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Methods Used by IRPL for the Prediction of Ionosphere Characteristics and Maximum Usable Frequencies.

Introduction

This paper describes the method used by the Interservice Radio Propagation Laboratory for long-time world-wide prediction of monthly average critical frequencies and maximum usable frequencies for the regular ionosphere layers. Tables are attached giving the necessary basic data for predicting for the ionosphere observatories which have been operating long enough for their trends to be well established.

The essential basis of long-time predictions is the fact that the critical frequencies and virtual heights of the ionosphere layers are subject to regular variations diurnally, seasonally, and from year to year with the sunspot cycle. These variations repeat themselves in a sufficiently regular manner so that average characteristics can be predicted with reasonable accuracy.

Superposed on the regular variations are random day-to-day variations which are difficult to forecast, and variations due to ionosphere storms, sudden ionosphere disturbances, and other similar phenomena. These day-to-day variations must be taken into account when use is made of average predictions. The present discussion, however, is confined entirely to the prediction of the regular average undisturbed diurnal variations of the ionosphere characteristics and maximum usable frequencies, for various times of year and epochs of the sunspot cycle.

Outline of General Prediction Method

The process of prediction of any quantity whose variations can be associated with a number of causes or periodicities consists principally of (1) analyzing the quantity into parts, each of which can be predicted separately by relating it to some other quantity whose variation can be readily predicted, and (2) recombining the separately predicted parts to obtain the predicted value of the whole.

The analysis which has proved satisfactory at the Interservice Radio Propagation Laboratory has been to break the maximum usable frequencies (m.u.f.), for transmission by a regular layer, at any latitude, into:-

(a) the vertical-incidence critical frequencies (f_c),

(b) factors by which the f_c can be multiplied to obtain the m.u.f. for a standard distance (3500 km).

(c) the relation of the m.u.f. factor for 3500 km to that for any other distance.

The f_c and m.u.f. factors for 3500 km have been considered as made up of three components, of which one varies with the local time of day, another with season of the year, and still another with the epoch of the sunspot cycle. The m.u.f. factor for other distances has been considered as bearing a fairly constant relation to the ones for 3500 km.

Extrapolation of trends manifested in the past for these variations is the basis for predicting future values of f_c and of the m.u.f. at any location for which ionosphere data have been available. Coordination of the predictions for a series of such stations, by determining latitude variations of the values of critical frequency at equal values of local time, and expressing longitude variations as equivalents of diurnal variations, afford the means of making world-wide predictions.

Variations with Sunspot Cycle

Since the ionosphere is produced by radiation from the sun, the variations of that radiation are related to at least some of the variations of the ionosphere. The first step in predicting ionosphere characteristics, therefore, is to predict the amount of ionizing radiation emitted from the sun. It has been found that in general, but not in detail, sunspot numbers are a measure of solar activity and of emission of ionizing radiation. On the average, a high value of sunspot number corresponds to a high value of ionizing radiation and consequent ionization of the earth's atmosphere.* Thus a prediction of the average sunspot number is the first step in making an ionosphere prediction.

Both for the purpose of smoothing out random irregularities and for that of later correlation with non-seasonal ionosphere trends, it has been found convenient to plot the 12-month running average of the monthly average Zurich sunspot number against time. Extrapolation of this curve to the middle of the season for which predictions are to be made affords an estimate of the moving average sunspot number, centered at the middle of that season.

It has been found advantageous to group the various months into seasons in each of which the solar radiation does not vary much. For temperate latitudes the months are thus grouped as follows: (a) November, December, January, February; (b) March, April; (c) May, June, July, August; (d) September, October. For the station of Huancayo, latitude 12°S, however, a preferable seasonal grouping appears to be: (a) October, November, December, January, February, March; (b) April, May; (c) June, July; (d) August, September.

The variation of critical frequency at a station with sunspot cycle, independent of seasonal variation, for any given local time, is conven-

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*"Trends of characteristics of the ionosphere for half a sunspot cycle," by N. Smith, T. R. Gilliland, and S.S.Kirby. J.Research N.B.S. 21, 335 (1938)

iently shown by curves of 12-month running averages of the monthly average critical frequencies plotted against the 12-month running averages of the monthly average Zurich sunspot numbers. These are called trend curves. It is remarkable that such trend curves, for all stations, and for all times of day seem to exhibit approximately the same slope. This circumstance is fortunate in that it enables better extrapolation of such trend curves in cases where there are but few data. Slopes and zero intercepts of the trend curves for several observation stations are presented in Table 1.

From the predicted average sunspot number for a given season, the predicted seasonal value of the 12-month running average of the monthly average critical frequency may be made, for a given station, for any time of day. This is done by extrapolation of a trend curve such as described above. Since for the E and F_1 layers it has been found that the diurnal variation of the critical frequency expressed as percentages of the noon value is independent of sunspot number, it is only necessary to estimate the 12-month running-average critical frequency for one time of day, usually for noon.

In the case of the F-,F_2-layer, there are notable changes in the diurnal variation of critical frequency with the epoch of the sunspot cycle. It has been found convenient to predict first the 12-month running average of the monthly average critical frequencies at the approximate times of the low and high points of the curve of diurnal variation, i.e., at the pre-sunrise minimum and at noon. Similar estimates are made for every fourth hour during the day in order to establish other points on the diurnal curve.

Seasonal Variation

An average seasonal value of the predicted critical frequency is obtained by multiplying the predicted 12-month running-average value for the middle of the season by a "seasonal index", defined as the ratio of the seasonal average to the 12-month running average at midseason. The seasonal indexes manifest in general a sunspot-cycle variation; they are obtained by extrapolation of trend curves in cases where there are sufficient data available to make a correlation between them and the sunspot numbers. Curves are plotted of seasonal indexes vs sunspot numbers, for various times of day. For the F- and F_2-layer data, a reversal of the slope of these curves occurs in temperate latitudes when the season changes from summer to winter, and vice versa; similarly the slopes are opposite in northern and southern hemispheres at the same time. In tropical latitudes for all seasons, and during the equinoctial seasons for north temperate latitudes, the variation of seasonal index with sunspot cycle is small. Similarly, only slight variation of E-layer and F_1-layer noon seasonal indexes occurs with changing sunspot number. Slopes and zero intercepts of the seasonal index trend curves, where these are fairly well established, as well as the average seasonal index, for all years of available data, for several observation stations, are presented in Table 2.

Monthly Variation

If critical-frequency predictions are to be made for a given month, the previously determined seasonal average is multiplied by a "monthly index", which is defined as the ratio of the monthly average critical frequency to the seasonal average critical frequency, for the hour under consideration. Monthly indexes exhibit variation with sunspot cycle, also, although such variations appear to be somewhat less regular with seasonal and latitude change than are those shown by the seasonal indexes. Slopes and zero intercepts of the monthly index trend curves, where these are fairly well established, as well as the average monthly index, for all years of available data, for several observation stations, are presented in Table 3.

Diurnal Variations of E and F_1 Layers

Having thus determined monthly averages of the noon critical frequency for the E or F_1 layer for each station for which data are available, the prediction of the values at other hours is made by multiplying the predicted noon critical frequency by the average ratios of the critical frequency at other hours to that at noon, obtained from all previous data for the same month on a given station.

Construction of World-Wide Prediction Charts

It is convenient to express world-wide predictions of critical frequencies by means of contour charts where longitude is expressed as its equivalent value of local time. To establish the contours on such charts, the times for integral values of the critical frequency(or other values selected for labeling the contour lines) are marked off on the line corresponding to the latitude of each station for which prediction has been made. Since integral values of critical frequency will not, in general, correspond to integral hour values of local time for which the trend curves and diurnal variation ratios have been established, it is convenient to obtain the times of integral values of critical frequencies from previously prepared diurnal curves of critical frequency for each station.

By preparing latitude variation curves among the various coordinated stations for any selected hour of local time, it is also possible to obtain as contour points the latitude locations of integral (or other selected) values of critical frequency. Usually, selection of such latitude variation curves at intervals of four hours is sufficient to delineate the contours adequately. In regions where there is wide separation between contour points, aid in determining the location of contour lines for the E layer is afforded by the well established fact that approximately equal critical frequencies exist for equal intensities of solar radiation. Actually, symmetry seems to exist about a location somewhat to the north of the subsolar point. The E-layer critical-frequency contour lines are hence of shapes similar to lines passing through points equidistant from the subsolar point.

The process of constructing predicted contour charts of F_1-layer critical frequencies is identical with that for the E-layer, except for the above mentioned close correlation between the shape of the contour lines and lines drawn through points of equal solar zenith angle.

Prediction of the Diurnal Variations of F- and F_2-Layer Critical Frequencies.

The hourly values of predicted average F- and F_2-layer critical frequencies for any station are obtained as follows. Hourly indexes are obtained for all available data, by dividing the difference between the hourly and the pre-sunrise minimum critical frequencies by the difference between the noon and pre-sunrise minimum critical frequencies. The mean hourly indexes for the month in question are then multiplied by the predicted value of noon minus pre-sunrise minimum critical frequency, and the predicted pre-sunrise minimum value is added.

Because there is a slight change in shape of the diurnal variation curve with sunspot cycle, it is necessary to consider also the hourly values for selected times of day, predicted from trends previously mentioned. The change in shape is apparent when the sunspot cycle trend curves taken at any station for differing hours of day are examined. The process of applying the average hourly indexes for all past data, while smoothing the shape of the curve, also obliterates all sunspot-cycle variation; an allowance should be made for this effect.

It is ordinarily sufficient for this purpose to obtain predicted values of the critical frequency for every four hours of local time, by reference to independent trend curves of (1) the 12-month running average of monthly average critical frequency, (2) the seasonal indexes, and (3) the monthly indexes. By modifying the predicted diurnal variation curve to include the points thus obtained, a somewhat better prediction of the values of critical frequency at each hour may be effected. Inspection of the progressive change shown in the monthly average diurnal curves of the station for previous years is also useful, and indicates whether further modification is necessary.

It is desirable to construct world-wide F- and F_2-layer contour charts, for the predicted critical frequencies. Once the diurnal variation curves have been made for each station, as well as latitude variation curves correlating the values at each station for the same local time, the process of constructing contour charts is exactly the same as that for the E layer and F_1 layer. In the case of the F and F_2 layers, the variations of critical frequency with intensity of solar radiation are much less regular than for the E or F_1 layers. Therefore the use of lines equidistant from the subsolar point is no aid in establishing the form of the contour lines between predicted points.

Prediction Methods for Regions of Sparse Data

For stations where data establishing diurnal variation are available, but where insufficient past data exist for the delineation of a trend curve, two means of prediction are possible. If the station is within very short distance (2 or 3 degrees of latitude) of another station where sufficient data have accrued for the determination of a trend curve, the trend curve of the other station may be used. In general this is not feasible, so a commoner method is to determine the ratios of noon values of the critical frequency at the new station to those at an older station, for the same month for all available data. The average value of this ratio for the given month is then applied to the predicted value for the older station.

At latitudes where insufficient stations exist for a good determination of contour lines, an approximate determination may sometimes be afforded by applying data for similar latitudes in the opposite hemisphere, for a time six months previous, at the same latitude, with appropriate corrections for latitude and annual variations. Exact reversal between hemispheres of data taken six months apart is not found to occur, even after allowance has been made for variation in sunspot number during the six-month period.

Prediction of Maximum Usable Frequencies

The procedure for construction of predicted maximum usable frequency contour charts, for any desired distance, is similar to the procedure outlined above for critical frequency charts.

Maximum usable frequencies are in general obtained by multiplying the critical frequencies by their respective maximum usable frequency factors, characteristic of the transmission distance stated. Curves are prepared showing diurnal variation of the maximum usable frequency at each station, and the latitude variation among the stations for several constant values of local time, and from them charts are constructed for maximum usable frequencies as above.

The F-,F_2-layer maximum usable frequency factors for a given distance vary with sunspot cycle, season, local time of day, and latitude. Ordinarily measurements of these are furnished by most stations contributing other ionospheric data, but where this is not done, interpolated values obtained from latitude variation curves of the factor at chosen constant values of local time among the stations contributing such factor measurements, must be used.

In the case of the E layer and approximately also the F_1 layer, the m.u.f. factors are nearly constant for all times and latitudes, for any given distance, 4.51 at 1000 miles for the E layer, for example, and 3.87 at 2000 miles for the F_1 layer.

Summary

The method of predicting critical frequencies of all ionospheric layers consists, essentially, of obtaining from all available data, for any observation station, at a given hour of day, the relation between the 12-month running average of monthly average Zurich sunspot number and (a) the 12-month running average of monthly average critical frequency, (b) the ratio of seasonal average critical frequency to the 12-month running average of monthly average critical frequency at midseason (seasonal index), and (c) the ratio of monthly average to seasonal average of critical frequency (monthly index). Extrapolation of the trend curves thus obtained and the time trend of 12-month running average of monthly average Zurich sunspot number to the time for which prediction is to be made gives a set of separately predicted values which may be combined to form the predicted critical frequency. This prediction is made for the noon values of E-layer and F_1-layer critical frequency, and for every four hours, as well as for the pre-sunrise minimum value of the F-,F_2-layer critical frequency.

Predicted monthly average diurnal values of critical frequency for each station are obtained by the aid of hourly indexes. In the case of the E layer and F_1 layer, the hourly index is the average ratio, for all past data on the month of prediction, of the critical frequency for the hour in question to that at noon. This, multiplied by the predicted noon value gives the predicted value for the hour in question. In the case of the F,F_2 layer, the hourly index is the average ratio for all past data on the month of prediction, of the critical frequency for the hour in question to the critical frequency range between noon and the pre-sunrise minimum. This, multiplied by the predicted range, after the predicted pre-sunrise minimum value has been added, gives a predicted value of critical frequency for the hour, which may be adjusted with that determined independently from the trend curves of 12-month running average value, seasonal index, and monthly index.

World-wide predictions are obtained by interpolation and extrapolation of latitude variation curves drawn, for any given hour, between the predicted values for various observation stations.

Maximum usable frequencies are predicted by multiplying the predicted critical frequencies by a factor which, for a given distance, is approximately constant in the case of the E layer and F_1 layer (a different factor for each layer, however). The factor for the F,F_2 layer varies with sunspot cycle epoch, season, hour of day, and latitude, and for a given distance must be predicted by a method similar to that used in the prediction of critical frequency. For any ionospheric layer the ratio of the maximum usable frequency at any selected distance to that at another selected distance is, to a practical approximation, considered constant.

Tables are furnished giving the zero intercepts and slopes of the various trend curves (approximately rectilinear) where these seem fairly well established, and the average values of seasonal and monthly indexes, for several observation stations.

Table 1

12-Month Running Average Monthly Average Sunspot Number - 12-Month Running Average Monthly Average Critical Frequency Trends

Local Time / Station:	f^o_{F,F_2}-Layer Trend									
	Presunrise Minimum		00		04		08		12	
	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2
College, Alaska	2.36	1.64							3.90	4.08
Slough									4.93	4.19
Washington	1.87	2.56	2.29	3.42	1.94	2.70	4.15	3.73	5.29	4.82
Puerto Rico	3.04	2.37	3.78	3.32	3.10	2.53	5.64	3.76	7.30	4.79
Huancayo	2.41	2.75	5.18	3.54	2.83	2.84	6.94	4.44	6.27	5.21
Watheroo	2.76	1.47	3.52	1.99	3.07	1.35	4.56	3.75	6.01	4.16
Mt. Stromlo	2.54	2.01							5.89	3.87

Local Time / Station:	f^o_{F,F_2}-Layer Trend				$f^o_{F_1}$-Layer Trend		f^o_E-Layer Trend	
	16		20		12		12	
	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2	O-Intercept	Slope x 10^2
College, Alaska					3.48	0.53	2.46	0.32
Washington	5.21	4.66	3.76	3.65	4.16	0.69	3.09	0.68
Puerto Rico	7.55	4.53	4.15	3.61	4.36	0.90	3.75	0.63
Huancayo	7.90	3.48	6.97	2.60	4.32	1.22	3.55	0.54
Watheroo	5.69	4.50	3.77	3.12	4.18	1.12	3.04	0.72
Mt. Stromlo					4.19	1.05	3.12	0.65

Table 2 - Seasonal Indexes

Averages, Seasonal Index - 12-Month Running Average Monthly Average Sunspot Number Trends

Winter — Local Time: / Station:	f^o_{F,F_2} Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2
College Alaska	0.824												1.109		
Slough													1.103	1.074	0.056
Washington	0.956	1.086	-0.200	0.830	0.856	-0.046	0.995	1.116	-0.191	1.025	1.021	0.002	1.155	1.075	0.126
Puerto Rico	0.918			0.810			0.911			1.099			0.950		
Huancayo	1.036	1.044	-0.011	1.055	1.076	-0.030	1.029	0.995	0.049	1.080	1.105	-0.033	1.066	1.130	-0.077
Watheroo	1.146	0.958	0.249	1.248	1.225	0.043	1.088	0.929	0.225	0.942	0.966	-0.030	0.956	1.037	0.097
Mt. Stromlo	1.163												0.949	1.079	-0.160

Local Time: / Station:	f^o_{F,F_2} Layer Trend						$f^o_{F_1}$ Layer Trend			f^o_E Layer Trend		
	16			20			12			12		
	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2
College, Alaska							0.818			0.766		
Washington	1.116	0.995	0.165	0.823	0.616	0.284	0.943			0.917	0.915	0.006
Puerto Rico	0.918			0.786			0.980					
Huancayo	1.091	1.136	-0.063	1.084	1.146	-0.087	1.011	1.040	-0.045	1.027	1.060	-0.048
Watheroo	0.953	1.090	-0.193	1.222	1.395	-0.252	1.036	1.004	0.045	1.041	1.060	-0.026
Mt. Stromlo							1.054			1.053		

Table 2 . Seasonal Indexes (continued)

Spring — Local Time; Station	f^o_{F,F_2}-Layer Trend: Presunrise Minimum Average	O-Intercept	Slope x 10^2	00 Average	O-Intercept	Slope x 10^2	04 Average	O-Intercept	Slope x 10^2	08 Average	O-Intercept	Slope x 10^2	12 Average	O-Intercept	Slope x 10^2
College, Alaska	1.133												0.965		
Slough													0.930		
Washington	1.037	1.020	0.053	1.082	1.084	-0.005	1.039	1.032	0.022	1.026	0.991	0.043	1.030	1.054	-0.014
Puerto Rico	0.971			1.107			1.005			1.012			1.130		
Huancayo	0.942	0.951	0.021	0.993	1.140	-0.174	0.942	0.986	-0.022	0.976	0.993	-0.012	0.988	0.966	0.040
Watheroo	0.950	1.085	-0.202	0.942	1.064	-0.189	0.955	1.047	-0.142	1.073	1.260	-0.275	1.107	1.160	-0.060
Mt. Stromlo	1.010												1.089	1.130	-0.037

Local Time; Station	f^o_{F,F_2}-Layer Trend: 16 Average	O-Intercept	Slope x 10^2	20 Average	O-Intercept	Slope x 10^2	$f^c_{F_1}$-Layer Trend: 12 Average	O-Intercept	Slope x 10^2	f^o_E-Layer Trend: 12 Average	O-Intercept	Slope x 10^2
College, Alaska							1.123			1.147		
Washington	1.039	1.018	0.024	1.107	1.139	-0.039	1.046			1.012	1.053	-0.045
Puerto Rico	1.084			1.027			1.056					
Huancayo	0.981	0.960	0.041	0.975	0.984	0.004	0.996	0.992	0.004	0.978	0.956	0.038
Watheroo	1.131	1.277	-0.207	1.026	1.185	-0.230	0.998	1.050	-0.081	0.983	1.007	-0.037
Mt. Stromlo							1.023			1.024		

Table 2 - Seasonal Indexes (continued)

Summer — Local Time: / Station:	f^o_{F,F_2}-Layer Trend: Presunrise Minimum Average	Presunrise Minimum 0-Intercept	Presunrise Minimum Slope x 10^2	00 Average	00 0-Intercept	00 Slope x 10^2	04 Average	04 0-Intercept	04 Slope x 10^2	08 Average	08 0-Intercept	08 Slope x 10^2	12 Average	12 0-Intercept	12 Slope x 10^2
College, Alaska													0.926		
Slough													0.851	0.974	-0.181
Washington	1.036	0.905	0.195	1.117	1.095	0.030	0.989	0.874	0.166	[illegible]	0.928	-0.038	0.788	0.789	-0.020
Puerto Rico	1.099			1.138			1.099			[illegible]			0.948		
Huancayo	0.903	0.840	0.075	0.832	0.695	0.175	0.906	0.884	0.026	[illegible]	0.753	0.061	0.852	0.750	0.123
Watheroo	0.837	0.992	-0.243	0.733	0.855	0.167	0.921	1.145	-0.339	0.968	0.910	0.089	0.966	0.869	0.118
Mt. Stromlo	0.849												0.968	0.826	0.182

Local Time: / Station:	f^o_{F,F_2}-Layer Trend: 16 Average	16 0-Intercept	16 Slope x 10^2	20 Average	20 0-Intercept	20 Slope x 10^2	$f^o_{F_1}$-Layer Trend: 12 Average	12 0-Intercept	12 Slope x 10^2	f^o_E-Layer Trend: 12 Average	12 0-Intercept	12 Slope x 10^2
College, Alaska							1.119					
Washington	0.812	0.873	-0.076	1.105	1.282	-0.235	1.029			1.075	1.069	0.011
Puerto Rico	1.021			1.228			0.999					
Huancayo	0.824	0.765	0.079	0.846	0.758	0.117	0.975	0.922	0.078	0.948	0.935	0.026
Watheroo	0.972	0.863	0.162	0.682	0.620	0.083	0.950	0.953	-0.004	0.952	0.931	0.031
Mt. Stromlo							0.919	-		0.920		

Table 2 - Seasonal Indexes (continued)

Fall

Local Time: / Station:	f^0_{F,F_2} - Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska													1.014		
Slough													1.124	0.904	0.338
Washington	1.007	0.963	0.061	1.037	0.970	0.100	1.024	0.932	0.128	1.134	1.060	0.095	1.079	1.081	0.012
Puerto Rico	0.906			0.958			0.886			1.036			1.093		
Huancayo	1.027	1.235	-0.266	1.002	1.172	-0.230	1.033	1.320	-0.379	0.975	0.980	-0.005	0.977	0.954	0.030
Watheroo	1.117	0.830	0.443	1.092	0.785	0.497	1.048	0.758	0.442	1.138	0.994	0.222	1.016	1.128	-0.147
Mt. Stromlo	0.951												1.069	1.076	-0.010

Local Time: / Station:	f^0_{F,F_2} - Layer Trend						$f^0_{F_1}$ Layer Trend			f^0_E - Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							0.989					
Washington	1.097	1.069	0.035	1.015	0.779	0.295	1.026			1.008	1.007	0.003
Puerto Rico	1.096			0.974			0.997					
Huancayo	0.926	0.912	0.020	0.927	0.919	0.016	0.999	0.970	0.045	1.003	1.006	-0.006
Watheroo	1.041	0.910	0.205	1.171	1.055	0.179	1.035	0.965	0.124	1.042	0.995	0.072
Mt. Stromlo							1.020			1.028		

Table 3 - Monthly Indexes
Averages, Monthly Index - 12 Month Running Average Monthly Average Sunspot Number Trends

January / Local Time: / Station.	f^o_{F,F_2}-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2
College, Alaska	0.842												0.990		
Burghead	0.946												1.104		
Great Baddow	0.909												0.903	1.025	-0.095
Ottawa	1.020												0.939		
Washington	0.975	1.083	-0.163	0.911	0.972	-0.100	0.931	1.124	-0.221	0.912	0.952	-0.068	0.957	0.984	-0.052
Stanford	0.876												0.951		
Puerto Rico	1.032			0.942			1.027			0.900			0.910		
Huancayo	0.782	0.793	-0.012	0.840	0.820	0.032	0.802	0.876	-0.102	0.893	0.925	-0.041	0.922	0.900	0.021
Watheroo	0.899	1.050	-0.212	0.990	0.952	0.053	0.922	1.050	-0.183	0.964	0.986	-0.033	0.959	0.982	-0.037
Mt. Stromlo	0.947												0.925	0.885	0.054

Local Time. / Station:	f^o_{F,F_2}-Layer Trend						$f^o_{F_1}$-Layer Trend			f^c_F-Layer Trend		
	16			20			12			12		
	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2	Average	O-Intercept	Slope x 10^2
College, Alaska							0.854			0.954		
Ottawa							1.013			1.027		
Washington	0.949	0.984	-0.042	0.942	0.872	0.054	0.971			0.993	0.995	-0.001
Stanford							0.976			0.983		
Puerto Rico	0.954			1.008			0.987			1.000		
Huancayo	0.962	0.945	0.029	0.982	0.866	0.166	0.988			0.991	0.995	0.004
Watheroo	0.938	0.996	-0.081	0.955	0.996	-0.060	0.982			1.011	1.032	-0.031
Mt. Stromlo							1.000			1.004		

Table 3 Monthly Indexes (continued)

February — Local Time: / Station:	$f^0_{F F_2}$ Layer Trend — Presunrise Minimum: Average	0-Intercept	Slope x 10^2	00: Average	0-Intercept	Slope x 10^2	04: Average	0-Intercept	Slope x 10^2	08: Average	0-Intercept	Slope x 10^2	12: Average	0-Intercept	Slope x 10^2
College, Alaska	0.960												0.956		
Burghead	0.866												1.013		
Great Baddow	1.061												0.972	1.021	0.034
Ottawa	0.863												0.909		
Washington	1.026	0.960	0.110	1.071	1.003	0.12[illegible]	1.05[illegible]	0.328	0.172	0.986	0.846	0.156	0.974	0.925	0.075
Stanford	1.032												0.949		
Puerto Rico	0.991			0.958			1.038			0.937			1.004		
Huancayo	1.053	1.035	0.025	1.047	1.068	-0.035	1.065	1.058	0.012	0.930	0.895	0.050	0.985	0.886	0.126
Watheroo	0.843	0.899	-0.081	0.876	0.895	-0.035	0.881	0.938	0.086	0.934	0.990	-0.08[illegible]	0.978	0.820	0.195
Mt. Stromlo	0.837												0.992	0.945	0.067

Local Time: / Station:	f^0_{F,F_2}-Layer Trend — 16: Average	0-Intercept	Slope x 10^2	20: Average	0-Intercept	Slope x 10^2	f^0_F Layer Trend — 12: Average	0-Intercept	Slope x 10^2	f^0_E Layer Trend — 12: Average	0-Intercept	Slope x 10^2
College, Alaska							1.083			1.138		
Ottawa							1.063			0.993		
Washington	1.008	0.935	0.098	1.131	1.043	0.151	1.030			1.032	1.025	0.011
Stanford							1.054			1.029		
Puerto Rico	1.041			0.940			1.012			1.006		
Huancayo	0.958	0.927	0.051	0.991	0.926	0.097	0.984			0.984	0.985	0.002
Watheroo	0.939	0.918	0.032	0.916	0.865	0.077	0.975			0.975	0.985	-0.014
Mt. Stromlo							0.979			1.002		

Table 3 - Monthly Indexes (continued)

March — $f^o_{F_2}$-Layer Trend

Local Time / Stations	Presunrise Minimum Average	Presunrise Minimum O-Intercept	Presunrise Minimum Slope x 10^2	00 Average	00 O-Intercept	00 Slope x 10^2	04 Average	04 O-Intercept	04 Slope x 10^2	08 Average	08 O-Intercept	08 Slope x 10^2	12 Average	12 O-Intercept	12 Slope x 10^2
College, Alaska	0.879												1.017		
Burghead	1.087												1.115		
Great Baddow	0.880												1.047	1.021	0.027
Ottawa	0.903												1.067		
Washington	0.994	0.995	-0.008	0.981	0.991	-0.016	1.004	0.994	0.020	1.033	0.990	0.063	1.080	1.065	0.025
Stanford															
Puerto Rico	0.887			0.892			0.951			1.040			1.016		
Huancayo	0.938	0.963	-0.040	1.129	1.190	-0.100	0.962	1.037	-0.123	0.974	1.026	0.081	0.986	0.923	0.127
Watheroo	1.020	1.010	0.015	1.056	1.054	0.004	1.006	0.934	0.114	0.932	0.965	-0.058	0.962	0.985	0.031
Mt. Stromlo	1.056												0.950	0.960	0.004

Local Time / Stations	$f^o_{F_2}$-Layer Trend 16 Average	16 O-Intercept	16 Slope x 10^2	20 Average	20 O-Intercept	20 Slope x 10^2	$f^o_{F_1}$-Layer Trend 12 Average	12 O-Intercept	12 Slope x 10^2	f^o_E-Layer Trend 12 Average	12 O-Intercept	12 Slope x 10^2
College, Alaska							0.972			0.966		
Ottawa							0.983			0.984		
Washington	1.051	1.017	0.068	0.968	0.899	0.101	0.997			0.980	1.085	0.010
Stanford							1.004			1.069		
Puerto Rico	1.040			0.909			1.004			0.989		
Huancayo	0.959	0.954	0.007	0.960	0.970	-0.015	0.988			0.987	1.028	0.067
Watheroo	0.950	0.983	-0.047	1.084	1.220	-0.210	1.017			1.020	1.000	0.031
Mt. Stromlo							1.017			1.022		

Table 3 - Monthly Indexes (continued)

April — Local Time: / Station:	f^o_{F,F_2}-Layer Trend: Presunrise Minimum Average	Presunrise Minimum O-Intercept	Presunrise Minimum Slope x 10^2	00 Average	00 O-Intercept	00 Slope x 10^2	04 Average	04 O-Intercept	04 Slope x 10^2	08 Average	08 O-Intercept	08 Slope x 10^2	12 Average	12 O-Intercept	12 Slope x 10^2
College, Alaska	1.121												0.983		
Burghead	0.913												0.885		
Great Baddow	1.120												0.953	0.985	-0.043
Ottawa	1.097												0.933		
Washington	1.006	0.997	0.014	1.019	1.013	0.017	0.996	0.970	0.046	0.967	1.005	-0.050	0.920	0.935	-0.024
Stanford															
Puerto Rico	1.113			1.108			1.049			0.960			0.984		
Huancayo	0.998	1.100	-0.135	1.124	1.200	-0.103	1.042	1.115	-0.102	1.057	1.100	-0.063	1.051	1.084	-0.042
Watheroo	0.979	1.000	-0.030	0.944	0.958	-0.026	0.994	1.064	-0.107	1.068	1.075	-0.001	1.038	1.030	0.010
Mt. Stromlo	0.944												1.050	1.061	-0.011

Local Time: / Station:	f^o_{F,F_2}-Layer Trend: 16 Average	16 O-Intercept	16 Slope x 10^2	20 Average	20 O-Intercept	20 Slope x 10^2	$f^o_{F_1}$-Layer Trend: 12 Average	12 O-Intercept	12 Slope x 10^2	f^o_E-Layer Trend: 12 Average	12 O-Intercept	12 Slope x 10^2
College, Alaska							1.028			1.034		
Ottawa							1.016			1.016		
Washington	0.948	0.979	-0.050	1.032	1.127	-0.134	1.003			1.019	1.013	0.007
Stanford							0.995			0.931		
Puerto Rico	0.960			1.091			0.999			1.012		
Huancayo	1.087	1.141	-0.068	1.064	1.084	-0.029	1.015			1.030	1.060	-0.040
Watheroo	1.050	1.034	0.026	0.916	0.800	0.191	0.983			0.980	0.986	-0.009
Mt. Stromlo							0.983			0.978		

Table 3 - Monthly Indexes (continued)

May — Local Time: / Station:	f^o_{F,F_2}-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska	1.147												1.104		
Burghead	1.073												1.125		
Great Baddow	1.183												1.124	1.063	-0.049
Ottawa	1.030												1.112		
Washington	1.064	1.005	0.055	1.021	0.970	0.046	1.063	1.005	0.050	1.024	1.053	-0.029	1.042	1.058	-0.008
Stanford	0.948												1.090		
Puerto Rico	1.084			1.062			1.069			1.066			1.089		
Huancayo	1.002	0.923	0.112	0.876	0.800	0.100	0.958	0.893	0.091	0.943	0.900	0.064	0.949	0.897	0.068
Watheroo	1.019	0.962	0.082	1.027	1.032	-0.008	1.052	1.065	-0.018	1.082	1.140	-0.086	1.091	1.154	-0.081
Mt. Stromlo	1.038												1.078	0.955	0.120

Local Time: / Station:	f^o_{F,F_2}-Layer Trend						$f^o_{F_1}$-Layer Trend			f^o_E-Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							1.055			1.009		
Ottawa							1.062			1.091		
Washington	1.063	1.095	-0.041	1.021	1.046	-0.031	1.005			0.984	0.975	0.005
Stanford							0.840			0.918		
Puerto Rico	1.075			1.028			1.028			1.030		
Huancayo	0.913	0.856	0.074	0.936	0.910	0.040	0.985			0.971	0.949	0.026
Watheroo	1.122	1.050	0.048	1.029	0.929	0.143	0.994			0.996	1.017	-0.032
Mt. Stromlo							1.010			1.006		

Table 3 - Monthly Indexes (continued)

June — Local Time: / Station:	f^o_{F,F_2}-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska	1.113												1.006		
Burghead	1.177												1.030		
Great Baddow	1.127												1.014	0.994	-0.004
Ottawa	1.091												1.004		
Washington	1.011	1.030	-0.023	1.045	1.100	-0.089	1.009	1.070	-0.078	1.005	1.131	-0.191	0.977	1.044	-0.096
Stanford	1.131												1.025		
Puerto Rico	1.000			1.053			0.998			1.057			1.002		
Huancayo	0.998	1.088	-0.130	0.995	0.976	0.028	0.993	1.078	-0.126	1.007	1.017	-0.009	1.006	1.025	-0.018
Watheroo	1.007	1.021	-0.016	0.976	1.006	-0.051	1.037	0.995	0.053	0.961	0.983	-0.034	0.979	0.960	0.030
Mt. Stromlo	1.052												0.956	0.961	-0.001

Local Time: / Station:	f^o_{F,F_2}-Layer Trend						$f^o_{F_1}$-Layer Trend			f^o_E-Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							1.026			1.036		
Ottawa							0.996			0.959		
Washington	0.994	1.045	-0.068	0.987	1.001	-0.001	1.000			1.008	1.025	-0.005
Stanford							1.070			1.032		
Puerto Rico	1.016			1.046			0.984			0.979		
Huancayo	1.015	1.029	-0.021	1.009	1.030	-0.030	0.996			0.994	0.980	0.020
Watheroo	0.982	0.995	-0.013	0.899	1.044	-0.206	0.979			0.982	0.993	-0.018
Mt. Stromlo							0.978			0.974		

Table 3 - Monthly Indexes (continued)

July — f^o_{F,F_2}-Layer Trend

Station / Local Time	Presunrise Minimum Average	Presunrise Minimum 0-Intercept	Presunrise Minimum Slope x 10²	00 Average	00 0-Intercept	00 Slope x 10²	04 Average	04 0-Intercept	04 Slope x 10²	08 Average	08 0-Intercept	08 Slope x 10²	12 Average	12 0-Intercept	12 Slope x 10²
College, Alaska	0.809												0.946		
Burghead	0.933												0.932		
Great Baddow	0.901												0.940	0.955	-0.010
Ottawa	0.939												0.933		
Washington	0.968	0.960	0.025	0.998	0.966	0.037	0.962	0.969	0.009	0.964	0.960	0.007	0.972	0.994	-0.045
Stanford	0.948												0.959		
Puerto Rico	0.972			0.976			0.987			0.930			0.934		
Huancayo	1.004	0.915	0.125	1.005	1.020	-0.024	1.007	0.920	0.128	0.993	0.990	0.005	0.993	0.975	0.024
Watheroo	0.933	0.967	-0.050	0.946	0.979	-0.044	0.941	0.990	-0.068	0.941	0.914	0.039	0.928	0.920	0.010
Mt. Stromlo	0.960												0.954	0.970	-0.008

Station / Local Time	f^o_{F,F_2}-Layer Trend 16 Average	16 0-Intercept	16 Slope x 10²	f^o_{F,F_2}-Layer Trend 20 Average	20 0-Intercept	20 Slope x 10²	$f^o_{F_1}$-Layer Trend 12 Average	12 0-Intercept	12 Slope x 10²	f^o_E-Layer Trend 12 Average	12 0-Intercept	12 Slope x 10²
College, Alaska							0.979			0.996		
Ottawa							0.973			0.992		
Washington	0.954	0.946	0.010	0.975	0.943	0.053	0.987			1.010	1.015	-0.003
Stanford							1.057			1.001		
Puerto Rico	0.914			0.984			0.988			0.994		
Huancayo	0.985	0.976	0.020	0.991	0.982	0.018	1.003			1.006	1.027	-0.028
Watheroo	0.945	0.926	0.030	0.907	0.989	-0.117	0.997			0.987	0.981	0.014
Mt. Stromlo							0.987			0.982		

Table 3 - Monthly Indexes (continued)

August — Local Time: / Station:	f^o_{F,F_2}-Layer Trend: Presunrise Minimum, Average	Presunrise Minimum, 0-Intercept	Presunrise Minimum, Slope x 10^2	00, Average	00, 0-Intercept	00, Slope x 10^2	04, Average	04, 0-Intercept	04, Slope	08, Average	08, 0-Intercept	08, Slope x 10^2	12, Average	12, 0-Intercept	12, Slope x 10^2
College, Alaska	0.925												0.940		
Burghead	0.818												0.913		
Great Baddow	0.789												0.922	1.120	-0.120
Ottawa	0.939												0.951		
Washington	0.957	0.993	-0.047	0.936	0.930	0.057	0.966	0.925	0.068	1.007	0.932	0.138	1.009	0.939	0.113
Stanford	0.972												0.926		
Puerto Rico	0.944			0.908			0.945			0.947			0.975		
Huancayo	0.948	0.962	0.006	0.943	0.887	0.105	0.956	0.900	0.093	0.911	0.920	-0.015	0.951	0.907	0.058
Watheroo	1.043	1.022	0.032	1.050	0.981	0.106	0.971	0.975	0.011	1.015	1.060	-0.028	1.002	1.041	-0.035
Mt. Stromlo	0.946												1.011	0.954	0.070

Local Time: / Station:	f^o_{F,F_2}-Layer Trend: 16, Average	16, 0-Intercept	16, Slope x 10^2	20, Average	20, 0-Intercept	20, Slope x 10^2	$f^o_{F_1}$-Layer Trend: 12, Average	12, 0-Intercept	12, Slope x 10^2	f^o_E-Layer Trend: 12, Average	12, 0-Intercept	12, Slope x 10^2
College, Alaska							0.940			0.959		
Ottawa							0.973			0.959		
Washington	0.989	0.951	0.077	1.016	1.062	-0.041	1.007			0.999	0.995	0.005
Stanford							1.033			1.048		
Puerto Rico	0.996			0.942			1.002			0.996		
Huancayo	0.929	0.954	-0.022	0.950	0.935	0.032	0.994			0.986	1.008	-0.031
Watheroo	0.951	1.020	-0.066	1.164	1.159	0.044	1.029			1.034	1.078	-0.049
Mt. Stromlo							1.025			1.040		

Table 3 - Monthly Indexes (continued)

September — Local Time: / Station:	f^o_{F,F_2}-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska	1.036												0.945		
Burghead	0.956												0.964		
Great Baddow	1.064												0.956	0.951	0.007
Ottawa	0.986												0.934		
Washington	0.964	0.870	0.144	0.988	0.972	0.041	0.961	0.860	0.154	0.910	0.978	-0.038	0.896	0.918	-0.043
Stanford	0.983												0.944		
Puerto Rico	1.083			1.055			1.079			0.939			0.958		
Huancayo	1.052	1.044	-0.010	1.057	1.128	-0.123	1.043	1.105	-0.100	1.089	1.082	0.007	1.048	1.144	-0.122
Watheroo	0.943	1.047	-0.139	0.915	0.935	-0.025	0.955	1.045	-0.120	1.024	1.000	0.031	0.997	0.896	0.131
Mt. Stromlo	0.889												1.030	1.008	[illegible]

Local Time: / Station:	f^o_{F,F_2}-Layer Trend						$f^o_{F_1}$-Layer Trend			f^o_E-Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							1.069			1.061		
Ottawa							1.035			1.000		
Washington	0.892	0.967	-0.072	1.066	1.168	-0.142	1.014			1.026	1.030	-0.002
Stanford							1.000			1.013		
Puerto Rico	0.996			1.109			1.007			1.023		
Huancayo	1.071	1.055	0.011	1.049	1.069	-0.039	1.006			1.013	0.990	0.029
Watheroo	0.998	0.957	0.055	0.946	0.892	0.069	0.989			0.999	0.984	0.022
Mt. Stromlo							0.990			0.990		

Table 3 - Monthly Indexes (continued)

October / Local Time / Station	f^o_{F,F_2}-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska	0.964												1.056		
Burghead	1.044												1.036		
Great Baddow	0.936												1.043	1.054	-0.005
Ottawa	1.014												1.066		
Washington	1.035	1.105	-0.121	1.021	1.043	-0.043	1.039	1.159	-0.159	1.089	1.293	-0.219	1.109	1.100	0.027
Stanford	1.017												1.056		
Puerto Rico	0.917			0.945			0.921			1.061			1.042		
Huancayo	1.148	1.312	-0.221	1.190	1.354	-0.229	1.158	1.256	-0.133	1.112	1.090	0.030	1.008	1.080	-0.085
Watheroo	1.058	0.955	0.135	1.085	1.078	0.008	1.045	0.950	0.124	0.976	1.008	-0.044	1.002	1.120	-0.149
Mt. Stromlo	1.112												0.970	0.974	0.000

Local Time / Station	f^o_{F,F_2}-Layer Trend						$f^o_{F_1}$-Layer Trend			f^o_E-Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							0.930			0.939		
Ottawa							0.965			1.000		
Washington	1.108	1.110	-0.001	0.934	0.864	0.116	0.986			0.974	0.980	-0.005
Stanford							1.000			0.987		
Puerto Rico	1.004			0.891			0.993			0.977		
Huancayo	1.030	1.038	-0.010	1.041	1.041	-0.006	1.011			1.010	0.985	0.035
Watheroo	1.002	1.054	-0.072	1.054	1.110	-0.078	1.011			1.000	1.024	-0.029
Mt. Stromlo							1.010			1.010		

Table 3 - Monthly Indexes (continued)

November / Local Time: / Station:	$f^o_{F_0F_2}$-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska	1.124												1.011		
Burghead	0.946												0.946		
Great Baddow	1.061												1.087	0.795	0.480
Ottawa	1.059												1.076		
Washington	0.991	0.897	0.121	1.073	0.990	0.115	0.973	0.650	0.492	1.129	1.105	0.035	1.060	1.040	0.030
Stanford	1.083												1.114		
Puerto Rico	0.978			1.072			0.952			1.112			1.134		
Huancayo	1.086	0.965	0.169	0.964	0.840	0.170	1.040	0.943	0.149	1.080	1.066	0.019	1.078	1.141	-0.076
Watheroo	1.132	0.951	0.245	1.059	1.028	0.039	1.090	0.887	0.274	1.100	0.996	0.139	1.073	1.103	-0.060
Mt. Stromlo	1.018												1.062	1.155	-0.113

Local Time: / Station:	$f^o_{F_0F_2}$-Layer Trend						$f^o_{F_1}$-Layer Trend			f^o_E-Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							1.064			1.000		
Ottawa							0.987			0.993		
Washington	1.067	1.075	-0.005	1.015	0.684	0.436	1.029			1.004	0.996	0.012
Stanford							1.000			1.016		
Puerto Rico	1.054			1.042			0.994			1.009		
Huancayo	1.050	1.071	-0.031	1.005	1.114	-0.149	1.012			1.012	0.988	0.034
Watheroo	1.110	1.064	0.061	1.065	1.030	0.042	1.032			1.001	0.999	0.005
Mt. Stromlo							0.999			0.986		

Table 3 - Monthly Indexes (continued)

December — Local Time: / Station:	f^o_{F,F_2}-Layer Trend														
	Presunrise Minimum			00			04			08			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska	1.075												1.043		
Burghead	1.243												1.243		
Great Baddow	0.969												1.038	1.080	-0.108
Ottawa	1.059												1.076		
Washington	1.008	1.174	-0.239	0.944	1.042	-0.136	1.025	1.180	-0.225	0.973	1.025	-0.069	1.009	1.046	-0.045
Stanford	1.009												0.986		
Puerto Rico	1.001			1.027			0.982			1.050			0.952		
Huancayo	0.988	0.939	0.067	0.830	0.722	0.154	0.972	0.791	0.259	1.007	1.003	0.003	1.022	1.060	-0.044
Watheroo	1.125	1.081	0.060	1.076	1.127	-0.074	1.107	1.080	0.036	1.002	1.022	-0.026	0.989	0.918	0.056
Mt. Stromlo	1.200												1.020	1.032	-0.012

Local Time: / Station:	f^o_{F,F_2}-Layer Trend						$f^o_{F_1}$-Layer Trend			f^o_E-Layer Trend		
	16			20			12			12		
	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2	Average	0-Intercept	Slope x 10^2
College, Alaska							0.999			0.909		
Ottawa							0.937			0.993		
Washington	0.976	0.977	0.003	0.912	0.983	-0.105	0.970			0.971	0.966	0.005
Stanford							0.969			0.973		
Puerto Rico	0.950			1.009			1.006			0.986		
Huancayo	1.040	1.079	-0.059	1.020	1.075	-0.084	1.018			1.012	1.031	-0.030
Watheroo	1.013	1.037	-0.036	1.064	1.105	-0.062	1.011			1.014	0.995	0.027
Mt. Stromlo							1.021			1.004		