AD-A066 658 NAVY UNDERWATER SOUND LAB NEW LONDON CONN F/G 17/1
AN AS-1 PROGRAM TO COMPUTE ATTENUATION COEFFICIENTS ON THE UNIV--ETC(U)
JAN 70 R B MACDONALD

UNCLASSIFIED NUSL-TM-2211-10-70 NL

| OF |
AD
A066658

END
DATE
FILMED
5-79
DDC

MOST Project -2

LEVEL II

OOVI LIBRARY COPY

Code No

Copy No 44

NAVY UNDERWATER SOUND LABORATORY
NEW LONDON, CONNECTICUT 06320

AN AS-1 PROGRAM TO COMPUTE ATTENUATION COEFFICIENTS ON THE UNIVAC 1230 COMPUTER

by

R. B. MacDonald

NUSL Problem No.
0-A-401-00-00
SF 11 552 001-11282

NUSL Technical Memorandum No. 2211-10-70

16 January 1970

14 pp.

INTRODUCTION

The program is called "ATTENLOSS" and assumes a table (RANGE) is filled in core with values of range and propagation loss in sets of two. The program then works on this table to calculate the attenuation coefficient (COEFF), the transitional range (INTERCEPT), a table of ranges (RANGE 1), and a table of adjusted propagation loss (ADJPRO). Additionally, the standard error of estimate (SEE) and the standard error of the regression coefficient (SERC) are calculated.

MATH MODEL

The equations in this program are essentially derived from the propagation loss equation of the following form:

$$PL - 10 \log R = \alpha R + H_o$$

where: PL = propagation loss in DB.

R = range in yards.

$H_o = 10 \log R_o$ = the transitional range in DB or the point at which cylindrical rather than spherical spreading becomes the dominant loss mode.

α = attenuation coefficient in DB/yard.

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Navy Underwater Sound Laboratory.

DDC FILE COPY AD A066658

DDC RECEIVED APR 2 1979 E

700306-0097

The loss equation written in the above fashion is simply the equation for a straight line where $Y = PL - 10 \log R$, the adjusted propagation loss (ADJPRO), and $X = R$, the range. The transitional range H_o is simply the Y intercept and α, which is the attenuation coefficient, is the slope of the line. The solution for α can then be written as:

$$\alpha = \frac{n\Sigma XY - \Sigma X \Sigma Y}{n(\Sigma X^2) - (\Sigma X)^2} \text{ in DB/yard}$$

where n = number of data points

Similarly:

$$H_o = \frac{(\Sigma X^2)\Sigma Y - \Sigma X \Sigma XY}{n(\Sigma X^2) - (\Sigma X)^2} \text{ in DB}$$

An estimate of the "goodness of fit" of the data points to a straight line approximation may be made by calculating the standard error of estimate of the data points about the straight line which is given by:

$$SEE = \sqrt{\frac{\Sigma(\alpha R + H_o - PL + 10 \log R)^2}{n-2}} \text{ in DB}$$

and the standard error of the regression coefficient, which tests the variability of the attenuation coefficient, and is given by:

$$SERC = \frac{SEE}{\sqrt{R^2}} \text{ in DB}$$

MATH DEVELOPMENT

The following statements list the solutions to the above equations in the manner in which they are solved in the program.

1) ΣR

2) ΣR^2

3) $10 \log R$

4) $PL - 10 \log R$

5) $R(PL - 10 \log R)$

6) $\Sigma R(PL - 10 \log R)$

ADJPRO 7) $PL - 10 \log R$

8) $\Sigma(PL - 10 \log R)$

ACCESSION for
NTIS White Section
DDC Buff Section
UNANNOUNCED
JUSTIFICATION Per Letter
on File
BY
DISTRIBUTION/AVAILABILITY CODES
Dist. AVAIL. and/or SPECIAL
A

9) $(\Sigma R)^2$

10) $n(\Sigma R^2)$

11) $n(\Sigma R^2)-(\Sigma R)^2$

12) $\Sigma R \Sigma (PL-10 \log R)$

13) $n \Sigma R (PL-10 \log R)$

14) $n \Sigma R (PL-10 \log R)-\Sigma R \Sigma (PL-10 \log R)$

COEFF 15) $n\Sigma R (PL-10 \log R)-\Sigma R \Sigma (PL-10 \log R)/n(\Sigma R^2)-(\Sigma R)^2$

16) $\Sigma R \Sigma R (PL-10 \log R)$

17) $\Sigma R^2 \Sigma (PL-10 \log R)$

18) $\Sigma R^2 \Sigma (PL-10 \log R)-\Sigma R \Sigma R (PL-10 \log R)$

INTERCEPT 19) $\Sigma R^2 \Sigma (PL-10 \log R)-\Sigma R \Sigma R (PL-10 \log R)/n(\Sigma R^2)-(\Sigma R)^2$

20) αR

21) $\alpha R + H_o$

22) $\alpha R + H_o - PL + 10 \log R$

23) $(\alpha R + H_o - PL + 10 \log R)^2$

24) $\Sigma (\alpha R + H_o - PL + 10 \log R)^2$

25) $\Sigma (\alpha R + H_o - PL + 10 \log R)^2 / n-2$

SEE 26) $\sqrt{\Sigma (\alpha R + H_o - PL + 10 \log R)^2 / n-2}$

27) $\sqrt{\Sigma R^2}$

SERC 28) $SEE/\sqrt{\Sigma R^2}$

PROGRAM INPUTS

The program computes only one coefficient per pass or one frequency at a time. An area of core called "RANGE" must be set aside and filled in the following manner:

Table "RANGE"

Cell 1 Range (1) in hundreds of yards, scaled 0 bits
Cell 2 Propagation Loss (1) in DB, scaled 3 bits
Cell 3 Range (2)
Cell 4 Propagation Loss (2)
Cell 5 Range (3) etc.

The range and propagation loss sets do not have to be in any particular order and the range may be either positive or negative, indicating an opening or closing run. The total number of cells used for Table "RANGE" is set into cell "LIMIT", scaled 0 bits.

PROGRAM OUTPUTS

The following are program outputs (which remain in core):

COEFF	=	Attenuation coefficient in DB, scaled 15D bits.
INTERCEPT	=	Transitional range in DB, scaled 9D bits.
SEE	=	Standard error of estimate in DB, scaled 9D bits.
SERC	=	Standard error of the regression coefficient in DB/unit range, scaled 9D bits.

Table ADJPRO, adjusted propagation loss and range in the following form:

Cell 1 Range (1) in kyds, scaled 3 bits
Cell 2 PL -10log R(1) in DB, scaled 3 bits
Cell 3 Range (2)
Cell 4 PL -10log R(2).
Cell 5 Range (3) etc.

OPERATING INSTRUCTIONS

1) Load Table "RANGE"

2) Set "LIMIT" to number of values in table "RANGE"

3) RJP * ATTENLOSS

OTHER PROGRAMS REQUIRED FOR COMPILATION

CONLOGIT - Decibel conversion routine

FLPARITH - Floating point package

CORE REQUIREMENTS

214_{10}	cells for ATTENLOSS minus tables
96_{10}	cells for CONLOGIT
650_{10}	cells for FLPARITH
960_{10}	Total cells

COGNIZANT SCIENTIST

W. Thorp, Code 2211.2

Robert B. MacDonald
ROBERT B. MACDONALD
Physicist

Definition of Terms

1. RANGE1 - Table - Range values in kiloyards, scaled 3 bits.

2. QSUMR2 - Variable - Q register portion of floating point number for ΣR^2.

3. ASUMR2 - Variable - A register portion of floating point number for ΣR^2.

4. RANGE - Table - Range-propagation loss values. Range in hundreds of yards, propagation loss in DB. Range, unscaled; PL, scaled 3 bits.

5. SUMR - Variable - Sum of range values in kyds., scaled 3 bits.

6. LIMIT - Variable - Total number of values to be processed (range plus propagation loss), scaled 0 bits.

7. NOP - Variable - Holds count of total number of values processed, scaled 0 bits.

8. MTEMP - Variable - Temporary storage.

9. ASUMRNW - Variable - A register portion of floating point quantity for $\Sigma R(PL - 10 \log R)$.

10. QSUMRNW - Variable - Q register portion of floating point quantity for $\Sigma R(PL - 10 \log R)$.

11. ADJPRO - Table - Adjusted propagation loss (PL - 10 log R) in DB, scaled 3 bits.

12. NW - Variable - Sum of adjusted propagation loss Σ(PL - lo log R) in DB, scaled 3 bits.

13. ASUMR - Variable - A register portion of floating point number for $(\Sigma R)^2$.

14. QSUMR - Variable - Q register portion of floating point number for $(\Sigma R)^2$.

15. ADIVISOR - Variable - A register portion of floating point number for $n(\Sigma R^2) - (\Sigma R)^2$.

16. QDIVISOR - Variable - Q register portion of floating point number for $n(\Sigma R^2) - (\Sigma R)^2$.

17. ANOP - Variable - A register portion of floating point number for n.

18. QNOP - Variable - Q register portion of floating point number for n.

19. ASUMR1 - Variable - A register portion of floating point number for ΣR.

20. QSUMR1 - Variable - Q register portion of floating point number for ΣR.

21. ASUMT - Variable - A register portion of floating point number for $\Sigma R \Sigma (PL - 10 \log R)$.

Definition of Terms (cont.)

22. QSUBT - Variable - Q register portion of floating point number for $\Sigma R \Sigma(PL - 10 \log R)$.

23. COEFF - Variable - Attenuation coefficient in DB/yd., scaled 15D.

24. QRRNW - Variable - Q register portion of floating point number for $\Sigma R \Sigma R(PL - 10 \log R)$.

25. ARRNW - Variable - A register portion of floating point number for $\Sigma R \Sigma R(PL - 10 \log R)$.

26. INTERCEPT - Variable - Transitional range in DB, scaled 9D.

27. DIF - Variable - $\Sigma(\alpha R + H_0 - PL + 10 \log R)^2$, scaled 3 bits.

28. LIMIT2 - Variable - Total number of range (only) values, scaled 0 bits.

29. SYN - Variable - $\Sigma(\alpha R + H_0 - PL + 10 \log R)^2/n - Z$, scaled 3 bits.

30. SEE - Variable - Standard error of estimate in DB, scaled 9D.

31. SERC - Variable - Standard error of the regression coefficient in DB/unit range, scaled 9D.

Floating Point Arithmetic Terms (FLPARITH)

1. FLENT - Enter floating point accumulator.

2. FLAD - Floating point add.

3. FLSB - Floating point subtract.

4. FLMP - Floating point multiply.

5. FLDV - Floating point divide.

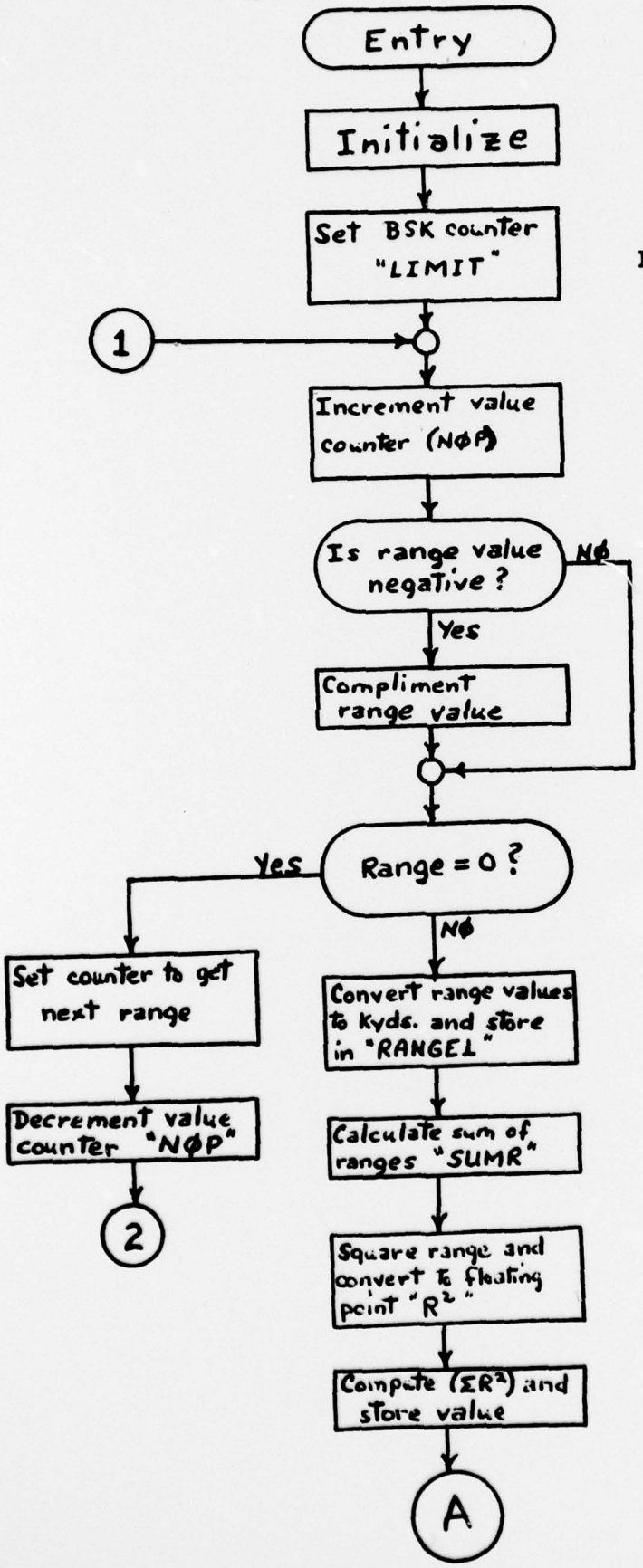
6. FLSTR - Floating point store.

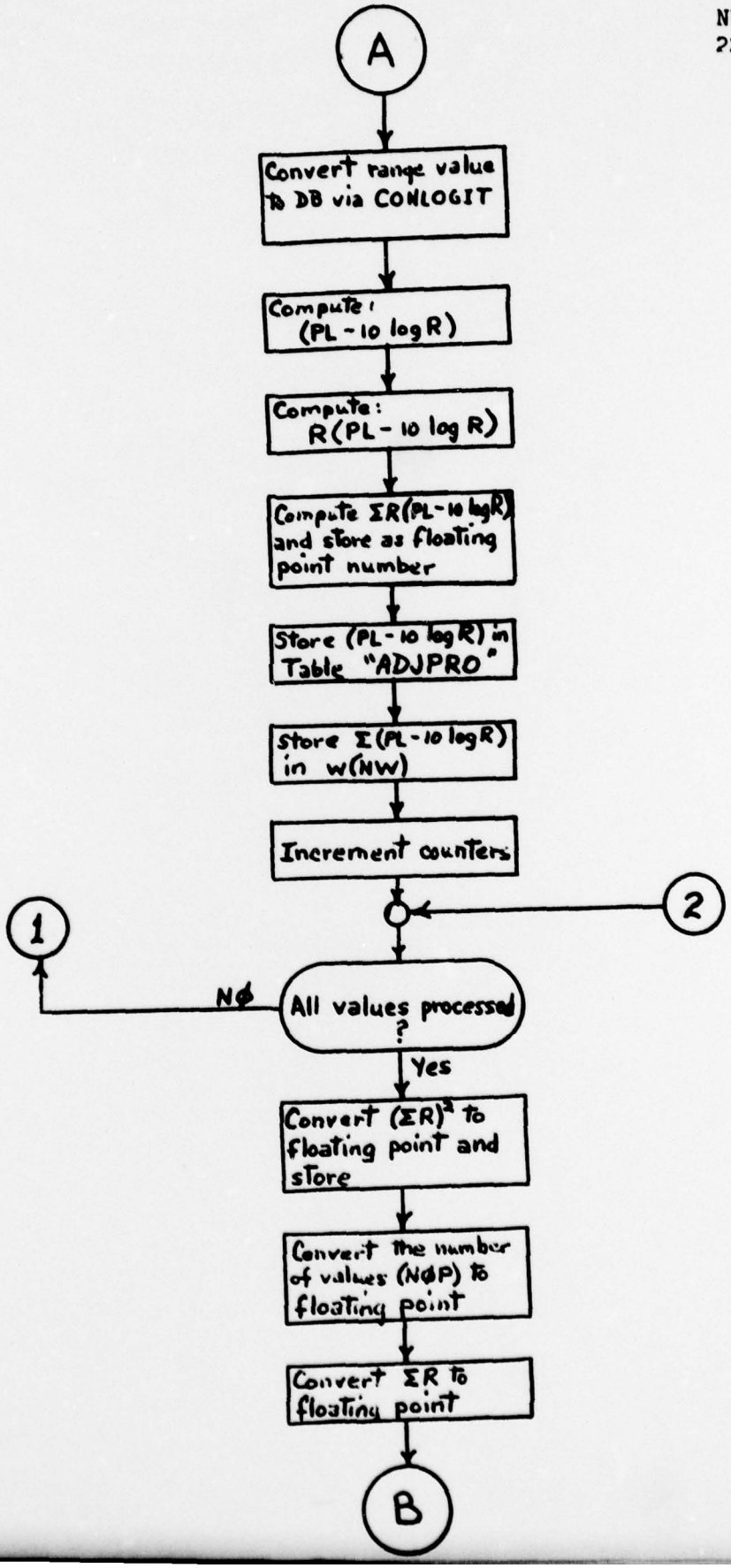
7. FIXFLT - Fixed point to floating point conversion.

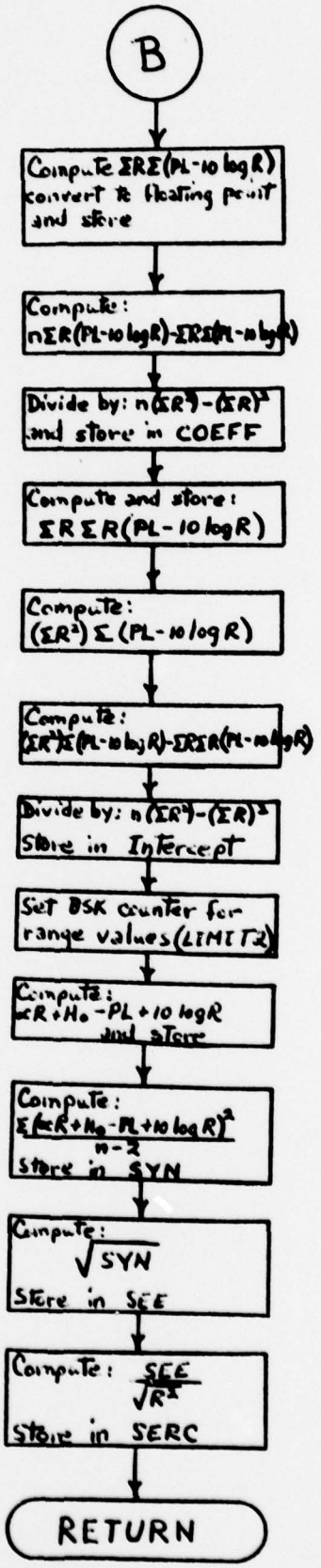
8. FLTFIX - Floating point to fixed point conversion.

FLOW DIAGRAM

Program "Attenloss"




A
Convert range value to DB via CONLOGIT
Compute: (PL - 10 log R)
Compute: R(PL - 10 log R)
Compute ΣR(PL-10 logR) and store as floating point number
Store (PL - 10 log R) in Table "ADJPRO"
Store Σ(PL - 10 log R) in w(NW)
Increment counters
1
2
NØ
All values processed ?
Yes
Convert (ΣR)² to floating point and store
Convert the number of values (NØP) to floating point
Convert ΣR to floating point
B


B
Compute ΣRΣ(PL-10 log R) convert to floating point and store
Compute: nΣR(PL-10 log R)-ΣRΣ(PL-10 log R)
Divide by: n(ΣR²)-(ΣR)² and store in COEFF
Compute and store: ΣRΣR(PL-10 log R)
Compute: (ΣR²)Σ(PL-10 log R)
Compute: (ΣR²)Σ(PL-10 log R)-ΣRΣR(PL-10 log R)
Divide by: n(ΣR²)-(ΣR)² Store in Intercept
Set BSK counter for range values (LIMIT2)
Compute: cR+H₀-PL+10 log R and store
Compute: Σ[cR+H₀-PL+10 log R]² / n-2 store in SYN
Compute: √SYN store in SEE
Compute: SEE/√R² store in SERC
RETURN

```
ATTN0001          C-CONTROL
ATTN0 02          ALLOCATION
ATTN0 03  BASE    20000
ATTN0 04          PROGRAM*MACDONALD*6JANUARY1969
ATTN0 13          LOC-DD
ATTN0 14          VRBL*SUMR*FXW'''SUM OF RANGE (YDS) SC 3
ATTN0 15          VRBL*NOP*FXW'''NUMBER OF RANGE VALUES
ATTN0 16          VRBL*ASUMR2*FXW'''SUM OF RNAGE SQUARED A REG. FLT PT
ATTN0 17          VRBL*QSUMR2*FXW'''SUM OF RANGE SQUARED Q REG. FLT PT
ATTN0 19          VRBL*ASUMRNW*FXW'''SUMR(NW-10LOGR) A REG. FLT PT
ATTN0 20          VRBL*QSUMRNW*FXW'''SUMR(NW-10LOGR) Q REG. FLT PT
ATTN0 21          VRBL*NW*FXW'''SUM(NW-10LOGR) SC 3
ATTN0 23          VRBL*ASUMR*FXW'''(SUM RANGE) SQUARED A REG. FLT PT
ATTN0 24          VRBL*QSUMR*FXW'''(SUM RANGE) SQUARED Q REG. FLT PT
ATTN0 25          VRBL*ADIVISOR*FXW'''NSUMR SQD.-(SUMR) SQD. AREG FLT
ATTN0026          VRBL*QDIVISOR*FXW'''NSUMR SQD.-(SUMR) SQD. QREG FLT
ATTN0 27          VRBL*ANOP*FXW'''NUMBER OF POINTS A REG. FLT. PT.
ATTN0 28          VRBL*QNOP*FXW'''NUMBER OF POINTS Q REG. FLT. PT.
ATTN0 29          VRBL*ASUBT*FXW'''SUMRSUM(NW-10LOGR) A REG. FLT PT
ATTN0 30          VRBL*QSUBT*FXW'''SUMRSUM(NW-10LOGR) Q REG. FLT PT
ATTN0 32          VRBL*QRRNW*FXW'''SUMRSUMR(NW-10LOGR) Q REG. FLT PT
ATTN0 33          VRBL*ARRNW*FXW'''SUMRSSUMR(NW-10LOGR) A REG. FLT PT
ATTN0 34          VRBL*SYN*FXW'''SUM(Y-YHAT)/N-2 SC 9
ATTN0 35          VRBL*DIF*FXW'''SUM(NW-10LOGR)A-(AR*H)P SC 6
ATTN0 36          VRBL*COEFF*FXW'''ATTEN COEFF(DB/YD)  SC 15D
ATTN0 37          VRBL*INTERCEPT*FXW'''TRANSITION RANGE(DB) SC 9
ATTN0 38          VRBL*SERC*FXW'''STAN. ERROR OF REG. COEFF. SC 15D
ATTN0 31          VRBL*LIMIT2*FXW'''NUMBER OF RANGE VALUES
ATTN0 18          VRBL*MTEMP*FXW'''TEMPORARY STORAGE
ATTN0 39          VRBL*SEE*FXW'''STAN. ERROR OF ESTIMATE SC 15D
ATTN0 22          VRBL*LIMIT*FXW'''TOTAL NUMBER OF POINTS(RANG + PROP)
ATTN              VRBL*ASUMR1*FXW'''SUM OF RANGES
ATTN              VRBL*QSUMR1*FXW'''SUM OF RANGES
ATTN0 40          END-LOC-DD
ATTN0 41  ATTNL   PROCEDURE*ATTENLOSS
ATTN0 42          ENT*B1*0'''INITIALIZE
ATTN0 43          ENT*Q*0'''INITIALIZE
ATTN0 44  MSTART  STR*Q*W(SUMR+B1)'''INITIALIZE SUMR
ATTN0 45          BSK*B1*50'''INITIALIZE OTHER VARIABLES
ATTN0 46          JP*MSTART
ATTN0 47          ENT*B2*0'''INITIALIZE
ATTN   48         RPL*Y-1*W(LIMIT)
ATTN   49 MSTART1 RPL*Y+1*W(NOP)
ATTN   50         ENT*Q*W(RANGE+B1)*QPOS
ATTN   5005       CP*Q
ATTN   5010       STR*Q*A*AZERO
ATTN   5015       JP*MBACK
ATTN   5022       ENT*B1*1+B1
ATTN   5020       RPL*Y-1*W(NOP)
ATTN   5025       JP*MNG
ATTN0051  MBACK   ENT*A*0
ATTN0051O5        LSH*Q*3
ATTN0051I0        DIV*12
ATTN   52         STR*Q*W(RANGE1+B2)
ATTN0 53          ADD*Q*W(SUMR)'''OBTAIN SUMR
ATTN0 54          STR*Q*W(SUMR)'''STORE
ATTN   55         ENT*Q*W(RANGE1+B2)
ATTN   56         MUL*W(RANGE1+B2)
```

```
ATTN0 57            LSH*AQ*30'''SET OCTAL PT. BET. A AND Q REGISTERS
ATTN0 58            RJP*FIXFLT'''RANGE SQUARED IN FLOATING POINT REG.
ATTN0 59            ENT*A*W(ASUMR2)'''ENTER SUM RANGE SQUARED
ATTN0 60            ENT*Q*W(QSUMR2)
ATTN0 61            RJP*FLAD'''SUM R SQUARED IN FLT PT REGISTER
ATTN0 62            RJP*FLSTR'''RESTORE R SQUARED TO A AND Q REGISTERS
ATTN0 63            STR*A*W(ASUMR2)'''STORE PARTS
ATTN0 64            STR*Q*W(QSUMR2)
ATTN  65            ENT*Q*W(RANGE1+B2)
ATTN0 66            LSH*Q*14'''SET UP FOR CONLOGIT
ATTN0 67            CONLOGIT'''INPUT SC 15D
ATTN0 68            STR*Q*W(MTEMP)'''STORE TEMPORARILY DB VALUE SC 3
ATTN0 69            ENT*Q*W(RANGE+1+B1)'''PROP LOSS VALUE  SC 3
ATTN0 70            SUB*Q*W(MTEMP)'''NW-10LOGR SC 3 IN DB
ATTN  71            MUL*W(RANGE1+B2)
ATTN0 72            LSH*AQ*30'''SET OCTAL PT BET A AND Q REGISTERS
ATTN0 73            RJP*FIXFLT'''CONVERT R(NW-10LOGR) GO FLT PT
ATTN0 74            ENT*A*W(ASUMRNW)'''SUM VALUES TO A AND Q
ATTN0 75            ENT*Q*W(QSUMRNW)
ATTN0076            RJP*FLAD'''COMPUTE SUMR(NW-10LOGR) IN FLT PT
ATTN0077            RJP*FLSTR'''SET VALUE TO A AND Q REGISTER
ATTN0078            STR*A*W(ASUMRNW)'''STORE PARTS
ATTN0079            STR*Q*W(QSUMRNW)
ATTN0080            ENT*Q*W(RANGE+1+B1)'''PROP LOSS SC 3 IN DB
ATTN0081            SUB*Q*W(MTEMP)
ATTN  82            STR*Q*W(ADJPRO+B2)
ATTN0083            ADD*Q*W(NW)'''SUM VALUES
ATTN0084            STR*Q*W(NW)'''SUM(NW-10LOGR)
ATTN0085            ENT*B2*1+B2'''INCREMENT COUNTER
ATTN  86            ENT*B1*1+B1
ATTN  87  MNG       BSK*B1*W(LIMIT)
ATTN0088            JP*MSTART1'''NO
ATTN0089            ENT*Q*W(SUMR)'''YES,CONTINUE
ATTN008905          CL*A
ATTN  90            LSH*AQ*33
ATTN  91            RJP*FIXFLT
ATTN  92            RJP*FLSTR
ATTN  93            RJP*FLMP
ATTN  9305          RJP*FLSTR
ATTN0094            STR*A*W(ASUMR)'''STORE PARTS
ATTN0095            STR*Q*W(QSUMR)
ATTN0096            ENT*A*0'''INITIALIZE
ATTN0097            ENT*Q*W(NOP)'''TOTAL RANGE VALUES  SC 0
ATTN0098            LSH*AQ*36'''SET OCTAL PT BET A AND Q REGISTERS
ATTN0099            RJP*FIXFLT'''CONVERT N TO FLT PT
ATTN0100            ENT*A*W(ASUMR2)'''SUMR(SQUARED) IN FLT PT
ATTN0101            ENT*Q*W(QSUMR2)
ATTN0102            RJP*FLMP'''NSUMR(SQ.) IN FLT PT
ATTN0103            ENT*A*W(ASUMR)'''(SUMR)SQUARED IN FLT PT
ATTN0104            ENT*Q*W(QSUMR)
ATTN0105            RJP*FLSB'''NSUMR(SQ.)-(SUMR)SQ. IN FLT PT
ATTN0106            RJP*FLSTR'''SET TO A AND Q
ATTN0107            STR*A*W(ADIVISOR)'''STORE PARTS
ATTN0108            STR*Q*W(QDIVISOR)
ATTN0109            ENT*A*0'''INITIALIZE
ATTN0110            ENT*Q*W(NOP)'''TOTAL NUMBER OF RANGE VALUES SC 0
ATTN0111            LSH*AQ*36'''SET OCTAL PT BET A AND Q REGISTERS
ATTN0112            RJP*FIXFLT'''CONVERT TO FLT PT
```

```
ATTN0113          RJP*FLSTR'''SET TO A AND Q
ATTN0114          STR*A*W(ANOP)'''STORE PARTS
ATTN0115          STR*Q*W(QNOP)
ATTN0116          CL*A
ATTN0117          ENT*Q*W(SUMR)
ATTN0118          LSH*AQ*33
ATTN0119          RJP*FIXFLT
ATTN0120          RJP*FLSTR
ATTN012005        STR*A*W(ASUMR1)
ATTN012010        STR*Q*W(QSUMR1)
ATTN012015        CL*A
ATTN012020        ENT*Q*W(NW)
ATTN012025        LSH*AQ*33
ATTN012030        RJP*FIXFLT
ATTN012035        ENT*Q*W(QSUMR1)
ATTN012040        ENT*A*W(ASUMR1)
ATTN 12045        RJP*FLMP
ATTN 12050        RJP*FLSTR
ATTN0121          STR*A*W(ASUBT)'''STORE PARTS
ATTN0122          STR*Q*W(QSUBT)
ATTN0123          ENT*Q*W(QNOP)'''TOTAL NUMBER OF RANGE PTS IN FLT PT
ATTN0124          ENT*A*W(ANOP)
ATTN0125          RJP*FLENT'''SET IN FLT PT REGISTER
ATTN0126          ENT*A*W(ASUMRNW)'''SET NSUMR(NW-10LOGR) TO A AND Q
ATTN0127          ENT*Q*W(QSUMRNW)
ATTN0128          RJP*FLMP'''NSUMR(NW-10LOGR) IN FLT PT REGISTER
ATTN0129          ENT*A*W(ASUBT)'''SET SUMRSUM(NW-10LOGR) TO A AND Q
ATTN0130          ENT*Q*W(QSUBT)
ATTN0131          RJP*FLSB'''NSUMR(NW-10LOGR)-SUMRSUM(NW-10LOGR) IN FP
ATTN0132          ENT*A*W(ADIVISOR)'''NSUMR(SQ.)-(SUMR)SQ.
ATTN0133          ENT*Q*W(QDIVISOR)
ATTN0134          RJP*FLDV'''ATTEN COEFF IN FLT PT REGISTER
ATTN0135          RJP*FLTFIX'''SET VALUE TO A AND Q  SC 30D
ATTN0136          RSH*AQ*17'''ATTEN COEFF SC 15D SET IN Q
ATTN0137          STR*Q*W(COEFF)'''STORE
ATTN0138          ENT*A*0'''INITIALIZE
ATTN0139          ENT*Q*W(SUMR)
ATTN0140          LSH*AQ*33'''SET OCTAL PT
ATTN0141          RJP*FIXFLT'''CONVERT TO FLT PT
ATTN0142          ENT*A*W(ASUMRNW)'''SUMR(NW-10LOGR) TO A AND Q
ATTN0143          ENT*Q*W(QSUMRNW)
ATTN0144          RJP*FLMP'''SUMRSUMR(NW-10LOGR)
ATTN0145          RJP*FLSTR'''SET TO A AND Q
ATTN0146          STR*Q*W(QRRNW)'''STORE PARTS
ATTN0147          STR*A*W(ARRNW)
ATTN0148          ENT*A*0'''INITIALIZE
ATTN0149          ENT*Q*W(NW)'''SUM(NW-10LOGR)
ATTN0150          LSH*AQ*33'''SET OCTAL PT
ATTN0151          RJP*FIXFLT'''CONVERT TO FLT PT
ATTN0152          ENT*Q*W(QSUMR2)'''SUMR(SQ.) IN FLT PT TO A AND Q
ATTN0153          ENT*A*W(ASUMR2)
ATTN0154          RJP*FLMP'''SUMR(SQ.)SUM(NW-10LOGR) IN FLT PT
ATTN0155          ENT*A*W(ARRNW)'''SUMRSUMR(NW-10LOGR)
ATTN0156          ENT*Q*W(QRRNW)
ATTN0157          RJP*FLSB'''SUMR(SQ)SUM(NW-10LOGR)-SUMRSUMR(NW-10LOGR
ATTN0158          ENT*A*W(ADIVISOR)'''NSUMR(SQ)-(SUMR)SQ
ATTN0159          ENT*Q*W(QDIVISOR)
ATTN0160          RJP*FLDV'''TRANSITION RANGE IN FLT PT REGISTER
```

```
ATTN0161                RJP*FLTFIX'''CONVERT TO FIXED POINT  SC 30D
ATTN0162                RSH*AQ*25'''TRANS. RANGE  SC 9
ATTN0163                STR*Q*W(INTERCEPT)'''STORE
ATTN0164                STR*B0*W(DIF)'''INITIALIZE
ATTN0165                RPL*Y+1*W(LIMIT)'''RESTORE VALUE
ATTN0166                STR*A*Q
ATTN0167                ENT*A*0'''INITIALIZE
ATTN0168                DIV*2
ATTN0169                STR*Q*W(LIMIT2)'''STORE
ATTN0170                RPL*Y-1*W(LIMIT2)'''SET BSK VALUE
ATTN 171                ENT*B2*0
ATTN 172   LIM          ENT*Q*W(RANGE1+B2)
ATTN0173                MUL*W(COEFF)'''PREDICTED AR  SC 18D
ATTN 174                RSH*AQ*9D
ATTN0175                ADD*Q*W(INTERCEPT)'''AR+H  SC 9 (PREDICTED)
ATTN0176                RSH*Q*6'''AR+H  SC 3
ATTN 177                ENT*A*W(ADJPRO+B2)
ATTN0178                STR*A-Q*Q'''DIF
ATTN 179                STR*Q*W(MTEMP)
ATTN 17905              MUL*W(MTEMP)
ATTN0180                ADD*Q*W(DIF)'''SUM VALUES
ATTN0181                STR*Q*W(DIF)'''STORE  SC 6
ATTN0182                BSK*B1*W(LIMIT2)'''COMPLETE SUM
ATTN0183                JP*LIM'''NO
ATTN0184                ENT*A*W(LIMIT2)
ATTN0185                SUB*A*1'''N-2
ATTN0186                ENT*Q*W(DIF)
ATTN0187                STR*A*W(MTEMP)'''TEM. STORE N-2
ATTN0188                ENT*A*0'''PREPARE TO DIVIDE
ATTN0189                LSH*AQ*15D
ATTN0190                DIV*W(MTEMP)'''DIF/N-2  SC 18D
ATTN0191                STR*Q*W(SYN)
ATTN0192                SQRT
ATTN0193                STR*Q*W(SEE)'''STAN. ERROR OF ESTIMATE  SC 9
ATTN0194                ENT*A*W(ASUMR2)
ATTN0195                ENT*Q*W(QSUMR2)
ATTN0196                RJP*FLENT
ATTN0197                RJP*FLTFIX
ATTN019705              RSH*AQ*30D
ATTN019710              SQRT
ATTN019715              STR*Q*W(MTEMP)
ATTN019720              ENT*Q*W(SYN)
ATTN019725              ENT*A*0
ATTN019730              DIV*W(MTEMP)
ATTN0198                SQRT
ATTN0199                STR*Q*W(SERC)'''STAN. ERROR OF REG. COEFF.  SC 15D
ATTN0200                RETURN
ATTN0201   RANGE        RESERVE*10000
ATTN0202   RANGE1       RESERVE*5000
ATTN0203   ADJPRO       RESERVE*5000
ATTN0204                END-PROC*ATTENLOSS
```