

Climate Predictability Tool (CPT)



Ousmane Ndiaye and Simon J. Mason

cpt@iri.columbia.edu

*International Research Institute for Climate and Society
The Earth Institute of Columbia University*

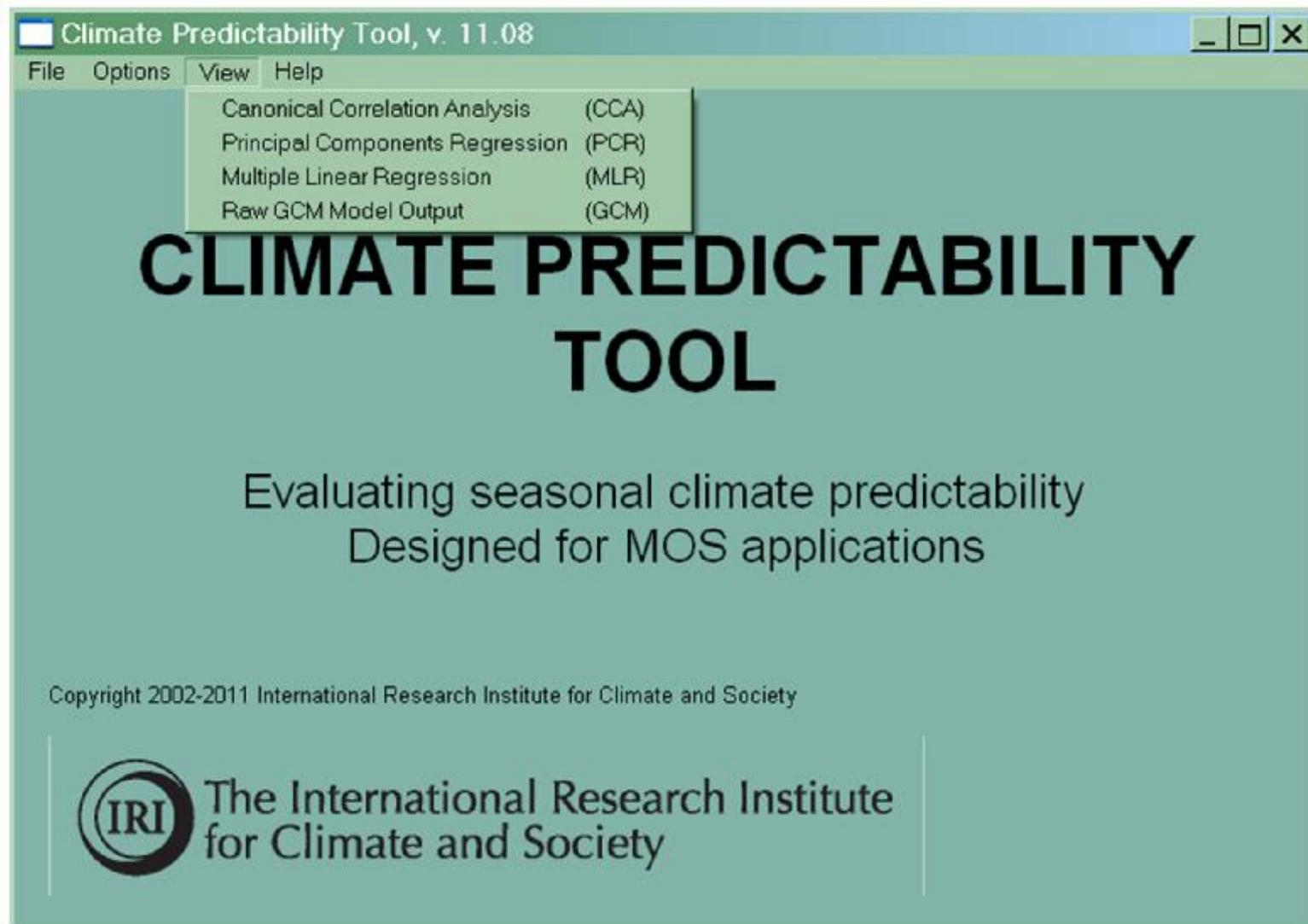


OVERVIEW

- The Climate Predictability Tool (CPT) provides a Windows package for :
 - seasonal climate forecasting
 - model validation
 - actual forecasts given updated data
- Uses ASCII input files
- Options :
 - Principal Components Regression (PCR)
 - Canonical Correlation Analysis (CCA)
 - Multi Linear Regression (MLR)
 - Global Model Output (GCM)
- Help Pages on a range of topics in HTML format
- Options to save outputs in ASCII format and graphics as JPEG
- Program source code is available for those using other systems (e.g., UNIX)



SELECTING THE ANALYSIS



Choose the analysis to perform: PCR, CCA, MLR, or GCM



INPUT DATASETS

Climate Predictability Tool, v. 11.08 - Principal Components Regression

File Edit Actions Tools Options View Help

Explanatory (X) Variables

browse

File name:

First data: N/A

Last data: N/A

Start at: 1

Number of fields: 0

Number of lags: 0

Number of variables: 0

Number used: 0

Response (Y) Variables

browse

File name:

First data: N/A

Last data: N/A

Start at: 1

Number of fields: 0

Number of lags: 0

Number of variables: 0

Number used: 0

Forecast Variables

browse

File name:

First data: N/A

Last data: N/A

Start at: 1

Number of fields: 0

Number of lags: 0

Number of variables: 0

Number used: 0

Training data

Length of training period: 0

Length of cross-validation window: 5

Number of forecasts: 1

Progress: 0%

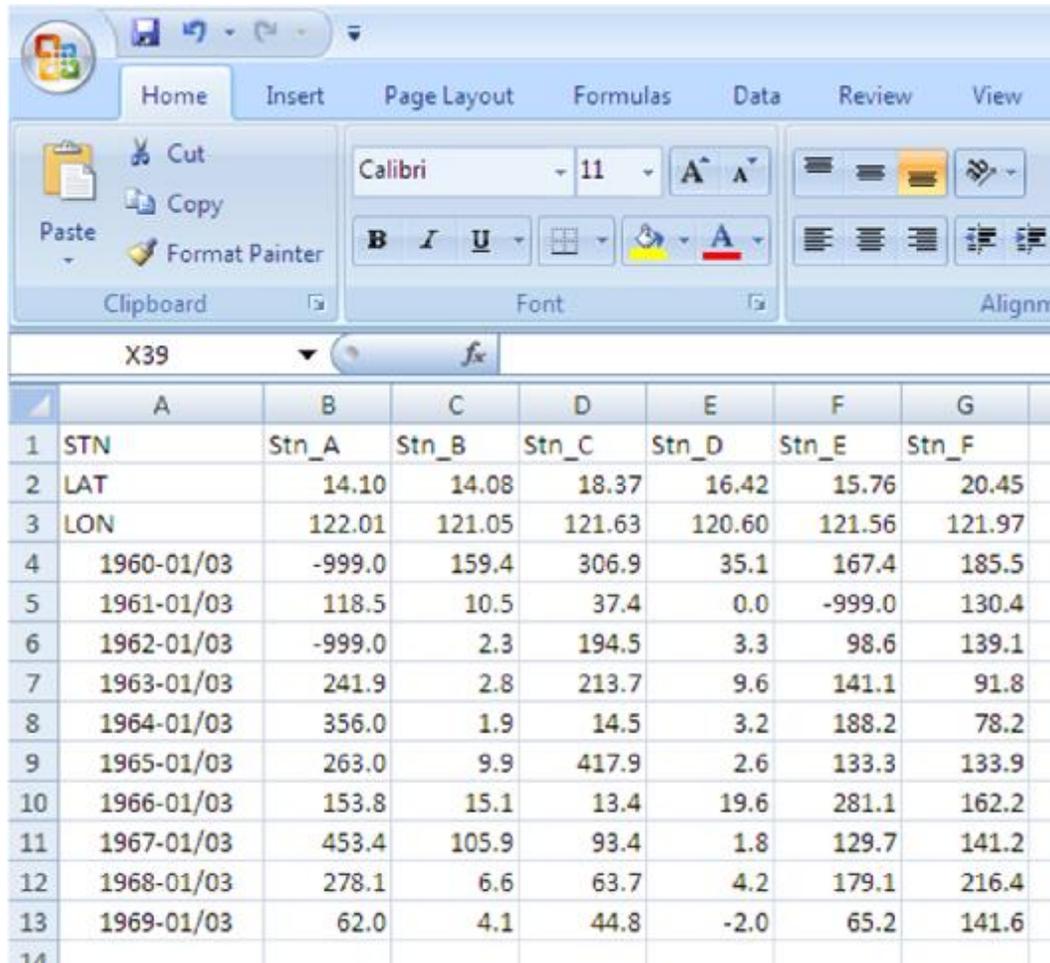
Actions:

All analysis methods require two datasets:
“X variables” or “Predictors” dataset;
“Y variables” or “Predictands” dataset.



CPT INPUT FILE FORMATS

1. STATION files



| | A | B | C | D | E | F | G |
|----|------------|--------|--------|--------|--------|--------|--------|
| 1 | STN | Stn_A | Stn_B | Stn_C | Stn_D | Stn_E | Stn_F |
| 2 | LAT | 14.10 | 14.08 | 18.37 | 16.42 | 15.76 | 20.45 |
| 3 | LON | 122.01 | 121.05 | 121.63 | 120.60 | 121.56 | 121.97 |
| 4 | 1960-01/03 | -999.0 | 159.4 | 306.9 | 35.1 | 167.4 | 185.5 |
| 5 | 1961-01/03 | 118.5 | 10.5 | 37.4 | 0.0 | -999.0 | 130.4 |
| 6 | 1962-01/03 | -999.0 | 2.3 | 194.5 | 3.3 | 98.6 | 139.1 |
| 7 | 1963-01/03 | 241.9 | 2.8 | 213.7 | 9.6 | 141.1 | 91.8 |
| 8 | 1964-01/03 | 356.0 | 1.9 | 14.5 | 3.2 | 188.2 | 78.2 |
| 9 | 1965-01/03 | 263.0 | 9.9 | 417.9 | 2.6 | 133.3 | 133.9 |
| 10 | 1966-01/03 | 153.8 | 15.1 | 13.4 | 19.6 | 281.1 | 162.2 |
| 11 | 1967-01/03 | 453.4 | 105.9 | 93.4 | 1.8 | 129.7 | 141.2 |
| 12 | 1968-01/03 | 278.1 | 6.6 | 63.7 | 4.2 | 179.1 | 216.4 |
| 13 | 1969-01/03 | 62.0 | 4.1 | 44.8 | -2.0 | 65.2 | 141.6 |
| 14 | | | | | | | |

This file-type contains :

Station_name (without spaces; ≤ 16 characters)

Latitude (south negative)

Longitude (west negative)

Year-season (in the first column)

Data (missing values should be filled with the same value, -999.0 for example)

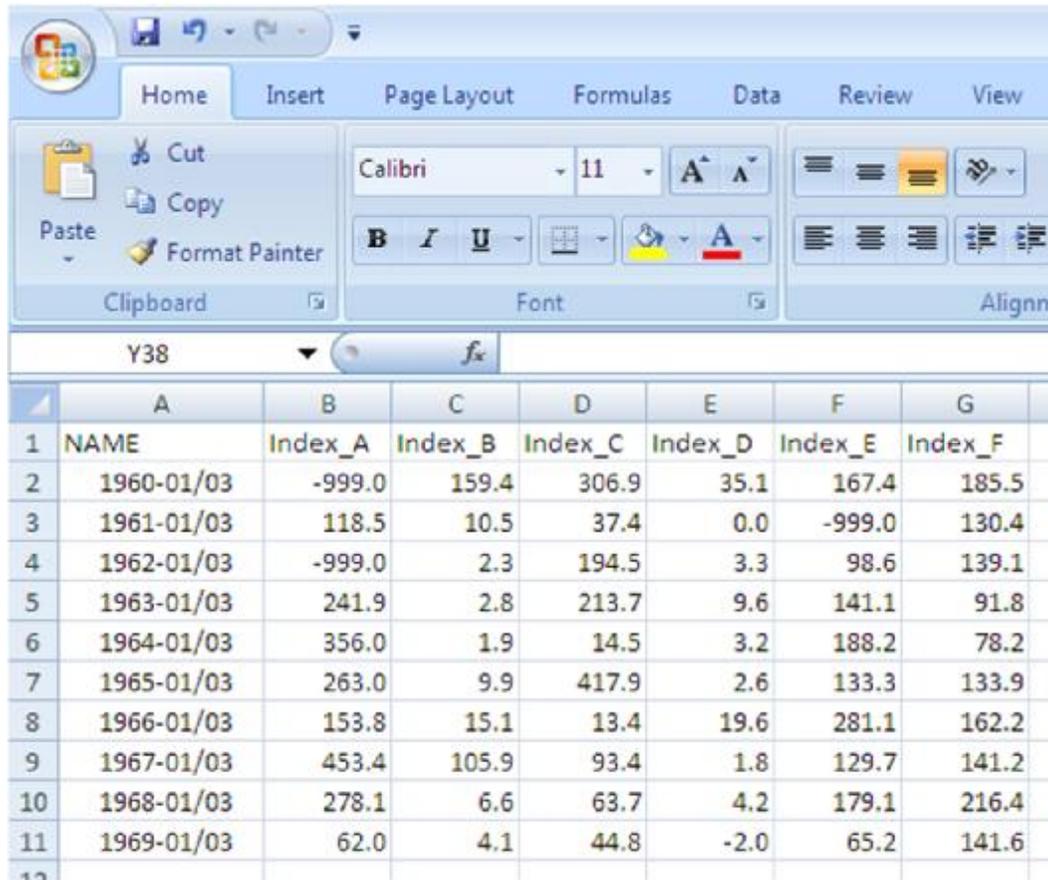
Keywords:

STN, LAT, LON



CPT INPUT FILE FORMATS

2. UNREFERENCED or INDEX files



The screenshot shows an Excel spreadsheet with the following data:

| | A | B | C | D | E | F | G |
|----|------------|---------|---------|---------|---------|---------|---------|
| 1 | NAME | Index_A | Index_B | Index_C | Index_D | Index_E | Index_F |
| 2 | 1960-01/03 | -999.0 | 159.4 | 306.9 | 35.1 | 167.4 | 185.5 |
| 3 | 1961-01/03 | 118.5 | 10.5 | 37.4 | 0.0 | -999.0 | 130.4 |
| 4 | 1962-01/03 | -999.0 | 2.3 | 194.5 | 3.3 | 98.6 | 139.1 |
| 5 | 1963-01/03 | 241.9 | 2.8 | 213.7 | 9.6 | 141.1 | 91.8 |
| 6 | 1964-01/03 | 356.0 | 1.9 | 14.5 | 3.2 | 188.2 | 78.2 |
| 7 | 1965-01/03 | 263.0 | 9.9 | 417.9 | 2.6 | 133.3 | 133.9 |
| 8 | 1966-01/03 | 153.8 | 15.1 | 13.4 | 19.6 | 281.1 | 162.2 |
| 9 | 1967-01/03 | 453.4 | 105.9 | 93.4 | 1.8 | 129.7 | 141.2 |
| 10 | 1968-01/03 | 278.1 | 6.6 | 63.7 | 4.2 | 179.1 | 216.4 |
| 11 | 1969-01/03 | 62.0 | 4.1 | 44.8 | -2.0 | 65.2 | 141.6 |

This file-type contains :

Index_name (without spaces; ≤16 characters)

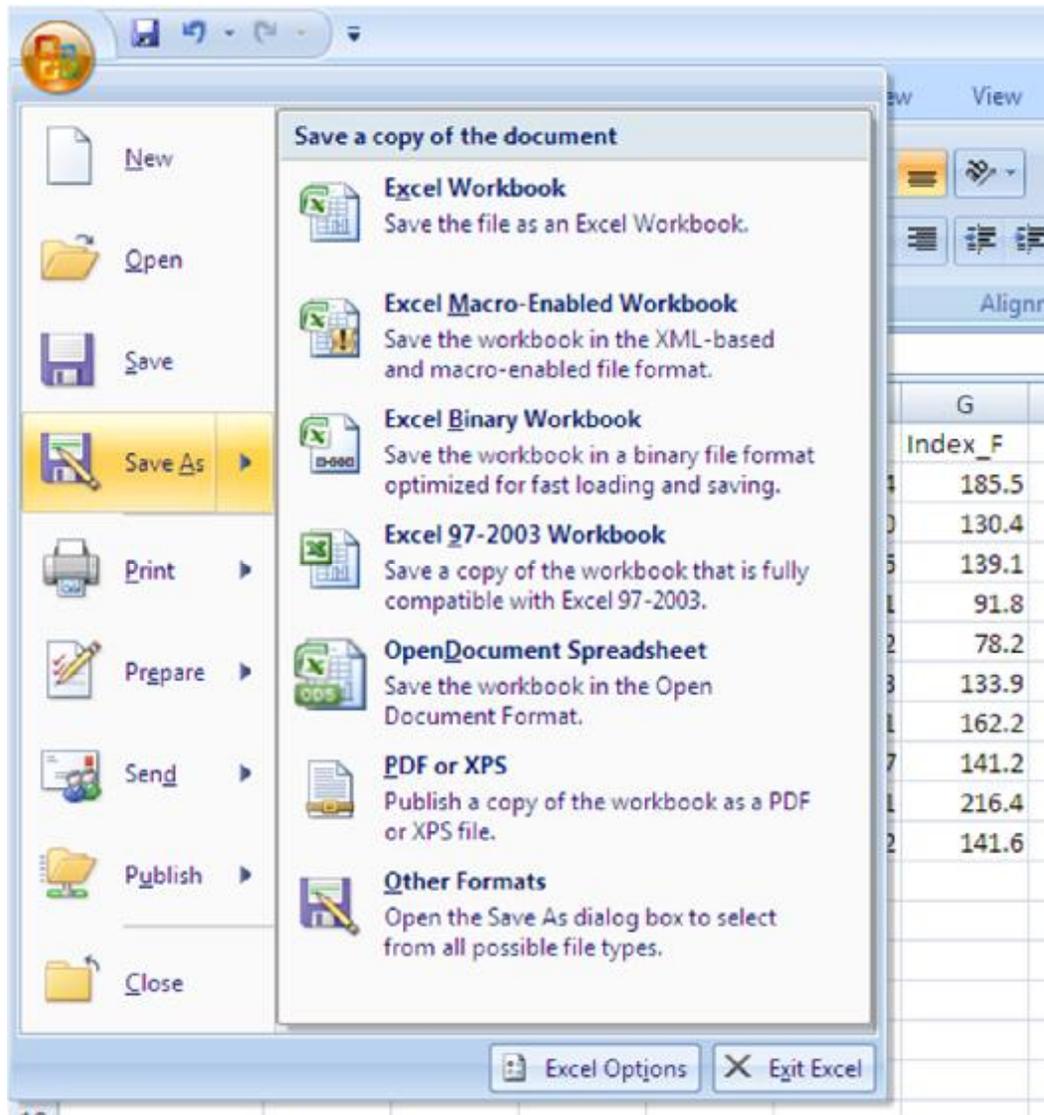
Year-season (in the first column)

Data (missing values should be filled with the same value, -999.0 for example)

Keywords:
NAME or YEAR



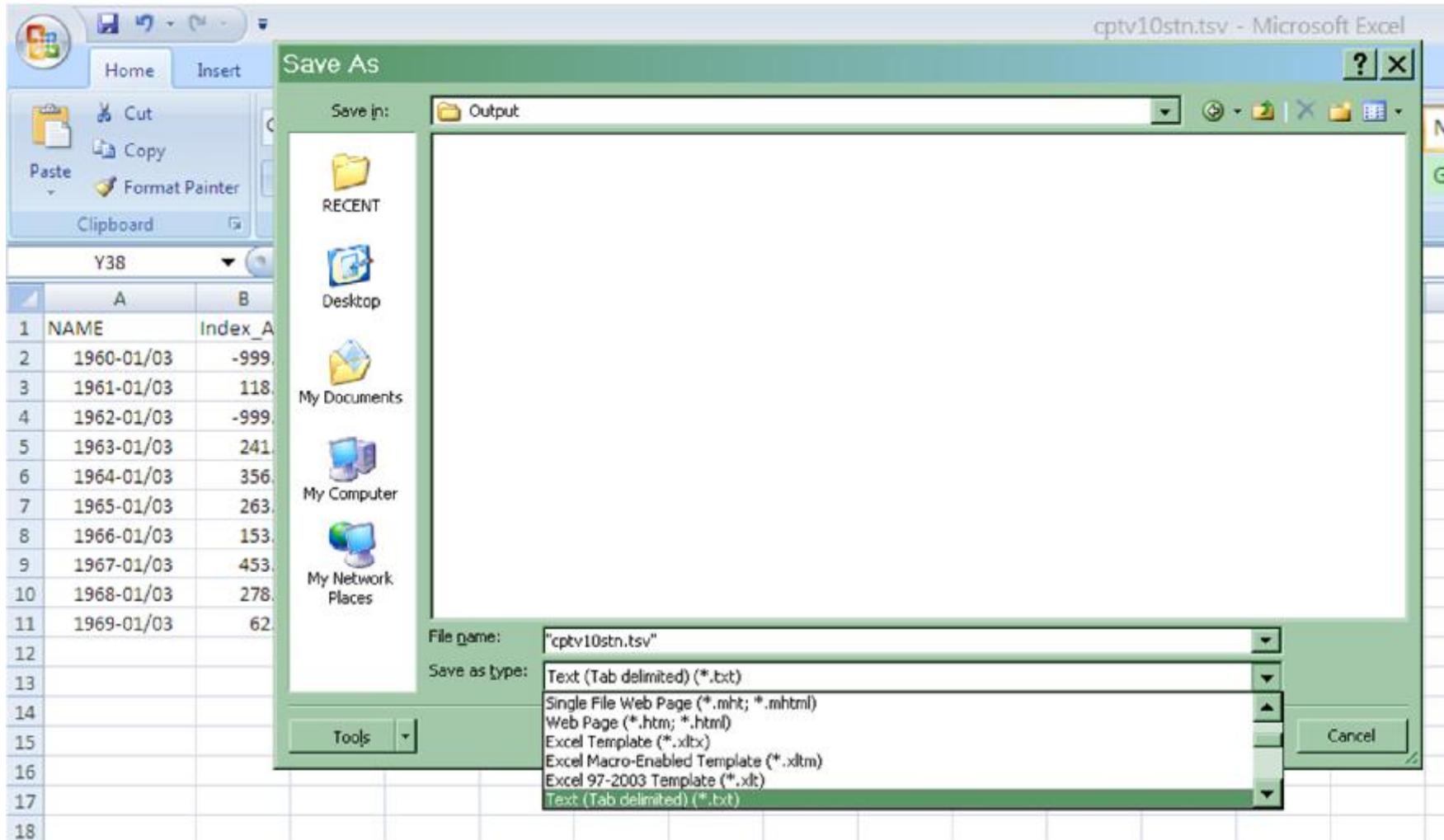
CPT INPUT FILE FORMATS



The input files could be easily made using a spreadsheet such as Excel



CPT INPUT FILE FORMATS



In Excel the file should be saved as:
“Text (Tab delimited) (*.txt)”



SELECTING INPUT FILES

Climate Predictability Tool, v. 11.08 - Principal Components Regression

File Edit Actions Tools Options View Help

Explanatory (X) Variables

browse

File name:

First data: N/A

Last data: N/A

Start at: 1

Number of fields: 0

Number of lags: 0

Number of variables: 0

Number used: 0

Input Files

browse

File name:

First data: N/A

Last data: N/A

Start at: 1

Number of fields: 0

Number of lags: 0

Number of variables: 0

Number used: 0

Forecast Variables

browse

File name:

First data: N/A

Last data: N/A

Start at: 1

Number of fields: 0

Number of lags: 0

Number of variables: 0

Number used: 0

Training data

Length of training period: 0

Length of cross-validation window: 5

Number of forecasts: 1

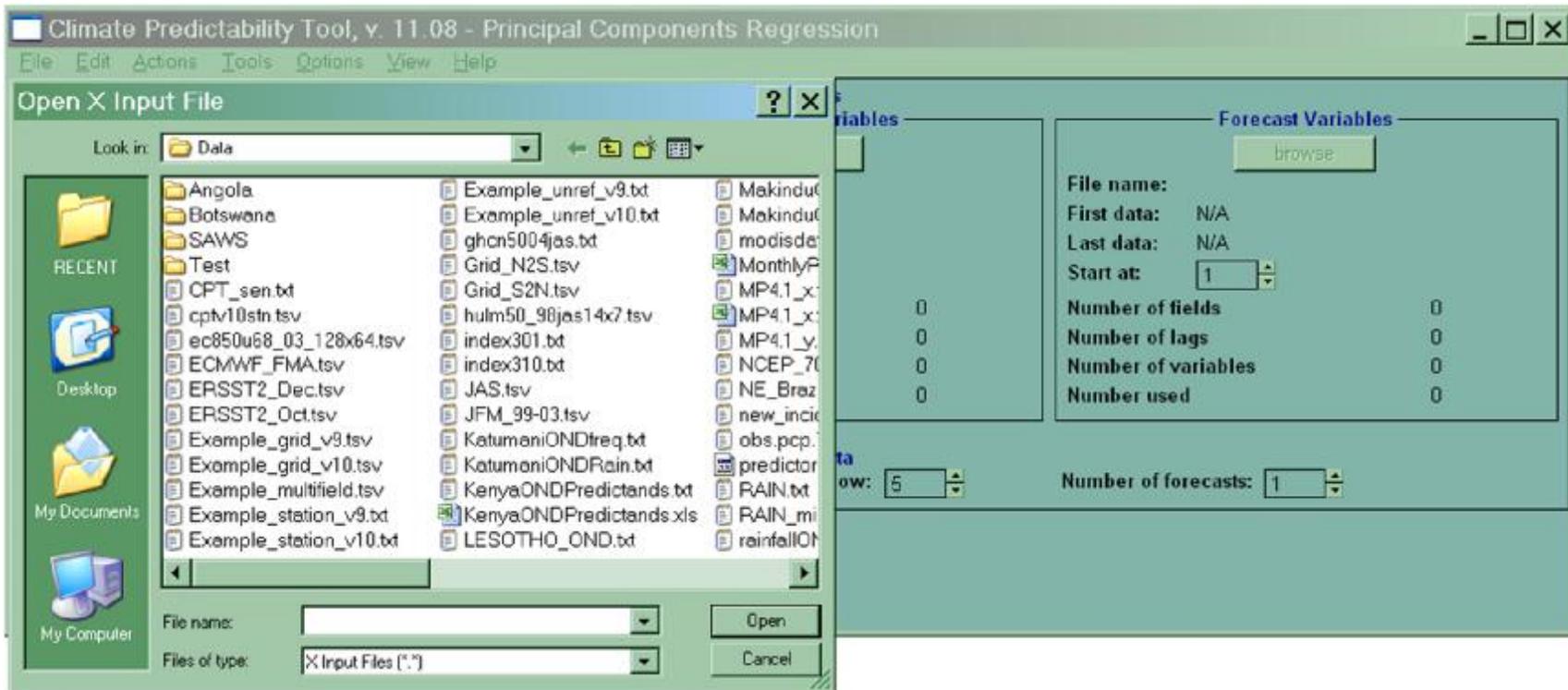
Progress: 0%

Actions:

To select input files just click on **browse**.



SELECTING INPUT FILES



CPT opens a browser, which by default looks for data in:
C:\Documents and Settings\user\Application Data\CPT\Data
or the directory specified during installation.
You can search for data from any other directory.



SELECTING INPUT FILES

The domain can be set by:

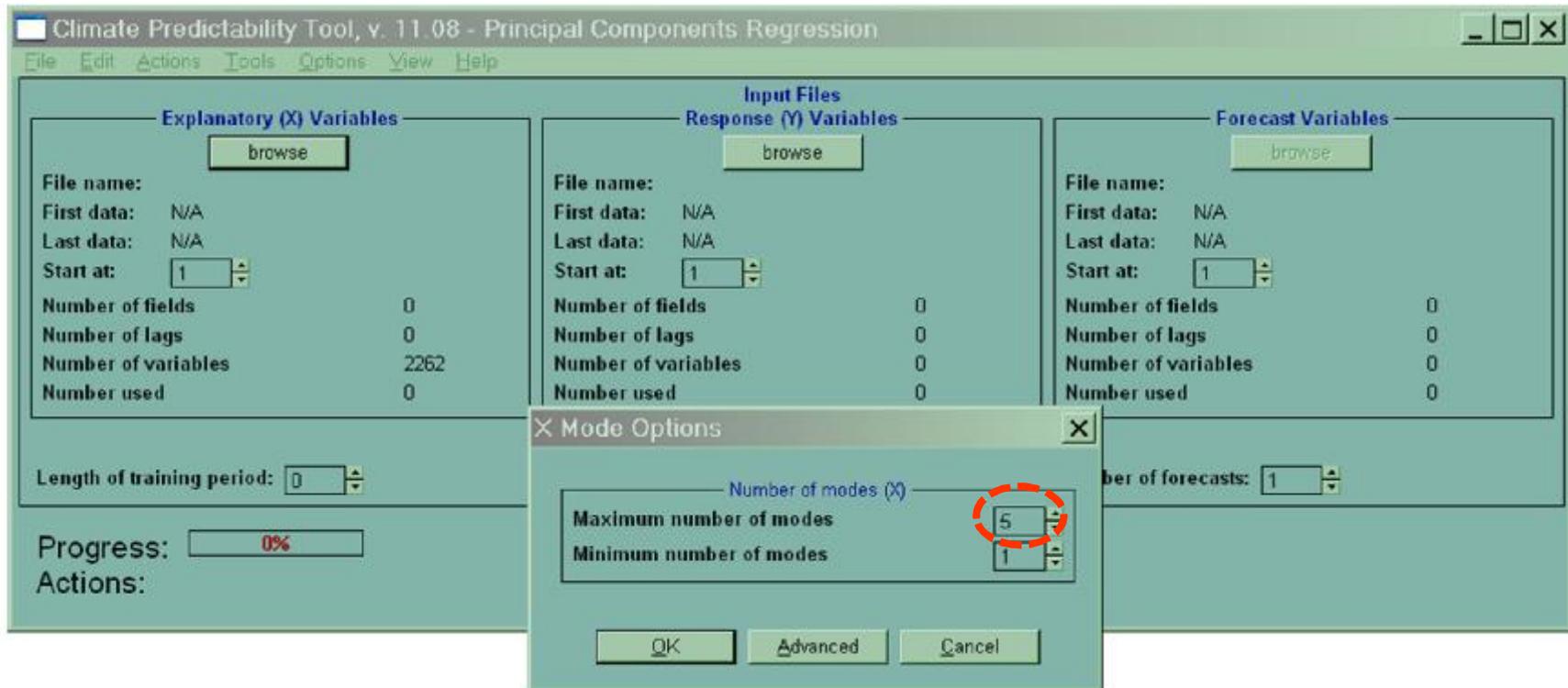
- typing in the domain limits
- or using the arrows,

The domain can also be selected by drawing a rectangle over the map.

For gridded and station datasets, CPT lets you choose the spatial domain over which you want to perform your analysis. For the X file you should choose a domain from where the predictors are known to affect climate over the region to be predicted.



SETTING ANALYSIS OPTIONS



For PCR and CCA, you have to choose the number of EOFs for the predictor fields used to fit the model. If you set the minimum to be less than the maximum, CPT will find the optimum number of modes between the two numbers. If you set the minimum equal to the maximum, then CPT will use that number of modes.



SELECTING INPUT FILES

The screenshot shows the 'Climate Predictability Tool, v. 11.08 - Principal Components Regression' window. It features a menu bar (File, Edit, Actions, Tools, Options, View, Help) and three main sections: 'Explanatory (X) Variables', 'Input Files', and 'Forecast Variables'. Each section has a 'browse' button and a table of statistics. The 'Input Files' section is highlighted with a red arrow pointing to its 'browse' button.

| Explanatory (X) Variables | | Response (Y) Variables | | Forecast Variables | |
|---------------------------|----------------|------------------------|-----|---------------------|----------------|
| File name: | ERSST3_Jan.tsv | File name: | | File name: | ERSST3_Jan.tsv |
| First data: | Jan 1950 | First data: | N/A | First data: | Jan 1950 |
| Last data: | Jan 2011 | Last data: | N/A | Last data: | Jan 2011 |
| Start at: | 1950 | Start at: | 1 | Start at: | 2011 |
| Number of fields | 1 | Number of fields | 0 | Number of fields | 1 |
| Number of lags | 1 | Number of lags | 0 | Number of lags | 1 |
| Number of gridpoint | 2418 | Number of variables | 0 | Number of gridpoint | 2418 |
| Number used | 0 | Number used | 0 | Number used | 0 |

Training data: Length of training period: 0, Length of cross-validation window: 5, Number of forecasts: 1

Progress: 0%

Actions:

Proceed in the same way to select your file containing the Y variables (predictands).



SETTING THE TRAINING PERIOD

Climate Predictability Tool, v. 11.08 - Principal Components Regression

File Edit Actions Tools Options View Help

| Explanatory (X) Variables | | Response (Y) Variables | | Forecast Variables | |
|---------------------------|----------------|------------------------|------------------|---------------------|----------------|
| File name: | ERSST3_Jan.tsv | File name: | NE_Brazil_v9.txt | File name: | ERSST3_Jan.tsv |
| First data: | Jan 1950 | First data: | FMA 1971 | First data: | Jan 1950 |
| Last data: | Jan 2011 | Last data: | FMA 1997 | Last data: | Jan 2011 |
| Start at: | 1950 | Start at: | 1971 | Start at: | 2011 |
| Number of fields | 1 | Number of fields | 1 | Number of fields | 1 |
| Number of lags | 1 | Number of lags | 1 | Number of lags | 1 |
| Number of gridpoint | 2418 | Number of stations | 71 | Number of gridpoint | 2418 |
| Number used | 0 | Number used | 0 | Number used | 0 |

Length of training period: 27 Length of cross-validation window: 5 Number of forecasts: 1

Progress: 0%

Actions:

By default CPT usually starts the analysis from the first years in the X and Y files; note that these years could be different. You would normally set them equal to the latest of the two first years in the files. (In the example, the start date for the X file would normally be set to 1971.)

If you cross the calendar year while using December predictors, for example, the starting year for the X file will need to be one year earlier than for the Y file. (In this case, 1970.)

If you use a NDJ or DJF season, the year is for the first month.



SETTING THE TRAINING PERIOD

Climate Predictability Tool, v. 11.08 - Principal Components Regression

File Edit Actions Tools Options View Help

| Explanatory (X) Variables | | Input Files Response (Y) Variables | | Forecast Variables | |
|---------------------------|----------------|---------------------------------------|------------------|---------------------|----------------|
| File name: | ERSST3_Jan.tsv | File name: | NE_Brazil_v9.txt | File name: | ERSST3_Jan.tsv |
| First data: | Jan 1950 | First data: | FMA 1971 | First data: | Jan 1950 |
| Last data: | Jan 2014 | Last data: | FMA 1997 | Last data: | Jan 2011 |
| Start at: | 1971 | Start at: | 1971 | Start at: | 2011 |
| Number of fields | 1 | Number of fields | 1 | Number of fields | 1 |
| Number of lags | 1 | Number of lags | 1 | Number of lags | 1 |
| Number of gridpoint | 2418 | Number of stations | 71 | Number of gridpoint | 2418 |
| Number used | 0 | Number used | 0 | Number used | 0 |

Length of training period: 27

Length of cross-validation window: 5

Number of forecasts: 1

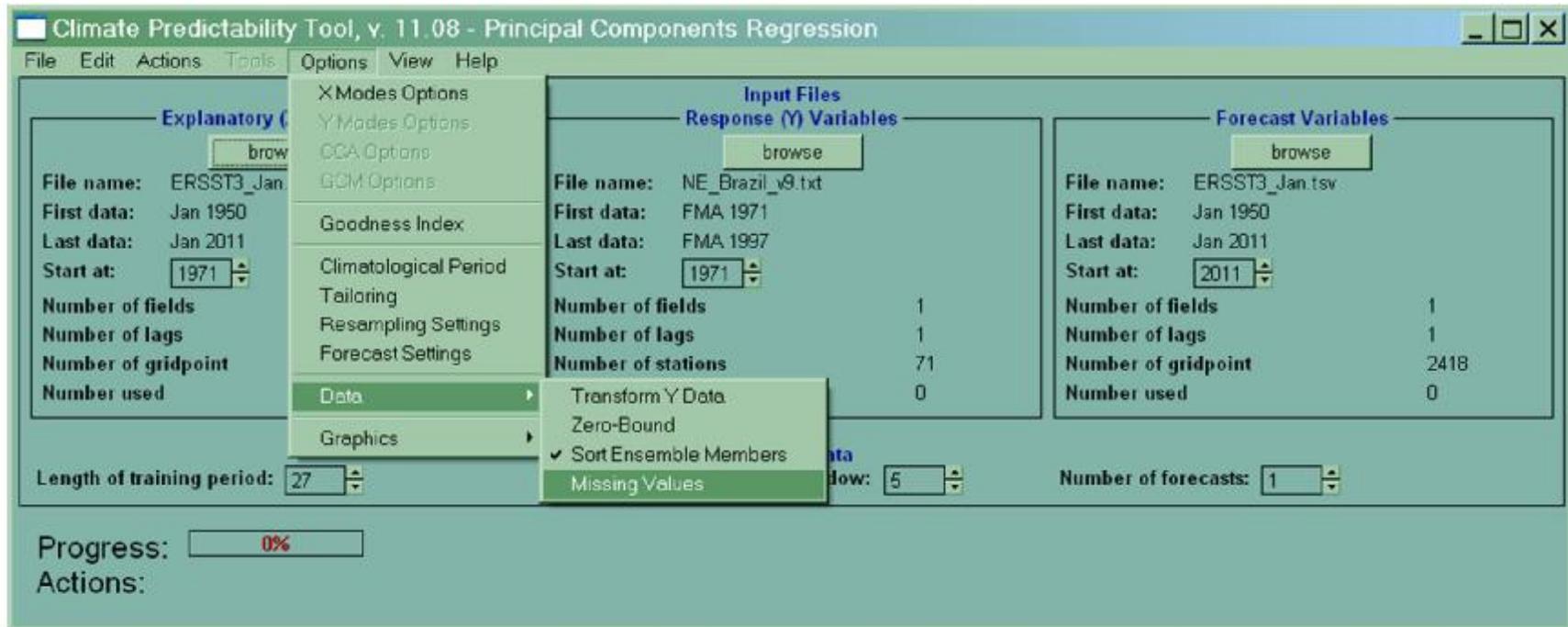
Progress: 0%

Actions:

You have to specify the length of the training period.
By default, CPT will try to use as many years as are available.



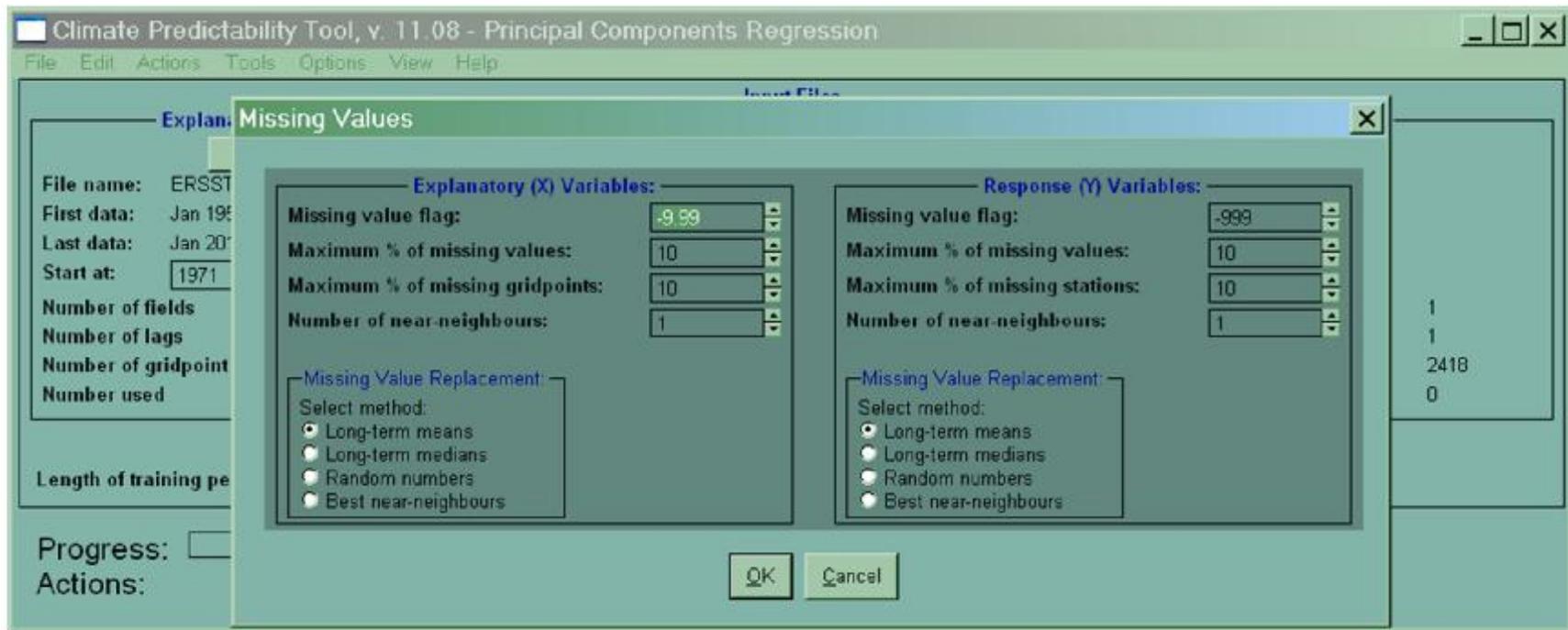
MISSING VALUES



If you have missing values in your dataset, you need to specify what you want CPT to do with them.



MISSING VALUES



Next to the **Missing value flag** box, you need to specify the number in your dataset that represents a missing value.

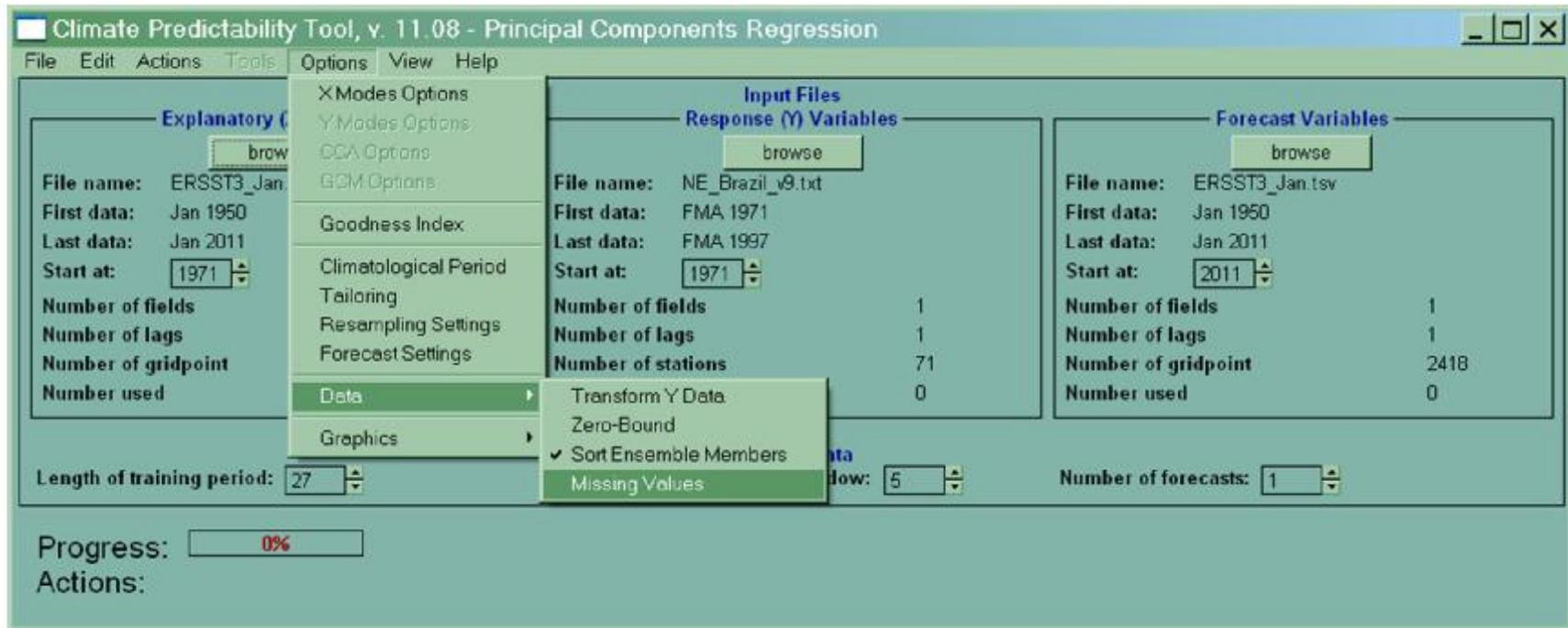
You can choose the **Maximum % of missing values**. If a station has more than that percentage of missing values, CPT will not use that station in its model.

You can choose the **Maximum % of missing stations**. If a year has more than that percentage of missing values, CPT will not use that year in its model.

You can also choose which method you want CPT to use to replace the values. If you choose **Best nearest neighbours** then CPT will use the **Number of near-neighbours** that you specify.



RAINFALL

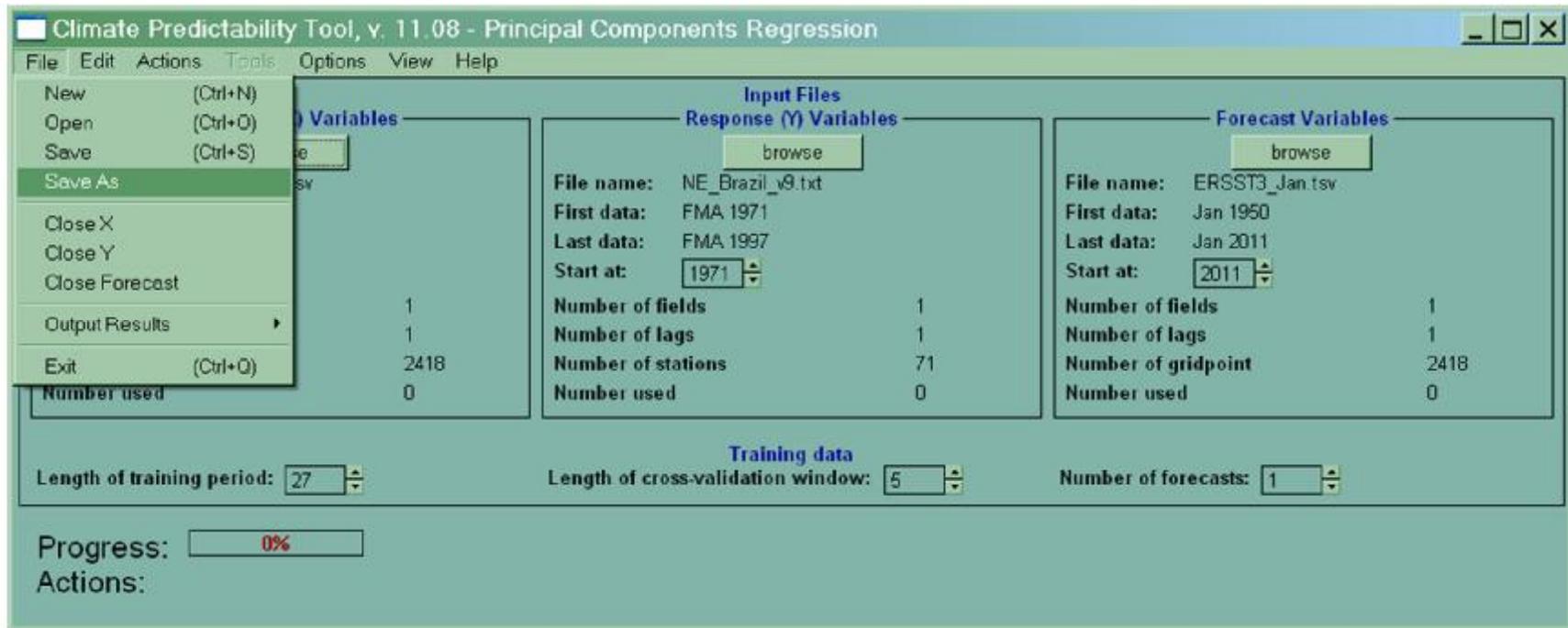


If you are predicting rainfall, you may want to switch on the **Zero-Bound**, which will force CPT never to predict negative values.

If the rainfall data are positively skewed (have occasional very large values), you may also want to switch on **Transform Y Data**, which will help to prevent lowest forecast probabilities on “normal”.



SAVING PROGRAM SETTINGS



Once you have selected the input files and your settings it is a good idea to save these settings in a project file to recall them later:

File ~ Save

By default, CPT saves all the project files in the subdirectory
C:\Documents and settings\user\Application Data\CPT\Projects



RUNNING CPT

The screenshot shows the 'Climate Predictability Tool, v. 11.08 - Example (PCR)' window. The 'Actions' menu is open, highlighting 'Calculate' and 'Cross-validated'. The interface is divided into three main sections: 'Input Files', 'Response (Y) Variables', and 'Forecast Variables'. Each section has a 'browse' button and a list of parameters. At the bottom, there are settings for 'Training data' and 'Number of forecasts', along with a progress bar showing 0% completion.

| Section | File name | First data | Last data | Start at | Number of fields | Number of lags | Number of gridpoint | Number used |
|------------------------|------------------|------------|-----------|----------|------------------|----------------|---------------------|-------------|
| Input Files | ERSST3_Jan.tsv | Jan 1950 | Jan 2011 | 1971 | 1 | 1 | 2418 | 0 |
| Response (Y) Variables | NE_Brazil_v9.txt | FMA 1971 | FMA 1997 | 1971 | 1 | 1 | 71 | 0 |
| Forecast Variables | ERSST3_Jan.tsv | Jan 1950 | Jan 2011 | 2011 | 1 | 1 | 2418 | 0 |

Length of training period: 27
Length of cross-validation window: 5
Number of forecasts: 1

Progress: 0%

Then you can run the analysis:
Actions ~ Calculate ~ Cross-validated



DATA ANALYSIS

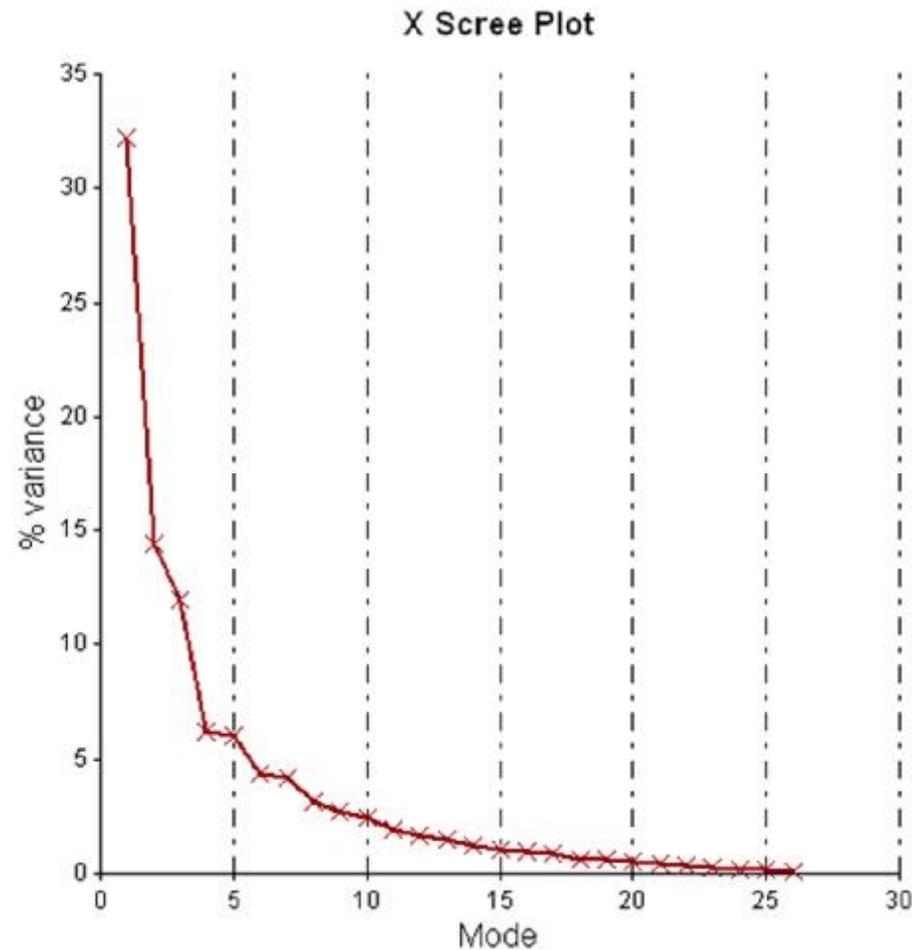
| CURRENT | | OPTIMUM | |
|-----------------|----------------|-----------------|----------------|
| Number of Modes | Goodness Index | Number of Modes | Goodness Index |
| 1 | -0.105 | 1 | -0.105 |
| 2 | 0.031 | 2 | 0.031 |
| 3 | 0.214 | 3 | 0.214 |
| 4 | 0.144 | 3 | 0.214 |
| 5 | 0.112 | 3 | 0.214 |

Optimizing the number of EOF modes:

1. CPT uses EOF #1 to make cross-validated forecasts then calculates a “goodness index” summarizing how good all the forecasts are (the closer to 1.0 the better). Then CPT uses EOF #1 and #2 to remake cross-validated forecasts and calculates a new goodness index for these, and so on until all five EOFs have been used.
2. At each step CPT compares the goodness indices and retains under the column “OPTIMUM” the highest goodness index and the corresponding number of EOFs (in the example above, 3).
3. CPT uses this number of EOFs (i.e., 3) to build the model.



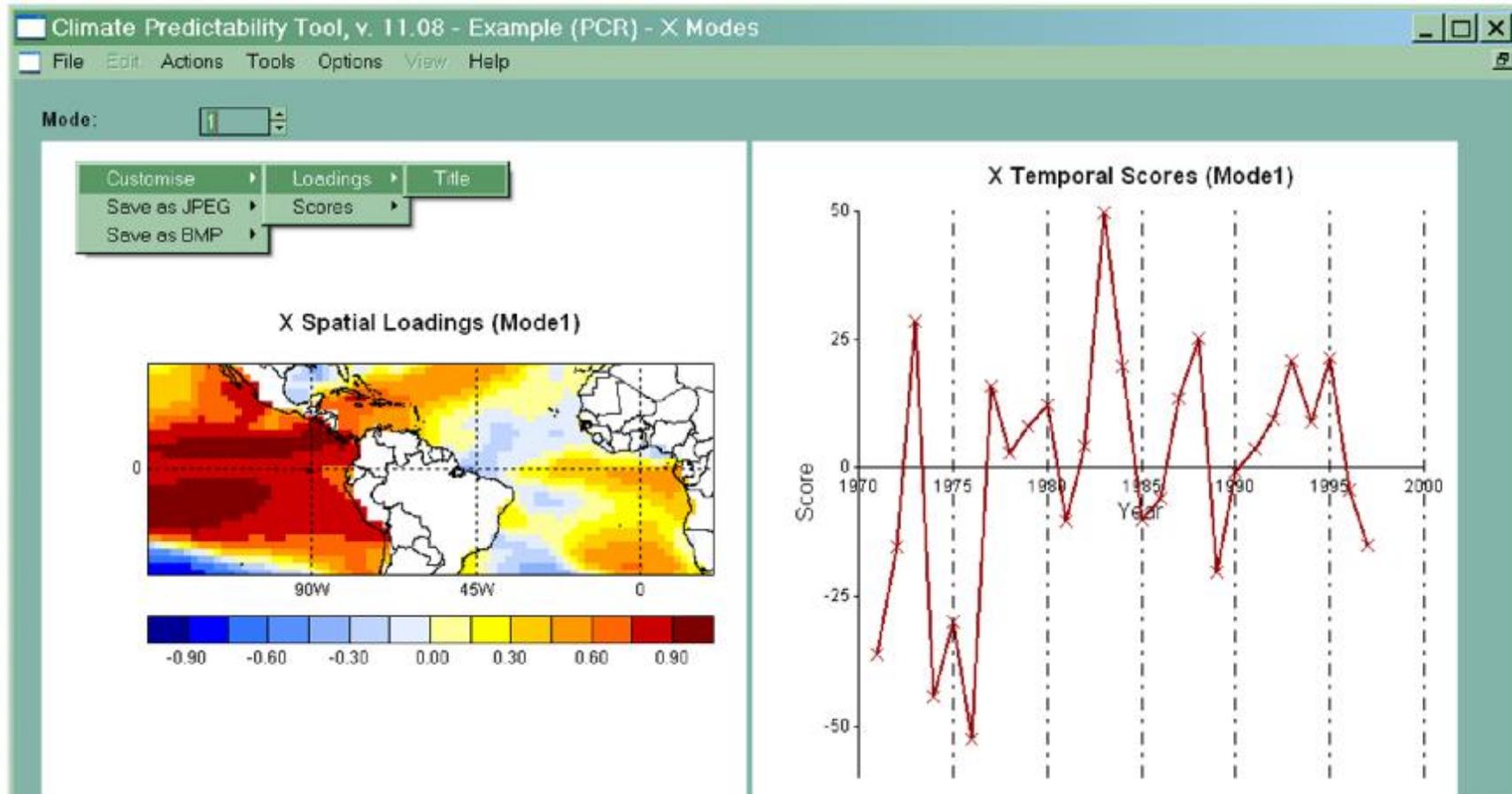
RESULTS – GRAPHICS



The menu **Tools ~ Modes ~ Scree plots** displays the percentage of variance associated with each EOF plotted.



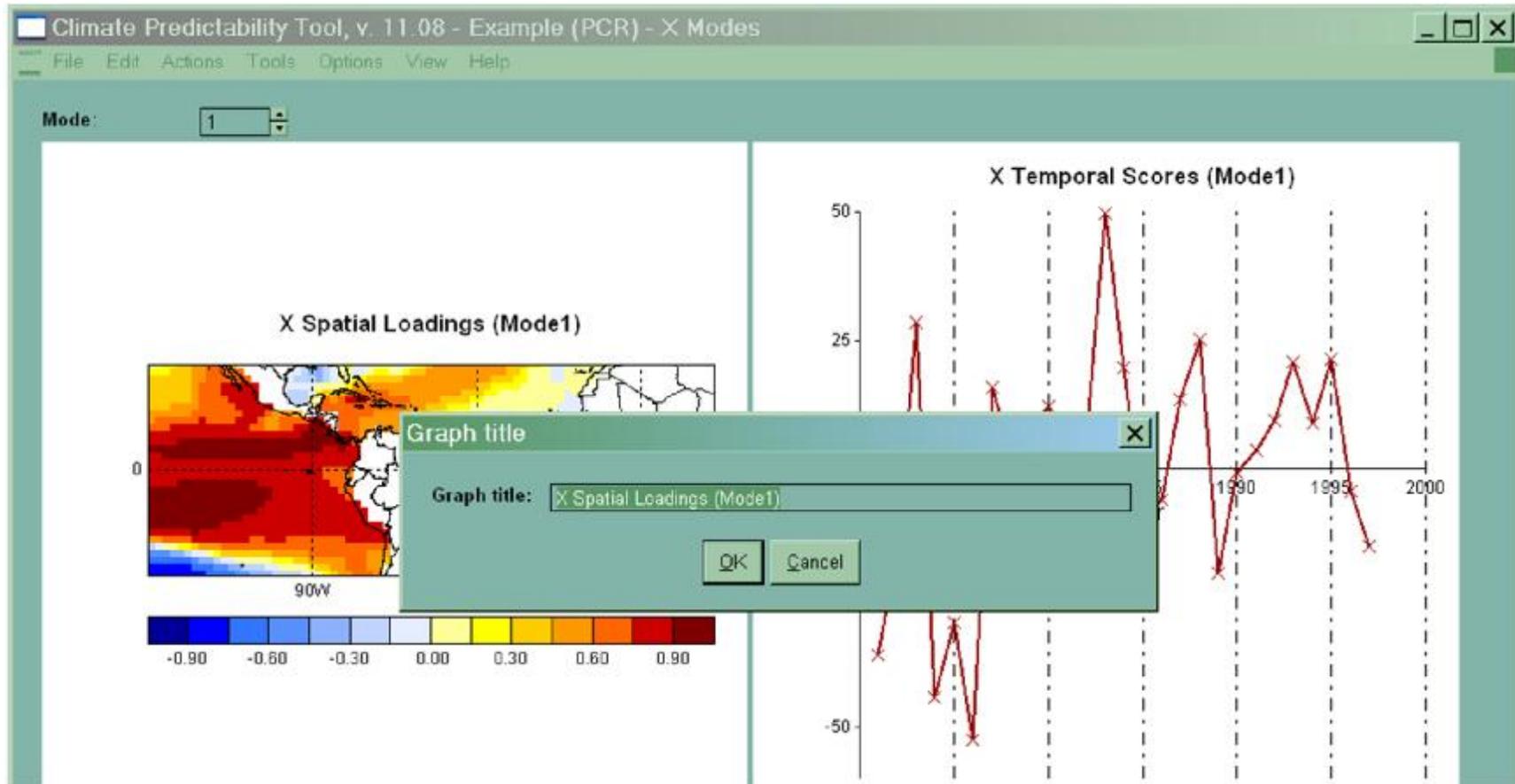
RESULTS – GRAPHICS



1. The menu **Tools ~ Modes ~ X EOF loadings and scores** displays the loading pattern of each EOF and the temporal series.
2. CPT allows you to customize and save each graphic by:
 - right-clicking on the mouse
 - selecting the graphic to customize / save



CHANGING THE TITLE

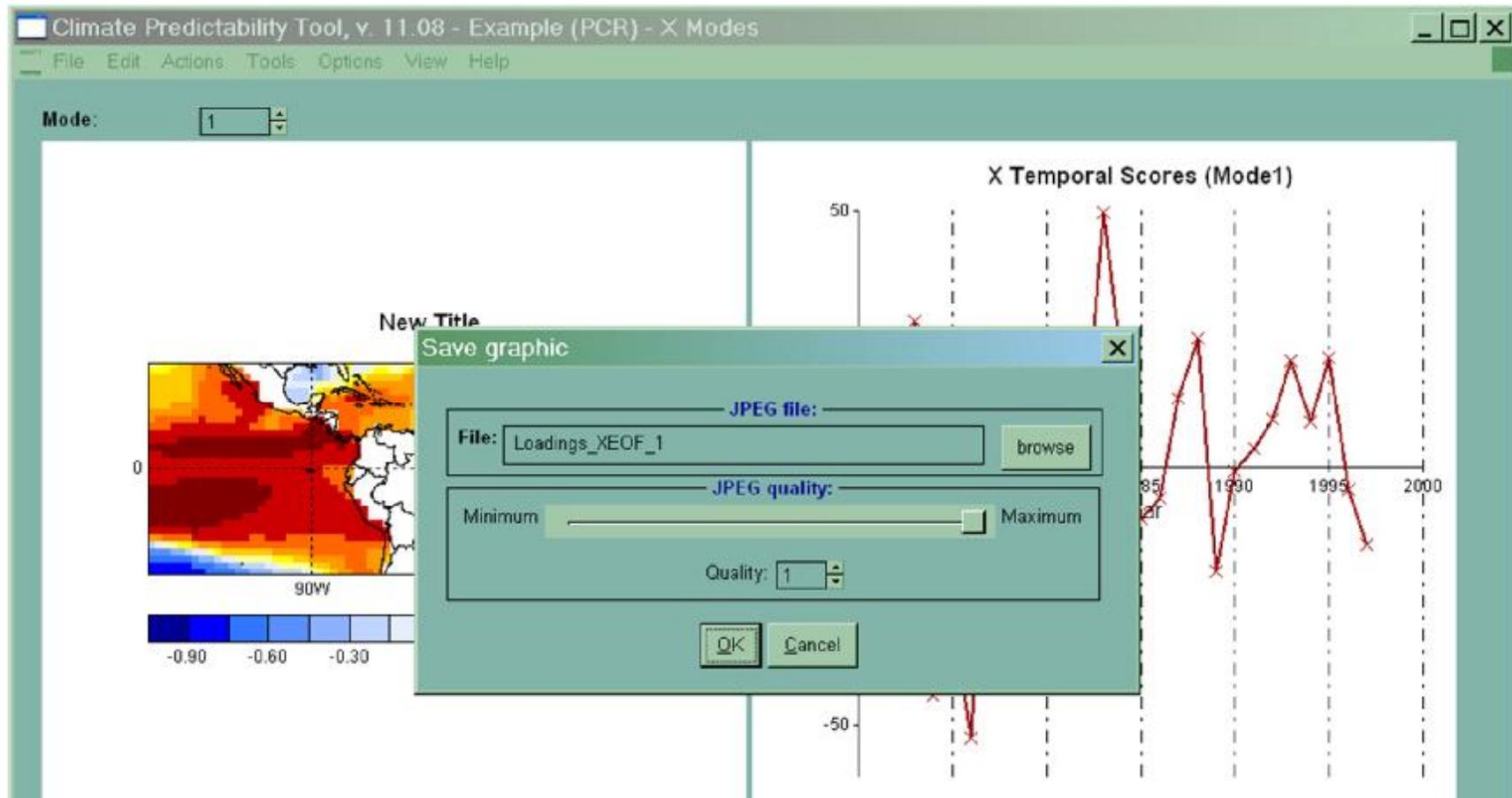


To change the title of the map

1. right-click the mouse
2. go to EOF Loadings
3. click on Title



SAVING GRAPHICS



You can choose the name of the graphic output file by clicking on browse. You can adjust the quality of the JPEG graphic as well.

All the output files are saved by default under:

C:\Documents and settings\user\Application Data\CPT\Output



RESULTS

Climate Predictability Tool, v. 11.08 - Example (PCR)

File Edit Actions Tools Options View Help

Validation
Verification
Contingency Tables
Modes
Climatological Maps
Forecasts

Cross-validated
Retroactive

Performance Measures
Bootstrap
Skill Maps
Scatter Plot

Forecast Variables
browse

File name: ERSST3_Jan.tsv
First data: Jan 1960
Last data: Jan 2011
Start at: 2011

Number of fields: 1
Number of lags: 1
Number of gridpoints: 2418
Number used: 0

File name: ERSST3_Jan.tsv
First data: FMA 1971
Last data: FMA 1997
Start at: 1971

Number of fields: 1
Number of lags: 1
Number of stations: 71
Number used: 71

File name: ERSST3_Jan.tsv
First data: Jan 1960
Last data: Jan 2011
Start at: 1971

Number of fields: 1
Number of lags: 1
Number of gridpoints: 2418
Number used: 1773

Length of training period: 27
Length of cross-validation window: 5
Number of forecasts: 1

Progress: 100%

Actions:

To see the results go to the menu “**Tools**”:

Validation : shows skill, hindcasts and observed series

Verification: shows probabilistic skill information for retroactive forecasts

Contingency Tables : shows contingency tables

Modes : shows EOF time series, loading patterns and scree plot

Climatological Maps: shows maps of terciles and averages



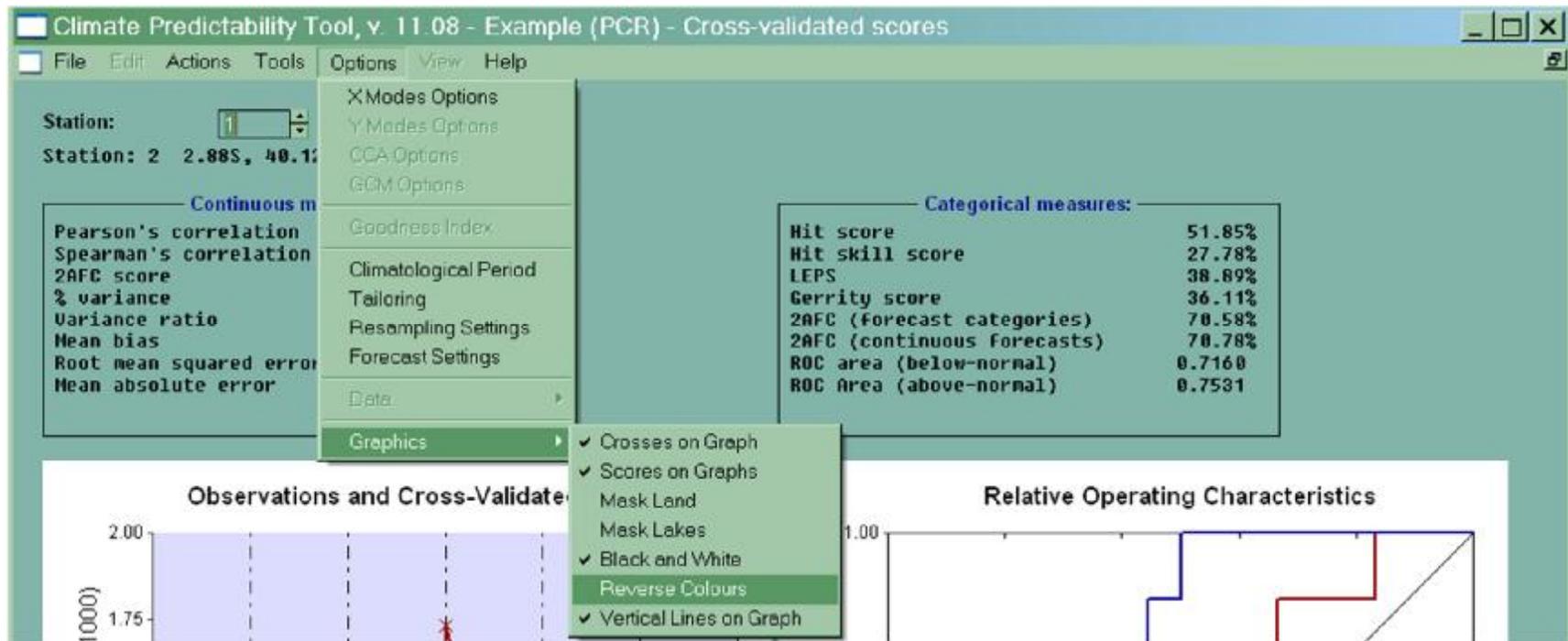
RESULTS

To see the observations and cross-validated forecasts at each station go to:

Tools ~ Validation ~ Cross-Validated ~ Performance Measures



REVERSING THE COLORS

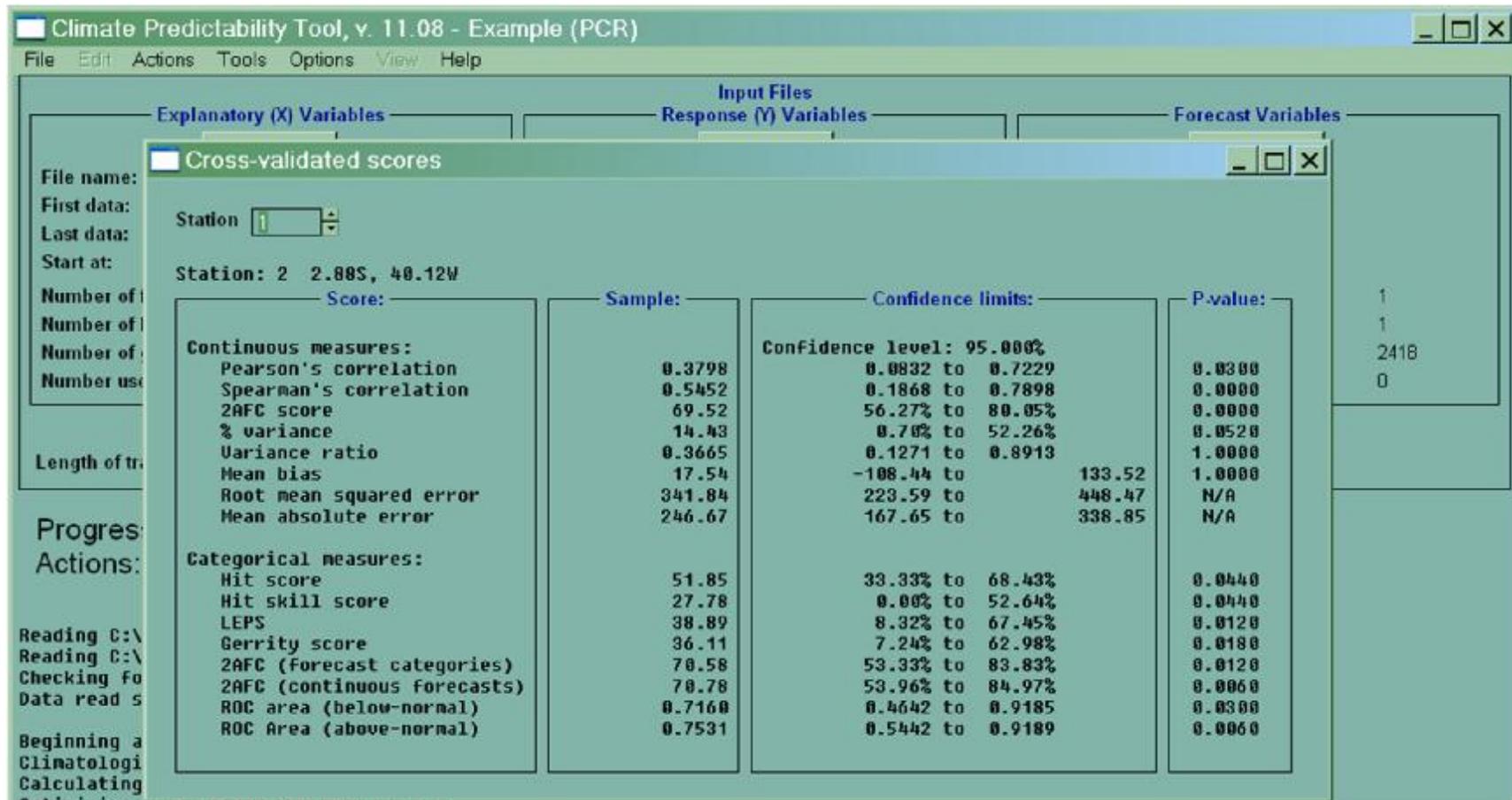


Options ~ Graphics ~ Reverse Colors

If you are forecasting temperature instead of precipitation, then it would be more intuitive to have red (hot) for above and blue (cold) for below, so you might want to invert the default colors. You might also want black and white images if they are to be included in a report or publication.



INDICATIONS OF SAMPLING ERRORS



For indications of sampling errors in the performance measures go to:

Tools ~ Validation ~ Cross-Validated ~ Bootstrap



ADJUSTING THE BOOTSTRAP SETTINGS

The screenshot displays the 'Climate Predictability Tool, v. 11.08 - Example (PCR)' interface. A 'Resampling Settings' dialog box is open, showing the following options:

- Skill maps:** Calculate p-values
- Permutations:** Number of permutations: 500
- Bootstrapping:** Number of bootstrap samples: 500, Confidence level (%): 95

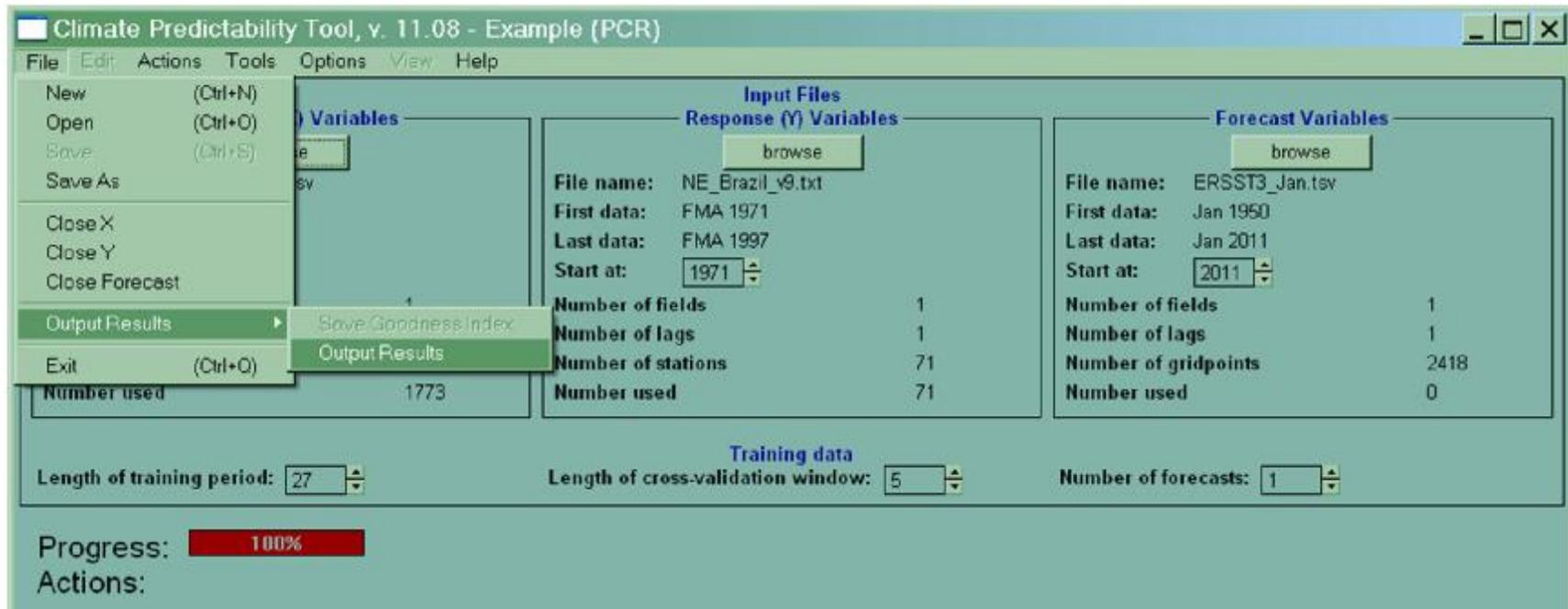
The background window shows a 'Cross-validated scores' dialog with a 'Station' dropdown set to '1' and 'Station: 2 2.88S, 40.12W'. The main interface is divided into 'Explanatory (X) Variables', 'Response (Y) Variables', and 'Forecast Variables' sections. A progress log on the left shows the tool is currently calculating climatological statistics.

Options ~ Resampling Settings

CPT allows you to adjust the bootstrap settings.



RESULTS – DATA FILES

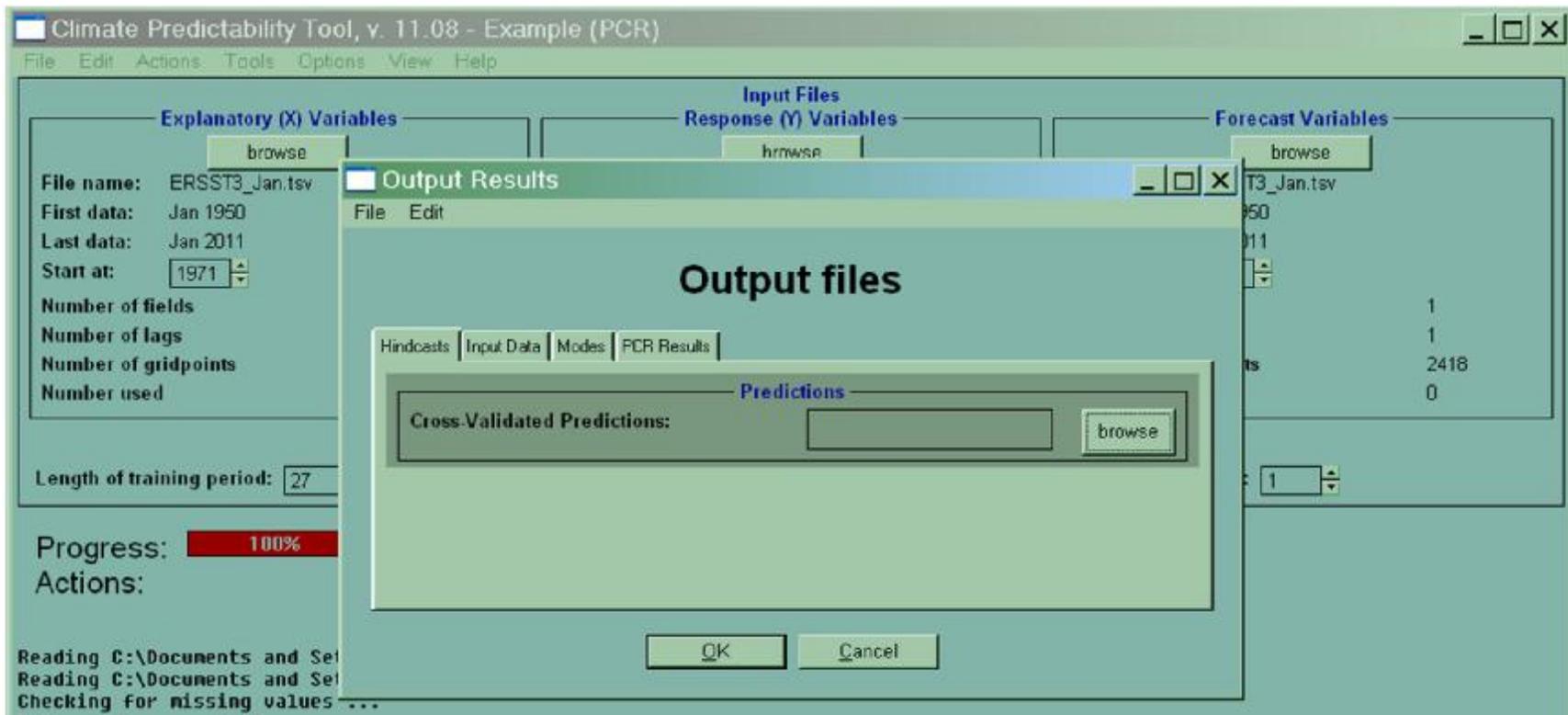


The menu **File** ~ **Output Results** ~ **Output Results** allows you to save output data:

1. Cross-validated forecasts
2. The input data (with the missing values filled)
3. EOFs: time series, loading patterns, variance
4. The parameters (coefficients) of the model (example: $Y = \underline{a}x + \underline{b}$)



SAVING OUTPUT FILES



In order to save the outputs you have to specify a file name by clicking on browse. By default CPT saves the output files under: **C:\Documents and settings\user\Application Data\CPT\Output**



FORECAST

The screenshot shows the 'Climate Predictability Tool, v. 11.08 - Principal Components Regression' window. It features a menu bar (File, Edit, Actions, Tools, Options, View, Help) and three main sections: 'Explanatory (X) Variables', 'Input Files Response (Y) Variables', and 'Forecast Variables'. The 'Forecast Variables' section is circled in red. Below these sections are 'Training data' settings and a progress indicator.

| Section | File name | First data | Last data | Start at | Number of fields | Number of lags | Number of gridpoint | Number used |
|------------------------------------|------------------|------------|-----------|----------|------------------|----------------|---------------------|-------------|
| Explanatory (X) Variables | ERSST3_Jan.tsv | Jan 1950 | Jan 2011 | 1971 | 1 | 1 | 2418 | 0 |
| Input Files Response (Y) Variables | NE_Brazil_v9.txt | FMA 1971 | FMA 1997 | 1971 | 1 | 1 | 71 | 0 |
| Forecast Variables | ERSST3_Jan.tsv | Jan 1950 | Jan 2011 | 2011 | 1 | 1 | 2418 | 0 |

Training data: Length of training period: 27, Length of cross-validation window: 5, Number of forecasts: 1

Progress: 0%

Actions:

Once your model is built, you can make a forecast using a forecast file with new records of the X variables stored in a “**forecast file**”. By default CPT selects the same input predictor file as the X file. You can change it by clicking **browse**.



FORECAST

Climate Predictability Tool, v. 11.08 - Principal Components Regression

File Edit Actions Tools Options View Help

| Explanatory (X) Variables | | Input Files Response (Y) Variables | | Forecast Variables | |
|---------------------------|----------------|---------------------------------------|------------------|---------------------|----------------|
| File name: | ERSST3_Jan.tsv | File name: | NE_Brazil_v9.txt | File name: | ERSST3_Jan.tsv |
| First data: | Jan 1950 | First data: | FMA 1971 | First data: | Jan 1950 |
| Last data: | Jan 2011 | Last data: | FMA 1997 | Last data: | Jan 2011 |
| Start at: | 1971 | Start at: | 1971 | Start at: | 2011 |
| Number of fields | 1 | Number of fields | 1 | Number of fields | 1 |
| Number of lags | 1 | Number of lags | 1 | Number of lags | 1 |
| Number of gridpoint | 2418 | Number of stations | 71 | Number of gridpoint | 2418 |
| Number used | 0 | Number used | 0 | Number used | 0 |

Length of training period: 27 Length of cross-validation window: 5 Number of forecasts: 1

Progress: 0%

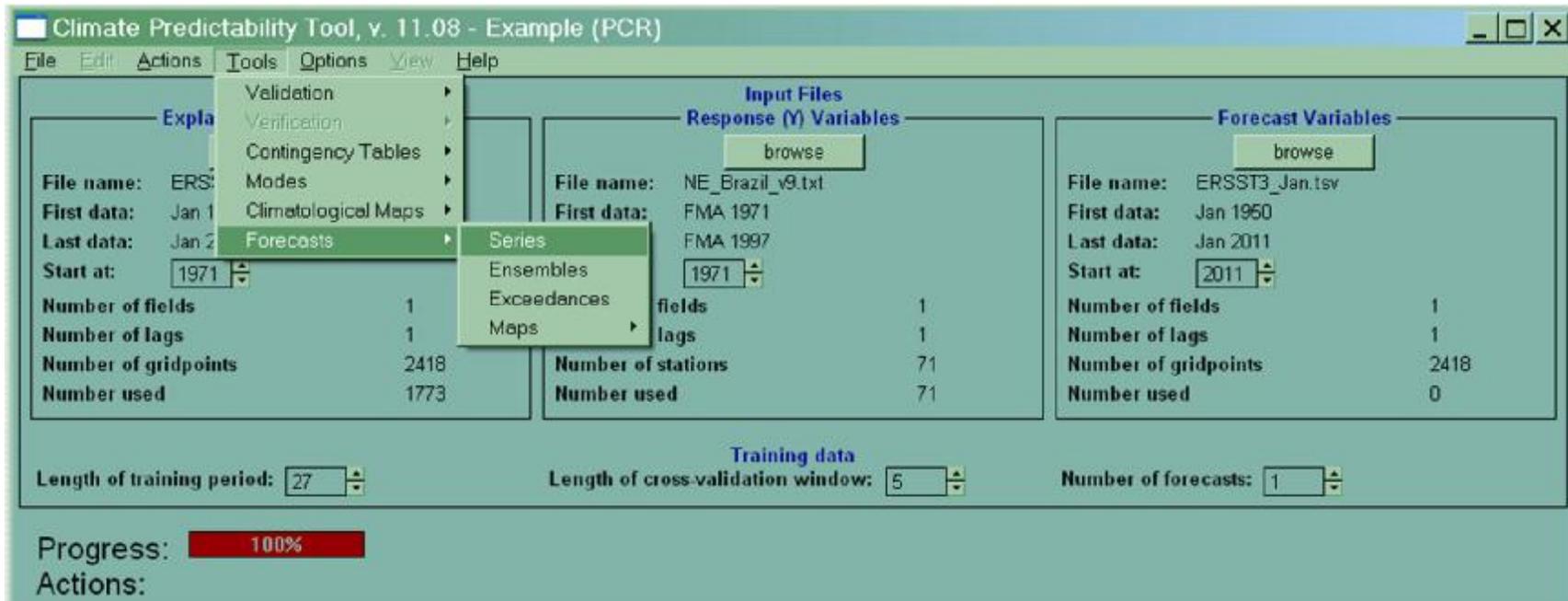
Actions:

You then select:

1. the starting year of the forecasts (the year is for the predictors not the predictand – for example if you are forecasting JFM 2012 from December 2011 SSTs, the year should be 2011).
2. the number of years to forecast



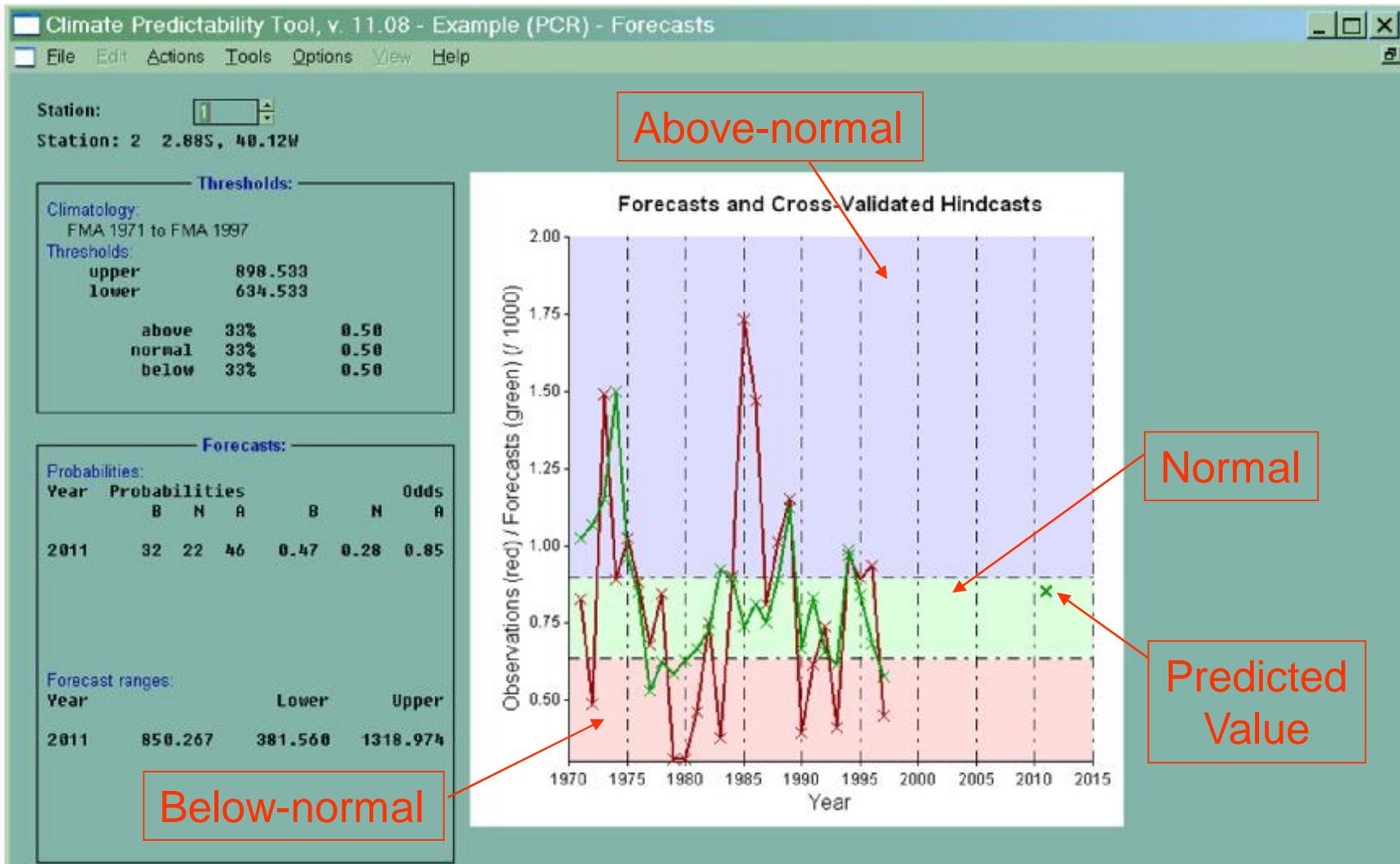
FORECAST



Once the file is selected and the years to forecast are chosen go to the menu **Tools ~ Forecast ~ Series** or **Maps**.



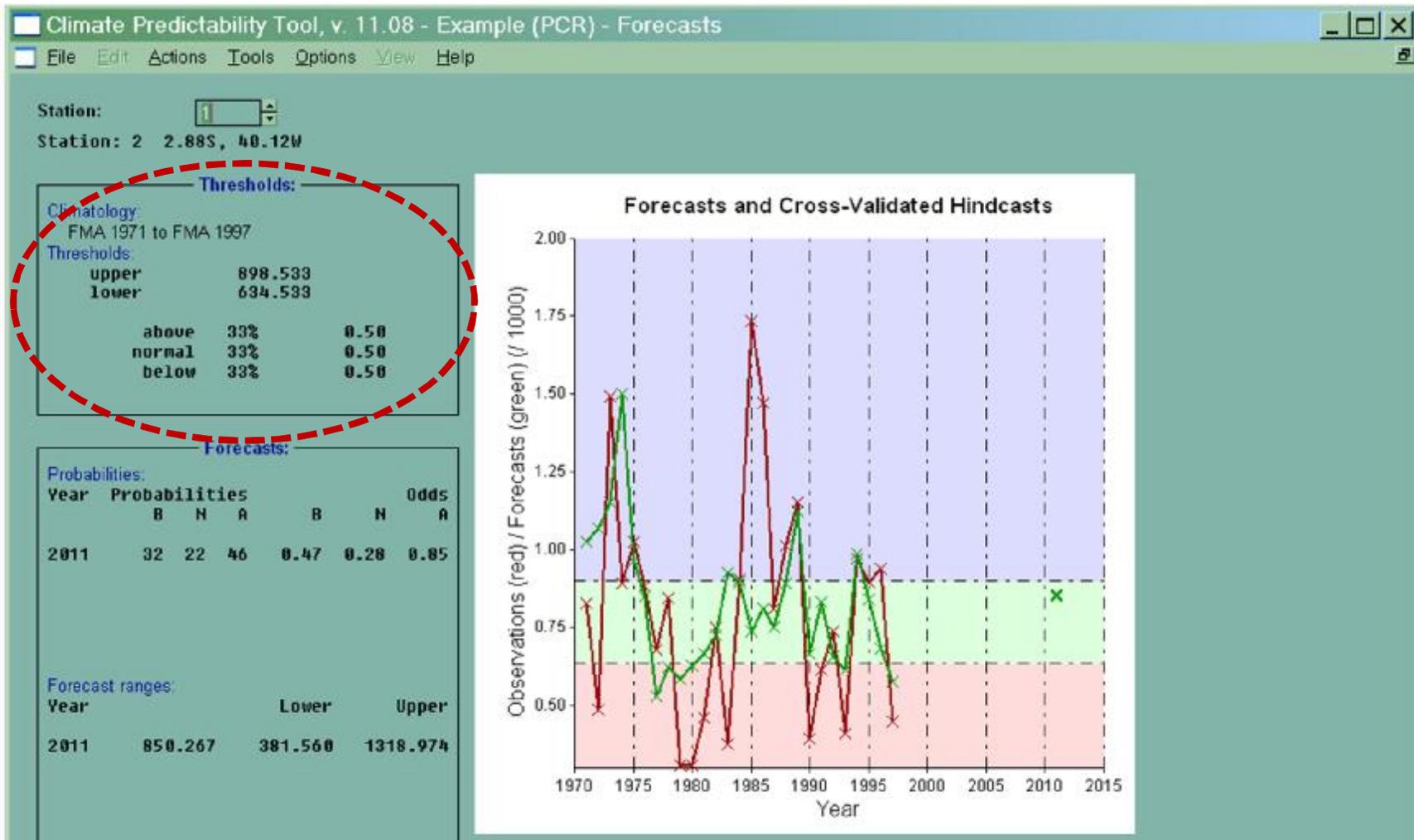
FORECAST



The option **Series** shows a graph of the cross-validated forecasts (green line) and the prediction (cross) for the current station, as well as detailed information about the forecast.



FORECAST



The “Thresholds” box indicates the definitions of below- and above-normal (less than the lower threshold and more than the upper threshold, respectively.) The climatological probabilities and odds of each of the three categories are shown.



CHANGING CATEGORY DEFINITIONS

The screenshot shows the 'Climate Predictability Tool, v. 11.08 - Example (PCR) - Forecasts' window. The main window displays station information (Station: 2, 2.88S, 48.12W) and two tables: 'Thresholds' and 'Forecasts'. The 'Thresholds' table shows climatological data for FMA 1971 to FMA 1997, with upper and lower thresholds at 898.533 and 634.533 respectively, and probabilities of 33% for above, normal, and below categories. The 'Forecasts' table shows probabilities for the year 2011, with values 32, 22, 46 for categories B, N, A, and odds of 0.47, 0.28, 0.85. A 'Tailoring' dialog box is open, allowing users to select a standardization method (No standardization, Anomalies, Standardized anomalies), set climatological probabilities for 'above' and 'below' categories (both set to 0.333333), define absolute thresholds (upper: 200, lower: 100), and specify analogue years (both set to 1971). The dialog box has 'OK' and 'Cancel' buttons.

Station: 1
Station: 2 2.88S, 48.12W

Thresholds:

Climatology:
FMA 1971 to FMA 1997

Thresholds:

| | |
|-------|---------|
| upper | 898.533 |
| lower | 634.533 |

above 33% 0.50
normal 33% 0.50
below 33% 0.50

Forecasts:

Probabilities:

| Year | Probabilities | | | Odds | | |
|------|---------------|----|----|------|------|------|
| | B | N | A | B | N | A |
| 2011 | 32 | 22 | 46 | 0.47 | 0.28 | 0.85 |

Forecast ranges:

| Year | Lower | Upper |
|------|---------|----------|
| 2011 | 850.267 | 1318.974 |

Tailoring

Standardization:

Select method:

- No standardization
- Anomalies
- Standardized anomalies

Thresholds:

Probabilities:

Climatological probabilities of outer categories:

above: 0.333333
below: 0.333333

Absolute thresholds:

Absolute thresholds:

upper: 200
lower: 100

Analogues:

Analogues:

Analogue 1: 1971
Analogue 2: 1971

OK Cancel

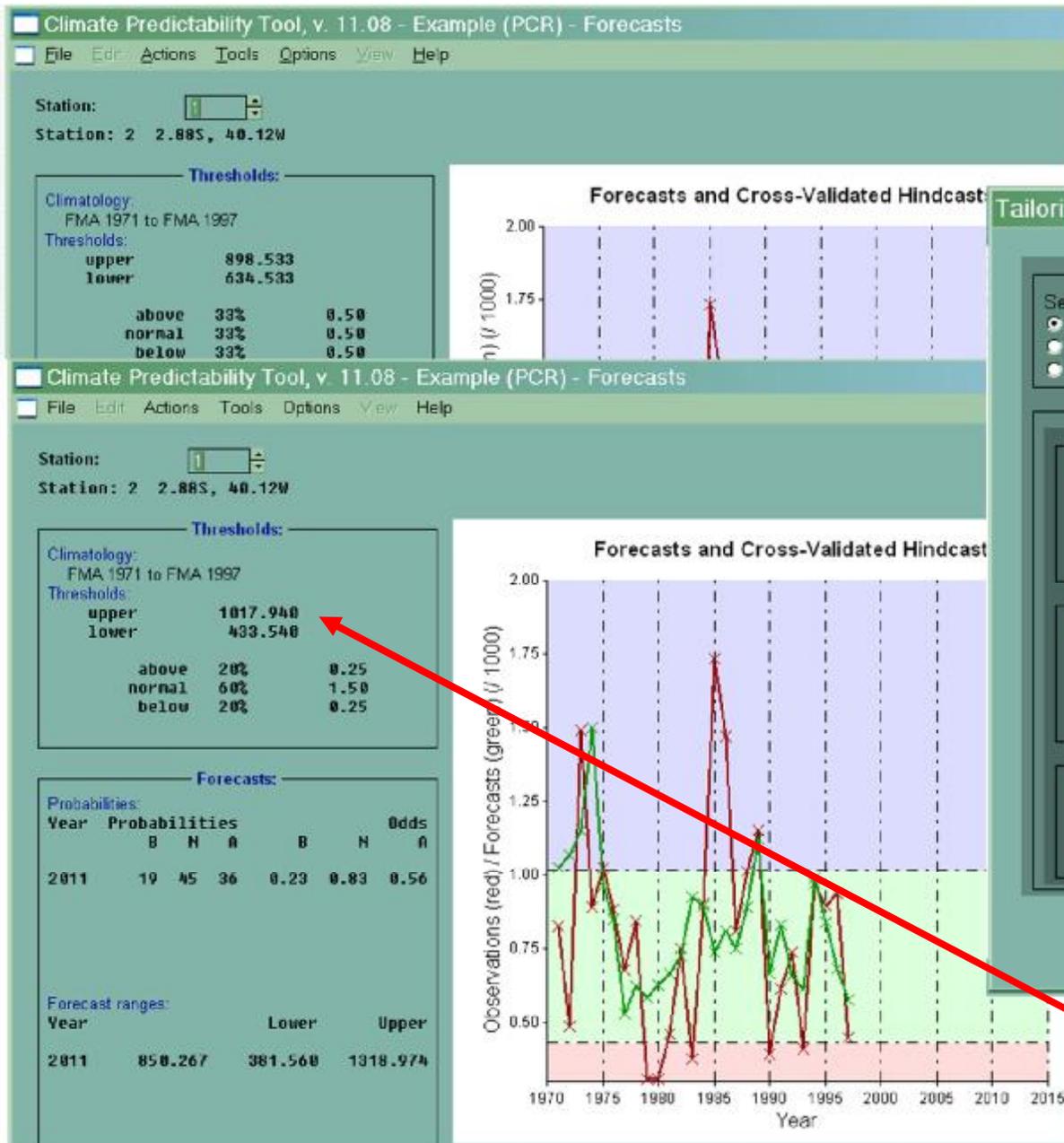
There are three ways to change how the categories are defined.

Options ~ Tailoring



CHANGING CATEGORY DEFINITIONS

1. Change the climatological probabilities



Tailoring

Standardization:

Select method:

- No standardization
- Anomalies
- Standardized anomalies

Thresholds:

Probabilities:

Climatological probabilities of outer categories:

above: 0.2

below: 0.2

Absolute thresholds:

Absolute thresholds:

upper: 200

lower: 100

Analogues:

Analogues:

Analogue 1: 1971

Analogue 2: 1971

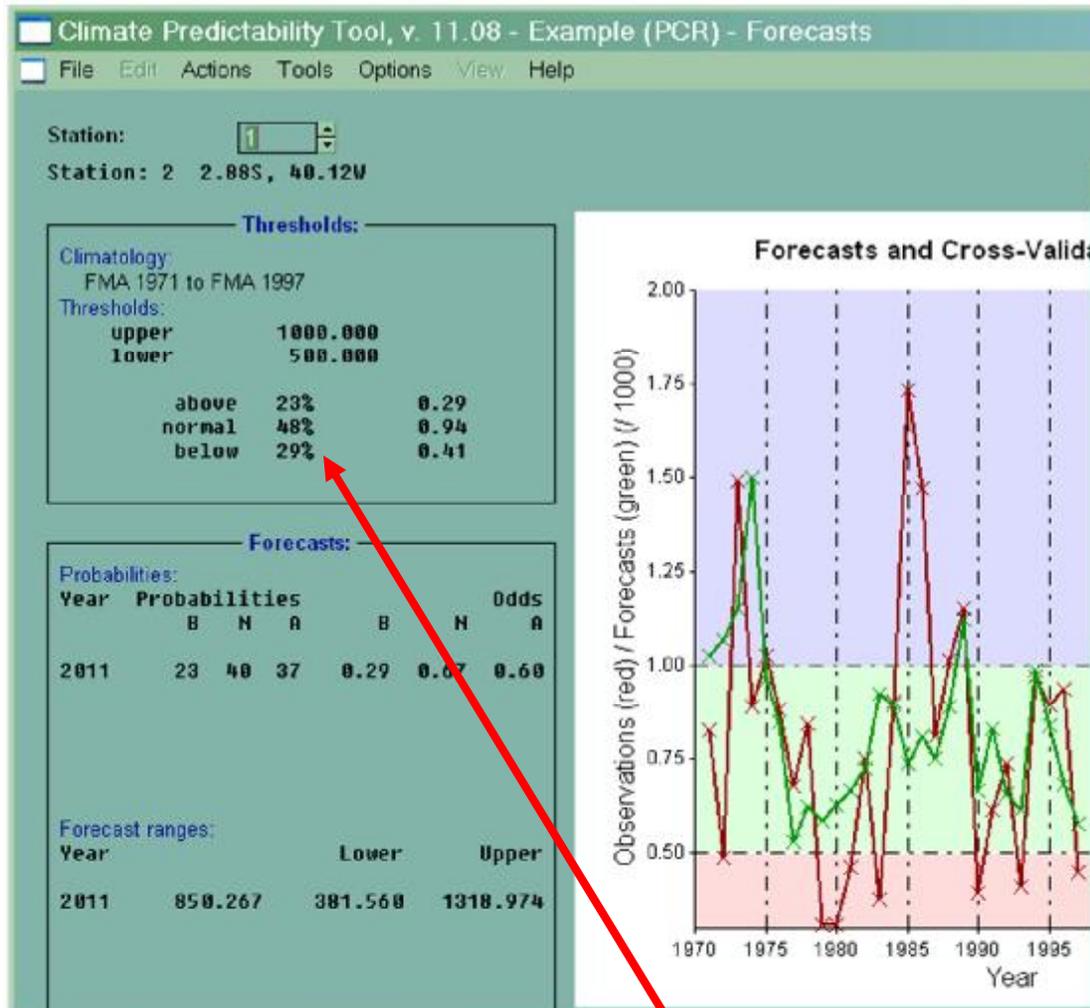
OK Cancel

CPT recalculates the thresholds



CHANGING CATEGORY DEFINITIONS

2. Define the actual thresholds



Tailoring

Standardization:
Select method:
 No standardization
 Anomalies
 Standardized anomalies

Thresholds:
Probabilities:
 Climatological probabilities of outer categories:
above: 0.2
below: 0.2

Absolute thresholds:
 Absolute thresholds:
upper: 1000
lower: 500

Analogues:
 Analogues:
Analogue 1: 1971
Analogue 2: 1971

OK Cancel

CPT recalculates the climatological probabilities



CHANGING CATEGORY DEFINITIONS

3. Set analogue years

Climate Predictability Tool, v. 11.08 - Example (PCR) - Forecasts

Station: 2 2.88S, 40.12W

Thresholds:
 Climatology: FMA 1971 to FMA 1997
 upper: 1733.500 (1985)
 lower: 395.000 (1990)
 above: 4% 0.04
 normal: 82% 4.60
 below: 14% 0.17

Forecasts:

| Year | Probabilities | | | Odds | | |
|------|---------------|----|---|------|------|------|
| | B | N | A | B | N | A |
| 2011 | 17 | 80 | 3 | 0.20 | 4.04 | 0.03 |

Forecast ranges:

| Year | Lower | Upper |
|------|---------|----------|
| 2011 | 850.267 | 1318.974 |

Forecasts and Cross-Validation

Observations (red) / Forecasts (green) (1000)

Year

Tailoring

Standardization:
 Select method:
 No standardization
 Anomalies
 Standardized anomalies

Thresholds:

Probabilities:
 Climatological probabilities of outer categories:
 above: 0.2
 below: 0.2

Absolute thresholds:
 Absolute thresholds:
 upper: 1000
 lower: 500

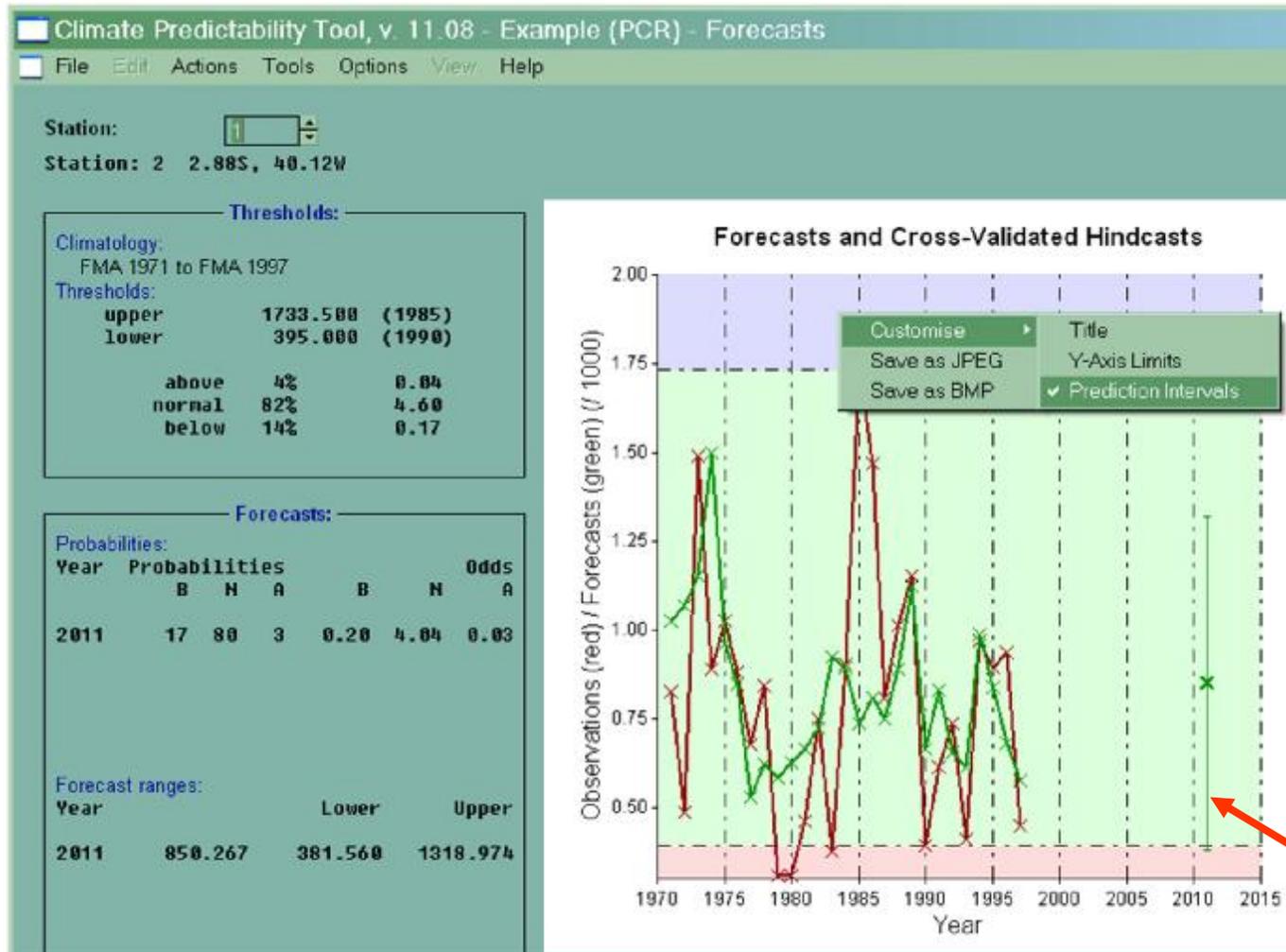
Analogues:
 Analogues:
 Analogue 1: 1985
 Analogue 2: 1990

OK Cancel

CPT recalculates the thresholds, and the climatological probabilities and odds



PREDICTION INTERVALS



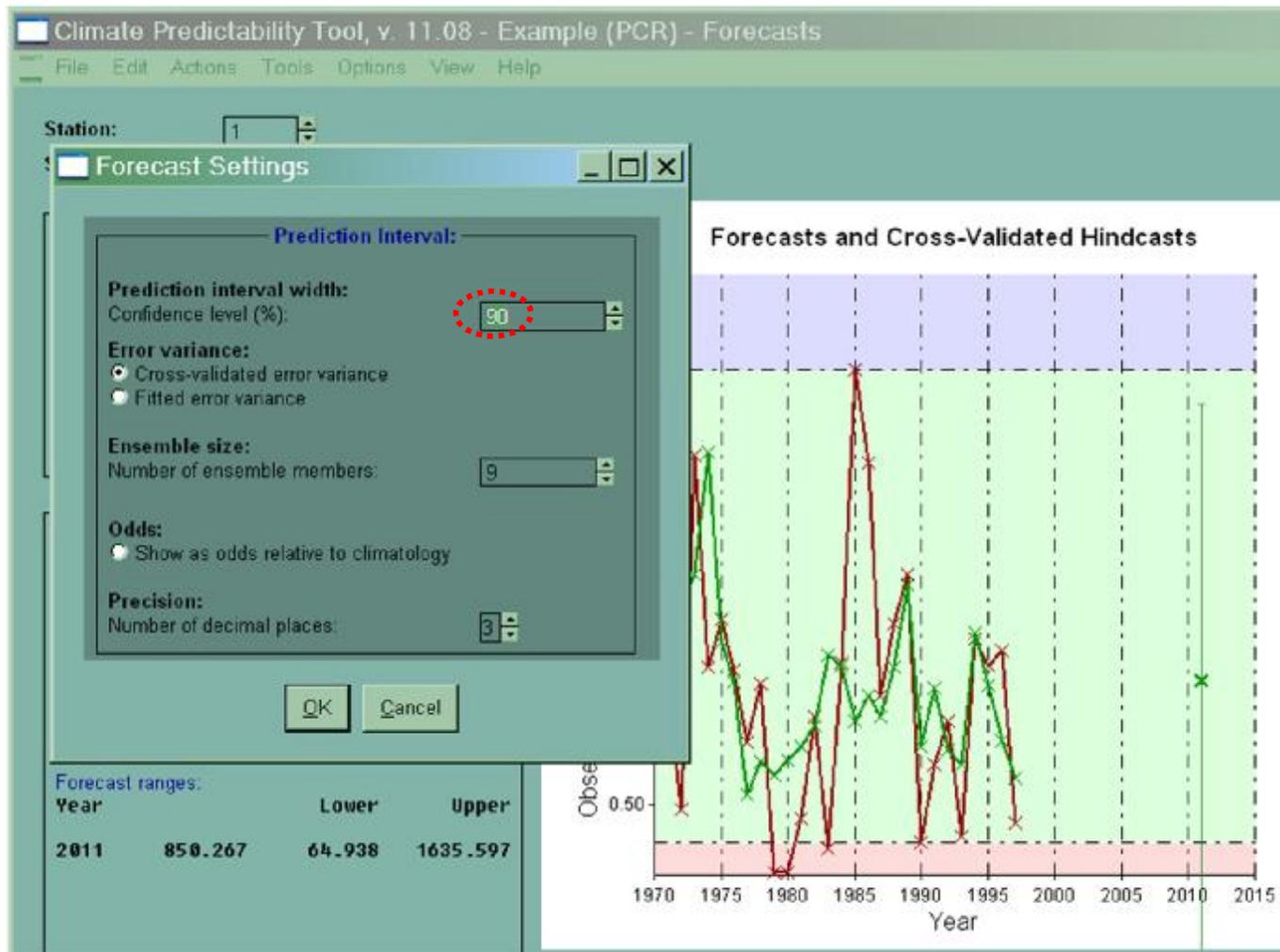
To draw error bars on the forecast, right click on the graph:

Customize ~ Prediction Intervals

An error bar is indicated.



CHANGING THE PREDICTION INTERVAL



You can also change the width of the prediction interval.
Options ~ Forecast Settings ~ Prediction interval width
The default setting of 68.3% gives standard error bars.



EXPRESSING THE FORECAST AS ANOMALIES

Climate Predictability Tool, v. 11.08 - Example (PCR) - Forecasts

File Edit Actions Tools Options View Help

Station: 1
Station: 2 2.88S, 40.12W

Thresholds:

Climatology:
FMA 1971 to FMA 1997

Thresholds:

| | |
|--------|----------|
| upper | 210.459 |
| lower | -379.941 |
| above | 20% 0.25 |
| normal | 60% 1.50 |
| below | 20% 0.25 |

Forecasts:

Probabilities:

| Year | Probabilities | | | Odds | | |
|------|---------------|----|----|------|------|------|
| | B | N | A | B | N | A |
| 2011 | 19 | 45 | 36 | 0.23 | 0.83 | 0.56 |

Forecast ranges:

| Year | Lower | Upper |
|------|--------|---------|
| 2011 | 42.786 | 511.493 |

Forecasts and Cross

Tailoring

Standardization:

Select method:

- No standardization
- Anomalies
- Standardized anomalies

Thresholds:

Probabilities:

Climatological probabilities of outer categories:

above: 0.2

below: 0.2

Absolute thresholds:

Absolute thresholds:

upper: 1000

lower: 500

Analogues:

Analogues:

Analogue 1: 1985

Analogue 2: 1990

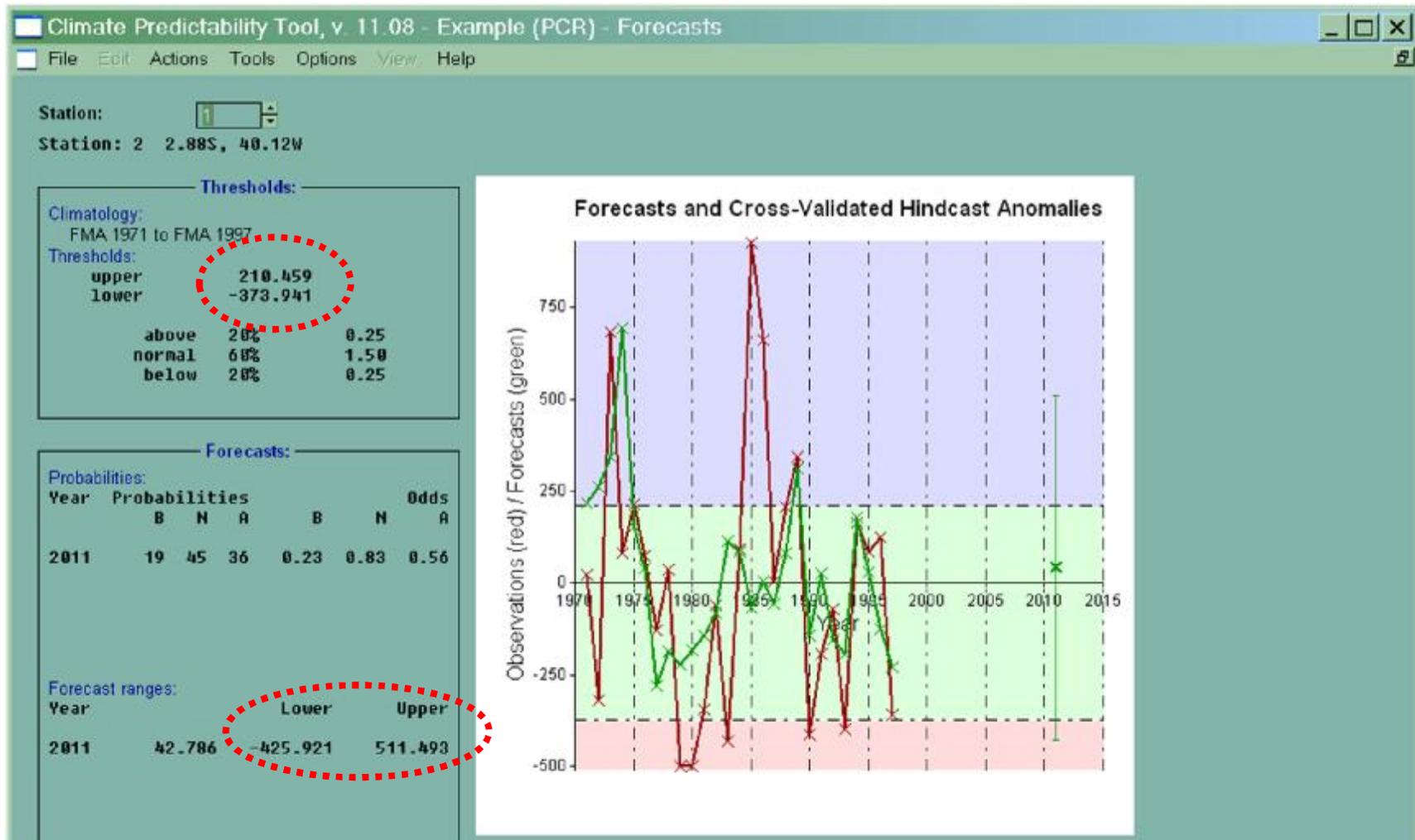
OK Cancel

The forecast can be expressed as anomalies,
rather than absolute values:

Options ~ Forecast Settings ~ Standardization ~ Anomalies



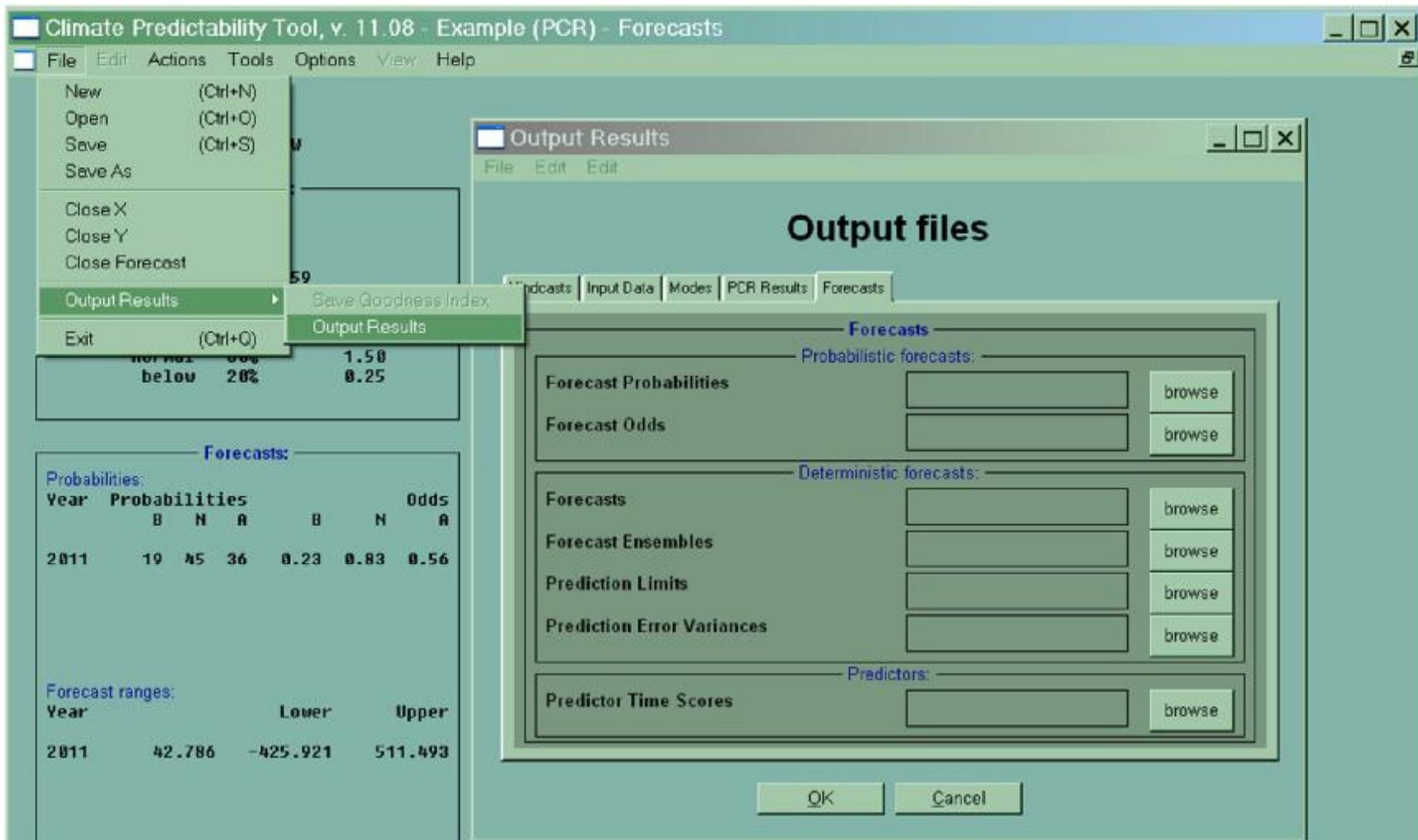
EXPRESSING THE FORECAST AS ANOMALIES



The thresholds, as well as the forecast ranges, are now defined as anomalies.



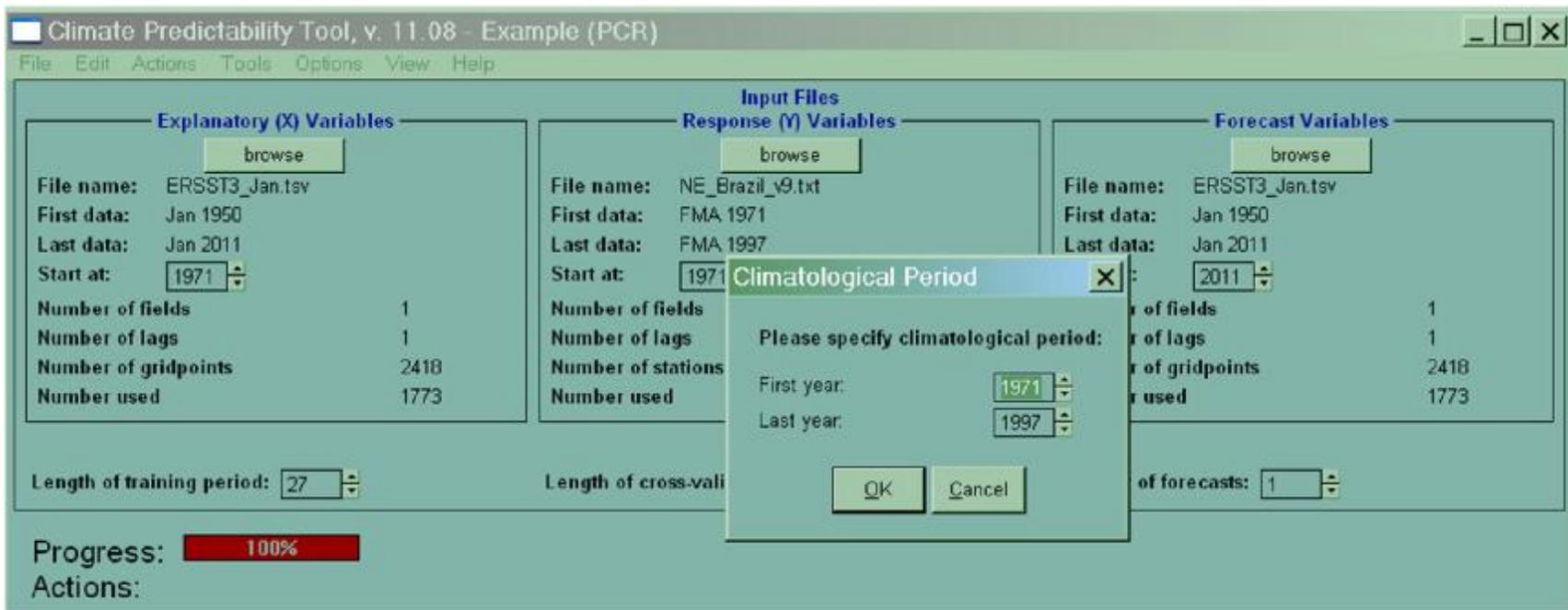
SAVING FORECASTS



To save the forecasts, go to
File ~ Output Results ~ Output Results
and on the **Forecasts** tab specify the required output files.



CHANGING THE CLIMATOLOGICAL PERIOD

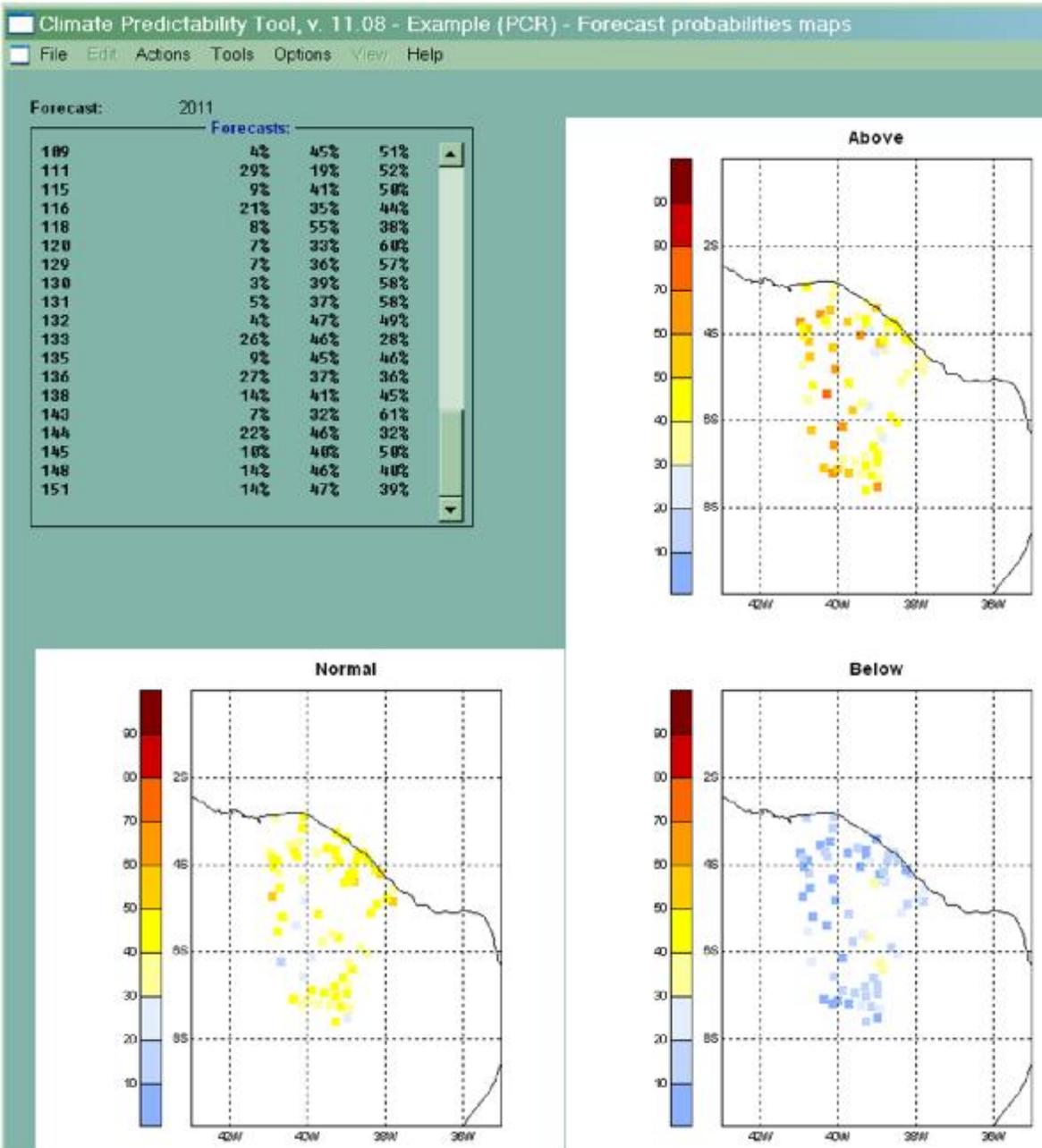


By default, the forecast probabilities are calculated relative to a climatological period that is the same as the training period. To change the climatological period go to:

Options ~ Climatological Period



FORECAST MAPS



Tools ~ Forecast ~ Maps

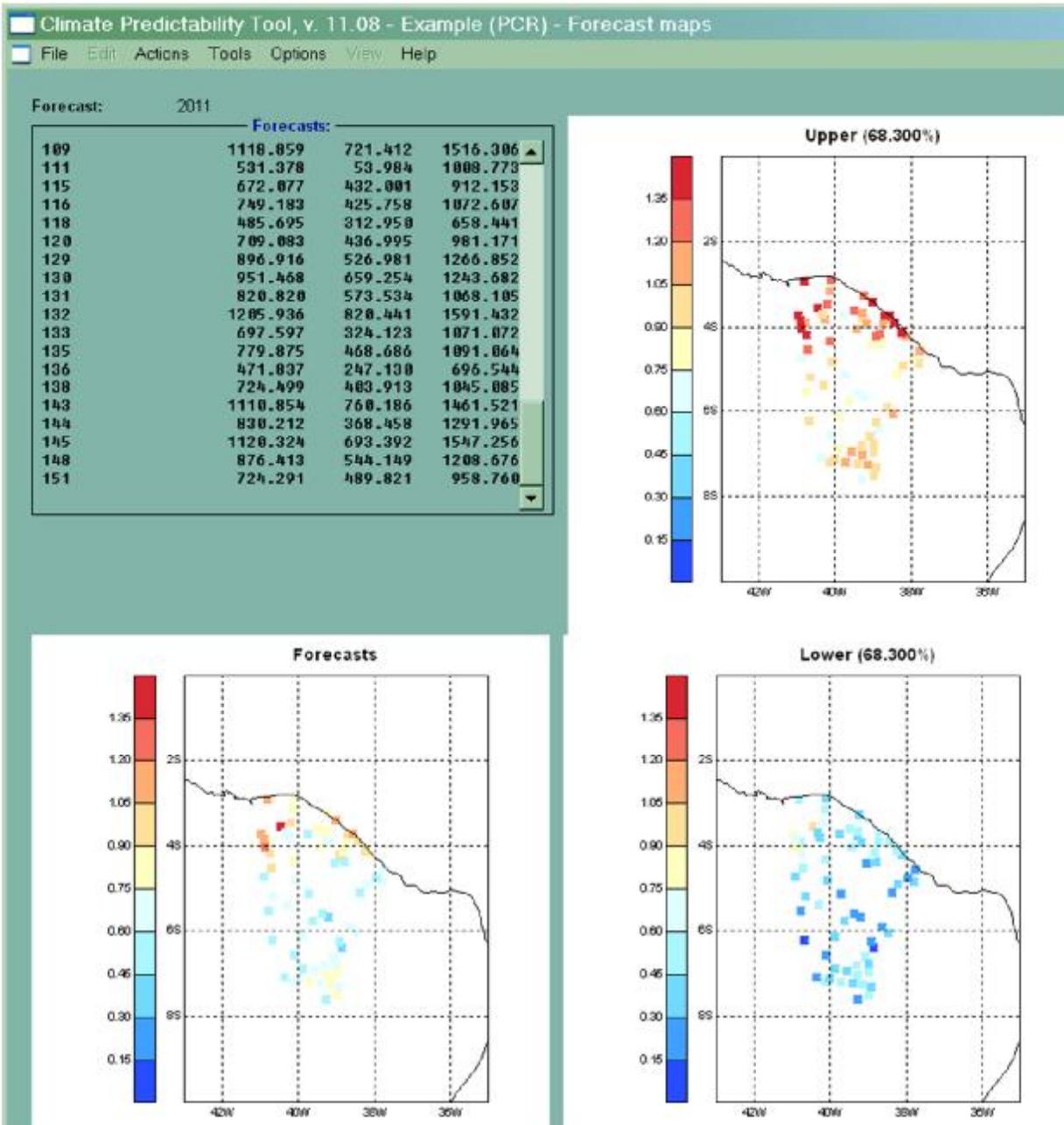
The option **Maps** lets you see maps of your forecasts – either maps of the probabilities or maps of the actual forecast values.

The forecast probabilities map lists the probabilities for each category at each location as well as the spatial distribution of the probabilities.

In this example, the below-normal category has the lowest probability over most of north-east Brazil.



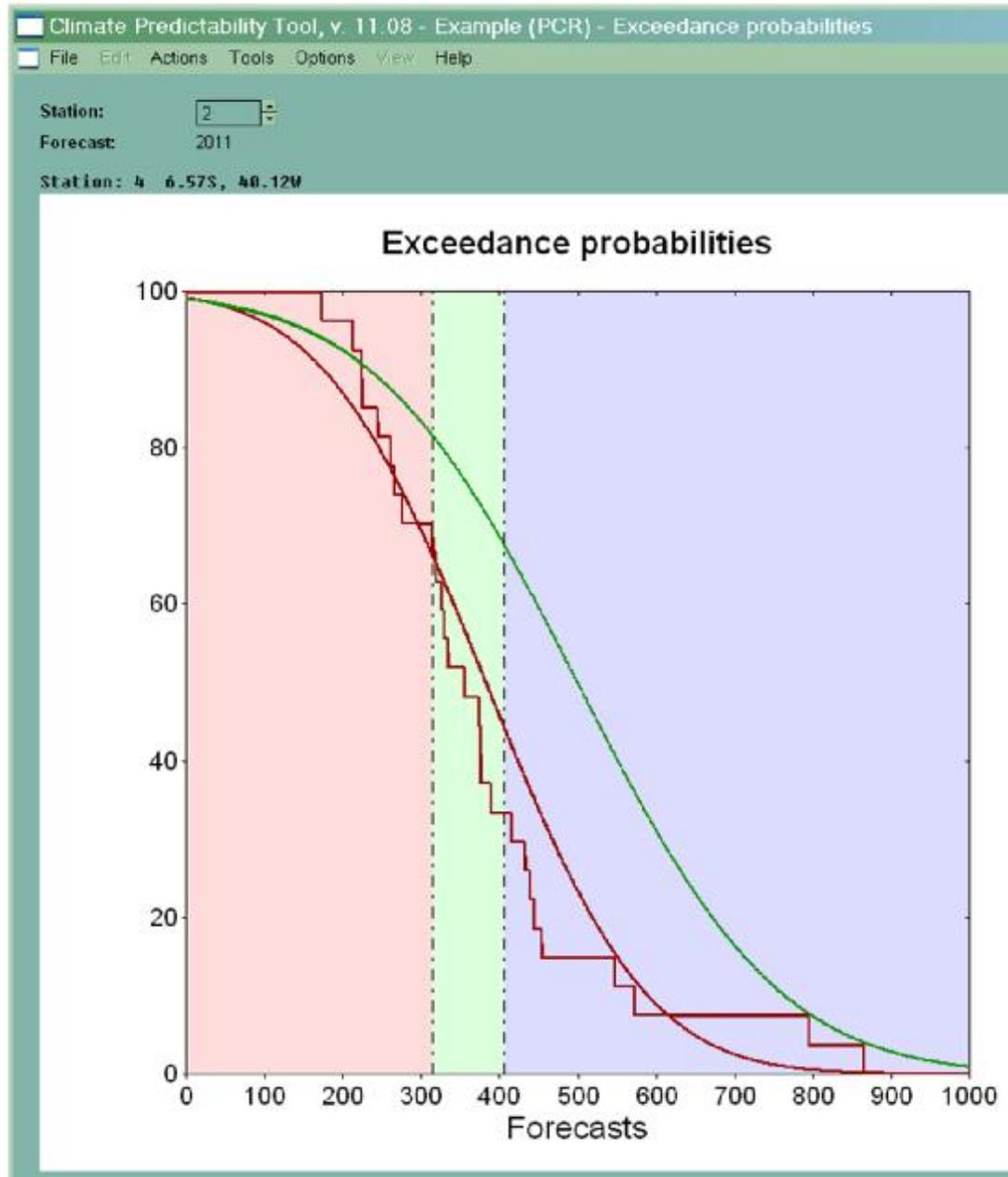
FORECAST MAPS



The forecast values map lists the actual forecast values for each category at each location as well as the spatial distribution of the values.



EXCEEDANCE PROBABILITIES



To draw the probabilities of exceedance go to:
Tools ~ Forecast ~ Exceedances



CONCLUSIONS

- For further details, read the help page of each menu and option.
- Subscribe to the user-list to be advised of updates:
<http://iri.columbia.edu/climate/tools/CPT/>
- We want to hear from you. Your comments and questions help us to improve the CPT so do not hesitate to write to us at:
cpt@iri.columbia.edu

