Sky wave Radio communication prediction for BSc,MSc,Phd and researchers

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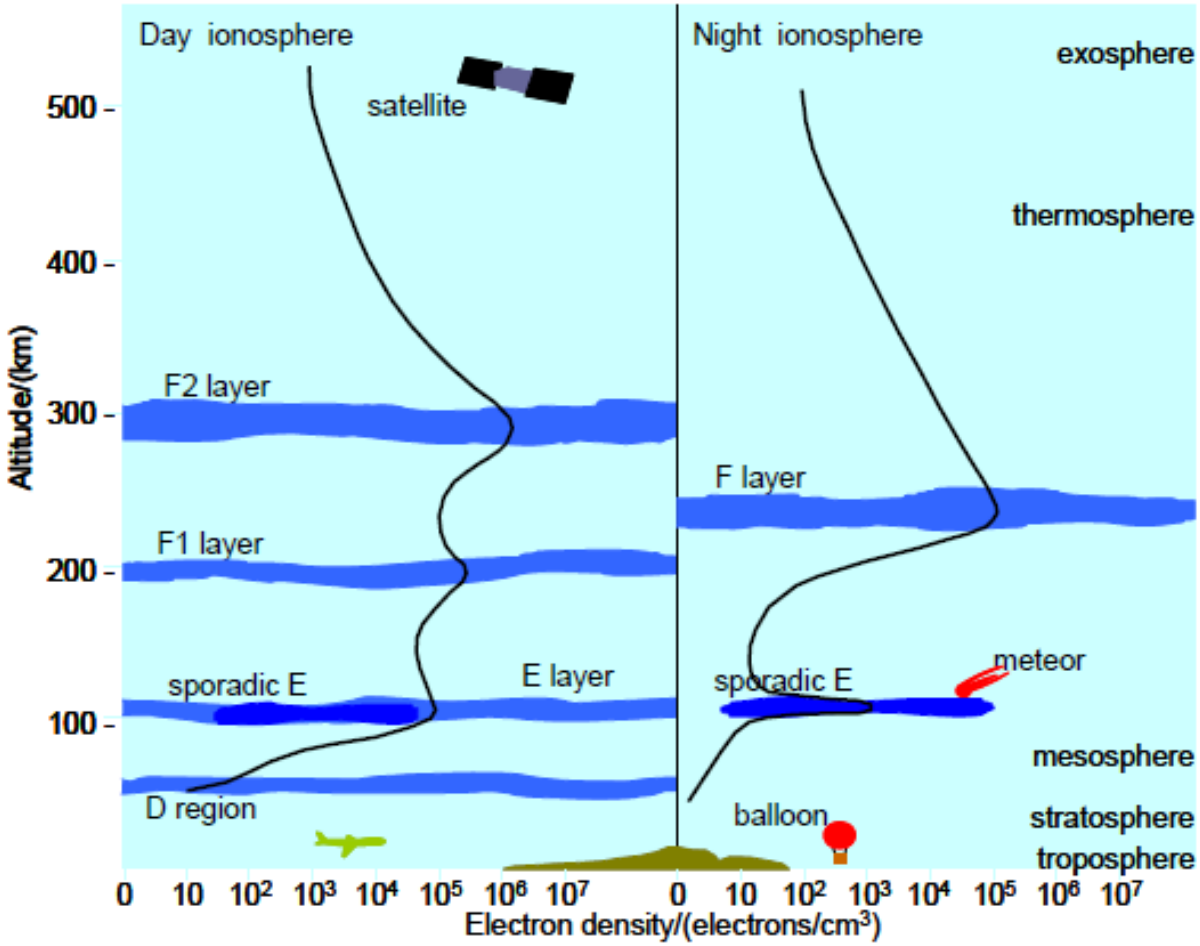
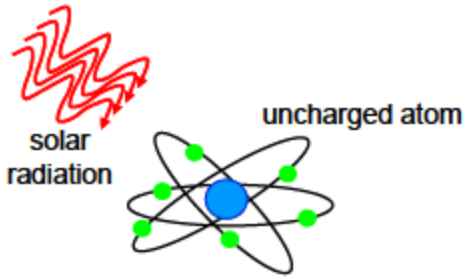
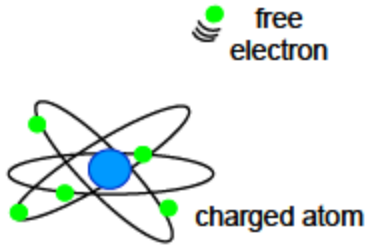
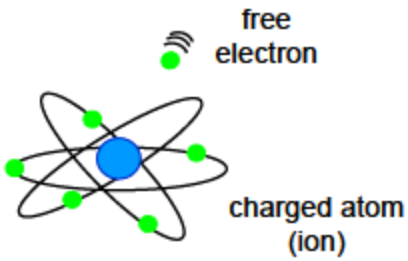
Introduction to HF Radio Propagation

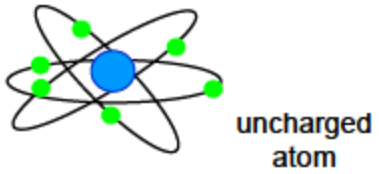


Production and losses of electrons

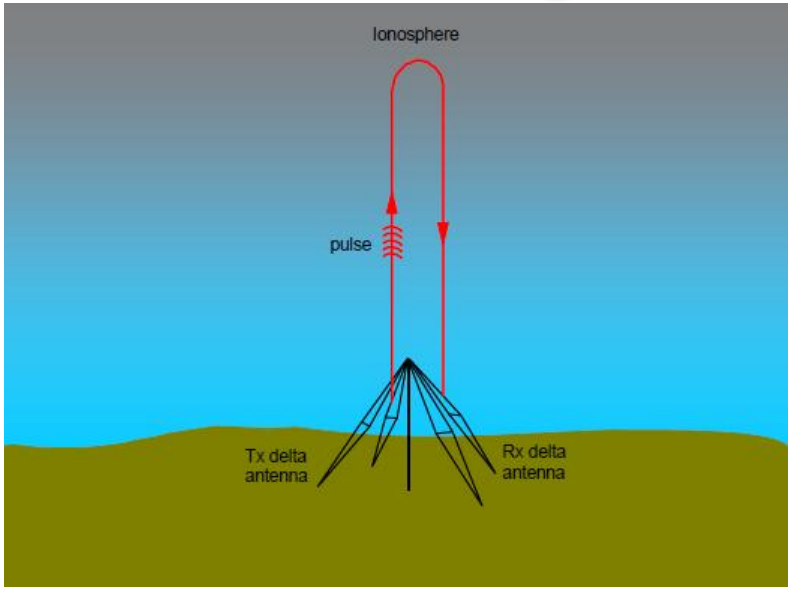


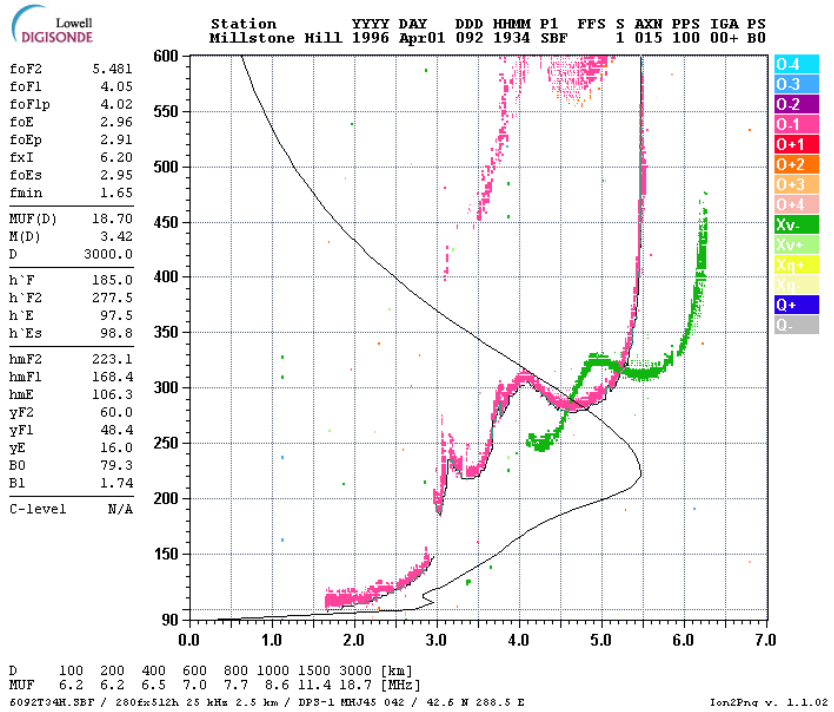




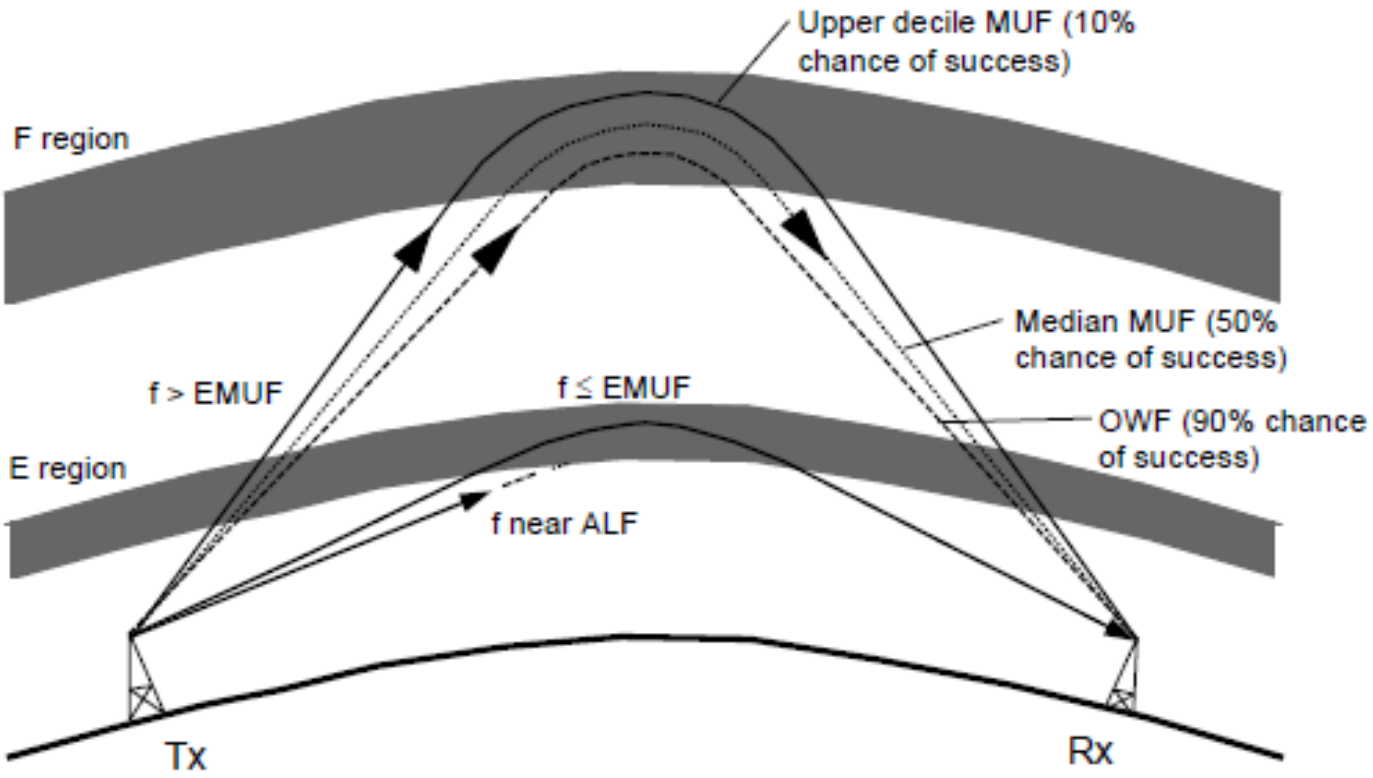


Observing the ionosphere

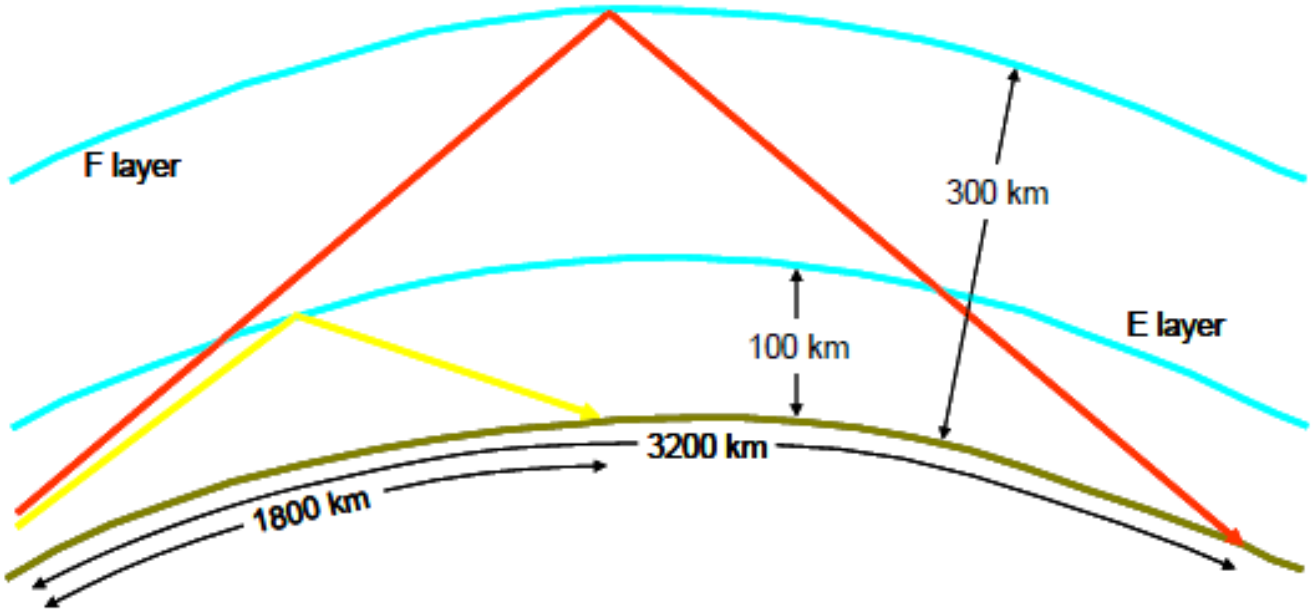




HF sky wave geometry



MUF



Prediction of MUF using VOCAP

What is VOCAP ?

VOACAP, or the Voice of America Coverage Analysis Program, is a software tool that predicts radio propagation for high-frequency (HF) broadcasts by modeling how signals travel through the atmosphere

VOACAP

- VOACAP is considered the "gold standard" of HF propagation-prediction programs, but it is difficult to use
- VOACAP is for point-to-point predictions (one transmitter site to one receiver site).
- VOACAP produces lengthy tabular printouts that require a lot of interpretation and massaging.

Typical VOACAP Tabular Output

```
Oct     1994          SSN = 100.              Minimum Angle= 0.100 degrees
SAN FRANCISCO       LONDON                AZIMUTHS          N. MI.      KM
37.78 N  122.42 W - 51.50 N    0.17 W     32.64  316.78    4651.1    8613.2
XMTR  2-30 + 10.0 dBi[samples\SAMPLE.00    ] Az= 52.9 OFFaz=339.7    1.500kW
RCVR  2-30 + 10.0 dBi[samples\SAMPLE.00    ] Az=234.9 OFFaz= 81.9
3 MHz NOISE = -163.6 dBW     REQ. REL = 50%    REQ. SNR = 43.0 dB
```

SUMMARY 6 MODES FREQ = 14.1 MHZ UT = 15.0

	3.F2	4.F2	4. E	5.F2	5.F2	5. E	Most REL 3.F2
TIME DEL.	29.87	30.41	29.17	31.76	31.89	29.37	29.87
ANGLE	4.57	10.22	1.72	17.85	18.35	5.06	4.57
VIR. HITE	287.27	297.20	125.30	353.16	362.42	137.00	287.27
TRAN.LOSS	149.88	158.17	602.22	184.45	187.14	1037.71	149.88
T. GAIN	10.00	10.00	10.00	10.00	10.00	10.00	10.00
R. GAIN	10.00	10.00	10.00	10.00	10.00	10.00	10.00
ABSORB	6.48	5.03	7.01	3.57	3.50	6.37	
FS. LOSS	134.47	134.63	134.27	135.01	135.04	134.33	
FIELD ST.	2.07	-6.22	-450.28	-32.51	-35.20	-885.77	2.67
SIG. POW.	-118.12	-126.41	-570.46	-152.69	-155.38	-1005.95	-117.52
SNR	51.41	43.12	-400.93	16.84	14.15	-836.42	52.01
MODE PROB	0.95	0.77	0.01	0.39	0.39	0.00	0.95
R. PWRG	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	-9.01
RELIABIL	0.70	0.50	0.00	0.10	0.07	0.00	0.71

Mode

Elev. angle

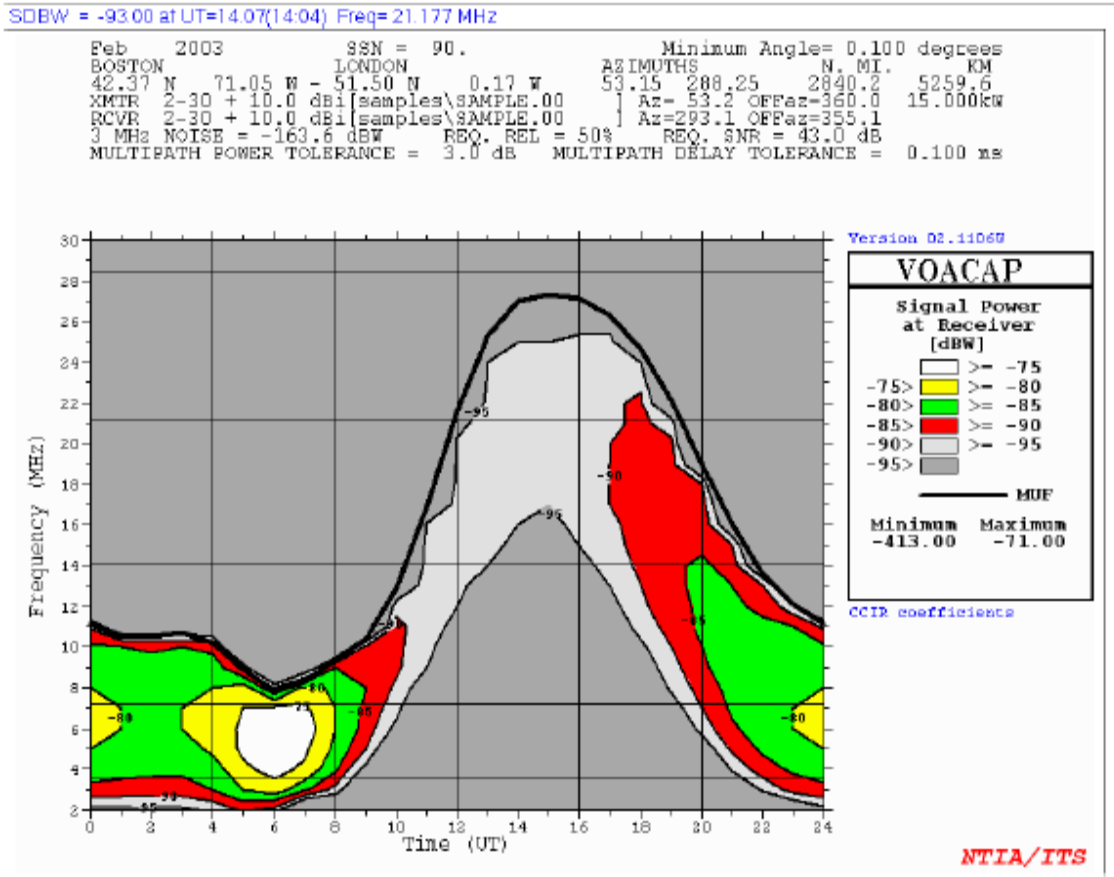
Signal power, dBW

SNR, in 1 Hz BW

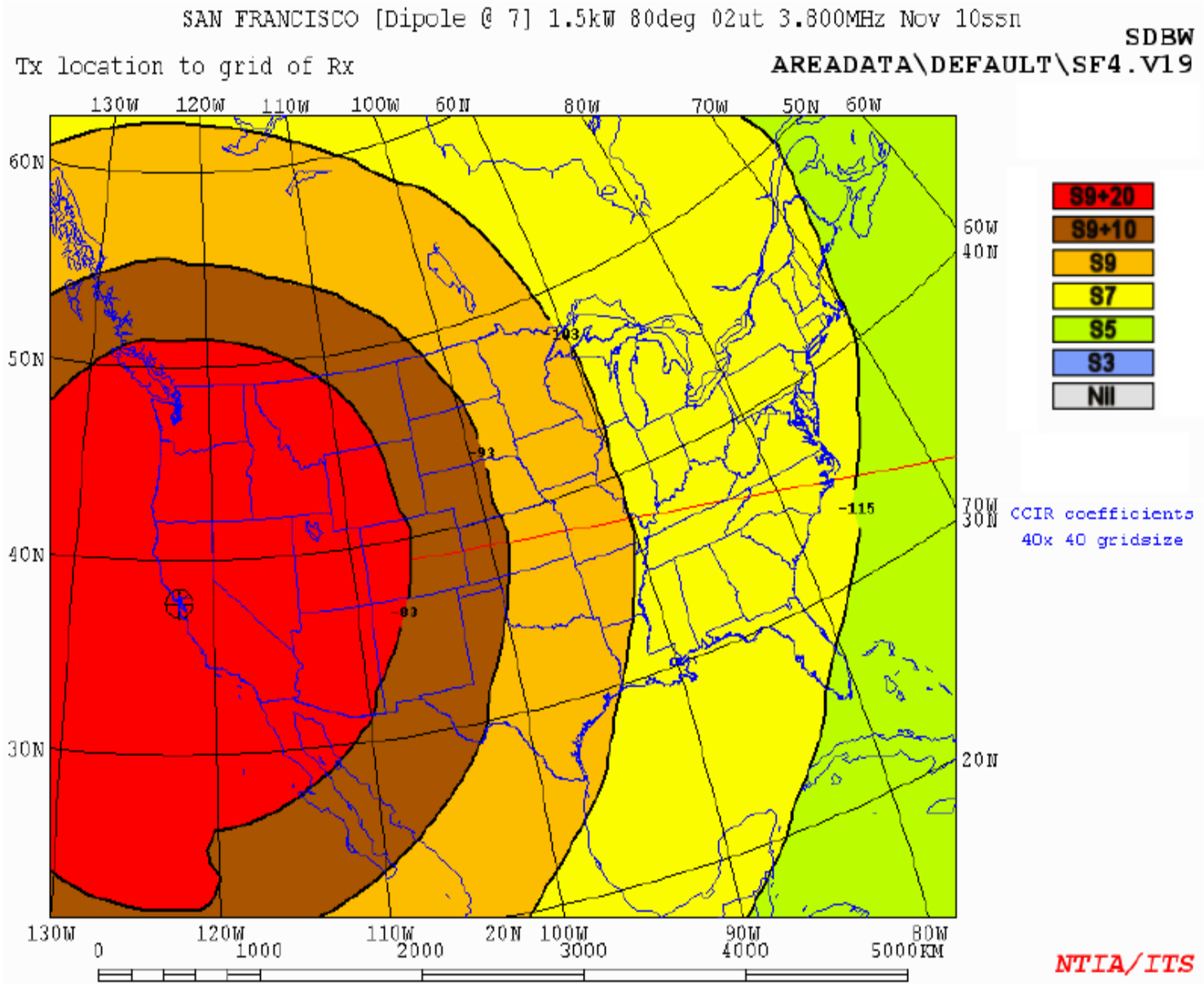
Mode probability

"Method 25": "All modes table," for one frequency, for each hour -- the output file is huge (about 250 kB = 28 printed pages)

VOACAP Graphs?

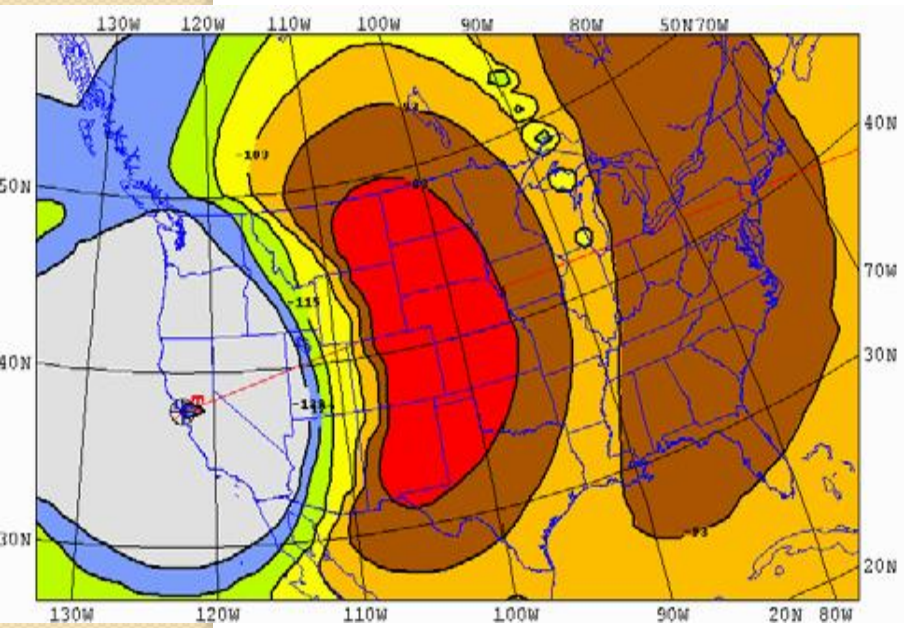


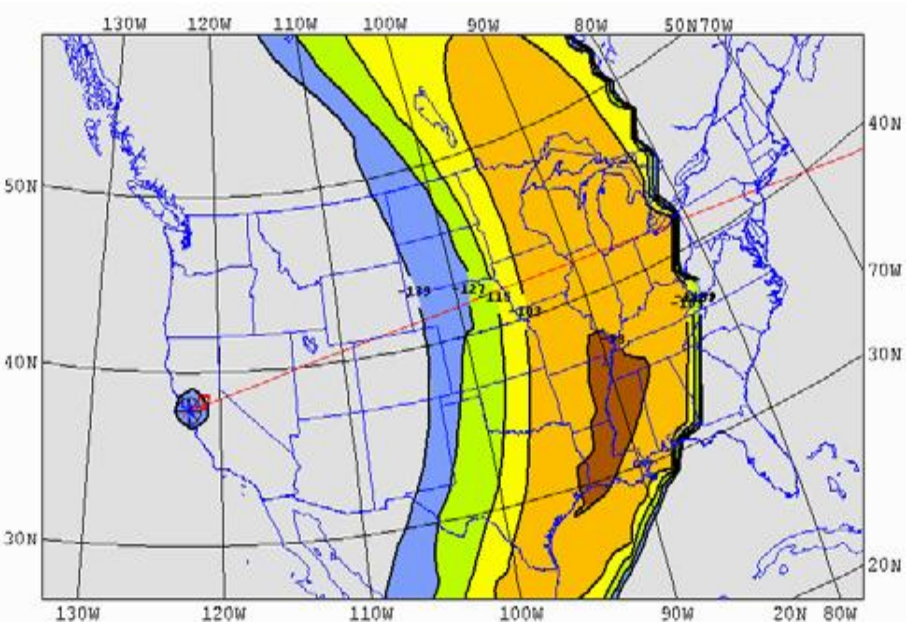
This graph looks pretty, but it doesn't really give that much useful information for planning.

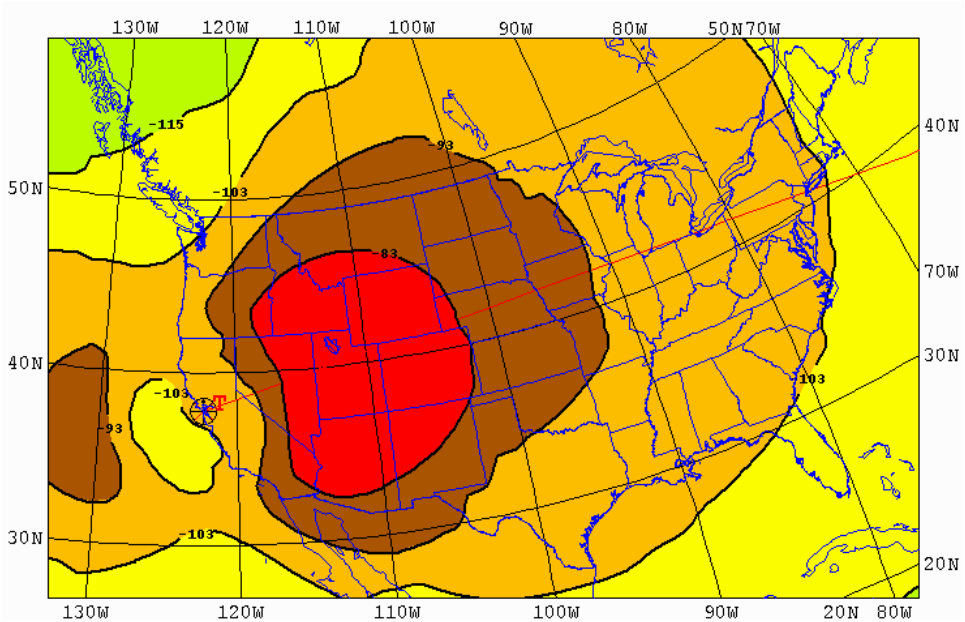

SAN FRANCISCO [Dipole @ 7] 1.5kW 80deg 02ut 3.800MHz Nov 10ssn
SDBW
Tx location to grid of Rx
AREADATA\DEFAULT\SF4.V19
130W 120W 110W 100W 60N 80W 70W 50N 60W
60N
50N
40N
30N
60W
40N
70W
30N
20N
S9+20
S9+10
S9
S7
S5
S3
Nil
CCIR coefficients
40x 40 gridsize
130W 120W 110W 20N 100W 90W 80W
0 1000 2000 3000 4000 5000KM
NTIA/ITS

VOAAREA

- *VOAAREA uses the VOACAP engine to produce area-wide coverage from a single transmitting site for a single frequency.*
- *VOAAREA charts are arguably the most intuitive presentation of propagation data —but only for a single frequency and a single UTC time.*
- *This makes it difficult to get the big picture, unless charts for several frequencies are combined in a montage, good for one hour at a time. A series of these makes a sort of "movie" to use while operating.*


130W 120W 110W 100W 90W 80W 50N70W
50N
40N
30N
40N
70W
30N
20N
-103
-115
-93
130W 120W 110W 100W 90W 20N 80W


130W 120W 110W 100W 90W 80W 50N70W
50N
40N
30N
40N
70W
30N
20N
-130
-122
-115
-103
130W 120W 110W 100W 90W 20N 80W


130W 120W 110W 100W 90W 80W 50N70W
50N
40N
30N
40N
70W
30N
20N
-115
-103
-93
-83
-103
-103
-93
130W 120W 110W 100W 90W 20N 80W

Thnk u