ClimateBC v3.2

A program to generate climate normal, decade, annual, seasonal and monthly data for genecology and climate change studies in British Columbia.

Tongli Wang, Andreas Hamann and Sally N. Aitken

UBC, Department of Forest Science
Centre for Forest Gene Conservation

Dave Spittlehouse
Research Branch, BC Ministry of Forests

May 31, 2007

Contact: tongli.wang@ubc.ca

About this program

ClimateBC v.3.2 is a standalone MS Windows® application written in Visual Basic 6.0. It extracts and downscales PRISM (Daly et al. 2002) 1961-1990 monthly normal data (2.5 x 2.5 arcmin) to scale-free and calculates seasonal and annual climate variables for specific locations based on latitude, longitude and elevation (optional). The coverage of ClimateBC includes British Columbia, Yukon Territories, the Alaska Panhandle, and part of Alberta and US (Figure 1). The program uses the scale-free data as baseline in combination with monthly variability data (Mitchell and Jones 2005) of individual years to calculate historical monthly, seasonal and annual climate variables for individual years and periods between 1901-2002. This program also downscales and integrates future climate datasets for 2020s (2010-2039), 2050s (2040-69) and 2080s (2070-2099) generated by various global circulation models. The output of the program includes both

directly calculated and derived climate variables. Downscaling of PRISM monthly data including bilinear interpolation and elevation adjustment, and calculations of climate variables and estimation of derived climate variables are described in Wang et al. (2006) and Hamann and Wang (2005).

Figure 1. The coverage of the PRISM data.

Climate variables predicted

1) **Annual variables:**

Directly calculated variables:

MAT	mean annual temperature (°C),
MWMT	mean warmest month temperature (°C),
MCMT	mean coldest month temperature (°C),
TD	temperature difference between MWMT and MCMT, or continentality (°C),
MAP	mean annual precipitation (mm),

MSP	mean annual summer (May to Sept.) precipitation (mm),
AH:M	annual heat:moisture index (MAT+10)/(MAP/1000))
SH:M	summer heat:moisture index ((MWMT)/(MSP/1000))

Derived variables:

DD<0	degree-days below 0°C, chilling degree-days
DD>5	degree-days above 5°C, growing degree-days
$DD5_{100}$	the Julian date on which DD>5 reaches 100, the date of budburst for most plants
DD<18	degree-days below 18°C, heating degree-days
DD>18	degree-days above 18°C, cooling degree-days
NFFD	the number of frost-free days
FFP	frost-free period
bFFP	the Julian date on which FFP begins
eFFP	the Julian date on which FFP ends
PAS	precipitation as snow (mm)
EMT	extreme minimum temperature over 30 years

2) Seasonal variables:

TAV_wt	winter mean temperature (°C)
TAV_sp	spring mean temperature (°C)
TAV_sm	summer mean temperature (°C)
TAV_at	autumn mean temperature (°C)
TMAX_wt	winter mean maximum temperature (°C)
TMAX_sp	spring mean maximum temperature (°C)
TMAX_sm	summer mean maximum temperature (°C)
TMAX_at	autumn mean maximum temperature (°C)
TMIN_wt	winter mean minimum temperature (°C)
TMIN_sp	spring mean minimum temperature (°C)
TMIN_sm	summer mean minimum temperature (°C)
TMIN_at	autumn mean minimum temperature (°C)
PPT_wt	winter precipitation (mm)
PPT_sp	spring precipitation (mm)
PPT_sm	summer precipitation (mm)
PPT_at	autumn precipitation (mm)

3) Monthly variables

TAV01 – TAV12	January - December mean temperatures (°C)
TMX01 – TMX12	January - December maximum mean temperatures (°C)
TMN01 – TMN12	January - December minimum mean temperatures (°C)
PPT01 – PPT12	January - December precipitation (mm)

How to install

No installation is required. Simply copy all two files ("ClimateBC_v3.2.exe" and "Help.rtf") and the three subfolders ("Prismdat", "Perioddat", GCMdat") to the same location on your hard disk and double click the file ClimateBC_v3.2.exe", or directly run from CD (Note that the program will run much faster from a hard drive).

How to use

1) Use the program interactively

Latitude and longitude can be entered in either decimal degrees (e.g. Lat: 51.542, Long: 129.333) or degree, minute and second (e.g., 51°30'15"N, 129°15'30'W). Longitude information is accepted either in positive or negative values. Elevation has to be entered in meters, or empty if no elevation data available. If monthly or seasonal time scale was selected, an additional output sheet appears and annual climate variables are still calculated.

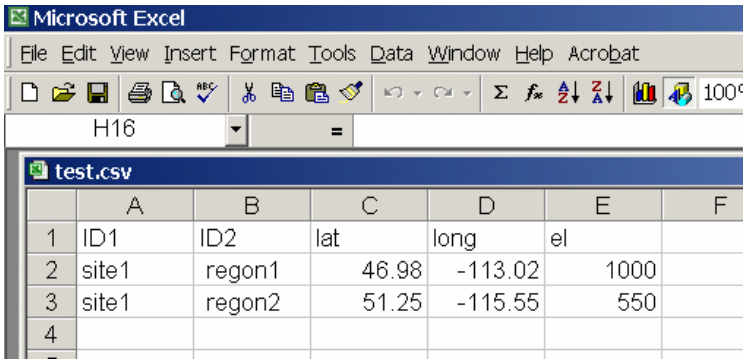
2) For multi-location process

- Most users will have their sample data information in an Excel spreadsheet or in a text file. To make it possible for the program to read this data it must first be modified to a standard format.

- Create a spreadsheet with the headers "ID1, ID2, lat, long, el" as shown in the example below. ID1 and ID2 can be "Location", "Region" or whatever. The file must have the title row and all variables in exactly the same order as shown. If you don't have elevation information or a second ID, you have to put in "." in the columns. If you have more information columns in your original file, you have to remove them.

- If you use a GPS or GIS software to obtain your location information for many samples latitude values in the western hemisphere will be negative. For

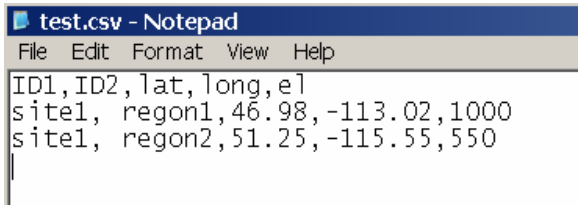
convenience, you can use either positive or negative values and the program will automatically convert the data.



	A	B	C	D	E	F
1	ID1	ID2	lat	long	el	
2	site1	regon1	46.98	-113.02	1000	
3	site1	regon2	51.25	-115.55	550	
4						

- After the spreadsheet is prepared as shown, save it as "comma delimited text file" by choosing "Save as …" form the file menu, and then specifying (*.csv) from the "Save as type …" drop down menu.

- You can also directly create a comma delimited text file in any text editor such as Notepad. If there is a missing value, you need to enter a "." between two commas.



- Save this text file with a .csv extension by writing out the full file name with extension in parenthesis when saving, e. g. "test.csv" instead of test.csv or test.

- Now you are ready for processing: Click on Select input file to read your spreadsheet and on Specify output file to specify your output file folder and file. Then, click the Calculate button. Climate variable information will be appended as additional columns to your input file. If elevation information is provided the climate variables will be elevation adjusted.

References

Wang, T., Hamann, A., Spittlehouse, D., and Aitken, S. N. 2006. Development of scale-free climate data for western Canada for use in resource management. *International Journal of Climatology*, **26**(3):383-397.

Hamann, A. & Wang, T. 2005. Models of climate normals for genecology and climate change studies in BC. *Agricultural and Forest Meteorology*, **128**: 211-221

Daly. C., Gibson. W.P., Taylor, G.H., Johnson, G.L., Pasteris, P. 2002. A knowledge-based approach to the statistical mapping of climate. *Climate Research,* **22**:99-113

Mitchell, T.D. and Jones, P.D. 2005. An improved method of constructing a database of monthly climate observations and associated high-resolution grids. *International Journal of Climatology*, **25**, 693-712.

Acknowledgements

We would like to thank Marvin Eng at the Research Branch, BC Ministry of Forests, Victoria for providing the high-resolution digital elevation models. Funding for this study was provided by the Forest Investment Account through both the BC Forest Science Program and the Forest Genetics Council of BC and a joint Strategic Grant from NSERC and the BIOCAP Canada Foundation.