README

Dataset for **"Oscillayers: A dataset for the study of climatic oscillations over Plio-Pleistocene time scales at high spatial-temporal resolution"**

The repository contains the ready to use palaeo-bioclim variables (Oscillayers: Bio1-Bio19) as well as an INPUT folder containing all files to recreate those palaeo-bioclim variables (see below). All archives have been created using 7-Zip v. 16.04 file archiver for Windows 10.

## READY-TO-USE:

For each variable (Bio1-Bio19) two files/archives are available (e.g. Bio1_Pleistocene & Bio1_Pliocene) containing layers (time periods) of the Pleistocene (20 kyr to 2.570 Myr) and the Pliocene (2.580 Myr to 5.40 Myr), respectively.

How to get started:

1. Make sure that you have enough space on the drive. Global scale Oscillayers for the full Plio-Pleistocene (539 time periods) require c. 80 GB per variable.

2. Download the data, unzip them.

3. (Optional) Clip the Oscillayers to the study region of interest. Clipping is a standard GIS procedure that allows extraction of a raster dataset based on a termplate extent (i.e. that of the region of interest). In the following a step by step guide is provided on how to clip the Oscillayers using two different commonly used programs (A: R package "raster" and B: ArcGIS v. 10.4) for an example study region (Madagascar).

Data format: The Oscillayers are in geodetic coordinate system (not projected). The datum is WGS84.

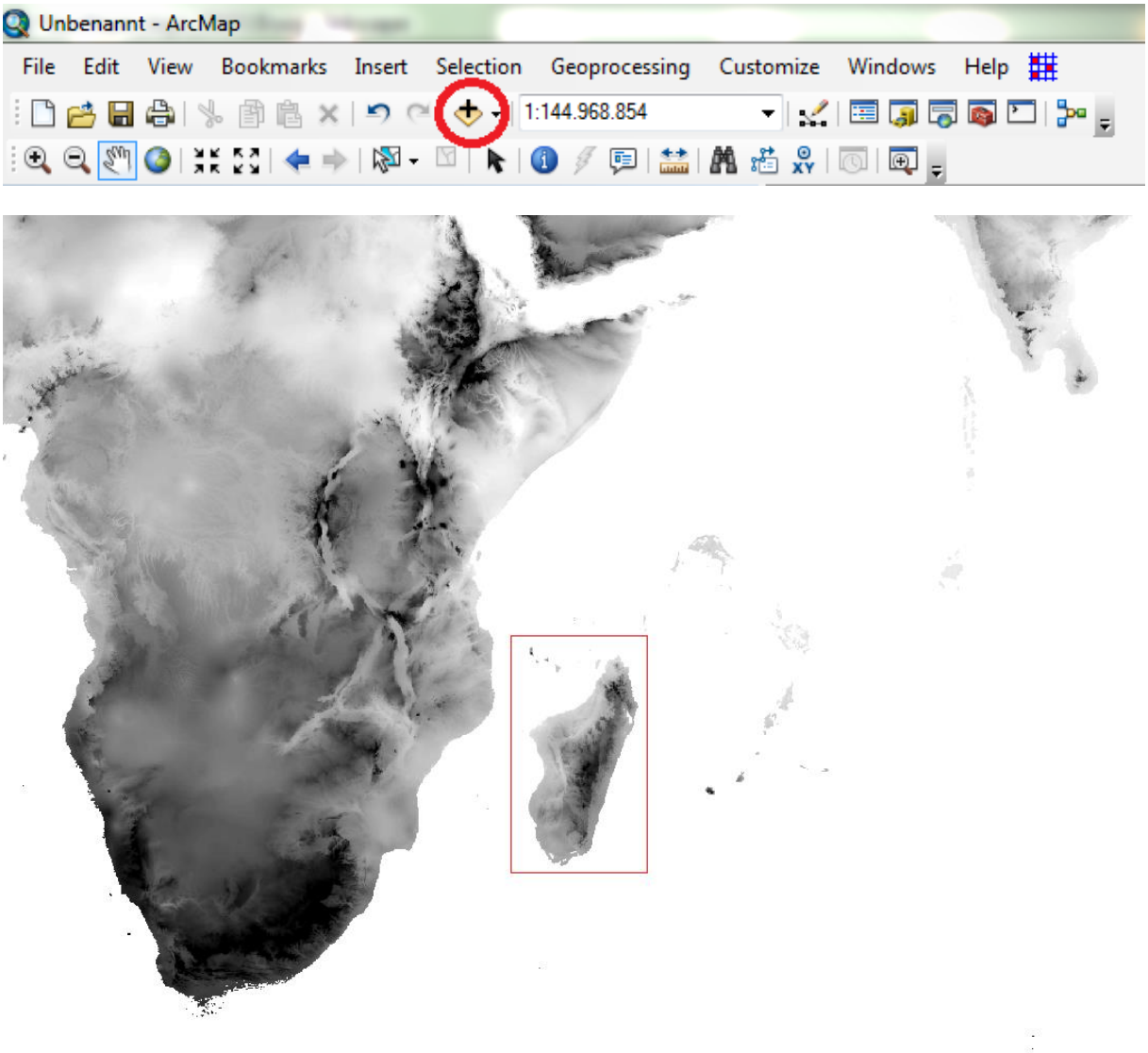
## A) R package raster to clip/crop

### Use "raster" to clip the Oscillayers to a smaller study area (e.g. Madagascar).

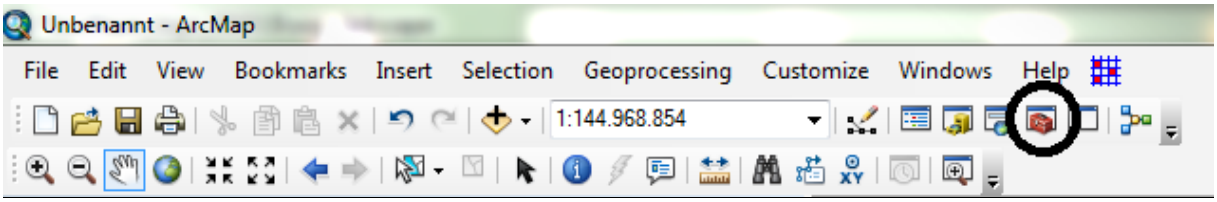
```
library(raster)

### set the working directory to the folder containing the downloaded Oscillayers (e.g. for Bio1).

### load all oscillayers from folder

raster_files <- list.files(full.names = T)

### stack all raster layers

osci <- stack(raster_files)

###### load shape file to clip/crop the input layers
###### INSERT SHAPEFILE OF CUSTOM STUDY AREA HERE

studyarea <- shapefile("MADAGASCAR.shp")

###### clip the stacks of input data to the extent of the study area

osci_cl <- crop (osci, studyarea)

### create a vector for labelling suffix

num <-c(2:540)

###### write the clipped/croppred Oscillayers to file

writeRaster(osci_cl, filename="bio1_t.asc", format="ascii", bylayer=TRUE, overwrite=TRUE, suffix=
num)
```

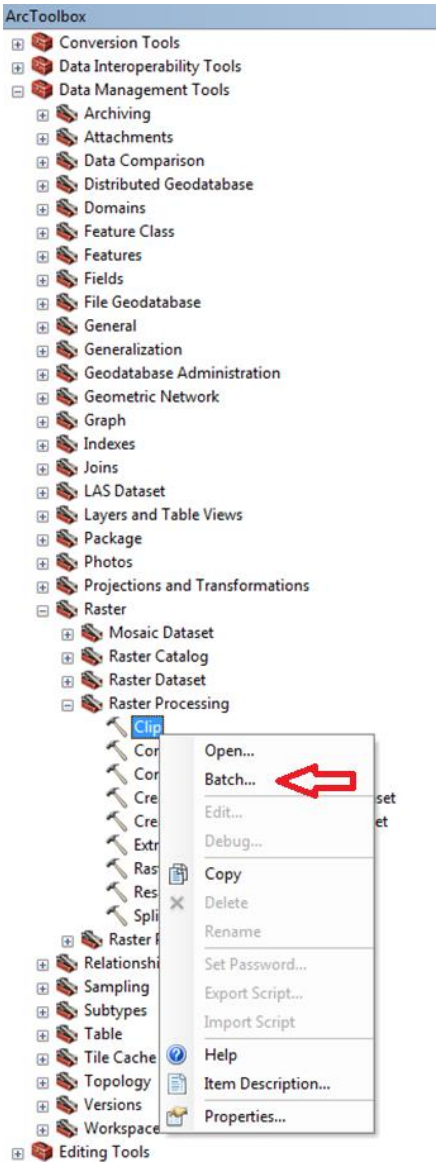
# B) Batch clip in ArcGIS

a. Open ArcMap and load the shapefile for the study region of interest (e.g. Madagascar) using the "Add Data" button (red circle).



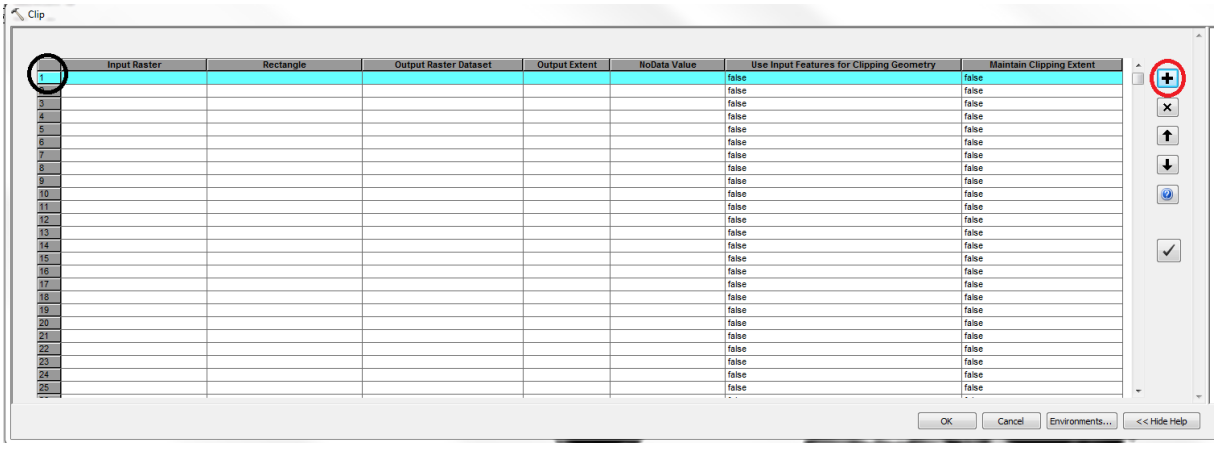

b. Click the ArcToolbox button (black circle) to open the ArcToolbox.






c. Go to the *Raster Processing* tools within the *Raster* tools within the *Data Management Tools* and right click the ***Clip*** tool. Select **Batch**… (red arrow).

d. In the open *Clip* window select the first row by clicking on 1 (black circle) and add 539 rows using the + button (red circle).



e. In the first row double click the *Input Raster* field and browse to the folder with the Oscillayers (e.g. Bio1). Select the first (T2) layer. Double click the *Output Raster Dataset* field and browse to the folder where all clipped files should be stored. Important: make sure that the output files end with the number for the first time period (here 2). Double click the *Output Extent* and select the shapefile for the study region of interest (here Madagascar). Select "true" for the field "*Use Input Features for Clipping Geometry*".

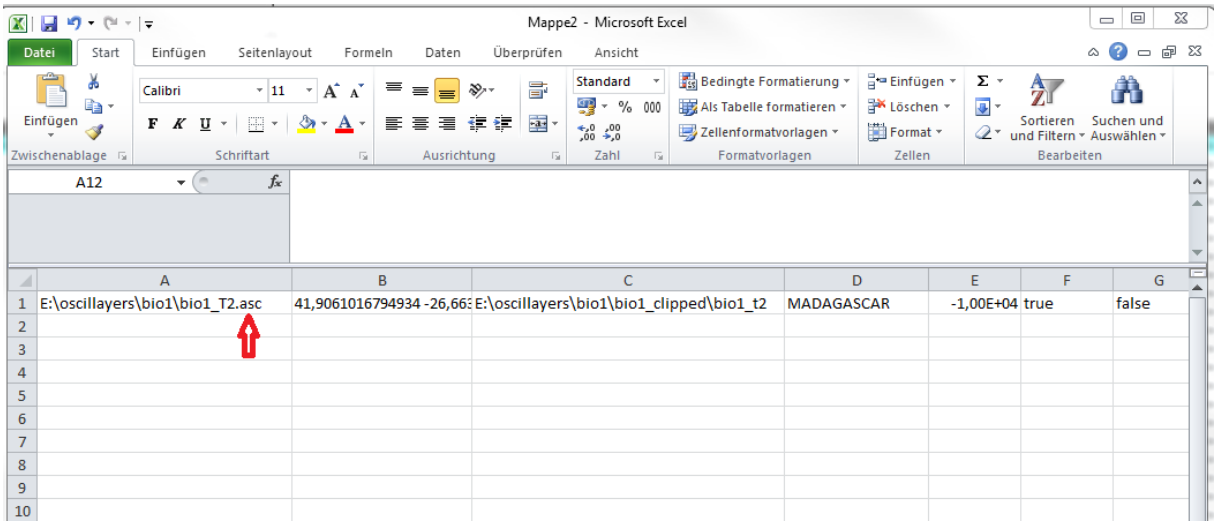
| | Input Raster | Rectangle | Output Raster Dataset |
|---|---|---|---|
| 1 | E:\oscillayers\bio1\bio1_T2.asc | 41,9061016794934 -26,663159519553 | E:\oscillayers\bio1\bio1_clipped\bio1_t2 |
| 2 | | | |

| Output Extent | NoData Value | Use Input Features for Clipping Geometry | Maintain Clipping Extent |
|---|---|---|---|
| MADAGASCAR | -9,999000e+003 | true | false |
| | | false | false |

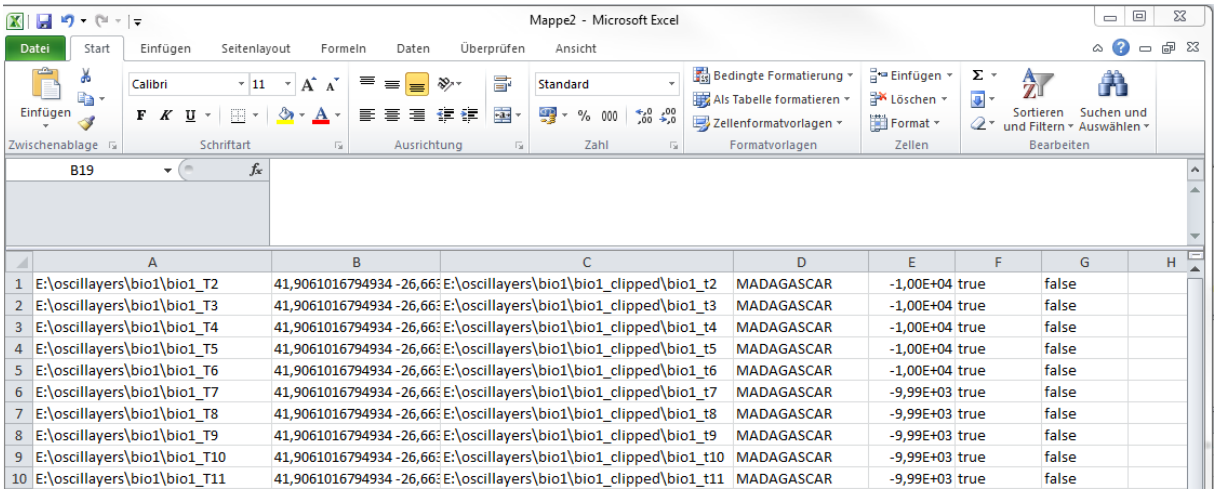
f. Select the first row and copy to Excel.

| | Input Raster | Rectangle | Output Raster Dataset | Output Extent | NoData Value | Use Input Features for Clipping Geometry | Maintain Clipping Extent |
|---|---|---|---|---|---|---|---|
| 1 | E:\oscillayers\bio1\bio1_T2.asc | 41,9061016794934 -26,663159519553 | E:\oscillayers\bio1\bio1_clipped\bio1_t2 | MADAGASCAR | -9,999000e+003 | true | false |
| 2 | | | | | | false | false |
| 3 | | | | | | false | false |

g. In Excel delete the .asc extension in field A1 (see red arrow).



h.Select the first row and copy to Excel. Select the first row (A1 to G1) and pull down until row 539 to automatically complete  the time period numbers in column A and C.

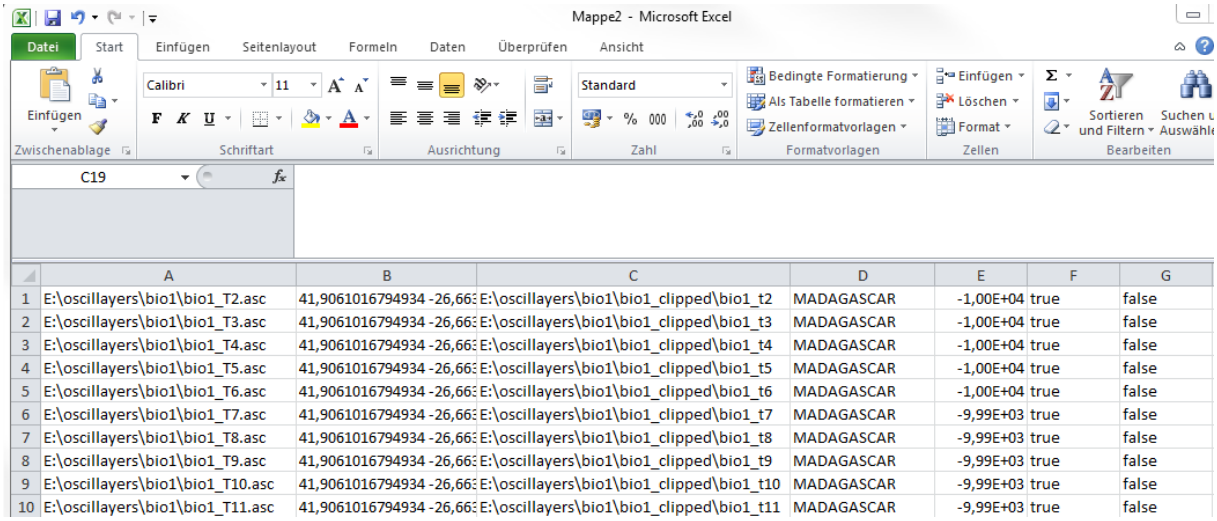



| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | E:\oscillayers\bio1\bio1_T2 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t2 | MADAGASCAR | -1,00E+04 | true | false | |
| 2 | E:\oscillayers\bio1\bio1_T3 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t3 | MADAGASCAR | -1,00E+04 | true | false | |
| 3 | E:\oscillayers\bio1\bio1_T4 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t4 | MADAGASCAR | -1,00E+04 | true | false | |
| 4 | E:\oscillayers\bio1\bio1_T5 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t5 | MADAGASCAR | -1,00E+04 | true | false | |
| 5 | E:\oscillayers\bio1\bio1_T6 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t6 | MADAGASCAR | -1,00E+04 | true | false | |
| 6 | E:\oscillayers\bio1\bio1_T7 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t7 | MADAGASCAR | -9,99E+03 | true | false | |
| 7 | E:\oscillayers\bio1\bio1_T8 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t8 | MADAGASCAR | -9,99E+03 | true | false | |
| 8 | E:\oscillayers\bio1\bio1_T9 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t9 | MADAGASCAR | -9,99E+03 | true | false | |
| 9 | E:\oscillayers\bio1\bio1_T10 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t10 | MADAGASCAR | -9,99E+03 | true | false | |
| 10 | E:\oscillayers\bio1\bio1_T11 | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t11 | MADAGASCAR | -9,99E+03 | true | false | |

i. Add the .asc extension back in field A. Add a column after A and fill it with .asc. Copy fields A and B into a text editor (e.g. Notepad) and replace Tab.

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | E:\oscillayers\bio1\bio1_T2 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t2 | MADAGASCAR |
| 2 | E:\oscillayers\bio1\bio1_T3 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t3 | MADAGASCAR |
| 3 | E:\oscillayers\bio1\bio1_T4 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t4 | MADAGASCAR |
| 4 | E:\oscillayers\bio1\bio1_T5 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t5 | MADAGASCAR |
| 5 | E:\oscillayers\bio1\bio1_T6 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t6 | MADAGASCAR |
| 6 | E:\oscillayers\bio1\bio1_T7 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t7 | MADAGASCAR |
| 7 | E:\oscillayers\bio1\bio1_T8 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t8 | MADAGASCAR |
| 8 | E:\oscillayers\bio1\bio1_T9 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t9 | MADAGASCAR |
| 9 | E:\oscillayers\bio1\bio1_T10 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t10 | MADAGASCAR |
| 10 | E:\oscillayers\bio1\bio1_T11 | .asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t11 | MADAGASCAR |

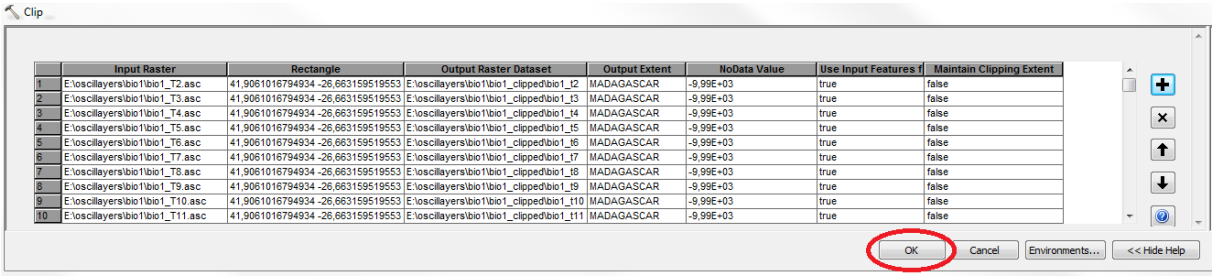
j. Copy back to excel over A and delete B (the column with only the .asc extension).



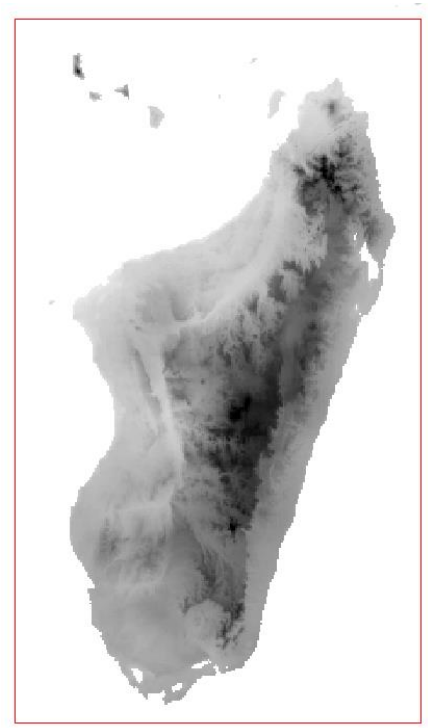

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | E:\oscillayers\bio1\bio1_T2.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t2 | MADAGASCAR | -1,00E+04 | true | false |
| 2 | E:\oscillayers\bio1\bio1_T3.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t3 | MADAGASCAR | -1,00E+04 | true | false |
| 3 | E:\oscillayers\bio1\bio1_T4.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t4 | MADAGASCAR | -1,00E+04 | true | false |
| 4 | E:\oscillayers\bio1\bio1_T5.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t5 | MADAGASCAR | -1,00E+04 | true | false |
| 5 | E:\oscillayers\bio1\bio1_T6.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t6 | MADAGASCAR | -1,00E+04 | true | false |
| 6 | E:\oscillayers\bio1\bio1_T7.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t7 | MADAGASCAR | -9,99E+03 | true | false |
| 7 | E:\oscillayers\bio1\bio1_T8.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t8 | MADAGASCAR | -9,99E+03 | true | false |
| 8 | E:\oscillayers\bio1\bio1_T9.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t9 | MADAGASCAR | -9,99E+03 | true | false |
| 9 | E:\oscillayers\bio1\bio1_T10.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t10 | MADAGASCAR | -9,99E+03 | true | false |
| 10 | E:\oscillayers\bio1\bio1_T11.asc | 41,9061016794934 -26,663 | E:\oscillayers\bio1\bio1_clipped\bio1_t11 | MADAGASCAR | -9,99E+03 | true | false |

k. Select in Excel columns A to G and copy into the *Clip* window (Crtl+v) of ArcGIS.

l. The *Clip* batch tool now contains all input files to automatically clip each layer of each time period to the study region of interest and automatically writes them to a designated output folder. Press OK to start the process (red circle).




m. Enjoy the Oscillayers clipped to the study region of interest.



# INPUT FILES TO RECREATE OSILLAYERS:

The INPUT folder contains all files to recreate the 19 Bioclim variables (also for smaller study regions):

- Bioclim delta layers (delta.zip)
- LGM Bioclim variables (CCSM_LGM_Bio1_19.zip)
- palaeo-coastlines (shapefiles_palaeocoastlines.zip)
- resampled digital elevation model (ETOPO1_res.asc)
- scaling factors (Scaling_factor_TabS1.csv)
- shapefiles major geographic regions (shapefiles major geographic regions_.zip)
- R script for Oscillayers generation (Oscillayer_R script.pdf)

How to get started:

1. Make sure that you have enough space on the drive. All unzipped data from the INPUT folder require c. 8.5 GB.

2. Use the R script to generate the variables of interest (also for smaller study regions).