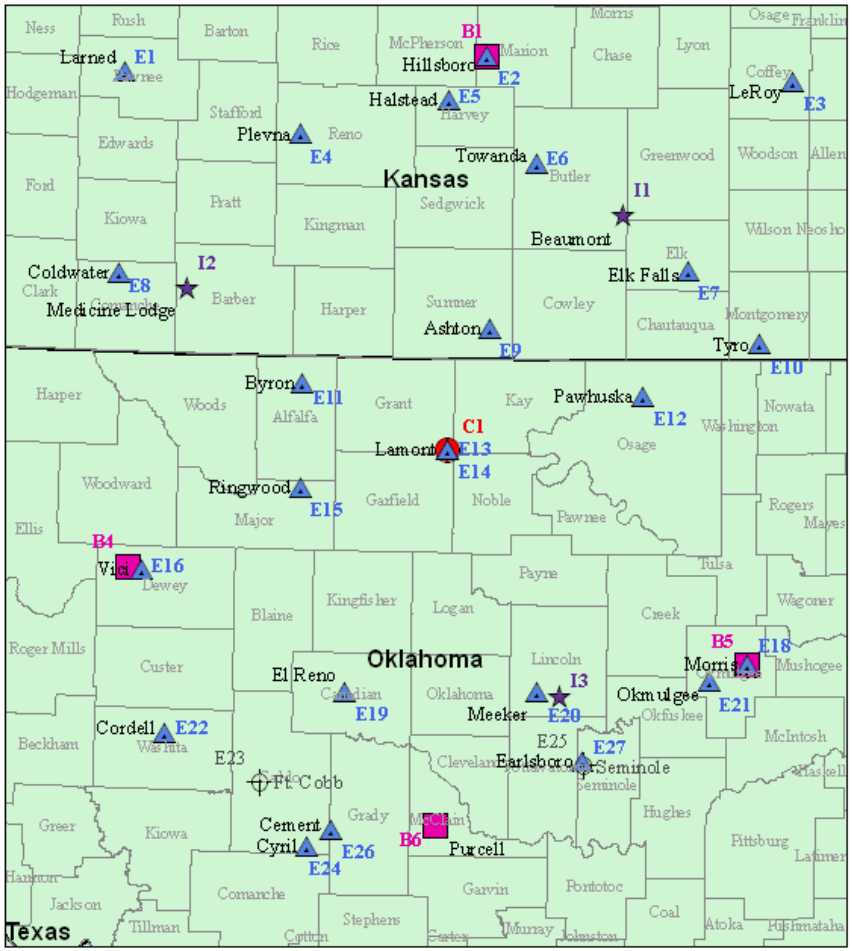
ARM Southern Great Plains Atmospheric Observatory



Data from ARM SGP MFRSRs showing the reduction in direct normal broadband radiation during the solar eclipse of 8/21/2017

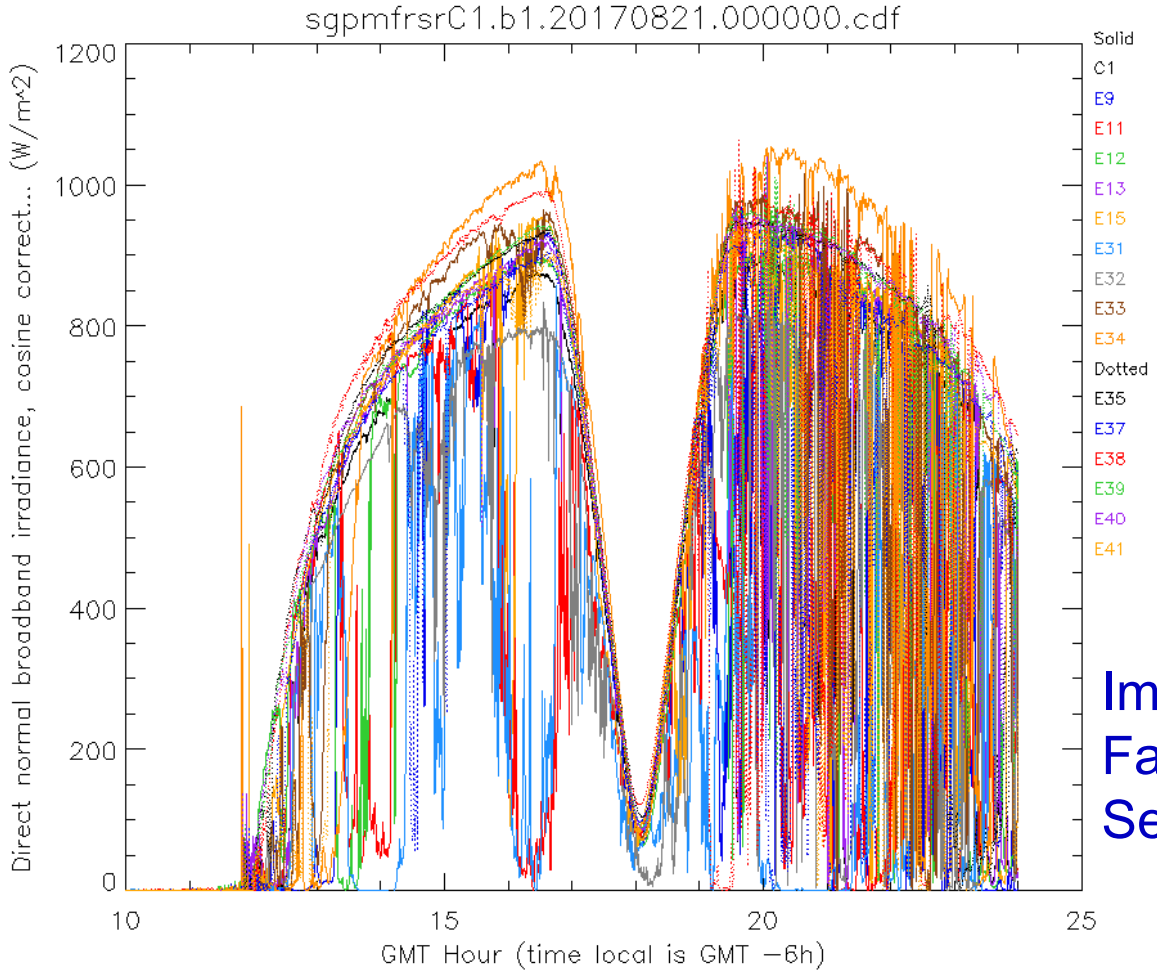
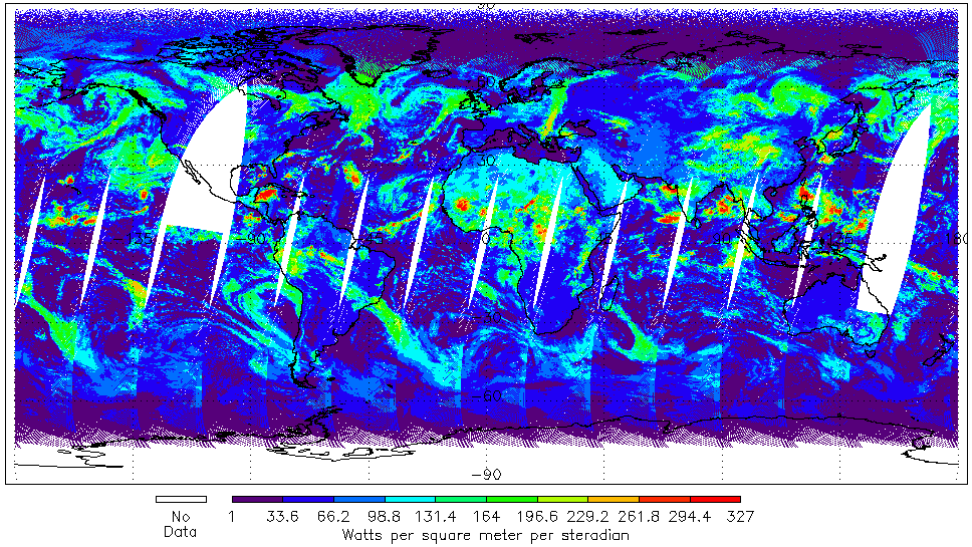


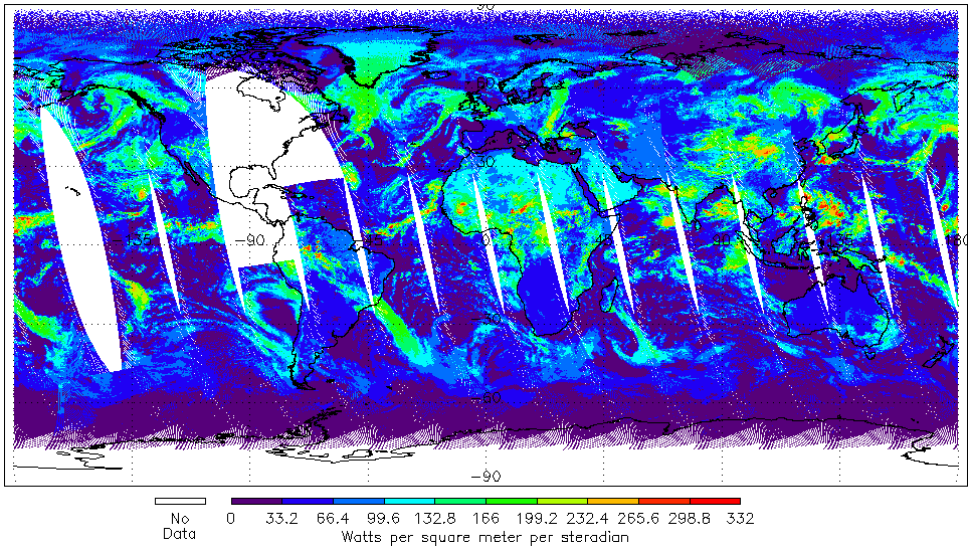
Image from ARM Facility News, September, 2017

Maximum eclipse was 89% at the ARM Southern Great Plains sites

Total Solar Eclipse August 21, 2017

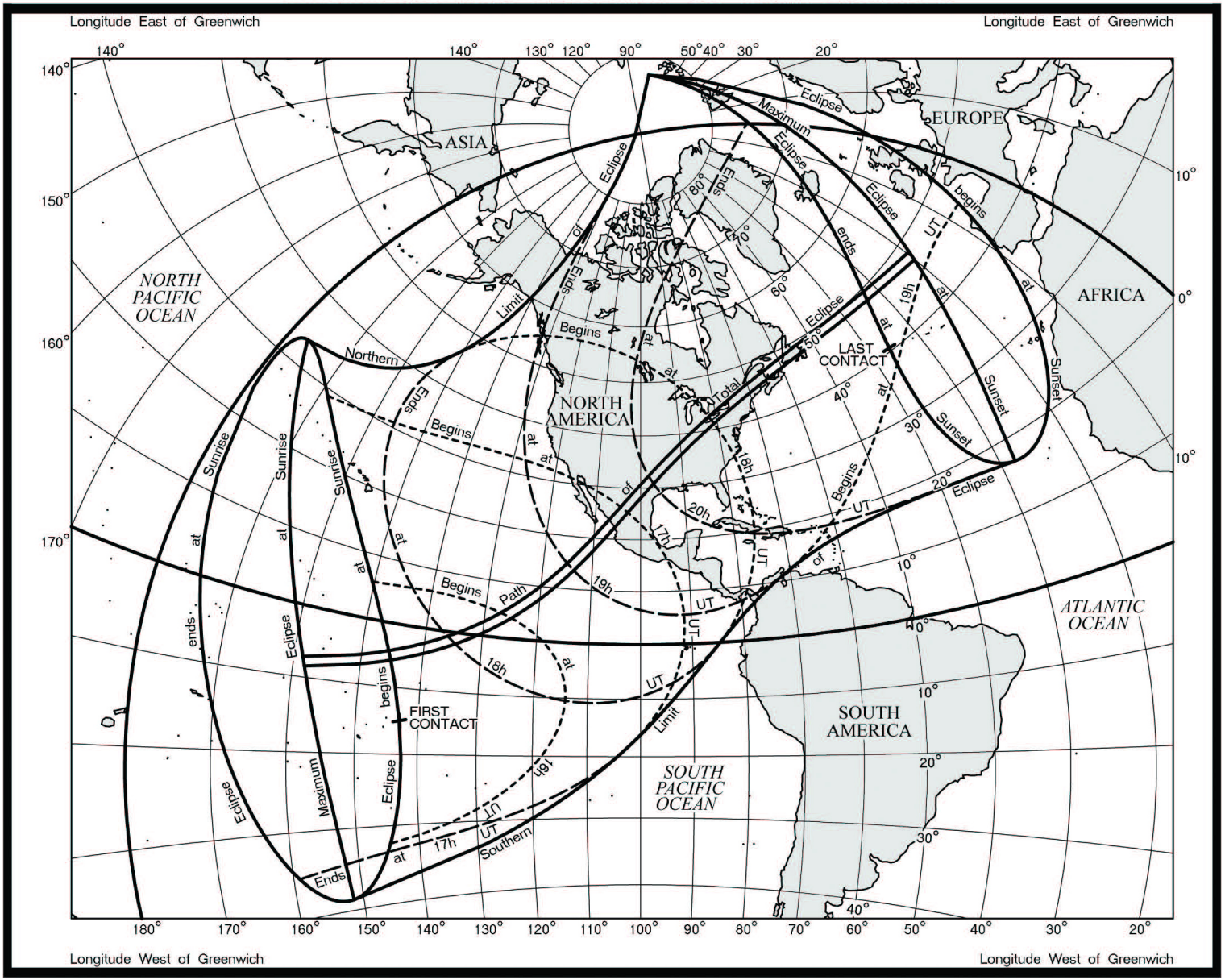


Terra



Aqua

TOTAL SOLAR ECLIPSE OF 2024 APRIL 8



ASTRONOMICAL APPLICATIONS DEPT.
U.S. NAVAL OBSERVATORY
WASHINGTON, DC 20392-5420 USA