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**A Step by Step Procedure for Producing  
Geomagnetic Reviews and 27 Days Geomagnetic Forecasts  
by Computer**

by  
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## Introduction:

A step by step procedure for producing geomagnetic reviews and 27 day geomagnetic forecasts by computer is presented. By following the steps outlined in this report, a user should be able to produce the final product ( a plot of the DRX index for the last Bartels solar rotation and a plot of the forecast DRX index for the next 27 days as shown in Appendices C and D) without much difficulty. The DRX index here refers to the daily mean of the hourly ranges in the X component of the geomagnetic field. It is assumed that the Tektronix 4107 terminal would be used and the user has some familiarity with the usage of Editor.

Briefly, after CHECKing the latest available data on TVS station files, the data for the *last complete* solar rotation are UNPACKed. The unpacked data are then plotted by running THREEZ4 ( THREEZ4 stands for THREE Zones ) after making the necessary changes in THREEZ4.DAT by using the Editor. The unpacked data are SORTed into the master DRX files. Then the DRX values for the last 9 solar rotations are UNSORTed from the master DRX files. After UNPACKing any *remaining* data from TVS station files, these data are then appended to the main files. The resultant files are used as input to the linear prediction filtering program called FORC (which stands for FOReCast) which produces forecast values for the next 30 days if this is done on Monday. Since the 27 day forecasts are normally prepared on Monday and mailed away on Wednesday for the forecast period beginning on Thursday for the next 27 days, the first 3 forecast values are not needed. It should be noted that the last 6 values of forecasts overlap the first 6 forecasts of the succeeding forecast period so that the users won't miss any forecasts. After deleting the first 3 values by means of Editor from the forecast files, the line numbers are CHANGED. The forecast data are plotted by running THREEZ2 after editing THREEZ2.DAT. Finally, the unnecessary files acquired during the operation are purged and deleted.

## Procedure:

Power the Tektronix 4107 terminal on by pressing the button besides the screen on the right. Press the Ctrl key and Z key at the same time. Type in CON OTTVAX and log on using TVS and its associated password. The terminal is now connected to VAX 750 and one is ready to follow the procedure presented below.

1. Check the latest available data on TVS station files by running a program called CHECK. To initiate the run , type in R CHECK. This program is highly interactive and all one has to do is to respond to the questions by typing Y , N, station codes, day or year. The stations used are RES for the polar cap, FCC for the auroral zone and OTT for the subauroral zone. Normally, the latest data available should be those of the day before. However, this may not be the case sometimes because of problems in one or more of the stations. So it is always useful to check to make sure what the latest date with data on TVS station file is.

2. Unpack the data from the TVS station files. In the following example, 27 days of data are unpacked starting from Day 275, 1986 for Rotation 2093.

*For the polar cap:*

R UNPACK

RESMR

POL2093N

275 86 27

*For the auroral zone:*

R UNPACK

FCCMR

AUR2093N

275 86 27

*For the subauroral zone:*

**R UNPACK**

OTTMR

SUB2093N

275 86 27

3. Plot the data in POL2093N, AUR2093N and SUB2093N. The resultant plot would be a review of geomagnetic activity for the last solar rotation (as shown in Appendix C) to be sent to users. To produce the plot, simply type **@THREEZ4**. But before doing that, one has to change the file names and date in a file called THREEZ4.DAT. The contents of THREEZ4.DAT are given in Appendix A which also describes the changes that are required. So, after making changes in THREEZ4.DAT by means of Editor, one can produce the plot by **@THREEZ4** which would ask whether one wants i (immediate), e (edit) or d (deferred) modes for the plot. If one types in i , a plot would appear on the screen but would not be saved. If one types in e , a plot would appear on the screen and would also be saved. One should forget about the d mode. It is advisable to use i mode at first because the wrong date might be plotted and the French accent might be misplaced. If this is the case, edit THREEZ4.DAT again. Then **@THREEZ4**. If one is satisfied with the plot, **@THREEZ4** again and use e mode to save the plot in BUPLOT.PF which would eventually be plotted by the laser printer.

4. Merge POL2093N, AUR2093N and SUB2093N into the master DRX files which contain data since Rotation 2059 and are growing. In the following, POLDATA1, AUR-DATA1 and SUBDATA1 are master DRX files.

*For the polar cap:*

**R SORT**

POL2093N  
POLDATA1  
2093

*For the auroral zone:*

**R SORT**  
AUR2093N  
AURDATA1  
2093

*For the subauroral zone:*

**R SORT**  
SUB2093N  
SUBDATA1  
2093

5. Unpack the last 9 rotations of DRX values from the master DRX files.

*For the polar cap:*

**R UNSORT**  
POLDATA1  
POL8593N  
2085 2093

*For the auroral zone:*

**R UNSORT**  
AURDATA1  
AUR8593N  
2085 2093

*For the subauroral zone:*

**R UNSORT**

SUBDATA1

SUB8593N

2085 2093

The POL8593N file now contains DRX values from Rotation 2085 to Rotation 2093 for the polar cap, with similar files for the auroral and subauroral zones.

6. Unpack any remaining data from TVS station files. In the following example, 5 more days of data are unpacked starting from Day 302, 1986 which is the beginning of Rotation 2094.

*For the polar cap:*

R UNPACK

RESMR

POL2094N

302 86 5

*For the auroral zone:*

R UNPACK

FCCMR

AUR2094N

302 86 5

*For the subauroral zone:*

R UNPACK

OTTMR

SUB2094N

302 86 5

7. Append the above files to the main files.

APPEND POL2094N.DAT POL8593N.DAT

APPEND AUR2094N.DAT AUR8593N.DAT  
APPEND SUB2094N.DAT SUB8593N.DAT

8. Now run the linear prediction filtering program.

*For the polar cap:*

R FORC  
POL8593N  
OUT  
POL2094C  
30  
0.1,100  
999.0  
AA

*For the auroral zone:*

R FORC  
AUR8593N  
OUT  
AUR2094C  
30  
0.1,100  
999.0  
AA

*For the subauroral zone:*

R FORC  
SUB8593N  
OUT  
SUB2094C



30

0.1,100

999.0

AA

9. The files POL2094C.DAT, AUR2094C.DAT and SUB2094C.DAT contain the forecast values for the next 30 days. Since the forecast is normally prepared on Monday and mailed away on Wednesday for the forecast period beginning on Thursday for the next 27 days, the first 3 values in the files are redundant. So, delete the first 3 lines in the data files by means of Editor. Then renumber the lines by running a program called CHANGE.

*For the polar cap:*

**R CHANGE**

POL2094C

POL2094C

*For the auroral zone:*

**R CHANGE**

AUR2094C

AUR2094C

*For the subauroral zone:*

**R CHANGE**

SUB2094C

SUB2094C

10. Plot the data in POL2094C, AUR2094C and SUB2094C. The resultant plot would be the 27 days geomagnetic forecasts (as shown in Appendix D) to be sent to users. To produce the plot, type @THREEZ2 after editing THREEZ2.DAT whose contents appear in Appendix B. The comments made in STEP 3 apply here.

**11.** Plot the reviews and forecasts by means of the laser printer on the second floor of the Seismology Building. Examples of the plots are given in Appendix C and Appendix D.

*Plot the reviews:*

**LASERPL BUPLOT.PF;1 -ROT**

*Plot the forecasts:*

**LASERPL BUPLOT.PF;2 -ROT**

**12.** If the forecast values have to be adjusted, edit the files POL2094C.DAT, AUR2094C.DAT and SUB2094C.DAT and repeat STEP 10 again and again until satisfactory and then plot the forecast by typing

**LASERPL BUPLOT.PF -ROT**

**13.** Finally, delete and purge the files acquired during the entire operation by typing

**@DELETE**

**@PURGE**

**14.** Log out and power the terminal off.

## Summary:

The entire procedure is summarized here using polar cap files as an example.

### R CHECK

RES

### R UNPACK

RESMR

POL2093N

275 86 27

### ED THREEZ4.DAT

@THREEZ4

### R SORT

POL2093N

POLDATA1

2093

### R UNSORT

POLDATA1

POL8593N

2085 2093

### R UNPACK

RESMR

POL2094N

302 86 5

APPEND POL2094N.DAT POL8593N.DAT

R FORC

POL8593N

OUT

POL2094C

30

0.1,100

999.0

AA

ED POL2094C.DAT

R CHANGE

POL2094C

POL2094C

ED THREEZ2.DAT

@THREEZ2

LASERPL BUPLOT.PF;1 -ROT

LASERPL BUPLOT.PF;2 -ROT

@DELETE

@PURGE

## Appendix A:

Contents of THREEZ4.DAT. Editing is required for the first few lines containing the rotation number, the line containing the date, the line containing the French months and the line immediately below for the French accent (in the example below, it is blank because French accent is not required for mars and avr). Other parameters should remain intact.

```
POL2099n
AUR2099n
SUB2099n
Rotation : 2099
          EMR CANADA   OTTAWA
REVIEW OF GEOMAGNETIC ACTIVITY : DR INDEX
COMPTE RENDU DE L'ACTIVITE MAGNETIQUE : INDICE DR
```

Q, U and A represent quiet, unsettled and active levels of geomagnetic activity  
Q, U et A representent des niveaux calmes, agites, et actifs de l'activite geom

```
      2      Mar  Apr 1987 13 31  1  8
mars avr
1.0
```

## Appendix B:

Contents of THREEZ2.DAT. The comments in Appendix A apply here. Note that in this example, the 27 days occur within a given month.

```
POL2100c
AUR2100c
SUB2100c
2099(to April 8) 2100(the rest)
    EMR CANADA OTTAWA
FORECAST DAILY MEAN OF HOURLY RANGES
PREVISION DU MOYEN QUOTIDIEN DES AMPLITUDES HORAIRES
```

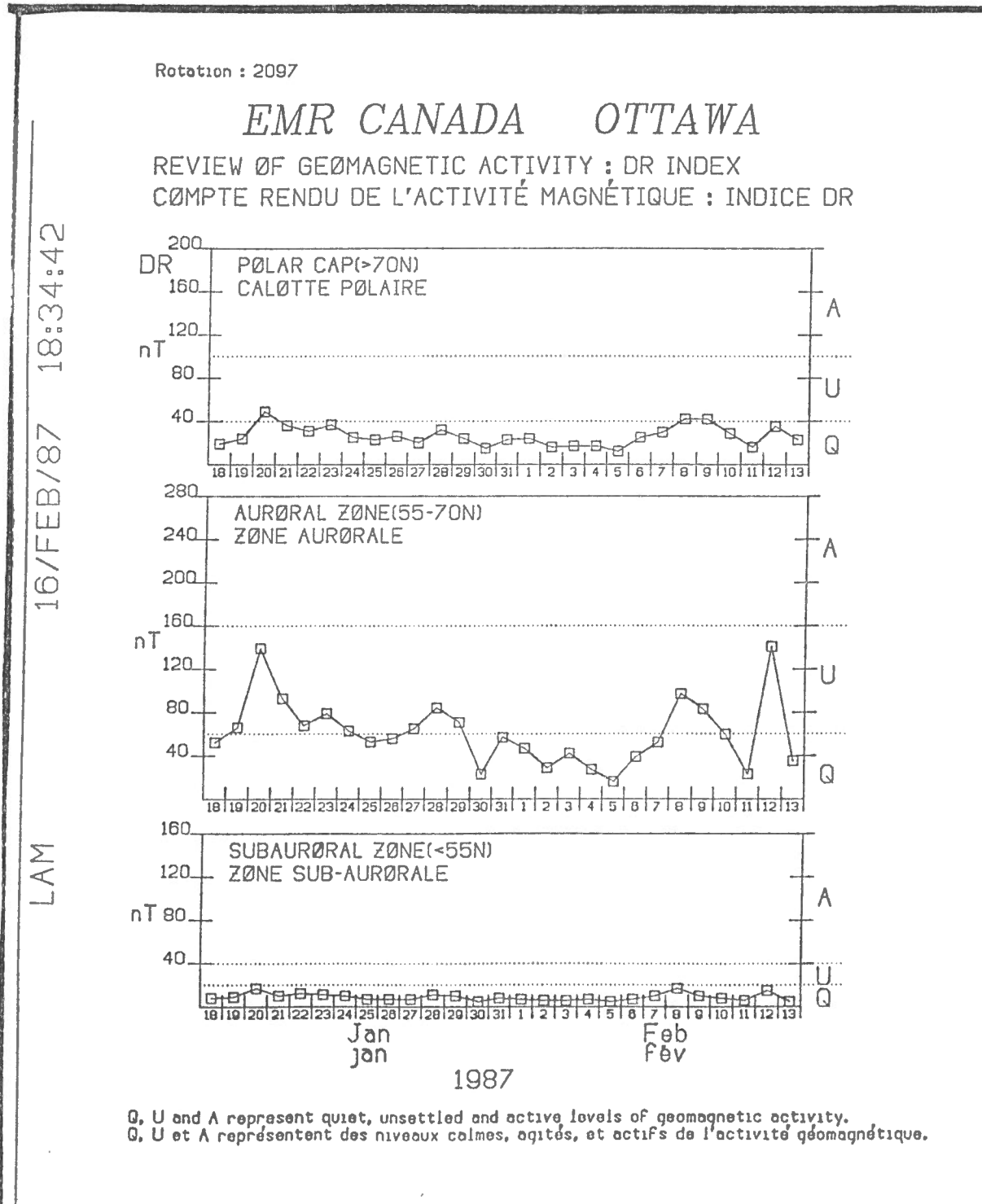
Q, U and A represent quiet, unsettled and active levels of geomagnetic activity.  
Q, U et A representent des niveaux calmes, agites, et actifs de l'activite geom.

```
For 72-hr forecast, dial : 1-613-992-1299
Pour la prevision de 72-h, telephoner: 1-613-992-1299
    2      Apr Apr 1987  2 28  1  1
avr avr
```

1.0

# Appendix C:

An example of the review of geomagnetic activity.



# Appendix D:

An example of the 27 days geomagnetic forecasts produced *solely* by means of linear prediction filtering.

