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GEOPHYSICAL VARIABLES AND HUMAN BEHAVIOR: VIII. SPECIFIC PREDICTION OF UFO REPORTS WITHIN THE NEW MADRID STATES BY SOLAR-GEOMAGNETIC AND SEISMIC MEASURES

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Summary.—Seismic and solar-geomagnetic variables that involved absolute measures and the percent change in these measures during 6-mo. intervals for the years 1952 and 1969 were used to predict numbers of UFO reports within the six states surrounding the New Madrid area in the central U.S.A. Expected values from sample optimal equations with multiple *r*s larger than 0.83 involving 5 or 6 lagged variables were compared to observations not involved with calculation of the equations. Optimal equations predicted all of the major "UFO flaps" within this region as well as some other minor increases not evident in the observed measures. Predicted UFO variations for the years 1970 to 1982 are presented.

The hypothesis that so-called UFOs (unidentified flying objects) are natural luminous phenomena generated by as yet unspecified processes associated with tectonic strain within the earth's crust (Persinger, 1976, 1979) has been supported empirically. Bivariate analyses first indicated that UFO reports (1) clustered in earthquake-prone regions (Persinger & Lafrenière, 1977) and (2) increased during the 6-mo. period before increased numbers of low intensity (IV or less) earthtremors (Persinger, 1980). Subsequent multivariate analyses indicated that appropriate selection of seismic and solar-geomagnetic variables could explain more than 80% of the variance in UFO reports sampled from a 17-yr. period (Persinger, 1981).

Since the ultimate test of a hypothesis involves its predictive capacity, a third series of analyses were designed to compare predicted UFO report measures with data not involved with the computation of the initial equations. To verify further the intrinsic consistency and general application of this concept, the analyses were completed with a data source, an area, and a temporal analysis increment that were not involved in previous investigations.

Numbers of monthly UFO reports for the years 1951 to 1977 were obtained from the UFOCAT file (Center for UFO Studies, Evanston, Illinois, 60201) for the six states (Illinois, Indiana, Kentucky, Tennessee, Arkansas, and Missouri) around the New Madrid Region (a moderately active seismic area in the central U.S.A.). Numbers of different intensity (MM, Modified Mercalli) seismic events were obtained for these six states and for the 16 states surrounding this key area.

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For the years 1945 to 1979, the seismic data were obtained from the yearly U.S. Earthquake publications (U.S. Department of Commerce) while geomagnetic and solar data were obtained from the *Journal of Geophysical Research.* Contemporary earthquake data were determined from the *Preliminary Determination of Epicenters* (U.S. Geological Survey) while the solar-geomagnetic data were calculated from the *Preliminary Report* and *Forecast of Solar-Geophysical Data* (NOAA) and *Solar Bulletin* (R. B. Ammons for the American Association of Variable Star Observers).

Since a 6-mo. analysis interval (January-June and July-December) was selected on the bases of previous maximum bivariate correlations between UFO reports and later earthquake activity, all UFO, earthquake, and solar-geomagnetic variables were calculated appropriately. Six-month *totals* of intensity V or less, VI, or VII or more quakes for the six states were called MALOW, MVI, and MVII, respectively, while these intensities for the surrounding states were called EXLOW, EXVI, and EXVII, respectively.

The total $\leq$ V intensity, VI, or $\geq$ VII earthquakes for the six states and the surrounding areas together were called ALLOW, TVI, and TVII. Since rates of change are important considerations for many strain effects (Hamada, 1981; Honkura, 1981), the percent change in MALOW (+1), EXLOW (+1), and ALLOW (+1) were calculated by dividing the absolute difference in numbers of tremors between the current interval and the previous interval by the number of tremors of the current interval (multiplied by 100). To eliminate the effects of a possible 0 in a denominator, the +1 was added to these variables for the calculation of the percent change measures only. The percent change variables (MALOCH, EXLOCH, and ALLOCH) were truncated to 100% to attenuate the effects of outliers. UFO report numbers involved absolute totals per 6-mo. interval (UFOSIX) and the square root (SQCUF) of UFOSIX.

A number of variables were generated from the monthly A_P measures of geomagnetic activity. The mean of the six monthly averages was called APAVE while the mean of the single most intense daily A_P index for each month was called APMAX. Since certain types of geomagnetic variation were predicted by more complex extrapolations of the hypothesis[2] to be critical "trigger" events for analysis intervals of 6 mo. or less, three other geomagnetic variables: AAVSD, APACH, and MAGPOW were calculated.

AAVSD (simple variation within the increment) was the standard deviation of the six monthly A_P averages, APACH (relative variation between increments) was the percent change in APAVE from the previous 6-mo. increment (truncated at $\pm$ 100%), and MAGPOW (a mean-weighted variation)

[2]M. A. Persinger, Prediction of UFO events and experience, 1981. (Manuscript submitted for publication)

was the square root of APAVE to the 1.5 power plus the absolute change in APAVE from the previous interval squared. The square root of the average sunspot numbers (6-mo., mean of the monthly averages) was SUNSQ and the percent change in SUNSQ from the previous increment was SQSCH. The means, standard deviations, and skewness values for all variables are shown in Table 1. All calculations and operations were completed using SPSS software.

TABLE 1

MEANS (M), STANDARD DEVIATIONS (SD), AND SKEWNESS (SK) VALUES OF THE VARIOUS SEISMIC, SOLAR-GEOMAGNETIC AND UFO REPORT MEASURES OF SIX-MONTH INTERVALS ($n = 40$) BETWEEN 1950 THROUGH 1969

	M	*SD*	*SK*		*M*	*SD*	*SK*
MALOW	1.98	1.46	0.46	ALLOCH	11.01	60.47	0.30
EXLOW	3.05	2.84	2.22	APAVE	15.35	5.25	0.53
MVI	0.43	0.71	1.85	APACH	3.00	29.60	1.06
MVII	0.05	0.22	4.29	AAVSD	4.28	2.53	1.79
EXVI	0.43	0.81	2.66	APMAX	61.58	27.50	1.39
EXVII	0.05	0.22	4.29	MAGPOW	8.59	2.66	1.31
ALLOW	5.03	3.69	1.98	SUNSQ	8.00	3.57	0.11
TVI	0.85	1.03	1.21	SQSCH	2.91	27.42	0.88
TVII	0.10	0.30	2.77	CUFSIX	93.12	91.55	3.14
MALOCH	11.25	57.98	0.36	SQCUF	8.93	3.70	1.73
EXLOCH	7.14	65.01	0.36				

Each variable was lagged (LAG) from 1 to 8, 6-mo. increments or 4 yr. (a total of eight variables for each source variable). Since AAVSD was predicted as a "trigger" variable, the no lag as well as the eight lags were allowed. As a separate check for the possible effects of skewness, square root values were computed for the low and VI intensity earthquake variables and for APAVE, APMAX, and AAVSD (all skewness values were reduced to $\leq$ 1.00). These variables were also lagged and allowed to enter in separate analyses.

The primary analysis procedure involved step-wise multiple regression (REGRESSION). For each dependent variable (either CUFSIX or SQCUF), the following combinations of lagged variables were allowed to enter: (1) quake measures from the six states only, (2) quake measures from the surrounding states only, (3) combinations of 1 and 2, (4) totals of both areas, and (5) all of the above plus geomagnetic solar variables. Cut-off criteria for the selection of variables for each analysis was based upon a r^2 change of greater than 5% per variable or a maximum of seven variables. A second analysis was then completed using those variables *only*.

Earlier work indicated a clear change in the slope in cumulative numbers of UFO reports in the UFOCAT file between the years 1965 and 1968. As one test to determine whether or not this change reflected altered sampling procedures or was due to other stimulus sources, the above analyses were completed on UFO reports for the periods 1952-1965 and 1952-1969. In addition, another series of analyses was performed on the 1952-1969 period where 50 had been subtracted from CUFSIX for each of the (5) 6-mo. intervals for the years 1965:2 (the second half of 1965) to 1967:2. This operation was instituted to accommodate what appears to be the contribution of either social facilitation or sampling procedure shifts in the CUFOS data pool. Comparison of this sample from another, reported in FATE magazine (Persinger, 1981), also indicated the major discrepancy within those increments.

To allow possible generalization of results to other data samples (with different numerical values), the optimal variables for both CUFSIX and SQCUF for the 1952-1965 ($n = 28$) and 1952-1969 ($n = 36$) analyses were re-entered to predict the percent variation of UFO reports around the mean for that period. For the 1952-1965 period, 6-mo. measures of UFO reports were subtracted from 66.8; this quantity was divided by 66.8 and the final value was multiplied by 100. The 1952-1969 period involved the mean 95.8. All analyses were completed on a DecSystem-20 computer.

Four of the most optimal (maximum multiple r values and smallest standard

TABLE 2

SAMPLE OPTIMAL EQUATIONS FOR PREDICTION OF UFO REPORT MEASURES WITHIN THE NEW MADRID STATES

	REQ1 ($n = 36$)	RSQ2 ($n = 28$)	RSQ3 ($n = 36$)	QSQ4 ($n = 36$)
X_1	APAVE4	AAVSD	MAGPOW2	APAVE4
B(SEB)	−12.43 (1.69)	5.96 (1.31)	−8.26 (1.60)	−17.86 (7.15)
X_2	TVII3	AAVSD3	TV16	AAVSD
B(SEB)	149.9 (32.2)	−4.41 (1.23)	−18.8 (4.07)	56.44 (8.17)
X_3	AAVSD	TV16	AAVSD	TV12
B(SEB)	21.19 (3.84)	−8.47 (2.93)	7.09 (1.71)	−24.33 (6.03)
X_4	TV12	TV12	APAVE8	TV16
B(SEB)	−29.15 (9.61)	−15.36 (3.48)	−2.21 (0.82)	−24.28 (5.91)
X_5	MAGPOW8	ALLOW5	ALLOCH6	ALLOW6
B(SEB)	−20.23 (4.31)	3.12 (0.96)	0.16 (0.07)	17.56 (4.86)
X_6	SQSCH5	APAVE4		MAGPOW1
B(SEB)	−1.58 (0.41)	−1.86 (0.69)		48.67 (13.89)
Constant	307.90	32.10	90.60	86.95
MR	0.88	0.86	0.84	0.87
AMRS	0.73	0.72	0.66	0.71
SEE	52.18	16.56	24.61	21.90
F	16.34	12.67	14.34	15.06
D-W	2.04	2.31	1.80	1.96
GIC	−0.50	0.40	−0.27	0.60

errors of the estimate) for the percent variation of UFO reports around the mean within the New Madrid States are shown in Table 2. For each equation, the various independent variables (lag increment is the last number), their partial regression coefficients (B) and their standard errors (SEB) are specified. The following equation data are also given: the constant, the multiple r (MR), the adjusted multiple r^2 (AMRS), the standard error of the estimate (SEE), the F values (F), the results of the Durbin-Watson test (D-W) and the greatest zero-order intercorrelation for any two independent variables.

The first equation REQ1 involved total UFO reports between the years 1952-1969 and raw geophysical-solar data while RSQ2 and RSQ3 were calculated from the square root of the UFO reports and absolute physical data for the years 1952 to 1965 and 1952 to 1969. The final equation involved square roots of the UFO reports (after the subtraction [—50] operation for 1965-1967) and square roots of the appropriate physical data for 1952-1969. For comparison, the actual means ± SEE for numbers of UFO reports for these equations were: REQ1 (95.8 ± 49.9), RSQ2 (7.81 ± 1.29), RSQ3 (9.05 ± 2.23), and QSQ4 (8.95 ± 1.92).

Fig. 1 displays the predicted and observed values for only the last portion (the bars with the diagonal lines) of the increments from which the equations were generated. Observed values after these periods were *not* involved with the generation of the equations and the predicted values were computed from the information in Table 2. Note the observed values terminated in 1977 and the predicted value for 1982:1 was based upon the solar-geophysical data collected for the first 4 mo. only.

All equations predicted the beginning of the 1973 flap while only the last three equations predicted the maintained reduction in UFO report numbers (until 1977) after that period. Clearly the square root equation, QSQ4, demonstrated the best fit for both data involved with its calculation and later observations. For reasons that are not clear, all equations were one increment early in the predicted maximum of UFO reports for the 1973 flap (which peaked in October, 1973).

Two important features emerged. First, RSQ2, whose calculation did *not* involve any data after 1965, accurately predicts not only the 1966-1967 elevation in reports but also the 1969 and early 1973 flap. Interestingly, equations generated from other non-UFOCAT data samples for: (1) a larger area and a year analysis increment (Persinger, 1981) and (2) these six states using 6-mo. increments (unpublished analyses), for the years 1949 to 1965, also predict a shift in baseline UFO reports after 1965. These patterns suggest that the elevation in UFOCAT report numbers may at least partially reflect processes other than data sampling.

The second major feature is the consistent prediction of elevated UFO

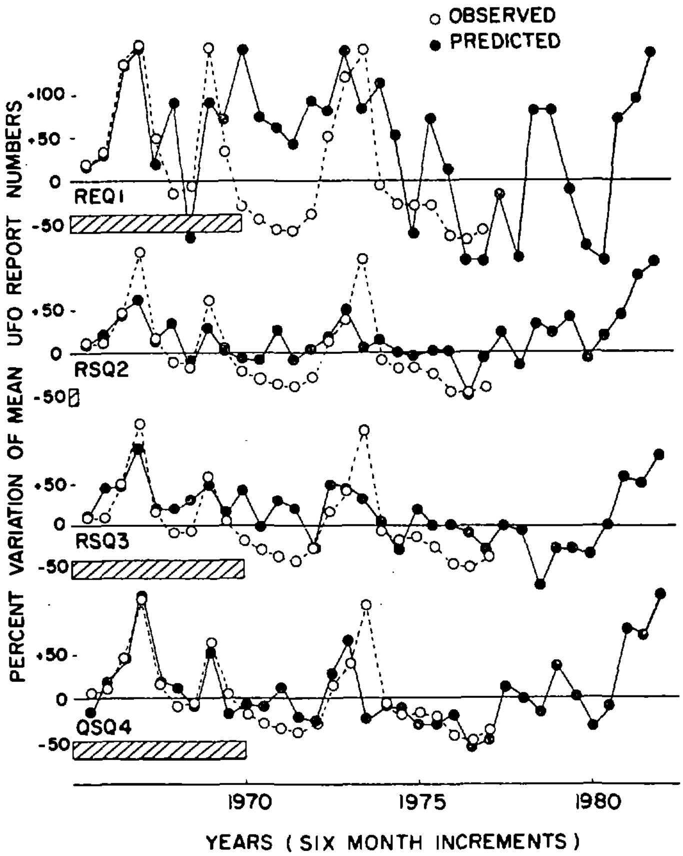

FIG. 1. Predicted (●) percent variation of mean UFO report numbers generated from different equations and observed variations (O) in UFO reports within the six states surrounding the New Madrid area for 6-mo. intervals during the years 1965 to 1982. The bars with the diagonal lines indicate the final portions of the intervals from which the equations were generated.

reports in the New Madrid states for the two intervals of 1981 and for the first half of 1982. Since a lag of not less than two increments was involved with each equation (and the only contemporary variable was AAVSD), these equations may be useful for *actual future* predictions. In other words, by making assumptions about the AAVSD value only, one could predict UFO reports within this region at least one year in advance.

One final pattern emerged frequently enough to be mentioned. At least half of the equations with multiple *R*s exceeding 0.80 involved first entry of either MVII3, MVII7, or TVII3. Since there were only 4 VII intensity quakes (2 MVII and 2 EXVII) during the sample (the last VII was in Kentucky, July, 1980), these equations were not reported. However, these equations did predict the peaks in the 1966-1967, 1969:1, and 1973 as well as the 1982 period (which would be the highest since 1973). They also predicted + 50% peaks for 1970:1 and 1972:1; these variations were not evident in the CUFOS' data pool but were present to some extent in all of the other equations.

In the most conservative sense, the equations are actually predicting the variations of UFO reports collected by CUFOS. However, if (1) the CUFOS sample is a reliable measure of the total population of reports within this area and (2) if the reports are valid measures of actual physical events that can be recorded by independent instrumentation, then more detailed analyses of the independent variables may facilitate the isolation of mechanism. At the very least, these unusual responses can be predicted by using patterns of geophysical stimuli.

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