

DIGITAL MAP OF CANADA - LAMBERT CONFORMAL PROJECTION
FOR USE ON THE EMR CYBER SYSTEM

by

F.M. Anglin

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Any area of Canada, (plus adjacent parts as outlined on the map of Canada MCR10 1:6,336,000) can be drawn on the Calcomp plotter with features and line weights chosen by the programmer. If desired, only the latitude and longitude grid can be drawn without the map outlines of Canada, or only the frame can be drawn thus allowing plots of data to be made as an overlay to a previously drawn map.

North of 80°N , the map from which the digital map data were derived is not a Lambert projection. However, in this program the latitude and longitudes and any data that are drawn are projected on a Lambert conformal projection for all latitudes. Thus there is a slight distortion of the land mass outlines with respect to any grid or data drawn north of 80°N . Any data points that are drawn will always be correctly located with respect to the latitude-longitude grid.

The program resides as a set of subroutines on a disc file of the Cyber system. The following notes outline how this file is accessed and how a program is set up.

Control cards - circled numbers refer to notes that follow.

A1234,CM70000,T100,MT1,NTL,PO, name, address ①

ACCØUNT,xxxxx,20. name address

MAP,PART.

FTN,ØPT=2.

⑤ → LABEL,TAPES,R,L= NTSCAN100,D=PE,X=SV,VSN=ER6544. ②

ATTACH,LIB,PLØTLIB,MR=1.

LIBRARY,LIB,MLIB.

REQUEST, PLOTTER.

LGØ.' name, address, class '③'

UNLOAD, TAPE5, ④

EXIT.DØ NOT PLOT ØR RETURN TAPE ⑥

UNLOAD, TAPE5. ④

7/8/9

Notes:

- ① ② ④ If first data card contains a 1 in column 1, then the NT1 must be present on the job card, the label card must be present and the unload cards should be present.
- ③ If more than one block of data is present on the plotter tape then the LGØ card must contain the plotting instructions eg LGØ.' YOUR NAME CLASS 1 BLOCK 1 .2MM BLACK BLOCK 2 .4MM BLACK'
- See comments in data card section
- ⑤ Any other REQUEST, ATTACH, or LABEL cards can be inserted here
- ⑥ An EXIT card must always be present, the instruction is optional

An example of a program that draws a map, a grid and data points

- ① PROGRAM MAP (INPUT, OUTPUT, TAPE1=INPUT, TAPE5)
- ② COMMON/PARM/RT, RG, X, Y
- ③ CALL INITMP (XL, XH, YL, YH)
- ④ CALL RESTRT
- ⑤ 2 READ (1,1) RT, RG
- 1 FORMAT(2F5.0)
- IF (EOF(1)) 9, 3
- ⑥ 3 CALL PROJEC
- IF (X.LT.XL.ØR.X.GT.XH.ØR.Y.LT.YL.ØR.Y.GT.YH) GØTØ 2

⑧ 10 CALL MARK(X,Y,0.5, 1,0)
GO TO 2

⑨ 9 CALL FINISH
STOP
END

7/8/9

Setup cards and data cards - see instructions that follow

7/8/9

6/7/8/9

Notes:

① The program card must always contain the parameters shown. Other parameters may be added.

② This ^{labeled} common links the values of latitude (RT) and longitude (RG) to the subroutines PROJEC from which the eastings (X) and northings (Y) are returned. If the subroutine PROJEC is used, this labeled common card must be present

③ This subroutine controls the map program. It must be the first executable statement in the program. It requires two or three set-up cards (see below) which must be the first set of data read by the program. See ⑦ re argument list.

④ In this example program, the data are to be plotted using a different pen. The call to RESTRT starts a new block of data on the plotter tape so as to allow the operator to change pens. This must be stated as an instruction on the LGØ. card.

⑤ Latitude and longitude data are read from the card input.

⑥ The latitudes and longitude read are projected to eastings and northings.

⑦ A check is made to see if the point is within the defined map area.

The values of XL, XH, YL, YH returned by INITMP are the minimum and maximum easting values and the minimum and maximum northing values that define a rectangular map area.

- ⑧ This subroutine draws a data point - see below 10
- ⑨ This call FINISH terminates the plot. It must always be present before a STOP statement.
- 10 If many data points are to be plotted, they should be stored as X,Y pairs in a dimensioned area before they are plotted. After a call to SORT they will be efficiently plotted - i.e. sorted so as to minimize the amount of pen travel.

```
DIMENSION XS(100), YS(100), ZS(100)
```

read & store XY data into XS & YS keeping track of number of points N

```
CALL SORT (XS,YS,ZS,N)
```

ZS is the permutation vector and contains the new order of the x,y pairs i.e. if ZS contains 4,7,1,5,2,3,6

this means that what was originally the 4th point is now the 1st, the 7th the 2nd, the 1st the 3rd,

```
DØ 4 I = 1,N
```

```
4 CALL MARK(XS(I),YS(I), 0.5, 1,D)
```

and now the points will be plotted in the optimum order

See list of subroutines in notes that follow.

Data cards required by subroutine INITMP and which are used to obtain the desired map.

First Card (I1,A1, I1) = 1 in column 1, Frame, Map and latitude-longitude grid will be drawn.

= 2 in column 1, Frame and Latitude-longitude grid

= 3 in column 1, Frame only

H in column 2, Header data will be drawn - see "Header cards"

1 in column 3, Restart if H is also present

Second card (F10.0,9F5.0,A1)

) Scale ^a - for an overlay to the 1:5000000 scale tectonic map of Canada a value of 5023000. should be used. A different value might be needed for different sheets - depends on paper shrinkage.

2) & 3) Latitude, longitude of a point that will define the western edge of the map. This edge will be parallel to the centre longitude 10)

4) & 5) Same as 2 & 3 except for eastern edge

6) & 7) Same as 2 & 3 except for northern edge and this edge will be orthogonal to the centre longitude.

8 & 9) Same as 6 & 7 except for southern edge

10) Centre longitude - default value is 91.65°W . A value entered here allows one to reorientate map area. Centre longitude will always be vertical.

11) If this is a C all above values except 10) will be in centimeters rather than degrees - (it will rarely be necessary to use this option)

x = 0 at the centre longitude and y = 0 at 63°N and the centre longitude

NB All longitudes that are west (W) must be expressed as a negative number.

If longitudes in the 100's East are used, use an extension of the negative western longitudes - i.e. $170\text{E} = -190$. $180\text{E} = -180$. (this is due to an unresolved program bug)

a If the map is too large to fit the calcomp paper, the program exits and an error message is printed.

Third card (2F5.0,I1, 2F5.0,I1,F5.0, A1)

This card must be omitted if the first card = 3

If no grid is desired with map, leave this card blank.

1) Starting latitude for latitude grid - must be south most latitude and must be a multiple of the latitude grid spacing. Units are degrees.

2) Latitude grid spacing

- 3) If = 1, every latitude grid line will be labelled in left & right margins,
= 2 every second grid line will be labelled, ...
- 4) Starting value for longitude grid. Must be most westernly longitude on map
and must be a multiple of longitude grid spacing.
- 5) Longitude grid spacing
- 6) If = 1 every longitude grid line will be labelled in bottom margin,
= 2, every second longitude grid line will be labelled in bottom margin.
- 7) Length of line segments used to draw above Grid - default 0.2°
i.e. latitudes & longitudes are drawn as a series of straight line segments
with a default length of 0.2° .
- 8) If an 0 is present, grid labels will not be drawn.
Fourth and subsequent cards to a blank card (2I4,I1)

These cards must be omitted if first card not equal to 1

- 1) Feature code of desired feature - see list of features
- 2) Minimum number of points a feature has to contain before it is drawn. This
allows one to omit small lakes, islands, --- while still retaining the larger
lakes, islands, ---

This parameter can be efficiently arrived at by using the DDP-124 computer,
in the data lab, to display the map on the CRT
- 3) If = 1 a new Plotter output block is started. This is equivalent to a CALL
RESTRT before the feature is drawn and thus allows an instruction on the LGØ
card to be used to have the calcomp operator mount a new pen.

Header cards

If first card of set of data cards (see above) contains an H in column 2,
then a set of header card data is required. The data on this set of cards
(which must terminate with a blank card) are centred in the top margin of the
frame and are drawn as characters 1 cm. high unless there are too many characters
to fit the available space in which case the size is reduced so as to allow all

the header data to be written. The header data can occupy up to 6 (including the blank) cards. If column 3 of the first card of the set of data cards contains a 1, a new output block is started before the header data are drawn. Thus a request for a new pen mount must be noted on the LGØ card.

The map features are plotted in the order specified below. Thus if feature 1230 is tagged with a 1, the new block would apply to 1230, 1640, 1658, ---, 5890, 6120.

Feature codes	Description	
1200	International boundary	
1207	International boundary Alaska to N pole	
1208	International boundary	
1210	Provincial boundary	
1213	Provincial boundary indefinite Yukon-NWT	
1218	Provincial boundary N. B.C., Alta., Man.	
1230	District boundary	
1640	International date line	
1658	Arctic circle	
1670	Continental shelf - Baffin bay & strait	
5050	Basic drainage	On the present tape these data are <u>not</u> in order - in the sense that a river is <u>not</u> one sequence of data points.
5070	Drainage	
5080	Drainage	
5100	Stream	
5860	Stream	
5870	Stream	
5010	Lakes	
5750	Double line rivers	
5780	Islands in lakes	
5790	Coast line	

5890 Polar ice limits

6120 Ice fields

This is the order in which the features occur on the digital tape of Canadian map data.

Notes:

A If calcomp subroutines are to be used in your program, the X and Y values must be changed to inches using the function XCØNV, YCØNV.

$$X = XCØNV(X)$$

will change the X value in centimeters (as setup in INITMP) to inches which can then be used as an X argument in a calcomp subroutine. Similarly for Y, YCØNV is used.

B The top margin of the plot is not used if the first data card does not contain an H and thus can contain any data you may wish to write. The X dimensions runs from XL to XH and the Y dimension ^{RUNS} ~~starts~~ from YH to YH + 1.2 cm.

C The following subroutines are on the file MAPSUBR.

GØTØ(X,Y) Moves the pen to X,Y with pen up

DRAWTØ(X,Y,I) Moves pen from present position to X,Y with pen down. I is a dummy.

LABELC(X,Y,S,A,N,IB) Equivalent to calcomp SYMBOL for drawing labels. S is the height in cm, A the angle, N number of characters, IB dimensioned area containing characters.

NUMBRC(X,Y,S,F,A,N) equivalent to calcomp NUMBER

MARK(X,Y,S,N,Z) For drawing centred symbols of height S cm see list in CSC users guide.

P8-5 for values of N that can be used. N = 91 gives S

Z is a dummy.

FRAME(XS,XF,YS,YF) For drawing a frame.

The following labeled common names and subroutines are used internally and so they should not be reused.

AREA

CTAS

DEFINE

FITP

INITILZ

INLCCP

INTERP

MAPL

MAPØ

MPHEAD

MPHD

P

PARM

PCØM

SSCALE

XCØNV

XEQUIV

XPØINT

XCØNV

YEQUIV

YPØINT