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Interfaces Between Statistical Analysis Packages and the ESRI Geographic Information System

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OCTOBER 1980
INTERFACES BETWEEN STATISTICAL ANALYSIS PACKAGES
AND THE ESRI GEOGRAPHIC INFORMATION SYSTEM

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Abstract

The Environmental Systems Research Institute (ESRI) geographic information system (GIS) in use at Goddard Space Flight Center provides users with the means of combining remote sensing data with ancillary data (soils maps, geologic maps, topographic maps, etc.) and performing qualitative analyses on the resulting multivariable data base. However, statistical techniques such as multiple regression, analysis of variance and spatial autocorrelation analyses are not available in the GIS. This paper describes interfaces between ESRI’s GIS data files and real valued data files written to facilitate statistical analysis and display of spatially referenced multivariable data. An example of data analysis which utilized the GIS and the Statistical Analysis System (SAS) is presented to illustrate the utility of combining the analytic capability of a statistical package with the data management and display features of the GIS.

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INTERFACES BETWEEN STATISTICAL ANALYSIS PACKAGES
AND THE ESRI GEOGRAPHIC INFORMATION SYSTEM

INTRODUCTION

Automated geographic information systems provide a framework in which spatially referenced data (maps and remote sensing imagery) may be manipulated, displayed and analyzed (Knapp, 1979). The utility of a geographic information system (GIS) lies in its ability to create and analyze a multivariable file derived from maps and images of a study area. Geographic information systems have been used by land planners to select sites for campgrounds in Canadian national parks (Arbour, 1980), by researchers at the National Cancer Institute to study patterns of mortality (Mason, 1980) and by geologists to examine relationships between petrologic and geophysical information on the moon (Andre et al., 1977).

The Environmental Systems Research Institute (ESRI) GIS provides the user with a tool for creating multivariable files from digitized map data and digital remote sensing data. A GIS multivariable file may be thought of as a cube made up of data cells. The horizontal axes of the cube correspond to geographic location. Along the vertical axes are the different variables in the multivariable file. Thus, each column of cells in the cube has a unique geographic location and each layer of cells in the cube corresponds to a unique thematic map variable, such as soil type, vegetation type or topographic elevations (see Figure 1). Analyses which can be performed on the multivariable files include: slope and aspect calculations, proximity analyses and the creation of qualitative models based on user supplied weights (ESRI staff, 1979). However, statistical analyses, such as multiple regression, analysis of variance and spatial autocorrelation analysis can not be performed within the GIS. Further, since observations in a GIS multivariable file are stored as sixteen bit integers, real values and integers outside the range ±32,768 can not be manipulated by the GIS.

The inability to perform statistical analyses on GIS multivariable files, precludes the development of powerful quantitative models for resource exploration or land use planning with the
GIS package. However, statistical packages, such as SAS, provide tools for performing a range of statistical analyses from the computation of simple descriptive statistics to complex multivariate techniques (Helwig and Council, 1979).

To provide a means of performing statistical analyses on variables in GIS files and to allow the results of these analyses to be merged with GIS multivariable files, interfaces between the ESRI GIS and real valued data files were created.

DESCRIPTION OF INTERFACES

SAS2GIS is a computer program which converts gridded real valued data into the single variable file (SVF) format used by the ESRI geographic information system. The data file of real values that is to be converted to an integer SVF must be sorted so that for a SVF file n rows by m columns, the real value for cell (i, j) in the SVF will correspond to entry (i*m+j) in the real valued data file. The conversion is accomplished by a linear transformation, \( y = ax + b \), which maps a real valued variable \( X \) into an integer variable \( Y \). The program provides the user with two options for converting the data into integer format. First, the user may supply the \( a \) and \( b \) terms of \( y = ax + b \). Second the user may specify a range for the transformed data. The original data will be mapped into this range using the linear transformation and the transformed data will be checked to insure that the conversion did not truncate the values more than a user specified amount. After the transformed data have been written to a disk file, an additional record is added to the file which contains the \( a \) and \( b \) terms that were used to make the transformation. This record is not read by any GIS software but may be used by the interface GIS2SAS to convert the SVF file to a real valued data file.

GIS2SAS is a computer program which transforms integer data in ESRI's SVF format into real valued data with row column references. The formula used to convert integer data to real valued data is \( x = (y - b)/a \); where \( x \) is a real value, \( y \) is an integer and \( a \) and \( b \) are constants. The user has two options for converting integers to real values. First, the user may specify \( a \) and \( b \)
terms for the transformation. This is required if the SVF file was not created by SAS2GIS.

Second, if no a and b values were provided by the user the program will use the a and b values in the last record written by SAS2GIS when the file was created. Program output consists of a real valued data file in a format specified by the user.

RUNNING SAS2GIS AND GIS2SAS

SAS2GIS and GIS2SAS are interactive computer programs written in FORTRAN IV. At Goddard Space Flight Center they run in the foreground on an IBM 360/91 and an IBM 360/75. Listings of these programs appear in Appendix 1. The clists (files which contain TSO commands and subcommands) used to set up and run the interfaces are presented in Appendix 1. To run a program the user types the program's name, SAS2GIS or GIS2SAS, followed by I ("input filename") and O ("output filename"). For example if the user types:

SAS2GIS I(BOTANY,DATA) O(GIS.DATA)

the program SAS2GIS will be run to create an SVF file GIS.DATA from a real valued data file BOTANY.DATA.

When the programs are running in the foreground they will prompt the user for two lines of input. The first line contains parameters used to make the transformations and the second line is the format of the real valued data file. Tables 1 and 2 summarize the input parameters for these interfaces.

Should the user wish to convert these interfaces to run in a batch environment, he must make two modifications. First, the clists must be replaced by JCL statements which assign disk files for input and output to logical units 8 and 10, as shown in Figures 2 and 3. Second, the write statements which prompt the user for input should be removed.

COMBINING THE GIS AND A STATISTICAL PACKAGE FOR DATA ANALYSIS

Some preliminary results in an analysis of gravity and elevation data from the Rio Grande rift are presented here to illustrate the utility of combining a package of statistical analysis
programs, SAS, with the ESP! geographic information system (GIS). The objective of this study was to remove the relationship between Bouguer gravity and topographic relief which was present in a data set of elevation and gravity observations compiled by Keller and Conrad at the University of Texas.

The gravitational field measured at a given point on the earth's surface includes effects unrelated to geology. These effects are due to: variations in the distance between the earth's center and the station where the gravity field was measured and the contribution of local topography to the observed gravity (Grant and West, 1965). Once corrections for these effects have been applied to the data, the resulting values are termed Bouguer gravity data and reflect the contribution of underlying geologic structures.

At present there is no agreement on the best method for computing Bouguer gravity from the observed gravity which is measured at a station. However, Nettleton (1940) has suggested that when the corrections to reduce observed gravity to Bouguer gravity are properly applied, the correlation between station elevation and Bouguer gravity should be low. A striking similarity between the Bouguer gravity and station elevation was first observed in three dimensional plots of these two data types produced by the GIS. In order to determine the degree of correlation between the gridded elevation data from the rift (Figure 4) and gridded Bouguer data (Figure 5), the statistical analysis package SAS76 was used to compute a Pearson product moment correlation coefficient. The correlation between Bouguer gravity and elevation was high, ~0.903, and a linear regression was computed to remove the variation in Bouguer gravity due to elevation. The residuals from the regression provide a better estimate of Bouguer gravity because the effect of station elevation has been removed. A plot of these residuals, Figure 6, reveals regions of high positive residuals in the North-west and South-east corners of the Rio Grande study area. This suggests that there are regional variations in rock density in the study area and that individual Bouguer gravity corrections should be calculated for each region.
In this analysis the Statistical Analysis System (SAS) and the ESRI GIS proved useful tools for examining the relationship between variables in a spatially referenced multivariable database.

With these interfaces the researcher can utilize the extensive data base management and graphics capabilities of the GIS to complement existing software in the analysis of real valued multivariate data.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Input Parameters for SAS2GIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter</strong></td>
<td><strong>Column</strong></td>
</tr>
<tr>
<td><strong>First Input Line</strong></td>
<td></td>
</tr>
<tr>
<td>ROW</td>
<td>1-5</td>
</tr>
<tr>
<td>COLUMN</td>
<td>6-10</td>
</tr>
<tr>
<td>A</td>
<td>11-15</td>
</tr>
<tr>
<td>B</td>
<td>16-20</td>
</tr>
<tr>
<td>MIN</td>
<td>26-30</td>
</tr>
<tr>
<td>MAX</td>
<td>26-30</td>
</tr>
<tr>
<td>NEWMIN</td>
<td>31-37</td>
</tr>
<tr>
<td>NEWMAX</td>
<td>38-44</td>
</tr>
<tr>
<td>TOLER</td>
<td>45-49</td>
</tr>
<tr>
<td>MISVAL</td>
<td>50-55</td>
</tr>
<tr>
<td>NEWVAL</td>
<td>56-61</td>
</tr>
<tr>
<td><strong>Second Input Line</strong></td>
<td></td>
</tr>
<tr>
<td>FMT</td>
<td>1-80</td>
</tr>
</tbody>
</table>
Table 2
Input Parameters for GIS2SAS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Column</th>
<th>Format</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Line of Input</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1-6</td>
<td>F6.0</td>
<td>Divisor in (x=(y-b)/a) used to transform integer values into real values default: use first value in last record of SVF file.</td>
</tr>
<tr>
<td>B</td>
<td>7-12</td>
<td>F6.0</td>
<td>b term in (x=(y-b)/a) used to transform integer values into real values default: use second value in last record of SVF file.</td>
</tr>
<tr>
<td><strong>Second Line of Input</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCOL</td>
<td>1-3</td>
<td>I3</td>
<td># columns in output file.</td>
</tr>
<tr>
<td><strong>Third Line of Input</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMT</td>
<td>1-80</td>
<td>80A1</td>
<td>User supplied output format for real valued data set.</td>
</tr>
</tbody>
</table>
REFERENCES


3. Environmental Systems Research Institute staff, 1979, ESRI geographic information software descriptions. 79 p.


Figure 1. Structure of an ESRI GIS Multivariable File (MVF)

Figure 2. Logical Units Required by SAS2GIS
Figure 3. Logical Units Required by GIS2SAS

<table>
<thead>
<tr>
<th>UNIT</th>
<th>STRUCTURE</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>CARD</td>
<td>USER CONTROL CARDS</td>
</tr>
<tr>
<td>6</td>
<td>PRINTER</td>
<td>JOB LISTING</td>
</tr>
<tr>
<td>8</td>
<td>SVF</td>
<td>INTEGER SINGLE VARIABLE FILE</td>
</tr>
<tr>
<td>10</td>
<td>CARD</td>
<td>REAL VALUED DATA FILE</td>
</tr>
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</table>

Figure 4. A Plot of Elevations in the Rio Grande Rift Study Area Produced by the ESRI GIS
Figure 5. Bouguer Gravity Values from the Rio Grande Rift Study Area

Figure 6. Residuals from a Regression of Elevation and Bouguer Gravity
APPENDIX 1

PROGRAM LISTINGS OF THE INTERACTIVE INTERFACES BETWEEN REAL VALUED DATA SETS AND THE ESRI GEOGRAPHIC INFORMATION SYSTEM

A. SAS2GIS PROGRAM LISTING

**T**ITLE: INTERFACE FOR REAL VALUE DATA AND ESRI GIS SINGLE VARIABLE FILES (SVF'S)
**E**NGINEER: EDWARD HANJOVA
**D**ATE: AUGUST 1, 1979

**T**HIS PROGRAM TRANSFORMS REAL VALUED DATA SETS INTO INTEGER DATA IN GIS Formatting IN 3 STEPS:

1. PROJECTS USER FORMS OF INPUT DATA AND PARAMETERS REQUIRED TO MAP REAL VALUES INTO INTERVALS

2. MAPS REAL VALUES INTO INTERVALS WITHIN THE RANGE -32,768 TO +32,768 WITH A LINEAR TRANSFORMATION

3. WRITES THE ESRI/GIS FILE AND INFORMATION REQUIRED TO TRANSFORM THE GIS FILE TO REAL VALUED DATA, AS THE LAST RECORD OF THE SVF FILE.

**U**SER INPUT:

**C**ARD 1 1-5 NROW # ROWS IN INPUT FILE
5-10 NCOL # COLUMNS IN INPUT FILE
11-15 A MULTIPlicative TERM IN Y=AX+B
16-20 B ADDITIVE TERM IN Y=AX+B
21-25 MIN MINIMUM VALUE OF INPUT DATA
DEFAULT: CALCULATED
26-30 MAX MAXIMUM VALUE IN INPUT DATA
DEFAULT: CALCULATED
31-37 MINMIN INTEGER MINIMUM AFTER TRANSFORMATION
38-44 MAXMAX INTEGER MAXIMUM AFTER TRANSFORMATION
45-49 TOLERANCE ADJUST FOR TOLERANCE RESULTING FROM THE TRANSFORMATION OF REAL VALUES TO INTERVALS
DEFAULT: .001
50-55 MVal VALE FOR MISSING OBSERVATIONS
DEFAULT: 0
56-61 INFVal VALE ASSIGNED TO MISCELLANEOUS OBSERVATIONS IN SVF FILE
DEFAULT: 0

**L**INE 2 1-50 FOR INTERNAL SUPPLIES FORMAT (2014)
REAL*4 Pi1T^20 ,DATA 1500),AA

** READ USER SUPPLIED PARAMETERS FOR THE TRANSFORMATION **

WRITE (6,111) FORMAT (140) INPUT: RCW COLUMN A & MIN MAX NEW_MIN NEW_MAX/

111 TOLERANCE MISS VAL NEW VAL USING:

WRITE (6,190) TOLERANCE:

1 WRITE (6,991) FORMAT (14K) PLEASE INPUT FORMAT OF REAL VALUED DATA!

991 READ AND ECH USER SPECIFIED FORMAT FOR DATA INPUT

WRITE (6,993) FORMAT (14K) IF A"," (I) GO TO 999

* SCALE DATA BETWEEN NEW_MIN AND NEW_MAX *

FIN MIN AND MAX OF DATA IF NOT SUPPLIED

IF (MIN < MIN) GO TO 360

MIN=MIN+1

DO 22 I=1,NCOL

FAE(S,F11) DATA (J),J=1,NCOL
DO 22 J=1, NCOL
  IF (DATA(J) .GT. MIN) MIN=DATA(J)
  IF (DATA(J) .GT. MAX) MAX=DATA(J)
  CONTINUE
22
IF (MIN .LT. NEWVAL .OR. MIN .EQ. MISSVAL) MIN=NEWVAL
IF (MAX .LT. NEWVAL .OR. MAX .EQ. MISSVAL) MAX=NEWVAL
REWIND 8

CALCULATE A AND B FOR SCALING FUNCTION Y=AX+B

300 RANGE=NEWMAX-NEWMIN
IF (NEWMAX+NEWMIN .LT. AES(NEWMAX+NEWMIN)) RANGE=RANGE-1.
A=RANGE/(MAX-MIN)
F=RANGE-A*MAX

******************************************************************************
* WA9ILM IMMEDIATE RESULTS *
******************************************************************************

WRITE (6,9) MIN, MAX
FORMAT (1X, 'MIN=', F10.5, ' MAX=', F10.5)
WRITE (9,6) A, B
FORMAT (1X, 'A=', F9.5/10, ' B=', F12.5//)

******************************************************************************
* WRITE THE SVG *
******************************************************************************

CHECK TO INSURE THAT THE TRANSFORMED VALUES HAVE NOT BEEN TRANSFORMED MORE THAN A USER SPECIFIED TOLERANCE

CALL C@KCL@ (DATA, NCOL, A, B, TOLER)
WRITE NOW AND COLUMN INFORMATION ON THE SVG FILE

WRITE (10) NOWCOL
SCALE THE DATA IRON + RANGE TO - RANGE

DC 30 I=1, NCOL
READ (9, END=9) (DATA(J), J=1, NCOL)
DC 40 J=1, NCOL
IF (DATA(J) .EQ. MISSVAL) DATA(J)=NEWVAL
FOR (J)=A*DATA(J)+B
40
CONTINUE

WRITE THE TRANSFORMED VALUES ON A ROW AT A TIME
CALL WRITEC (ROW, NCOL)
3c continue

write the coefficients used to make the transformation
and the format of the real valued data set
as the last records of the transformed file

write (10) ab
write (10) fmt
format (1,11) "***** successful conversion to esri sup file *****")
stop 1

error messages for incorrect control cards

write (4,3) format (1,1", "toc fe4 observations ")
stop 2
end

***********************************************************************
* this subroutine writes the integers
* as a single variable file
***********************************************************************

subroutine writec(scw,ncgl)
integer*2 ncl(ncol)
write (10) ncl
return
end

***********************************************************************
* this subroutine compates the original real valued
* data file with the real valued file which will be
* produced if the sup is transformed back to a real
* values if the difference between
* entries in input files exceeds a user specified
* tolerance an error message is written and the job
* is aborted.
***********************************************************************

subroutine chkcl(tata,nccl,a,b,tolv)
integer*4 nccl
data*4 data(ncl),a,b,tolv,dat
integer*2 dat

calculate effect of transformation on
values of the input data

dc 10 i=1,nccl
dat=tata(i)*a+b
REAL=ICAT
RDAT=(ROAT-B)/A

*************************************************************************
* COMPARE ORIGINAL REAL VALUE WITH REAL VALUE                      *
* WHICH RESULTS FROM TRANSFORMING GIS FILES BACK                    *
* TO A REAL FILE USING SLOPE AND INTERCEPT CALCULATED               *
* FROM THE USER SPECIFIED RANGE FOR TRANSFORMED DATA                *
* TOLERANCE CREATE GIS FILE                                         *
*************************************************************************

IF (ABS(EDAT-DAI(I)) .LT. TOLER) 10 TO 10
ELSEIF WRITE AN ERROR MESSAGE AND STOP
  WRITE (*,1) *** TOLERANCE EXCEEDED DURING TRANSFORMATION!
  STOP 2
  CONTINUE
  RETURN
END
B. GIS2SAS PROGRAM LISTING

```
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** TITLE: INTERFACE BETWEEN 1ST GEOPHYSICAL INFORMATION SYSTEM CSV DATA SETS **
** AND REAL VALUED DATA SETS USED BY STATISTICAL PACKAGES **
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** PROGRAMMER: EDWARD MASICKA **
** DATE: AUGUST 1, 1979 **
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** THIS PROGRAM TRANSFORMS GIS FILES IN INTEGER*2 **
** INTO THE ORIGINAL REAL VALUED DATA IN 3 STEPS: **
** 1. READS ROW COLUMN INFORMAION FROM RECORD 1 **
** 2. TRANSFORMS INTEGERS TO REAL VALUES USING **
** A LINEAR TRANSFORMATION: REAL = (INTEGER-R)/A **
** 3. WRITES THE REAL DATA TO A FILE WITH A **
** USER SUPPLIED FORMAT **
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** VARIABLE FUNCTION **
** DATA Stores real data **
** ROWCOL Stores row and columns **
** ROW # of rows in data and GIS file **
** COLUMN # columns in data & GIS file **
** ALL Stores linear transform parameters **
** SLOPE SLOPE OF LINEAR FUNCTION USED **
** TO TRANSFORM REAL DATA **
** INTERCEPT OF LINEAR TRANSFORM **
** FROM Stores a row of the transformed data **
** FAT User supplied format for real **
** valued data set **
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** REAL*4 DATA (150), AP (2), SLOPE, INTER **
** INTEGER*2 ALL (150), COL (150) **
** INTEGER*4 ROW, COLUMN, NUM (20), X (20) **
** LOGICAL*1 BUFFER (20) **
** EQUIVALENCE (AP (2), SLOPE), (AP (2), INTER), **
** (BUFFER (20), FMT (1)) **
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** READ USER SUPPLIED OUTPUT FORMAT AND PARAMETERS **
** WRITE (6, 4) **
** 4 FORMAT (150, 10, 'PLEASE INPUT A (55.1) B(55.9) C(55.1)**
** IN, '15, 110, WHICH WILL BE USED TO TAKE THE TRANSFORMATION') **
```
**IH** (DEFAULT: IF ZERO, PROGRAM WILL USE LAST RECORD OF SVF)

**IH** (DEFAULT: IF ZERO, PROGRAM WILL USE LAST RECORD OF SVF)

READ (5, 11) SLOPE, INTER

READ (5, 11) SLOPE, INTER

FORMAT (2F5.0)

WRITE (6, 2)

2 FORMAT (/' PLEASE INPUT # OF COLUMNS FOR OUTPUT DATA SET: (13)'/
* DEFAULT: IF ZERO, PROGRAM WILL USE # COLUMNS IN SVF*)

READ (5, 6) NCCL

WRITE (6, 3)

8 FORMAT (/' PLEASE INPUT FORMAT FOR REAL VALUED DATA SET: (8OA1)',/
* DEFAULT: LAST RECORD OF SVF WILL BE USED')

READ (5, 1) FMT

FORMAT (8OA1)

READ AND ZCHO # 1045 AND COLUMNS IN GIS FILE

READ (3) ROWCCL

FORMAT (10O/T10, 'NC4S=', 'T22, T5/IX, T10, 'COLUMNS=' , 'T22, T5')

IF (SLOPE .GE. .9 .CR. INTER .GE. .9) GO TO 40

WRITE (6, 3) ACW, COLUMN

WRITE (6, 3) ACW, COLUMN

SPACE FAST TRANSFORMED DATA

DO 30 I=1, NCW

CALL REAC (1ROW, COLUMN, 9)

READ AND ZCHO PARAMETERS USED TO TRANSFORM ORIGINAL REAL DATA

READ (8) AB

FORMAT (1H, 'T10, 'SLOPE=', 'T10, 'INTER=SFT=' , 'T21, F8.3')

WRITE (6, 5) SLOPE, INTER

WRITE (6, 5) SLOPE, INTER

CHECK FOR USER SPECIFIED FORMAT

DO 50 I=1, 20

IF (END=1) .NE. BLNK) GC TO 67

CONTINUE

NCNE FOUND USE LAST RECORD OF SVF

READ (8, END=99) FAT

TRANSFORM THE DATA INTO ORIGINAL VALUES

A RCW AT A TIME

IF (NCOL .GE. 0) NCOL=COL

READ (3) AC, COL

GO TO 10 I=1, RCW
CALL READC (IRow, COLUMN, 9)
DO 20 J = 1, COLUMN
20 DATA (J) = (IRow(J) - INTER) / SLOPE
WRITE THE REAL VALUED DATA FILE.

CALL WRITEC (DATA, NCCL, FMT, 10)
WRITE (10), '++++ SUCCESSFUL CONVERSION TO REAL VALUED FILE ++++
STOP 1

WRITE (0, 100), '++++ FATAL ERROR: NG FORMAT SPECIFIED.
STOP 2

SUBROUTINE READC (IRow, COLUMN, LUNIT)
INTEGER*4 COLUMN
INTEGER*2 IRow(COLUMN)
READ (LUNIT) IRow.
RETURN
END

SUBROUTINE WRITEC (DATA, COLUMN, FMT, LUNIT)
INTEGER*4 COLUMN
REAL*4 DATA (COLUMN), FMT (20)
WRITE (LUNIT, FMT) DATA
RETURN
END

********************************************************************
* THIS SUBROUTINE READS A SVF FORMAT FILE
********************************************************************

********************************************************************
* THIS SUBROUTINE WRITES THE REAL VALUED DATA
* WITH A USER SPECIFIED FORMAT
********************************************************************
APPENDIX 2

CLISTS

A. CLIST FOR SAS2GIS

PROC O INFILE (REAL.DATA) OUTFILE (SAS.GIS)
CALLOC DA (&INFILE.) F(FT08F001)
ALLOC DA (&OUTFILE.) N SP (10, 1) TR U (GIS)
CALLOC DA (&OUTFILE.) F (FT10F001)
DO SAS2SVF LIB (PROG.LOAD)

B. CLIST FOR GIS2SAS

PROC O INFILE (SAS.GIS) OUTFILE (REAL.DATA)
CALLOC DA (&INFILE.) F (FT08F001)
CALLOC DA (&OUTFILE.) N SP (10, 10) TR U (FORT)
CALLOC DA (&OUTFILE.) F (FT10F001)
ALLOC DA (*) F (FT05F001)
ALLOC DA (*) F (FT06F001)
DO SVF2SAS LIB (PROG.LOAD)
APPENDIX 3

AN EXAMPLE OF THE OUTPUT FROM THE INTERACTIVE PROGRAMS, SAS2GIS AND GIS2SAS. PROGRAM OUTPUT IS IN UPPERCASE AND USER INPUT IS IN LOWERCASE LETTERS.

A. EXAMPLE OF RUNNING SAS2GIS

sas2gis infile (realdata) outfile (elev2.svf)

INPUT: ROW COLUMN A B MIN MAX NEW_MIN NEW_MAX TOLERANCE MISS_VAL NEW_VAL USING.
(215, 2F5.0, 2F5.0, 2F7.0, F5.0, 2F6.0)

.... 5 ... 10 ... 15 ... 20 ... 25 ... 30 ... 35 ... 40 ... 45 ... 50 ... 55 ... 60

+ + + + + + + + + +
36 48 1 . 0 .

ROWS = 36
COLUMNS = 48
SLOPE = 1.000
INTERSEPT = 0.0

PLEASE INPUT FORMAT OF REAL VALUED DATA
(10F8.0)

+++ SUCCESSFUL CONVERSION TO ESRI SVF FILE ++++
IH00021 STOP 1
CONDITION CODE = 01

B. EXAMPLE OF RUNNING GIS2SAS

gis2sas infile (elev.svf) outfile (real.data)

PLEASE INPUT A (F5.0) B (F5.0) TERMS WHICH WILL BE USED TO MAKE THE TRANSFORMATION
(DEFAULT: IF ZERO, PROGRAM WILL USE LAST RECORD OF SVF)
A B
.... + .... +
1 . 0 .

PLEASE INPUT # OF COLUMNS FOR OUTPUT DATA SET: (13)
DEFAULT: IF ZERO, PROGRAM WILL USE # COLUMNS IN SVF

PLEASE INPUT FORMAT FOR REAL VALUED DATA SET: (80A1)
DEFAULT: LAST RECORD OF SVF WILL BE USED
(10F8.0)
ROWS = 36
COLUMNS = 48
SLOPE = 1.000
INTERCEPT = 0.0

++++ SUCCESSFUL CONVERSION TO REAL VALUED FILE ++++

IH00021 STOP 1
CONDITION CODE = 01