

Introduction to ClimateNAr v2.0.0

Tongli Wang

Centre for Forest Conservation Genetics

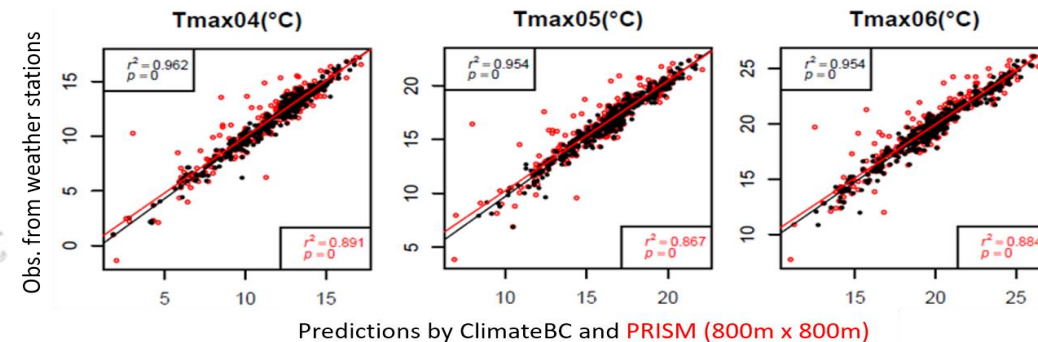
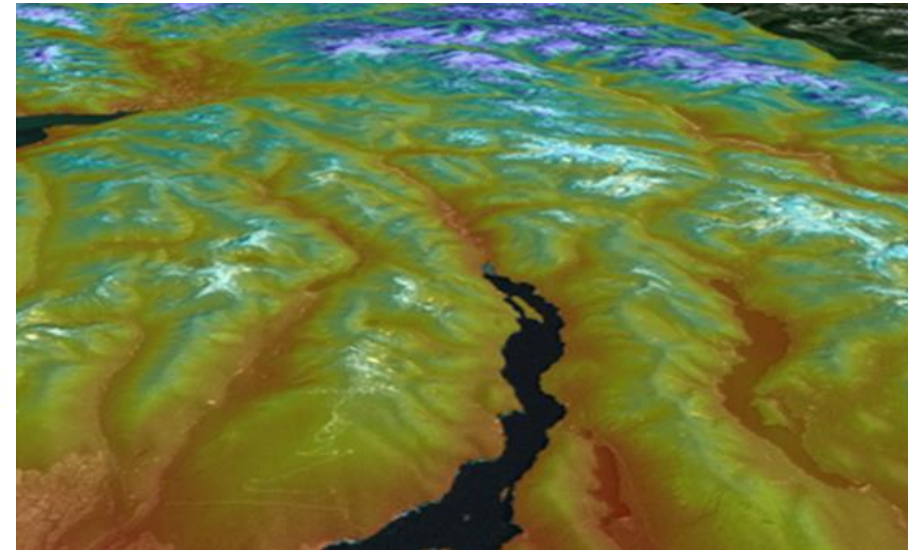
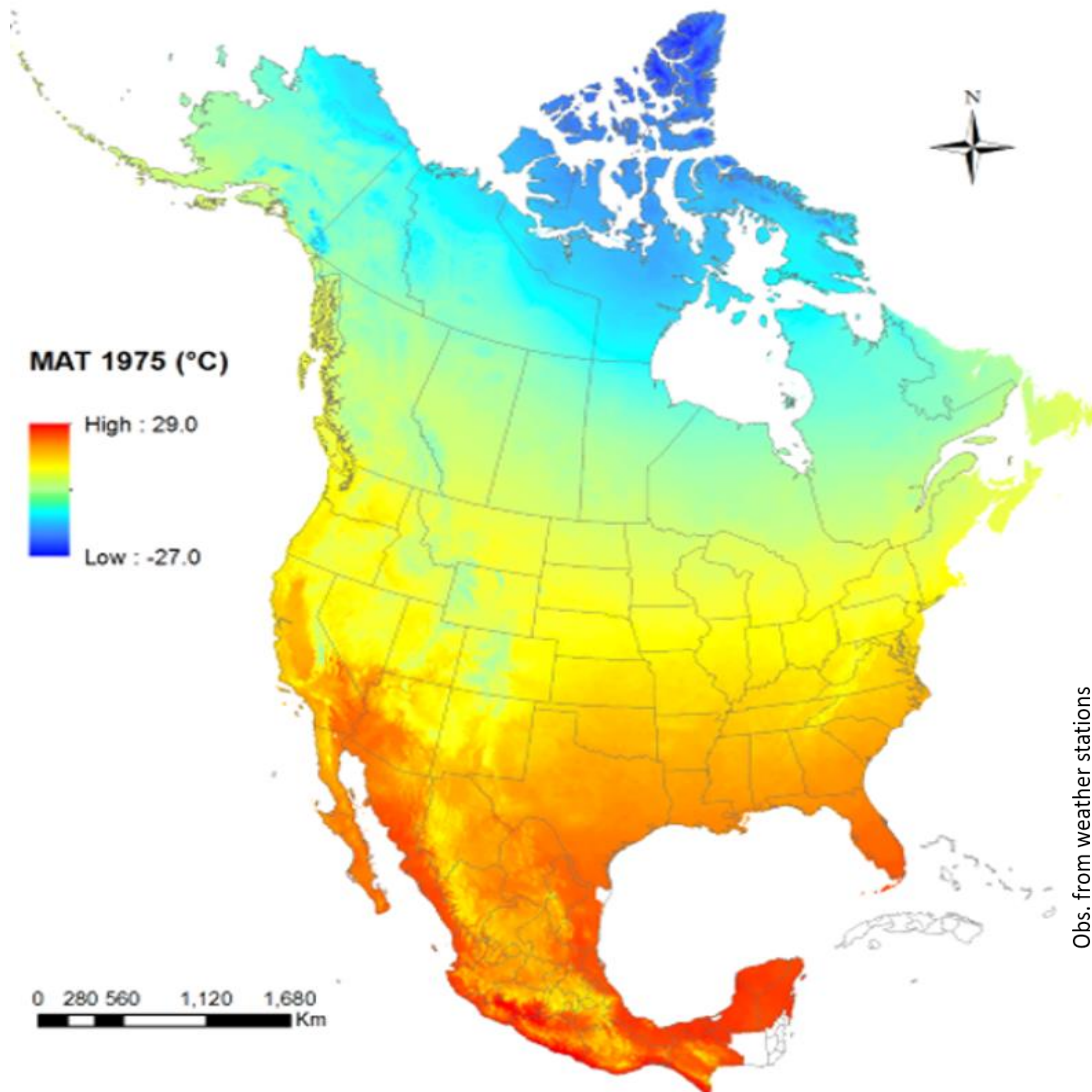
Department of Forest and Conservation Sciences

UBC, Vancouver, Canada

Outline

- Background
- Main features
- Download and installation
- Input parameters
- Return
- Examples

ClimateNA has been widely used for its **scale-free** feature



Desktop version

- Unlimited locations
- Map-in & map-out
- CMD line support

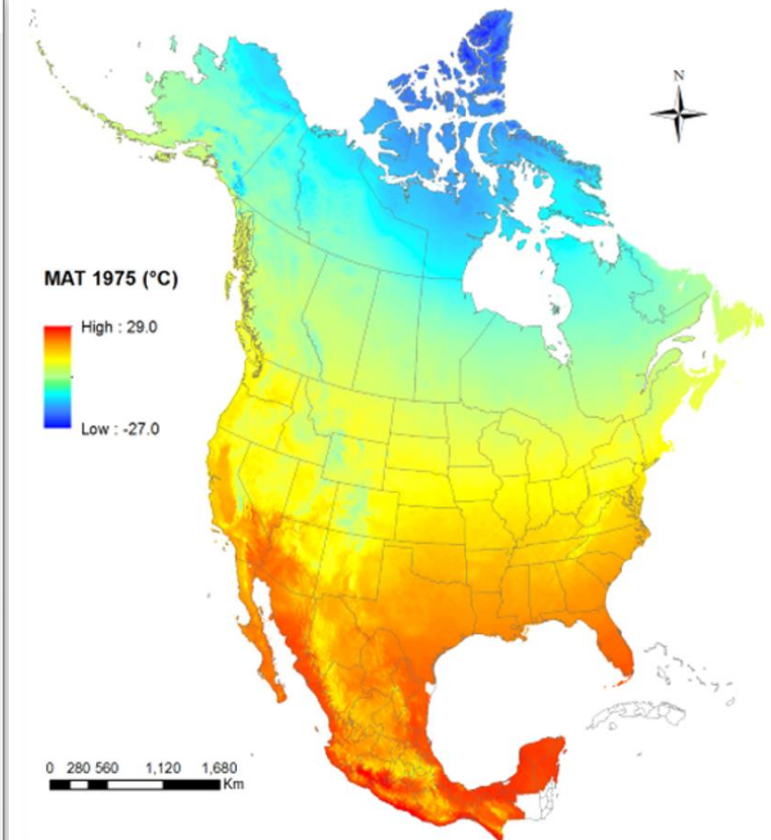
ClimateNA_v7.30 Copyright (2022) UBC. All rights reserved.

Single location ☒ Decimal ☐ Degree About Help

Latitude Elevation (m)
Longitude

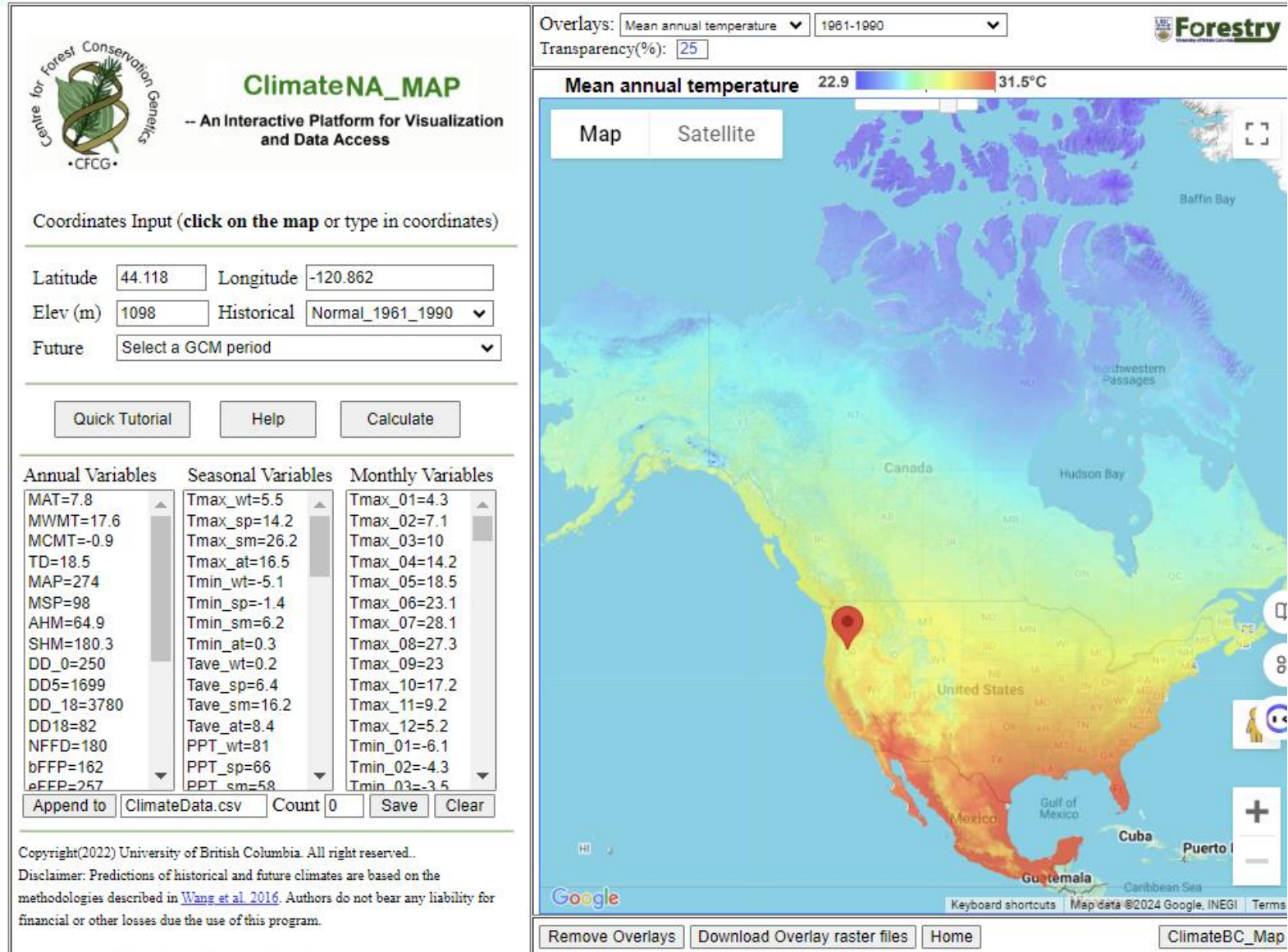
Annual variables	Seasonal variables	Monthly variables
MAT = 5.3	Tmax_wt = -0.9	Tmax(01) = -2.6
MVMT = 17.2	Tmax_sp = 11.8	Tmax(02) = 1.9
MCMT = -6.8	Tmax_sm = 24.5	Tmax(03) = 6.1
TD = 24	Tmax_at = 11.4	Tmax(04) = 12.2
MAP = 554	Tmin_wt = -9.6	Tmax(05) = 17.2
MSP = 250	Tmin_sp = -1.3	Tmax(06) = 21.6
AHM = 27.6	Tmin_sm = 7.3	Tmax(07) = 26.2
SHM = 68.7	Tmin_at = -0.7	Tmax(08) = 25.6
DD<0 = 698	Tave_wt = -5.2	Tmax(09) = 19.4
DD>5 = 1495	Tave_sp = 5.3	Tmax(10) = 11.9
DD<18 = 4666	Tave_sm = 15.9	Tmax(11) = 2.9
DD>18 = 60	Tave_at = 5.4	Tmax(12) = -2.1
NFFD = 169	PPT_wt = 149	Tmin(01) = -11
bFFP = 149	PPT_sp = 133	Tmin(02) = -8.2

Multi-location



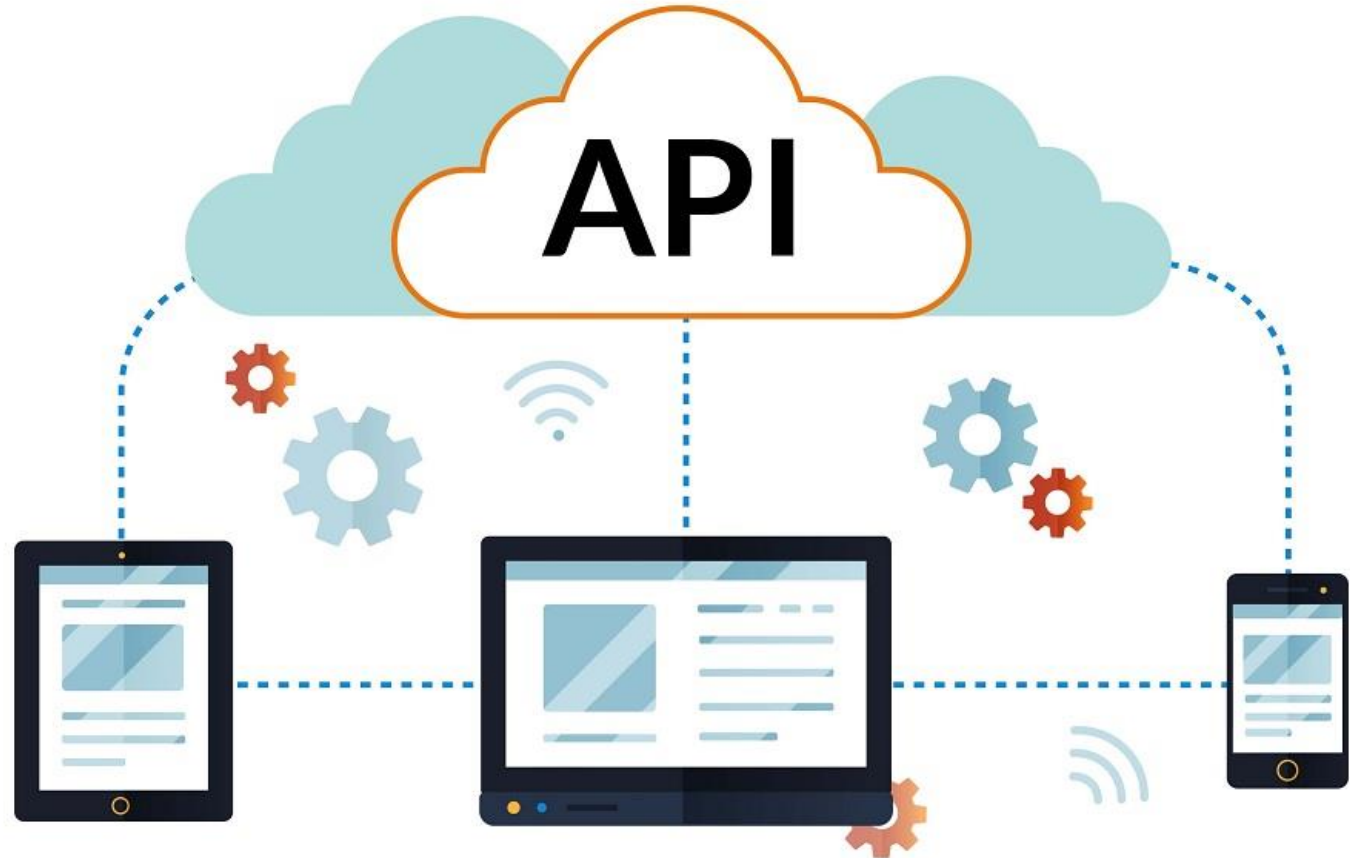
Map-based web version

- Click to get climate variables
- Visualization of spatial patterns



Web API version

- Supports various apps



R package: ClimateNAr v1.2.0

- Various R functions to help the use of ClimateNA

R Functions.....
rasterDownload
rasterStack
ClimateNA_cmdLine.....
ClimateNA_API.....
ClimateNA_API2.....
varScan

R package: ClimateNAr v2.0.0

- It includes the R version of ClimateNA, *climateNAr*
- **A significant step** in developing the functionality of ClimateNA!

Outline – Introduction of *climateNAr*

- Background
- Main features
- Download and installation
- Input parameters
- Return
- Examples

Main features

- Full integration into a programming workflow in R
 - Independent of the desktop version – working on MacOS and Linux
 - Using an external input file or an internal dataframe
- Using DEM raster files in any format
 - *.tif, *.asc, or GIS grid
- Output raster files are in *.tif format
 - Much smaller and efficient
- Output climate variables customizable
 - Choose any combination of climate variables
- Smaller package and faster processing speed
 - 165 MB in total, 1/10 of the desktop package
 - Processing speed is 10 times faster

Limitations

- High RAM demand
 - Works for 4 million locations on 32mb RAM
 - Big files require large RAM or to be split or use the desktop version
- Slow initiation
 - It needs to load all baseline data first (~1 min)
 - It is better to use ClimateNA API for <100 locations

Outline

- Background
- Main features
- **Download and installation**
- Input parameters
- Return
- Examples

Download

ClimateBC/NA Registration [Home](#) [Privacy](#) [Download](#)

[Register](#) [Login](#)

Welcome

To ClimateBC/NA registration website.

The registration process has been changed from using Mailchimp to our own registration platform for more functions, better protection of users' privacy, and lower cost.

Please register or login to access to the Download page

© 2024 - The University of British Columbia. Last update time: September 30, 2024 - [Privacy](#)

Download page

ClimateBC

The latestest version including GCMs from CMIP6: ClimateBC v7.50 package, [Click here](#)

The latestest version including GCMs from CMIP5 with paleo climate data: ClimateBC v6.40 package, [Click here](#)

ClimateNA

The latestest version including GCMs from CMIP6: ClimateNA v7.50 package, [Click here](#)

The latestest version including GCMs from CMIP5 with paleo climate data: ClimateNA v6.41 package (the bug on downscaling Tmins has been fixed), [Click here](#)

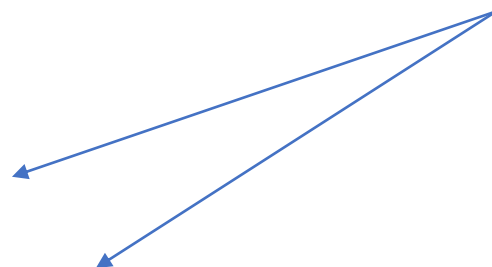
ClimateBC/NA web API

ClimateBC/NA webAPI document in PDF can be downloaded [here](#)

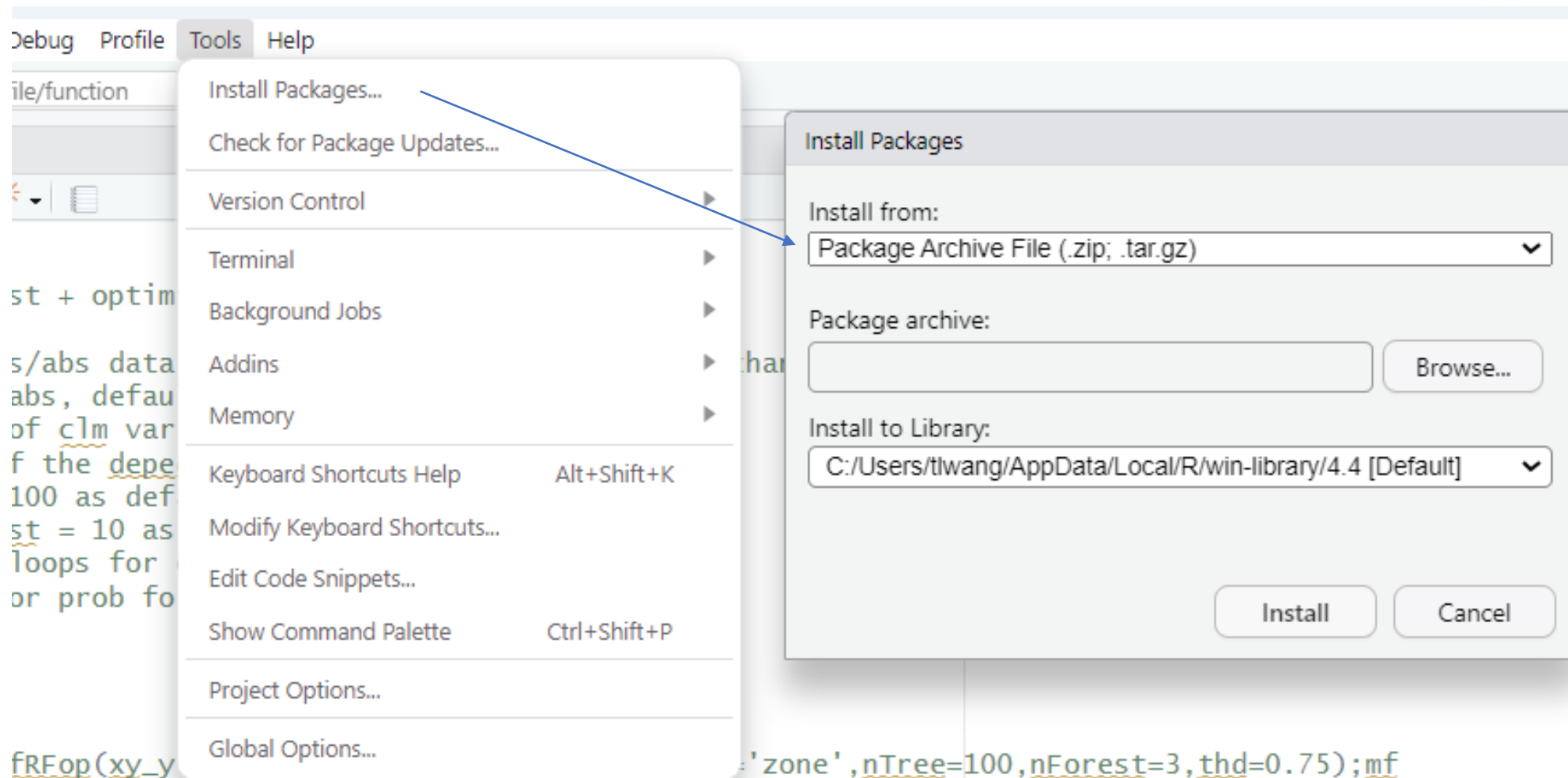
ClimateBC/NA R package

ClimateNA R document (v2.0.0) can be downloaded [here](#)

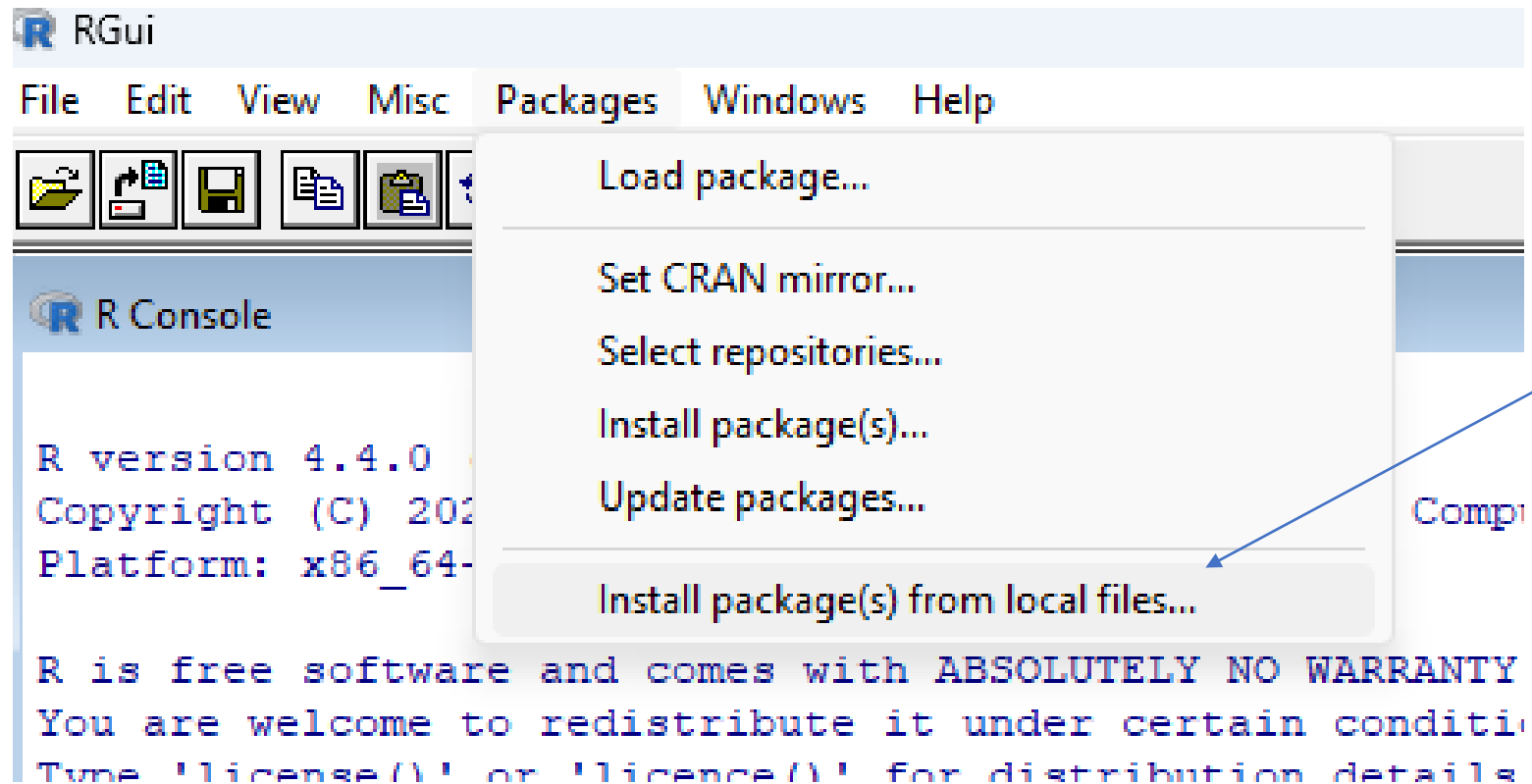
ClimateNA R package climateNAr (v2.0.0) can be downloaded [here](#)



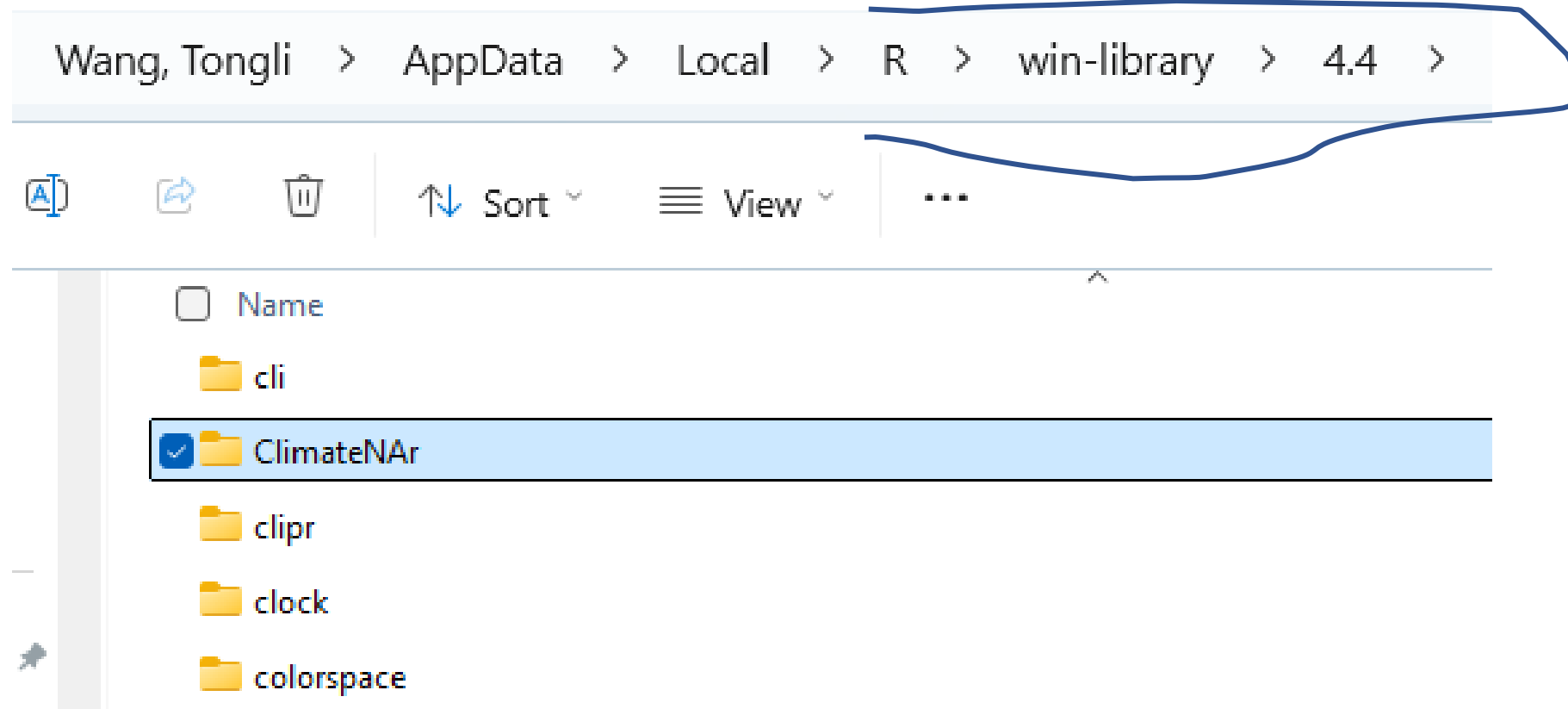
Installation in Rstudio



Installation in R console



Directly unzip the package to your library



Outline

- Background
- Main features
- Download and installation
- **Input parameters**
- Return
- Examples

Input parameters

```
climateNAr(inputFile, periodList, varList, outDir)
```

inputFile – The full name of the input file

- A CSV file
 - `inputFile = 'C:/test/testLocations.csv'`
- a data frame in R
 - `dat <- read.csv('C:/test/testLocations.csv')`
 - `inputFile = dat`
- A raster (.tif or .asc) format and
 - `inputFile = 'C:/test/ dem.tif'`
- All in latitude-longitude projection (WGS84).

periodList – a list of periods

- A single period
 - `periodList = 'Normal_1961_1990.nrm'`
- A list of periods
 - `periodList = c('Normal_1961_1990.nrm','8GCMs_ensemble_ssp245_2041-2070.gcm')`
- Time-series
 - `periodList = 1961:1965`

varList – a list of climate variables to generate

- Individually picked
 - `varList = c('MAT', 'MAP', 'DD5')`
- *A variable group for a time scale*
 - `varList = 'Y'`, annual variables
 - `varList = 'S'`, seasonal variables
 - `varList = 'M'`, monthly variables
- *A combination of variable groups*
 - `varList = 'YS'`,
 - `varList = 'YM'`
 - `varList = 'SM'`
 - `varList = 'YSM'`

outDir – the folder to save the output files

- inputFile being a .CSV file
 - outDir = 'C:/test/', the output files will be in this folder
- inputFile being a raster file (e.g, 'BC800.tif')
 - outDir = 'C:/test/',
 - Sub-folders will be auto-generated based on the inputFile and period:
 - Output folder: 'C:/test/BC800/Normal_1961-1990/'

Outline

- Background
- Main features
- Download and installation
- Input parameters
- **Return**
- Examples

The return of *climateNAr*

- `Clm <- climateNAr(inputFile, periodList, varList, outDir)`
- All the output files are saved into the *outDir* designated folder
- `Clm` contains the climate variable of the last period only

Outline

- Background
- Main features
- Download and installation
- Input parameters
- Return
- Examples

Using a CSV file

```
library(ClimateNAr)
csvFile = 'C:/temp/test.csv'
varList=c('MAT','MAP','DD5','CMI','RH')
periodList= c('Normal_1961_1990.nrm','Year_1902.ann','8GCMs_ensemble_ssp245_2041-2070.gcm')
outDir= 'C:/temp/'
```


```
test <- climateNAr(inputFile=csvFile,periodList,varList,outDir); test
```


```
100% completed for 8GCMs_ensemble_ssp245_2041-2070.gcm
Saving files ...
8GCMs_ensemble_ssp245_2041-2070.gcm --- completed
```


	idl	id2	lat	long	elev	MAT	MAP	DD5	CMI	RH
1	1	1	48.980	-115.020	1000	8.00	581	2084	-22.16	59
2	2	2	50.000	-100.000	1000	2.11	549	1547	5.61	59
3	3	3	50.000	-90.000	1000	2.09	918	1610	34.77	55
4	4	4	27.950	-99.194	128	24.50	565	7129	-135.80	60
5	5	5	73.314	-78.628	1069	-14.90	363	66	32.71	75


```
>
```

Output files

 test_na_8GCMs_ensemble_ssp245_2041-2070.csv

 test_na_Normal_1961_1990.csv

 test_na_Year_1901.csv

 test_na_Year_1902.csv





Using DEM raster files

```
library(ClimateNAr)
tif <- 'C:/temp/na20k.tif'
varList=c('MAT','MAP','DD5','CMI','RH')
periodList= c('Normal_1961_1990.nrm','8GCMs_ensemble_ssp245_2041-2070.gcm')
outDir= 'C:/temp/'
```

```
test <- climateNAr(inputFile=tif,periodList,varList,outDir); test
```

```
8GCMs_ensemble_ssp245_2041-2070.gcm --- completed
class      : SpatRaster
dimensions  : 281, 600, 5  (nrow, ncol, nlyr)
resolution  : 0.04166667, 0.04166667  (x, y)
extent      : -139.0632, -114.0632, 48.29235, 60.0
coord. ref. :
source(s)   : memory
names       :      MAT,      MAP,      DD5,      CMI,      RH
min values  : -10.24,      223,      15,    -68.79,      51
max values  :  12.87, 12589, 3230, 1244.22,      86
```

Output folders containing .tif files

<input type="checkbox"/> Name	Date modified
 8GCMs_ensemble_ssp245_2041-2070	9/30/2024 1:
 Normal_1961_1990	9/30/2024 1:
 Year_1901	9/30/2024 1:
 Year_1902	9/30/2024 1:

Acknowledgements

