CORDEX CAM / SAM WORKSHOP

SDSM TRAINING SESSION

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Loughborough University

SDSM – Statistical Downscaling Model

- End of 2016:

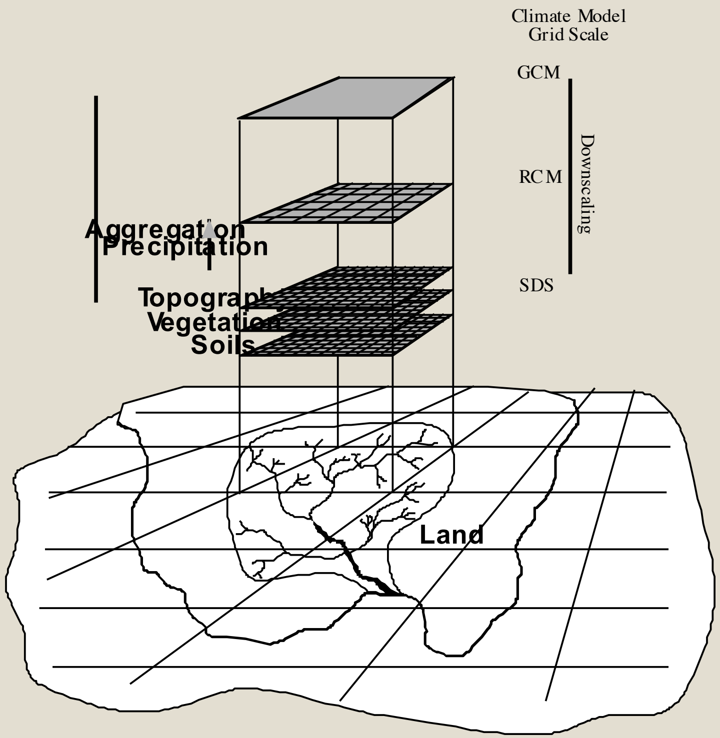
- 11,252 Registered Users
- 100+ Countries

SDSM – Statistical Downscaling Model

- Sponsors
  - Environment Agency of England and Wales
  - Canadian Climate Impact Scenarios Group
  - Environment Canada
  - Loughborough University

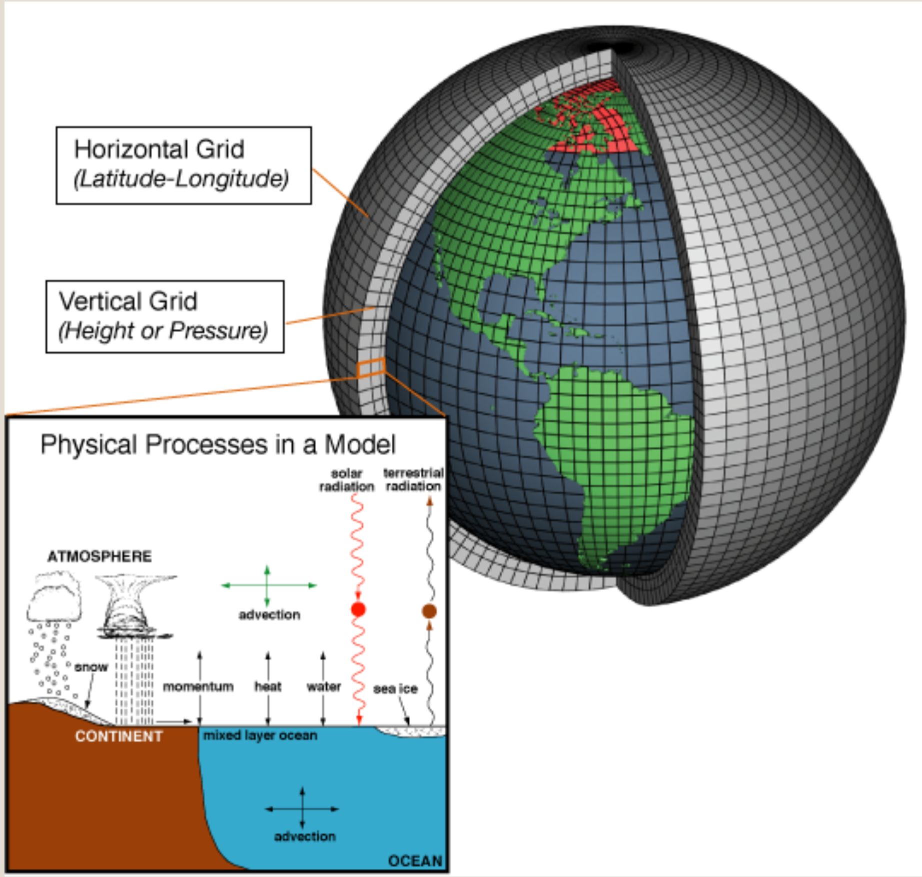
Statistical downscaling

- **A means of deriving local–scale surface weather from regional–scale atmospheric predictor variables**
- Method to obtain local-scale weather and climate, particularly at the surface level, from regional-scale atmospheric variables that are provided by GCMs



Statistical downscaling

- General Circulation models (GCM) are physical representations of key processes in the atmosphere, ocean and land.
- GCMs are coarse in their resolution (~200km), so there is a limitation to the scale of useful information obtainable for small island states.(i.e. They are unable to resolve important sub grid features such as topography)
- GCM’s therefore cannot be used for local impact studies.


Horizontal Grid
(Latitude-Longitude)
Vertical Grid
(Height or Pressure)
Physical Processes in a Model
solar radiation
terrestrial radiation
ATMOSPHERE
advection
snow
momentum
heat
water
sea ice
CONTINENT
mixed layer ocean
advection
OCEAN

Statistical downscaling

- To obtain high resolution future climate information two main types of downscaling techniques are used.
  - Statistical downscaling (Point Location)
  - Dynamical downscaling (Region) using Regional Climate Models (10-50km)

  - Statistical downscaling methods involve developing quantitative relationships between large-scale atmospheric variables—the predictors—and local surface variables the predictands (Giorgi 1990; Kidson and Thompson 1998).

Statistical downscaling

- Statistical downscaling methodologies have several practical advantages over dynamical downscaling approaches.

- In situations where low–cost, rapid assessments of localised climate change impacts are required, statistical downscaling (currently) represents the more promising option.

	Statistical downscaling	Dynamical downscaling
Strengths	• Station–scale climate information from GCM–scale output • Cheap, computationally undemanding and readily transferable • Ensembles of climate scenarios permit risk/ uncertainty analyses • Applicable to 'exotic' predictands such as air quality and wave heights	• 10–50 km resolution climate information from GCM–scale output • Respond in physically consistent ways to different external forcings • Resolve atmospheric processes such as orographic precipitation • Consistency with GCM
Weakness	• Dependent on the realism of GCM boundary forcing • Choice of domain size and location affects results • Requires high quality data for model calibration • Predictor–predictand relationships are often non–stationary • Choice of predictor variables affects results • Choice of empirical transfer scheme affects results • Low–frequency climate variability problematic • Always applied off-line, therefore, results do not feedback into the host GCM	• Dependent on the realism of GCM boundary forcing • Choice of domain size and location affects results • Requires significant computing resources • Ensembles of climate scenarios seldom produced • Initial boundary conditions affect results • Choice of cloud/ convection scheme affects (precipitation) results • Not readily transferred to new regions or domains • Typically applied off-line, therefore results do not always feedback into the host GCM

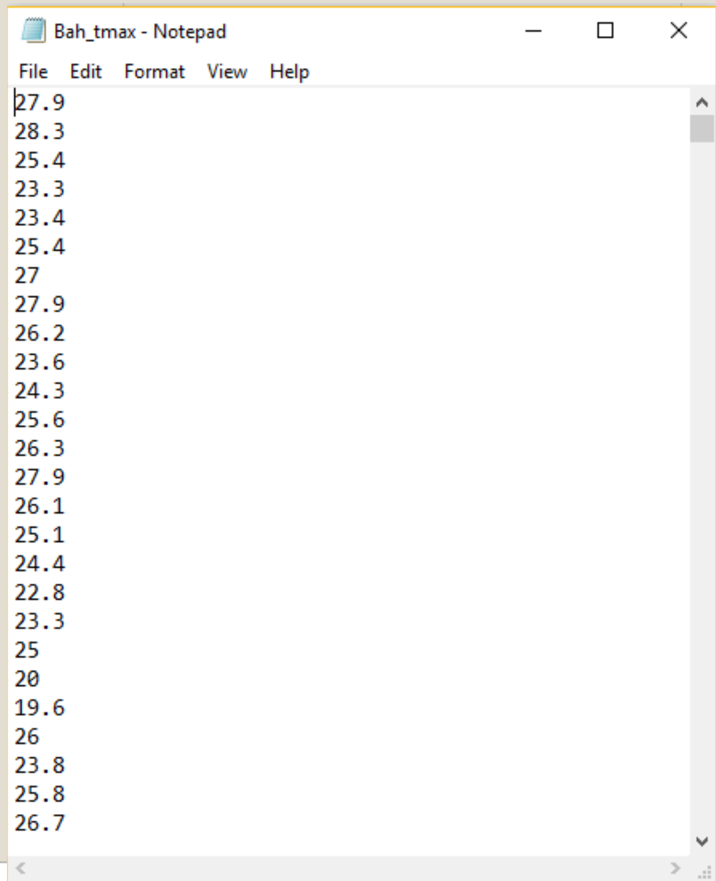
SDSM – **S**tatistical **D**own**S**caling **M**odel

- SDSM uses a hybrid statistical downscaling approach which incorporates multiple linear regression and weather generator schemes to create the statistical models and produce the future daily time series for the climate variables of interest. (Stennett-Brown R. et al 2017).

Getting started

- Ensure model is installed and for ease a shortcut created on desktop.
- Grid box is downloaded and extracted to suitable file location.
- SDSM File format:
  - ✓Predictand (i.e. station data for e.g. Tmax) should be single column daily data starting from 1961.
  - ✓Start date is 1961. Use -999 for any missing data.
  - ✓ensure predictand (station data) is .txt file.

File format for predictand



Settings

Year Length: The default "Calendar (366)" allows 29 days in February every fourth year (i.e., leap years) and should be used with observed data.

Standard Start/End Date:

- Enter Start date: 01/01/1961 and
- End date: 31/12/2005.
- These dates will appear throughout the operation of SDSM, but may be updated from any screen.

Allow Negative Values: The default allows simulation of negative values by unconditional processes in the downscaling model (e.g., for minimum temperature); deselection truncates values at zero (e.g., for sunshine hours). Conditional processes (e.g., rainfall amounts) are unaffected by this button.

Default File Directory: Allows the user to select a default directory that is accessed by all screens when first searching for files. Select the SDSM folder.

Name	Date modified	Type	Size
CanESM2_historical_1961_2005	25/6/2018 11:18 AM	File folder	
CanESM2_rcp26_2006_2100	25/6/2018 11:18 AM	File folder	
CanESM2_rcp45_2006_2100	25/6/2018 11:18 AM	File folder	
CanESM2_rcp85_2006_2100	25/6/2018 11:18 AM	File folder	
NCEP-NCAR_1961_2005	25/6/2018 11:18 AM	File folder	
gauss42_orog	25/4/2014 5:34 PM	Text Document	1 KB
gauss42_sftlf	25/4/2014 5:33 PM	Text Document	1 KB

Advanced Settings

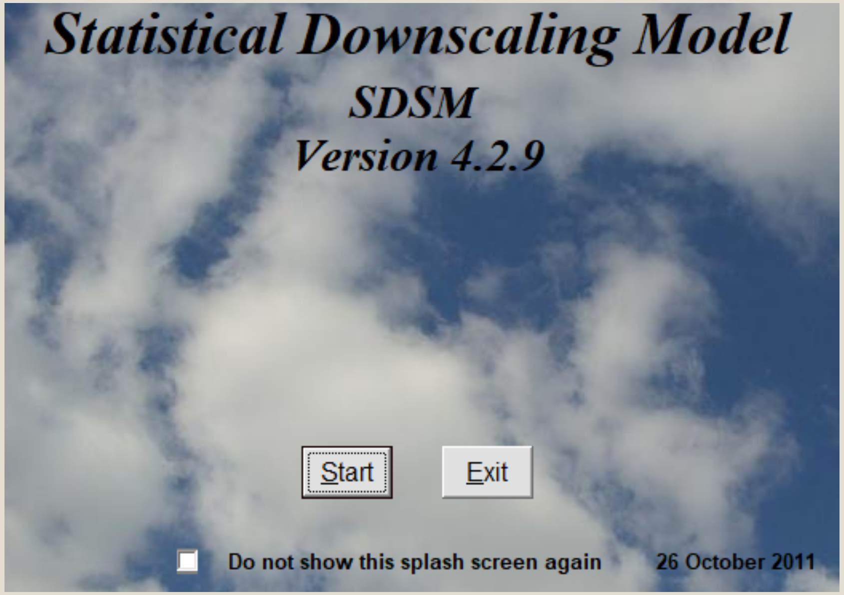
Model Transformation: The default (None) is used whenever the predictand is normally distributed (as is often the case for daily temperature). The alternatives (Fourth root, Natural log and Inverse Normal) are used whenever data are skewed (as in the case of daily precipitation).

Optimisation Algorithm: SDSM 4.2 provides two means of optimising the model – Dual Simplex (as in earlier versions of SDSM) and Ordinary Least Squares. Although both approaches give comparable results, Ordinary Least Squares is much faster.

SDSM file names and recommended directory structure

Extension	Explanation	Directory
*.DAT	Observed daily predictor and predictand files employed by the **Calibrate** and **Weather Generator** operations (input).	SDSM/Scenarios/Calibration
*.PAR	Meta–data and model parameter file produced by the **Calibrate** operation (output) and used by the **Weather Generator** and **Generate Scenario** operations (input).	SDSM/Scenarios/Calibration
*.SIM	Meta–data produced by the **Weather Generator** and **Generate Scenario** operations (output).	SDSM/Scenarios/Results
*.OUT	Daily predictand variable file produced by the **Weather Generator** and **Generate Scenario** operations (output).	SDSM/Scenarios/Results

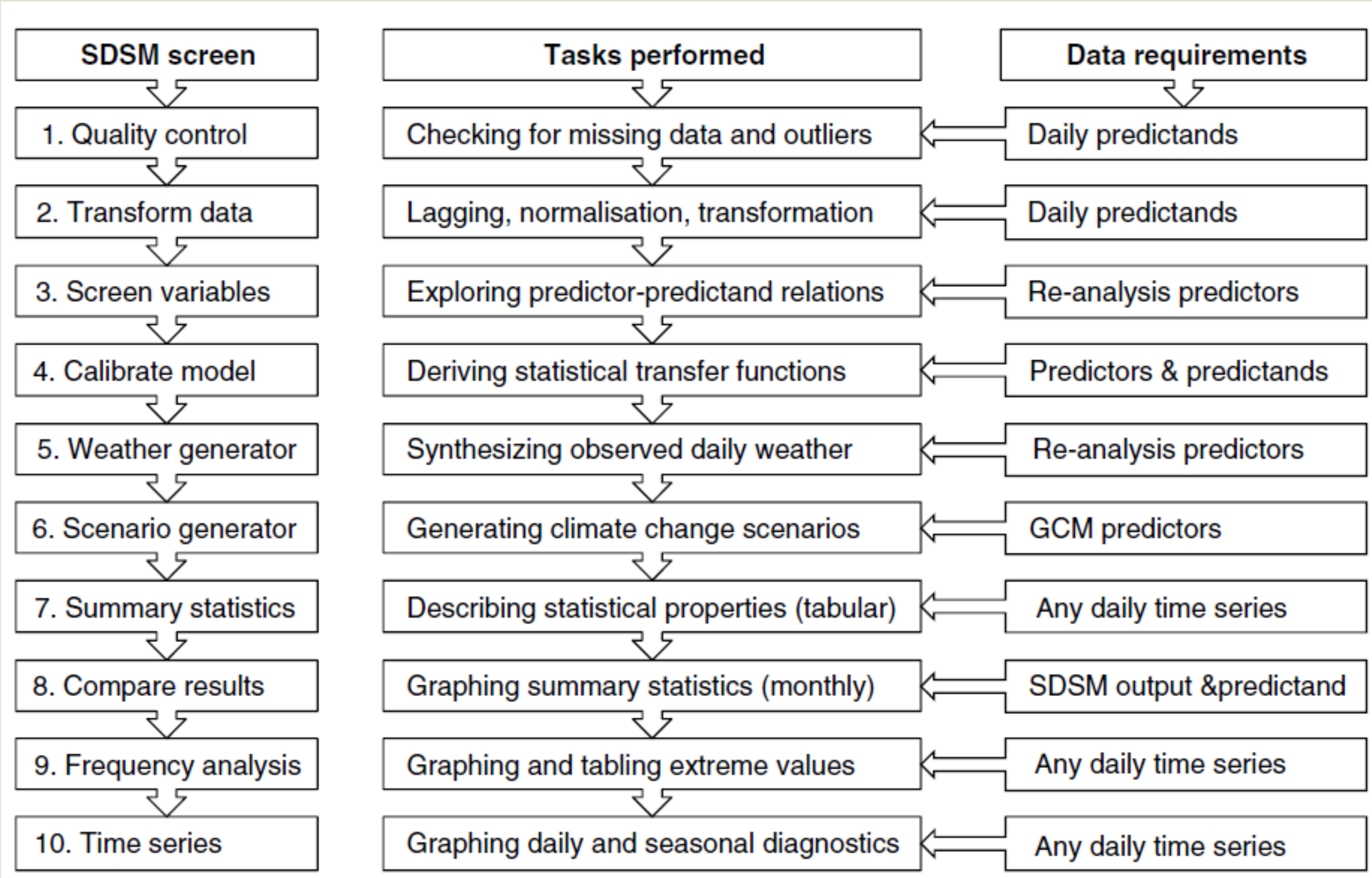
SDSM Version 4.2.9



SDSM Steps

- The SDSM software reduces the task of statistically downscaling daily weather series into seven discrete steps:

1. quality control and data transformation;
2. screening of predictor variables;
3. model calibration;
4. weather generation (using observed predictors);
5. statistical analyses;
6. graphing model output;
7. scenario generation (using climate model predictors).



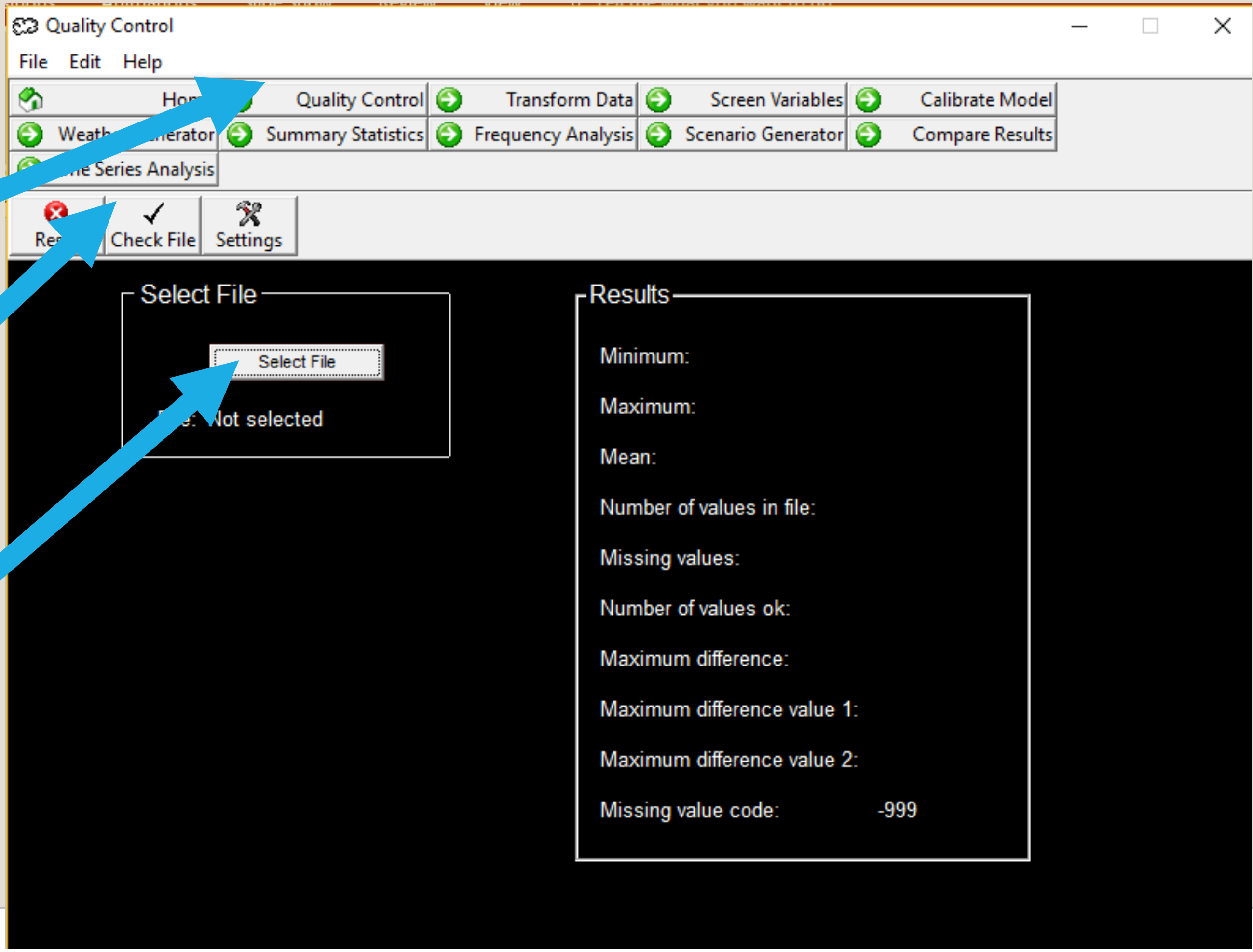
*Wilby and Dawson 2013

Quality control and data transformation

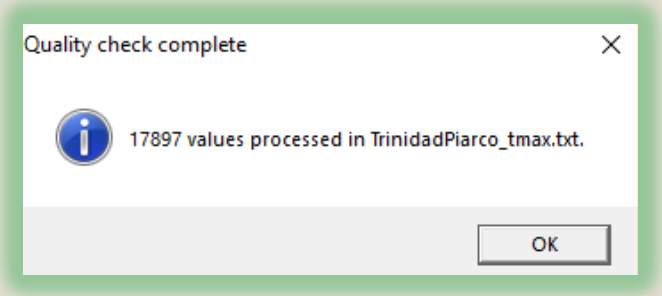
Step 1.1: click on the **Quality Control** button

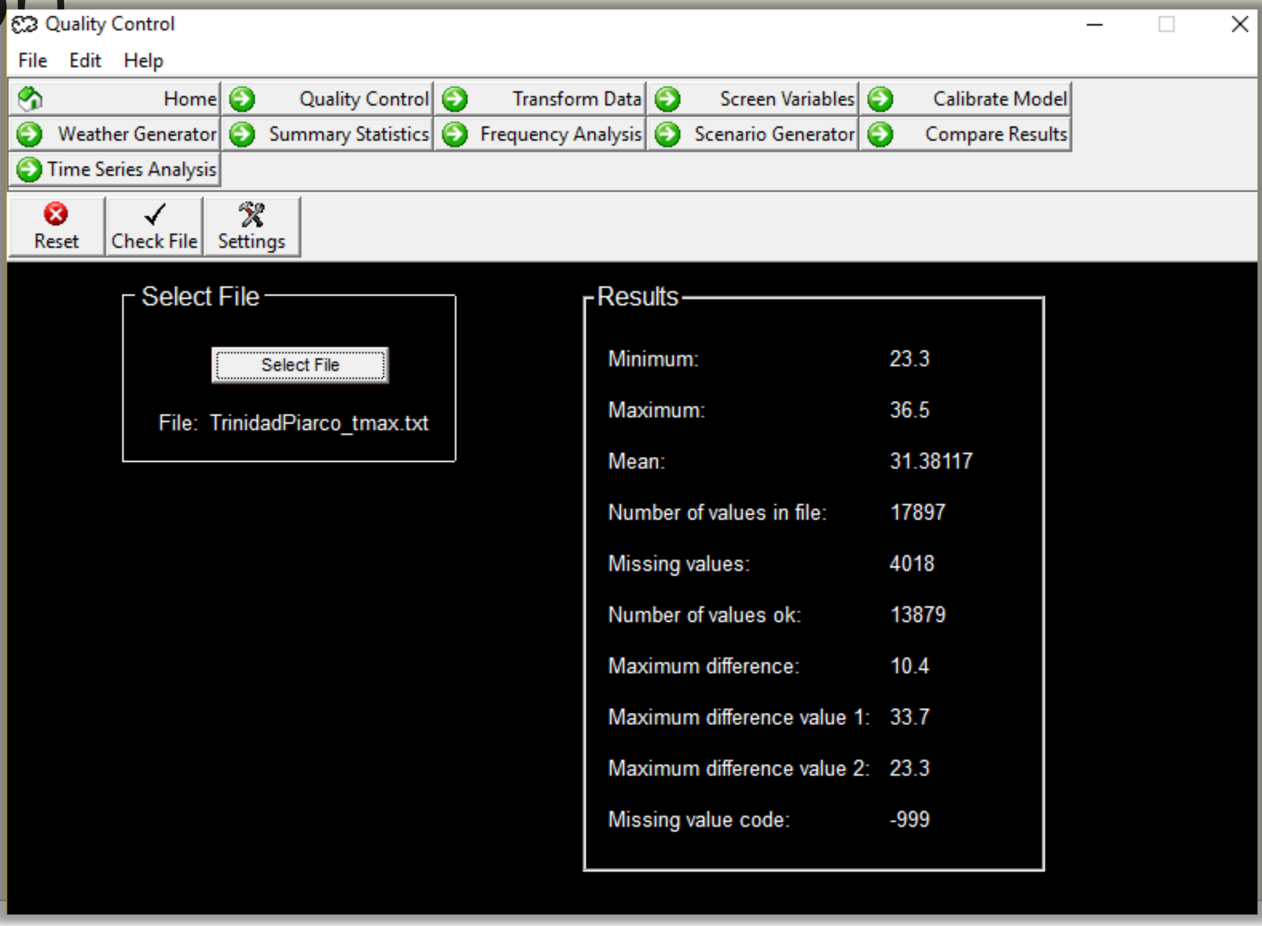
Step 1.3: select check file

Step 1.2: select predictand file for e.g. Tmax, Tmin.

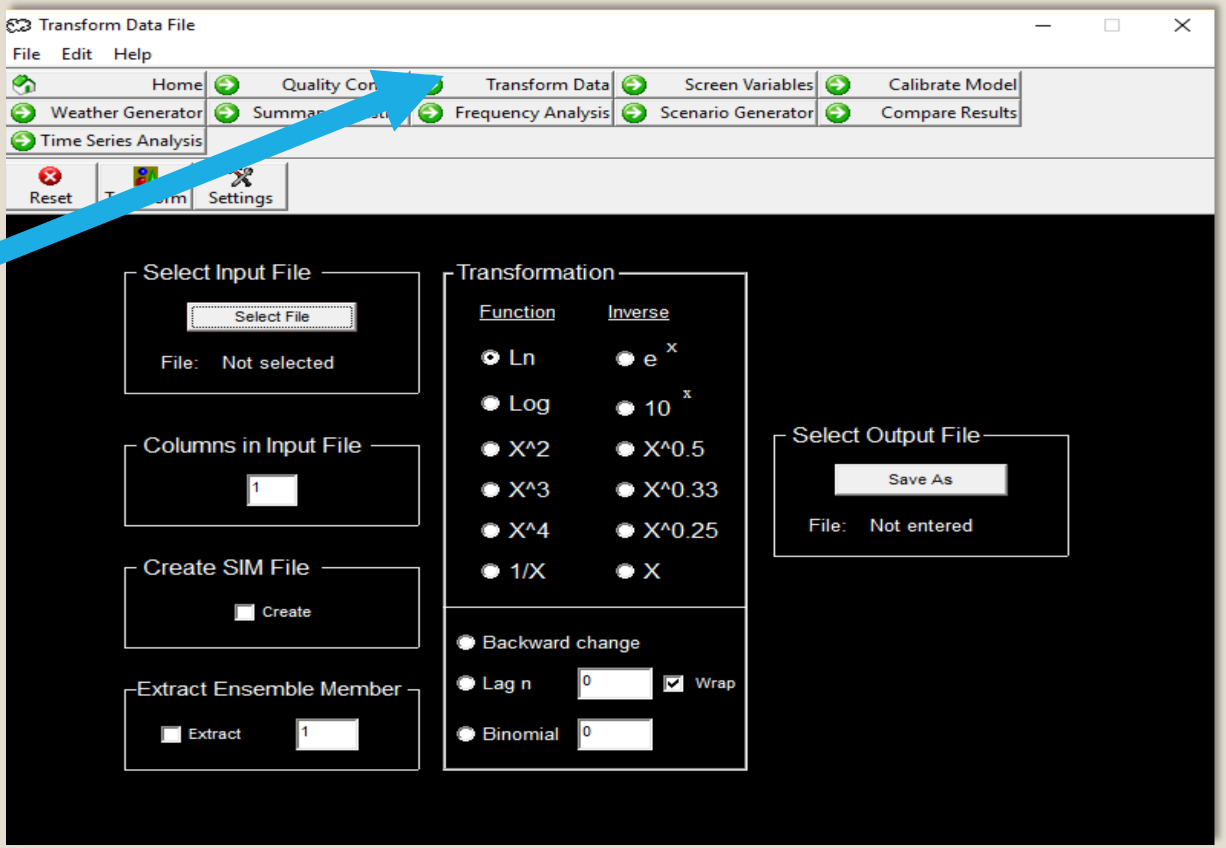


Quality control and data transformation



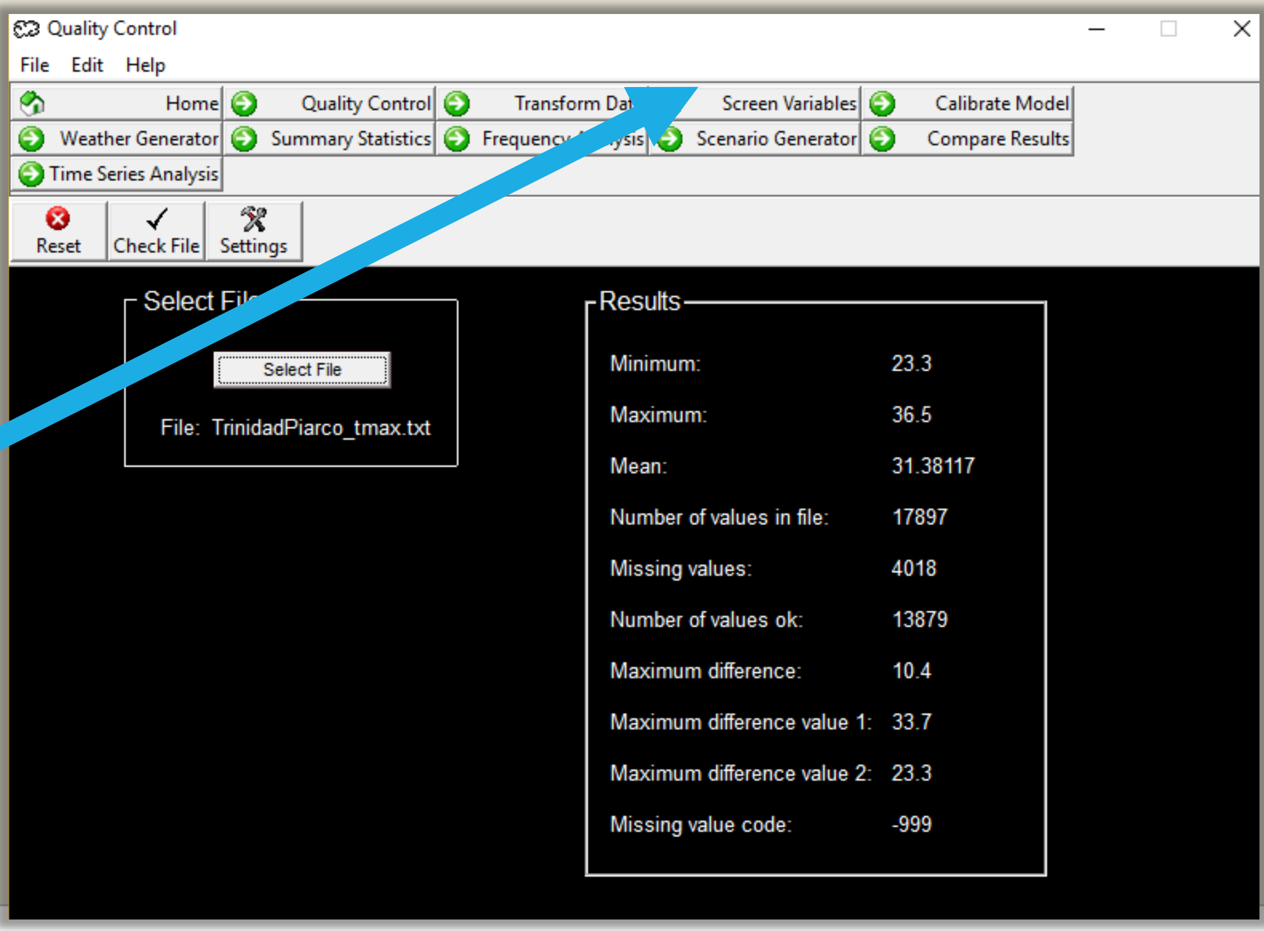


Quality control and data transformation



Step 1.4: click on the **Transform Data** (if necessary)

Screening of predictor variables



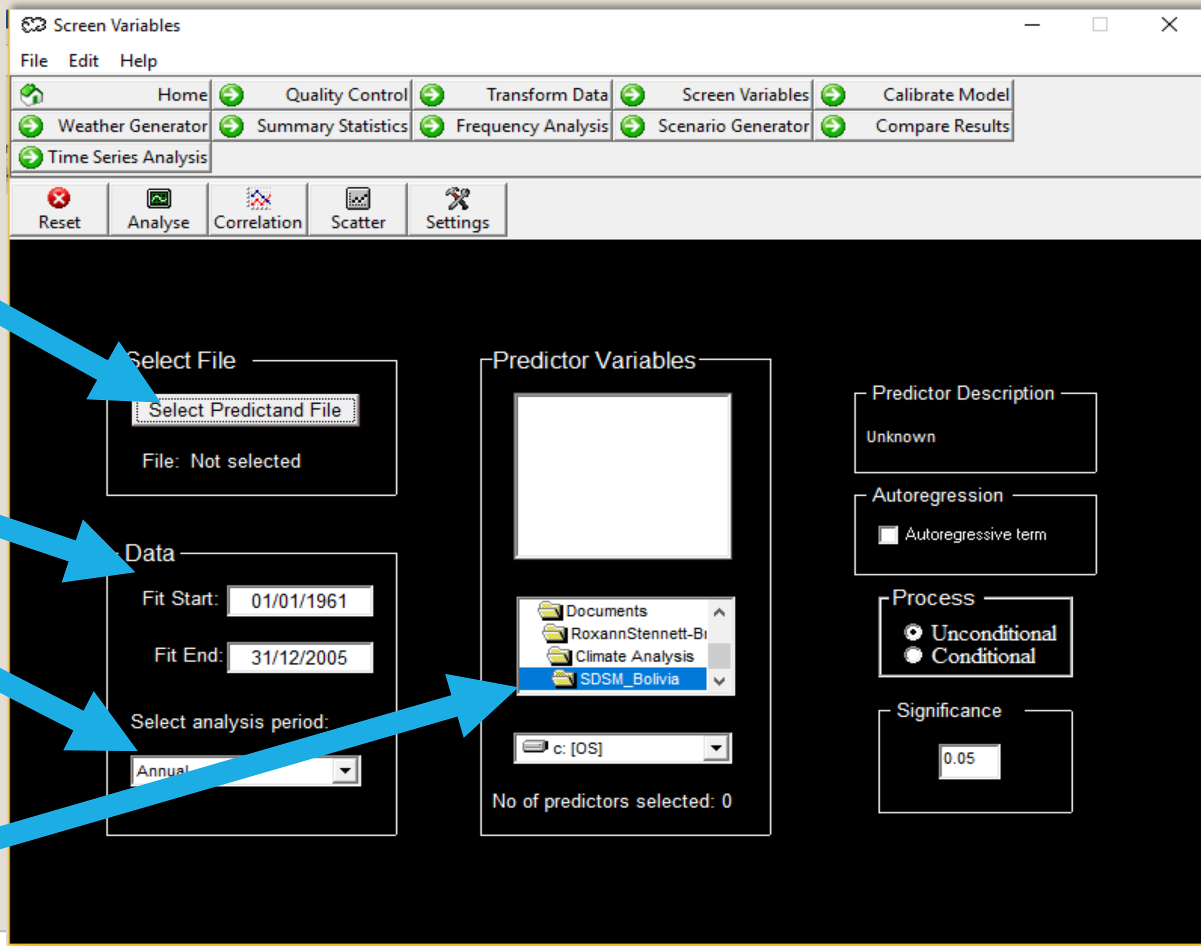
Step 2.1: Click on the **Screen Variables** button

Screening of predictor variables

Step 2.2a:
- Click on the **Select Predictand File** button

Step 2.2c:
- Enter start/end date
- Choose **Annual** under **Select Analysis Period**

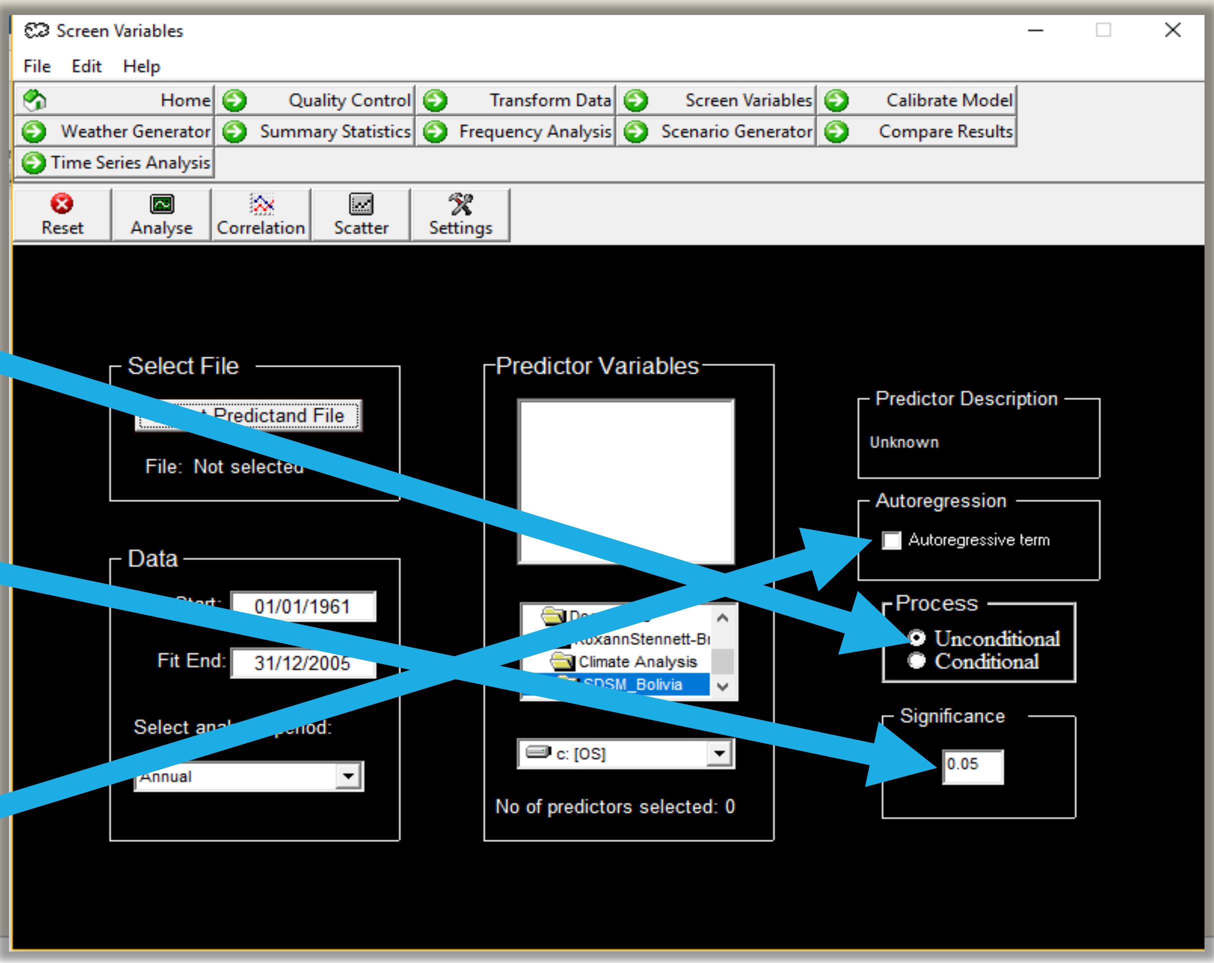
Step 2.2b:
- Click on the **Select Predictor Variables**



Step 2.2d:
- Select unconditional (for temperature)

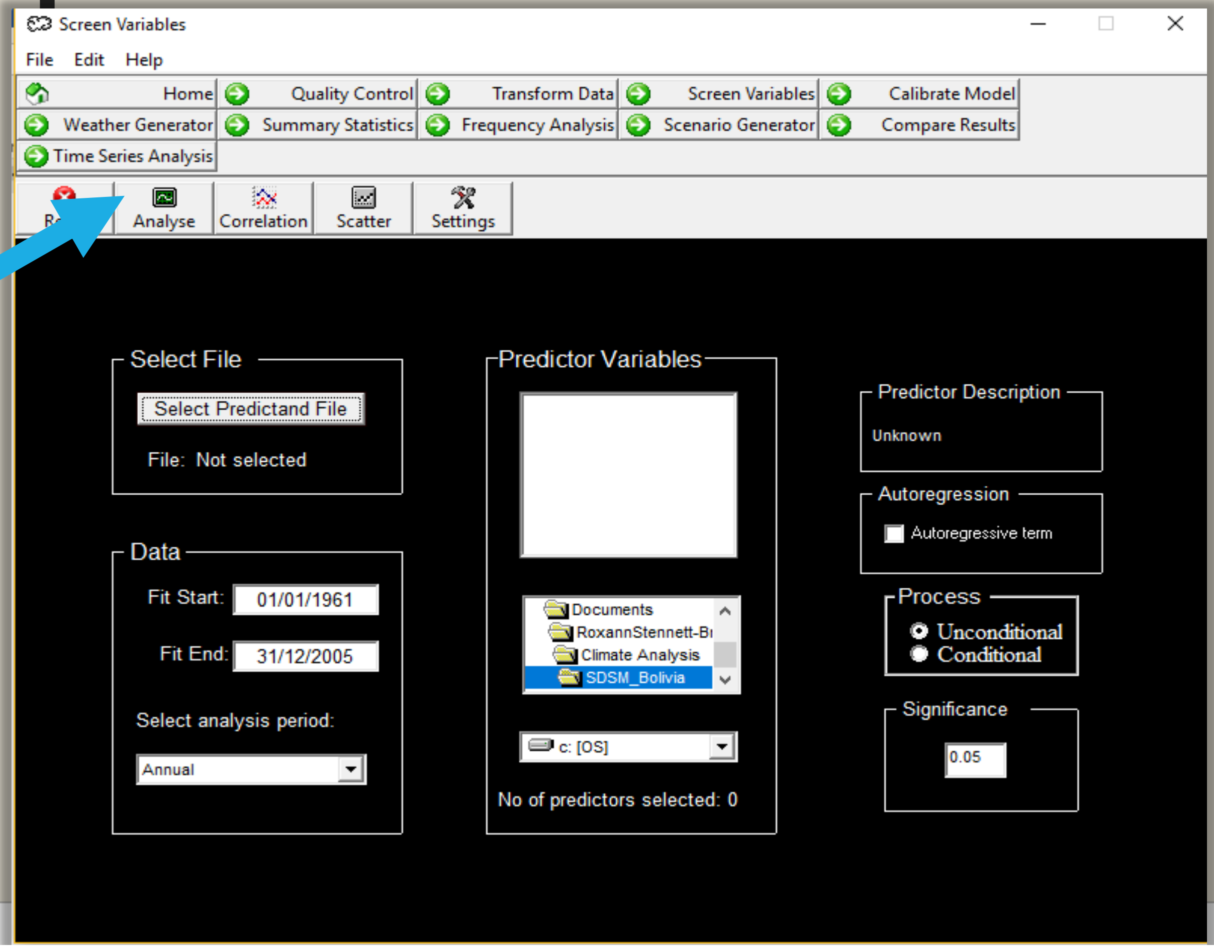
Step 2.2e:
- Amend the **Significance Level** as required

Step 2.2d:
- Select autoregressive term if needed.



Screening of predictor variables

Step 2.3:
- Click on the **Analyse** button



Screening of predictor variables

Results

File Help

Back Print Help

RESULTS: EXPLAINED VARIANCE

Analysis Period: 01/01/1961 - 31/12/2005
Significance level: 0.05

Total missing values: 270

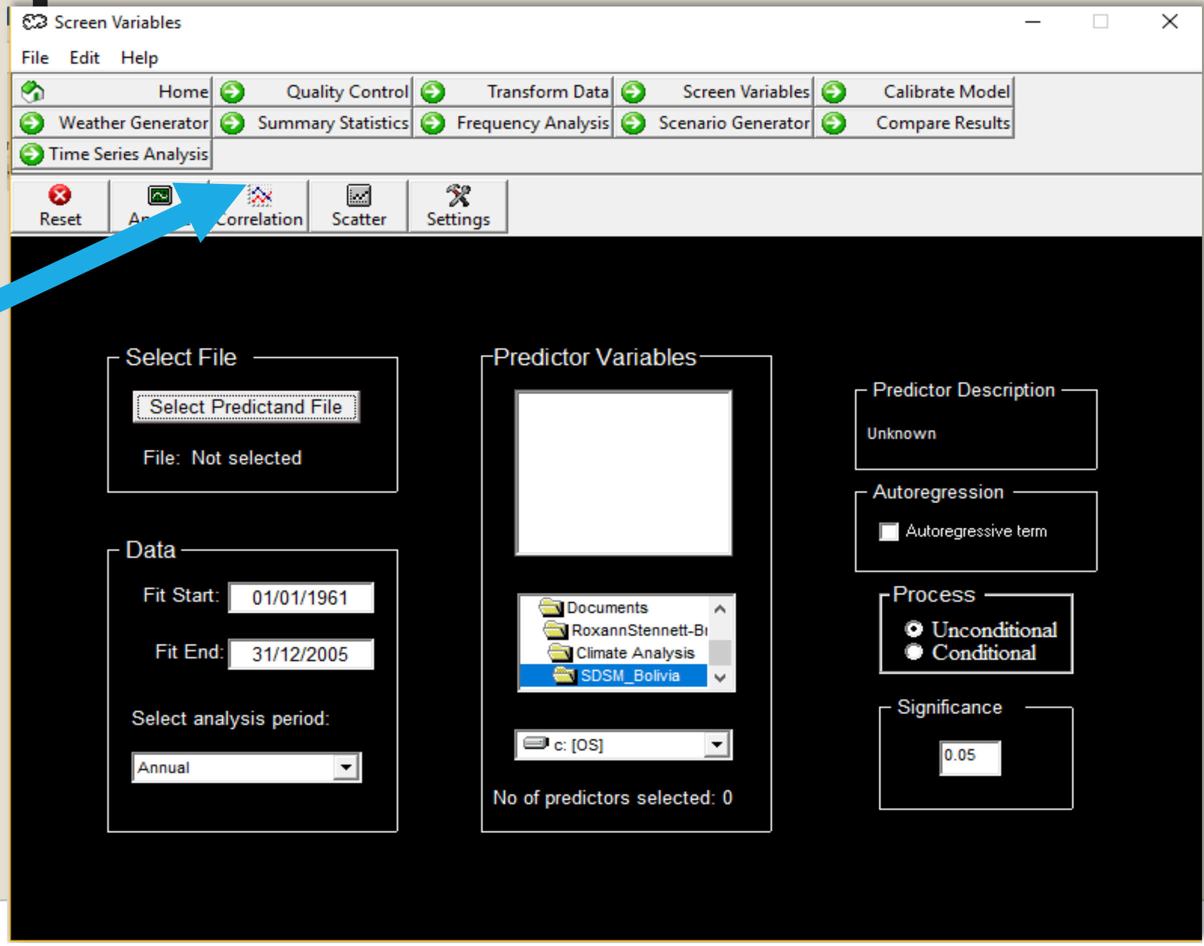
Predictand: TrinidadPiarco_tmax.txt

Predictors:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ncepp1_ugl.dat	0.042	0.067	0.041		0.047	0.029	0.056	0.068	0.108	0.176	0.113	0.032
ncepp1zhgl.dat	0.033	0.096	0.104	0.060	0.082	0.034	0.012	0.012	0.037	0.032	0.032	0.015
ncepp500gl.dat	0.064	0.098	0.130	0.086	0.036	0.017	0.007	0.010	0.035	0.030		0.041
ncepshumgl.dat	0.037	0.097	0.112	0.076	0.010			0.019	0.053	0.045	0.020	0.032

The strongest correlation in each month is shown in red, indicating that the relationship between maximum temperature and *p500* , *p1__u and p1zh* are most important. Blanks represent insignificant relationships at the chosen **Significance Level.**

The local knowledge base is invaluable when determining sensible combinations of predictors

Screening of predictor variables



Step 2.4:

- Click on the **Correlation** button

Screening of predictor variables:
Correlation Matrix

Results

File Help

Back Print Help

CORRELATION MATRIX

Analysis Period: 01/01/1961 - 31/12/2005 (Annual)

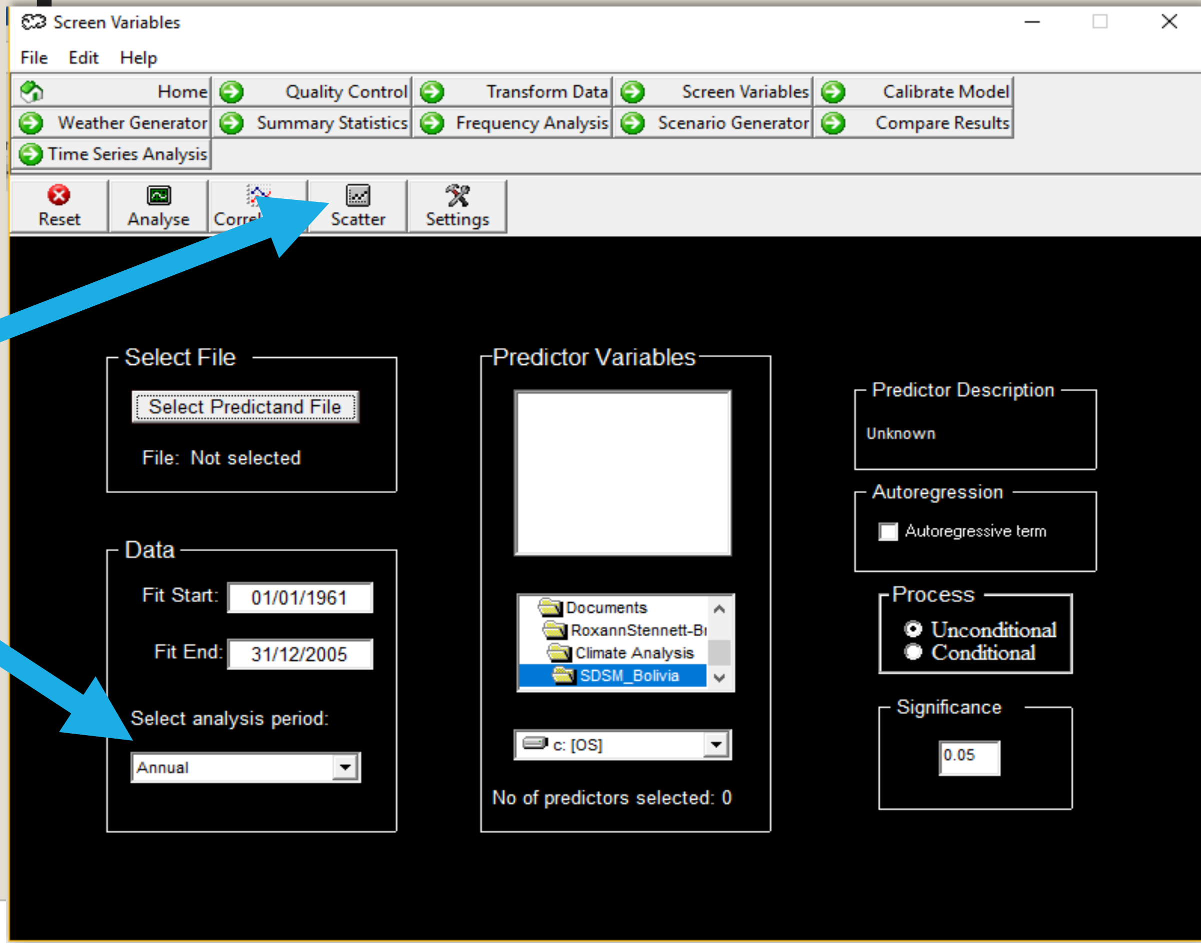
Missing values: 54
Missing rows: 54

		1	2	3	4	5
1	TrinidadPiarco_tmax.txt	1	0.284	0.228	0.224	0.256
2	ncepp1_ugl.dat	0.284	1	0.187	-0.185	0.146
3	ncepp1zhgl.dat	0.228	0.187	1	-0.010	-0.239
4	ncepp500gl.dat	0.224	-0.185	-0.010	1	0.497
5	ncepshumgl.dat	0.256	0.146	-0.239	0.497	1

PARTIAL CORRELATIONS WITH TrinidadPiarco_tmax.txt

	Partial r	P value
ncepp1_ugl.dat	0.244	0.0000
ncepp1zhgl.dat	0.229	0.0000
ncepp500gl.dat	0.162	0.0000
ncepshumgl.dat	0.160	0.0000

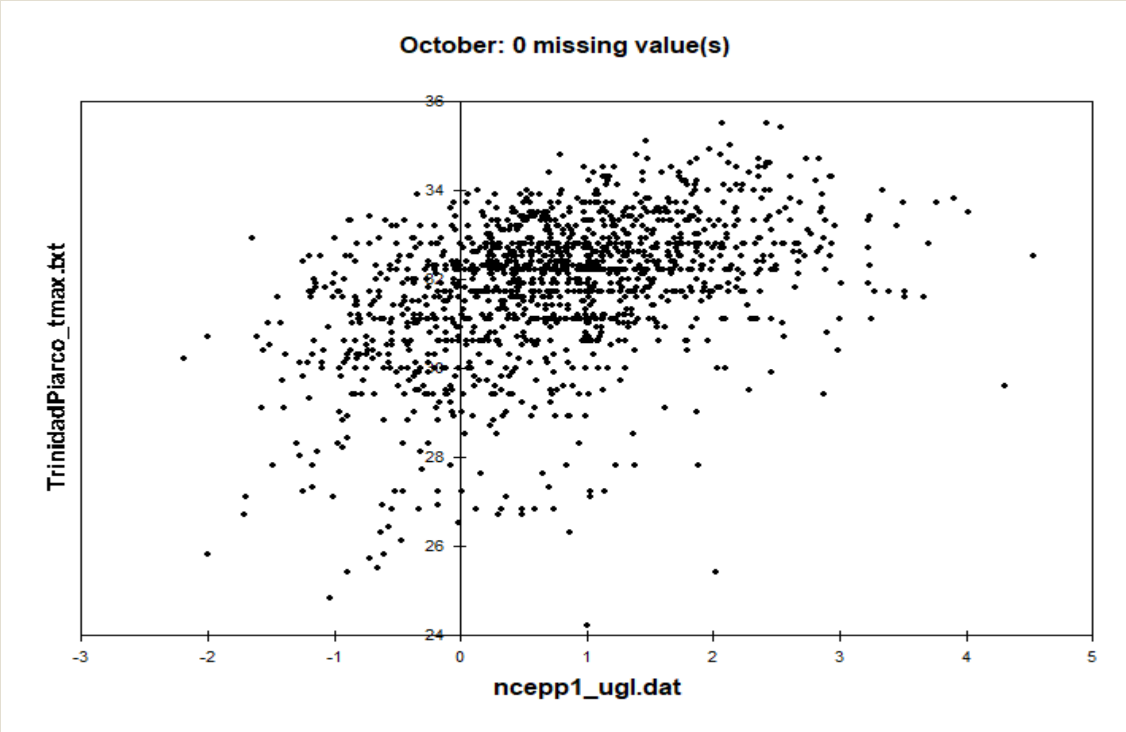
Screening of predictor variables



Step 2.4:

- Select month with the highest correlation.
- Click on the **Scatter** button

Screening of predictor variables: Scatter Plot



Model Calibration

Step 3.1:

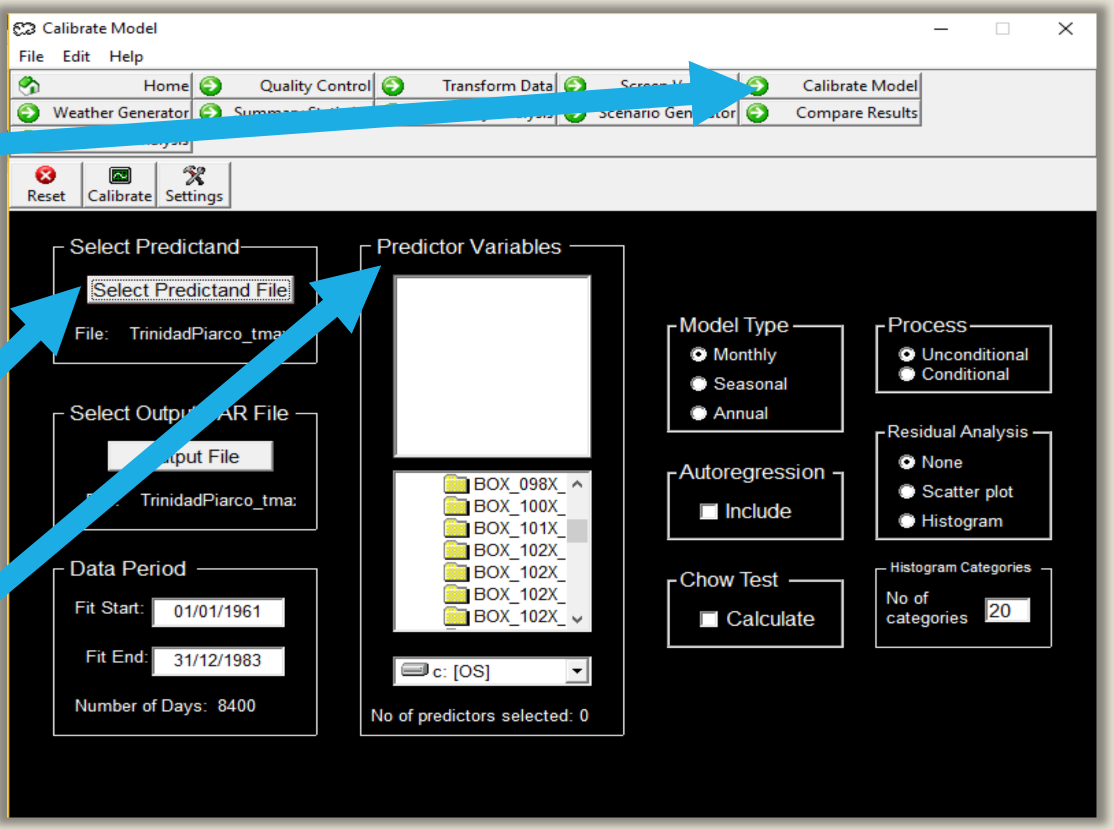
- Select Calibrate model button

Step 3.2a:

- Click on the **Select Predictand File** button

Step 3.2b:

- select the desired **predictor variables**

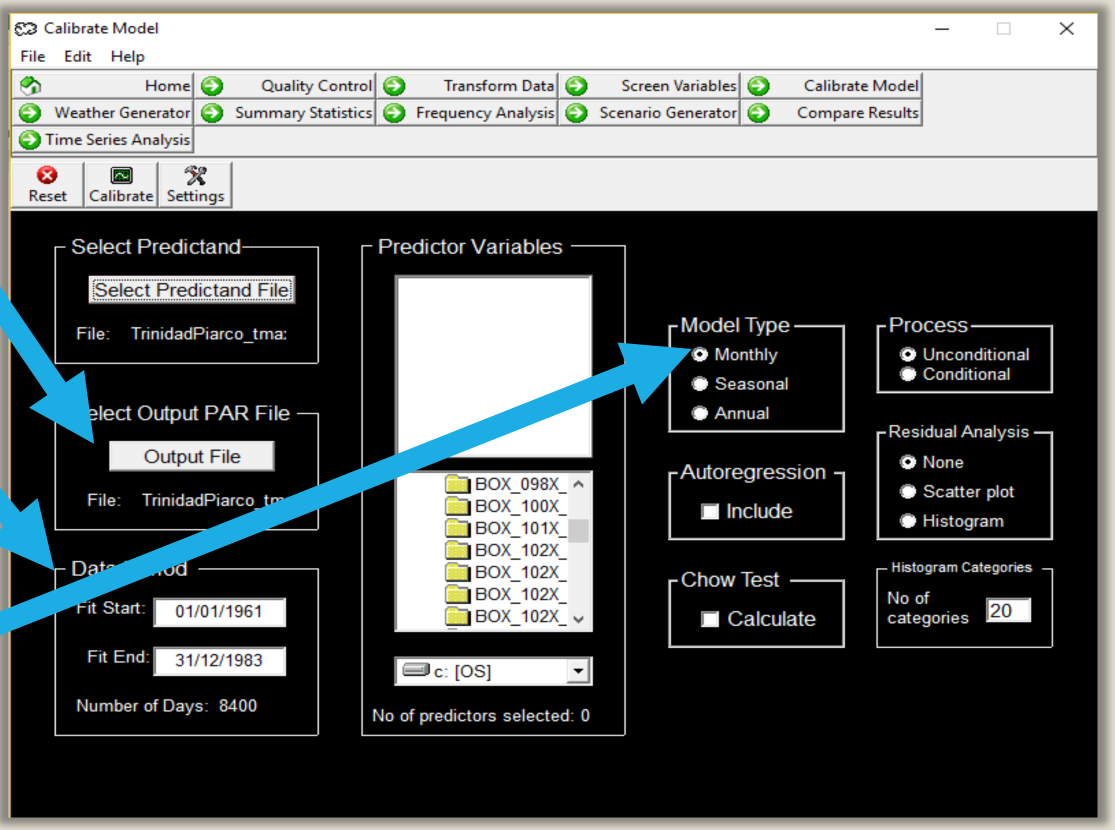


Model Calibration

Step 3.2d:
- click on the **Output File** button.

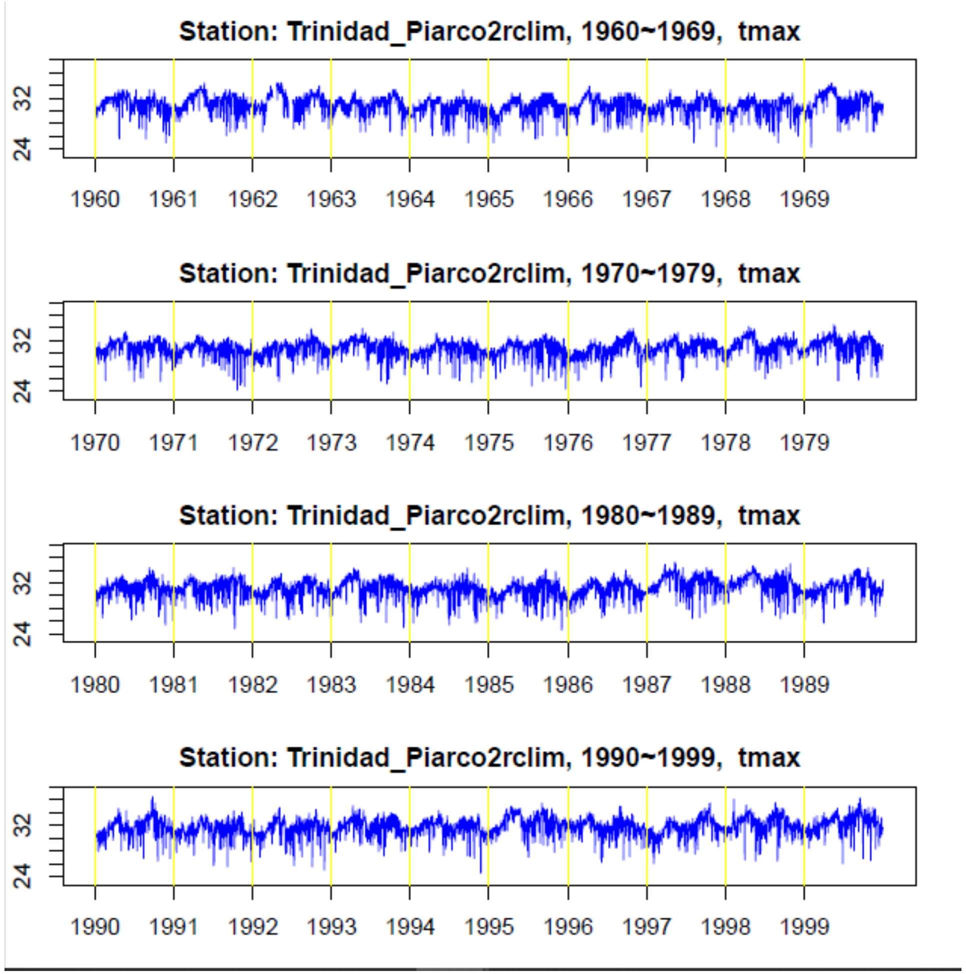
Step 3.2c:
- Enter data period

Step 3.2e:
- Select Monthly for **Model Type**

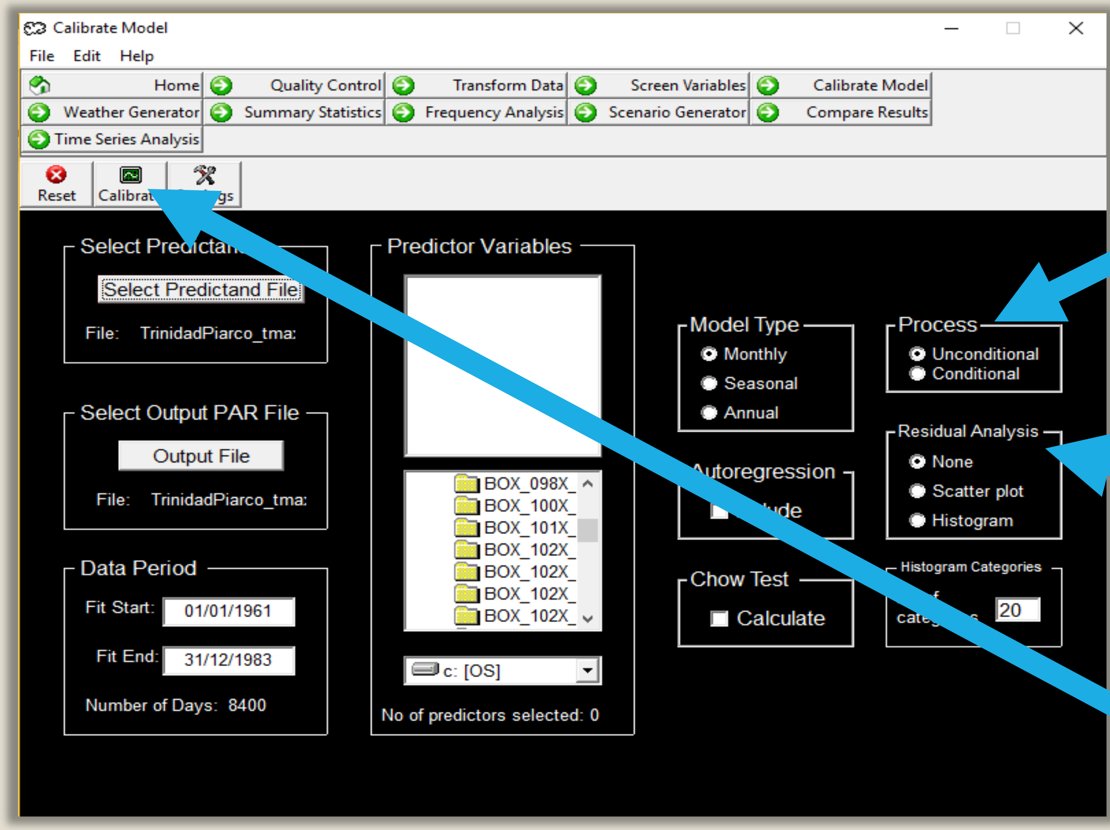


Model Calibration

- ***By using an appropriate quality control tool (see Figure) you may be able to have a good visualization of the data and hence will be guided best on how to split the data.***
-



Model Calibration



Step 3.2f:
- Select unconditional for temperature.
- Select Autoregression include if necessary.

Step 3.2g: Residual analysis.

Step 3.2h: click on the **Calibrate** button.

Calibration Results

Calibration Results

File Help

Back Print Help

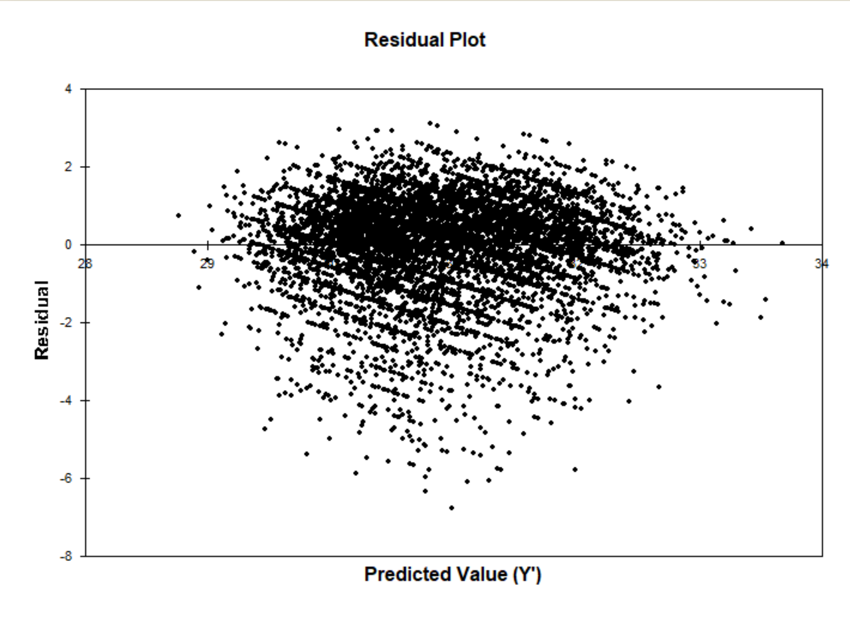
Predictand: TrinidadPiarco_tmax.txt

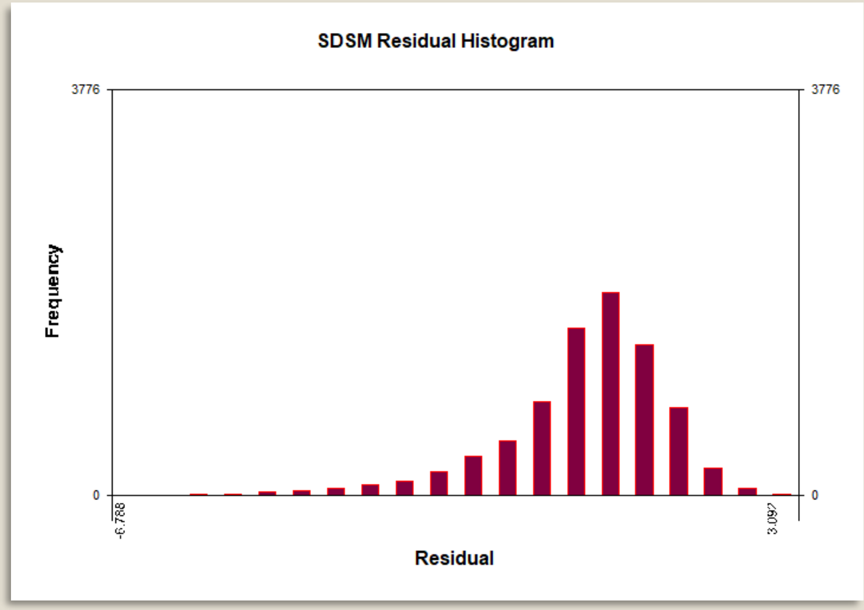
Predictors:
ncepp1_ugl.dat
ncepp1zhgl.dat
ncepp500gl.dat
ncepshumgl.dat

Unconditional Statistics

Month	RSquared	SE	Durbin-Watson
January	0.126	0.813	1.468
February	0.211	0.992	1.418
March	0.315	0.947	1.227
April	0.187	1.112	1.209
May	0.170	1.246	1.155
June	0.066	1.354	1.517
July	0.051	1.280	1.540
August	0.066	1.366	1.512
September	0.111	1.360	1.710
October	0.224	1.299	1.503
November	0.145	1.314	1.661
December	0.084	1.098	1.419
Mean	0.146	1.182	1.445

Calibration Results





The Scatter diagram plots the residuals against the modelled predictor while the histogram shows the distribution of the residuals

Model Calibration

- During model calibration a *.PAR file is generated that stores various parameters relating to the structure of the model. It is useful in diagnosing the cause of any unexpected model results or behaviour. The information held in the par file is below:

- [1] The number of predictors
- [2] The season code (12 = months, 4 = seasons, 1 = annual model)
- [3] The year length indicator (366, 365, or 360)
- [4] Record start date
- [5] Record length (days)
- [6] Model fitting start date
- [7] Number of days used in the model fitting

Model Calibration

- [8] Whether the model is conditional (True) or unconditional (False)
- [9] Transformation (1 = none, 2 = fourth root, 3 = natural log, 4 = lognormal)
- [10] Ensemble size
- [11] Autoregression indicator (True or False)
- [12] Predictand file name
- [13-16] Predictor filenames (in this case four)
- [17-28] Model parameters; the first 5 columns in this example are the parameters (including the intercept), the last two columns are the SE and r-squared statistic.
- [30] The root directory of the predictand file

The *.PAR file produced by the **Calibrate Model** screen

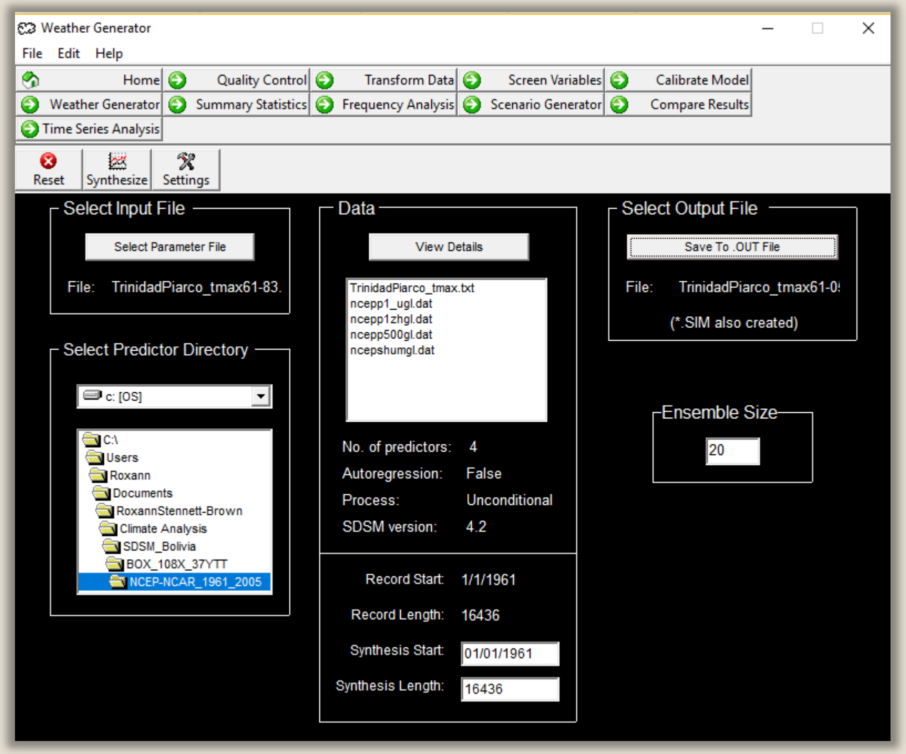
TrinidadPiarco_tmax61-83 - Notepad

File Edit Format View Help

```
 4
 12
 366
01/01/1961
 16436
01/01/1961
 8400
#FALSE#
1
 1
False
TrinidadPiarco_tmax.txt
ncepp1_ugl.dat
ncepp1zhgl.dat
ncepp500gl.dat
ncepshumgl.dat
30.286        0.095        0.161        0.140        0.191        0.813        0.126
30.672        0.105        0.259        0.209        0.313        0.992        0.211
31.188        0.307        0.201        0.361        0.314        0.947        0.315
31.320        0.093        0.265        0.327        0.362        1.112        0.187
30.990        0.258        0.371        0.401        0.172        1.246        0.170
30.538        0.215        0.225        0.245        -0.174       1.354        0.066
30.842        0.267        0.159        0.134        -0.233       1.280        0.051
30.770        0.239        0.390        0.001        0.352        1.366        0.066
30.760        0.283        0.270        0.177        0.386        1.360        0.111
30.856        0.633        0.145        0.409        0.015        1.299        0.224
30.594        0.442        0.140        0.288        0.142        1.314        0.145
30.227        0.184        0.089        0.236        0.196        1.098        0.084
C:\Users\Roxann\Documents\RoxannStennett-Brown\Climate Analysis\SDSM Bolivia\TrinidadPiarco_tmax.txt
```

Weather Generator

- The **Weather Generator** can also be used to reconstruct predictands or to infill missing data.
- Follow the instruction in the manual.



An example of simulated file (.OUT file)

TrinidadPiarco_tmax61-05 - Notepad

File Edit Format View Help

29.741	30.085	29.940	28.529	28.763	31.090	29.791	30.400	30.558	30.116	32.308	30.286
31.953	29.228	30.342	28.688	30.897	27.930	30.389	30.663	30.926	29.670	30.194	29.573
30.186	29.928	30.571	30.245	27.923	31.091	30.090	30.178	29.120	29.740	30.523	30.030
30.434	30.252	29.708	30.860	29.898	30.509	30.415	30.669	30.319	30.831	29.939	30.130
29.498	30.456	30.654	28.759	30.372	30.506	30.198	29.548	28.887	29.948	28.902	28.910
31.481	28.341	30.599	30.277	30.194	29.696	29.882	29.900	31.364	29.769	29.481	28.642
29.809	28.920	29.882	31.078	30.110	30.652	29.805	29.014	30.364	30.430	30.388	29.868
30.102	29.073	31.275	30.074	29.233	28.629	30.302	29.868	29.881	28.809	31.144	29.873
30.098	29.179	29.671	29.679	30.181	30.510	31.143	29.996	29.279	29.353	29.083	30.257
29.431	29.890	29.990	29.322	29.336	30.442	29.931	28.828	30.630	29.459	29.120	30.452
29.037	30.719	30.322	29.737	30.885	28.752	28.007	29.539	27.555	30.267	29.350	28.751
30.297	29.183	27.575	29.662	28.892	28.648	30.411	29.238	30.376	30.109	30.743	28.770
29.286	29.693	30.427	29.848	30.002	30.475	28.746	29.489	27.852	28.515	28.970	30.447
29.248	30.003	30.333	30.082	29.328	30.363	29.103	28.456	29.731	28.932	29.306	31.944
28.687	29.636	29.456	31.918	29.440	31.083	30.391	29.316	29.639	30.069	29.038	29.123
30.188	29.751	29.973	29.607	28.857	28.922	29.911	29.574	29.348	29.021	31.968	30.057
30.871	30.113	31.039	28.196	30.390	30.956	30.880	28.585	30.042	31.242	29.119	30.036
29.827	30.015	32.149	28.199	29.879	29.978	30.358	28.489	30.000	29.523	31.372	30.387
29.969	30.134	30.933	30.700	30.237	30.729	30.850	29.557	29.697	29.419	30.663	30.568
30.423	29.800	30.176	29.744	29.776	30.099	30.263	29.899	31.509	30.259	30.590	30.316
30.827	30.480	30.734	29.642	30.573	30.368	32.707	31.387	31.010	31.071	30.385	29.876
30.393	31.589	29.787	29.404	30.215	30.140	29.669	29.780	30.664	31.271	28.852	30.698
30.752	29.270	29.372	31.271	29.519	32.060	29.692	28.943	29.662	30.253	28.030	30.143
30.586	29.726	29.391	28.842	28.793	30.949	30.238	29.795	30.752	30.155	29.445	29.943
31.637	30.837	30.367	28.536	30.593	29.566	29.391	30.622	29.986	31.296	28.743	30.824
30.952	30.666	29.754	31.262	29.526	30.040	30.295	29.895	28.474	30.927	30.695	29.629
30.429	30.502	29.855	30.583	29.931	30.405	29.563	30.120	28.928	28.710	29.473	30.492
30.308	30.786	31.316	31.413	31.231	31.105	30.281	31.335	29.962	29.965	30.603	30.197
28.318	30.266	29.835	30.467	30.346	30.886	30.584	30.251	30.117	31.000	31.408	30.336
29.680	31.113	31.040	30.323	30.869	29.481	32.849	31.075	31.364	30.734	29.384	31.861
30.909	31.672	30.225	32.171	30.941	30.925	29.118	29.305	31.029	30.765	30.398	29.458
30.540	31.702	31.358	31.210	29.773	29.748	29.534	28.616	29.988	29.672	29.056	30.372
30.747	30.463	29.923	28.676	31.761	30.302	30.710	30.317	31.697	32.190	31.278	28.045
30.776	30.592	30.473	29.797	31.200	30.101	30.011	30.076	29.476	29.845	30.741	30.087
33.288	31.030	29.220	31.033	31.743	33.046	30.594	31.300	31.941	31.498	31.595	31.965
32.017	30.720	30.315	31.823	30.100	30.143	30.658	30.450	31.831	31.133	31.046	30.142
31.748	30.725	31.101	30.750	29.070	29.399	30.521	32.062	28.972	30.803	30.404	30.145
30.500	32.289	30.095	30.548	30.643	31.067	30.684	30.933	31.303	31.754	32.155	30.739
31.389	30.841	30.908	32.098	30.988	30.575	29.799	29.929	31.028	31.396	28.999	30.823

Weather Generator

a)

TrinidadPiarco_tmax61-05 - Notepad

File Edit Format View Help

```
 4
 12
 366
1/1/1961
 16436
#FALSE#
 20
 12
 1
 1
TrinidadPiarco_tmax.txt
ncepp1_ugl.dat
ncepp1zhgl.dat
ncepp500gl.dat
ncepshumgl.dat
```

b)

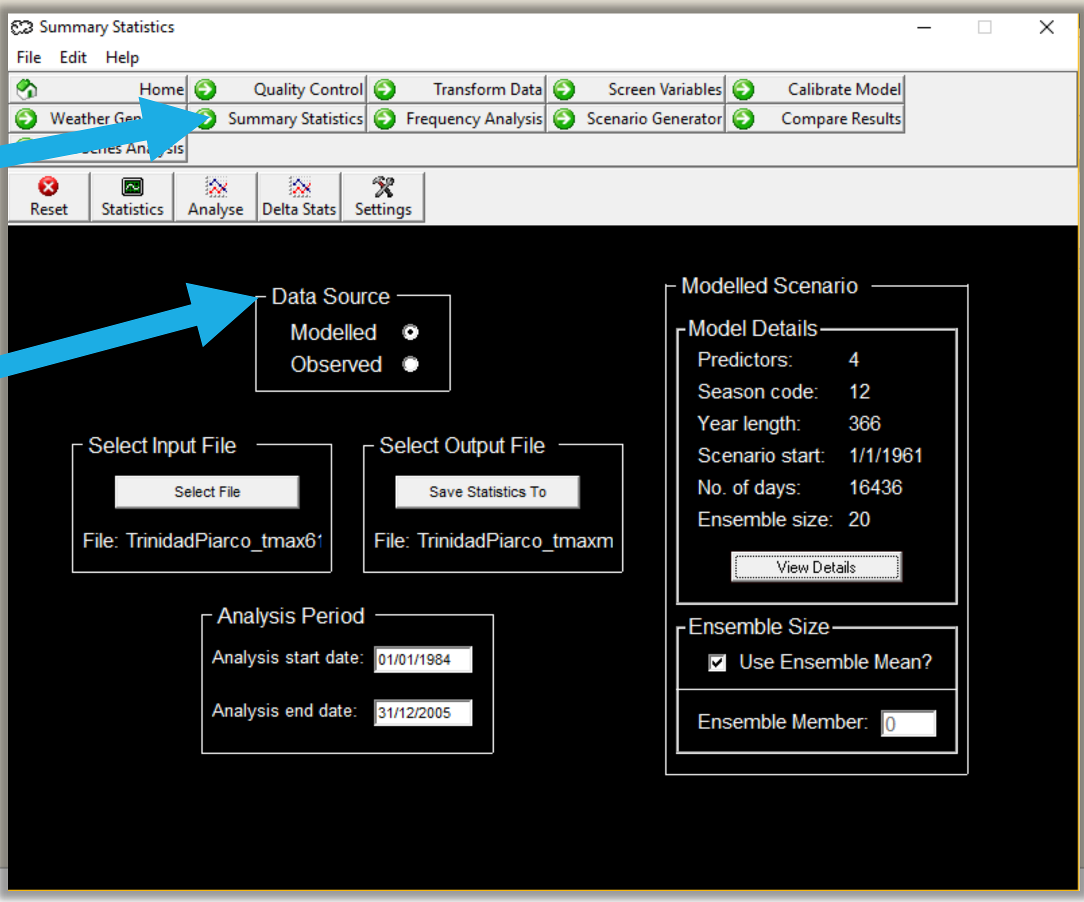
- [1] the number of predictor variables;
- [2] the number of regression models used (1=annual, 4=seasonal, 12=monthly);
- [3] the maximum number of days in a year (here a calendar year is used, so there are up to 366 days in leap years);
- [4] the start date of the data used for model calibration;
- [5] the number of days simulated;
- [6] whether or not the predictand is a conditional (#TRUE#) or unconditional (#FALSE#) variable;
- [7] the number of ensemble members;
- [8] the variance inflation parameter (see **Advanced Settings**);
- [9] the transformation code for conditional variables (1=none, 2=fourth root, 3=natural log, 4=inverse normal); [10] the bias correction parameter (see **Advanced settings**);
- [11] the predictand file name;
- [12 onward] the predictor file name(s).

a) An example of the **.SIM file** which contains meta–data associated with the synthesis and **b)** Description of each line in SIM file.

Statistical Analyses

Step 5.1:
Click the **Summary Statistics** button

Step 5.2:
Select Modelled under **Data Source**



Statistical Analyses

Results

File Help

Back Print Help

SUMMARY STATISTICS FOR: TrinidadPiarco_tmax61-05.OUT

Analysis Start Date: 1/1/1984
Analysis End Date: 31/12/2005
Ensemble Member(s): Ensemble Member(s): ALL

Month	Mean	Maximum	Minimum	Variance	Sum
January	30.091	32.754	27.469	0.748	932.833
February	30.513	34.131	26.949	1.286	862.675
March	31.219	34.591	27.796	1.246	967.787
April	31.728	35.477	28.081	1.505	951.831
May	31.567	35.964	27.279	1.933	978.581
June	30.462	34.687	26.117	1.946	913.845
July	30.610	34.687	26.589	1.742	948.903
August	31.102	35.820	26.631	2.122	964.154
September	31.598	36.067	27.152	2.145	947.950
October	31.537	36.051	26.942	2.236	977.652
November	30.813	35.304	26.483	2.095	924.403
December	30.208	33.783	26.800	1.353	936.456
Winter	30.263	34.167	26.632	1.156	2613.183
Spring	31.502	36.052	27.223	1.608	2898.200
Summer	30.727	35.839	25.993	2.013	2826.902
Autumn	31.319	36.386	26.361	2.287	2850.004
Annual	30.955	36.571	25.914	2.008	11307.070
Standard Deviations of Results					
January	0.031	0.278	0.384	0.039	0.964
February	0.033	0.317	0.392	0.070	0.944
March	0.030	0.298	0.301	0.041	0.938
April	0.049	0.389	0.476	0.075	1.461
May	0.039	0.578	0.559	0.080	1.215
June	0.050	0.433	0.360	0.089	1.508
July	0.052	0.444	0.354	0.116	1.617
August	0.057	0.660	0.410	0.123	1.756
September	0.046	0.522	0.461	0.131	1.376
October	0.051	0.359	0.576	0.084	1.582
November	0.052	0.555	0.313	0.087	1.558
December	0.051	0.371	0.332	0.086	1.596
Winter	0.019	0.305	0.317	0.028	1.650
Spring	0.022	0.513	0.585	0.039	2.043
Summer	0.028	0.643	0.350	0.069	2.593
Autumn	0.029	0.441	0.379	0.064	2.618
Annual	0.012	0.472	0.336	0.031	4.486

Results

File Help

Back Print Help

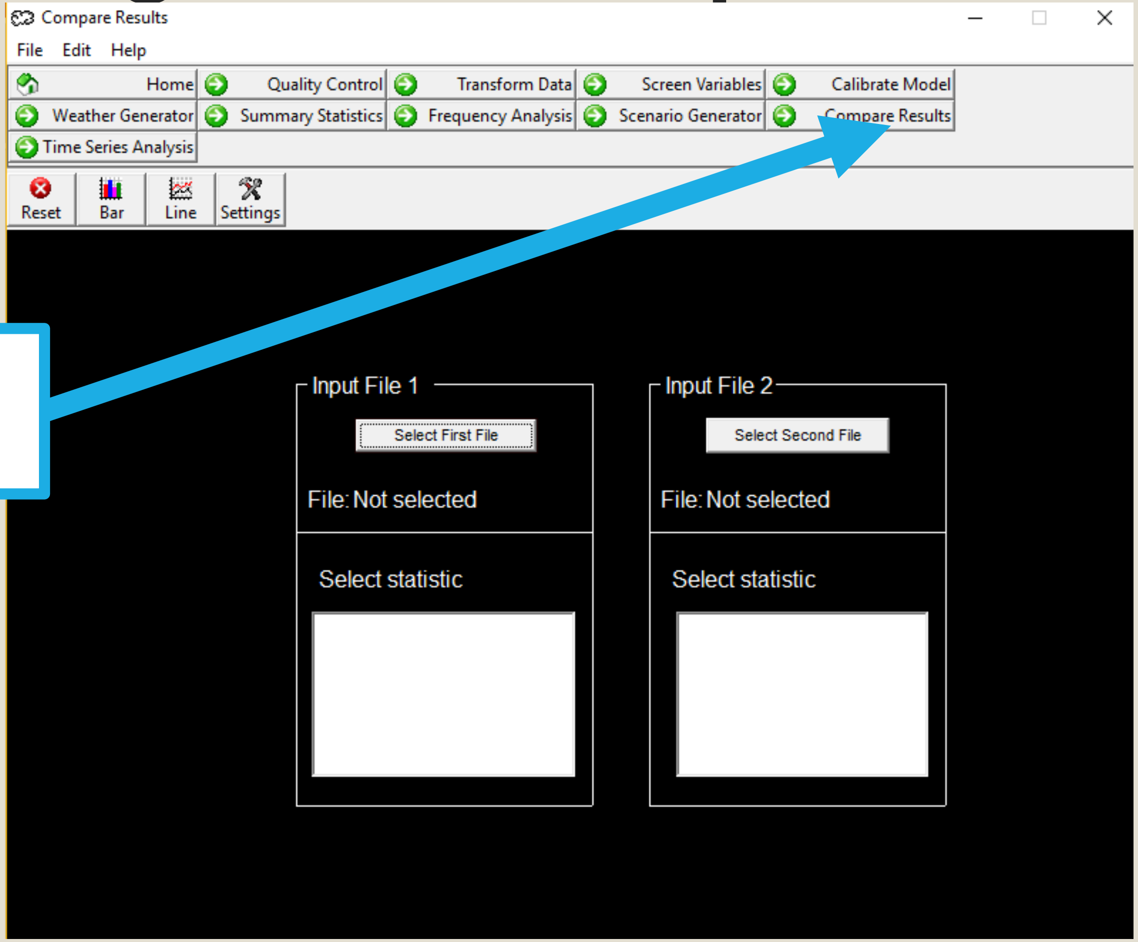
SUMMARY STATISTICS FOR: TrinidadPiarco_tmax.txt

Analysis Start Date: 1/1/1984
Analysis End Date: 31/12/2005
Ensemble Member(s):

Month	Mean	Maximum	Minimum	Variance	Sum
January	30.779	33.200	25.700	1.028	954.159
February	31.055	36.100	26.000	1.522	877.995
March	31.859	35.300	25.700	1.471	987.636
April	32.513	35.900	26.700	1.563	975.400
May	32.281	35.300	26.400	1.696	1000.723
June	31.235	34.700	25.400	1.865	937.041
July	31.512	35.100	25.700	2.057	976.873
August	32.164	35.600	26.400	2.246	997.073
September	32.444	36.500	25.500	2.901	973.314
October	32.265	35.500	25.400	2.480	1000.214
November	31.436	34.800	24.500	2.399	943.082
December	30.928	33.900	24.600	1.442	958.777
Winter	30.917	36.100	24.600	1.337	2669.587
Spring	32.215	35.900	25.700	1.650	2963.759
Summer	31.641	35.600	25.400	2.210	2910.986
Autumn	32.051	36.500	24.500	2.783	2916.609
Annual	31.709	36.500	24.500	2.246	11582.286

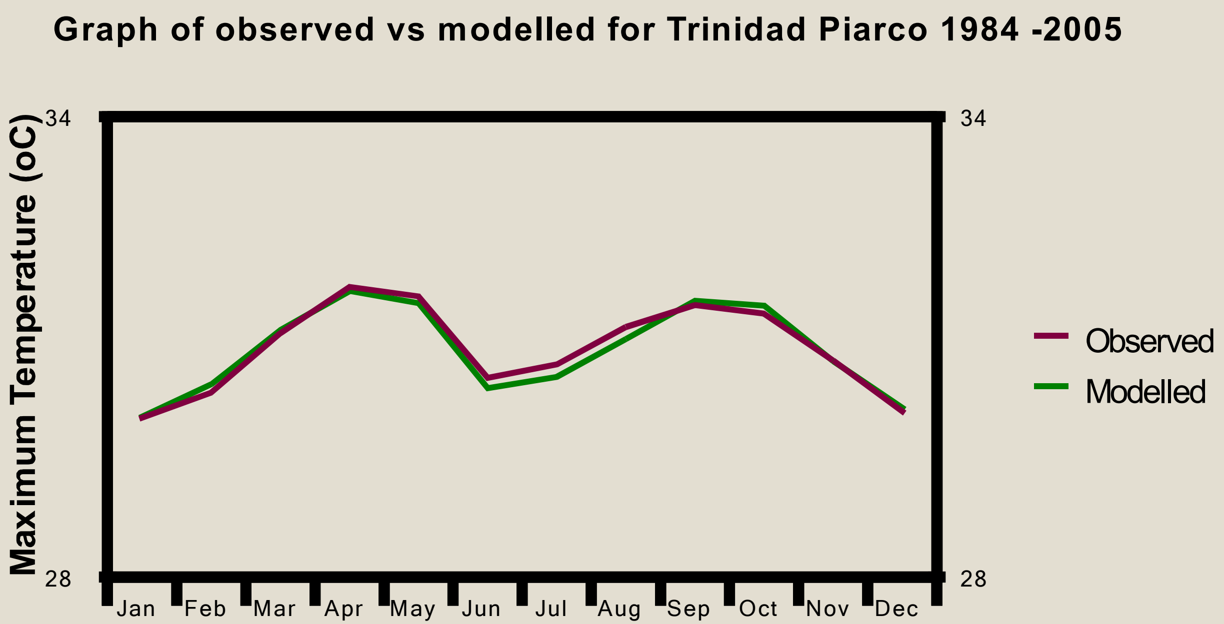
Example output of **Summary Statistics** (Modelled results-left, Observed results-right) showing the mean and standard deviation (modelled) of diagnostics for a 20-member ensemble

Graphing Model Output



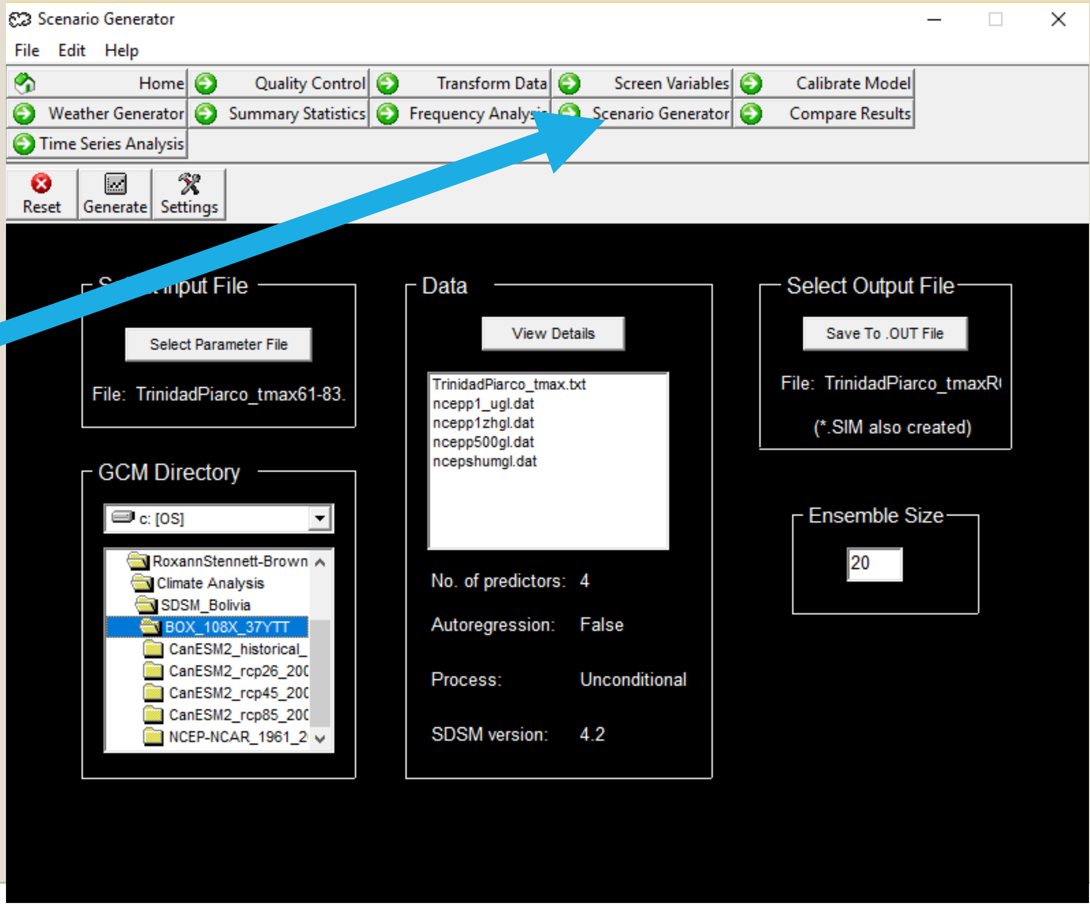
Step 6.1:
Click the **Compare Results** button.

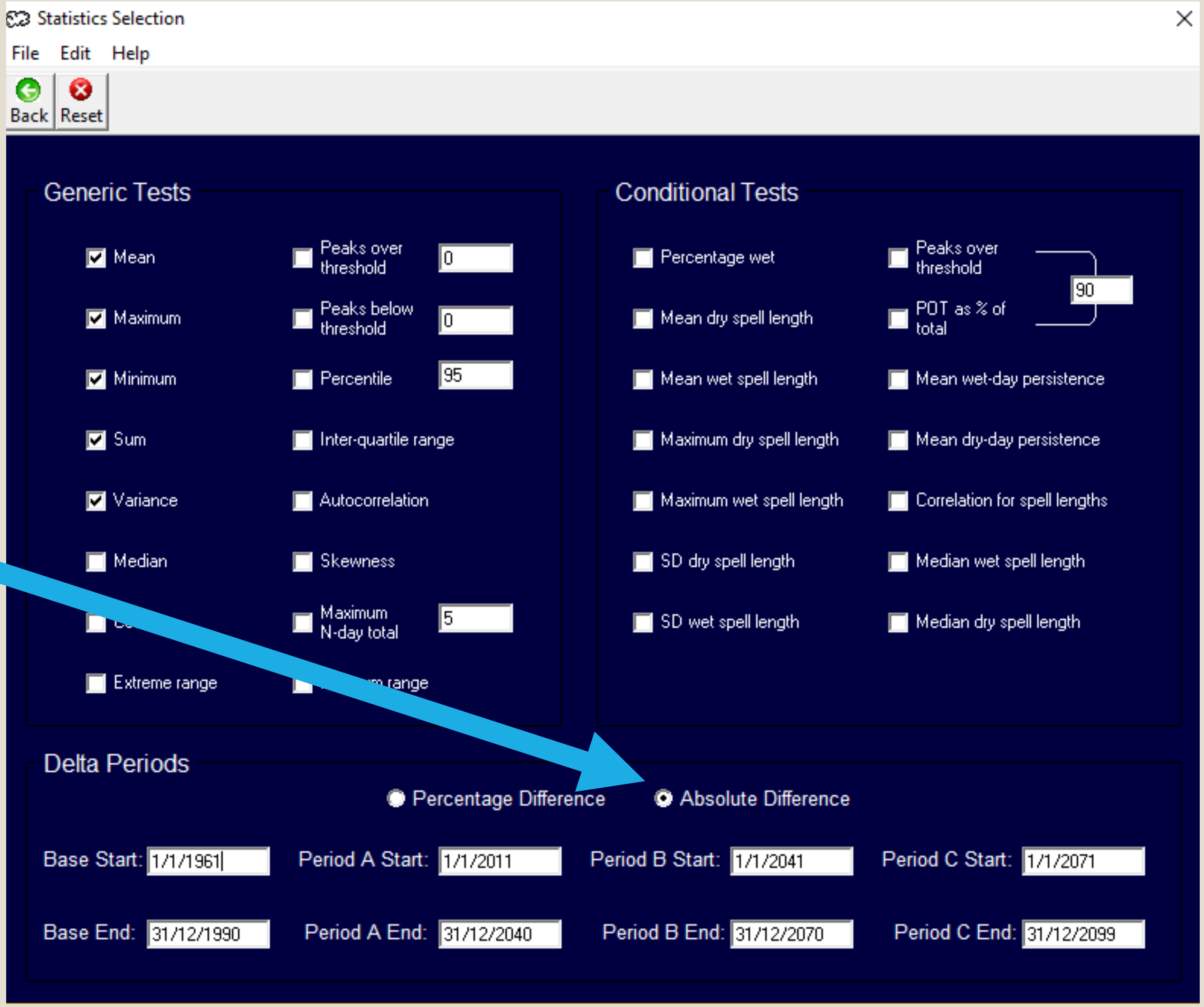
Graphing Model Output



Scenario generation

Step 7.1:
Select **Scenario Generator.**





Step 5.9: Select appropriate statistics.

Results

Results

File Help

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SUMMARY STATISTICS FOR: TrinidadPiarco_tmaxRCP26.OUT

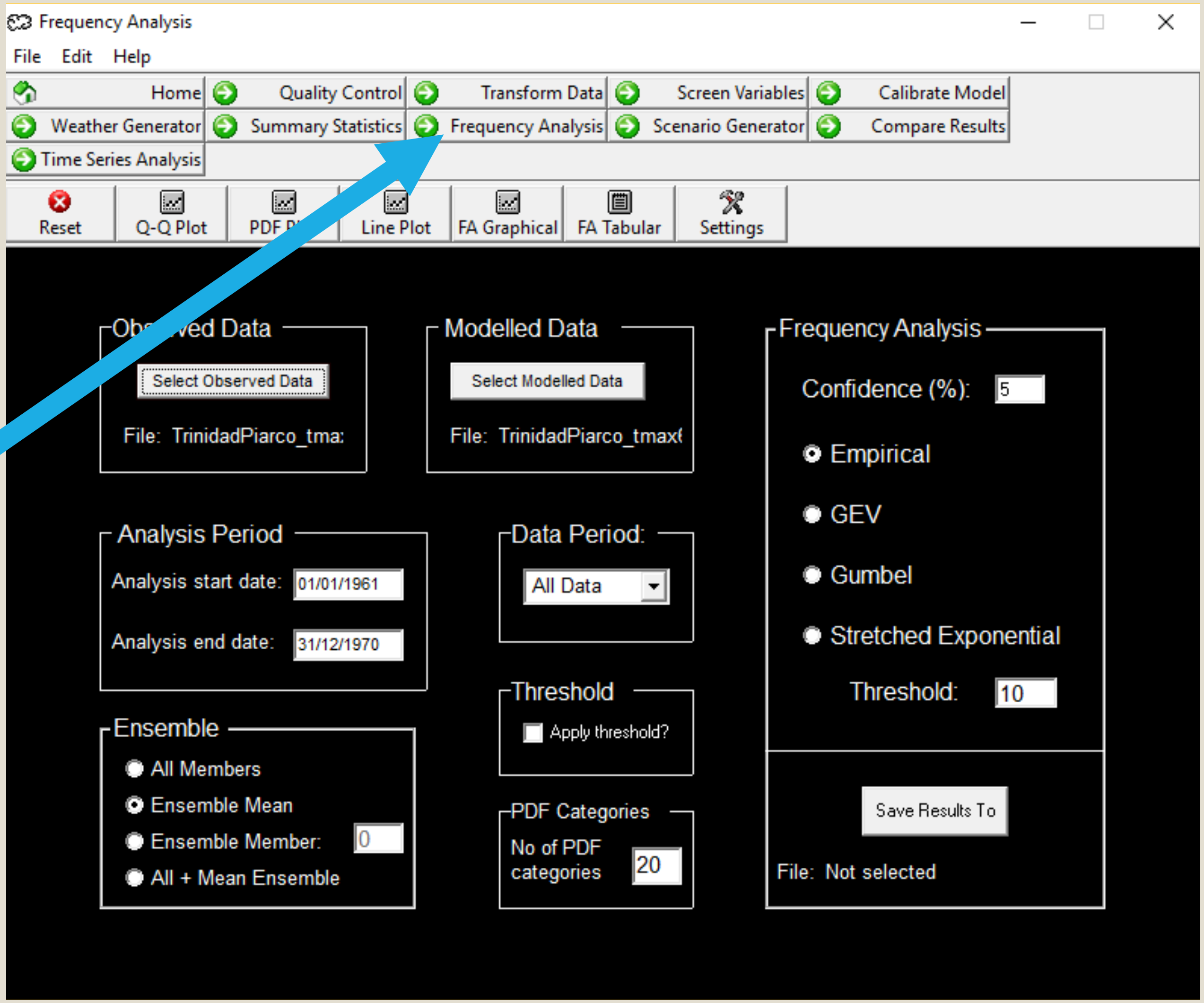
Analysis Start Date: 1/1/1961
Analysis End Date: 31/12/1990
Ensemble Member(s): Ensemble Member(s): ALL

Month	Mean	Maximum	Minimum	Variance	Sum
January	30.799	33.645	27.963	0.820	923.982
February	31.188	35.014	27.578	1.360	935.653
March	31.681	35.536	28.003	1.384	950.416
April	31.752	35.712	27.829	1.535	952.549
May	31.568	35.996	27.026	1.909	947.030
June	30.947	35.333	26.533	1.930	928.411
July	30.991	35.137	26.873	1.718	929.731
August	31.210	35.614	26.736	1.978	936.302
September	31.846	36.345	27.605	2.005	955.392
October	32.090	36.612	27.527	2.050	962.696
November	31.662	35.999	27.186	1.945	949.862
December	31.158	34.850	27.432	1.374	934.755
Winter	31.049	35.168	27.262	1.217	2704.248
Spring	31.667	36.105	27.011	1.616	2849.995
Summer	31.049	35.824	26.358	1.890	2794.444
Autumn	31.866	36.828	26.959	2.032	2867.950
Annual	31.408	36.828	26.243	1.823	11306.778

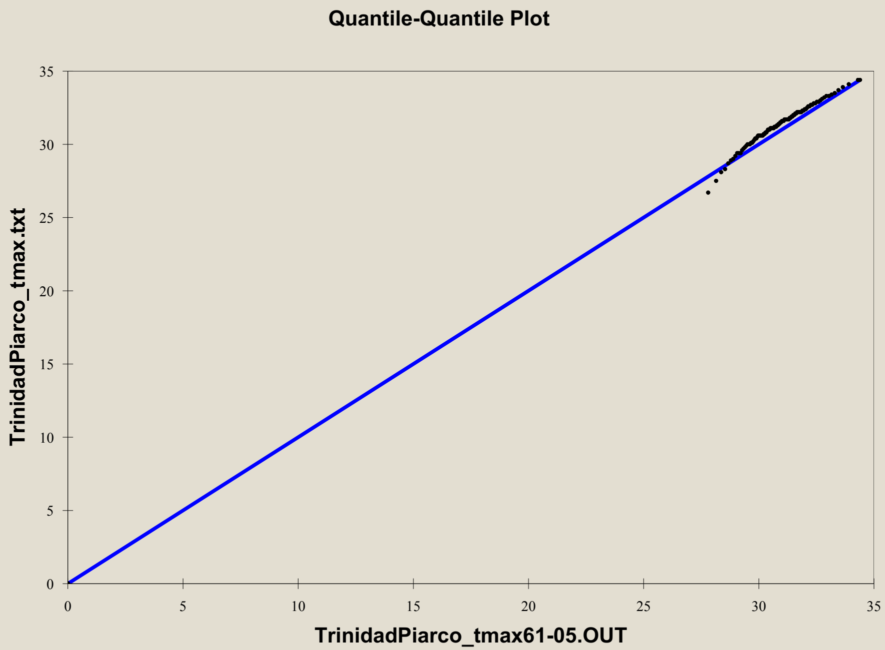
Standard Deviations of Results

January	0.021	0.316	0.223	0.034	0.618
February	0.027	0.413	0.337	0.060	0.813
March	0.026	0.378	0.359	0.053	0.777
April	0.045	0.393	0.375	0.054	1.353
May	0.047	0.399	0.670	0.084	1.398
June	0.050	0.427	0.510	0.074	1.501
July	0.037	0.457	0.272	0.090	1.123
August	0.056	0.382	0.379	0.093	1.690
September	0.045	0.486	0.463	0.086	1.360
October	0.041	0.423	0.570	0.124	1.236
November	0.055	0.370	0.466	0.063	1.636
December	0.049	0.461	0.409	0.046	1.478
Winter	0.021	0.394	0.326	0.023	1.856
Spring	0.020	0.364	0.668	0.038	1.817
Summer	0.034	0.323	0.475	0.056	3.032
Autumn	0.023	0.389	0.469	0.048	2.047
Annual	0.014	0.389	0.565	0.018	5.124

Step 7.1:
Select Select
Frequency Analysis.



Result



Quantile-Quantile Plot
TrinidadPiarco_tmax.txt
TrinidadPiarco_tmax61-05.OUT
0
5
10
15
20
25
30
35

GRACIAS