

2

AFGL-TR-77-0193

204

THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMAGNETIC FIELD ON VERTICAL CUTOFF RIGIDITY CALCULATIONS

> M. A. Shea and D. F. Smart Air Force Geophysics Laboratory Bedford, Massachusetts 01731, USA

Recent geomagnetic measurements have shown that changes in the geomagnetic field have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives, Accordingly, a new set of time derivatives have been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of the changes of geomagnetic field time derivatives on cosmic ray analyses, vertical cutoff rigidities were calculated for selected locations using the IGRF 1965 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and the new time derivatives making each set of calculations appropriate for a 1980 Epoch. A comparison of these two sets of calculations shows that the uncertainty in predicted magnetic fields does not appear to be a serious limiting factor in the use of calculated vertical cutoff rigidities for the analyses of cosmic radiation data.



Many analyses of cosmic radiation data are dependent upon the cutoff rigidity of the locations where data are acquired. For the past fifteen years these cutoff rigidities have been determined by the computational technique of numerically tracing the orbits of cosmic rays through a mathematical model of the magnetic field. Although this technique is considered as the most reliable method of determining cutoff rigidities, it is also recognized that the cutoff rigidities determined in this manner can only be as accurate as the magnetic field description utilized in the trajectory-tracing process.

The International Geomagnetic Reference Field (IGRF) adopted by IAGA in 1969 (IAGA Commission 2 Working Group 4, 1969) is a composite of several geomagnetic field models. Although the model itself was normalized to a 1965 Epoch, the time derivatives were derived from actual field measurements through 1967. Thus, the utilization of the time derivatives for years prior to 1965 resulted in fairly representative models of the actual field as these time derivatives were determined from magnetic field measurements; however, extension of the time derivatives into the future (i.e. beyond 1968) produced a "predicted" field based upon the assumption that the time derivatives themselves were constant.

Subsequent measurements of the geomagnetic field revealed changes that were not consistent with the predictions of the original IGRF time derivatives. In general, the geomagnetic field has been changing more rapidly than was predicted in 1968 (Cain, 1975).

After consideration of the problems associated with deriving updated models and also considering the various uses of the models, the IAGA Division 1 Study Group (1976) recommended the following: that the IGRF 1965 model with its time derivatives should be used for the period 1955-1975, but that a new set of time derivatives to give a reasonable estimate of the true rate of the ecular variation at Epoch 1975 should be utilized for predicting magnetic field coefficients for epochs later than 1975. Thus, a discontinuity in the IGRF specification of the geomagnetic field would occur at 1975. In this paper we have investigated if this discontinuity in the geomagnetic field specification, results in a similar discontinuity in the calculation of vertical cutoff rigidities.

2. METHOD

Vertical cutoff rigidities were calculated by the trajectory-tracing technique using two mathematical representations of the internal geomagnetic field adjusted to a 1980 Epoch as follows: (A) the IGRF coefficients for Epoch 1965 (IAGA Commission 2 Working Group 4, 1969) with their original time derivatives applied for a span of 15 years to Epoch 1980, and (B) the IGRF coefficients for Epoch 1975 (IAGA Division 1 Study Group, 1976) with the new time derivatives applied for a span of 5 years to Epoch 1980. These two representations will be called the original and adjusted time derivatives, respectively, for the remainder of this paper.

These vertical cutoff rigidities were determined by the method described by Shea et al. (1965) using 0.01 GV intervals throughout the penumbral region. These values were obtained for the following locations: (A) cosmic ray stations in the Western Hemisphere where the vertical cutoff rigidity decreases with time (Shea, 1971), and (B) selected locations on the world grid of vertical cutoff rigidities (Shea and Smart, 1975) where the vertical cutoff rigidity (1) increased, (2) decreased, or (3) remained essentially constant with respect to the 1965-1975 interval.

Once the vertical cutoff rigidities were determined for these locations, the results were evaluated in the following manner:

TABLE 1

VERTICAL CUTOFF RIGIDITIES FOR SELECTED COSMIC RAY STATIONS IN LATIN AMERICA

		Vertica	al Cutof	f Rigidi	ty (GV)	
Rigidity	Epoch	Epoch	Epoch	Epoch	Epoch	Epoch
Parameter	1955	1965	1970	1975	1980	1980A
P(m)	10.06	9.57	9.51	9.44	9.35	9:33
P(c)	9.46	9.12	8.99	8.88	8.70	8.71
P(s)	8.95	8.77	8.67	8.57	8.47	8.46
P(m)	10.89	10.59	10.44	10.31	10,15	10.13
P(c)	10.58	10.22	10.03	9.88	9.73	9.69
P(s)	10.17	9.80	9.62	9.46	9.30	9.28
P(m)	5.80	5.60	5.50	5.42	5.32	5.29
P(c)	5.67	5.51	5.33	5.29	5.17	5.14
P(s)	5.15	4.79	4.78	4.73	4.72	4.88
P(c)*	13.07	12.85	12.75	12.64	12.54	12.52
P(c)*	13.44	13.24	13.14	13,04	12.95	12.92
	Rigidity Parameter P(m) P(c) P(s) P(m) P(c) P(s) P(c) P(s) P(c)* P(c)*	Rigidity Parameter Epoch 1955 P(m) 10.06 P(c) 9.46 P(s) 8.95 P(m) 10.89 P(c) 10.58 P(s) 10.17 P(m) 5.80 P(c) 5.67 P(s) 5.15 P(c)* 13.07	Vertic. Rigidity Epoch Epoch Parameter 1955 1965 P(m) 10.06 9.57 P(c) 9.46 9.12 P(s) 8.95 8.77 P(m) 10.89 10.59 P(c) 10.58 10.22 P(s) 10.17 9.80 P(m) 5.80 5.60 P(c) 5.15 4.79 P(c)* 13.07 12.85 P(c)* 13.44 13.24	Vertical Cutof Rigidity Epoch Ep	Vertical Cutoff Rigidit Rigidity Epoch Epoch	Vertical Cutoff Rigidity (GV)RigidityEpochEpochEpochEpochEpochEpochParameter19551965197019751980P(m)10.069.579.519.449.35P(c)9.469.128.998.888.70P(s)8.958.778.678.578.47P(m)10.8910.5910.4410.3110.15P(c)10.5810.2210.039.889.73P(s)10.179.809.629.469.30P(m)5.805.605.505.425.32P(c)5.154.794.784.734.72P(c)*13.0712.8512.7512.6412.54P(c)*13.4413.2413.1413.0412.95

"No penumbral structure in the vertical direction for Chacaltaya or Huancayo.

205

(A) Does the general trend of the vertical cutoff rigidity (i.e. increase, decrease or no change) remain constant with both field representations for 1980 (i.e. using the original time derivatives and the adjusted time derivatives)?

(B) Do significant differences occur in the vertical cutoff rigidity values for the two field representations?

3. RESULTS

Table 1 presents vertical cutoff rigidities for selected Latin American locations where the vertical cutoff rigidity has been decreasing with time. All values were calculated using the IGRF Epoch 1965 field coefficients with its associated time derivatives with the exception of the last columm, labeled 1980A, where the adjusted time derivatives were utilized. Table 2 presents

TABLE 2

VERTICAL CUTOFF RIGIDITIES FOR SELECTED LOCATIONS

	Cuto	II KIG	laity	(GV)	
Location/	Epoch	Epoch	Epoch	Epoch	
Parameter	1965	1975	1980	1980A	
20N, 315E					
P(m)	11.32	11.59	11.72	11.72	
P(c)	10.88	11.45	11.63	11,63	
P(s)	9.78	10.35	10.65	10.64	
15N, 300E					
P(m)	11.08	11.29	11.40	11.41	
P(c)	10.15	10.71	10.97	10.99	
P(s)	9.10	9.63	9.86	9.88	
255. 135E					
P(m)	8.17	8.02	7.91	7.92	
P(c)	7.93	7.71	7.61	7.67	
P(s)	6.37	6.25	6.35	6.32	
305, 330E					
P(m)	10.29	10.41	10.47	10.47	
P(c)	7.91	8.46	8.64	8.63	
P(s)	7.49	7.83	7.97	8.06	
45N. 105E					
P(m)	6.58	6.62	6.63	6.59	
P(c)	6.27	6.29	6.31	6.29	
P(s)	5.56	5.51	5.18	5.33	
255, 195E					
P(m)	11,69	11.65	11.63	11.76	
P(c)	11,20	11.22	11.23	11.18	
P(s)	10.25	10.29	10.31	10.25	

vertical cutoff rigidities for six locations as follows: two locations each where the vertical cutoff rigidity increases, decreases, or remains essentially constant with respect to time. The parameters listed in these tables are the main cone cutoff rigidity, P(m), the effective cutoff rigidity, P(c), and the Stormer cutoff rigidity, P(s). The cutoff rigidity values were taken from Shea et al. (1976).

4. DISCUSSION

An inspection of the values given in Tables 1 and 2 show that the general trend (increase, decrease or no change) is preserved for vertical cutoff rigidity calculations for 1980 irrespective of the utilization of the original or adjusted time derivatives in the determination of the geomagnetic field coefficients for Epoch 1980. Differences in the actual values for both the main cone and effective cutoff rigidity are of the order of 0.05 GV. (We exclude the Stormer cone cutoff rigidity in this discussion since it is the most difficult value to accurately determine by the trajectorytracing process.) The question then arises as to whether 0.05 GV is significant in the utilization of these values in analyses of cosmic radiation data. In discussing this problem we must consider (A) the relative accuracy of the values, (B) the absolute accuracy of the values, and (C) the uncertainties in the trajectorytracing technique.



<u>Relative Accuracy</u>. For analyses where the cosmic radiation intensity observations at one location are compared with those at other locations, the vertical cutoff rigidity calculated for 1980 using either set of time derivatives would be adequate provided consistency was maintained.

Absolute Accuracy. We know of no experimental measurements at the present time capable of determining a 0.05 GV difference in vertical cutoff rigidity. In utilizing vertical cutoff rigidity as an analysis parameter, we must remember that this is the cutoff value in one specific direction (i.e. radial vertical) often accepted as a value typifying the location. Absolute differences of 0.05 GV would be a second order effect when compared against the above simplifying assumption. If the vertical value is extrapolated (perhaps by the application of Stormer theory) to other azimuth and zenith angles, then the absolute differences of 0.05 GV are probably smaller than the uncertainties introduced by the extrapolation process.

<u>Computational Technique</u>. The problems in the computational technique can be separated into two parts - the increment of rigidity used in the determination of the vertical cutoff rigidities, and the size of the step length used in the trajectory-tracing process.

Most vertical cutoff rigidities calculated by the trajectory-tracing procedure have utilized 0.01 GV rigidity intervals, particularly in the penumbral regions. (See Shea et al., 1965 and Shea and Smart, 1974, for a discussion of the effects of interval size,) Even using a standard interval of 0.01 GV can result in slight differences in the calculation of an allowed or a forbidden orbit in the penumbral region when utilizing two different computers simply because of the manner in which each computer operates, such as the number of significant figures carried, etc. However, even though minor differences in the determination of allowed and forbidden orbits in the penumbra might be calculated, the gross features in the penumbra are preserved. This same effect is true of the trajectories calculated for this paper. Figure 1 illustrates the penumbral structure for particles vertically incident at 15°N, 300°E for Epochs 1965, 1975 and the two sets of coefficients utilized for Epoch 1980. Although the effective vertical cutoff rigidity increases with time at this location (See Table 2), the gross characteristics of the penumbral stfucture are preserved.

The original trajectory-tracing program of McCracken et al. (1962) utilized a library of step sizes in the numerical integration technique that were deliberately made small in an attempt to minimize the error accumulation in the Runge-Kutta iteration process. In an effort to make the computer program more efficient and less time consuming, the standard McCracken library of step sizes was replaced by a variable step size that was about 1/50 of the distance a particle with a specific rigidity traveled during one gyration (Shea et al., 1976). Although this necessitated the recalculation of the step length for each Runge-Kutta iteration, the trajectory calculations could be performed with considerably greater speed without loss of appreciáble accuracy. Minor differences between the two programs that occurred, primarily in the penumbral region, were attributable to the slightly different orbits calculated for two identical particles.

An example of the differences that may occur in the utilization of different step sizes in the trajectory-tracing process is given in Figure 2 which illustrates the penumbral structure for particles vertically incident at 45°S, 240°E as calculated using four different step sizes in tracing the ' particle trajectories through the IGRF (Epoch 1965) geomagnetic field model. Although minor differences in the fine line structure can be ascertained, the gross features are similar. These minor differences result in the determination of effective vertical cutoff rigidities that differ by 0.06 GV approximately the same differences that are found in the vertical cutoff

207



particles vertically incident at 15°N, 300°E for Epochs 1965, 1975, and the two sets of coefficients utilized for Epoch 1980. The column labeled 1980A indicates Epoch 1980 utilizing the adjusted time derivatives. White indicates allowed rigidities and black indicates forbidden rigidities. Figure 2. Penumbral structure for particles vertically incident at $45^{\circ}S$, $240^{\circ}E$, as calculated using four different step sizes: the original McCracken step size, the new variable step size (v. step), and the variable step size divided by 2 (v. step/2) and divided by 4 (v. step/4). The main cone cutoff rigidity is given by P_m, the effective cutoff rigidity by P_c, and the Stormer cutoff rigidity by P_s. White indicates allowed rigidities and black indicates

208

rigidity calculations determined utilizing the two sets of coefficients for a 1980 Epoch of the geomagnetic field.

5. CONCLUSIONS

From the results presented in this paper we conclude that the utilization of the adjusted time derivatives with the 1975 IGRF coefficients does not result in a discontinuity in the calculation of vertical cutoff rigidities. The cutoff rigidity differences we calculate utilizing the original time derivatives for the IGRF (Epoch 1965) field coefficients and the adjusted time derivatives for the IGRF (Epoch 1975) field coefficients are approximately 0.05 GV - the same order of uncertainty that is present in the computational technique itself. We, therefore, recommend that the new adjusted time derivatives with the 1975 Epoch of the geomagnetic field be utilized in determining cutoff rigidity values for the interval 1976-1980.

References.

- Cain, J. C., "Round Table Discussion of Recommendations for Revision of the IGRF", EOS, 56, 538, 1975.
- IAGA Commission 2 Working Group 4, "International Geomagnetic Reference Field, 1965.0", J. Geophys. Res., 74, 4407, 1969.
- IAGA Division 1 Study Group, "International Geomagnetic Reference Field 1975", J. Geophys. Res., 81, 5163, 1976.
- McCracken, K. G., U. R. Rao, and M. A. Shea, <u>The Trajectories of Cosmic Rays</u> <u>in a High Degree Simulation of the Geomagnetic Field</u>, MIT Technical Report No. 77, NYO-2670, 1962.
- Shea, M. A., "Changes in Neutron Monitor Response and Vertical Cutoff Rigidities Resulting from Secular Variations in the Geomagnetic Field", 12th International Conference on Cosmic Rays, Hobart, <u>Conference Papers</u> (University of Tasmania), <u>3</u>, 859, 1971.
- Shea, M. A., and D. F. Smart, <u>Tables of Asymptotic Directions, Cutoff</u> <u>Rigidities, and Reentrant Albedo Calculations for Palestine, Dallas, and</u> <u>Midland, Texas</u>, Air Force Cambridge Research Laboratories, Special Reports No. 175, AFCRL-TR-74-0159, 1974.
- Shea, M. A., and D. F. Smart, "A Five by Fifteen Degree World Grid of Calculated Cosmic-Ray Vertical Cutoff Rigidities for 1965 and 1975", 14th International Cosmic Ray Conference, <u>Conference Papers</u>, 4, 1298, 1975.
- Shea, M. A., D. F. Smart, and H. Carmichael, <u>Summary of Cutoff Rigidities</u> <u>Calculated with the International Geomagnetic Reference Field for Various</u> <u>Epochs</u>, Air Force Geophysics Laboratory, AFGL-TR-76-0115, 1976.
- Shea, M. A., D. F. Smart, and K. G. McCracken, "A Study of Vertical Cutoff Rigidities Using Sixth Degree Simulations of the Geomagnetic Field", J. Geophys. Res., 70, 4117, 1965.

T BEFORT WOMENT 2 GOVT ACCESSION NO 1 HECHPICHT'S CATALOG HUMBER AFGL-TR-77-0193 5 TYPE OF REPORT A PERHOD COVE THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE CALCULATIONS, 5 TYPE OF REPORT A PERHOD COVE THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE CALCULATIONS, 6 PERFORMING ONG, REPORT NUMBER, 7 AUTHOR(*) 6. CONTRACT OR GRANT NUMBER, 7 AUTHOR(*) 8. CONTRACT OR GRANT NUMBER, 8 APR TEMPS, PROJECT, TALE 8. CONTRACT OR GRANT NUMBER, 9 ARAF TEMPS, PROJECT, TALE 9. CONTRACT OR GRANT NUMBER, 9 Hanscom Air Force Base 10. PROVAMER, AND	THEORY NUMBER 2 GOVT ACCESSION NO 2 HECHMENT'S CATALOG NUMBER AFGL-TR-77-6193 5 TYPE OF RECENT SECULAR VARIATIONS OF THE GEOMACRETIC FIELD ON VERTICAL CUTOPF RIGDITY 5 TYPE OF REPORT A PERIOD COVE THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMACRETIC FIELD ON VERTICAL CUTOPF RIGDITY 5 TYPE OF REPORT A PERIOD COVE AUTHOR: 6 CONTRACT OF GRANT NUMBER: 5 TYPE OF REPORT A PERIOD COVE AUTHOR: 6 CONTRACT OF GRANT NUMBER: 5 TYPE OF REPORT A PERIOD COVE AUTHOR: 6 CONTRACT OF GRANT NUMBER: 6 CONTRACT OF GRANT NUMBER: AUTHOR: 7 AUTHOR: 6 CONTRACT OF GRANT NUMBER: AUTHOR: 8 CONTRACT OF GRANT NUMBER: 7 AUTHOR: AUTHOR: 8 CONTRACT OF GRANT NUMBER: 7 AUTHOR: AUTHOR: 9 ANTE FORCE BASE 10 PERCENT SECULAR ONE OF THE NUMBER: AUTHOR: 9 ANTE FORCE BASE 10 PERCENT SECURATION ONE OF THE NUMBER: Massachusetts 01731 10 PERCENT SECURATION OF THE NUMBER: 10 PERCENT SECURATION OF THE NUMBER: Massachusetts 01731 11 PERCENT SECURATION STATEMENT (of this Report) 12 PERCENT SECURATION TO NUMBER: Massachusetts 01731 12 PERCENT SECURATION STATEMENT (of this Report) 13 SECURATION STATEMENT (of this Report) Approved for public release; distributio	1 BECRATTINUMBER 2 GOVT ACCESSION NO 1 HECHMENT'S CATALOG HUMBER AFTLE CHARABANHO 1 TTLE CALCULATIONS 1 HECHMENT'S CATALOG HUMBER THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE CEOMACRETIC FIELD ON VERTICAL CUTOFF BIGDITY 5 TVPC OF REPORT A PERIOD CONTACTOR MARKED AND AND RESERVED AND AND AND AND AND AND AND AND AND AN		REPORT DOCUMENTAT	ION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
 A TITLE CHARLAMANDER THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMAGRETIC FIELD ON VERTICAL CUTOPF RIGIDITY CALCULATIONS, A ANTHORE, A A. /Shea D. F. /Smart A ATHORE, M. A. /Shea D. F. /Smart CONTRACT OR GRANT NUMBER/OF THE CALCULAR OF THE CONTRACT OR GRANT NUMBER/OF THE A WORK OWN PROJECT. THE A WORK OWN PROJECT A WORK OWN PROJECT. THE A WORK OWN PROJECT A WORK OWN PROJECT. THE A WORK OWN PROJECT A WORK OWN PROJECT. THE A WORK OWN PROJECT A WORK OWN PROJECT. THE A WORK OWN PROJECT A	 A TYTE (and Shaduto) THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMAGRETIC FIELD ON VERTICAL CUTOPF RIGIDITY CALCULATIONS, A AUTHOR(*) A A. /Shea D. F. /Smart A AUTHOR(*) A AND A /Shea D. F. /Smart A AUTHOR(*) A AND A /Shea D. F. /Smart A AUTHOR(*) A AND A /Shea D. F. /Smart A AUTHOR(*) A AND A /Shea D. F. /Smart A AUTHOR(*) A AND A /Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A A / Shea D. F. /Smart A AUTHOR(*) A AUTHOR(*) A AUTHOR(*) A AUTHOR(*) A AUTHOR(*) A A / Shea D. //Smart A AUTHOR(*) A A / Shea D. //Smart A AUTHOR(*) A A	 A TTLE GALADATE THE EFFECTS OF RECENT SECURAR VARIATIONS OF THE EFFECTS OF RECENT SECURAR VARIATIONS OF THE ECONACNENT OF FILD ON VERTICAL CUTOFF RIGIDITY CALCULATIONS, A AUTHORNS, A ALTORNS, A ADDRESS, A ALTORNS, A ALTORNS	1. REPORT NU	DABER	2. GOVT ACCESSION N	0. 3. RECIPIENT'S CATALOG NUMBER
THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMACRETIC FIELD ON VERTICAL GUTOFF RIGIDITY CALCULATIONS, AUTHOR: AU	THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMACRETIC FIELD ON VERTICAL GUTOFF RIGIDITY CALCULATIONS, AUTHOR(s) M. A. /Shea D. F./Smart ANF OFGNERS (Contract of GRANT NUMBER(s) M. A. /Shea D. F./Smart ANF OFGNERS (Contract of GRANT NUMBER(s) Massachusetts 01731 Author of Proce Base Massachusetts 01731 M. MONITORING AGENCY MAKE & ADDRESS Massachusetts 01731 M. MONITORING AGENCY NAME & ADDRESS Massachusetts 01731 M. MONITORING AGENCY (PHG) Hanscom Air Force Base Massachusetts 01731 M. MONITORING AGENCY (PHG) Hanscom Air Force Base Massachusetts 01731 M. MONITORING AGENCY (PHG) Hanscom Air Force Base Massachusetts 01731 M. MONITORING AGENCY (PHG) H. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abutact corered in Block 20, 11 different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	THE EFFECTS OF RECENT SECULAR VARIATIONS OF THE GEOMAGNETIC FIELD ON VERTICAL GUTOFF BIGIDITY CALCULATIONS, Interim - Scientific 6 PLEFORMING ONG REPORT NUMBER 6 PLEFORMING ONG REPORT NUMBER 6 PLEFORMING ONG REPORT NUMBER 7 AUTORN 8 CONTRACT OF GRANT NUMBER 9 CONTRACT OF GRANT NUMER 9 CONTRACT OF GRANT NUMBER 9 CONTRACT OF G	AT GL-1			5. TYPE OF REPORT & PERIOD COVE
CALCULATIONS, AUTHOR(*) AUTHOR	CALCULATIONS, CALCULATIONS, AUTHOR: CALCULATIONS, AUTHOR: AUTHOR: AUTHOR: AUTHOR: A. A. /Shea D. F. /Smart AGAF 9F80P2 0'CAUGAIGNING 446 AND ADDRESS A. F. /Smart AGAF 9F80P2 0'CAUGAIGNING 446 AND ADDRESS AIT Force Base Massachusetts 01731 AIT Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 AUTHOR:	ALCULATIONS, Authoms, M. A. /Shea D. F. /Smart Massachusetts 01731 M. A. /Shea Massachusetts 01731 M. A /Shea Massachusetts 01731 M. A. /Shea Massachusetts 01731 M. M. / Controlling Office Massachusetts 01731 M. MONITORING AGENEY MAKE A ADDRESS(/ different from Controlling Office) M. Statistical Control of the Address Massachusetts 01731 MONITORING AGENEY MAKE A ADDRESS(/ different from Controlling Office) M. Statistical Control of the Address Massachusetts 01731 MONITORING AGENEY MAKE A ADDRESS(/ different from Controlling Office) Monitore of the Address Massachusetts 01731 Monitore of the Address Monitore of the Address Massachusetts 01731 Monitore of the Address Monitore	THE EFFE	CTS OF RECENT SECULAR	VARIATIONS OF THE	I nterim - Scientific
 AUTHOR(*) M. A. /Shea D. F. / Smart AGRET GENERACTOR GRANT NUMBER(*) AGRET GENERACTOR GRANT Structure and a control of the substract entered in Block 20. If different from Report) Is supplementary notes Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. Contract of frigidities Contract of frigidities Contract of frigidities Contract of frigidities 	 AUTHOR(s) M. A. Shea D. F./Smart ANT GRANT NUMBER(s) ANT FORCE BASE AND FORCE BASE <	 AUTHOR(a) AUTHOR(a) M. A. /Shea D. F. /Smart Reprint Prove Group Name Force Base Massachusetts 01731 Contract or Generation Air Force Base Massachusetts 01731 Controlling Office Ange AND ADDRESS Air Force Group Nics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 MonitoRing Agency Ange And Address Massachusetts 01731 MonitoRing Agency Ange A address Massachusetts 01731 MonitoRing Agency Ange Address Massachusetts 01731 MonitoRing Agency Ange Address Massachusetts 01731 MonitoRing Agency Agency Address Massachusetts 01731 MonitoRing Agency Address Massachusetts 01731 MonitoRing Agency Address Massachusetts 01731 MonitoRing Agency Address Massachus	CALCULAT	TIONS,		6. PERFORMING ORG. REPORT NUMBE
M. A. Shea D. F. Smart A ATF FEMAL CONTROL NO OFFICE NAME AND ADDRESS Hanscom Air Force Base Massachusetts 01731 I. control in office NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 I. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) I. Security CLASS. (67-40.00000000000000000000000000000000000	M. A. /Shea D. F. / Smart AGHF GFWNR & CANNON HUSSING M ANS APBETSRY (PHG) Hanscom Air Force Base Massachusetts 01731 1. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS Massachusetts (clubic Report) Approved for public release; distribution unlimited. 1. DISTRIBUTION STATEMENT (clubic entered in Block 20, 11 different from Report) 1. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 1. KEY WORDS (Continue on reverse unde if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 M. A. / Shea D. F. / Smart ANY TRAKE OF CONSTRUCTS AND ADDRESS Hanseem Air Force Base Massachusetts 01731 CONTROLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanseom Air Force Base Massachusetts 01731 CONTROLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanseom Air Force Base Massachusetts 01731 MONITORING AGENCY NAME & ADDRESSIT different from Controlling Office) Stepson Air Force Base Massachusetts 01731 MONITORING AGENCY NAME & ADDRESSIT different from Controlling Office) Stepson Air Force Base Massachusetts 01731 MONITORING AGENCY NAME & ADDRESSIT different from Controlling Office) Stepson Additional Controlling Office) Distribution statement (of the Report) Approved for public release; distribution unlimited. DISTRUBUTION STATEMENT (of the ebstract entered in Block 20, if different from Report) SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. XEV WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accon a new set of time derivatives has been determined with the suggestion the these be applied for time periods after 1975. To assect at the the Fields of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1 field coefficients and associated time derivatives and the IGRF 1975 fiel 	7. AUTHOR(S)			B. CONTRACT OR GRANT NUMBER(S)
 A STAF FROM & O'CANGATION STATE AND OVERED BY (PHG) Hanscom Air Force Base Massachusetts 01731 10. Decontam Element, PROJECT, 7/ Heat as worker white Numbers Air Force Base Massachusetts 01731 11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 12. MUMBER OFFICE NAME AND ADDRESS Massachusetts 01731 13. NUMBER OF PAGES Massachusetts 01731 14. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS (61-4ul open) Unclassified 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, 11 different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 A STIF FEWRS OFCASSINGERS MATE AND OUTPERS Massachusetts 01731 10. Descondam Element. PROJECT. TABLE AND ADDRESS Massachusetts 01731 11. CONTROLLING OFFICE NAME AND ADDRESS Air FOrce Base Massachusetts 01731 12. MILLING OFFICE NAME AND ADDRESS Massachusetts 01731 13. MUNIFORING AGENCY NAME & ADDRESS(II different from Controlling Office) 14. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (01-44) (1-2-1) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, 11 different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 ANT PROME OF CHARGENEESS AND ADDRESS (AND SPRIGHY (PHG) Hanscom Air Force Base Massachusetts 01731 1. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS (All Green them Controlling Office) 1. Structure of Paces Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS(all Green them Controlling Office) 1. Structure of Paces Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS(all Green them Controlling Office) 1. Structure of Paces Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS(I all Green them Controlling Office) 1. Structure of Paces Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS(I all Green them Controlling Office) 1. Structure of Paces Massachusetts 01731 1. MONITORING AGENCY NAME & ADDRESS(I all Green them Controlling Office) 1. Structure of Paces Massachusetts 01731 1. Distribution statement (of this Report) 1. Distribution statement (of the abstract entered in Block 20, if different from Report) 1. Distribution Statement (of the abstract entered in Block 20, if different from Report) 1. Supple LEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 1. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 1. ABSTRACT (Continue on reverse side if mecassary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert routoff	10	M. A./Shea D. F./Smart		
Hanscom Air Force Base Massachusetts 01731 H. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 H. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) J. Security CLASS (H-Huld securit) Unclassified 15. SECURITY CLASS (H-Huld securit) Approved for public release; distribution unlimited. 16. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, II different from Report) 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, II different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Hanscom Air Force Base Massachusetts 01731 II. CONTROLLING OFFICE NAME AND ADDRESS Air Force Grophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 I. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) I. Schuller of PAGES Massachusetts 01731 I. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) I. Schuller of PAGES I. DECLASSIFICATION DOWNGRADIN Schedule I. DistRibution statement (of the abstract entered in Block 20, II different from Report) I. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, II different from Report) I. Supplementary NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. I. Suppletion is reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Hanscom Air Force Base Massachusetts 01731 11. CONTROLLING OFFICE NAME AND ADDRESS Air FORCe Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 12. MULUOIT OATE Massachusetts 01731 13. NUMMEp OF DAGLE Massachusetts 01731 14. MONITORING AGENCY NAME A ADDRESS(I different from Controlling Office) 15. SECURITY CLASS, (Fr-Aulerent Unclassified 15. DECLASSIFICATION DOWNOR. 16. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, If different from Report) 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, If different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measure and if an ecessary and identify by block number) Recent geomagnetic measure and if an ecessary and identify by block number) Recent geomagnetic field time derivatives have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities vere calculated for selected locations using the IGRF 1975 field field coefficients and associated time derivatives and the IGRF 1975 field	· A97 9884	NE 8"Geophysics" Labor	atory (PHG)	10. PROGRAM ELEMENT, PROJECT, TA AREA & WORK UNIT NUMBERS
Massachusetts 01731 61102F 11. CONTROLLING OFFICE NAME AND ADDRESS 12. BLEDONT DATE Air Force Geophysics Laboratory (PHG) 2. September 177 Hanscom Air Force Base 13. NUMBER OF PAGES Massachusetts 01731 13. NUMBER OF PAGES 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) 15. SECURITY CLASS. (Br-tuberor) 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) 15. SECURITY CLASS. (Br-tuberor) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Massachusetts 01731 61102F H. CONTROLLING OFFICE NAME AND ADDRESS 12. MILDONT DATE Air FOrce Geophysics Laboratory (PHG) 12. MILDONT DATE Hanssechusetts 01731 13. NUMBER OF PAGES 14. MONITORING AGENEY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (BHALL PROFIL) 14. MONITORING AGENEY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (BHALL PROFIL) 14. MONITORING AGENEY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (BHALL PROFIL) 15. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20. If different from Report) 16. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. States and identify by block number)	Massachusetts 01731 61102F I'. Courrecting office HAME AND ADDRESS 12. HE DATA ONTERS Air Force Geophysics Laboratory (PHG) 12. HE DATA ONTER Massachusetts 01731 2.S. ptender 177 14. MONITORING AGENCY NAME & ADDRESS(I different from Controlling Office) 15. SECURITY CLASS. (04-40) 14. MONITORING AGENCY NAME & ADDRESS(I different from Controlling Office) 15. SECURITY CLASS. (04-40) 14. MONITORING AGENCY NAME & ADDRESS(I different from Controlling Office) 15. SECURITY CLASS. (04-40) 14. MONITORING AGENCY NAME & ADDRESS(I different from Controlling Office) 15. SECURITY CLASS. (04-40) 14. MONITORING AGENCY NAME & ADDRESS(I different from Controlling Office) 15. SECURITY CLASS. (04-40) 15. DISTRIBUTION STATEMENT (of the Report) 15. SECURITY CLASS. (04-40) 16. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 16. SUPPLEMENTARY NOTES 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)	Hansco	m Air Force Base		IHWU 2311G101
 11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 14. MONITORING AGENCY NAME & ADDRESS(<i>if different from Controlling Office</i>) 15. SECURITY CLASS. (#+4)(400000) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 11. CONTROLLING OFFICE NAME AND ADDRESS Air FOrce Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 14. MONITORING AGENCY NAME & ADDRESS(<i>il dillerent from Controlling Office</i>) 15. SECURITY CLASS. (<i>It dullerent from Controlling Office</i>) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, il different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (PHG) Hanscom Air Force Base Massachusetts 01731 12. NUMBER OF PAGE Massachusetts 01731 14. MONITORING AGERCY NAME & ADDRESS(II different from Controlling Office) Massachusetts 01731 15. SECURITY CLASS. (BF-Marger Unclassified) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accord a new set of time derivatives has been determined with the suggestion the these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field 	Massac	chusetts 01731		61102F
Hanscom Air Force Base Massachusetts 01731 13. NUMBER OF PAGES Massachusetts 01731 14. MONITORING AGENCY NAME & ADDRESS(<i>il dillerent from Controlling Office</i>) 15. SECURITY CLASS. (64-441 eport) Unclassified 15. DECLASSIFICATION/DOWNGRADIN 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, il different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Hanscom Air Force Base Massachusetts 01731 14. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (04-bit egor) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 Hanscom Air Force Base Massachusetts 01731 MONITORING AGENCY NAME & ADDRESS(<i>il different from Controlling Office</i>) SECURITY CLASS (<i>if Add Megori</i>) MONITORING AGENCY NAME & ADDRESS(<i>il different from Controlling Office</i>) SECURITY CLASS (<i>if Add Megori</i>) Monitors for public release; distribution unlimited. DISTRIBUTION STATEMENT (<i>of this Report</i>) Approved for public release; distribution unlimited. DISTRIBUTION STATEMENT (<i>of the abstract entered in Block 20, il different from Report</i>) DISTRIBUTION STATEMENT (<i>of the abstract entered in Block 20, il different from Report</i>) SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. KEY WORDS (<i>Continue on reverse side il necessary and identify by block number</i>) geomagnetic field vertical cutoff rigidities cosmic rays ABSTRACT (<i>Continue on reverse side il necessary and identify by block number</i>) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Comagnet Reference Field (IGRF) coefficients and associated time derivatives. Accon a new set of time derivatives has been determined with the suggestion the these be applied for thme periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field coefficients and associated time deriv	11. CONTROLL	LING OFFICE NAME AND ADDRESS	tory (PHC)	2 SONT DATE
Massachusetts 01731 14. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (84-444 Seport) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, il different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Massachusetts 01731 14 MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15 SECURITY CLASS. (01-4)Labourt Unclassified 15. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, il different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Massachusetts 01731 14 MONITORING AGENEY NAME & ADDRESS(I dillerent from Controlling Office) 15. SECURITY CLASS (81-44) Measure Unclassified 15. DESTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Acco a new set of time derivatives has been determined with the suggestion the these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, verti- field coefficients and associated time derivatives and the IGRF 1975 field	Hanscon	n Air Force Base		
 14. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS (70-41,4 eport) Unclassified 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 14. MONITORING AGENCY NAME & ADDRESS(il different from Controlling Office) 15. SECURITY CLASS. (7) Half epoil) Unclassified 15. DECLASSIFICATION / DOWNGRADID 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, il different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 14 MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 15. SECURITY CLASS. (If different Unclassified 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 19. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnetic have soft time derivatives. Accord a new set of time derivatives has been determined with the suggestion the these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field 	Massach	husetts 01731		B. NUMBER OF PAGE 7 70.
Unclassified Unclassified Unclassified 15a. DECLASSIFICATION DOWNGRADIN SCHEDULE 16. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , <u>4</u> , 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Unclassified Un	Unclassified Un	14. MONITORI	NG AGENCY NAME & ADDRESS(II	different from Controlling Office) 15. SECURITY CLASS. (of this port)
 15. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 15. DECLASSIFICATION/DOWNGRADII SCHEDULE 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 	 15. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Black 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, Conference Papers, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by black number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by black number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives and constitutions using the IGRF 19 field coefficients and associated time derivatives and the IGRF 1975 field 		(16)2311	7	Unclassified
 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, 4, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnetic have deviated from the predictions of the original International Geomagnetic these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field in the predictions of accessing solution that these on cosmic ray and sociated time derivatives. Accound a new set of time derivatives has been determined with the suggestion that these of spiled for time periods after 1975. To ascertain the effects of changes of geomagnetic field in the derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field		TACI		15a. DECLASSIFICATION DOWNGRADIN SCHEDULE
 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 18. SUPPLEMENTARY NOTES Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u>, <u>4</u>, 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accor a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 19 field coefficients and associated time derivatives and the IGRF 1975 field 	Approved	TION STATEMENT (of this Report) I for public release; c	distribution unlimit	(trom Report)
Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , <u>4</u> , 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , <u>4</u> , 204, 1977. 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	Reprint from 15th International Cosmic Ray Conference, <u>Conference Papers</u> , <u>4</u> , 204, 1977. ¹⁹ KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays ¹⁰ ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accor a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 19 field coefficients and associated time derivatives and the IGRF 1975 fiel	Approved	TION STATEMENT (of this Report) I for public release; c	distribution unlimit	trom Report)
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays	 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) geomagnetic field vertical cutoff rigidities cosmic rays 10. ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original international Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accor a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 19 field coefficients and associated time derivatives and the IGRF 1975 field 	Approved	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES	distribution unlimit	rom Report)
geomagnetic field vertical cutoff rigidities cosmic rays	geomagnetic field vertical cutoff rigidities cosmic rays	geomagnetic field vertical cutoff rigidities cosmic rays	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u>	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, <u>4</u> , 204, 197	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77.	(rom Report)
vertical cutoff rigidities cosmic rays	vertical cutoff rigidities cosmic rays	 vertical cutoff rigidities cosmic rays ABSTRACT (Continue on reverse side If necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accor a new set of time derivatives has been determined with the suggestion tha these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 fiel 	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, <u>4</u> , 204, 197	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77.	rence,
cosmic rays	cosmic rays	Cosmic rays ABSTRACT (Continue on reverse side if necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accor a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field field coefficients and associated time derivatives and the IGRF 1975 field	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD geomagne	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, <u>4</u> , 204, 197 DS (Continue on reverse side if neces etic field	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77.	rence,
		^{10.} ABSTRACT (Continue on reverse side II necessery and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic have deviated from the predictions of the original International Geomagnet Reference Field (IGRF) coefficients and associated time derivatives. Accor a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field field coefficients and associated time derivatives and the IGRF 1975 field	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD geomagne vertical	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 DS (Continue on reverse side if necess stic field cutoff rigidities	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77.	rence,
ABSTRACT (Continue on reverse side if necessary and identify by block number)		Reference Field (IGRF) coefficients of the original international Geomagnet a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD geomagne vertical cosmic r	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 DS (Continue on reverse side if necession etic field cutoff rigidities rays T (Continue on reverse side if necession t of the state of the side of the second t of the side of the second t of the second side of the second t of the side of the second side of the second t of the second side of the second side of the second t of the second side of the second si	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77.	rence, er)
Recent geomagnetic measurements have shown that changes in the geomagnetic f	have deviated from the predictions of the original international Comparation	a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1975 field coefficients and associated time derivatives and the IGRF 1975 field	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD geomagne vertical cosmic r Recent g have der	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 DS (Continue on reverse side if necess etic field cutoff rigidities rays T (Continue on reverse side If necess geomagnetic measurement riated from the predict	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77. The sary and identify by block numbers have shown that a	rence, er) changes in the geomagnetic f
Recent geomagnetic measurements have shown that changes in the geomagnetic f have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. According	have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi	these be applied for time periods after 1975. To ascertain the effects of changes of geomagnetic field time derivatives on cosmic ray analyses, ver cutoff rigidities were calculated for selected locations using the IGRF 1 field coefficients and associated time derivatives and the IGRF 1975 field	Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD geomagne vertical cosmic r Recent g have dev Referenc	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, <u>4</u> , 204, 197 DS (Continue on reverse side if necessive tic field cutoff rigidities rays T (Continue on reverse side if necessive geomagnetic measurement viated from the prediction ce Field (IGRF) coefficient	istribution unlimit entered in Block 20, if different al Cosmic Ray Confer 7. Sary and identify by block number to have shown that a clients and associate	er) cence, er) changes in the geomagnetic for al International Geomagnetic ed time derivatives Accordi
ABSTRACT (Continue on reverse side II necessary and identify by block number) Recent geomagnetic measurements have shown that changes in the geomagnetic f have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi a new set of time derivatives has been determined with the suggestion that	have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi a new set of time derivatives has been determined with the suggestion that	changes of geomagnetic field time derivatives on cosmic ray analyses, vert cutoff rigidities were calculated for selected locations using the IGRF 1 field coefficients and associated time derivatives and the IGRF 1975 fiel	Approved 17. DISTRIBUT 18. SUPPLEME Reprint Conferen 19. KEY WORD geomagne vertical cosmic r Recent g have dev Referenc a new se	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 DS (Continue on reverse side if necessive etic field cutoff rigidities rays T (Continue on reverse side If necessive geomagnetic measurement viated from the predict ce Field (IGRF) coeffice et of time derivatives	Antipatribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77. Sary and identify by block number is have shown that a tions of the original cients and associated has been determine	rence, er) changes in the geomagnetic f al International Geomagnetic d time derivatives. According ed with the suggestion that
Recent geomagnetic measurements have shown that changes in the geomagnetic f have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of t	have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of t	field coefficients and associated time derivatives and the IGRF 1975 fiel	Approved 17. DISTRIBUT 18. SUPPLEME Reprint Conferen 19. KEY WORD geomagne vertical cosmic r 10. ABSTRACT Recent g have dev Referenc a new se these be	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 DS (Continue on reverse side if necession etic field cutoff rigidities rays T (Continue on reverse side If necession rated from the prediction rated from the prediction of time derivatives applied for time period	distribution unlimit entered in Block 20, if different al Cosmic Ray Confer 77. The same and identify by block numbers have shown that a tions of the original cients and associate has been determine lods after 1975. To	trom Report) rence, er) changes in the geomagnetic for al International Geomagnetic ed time derivatives. According ed with the suggestion that by ascertain the effects of t
Recent geomagnetic measurements have shown that changes in the geomagnetic if have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordin a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of the changes of geomagnetic field time derivatives on cosmic ray analyses, vertice	have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of t changes of geomagnetic field time derivatives on cosmic ray analyses, vertice		Approved 17. DISTRIBUT 18. SUPPLEME Reprint <u>Conferen</u> 19. KEY WORD geomagne vertical cosmic r 80. ABSTRACT Recent g have dev Referenc a new se these be changes	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 S (Continue on reverse side if necessive etic field cutoff rigidities rays T (Continue on reverse side if necessive geomagnetic measurement viated from the prediction the field (IGRF) coefficient et of time derivatives applied for time period	An end identify by block numbers and identify by block numbers and identify by block numbers have shown that a cients and associated has been determined to after 1975. The ime derivatives on a sociated in the former of the sociated in the social term in	er) er) cence, er) er) changes in the geomagnetic for al International Geomagnetic ed time derivatives. According ed with the suggestion that b ascertain the effects of t cosmic ray analyses, vertice or analyses for the room 1000
Recent geomagnetic measurements have shown that changes in the geomagnetic is have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordin a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of the changes of geomagnetic field time derivatives on cosmic ray analyses, vertice cutoff rigidities were calculated for selected locations using the IGRF 1965 field coefficients and associated time derivatives and the IGRF 1975 field	have deviated from the predictions of the original International Geomagnetic Reference Field (IGRF) coefficients and associated time derivatives. Accordi a new set of time derivatives has been determined with the suggestion that these be applied for time periods after 1975. To ascertain the effects of t changes of geomagnetic field time derivatives on cosmic ray analyses, vertic cutoff rigidities were calculated for selected locations using the IGRF 1965 field coefficients and associated time derivatives and the IGRF 1975 field	DD FORM 1472 EDITION OF LNOV 45 IS OBSOLETE	Approved 17. DISTRIBUT 18. SUPPLEME Reprint Conferen 19. KEY WORD geomagne vertical cosmic r 10. ABSTRACT Recent g have dev Referenc a new se these be changes cutoff r field co	TION STATEMENT (of this Report) I for public release; d TION STATEMENT (of the abstract of ENTARY NOTES from 15th Internationa ice Papers, 4, 204, 197 DS (Continue on reverse side if necession etic field cutoff rigidities rays T (Continue on reverse side If necession geomagnetic measurement viated from the predict the Field (IGRF) coefficient et of time derivatives applied for time period of geomagnetic field to igidities were calculated perficients and associal	al Cosmic Ray Confer Al Cosmic Ray Confer 77. Sary and identify by block number to have shown that of tions of the originations of the origination tions of the origination of the origination tions of the origination of the origination of the origination tions of the origination of the origination of the origination tions of the origination of t	rence, er) er) er) er) er) er) er) er)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

coefficients and the new time derivatives making each set of calculations appropriate for a 1980 Epoch. A comparison of these two sets of calculations shows that the uncertainty in predicted magnetic fields does not appear to be a serious limiting factor in the use of calculated vertical cutoff rigidities for the analyses of cosmic radiation data.

UNCLASSIFIED

W.C.r.

SECURITY CLASSIFICATION OF THIS PAGE(When Date Entered)