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1980/46

ERTIDE1: A COMPUTER PROGRAM TO
CALCULATE TIDAL GRAVITY CORRECTIONS

by

A.S. Murray

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ERTIDE1: A COMPUTER PROGRAM TO
CALCULATE TIDAL GRAVITY CORRECTIONS

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ERTIDE1 is a computer program which calculates tidal gravity corrections for given times and dates.

This Record contains a listing of the program (figs. 1-9), gives the input format (fig. 10), and provides an example of the output (fig. 11).

ERTIDE1 has been written to run on a CYBER 76 computer. No assistance can be given by BMR to convert it to run on other computers.

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1      PROGRAM LRTIDE1 (INPUT,OUTPUT,PUNCH,TAPE60=INPUT,TAPE61=OUTPUT,      ENT 000
      TAPE1,TAPE11,TAPE31,TAPE00)      ENT 000
C * * * CALCULATES TIDAL GRAVITY CORRECTIONS FOR GIVEN DATES AND TIMES. * * * C
C * * * CORRECTIONS CAN BE APPLIED TO FIELD READINGS IN GRVMTS FORMAT * * * C
5 C * * * AND A CORRECTED DECK OF FIELD READINGS CAN BE PUNCHED. * * * C
C * * * HOURLY TIDAL VALUES CAN BE CALCULATED BETWEEN TWO GIVEN DATES * * * C
C * * * AND CAN BE LISTED IN MILLIGALS WITH A HISTOGRAM OR AS A TABLE. * * * C
C * * * PROGRAM TIDYTIDE WRITTEN AND TESTED BY R. TOWERS IN DECEMBER 1969. * * * C
C * * * MODIFIED TO ALLOW STATION COORDS TO BE STORED TO AVOID DUPLICATION. * * * C
10 C * * * MODIFIED TO PRODUCE HOURLY VALUE LIST BY A. MURRAY IN FEB. 1971. * * * C
C * * * RENAMED TIDYTIDE AND CONVERTED TO CYMEX 76 IN NOVEMBER 1973. ASM. * * * C
C * * * REWRITTEN AND RENAMED ENTIDE1. NEW HOURLY VALUE FORMATS. OCT. 75. ASM. * * * C
C * * * THIS EDITION DATED 90/10/75. THIS VERSION DATED 26/02/80. * * * C
      COMMON/MIST/D,MATRIC(6)      ENT 001
15      COMMON/LATS/LATSTN,LONSTN,LATHEM,LONHEM,ALAT,ALON,ISN,FLAT,FLON      ENT 002
      COMMON/PAGE/LINE,IMHV,LOCALE(2),LATDEG,LATMIN,LONDEG,LONMIN,NPAGE      ENT 003
      COMMON/TIDE/IDAY,THON,IYER,NUNU(12),KMH,KMN,IMR,IMN,DFLAG,J,TDATF      ENT 004
      DIMENSION INFO(4),NDAY(12),MUNAME(12),IVAL(20),MHF(4),IFML(4)      ENT 005
20      DATA(NDDU=0.,71.,79.,90.,120.,151.,181.,212.,243.,273.,304.,334.)      ENT 0 1
      DATA(NDAY=31,28,31,30,31,30,31,31,30,31,30,31)      ENT 0 2
      DATA(MUNAME=7HJANUARY,8HFEBRUARY,9HMARCH,5HAPRIL,7HMay,6HJUNE,      ENT 0 3
      4HJULY,6HAUGUST,9HSEPTEMBER,7HNOVEMBER,8HNOVEMBER,8HDECEMBER)      ENT 0 4
      DATA(MHF=10H(48,212,14,10H,13,45,46,,1H348,16X,,7H48))      ENT 0 5
      DATA(IFML=13H,13,46,47,),(JRF=10H6V,3AR,8X,))
25      C
      C * * * READ CONTROL CARD FROM INPUT DECK
      C
      CALL FRRSET (IERR,(0000) & KRF=MHF(2) & LRF=MHF(3)
      IMHAC=0 & LINE=51 & INP=60 & CALL DATE (IDATE)      ENT 006
30      READ 20,INFO & IF(EOF(60))1450,30      ENT 007
      10 FORMAT (A8,4A10,4X,A10,A8)      ENT 008
      20 IF(INFO,NE,6HADJUST)GO TO 40 & IMHV=0 & GO TO 90      ENT 009
      30 IF(INFO,EO,6HMOURLY)GO TO 80      ENT 010
      IF(IMHAC,EO,1,AND,INP,EO,60)GO TO 130      ENT 011
35      PRINT 50,INFO(1) & LINE=51      ENT 012
      50 FORMAT (1H1,0 A CONTROL CARD IS MISSING. THE FIRST WORD WAS *A8)      ENT 013
      60 READ 20,INFO & IF(EOF(60))110,70      ENT 014
      70 IF(INFO(8),EO,8HENDFLIGHT)10,60      ENT 015
      80 IMHV=1      ENT 016
40      90 DECODE(70,100,INFO(2))KMH,KMN,MODE,LOT,LAGTIM,LATDEG,LATMIN,      ENT 017
      1 LONDEG,LONMIN,LATHEM,LONHEM,IDAY,THON,IYER,LUAY,LON,LYER,LOCALE      ENT 018
100      FORMAT (I3,I2,1X,A5,A1,I2,2(I3,I2,1X),2(A1,1X),2(1X,7(1X,I2)),2A10)      ENT 019
      ON 114 I=1,6      ENT 020
110      MATRIC(I)=1H & LINE=51      ENT 021
45      J=1H & IF(KMH,LE,0)J=1H & IF(KMH,EO,0)KMH=0 & IF(KMN,EO,0)KMN=0      ENT 022
      IF(LOT,EO,1H,AND,IMHV,NE,0)IMHV=2 & IF(LOT,EO,1H)10TER      ENT 023
      IF(LATHEM,EO,1H)LATHEM=1H & IF(LONHEM,EO,1H)LOHEM=1H      ENT 024
      IF(IMHV,NE,0)GO TO 300 & IMHAC=1 & INP=60 & IF(IDAY,NE,0)INP=IDAY      ENT 025
      MHF(2)=KMH & MHF(3)=LRF & IF(THON,EO,0)GO TO 115
      MHF(2)=IMF & MHF(3)=JRF
50      115 FLAT=0.0 & IF(LATDEG,AND,MASK(6))1,NE,0)GO TO 120      FRTA025
      FLAT=(LATDEG+0.0007+LATMIN/60.0 & FLON=LONDEG+0.0007+LONMIN/60.0      ENTP025
      C
      C * * * READ INFORMATION FROM FLIGHT HEADER CARD ON UNIT INP
      C
55      120 READ (INP,20)INFO & IF(EOF(INP))1400,130      ENT 026
      130 IF(INFO(8),NE,8HENDGRAVS)140,400      ENT 027

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140 DECODE(RH,145,INFO)LOCALF,IDAY,IMON,IYER,METER,SCALE      ERT 028
145 FORMAT (A8,2X,A3,3I2,A7,PA,5)                             ERT 029
    IF(SCALE.EQ.0.0)SCALE=1.05                                  ERT 030
C
C . . . PUNCH AND/OR PRINT FLIGHT HEADER INFORMATION
C
    IF(MODE.NE.5)PUNCH)GO TO 169 & KAPPA=SCALE*1E5            ERT 031
    PUNCH 150,LOCALF,IDAY,IMON,IYER,METER,KAPPA              ERT 032
65 150 FORMAT (A8,A3,3I2,A7,I8)                                ERT 033
160 IF(LINE.GT.40)CALL PAGE 5 LINE=LINE+2 & LAWR=0          ERT 034
    PRINT 170,LOCALF,IDAY,IMON,IYER,METER,SCALE,J,KMM,KMN    ERT 035
70 170 FORMAT(1H0,A9,A6,2(I2,1H/),I2,2X,A6,F6.5,14X,GMT=A1,I3+H=I3+H=)
    CALL BASE                                                  ERT 037
C
C . . . READ INFORMATION FROM FIELD HEADING CARD ON UNIT INP
C
75 175 READ(INP,MHF)ISN,IMR,IMN,IMD,ITM,LATSTN,LONSTN,IFML,LA
    IF(EOF(INP))200,190
    IF(LAST.NE.8)MENUFLIGHT1 GO TO 220
    190 IF(MODE.NE.5)PUNCH)GO TO 120
    200 IF(MODE.NE.5)PUNCH)GO TO 120
    PUNCH 210 & GO TO 120
    210 FORMAT (72(1H),8MENUFLIGHT)
    220 IF(LAWR=IMR.GT.18)IMR=IMR+24 & LAWR=IMR & IMR=IMR-LAGTIM
    CALL SITE & IF(LATSTN.EQ.0)LOST1GO TO 175
    ERT 038
    ERT 039
    ERT 040
    ERT 041
    ERT 042
    ERT 043
    ERT 044
    ERT 045
    ERT 046
C
C . . . LOCATE STATION CORRS AND CALCULATE TIDAL CORRECTION.
C
85 230 CALL TIDE & IMR=IMR+LAGTIM
    ERT 047
C
C . . . PUNCH AND/OR PRINT CORRECTION AND CORRECTED READING
C
90 240 IAT=ALAT & PLAT=(ALAT-IAT)*.001 & MAT=BLAT*100.
    ION=AION & BLON=(ALON-ION)*.001 & MON=BLON*100. & D=DELTA/SCALE
    DELTA=DELTA/SCALE*.001 & IF(DELTA.LT.0.5)DELTA=DELTA-1.0
    IRU=IPD+DELTA & IF(MODE.NE.5)PUNCH)GO TO 240
    PUNCH 250,ISN,IMR,IMN,IRU,ITM,IAT,MAT,ION,MON,IFML
    250 FORMAT (A8,2I2,I6,I3,I2,I4,I3,I4,3A8)
    260 IF(LINE.GE.49)CALL PAGE 5 LINE=LINE+1 & IF(LOT.NE.0)CALL MIST
    PRINT 250,ISN,IMR,IMN,IPD,ITM,IAT,BLAT,LATHEM,ION,BLON,LONHEM,
    DELTA,MATRIC
    270 FORMAT(1X,A10,2I3,I9,I7,2X,2(I3,F5.1,1X,A6),5X,F6.3,2X,4A10,A4)
    GO TO 175
    ERT 048
    ERT 049
    ERT 050
    ERT 051
    ERT 052
    ERT 053
    ERT 054
    ERT 055
    ERT 056
    ERT 057
    ERT 058
100 C
C . . . HOURLY VALUES REQUIRED STARTING AT 0100 ON GIVEN DATE.
C
300 IMR=0 & IMN=0 & INC=LAGTIM & IF(IWHV.EQ.2.0)INC=1
    LAUDAY=LYER*366+DUDU(IMON)+LDAY & NPAGE=0 & CALL PAGE
    105 ALAT=IATDFG+LATMIN/60.0
    ALON=LONDFG+LODMIN/60.0 & GO TO 330
    ERT 059
    ERT 060
    ERT 061
    ERT 062
C
C . . . PRINT ONE DAYS HOURLY VALUES IN TABLE FORMAT
C
110 310 PRINT 320,JYER,IMON,IDAY,(IVAL(I),I=1,24) & JYER=JMON+1
    320 FORMAT (A8,A9,I2,24(I5))
    ERT 063
    ERT 064
C
C . . . INCREMENT DATE BY ONE DAY AND PRINT HEADING IF REQUIRED
C

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115      325 IMR=IMR+24*INC & IDAY=IDAY+1 & IF(IDAY,LE,MDAY)GO TO 340
      IDAY=IDAY-MDAY & IMON=IMON+1 & IF(IMON,LE,12)LINE=41
      IF(IMON,LE,12)GO TO 330 & IMON=IMON-12 & IYER=IYER+1
120      330 LPY=IYER-IYER/400 & MDAY=MDAY(IMON)
      IF(LP,LE,0,AND,IMON,GE,2)MDAY=MDAY+1
      JMUN=MONAME(IMON) & ENCOUF(6,335,IYER)IYER
      335 FORMAT(3H 10,12,1X)
      340 MDAY=IYER*366+DOOO(IMON)+IDAY & IF(MDAY,GT,LADAY)GO TO 10
      ENCOUF(10,340,JDATE)IDAY,IMON,IYER
      350 FORMAT(13,2(1H/,12))
125      CALL PAGE & IF(LINE,GT,40)CALL PAGE
      C
      C . . . CALCULATE HOURLY TIDAL VALUES AT INTERVALS OF INC HOURS AND LIST THEM
      C
130      360 IMR=IMR+INC & IF(IMR,GT,24)GO TO (325,310)IMHV & CALL TIDE
      IF(IMHV,NE,2)GO TO 370 & TVAL(IMR)=DELTAC+1800.0 & GO TO 360
      370 IF(LINE,GE,56)CALL PAGE & LINE=LINE+1 & D=DELTAC & CALL H1ST
      PRINT 380,JDATE,IMR,IMN,DELTAC,MATRIC & JDATE=IM & GO TO 360
      380 FORMAT (15X,A10,13X,12,15,16X,F6.3,13X,5A10,A6)
      C
135      C . . . END OF GNVHTS DATA OR END OF FILE
      C
      400 IF(MODE,EQ,4)HPUNCH)PUNCH 410 & THRAC=0 & GO TO 10
      410 FORMAT (72(1H0),8HENDGNVHTS)
      420 IF(THRAC,EQ,1)GO TO 400
140      PRINT 440
      440 FORMAT (4H+---, & END TIDYTIME, &,3H+---)
      END

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ERT 065
ERT 066
ERT 067
ERT 068
ERT 069
ERT 070
ERT 071
ERT 072
ERT 073
ERT 074
ERT 075
ERT 076
ERT 077
ERT 078
ERT 079
ERT 080
ERT 081
ERT 082
ERT 083
ERT 084
ERT 085
ERT 086

```

Fig. 3

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1      SUBROUTINE HIST                                MST 001
      C . . . SETS UP A HISTOGRAM OF + OR - SIGNS IN ARRAY MATRIC FOR TIDE OF DELTAG
      C . . . CALLED FROM ERTIDF
      COMMON/HIST/DELTAG,MATRIC(6)
5      DATA(KM=10), (KO=10), (KP=10), (KR=10)
      C . . .
      NUM=DELTAG*100.0+0.5 & IF (DELTAG.LE.-0.005) NUM=NUM-1
      IF (NUM) 20,30,5                                MST 002
                                                    MST 003
                                                    MST 004
                                                    MST 005
10     C . . . POSITIVE CORRECTION
      C
      5 NUM=MOD(NUM,25)                                MST 006
      NOB=20-NUM                                       MST 007
      ENCODE(40,10,MATRIC)(KB,I=1,27),KO,(KP,I=1,NUM),(KR,I=1,NOB)
15     10 FORMAT(40R1)                                MST 008
      1 RETURN                                         MST 009
      C
      C . . . NEGATIVE CORRECTION
      C
20     20 NUM=NUM & NUM=MOD(NUM,25)                   MST 011
      NOB=27-NUM                                       MST 012
      ENCODE(40,10,MATRIC)(KB,I=1,NOB),(KM,I=1,NUM),KO,(KP,I=1,20)
      RETURN                                           MST 013
                                                    MST 014
25     C
      C . . . ZERO CORRECTION
      C
      30 ENCODE(40,10,MATRIC)(KB,I=1,27),KO,(KR,I=1,20)
      END
                                                    MST 015
                                                    MST 016

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Fig. 4

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1      SUBROUTINE PAGE                                PGE 000
C      * PRINTS PAGE HEADINGS AND ERROR MESSAGES FOR ERTIDE OUTPUT.
C      * CALLED FROM ERTIDE
C      COMMON/LATS/LATSTN,LONSTN,LATHEM,LONHEM,ALAT,ALON,ISN,FLAT,FLON
5      COMMON/PAGE/LINE,IHHV,LOCALE(P),LATDEG,LATMIN,LONDEG,LONMIN,NPAGE
C      COMMON/TIME/IDAY,IMON,IYER,DUND(12),KMH,KMN,IHR,IMN,DELTAJ,J,TDAT
C      DATA (NPAGE=0), (NAX=61)                                PGE 001
C                                                                PGE 002
C                                                                PGE 003
C                                                                PGE 004
C      * PAGE NUMBER
10     C
C      NPAGE=NPAGE+1 & LINE=3 & IF (NPAGE.LT.NAX)GO TO 500 & NAX=NAX+60
C      CALL DISPOSE (6LOUTPUT,5LRIOCP,2LPH,0) & CALL REOPEN (6LOUTPUT)
C      PRINT 505,NPAGE,TDAT
C      FORMAT (1H1.61X,0PAGE NO.,14.1X,0COMPUTED UN.,A10/1X)
15     IF (IHHV-1)510,530,540                                PGE 005
C                                                                PGE 006
C                                                                PGE 007
C                                                                PGE 008
C      * FIELD DATA INPUT
C      510 PRINT 520 & RETURN
C      520 FORMAT (0 STATION, MRS MIN CORR,0UG, TEMP LAT(0EG,MIN) LONG0,
C      1      0(0EG,MIN) CORRECTION(MGAL)0)
C                                                                PGE 009
C                                                                PGE 010
C                                                                PGE 011
C      * HOURLY VALUE LIST
C      530 PRINT 540
C      540 FORMAT (10X,0DATE0,15X,0MRS MIN0,15X,0CORRECTION(MGAL)0)
C                                                                PGE 012
C                                                                PGE 013
C      * SITE DESCRIPTION FOR HOURLY VALUES
C      550 PRINT 560,LOCALE,LATDEG,LATMIN,LATHEM,LONDEG,LONMIN,LONHEM,J,
C      1      KMH,KMN & LINE=LINE+5
C      560 FORMAT (1H0,65X,23(1H0)/1X,A0,A7,0LATITUDE = 0.12,13,0.0 0.01,
C      1      0X,0LONGITUDE = 0.213,0.0 0.05,2H0 0,0TIME = GMT0,A1,
C      2      13,1H0,13,1H0,2H 0/60X,23(1H0)/1X)
30     PGE 014
C                                                                PGE 015
C                                                                PGE 016
C                                                                PGE 017
C                                                                PGE 018
C      * HEADING FOR TABLE OF HOURLY VALUES
35     C
C      IF (IHHV.EQ.2)PRINT 570,(1,1=1,24)
C      570 FORMAT (1H0,55X,0TIDAL GRAVITY CORRECTIONS IN MICROGALS0/5X,
C      1      0DATE / TIME00,24/13,0000/1X)
C                                                                PGE 019
C                                                                PGE 020
C                                                                PGE 021
C                                                                PGE 022
C      RETURN
C      * ERROR MESSAGE FOR MISSING COORDINATES, CALLED FROM SITE
C      ENTRY LOST
C      PRINT 5A2,ISN & LINE=LINE+3 & LATSTN=4HLOST
C      5A0 FORMAT (1H0,0 COORDINATES OF STATION 0A00 ARE MISSING0/1X)
C      RETURN
45     PGE 023
C                                                                PGE 024
C                                                                PGE 025
C                                                                PGE 026
C      * ILLEGAL DATE ON FLIGHT HEADER, CALLED FROM TIME
50     C
C      ENTRY WHEN
C      PRINT 590,TDAY,IMON & LINE=LINE+3
C      590 FORMAT (1H00 ILLEGAL DATE IN FLIGHT HEADER, DAY0130 MONTH 013/X)
C                                                                PGE 027
C                                                                PGE 028
C                                                                PGE 029
55     RETURN
C      * DIFFERENT COORDINATES FOR A STATION - CALLED FROM SITE.

```


SUBROUTINE PAGE

76/76 UPT=1

FTN 4,6+060

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PAGE 2

C

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ENTRY DILT
PRINT 595,ISM & LINE=LINE+3
595 FORMAT(1H0,0 PREVIOUS COORDINATES DIFFER FOR STATION *,A8)
END
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PGE 030

G452-81A

Fig.6

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1      SUBROUTINE SITE
C * * * STORES AND RELOCATES COORDINATE FOR UP TO 1000 STATIONS.
C * * * CALLED FROM ERTIOF
COMMON/LATS/LATSTN(2),LATHEM,LONHEM,ALAT,ALON,ISN,FLAT,FLON
5      DIMENSION LIST(1000),SLAT(1000),SLOM(1000)
DATA (NOST=1001),(I=1001)
LATISH=0 & IF(LATSTN(1).NE.1H)LATISH=1
C
C * * * NO LATITUDE GIVEN. SEARCH LIST
10     IF(NOST.GT.1000)GO TO 605
        DO 600 I=NOST,1000
            IF(ISN.EQ.LIST(I))GO TO 600
        600 CONTINUE & I=1001
15     IF(LATISH.EQ.1)GO TO 620
C
C * * * STATION NOT IN LIST. TRY LATITUDE ON CONTROL CARD.
C
C         IF(FLAT.EQ.0.P)GO TO 410 & ALAT=FLAT & ALON=FLON & RETURN
20     C
C * * * NO COORDINATES AVAILABLE. CALL FOR DIAGNOSTIC
C
C         610 CALL LOST & RETURN
25     C
C * * * COORDINATES ARE ON STATION CARD. DECODE AND STORE
C
C         620 DECODE (20,630,LATSTN(1),CLAM,CLOD,CLOM
        630 FORMAT (F2.0,F3.1,F3.0,F3.1)
        ALAT=CLAD+CLAM/60.0 & ALON=CLOD+CLOM/60.0
30     IF(LATISH.EQ.1.AND.I.LT.1001)GO TO 660
        645 IF(NOST.LE.1)GO TO 640
        NOST=NOST-1 & SLAT(NOST)=ALAT & SLOM(NOST)=ALON & LIST(NOST)=ISN
        640 RETURN
C
C * * * STATION FOUND IN LIST. RETRIEVE COORDINATES.
35     C
C         650 ALAT=SLAT(I) & ALON=SLOM(I) & IF (LATISH.EQ.1)620,640
C
C * * * REPEATED COORDINATES FOR A STATION - ARE THEY THE SAME.
40     C
C         660 IF(SLAT(I).EQ.ALAT.AND.SLOM(I).EQ.ALON)RETURN
        CALL DILT & GO TO 635
        END

```

STE 001
STE 002
STE 003
STE 004
STE 005
STE 006

STE 008
STE 009
STE 010
STE 011

STE 012

STE 013

STE 014
STE 015
STE 016

STE 017
STE 018

STE 019

STE 020

Fig.7

76/76 00701

FTN 4.6+460

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PAGE 2

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720 DIM=DOODN(IMON) $ IF(IMON.LE.2)GO TO 730 $ IF(IYER.EQ.0)GO TO 730 TOE #37
  LY=IYER-IYER/400 $ IF(LY.EQ.0)DIM=DIM+1 TOE #38
730 DIM=DIM+DAY-1.0 TOE #39
  U=1.0 $ IF(J.NE.1)U=-1.0 $ WRB=KMR+U*KMN/60.0 TOE #40
  U=(NIV+DIM-WRB/24.0)/36525.0 TOE #41
  END TOE #42

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*** END TIDYTIME. ***

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G452-83A

Fig. 8

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1      SUBROUTINE TIDE                                TDE 000
C      * CLACULATES TIDAL GRAVITY CORRECTIONS AT A GIVEN TIME AND PLACE.
C      * CALLED FROM ERTIDE
C      * COMMON/LATS/LATSTN(2),LATHEM,LONHEM,ALAT,ALON,ISN,FLAT,FLON
C      * COMMON/TIDE/IDAY,IMON,IVER,DDO(12),KMR,KMN,IHR,IMN,DELTAJ,J,TOATE
C      * DATA (SI=0.009677),(SM=0.397981),(SWC=0.396378),(CWSI=0.002269)
C      * DATA (CWC=0.013698),(SWSI=0.03569),(RADIAN=0.017453),(CH=0.917394)
C      * DATA (PI=3.141592)
10     C      * DETERMINE TIME IN JULIAN CENTURIES AT WHICH OBSERVATION IS MADE.
C      *
C      * GCT=IHR+IMN/60.0 & T=0+GCT/876600.0 & GCT=GCT-HRS
C      *
C      * DETERMINE MEAN ECLIPTIC COORDINATES OF SUN AND MOON.
15     C      *
C      * CLAT=ALAT+RADIAN & IF(LATHEM,EU,IMS)CLAT=CLAT & SINCLAT=SIN(CLAT)
C      * COSCLAT=COS(CLAT) & R=1.0-R*0.003369+SINCLAT**2
C      * CLON=ALON+RADIAN & IF(LONHEM,EU,IMS)CLON=CLON
C      * S = 270.437+481267.891*T & S = AMOD(S,360.0)+RADIAN
C      * M = 279.697+36088.769*T & M = AMOD(M,360.0)+RADIAN
C      * PM = 374.330+4869.034*T & PM = AMOD(PM,360.0)+RADIAN
C      * PS = 241.221+1.719*T & PS = AMOD(PS,360.0)+RADIAN
C      * EN = 249.143-1934.142*T & EN = AMOD(EN,360.0)+RADIAN
C      * SINNSIN(EN) & COSNCOS(EN)
C      * COSI=CWC-SWSI*COSNCOS & SINT=SQRT(1-COSI**2)
C      * SINVSIN(SINN/SINI) & V=ASIN(SINV)
C      * IF(ABS(PI-APS(EN)).GT.0.0034)GO TO 702 & ALPHA=PI & GO TO 705
C      * ALPHA=2*ATAN2(SW* SINN, SINT+SWCI*COSNCOS+CWSI)
C      * ELM=S-EN+ALPHA+0.1098*SIN(S-PH)+0.00376*SIN(2*(S-PH))
C      * P=0.0154*SIN(S+PM-2*M)+0.007498*SIN(2*(S-M)) & SINMSIN(ELM)
C      * NDM=1+0.0549*COS(S-PH)+0.007014*COS(2*(S-PH))
C      * P=0.0008*COS(S+PM-2*M)+0.005596*COS(2*(S-M))
C      * ELS=M+0.03350*SIN(M-PS) & SINMSIN(ELS)
C      * KDS=1+0.01675*COS(M-PS)
C      * SHA=0.2618*(GCT-12.0)+CLON & XIS=SHA+M & XIM=XIS-V
C      *
C      * DETERMINE ZENITH ANGLES OF SUN AND MOON.
C      *
C      * CTHETA=SINCLAT*SINN+COSCLAT*(COS(ELM)*COS(XIM)+COST*SINMSIN(XIM))
C      * COSPHI=SINCLAT*SW+SINN+COSCLAT*(COS(ELS)*COS(XIS)+CH*SINMSIN(XIS))
C      *
C      * DETERMINE GRAVITY CORRECTION IN MILLIGALS
C      *
C      * GM=0.055078+RDM**3+R*(3*CTHETA**2-1)+0.001371+RDM**4+R**2*
C      * (5*CTHETA**3-3*CTHETA)
C      * GS=0.02538+RDS**3+R*(3*COSPHI**2-1)
C      * DELTAJ=1.2*(GM+GS)
C      * RETURN
C      *
C      * DETERMINE JULIAN CENTURIES ELAPSED FROM 1200 HOURS G.M.T. ON 11/12/1899
C      * TO 0000 HOURS L.M.T. ON THE DATE OF THE FLIGHT.
C      *
C      * ENTRY BASE
C      * NOLY=(IVER-1)/4 & DIY=NOLY*366.0+(IVER-NOLY)*365.0+0.5
C      * IF(IDAY,LE,0,OR,IDAY,GE,32)GO TO 710
C      * IF(IMON,GE,1,AND,IMON,LE,12)GO TO 720
C      * CALL WHEN & IDAY=IMON=1

```

BMR DATA CODING FORM

NAME		INPUT FORMAT FOR ERTIDEI																																																												DATE		SHEET OF															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
HOURLY		1000					T		1655					14546					S		E		01/02/80					30/03/80					CAIRNS																																														
		Correction to							Deg.Min.					Deg.Min							Starting Date					Finishing date					Locality name																																																
		GMT in hours							Latitude					Longitude																																																																	
FORMAT(A8,I3,I2,6X,A1,2X,2(I3,I2,1X),2(A1,1X),2(1X,3(1X,I2)),2A10)																																																																															

(Based on G452-21A)

Record 19CO/46

G452-85A

Fig.10

CANBERRA

LATITUDE = 35 17.0 S

LONGITUDE = 149 7.0 E

 * TIME = GMT+ 10H PM *

		TIDAL GRAVITY CORRECTIONS IN MICROGALS																							
DATE / TIME		12H	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
1980 MAY	1	131	94	52	-1	-48	-79	-89	-78	-51	-19	9	25	24	0	-22	-54	-78	-87	-75	-42	6	60	107	138
	2	144	125	84	33	-19	-60	-83	-85	-69	-42	-14	7	14	6	-15	-43	-69	-83	-80	-56	-15	35	86	126
	3	145	140	112	68	16	-31	-65	-81	-74	-60	-34	-13	0	0	-12	-33	-57	-74	-79	-65	-34	8	58	102
	4	132	142	130	97	53	5	-36	-64	-75	-70	-54	-34	-18	-10	-13	-26	-44	-61	-70	-66	-47	-15	26	70
	5	106	124	132	116	84	42	0	-15	-59	-60	-64	-52	-37	-25	-20	-23	-32	-45	-55	-58	-51	-31	-1	34
	6	70	100	117	119	103	74	34	0	-32	-54	-64	-64	-55	-43	-32	-25	-24	-28	-35	-40	-42	-36	-21	2
	7	31	61	84	102	105	94	70	37	2	-29	-53	-66	-68	-61	-48	-34	-22	-14	-12	-15	-20	-25	-25	-19
	8	-4	17	43	60	87	94	84	68	37	2	-31	-57	-73	-75	-66	-48	-27	-7	7	13	18	0	-12	-22
	9	-26	-19	-2	22	49	73	84	83	65	35	-2	-19	-68	-83	-82	-66	-39	-8	19	30	45	37	18	-5
	10	-27	-40	-40	-25	0	32	61	77	77	59	25	-14	-53	-81	-92	-84	-57	-19	21	55	76	78	61	31
	11	-5	-48	-50	-63	-47	-17	18	50	69	67	46	9	-33	-71	-95	-97	-77	-39	9	57	94	112	106	78
	12	35	-12	-50	-79	-82	-64	-30	8	41	57	51	27	-11	-54	-80	-103	-90	-62	-12	44	95	130	140	124
	13	84	31	-24	-69	-94	-95	-73	-37	1	31	43	33	4	-35	-74	-100	-104	-83	-39	10	79	120	156	157
	14	129	80	20	-37	-81	-102	-99	-75	-39	-3	21	27	12	-18	-56	-88	-100	-96	-64	-12	49	108	151	169
	15	150	123	68	7	-48	-87	-103	-95	-70	-37	-7	10	9	-9	-39	-71	-94	-99	-80	-40	15	75	127	160
	16	168	149	107	52	-4	-54	-84	-96	-86	-62	-34	-11	-1	-7	-26	-53	-78	-91	-86	-59	-15	30	91	134
	17	156	155	130	87	35	-15	-54	-80	-85	-75	-54	-32	-16	-12	-20	-18	-59	-76	-79	-66	-34	6	54	90
	18	129	142	133	106	66	20	-21	-54	-71	-74	-64	-48	-32	-21	-20	-28	-42	-56	-64	-61	-44	-15	22	61
	19	95	110	121	109	83	47	9	-24	-49	-63	-64	-50	-45	-33	-25	-23	-28	-36	-44	-46	-40	-24	0	30
	20	50	83	94	97	85	63	33	2	-25	-46	-58	-60	-55	-45	-33	-24	-20	-20	-23	-26	-26	-21	-9	8
	21	-29	50	-64	76	-75	66	47	23	-2	-26	-45	-57	-60	-54	-43	-29	-17	-8	-3	-3	-6	-8	-7	-2
	22	7	20	34	08	57	58	51	37	16	-7	-30	-49	-60	-61	-53	-38	-19	-1	11	18	17	11	4	-2
	23	-5	-1	4	19	32	42	46	42	29	9	-15	-39	-57	-65	-62	-48	-24	0	21	36	42	36	24	7
	24	-6	-15	-14	-9	0	19	32	39	35	21	0	-26	-50	-66	-69	-59	-36	-5	25	50	64	63	49	27
	25	2	-18	-31	-32	-23	-6	12	27	34	28	10	-14	-42	-64	-74	-69	-48	-15	22	57	81	88	78	53
	26	21	-11	-34	-44	-47	-33	-11	10	25	28	18	-3	-31	-58	-76	-78	-62	-29	13	56	91	109	106	84
	27	48	0	-30	-56	-65	-57	-37	-12	10	23	21	5	-21	-50	-74	-84	-74	-45	-2	47	91	121	130	115
	28	80	34	-12	-51	-73	-76	-62	-37	-9	10	18	10	-11	-40	-68	-85	-84	-62	-22	29	82	123	145	141
	29	113	68	14	-34	-69	-85	-81	-61	-33	-6	9	10	-4	-30	-59	-82	-90	-77	-43	6	62	113	148	158
	30	142	103	49	-6	-53	-82	-91	-80	-56	-28	-5	4	-1	-20	-44	-74	-90	-87	-63	-19	35	92	137	163
	31	161	134	84	29	-24	-67	-89	-90	-75	-49	-23	-6	-2	-13	-36	-62	-82	-59	-77	-44	4	61	113	151

Record 1980/46

G452-86A

Fig.11