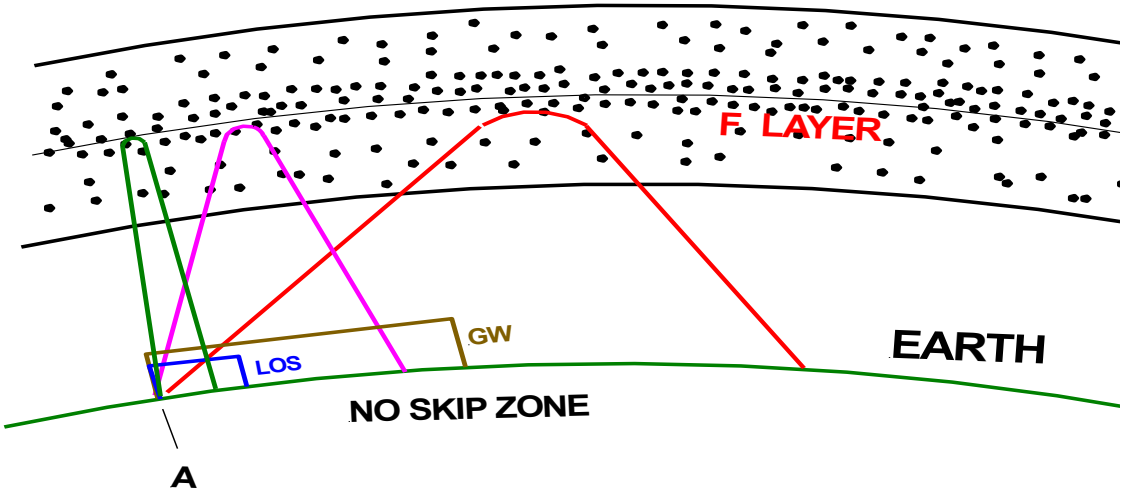
40m NVIS Power Level Test



Ken Larson KJ6RZ

July 16, 2025

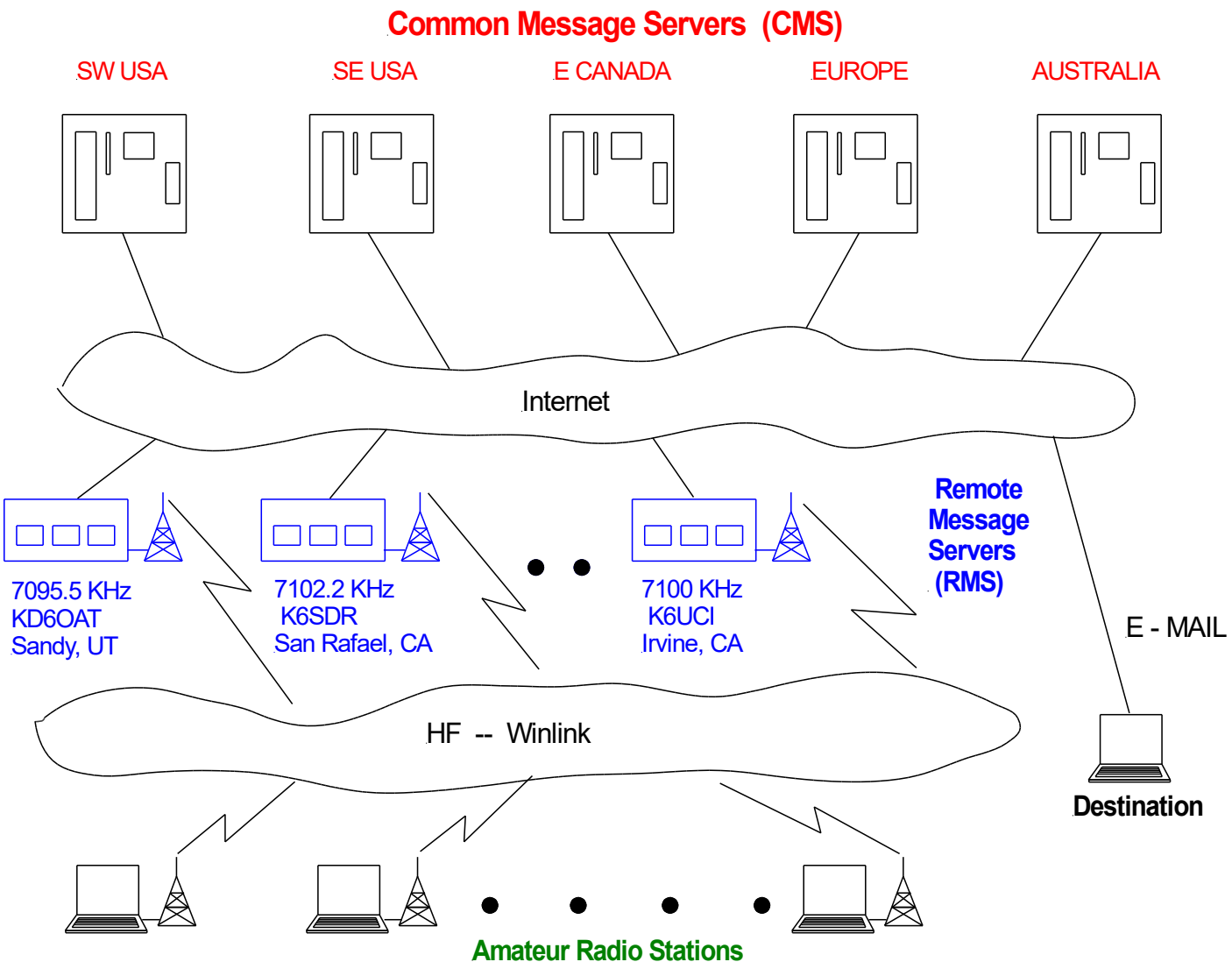
www.skywave-radio.org

40m NVIS Power Level Test

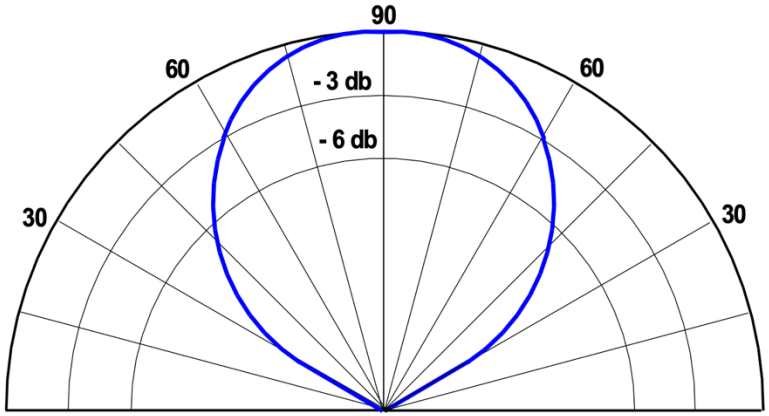
Date:	7/16/25						
					SFI	139	
	Sun Rise	4:20	Sun Set	19:01	fcF2	See Below	hmF2 = 300 km
					X-Ray	C1.7	
					Kp	1.67	
					Proton	0.175	
					SSN	146	
Time	Frequency MHZ	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
1202	7.1021	W6BI	11	26	80	Yellow	Simi Valley, CA
				25	40		
				39	20		
1212				38	10		
1214	7.1065	KD6LLB	13	18	80		Oxnard, CA
1215				18	40		
1216				16	20		
1217				18	10		
1221	7.1015	NR6V	20	24	80		Northridge, CA
1222				44	40		
1223				32	20		
1226				46	10		
1228	7.1005	AJ7C	31	16	80		Culver City, CA
1229				16	40		
1231				29	20		
1240				25	10		
1234	7.1000	KN6BKT	48	19	80		San Gabriel, CA
1235				24	40		
1236				17	20		
1238				56	10		

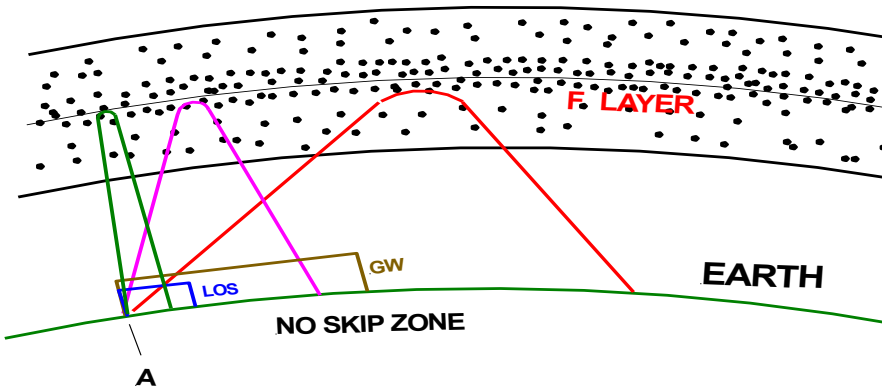
- 40m NVIS Power Level test 12:00 - 15:30 PDT July 16, 2025, Antenna: 40 meter inverted V with apex at 32 ft, VARA digital protocol used to connect to Winlink RMS stations (next slide)
- Contacts at 10, 20, 40, and 80 watts were made to each RMS station
- Beginning at 10 watts, each power level was 3 db greater than the one before it
- Contact duration is the time to connect to a RMS station, send a message, and disconnect
- For this test a contact consisted of a Connect followed by a Disconnect since the message field was empty, i.e. it did not contain any text
- A test contact duration (connect followed by disconnect) greater than 40 seconds was considered a very poor connection unsuitable for sending text messages
- nc = No Connection, the station could not be contacted

Winlink Network



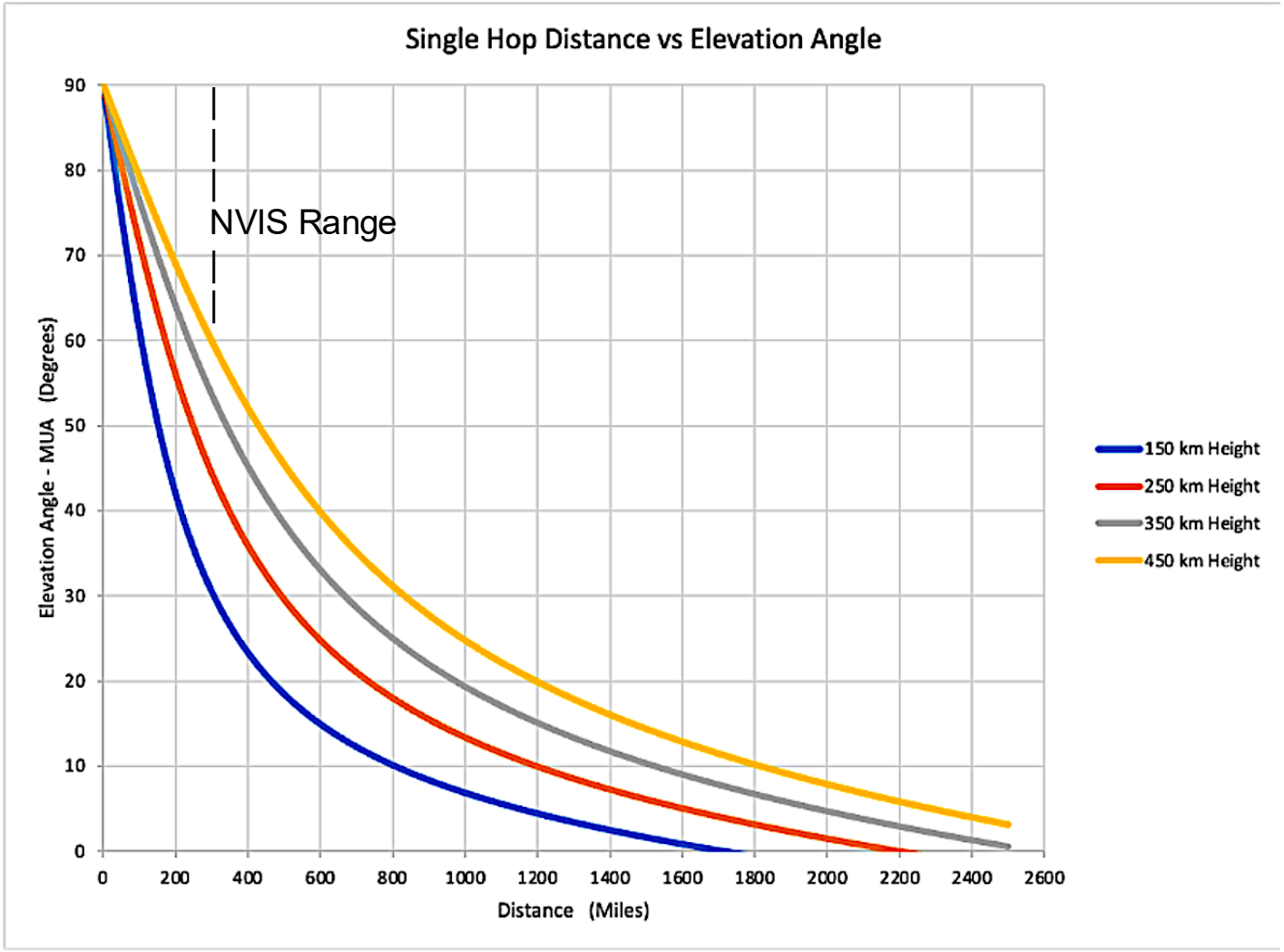
NVIS Propagation





- Signals transmitted at an elevation angle greater than 60° are considered NVIS transmissions
- Green, magenta, and red traces are NVIS signals transmitted at various angles
- Blue Line of Sight (LOS) and brown Ground Wave (GW) propagation is always present and independent of ionospheric conditions
- The range of LOS signals is generally less than 20 miles while GW signals may have a range of nearly 50 miles depending on ground conditions
- Multipath interference between NVIS, LOS, and GW signals can occur within these distances seriously degrading signal reception

NVIS Range



- At an elevation angle of 60^{o}, the NVIS propagation range is 200 to 300 miles

40m NVIS Power Level Test Data Discussion 11 to 45 Miles

Date:	7/16/25						
					SFI	139	
	Sun Rise	4:20	Sun Set	19:01	fcF2	See Below	hmF2 = 300 km
					X-Ray	C1.7	
					Kp	1.67	
					Proton	0.175	
					SSN	146	
Time	Frequency MHZ	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
1202	7.1021	W6BI	11	26	80	Yellow	Simi Valley, CA
				25	40		
				39	20		
1212				38	10		
1214	7.1065	KD6LLB	13	18	80		Oxnard, CA
1215				18	40		
1216				16	20		
1217				18	10		
1221	7.1015	NR6V	20	24	80		Northridge, CA
1222				44	40		
1223				32	20		
1226				46	10		
1228	7.1005	AJ7C	31	16	80		Culver City, CA
1229				16	40		
1231				29	20		
1240				25	10		
1234	7.1000	KN6BKT	48	19	80		San Gabriel, CA
1235				24	40		
1236				17	20		
1238				56	10		

- Good connections with Oxnard, Culver City, and San Gabriel with performance at 10 watts nearly as good as 80 watts. For some unknown reason San Gabriel 10W connection was very poor. Probably should have rerun the 10W test
- Simi Vally communications was relatively poor probably because of NVIS and Ground Wave multipath interference. Notice that Oxnard did not have this problem
- Multipath interference could have been the problem with the Northridge connection as well. Northridge has been problematical in previous NVIS tests.

40m NVIS Power Level Test Data Discussion 52 to 80 Miles

Time	Frequency MHZ	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
1514	7.1060	N7OP	52	25	80		Lancaster, CA
1518				49	40		
1520				92	20		
1522				nc	10		
1258	7.0835	KF6NYM	55	16	80		Santa Barbara, CA
1259				17	40		
1300				16	20		
1301				17	10		
1506	7.1005	WB6TT	80	17	80		Corona, CA
1507				30	40		
1509				31	20		
1510				45	10		

- Communications with Santa Barbara was excellent with operations at 10 watts the same quality as at 80 watts
- Communications with Corona later in the day (1506 PDT) was relatively good with operations at 40 and 20 watts nearly as good as at 80 watts. However, for some reason, the connection was poor at 10 watts
- Communications with Lancaster later in the day (1514 PDT) was poor at power levels of 10 through 40 watts. Communications at 80 watts was OK
- Lancaster demonstrates that higher power is required under poor conditions
- Unfortunately there were not any reachable RMS stations in the range of 100 to 250 miles

40m NVIS Power Level Test Data Discussion 275 to 368 Miles

Time	Frequency MHZ	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
1311	7.1000	KD6UCA	275	21	80		La Honda, CA (SW of San Jose)
1312				16	40		
1313				19	20		
1315				16	10		
1316	7.1000	K9ONR	311	16	80		Walnut Creek, CA
1318				17	40		
1319				17	20		
1321				18	10		
1323	7.1015	KD7NHC	320	28	80		Wellington, NV (SE Carson City)
1324				28	40		
1326				28	20		
1327				28	10		
1334	7.1020	KG6MDW	332	16	80		Fairfield, CA. (NE Berkeley)
1336				20	40		
1338				18	20		
1339				31	10		
1342	7.1050	W6LHR	349	22	80		Lincoln, CA. (NE Sacramento)
1343				17	40		
1344				23	20		
1345				20	10		
1347	7.1065	N0DAJ	348	16	80		Wickenburg, AZ (NW Phoenix)
1348				18	40		
1350				21	20		
1351				31	10		
1355	7.1005	KL7RI	368	30	80		Reno, NV
1356				22	40		
1357				16	20		
1358				17	10		

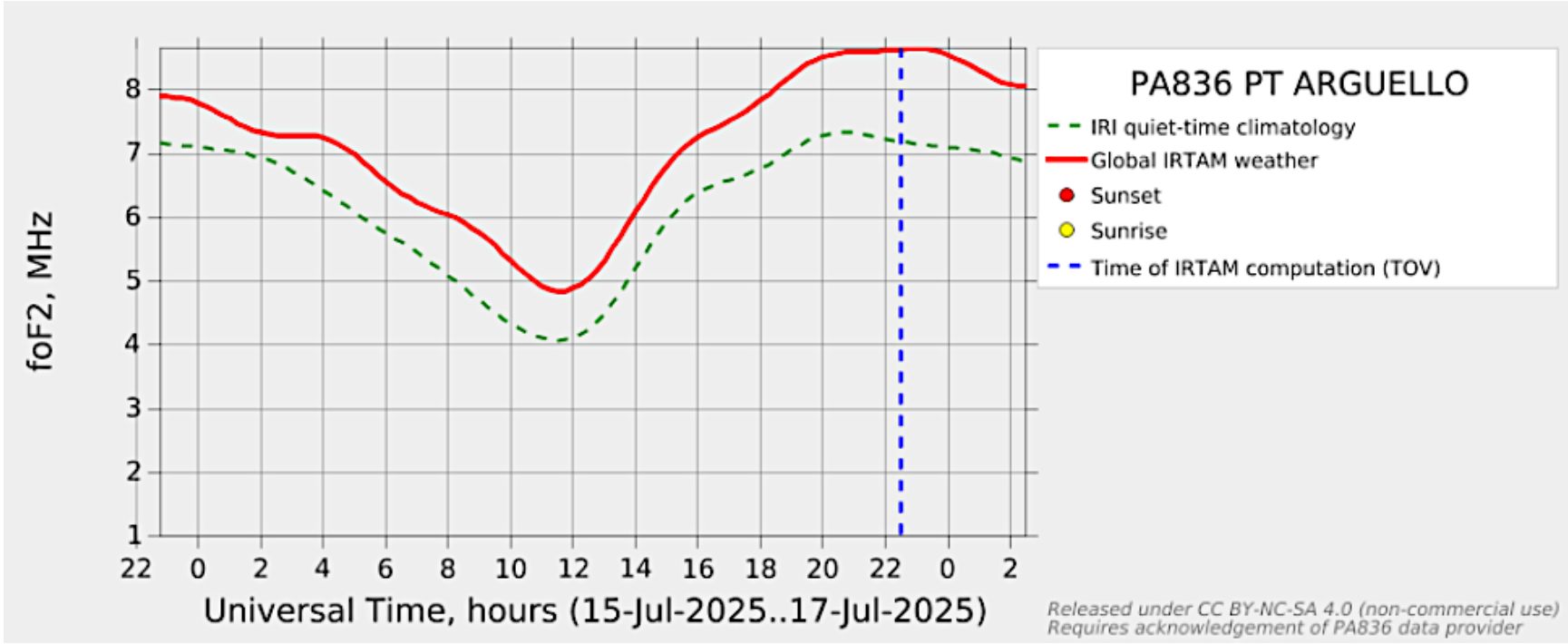
- At distances of 275 out to 368 miles (the NVIS outer limit) 10W operation performed as well as at 80 watts

40m NVIS Power Level Test Conclusion

Time	Frequency MHZ	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
1202	7.1021	W6BI	11	26	80	Yellow	Simi Valley, CA ----- Multipath problems?
				25	40		
				39	20		
1212				38	10		
1214	7.1065	KD6LLB	13	18	80		Oxnard, CA
1215				18	40		
1216				16	20		
1217				18	10		
1228	7.1005	AJ7C	31	16	80		Culver City, CA
1229				16	40		
1231				29	20		
1240				25	10		
1514	7.1060	N7OP	52	25	80		Lancaster, CA ---- Poor conditions
1518				49	40		
1520				92	20		
1522				nc	10		
1258	7.0835	KF6NYM	55	16	80		Santa Barbara, CA
1259				17	40		
1300				16	20		
1301				17	10		
1311	7.1000	KD6UCA	275	21	80		La Honda, CA (SW of San Jose)
1312				16	40		
1313				19	20		
1315				16	10		
1316	7.1000	K9ONR	311	16	80		Walnut Creek, CA
1318				17	40		
1319				17	20		
1321				18	10		

- NVIS Operation at higher power levels is necessary under adverse conditions and when fighting multipath interference problems
- Typically, however, excellent NVIS communications is achieved using 10 to 20 Watts
- Battery power is often utilized for 2 meter and 440 local communications at 10 to 20W
- The low power capability of NVIS means that regional HF emergency communications out 200 to 300 miles can also be conducted utilizing battery power --- This is important!

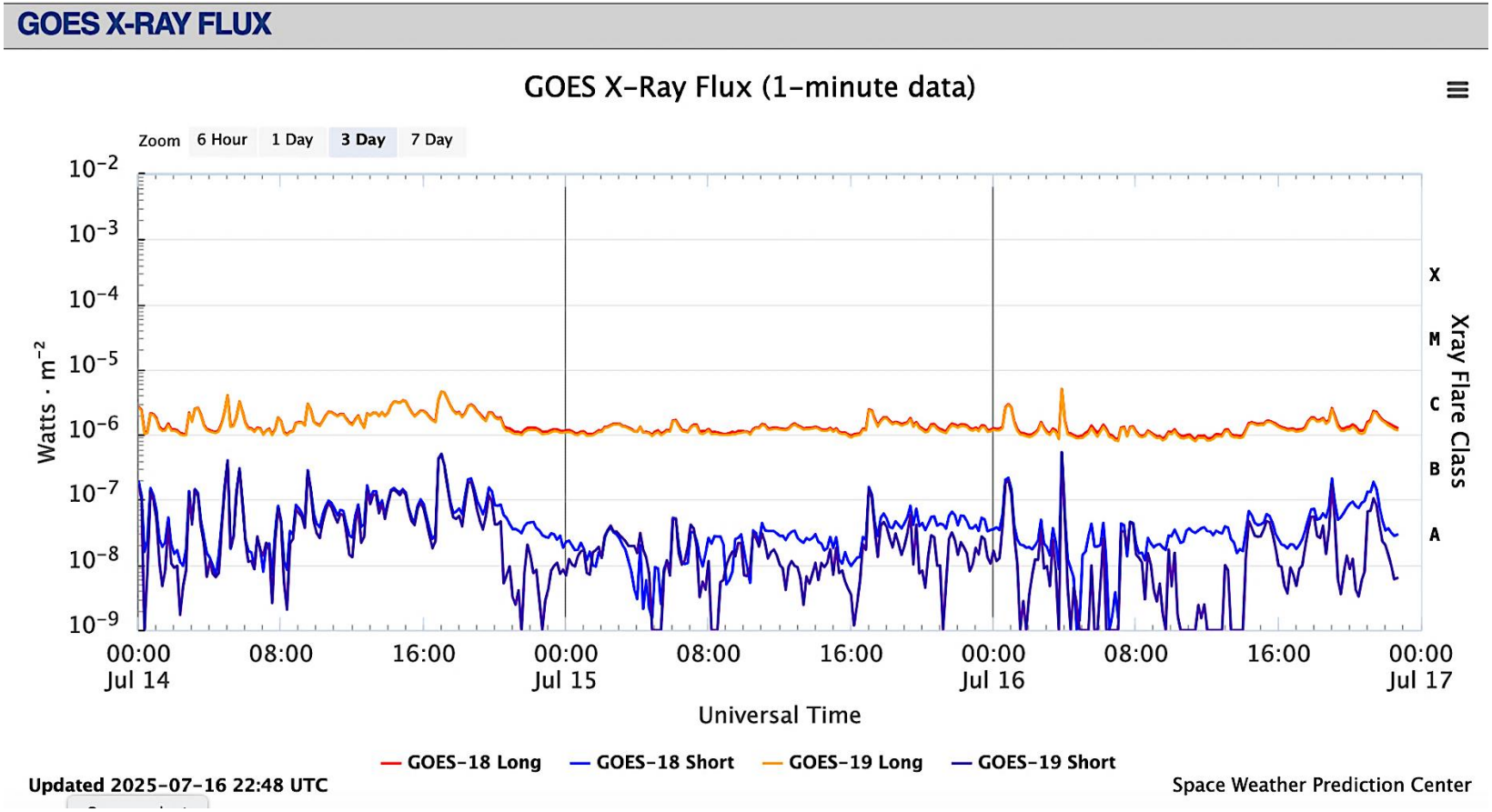
40m NVIS Power Level Test Critical Frequency



11 13 15 PDT

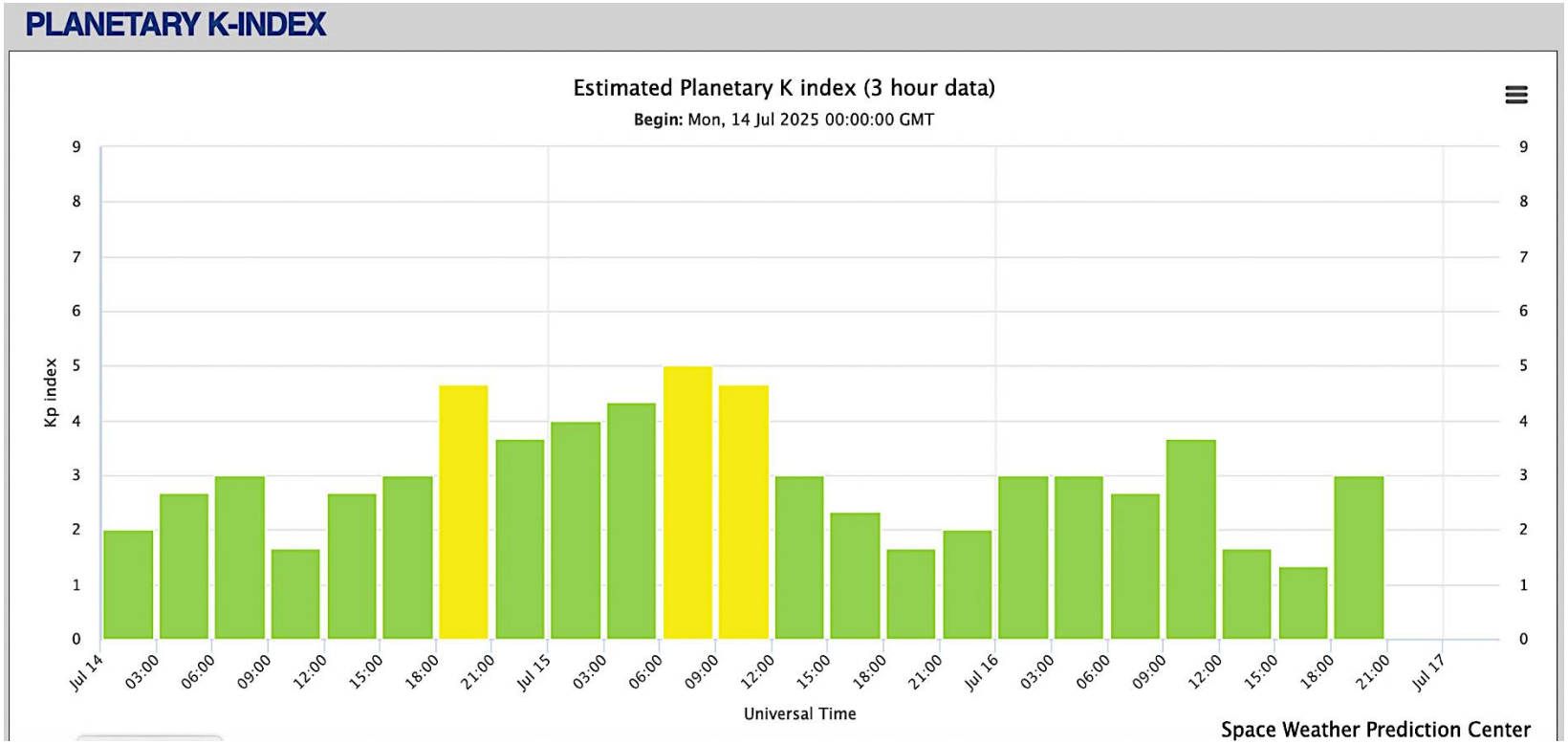
- Red trace is the critical frequency measured at Pt Arguello, CA on the California coast west of Lompoc during the duration of the test (1200 to 1530 PDT)
- Green trace is the Ionosphere Reference model critical frequency estimate
- Left of the vertical blue line is the critical frequency history, to the right of the blue line is the projected critical frequency

40m NVIS Power Level Test X-Ray Flux



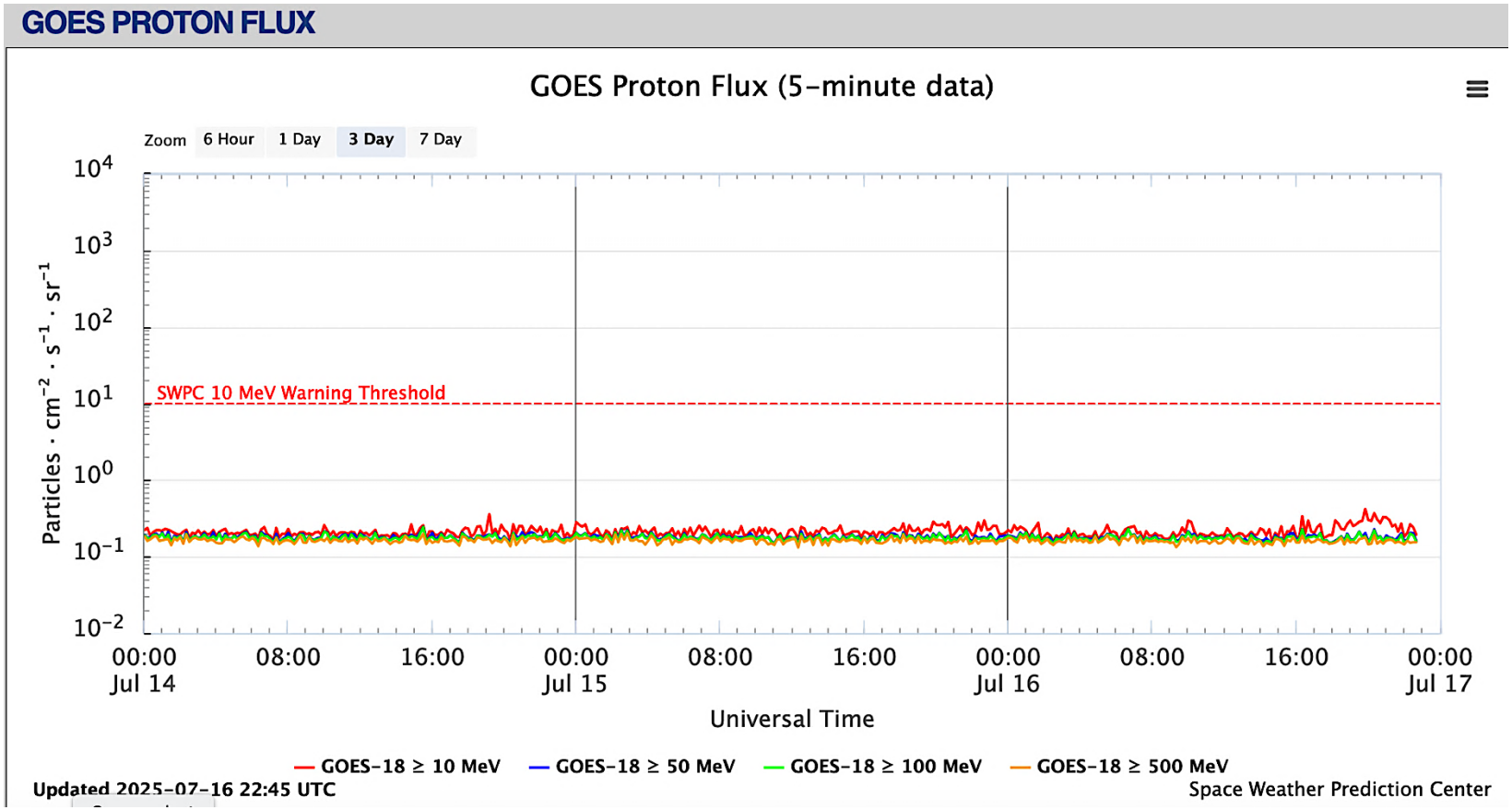
- Red trace is the X-Ray Flux in the days prior to and during the power level test
- X-Ray Flux was relatively quiet

40m NVIS Power Level Test Kp-Index



- Kp Index in the days prior to and during the power level test
- At 3 Kp Index slightly elevated

40m NVIS Power Level Test Proton Flux



- Proton Flux in the days prior to and during the power level test
- Levels were well below the SWPC 10 MeV warning threshold