Documentation of Climatic Weather Generator Surfaces for Afghanistan

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This chapter documents the databases used to develop statistical surfaces for the climatic generator WXGEN. This generator in turn was used to create statistically representative daily weather records used in simulation models to estimate forage production for selected 10km grids.

Data Sources

Several data sets were used to collect the information used in developing the surfaces. Primary Sources include:

Long-term historical average monthly information

1) World Meteorological Organization Global Climatic Normals (CLINO) for 1961 to 1990. Produced by National Climatic Data Center, NOAA Ashville, N.C. Version 1.0 1998

2) The United Nations Food and Agriculture Organization (FAO), AgroMet Division, Average Climate Information from 1961 and 1990 Data used here was taken from non published CDs obtained directly from the FAO AgroMet Division in1999. The online version is at:
http://freegeographytools.com/2007/fao-world-climate-data

3) Monthly weather statistics compiled by International Center for Tropical Agriculture (CIAT). This included some WMO information, FAO information, and information obtained from individual countries.

4) Historical records from the Afghanistan Ministry of Transportation that were obtained in hard copy and were coded into digital formats by AGROMET and the Afghanistan PEACE Project in Kabul.

Recent daily weather records collected for the period of record.

1) Global Daily Summary Temperature and Precipitation 1977 to 1991. Version 1.0. Produced jointly by National Climatic Data Center, Asheville, North Carolina, and Texas A&M University's Blackland Research Center Temple Texas. March 1994 and updated annually 1991-2004 for all worldwide stations that were available.

2) Global Summary of the Day (GSOD) National Climatic Data Center NNDC Climate Data Online at: ftp://ftp.ncdc.noaa.gov/pub/data/gsod/ was accessed in spring 2008 and all available stations and years for Pakistan, Iran, Iraq, Kuwait, and Central Asia Countries were downloaded.

Analytical Procedures

Point Location Statistic and Procedures

All the long term monthly climatic historical norms were collected for Afghanistan and combined into one database. In addition, all available daily data for Afghanistan was combined into a data directory and processed using the SAS program listed in Appendix A. This program generates all of the statistical coefficients needed by the weather generator for each individual station. It was quickly determined that neither the number of stations nor the period of record for the stations was sufficient to provide data to generate the necessary surfaces. Afghanistan climate data is very scarce and incomplete.

It was determined that additional stations must be found outside of the boundaries of Afghanistan to contribute to the development of the surfaces. To obtain additional station data, the Global Daily Summaries were downloaded for the period 1970-2007 for the shrouding regions of Pakistan, Iran, Iraq, Kuwait, and Central Asia Countries. The daily data was processed using the SAS programs, as indicated above, to obtain the statistical coefficients from the daily data for the new countries and stations.

Monthly coefficients were created for each station where data were available from the SAS statistical outputs and the monthly historical norms for Afghanistan from the above listed database. This was accomplished by loading all of the available information for a single station into a database and all records for that station were manually reviewed. Then, one data source was chosen for each attribute that showed consistency and completeness to represent that station's data. Some attribute values came from the daily processed data such as the standard deviations of temperature, while values for other attributes came from the monthly historical data. Because stations varied dramatically with respect to attributes reported, individual files were created that contained data from all of the stations for a given attribute. For example, separate files were created for rain, temperature, radiation, relative humidity, etc. This allowed the use of all weather stations rather than having to eliminate some stations because the data for one attribute was missing.

Generation of Climatic Surfaces using Thin Plate Smoothing Spline Methodology

The creation of climatic surfaces is a procedure that allows one to take sparse points or station data and generalize that data such that weather generator coefficients can be estimated for locations and elevations where weather data are not available. There are numerous interpolation programs available to generate surfaces. One of the more documented and rigorous techniques known is the thin plate smoothing spline method. For our purposes, we elected to use the program ANUSPLIN developed by M. F. Hutchinson at the Australian National University. Documentation on the theory and use of this program can be found on the ANU website at:
http://fennerschool.anu.edu.au/publications/software/anusplin.php

This program was used as described below to create 108 surfaces of coefficients for the Afghanistan weather generator used in PHYGROW. This constitutes 12 monthly surfaces for 9 attributes; and extended to the region that included all of Afghanistan and surrounding countries.

Figure 1 shows a typical input file--in this case standard deviation of maximum temperature. The file is a text file that contains one line for each climatic station. Each record contains the WMO station number, longitude and latitude information followed by 12 columns of data that contain monthly standard deviations of maximum temperature for the period January to December. Similar files were built for all attributes. In some cases, elevation was added to the database after the latitude and longitude data when elevation was used in ANUSPLIN.

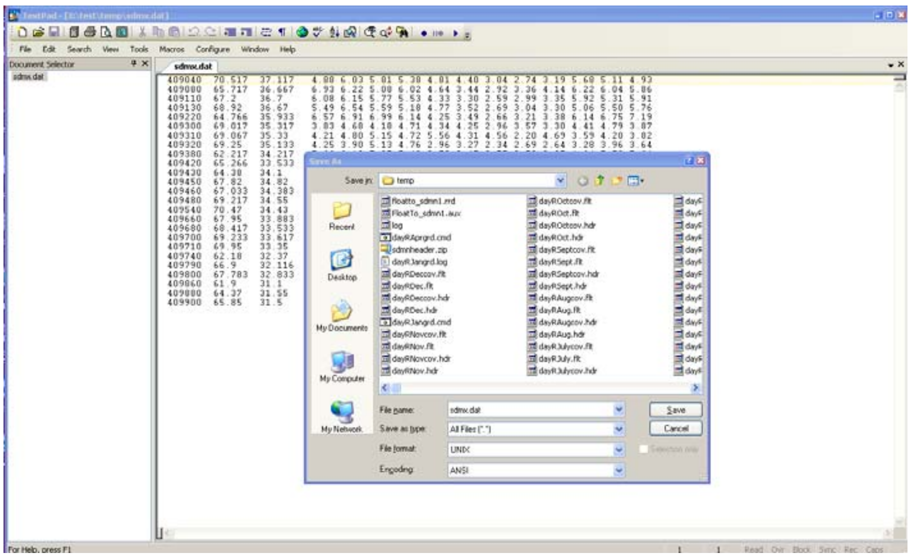

Figure 1: Representative input file of station data.

The Afghanistan surfaces were developed using the UNIX program of ANUSPLIN. If a UNIX computer is used one should be careful to make sure the data files are saved in the UNIX format.

Surfaces were generated for 9 attributes including: maximum temperature, minimum temperature, standard deviation of maximum temperature, standard deviation of minimum temperature, monthly rainfall, number of days of rain, relative humidity, solar radiation and wind speed.

The default configuration for the weather generator requires 13 attributes. In the case of the Afghanistan climate surfaces, four attributes were omitted for lack of data. These included the probability of a wet day given that the previous day was a wet day; the probability of a wet day given that the previous day was dry; the standard deviation of rainfall; and the skew coefficients for rainfall. One of the options in the weather generator is to substitute the days of rain for the wet-dry probabilities and use default coefficients for the standard deviations and skew coefficients for rain. These defaults were used.

The ANUSPLIN program runs in two steps. The first requires two input files and produces two output files. Required files are the station/attribute text file and the SPLINa header file. This step creates the equations for the spline surfaces. Step two (the "lapgrd" program, requires three input files: the output from step one, a second header file, and a DEM for the area to be fit (a 1 km DEM is available from the NOAA National Geophysical Data Center (NGDC) http://www.ngdc.noaa.gov/mgg/topo/globe.html). The output of this program is a matrix of values that contain the interpolated values for each cell in the DEM; in this case we interpolated to 1km^2 cells. A copy of the 18 header files for the nine attributes can be found in Appendix B.

After the ANUSPLIN program wae executed, the resulting files wree ready to be loaded back as GIS layers for use. This was done by converting and loading the matrix file of floating point numbers into a raster GIS file. This step required the DEM that was used in step two or a subset of that DEM containing the appropriate metadata for positioning of the splined coefficients.

All 108 surfaces were delivered to be inserted into the PHYGROW Model management database. To obtain monthly average weather generator coefficients for a given location, a "drill down" algorithms was used to extract the appropriate 108 values for a given latitude and longitude from the surfaces cloud. These coefficients were in turn input into the weather generator as documented in PHYGROW; and the weather generator was run to obtain estimates of daily values for the period of interest for the model runs.

Appendix A
SAS programming code for processing daily weather data into weather generator coefficients for individual stations.

This program accepts the format from Global Summary of the Day (GSOD) National Climatic Data Center (NCDC) Climate Data

```
TITLE1 "CLIMATIC DATA FOR ANUSPLIN INPUT";
PROC DATASETS KILL;
%MACRO CLIMA(COUNTRY,STA);
TITLE2 "&COUNTRY CentAsia ";

DATA ONE;INFILE "E:\WMO2004-2007\&STA" firstobs=2;
INPUT STATION  1-6 YEAR 15-18 MONTH 19-20 DAY 21-22
     temp 25-30 dewp 36-41 slp 47-51 stp 58-63 VISIB 69-73 wdsp 79-83 MXSPD 89-93
     GUST 96-100 MAXTEMP 103-108  MINTEMP 111-116 RAIN 119-123  RAINFLAG $
124
     SNDP 126-130 fogF 133 RainF 134 SnowF 135 HailF 136 ThunderF 137 TornadoF
138;

DATA TWO1;SET ONE;
COUNTRY="&COUNTRY";
/*STATION="&STA";*/
/* CHECK FOR OUT OF RANGE VALUES */

IF TEMP    GT  130. THEN TEMP = .;
IF MAXTEMP GT  130. THEN MAXTEMP = .;
IF MINTEMP GT  130. THEN MINTEMP = .;
IF RAIN    GT   20. THEN RAIN = .;
IF dewp    GT  130. THEN dewp =.;
IF wdsp    GT  100. THEN wdsp =.;
rainday=0;
clearday=0;
Totday=0;
IF RAIN= 0.0           THEN CLEARDAY=1;ELSE CLEARDAY=0;
IF RAIN GT 0.0          THEN RAINDAY =1;ELSE RAINDAY =0;
IF RAIN =99.99          THEN RAINMISS=1;ELSE RAINMISS=0;

IF RainF=1 or SnowF=1 then rainday=1;else rainday=0;
IF RainF=0 and SnowF=0 then clearday=1;else clearday=0;
IF RainFlag="I" then RAIN =.;
CLEARDAA = CLEARDAY;
RAINDAYA = RAINDAY;

IF MAXTEMP =  9999.9 THEN MAXTEMP = .;
IF MINTEMP =  9999.9 THEN MINTEMP = .;
IF RAIN    =  99.99 THEN RAIN = .;
IF dewp    =  9999.9 then dewp =.;
```

```
IF SLP    =  9999.9  then SLP =.;
IF STP    =  9999.9  then STP  =.;
IF VISIB  =  999.9  then VISIB  =.;
IF wdsp    =  999.9  then wdsp =.;
IF MXSPD    =  999.9  then MXSPD =.;
IF GUST    =  999.9  then GUST =.;
IF SNDP    =  999.9  then SNDP =.;

/* CHECK FOR OUT OF RANGE VALUES */

IF TEMP    GT  130. THEN TEMP = .;
IF MAXTEMP GT  130. THEN MAXTEMP = .;
IF MINTEMP GT  130. THEN MINTEMP = .;
IF RAIN    GT   20. THEN RAIN = .;
IF dewp    GT  130. THEN dewp =.;
IF wdsp    GT  100. THEN wdsp =.;

TEMP = (TEMP - 32)/1.8;
MAXTEMP = (MAXTEMP - 32)/1.8;
MINTEMP = (MINTEMP - 32)/1.8;
DEWP = (DEWP - 32)/1.8;
RAIN = RAIN*25.4;
SNDP= SNDP*25.4;
WDSP = WDSP*.514722;   /*meters/sec*/
GUST = GUST*.514722;  /*meters/sec*/
MXSPD = MXSPD*.514722; /*meters/sec*/
VISIB = VISIB*1.6093; /*km*/
TOTDAY = CLEARDAY + RAINDAY;

IF RAIN = 0 THEN RAIN = .;
DATE    = MDY(MONTH,DAY,YEAR);
JULIAN  = JULDATE(DATE);

if year < 2000 then yr = year - 1900;
else yr = year - 2000;

JDAY    = ((JULIAN/1000) - yr) * 1000;
jday = int(jday);
JDAY1   = JDAY - 1;
JDAYLAG = LAG(JDAY);
 if jday1 ne jdaylag then rainlag = .; else
 rainlag = lag(raindaya);
 /* end of joaquin's edits */

IF RAINLAG = 1 AND RAINDAYA = 1 THEN PWW = 1; ELSE PWW = .;
IF RAINLAG = 1 AND RAINDAYA = 0 THEN PWW = 0;
IF RAINLAG = 0 AND RAINDAYA = 1 THEN PWD = 1; ELSE PWD = .;
IF RAINLAG = 0 AND RAINDAYA = 0 THEN PWD = 0;
```

```
IF RAINLAG = . THEN DO;
   PWW = .;
   PWD = .;
END;

/*
DATA TWO3;
INFILE "D:\WMO2001\soi77-2001.txt";
INPUT YEAR 1-4 MONTH 7-8 SOI 11-15 SOIPHAS 18;

PROC SORT DATA=union;BY YEAR MONTH;
PROC SORT DATA=TWO3;BY YEAR MONTH;

DATA UNION2;
MERGE union TWO3;
BY YEAR MONTH;
*/
DATA THREE;SET TWO1;
IF STATION =. then delete;
data three1; set three;
PROC SORT DATA=three1; BY STATION MONTH;

PROC MEANS N MIN MEAN MAX STD SKEWNESS NOPRINT DATA=THREE1; BY
STATION MONTH;
VAR MAXTEMP MINTEMP RAIN dewp wdsp TOTDAY CLEARDAY RAINDAY RAINMISS
CLEARDAA RAINDAYA
PWW PWD;
OUTPUT OUT=OUT  MEAN = MXTM MNTM RAINM dewpm wdspm TOTDAYM CLRDAYM
RAINDAYM RAINMISM
                       CLRDAAM RNDAYAM PWWM PWDM
                 STD = MXTS MNTS RAINS dewps wdsps
                 MAX = MXTMX MNTMX RAINMX dewpmx wdspmx
                 MIN = MXTMN MNTMN RAINMN dewpmn wdspmn
                   N = MXTN MNTN RAINN dewpn wdspn  TOTDAYN CLRDAYN RAINDAYN
                       RAINMISN CLRDAAN RNDAYAN PWWN PWDN
            SKEWNESS = MXTSK MNTSK RAINSK;
ID COUNTRY YEAR;

DATA OUT; SET OUT;
DROP _TYPE_ _FREQ_;

PROC APPEND BASE=ALL DATA=OUT;

DATA LAST;SET ALL;

RUN;
%MEND CLIMA;
```

```
%CLIMA(CentAsia,CentAsia_all.txt)

DATA LAST1;SET ALL;
IF MONTH=1  THEN NDAYS=31;
IF MONTH=2  THEN NDAYS=28.25;
IF MONTH=3  THEN NDAYS=31;
IF MONTH=4  THEN NDAYS=30;
IF MONTH=5  THEN NDAYS=31;
IF MONTH=6  THEN NDAYS=30;
IF MONTH=7  THEN NDAYS=31;
IF MONTH=8  THEN NDAYS=31;
IF MONTH=9  THEN NDAYS=30;
IF MONTH=10 THEN NDAYS=31;
IF MONTH=11 THEN NDAYS=30;
IF MONTH=12 THEN NDAYS=31;

DAYRAIN=RNDAYAM*NDAYS;
TOTMRAIN=RAINM*RNDAYAM*NDAYS;

FILE "E:\WMO2004-2007\CentAsia\CentAsia-out\CentAsia_one_C.DAT" ls=316;
PUT COUNTRY $ 1-8 STATION 10-15 MONTH 17-18 MXTN 22-25
MXTMN 27-32 .2
MXTM 34-39 .2 MXTMX 41-46 .2 MXTS 48-53 .2 MXTSK 55-60 .2
MNTN 62-65 MNTMN 67-72 .2 MNTM 74-79 .2 MNTMX 81-86 .2 MNTS 88-93 .2
MNTSK 95-100 .2
RAINN 102-105 RAINMN 107-112 .2 RAINM 114-119 .2 RAINMX 121-126 .2
RAINS 128-133 .2 RAINSK 135-140 .2
TOTDAYN 142-145 TOTDAYM 147-152 .2 CLRDAYN 154-157 CLRDAYM 159-164 .3
RAINDAYN 166-169 RAINDAYM 171-176 .3 RAINMISN 178-181 RAINMISM 183-188 .3
PWWN 190-193 PWWM 195-200 .3 PWDN 202-205 PWDM 207-212 .3
CLRDAAN 214-217 CLRDAAM 219-224 .3 RNDAYAN 226-229  RNDAYAM  231-236 .3
DAYRAIN 238-243 .3 TOTMRAIN 245-250 .1
dewpn 252-255 dewpmn 257-262 .2
dewpm 264-269 .2 dewpmx 271-276 .2 dewps 278-283 .2
wdspn 285-288 wdspmn 290-295 .1 wdspm 297-302 .1 wdspmx 304-309 .1
wdsps 311-316 .2;

RUN;

DATA THREE;
INFILE "E:\WMO2004-2007\CentAsia\CentAsia-out\CentAsia_one_C.DAT" ls=316;
INPUT COUNTRY $ 1-8 STATION 10-15 MONTH 17-18 MXTN 22-25
MXTMN 27-32 .2
MXTM 34-39 .2 MXTMX 41-46 .2 MXTS 48-53 .2 MXTSK 55-60 .2
MNTN 62-65 MNTMN 67-72 .2 MNTM 74-79 .2 MNTMX 81-86 .2 MNTS 88-93 .2
MNTSK 95-100 .2
RAINN 102-105 RAINMN 107-112 .2 RAINM 114-119 .2 RAINMX 121-126 .2
RAINS 128-133 .2 RAINSK 135-140 .2
```

```
TOTDAYN 142-145 TOTDAYM 147-152 .2 CLRDAYN 154-157 CLRDAYM 159-164 .3
RAINDAYN 166-169 RAINDAYM 171-176 .3 RAINMISN 178-181 RAINMISM 183-188 .3
PWWN 190-193 PWWM 195-200 .3 PWDN 202-205 PWDM 207-212 .3
CLRDAAN 214-217 CLRDAAM 219-224 .3 RNDAYAN 226-229  RNDAYAM  231-236 .3
DAYRAIN 238-243 .3 TOTMRAIN 245-250 .1
dewpn 252-255 dewpmn 257-262 .2
dewpm 264-269 .2 dewpmx 271-276 .2 dewps 278-283 .2
wdspn 285-288 wdspmn 290-295 .1 wdspm 297-302 .1 wdspmx 304-309 .1
wdsps 311-316 .2;

DATA FOUR;
INFILE "E:\WMO2004-2007\WMO-station.txt" firstobs=18;
INPUT STATION  1-6 WBAN $ 8-11 NAME $ 14-43 Countrycode $ 44-45 State $ 47-48
Call $53-56 LAT 59-64
LON 66-72  ELEV 74-79;

LAT = LAT/1000;
LON = LON/1000;
Elev = ELEV/10;

PROC SORT DATA=THREE; BY STATION;
PROC SORT DATA=FOUR; BY STATION;

DATA TOTAL;
MERGE THREE FOUR;
BY STATION;


DATA TOTAL1; SET TOTAL;
IF MONTH = .  THEN DELETE;

DATA TOTAL2; SET TOTAL1;
If Lat2="S" then lat=lat*-1.0;
If Lon2 = "W" then LON= LON*-1.0;

FILE "E:\WMO2004-2007\CentAsia\CentAsia-out\CentAsiaMRG.DAT" LS=367;
PUT COUNTRY $ 1-8 STATION 10-15 MONTH 17-18 MXTN 22-25
MXTMN 27-32 .2
MXTM 34-39 .2 MXTMX 41-46 .2 MXTS 48-53 .2 MXTSK 55-60 .2
MNTN 62-65 MNTMN 67-72 .2 MNTM 74-79 .2 MNTMX 81-86 .2 MNTS 88-93 .2
MNTSK 95-100 .2
RAINN 102-105 RAINMN 107-112 .2 RAINM 114-119 .2 RAINMX 121-126 .2
RAINS 128-133 .2 RAINSK 135-140 .2
TOTDAYN 142-145 TOTDAYM 147-152 .2 CLRDAYN 154-157 CLRDAYM 159-164 .3
RAINDAYN 166-169 RAINDAYM 171-176 .3 RAINMISN 178-181 RAINMISM 183-188 .3
PWWN 190-193 PWWM 195-200 .3 PWDN 202-205 PWDM 207-212 .3
CLRDAAN 214-217 CLRDAAM 219-224 .3 RNDAYAN 226-229  RNDAYAM  231-236 .3
DAYRAIN 238-243 .3 TOTMRAIN 245-250 .1
```

```
dewpn 252-255 dewpmn 257-262 .2
dewpm 264-269 .2 dewpmx 271-276 .2 dewps 278-283 .2
wdspn 285-288 wdspmn 290-295 .1 wdspm 297-302 .1 wdspmx 304-309 .1
wdsps 311-316 .2
CALL $ 318-321 NAME $ 323-342 LAT 344-351 .3
LON 353-360 .3  ELEV 362-367;

PROC SORT;BY STATION;

DATA TOTAL3; SET TOTAL1;

/*If Lat2="S" then lat=lat*-1.0;
If Lon2 = "W" then LON= LON*-1.0;*/
If DAYRAIN   = . OR 0.0 THEN  DAYRAIN  = .001;
If TOTMRAIN  = . OR 0.0 THEN  TOTMRAI  = .001;
If PWDM      = . OR 0.0 THEN  PWDM     = .001;
If PWWM      = . OR 0.0 THEN  PWWM     = .001;
/*IF RAINS     = . OR 0.0 THEN  RAINS    =  RAINM *1.5;*/
IF RAINSK    = . OR 0.0 THEN  RAINSK   =  2.0;
IF RAINSK    > 4.0      THEN  RAINSK   =  4.0;

DATA TOTAL4; SET TOTAL3;

FILE "E:\WMO2004-2007\CentAsia\CentAsia-out\CentAsiaMRG-CLEAN.DAT" LS=155;
PUT COUNTRY $ 1-8 STATION 10-15 MONTH 17-18  DAYRAIN 22-27 .3
TOTMRAIN 29-34 .1 PWDM 36-41 .3 PWWM 43-48 .3
dewpm 50-55 .2 MNTS 57-62 .2 MXTS 64-69 .2
RAINS 71-76 .2 RAINSK 78-83 .2 MNTM 85-90 .2  MXTM 92-97 .2
wdspm 99-104 .1 CALL $ 106-109 NAME $ 111-130 LAT 132-139 .3
LON 141-148 .3  ELEV 150-155;

PROC SORT;BY STATION MONTH;

PROC PRINT;BY STATION;
VAR STATION MONTH RAINN dayrain RAINM RNDAYAM TOTMRAIN NAME LAT  LON
ELEV;
SUM TOTMRAIN ;

RUN;

/*
COUNTRY STATION MONTH MXTN MXTMN MXTM MXTMX MXTS MXTSK MNTN MNTMN
MNTM MNTMX MNTS MNTSK RAINN RAINMN
RAINM RAINMX RAINS RAINSK TOTDAYN TOTDAYM CLRDAYN CLRDAYM RAINDAYN
RAINDAYM RAINMISN RAINMISM
PWWN PWWM PWDN PWDM CLRDAAN CLRDAAM RNDAYAN RNDAYAM DAYRAIN
TOTMRAIN
```

DEWPN DEWPMN DEWPM DEWPMX DEWPS WDSPN WDSPMN WDSPM WDSPMX
WDSPS CALL NAME LAT LAT2 LON LON2 ELEV
*/

Appendix B
Header files used to execute AUSPLIN for 9 attributes: solar radiation, relative humidity, wind speed, minimum temperature, maximum temperature, rainfall, days of rain, standard deviation minimum and standard deviation maximum.

rad11afg.cmd

```
Solar Radiation
0
2
0
0
0
39 91 0 5
12 55 0 5
0
2
12
0
1
1
rad11x.dat
200
20

rad11afg.res
rad11afg.opt
rad11afg.sur
rad11afg.lis
rad11afg.cov
```

rad11grd.cmd

```
rad11afg.sur
0
1
rad11afg.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
2
afghdd1km2.dem
2
-99.0
rad11x1a.flt
rad11x2a.flt
rad11x3a.flt
rad11x4a.flt
rad11x5a.flt
rad11x6a.flt
rad11x7a.flt
rad11x8a.flt
rad11x9a.flt
rad11x10a.flt
rad11x11a.flt
rad11x12a.flt

2
-9.0
rad11xcov1a.flt
rad11xcov2a.flt
rad11xcov3a.flt
rad11xcov4a.flt
rad11xcov5a.flt
rad11xcov6a.flt
rad11xcov7a.flt
rad11xcov8a.flt
rad11xcov9a.flt
rad11xcov10a.flt
rad11xcov11a.flt
rad11xcov12a.flt
```

rhum12afg.cmd

```
Relative Humidity
```

0
2
0
0
0
39 91 0 5
12 55 0 5
0
2
12
0
1
1
rhum12x.dat
200
20

rhum12afg.res
rhum12afg.opt
rhum12afg.sur
rhum12afg.lis
rhum12afg.cov

rhum12grd.cmd

```
rhum12afg.sur
0
1
rhum12afg.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
2
afghdd1km2.dem
2
-99.0
rhum12x1a.flt
rhum12x2a.flt
rhum12x3a.flt
rhum12x4a.flt
rhum12x5a.flt
rhum12x6a.flt
rhum12x7a.flt
rhum12x8a.flt
rhum12x9a.flt
rhum12x10a.flt
rhum12x11a.flt
rhum12x12a.flt

2
-9.0
rhum12xcov1a.flt
rhum12xcov2a.flt
rhum12xcov3a.flt
rhum12xcov4a.flt
rhum12xcov5a.flt
rhum12xcov6a.flt
rhum12xcov7a.flt
rhum12xcov8a.flt
rhum12xcov9a.flt
rhum12xcov10a.flt
rhum12xcov11a.flt
rhum12xcov12a.flt
```

wind13afg.cmd

Wind Speed
0
2
0
0
0
39 91 0 5
12 55 0 5
0
2
12
0
1
1
wind13x.dat
200
20

wind13afg.res
wind13afg.opt
wind13afg.sur
wind13afg.lis
wind13afg.cov

wind13grd.cmd

```
wind13afg.sur
0
1
wind13afg.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
2
afghdd1km2.dem
2
-99.0
wind13x1a.flt
wind13x2a.flt
wind13x3a.flt
wind13x4a.flt
wind13x5a.flt
wind13x6a.flt
wind13x7a.flt
wind13x8a.flt
wind13x9a.flt
wind13x10a.flt
wind13x11a.flt
wind13x12a.flt

2
-9.0
wind13xcov1a.flt
wind13xcov2a.flt
wind13xcov3a.flt
wind13xcov4a.flt
wind13xcov5a.flt
wind13xcov6a.flt
wind13xcov7a.flt
wind13xcov8a.flt
wind13xcov9a.flt
wind13xcov10a.flt
wind13xcov11a.flt
wind13xcov12a.flt
```

tmn2.cmd

```
Minimum Temperature
```

```
5
2
1
0
0
39 91 0 5
12 55 0 5
-50 8570 1 1
1000.0
0
2
12
0
1
1
tmn2x.dat
200
6

tmn2.res
tmn2.opt
tmn2.sur
tmn2.lis
tmn2.cov
```

tmn2grdb.cmd

```
tmn2.sur
0
1
tmn2.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
0
2
afghdd1km2.dem
2
-99.0
tmn2mn1b.flt
tmn2mn2b.flt
tmn2mn3b.flt
tmn2mn4b.flt
tmn2mn5b.flt
tmn2mn6b.flt
tmn2mn7b.flt
tmn2mn8b.flt
tmn2mn9b.flt
tmn2mn10b.flt
tmn2mn11b.flt
tmn2mn12b.flt

2
-9.0
tcovmn1b.flt
tcovmn2b.flt
tcovmn3b.flt
tcovmn4b.flt
tcovmn5b.flt
tcovmn6b.flt
tcovmn7b.flt
tcovmn8b.flt
tcovmn9b.flt
tcovmn10b.flt
tcovmn11b.flt
tcovmn12b.flt
```

tmax.cmd

```
Maximum Temperature
5
2
1
0
0
39 91 0 5
12 55 0 5
-50 8570 1 1
1000.0
0
2
12
0
1
1
tmx1.dat
200
6

tmax.res
tmax.opt
tmax.sur
tmax.lis
tmax.cov
```

tmx1grdb.cmd

```
tmax.sur
0
1
tmax.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
0
2
afghdd1km2.dem
2
-99.0
tmx2mx1b.flt
tmx2mx2b.flt
tmx2mx3b.flt
tmx2mx4b.flt
tmx2mx5b.flt
tmx2mx6b.flt
tmx2mx7b.flt
tmx2mx8b.flt
tmx2mx9b.flt
tmx2mx10b.flt
tmx2mx11b.flt
tmx2mx12b.flt

2
-9.0
tcovmx1b.flt
tcovmx2b.flt
tcovmx3b.flt
tcovmx4b.flt
tcovmx5b.flt
tcovmx6b.flt
tcovmx7b.flt
tcovmx8b.flt
tcovmx9b.flt
tcovmx10b.flt
tcovmx11b.flt
tcovmx12b.flt
```

rain1.cmd

Afghanistan Rainfall Using Knots & Square Root Transformation
7
3
0
0
0
39 91 0 5 3.0
12 55 0 5 2.0 2.0
0 5000 1 1
1000.0
2
2
12
0
1
1
prcp5x.dat
400
20

prcp5xnot.not
400

prcp5afg.flg
prcp5afg.res
prcp5afg.opt
prcp5afg.sur
prcp5afg.lis
prcp5afg.cov

raingrdafg.cmd

```
prcp5afg.sur
0
1
1
prcp5afg.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
0
2
afghdd1km2.dem
2
-99.0
rain1a.flt
rain2a.flt
rain3a.flt
rain4a.flt
rain5a.flt
rain6a.flt
rain7a.flt
rain8a.flt
rain9a.flt
rain10a.flt
rain11a.flt
rain12a.flt

2
-9.0
tcovrain1a.flt
tcovrain2a.flt
tcovrain3a.flt
tcovrain4a.flt
tcovrain5a.flt
tcovrain6a.flt
tcovrain7a.flt
tcovrain8a.flt
tcovrain9a.flt
tcovrain10a.flt
tcovrain11a.flt
tcovrain12a.flt
```

dayRApr.cmd

```
Days of Rain April
0
2
0
0
0
39 91 0 5
12 55 0 5
0
2
1
0
1
1
DaysRApr.dat
200
20

dayRApr.res
dayRApr.opt
dayRApr.sur
dayRApr.lis
dayRApr.cov
```

dayRAprgrd.cmd

```
dayRApr.sur
0
1
dayRApr.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
2
afghdd1km2.dem
2
-99.0
dayRApr.flt

2
-9.0
dayRAprcov.flt
```

sdmnafg.cmd

Standard Deviation Minimun
0
2
0
0
0
39 91 0 5
12 55 0 5
0
2
12
0
1
1
sdmn2.dat
200
20

sdmnafg2.res
sdmnafg2.opt
sdmnafg2.sur
sdmnafg2.lis
sdmnafg2.cov

sdmngrd.cmd

```
sdmnafg2.sur
0
1
sdmnafg2.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
2
afghdd1km2.dem
2
-99.0
sdmn1a.flt
sdmn2a.flt
sdmn3a.flt
sdmn4a.flt
sdmn5a.flt
sdmn6a.flt
sdmn7a.flt
sdmn8a.flt
sdmn9a.flt
sdmn10a.flt
sdmn11a.flt
sdmn12a.flt

2
-9.0
sdmncov1a.flt
sdmncov2a.flt
sdmncov3a.flt
sdmncov4a.flt
sdmncov5a.flt
sdmncov6a.flt
sdmncov7a.flt
sdmncov8a.flt
sdmncov9a.flt
sdmncov10a.flt
sdmncov11a.flt
sdmncov12a.flt
```

sdmxafg.cmd

```
Standard Deviation Maximum
```

0
2
0
0
0
39 91 0 5
12 55 0 5
0
2
12
0
1
1
sdmx.dat
200
20

sdmxafg.res
sdmxafg.opt
sdmxafg.sur
sdmxafg.lis
sdmxafg.cov

sdmxgrd.cmd

```
sdmxafg.sur
0
1
sdmxafg.cov
2

1
1
58.5 80.0 0.01
2
23.0 42.0 0.01
2
afghdd1km2.dem
2
-99.0
sdmx1a.flt
sdmx2a.flt
sdmx3a.flt
sdmx4a.flt
sdmx5a.flt
sdmx6a.flt
sdmx7a.flt
sdmx8a.flt
sdmx9a.flt
sdmx10a.flt
sdmx11a.flt
sdmx12a.flt

2
-9.0
sdmxcov1a.flt
sdmxcov2a.flt
sdmxcov3a.flt
sdmxcov4a.flt
sdmxcov5a.flt
sdmxcov6a.flt
sdmxcov7a.flt
sdmxcov8a.flt
sdmxcov9a.flt
sdmxcov10a.flt
sdmxcov11a.flt
sdmxcov12a.flt
```