

An Introductory Tutorial to W6ELProp Running Your Own Propagation Predictions

Carl Luetzelschwab, K9LA 4/2004, rev 8/2011, rev 7/2013, rev 3/2015, rev 5/2016

Are you interested in rolling your own propagation predictions? If you answered yes, read on. There's a very user-friendly program out there that allows you to do this. It's from Shel, W6EL, and it's called W6ELProp. W6ELProp is the Windows version of his popular (but now discontinued) DOS-based MINIPROP series. And it's a free download, too. So let's download it and set up the options. Then we'll run a prediction and review what the outputs mean.

Downloading W6ELProp is easy. Either get it from www.qsl.net/w6elprop or send me an e-mail at k9la at arrl.net, and I'll send you the executable file. You'll now have an approximate 480K file called W6ELPropInst270.exe. Execute it, and follow the directions. You'll end up with the W6ELProp icon on your desktop.

Note that Version 2.70 was in the 2002 era, and as far as I'm aware Shel W6EL never checked it with the newer operating systems like Vista or Windows 7, 8 or 9. One tip is to install it in the Administrator mode.

Start W6ELProp and then click on the Options menu. In the Default Terminal folder, enter your call and your latitude and longitude (from www.qrz.com, for example).

Next go to the Frequencies and Constants folder. For the frequencies, enter the frequencies you'd like predictions on. I usually use 3.7, 7.1, 10.1, 14.2, 18.1, 21.2, 24.9, and 28.3 (you can even add the new 60m frequency, too). Note that W6ELProp only allows frequencies down to 3.0MHz. It does not do predictions on 160m. For 160m, I usually note the times when the entire path is in darkness.

For Additive Signal Level Constants, this is where you input your station specifics in dB referenced to 100w and a dipole. For example, if you have an older 1000w amp that does 80-10m but excludes the WARC bands, you'd add 10dB [$10 \log (1000w/100w)$] to all but the WARC frequencies. If you have a tri-bander on 20m, 15m, and 10m, then you'd add an additional 6dB on those frequencies (that's roughly the gain of a small tri-bander over a dipole). The following figure shows the frequencies and additive signal level constants for the above scenario.

<u>Frequencies (MHz)</u>	<u>Additive Signal Level Constants (dB)</u>
3.7	10.0
7.1	10.0
10.1	0.0
14.2	16.0
18.1	0.0
21.2	16.0
24.9	0.0
28.3	16.0

In the Prediction Parameters folder, go with Minimum Radiation Angle = 1.0 degree (use higher values if your QTH is blocked at low elevation angles), Noise Bandwidth = 3000Hz for SSB (use 500Hz for CW), Signal Level Suppression Threshold = 0dB, Man-Made Noise Environment as dictated by your QTH (mine is Rural), and put a check in the Suppress Zero-Availability Predictions box.

In the User Preferences folder, go with Sunspot Number for the Primary Solar Index, Signals Levels for the Primary Signal Display, UTC for Time Display, 3 minutes for map Auto Upgrade Interval, and Low for Frequency Map Resolution.

Now click on the Save My Settings and Exit button. Don't forget to do this! You should now be back at the main screen.

Click on the Predictions menu. Then select On-Screen. Hit "enter", and the default call, latitude, and longitude that you entered earlier should show up on the left side of the window as Terminal A. For this example, my default data will be used.

Let's run a prediction to Argentina. If you don't know the prefix, click on Select from Atlas and select Search by Name. Scroll down until you see Argentina. Highlight it, and then click OK. The prefix, the latitude, the longitude, and the name should show up as Terminal B. For a Date, let's go with December 15, 2003, which is typed in using the format MM/DD/YY.

For Solar Index, earlier we selected Sunspot Number as the Primary Solar Index. The smoothed sunspot number should be entered here. Since the smoothed sunspot number is a 13-month running average centered on the desired month, the official smoothed sunspot number is 7 months behind real time. So how do we find the predicted smoothed sunspot number for December 2003 (or for any future month)? One method is to go to www.swpc.noaa.gov/products/predicted-sunspot-number-and-radio-flux (thanks to K6BLG for pointing out that this is the new url) and use the value in the left-most column (which is the PREDICTED smoothed sunspot number) for December 2003. From that table, we'll enter 47 for the Solar Index. Note that the data on that website also has smoothed solar flux. So if we had chosen Solar Flux as our Primary Solar Index, we could have entered a smoothed solar flux (also from the PREDICTED column).

Why should we use the smoothed sunspot number (or smoothed solar flux) and not the daily solar flux? To develop the model of the ionosphere for our propagation predictions, solar data was compared to ionosphere data. The best correlation was between the smoothed sunspot number (or smoothed solar flux) and monthly median ionospheric parameters. Thus the model was designed to take a smoothed solar index. The “monthly median” aspect means that our predictions are statistical in nature. We’ll get into that a little bit later.

For the K Index, enter -1, which indicates the predictions will be for an average K index.

Now click on OK. After a couple seconds, you should see data specific to the chosen path - the latitude and longitude of both terminals, sunrise and sunset for both terminals, the bearings, and the short and long path lengths. Click on Show Predictions and you should have a screen full of data like the following.

W6ELProp Short-Path Prediction for 12/15/2003

TERMINAL A: 41.00 N 85.40 W K9LA Sunrise/Set: 1302/2212 UTC Bearing to B: 160.3 deg
 TERMINAL B: 36.50 S 61.00 W Argentina Sunrise/Set: 0847/2311 UTC Bearing to A: 341.6 deg
 SSN: 47.0 Flux: 103.2 K: Average Path Length: 8970 km

		SIGNAL LEVELS IN dB ABOVE 0.5 μV							
UTC	MUF	3.7 MHz	7.1 MHz	10.1 MHz	14.2 MHz	18.1 MHz	21.2 MHz	24.9 MHz	28.3 MHz
0000	12.3	51 A	48 A	45 A	48 D				
0030	11.1	51 A	48 A	45 B	48 D				
0100	10.8	40 A	48 A	45 B	48 D				
0130	10.5	53 A	48 A	45 B	48 D				
0200	10.4	53 A	48 A	45 B	48 D				
0230	10.4	53 A	48 A	45 B	48 D				
0300	10.5	53 A	48 A	45 B	48 D				
0330	10.6	53 A	48 A	45 B	48 D				
0400	10.8	53 A	48 A	45 B	48 D				
0430	10.4	53 A	48 A	45 B	48 D				
0500	10.7	53 A	48 A	45 B	48 D				
0530	11.0	53 A	48 A	45 B	48 D				
0600	11.0	53 A	48 A	45 B	48 D				
0630	11.1	53 A	48 A	45 A	48 D				
0700	11.3	53 A	48 A	45 A	48 D				
0730	11.5	53 A	48 A	45 A	48 D				
0800	11.6	53 A	48 A	45 A	48 D				
0830	11.8	57 A	47 A	45 A	48 D				
0900	11.1	50 A	46 A	44 B	48 D				
0930	10.6	29 A	47 A	43 B	47 D				
1000	10.6	24 A	30 A	45 B	46 D				
1030	11.4	5 A	7 D	27 C	44 D				
1100	12.0		21 A	24 B	43 D				
1130	13.1			26 A					
1200	14.2			6 D					
1230	16.4			2 C	33 A				
1300	17.3			1 A	20 C	31 D			
1330	20.2				18 A	30 A	37 C	28 D	
1400	22.6				16 A	29 A	36 B	27 D	
1430	24.7				15 B	28 A	36 A	27 C	37 D
1500	26.5				14 A	25 A	35 A	26 B	37 D
1530	27.9				13 A	12 A	35 A	26 A	36 C
1600	28.9				12 A	12 A	35 A	26 A	36 B
1630	29.5				12 A	12 A	34 A	26 A	36 B
1700	29.7				12 A	12 A	34 A	26 A	36 B
1730	29.7				12 A	12 A	35 A	26 A	36 B
1800	29.5				13 A	27 A	35 A	26 A	36 B
1830	29.0				14 A	28 A	35 A	26 A	37 B
1900	28.4				15 A	28 A	36 A	27 A	37 B
1930	27.5				18 A	29 A	37 A	27 A	37 C
2000	26.2				20 A	30 A	37 A	28 B	38 D
2030	24.7			1 A	20 A	31 A	38 A	28 C	38 D
2100	23.0			7 A	22 A	33 A	39 A	29 D	39 D
2130	21.0			14 A	39 A	34 A	40 C	30 D	
2200	19.5		6 A	18 A	41 A	35 A	41 D		
2230	17.5		20 A	22 A	43 A	37 C	42 D		
2300	16.0	19 A	34 A	41 A	46 A	38 D			
2330	14.2	44 A	32 A	44 A	48 B	40 D			

Availabilities A: 75 - 100% B: 50 - 75% C: 25 - 50% D: 1 - 25%
 Signal levels suppressed if below 0 dB relative to 0.5 μV or if predicted availability is zero

One of the most obvious features of this data is the difference between the lower frequencies (80m, 40m, and 30m) and the higher frequencies (17m, 15m, 12, and 10m). They're essentially 180 degrees out of phase. This is because absorption drives the low bands so they're best only during the night, whereas MUF (maximum usable frequency) drives the high bands so they're best during the day.

The first column in the figure is the time in UTC. The second column is the monthly median MUF. Remember when I said our predictions are statistical in nature? What this means is that the actual MUF is predicted to be at least as high as the monthly median MUF on half the days of the month. For example, at 1700 UTC, the actual MUF on half the days of the month will be at least 29.7MHz. On the other half of the days of the month the actual MUF will be lower than 29.7MHz. The big problem is we don't know which are the "good" days and which are the "bad" days.

Each frequency column has two entries – a number and a letter. The number is the predicted monthly median signal strength in dB above 0.5uv. Assuming S9 is 50uv and an S-unit is 5dB (the generally accepted standard), the dB values in W6ELProp translate to S-units as follows:

Signal level in dB ref 0.5 uV	Signal power in dBm	S-units
50	-63	10dB over S9
45	-68	5dB over S9
40	-73	S9
35	-78	S8
30	-83	S7
25	-88	S6
20	-93	S5
15	-98	S4
10	-103	S3
5	-108	S2
0	-113	S1

Being a median value, on any given day of the month the signal strength could be somewhat above or below this predicted value.

The letters A, B, C, and D refer to the probability (in terms of the number of days of the month) that the desired frequency is below the predicted monthly median MUF. This probability is called Availability. W6ELProp puts Availability into four categories, and the definitions of the limits for each category are at the bottom of the page. For example, the 28.3MHz column at 1530 UTC shows a C. This means 10m should be open on 8 to 16 days of the month (25% to 50%). To reiterate, we don't know which specific days these will be. From 1600 to 1900 UTC the probability increases to 16 to 24 days of the month (B = 50% to 75%), with a signal level of about S8.

That's it for a basic introduction to W6ELProp. The best thing to do is to dive in and run predictions – I'm sure you'll become familiar with it. For more details, go to Help and then Contents. There's lots of good information there. Have fun playing with all the features of W6ELProp. The end result should be more DX success. Good luck!

One last comment - check out the mapping feature (under the Map menu) – it's really great for visualizing low band openings, where the dark ionosphere is the best place to be for our RF.