

# Package ‘metis’

February 4, 2019

**Title** Sub-Regional Nexus Modeling Tool

**Version** 0.0.1

**Description** Package to process water-energy-land nexus data to different sub-regional levels.

**Depends**

**License** MIT + file LICENSE

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.0

**Imports** raster (>= 2.7.15),  
RColorBrewer (>= 1.1.2),  
rgcam (>= 0.5.0),  
tibble (>= 1.4.2),  
dplyr (>= 0.7.7),  
tmap (>= 2.1.1),  
ggplot2 (>= 3.1.0),  
scales (>= 0.5.0),  
utils (>= 3.5.0),  
tidyr (>= 0.8.1),  
rlang (>= 0.3.0),  
grDevices (>= 3.5.0),  
processx (>= 3.2.0),  
rgdal (>= 1.2.20),  
magrittr (>= 1.5),  
sp (>= 1.2.7),  
methods (>= 3.5.0),  
tidyselect (>= 0.2.5),  
rgeos (>= 0.3.26),  
zoo (>= 1.8.4),  
stats (>= 3.5.0),  
dbplyr (>= 1.3.0),  
RSQLite (>= 2.1.1),  
data.table,  
DBI

**Suggests** testthat (>= 2.0.1),  
knitr (>= 1.20),  
rmarkdown (>= 1.10)

**Remotes** github::JGCRI/rgcam

**VignetteBuilder** knitr

**R topics documented:**

met.io . . . . .	2
met.irio . . . . .	3
met.mrio . . . . .	3
metis . . . . .	4
metis.assumptions . . . . .	4
metis.boundaries . . . . .	5
metis.chart . . . . .	6
metis.chartsProcess . . . . .	8
metis.colors . . . . .	10
metis.grid2poly . . . . .	11
metis.map . . . . .	12
metis.mapProcess . . . . .	14
metis.prepGrid . . . . .	17
metis.readgcam . . . . .	19
metis.templates . . . . .	20
<b>Index</b>	<b>22</b>

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met.io	<i>metis.io</i>
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**Description**

This function prepares gridded data for use with other metis modules.

**Usage**

```
met.io(Z0 = NULL, D0 = NULL, X0 = NULL, D = NULL,  
  dirOutputs = paste(getwd(), "/outputs", sep = ""))
```

**Arguments**

Z0	Default = NULL,
D0	Default = NULL,
X0	Default = NULL,
D	Default = NULL,
dirOutputs	Default =paste(getwd(),"/outputs",sep=""),

**Value**

A table with data by polygon ID for each shapefile provided

---

met.irio

metis.irio

**Description**

This function prepares gridded data for use with other metis modules.

**Usage**

```
met.irio(Z0 = NULL, D0 = NULL, X0 = NULL, D = NULL,
        dirOutputs = paste(getwd(), "/outputs", sep = ""))
```

**Arguments**

Z0	Default = NULL,
D0	Default = NULL,
X0	Default = NULL,
D	Default = NULL,
dirOutputs	Default =paste(getwd(),"/outputs",sep=""),

**Value**

A table with data by polygon ID for each shapefile provided

---

met.mrio

metis.mrio

**Description**

This function prepares gridded data for use with other metis modules.

**Usage**

```
met.mrio(Z0 = NULL, Q0 = NULL, D0 = NULL, X0 = NULL, D = NULL,
        n_regions = 2, dirOutputs = paste(getwd(), "/outputs", sep = ""))
```

**Arguments**

Z0	Initial intermediate flow matrix. All diagonal matrices 0. Default = NULL,
Q0	Initial trade matrix. Columns sum to 100. Default = NULL,
D0	Initial External demand. Default = NULL,
X0	Initial total Demand internal and external. Default = NULL,
D	External demand or Household demand. Default = NULL,
n_regions	Number of regions. Default = NULL,
dirOutputs	Default =paste(getwd(),"/outputs",sep=""),

**Value**

A table with data by polygon ID for each shapefile provided

---

metis

*metis: Sub-Regional nexus Package*


---

### Description

The Metis package provides

### Metis functions

The Metis functions ...

---

metis.assumptions

*metis.assumptions*


---

### Description

This function loads holds the different assumptions used throughout the metis package.

### Usage

```
metis.assumptions()
```

### Details

List of Assumptions

- convEJ2TWh
- convEJ2GW
- conv1975USDperGJ22017USDperMWh
- conv1975USDperGJ22017USDperMBTU
- convertGgTgMTC
- GWPType

### Value

A list of assumptions

### Examples

```
library(metis)
a<-metis.assumptions()
a # will give full list of assumptions
```

---

metis.boundaries	<i>metis.boundaries</i>
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---

## Description

This function takes a .csv file with gridded lat, long data and aggregates the data by spatial boundaries given different shapefiles.

## Usage

```
metis.boundaries(boundaryRegShape = NULL, boundaryRegShpFolder = NULL,
  boundaryRegShpFile = NULL, boundaryRegCol = NULL,
  boundaryRegionsSelect = NULL, subRegShape = NULL,
  subRegShpFolder = NULL, subRegShpFile = NULL, subRegCol = NULL,
  subRegionsSelect = NULL, subRegType = "subRegType",
  dirOutputs = paste(getwd(), "/outputs", sep = ""), nameAppend = "",
  expandPercent = 2, overlapShape = NULL, overlapShpFolder = NULL,
  overlapShpFile = NULL, labelsSize = 1.2, fillcolorNA = NULL,
  projX = "+proj=longlat +datum=WGS84 +no_defs +ellps=WGS84 +towgs84=0,0,0",
  extendedFillColor = "grey75", extendedBGColor = "lightblue1",
  extendedHighLightColor = "cornsilk1", extendedLabelsColor = "grey30",
  extendedLabelSize = 0.7, extension = T, fillPalette = "Spectral",
  cropSubShape2Bound = T, grids = NULL)
```

## Arguments

boundaryRegShape	Default=NULL. Boundary region shape if already read into R.
boundaryRegShpFolder	Default= NULL. Folder containing boundary region shapefile. Suggested: paste(getwd(),"/dataFiles/gi Default=""),
boundaryRegShpFile	Default=NULL. Name of shapefile. Suggested: paste("ne_10m_admin_0_countries",sep Default=""),
boundaryRegCol	Default=NULL. Column name with region names. Suggested "NAME_0",
boundaryRegionsSelect	Default=NULL. The region to choose from the given shapefile.
subRegShape	Default=NULL. Sub-region shape if already read into R.
subRegShpFolder	Default=NULL. Folder containing boundary region shapefile. Suggested paste(getwd(),"/dataFiles/gi Default=""),
subRegShpFile	Default=NULL. Name of sub-region shapefile. Suggested paste("ne_10m_admin_1_states_provinces Default=""),
subRegCol	Default= NULL. Suggested for states "name",
subRegionsSelect	Default=NULL. The region to choose from the given sub-region shapefile.
subRegType	Default="subRegType". Eg. "states", "basins" etc.
dirOutputs	Default=paste(getwd(),"/outputs",sep Default=""). Location for outputs.

nameAppend	Default="".
expandPercent	Default=2. Percentage to expand boundary region beyond chosen region.
overlapShape	Default = NULL. If boundary lines of another shapefile are desired specify the shape here.
overlapShpFolder	Default = NULL. For GCAM basins use paste(getwd(),"/dataFiles/gis/basin_gcam",sep="").
overlapShpFile	Default = NULL. For GCAM basins use ="Global235_CLM_final_5arcmin_multipart"
labelsSize	Default =1.2.
fillcolorNA	Default =NULL.
projX	Default ="+proj=longlat +datum=WGS84 +no_defs +ellps=WGS84 +towgs84=0,0,0".
extendedFillColor	Default = "grey75".
extendedBGColor	Default = "lightblue1".
extendedHighLightColor	Default = "cornsilk1".
extendedLabelsColor	Default = "grey30".
extdendedLabelSize	Default =0.7.
extension	Default = T
fillPalette	Default ="Spectral".
cropSubShape2Bound	Default = T. Set to False if subregion shape is larger than boundary, but desired fro extension.
grids	Default = NULL. Suggested is c(paste(getwd(),"/dataFiles/grids/emptyGrids/grid_025.csv",sep=""), paste(getwd(),"/dataFiles/grids/emptyGrids/grid_050.csv",sep="")) This may happen in the case of disputed boundaries.

### Value

A table with data by polygon ID for each shapefile provided

---

metis.chart	<i>metis.chart</i>
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---

### Description

This function produce different kinds of charts for the metis package. ilt requires a table in the Metis format. Each figure is accompanied with a csv table.

**Usage**

```
metis.chart(data, chartType = "bar", position = "stack", xData = "x",
  yData = "value", class = "class1", group = "scenario",
  classPalette = "classPalette1", classLabel = "classLabel1",
  xLabel = "xLabel", yLabel = "yLabel", facet_rows = "region",
  facet_columns = "scenario", ncolrow = 4, scales = "fixed",
  useNewLabels = 0, units = "units", xBreaksMaj = 10,
  xBreaksMin = 5, yBreaksMaj = 5, yBreaksMin = 10,
  sizeBarLines = 0.5, sizeLines = 1.5, printFig = T,
  fileName = "chart", dirOutputs = paste(getwd(), "/outputs", sep =
  ""), figWidth = 13, figHeight = 9, pdfpng = "png")
```

**Arguments**

data	data table for charting
chartType	Type of chart: "bar" or "line"
position	Position in bar charts. "identity", "stack" or "dodge"
xData	Default "x"
yData	Default "value"
class	Default "class1"
group	Default "scenario"
classPalette	Default "classPalette1"
classLabel	Default "classLabel1"
xLabel	Default "xLabel"
yLabel	Default "units"
facet_rows	Default "region"
facet_columns	Default "scenario"
ncolrow	Number of columns or Rows for Faceted plots
scales	Default "fixed"
useNewLabels	Default 0
units	Default "units"
xBreaksMaj	Default 10
xBreaksMin	Default 5
yBreaksMaj	Default 5
yBreaksMin	Default 10
sizeBarLines	Default 0.5
sizeLines	Default 1.5
printFig	Default = T,
fileName	Default = "map",
dirOutputs	Default = paste(getwd(), "/outputs", sep Default = "")
figWidth	Default = 9,
figHeight	Default = 7,
pdfpng	Default = "png",

**Value**

Returns the formatted data used to produce chart

**Examples**

```
# Examples below show the default chart with minimum information
# and then adding progressively more details.
```

```
library(tibble)
library(dplyr)
tbl <- tribble (
  ~x,      ~value,
  2010,    15,
  2020,    20,
  2030,    30
)
metis.chart(data=tbl,xData="x",yData="value",chartType = "line")
metis.chart(data=tbl,xData="x",yData="value",chartType = "bar")
```

---

```
metis.chartsProcess      metis.chartsProcess
```

---

**Description**

This function produces charts given any number of tables in the metis format. The metis.chart() function produces charts for each region and scenario. If there are more than one scenario then the function also produces a folder for diffplots. The input tables should be .csv files with the following columns: scenario, region, sources, param, x, xLabel, vintage, class1, class2, units, value, aggregate, classLabel1, classPalette1, classLabel2, classPalette2. Running the metis.readgcam automatically produces an empty template with these columns for the relevant parameters. Each column is defined below:

**Usage**

```
metis.chartsProcess(dataTables = NULL, rTable = NULL, scenRef = NULL,
  dirOutputs = paste(getwd(), "/outputs", sep = ""), pdfpng = "png",
  xRange = "All", xCompare = c("2015", "2030", "2050", "2100"),
  paramsSelect = "All", regionsSelect = "All", xData = "x",
  yData = "value", xLabel = "xLabel", yLabel = "units",
  aggregate = "sum", class = "class", classPalette = "pal_Basic",
  regionCompareOnly = 1, useNewLabels = 0, sizeBarLines = 0,
  sizeLines = 1.5, nameAppend = "")
```

**Arguments**

dataTables	Vector of strings with full path to datatables to be read in. Example c("D:/metis/outputs/Colombia/dataTableLocal_Colombia_1975to2100.csv"). Where "dataTableLocal_Colombia_1975to2100.csv" is the new datafile created based on "dataTableTemplate_Colombia_1975to2100.csv" and contains new local data.
rTable	If a table is created directly in R as a data.frame or tibble it can be entered here.
scenRef	The reference scenario to compare against. Default will pick first scenario from list of all scenarios



dirOutputs	Full path to directory for outputs. Default is paste(getwd(),"/outputs",sep="")
pdfpng	Choose the format for outputs. Either "pdf", "png" or "both". Default is "png"
xRange	Default "All". Range of x values eg. c(2001:2005)
xCompare	Choose the years to compare scenarios for xScenSelectYears plot. Default is c("2015","2030","2050","2100")
paramsSelect	Default = "All". Select the paramaters to analyze from the the tables provided. Full list of parameters: c("finalNrgbySec", "primNrgConsumByFuel", "elecByTech", "watConsumBySec", "watWithdrawBySec", "watWithdrawByCrop", "watBioPhysCons", "irrWatWithBasin", "irrWatConsBasin", "gdpPerCapita", "gdp", "gdpGrowthRate", "pop", "agProdbyIrrRfd", "agProdBiomass", "agProdForest", "agProdByCrop", "landIrrRfd", "aggLandAlloc", "LUCemiss", "co2emission", "co2emissionByEndUse", "ghgEmissionByGHG", "ghgEmissByGHGGROUPS")
regionsSelect	Default = "All". Select regions to create charts for.
xData	Default "x"
yData	Default "value"
xLabel	Default "xLabel"
yLabel	Default "units"
aggregate	Default "sum"
class	Default "class"
classPalette	Default "pal_Basic" from metis.colors()\$pal_Basic
regionCompareOnly	Default 0. If set to 1, will only run comparison plots and not individual
useNewLabels	Default 0
sizeBarLines	Default 0.5
sizeLines	Default 1.5
nameAppend	Default = ""

## Details

### List of Assumptions

- scenario: The name of the new data scenario
- region: The region for the data
- sources: Sources for the data
- param: Name of the parameter
- x: The x axis variable values
- xLabel: X axis Label
- vintage: Vintages if any. If not relevant then just enter "Vintage"
- class1: Classes or types (eg. if param is water\_demands then the classes may be Industry, Agriculture etc.)
- class2: A second category of classes if exists.
- units: Units for the parameter. These are used as the y axis label.
- value: The parameter value.
- aggregate: Either "sum" or "mean". This paramater is used to determine how to aggregate across regions or scenarios.

- classLabel1: If class1 exists then this will be legend Label. If it doesnt exist enter "classLabel1"
- classPalette1: An R or metis.colors() palette. Can leave the default as "pal\_16".
- classLabel2: If class2 exists then this will be legend Label. If it doesnt exist enter "classLabel2"
- classPalette2: An R or metis.colors() palette. Can leave the default as "pal\_16".

### Value

Produces charts in output folder and also returns combined table in metis format.

---

metis.colors	<i>metis.colors</i>
--------------	---------------------

---

### Description

This function loads various color palettes used previously in GCAM as well as new palettes for Metis modeling to the global environment

### Usage

```
metis.colors(palx = NULL)
```

### Arguments

palx                      Palette name to view the palette colors. Eg. metis.colors("pal\_Basic")

### Details

List of Color Palettes

- pal\_HDDCDD
- pal\_16
- elec\_tech\_colors
- elec\_renew\_colors
- building\_colors
- trn\_fuel\_colors
- enduse\_fuel\_numbered
- enduse\_colors
- pal\_pri\_ene
- pal\_pri\_fuelcost
- pal\_emiss\_sector
- pal\_landuse
- pal\_hydrogen
- pal\_refliq
- emiss\_by\_enduse\_colors
- biouse\_colors

- pal\_Basic
- pal\_Gas
- pal\_Diff
- pal\_Diff5
- pal\_Absolute
- pal\_Absolute5
- pal\_Unassigned
- pal\_elec\_subsec
- pal\_elec\_finalNrgFuel
- pal\_elec\_techs
- pal\_elec\_sec
- pal\_finalNrg\_sec
- pal\_pri\_ene
- pal\_elec\_tech\_colors

### Value

A list of color palettes.

### Examples

```
library(metis)
a<-metis.colors()
pie(rep(1,length(a$pal_Basic)),label=names(a$pal_Basic),col=a$pal_Basic)
```

---

metis.grid2poly

*metis.grid2poly*


---

### Description

This function takes a .csv file with gridded lat, long data and aggregates the data by spatial boundaries given different shapefiles.

### Usage

```
metis.grid2poly(grid = NULL, boundaryRegionsSelect = NULL,
  subRegShape = NULL, subRegShpFolder = NULL, subRegShpFile = NULL,
  subRegCol = NULL, subRegType = "subRegType", aggType = NULL,
  dirOutputs = paste(getwd(), "/outputs", sep = ""), nameAppend = "",
  labelsSize = 1.2, paramsSelect = "All", sqliteUSE = F,
  sqliteDBNamePath = paste(getwd(), "/outputs/Grids/gridMetis.sqlite",
  sep = ""))
```

**Arguments**

grid	Default=NULL. Grid file in .csv format or a R table, data frame or tibble with as a minimum columns with "lat", "lon" and "value",
boundaryRegionsSelect	Default=NULL. Larger region name which will be used as the folder name for outputs.
subRegShape	Default=NULL. shapefile over which grid data is to be aggregated.
subRegShpFolder	Default=NULL. Folder containing boundary region shapefile. Suggested paste(getwd(), "/dataFiles/gi", Default=""),
subRegShpFile	Default=NULL. Name of sub-region shapefile. Suggested paste("ne_10m_admin_1_states_provinces", Default=""),
subRegCol	Default= NULL. Suggested for states "name",
subRegType	Default="subRegType". Eg. "states", "basins" etc.
aggType	Default=NULL. Aggregation method to be used. Either "vol" or "depth" depending on the type of data provided.
dirOutputs	Default=paste(getwd(), "/outputs", sep Default=""),
nameAppend	Default="",
labelsSize	Default = 1.2. Label size for the region names for the gridoverlay plot.
paramsSelect	Default = "All"
sqliteUSE	Default = T,
sqliteDBNamePath	Default = paste(getwd(), "/outputs/Grids/gridMetis.sqlite", sep = "")

**Value**

A table with data by polygon ID for each shapefile provided

---

metis.map	<i>metis.map</i>
-----------	------------------

---

**Description**

This function produce different kinds of maps for the metis package. Each figure is accompanied with a csv table.

**Usage**

```
metis.map(dataPolygon = NULL, dataGrid = NULL, dataRaster = NULL,
  shpFolder = NULL, shpFile = NULL, fillPalette = "Spectral",
  borderColor = "gray20", lwd = 1, lty = 1, bgColor = "white",
  frameShow = F, fillColumn = NULL, labels = F, labelsSize = 1.2,
  labelsColor = "black", labelsAutoPlace = F, figWidth = 9,
  figHeight = 7, legendWidth = -1, legendShow = F,
  legendOutside = T, legendTextSize = 1, legendTitleSize = 2,
  legendOutsidePosition = NULL, legendPosition = NULL,
  legendDigits = NULL, legendTitle = "Legend",
```

```

legendStyle = "pretty", legendFixedBreaks = 5, legendBreaks = NULL,
pdfpng = "png", underLayer = NULL, overLayer = NULL,
printFig = T, fileName = "map", dirOutputs = paste(getwd(),
"/outputs", sep = ""), facetFreeScale = F, facetRows = NA,
facetCols = 3, facetBGColor = "grey30", facetLabelColor = "white",
facetLabelSize = 1.5, alpha = 1, fillcolorNA = "grey30",
fillshowNA = NA, fillcolorNULL = "grey30", facetsON = T,
panellabel = NULL, multiFacetRows = NULL, multiFacetCols = NULL,
mapTitle = NULL, mapTitleSize = 1)

```

### Arguments

dataPolygon	Default = NULL,
dataGrid	Default = NULL,
dataRaster	Default = NULL,
shpFolder	Default = paste(getwd(),"/dataFiles/gis/admin_gadm36_1",sep Default = ""),
shpFile	Default = paste("gadm36_1",sep Default = ""),
fillPalette	Default = "Spectral",
borderColor	Default = "gray20",
lwd	Default = 1,
lty	Default = 1,
bgColor	Default = "white",
frameShow	Default = F,
fillColumn	Default = NULL, # Or give column data with
labels	Default = F,
labelsSize	Default = 1.2,
labelsColor	Default = "black",
labelsAutoPlace	Default = F,
figWidth	Default = 9,
figHeight	Default = 7,
legendWidth	Default = -1,
legendShow	Default = F,
legendOutside	Default = T,
legendTextSize	Default = 0.8,
legendTitleSize	Default = 1,
legendOutsidePosition	Default = NULL, # "right","left","top","bottom", "center"
legendPosition	Default = NULL, # c("RIGHT",'top') - RIGHT LEFT TOP BOTTOM
legendDigits	Default = NULL,
legendTitle	Default = "Legend",
legendStyle	Default = "pretty",
legendFixedBreaks	Default = "5",

```

legendBreaks    Default = NULL,
pdfpng          Default = "png",
underLayer      Default = NULL,
overLayer       Default = NULL,
printFig        Default = T,
fileName        Default = "map",
dirOutputs      Default = paste(getwd(), "/outputs", sep = ""),
facetFreeScale  Default = F,
facetRows       Default = NA,
facetCols       Default = 3,
facetBGColor    Default = "grey75",
facetLabelColor Default = "black",
facetLabelSize  Default = 1.5,
alpha           Default = 1
fillcolorNA     Default = NULL
fillshowNA      Default = NA
fillcolorNULL   Default = NULL
facetsON        Default = F,
panelLabel      Default = NULL,
multiFacetRows  Default = NULL,
multiFacetCols  Default = NULL,
mapTitle        Default = NULL
mapTitleSize    Default = 1

```

**Value**

Returns the formatted data used to produce chart

---

metis.mapProcess	<i>metis.mapProcess</i>
------------------	-------------------------

---

**Description**

This function produce different kinds of maps for the metis package. Each figure is accompanied with a csv table.

## Usage

```
metis.mapProcess(polygonDataTables = NULL, gridDataTables = NULL,
  dirOutputs = paste(getwd(), "/outputs", sep = ""), xRange = "All",
  labels = F, labelsSize = 1.2, subRegShape = NULL,
  subRegShpFolder = NULL, subRegShpFile = NULL, subRegCol = NULL,
  subRegType = "subRegType", nameAppend = "",
  legendOutsideSingle = F, legendOutsidePosition = NULL,
  legendPosition = NULL, legendFixedBreaks = 5, legendTitleSize0 = 2,
  legendTextSize0 = 1, legendTitleSizeI = 1.5, legendTextSizeI = 1,
  animateOn = T, delay = 100, scenRef = NULL, extension = F,
  boundaryRegShape = NULL, boundaryRegShpFolder = NULL,
  boundaryRegShpFile = NULL, boundaryRegCol = NULL,
  boundaryRegionsSelect = NULL, fillColorNA = NULL,
  extendedFillColor = "grey75", extendedBGColor = "lightblue1",
  extendedHighLightColor = "cornsilk1", extendedLabelsColor = "grey30",
  extendedLabelSize = 0.7, extendedShape = NULL,
  extendedShapeCol = NULL, expandPercent = 2,
  projX = "+proj=longlat +datum=WGS84 +no_defs +ellps=WGS84 +towgs84=0,0,0",
  figWidth = 9, figHeight = 7, scaleRange = NULL,
  paramsSelect = "All", indivScenarios = T, GCMRCPSSPPol = F,
  multiFacetCols = "scenarioRCP", multiFacetRows = "scenarioGCM",
  legendOutsideMulti = T, legendPositionMulti = NULL,
  legendTitleSizeMulti = NULL, legendTextSizeAnim = NULL,
  legendTextSizeMulti = NULL, refGCM = NULL, refRCP = NULL,
  chosenRefMeanYears = NULL)
```

## Arguments

polygonDataTables	Default = NULL,
gridDataTables	Default = NULL,
dirOutputs	Default = paste(getwd(), "/outputs", sep = ""),
xRange	Default = "All",
labels	Default = F,
labelsSize	Default = 1.2,
subRegShape	Default = NULL,
subRegShpFolder	Default = paste(getwd(), "/dataFiles/gis/admin_gadm36", sep = ""),
subRegShpFile	Default = paste("gadm36_1", sep = ""),
subRegCol	Default = "NAME_1",
subRegType	Default = "subRegType",
nameAppend	Default = ""
legendOutsideSingle	Default = F, Single plots by default have legends inside. This can be moved out if wanted.
legendOutsidePosition	Default = NULL, # "right", "left", "top", "bottom", "center"
legendPosition	Default = NULL, # c("RIGHT", "top") - RIGHT LEFT TOP BOTTOM

```

legendFixedBreaks
    Default = "5",
legendTitleSize0
    Default = 2,
legendTextSize0
    Default = 1,
legendTitleSizeI
    Default = 1,
legendTextSizeI
    Default = 0.5,
animateOn
    Default = T,
delay
    Default = 100,
scenRef
    Default = NULL
extension
    Default = F,
boundaryRegShape
    Default = NULL,
boundaryRegShpFolder
    Default= NULL . Suggested paste(getwd(),"/dataFiles/gis/naturalEarth",sep De-
    fault="")
boundaryRegShpFile
    Default=NULL . Suggested paste("ne_10m_admin_0_countries",sep Default=""),
boundaryRegCol
    Default=NULL. Suggested "NAME_0",
boundaryRegionsSelect
    Default = NULL,
fillcolorNA
    Default = NULL
extendedFillColor
    Default = "grey75",
extendedBGColor
    Default = "lightblue1",
extendedHighLightColor
    Default = "cornsilk1",
extendedLabelsColor
    Default = "grey30",
extdendedLabelSize
    Default = 0.7,
extendedShape
    Default = NULL,
extendedShapeCol
    Default = NULL,
expandPercent
    Default = 2
projX
    Default = projX="+proj=longlat +datum=WGS84 +no_defs +ellps=WGS84 +towgs84=0,0,0"
figWidth
    Default = 9
figHeight
    Default = 7
scaleRange
    Default NULL. Dataframe with columns param, maxScale, minScale to indicate
    maximum and minumum values for a parameter scale.
paramsSelect
    Default = "All"
indvScenarios
    Default = T,

```



```

GCMRCPSSPPol    Default = F,
multiFacetCols  Default = "scenarioRCP",
multiFacetRows  Default = "scenarioGCM",
legendOutsideMulti
                  Default = NULL,
legendPositionMulti
                  Default = NULL,
legendTitleSizeMulti
                  Default = NULL,
legendTextSizeAnim
                  Default = NULL,
legendTextSizeMulti
                  Default = NULL,
refGCM           Default = NULL , eg. "gfdl-esm2m"
refRCP           Default = NULL , eg. "rcp2p6"
chosenRefMeanYears
                  Default=NULL

```

### Value

Returns the formatted data used to produce chart

---

metis.prepGrid	<i>metis.prepGrid</i>
----------------	-----------------------

---

### Description

This function prepares gridded data for use with other metis modules.

### Usage

```

metis.prepGrid(demeterFolder = "NA", demeterScenario = "NA",
  demeterTimesteps = seq(from = 2005, to = 2100, by = 5),
  demeterUnits = "NA", tethysFolder = "NA", tethysScenario = "NA",
  tethysUnits = "NA", tethysFiles = c("wddom", "wdelec", "wdirr",
    "wdliv", "wdmfg", "wdmin", "wdnonag", "wdtotal"), xanthosFolder = "NA",
  xanthosFiles = "NA", xanthosScenarioAssign = "NA",
  xanthosCoordinatesPath = "NA", xanthosGridAreaHechsPath = "NA",
  scarcityXanthosRollMeanWindow = 10, spanLowess = 0.25,
  popFolder = "NA", popFiles = "NA", popUnits = "NA",
  dirOutputs = paste(getwd(), "/outputs", sep = ""), reReadData = 1,
  gridMetisData = paste(getwd(), "/outputs/Grids/gridMetis.RData", sep =
    ""), sqliteUSE = F, sqliteDBNamePath = paste(getwd(),
    "/outputs/Grids/gridMetis.sqlite", sep = ""))

```

**Arguments**

demeterFolder	Full path to demeter outputs
demeterScenario	Name of demeter scenario
demeterTimesteps	Default is seq(from=2005,to=2100,by=5)
demeterUnits	No Default
tethysFolder	Folder for tethys results
tethysScenario	Scenario name for tethys run
tethysUnits	No Default
tethysFiles	Default =c("wddom","wdelec","wdirr","wdliv","wdmfg","wdmin","wdnonag","wdtotal"),
xanthosFolder	Xanthos Folder Path
xanthosFiles	Xanthos Files to Read
xanthosScenarioAssign	Default "NA". Scenario name if testing single scenario.
xanthosCoordinatesPath	paste(getwd(),"/dataFiles/grids/xanthosCoords/coordinates.csv",sep="")
xanthosGridAreaHechsPath	=paste(getwd(),"/dataFiles/grids/xanthosRunsChris/reference/Grid_Areas_ID.csv",sep=""),
scarcityXanthosRollMeanWindow	Default = 10,
spanLowess	Default = 0.25
popFolder	Default = <-paste(getwd(),"/dataFiles/grids/griddedIDsPop/",sep="")
popFiles	Default = <-"grid_pop_map"
popUnits	Default = <-"person"
dirOutputs	Default =paste(getwd(),"/outputs",sep=""),
reReadData	Default =1,
gridMetisData	Default = paste(dirOutputs, "/Grids/gridMetis.RData", sep = "")
sqliteUSE	Default = T,
sqliteDBNamePath	Default = paste(getwd(),"/outputs/Grids/gridMetis.sqlite", sep = "")

**Value**

A table with data by polygon ID for each shapefile provided

---

metis.readgcam	<i>metis.readgcam</i>
----------------	-----------------------

---

## Description

This function connects to a gcamdatabase and uses a query file to out results into a table ready for plotting.

## Usage

```
metis.readgcam(gcamdatabasePath, gcamdatabaseName,
  queryxml = "metisQueries.xml", scenOrigNames, scenNewNames = NULL,
  reReadData = T, dataProj = "dataProj.proj",
  dirOutputs = paste(getwd(), "/outputs", sep = ""),
  regionsSelect = NULL, queriesSelect = "All", paramsSelect = "All")
```

## Arguments

gcamdatabasePath	Path to gcam database folder
gcamdatabaseName	Name of gcam database
queryxml	Full path to query.xml file
scenOrigNames	Original Scenarios names in GCAM database in a string vector. For example c('scenario1','scenario2').
scenNewNames	New Names which may be shorter and more useful for figures etc. Default will use Original Names. For example c('scenario1','scenario2')
reReadData	If TRUE will read the GCAM data base and create a queryData.proj file in the same folder as the GCAM database. If FALSE will load a '.proj' file if a file with full path is provided otherwise it will search for a dataProj.proj file in the existing folder which may have been created from an old run.
dataProj	Optional. A default 'dataProj.proj' is produced if no .Proj file is specified.
dirOutputs	Full path to directory for outputs
regionsSelect	The regions to analyze in a vector. Example c('Colombia','Argentina')
queriesSelect	Default = "All". Vector of queries to read from the queryxml for example c("Total final energy by aggregate end-use sector", "Population by region"). The queries must be availble in the queryxml file. Current list of queries and generated paramaters are: <ul style="list-style-type: none"> <li>"Total final energy by aggregate end-use sector". Parameters generated: finalNrgbySec.</li> <li>"primary energy consumption by region (direct equivalent)". Parameters generated: primNrgConsumByFuel</li> <li>"Electricity generation by aggregate technology". Parameters generated: elecByTech</li> <li>"water withdrawals by sector". Parameters generated: watWithdrawBySec</li> <li>"water consumption by sector". Parameters generated: watConsumBySec</li> <li>"water withdrawals by crop". Parameters generated: watWithdrawByCrop</li> </ul>

- "biophysical water demand by crop type and land region". Parameters generated: watBioPhysCons
- "water withdrawals by water mapping source". Parameters generated: irrWatWithBasin
- "water consumption by water mapping source". Parameters generated: irrWatConsBasin
- "GDP per capita MER by region". Where MER is "Market Exchange Rate". Parameters generated: gdpPerCapita.
- "GDP MER by region". Where MER is "Market Exchange Rate". Parameters generated: gdp, gdpGrowthRate
- "Population by region". Parameters generated: pop.
- "ag production by tech". Where technologies signify irrigated or rainfed. Parameters generated: agProdbyIrrRfd
- "Ag Production by Crop Type". Parameters generated: agProdBiomass, agProdForest, agProdByCrop
- "land allocation by crop and water source". Parameters generated: landIrrRfd
- "aggregated land allocation". Parameters generated: aggLandAlloc
- "Land Use Change Emission". Parameters generated: LUCemissFut
- "CO2 Emissions by enduse". Parameters generated: co2emission, co2emissionByEndUse,
- "GHG emissions by subsector". Parameters generated: ghgEmissByGHG-GROUPS, ghgEmissionByGHG

paramsSelect Default = "All". If desired select a subset of paramaters to analyze from the full list of parameters: c("finalNrgbySec", "primNrgConsumByFuel", "elecByTech", "watConsumBySec", "watWithdrawBySec", "watWithdrawByCrop", "watBioPhysCons", "irrWatWithBasin", "irrWatConsBasin", "gdpPerCapita", "gdp", "gdpGrowthRate", "pop", "agProdbyIrrRfd", "agProdBiomass", "agProdForest", "agProdByCrop", "landIrrRfd", "aggLandAlloc", "LUCemiss", "co2emission", "co2emissionByEndUse", "ghgEmissionByGHG", "ghgEmissByGHGGROUPS")

## Value

A list with the scenarios in the gcam database, queries in the queryxml file and a tibble with gcam data formatted for metis charts.

---

metis.templates

*metis.templates*

---

## Description

This script holds various templates used for different scripts.

## Usage

```
metis.printPdfPng(figure, dir, filename, figWidth = 13, figHeight = 9,
  pdfpng = "png")
```

```
metis.chartsThemeLight()
```

**Arguments**

figure	Figure to be printed in function metis.printPdfPng
dir	Directory to print figure to in function metis.printPdfPng
filename	Filename for figure printed in function metis.printPdfPng
figWidth	Figure Width in inches for figures to be printed in function metis.printPdfPng
figHeight	Figure height in inches for figures to be printed in function metis.printPdfPng
pdfpng	Either "pdf", "png" or "both" to define the format of output

**Details**

List of Templates in this script:

- metis.printPdfPng: Function used to print charts to a pdf or png or both.
- metis.chartsThemeLight: A light ggplot theme for charts
- metis.tmapAnimate: A function to animate tmaps across a variable.
- metis.tmapLayout: A function to define tmap layouts

**Value**

A list of different templates

# Index

## \*Topic **assumptions**

metis.assumptions, 4

## \*Topic **charts,**

metis.chart, 6

metis.chartsProcess, 8

metis.map, 12

metis.mapProcess, 14

metis.templates, 20

## \*Topic **colors,**

metis.colors, 10

## \*Topic **database,**

metis.io, 2

metis.irio, 3

metis.mrio, 3

metis.boundaries, 5

metis.grid2poly, 11

metis.prepGrid, 17

metis.readgcam, 19

## \*Topic **diffplots**

metis.chart, 6

metis.chartsProcess, 8

metis.map, 12

metis.mapProcess, 14

## \*Topic **gcam,**

metis.io, 2

metis.irio, 3

metis.mrio, 3

metis.boundaries, 5

metis.grid2poly, 11

metis.prepGrid, 17

metis.readgcam, 19

## \*Topic **gcam**

metis.io, 2

metis.irio, 3

metis.mrio, 3

metis.boundaries, 5

metis.grid2poly, 11

metis.prepGrid, 17

metis.readgcam, 19

## \*Topic **maps,**

metis.templates, 20

## \*Topic **palette**

metis.colors, 10

## \*Topic **print**

metis.templates, 20

## \*Topic **query**

metis.io, 2

metis.irio, 3

metis.mrio, 3

metis.boundaries, 5

metis.grid2poly, 11

metis.prepGrid, 17

metis.readgcam, 19

## \*Topic **templates,**

metis.templates, 20

metis.io, 2

metis.irio, 3

metis.mrio, 3

metis, 4

metis-package (metis), 4

metis.assumptions, 4

metis.boundaries, 5

metis.chart, 6

metis.chartsProcess, 8

metis.chartsThemeLight  
(metis.templates), 20

metis.colors, 10

metis.grid2poly, 11

metis.map, 12

metis.mapProcess, 14

metis.prepGrid, 17

metis.printPdfPng (metis.templates), 20

metis.readgcam, 19

metis.templates, 20