The Total Solar Eclipse of April 8, 2004 in the Great Lakes Region:

Some Preliminary Thoughts

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Why Talk About This?

Weather information is critical to eclipse viewing

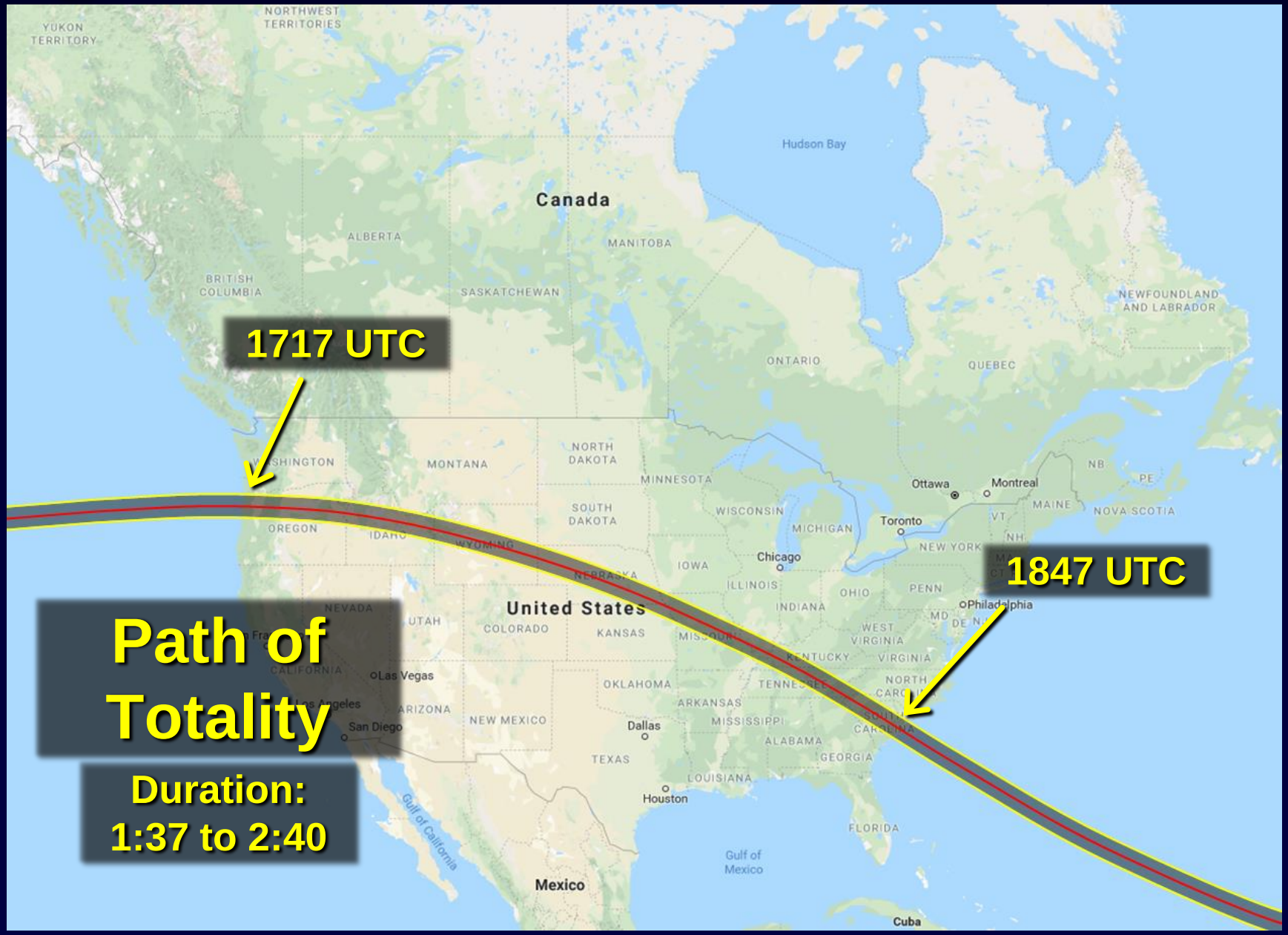
The National Weather Service and meteorologists in general are publicly looked to as the "experts" for weather and eclipse information (even stuff that we "don't do")

This event will literally be the biggest Large Event Venue you will ever work

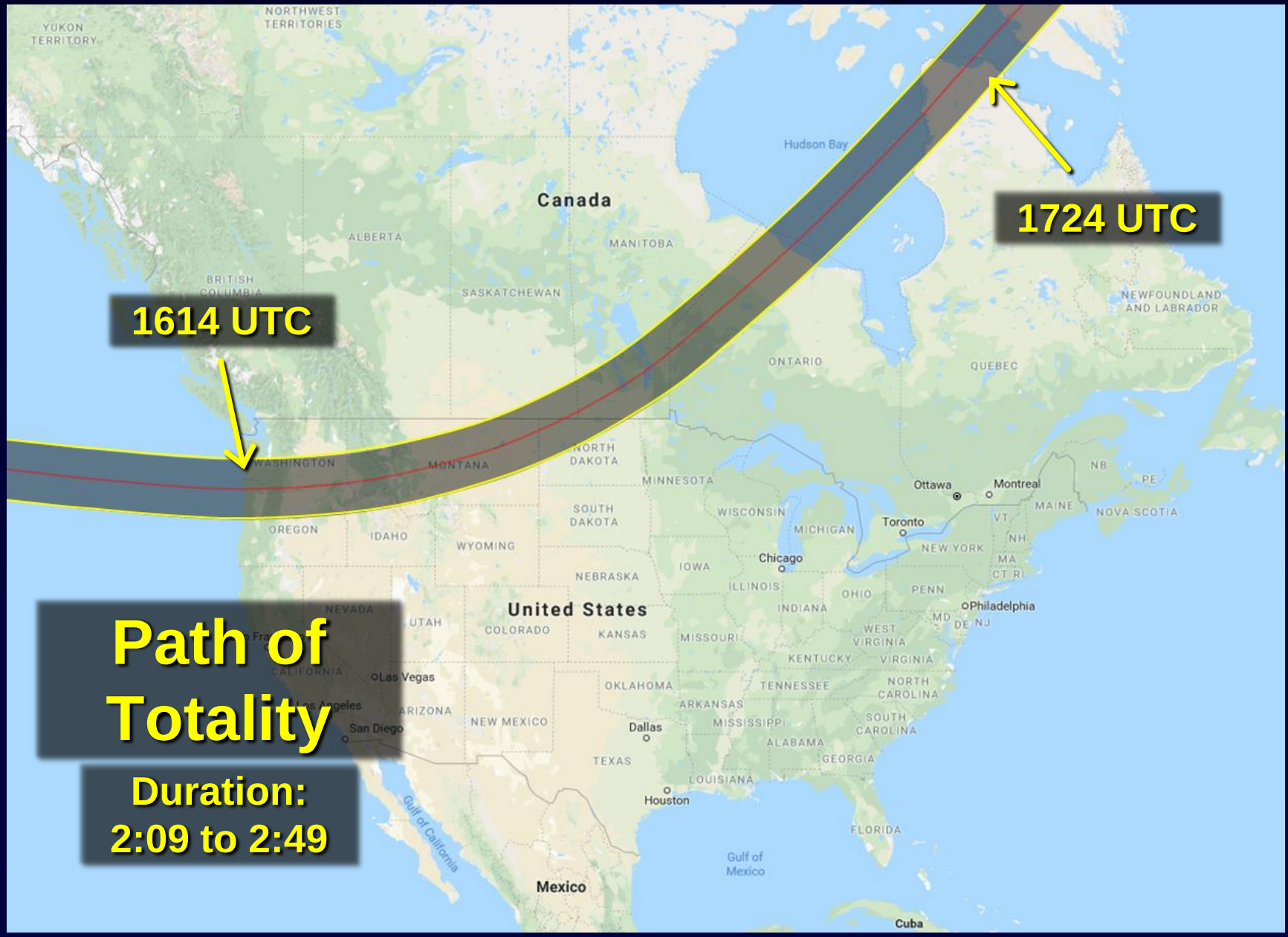
It's only 6 years away - plenty of time to help partners plan

It interests me!

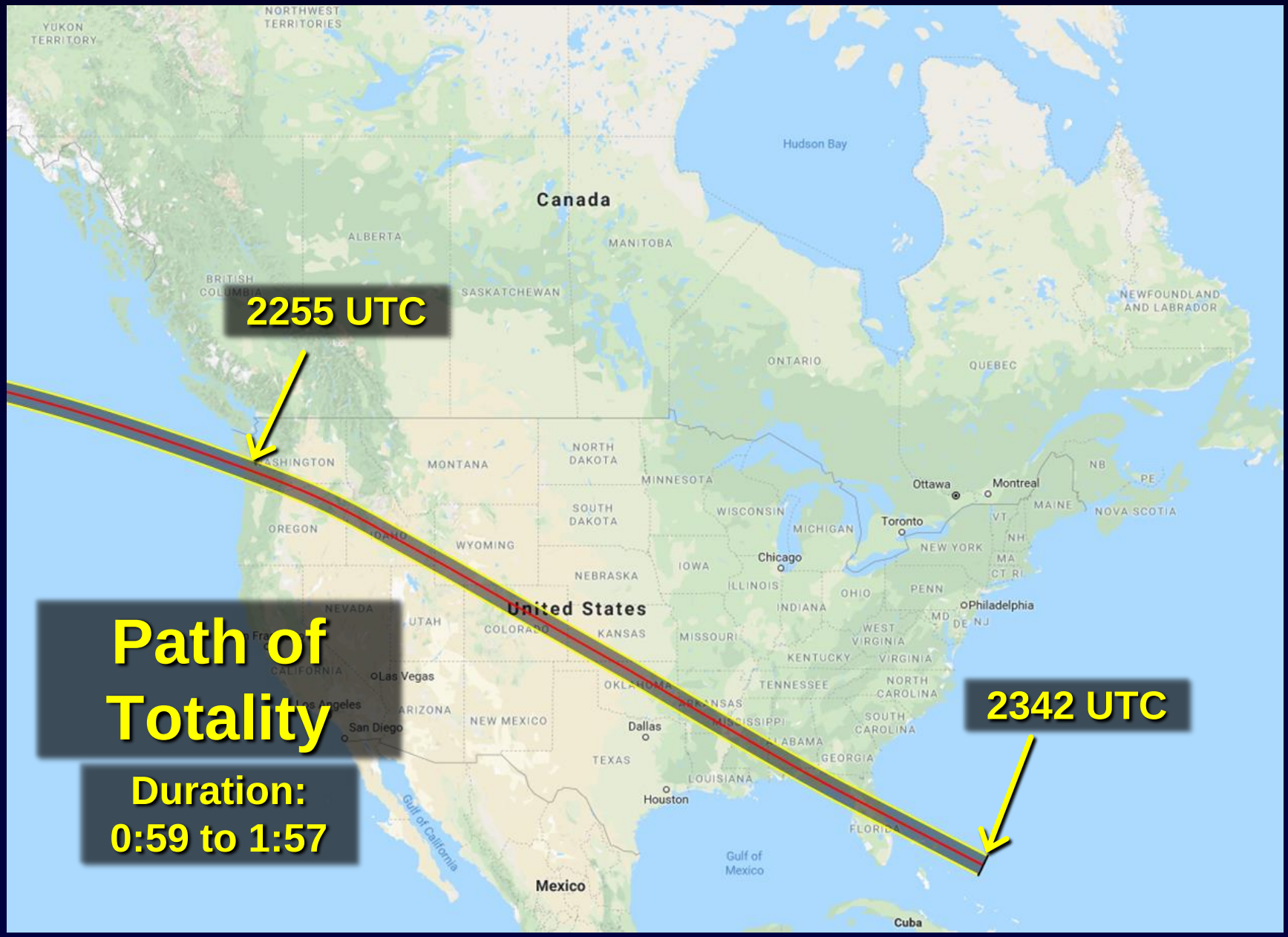
August 21, 2017 Solar Eclipse



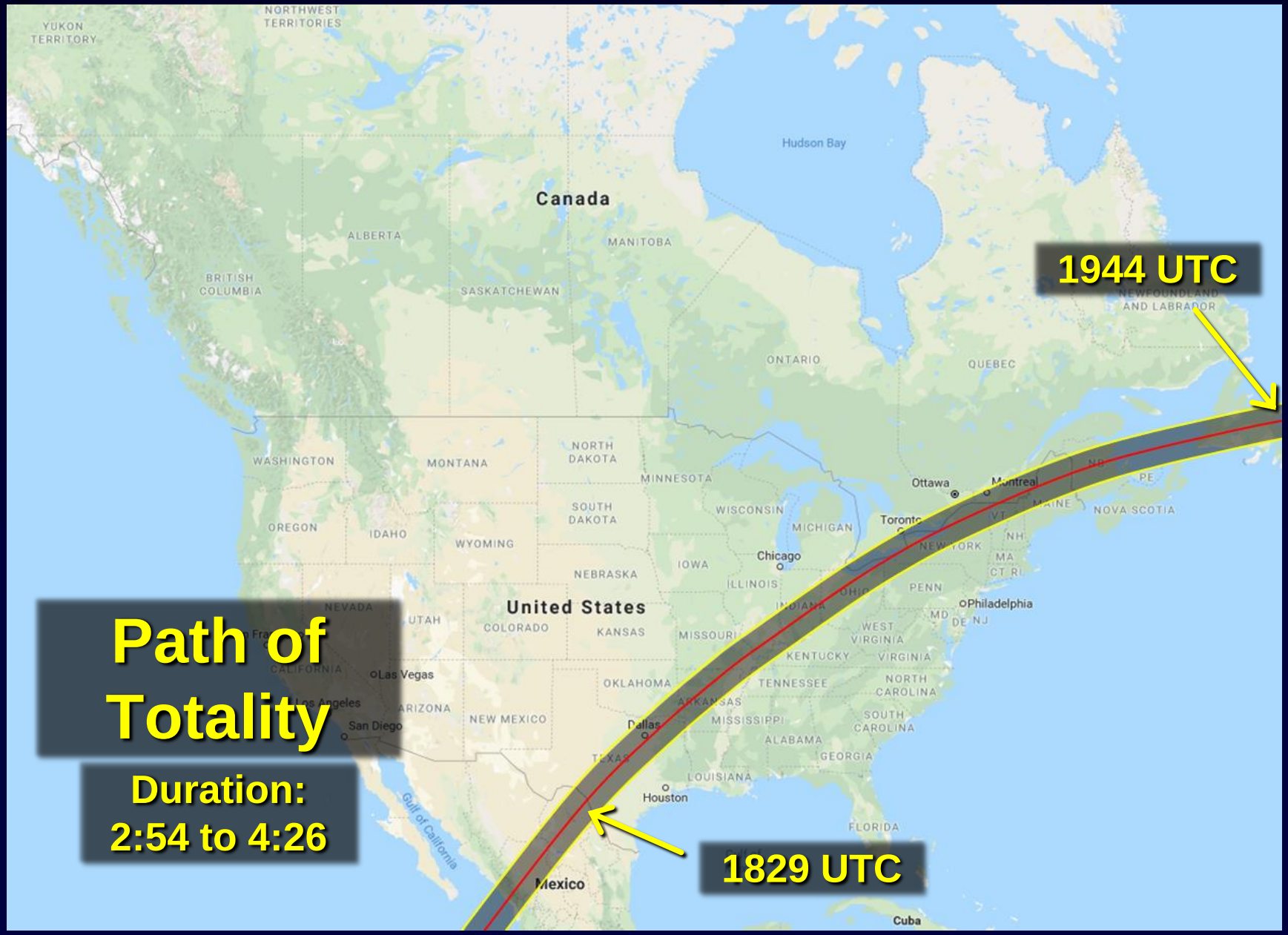
February 26, 1979 Solar Eclipse



June 8, 1918 Solar Eclipse



April 8, 2024 Solar Eclipse



Paths of Totality Composite

Paths of Totality Composites

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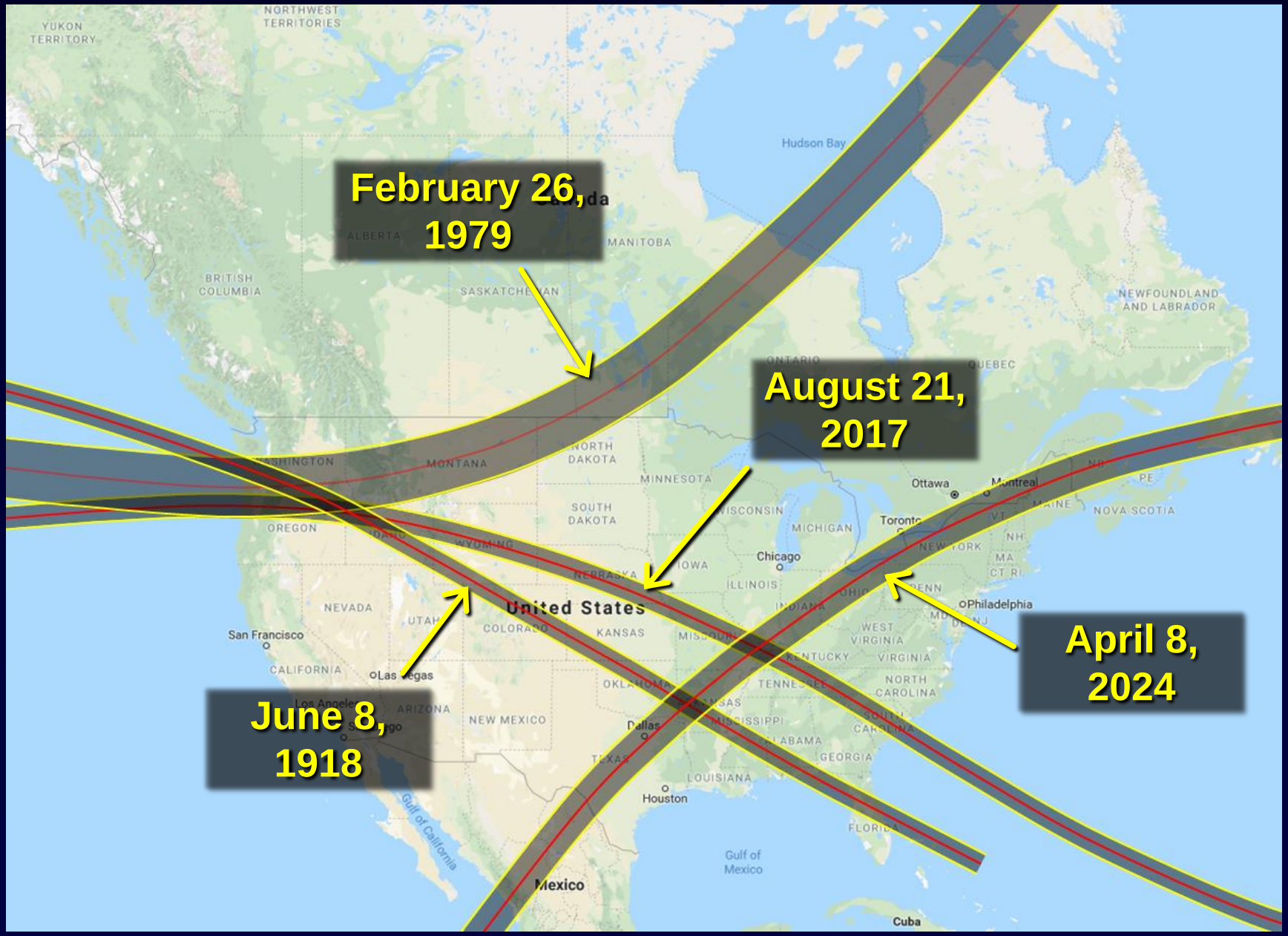
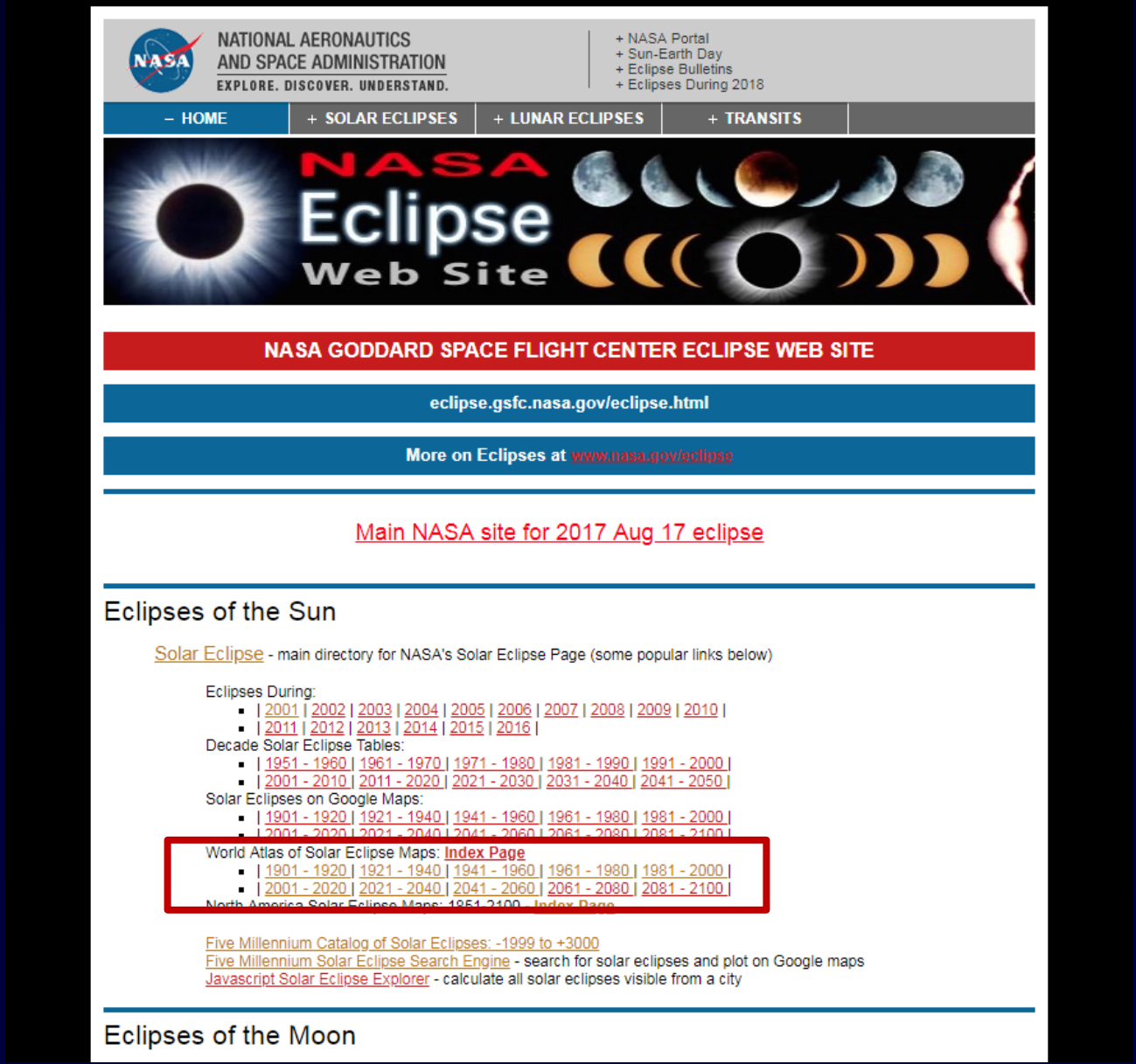


Let's Focus on 2024

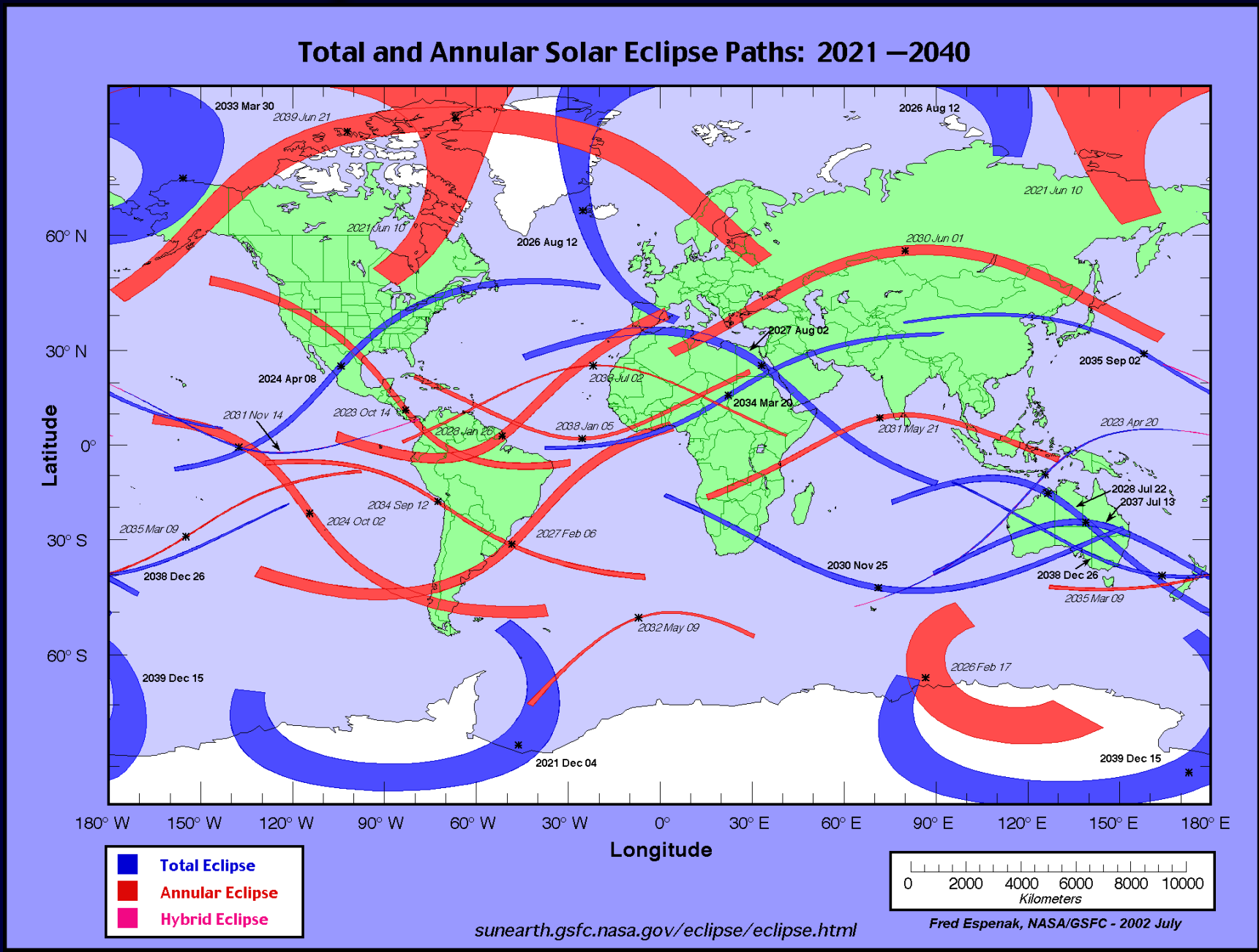
First: Data Sources

Data Sources

https://eclipse.gsfc.nasa.gov/eclipse.html



Global Eclipses: 2021-2040



Data Sources

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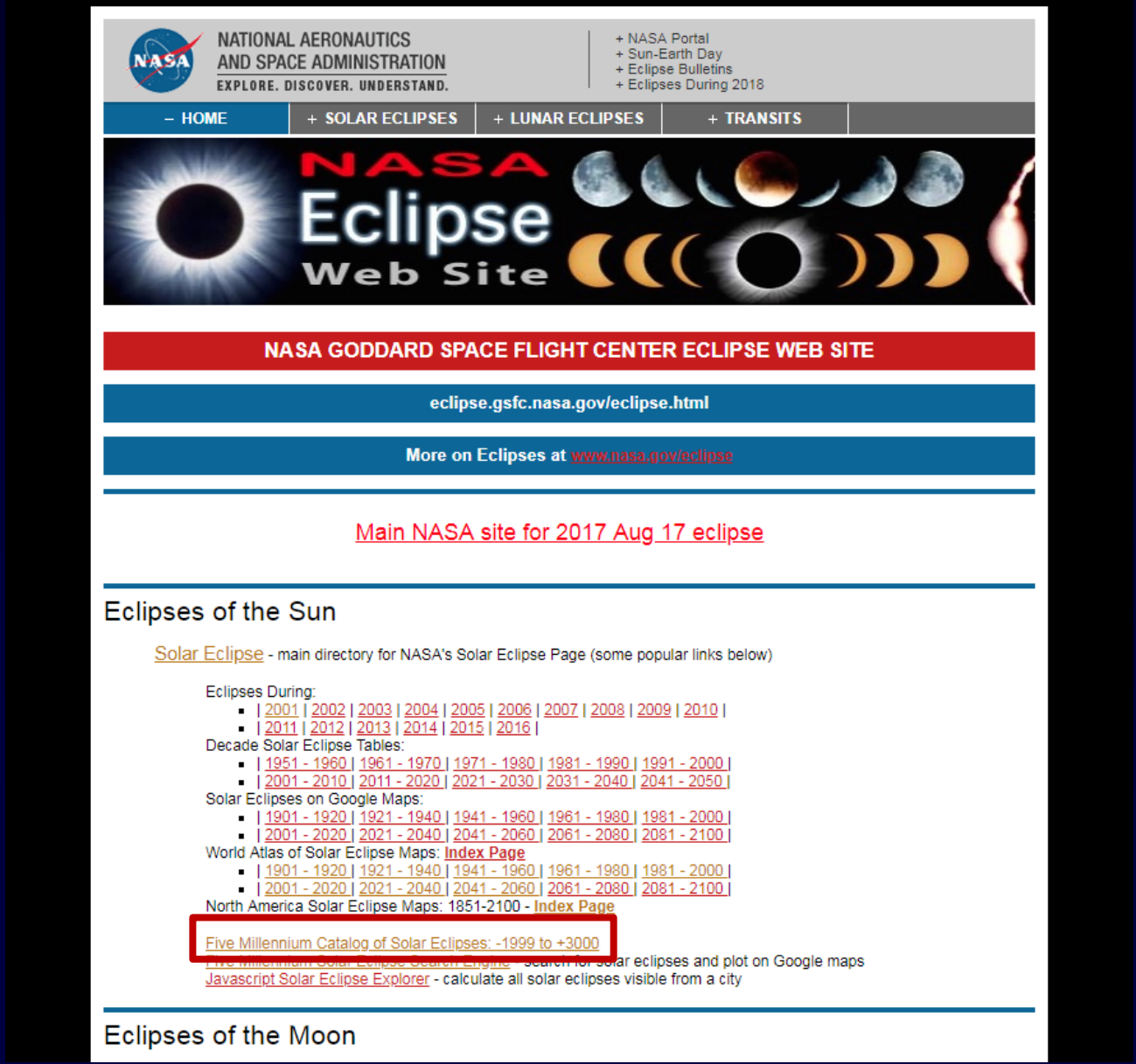


Data Sources

https://eclipse.gsfc.nasa.gov/eclipse.html

Five Millennium Catalog of Solar Eclipses

Century Interval	Number of Eclipses	Number of Partial Eclipses	Number of Annular Eclipses[6]	Number of Total Eclipses[6]	Number of Hybrid Eclipses
-1999 to -1900	239	84	70 [1]	62 [0]	22
-1899 to -1800	253	93	80 [0]	62 [1]	17
-1799 to -1700	254	95	73 [1]	63 [1]	21
-1699 to -1600	230	75	70 [1]	60 [0]	24
-1599 to -1500	225	78	65 [2]	59 [0]	21
-1499 to -1400	226	77	65 [4]	61 [1]	18
-1399 to -1300	234	76	83 [1]	68 [0]	6
-1299 to -1200	250	93	86 [0]	64 [0]	7
-1199 to -1100	252	93	89 [0]	63 [0]	7
-1099 to -1000	238	79	89 [2]	67 [1]	0
-0999 to -0900	226	84	74 [1]	58 [3]	6
-0899 to -0800	225	80	73 [2]	64 [2]	4
-0799 to -0700	234	79	88 [0]	64 [0]	3
-0699 to -0600	253	96	86 [1]	63 [0]	7
-0599 to -0500	255	96	85 [1]	65 [0]	8
-0499 to -0400	241	84	76 [2]	62 [0]	17
-0399 to -0300	225	83	62 [1]	56 [0]	23
-0299 to -0200	226	83	61 [1]	55 [2]	24
-0199 to -0100	237	80	71 [2]	62 [1]	21
-0099 to 0000	251	92	77 [0]	64 [1]	17
0001 to 0100	248	90	74 [1]	58 [0]	25
0101 to 0200	237	80	75 [2]	63 [1]	16
0201 to 0300	227	79	70 [4]	69 [0]	5
0301 to 0400	222	73	74 [2]	65 [1]	7
0401 to 0500	233	80	83 [1]	67 [0]	2
0501 to 0600	251	93	86 [1]	65 [0]	6
0601 to 0700	251	90	89 [1]	67 [0]	4
0701 to 0800	233	77	86 [2]	66 [0]	2
0801 to 0900	222	78	72 [2]	62 [2]	6
0901 to 1000	227	76	83 [1]	65 [1]	1
1001 to 1100	241	84	90 [0]	61 [0]	6
1101 to 1200	250	92	82 [0]	61 [0]	15
1201 to 1300	246	87	80 [1]	60 [0]	18
1301 to 1400	229	76	72 [3]	54 [0]	24
1401 to 1500	222	77	62 [3]	60 [1]	19
1501 to 1600	228	75	69 [3]	62 [0]	19
1601 to 1700	248	89	74 [0]	60 [1]	24
1701 to 1800	251	92	78 [0]	62 [0]	19
1801 to 1900	242	87	77 [0]	63 [0]	15
1901 to 2000	228	78	71 [2]	68 [3]	6
2001 to 2100	224	77	70 [2]	67 [1]	7
2101 to 2200	235	79	82 [5]	65 [0]	4

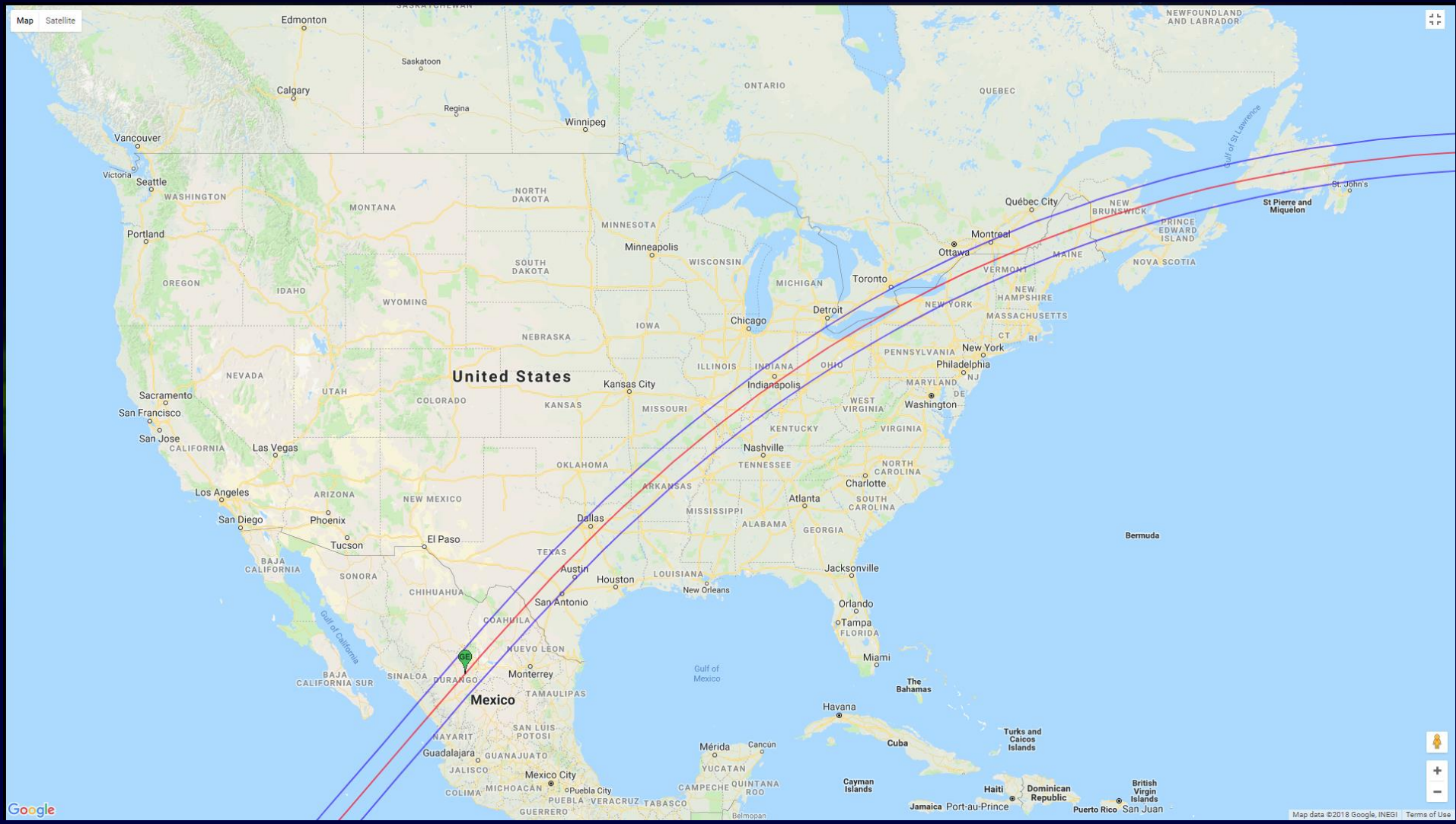
Data Sources

https://eclipse.gsfc.nasa.gov/eclipse.html

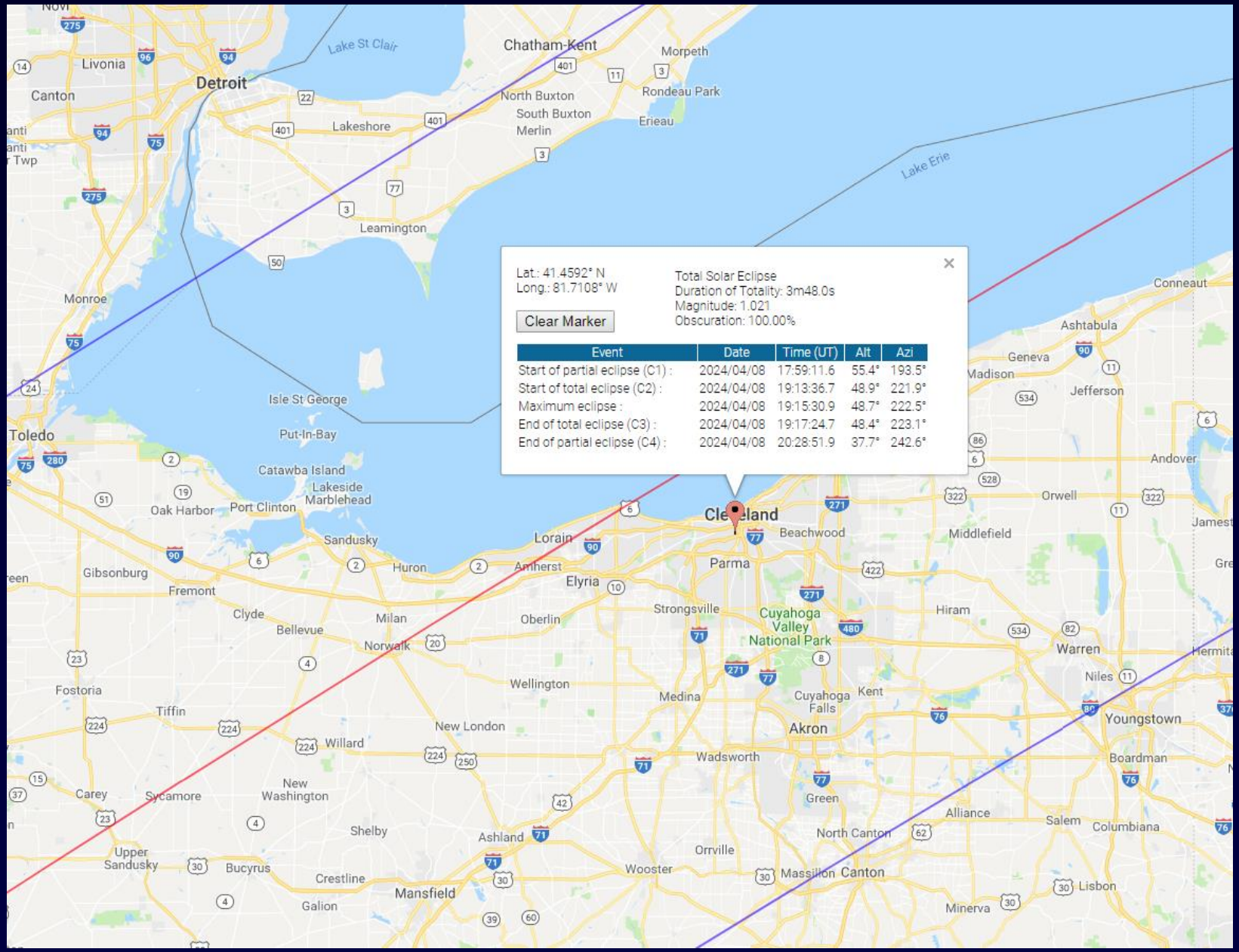
Catalog of Solar Eclipses: 2001 to 2100

Catalog Number	Calendar Date	TD of Greatest Eclipse	ΔT s	Luna Num	Saros Num	Ecl. Type	QLE	Gamma	Ecl. Mag.	Lat °	Long °	Sun Alt °	Path Width km	Central Dur.
09551	2024 Apr 08	18:18:29	74	300	139	T	n-	0.3431	1.0566	25N	104W	70	198	04m28s
09562	2025 Oct 02	19:46:13	74	306	144	A	p-	-0.3509	0.9326	22S	114W	69	266	07m25s
09563	2025 Mar 29	10:48:36	75	312	149	P	t-	1.0405	0.9376	61N	77W	0		
09564	2025 Sep 21	19:43:04	75	318	154	P	t-	-1.0651	0.8550	61S	154E	0		
09565	2026 Feb 17	12:13:06	75	323	121	A	-t	-0.9743	0.9630	65S	87E	12	616	02m20s
09566	2026 Aug 12	17:47:06	75	329	126	T	-p	0.8977	1.0386	65N	25W	26	294	02m18s
09567	2027 Feb 06	16:00:48	76	335	131	A	-n	-0.2952	0.9281	31S	48W	73	282	07m51s
09568	2027 Aug 02	10:07:50	76	341	136	T	nn	0.1421	1.0790	26N	33E	82	258	06m23s
09569	2028 Jan 26	15:08:59	76	347	141	A	p-	0.3901	0.9208	3N	52W	67	323	10m27s
09570	2028 Jul 22	02:56:40	77	353	146	T	p-	-0.6056	1.0560	16S	127E	53	230	05m10s
09571	2029 Jan 14	17:13:48	77	359	151	P	t-	1.0553	0.8714	64N	114W	0		
09572	2029 Jun 12	04:06:13	77	364	118	P	-t	1.2943	0.4576	67N	66W	0		
09573	2029 Jul 11	15:37:19	77	365	156	P	t-	-1.4191	0.2303	64S	86W	0		
09574	2029 Dec 05	15:03:58	77	370	123	P	-t	-1.0609	0.8911	68S	136E	0		
09575	2030 Jun 01	06:29:13	78	376	128	A	-p	0.5626	0.9443	57N	80E	55	250	05m21s
09576	2030 Nov 25	06:51:37	78	382	133	T	-n	-0.3867	1.0468	44S	71E	67	169	03m44s
09577	2031 May 21	07:16:04	78	388	138	A	nn	-0.1970	0.9589	9N	72E	79	152	05m26s
09578	2031 Nov 14	21:07:31	79	394	143	H	n-	0.3078	1.0106	1S	138W	72	38	01m08s
09579	2032 May 09	13:26:42	79	400	148	A	t-	-0.9375	0.9957	51S	7W	20	44	00m22s
09580	2032 Nov 03	05:34:13	79	406	153	P	t-	1.0643	0.8554	70N	133E	0		
09581	2033 Mar 30	18:02:36	80	411	120	T	-t	0.9778	1.0462	71N	156W	11	781	02m37s
09582	2033 Sep 23	13:54:31	80	417	125	P	-t	-1.1583	0.6890	72S	121W	0		
09583	2034 Mar 20	10:18:45	80	423	130	T	-n	0.2894	1.0458	16N	22E	73	159	04m09s
09584	2034 Sep 12	16:19:28	81	429	135	A	-p	-0.3936	0.9736	18S	73W	67	102	02m58s
09585	2035 Mar 09	23:05:54	81	435	140	A	n-	-0.4368	0.9919	29S	155W	64	31	00m48s
09586	2035 Sep 02	01:56:46	81	441	145	T	p-	0.3727	1.0320	29N	158E	68	116	02m54s
09587	2036 Feb 27	04:46:49	82	447	150	P	t-	-1.1942	0.6286	72S	131W	0		
09588	2036 Jul 23	10:32:06	82	452	117	P	-t	-1.4250	0.1991	69S	4E	0		
09589	2036 Aug 21	17:25:45	82	453	155	P	t-	1.0825	0.8622	71N	47E	0		
09590	2037 Jan 16	09:48:55	82	458	122	P	-t	1.1477	0.7049	69N	21E	0		
09591	2037 Jul 13	02:40:36	83	464	127	T	-p	-0.7246	1.0413	25S	139E	43	201	03m58s
09592	2038 Jan 05	13:47:11	83	470	132	A	-n	0.4169	0.9728	2N	25W	65	107	03m18s
09593	2038 Jul 02	13:32:55	84	476	137	A	nn	0.0398	0.9911	25N	22W	88	31	01m00s
09594	2038 Dec 26	01:00:10	84	482	142	T	n-	-0.2881	1.0268	40S	164E	73	95	02m18s
09595	2039 Jun 21	17:12:54	84	488	147	A	p-	0.8312	0.9454	79N	102W	33	365	04m05s
09596	2039 Dec 15	16:23:46	85	494	152	T	p-	-0.9458	1.0356	81S	173E	18	380	01m51s
09597	2040 May 11	03:43:02	85	499	119	P	-t	-1.2529	0.5306	63S	174E	0		
09598	2040 Nov 04	19:09:02	85	505	124	P	-t	1.0993	0.8074	62N	53W	0		
09599	2041 Apr 30	11:52:21	86	511	129	T	-p	-0.4492	1.0189	10S	12E	63	72	01m51s
09600	2041 Oct 25	01:36:22	86	517	134	A	-p	0.4133	0.9467	10N	163E	66	213	06m07s
09601	2042 Apr 20	02:17:30	86	523	139	T	n-	0.2956	1.0614	27N	137E	73	210	04m51s
09602	2042 Oct 14	02:00:42	87	529	144	A	n-	-0.3030	0.9300	24S	138E	72	273	07m44s
09603	2043 Apr 09	18:57:49	87	535	149	T+	t-	1.0031	1.0095	61N	152E	0		
09604	2043 Oct 03	03:01:49	88	541	154	A-	t-	-1.0102	0.9497	61S	35E	0		
09605	2044 Feb 28	20:24:39	88	546	121	As	-t	-0.9954	0.9600	62S	26W	4	-	02m27s
09606	2044 Aug 23	01:17:02	88	552	126	T	-t	0.9613	1.0364	64N	120W	15	453	02m04s
09607	2045 Feb 16	23:56:07	89	558	131	A	-n	-0.3125	0.9285	28S	166W	72	281	07m47s
09608	2045 Aug 12	17:42:39	89	564	136	T	-n	0.2116	1.0774	26N	79W	78	256	06m06s
09609	2046 Feb 05	23:06:26	90	570	141	A	p-	0.3765	0.9232	5N	171W	68	310	09m42s
09610	2046 Aug 02	10:21:13	90	576	146	T	p-	-0.5350	1.0531	13S	15E	58	206	04m51s

Interactive Google Map



Interactive Google Map



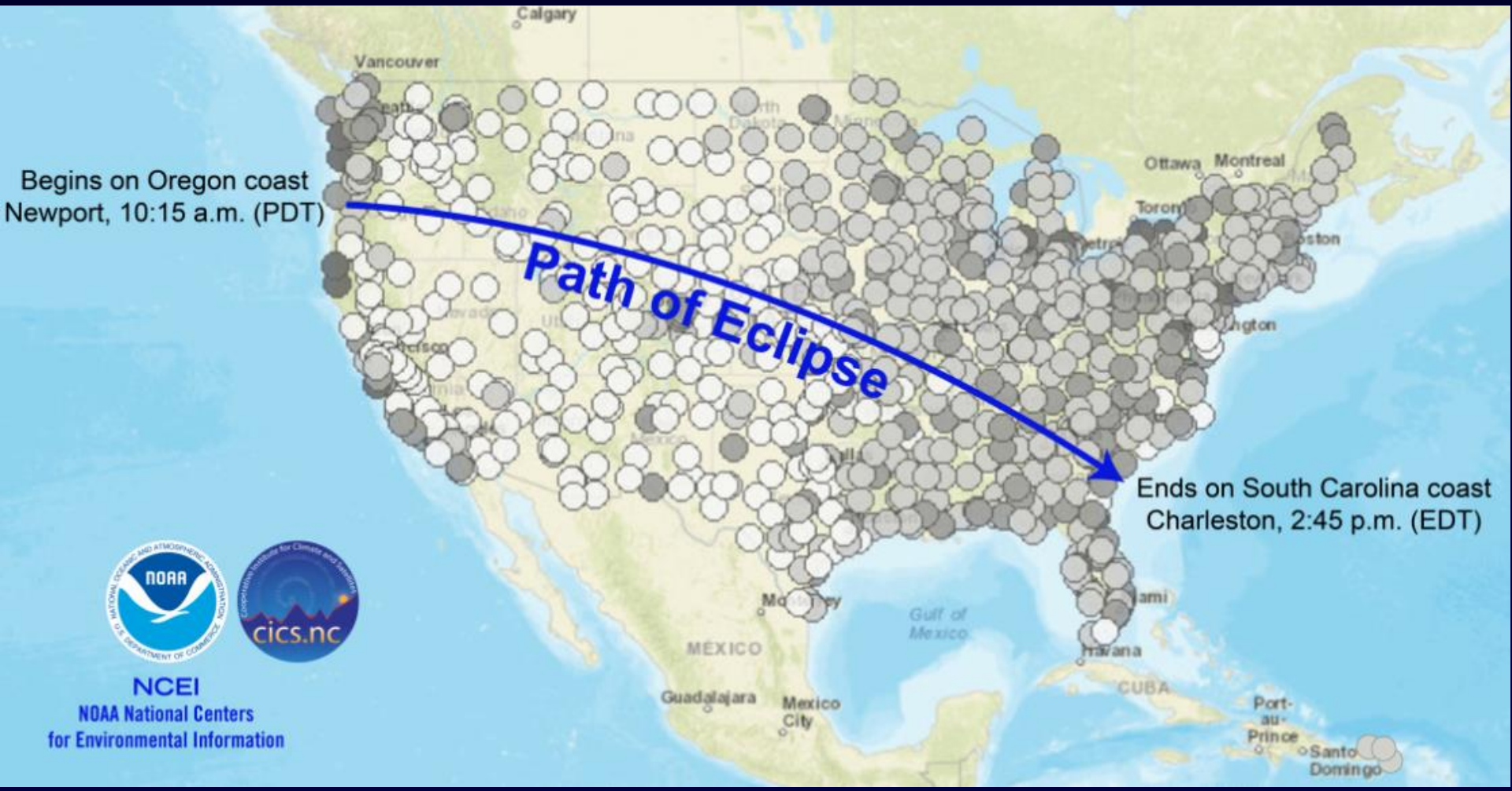
Forecasting the Eclipse is actually the easy part…

…The weather will also be a big player - and April weather is much different than August weather

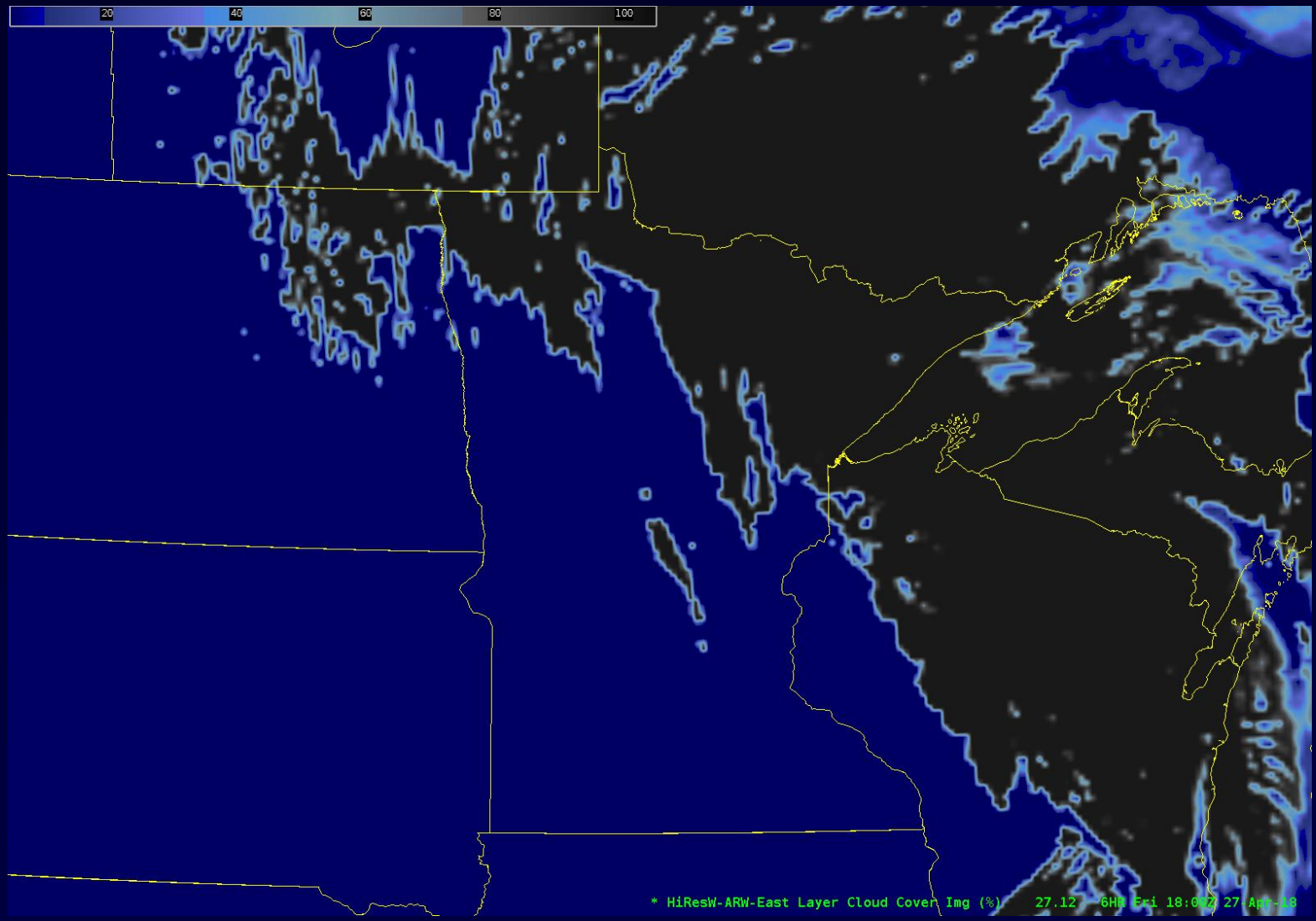
Sky Cover Forecast is of critical importance - including cloud opacity

Temperature forecasts could also be very important - April weather much more variable than August

Climatological Sky Cover: 2017

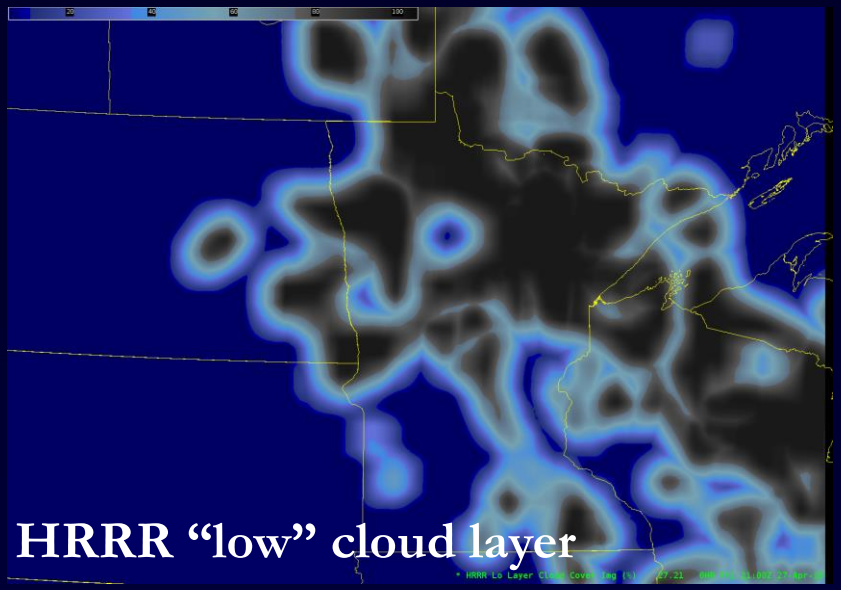


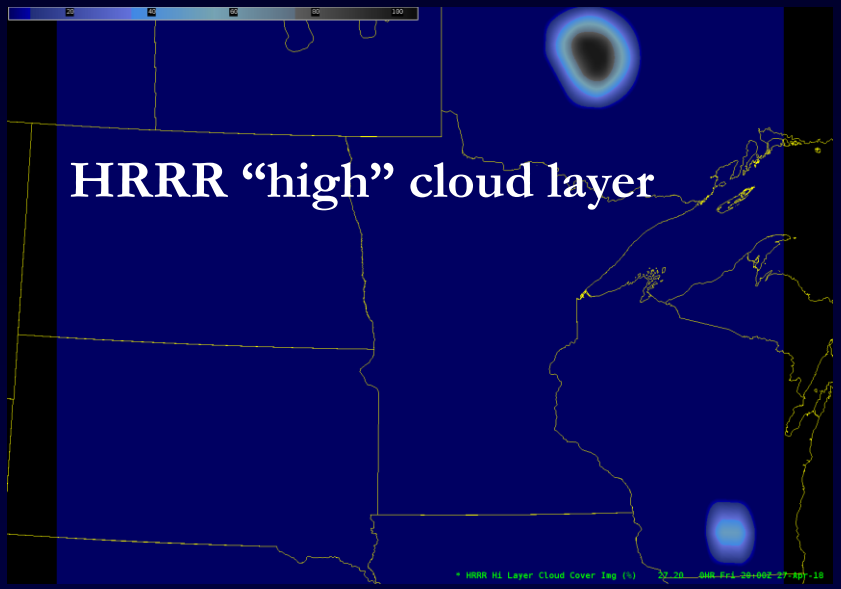
Model Sky Cover Forecasts

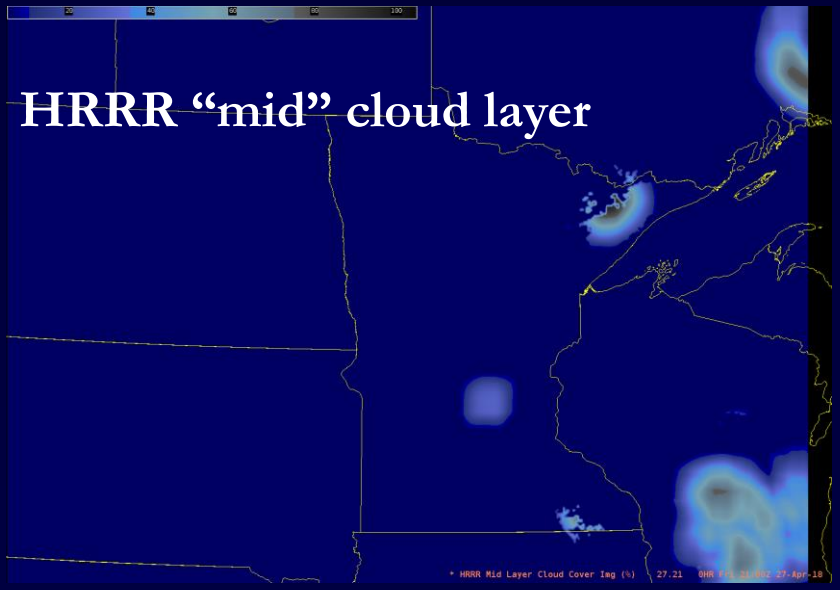


Model cloud forecast from Hi-Res ARW - only from one “layer” - basically is it cloudy or not. Model forecasts likely to radically evolve over next 6 years

Model Sky Cover Forecasts





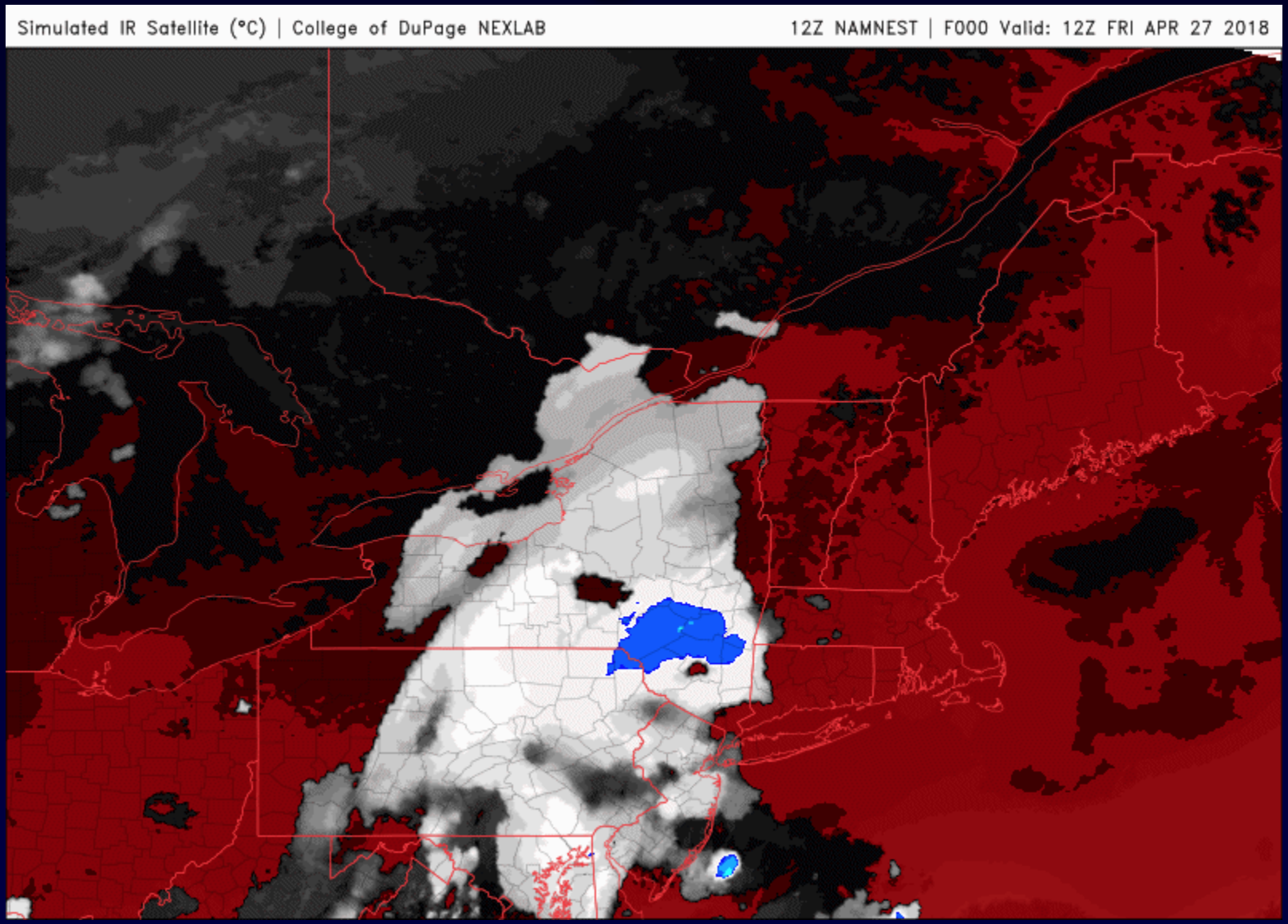


NDFD Sky Cover Example

Consistency issues - note northern Plains, Nebraska area, Georgia/Florida

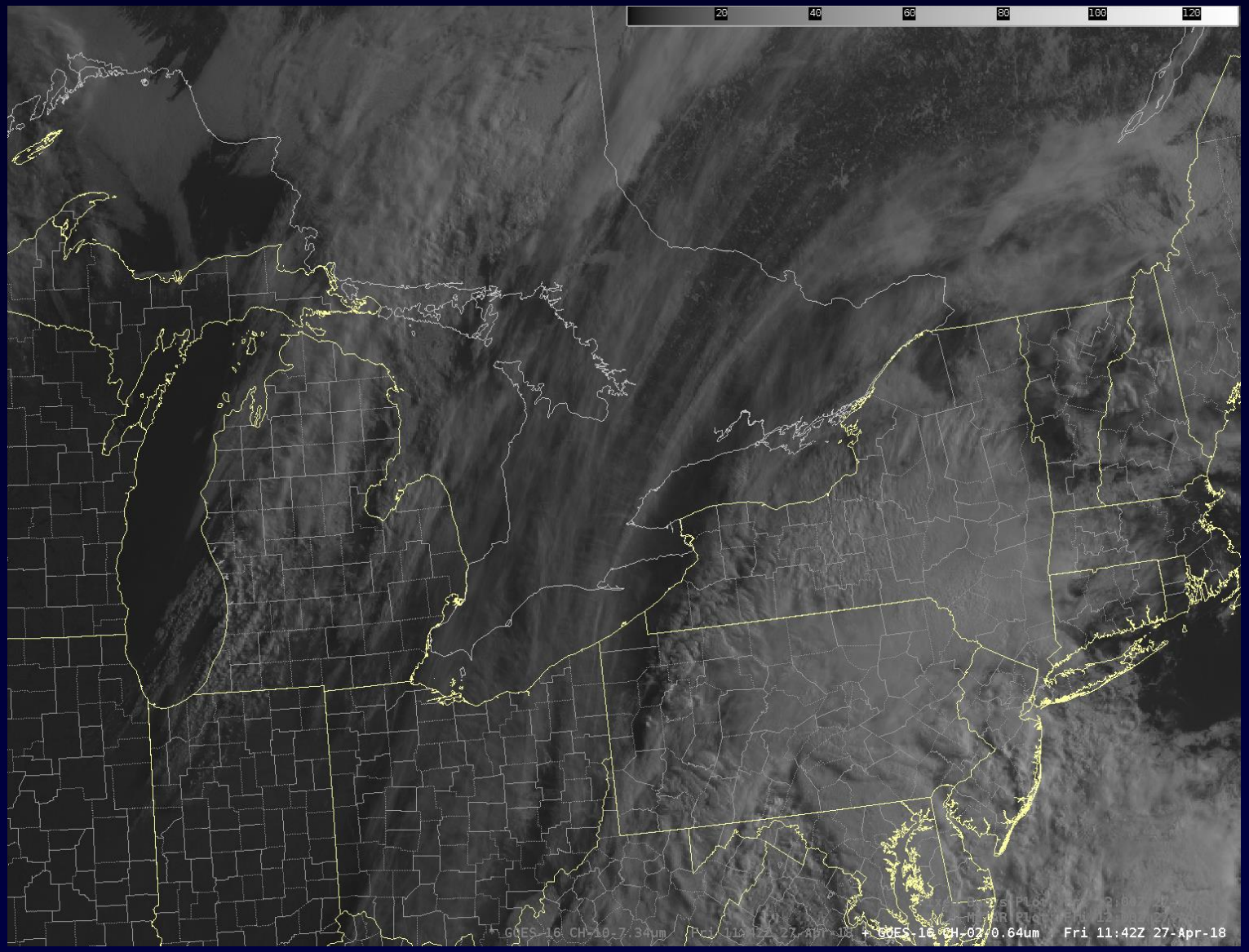
However, what about cloud opacity forecasts?

How to Handle High Thin Cirrus?



3 km NAM Simulated IR satellite

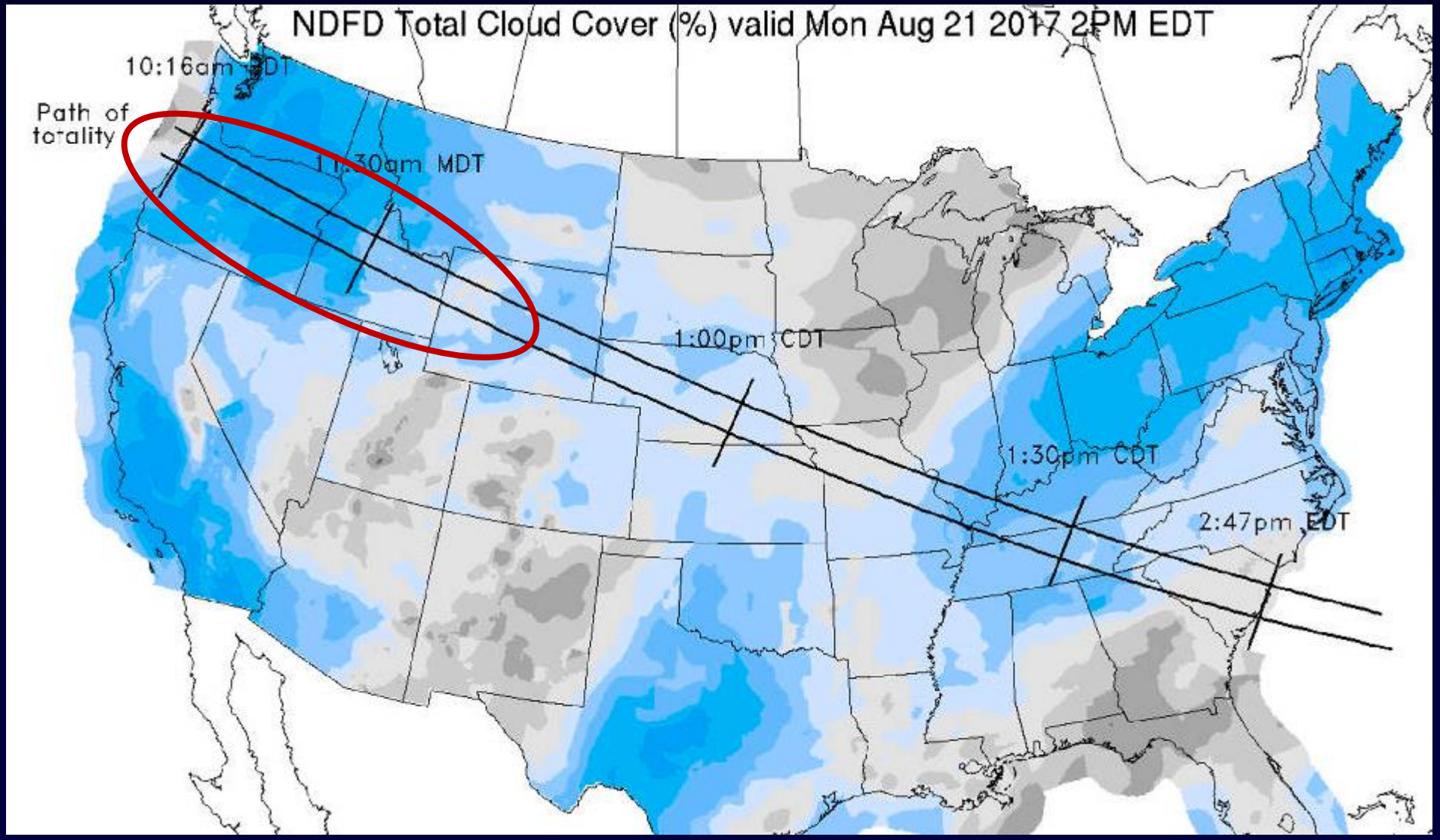
How to Handle High Thin Cirrus?



Corresponding visible satellite loop

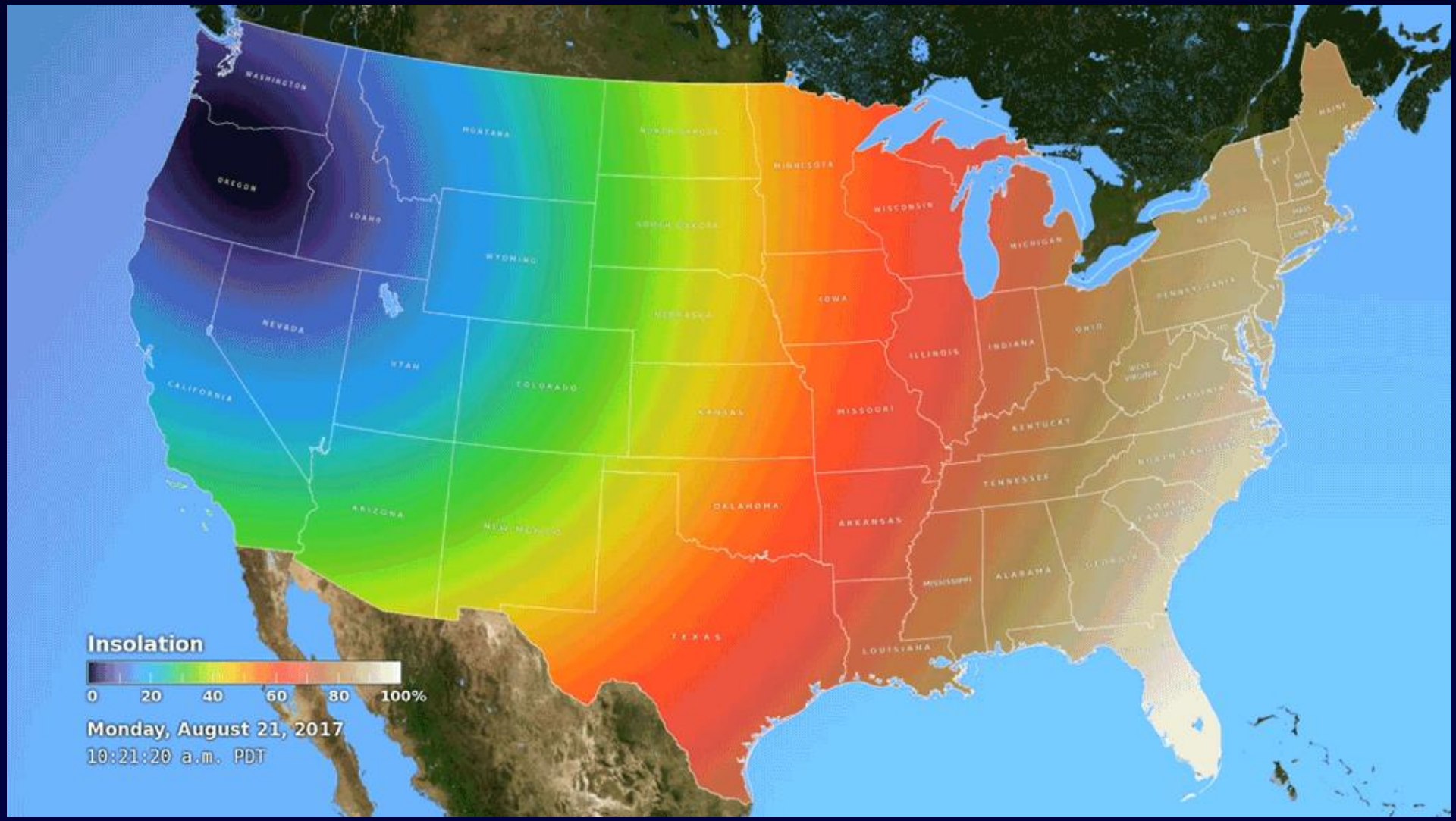
NWS Sky Cover Forecast: 2017

Clear sky forecast over Oregon and Idaho

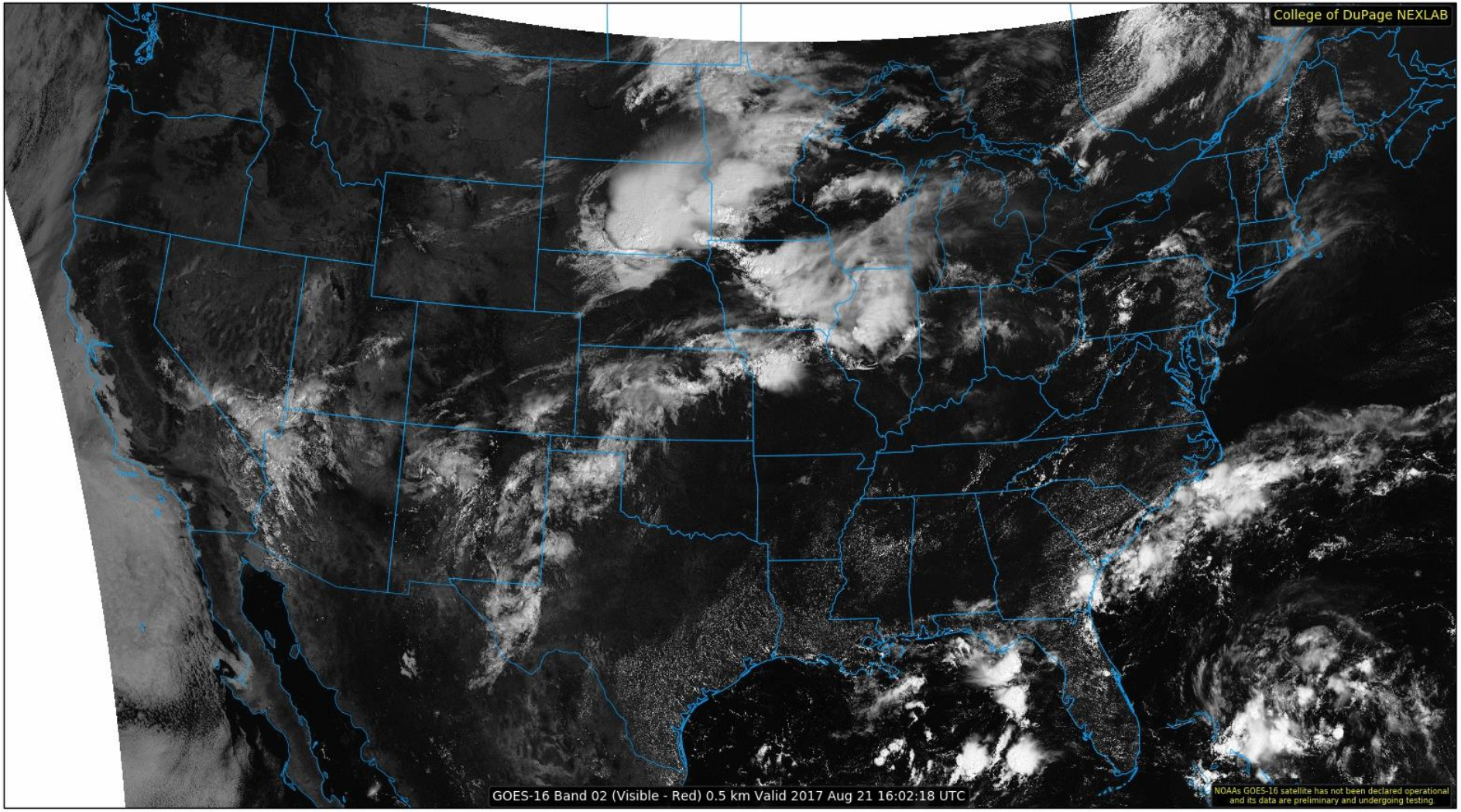


Effect on Insolation

Decrease in insolation does have a significant effect on boundary layer rooted clouds - but has little effect on mid/high clouds. Also - note the effect on deep convection driven be larger forcing processes

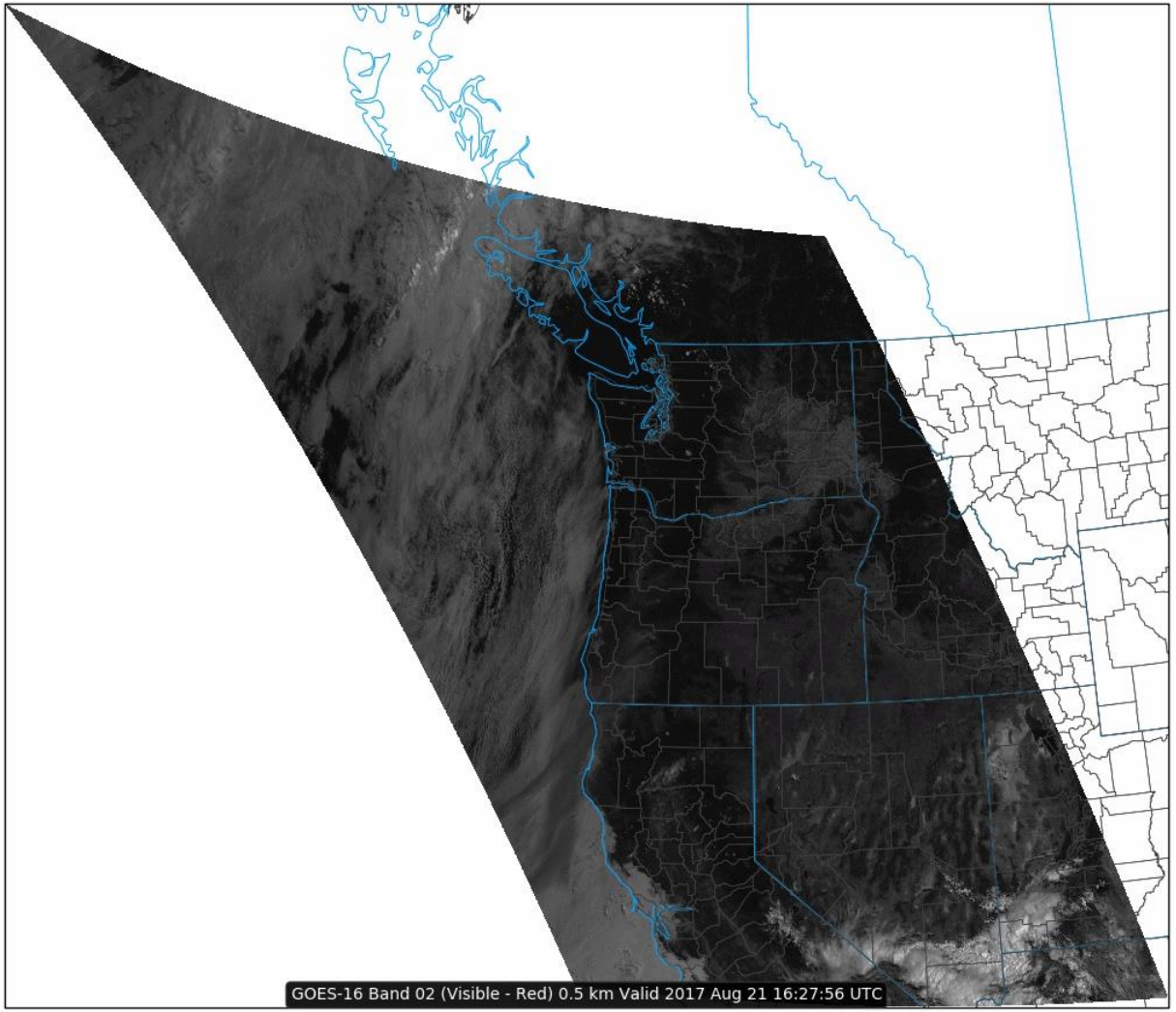


GOES-16: Total Solar Eclipse: 21 August 2017



August 21, 2017: GOES-16 Band 2 (red vis) - 5 min sampling from 1602 UTC to 1957 UTC. Average umbral shadow speed is ~1700 mph.

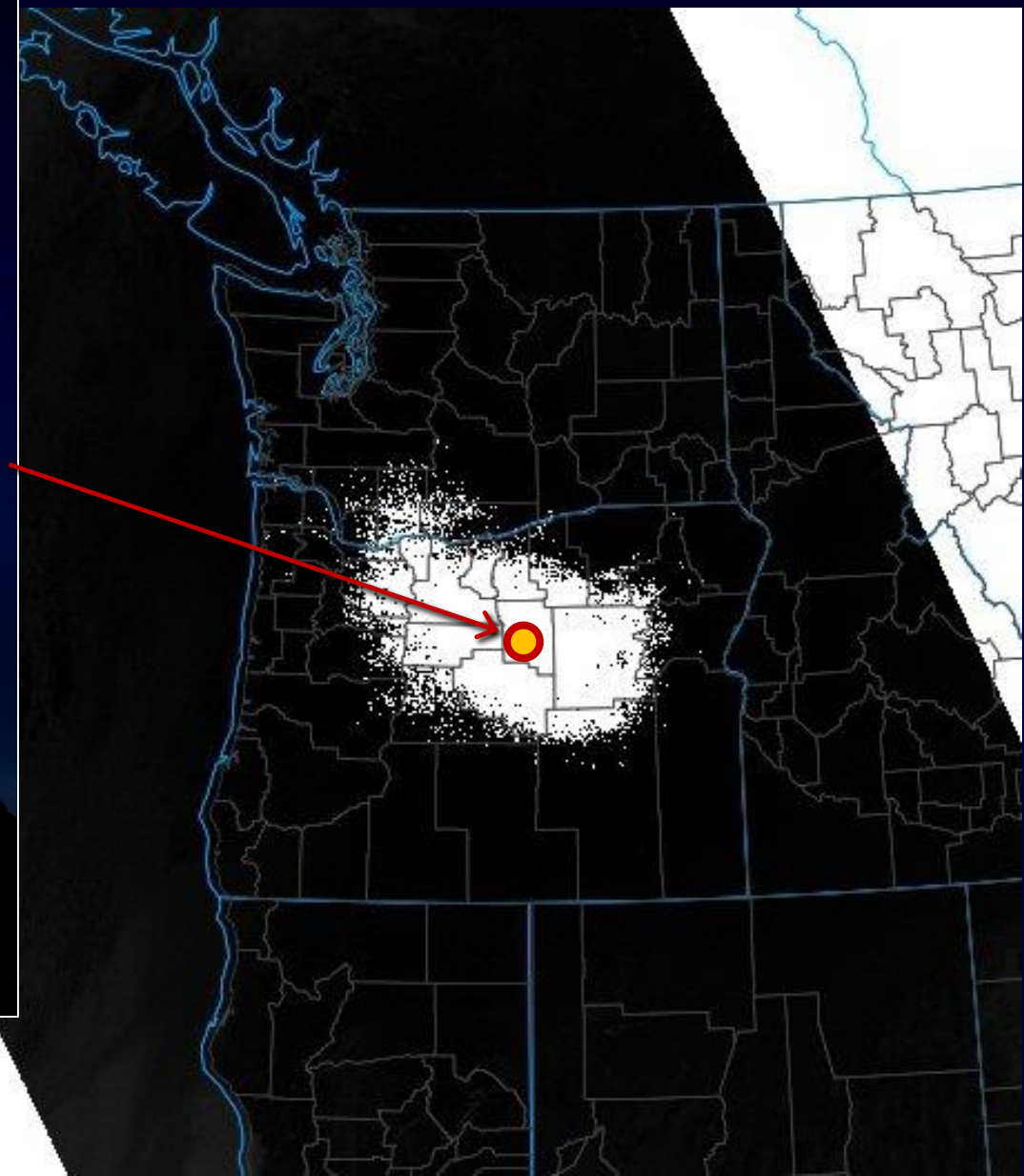
GOES-16: Total Solar Eclipse: 21 August 2017



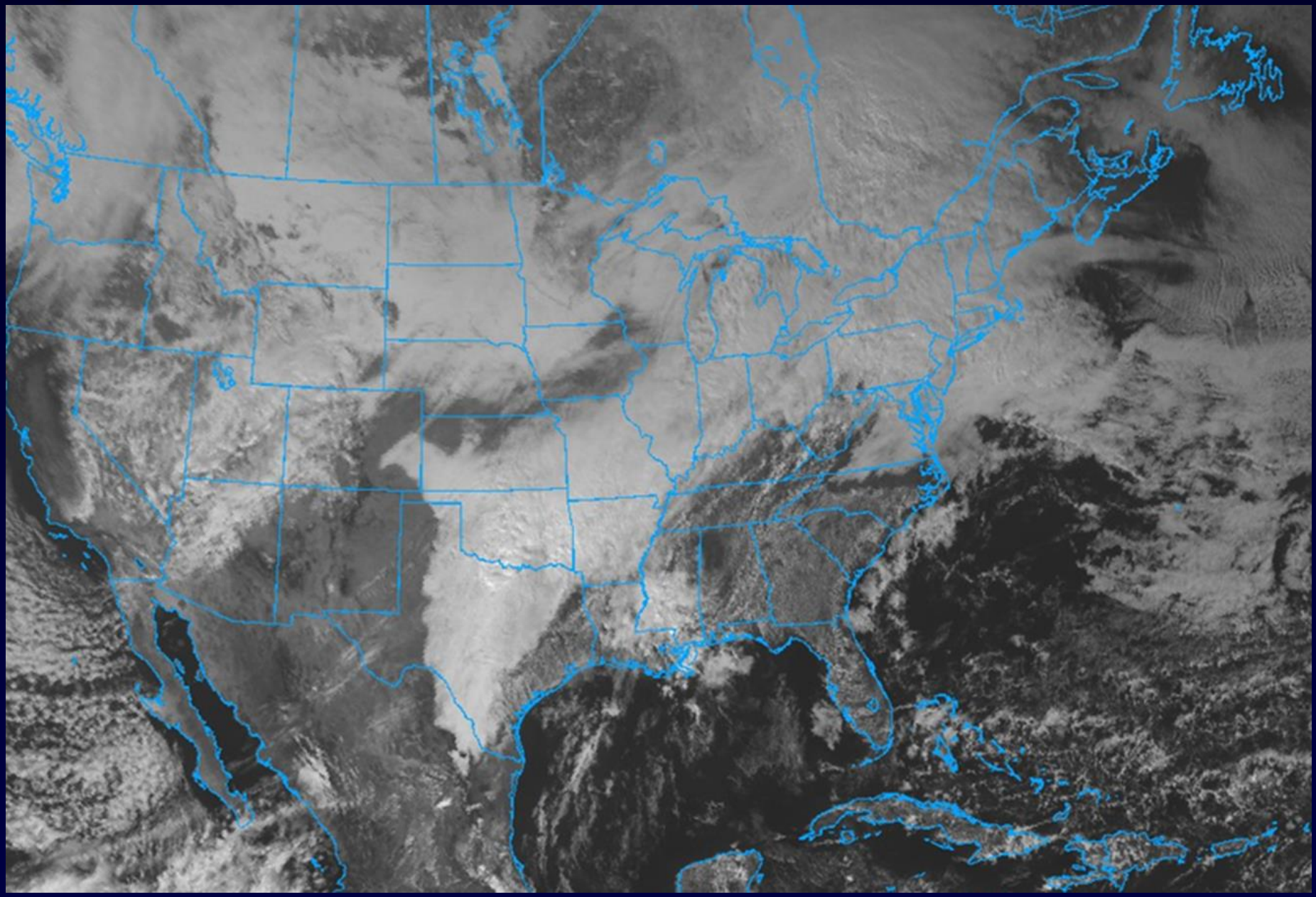
August 21, 2017: GOES-16 Band 2 (red vis) - 1 min sampling from 1627 UTC to 1758 UTC (827 AM-1058 AM PDT). Umbral shadow speed is ~1950 MPH

GOES-16: Total Solar Eclipse: 21 August 2017

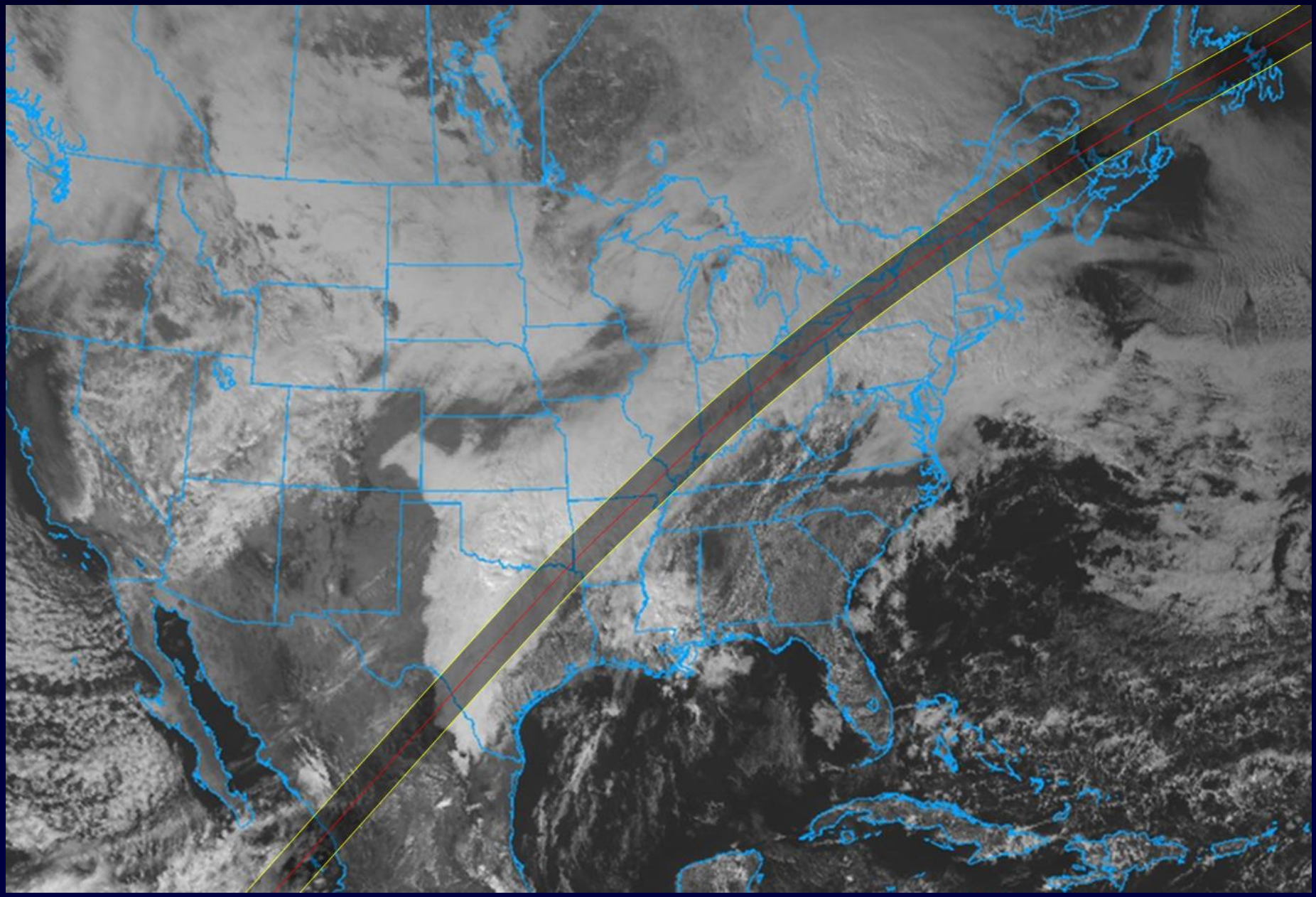
Picture taken at 1021 AM PDT



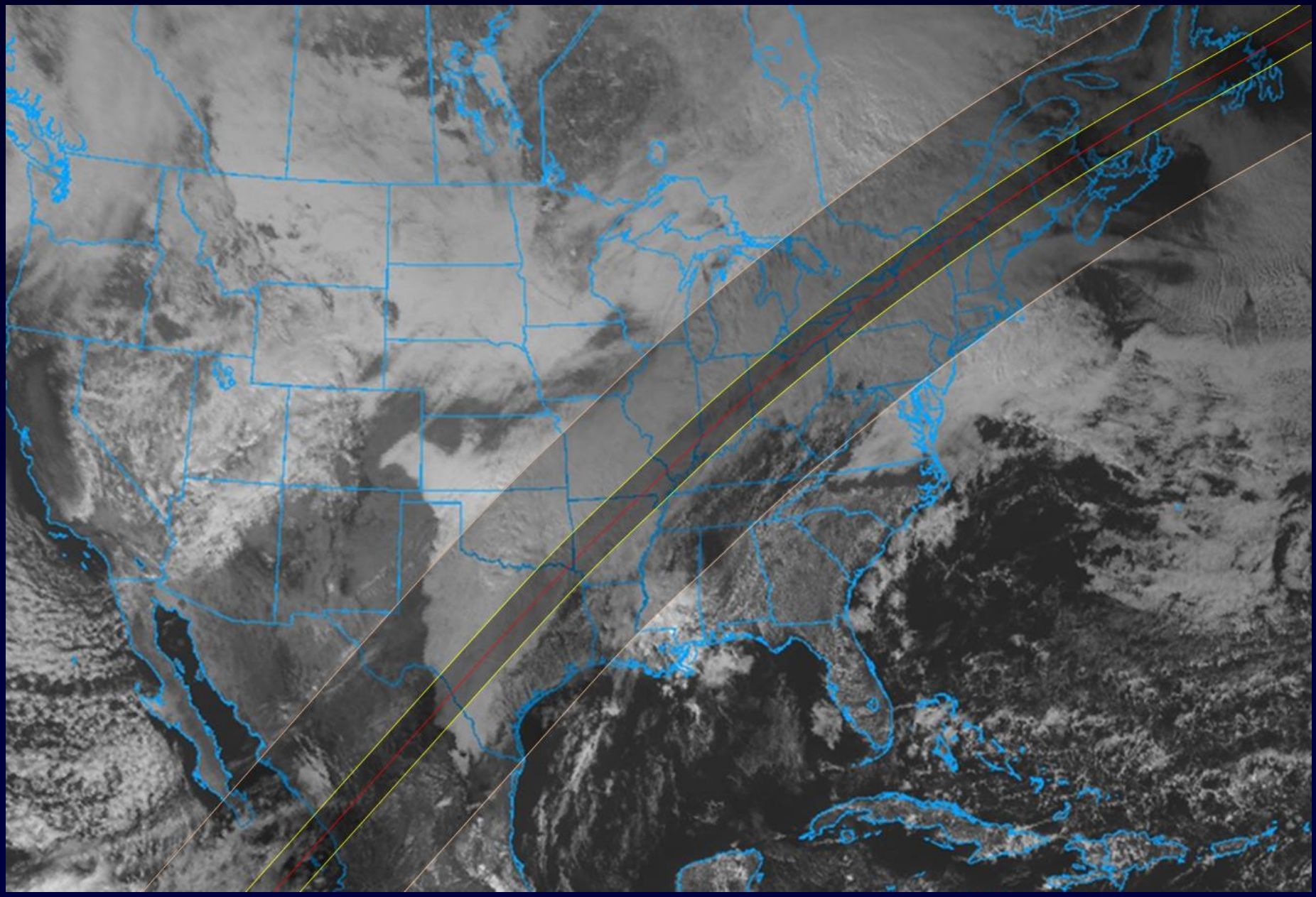
April 2024: A Possible Scenario



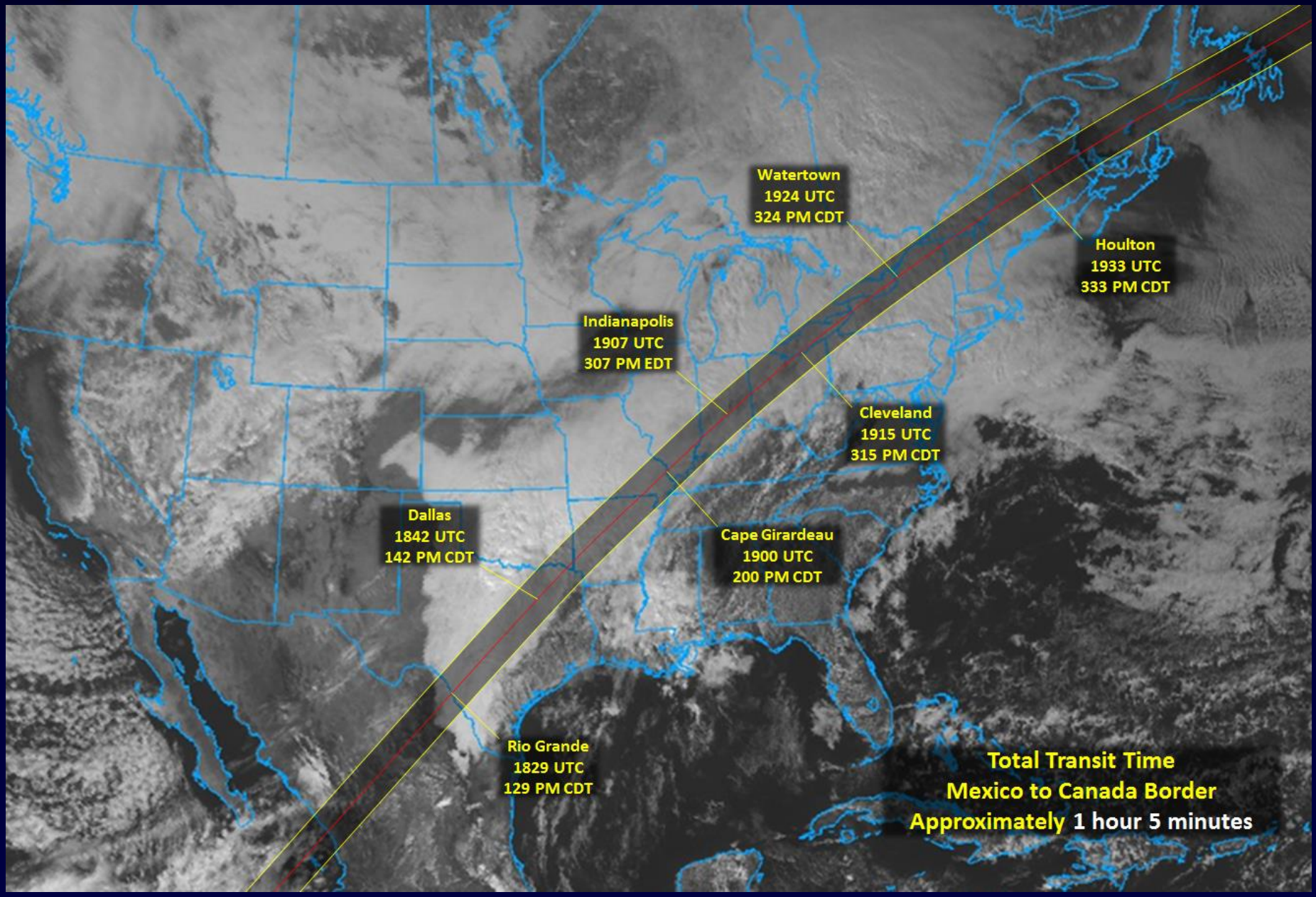
April 2024: A Possible Scenario



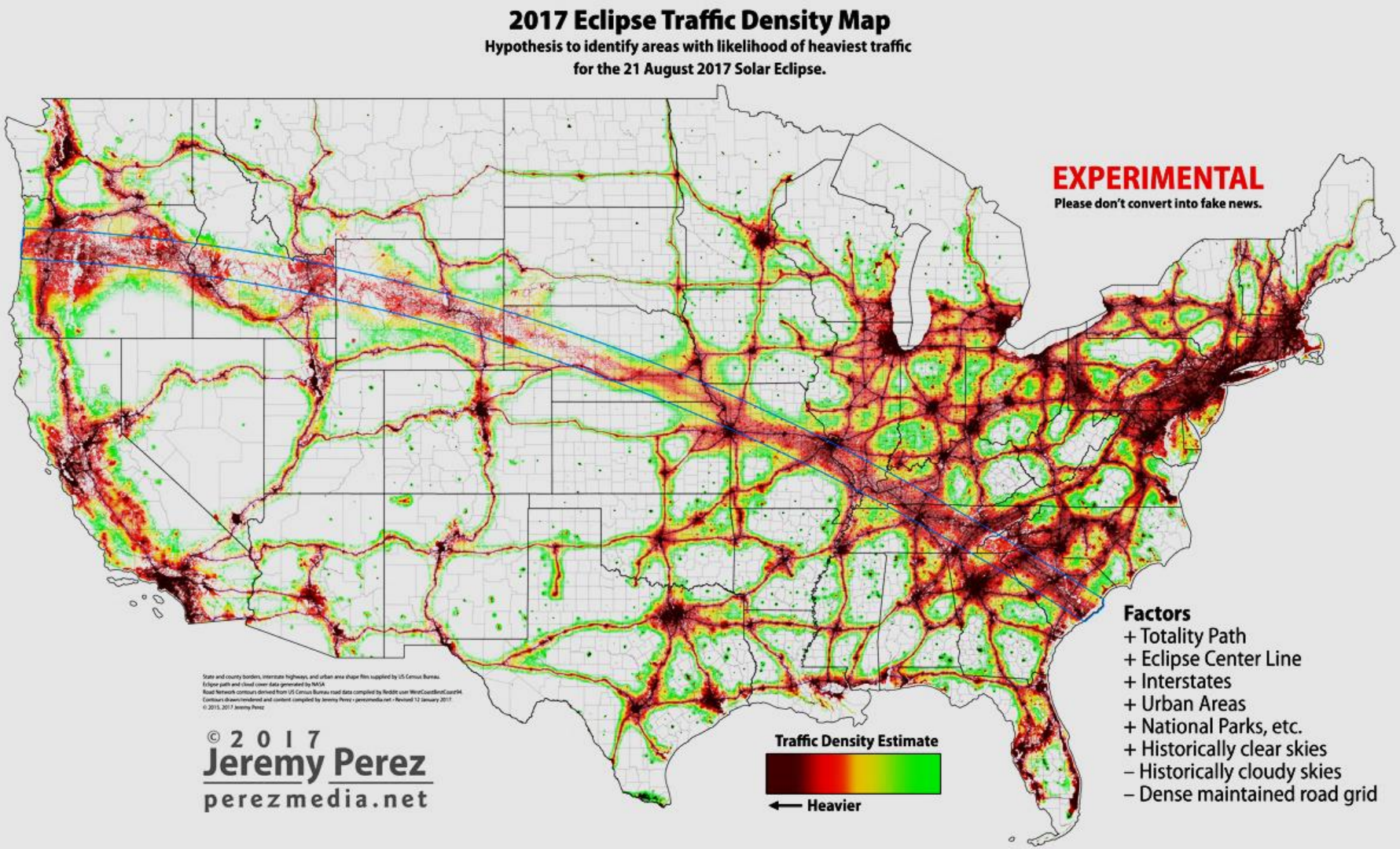
April 2024: A Possible Scenario



April 2024: A Possible Scenario



Traffic Density Map: August 21, 2017



Traffic Issues

Traffic congestion will start the night before

Every po-dunk road in the path of totality will become a parking lot!

Exit traffic will start within minutes after totality has ended

Thing to Think About

The entire path of totality will be a Large Event Venue

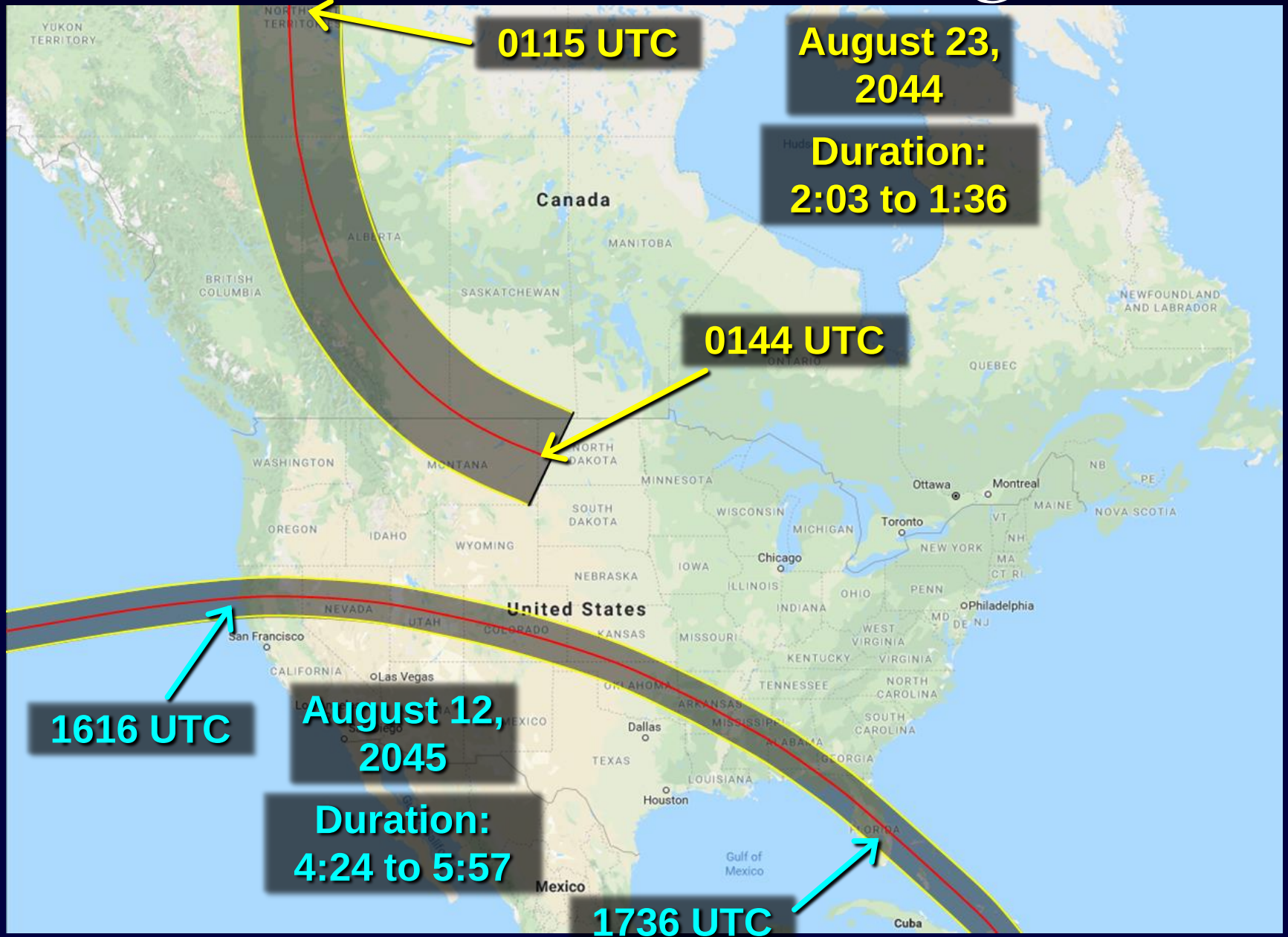
April weather could range from a severe weather outbreak, to a snowstorm, to perfect viewing

Cloud opacity matters as much as the amount of cloud cover - especially to photographers - we need tools for this

Expect large and long-duration traffic jams - think about the implications of that and hazardous weather

Important to plan with emergency managers and first responders

Just in Case You are Wondering…



Thanks for Your Attention!