

Table of Contents

SECTION 1: ECLIPSE PREDICTIONS AND UMBRAL PATH	9
1.1 INTRODUCTION	9
<i>Figure 1-1: Orthographic Projection Map of 2017 Eclipse Path.....</i>	10
1.2 ORTHOGRAPHIC PROJECTION MAP OF THE ECLIPSE PATH	11
1.3 STEREOGRAPHIC PROJECTION MAP OF THE ECLIPSE PATH.....	12
1.4 EQUIDISTANT CONIC PROJECTION MAP OF THE ECLIPSE PATH.....	12
<i>Figure 1-2: Stereographic Projection Map of 2017 Eclipse Path.....</i>	13
<i>Figure 1-3: Equidistant Conic Projection Map of 2017 Eclipse Path.....</i>	14
1.5 DESCRIPTION OF THE UMBRAL PATH.....	15
1.6 BESSELIAN ELEMENTS AND ECLIPSE PATH TABLES.....	19
<i>Table 1-1: Elements of the Total Solar Eclipse of 2017 August 21.....</i>	22
<i>Table 1-2: Shadow Contacts and Circumstances.....</i>	23
<i>Table 1-3: Path of the Umbral Shadow</i>	24
<i>Table 1-4: Physical Ephemeris of the Umbral Shadow.....</i>	25
<i>Table 1-5: Local Circumstances on the Central Line</i>	26
<i>Table 1-6: Topocentric Data and Path Corrections Due to Lunar Limb Profile.....</i>	27
<i>Table 1-7a: Mapping Coordinates for the Path of Totality.....</i>	28
<i>Table 1-7b: Mapping Coordinates for the Path of Totality.....</i>	29
<i>Table 1-8a: Mapping Coordinates for the Zones of Grazing Eclipse.....</i>	30
<i>Table 1-8b: Mapping Coordinates for the Zones of Grazing Eclipse.....</i>	31
1.7 MEAN LUNAR RADIUS	32
1.8 CENTRAL LINE AND DURATION OF TOTALITY	32
<i>Figure 1-4: Duration Vs. Distance from the Central Line</i>	33
1.9 LUNAR LIMB PROFILE	33
<i>Figure 1-5: Lunar Limb Profile for 2017 August 21 at 18:00:00 UT1.....</i>	35
<i>Table 1-9: Correction to Central Line Duration of Totality Due To Lunar Limb Profile</i>	36
<i>Figure 1-6: Limb Profile Effects on the Duration of Totality</i>	37
1.10 LIMB PROFILE EFFECTS ON THE MAXIMUM DURATION OF TOTALITY.....	38
<i>Figure 1-7: Duration on the Central Line and the Point of Maximum Duration.....</i>	39
1.11 LIMB CORRECTIONS TO THE PATH LIMITS: GRAZE ZONES.....	39
1.12 SAROS HISTORY.....	41
<i>Table 1-10: Solar Eclipses of Saros Series 145</i>	43
SECTION 2: LOCAL CIRCUMSTANCES FOR THE ECLIPSE	45
2.1 INTRODUCTION	45
<i>Figure 2-1: Moon's Shadows and Local Circumstances.....</i>	45
2.2 SOLAR ECLIPSE CONTACTS.....	46
2.3 LOCAL CIRCUMSTANCES TABLES.....	46
2.4 LUNAR LIMB CORRECTIONS TO CONTACT TIMES.....	47
2.5 LOCAL CIRCUMSTANCES TABLES.....	49
<i>Table 2-1: Local Circumstances for Alabama, Alaska, Arizona & Arkansas</i>	49
<i>Table 2-2: Local Circumstances for California</i>	50
<i>Table 2-3: Local Circumstances for Colorado, Connecticut, Delaware, & DC</i>	51
<i>Table 2-4: Local Circumstances for Florida & Georgia.....</i>	52
<i>Table 2-5: Local Circumstances for Hawaii & Idaho</i>	53

<i>Table 2-6: Local Circumstances for Illinois.....</i>	54
<i>Table 2-7: Local Circumstances for Indiana & Iowa</i>	55
<i>Table 2-8: Local Circumstances for Kansas & Kentucky.....</i>	56
<i>Table 2-9: Local Circumstances for Louisiana, Maine, Maryland & Mass.....</i>	57
<i>Table 2-10: Local Circumstances for Michigan, Minnesota & Mississippi.....</i>	58
<i>Table 2-11: Local Circumstances for Missouri - 1.....</i>	59
<i>Table 2-12: Local Circumstances for Missouri - 2.....</i>	60
<i>Table 2-13: Local Circumstances for Montana & Nebraska.....</i>	61
<i>Table 2-14: Local Circumstances for Nevada, N. Hampshire, N. Jersey & N. Mexico.....</i>	62
<i>Table 2-15: Local Circumstances for New York, North Dakota & Ohio.....</i>	63
<i>Table 2-16: Local Circumstances for North Carolina & Oklahoma.....</i>	64
<i>Table 2-17: Local Circumstances for Oregon.....</i>	65
<i>Table 2-18: Local Circumstances for Penn., Rhode Island, South Dakota & Utah</i>	66
<i>Table 2-19: Local Circumstances for South Carolina.....</i>	67
<i>Table 2-20: Local Circumstances for Tennessee.....</i>	68
<i>Table 2-21: Local Circumstances for Texas.....</i>	69
<i>Table 2-22: Local Circumstances for Vermont, Virginia & Washington.....</i>	70
<i>Table 2-23: Local Circumstances for West Virginia, Wisconsin & Wyoming.....</i>	71
<i>Table 2-24: Local Circumstances for Canada - 1.....</i>	72
<i>Table 2-25: Local Circumstances for Canada - 2.....</i>	73
<i>Table 2-26: Local Circumstances for Canada - 3.....</i>	74
<i>Table 2-27: Local Circumstances for Mexico & Central America.....</i>	75
<i>Table 2-28: Local Circumstances for South America</i>	76
<i>Table 2-29: Local Circumstances for Europe</i>	77
<i>Table 2-30: Local Circumstances for Africa & North Atlantic.....</i>	78
SECTION 3: DETAILED MAPS OF THE UMBRAL PATH	79
3.1 INTRODUCTION	79
<i>Figure 3-1: Detailed Path Map – Western Oregon</i>	80
<i>Figure 3-2: Detailed Path Map – Eastern Oregon.....</i>	81
<i>Figure 3-3: Detailed Path Map – Western Idaho.....</i>	82
<i>Figure 3-4: Detailed Path Map – Idaho & Wyoming.....</i>	83
<i>Figure 3-5: Detailed Path Map – Wyoming</i>	84
<i>Figure 3-6: Detailed Path Map – Wyoming & Nebraska.....</i>	85
<i>Figure 3-7: Detailed Path Map – Nebraska</i>	86
<i>Figure 3-8: Detailed Path Map – Nebraska & Kansas.....</i>	87
<i>Figure 3-9: Detailed Path Map – Kansas & Missouri</i>	88
<i>Figure 3-10: Detailed Path Map – Missouri & Illinois</i>	89
<i>Figure 3-11: Detailed Path Map – Kentucky & Tennessee</i>	90
<i>Figure 3-12: Detailed Path Map – Tennessee, Georgia & Carolinas</i>	91
<i>Figure 3-13: Detailed Path Map – South Carolina.....</i>	92
<i>Figure 3-14: Detailed Path Map – Bowling Green, KY.....</i>	93
<i>Figure 3-15: Detailed Path Map – Charleston, SC.....</i>	94
<i>Figure 3-16: Detailed Path Map – Kansas City, KS.....</i>	95
<i>Figure 3-17: Detailed Path Map – Knoxville, TN</i>	96
<i>Figure 3-19: Detailed Path Map – Nashville, TN</i>	98
<i>Figure 3-20: Detailed Path Map – North Platte, NE</i>	99
<i>Figure 3-21: Detailed Path Map – St. Louis, MO</i>	100
SECTION 4: OBSERVING AND PHOTOGRAPHING THE ECLIPSE.....	101
4.1 EYE SAFETY AND SOLAR ECLIPSES.....	101

<i>Figure 4-1: Spectral Response of Some Commonly Available Solar Filters</i>	103
4.2 SOURCES FOR SOLAR FILTERS.....	105
4.3 ECLIPSE PHOTOGRAPHY.....	106
<i>Figure 4-2: Lens Focal Length Vs. Image Size for Eclipse Photography</i>	107
Table 4-1: Field of View & Sun Size for Various Photographic Focal Lengths	107
Table 4-2: Solar Eclipse Exposure Guide.....	108
4.4 SKY AT TOTALITY	110
Table 4-3: Geocentric Solar System Ephemeris for 2017 August 21 at 18:00 UT1	111
<i>Figure 4-3: Sky During Totality As Seen From Central Line At 18:00:00 UT1</i>	111
4.5 CONTACT TIMINGS FROM THE PATH LIMITS.....	112
4.6 ECLIPSE PATH ON GOOGLE MAPS	112
SECTION 5: CLIMATOLOGY ALONG THE UMBRAL PATH	113
5.1 INTRODUCTION	113
<i>Figure 5-1: Oregon Topography Along the Eclipse Track.....</i>	113
5.2 OREGON.....	114
Table 5-1: August Cloud-Cover Statistics for Oregon.....	114
<i>Figure 5-2: Graphs of Average Cloud Cover Along the Eclipse Path.....</i>	116
5.3 IDAHO	117
<i>Figure 5-3: Idaho Topography Along the Eclipse Track.....</i>	117
Table 5-2: August Cloud-Cover Statistics for Idaho	118
5.4 WYOMING	118
<i>Figure 5-4: Wyoming Topography Along the Eclipse Track.....</i>	119
Table 5-3: August Cloud-Cover Statistics for Wyoming	120
5.5 NEBRASKA AND KANSAS	121
<i>Figure 5-5: Nebraska and Kansas Topography Along the Eclipse Track.....</i>	122
Table 5-4: August Cloud-Cover Statistics for Nebraska and Kansas	122
5.6 MISSOURI AND ILLINOIS.....	123
Table 5-5: August Cloud-Cover Statistics for Missouri and Illinois	123
<i>Figure 5-6: Missouri and Illinois Topography Along the Eclipse Track.....</i>	124
5.7 KENTUCKY AND TENNESSEE	125
<i>Figure 5-7: Kentucky and Tennessee Topography Along the Eclipse Track.....</i>	125
Table 5-6: August Cloud-Cover Statistics for Kentucky and Tennessee	125
5.8 GEORGIA, NORTH CAROLINA, AND SOUTH CAROLINA	126
<i>Figure 5-8: North and South Carolina Topography Along the Eclipse Track.....</i>	126
Table 5-7: August Cloud-Cover Statistics for Georgia, North Carolina and South Carolina	127
5.9 IN RETROSPECT	127
5.10 GETTING A FORECAST AHEAD OF ECLIPSE DAY	128
SECTION 6: A TRAVELOGUE ALONG THE UMBRAL PATH.....	129
6.1 INTRODUCTION	129
6.2 OREGON.....	129
6.3 IDAHO	132
6.4 WYOMING	133
6.5 NEBRASKA	134
6.6 KANSAS AND MISSOURI.....	135
6.7 ILLINOIS.....	135
6.8 KENTUCKY	136
6.9 TENNESSEE	137
6.10 GEORGIA AND THE CAROLINAS	137
6.11 FINAL THOUGHTS	138

SECTION 7: ECLIPSE RESOURCES.....	139
7.1 ECLIPSEWISE.COM WEB SITE.....	139
7.2 WEB SITES ON THE 2017 ECLIPSE.....	140
7.3 ADDITIONAL WEB SITES ON SOLAR ECLIPSES	140
7.4 IAU WORKING GROUP ON ECLIPSES	141
7.5 AAS ECLIPSE 2017 WORKSHOPS.....	141
7.6 SOLAR ECLIPSE MAILING LIST	141
7.7 INTERNATIONAL SOLAR ECLIPSE CONFERENCE IN 2018	142
7.8 ALGORITHMS, EPHemerides, AND PARAMETERS	142
7.9 TOTAL SOLAR ECLIPSE OF 2024 APRIL 8	143
<i>Figure 7-1: Total Solar Eclipses of 2024 April 8.</i>	143
7.10 TOTAL SOLAR ECLIPSES THROUGH THE USA DURING THE 21 ST CENTURY	144
<i>Figure 7-2: Total Solar Eclipses Through the USA During the 21st Century.</i>	144
BIBLIOGRAPHY.....	145
REFERENCES	145
FURTHER READING ON ECLIPSES	145
FURTHER READING ON EYE SAFETY	146
FURTHER READING ON METEOROLOGY	146
ECLIPSE MARKETPLACE.....	147
PRODUCTS FOR SAFELY VIEWING SOLAR ECLIPSES AND THE SUN, AND SOLAR ECLIPSE TOURING.....	147
<i>Great American Eclipse</i>	147
<i>Rainbow Symphony, Inc.</i>	148
<i>Lunt Solar Systems</i>	149
<i>Thousand Oaks Optical</i>	150
<i>American Paper Optics</i>	151
<i>Tropical Sales Corp.</i>	152
<i>Thousand Year Canons of Solar and Lunar Eclipses</i>	152
<i>TravelQuest International</i>	153
<i>MTW Associates – MelitaTrips</i>	154
<i>Spectrum Telescope</i>	154
<i>Insight Cruises</i>	154
<i>MrEclipse.com</i>	154