1560 KBEW MN, Blue Earth 12/2 0637 sudden s/on, early, w/school closures, blizzard updates. Temp. was -2°, wind chill -40°. Good sig, but rapid fading. (ØW-CO)

WQXR NY, New York 10/31 0320 brief ID & opera, not enuf for a report yet. Do West Coasters hear this? (REW-HI) (Not very often here.-NH)

1580 KLOQ CA, Merced 11/11 1110 PSA to report immigration harassment, pharmacy spot in SS, fiesta promo. O/u KDAY, I haven't heard CBJ this season. (REW-HI)

KPIK CO, Colorado Springs 12/3 1703 "Talkback," w/Bob Larson, discussing suggestive lyrics in modern C&W mx. 1759 ID as "Modern Christian Radio," no QRM until 1745 when KNIX showed up (playing C&W mx w/suggestive lyrics). (ØW-CO)

KHBJ TX, Canyon 9/19 1900 fading out w/local spots, oldies, EZL inst. mx, promo for "United Station's Network News," and Dick Clark's "Rock, Roll and Remember" on Sundays at 1000. (MH-OTR)

1590 KVGB KS, Great Bend 12/3 1818 YL w/wx. Fair sig, but bad KRXY-1600 slop. (ØW-CO)

1610 KMC490 CA, Barstow 9/18 1330 male anncr w/info on wx, Mojave desert, Barstow weigh stn, hours of 0830-1700 Pacific Time as hours open (not sure what the hours were in reference to: weigh stn or just what), and ended w/brief instrumental mx of 8-10 sec, and repeat. Address: Bureau of Land Management, 831 Barstow Road, Barstow, CA 92311. (MH-OTR)

ID'ing an UNID:
LHC's report of KIKR-900 in 11/23 WDXR not possible, as KIKR now on 880 kHz, and has applied for calls KNRO. Per old IRCA Almanac, other poss's are KALT and KCLW-TX, 500 & 250-D respectively. However, I haven't seen either of these reported on WC before. KFBA, Floydada, TX (now KKAP) is reported occas. in S. CA, perhaps they're now on the Texas State network, i.e. a new affiliate. (RW-CA)

UNIDs:

720 11/25 0721 unID u/WGN, faded out quickly w/TC of "7:21," putting it in EST. Only possible choice seems to be WMXY-GA. Other ideas? (RW)

880 12/2 0339 unID u/KRVN w/MCN // KTRB-860. No affiliates listed in new Almanac on this freq, but KJJR-MT listed as affiliate in 11/2 WDXR, probably them. (RW-CA)

890 11/8 0530-0555 1000 Hz tone o/WLS; off 0555. Suggest either KDXU or KBYE. (REW-HI)

1400 11/18 0041 unID way u/KRE w/Portland Trailblazers post-game show // KMFR-880. Only affiliates listed are KNND, KJDY & KBCH, all of which I still need! Whatever it was, it was new! (RW-CA)

I've received a request for all Mexican stations to be deleted from WDXR. Currently, if a Mexican is a U.S. border station I've included it in the column. It has been argued that a Mexican station belongs in the foreign sections and not WDXR. What is your opinion? Do the Mexicans belong in DXWW instead of WDXR? Please let me know your opinion! ♡

Washington Post 12-8-85, via Gardiner Smith

Second Catholic Radio Closes in Haiti

Stations Went Off the Air After Reporting on Demonstrations

United Press International

PORT-AU-PRINCE, Haiti, Dec. 7—A Catholic radio station in Cap Haitien, Haiti's second largest city, went off the air yesterday following several power outages and telephone threats against the staff, a spokesman said. It was the second station to go off the air following growing unrest in the country.

"Things have been rough. We've had interruptions in electric power and telephone threats," a spokesman for Radio Ave Maria said.

The 5-kilowatt radio station is affiliated with Catholic Radio Soleil, a station ordered off the air late Thursday. Authorities closed down Radio Soleil after it reported on the growing unrest and violence.

[A spokesman for the Washington Office on Haiti, a church-funded group, said two Cabinet ministers visited Radio Soleil on Thursday and ordered the station not to broadcast any news about demonstrations. It was then shut down.]

Four students were killed by police Nov. 28 in Gonaives, the scene of Haiti's food riots last year, and several other demonstrators were wounded.

Although no government-run media issued an official statement on Radio Ave Maria, officials say authorities were unhappy with its antigovernment stand.

Radio Ave Maria sponsored a prayer march following the Nov. 28 deaths in Gonaives, 110 miles north of Port-au-Prince.

The students were killed during a demonstration protesting the July 22 referendum giving President Jean-Claude Duvalier more power.

The government-run National Television repeated an official statement issued by the minister of interior and national security, Jean-Marie Chanoince, announcing that Hubert Deronceray, a former minister of social affairs and delegate to UNESCO, had been arrested in his home Thursday.

Unconfirmed reports suggested that several other people have been arrested in Petit Goave, Cayes and Gonaives, where several demonstrations have been held following the students' deaths.

In Port-au-Prince, a government official said, "The president is in full control of the situation."

Voix d'ave Maria is on 1230 & listed as 1kw in WRTH. R. Soleil is on 1170 with 10kw & widely heard on east coast per Gardiner Smith

A SURVEY OF AVAILABLE MEDIUM WAVE FIELD STRENGTH PREDICTION METHODS

Randall J. Seaver, (c) 1985

1. INTRODUCTION

The prediction of the field strength of Medium Wave radio waves at night has been of interest to the radio broadcasting community since the inception of radio in the 1920's. Predictions are necessary to enable estimation of interference to adjacent and co-channel stations and to permit allocation of new stations.

Field strength predictions are of interest to DXers because they provide a data base for comparison of receptions of individuals. If observed field strengths were consistent with predicted field strengths, then the prediction method could be used to systematically evaluate potential target stations.

The field strength prediction methods described in this survey article have been summarized and defined in:

PoKempner, Margo
"Comparison of Available Methods for Predicting Medium Frequency Sky-Wave Field Strengths",
U.S. Department of Commerce,
National Telecommunications and Information Administration,
Institute for Telecommunications Sciences,
Boulder, CO 80303 USA
NTIA Report 80-42
June 1980
(Available from Dept. of Commerce NTIS as PB80-211444)

The summary of this report is:

"The chronological development of the available methods for predicting medium frequency sky-wave field strengths is presented with a brief discussion of each method. Measured field strengths for 36 medium frequency skywave paths are compared with the predicted field strengths from several prediction methods. Based on the rms errors between observations and predictions, the 1938 Cairo Curves provide the best estimates of the sky-wave field strengths for very long paths worldwide. A new prediction method developed for use in North and South America only, provides improved estimates of the sky-wave field strengths for paths < 3500 km."

The report was concerned only with the reliability of existing methods of predicting long-distance propagation of MF radio waves at night. It was prepared to support the second session of the International Radio Consultative Committee (CCIR in French) of the International Telecommunication Union (ITU) in Buenos Aires in 1981 where a frequency plan of assignments in the MF broadcasting band in North and South America was to be drawn up.

2. AVAILABLE MEASURED FIELD STRENGTH DATA

There are two basic sets of measured field strength data that have been used for comparison of prediction methods. These are:

a) The International Broadcasting Union (IBU) conducted three measurement campaigns in the northern hemisphere during the winters of 1934/5, 1935/6, and 1936/7. The campaigns involved paths ranging from 5000 km to 11900 km and frequencies close to 1000 khz. This resulted in 36 transmission paths which are tabulated in Table 1 below. This data was used to develop the Cairo Curves, which will be discussed in more detail in Section 3.

b) The FCC curves for sky-wave propagation are based on recordings on 500 transmission paths at frequencies ranging from 640 to 1190 khz and distances of 160 to 4000 km during early 1935, and

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an extensive measurement campaign on 27 paths ranging from 300 to 3500 km and transmitting on frequencies from 540 to 1500 khz taken between 1939 and 1944. The FCC curves will be discussed in more detail in Section 3. The measured data for the 27 paths taken in 1944 is presented in Table 2.

All of the data in these tables have been normalized to represent an effective monopole radiated power of 1 kw, thereby removing the effects of transmitter power from the measurements using the standard equation:

$$Fp = 10 \log P \quad \text{(dB)}$$

where P is the effective radiated power in kilowatts

Fp is the field strength gain in decibels relative to 1 μv/m.

3. PREDICTION METHODS

The field strength prediction methods recommended by PoKempner (1980) are presented in the sections below. Full details on their derivation can be found in PoKempner (1980).

TABLE 1. PROPAGATION PATH DATA (1934-1937 IBU DATA)

Path No.	Transmitter Location	Receiver Location	Freq. (khz)	Dist. (km)	Sunspot No.	Observed (dB) *
1	Northern Ireland	Ottawa, Canada	977	4797	100	-14.1
2	Sackville, Canada	Chatonnaye, France	1070	5272	0	2.6
3	Moncton, Canada	Chatonnaye, France	1070	5298	0	0.0
4	Northern Ireland	Washington, DC	977	5346	100	-18.2
5	Rennes, France	Ottawa, Canada	1040	5426	100	-13.5
6A	Rennes, France	New York City	1040	5573	20	-9.0
6B	Rennes, France	New York City	1040	5573	100	-21.0
7	Masirah Is, Oman	Leucate, France	1410	5706	0	18.3
8	New York City	Brussels, Belgium	860	5791	100	-17.0
9A	New York City	Eindhoven, Neth.	860	5839	20	-13.6
9B	New York City	Eindhoven, Neth.	860	5839	100	-15.1
10	Masirah Is, Oman	Limours, France	1410	5884	0	10.8
11	Akita, Japan	Darwin, Australia	770	5885	0	17.5
12	Rennes, France	Washington, DC	1040	5910	100	-18.5
13	Singapore	Brisbane, Australia	790	6055	0	-1.0
14A	New York City	Berlin, Germany	860	6287	20	-19.5
14B	New York City	Berlin, Germany	860	6287	100	-31.0
15	Rome, Italy	Tsumeb, SW Africa	845	6795	0	5.5
16	Martinique	Jurbise, Belgium	1310	7001	0	0.0
17	Ban Phachi, Thai.	Brisbane, Austr.	1580	7198	0	3.0
18	Ismaning, Germany	Tsumeb, SW Africa	1602	7526	0	-1.1
19	Akita, Japan	Brisbane, Austr.	770	7584	0	8.5
20	Bangkok, Thailand	Helsinki, Finland	1580	7882	0	-7.5
21	Cairo, Egypt	Klang, Malaysia	620	7886	0	0.7
22	Rome, Italy	St Denis, Reunion	845	8240	0	9.8
23	Buenos Aires	Washington, DC	1070	8383	0	2.0
24	New York City	Buenos Aires	860	8518	0	2.0
25	Buenos Aires	New York City	1070	8536	0	2.0
26	Pittsburgh, Pa	Buenos Aires	980	8622	0	2.0
27	Akita, Japan	Melbourne, Austr.	770	8644	0	5.0
28	Poro, Philipines	Helsinki, Finland	1140	8791	0	-5.2
29	Buenos Aires	Ottawa, Canada	1070	9043	0	2.0
30	Swan Island	Helsinki, Finland	1157	9333	0	-22.0
31	Kuwait	Darwin, Austr.	1345	9986	0	-7.0
32	Rennes, France	Buenos Aires	1040	10786	100	-9.9
33	Buenos Aires	London	1070	11127	100	-11.5
34	Buenos Aires	Brussels, Belgium	1070	11298	100	-13.5
35	Buenos Aires	Eindhoven, Neth.	1070	11400	100	-7.5
36	Buenos Aires	Berlin, Germany	1070	11903	100	-17.0

* Measured Field Strength in dB relative to 1 μV/m

TABLE 2. PROPAGATION PATH DATA (FCC 1944 DATA)

Path No.	Transmitter Location	Receiver Location	Freq. (khz)	Dist. (km)	Observed (dB) *
US 1	New York City	Baltimore, Md	880	300	44.8
US 2	Des Moines, Iowa	Grand Island, Neb.	1040	425	44.8
US 3	Rochester, NY	Baltimore, Md	1180	430	44.7
US 4	Raleigh, NC	Baltimore, Md	680	432	44.7
US 5	Denver, Colo	Grand Island, Neb.	850	568	46.5
US 6	Cincinnati, Ohio	Atlanta, Ga	1530	592	47.9
US 7	Cincinnati, Ohio	Atlanta, Ga	700	623	44.2
US 8	Minneapolis	Grand Island, Neb.	830	623	38.0
US 9	St. Paul, Minn	Grand Island, Neb.	1500	627	41.2
US 10	Cincinnati, Ohio	Baltimore, Md	700	662	41.5
US 11	Cincinnati, Ohio	Baltimore, Md	1530	687	44.9
US 12	Dallas, Tex.	Grand Island, Neb.	820	898	43.9
US 13	Salt Lake City	Grand Island, Neb.	1160	1155	40.3
US 14	Cincinnati, Ohio	Grand Island, Neb.	700	1203	30.6
US 15	San Antonio, Tex.	Grand Island, Neb.	1200	1262	39.7
US 16	Watrous, Sask.	Portland, Ore.	540	1434	25.6
US 17	Guatemala City	Kingsville, Tex.	1020	1636	37.5
US 18	Belize	Powder Spr., Ga.	834	1850	35.0
US 19	Los Angeles	Grand Island, Neb.	640	1900	23.6
US 20	Dallas, Tex.	Baltimore, Md	820	1959	24.2
US 21	Minneapolis	Portland, Ore.	830	2278	10.4
US 22	St. Paul, Minn.	Portland, Ore.	1500	2305	10.9
US 23	Dallas, Tex.	Portland, Ore.	820	2598	13.9
US 24	Chicago, Ill.	Portland, Ore.	890	2818	0.1
US 25	Cincinnati, Ohio	Portland, Ore.	700	3188	0.1
US 26	New Orleans, La.	Portland, Ore.	870	3297	13.3
US 27	Atlanta, Ga.	Portland, Ore.	750	3494	-1.9

* Median (50%) Measured Field Strengths in dB relative to 1 μV/m for a transmitter power of 1 kW

Cairo Curves

The Cairo Curves are shown in Figure 1. The North-South curve represents trans-equatorial propagation, and the East-West curve represents propagation at high latitudes. The curves are solely a function of distance, and the effects of transmitter power can be added to the predicted field strength. A curve of the inverse distance is also shown; the difference between the inverse distance curve and the other curves is the additional loss due to ground losses, absorption losses, etc.

The original curves were in terms of the quasi-maximum value (exceeded not more than 5% of the time). For the median values, these curves should be reduced by 9 dB, according to the CCIR 1978 meeting.

FCC Curves

There are two sets of the FCC curves for sky-wave propagation. Both sets of curves are contained in the FCC Rules and Regulations.

Figure 2 shows the 1935 data for field strength exceeded 10% and 50% of the time, based on vertical polarization and second hour after sunset at the west end of the path. The 1935 curves were adopted by treaty in 1960 by Canada, Cuba, Mexico, the Dominican Republic and the Bahama Islands and are used for determining frequency assignments for international clear-channel broadcasting stations.

Figure 3 shows the 1944 curves for field strength exceeded 10% and 50% of the time, based on vertical polarization and second hour after sunset at the path midpoint, as a function of geographic latitude and distance. Minimum solar activity occurred in 1944, and the highest skywave field strengths were measured, and therefore this data represents the worst case for determining service areas and interference. These curves are used by the FCC for determining

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frequency assignments for domestic non-clear-channel broadcasting stations.

The FCC curves only extend to a range of about 4000 km, and should not be used beyond that distance.

CCIR 1978 Method

The recommended CCIR (Recommendation 435-3) sky-wave field strength prediction method is:

$$Fo = 106.6 - 2 \sin \phi - 20 \log p - .001\ kr\ p - Lp + Gs$$

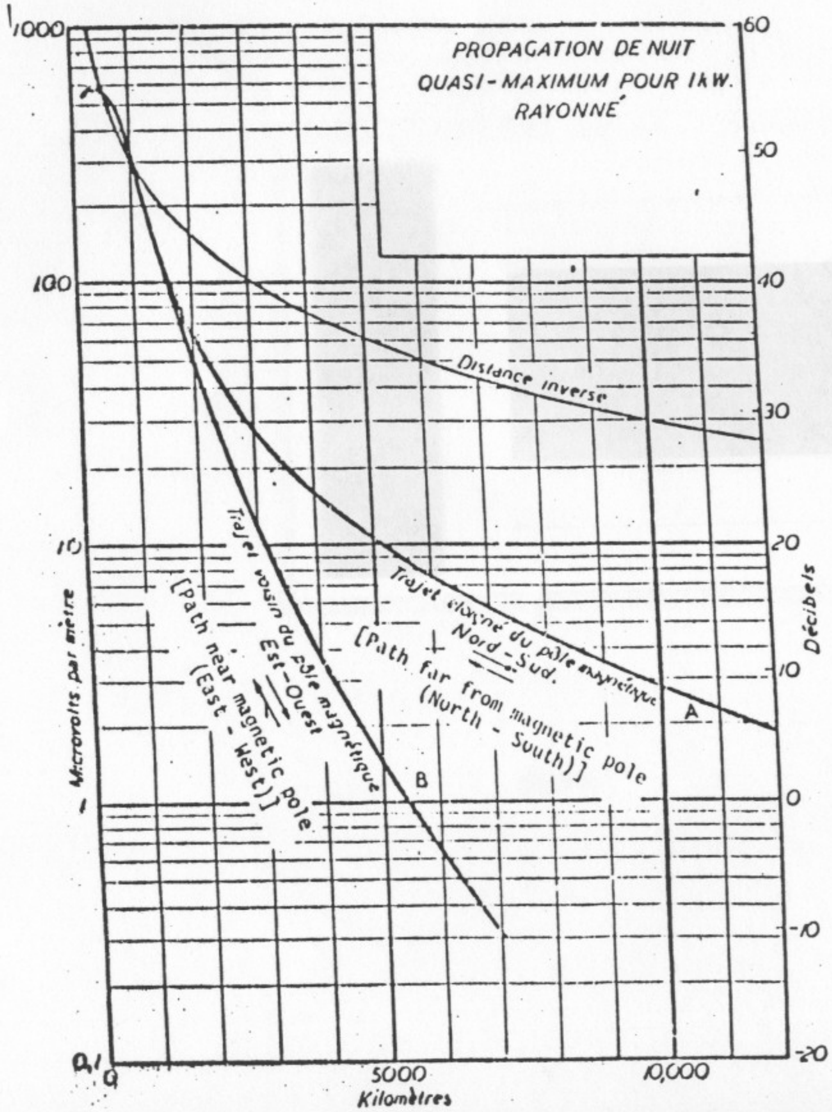

Figure 1. Quasi-maximum field intensity at great distances for propagation at night for a radiated power of 1 kW.

where: Fo is the annual median field strength (dB above μV/m) at the reference time (6 hours after sunset 750 km from the terminal where the sun sets last)

ϕ is a geomagnetic latitude parameter, calculated from the transmitter and receiver geomagnetic latitudes.

p is the slant propagation distance in km, calculated by the equation:

$$p = \sqrt{(d^2 + 4 h^2)} \quad \text{(km)}$$

where d is the ground distance (km)

h is the virtual height of the ionosphere.
h = 100 km for E-layer (f < f')
h = 220 km for F-layer (f > f')

and $f' = 350 + \sqrt{[300^2 + (2.8\ d)^2]}$ (kHz)

kr is a loss factor, defined as:

$$kr = k + .01\ b\ R$$

where $k = 3.2 + 0.19\ (f)^{0.4} \tan^2 (\phi + 3)$

f is frequency in kHz

b is a solar activity dependence factor,
b = 1 for Europe and Australia,
b = 4 for North America
b = 0 elsewhere

R is the 12-month smoothed Zurich sunspot number

Lp is the excess polarization-coupling loss (dB)

Gs is the sea gain correction (dB)

Pokempner (1980) contains the figures and maps required to determine the geomagnetic latitude parameter, the polarization loss and the sea gain.

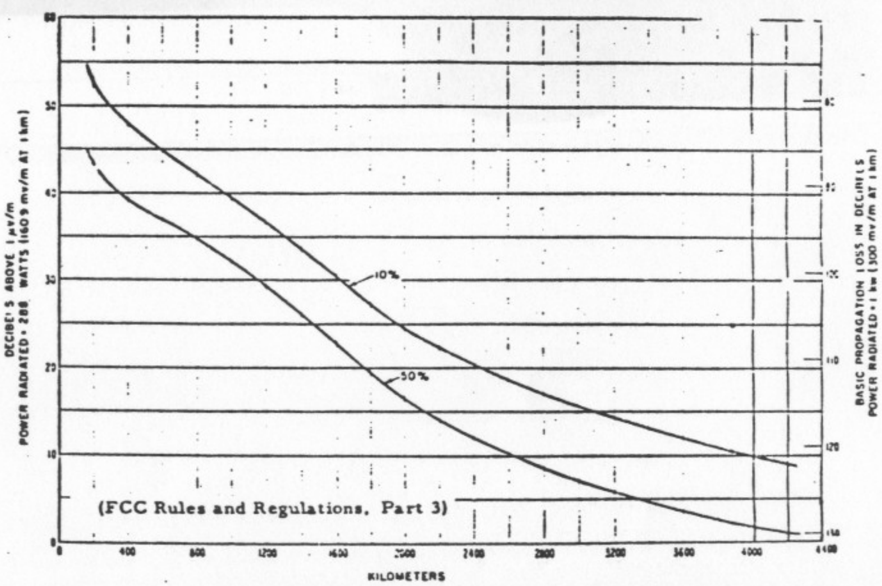

Figure 2. U.S. sky-wave field strength exceeded 10 percent and 50 percent of the time at 1000 kHz. Based on 1935 measurements, vertical polarization, and second hour after sunset at west end of path (Barghausen, 1966).

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Wang 1979 Method

This is a proposed modification of the recommended CCIR 1978 prediction method. Wang suggested that the basic loss factor, k, be changed to:

$$k = (0.0667\,|\phi| + 0.2) + 3\tan^2(\phi + 3) \qquad (\text{for } 0 < \phi < 60 \text{ deg})$$

Wang claimed that this increases the accuracy in high- and low-latitude areas without affecting the prediction in average latitude areas and assumes no frequency dependence.

For the solar activity dependence factor, b, Wang proposed modifying the CCIR fixed values for each continent to:

$$b = 0.4\,|\phi| - 16 \qquad (\text{for } |\phi| > 45 \text{ deg})$$

$$b = 0.0 \qquad (\text{for } |\phi| < 45 \text{ deg})$$

These equations attempt to simulate the auroral zone effects by assigning a high solar activity factor, b, above 45 degrees geomagnetic latitude. Unfortunately, Wang proposed no upper limit on the value of b, and a geomagnetic latitude of 90 degrees results in a b value of 20. An upper value of b = 4 may be more reasonable.

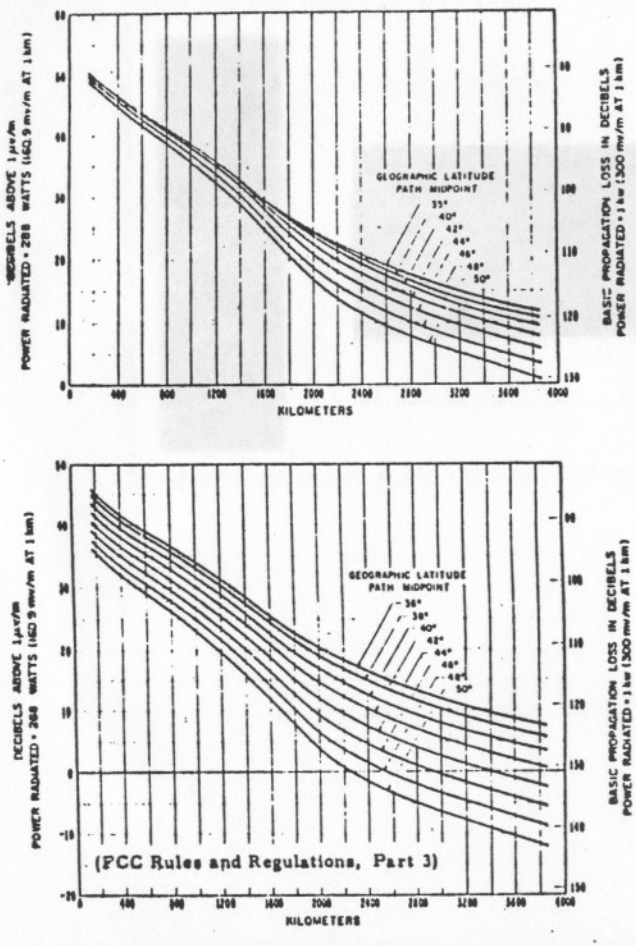

Figure 3. U.S. sky-wave field strength exceeded 10 percent (upper curve) and 50 percent (lower curve) of the time at 1000 kHz. Based on 1944 measurements, vertical polarization, and second hour after sunset at path midpoint (Barghausen, 1966).

Other Methods

PoKempner (1980) lists other methods considered by the CCIR during its evolution of field strength prediction methods. One of the methods considered was that of Knight (1973), which provides graphs and curves for determining the number of hops, ground loss at transmitter and receiver, polarization coupling loss at transmitter and receiver, ionospheric loss, intermediate reflection loss, and corrections for two or more propagation modes. The Knight method was tested for 152 paths by the EBU, but it tended to be laborious and time-consuming, especially for long distance paths. Therefore, the Knight method was not compared with the other methods in the PoKempner report.

4. COMPARISON OF PREDICTED AND MEASURED VALUES

PoKempner (1980) provides the observed and the predicted field strength values for 36 paths measured in the early 1930's, including some paths from which the Cairo Curves were derived. The various CCIR prediction methods were probably developed from most of the 36 paths. Twenty-two of the paths have at least one terminal in North, Central or South America, and the remaining 14 paths are representative of other CCIR regions.

The following conditions were established for the CCIR 1978 and Wang methods:

Fo is the annual median half-hourly median field strengths for an effective monopole radiated power of 1 kw, relative to local midnight at the path midpoint(s). Average ground conductivity is assumed, typically 3 to 10 mS/m; and the antennas are assumed to be omnidirectional short verticals.

However, the Cairo Curves are based on the quasi-maximum measured field strengths, which is about 9 dB above the median field strength. The Cairo Curve data should have 9 dB subtracted from it to be consistent with the CCIR 1978 and Wang methods.

The observed field strength and the predicted field strengths using the Cairo Curves, the CCIR 1978 and the Wang methods are presented in Table 3 for the 36 paths, grouped according to path. The CCIR 1978 and Wang methods include the method for determining sea gain, and this is included where applicable. The Wang method was not used to predict field strengths on the Europe, Africa, Asia and Pacific paths.

Because the Cairo Curves were derived from measured field strengths, the effects of sea gain, polarization loss and solar activity are included in the curves.

The CCIR 1978 and Wang methods predict median field strengths, and should have 9 dB added to them for comparison with the measured field strengths listed, since the measured data is quasi-maximum field strengths. The CCIR 1978 method data has been modified by adding 9 dB to the predicted median field strengths for comparison purposes in the second column for the CCIR 1978 data.

The root-mean-square (RMS) error between the measured and predicted field strength values are also shown in Table 3 for each prediction method.

Table 4 provides a similar comparison of predicted (Cairo Curves, CCIR 1978, and Wang 1979 methods) with observed data for 27 U.S. paths and 5 North America to South America paths. The CCIR 1978 and Wang 1979 predictions include the effects of sea gain where applicable. Due to the relative shortness of the U.S. paths, the 9 dB correction from quasi-maximum Cairo Curve values has not been applied. No sunspot effects are listed since most of the data was taken in one calendar year.

It is extremely difficult to draw valid conclusions from the comparison of prediction methods with the observed data because the reliability of the observed field strengths is uncertain. The IBU data was taken over several years, and at different times of the year. The effects of transmitter height (assumed a short vertical in the Cairo curves), the effect of solar activity and magnetic field effects, diurnal effects (the prediction methods assume path mid-point local midnight), and the known non-reciprocal propagation on East-West paths are other factors that may contribute to the uncertainty of the data.

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Inclusion of the sea gain factor in the CCIR and Wang prediction methods is based on assumed locations of transmitters and receivers. The sea gain correction seems to bring the predicted field strengths on the paths between Europe and the Americas and between the Americas more into line with the observed data, but tends to worsen the correlation of the paths between Europe, Africa, the Mideast, Asia and the Pacific with the observed data. This may occur because the former paths are primarily overwater paths, while the latter paths are primarily overland paths.

On an overall basis, the Cairo curves seem to provide the best correlation with the observed data, with an RMS error of about 8 dB. This should not be surprising, since the Cairo curves were partially based on the observed data.

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TABLE 3 - COMPARISON OF MEASURED AND PREDICTED FIELD STRENGTH VALUES

Path No.	Freq. (khz)	GCD (km)	R	Cairo Curve	CCIR 1978	CCIR + 9 dB	Wang 1979	Observed
1. North America to Europe								
1	977	4797	100	-3.8	-42.0	-33.0	-68.5	-14.1
2	1070	5272	0	-7.6	-17.8*	- 8.8*	-20.4*	2.6
3	1070	5298	0	-7.7	-19.4*	-10.4*	-22.3*	0.0
4	977	5346	100	-8.0	-40.3	-31.3	-61.8	-18.2
5	1040	5426	100	-9.0	-40.2	-31.2	-59.3	-13.5
6	1040	5573	20	-9.8	-21.3*	-12.3*	-23.9*	-9.0
6	1040	5573	100	-9.8	-32.4*	-23.4*	-48.0*	-21.0
8	860	5791	100	-11.5	-29.0*	-20.0*	-48.5*	-17.0
9	860	5839	20	-11.7	-18.4*	- 9.4*	-26.6*	-13.6
9	860	5839	100	-11.7	-30.1*	-21.1*	-50.2*	-15.1
12	1040	5910	100	-12.1	-37.7	-28.7	-50.0	-18.5
14	860	6287	20	-14.4	-22.1*	-13.1*	-30.6*	-19.5
14	860	6287	100	-14.4	-34.7*	-25.7*	-55.5*	-31.0
RMS Error				8.4	17.2	10.1	31.7	
2. North America to South America								
23	1070	8383	0	3.4	-5.7	3.3	9.3	2.0
24	860	8518	0	3.1	1.7*	10.7*	15.6*	2.0
25	1070	8536	0	2.9	0.6*	9.6*	15.0*	-2.0
26	980	8622	0	2.7	-7.2	1.8	7.9	2.0
29	1070	9043	0	1.8	-11.9	- 2.9	3.5	2.0
RMS Error				2.4	8.3	6.9	10.6	
3. South/Central America to Europe								
16	1310	7001	0	6.6	-9.9*	-0.9*	-6.1*	0.0
30	1157	9333	0	1.4	-31.1*	-22.1*	-27.7*	-22.0
32	1040	10774	100	-1.3	-12.2*	- 3.2*	9.1*	-9.9
33	1070	11127	100	-1.8	-17.7*	- 8.7*	3.8*	-11.5
34	1070	11298	100	-2.3	-15.3*	- 6.3*	7.4*	-13.5
35	1070	11400	100	-2.5	-16.0*	- 7.0*	6.8*	-7.5
36	1070	11903	100	-3.2	-18.2*	- 9.2*	5.6*	-17.0
RMS Error				12.5	7.1	4.9	16.1	
4. Europe, Africa, Mideast, and Asia								
7	1410	5706	0	9.6	16.9*	25.9*		18.3
10	1410	5884	0	9.2	4.9*	13.9*		10.8
15	845	6795	0	7.0	11.0*	20.0*		5.5
18	1602	7506	0	5.2	-2.2	6.8		-1.1
20	1580	7882	0	4.6	-7.3*	1.7*		-7.5
22	845	8240	0	3.7	7.6*	16.6*		9.8
28	1140	8791	0	2.3	-9.1*	-0.1*		-5.2
RMS Error				7.2	3.6	8.4		
5. Mideast, Asia and Pacific								
11	770	5835	0	9.2	15.4*	24.4*		17.5
13	790	6055	0	8.9	16.4*	25.4*		-1.0
17	1580	7198	0	6.2	11.0*	20.0*		3.0
19	770	7584	0	5.0	3.1	12.1		8.5
21	620	7886	0	4.6	5.8*	14.8*		0.7
27	770	8644	0	2.6	-2.7	6.3		5.0
31	1345	9988	0	0.4	7.4*	16.4*		-7.0
RMS Error				6.0	9.9	15.8		
TOTAL RMS ERROR				8.2	11.7	10.1	23.4	

* Includes Sea Gain in Calculation

TABLE 4 - COMPARISON OF MEASURED AND PREDICTED FIELD STRENGTH VALUES

NORTH AND SOUTH AMERICAN PATHS

Path No.	Freq. (khz)	GCD (km)	Cairo Curves	CCIR 1978	Wang 1979	Observed
US 1	880	300	46.8	52.8	52.6	44.8
US 2	1040	425	46.8	48.6	48.4	44.8
US 3	1180	430	46.8	48.0	48.0	44.7
US 4	680	432	46.8	49.2	48.8	44.7
US 5	850	568	46.7	45.4	45.1	46.5
US 6	1530	592	46.6	44.7	45.1	47.9
US 7	700	623	46.4	44.8	44.4	44.2
US 8	830	623	46.4	43.3	42.6	38.0
US 9	1500	627	46.4	42.2	42.6	41.2
US 10	700	662	46.2	43.3	42.6	41.5
US 11	1530	687	46.2	41.7	42.1	44.9
US 12	820	898	43.9	39.7	39.3	43.9
US 13	1160	1155	37.5	33.8	33.8	40.3
US 14	700	1203	37.2	33.8	32.5	30.6
US 15	1200	1262	36.6	34.1	34.4	39.7
US 16	540	1434	33.9	27.9	24.3	25.6
US 17	1020	1636	30.6	33.2	34.7	37.5
US 18	834	1850	29.1	30.6	31.4	35.0
US 19	640	1900	28.1	27.2	25.9	23.6
US 20	820	1959	27.7	25.4	24.6	24.2
US 21	830	2278	25.2	16.0	13.7	10.4
US 22	1500	2305	25.0	11.8	13.4	10.9
US 23	820	2598	23.3	18.1	16.9	13.9
US 24	890	2818	21.4	10.6	8.5	0.1
US 25	700	3188	19.1	9.0	5.4	0.1
US 26	870	3297	18.3	11.5	10.5	13.3
US 27	750	3494	17.2	8.4	5.9	-1.9
23	1070	8383	3.2	-5.7	9.3	2.0
24	860	8518	3.0	1.7	15.6	2.0
25	1070	8536	2.8	0.6	15.0	-2.0
26	980	8622	2.5	-7.2	7.9	2.0
29	1070	9043	1.7	-11.9	3.5	2.0
RMS Error			8.2	5.7	5.7	

The CCIR 1978 prediction method is superior to the Wang method, which tends to over-predict the losses due to the Earth's magnetic field on high-latitude intercontinental paths. However, for the North and South American paths of Table 4, the CCIR 1978 and Wang 1979 prediction methods are equal in RMS error, and are both better than the Cairo curves. This is partially due to the Cairo curves being developed from the quasi-maximum field strengths rather than median field strengths as predicted by the CCIR 1978 and Wang 1979 methods. Also, the Wang method was developed specifically for North and South American paths and could be expected to be more usable on those paths.

5. CLOSURE

The major purpose of this article was to publish some of the field strength data and prediction methods available in the open technical literature. It was not intended to be an exhaustive study, but rather a summary and an example of what the broadcasting industry and regulating bodies are doing and have done over the past 50 years in the field of medium frequency propagation.

The author hopes to publish some of his experimental data gathered over the past five years, compared to predicted field strengths, in the future.

6. REFERENCES

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