DC.7.09 – Public Education and Outreach for Observing Solar Eclipses and Transits

Jay Pasachoff

- The general public is often very interested in observing solar eclipses, with widespread attention from newspapers and other sources often available only days before the events. Recently, the 2012 eclipse's partial phases in Australia and the 2015 eclipse's partial phases throughout Europe as well as western Asia and northern Africa, were widely viewed. The 21 August 2017 eclipse, whose totality will sweep across the Continental United States from northwest to southeast, will have partial phases visible throughout the U.S., Canada, Mexico, Central America, and into South America.

- The 2019 and 2020 partial phases of total eclipses will be visible throughout South America, and partial phases from annular eclipses will be visible from other parts of the world. The 9 May 2016 transit of Mercury will be best visible from the Western Hemisphere, Europe, and Africa. Many myths and misunderstandings exist about the safety of observing partial phases, and it is our responsibility as astronomers and educators to transmit accurate information and to attempt the widest possible distribution of such information.

- The Working Group on Public Education at Eclipses and Transits, formerly of Commission 46 on Education and Development and now of New Commission 11, tries to coordinate the distribution of information. In collaboration with the Solar Division's Working Group on Solar Eclipses, their website at http://eclipses.info is a one-stop shop for accurate information on how to observe eclipses, why it is interesting to do so, where they will be visible (with links to online maps and weather statistics), and how encouraging students to observe eclipses can be inspirational for them, perhaps even leading them to realize that the Universe can be understood and therefore renewing the strength of their studies. Links to information about transits of Mercury and Venus are also included.

- Jay Pasachoff (USA), Chair
- Iraida Kim (Russia)
- Kiroki Kurokawa (Japan)
- Jagdev Singh (India)
- Vojtech Rusin (Slovakia)
- Zhongquan Qu (China)

- Fred Espenak (eclipse bulletins; EclipseWise.com)
- Jay Anderson (meteorology: eclipser.ca)
- Glenn Schneider (airborne observations)
- Michael Gill (moderator: Solar Eclipse Mailing List)
- Xavier Jubier (Google maps with eclipse paths; airborne expertise)
- Michael Zeiler (eclipse-maps.com)
- Bill Kramer (eclipse-chasers.com)
- Ralph Chou (prof. emeritus of optometry)

International Astronomical Union

Working Group on Solar Eclipses/Program Group on Public Education at Solar Eclipses

Search

Working Group on Solar Eclipses

Reference Materials

- Eclipse Map Sites
  - 2014: October 23 Partial Eclipse in Western US/Canada, Pacific, and Siberia
  - 2015: March 20 Total Eclipse in Arctic, including Svalbard and Faroes; Partial Throughout Europe
    - 2015 Map with Partial-Eclipse Contours
  - 2016: March 9 Total Eclipse in Indonesia
  - 2016: September 1 Annular Eclipse in Africa
  - 2017: August 21 Total Eclipse in the U.S.
  - Jay Anderson's Weather Statistics for Future Eclipses
- Eclipse Web Sites
- Eye Safety & Solar Filters
- Publications
- Satellites and Observatories
- Shadow Bands and Sunspot Numbers
- Miscellaneous Links
- "The Eclipse" by James Fenimore Cooper

International Astronomical Union
Union Astronomique Internationale

Working Group on Solar Eclipses
of Division II

and

Program Group on Public Education
on the Occasions of Solar Eclipses
of Commission 46 on Education
and Development

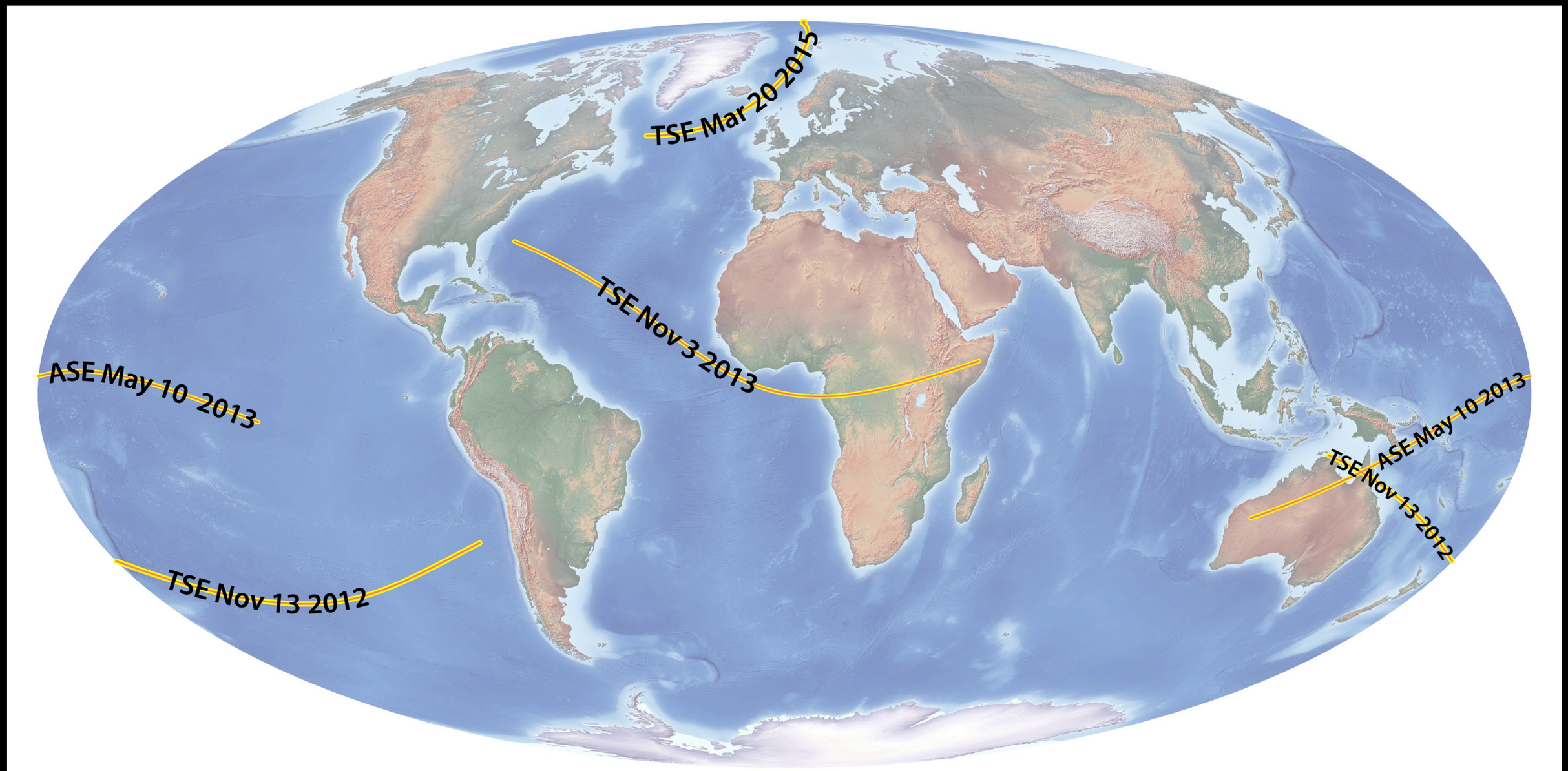
IAU Working Group on Eclipses Members

Search

Eclipse Web Sites

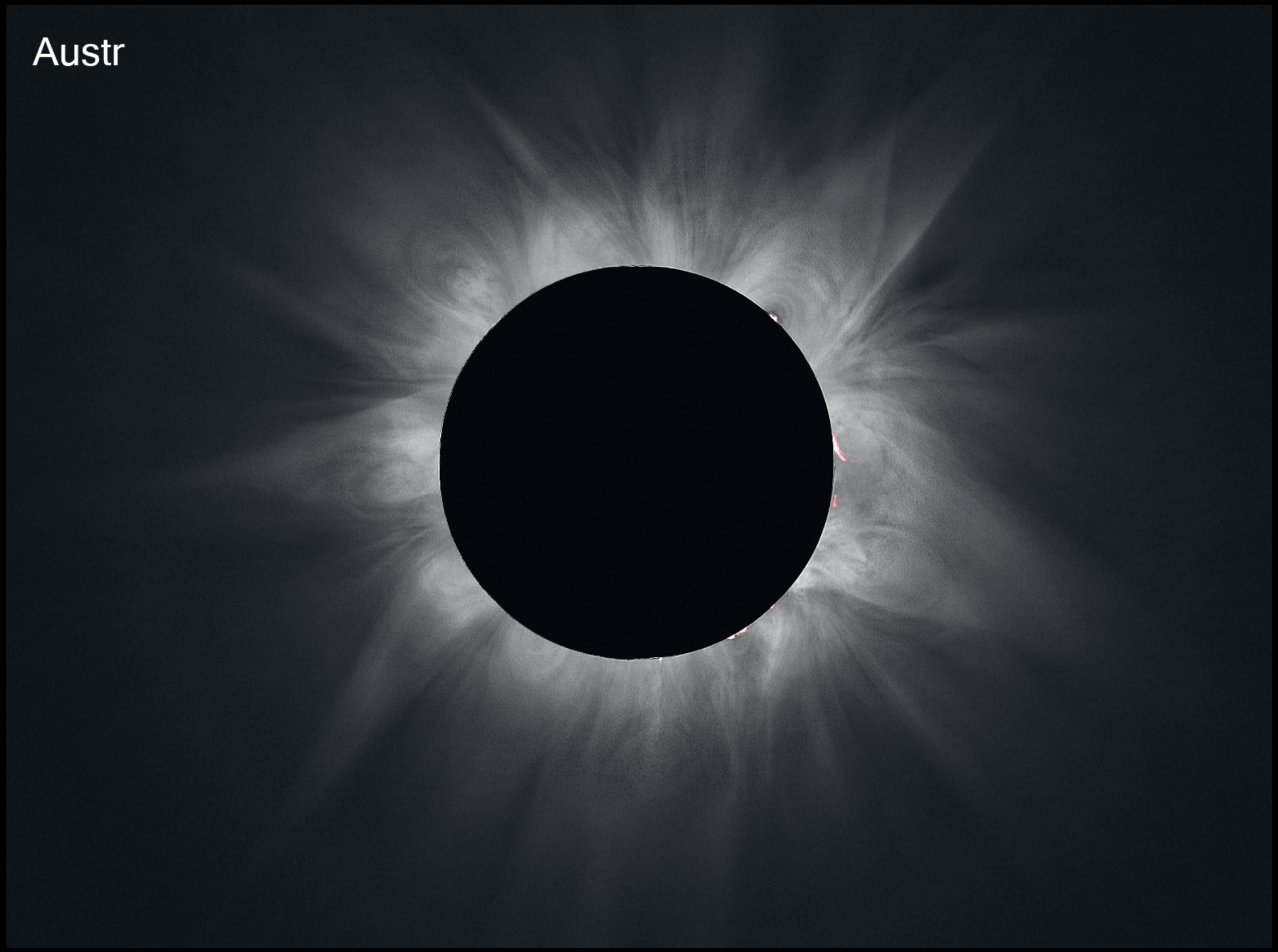
- Fred Espenak's NASA Eclipse Web Site
- Fred Espenak's NASA World Atlas of Solar Eclipse Paths
- Fred Espenak's NASA Solar Eclipses
- Fred Espenak's NASA Lunar Eclipses
- Fred Espenak's NASA Eclipse Resources
- Xavier Jubier's *Google Maps* Eclipse Maps
- Xavier Jubier's Interactive maps for upcoming solar eclipses
- Xavier Jubier's *Google Earth* KMZ files for eclipse tracks
- Xavier Jubier's 5MCSE "Five Millennium (–1999 to +3000) Canon of Solar Eclipses"
  Using the 5MCSE link will get you to any eclipse type
- For TSE 2017 it will generate an URL such as
  http://xjubier.free.fr/en/site_pages/solar_eclipses/xSE_GoogleMap3.php?
  Ecl=+20170821&Acc=2&Umb=1&Lmt=1&Mag=1
- &Lmt=x (x set to 1 or 0) will display or not the penumbral limits, maximum on horizon and rise/set curves
  &Mag=x (x set to 1 or 0) will display or not the equal magnitude curves
  &Max=x (x set to 1 or 0) will display or not the maximum eclipse curves
- Michael Zeiler: eclipse-maps.com
- Glenn Schneider's site
- The Cosmic Mirror: Daniel Fischer looks into the Universe
- Arnold Barmettler: Interactive Eclipse Maps 1900-2100
- Eclipse Chasers (Bill Kramer), with list of statistics
- Jay M. Pasachoff: Williams College Solar Eclipse Expeditions
- Miloslav Druckmüller: Eclipse Photography
- Stanford Solar Center
- Eclipse statistics and other links (Sheridan Williams)
- spaceweather.com
- Solar Monitor
- Lockheed master list of solar web sites
- Phil Harrington's eclipse home page
- The solar section of the Association of Lunar and Planetary observers (ALPOSS)
- Daily Big Bear solar observatory images
- Fred Espenak's Eclipse Page
- Bill Kramer's Eclipse Page
- Glenn Schneider's images

2012-2015



map by Michael Zeiler, eclipse-maps.com

Austr

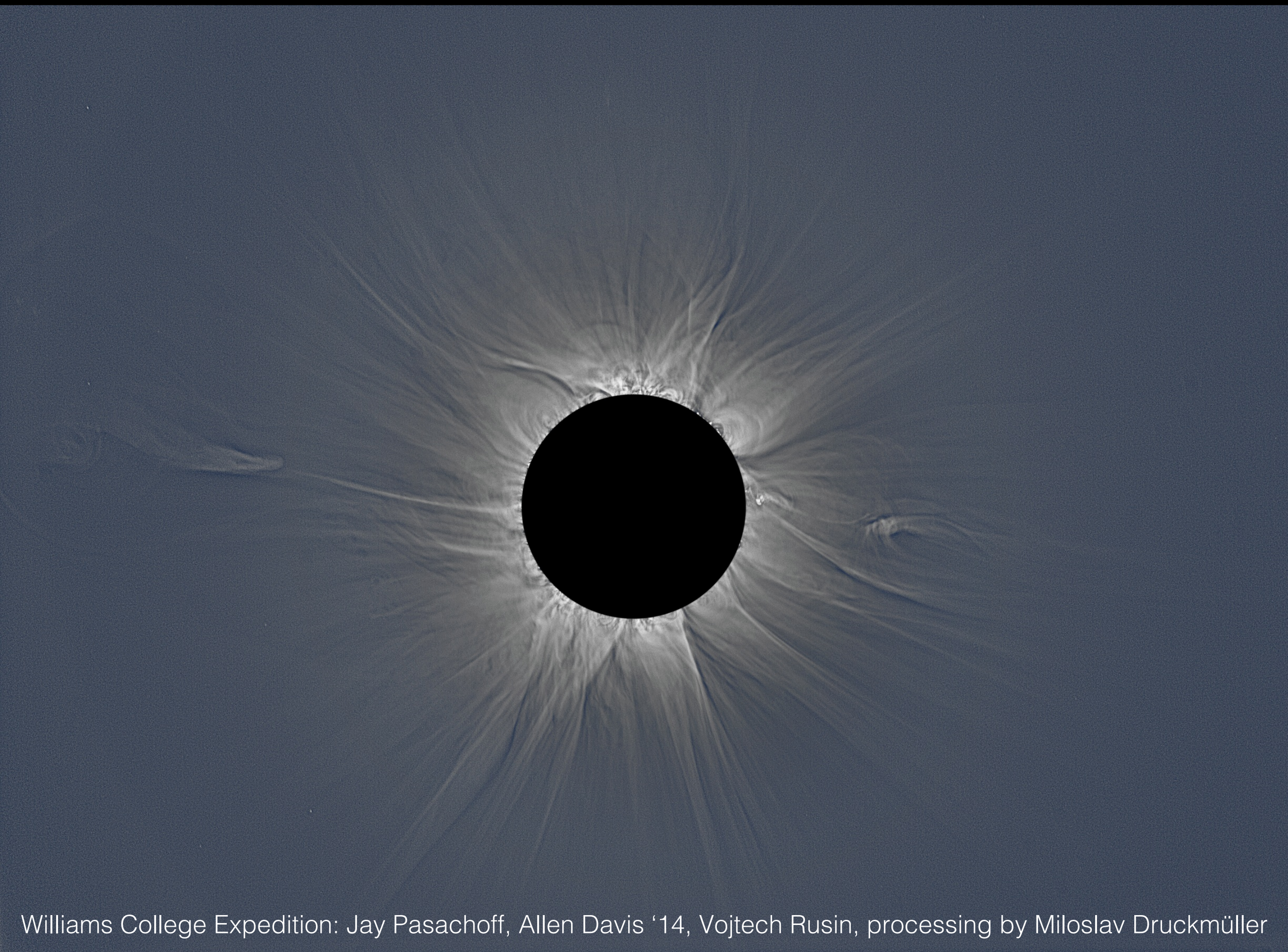


November 13, 2012

Taken with a Nikon D600 FX and a 400-mm Nikkor lens with a Thousand Oaks Optical filter from a site 70 km north of Tennant Creek, Northern Territories, Australia. Many more in the series are also available.

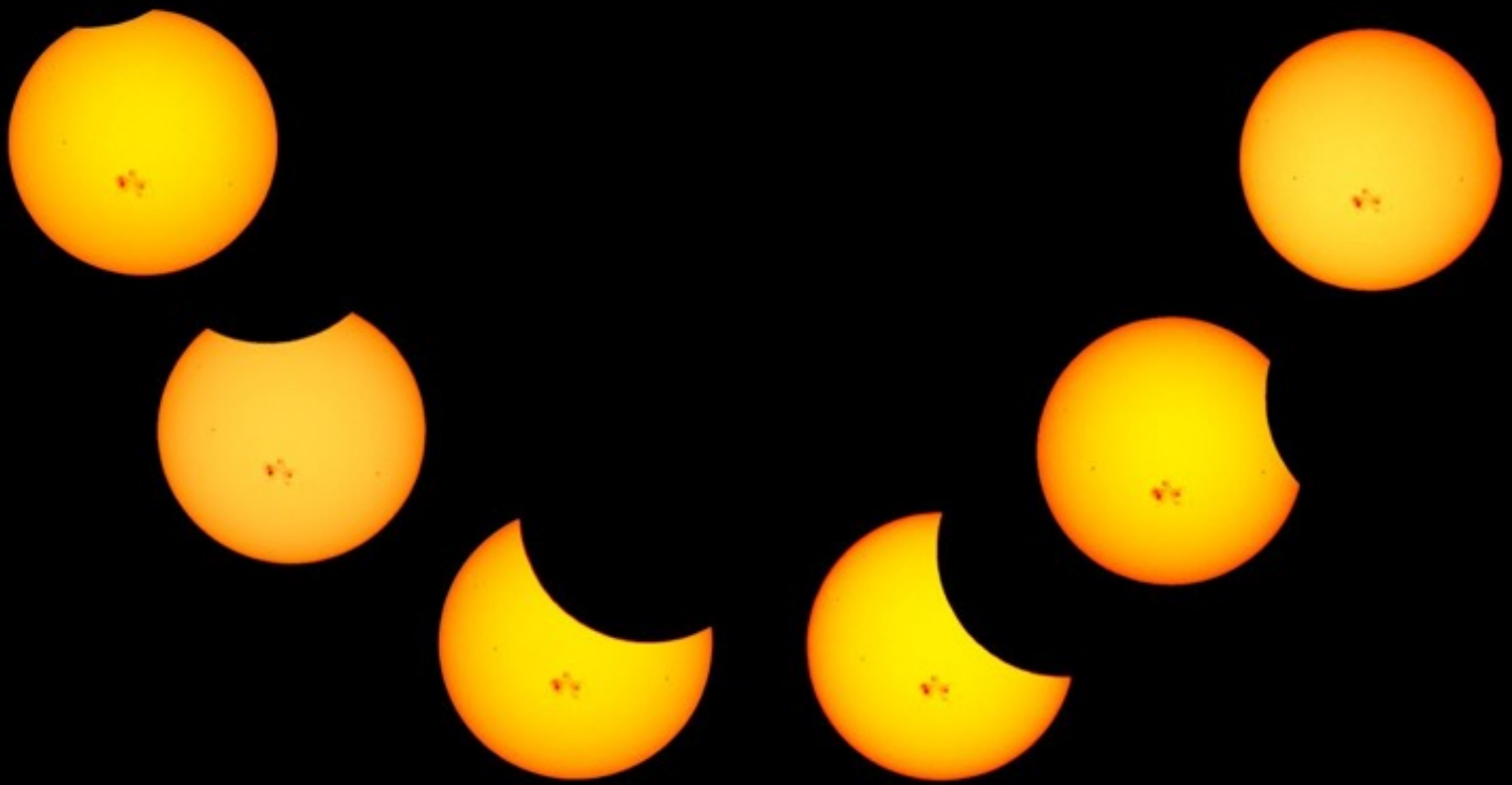
May 10, 2013

November 3, 2013



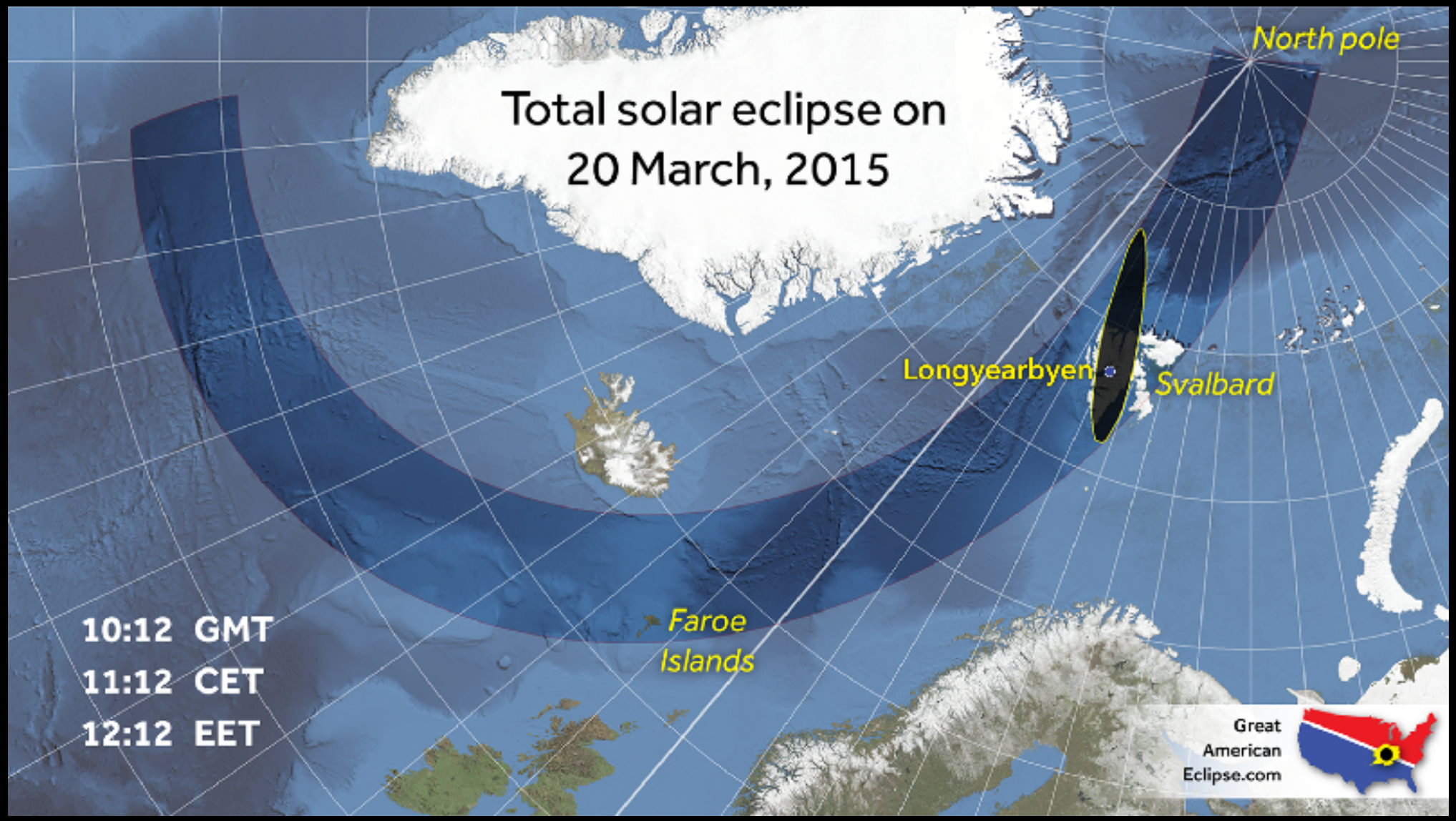
Williams College Expedition: Jay Pasachoff, Allen Davis ‘14, Vojtech Rusin, processing by Miloslav Druckmüller

April 29, 2014, partial eclipse, from Albany, Western Australia



partial solar eclipse of October 23, 2014, viewed from Sacramento Peak Observatory, Sunspot, New Mexico

March 20, 2015, eclipse

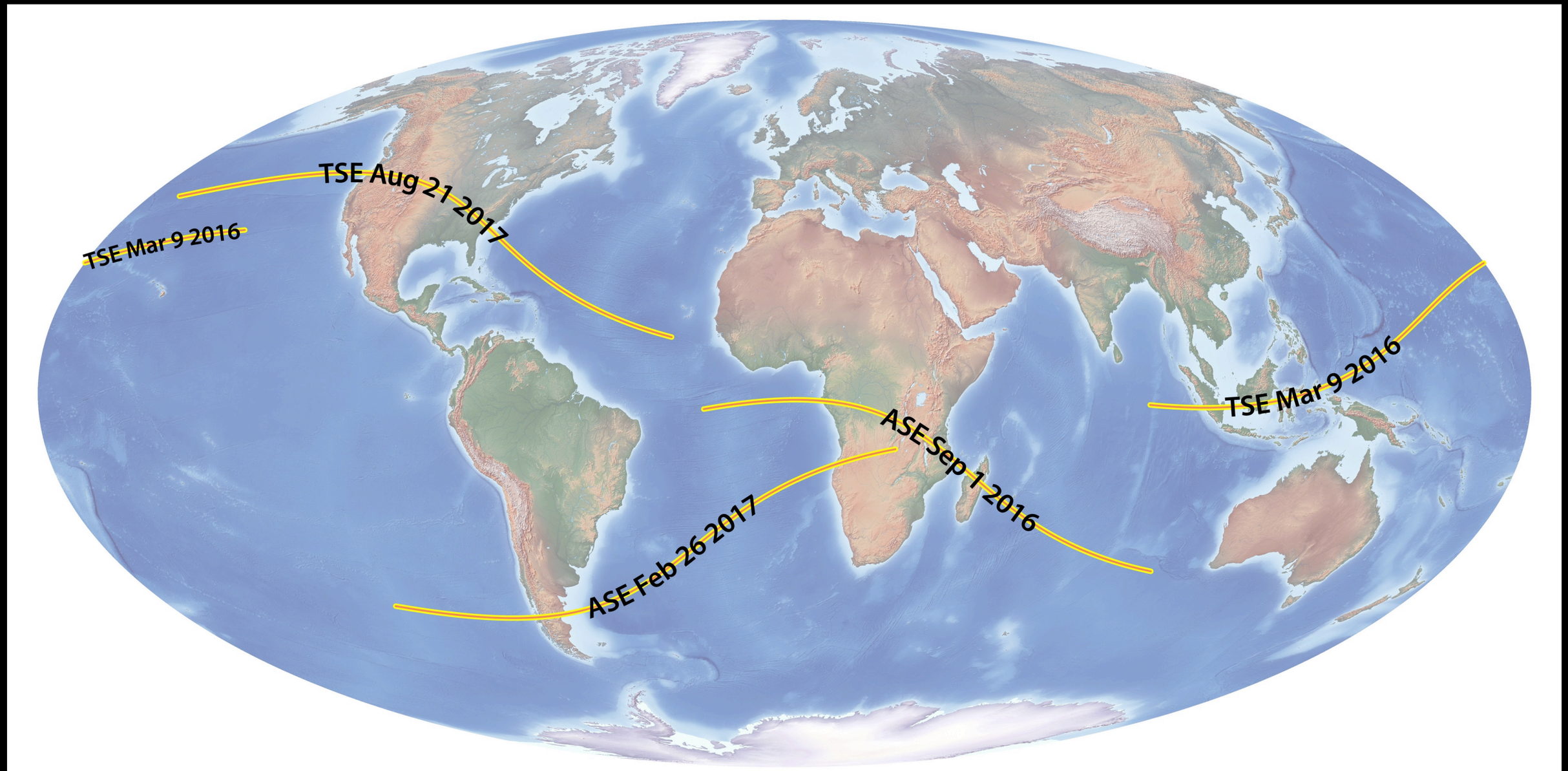


Map by Michael Zeiler

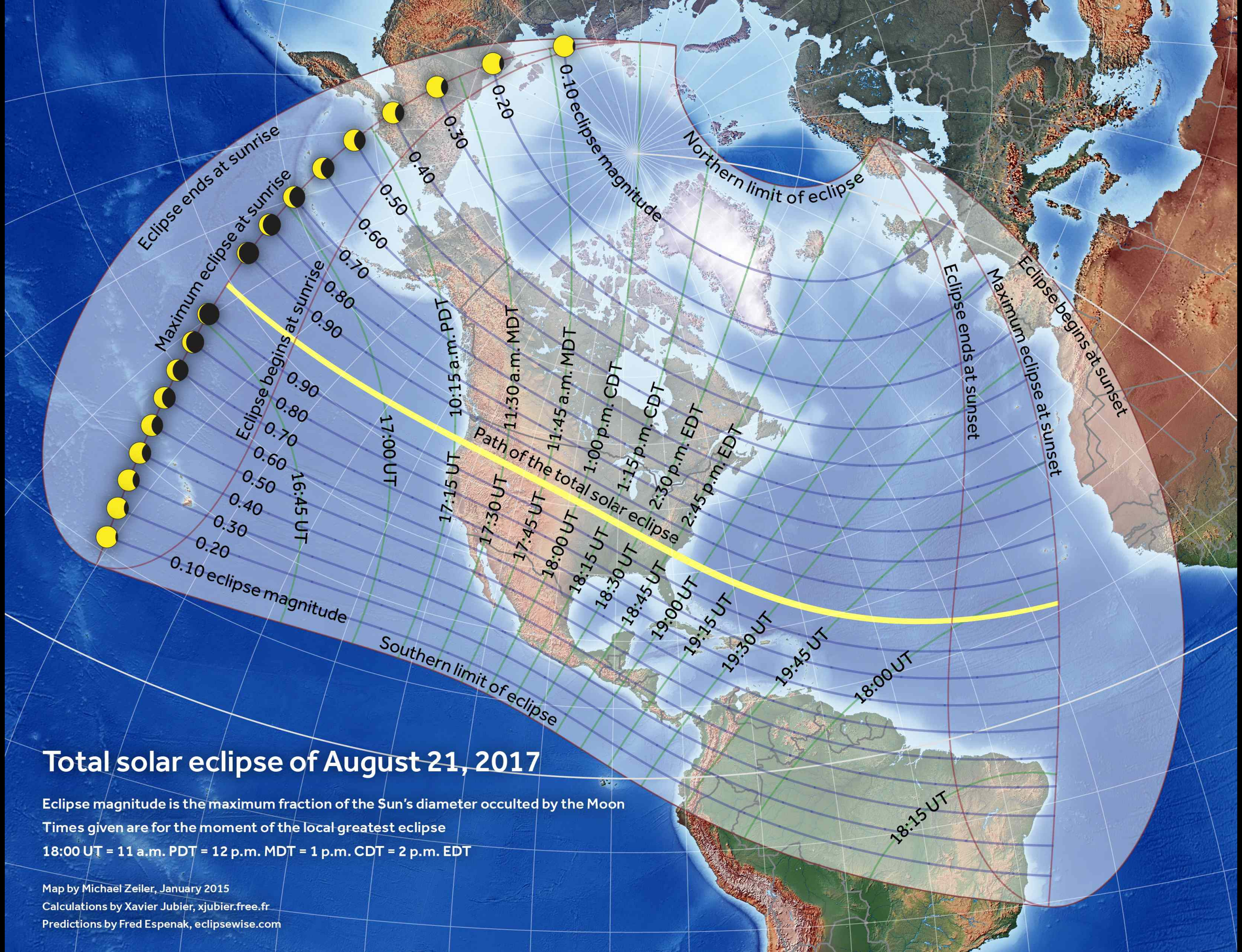
We were supported by a grant from the Committee for Research and Exploration of the National Geographic Society, with additional support from Williams College.

Fisheye image by Michael Zeiler

2015-2018



map by Michael Zeiler, eclipse-maps.com



Total solar eclipse of August 21, 2017

Eclipse magnitude is the maximum fraction of the Sun's diameter occulted by the Moon

Times given are for the moment of the local greatest eclipse

18:00 UT = 11 a.m. PDT = 12 p.m. MDT = 1 p.m. CDT = 2 p.m. EDT

Map by Michael Zeiler, January 2015

Calculations by Xavier Jubier, xjubier.free.fr

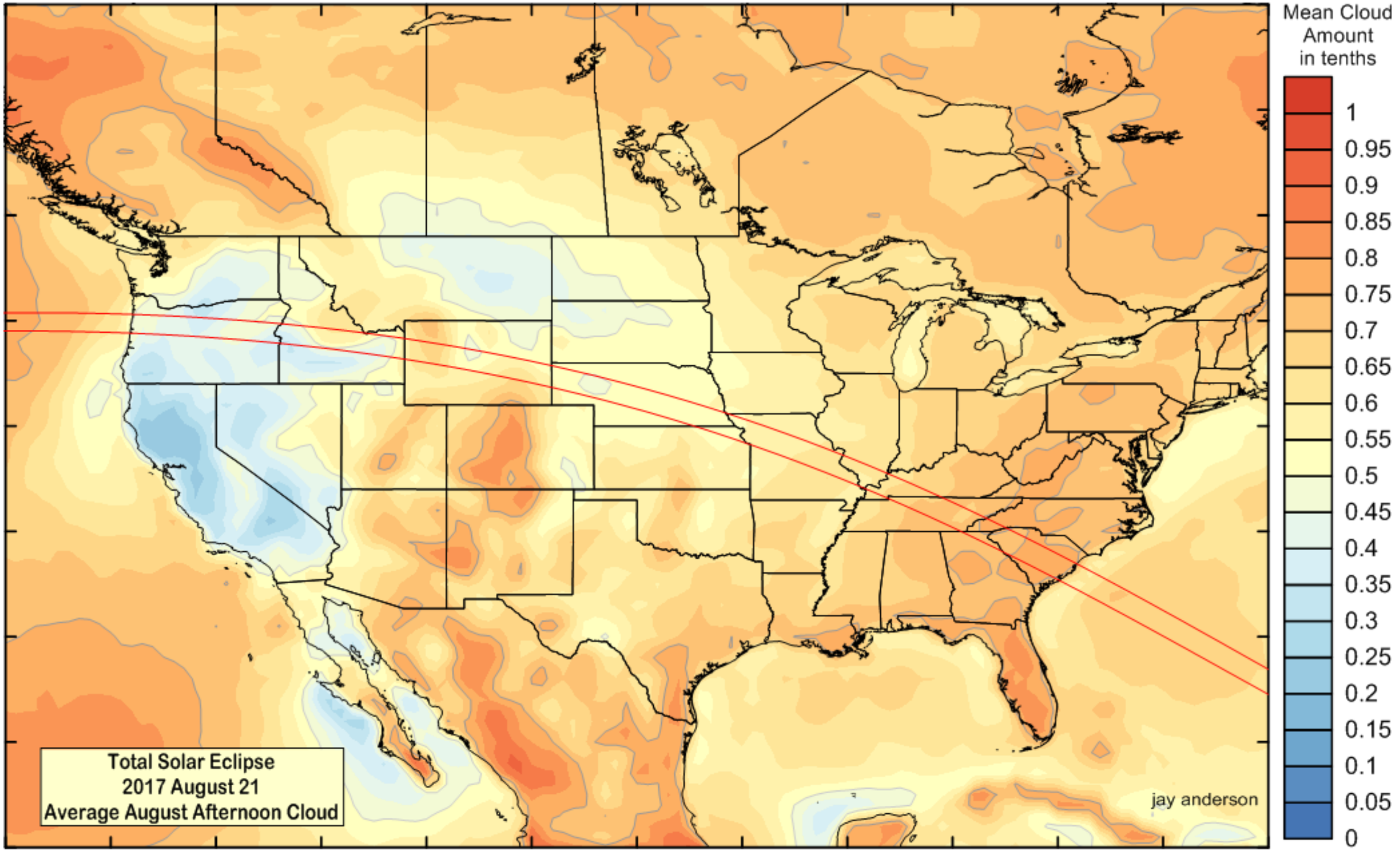
Predictions by Fred Espenak, eclipsewise.com

Total Solar Eclipse of August 21, 2017

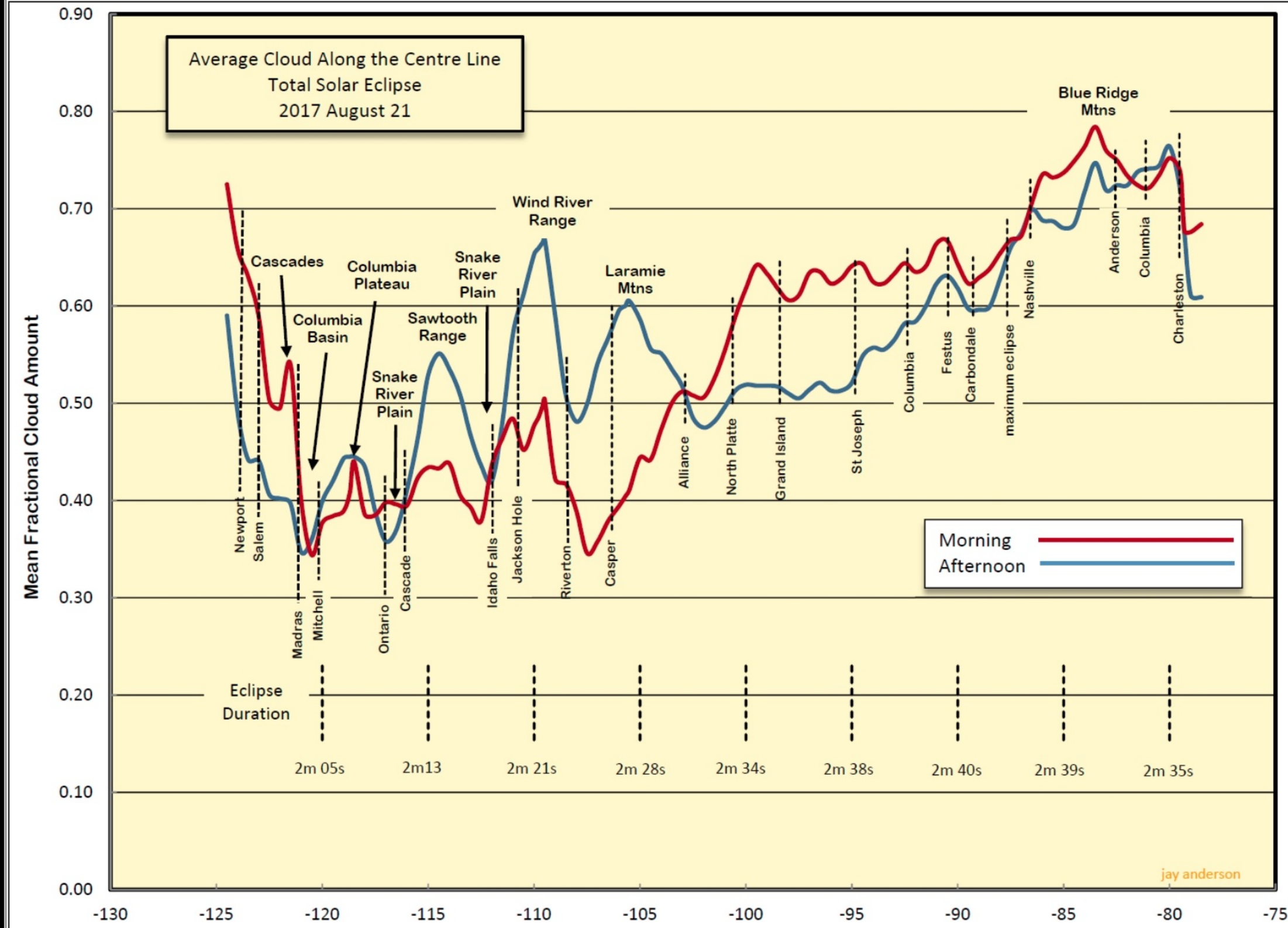
2 min
2 min 10 sec
2 min 20 sec
2 min 30 sec
2 min 40 sec
2 min 40 sec
2 min 30 sec

50%
60%
70%
80%
90%
90%
80%
70%
60%
50%
40%
30%

2017

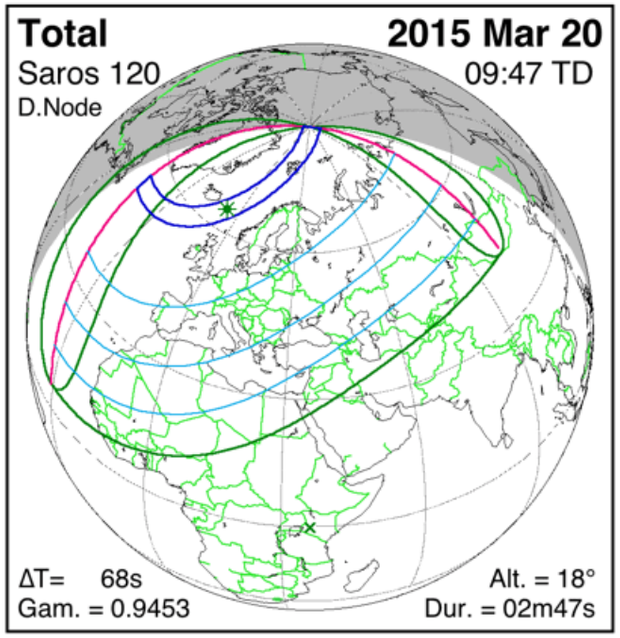


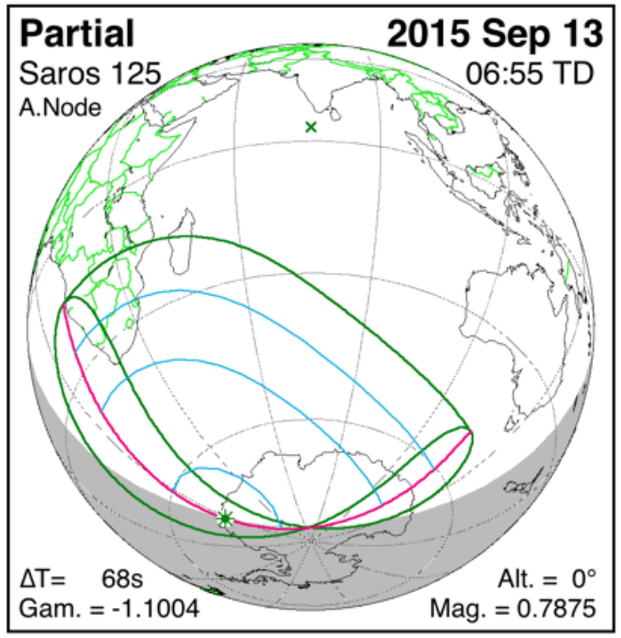
Michael Zeiler, eclipse-maps.com



Graph 1: Average morning and afternoon cloud cover along the eclipse centreline extracted from 20 years of satellite imagery. The location of cities and towns along the track are indicated by dashed vertical lines above their names. Prominent topographical features are named above the graphs. Source: Patmos-X: CIMMS/ SSEC.

Jay Anderson, eclipser.ca


Total
2015 Mar 20
Saros 120
09:47 TD
D.Node
ΔT= 68s
Alt. = 18°
Gam. = 0.9453
Dur. = 02m47s


Partial
2015 Sep 13
Saros 125
06:55 TD
A.Node
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Alt. = 0°
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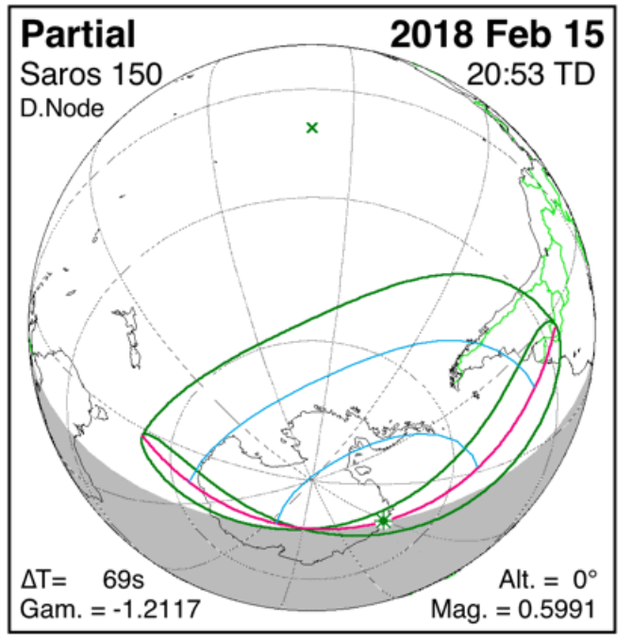
Mag. = 0.7875


Partial
2018 Feb 15
Saros 150
20:53 TD
D.Node
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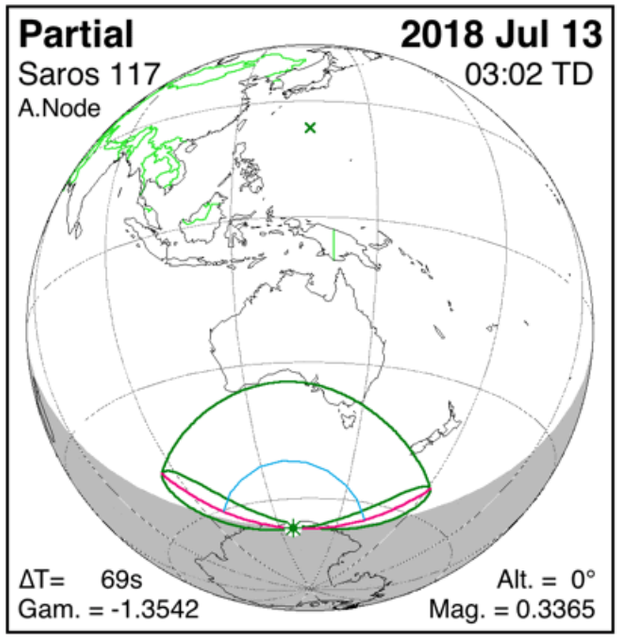
Alt. = 0°
Gam. = -1.2117
Mag. = 0.5991


Partial
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03:02 TD
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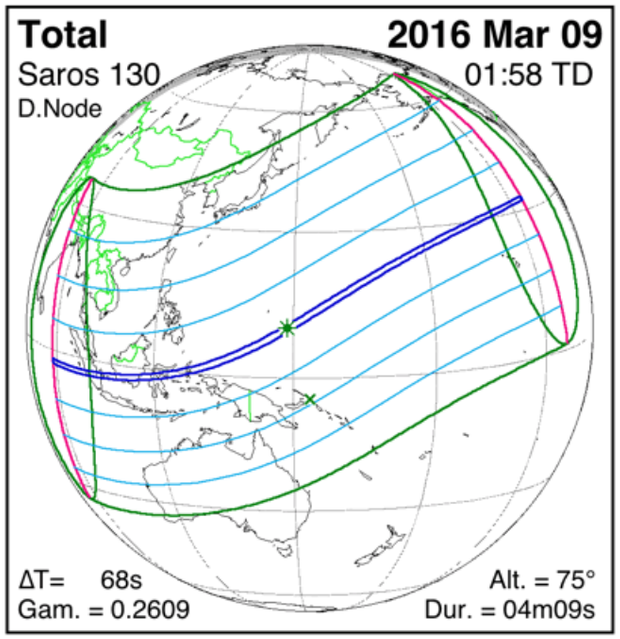
Mag. = 0.3365


Total
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Saros 130
01:58 TD
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Gam. = 0.2609
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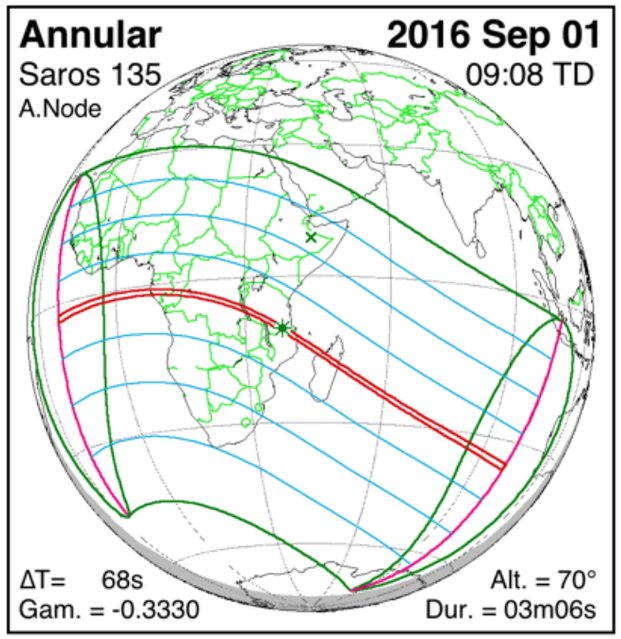
Annular
2016 Sep 01
Saros 135
09:08 TD
A.Node
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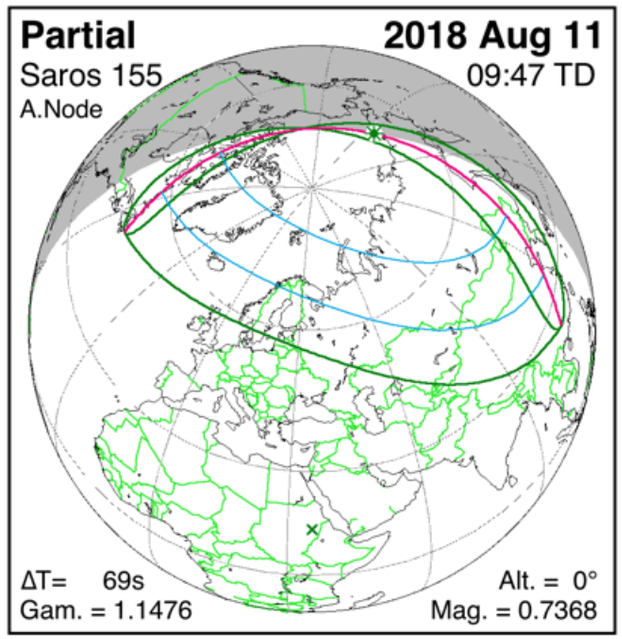
Alt. = 70°
Gam. = -0.3330
Dur. = 03m06s


Partial
2018 Aug 11
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Gam. = 1.1476
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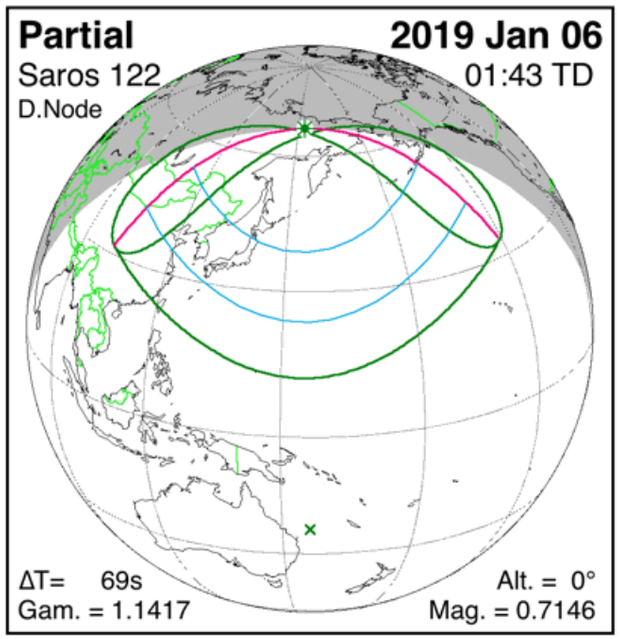
Partial
2019 Jan 06
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01:43 TD
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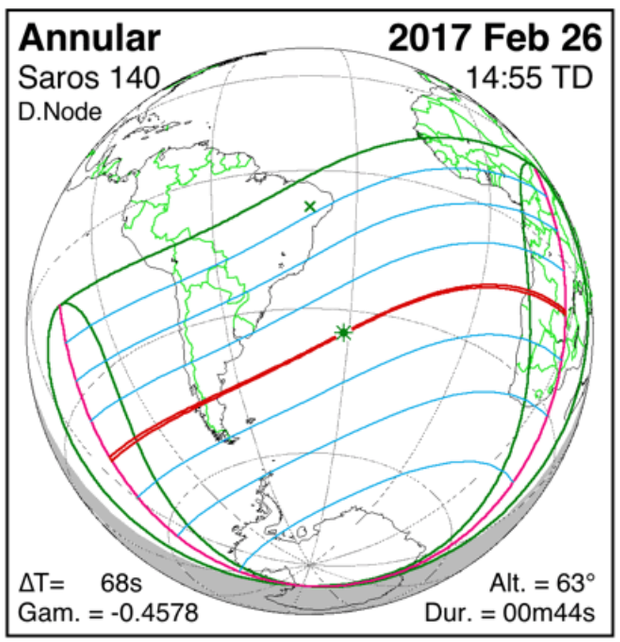
Mag. = 0.7146


Annular
2017 Feb 26
Saros 140
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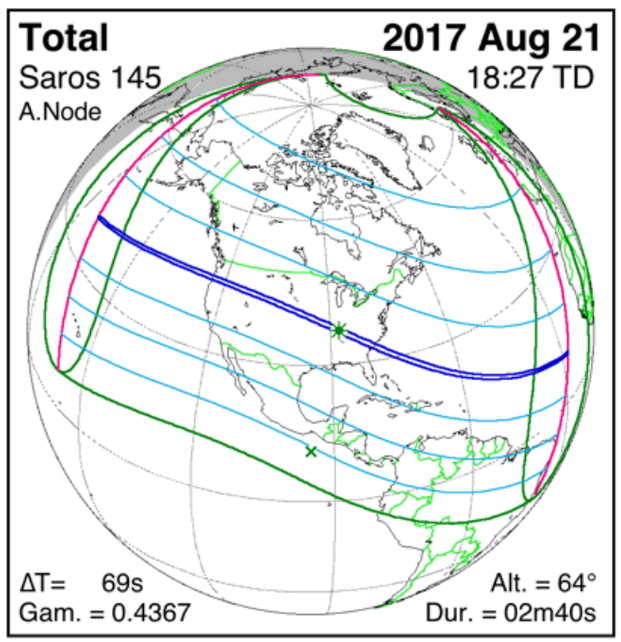
Dur. = 00m44s


Total
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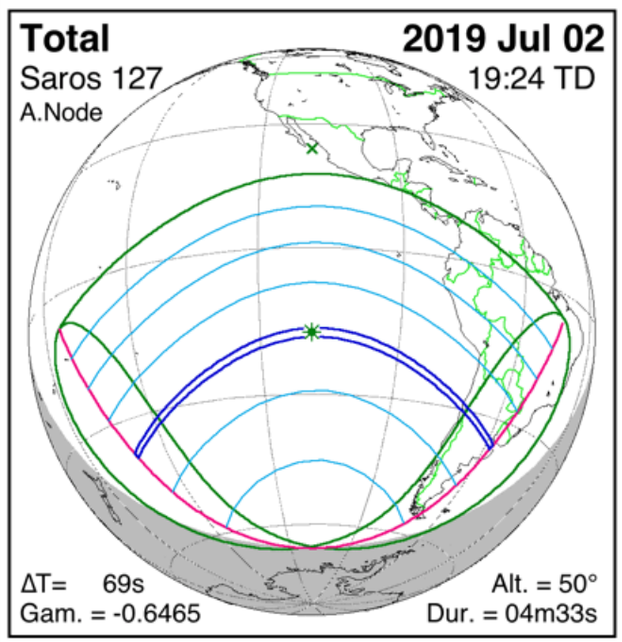
Total
2019 Jul 02
Saros 127
19:24 TD
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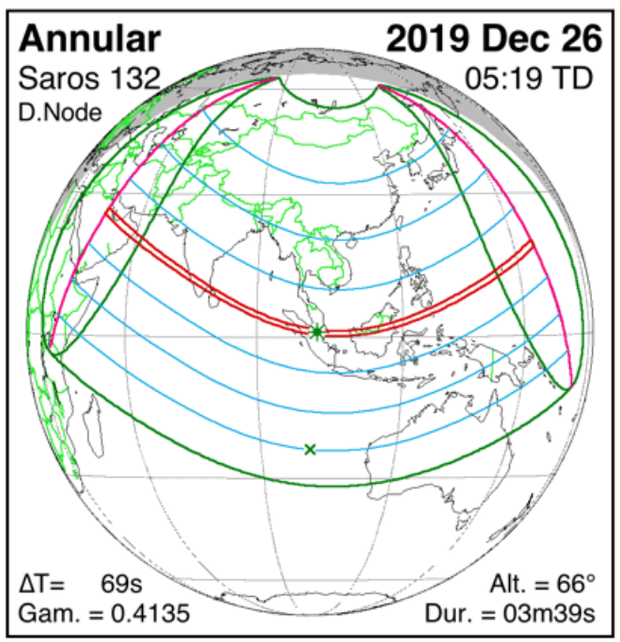
Dur. = 04m33s


Annular
2019 Dec 26
Saros 132
05:19 TD
D.Node
ΔT= 69s
Alt. = 66°
Gam. = 0.4135
Dur. = 03m39s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The Advertiser
DON'T LOOK


The Advertiser
SATURDAY EDITION
Surface to air missile menace
From girl next door to screen siren
The best Saturday market for cars & homes
DON'T LOOK
Eclipse glasses can hurt your eyes
Council introduces watering bans

- Dr. Don Bienfang of the Brigham Hospital in Boston recently issued a statement (aetnahealth) that includes the incorrect information "No phase of a solar eclipse, even the total eclipse phase, is safe to watch without filters or projection techniques" and I will send him your references. From his signature, he is "Chief of Neuro-Ophthalmology Harvard Medical School, Brigham and Women's Hospital. Associate Prof HMS." We would like him to withdraw the phrase "even the total eclipse phase," which is clearly incorrect.

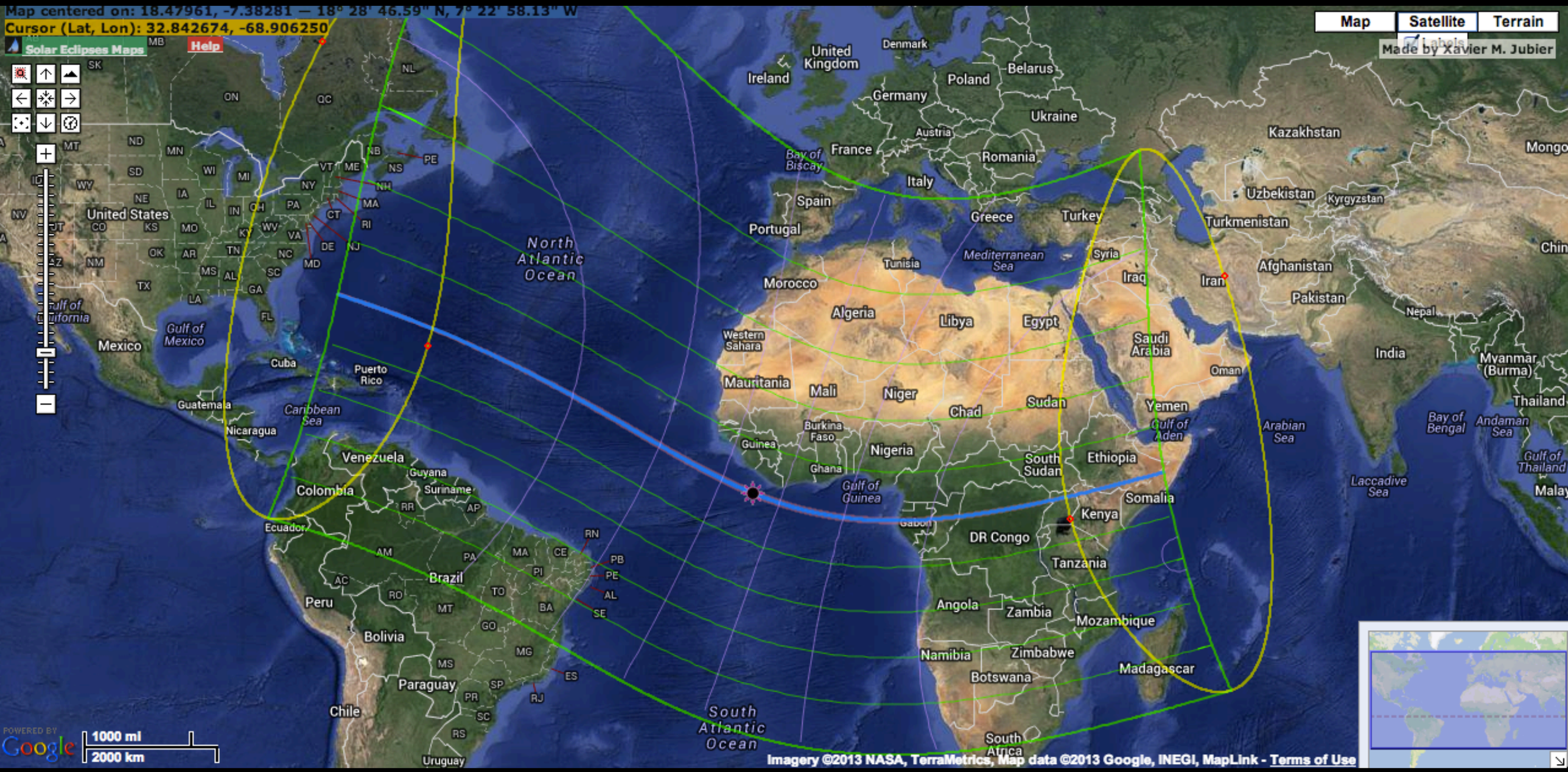
- Bienfang, Don C.,M.D. <DBIENFANG@partners.org>
- 7/14/14
- to Jay
- Wow, all this about an eclipse! A gentle approach and wording goes a long way. In any case I will attend to this ASAP if for no other reason than.

- Bienfang, Don C.,M.D. <DBIENFANG@partners.org>
- Attachments7/21/14

- to Jay

- I have touched this up a bit. My original article was based on the assumption that the high energy UV light of the sun was refracted by the atmosphere of the moon and thus could reach the eye unnoticed..

Nov 3, 2013


Map centered on: 18.47961, -7.38281 — 18° 28' 46.59" N, 7° 22' 58.13" W
Cursor (Lat, Lon): 32.842674, -68.906250
Solar Eclipses Maps
Help
Map
Satellite
Terrain
Labels
Made by Xavier M. Jubier
North Atlantic Ocean
South Atlantic Ocean
Gulf of Mexico
Caribbean Sea
Mediterranean Sea
Bay of Biscay
Gulf of Guinea
Gulf of California
Arabian Sea
Laccadive Sea
Bay of Bengal
Andaman Sea
Gulf of Aden
Gulf of Thailand
United States
Mexico
Cuba
Puerto Rico
Guatemala
Nicaragua
Venezuela
Guyana
Suriname
Colombia
Ecuador
Peru
Brazil
Bolivia
Paraguay
Chile
Uruguay
Ireland
United Kingdom
Denmark
Belarus
Poland
Germany
Ukraine
Austria
France
Romania
Italy
Spain
Portugal
Greece
Turkey
Kazakhstan
Uzbekistan
Kyrgyzstan
Turkmenistan
Afghanistan
Pakistan
Nepal
India
Myanmar (Burma)
Thailand
Mongo
Chin
Syria
Iraq
Iran
Saudi Arabia
Oman
Yemen
Egypt
Libya
Tunisia
Algeria
Morocco
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
South Sudan
Ethiopia
Somalia
Kenya
Nigeria
Burkina Faso
Guinea
Ghana
Gabon
DR Congo
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
South Africa
Madagascar
1000 mi
2000 km
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Portugal
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Turkey
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Palestine
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Kuwait
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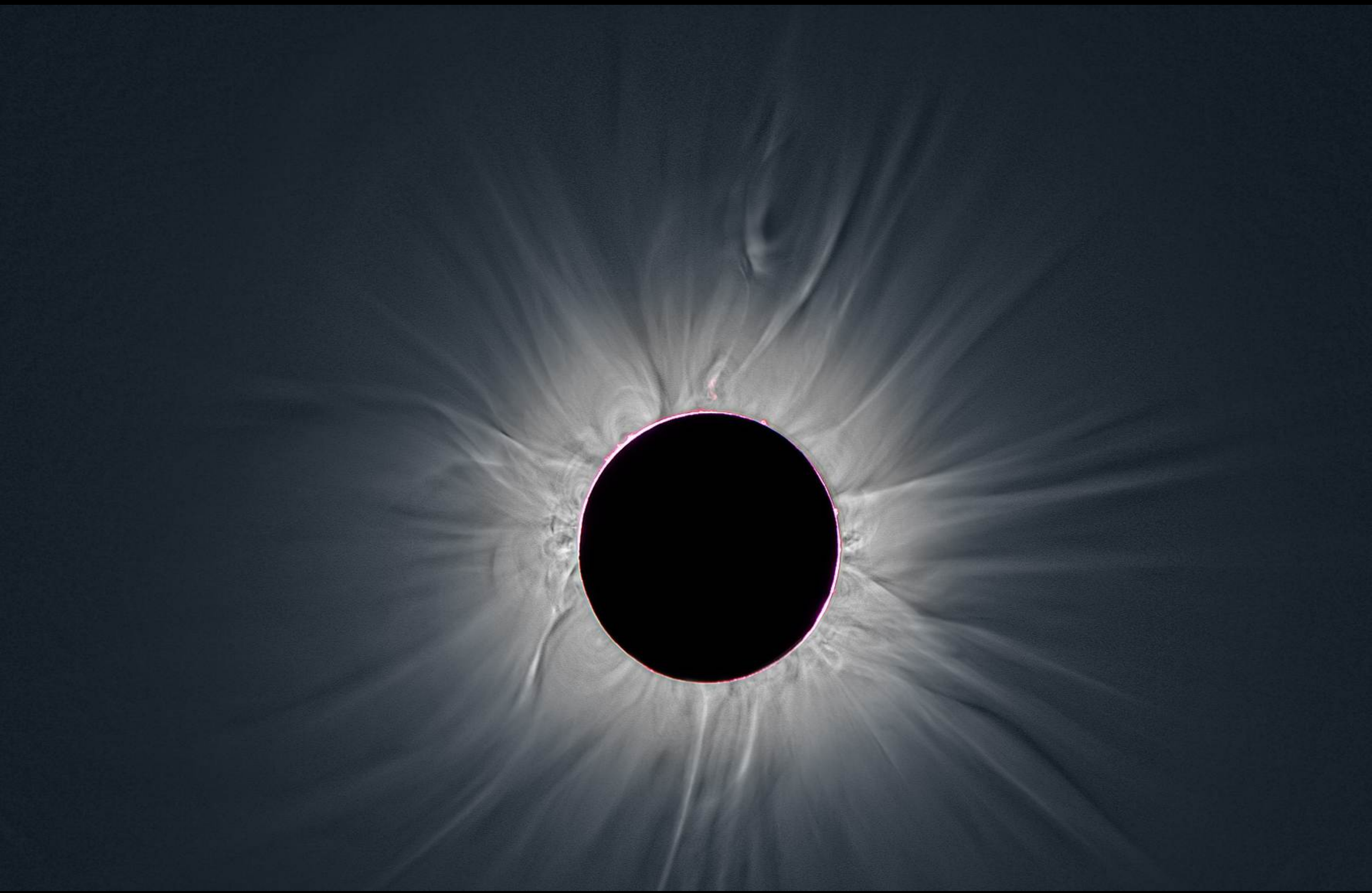
Egypt
Saudi Arabia
Yemen
Tunisia
Morocco
Algeria
W. Sahara
Libya
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Djibouti
Somaliland
Ethiopia
Senegal
Gambia
Guinea-Bissau
Guinea
Sierra Leone
Liberia
Côte d'Ivoire
Burkina Faso
Ghana
Togo
Benin
Nigeria
Cameroon
Central African Rep.
S. Sudan
Somalia
Uganda
Kenya
São Tomé and Príncipe
Congo
Gabon
Dem. Rep. Congo
Rwanda
Burundi
Tanzania
Angola
Zambia
Malawi
Mozambique
Madagascar
Seychelles
0.10 mag
0.20 mag
0.30 mag
0.40 mag
0.50 mag
0.60 mag
0.70 mag
0.80 mag
0.90 mag
fraction of Sun's diameter occulted
0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90

Jay Pasachoff

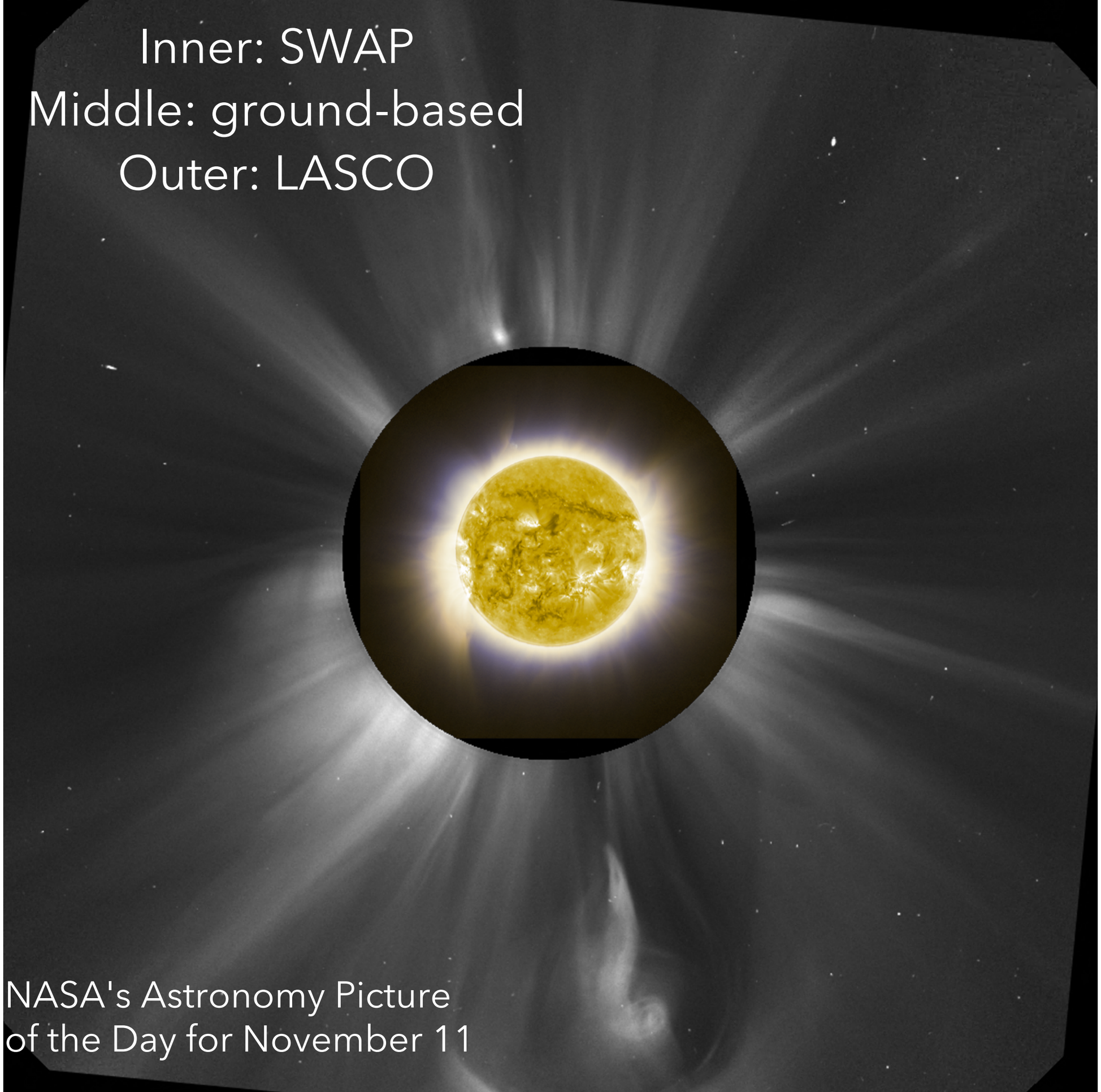
Allen Davis

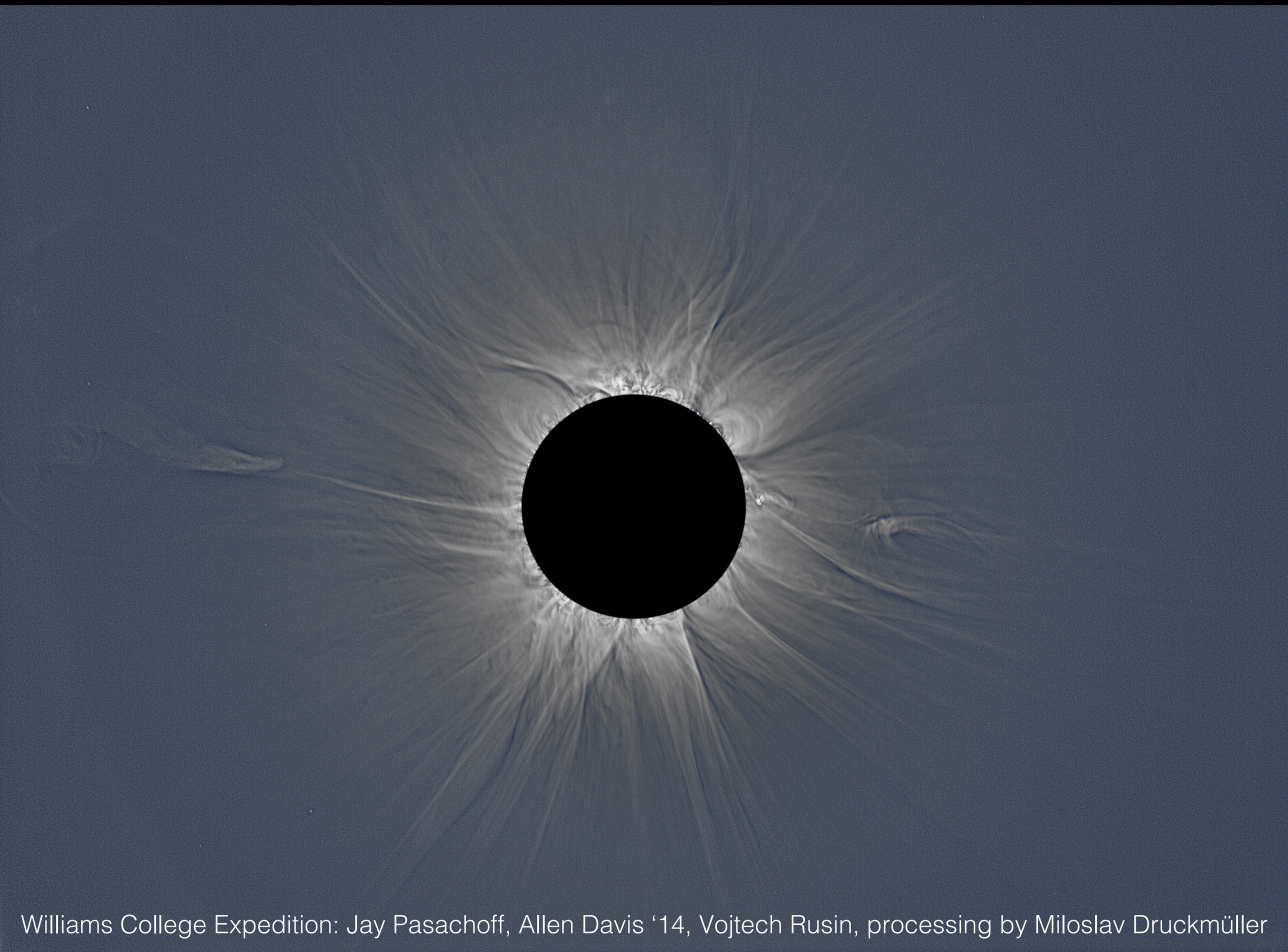
alongside La Lopé National Park, Gabon

3 November 2013, Gabon



Williams College Eclipse Expedition; combination by Paul Gaintatzis from images by Allen Davis and Jay Pasachoff


Inner: SWAP
Middle: ground-based
Outer: LASCO
NASA's Astronomy Picture
of the Day for November 11



Williams College Expedition: Jay Pasachoff, Allen Davis ‘14, Vojtech Rusin, processing by Miloslav Druckmüller

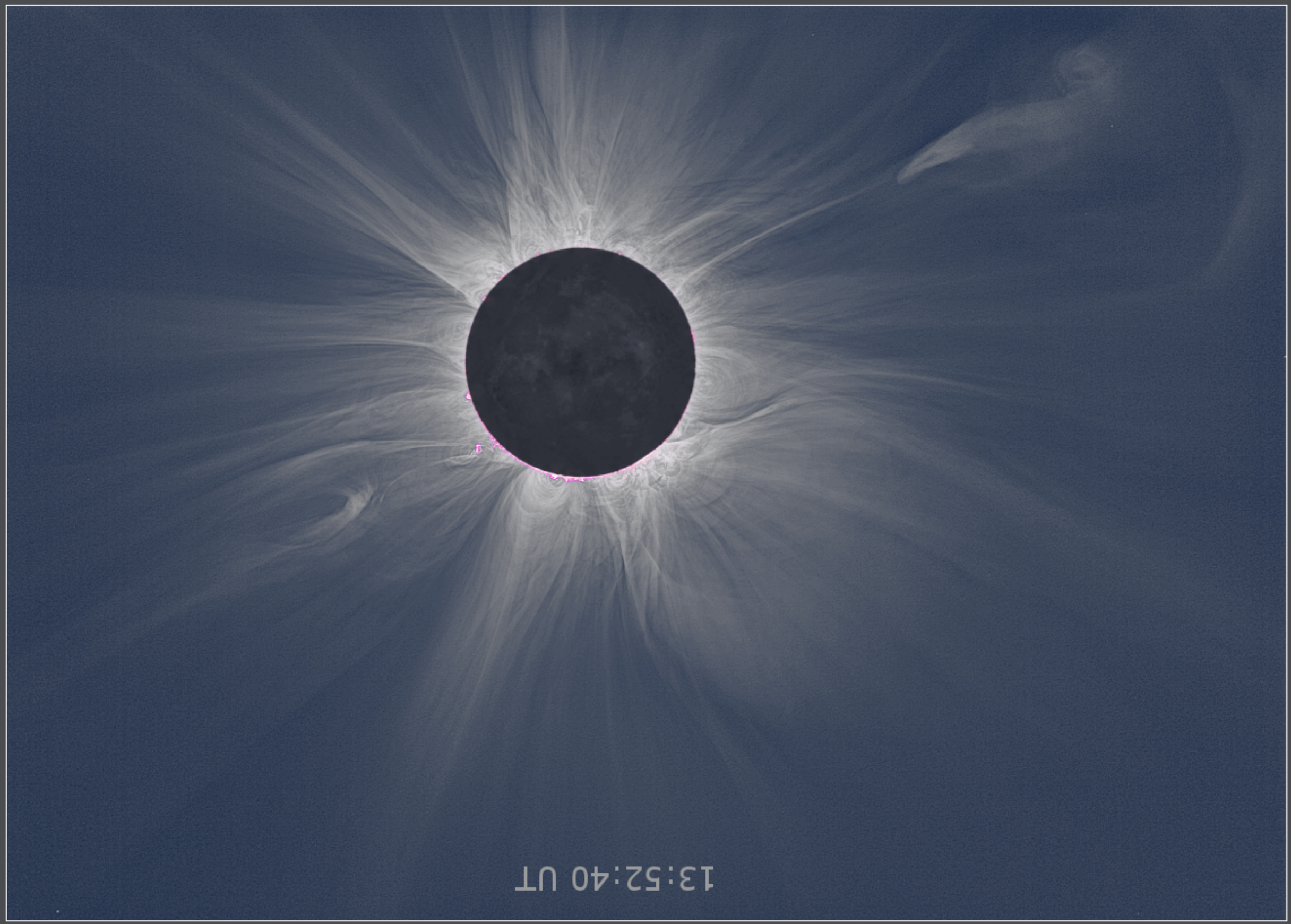
2013 Eclipse GIFs

assembled by Tina Seeger ‘16

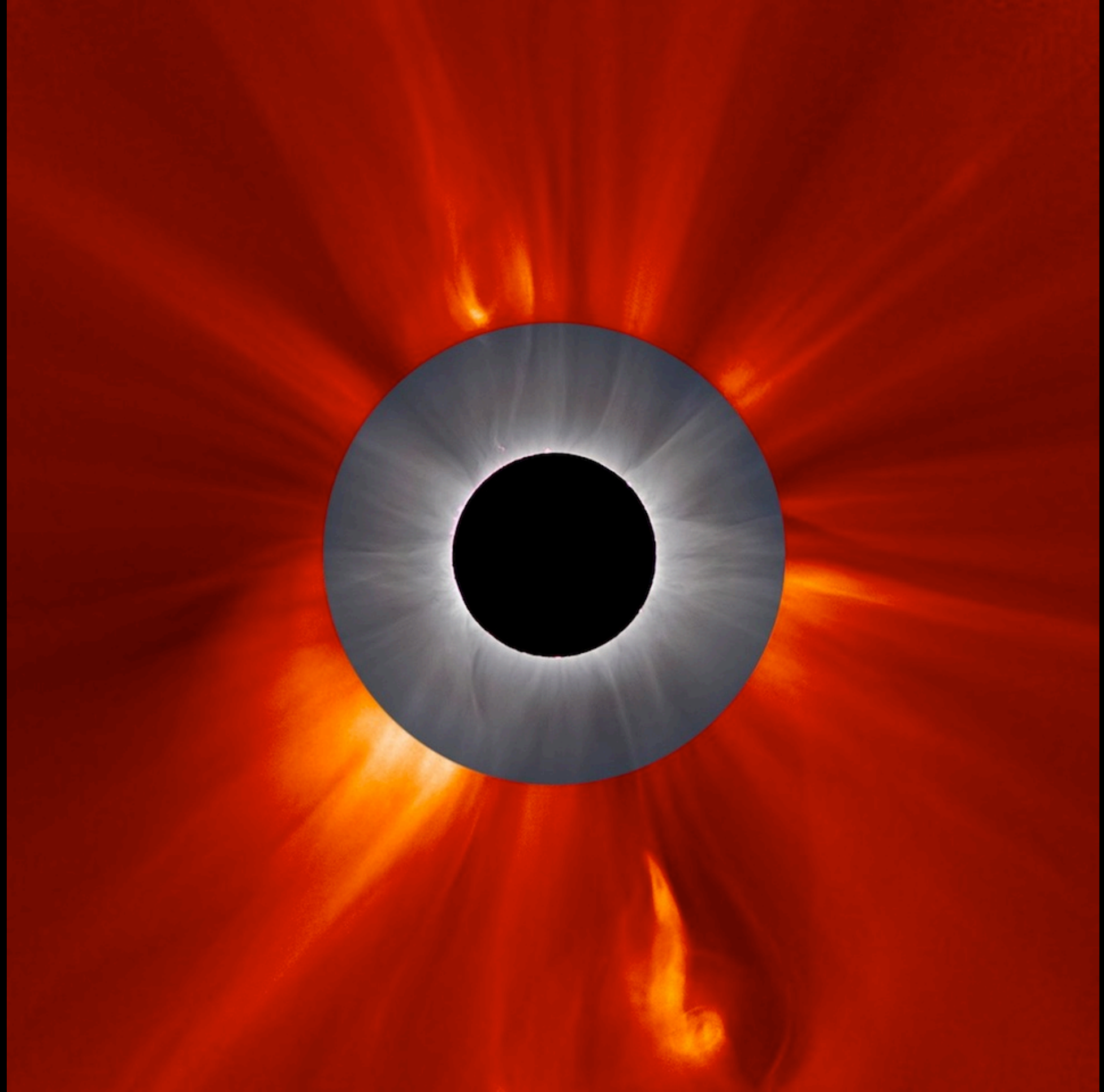
2

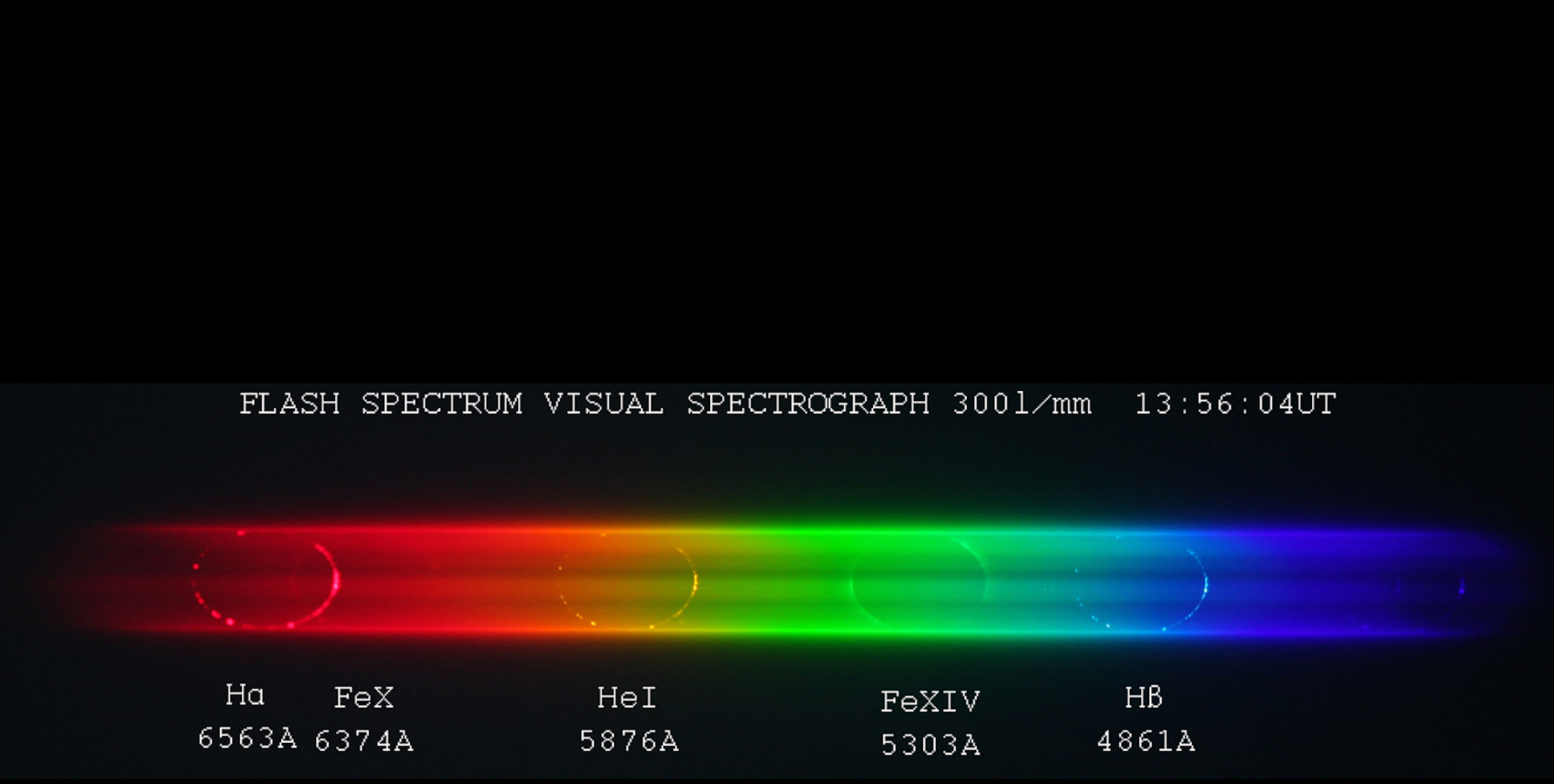
- Druckmüller: Gabon (Constantinos Emmanouilidis), Gabon (Jay Pasachoff, Allen Davis, Vojtech Rusin), Uganda (Petr Horálek – Upice Observatory, Jan Sládeček), Kenya (Pavel Štarha, Kristián Molnár, Shadia Habbal)

- UTC: 13:52:40, 13:55:44, 14:22:18, 14:24:46

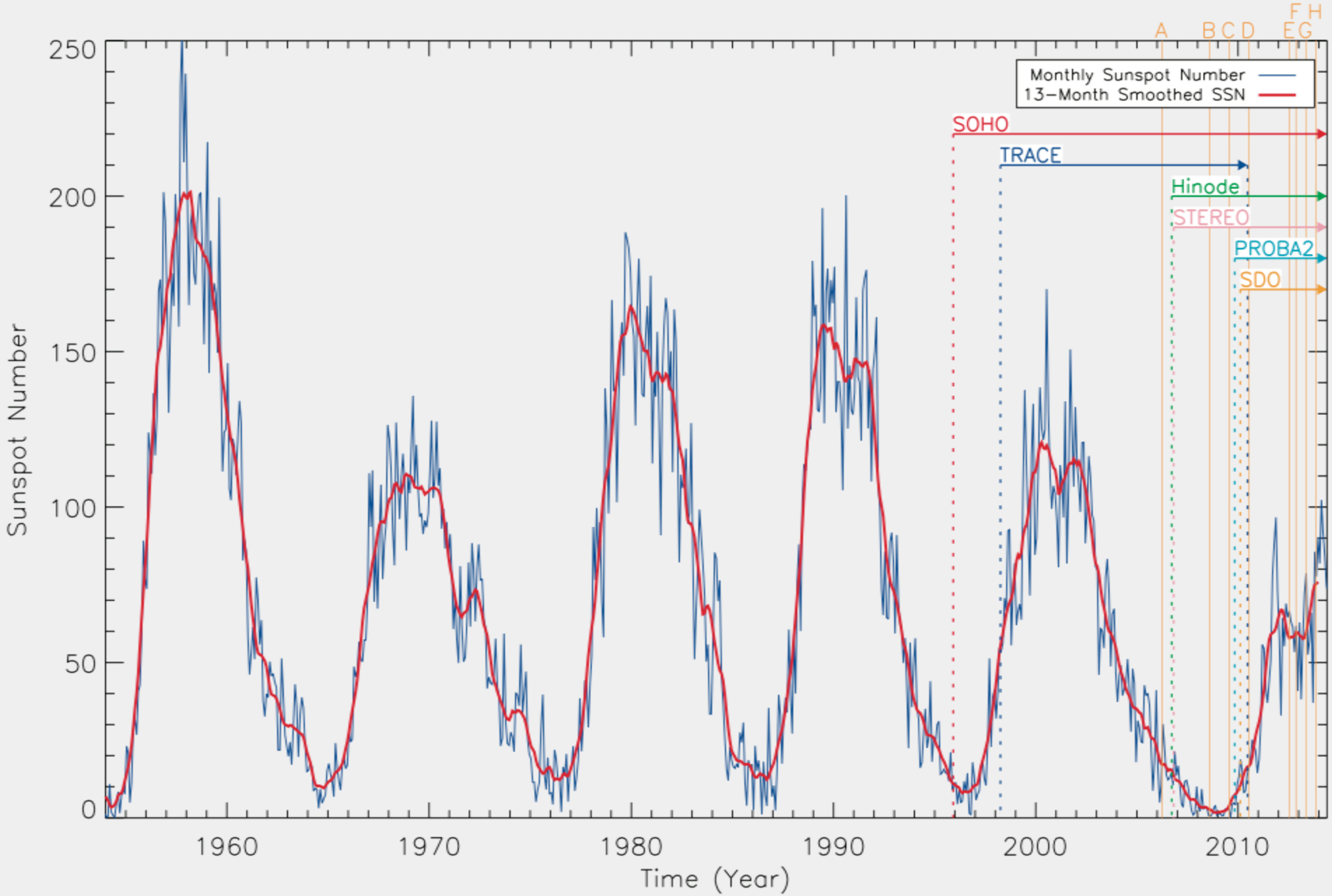


Total Solar Eclipse 2013





Aris Voulgaris, Aristotle U. Thessaloniki


A
B
C
D
E
F
G
H
Monthly Sunspot Number
13-Month Smoothed SSN
SOHO
TRACE
Hinode
STEREO
PROBA2
SDO
Sunspot Number
250
200
150
100
50
0
1960
1970
1980
1990
2000
2010
Time (Year)

Taken with a Nikon D600 FX and a 400-mm Nikkor lens with a Thousand Oaks Optical filter from a site 70 km north of Tennant Creek, Northern Territories, Australia. Many more in the series are also available.

Antarctica – 2014 April 29 Annular Solar Eclipse – Interactive Google Map – Xavier Jubier

xjubier.free.fr/en/site_pages/solar_eclipses/ASE_2014_GoogleMapFull.html

CUP-email C4-CUP C4 2013 2017 AASDir WmDir Wms Online Alarm Clock nytimes.com NYTsearch LATimes APOD moon TSEimages 490 HarvProg HarvPhD Wms_ecl

192.168.100.1/login | Photography by Ru... | WmDir | E Proof Tracker | Failed to open page | Solar Eclipses – Int... | Antarctica – 2014...

Map centered on: -54.26522, 123.04688 — 54° 15' 54.81" S, 123° 02' 48.75" E

Cursor (Lat, Lon): --.-------, --.-------

Solar Eclipses Maps | Help

Map | Satellite | Terrain | Labels

Made by Xavier M. Jubier

34° 44' 29.80" S <—> -34.74161°
151° 10' 18.75" E <—> 151.17188°

(partial solar eclipse) Help

Obscuration : ???

Max

Magnitude at maximum : 0.54153
Moon/Sun size ratio : 0.98364

Event (ΔT=68.6s)	Date	Time (UT)	Alt	Azi	P	V
Start of partial eclipse (C1) :	2014/04/29	06:11:39.7	+11.4°	296.7°	234°	08.5
Maximum eclipse :	2014/04/29	07:13:52.0*	-00.4°	287.4°	172°	10.5
End of partial eclipse (C4) :	2014/04/29	08:10:05.2*	-11.6°	279.6°	109°	12.5

Sudan Ethiopia Somalia Kenya DR Congo Tanzania Angola Zambia Mozambique Zimbabwe Botswana Namibia South Africa Madagascar

Laccadive Sea Arabian Sea Bengal Sea China Sea Vietnam Philippines Gulf of Thailand Malaysia Indonesia

Indian Ocean

Australia WA SA NSW VIC TAS ACT Great Australian Bight Tasman Sea New Zealand

South Pacific Ocean

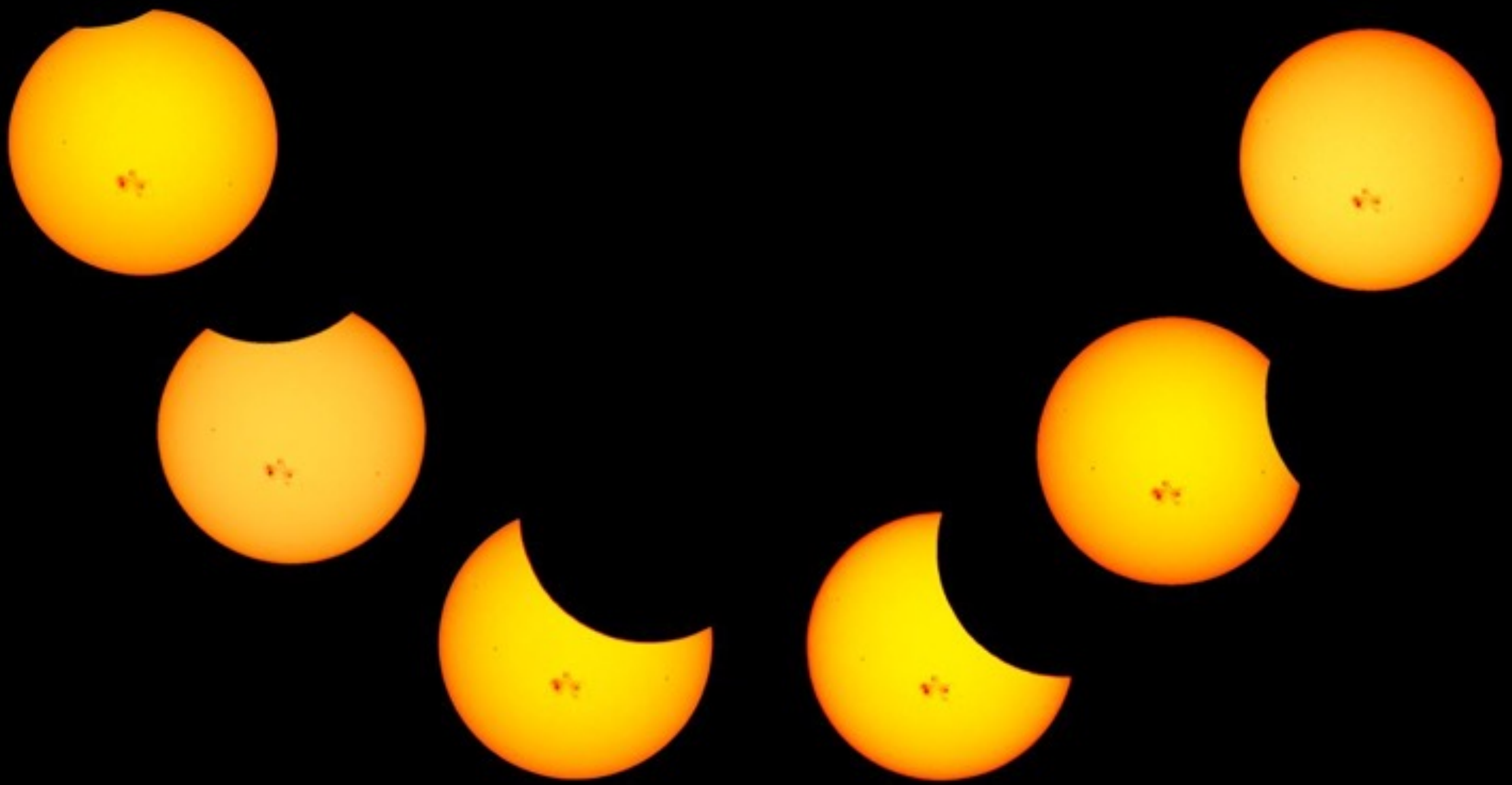
Southern Ocean

ANTARCTICA

POWERED BY Google 500 mi 1000 km

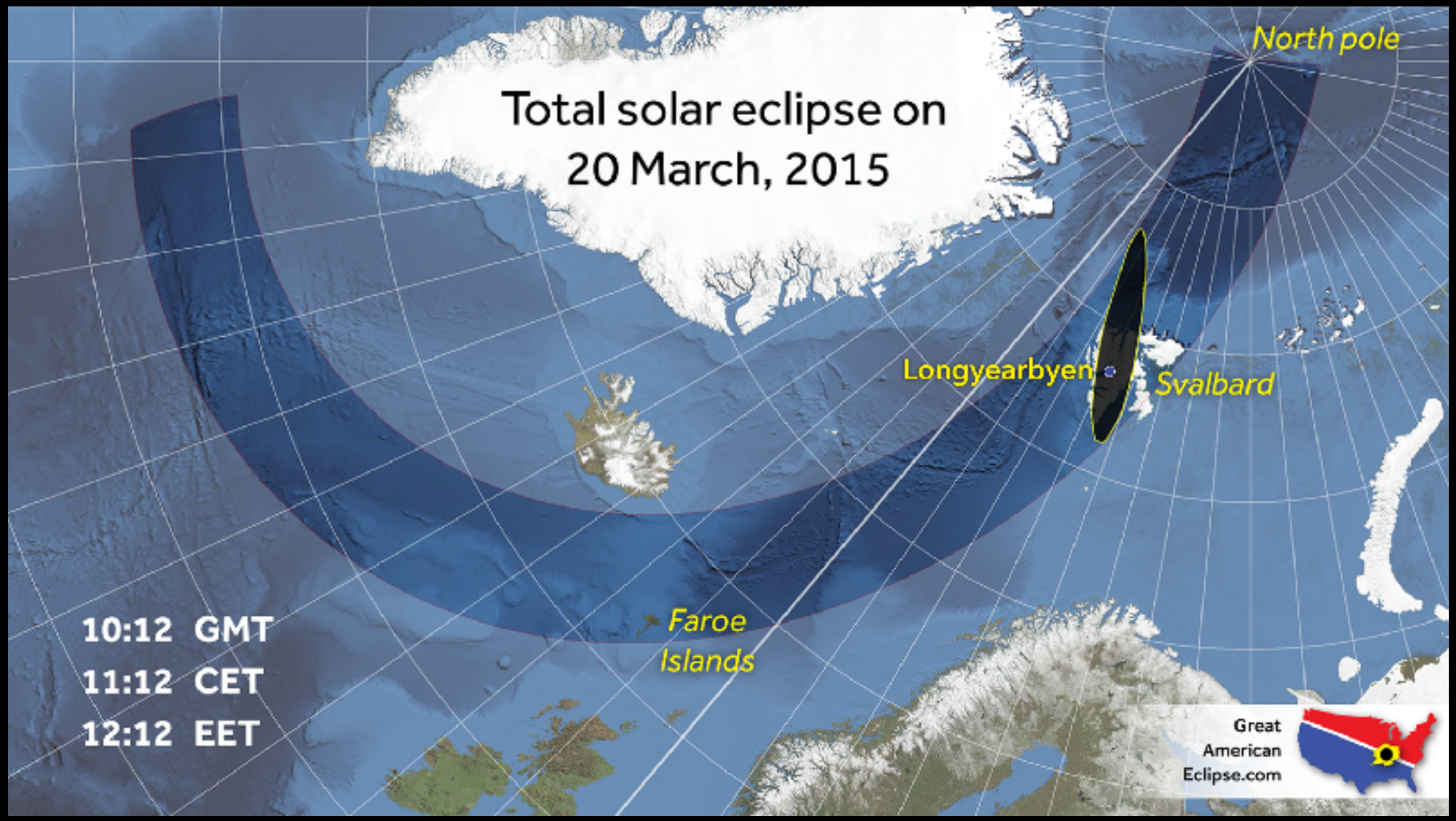
Imagery ©2013 NASA, Map data ©2013 Google - Terms of Use

29 April 2014 partial eclipse, from Albany, Western Australia



partial solar eclipse of 23 October 2014, viewed from Sacramento Peak Observatory, Sunspot, New Mexico

March 20, 2015, eclipse



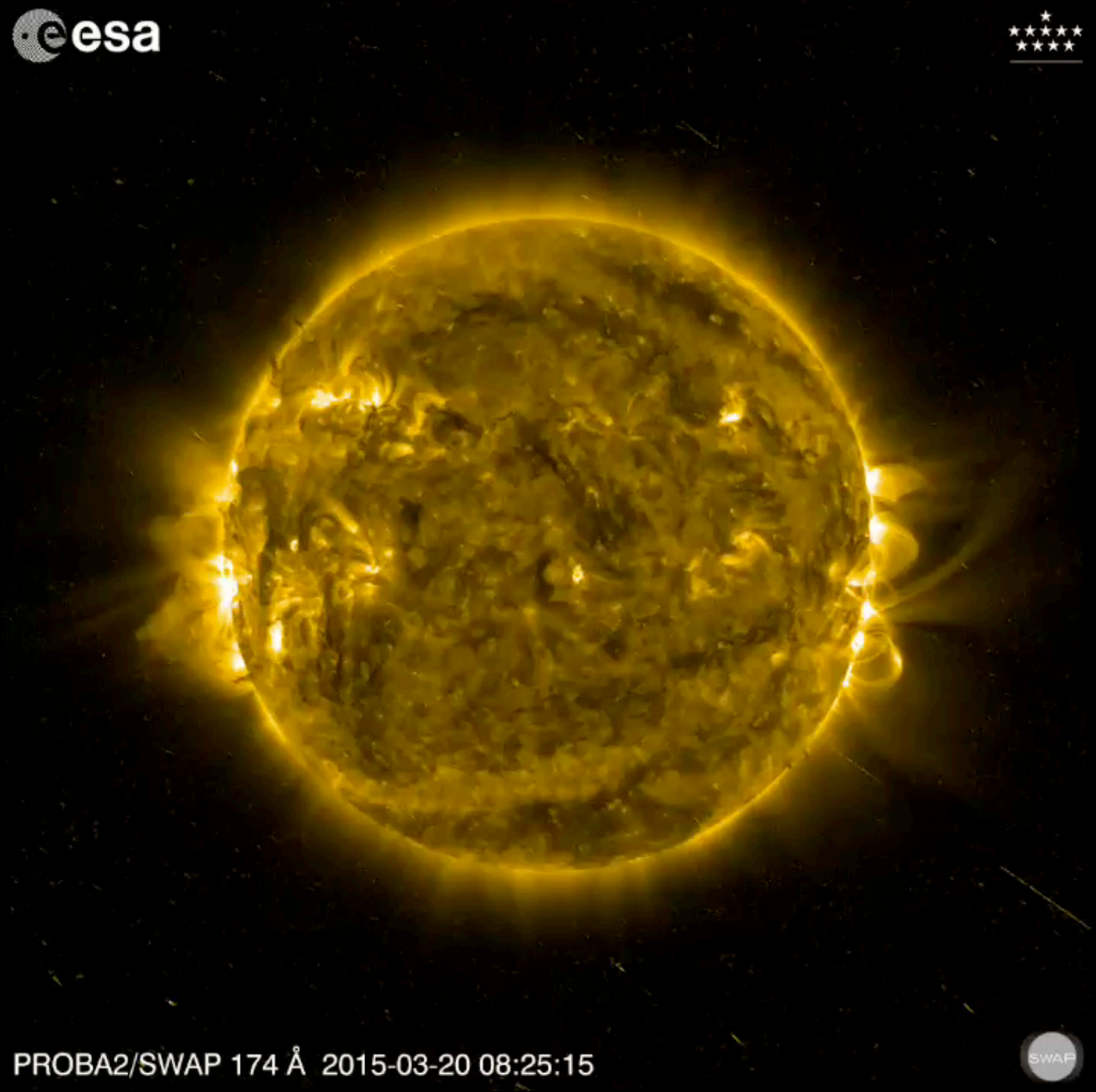
Map by Michael Zeiler

We were supported by a grant from the Committee for Research and Exploration of the National Geographic Society, with additional support from Williams College.

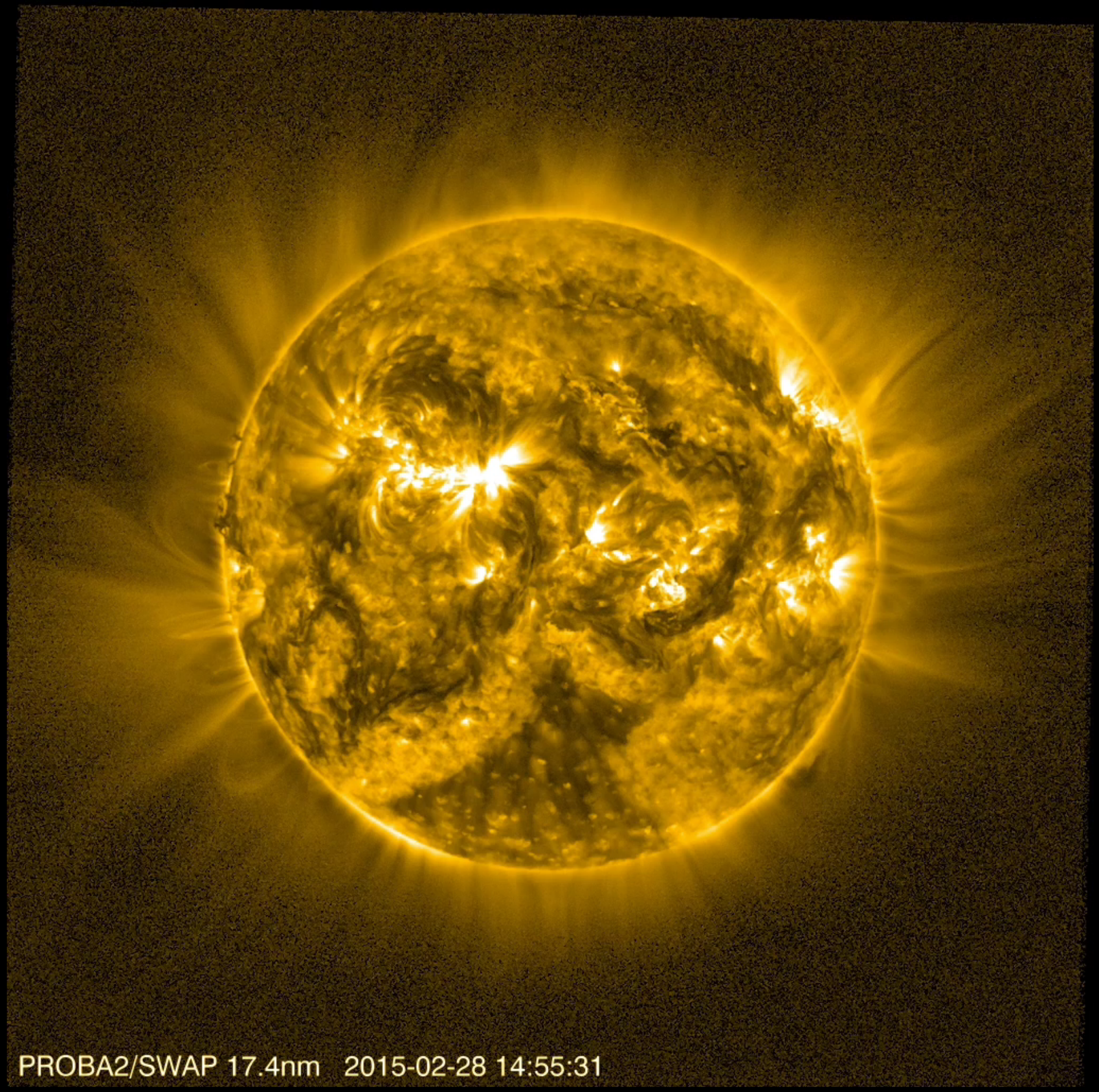

coop
Svalbard
SVALBARDBUTIKKEN
Velkommen til verdens nordligste varehus
Avgang Departures Вылет
Café
Ikke rør isbjørnen
Do not touch the polar bear
Det er forbudt å gå på bagasjebåndet
Walking on belt is prohibited
Området er kameraovervåket
The area has camera surveillance

movie by Rob Lucas

movie by Aykut Ak

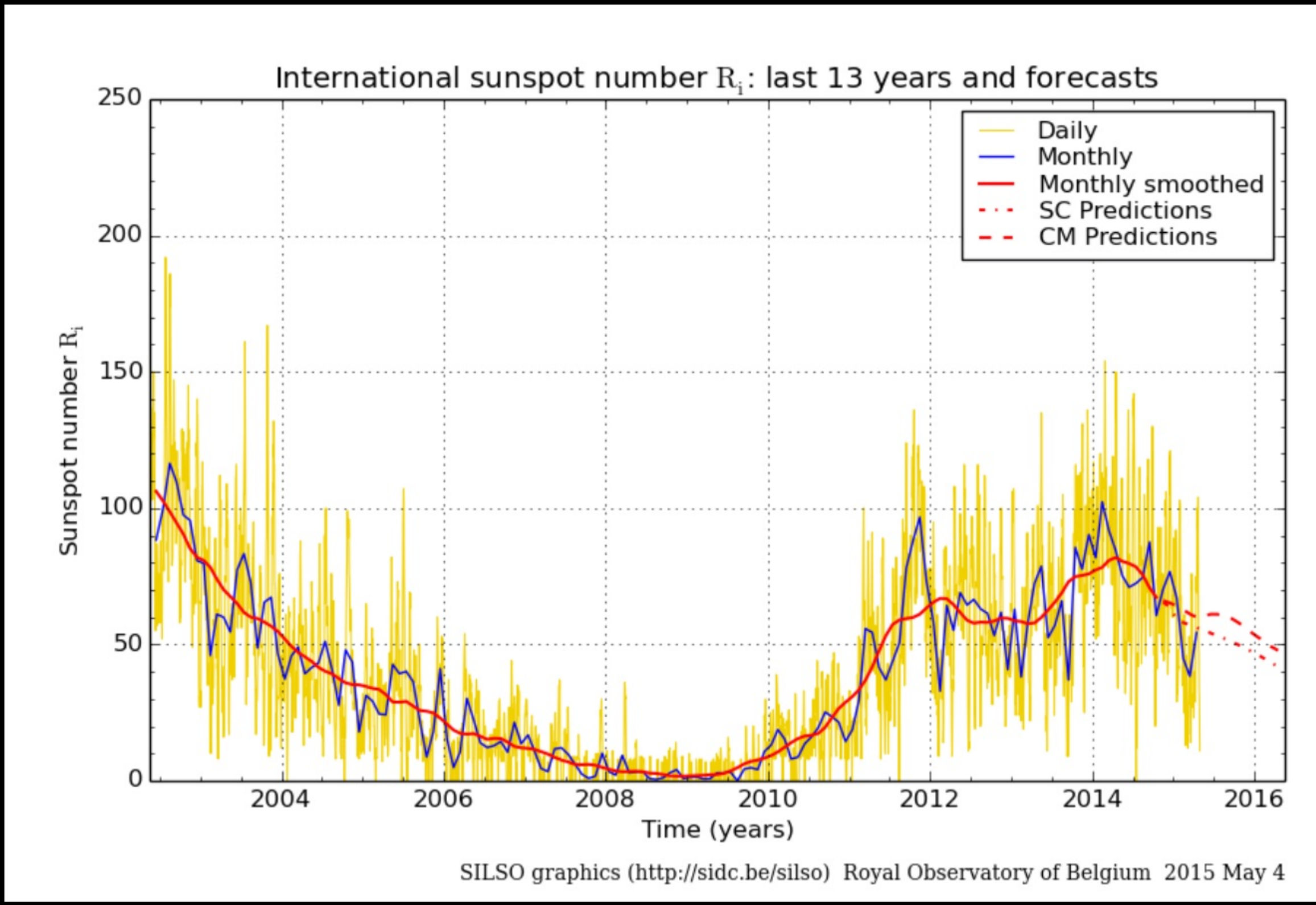


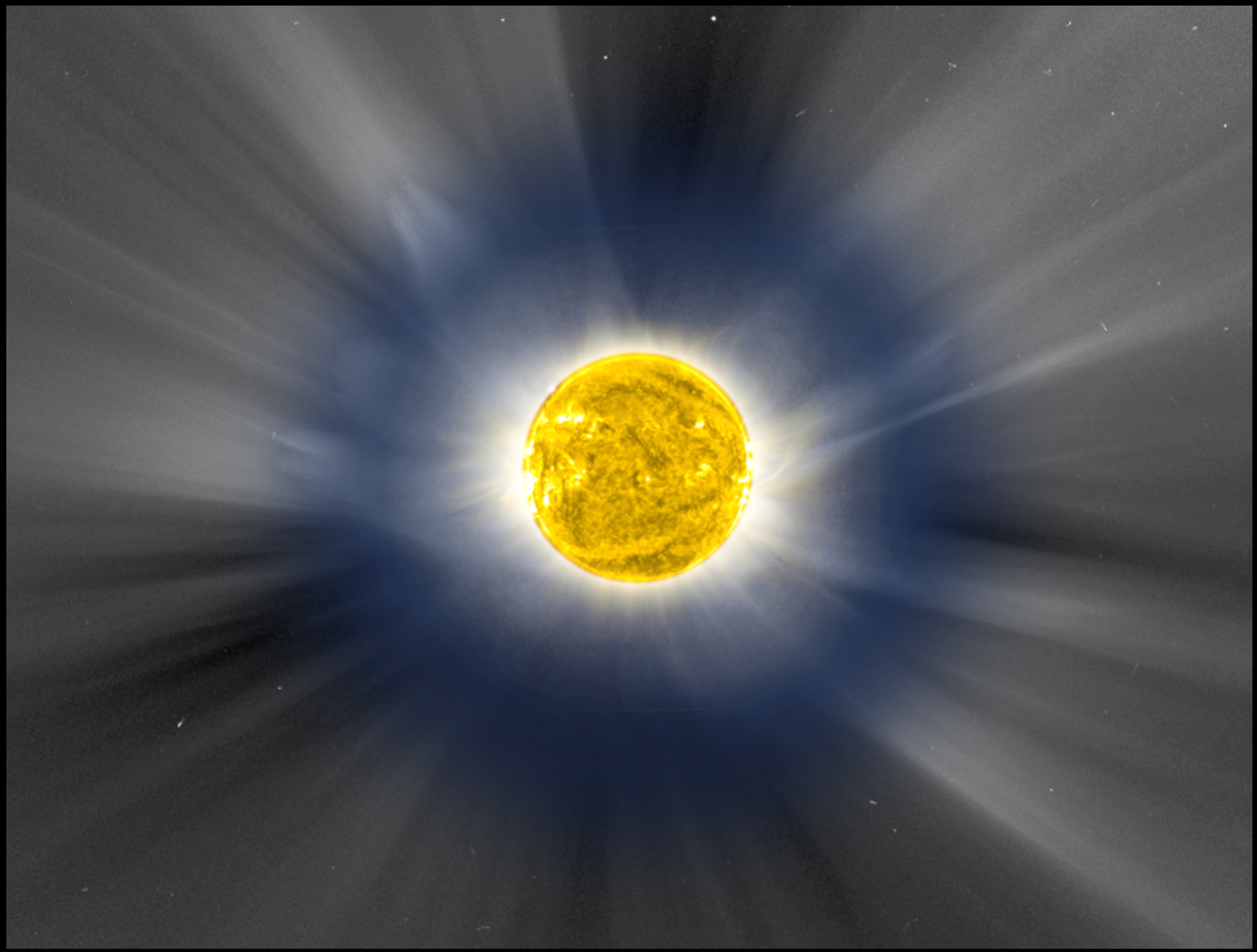
Courtesy of Daniel B. Seaton ‘01, ROB



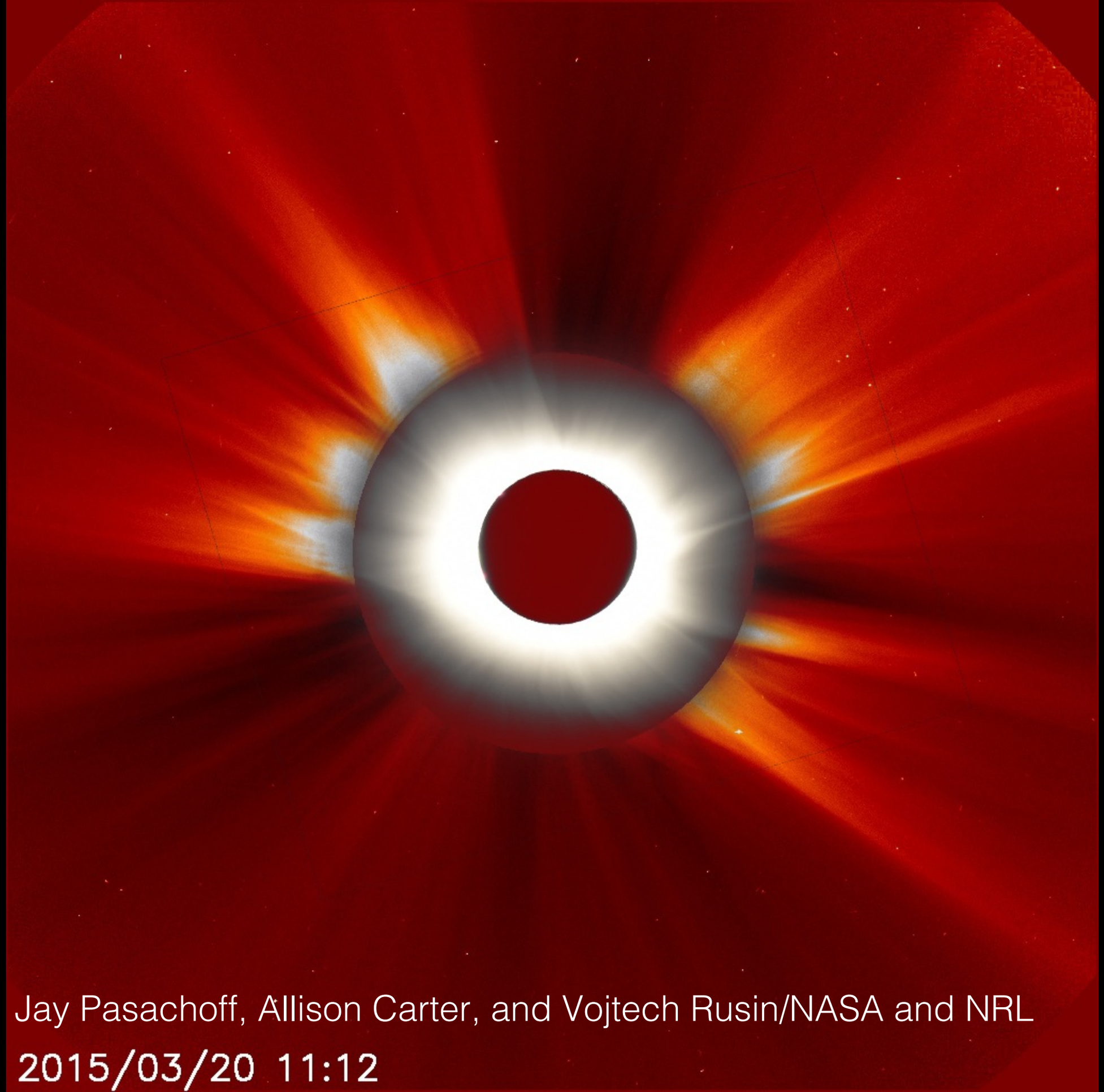
Courtesy of Daniel B. Seaton ‘01, Royal Observatory of Belgium

composite image by Jay Pasachoff and Ron Dantowitz

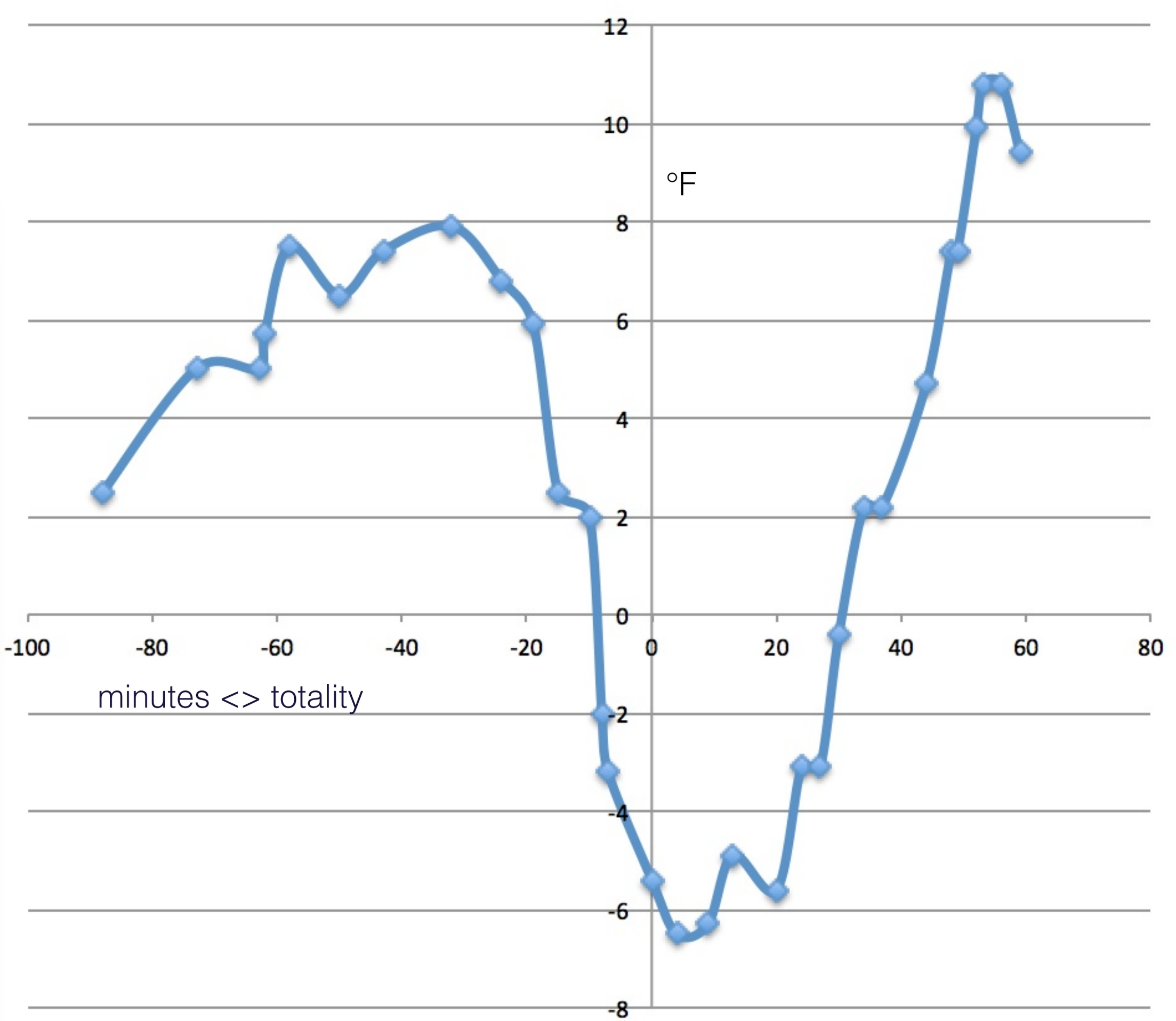

International sunspot number R_i: last 13 years and forecasts
Daily
Monthly
Monthly smoothed
SC Predictions
CM Predictions
Sunspot number R_i
250
200
150
100
50
0
2004
2006
2008
2010
2012
2014
2016
Time (years)
SILSO graphics (http://sidc.be/silso) Royal Observatory of Belgium 2015 May 4

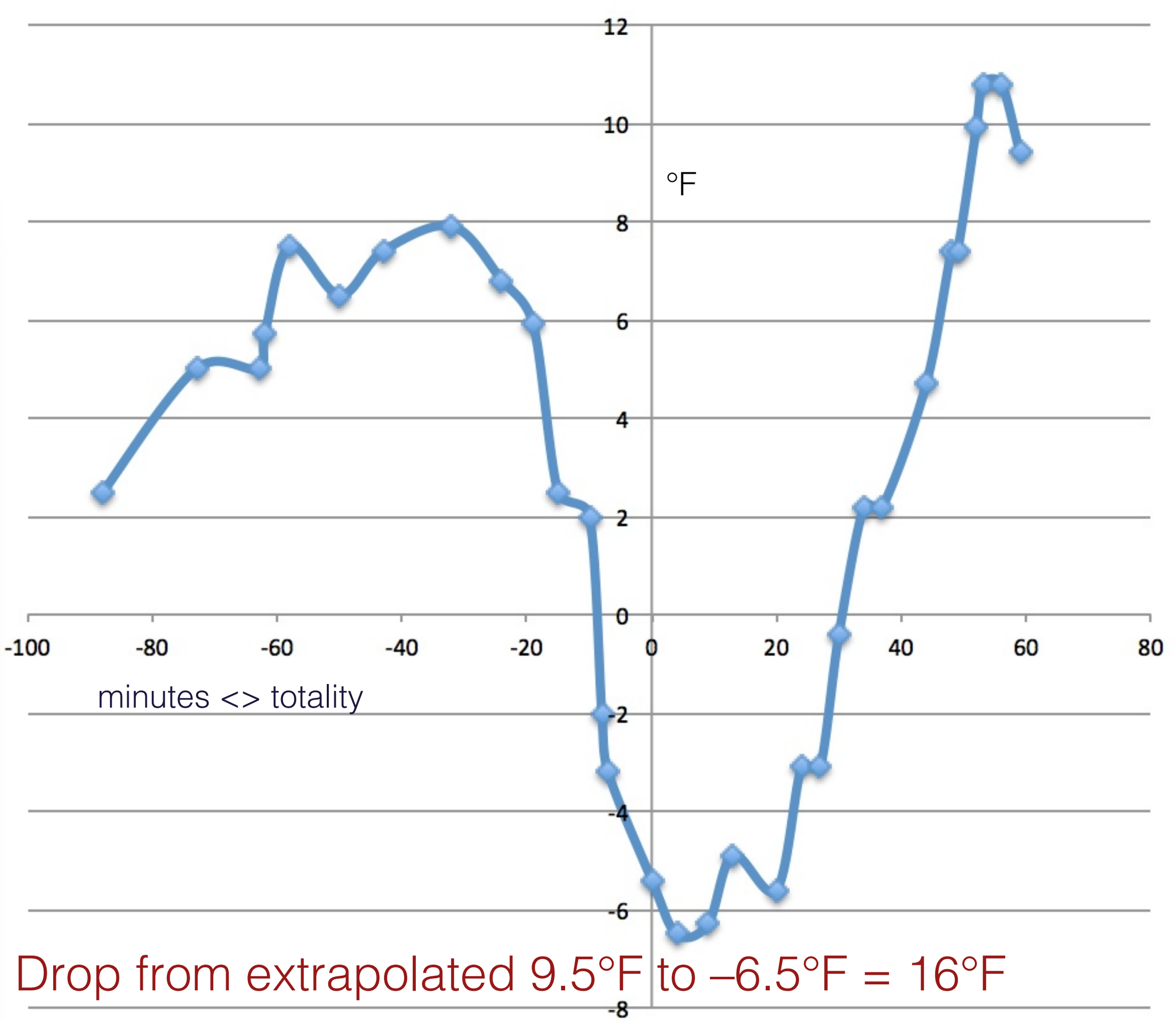


Jay Pasachoff, Allison Carter, Wendy Carlos, and Dan Seaton


Jay Pasachoff, Allison Carter, and Vojtech Rusin/NASA and NRL
2015/03/20 11:12

Fisheye image by Michael Zeiler


12
10
°F
8
6
4
2
0
-2
-4
-6
-8
-100
-80
-60
-40
-20
0
20
40
60
80
minutes <> totality



Drop from extrapolated 9.5°F to –6.5°F = 16°F

Eclipse in the Arctic

Total Solar Eclipse 20 March near Longyearbyen, Svalbard

Terry Cuttle

- movie by CJay Mcintire

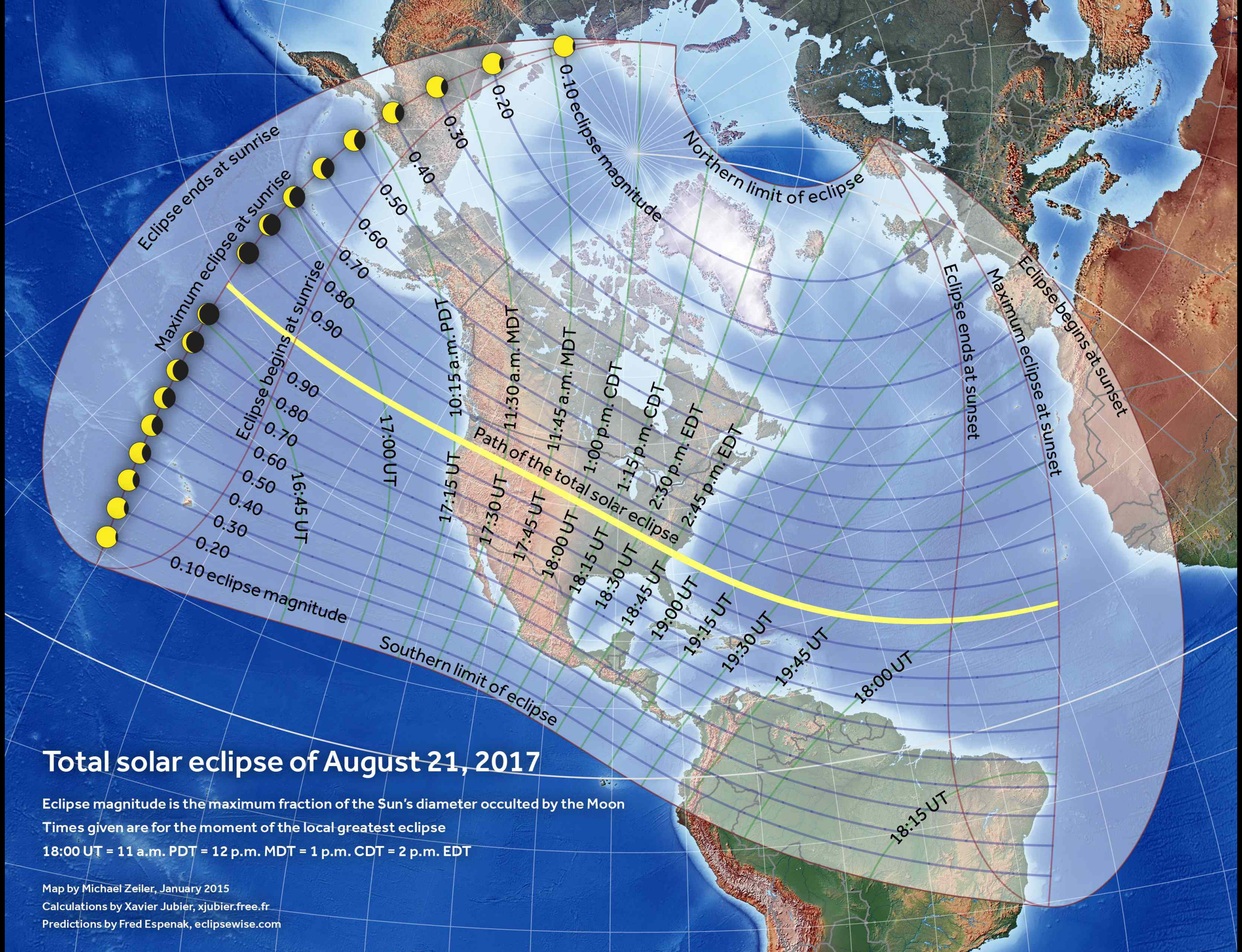
Glenn Schneider (U. Arizona) and Geoff Sims (U. New South Wales)


airberlin.com

- *We were supported by a grant from the Committee for Research and Exploration*

of the National Geographic Society, with additional support from Williams College.

- *Our team included*
- Jay Pasachoff/Naomi Pasachoff
- Allison Carter ‘16
- Vojtech Rusin
- Ron Dantowitz
- Aris Voulgaris
- John Seiradakis
- Michael Zeiler
- Michael Kentrianakis
- Edw. Ginsberg
- Rob Lucas/Helen Robinson
- *And we are coordinating for data display and reduction, and accessing space results, with*
- Dan Seaton ‘01 (SWAP)
- Pavlos Gaintatzis
- Wendy Carlos
- Alphonse Sterling



Total solar eclipse of August 21, 2017

Eclipse magnitude is the maximum fraction of the Sun's diameter occulted by the Moon

Times given are for the moment of the local greatest eclipse

18:00 UT = 11 a.m. PDT = 12 p.m. MDT = 1 p.m. CDT = 2 p.m. EDT

Map by Michael Zeiler, January 2015

Calculations by Xavier Jubier, xjubier.free.fr

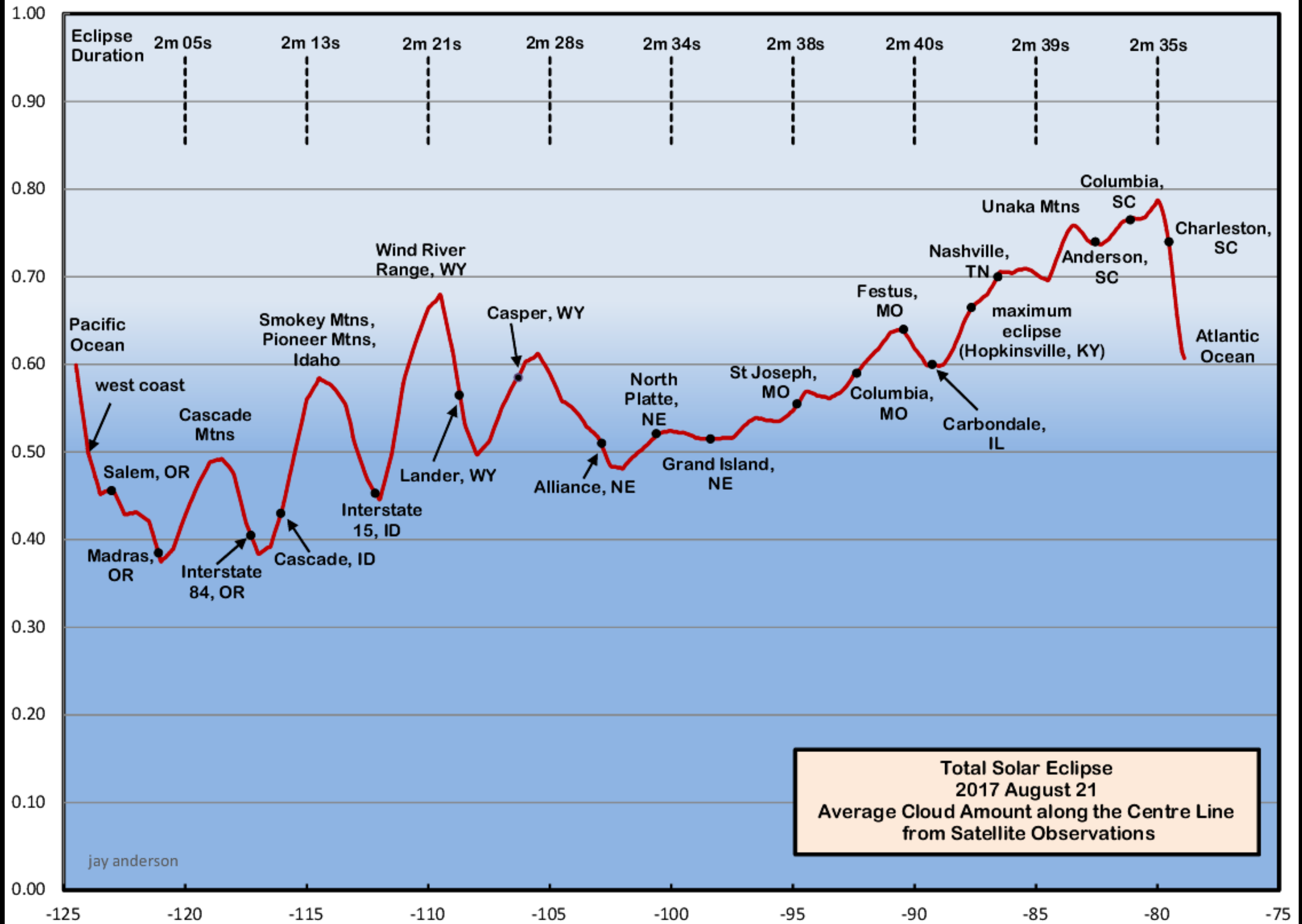
Predictions by Fred Espenak, eclipsewise.com

Total Solar Eclipse of August 21, 2017

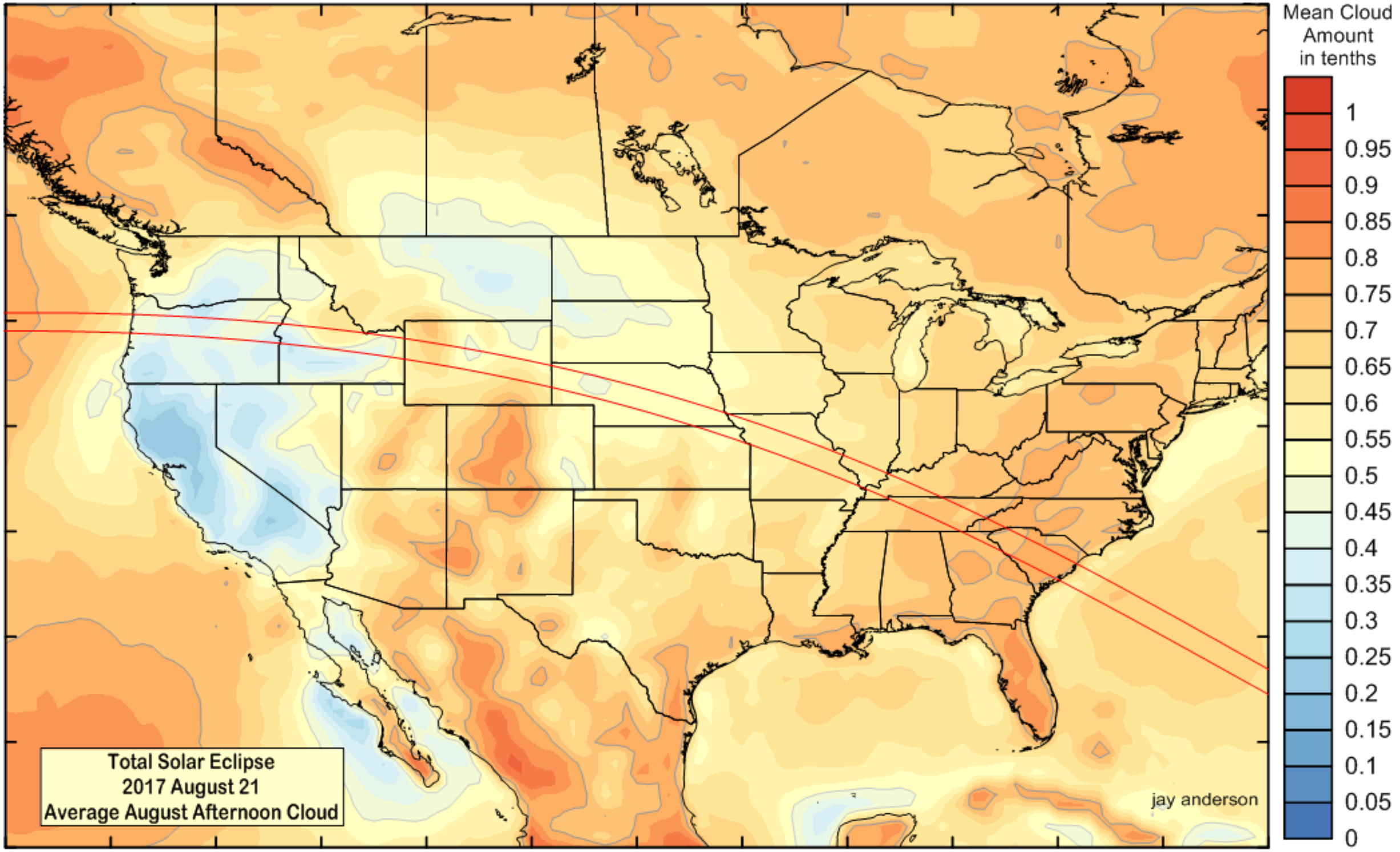
2 min
2 min 10 sec
2 min 20 sec
2 min 30 sec
2 min 40 sec
2 min 40 sec
2 min 30 sec

50%
60%
70%
80%
90%
90%
80%
70%
60%
50%
40%
30%

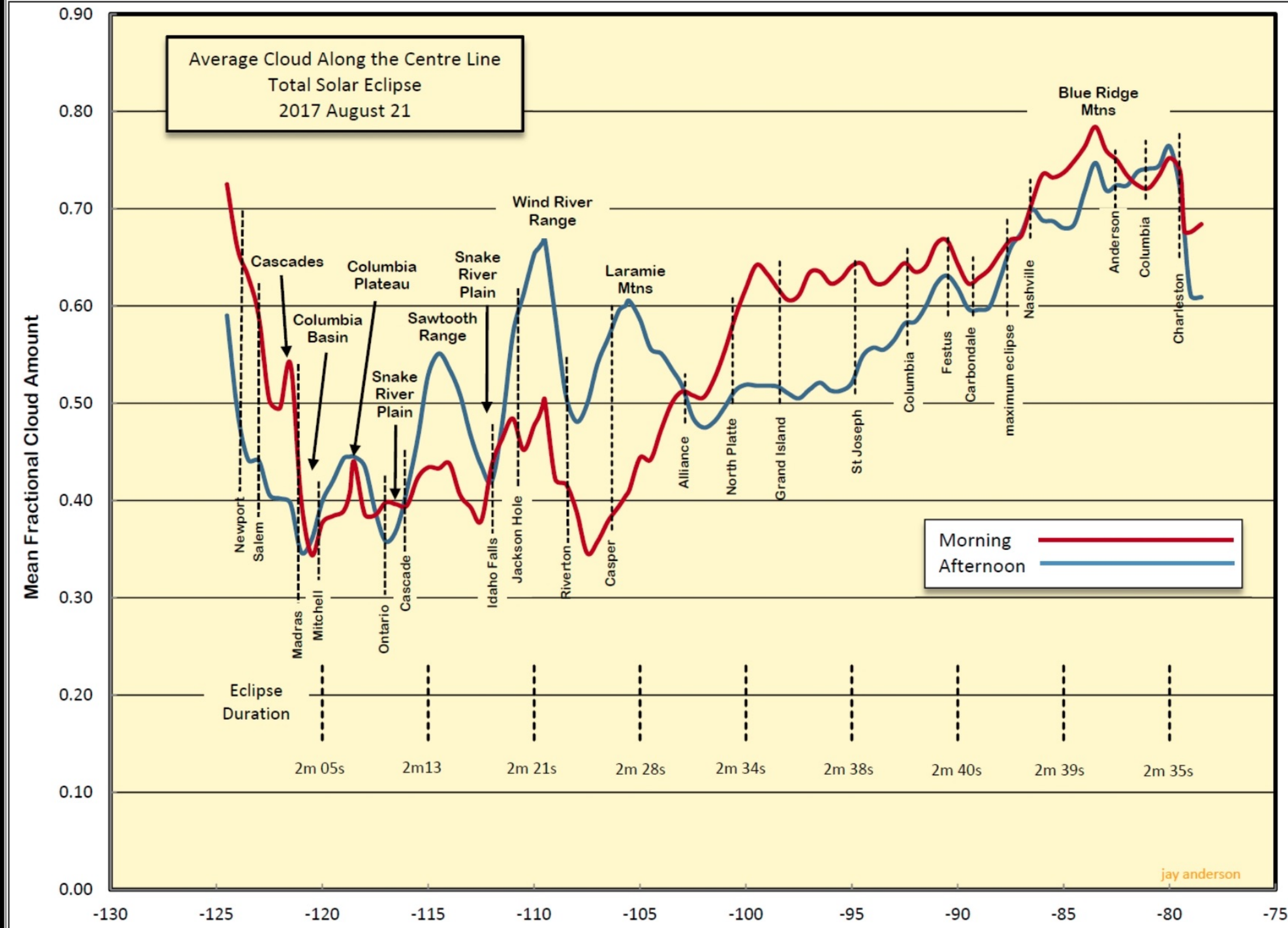
2017


Eclipse Duration
2m 05s
2m 13s
2m 21s
2m 28s
2m 34s
2m 38s
2m 40s
2m 39s
2m 35s
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-125
-120
-115
-110
-105
-100
-95
-90
-85
-80
-75
Pacific Ocean
west coast
Salem, OR
Cascade Mtns
Madras, OR
Interstate 84, OR
Smokey Mtns, Pioneer Mtns, Idaho
Cascade, ID
Wind River Range, WY
Interstate 15, ID
Lander, WY
Casper, WY
North Platte, NE
Alliance, NE
St Joseph, MO
Grand Island, NE
Festus, MO
Columbia, MO
Carbondale, IL
Nashville, TN
maximum eclipse (Hopkinsville, KY)
Unaka Mtns
Columbia, SC
Anderson, SC
Charleston, SC
Atlantic Ocean
Total Solar Eclipse
2017 August 21
Average Cloud Amount along the Centre Line
from Satellite Observations
jay anderson

2017



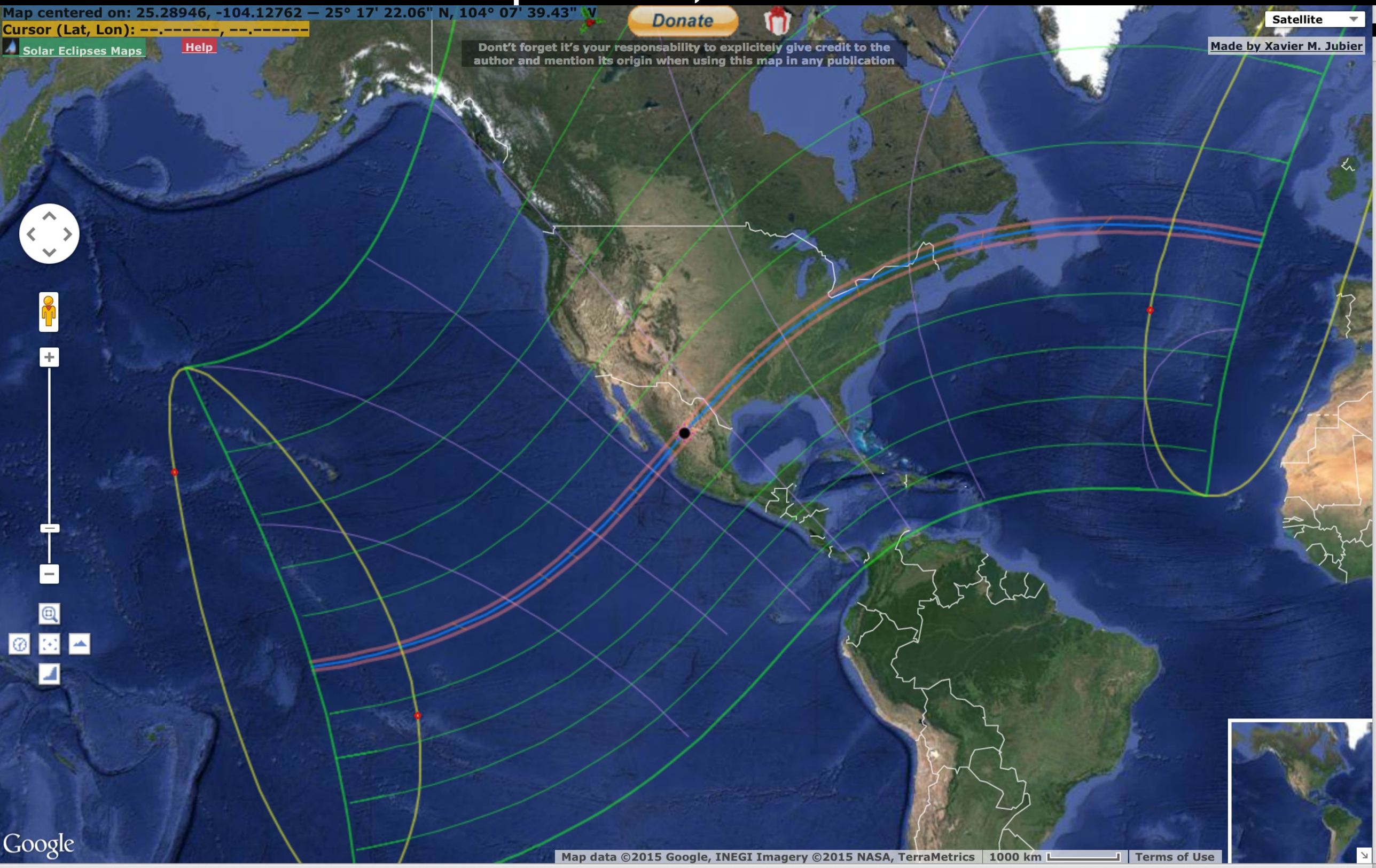
Michael Zeiler, eclipse-maps.com



Graph 1: Average morning and afternoon cloud cover along the eclipse centreline extracted from 20 years of satellite imagery. The location of cities and towns along the track are indicated by dashed vertical lines above their names. Prominent topographical features are named above the graphs. Source: Patmos-X: CIMMS/ SSEC.

Jay Anderson, eclipser.ca

April 8, 2024



http://xjubier.free.fr/en/site_pages/solar_eclipses/xSE_GoogleMap3_Test.php?Ecl=+20240408&Acc=1&Umb=0&Lmt=1&Mag=1&Max=1

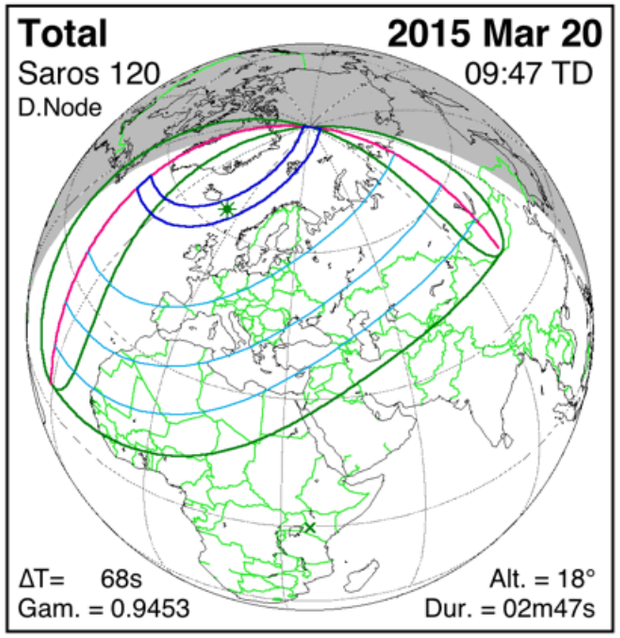
Total solar eclipse of April 8, 2024

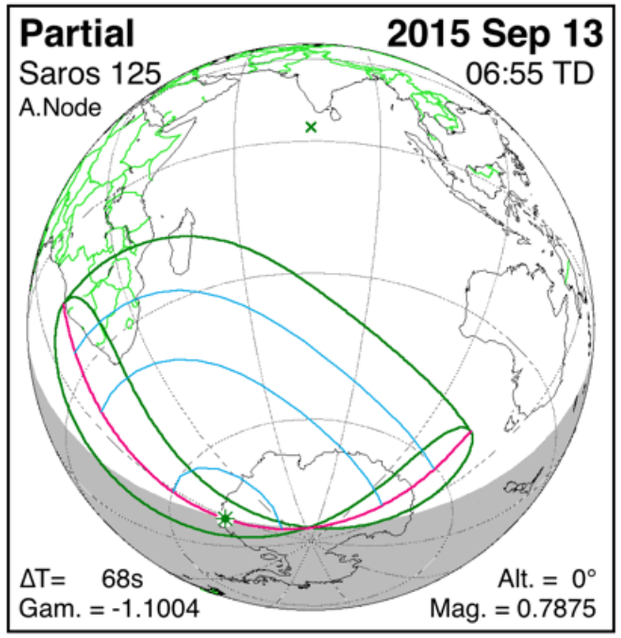
Northern limit of total eclipse

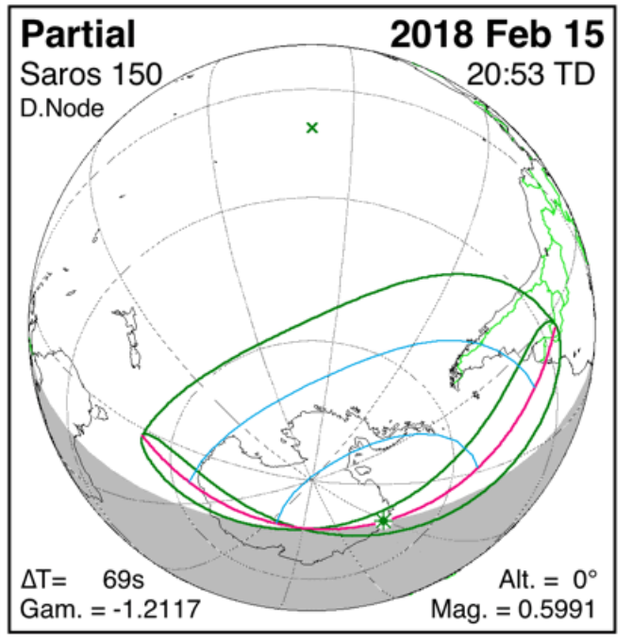
Central line of total eclipse

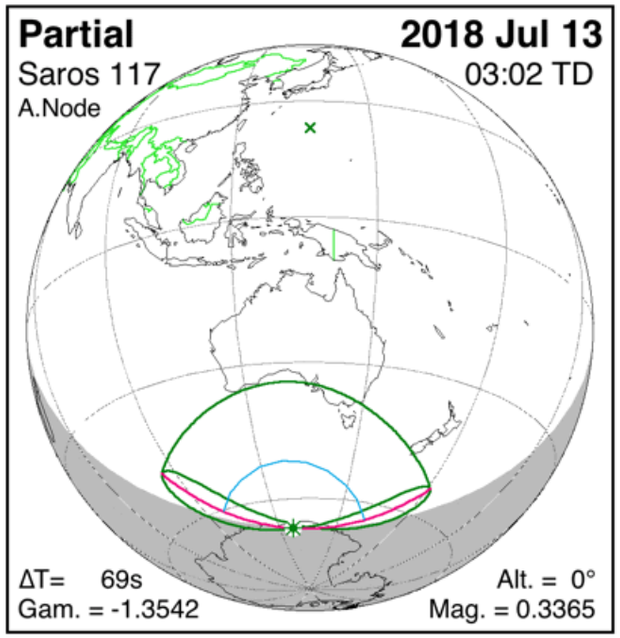
Southern limit of total eclipse

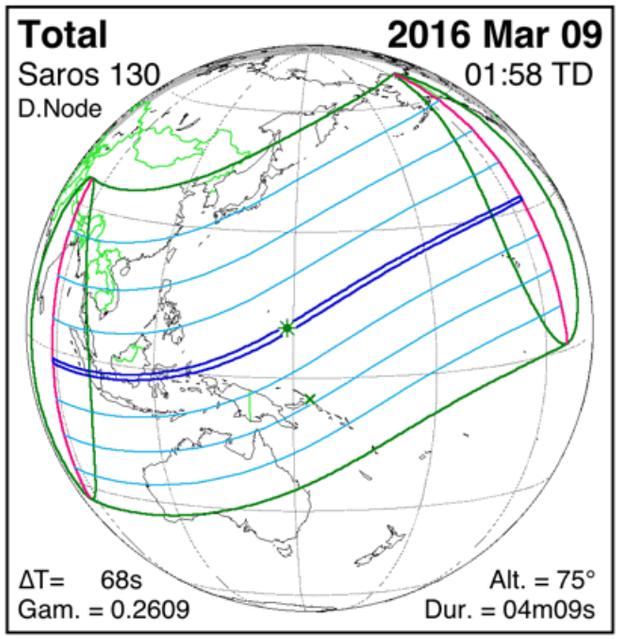
Great American Eclipse.com

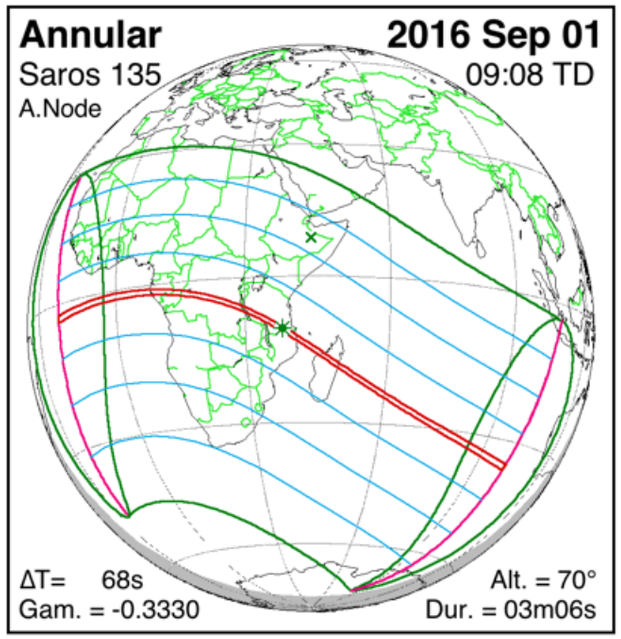

Total
2015 Mar 20
Saros 120
09:47 TD
D.Node
ΔT= 68s
Alt. = 18°
Gam. = 0.9453
Dur. = 02m47s

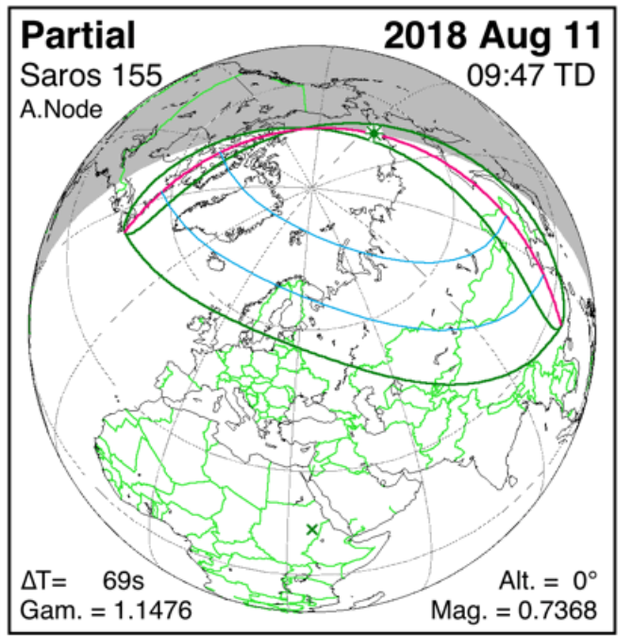

Partial
2015 Sep 13
Saros 125
06:55 TD
A.Node
ΔT= 68s
Alt. = 0°
Gam. = -1.1004
Mag. = 0.7875

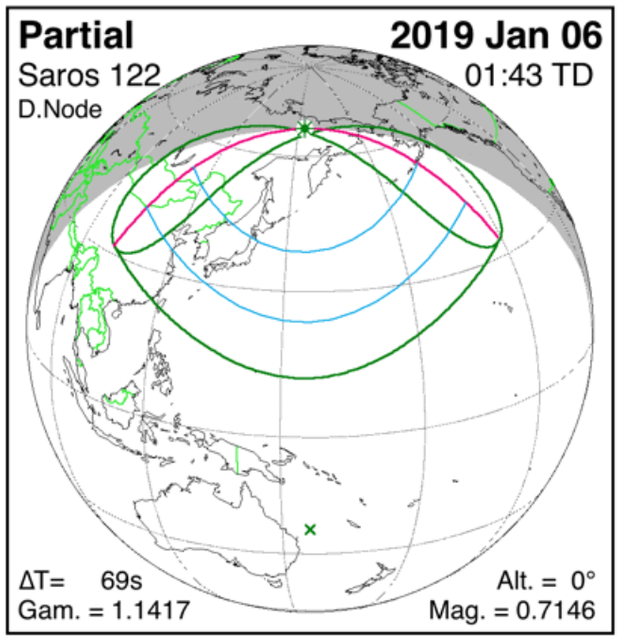

Partial
2018 Feb 15
Saros 150
20:53 TD
D.Node
ΔT= 69s
Alt. = 0°
Gam. = -1.2117
Mag. = 0.5991

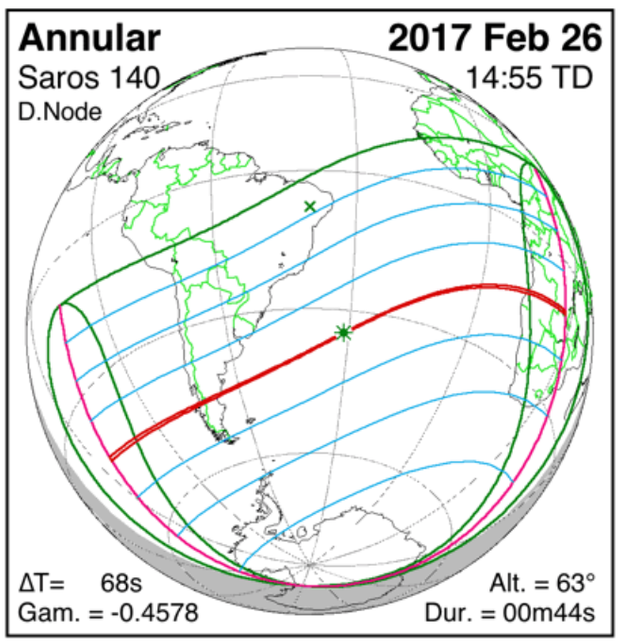

Partial
2018 Jul 13
Saros 117
03:02 TD
A.Node
ΔT= 69s
Alt. = 0°
Gam. = -1.3542
Mag. = 0.3365

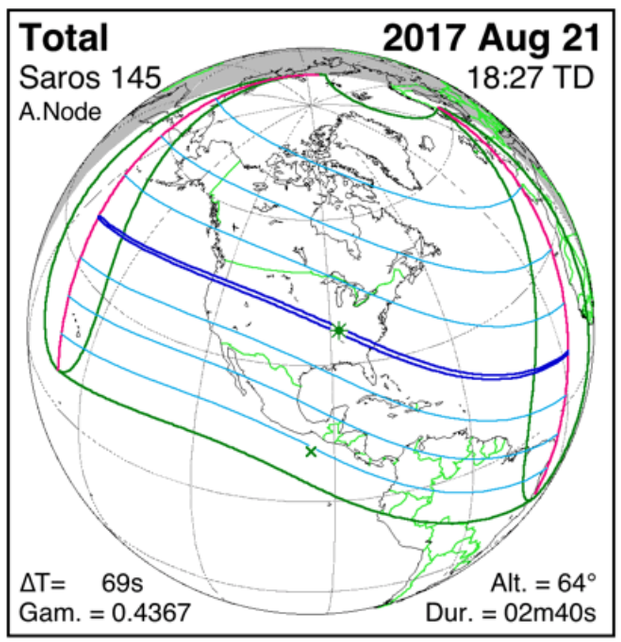

Total
2016 Mar 09
Saros 130
01:58 TD
D.Node
ΔT= 68s
Alt. = 75°
Gam. = 0.2609
Dur. = 04m09s

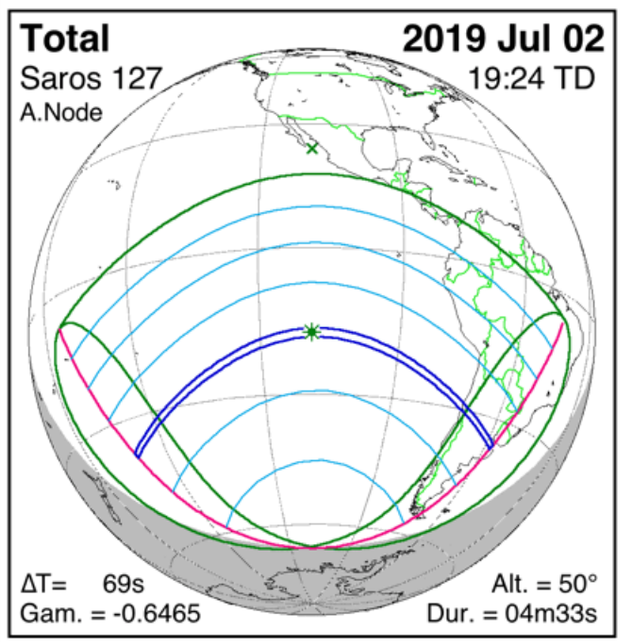

Annular
2016 Sep 01
Saros 135
09:08 TD
A.Node
ΔT= 68s
Alt. = 70°
Gam. = -0.3330
Dur. = 03m06s

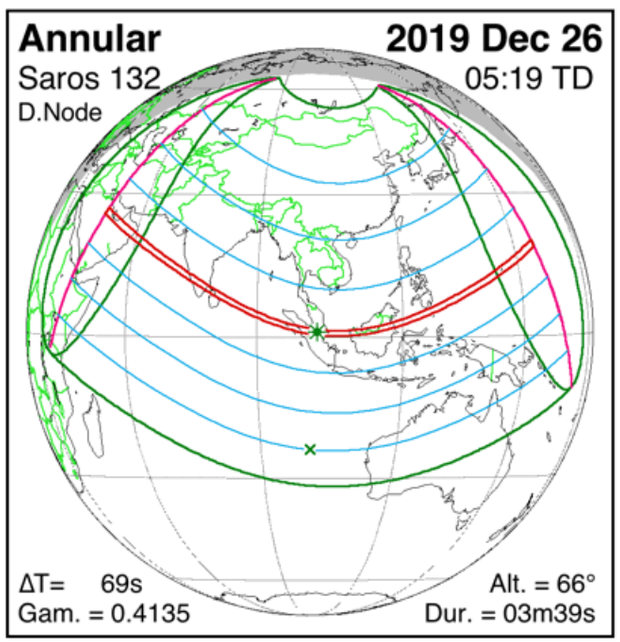

Partial
2018 Aug 11
Saros 155
09:47 TD
A.Node
ΔT= 69s
Alt. = 0°
Gam. = 1.1476
Mag. = 0.7368

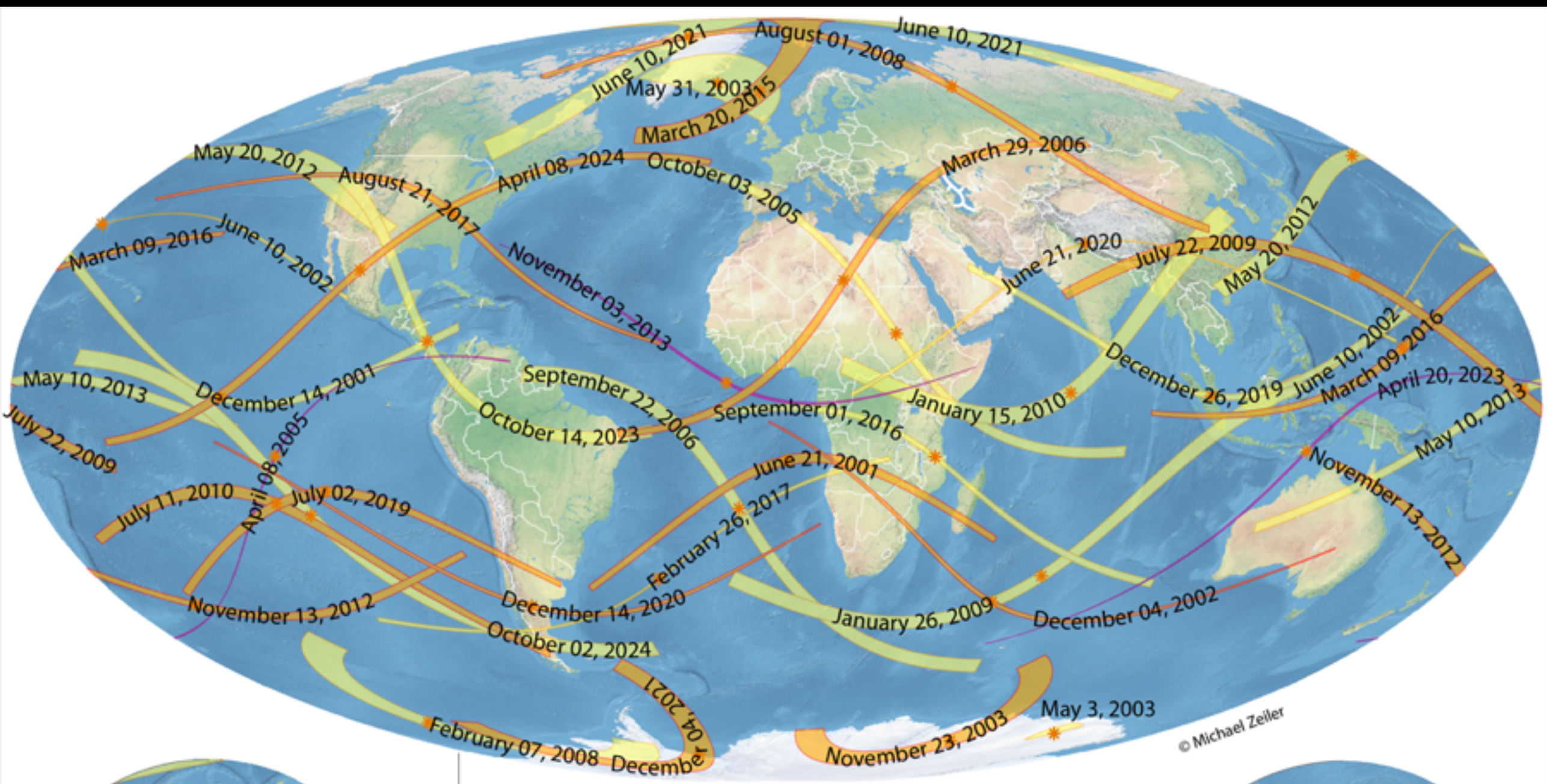

Partial
2019 Jan 06
Saros 122
01:43 TD
D.Node
ΔT= 69s
Alt. = 0°
Gam. = 1.1417
Mag. = 0.7146


Annular
2017 Feb 26
Saros 140
14:55 TD
D.Node
ΔT= 68s
Alt. = 63°
Gam. = -0.4578
Dur. = 00m44s


Total
2017 Aug 21
Saros 145
18:27 TD
A.Node
ΔT= 69s
Alt. = 64°
Gam. = 0.4367
Dur. = 02m40s


Total
2019 Jul 02
Saros 127
19:24 TD
A.Node
ΔT= 69s
Alt. = 50°
Gam. = -0.6465
Dur. = 04m33s


Annular
2019 Dec 26
Saros 132
05:19 TD
D.Node
ΔT= 69s
Alt. = 66°
Gam. = 0.4135
Dur. = 03m39s



Solar eclipses from 2001 to 2025

- Path of total solar eclipse
- Path of annular solar eclipse
- Path of hybrid solar eclipse
- Point of greatest eclipse