Validating Propagation Predictions

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Since the model of the ionosphere in our propagation prediction programs is a monthly median model, we shouldn't just listen on one day and use that data to validate a prediction. Even listening over a weekend (for example, during a DX contest) doesn't really validate a prediction.

To do it properly, we need a month's worth of data. And we need data to validate the MUF prediction and data to validate the signal strength prediction. Let's walk through a validation process to see what it entails.

Let's assume we want to validate a prediction from K9LA (41N/85W) to 5Z (1S/37.4E) at 1500 UTC on 12m (24.9 MHz) during the month of December at a smoothed sunspot number of 25. Under those conditions, along with assumptions about transmit power and antenna gains, VOACAP gives the following prediction:

Time (UTC)	Median MUF (MHz)	12m MUFday parameter	12m signal strength (dBm)
1500	26.8	0.79	-95

The 12m MUFday parameter tells us that VOACAP predicts 12m to be open (enough ionization to get an electromagnetic wave from K9LA to 5Z) on 0.79 days of the month (that's 24 days when rounded to the nearest whole number). Note that we don't know which days will be the "good" ones with respect to MUF and which days will be the "bad" ones with respect to MUF.

The predicted signal strength is a median value. That means on half of the days of the month the actual signal strength will be below -95 dBm. On the other half of the days of the month, the signal strength will be above -95 dBm. Again, we don't know which days will be the "good" ones with respect to signal strength and which days will be the "bad" ones with respect to signal strength.

It should be obvious that we need an entire month's worth of data to validate these predictions. For this example, the best way to do that would be to monitor the 5Z4B NCDXF/IARU beacon on 24.930 MHz every day in December at 1500 UTC. For details about the NCDXF/IARU beacon system, visit **www.ncdxf.org/beacons.html**.

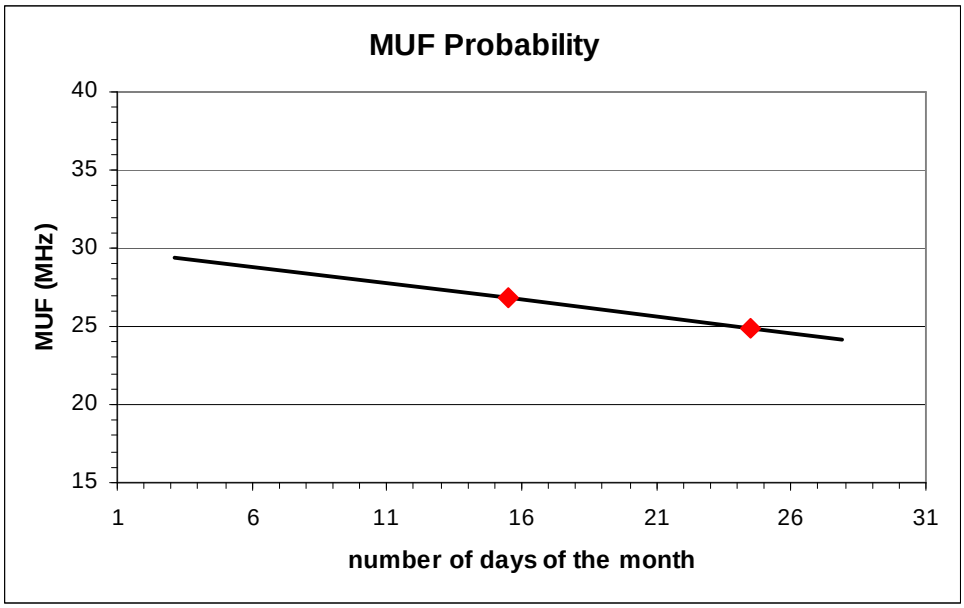
After a month's worth of listening, you'll end up with the number of days you heard 5Z4B, and a signal strength measurement on each of those days.

To validate the MUFday prediction, simply divide the number of days you heard 5Z4B by 31 and compare that decimal number to the prediction.

To validate the signal strength prediction, order all your signal strength measurements in ascending order (lowest signal strength first). Then pick out the value that has half the

data above it and half the data below it. That's the actual median signal strength on the path. Compare it to the prediction. It's essential to know the calibration of your S-meter for signal strength validation, so you need to use a signal generator to do this. Lacking that, you could build (or buy) a test oscillator of known output power and use a step attenuator to calibrate your S-meter.

What does the Median MUF column tell us? Knowing the 12m MUFday parameter and the median MUF allows us to estimate the MUF probability curve since median implies 50% (0.50 in decimal). Thus we can plot two points: 26.8 MHz is 15.5 days (0.50 times 31) and 24.9 MHz is 24.49 days (0.79 times 31). These are the red data points in the following plot.



Assuming the mode is the same on the higher frequencies (an F_2 mode in this case), the plot indicates that 10m should be open on 9 days of the month. It also says 15m (and lower) should be open on all the days. The lower frequencies should have less signal strength, though, due to ionospheric absorption being inversely proportional to the square of the frequency (which would be reflected in the VOACAP prediction).

Although I did this exercise using a VOACAP prediction, I could have done this with a W6ELProp prediction. W6ELProp defines the MUFday parameter as availability, and the availability value is in the Advanced option screen. Signal strength predictions are in terms of dB above 0.5 uv, so you'd have to convert this to dBm to compare to your S-meter calibration chart. The MUF column (to the right of the time column) on the main prediction screen in W6ELProp is the median MUF – just like in VOACAP.

Going through this exercise has validated a prediction for one time of day for one month on one band at one smoothed sunspot number. You can understand why it takes a lot of work to validate predictions on several bands throughout the day during all twelve months for all phases of a solar cycle.