Documentation on the MyTools python package:

The MyTools package is located here: R:\CHILD\pycharmVE\MyTools\.

My Tools:

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* CHILD\_to\_xyz
  + CHILDxyz [SP]
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* ERinRiverNet.py
  + ERcatAv [PY]
  + ERcatAvPlot [SP]

[PY] means the script uses Python 2.7

[SP] means the script uses Python 3

Yes I know this is not ideal, but any module that uses arcpy has to be run using python 2.7!

Module Documentation:

***CHILD\_to\_xyz***

*This module can be used to convert CHILD output files into a format that is readable with python. A new .txt and .csv file is created containing all of the model’s nodes for each time step.*

**CHILDxyz**(CHILDlocation, Runame, SaveLocation)

CHILDlocation – Where the CHILD .z and .nodes files are saved.

Runame – The name of the CHILD files <’\_’>.z or <’\_’>.nodes

SaveLocation – Where the output time step .text files will be saved.

*This module plots all of the model’s nodes for each time step and shades them based on elevation.*

**Mapxyz**(CHILDlocation, Runame, Ymax, SaveSpace)

CHILDlocation – The location where the CHILD output files have been saved

Runame – The name of the CHILD files <’\_’>.z or <’\_’>.nodes

Ymax – The maximum y coordinates to be plotted

SaveSpace – The directory were the map figure(s) will be saved

*This module differs from Mapxyz in that it plots the data based upon fixing the fault. This makes it easier to visualise the impact of advection on the mountain range when topography is being advected.*

**MapxyzAD**(CHILDlocation, Runame, Ymax, SaveSpace, AD)

CHILDlocation – The location where the CHILD output files have been saved

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

Ymax – The maximum y coordinates to be plotted in the first time step

SaveSpace – The directory were the map figure(s) will be saved

AD – The rate of advection in m/yr

*This module differs from Mapxyz and MapxyzAD in that it plots the data in the same form as MapxyzAD, however no advection is accounted for here. It simply means that a video with consistent framing can be made by combining the use of MapxyzAD and MapzyzNOAD when advection is and is not occurring respectively.*

**MapxyzNOAD**(CHILDlocation, Runame, Ymax, SaveSpace)

CHILDlocation – The location where the CHILD output files have been saved

Runame – The name of the CHILD files <’\_’>.z or <’\_’>.nodes

Ymax – The maximum y coordinates to be plotted

SaveSpace – The directory were the map figure(s) will be saved

***TINDEM***

*This module takes the .csv files from CHILDxyz and creates a Triangular Irregular Network (TIN) and then a Digital Elevation Model (DEM) for each time step.*

**TINDEM**(Workspace, Runame) [arcpy dependent]

Workspace – The directory in which to search for the files

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

***MDDandGMextraction***

*This module takes a series of DEMs which have two closed boundaries (left and right) and calculates the location of the Main Drainage Divide (MDD) by calculating the upslope drainage area at each point along the open boundaries and identifying where these combined upslope drainage areas for each flank intersect.*

**MDD**(Workspace, Runame, FaultStartingPosition, FaultPropRate, StartTime, WedgeWidth, Xmin, Xmax) [arcpy dependent]

Workspace - The directory in which to search for the files

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

FaultStartingPosition – The distance from the x axis at which the fault begins at time 0

FaultPropRate – The propagation rate of the fault towards the x axis given in m/yr

StartTime – The time when the fault propagation first begins. If FaultPropRate = 0, StartTime = 0

WedgeWidth – The width of the area of active uplift

Xmin – The minimum x value of the model space.

Xmax – The maximum x value of the model space.

[Note: The timeslices file required to apply this module to different timesteps must be named using the convention Runame + ‘timeslices2run.txt’ – this is so that this module can be used alongside the GM module providing the same timeslices are not used in both or so long as the Workspace is different]

*This module identifies headwater catchments on either side of the MDD (~ 0.1 km2) and calculates mean Gilbert Metrics (Elevation (Z), Slope (S), Relief (R)) in all headwaters. These values are then compared with the nearest headwater catchment on the other side of the MDD to reach a difference (Δ); ΔZ, ΔS, ΔR value.*

**GM**(Workspace, Runame, FaultStartingPosition, FaultPropRate, StartTime, WedgeWidth, Xmin, Xmax) [arcpy dependent]

Workspace - The directory in which to search for the files

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

FaultStartingPosition – The distance from the x axis at which the fault begins at time 0

FaultPropRate – The propagation rate of the fault towards the x axis given in m/yr

StartTime – The time when advection begins. If no advection put 0

WedgeWidth – The width of the area of active uplift

Xmin – The minimum x value of the model space.

Xmax – The maximum x value of the model space.

[Note: The timeslices file required to apply this module to different timesteps must be named using the convention Runame + ‘timeslicesGM.txt’ – this is so that this module can be used alongside the MDD module providing the same timeslices are not used in both or so long as the Workspace is different]

*This module reads a MDDlocationTable.csv and plots the location of the MDD throughout the duration of the model run.*

**MDDplot**(MDDlocationTable, Figure, FigureTitle)

MDDlocationTable – The directory location and name of the .csv file that stores the location of the MDD relative to the fault

Figure – The name that the output figure is to be saved under (This will be saved in the directory where the script file calling this module is saved)

FigureTitle – The title of the figure to be printed

*This module will plot a histogram and boxplot of ); ΔZ, ΔS, ΔR values.*

**GMplot**(Workspace, Runame)

Workspace – The directory in which to search for the files

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

**GMplotTimeseries**

Currently only available as a python script. This will plot the Gilbert Metric comparisons with time similar to the MDD plot form.

***CSxyz***

*This module plots a cross section of the complete model domain for each given time step.*

**CS**(Workspace, Runame)

Workspace - The directory in which to search for the files

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

Ymax – The maximum y coordinate used in the model

[Note: The timeslices file required to apply this module to different timesteps must be named using the convention Runame + ‘timeslicesCS.txt’ – this allows for select timesteps to be included within this cross section plotting]

*This module plots a cross section of the mountain range and will adjust the extent of the cross section in terms of the model domain based upon the total advection that has been induced.*

**CSstandardFaultAD**(Workspace, Runame, WW, ADrate, NonUpliftY, SaveName)

Workspace - The directory in which to search for the files

Runame - The name of the CHILD files <’\_’>.z or <’\_’>.nodes

WW – Wedge Width

ADrate – Advection Rate induced (if no advection use 0)

NonUpliftY – The length of the grid that is below the fault and is not experiencing any uplift

SaveName – The file name to be used when saving the figure

***XYZ\_Evolution***

*This module will plot maximum landscape elevation, landscape volume, and maybe a couple of other things. I haven’t used this module much!*

**Zevolution**(BLOCKWorkspace, BLOCKRuname, UGWorkspace, UGRuname, UGADWorkspace, UGADRuname, StormInterval, InitialFaultPositionBLOCK, InitialFaultPositionUG, InitialFaultPositionUGAD, ProprateBLOCK, ProprateUG, ProprateUGAD, WedgeWidth, BLOCKTimeAdjust, UGTimeAdjust, UGADTimeAdjust, Figure, FigureTitle)

BLOCKWorkspace – The directory in which the BLOCK model files are stored

BLOCKRuname – The runame of the BLOCK model phase

UGWorkspace – The directory in which the UG model files are stored (namely, the files from CHILDxyz())

UGRuname – The runame of the UG model phase

UGADWorkspace – The directory in which the UGAD model files are stored (namely, the files from CHILDxyz())

UGADRuname – The runame of the UGAD model phase

StormInterval – The frequency with which storms are applied in the model(s). This is the variable “ST\_STDUR” in the CHILD input file

InitialFaultPositionBLOCK – Position of the fault relative to the x axis at the start of the BLOCK model phase

InitialFaultPositionUG – Position of the fault relative to the x axis at the start of the UG model phase

InitialFaultPositionUGAD – Position of the fault relative to the x axis at the start of the UGAD model phase

ProprateBLOCK – The rate of fault propagation towards the x axis during the BLOCK model phase (0)

ProprateUG – The rate of fault propagation towards the x axis during the UG model phase (0)

ProprateUGAD – The rate of fault propagation towards the x axis during the UGAD model phase

WedgeWidth – The width of the area of active uplift

BLOCKTimeAdjust – Accounts for any adjustment required in the timing of the BLOCK phase

UGTimeAdjust – Accounts for any adjustment required in the timing of the UG phase

UGADTimeAdjust – Accounts for any adjustment required in the timing of the UGAD phase

Figure – The directory location and the name of the figure to be saved

FigureTitle – The title to be included at the top of the figure output

***ERxyz***

*This module will calculate the erosion rate for all nodes within the model domain. ER is calculated by calculating the mean uplift rate over the time period, calculating the change in elevation between two adjacent time steps, and calculating the elapsed time between the two adjacent time steps. The formula; Mean Uplift – (Change in elevation / Time). This script is used when uplift maps are being used in the model. [If no uplift maps are being used, use ERcyxUG or ERxyzOneUmap or ERxyzNoUmap – See the relevant python scripts to see how the inputs slightly change in relation to each of these.]*

**ERxyz**(Workspace, Runame, UMnamebase, Ufilemin, UFilesPerTimestep, TotalNumberOfNodes, Xmax, Ymax, SaveSpace)

Workspace – The directory in which all the required files are stored

Runame – The runame of the model

UMnamebase – The base name of the uplift maps – i.e. UMUG02AD02\_25km

Ufilemin – The minimum uplift map file number – i.e. Umap001 would be 1

UFilesPerTimestep – The number of uplift files used to adjust uplift rates across the model for each timestep. For example, if a model is run for 100 Myr and outputs data every 10 Myr and the maximum number of uplift maps (1,000) are used, then there would be 100 different uplift maps applied during the interval between each timestep. It is this number of uplift maps used between each timestep that must be specified here.

Xmax – The maximum x coordinates to be plotted

Ymax – The maximum y coordinates to be plotted

SaveSpace – The directory were the map figure(s) will be saved

[Note: This calculates the average erosion rate at each node between each timestep and creates a map of erosion rates between each adjacent timesteps] [Note 2: An alternative script called ERxyzOneUmap.py can be used when there is no advection – or in other words when there is only the one uplift map being used] [Note3: An alternative script called ERxyzNoUmap.py can be used when there is no Umap being used -like during the Uniform Uplift stage of the modelling] [When Uplift maps have UM at their start ‘UM’ must be added to the line UmapName = ‘’ Runame + str(f3)]

*This module will plot a cross section of the erosion rate for all time steps of the model run that are specified.*

**ERcs**(Workspace, Runame, PlotXmin, PlotXmax, PlotYmin, PlotYmax, SaveSpace)

Workspace – The directory in which all the required files are stored

Runame – The runame of the model

PlotXmin – The minimum x coordinates to be plotted

PlotXmax – The maximum x coordinates to be plotted

PlotYmin – The minimum y coordinates to be plotted

PlotYmax -The maximum y coordinates to be plotted

SaveSpace – The directory were the map figure(s) will be saved

[Note: This calculates the distance between the nodes and the nearest part of the MDD and creates a plot of Erosion Rate with distance from the MDD for each flank. Also Note that timeslices file is set as ‘timeslices2run.txt’ this is because the MDD location is calculated less frequently than the timestep interval – see MDD module] [Note: If only running for the one timestep the -1 must be removed in the ERcs file during the loop functions]

***ERinRiverNet***

*This module takes a DEM file, erosion rate data for each node in the landscape (output from ER.py) and the location of the MDD (output from MDDandGMextraction.py). The module then extracts the channel network and calculates the mean erosion rate for the upstream area at each point in the channel network.*

**ERcatAv**(Workspace, DEMfileName, ERxyzfileName, MDDcentralmeanfileName, LSDcatchmentsfileName)

Workspace – The location where files are retrieved and saved

DEMfileName – The file name of the DEM that this analysis is going to be applied to

ERxyzfileName – The file name of the ERxyz, output from ER.py

MDDcentralmeanfileName – The file name of the mean MDD locations associated with this timestep, output from MDDandGMextraction.py

LSDcatchmentsfileName – Is a .bil file of the catchments as extracted in LSDtopotools, using scripts 1ChannelExtraction.driver and 2CatchmentExtraction.driver

[Note: The area represented by each node must be added as a column to the file ERxyz190000000.csv, also remember to remove boundary points from the data as these have no area associated with them]

This module will plot four graphs combining; mean upstream erosion rate, distance from the MDD and longitudinal profiles.

**ERcatAvPlot**(Workspace, RiverPointsFileName, ProxCatNo, DistCatNo)

Workspace – The workspace, i.e. "E:/ERcatavWork/

RiverPointsFileName – The name of the river points .txt file holding the ER data (output from ERcatAv).

ProxCatNo – The catchment number associated with the proximal flank catchment we wish to plot data for

DistCatNo – The catchment number associated with the distal flank catchment we wish to plot data for