Package ‘RSAGA’

January 5, 2016

Type Package
Title SAGA Geoprocessing and Terrain Analysis in R
Version 0.94-5
Date 2015-12-23
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Description Provides access to geocomputing and terrain analysis
   functions of the geographical information system (GIS) 'SAGA' (System for
   Automated Geoscientific Analyses) from within R by running the command
   line version of SAGA. This package furthermore provides several R functions
   for handling ASCII grids, including a flexible framework for applying local
   functions (including predict methods of fitted models) and focal functions to
   multiple grids. SAGA GIS is available under GPLv2 / LGPLv2 licence from
   http://sourceforge.net/projects/saga-gis/.
License GPL-2 | file LICENSE
SystemRequirements SAGA GIS (2.0.4 - 2.2.3)
Depends R (>= 2.10), gstat, shapefiles, plyr
Suggests knitr
LazyLoad yes
Collate 'gridtools.R' 'RSAGA-core.R' 'RSAGA-modules.R' 'RSAGA-utils.R'
   'RSAGA-package.R' 'landslides.R'
VignetteBuilder knitr
NeedsCompilation no
Repository CRAN
Date/Publication 2016-01-05 09:34:50

R topics documented:

RSAGA-package ................................................................. 3
centervalue ................................................................. 4
R topics documented:

<table>
<thead>
<tr>
<th>Function</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>create.variable.name</td>
<td>4</td>
</tr>
<tr>
<td>focal.function</td>
<td>5</td>
</tr>
<tr>
<td>grid.predict</td>
<td>8</td>
</tr>
<tr>
<td>grid.to.xyz</td>
<td>10</td>
</tr>
<tr>
<td>landslides</td>
<td>11</td>
</tr>
<tr>
<td>match.arg.ext</td>
<td>13</td>
</tr>
<tr>
<td>multi.focal.function</td>
<td>14</td>
</tr>
<tr>
<td>pick.from.points</td>
<td>18</td>
</tr>
<tr>
<td>read.ascii.grid</td>
<td>22</td>
</tr>
<tr>
<td>relative.position</td>
<td>25</td>
</tr>
<tr>
<td>resid.median</td>
<td>26</td>
</tr>
<tr>
<td>rsaga.add.grid.values.to.points</td>
<td>27</td>
</tr>
<tr>
<td>rsaga.close.gaps</td>
<td>28</td>
</tr>
<tr>
<td>rsaga.contour</td>
<td>29</td>
</tr>
<tr>
<td>rsaga.copy.sgrd</td>
<td>30</td>
</tr>
<tr>
<td>rsaga.default.path</td>
<td>31</td>
</tr>
<tr>
<td>rsaga.env</td>
<td>31</td>
</tr>
<tr>
<td>rsaga.esri.to.sgrd</td>
<td>34</td>
</tr>
<tr>
<td>rsaga.esri.wrapper</td>
<td>35</td>
</tr>
<tr>
<td>rsaga.fill.sinks</td>
<td>37</td>
</tr>
<tr>
<td>rsaga.filter.gauss</td>
<td>39</td>
</tr>
<tr>
<td>rsaga.filter.simple</td>
<td>39</td>
</tr>
<tr>
<td>rsaga.geoprocessor</td>
<td>40</td>
</tr>
<tr>
<td>rsaga.get.modules</td>
<td>43</td>
</tr>
<tr>
<td>rsaga.get.usage</td>
<td>45</td>
</tr>
<tr>
<td>rsaga.get.version</td>
<td>46</td>
</tr>
<tr>
<td>rsaga.grid.calculus</td>
<td>47</td>
</tr>
<tr>
<td>rsaga.grid.to.points</td>
<td>49</td>
</tr>
<tr>
<td>rsaga.hillshade</td>
<td>50</td>
</tr>
<tr>
<td>rsaga.html.help</td>
<td>52</td>
</tr>
<tr>
<td>rsaga.import.gdal</td>
<td>53</td>
</tr>
<tr>
<td>rsaga.insolation</td>
<td>59</td>
</tr>
<tr>
<td>rsaga.inverse.distance</td>
<td>61</td>
</tr>
<tr>
<td>rsaga.lib.prefix</td>
<td>63</td>
</tr>
<tr>
<td>rsaga.local.morphometry</td>
<td>64</td>
</tr>
<tr>
<td>rsaga.parallel.processing</td>
<td>65</td>
</tr>
<tr>
<td>rsaga.pisr</td>
<td>68</td>
</tr>
<tr>
<td>rsaga.pisr2</td>
<td>71</td>
</tr>
<tr>
<td>rsaga.sgrd.to.esri</td>
<td>73</td>
</tr>
<tr>
<td>rsaga.sink.removal</td>
<td>74</td>
</tr>
<tr>
<td>rsaga.sink.route</td>
<td>76</td>
</tr>
<tr>
<td>rsaga.slope.asp.curv</td>
<td>77</td>
</tr>
<tr>
<td>rsaga.solar.radiation</td>
<td>79</td>
</tr>
<tr>
<td>rsaga.target</td>
<td>81</td>
</tr>
<tr>
<td>rsaga.topdown.processing</td>
<td>83</td>
</tr>
<tr>
<td>rsaga.wetness.index</td>
<td>85</td>
</tr>
<tr>
<td>set.file.extension</td>
<td>87</td>
</tr>
<tr>
<td>wind.shelter</td>
<td>88</td>
</tr>
</tbody>
</table>
Description

RSAGA provides direct access to SAGA GIS functions including, for example, a comprehensive set of terrain analysis algorithms for calculating local morphometric properties (slope, aspect, curvature), hydrographic characteristics (size, height, and aspect of catchment areas), and other process-related terrain attributes (potential incoming solar radiation, topographic wetness index, and more). In addition, (R)SAGA provides functions for importing and exporting different grid file formats, and tools for preprocessing grids, e.g. closing gaps or filling sinks.

Details

RSAGA adds a framework for creating custom-defined focal functions, e.g. specialized filter and terrain attributes such as the topographic wind shelter index, within R. This framework can be used to apply predict methods of fitted statistical models to stacks of grids representing predictor variables. Furthermore, functions are provided for conveniently picking values at point locations from a grid using kriging or nearest neighbour interpolation.

RSAGA requires SAGA GIS (versions 2.0.4 - 2.2.3) are currently supported) and its user-contributed modules to be available on your computer. These can be downloaded under GPL from [http://sourceforge.net/projects/saga-gis/](http://sourceforge.net/projects/saga-gis/). Please check the help page for rsaga.env to make sure that RSAGA can find your local installation of SAGA. You may need to ‘tell’ RSAGA where to find SAGA GIS.

Thanks to Olaf Conrad, Andre Ringeler and all the other SAGA GIS developers and contributors of this excellent geocomputing tool! Thanks to Rainer Hurling, Johan van de Wauw, Massimo Di Stefano and others for helping to adapt SAGA to and test it on unix and Max OSX.

Author(s)

Alexander Brenning and Donovan Bangs

References


centervalue

**Pick Center Value from Matrix**

**Description**

Pick the value in the center of a square matrix. Auxiliary function to be used by functions called by `focal.function`.

**Usage**

```r
centervalue(x)
```

**Arguments**

- `x`: a square matrix

**Details**

See for example the code of `resid.median`.

**See Also**

`focal.function`, `resid.median`

**Examples**

```r
( m <- matrix(round(runif(9,1,10)), ncol=3) )
centervalue(m)
```

---

create.variable.name

**Convert file name to variable name**

**Description**

Convert a file name into a variable name

**Usage**

```r
create.variable.name(filename, prefix = NULL, fsep = .Platform$file.sep)
```

**Arguments**

- `filename`: character string
- `prefix`: character string: optional prefix to be added
- `fsep`: character used to separate path components
focal.function  Local and Focal Grid Functions

Description

focal.function cuts out square or circular moving windows from a grid (matrix) and applies a user-defined matrix function to calculate e.g. a terrain attribute or filter the grid. The function is suitable for large grid files as it can process them row by row. local.function represents the special case of a moving window of radius 1. Users can define their own functions operating on moving windows, or use simple functions such as median to define filters.

Usage

```r
focal.function(in.grid, in.factor.grid, out.grid.prefix, path = NULL, in.path = path, out.path = path, fun, varnames, radius = 0, is.pixel.radius = TRUE, na.strings = "NA", valid.range = c(-Inf, Inf), nodata.values = c(), out.nodata.value, search.mode = c("circle", "square"), digits = 4, hdr.digits = 10, dec = ".", quiet = TRUE, nlines = Inf, mw.to.vector = FALSE, mw.na.rm = FALSE, ...) 

gapply(in.grid, fun, varnames, mw.to.vector = TRUE, mw.na.rm = TRUE, ...) 

local.function(...) 
```

Arguments

- `in.grid`: file name of input ASCII grid, relative to `in.path`
- `in.factor.grid`: optional file name giving a gridded categorical variables defining zones; zone boundaries are used as breaklines for the moving window (see Details)
- `out.grid.prefix`: character string (optional), defining a file name prefix to be used for the output file names; a dash (`-`) will separate the prefix and the `varnames`
- `path`: path in which to look for `in.grid` and write output grid files; see also `in.path` and `out.path`, which overwrite path if they are specified
- `in.path`: path in which to look for `in.grid` (defaults to path)
- `out.path`: path in which to write output grid files; defaults to path
- `fun`: a function, or name of a function, to be applied on the moving window; see Details

Examples

```r
## Not run:
create.variable.name("C:/my-path/my-file-name.Rd",prefix="res")

## End(Not run)
```
varnames character vector specifying the names of the variable(s) returned by fun; if missing, focal.function will try to determine the varnames from fun itself, or from a call to fun if this is a function (see Details)

radius numeric value specifying the (circular or square) radius of the moving window; see is.pixel.radius and search.mode; note that all data within distance \(<=\text{radius}\) will be included in the moving window, not \(\text{radius}\).

is.pixel.radius logical: if TRUE (default), the radius will be interpreted as a (possibly non-integer) number of pixels; if FALSE, it is interpreted as a radius measured in the grid (map) units.

na.strings passed on to scan

valid.range numeric vector of length 2, specifying minimum and maximum valid values read from input file; all values \(<\text{valid.range}[1]\) or \(>\text{valid.range}[1]\) will be converted to NA.

nodata.values numeric vector: any values from the input grid file that should be converted to NA, in addition to the nodata value specified in the grid header

out.nodata.value numeric: value used for storing NAs in the output file(s); if missing, use the same nodata value as specified in the header of the input grid file

search.mode character, either "circle" (default) for a circular search window, or "square" for a squared one.

digits numeric, specifying the number of digits to be used for output grid file.

hdr.digits numeric, specifying the number of digits to be used for the header of the output grid file (default: 10; see write.ascii.grid.header).

dec character, specifying the decimal mark to be used for input and output.

quiet If TRUE, gives some output ("*") after every 10th line of the grid file and when the job is done.

nlines Number of lines to be processed; useful for testing purposes.

mw.to.vector logical: Should the content of the moving window be coerced (from a matrix) to a vector?

mw.na.rm logical: Should NAs be removed from moving window prior to passing the data to fun? Only applicable when mw.to.vector=TRUE.

... Arguments to be passed to fun; local.function: arguments to be passed to focal.function.

Details

focal.function passes a square matrix of size \(2*\text{radius}+1\) to the function fun if mw.to.vector=FALSE (default), or a vector of length \(<=\left(2*\text{radius}+1\right)^2\) if mw.to.vector=TRUE. This matrix or vector will contain the content of the moving window, which may possibly contain NAs even if the in.grid has no nodata values, e.g. due to edge effects. If search.mode="circle", values more than radius units (pixels or grid units, depending on is.pixel.radius) away from the center pixel / matrix entry will be set to NA. In addition, valid.range, nodata.values, and the nodata values specified in the in.grid are checked to assign further NAs to pixels in the moving window. Finally, if
in.factor.grid specifies zones, all pixels in the moving window that belong to a different zone than the center pixel are set to NA, or, in other words, zone boundaries are used as breaklines.

The function fun should return a single numeric value or a numeric vector. As an example, the function resid.minmedmax returns the minimum, median and maximum of the difference between the values in the moving window and the value in the center grid cell. In addition to the (first) argument receiving the moving window data, fun may have additional arguments; the ... argument of focal.function is passed on to fun. resid.quantile is a function that uses this feature.

Optionally, fun should support the following feature: If no argument is passed to it, then it should return a character vector giving variable names to be used for naming the output grids. The call resid.minmedmax(), for example, returns c("rmin","rmed","rmax"); this vector must have the same length as the numeric vector returned when moving window data is passed to the function. This feature is only used if no varnames argument is provided. Note that the result is currently being abbreviated to a length of 6 characters.

Input and output file names are built according to the following schemes:

Input: [<in.path>/]<in.grid>
Zones: [<in.path>/]<in.factor.grid> (if specified)
Output: [<out.path>/]<out.grid.prefix>-<varnames>.asc

For the input files, .asc is used as the default file extension, if it is not specified by the user.

Value

focal.function and local.function return the character vector of output file names.

Note

These functions are not very efficient ways of calculating e.g. (focal) terrain attributes compared to for example the SAGA modules, but the idea is that you can easily specify your own functions without starting to mess around with C code. For example try implementing a median filter as a SAGA module... or just use the code shown in the example!

Author(s)

Alexander Brenning

References


See Also

multi.focal.function, multi.local.function, resid.median, resid.minmedmax, relative.position, resid.quantile, resid.quartiles, relative.rank, wind.shelter, create.variable.name
Examples

```r
## Not run:
# A simple median filter applied to dem.asc:
gapply("median",radius=3)
# Same:
#focal.function("median",radius=3,mw.to.vector=TRUE,mw.na.rm=TRUE)
# See how the filter has changed the elevation data:
d1 = as.vector(read.asciigrid("median")$data)
d2 = as.vector(read.asciigrid("median")$data)
hist(d1-d2,br=50)

## End(Not run)
# Wind shelter index used by Plattner et al. (2004):
## Not run:
ctrl = wind.shelter.prep(6,-pi/4,pi/12,10)
focal.function("dem",fun=wind.shelter.control=ctrl,
              radius=6,search.mode="circle")

## End(Not run)
# Or how about this, if "aspect" is local terrain exposure:
## Not run:
gapply("aspect","cos") # how "northerly-exposed" is a pixel?
gapply("aspect","sin") # how "easterly-exposed" is a pixel?
# Same result, but faster:
focal.function("aspect",fun=function(x) c(cos(x),sin(x)), varnames=c("cos","sin"))

## End(Not run)
```

grid.predict  

*Helper function for applying predict methods to stacks of grids.*

Description

This function can be used to apply the predict method of hopefully any fitted predictive model pixel by pixel to a stack of grids representing the explanatory variables. It is intended to be called primarily by `multi.local.function` or `multi.focal.function`.

Usage

```r
grid.predict(fit, predfun, trafo, control.predict, predict.column, trace = 0,
             location, ...)
```

Arguments

- **fit**
  a model object for which prediction is desired

- **predfun**
  optional prediction function; if missing, the fit's `predict` method is called. In some cases it may be convenient to define a wrapper function for the predict method that may be passed as `predfun` argument.
trafo

an optional function(x) that takes a data.frame x and returns a data.frame with the same number of rows; this is intended to perform transformations on the input variables, e.g. derive a log-transformed variable from the raw input read from the grids, or more complex variables such as the NDVI etc.; the data.frame resulting from a call to trafo (if provided) is passed to predfun

control.predict

an optional list of arguments to be passed on to predfun; this may be e.g. type="response" to obtain probability prediction maps from a logistic regression model

predict.column

optional character string: Some predict methods (e.g. predict.lda) return a data.frame with several columns, e.g. one column per class in a classification problem. predict.column is used to pick the one that is of interest

trace

integer >=0: positive values give more (=2) or less (=1) information on predictor variables and predictions

location

optional location data received from multi.focal.function; is added to the nndata object that is passed on to predfun.

... these arguments are provided by the calling function, usually multi.local.function or multi.focal.function. They contain the explanatory (predictor) variables required by the fit model.

Details

grid.predict is a simple wrapper function. First it binds the arguments in ... together in a data.frame with the raw predictor variables that have been read from their grids by the caller, multi.local.function (or multi.focal.function). Then it calls the optional trafo function to transform or combine predictor variables (e.g. perform log transformations, ratioing, arithmetic operations such as calculating the NDVI). Finally the predfun (or, typically, the default predict method of fit) is called, handing over the fit, the predictor data.frame, and the optional control.predict arguments.

Value

grid.predict returns the result of the call to predfun or the default predict method.

Note

Though grid.predict can in principle deal with predict methods returning factor variables, its usual caller multi.local.function / multi.focal.function cannot; classification models should be dealt with by setting a type="prob" (for rpart) or type="response" (for logistic regression and logistic additive model) argument, for example (see second Example below).

Author(s)

Alexander Brenning
grid.to.xyz

Convert Grid Matrix to (x,y,z) data.frame

Description

Convert a grid matrix to a (x,y,z) data.frame.
Usage

grid.to.xyz(data, header, varname = "z", colnames = c("x", "y", varname))

Arguments

data: grid data: either a grid data matrix, or a list with components data (a matrix with the grid data) and header (the grid header information); see read.ascii.grid for details

header: optional list giving grid header information; see read.ascii.grid for details

varname: character: name to be assigned to the column with the z values in the output data.frame

colnames: names to be given to the columns corresponding to the x and y coordinates and the grid variable in the output data.frame

Value

a data.frame with three columns (names are specified in the colnames argument) giving the x and y coordinates and the attribute values at the locations given by the grid data.

See Also

read.ascii.grid, pick.from.ascii.grid

Examples

```
## Not run:
d = read.ascii.grid("dem")
xyz = grid.to.xyz(d, varname="elevation")
str(xyz)

## End(Not run)
```

Description

Landslide initiation points in the Reserva Biologica San Francisco (RBSF) area of the tropical Andes in Ecuador. The landslide inventory was mapped by Stoyan (2000) in the field and by the presence of landslide scars in aerial imagery. The 10 m x 10 m digital elevation model (DEM) was triangulated from aerial imagery as described by Jordan *et al.* (2005) and provided courtesy of Lars Ungerechts (2010).
Format

A data frame of 1535 rows and 3 variables:

- `x`: the x coordinate of the sample point
- `y`: the y coordinate of the sample point
- `lslpts`: TRUE or FALSE of landslide observation at sample point

A digital elevation model as a .Rd grid dem

- `$header` list of 8 DEM header properties
- `$data` grid elevation values (m ASL)

Details

Loading this dataset also loads the object `dem`. Existing objects named `dem` may be overwritten.

Landslide data provided here are a subset of that used to build generalized additive models (GAMs) as landslide susceptibility models by Muenchow et al. (2012). These data correspond to those in the "natural" part of the RBSF area. Please refer to the accompanying vignette for an introductory tutorial on the use of the RSAGA package for terrain analysis, geoprocessing, and model-building using these data.

Source

**DEM:**


**Landslide Data:**

Muenchow, J., Brenning, A., Richter, R. (2012) Geomorphic process rates of landslides along a humidity gradient in the tropical Andes, Geomorphology, 139-140, 271-284


Examples

```r
# Not run:
library(RSAGA)
data(landslides)

# Print the DEM header:
dem$header

# Write the DEM to a SAGA grid:
write.sgrd(data = dem, file = "dem", header = dem$header, env = env)
```
# Calculate slope of DEM:
rsaga.slope(in.dem = "dem", out.slope = "slope", method = "poly2zevenbergen", env = env)

# Pick slope values at landslide points.
# added to landslides data.frame as variable "slope":
landslides <- pick.from.saga.grid(data = landslides,
   filename = "slope",
   varname = "slope",
   env = env)

## End(Not run)

---

**match.arg.ext**  
*Extended Argument Matching*

**Description**

`match.arg.ext` matches `arg` against a set of candidate values as specified by `choices`; it extends `match.arg` by allowing `arg` to be a numeric identifier of the `choices`.

**Usage**

```
match.arg.ext(arg, choices, base = 1, several.ok = FALSE, numeric = FALSE, ignore.case = FALSE)
```

**Arguments**

- `arg`  
a character string or numeric value
- `choices` 
a character vector of candidate values
- `base`  
numeric value, specifying the numeric index assigned to the first element of `choices`
- `several.ok`  
logical specifying if `arg` should be allowed to have more than one element
- `numeric`  
logical specifying if the function should return the numerical index (counting from `base`) of the matched argument, or, by default, its name
- `ignore.case`  
logical specifying if the matching should be case sensitive

**Details**

When `choices` are missing, they are obtained from a default setting for the formal argument `arg` of the function from which `match.arg.ext` was called.

Matching is done using `pmatch` (indirectly through a call to `match.arg`, so `arg` may be abbreviated. If `arg` is numeric, it may take values between `base` and `length(choices)+base-1`. `base=1` will give standard 1-based R indices, `base=0` will give indices counted from zero as used to identify SAGA modules in library RSAGA.
multi.focal.function

Value

If `numeric` is false and `arg` is a character string, the function returns the unabbreviated version of the unique partial match of `arg` if there is one; otherwise, an error is signalled if `several.ok` is false, as per default. When `several.ok` is true and there is more than one match, all unabbreviated versions of matches are returned.

If `numeric` is false but `arg` is numeric, `match.arg.ext` returns name of the match corresponding to this index, counting from base; i.e. `arg`=base corresponds to `choices[1]`.

If `numeric` is true, the function returns the numeric index(es) of the partial match of `arg`, counted from base to `length(choices)+base-1`. If `arg` is already numeric, the function only checks whether it falls into the valid range from `arg` to `length(choices)+base-1` and returns `arg`.

Author(s)

Alexander Brenning

See Also

`match.arg`, `pmatch`

Examples

```r
# Based on example from 'match.arg':
require(stats)
center <- function(x, type = c("mean", "median", "trimmed")) {
  type <- match.arg.ext(type, base=0)
switch(type,
    mean = mean(x),
    median = median(x),
    trimmed = mean(x, trim = 0.1))
}
x <- rcauchy(10)
center(x, "t")       # Works
center(x, 2)         # Same, for base=0
center(x, "med")    # Works
center(x, 1)         # Same, for base=0
try(center(x, "m")) # Error
```

multi.focal.function  Local and Focal Grid Function with Multiple Grids as Inputs

Description

`multi.focal.function` cuts out square or circular moving windows from a stack of grids (matrices) and applies a user-defined matrix function that takes multiple arguments to this data. `multi.local.function` is a more efficiently coded special case of moving windows of size 0, i.e. functions applied to individual grid cells of a stack of grids. This is especially useful for applying predict methods of statistical models to a stack of grids containing the explanatory variables (see Examples and `grid.predict`). The function is suitable for large grid files as it can process them row by row; but it may be slow because one call to the focal function is generated for each grid cell.
**Usage**

multi.focal.function(in.grids, in.grid.prefix, in.factor.grid, out.grid.prefix, path = NULL, in.path = path, out.path = path, fun, in.varnames, out.varnames, radius = 0, is.pixel.radius = TRUE, na.strings = "NA", valid.ranges, nodata.values = c(), out.nodata.value, search.mode = c("circle", "square"), digits = 4, hdr.digits = 10, dec = ".", quiet = TRUE, nlines = Inf, mw.to.vector = FALSE, mw.na.rm = FALSE, pass.location = FALSE, ...)

multi.local.function(in.grids, in.grid.prefix, out.grid.prefix, path = NULL, in.path = path, out.path = path, fun, in.varnames, out.varnames, path in which to look for in.grids and write output grid files; see also in.path and out.path, which overwrite path if they are specified

**Arguments**

- **in.grids**: character vector: file names of input ASCII grids, relative to in.path; in.grid.prefix will be used as a prefix to the file name if specified; default file extension: .asc
- **in.grid.prefix**: character string (optional), defining a file name prefix to be used for the input file names; a dash (-) will separate the prefix and the in.varnames
- **in.factor.grid**: optional file name giving a gridded categorical variables defining zones; zone boundaries are used as breaklines for the moving window (see Details)
- **out.grid.prefix**: character string (optional), defining a file name prefix to be used for the output file names; a dash (-) will separate the prefix and the out.varnames
- **path**: path in which to look for in.grids and write output grid files; see also in.path and out.path, which overwrite path if they are specified
- **in.path**: path in which to look for in.grids (defaults to path)
- **out.path**: path in which to write output grid files; defaults to path
- **fun**: a function, or name of a function, to be applied on the moving window; see Details; fun is expected to accept named arguments with the names given by in.varnames; grid.predict is a wrapper function that can be used for applying a model's predict method to a stack of grids; see Details. In multi.local.function, fun must be able to process arguments that are vectors of equal length (e.g., a vector of 50 slope angles, another vector of 50 elevation values, etc.).
- **in.varnames**: character vector: names of the variables corresponding to the in.grids; if missing, same as in.grids; if specified, must have the same length and order as in.grids
- **out.varnames**: character vector specifying the name(s) of the variable(s) returned by fun; if missing, multi.focal.function will try to determine the varnames from fun itself, or or from a call to fun if this is a function (see Details)
- **radius**: numeric value specifying the (circular or square) radius of the moving window; see is.pixel.radius and search.mode; note that all data within distance <=radius will be included in the moving window, not <radius.
is.pixel.radius
  logical: if TRUE (default), the radius will be interpreted as a (possibly non-
  integer) number of pixels; if FALSE, it is interpreted as a radius measured in the
  grid (map) units.

na.strings
  passed on to scan

valid.ranges
  optional list of length length(in grids) with numeric vector of length 2, spec-
  ifying minimum and maximum valid values read from input file; all values
  in valid.ranges[[i]][1] or >valid.ranges[[i]][1] will be converted to NA.

nodata.values
  numeric vector: any values from the input grid file that should be converted to
  NA, in addition to the nodata value specified in the grid header

out.nodata.value
  numeric: value used for storing NAs in the output file(s); if missing, use the same
  nodata value as specified in the header of the input grid file

search.mode
  character, either "circle" (default) for a circular search window, or "square"
  for a squared one.

digits
  numeric, specifying the number of digits to be used for output grid file.

hdr.digits
  numeric, specifying the number of digits to be used for the header of the output
  grid file (default: 10; see write.ascii.grid.header).

dec
  character, specifying the decimal mark to be used for input and output.

quiet
  If FALSE, gives some output ("*") after every 10th line of the grid file and when
  the job is done.

nlines
  Number of lines to be processed; useful for testing purposes.

mw.to.vector
  logical: Should the content of the moving window be coerced (from a matrix)
  to a vector?

mw.na.rm
  logical: Should NAs be removed from moving window prior to passing the data
  to fun? Only applicable when mw.to.vector=TRUE.

pass.location
  logical: Should the x,y coordinates of grid points (center of grid cells) be passed
  to fun? If TRUE, two additional arguments named arguments x and y are passed
  to fun; NOTE: This currently only works for radius=0, otherwise a warning is
  produced and pass.location is reset to FALSE.

na.action
  function: determines if/how NA values are omitted from the stack of input vari-
  ables; use na.exclude (default) or na.pass if fun can handle NA values cor-

... 
  Arguments to be passed to fun; local.function: arguments to be passed to
  focal.function.

Details

multi.local.function is probably most useful for applying the predict method of a fitted
model to a grids representing the predictor variables. An example is given below and in more
detail in Brenning (2008) (who used multi.focal.function for the same purpose); see also
grid.predict.

multi.local.function is essentially the same as multi.focal.function for radius=0, but
coded MUCH more efficiently. (The relevant code will eventually migrate into multi.focal.function
as well, but requires further testing.) Applying a GAM to the data set of Brenning (2008) takes about 1/100th the time with `multi.local.function` compared to `multi.focal.function`.

`multi.focal.function` extends `focal.function` by allowing multiple input grids to be passed to the focal function `fun` operating on moving windows. It passes square matrices of size \(2\times radius + 1\) to the function `fun` if `mw.to.vector=FALSE` (default), or a vector of length \(\leq (2\times radius + 1)\times 2\) if `mw.to.vector=TRUE`; one such matrix or vector per input grid will be passed to `fun` as an argument whose name is specified by `in.varnames`.

These matrices or vectors will contain the content of the moving window, which may possibly contain NAs even if the `in.grid` has no nodata values, e.g. due to edge effects. If `search.mode="circle"`, values more than `radius` units (pixels or grid units, depending on `is.pixel.radius`) away from the center pixel / matrix entry will be set to `NA`. In addition, `valid.range`, `nodata.values`, and the nodata values specified in the `in.grid` are checked to assign further NAs to pixels in the moving window. Finally, if `in.factor.grid` specifies zones, all pixels in the moving window that belong to a different zone than the center pixel are set to `NA`, or, in other words, zone boundaries are used as breaklines.

The function `fun` should return a single numeric value or a numeric vector, such as a regression result or a vector of class probabilities returned by a soft classifier. In addition to the named arguments receiving the moving window data, `fun` may have additional arguments; the `...` argument of `focal.function` is passed on to `fun`. `grid.predict` uses this feature.

Optionally, `fun` should support the following feature: If no argument is passed to it, then it should return a character vector giving variable names to be used for naming the output grids.

For the input files, `.asc` is used as the default file extension, if it is not specified by the user.

See `focal.function` for details.

**Value**

`multi.focal.function` returns the character vector of output file names.

**Note**

`multi.focal.function` can do all the things `focal.function` can do.

**Author(s)**

Alexander Brenning

**References**


**See Also**

`focal.function`, `grid.predict`
Examples

## Not run:

# Assume that `d` is a data.frame with point observations
# of a numerical response variable `y` and predictor variables
# `a`, `b`, and `c`.
# Fit a generalized additive model to `y`, `a`, `b`, `c`.
# We want to model `b` and `c` as nonlinear terms:
require(gam)
fit <- gam(y ~ a + s(b) + s(c), data = d)
multi.local.function(in.grids = c("a", "b", "c"),
  out.varnames = "pred",
  fun = grid.predict, fit = fit)
  # Note that the 'grid.predict' uses by default the
  # predict method of 'fit'.
# Model predictions are written to a file named pred.asc

## End(Not run)

## Not run:

# A fake example of a logistic additive model:
require(gam)
fit <- gam(cl ~ a + s(b) + s(c), data = d, family = binomial)
multi.local.function(in.grids = c("a", "b", "c"),
  out.varnames = "pred",
  fun = grid.predict, fit = fit,
  control.predict = list(type = "response") )
  # 'control.predict' is passed on to 'grid.predict', which
  # dumps its contents into the arguments for 'fit''s
  # 'predict' method.
# Model predictions are written to a file named pred.asc

## End(Not run)

---

pick.from.points Pick Variable from Spatial Dataset

### Description

These functions pick (i.e. interpolate without worrying too much about theory) values of a spatial variables from a data stored in a data.frame, a point shapefile, or an ASCII or SAGA grid, using nearest neighbor or kriging interpolation. `pick.from.points` and `[internal.]pick.from.ascii.grid` are the core functions that are called by the different wrappers.

### Usage

```
pick.from.points(data, src, pick, method = c("nearest.neighbour", "krige"),
  set.na = FALSE, radius = 200, nmin = 0, nmax = 100, sill = 1,
  range = radius, nugget = 0, model = vgm(sill - nugget, "Sph", range =
  range, nugget = nugget), log = rep(FALSE, length(pick)), x.name = "x",
```
Y.name = "y", cbind = TRUE)

pick.from.shapefile(data, shapefile, X.name = "x", Y.name = "y", ...)  

pick.from.ascii.grid(data, file, path = NULL, varname = NULL, 
prefix = NULL, method = c("nearest.neighbour", "krige"), cbind = TRUE, 
parallel = FALSE, nsplit, quiet = TRUE, ...)  

pick.from.ascii.grids(data, file, path = NULL, varname = NULL, 
prefix = NULL, cbind = TRUE, quiet = TRUE, ...)  

internal.pick.from.ascii.grid(data, file, path = NULL, varname = NULL, 
prefix = NULL, method = c("nearest.neighbour", "krige"), 
nodata.values = c(-9999, -99999), at.once, quiet = TRUE, X.name = "x", 
Y.name = "y", nlines = Inf, cbind = TRUE, range, radius,  
na.strings = "NA", ...)  

pick.from.saga.grid(data, filename, path, varname, prec = 7, 
show.output.on.console = FALSE, env = rsaga.env(), ...)  

Arguments  

data data.frame giving the coordinates (in columns specified by X.name, Y.name) of point locations at which to interpolate the specified variables or grid values  

src data.frame  

pick variables to be picked (interpolated) from src; if missing, use all available variables, except those specified by X.name and Y.name  

method interpolation method to be used; uses a partial match to the alternatives "nearest.neighbor" (currently the default) and "krige"  

set.na logical: if a column with a name specified in pick already exists in data, how should it be dealt with? set.na=FALSE (default) only overwrites existing data if the interpolator yields a non-NA result; set.na=TRUE passes NA values returned by the interpolator on to the results data.frame  

radius numeric value specifying the radius of the local neighborhood to be used for interpolation; defaults to 200 map units (presumably meters), or, in the functions for grid files, 2.5*cellsize.  

nmin numeric, for method="krige" only: see krig function in package gstat  

nmax numeric, for method="krige" only: see krig function in package gstat  

sill numeric, for method="krige" only: the overall sill parameter to be used for the variogram  

range numeric, for method="krige" only: the variogram range  

nugget numeric, for method="krige" only: the nugget effect  

model for method="krige" only: the variogram model to be used for interpolation; defaults to a spherical variogram with parameters specified by the range, sill, and nugget arguments; see vgm in package gstat for details
log  logical vector, specifying for each variable in pick if interpolation should take place on the logarithmic scale (default: FALSE)

X.name  name of the variable containing the x coordinates

Y.name  name of the variable containing the y coordinates

cbind  logical: should the new variables be added to the input data.frame (cbind=TRUE, the default), or should they be returned as a separate vector or data.frame? cbind=FALSE

shapefile  point shapefile

...  arguments to be passed to pick.from.points, and to internal.pick.from.ascii.grid in the case of pick.from.ascii.grid

file  file name (relative to path, default file extension .asc) of an ASCII grid from which to pick a variable, or an open connection to such a file

path  optional path to file

varname  character string: a variable name for the variable interpolated from grid file file in pick.from.*.grid; if missing, variable name will be determined from filename by a call to create.variable.name

prefix  an optional prefix to be added to the varname

parallel  logical (default: FALSE): enable parallel processing; requires additional packages such as doSNOW or doMC. See example below and dplyr

nsplit  split the data.frame data in nsplit disjoint subsets in order to increase efficiency by using dplyr in package plyr. The default seems to perform well in many situations.

quiet  logical: provide information on the progress of grid processing on screen? (only relevant if at.once=FALSE and method="nearest.neighbour")

nodata.values  numeric vector specifying grid values that should be converted to NA; in addition to the values specified here, the nodata value given in the input grid’s header will be used

at.once  logical: should the grid be read as a whole or line by line? at.once=FALSE is useful for processing large grids that do not fit into memory; the argument is currently by default FALSE for method="nearest.neighbour", and it currently MUST be TRUE for all other methods (in these cases, TRUE is the default value); piecewise processing with at.once=FALSE is always faster than processing the whole grid at.once

nlines  numeric: stop after processing nlines lines of the input grid; useful for testing purposes

na.strings  passed on to scan

filename  character: name of a SAGA grid file, default extension .sgrd

prec  numeric, specifying the number of digits to be used in converting a SAGA grid to an ASCII grid in pick.from.saga.grid

show.output.on.console  a logical (default: FALSE), indicates whether to capture the output of the command and show it on the R console (see system, rsaga.geoprocessor).

env  list: RSAGA geoprocessing environment created by rsaga.env
pick.from.points

Details

pick.from.points interpolates the variables defined by pick in the src data.frame to the locations provided by the data data.frame. Only nearest neighbour and ordinary kriging interpolation are currently available. This function is intended for 'data-rich' situations in which not much thought needs to be put into a geostatistical analysis of the spatial structure of a variable. In particular, this function is supposed to provide a simple, 'quick-and-dirty' interface for situations where the src data points are very densely distributed compared to the data locations.

pick.from.shapefile is a front-end of pick.from.points for point shapefiles.

pick.from.ascii.grid retrieves data values from an ASCII raster file using either nearest neighbour or ordinary kriging interpolation. The latter may not be possible for large raster data sets because the entire grid needs to be read into an R matrix. Split-apply-combine strategies are used to improve efficiency and allow for parallelization.

The optional parallelization of pick.from.ascii.grid computation requires the use of a parallel backend package such as doSNOW or doMC, and the parallel backend needs to be registered before calling this function with parallel=TRUE. The example section provides an example using doSNOW on Windows. I have seen 25-40 pick.from.ascii.grids performs multiple pick.from.ascii.grid calls. File path and prefix arguments may be specific to each file (i.e. each may be a character vector), but all interpolation settings will be the same for each file, limiting the flexibility a bit compared to individual pick.from.ascii.grid calls by the user. pick.from.ascii.grids currently processes the files sequentially (i.e. parallelization is limited to the pick.from.ascii.grid calls within this function).

pick.from.saga.grid is the equivalent to pick.from.ascii.grid for SAGA grid files. It simply converts the SAGA grid file to a (temporary) ASCII raster file and applies pick.from.ascii.grid.

internal.pick.from.ascii.grid is an internal 'workhorse' function that by itself would be very inefficient for large data sets data. This function is called by pick.from.ascii.grid, which uses a split-apply-combine strategy implemented in the plyr package.

Value

If cbind=TRUE, columns with the new, interpolated variables are added to the input data.frame data. If cbind=FALSE, a data.frame only containing the new variables is returned (possibly coerced to a vector if only one variable is processed).

Note

method="krige" requires the gstat package.

pick.from.shapefile requires the shapefiles package.

The nearest neighbour interpolation currently randomly breaks ties if pick.from.points is used, and in a deterministic fashion (rounding towards greater grid indices, i.e. toward south and east) in the grid functions.

Author(s)

Alexander Brenning
References


See Also

grid.to.xyz.

Examples

```r
## Not run:
# assume that 'dem' is an ASCII grid and d a data.frame with variables x and y
pick.from.ascii.grid(d, "dem")
# parallel processing on Windows using the doSNOW package:
require(doSNOW)
registerDoSNOW(cl <- makeCluster(2, type = "SOCK")) # DualCore processor
pick.from.ascii.grid(d, "dem", parallel = TRUE)
# produces two (ignorable) warning messages when using doSNOW
# typically 25-40% faster than the above on my DualCore notebook
stopCluster(cl)

## End(Not run)

## Not run:
# use the meuse data for some tests:
require(gstat)
data(meuse)
data(meuse.grid)
meuse.nn = pick.from.points(data=meuse.grid, src=meuse,
    pick=c("cadmium","copper","elev"), method="nearest.neighbour")
meuse.kr = pick.from.points(data=meuse.grid, src=meuse,
    pick=c("cadmium","copper","elev"), method="krige", radius=100)
# it does make a difference:
plot(meuse.kr$cadmium, meuse.nn$cadmium)
plot(meuse.kr$copper, meuse.nn$copper)
plot(meuse.kr$elev, meuse.nn$elev)

## End(Not run)
```

**read.ascii.grid**

**Read/write ASCII, SAGA and Rd Grid Files**

**Description**

These functions provide simple interfaces for reading and writing grids from/to ASCII grids and Rd files. Grids are stored as matrices, their headers in lists.
Usage

read.ascii.grid(file, return.header = TRUE, print = 0,
        nodata.values = c(), at.once = TRUE, na.strings = "NA")

read.ascii.grid.header(file, ...)

read.sgrd(fname, return.header = TRUE, print = 0, nodata.values = c(),
        at.once = TRUE, prec = 7, ...)

read.Rd.grid(fname, return.header = TRUE)

write.ascii.grid(data, file, header = NULL, write.header = TRUE, digits,
        hdr.digits = 10, dec = ".", georef = "corner")

write.ascii.grid.header(file, header, georef, dec = ".", hdr.digits = 10)

write.sgrd(data, file, header = NULL, prec = 7, hdr.prec = 10,
        georef = "corner", ...)

write.Rd.grid(data, file, header = NULL, write.header = TRUE,
        compress = TRUE)

Arguments

file file name of an ASCII grid (extension defaults to .asc if not specified), or a
        connection open for reading or writing, as required

return.header logical: should the grid header be returned (default), or just the grid data matrix?
        In the former case, read.ascii.grid returns a list with two components named
        data and header.

print numeric, specifying how detailed the output reporting the progress should be
        (currently 0 to 2, 0 being minimum output).

nodata.values optional numeric vector specifying nodata values to be used in addition to the
        nodata value specified in the grid header; nodata values are converted to NA.

at.once logical: if TRUE, read the whole grid with one scan command; if FALSE, read it
        row by row using scan with option nlines=1.

na.strings passed on to scan.

... read.sgrd, write.sgrd: additional arguments to be passed to rsaga.geoprocessor

fname file name of a grid stored as an R (.Rd) file; extension defaults to .Rd

prec integer: number of digits of temporary ASCII grid used for importing or exporting
        a SAGA grid

data grid data: a data matrix, or a list with components data (the grid data matrix)
        and header (the grid header information).

header optional list argument specifying the grid header information as returned by the
        read.ascii.grid or read.ascii.grid.header function; see Details

write.header logical: should the header be written with the grid data? (default: TRUE)
digits numeric: if not missing, write data rounded to this many decimal places
hdr.digits numeric: see hdr.prec
dec character (default: "."): decimal mark used in input or output file
georef character: specifies whether the output grid should be georeferenced by the "center" or "corner" of its lower left grid cell; defaults to "corner".
hdr.prec numeric: write (non-integer) header data with this many decimal places; a value of 9 or higher is recommended for compatibility with SAGA GIS (default: 10)
compress logical: should the .Rd file written by write.Rd.file be compressed? (default: TRUE)

Value

The read.* functions return either a list with components data (the grid data matrix) and header (the grid header information, see below), if return.header=TRUE, or otherwise just the grid data matrix return.header=FALSE.

The grid data matrix is a numeric matrix whose first column corresponds to the first (i.e. northern-most) row of the grid. Columns run from left = West to right = East.

The header information returned by the read.ascii.grid[.header] functions (if return.header=TRUE) is a list with the following components:

ncols Number of grid columns.
nrows Number of grid rows.
xllcorner x coordinate of the corner of the lower left grid cell.
yllcorner y coordinate of the corner of the lower left grid cell.
cellsze Single numeric value specifying the size of a grid cell or pixel in both x and y direction.
nodata_value Single numeric value being interpreted as NA (typically -9999).
xllcenter x coordinate of the center of the lower left grid cell
ycenter y coordinate of the center of the lower left grid cell

Note: The order of the components, especially of ?llcorner and ?llcenter, may change, depending on the order in which they appear in the grid header and on the georeferencing method (center or corner) used for the grid. The ?llcorner and ?llcenter attributes differ only by cellsize/2.

Note

read.sgrd and write.sgrd import/export grids indirectly by creating temporary ASCII grid files (this explains why write.sgrd has prec and hdr.prec arguments). Consider using readGDAL and writeGDAL in package rgdal instead, which are likely more efficient but may require coercion of your gridded data to/from a Spatial...DataFrame-class.

The read.Rd.grid and write.Rd.grid functions use the load and save commands to store a grid. The variable name used is data, which is either a numeric matrix or a list with components data (the grid data matrix) and header (the grid header information).
**relative.position**

Author(s)
Alexander Brenning

See Also
readGDAL and writeGDAL in package rgdal, and readAsciiGrid and writeAsciiGrid in package maptools

---

**Description**

relative.position and relative.rank are used with focal.function to determine the relative value of a grid cell compared to its surroundings, either on a metric scale or based on ranks.

**Usage**

relative.position(x)

relative.rank(x, ties.method = "average")

**Arguments**

- **x**: a square matrix with the grid data from the moving window, possibly containing NA values
- **ties.method**: see rank

**Value**

If `x` is provided, a numeric value in the interval [0,1] is returned.

If `x` is missing, a character vector of same length giving suggested variable (or file) names, here "relpos" and "relrank", respectively. See focal.function for details.

**See Also**

focal.function.rank, centervalue

**Examples**

```r
m = matrix( round(runif(9,1,10)), ncol=3 )
print(m)
relative.position(m)
relative.rank(m)
## Not run:
focal.function("dem",fun=relative.rank, radius=5)
focal.function("dem",fun=relative.position, radius=5)
```
Description

These functions use the median and other quantiles to describe the difference between a grid value and its neighborhood. They are designed for use with `focal.function`.

Usage

```r
## S3 method for class 'median'
resid(x)

## S3 method for class 'minmedmax'
resid(x)

## S3 method for class 'quantile'
resid(x, probs)

## S3 method for class 'quartiles'
resid(x)
```

Arguments

- `x` a square matrix with the grid data from the moving window, possibly containing NA values
- `probs` numeric vector of probabilities in [0,1] to be passed to `quantile`

Details

These functions are designed for being called by `focal.function`, which repeatedly passes the contents of a square or circular moving window to these functions.

The `resid.median` function rests the value of the central grid cell from the median of the whole moving window. Thus, in terms of topography, a positive residual median indicates that this grid cell stands out compared to its surroundings. `resid.quantile` gives more flexibility in designing such residual attributes.
Value

If \( x \) is provided, a numeric vector of length 1 (\texttt{resid.median}), 3 (\texttt{resid.minmedmax} and \texttt{resid.quartiles}), or length(probs) (\texttt{resid.quantile}).

If \( x \) is missing, a character vector of same length giving suggested variable (or file) names, such as "rmed". See \texttt{focal.function} for details.

See Also

\texttt{focal.function, quantile, median, centervalue}

rsaga.add.grid.values.to.points

\textit{Add Grid Values to Point Shapefile}

Description

Pick values from SAGA grids and attach them as a new variables to a point shapefile.

Usage

\begin{verbatim}
rsaga.add.grid.values.to.points(in.shapefile, in.grids, out.shapefile,
method = c("nearest.neighbour", "bilinear", "idw", "bicubic.spline",
"b.spline"), ...)
\end{verbatim}

Arguments

\begin{itemize}
\item \texttt{in.shapefile} Input point shapefile (default extension: .shp).
\item \texttt{in.grids} Input: character vector with names of (one or more) SAGA GIS grid files to be converted into a point shapefile.
\item \texttt{out.shapefile} Output point shapefile (default extension: .shp).
\item \texttt{method} interpolation method to be used; choices: nearest neighbour interpolation (default), bilinear interpolation, inverse distance weighting, bicubic spline interpolation, B-splines.
\item ... Optional arguments to be passed to \texttt{rsaga.geoprocessor}, including the env RSAGA geoprocessing environment.
\end{itemize}

Details

Retrieves information from the selected grids at the positions of the points of the selected points layer and adds it to the resulting layer.

Note

This function uses module \texttt{Add Grid Values to Points} in SAGA GIS library \texttt{shapes_grid}.  

---

\texttt{rsaga.add.grid.values.to.points}

\textit{Add Grid Values to Point Shapefile}

Description

Pick values from SAGA grids and attach them as a new variables to a point shapefile.

Usage

\begin{verbatim}
rsaga.add.grid.values.to.points(in.shapefile, in.grids, out.shapefile,
method = c("nearest.neighbour", "bilinear", "idw", "bicubic.spline",
"b.spline"), ...)
\end{verbatim}

Arguments

\begin{itemize}
\item \texttt{in.shapefile} Input point shapefile (default extension: .shp).
\item \texttt{in.grids} Input: character vector with names of (one or more) SAGA GIS grid files to be converted into a point shapefile.
\item \texttt{out.shapefile} Output point shapefile (default extension: .shp).
\item \texttt{method} interpolation method to be used; choices: nearest neighbour interpolation (default), bilinear interpolation, inverse distance weighting, bicubic spline interpolation, B-splines.
\item ... Optional arguments to be passed to \texttt{rsaga.geoprocessor}, including the env RSAGA geoprocessing environment.
\end{itemize}

Details

Retrieves information from the selected grids at the positions of the points of the selected points layer and adds it to the resulting layer.

Note

This function uses module \texttt{Add Grid Values to Points} in SAGA GIS library \texttt{shapes_grid}.  

---
Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA modules)

See Also

pick.from.points, pick.from.ascii.grid, pick.from.saga.grid, rsaga.grid.to.points

rsaga.close.gaps  SAGA Modules Close Gaps and Close One Cell Gaps

Description

Close (Interpolate) Gaps

Usage

rsaga.close.gaps(in.dem, out.dem, threshold = 0.1, ...)

rsaga.close.one.cell.gaps(in.dem, out.dem, ...)

Arguments

in.dem  input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
out.dem  output: DEM grid file without no-data values (gaps). Existing files will be over-written!
threshold  tension threshold for adjusting the interpolator (default: 0.1)
...  optional arguments to be passed to rsaga.geoprocessor, including the env RSAGA geoprocessing environment

Details

rsaga.close.one.cell.gaps only fill gaps whose neighbor grid cells have non-missing data.
In rsaga.close.gaps, larger tension thresholds can be used to reduce overshoots and undershoots in the surfaces used to fill (interpolate) the gaps.

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.
rsaga.contour

Note

This function uses modules 7 (rsaga.close.gaps and 6 rsaga.close.one.cell.gaps from the SAGA library grid_tools.

SAGA GIS 2.0.5+ has a new additional module Close Gaps with Spline, which can be accessed using rsaga.geoprocessor (currently no R wrapper available). See rsaga.get.usage("grid_tools","Close Gaps with Spline") or in version 2.1.0+ call rsaga.html.help("grid_tools","Close Gaps with Spline").

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

rsaga.geoprocessor, rsaga.env

Examples

```r
## Not run:
# using SAGA grids:
rsaga.close.gaps("rawdem.sgrd","dem.sgrd")
# using ASCII grids:
rsaga.esri.wrapper(rsaga.close.gaps,in.dem="rawdem",out.dem="dem")
```

## End(Not run)

---

rsaga.contour  Contour Lines from a Grid

Description

Creates a contour lines shapefile from a grid file in SAGA grid format.

Usage

```r
rsaga.contour(in.grid, out.shapefile, zstep, zmin, zmax, vertex = "xy",
env = rsaga.env(), ...)
```

Arguments

- `in.grid`: input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
- `out.shapefile`: output: contour line shapefile. Existing files will be overwritten!
- `zstep, zmin, zmax`: lower limit, upper limit, and equidistance of contour lines
- `vertex`: optional parameter: vertex type for resulting contours. Default "xy" (or 0). Only available with SAGA GIS 2.1.3+
Description

Creates a copy of a SAGA grid file, optionally overwriting the target file if it already exists. Intended mainly for internal use by RSAGA functions, currently in particular `rsaga.inverse.distance`.

Usage

```
rsaga.copy.sgrd(in.grid, out.grid, overwrite = TRUE, env = rsaga.env())
```

Arguments

- `in.grid` name of a SAGA GIS grid file; file extension can be omitted
- `out.grid` name of a SAGA GIS grid file; file extension can be omitted
- `overwrite` logical; if TRUE (the default), overwrite `out.grid` if it already exists; if FALSE and the `out.grid` already exists, copying will be skipped without causing an error.
- `env` a SAGA geoprocessing environment as created by `rsaga.env`

Note

SAGA grid files consist of three (or more) individual files with file extensions `.mgrd`, `.sgrd` and `.sdat`. The files with these three file extensions are copied, any additional files (e.g. a history file) are ignored.
rsaga.default.path  

**Determine SAGA GIS default paths**

**Description**

Internal functions that determine OS-specific default paths in which SAGA GIS binaries and modules might be located.

**Usage**

```r
rsaga.default.path(sysname = Sys.info()["sysname"])  
rsaga.default.modules.path(sysname = Sys.info()["sysname"],  
                          saga.path = rsaga.default.path(sysname))
```

**Arguments**

- **sysname**  
  character: name of the operating system, determined by default by `Sys.info`: e.g., "Windows", "Linux", "Darwin" (for Mac OSX), or "FreeBSD"

- **saga.path**  
  character: path with SAGA GIS binaries, as determined (e.g.) by `rsaga.default.path`

**Details**

These functions are used internally by `rsaga.env`. On Windows systems, the guess made by `rsaga.default.path` is "C:/Program Files/SAGA-GIS", and for the modules, it is the "modules" sub-folder of the path with the binaries.

On non-Windows systems, `rsaga.default.path` submits a `which saga_cmd` call to the operating system to find the binaries, usually in `/usr/local/bin` or in `/usr/bin`. To find the modules, `rsaga.default.modules.path` first checks if a SAGA_MLB environment variable exists. If not, it will replace the `/bin` part (if present) with `/lib/saga` or otherwise it just guesses that it's `/usr/local/lib/saga`.

**See Also**

`rsaga.env`

---

rsaga.env  

**Set up the RSAGA Geoprocessing Environment**

**Description**

`rsaga.env` creates a list with system-dependent information on SAGA path, module path and data (working) directory. This kind of a list is required by most RSAGA geoprocessing functions and is referred to as the 'RSAGA geoprocessing environment.'
Usage


Arguments

workspace path of the working directory for SAGA; defaults to the current directory (".").

cmd name of the SAGA command line program; defaults to saga_cmd.exe, its name under Windows

path path in which to find cmd; rsaga.env is usually able to find SAGA on your system if it is installed; see Details.

modules path in which to find SAGA libraries; see Details

version optional character string: SAGA GIS (API) version, e.g. "2.0.8"; if missing, a call to rsaga.get.version is used to determine version number of SAGA API

cores optional numeric argument, or NA: number of cores used by SAGA GIS; supported only by SAGA GIS 2.1.0 (and higher), ignored otherwise (with a warning). Multicore-enabled SAGA GIS modules such as the one used by rsaga.pisr seem to run in multicore mode by default when this argument is not specified, therefore cores should only be specified to use a smaller number of cores than available on a machine.

parallel optional logical argument (default: FALSE): if TRUE, run RSAGA functions that are capable of parallel processing in parallel mode; note that this is completely independent of the behaviour of SAGA GIS (which can be controlled using the cores argument); currently only some RSAGA functions support parallel processing (e.g., pick.from.ascii.grid or rsaga.get.modules). parallel=TRUE requires that a parallel backend such as doSNOW or doMC is available and has been started prior to calling any parallelized RSAGA function, otherwise warnings may be generated

check.libpath if TRUE (default), first look for SAGA GIS in the folder where the RSAGA package is installed

check.SAGA if TRUE (default), next check the path given by the environment variable SAGA, if it exists

check.PATH if TRUE (default on Windows), next look for SAGA GIS in all the paths in the PATH environment variable; defaults to FALSE on non-Windows OS

check.os.default if TRUE, look for SAGA GIS in the folder specified by os.default.path.

os.default.path on Windows, C:/Progra~1/SAGA-GIS; on unix, an attempt is made to locate saga_cmd

lib.prefix character string: a possible (platform-dependent) prefix for SAGA GIS library names; if missing (recommended), a call to rsaga.lib.prefix tries to determine the correct prefix, e.g. "" on Windows systems and "lib" on non-
Windows systems with SAGA GIS pre-2.1.0. Try specifying "" or "lib" manually if this causes problems, and contact the package maintainer if the detection mechanism fails on your system (indicate your Sys.info("sysname") and your SAGA GIS version)

**Details**

IMPORTANT: Unlike R functions such as `options`, which changes and saves settings somewhere in a global variable, `rsaga.env` does not actually 'save' any settings, it simply creates a list that can (and has to) be passed to other `rsaga.*` functions. See example below.

I strongly recommend to install SAGA GIS in "C:/Program Files/SAGA-GIS" in the case of English-language Windows platforms (the equivalent non-English installation folder in the case of non-English Windows versions seems to work as well). If this is the only SAGA GIS copy on the computer and you do **not** define a Windows environment variable `SAGA`, then RSAGA should normally be able to find your SAGA GIS installation in this folder.

`rsaga.env` tries to collect information on the (R)SAGA environment. If `path` is missing, `rsaga.env` first looks for an environment variable `SAGA`; if this is undefined, it checks the current working directory, then the paths given in the `PATH` environment variable, and finally the function's guess is "C:/Program Files/SAGA-GIS" (or "/usr/local/bin" on non-Windows systems).

The default modules folder on Windows systems is the `modules` subfolder of the SAGA binaries' folder. The SAGA_MLB environment variable is **not** checked by `rsaga.env`.

On Unix (and Mac OS X) systems, the default modules folder is as specified in the `SAGA_MLB` environment variable. If this is empty / not set, then the following backup path is used. If `path` ends with "/bin", then "/bin" is changed to "/lib/saga" and taken as the modules path; otherwise, "/usr/local/lib/saga" is used.

**Value**

A list with components `workspace`, `cmd`, `path`, `modules`, `version`, `cores` and `parallel` with values as passed to `rsaga.env` or default values as described in the Details section.

**Note**

Note that the default workspace is ".", **not** `getwd()`: i.e. the default SAGA workspace folder is not fixed, it changes each time you change the R working directory using `setwd`.

**Author(s)**

Alexander Brenning

**See Also**

`rsaga.get.version`

**Examples**

```r
# Not run:
# Check the default RSAGA environment on your computer:
myenv <- rsaga.env()
```
rsaga.esri.to.sgrd  

Convert ESRI ASCII/binary grids to SAGA grids

Description

rsaga.esri.to.sgrd converts grid files from ESRI’s ASCII (.asc) and binary (.flt) format to SAGA’s (version 2) grid format (.sgrd).

Usage

rsaga.esri.to.sgrd(in.grids, out.sgrds = set.file.extension(in.grids, 
".sgrd"), in.path, ...)

Arguments

in.grids  character vector of ESRI ASCII/binary grid files (default file extension: .asc); files should be located in folder in.path

out.sgrds  character vector of output SAGA grid files; defaults to in.grids with file extension being replaced by .sgrd, which is also the default extension if file names without extension are specified; files will be placed in the current SAGA workspace (default: rsaga.env()$workspace, or env$workspace if an env argument is provided

in.path  folder with in.grids

...  optional arguments to be passed to rsaga.geoprocessor, including the env RSAGA geoprocessing environment
Value

The type of object returned depends on the `intern` argument passed to the `rsaga.geoprocessor`. For `intern=FALSE` it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

If multiple `in.grids` are converted, the result will be a vector of numerical error codes of the same length, or the combination of the console outputs with `c()`.

Note

This function uses module 1 from the SAGA library `io_grid`.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

`rsaga.esri.wrapper` for an efficient way of applying RSAGA to ESRI ASCII/binary grids; `rsaga.env`

Description

This wrapper converts input grid files provided in ESRI binary (.flt) or ASCII (.asc) formats to SAGA’s (version 2) grid format, calls the RSAGA geoprocessing function, and converts the output grids back to the ESRI grid format. Conversion can also be limited to either input or output grids.

Usage

```r
rsaga.esri.wrapper(fun, in.esri = TRUE, out.esri = TRUE,
env = rsaga.env(), esri.workspace = env$workspace, format = "ascii",
georef = "corner", prec = 5, esri.extension, condensed.res = TRUE,
clean.up = TRUE, intern = TRUE, ...)```

Arguments

- `fun` function: one of the RSAGA geoprocessing functions, such as `rsaga.close.gaps` or `rsaga.hillshade` etc.
- `in.esri` logical: are input grids provided as ESRI grids (`in.esri=TRUE`) or as SAGA grids?
- `out.esri` logical: should output grids be converted to ESRI grids?
- `env` RSAGA environment as returned by `rsaga.env`
- `esri.workspace` directory for the input and output ESRI ASCII/binary grids
- `format` output file format, either "ascii" (default; equivalent: `format=1`) for ASCII grids or "binary" (equivalent: `0`) for binary ESRI grids (.flt).
georef character: "corner" (equivalent numeric code: 0) or "center" (default; equivalent: 1). Determines whether the georeference will be related to the center or corner of its extreme lower left grid cell.

prec number of digits when writing floating point values to ASCII grid files (only relevant if out.esri=TRUE).

esri.extension extension for input/output ESRI grids: defaults to .asc for format="ascii", and to .flt for format="binary"

condensed.res logical: return only results of the RSAGA geoprocessing function fun (condensed.res=TRUE), or include the results of the import and export operations, i.e. the calls to rsaga.esri.to.sgrd and rsaga.sgrd.to.esri? (see Value)

clean.up logical: delete intermediate SAGA grid files?

intern intern argument to be passed to rsaga.geoprocessor; see Value

... additional arguments for fun; NOTE: ESRI ASCII/float raster file names should NOT include the file extension (.asc, .flt); the file extension is defined by the esri.extension and format arguments!

Details

ESRI ASCII/float raster file names should NOT include the file extension (.asc, .flt); the file extension is defined by the esri.extension and format arguments!

Value

The object returned depends on the condensed.res arguments and the intern argument passed to the rsaga.geoprocessor.

If condensed.res=TRUE and intern=FALSE, a single numerical error code (0: success) is returned. If condensed.res=TRUE and intern=TRUE (default), a character vector with the module’s console output is returned (invisibly).

If condensed.res=FALSE the result is a list with components in.res, geoproc.res and out.res. Each of these components is either an error code (for intern=FALSE) or (for intern=TRUE) a character vector with the console output of the input (rsaga.esri.to.sgrd), the geoprocessing (fun), and the output conversion (rsaga.sgrd.to.esri) step, respectively. For in.esri=FALSE or out.esri=FALSE, the corresponding component is NULL.

Note

Note that the intermediate grids as well as the output grids may overwrite existing files with the same file names without prompting the user. See example below.

See Also

rsaga.esri.to.sgrd, rsaga.sgrd.to.esri, rsaga.geoprocessor, rsaga.env
Examples

## Not run:
```r
rsaga.esri.wrapper(rsaga.hillshade,in.dem="dem",out.grid="hshd",condensed.res=FALSE,intern=FALSE)
# if successful, returns list(in.res=0,geoproc.res=0,out.res=0),
# and writes hshd.asc; intermediate files dem.sgrd, dem.hgrd, dem.sdat,
# hshd.sgrd, hshd.hgrd, and hshd.sdat are deleted.
# hshd.asc is overwritten if it already existed.
```

## End(Not run)

---

**rsaga.fill.sinks**  
*Fill Sinks*

**Description**

Several methods for filling closed depressions in digital elevation models that would affect hydrological modeling.

**Usage**

```r
rsaga.fill.sinks(in.dem, out.dem, method = "planchon.darboux.2001",
out.flowdir, out.wshed, minslope, ...)
```

**Arguments**

- `in.dem`  
  Input: digital elevation model (DEM) as SAGA grid file (default extension: `.sgrd`).

- `out.dem`  
  Output: filled, depression-free DEM (SAGA grid file). Existing files will be overwritten!

- `method`  
  The depression filling algorithm to be used (character). One of "planchon.darboux.2001" (default), "wang.liu.2006", or "xxl.wang.liu.2006".

- `out.flowdir` (only for "wang.liu.2001")  
  Optional output grid file for computed flow directions (see Notes).

- `out.wshed` (only for "wang.liu.2001")  
  Optional output grid file for watershed basins.

- `minslope`  
  Minimum slope angle (in degree) preserved between adjacent grid cells (default value of 0.01 only for method="planchon.darboux.2001", otherwise no default).

- `...`  
  Optional arguments to be passed to `rsaga.geoprocessor`, including the env RSAGA geoprocessing environment.
Details

This function bundles three SAGA modules for filling sinks using three different algorithms (method argument).

"planchon.darboux.2001": The algorithm of Planchon and Darboux (2001) consists of increasing the elevation of pixels in closed depressions until the sink disappears and a minimum slope angle of minslope (default: 0.01 degree) is established.

"wang.liu.2006": This module uses an algorithm proposed by Wang and Liu (2006) to identify and fill surface depressions in DEMs. The method was enhanced to allow the creation of hydrologically sound elevation models, i.e. not only to fill the depressions but also to preserve a downward slope along the flow path. If desired, this is accomplished by preserving a minimum slope gradient (and thus elevation difference) between cells. This is the fully featured version of the module creating a depression-free DEM, a flow path grid and a grid with watershed basins. If you encounter problems processing large data sets (e.g. LIDAR data) with this module try the basic version (xx1.wang.lui.2006).

"xx1.wang.lui.2006": This modified algorithm after Wang and Liu (2006) is designed to work on large data sets.

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

The function writes SAGA grid files containing of the depression-free preprocessed DEM, and optionally the flow directions and watershed basins.

Note

The flow directions are coded as 0 = north, 1 = northeast, 2 = east, ..., 7 = northwest.
If minslope=0, depressions will only be filled until a horizontal surface is established, which may not be helpful for hydrological modeling.

Author(s)

Alexander Brenning (R interface), Volker Wichmann (SAGA module)

References


See Also

rsaga.sink.removal, rsaga.sink.route.
**rsaga.filter.gauss**  
**Gauss Filter**

**Description**
Smooth a grid using a Gauss filter.

**Usage**
```r
cpy {in.grid, out.grid, sigma, radius = ceiling(2 * sigma), ...}
```

**Arguments**
- `in.grid`: input: SAGA GIS grid file (default file extension: .sgrd)
- `out.grid`: output: SAGA GIS grid file
- `sigma`: numeric, >0.0001: standard deviation parameter of Gauss filter
- `radius`: positive integer: radius of moving window
- `...`: optional arguments to be passed to `rsaga.geoprocessor`, including the `env` RSAGA geoprocessing environment

**Value**
The type of object returned depends on the `intern` argument passed to the `rsaga.geoprocessor`. For `intern=FALSE` it is a numerical error code (0: success), or otherwise (the default) a character vector with the module’s console output.

**Author(s)**
Alexander Brenning (R interface), Olaf Conrad (SAGA module)

**See Also**
- `rsaga.filter.simple`

---

**rsaga.filter.simple**  
**Simple Filters**

**Description**
Apply a smoothing, sharpening or edge filter to a SAGA grid.

**Usage**
```r
rsaga.filter.simple(in.grid, out.grid, mode = "circle", method = c("smooth", "sharpen", "edge"), radius, ...)
```
Arguments

in.grid  input: SAGA grid file (default file extension: .sgrd)
out.grid output: SAGA grid file
mode    character or numeric: shape of moving window, either "square" (=0) or "circle" (=1, default)
method  character or numeric: "smooth" (=0), "sharpen" (=1), or "edge" (=2)
radius  positive integer: radius of moving window
...

optional arguments to be passed to rsaga.geoprocessor, including the env

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (the default) a character vector with the module’s console output.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

rsaga.filter.gauss

Examples

## Not run: rsaga.filter.simple("dem","dem-smooth",radius=4)

rsaga.geoprocessor  Generic R interface for SAGA modules

Description

This function is the workhorse of the R–SAGA interface: It calls the SAGA command line tool to run SAGA modules and pass arguments.

Usage

rsaga.geoprocessor(lib, module = NULL, param = list(),
  show.output.on.console = TRUE, invisible = TRUE, intern = TRUE,
  prefix = NULL, flags = ifelse(show.output.on.console, "q", "s"), cores,
  env = rsaga.env(), display.command = FALSE, reduce.intern = TRUE,
  check.module.exists = TRUE, warn = options("warn")$warn, argsep = " ",
  ...)

Arguments

lib Name of the SAGA library to be called (see Details).

module Number (>=0) or name of the module to called within the library lib (see Details).

param A list of named arguments to be passed to the SAGA module (see Examples).

show.output.on.console a logical (default: TRUE), indicates whether to capture the output of the command and show it on the R console (see system).

invisible a logical, indicates whether the command window should be visible on the screen.

intern a logical, indicates whether to make the output of the command an R object

prefix optional character string: prefix such as "-h" used in the saga_cmd call; mostly for internal purposes; call saga_cmd -h from the command line for details; see also flags

flags optional character string indicating any command line flags: supported only by SAGA GIS 2.1.0 (and higher), quietly ignored otherwise: "q": no progress report (the default for show.output.on.console=TRUE); "r": no messages report; "s": silent mode, i.e. no progress and no messages report (the default for show.output.on.console=FALSE); other flag options probably not relevant within RSAGA

cores optional numeric argument, or NA: number of cores used by SAGA GIS; supported only by SAGA GIS 2.1.0 (and higher), ignored otherwise (with a warning); overwrites the cores setting specified in the env argument (see rsaga.env). Multicore-enabled SAGA GIS modules such as the one used by rsaga.pisr seem to run in multicore mode by default when this argument is not specified, therefore cores should only be specified to use a smaller number of cores than available on a machine.

eenv A SAGA geoprocessing environment, i.e. a list with information on the SAGA and SAGA modules paths and the name of the working directory in which to look for input and output files. (Defaults: see rsaga.env.)

display.command Display the DOS command line for executing the SAGA module (including all the arguments to be passed). Default: FALSE.

reduce.intern If intern=TRUE, reduce the text output of SAGA returned to R by eliminating redundant lines showing the progress of module execution etc. (default: TRUE).

check.module.exists logical (default: TRUE): call rsaga.module.exists to determine if the specified module can be called in the current SAGA installation

warn logical (default: TRUE): for internal purposes - can be used to suppress warning messages generated by failed SAGA_CMD calls; currently used by rsaga.get.lib.modules and related functions; see options argument warn for details

argsep character (default: " "; currently for internal use): defines the character symbol used as a separator between each argument name and argument value passed to saga_cmd. SAGA GIS 2.1.0 (RC1) seems to move toward "=" as a separator,
but " " still works and some modules (e.g. the used by \texttt{rsaga.pisr}) don’t seem to work with \texttt{argsep="="}. Future releases of RSAGA may change the default \texttt{argsep} value and/or delete or ignore this argument and/or move it to \texttt{rsaga.env}.

... Additional arguments to be passed to \texttt{system}.

Details

This workhorse function establishes the interface between the SAGA command line program and R by submitting a system call. This is a low-level function that may be used for directly accessing SAGA; specific functions such as \texttt{rsaga.hillshade} are intended to be more user-friendly interfaces to the most frequently used SAGA modules. These higher-level interfaces support default values for the arguments and perform some error checking; they should therefore be preferred if available.

A warning is issued if the RSAGA version is not one of 2.0.4-2.0.8 or 2.1.0-2.1.4.

Value

The type of object returned depends on the \texttt{intern} argument passed to \texttt{system}.

If \texttt{intern=FALSE}, a numerical error/success code is returned, where a value of 0 corresponds to success and a non-zero value indicates an error. Note however that the function always returns a success value of 0 if \texttt{wait=FALSE}, i.e. if it does not wait for SAGA to finish.

If \texttt{intern=TRUE} (default), the console output of SAGA is returned as a character vector. This character vector lists the input file names and modules arguments, and gives a more or less detailed report of the function’s progress. Redundant information can be cancelled out by setting \texttt{reduce.intern=TRUE}.

Note

Existing output files will be overwritten by SAGA without prompting!

If a terrain analysis function is not directly interfaced by one of the RSAGA functions, you might still find it in the growing set of SAGA libraries and modules. The names of all libraries available in your SAGA installation can be obtained using \texttt{rsaga.get.libraries} (or by checking the directory listing of the modules folder in the SAGA directory). The names and numeric codes of all available modules (globally or within a specific library) are retrieved by \texttt{rsaga.get.modules}. Full-text search in library and module names is performed by \texttt{rsaga.search.modules}. For information on the usage of SAGA command line modules, see \texttt{rsaga.get.usage}, or the RSAGA interface function if available.

\texttt{display.command=TRUE} is mainly intended for debugging purposes to check if all arguments are passed correctly to SAGA CMD.

Author(s)

Alexander Brenning (R interface); Olaf Conrad and the SAGA development team (SAGA development)
References

See Also
rsaga.env, rsaga.get.libraries, rsaga.get.modules, rsaga.search.modules, rsaga.get.usage; rsaga.esri.wrapper for a wrapper for ESRI ASCII/binary grids; rsaga.hillshade and other higher-level functions.

Examples
```r
## Not run:
rsaga.hillshade("dem","hillshade",exaggeration=2)
# using the RSAGA geoprocessor:
rsaga.geoprocessor("ta_lighting",0,list(ELEVATION="dem.sgrd",SHADE="hillshade",EXAGGERATION=2))
# equivalent DOS command line call:
# saga_cmd.exe ta_lighting 0 -ELEVATION dem.sgrd -SHADE hillshade -EXAGGERATION 2

## End(Not run)
```

rsaga.get.modules Find SAGA libraries and modules

Description
These functions list the SAGA libraries (rsaga.get.libraries) and modules (rsaga.get.lib.modules, rsaga.get.modules) available in a SAGA installation, and allow to perform a full-text search among these functions.

Usage
```r
rsaga.get.modules(libs, env = rsaga.env(), interactive = FALSE, parallel = env$parallel)
rsaga.get.libraries(path = rsaga.env()$modules, dll)
rsaga.get.lib.modules(lib, env = rsaga.env(), interactive = FALSE)
rsaga.module.exists(libs, module, env = rsaga.env(), ...)  
rsaga.search.modules(text, modules, search.labs = TRUE, search.modules = TRUE, env = rsaga.env(), ignore.case = TRUE, ...)
```
Arguments

libs character vector with the names of libraries in which to look for modules; if
missing, all libraries will be processed
env a SAGA geoprocessing environment as created by rsaga.env
interactive logical (default FALSE): should modules be returned that can only be executed
in interactive mode (i.e. using SAGA GUI)?
parallel logical (defaults to env$parallel): if TRUE, run in parallel mode; requires a
parallel backend such as doSNOW or doMC
path path of SAGA library files (modules subfolder in the SAGA installation folder);
defaults to the path determined by rsaga.env.
dll file extension of dynamic link libraries
lib character string with the name of the library in which to look for modules
module module name or numeric code
... currently only interactive to be passed on to rsaga.get.lib.modules
text character string to be searched for in the names of available libraries and/or
modules
modules optional list: result of rsaga.get.modules; if missing, a list of available mod-
ules will be retrieved using that function
search.libs logical (default TRUE); see search.modules
search.modules logical (default TRUE): should text be searched for in library and/or module
names?
ignore.case logical (default FALSE): should the text search in library,module names be case
sensitive?

Value

rsaga.get.libraries returns a character vector with the names of all SAGA libraries available in
the folder env$modules.
rsaga.get.lib.modules returns a data.frame with:

- name the names of all modules in library lib,
- code their numeric identifiers,
- interactive and a logical variable indicating whether a module can only be executed in inter-
active (SAGA GUI) mode.

rsaga.get.modules returns a list with, for each SAGA library in libs, a data.frame with module
information as given by rsaga.get.lib.modules. If libs is missing, all modules in all libraries
will be retrieved.

Note

For information on the usage of SAGA command line modules, see rsaga.get.usage, or rsaga.html.help
(in SAGA GIS 2.1.0+), or the RSAGA interface function, if available.
See Also

rsaga.get.usage, rsaga.html.help, rsaga.geoprocessor, rsaga.env

Examples

```r
## Not run:
# make sure that 'rsaga.env' can find 'saga_cmd.exe'
# before running this:
rsaga.get.libraries()
# list all modules in my favorite libraries:
rsaga.get.modules(c("io_grid", "grid_tools", "ta_preprocessor",
                     "ta_morphometry", "ta_lighting", "ta_hydrology"))
# list *all* modules (quite a few!):
# rsaga.get.modules(interactive=TRUE)

# find modules that remove sink from DEMs:
rsaga.search.modules("sink")
# find modules that close gaps (no-data areas) in grids:
rsaga.search.modules("gap")

## End(Not run)
```

rsaga.get.usage  

Usage of SAGA command line modules

Description

rsaga.get.usage provides information on the usage of and arguments required by SAGA command line modules.

Usage

rsaga.get.usage(lib, module, env = rsaga.env(), show = TRUE)

Arguments

- **lib**  
  name of the SAGA library
- **module**  
  name or numeric identifier of SAGA module in library lib
- **env**  
  a SAGA geoprocessing environment as created by rsaga.env
- **show**  
  logical (default: TRUE); display usage in the R console?

Details

This function is intended to provide information required to use the rsaga.geoprocessor and for writing your own high-level interface function for SAGA modules. R–SAGA interfaces already exist for some SAGA modules, e.g. rsaga.hillshade, rsaga.local.morphometry, but there are many more.
rsaga.get.version

Determine SAGA GIS version

Description

Determine SAGA GIS version.

Usage

rsaga.get.version(env = rsaga.env(version = NA), ...)

Arguments

env list, setting up a SAGA geoprocessing environment as created by rsaga.env. Note that version=NA ensures that rsaga.env won’t call rsaga.get.version itself.

... additional arguments to rsaga.geoprocessor

Details

The function first attempts to determine the SAGA version directly through a system call saga_cmd --version, which is supported by SAGA GIS 2.0.8+. If this fails, saga_cmd -h is called, and it is attempted to extract the version number of the SAGA API from the output generated, which works for 2.0.4 - 2.0.7.

Value

A character string defining the SAGA GIS (API) version. E.g., "2.0.8".
rsaga.grid.calculus

See Also

rsaga.env

Examples

```r
## Not run:
myenv <- rsaga.env()
myenv$version
# rsaga.env actually calls rsaga.get.version:
rsaga.get.version()

# I keep several versions of SAGA GIS in SAGA-GIS_2.0.x folders:
myenv05 = rsaga.env(path = "C:/Progra-1/SAGA-GIS_2.0.5", version = NA)
# Check if it's really version 2.0.5 as suggested by the folder name:
rsaga.get.version(env = myenv05)

## End(Not run)
```

rsaga.grid.calculus  \emph{SAGA Module Grid Calculus}

Description

Perform Arithmetic Operations on Grids

Usage

\begin{verbatim}
rsaga.grid.calculus(in.grids, out.grid, formula, env = rsaga.env(), ...)

rsaga.linear.combination(in.grids, out.grid, coef, cf.digits = 16, 
remove.zeros = FALSE, remove.ones = TRUE, env = rsaga.env(), ...)
\end{verbatim}

Arguments

\begin{itemize}
\item \textbf{in.grids}  
input character vector: SAGA grid files (default file extension: .sgrd)
\item \textbf{out.grid}  
output: grid file resulting from the cell-by-cell application of 'formula' to the grids. Existing files will be overwritten!
\item \textbf{formula}  
character string of formula specifying the arithmetic operation to be performed on the \texttt{in.grids} (see Details); if this is a formula, only the right hand side will be used.
\item \textbf{env}  
RSAGA geoprocessing environment, generated by a call to \texttt{rsaga.env}
\item \textbf{...}  
onoptional arguments to be passed to \texttt{rsaga.geoprocessor}
\item \textbf{coef}  
numeric: coefficient vector to be used for the linear combination of the \texttt{in.grids}. If \texttt{coef} as one more element than \texttt{in.grids}, the first one will be interpreted as an intercept.
\end{itemize}
cf.digits  integer: number of digits used when converting the coefficients to character strings (trailing zeros will be removed)
remove.zeros  logical: if TRUE, terms (grids) with coefficient (numerically) equal to zero (after rounding to cf.digits digits) will be removed from the formula
remove.ones  logical: if TRUE (the default), factors equal to 1 (after rounding to cf.digits digits) will be removed from the formula

Details

The in.grids are represented in the formula by the letters a (for in.grids[1]), b etc. Thus, if in.grids[1] is Landsat TM channel 3 and in.grids[2] is channel 4, the NDVI formula (TM3-TM4)/(TM3+TM4) can be represented by the character string ")((a-b)/(a+b))" (any spaces are removed) or the formula ~a-b)/(a+b) in the formula argument.

In addition to +, -, *, and /, the following operators and functions are available for the formula definition:

- ^ power
- sin(a) sine
- cos(a) cosine
- tan(a) tangent
- asin(a) arc sine
- acos(a) arc cosine
- atan(a) arc tangent
- atan2(a,b) arc tangent of b/a
- abs(a) absolute value
- int(a) convert to integer
- sqr(a) square
- sqrt(a) square root
- ln(a) natural logarithm
- log(a) base 10 logarithm
- mod(a,b) modulo
- gt(a, b) returns 1 if a greater b
- lt(a, b) returns 1 if a lower b
- eq(a, b) returns 1 if a equal b
- ifelse(switch, x, y) returns x if switch equals 1 else y

Using remove.zeros=FALSE might have the side effect that no data areas in the grid with coefficient 0 are passed on to the results grid. (To be confirmed.)

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (the default) a character vector with the module’s console output.
Author(s)
Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also
local.function, focal.function, and multi.focal.function for a more flexible framework for combining grids or applying local and focal functions; rsaga.geoprocessor, rsaga.env

Examples

```r
## Not run:
# using SAGA grids:
# calculate the NDVI from Landsat TM bands 3 and 4:
rsaga.grid.calculus(c("tm3.sgrd","tm4.sgrd"), "ndvi.sgrd", -(a-b)/(a+b))
# apply a linear regression equation to grids:
coefs = c(20,-0.6)
# maybe from a linear regression of mean annual air temperature (MAAT)
# against elevation - something like:
# coefs = coef( lm( maat ~ elevation ) )
rsaga.linear.combination("elevation.sgrd", "maat.sgrd", coefs)
# equivalent:
rsaga.grid.calculus("elevation.sgrd", "maat.sgrd", "20 - 0.6*a")
## End(Not run)
```

rsaga.grid.to.points  Convert SAGA grid file to point shapefile

Description
Convert SAGA grid file to point (or polygon) shapefile - either completely or only a random sample of grid cells.

Usage

```r
rsaga.grid.to.points(in.grids, out.shapefile, in.clip.polygons, exclude.nodata = TRUE, type = "nodes", env = rsaga.env(), ...)
rsaga.grid.to.points.randomly(in.grid, out.shapefile, freq, ...)
```

Arguments

- **in.grids**  Input: names of (possibly several) SAGA GIS grid files to be converted into a point shapefile.
- **out.shapefile**  Output: point shapefile (default extension: .shp). Existing files will be overwritten!
- **in.clip.polygons**  optional polygon shapefile to be used for clipping/masking an area
exclude.nodata  logical (default: TRUE): skip 'nodata' grid cells?
type    character string: "nodes": create point shapefile of grid center points; "cells"
         (only supported by SAGA GIS 2.0.6+): create polygon shapefile with grid cell
         boundaries
env     RSAGA geoprocessing environment created by rsaga.env; required by rsaga.grid.to.points
         to determine version-dependent SAGA module name and arguments
...     Optional arguments to be passed to rsaga.geoprocessor
in.grid Input: SAGA grid file from which to sample.
freq    integer >=1: sampling frequency: on average 1 out of 'freq' grid cells are selected

Note

These functions use modules Grid Values to Shapes (pre-2.0.6 name: Grid Values to Points)
and Grid Values to Points (randomly) in SAGA library shapes_grid.
The SAGA 2.0.6+ module Grid Values to Shapes is more flexible than the earlier versions as it
allows to create grid cell polygons instead of center points (see argument type).

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA modules)

See Also

rsaga.add.grid.values.to.points

Examples

## Not run:
# one point per grid cell, exclude nodata areas:
rsaga.grid.to.points("dem", "dempoints")
# take only every 20th point, but to not exclude nodata areas:
rsaga.grid.to.points.randomly("dem", "dempoints20", freq = 20)

## End(Not run)

rsaga.hillshade     Analytical hillshading Analytical hillshading calculation.

Description

Analytical hillshading Analytical hillshading calculation.

Usage

rsaga.hillshade(in.dem, out.grid, method = "standard", azimuth = 315,
                declination = 45, exaggeration = 4, ...)
Arguments

in.dem Input digital elevation model (DEM) as SAGA grid file (default extension: .sgrd).
out.grid Output hillshading grid (SAGA grid file). Existing files will be overwritten!
method Available choices (character or numeric): "standard" (or 0 - default), "max90deg.standard" (1), "combined.shading" (2), "ray.tracing" (3). See Details.
avoid Direction of the light source, measured in degree clockwise from the north direction; default 315, i.e. northwest.
decimation Declination of the light source, measured in degree above the horizon (default 45).
exaggeration Vertical exaggeration of elevation (default: 4). The terrain exaggeration factor allows to increase the shading contrasts in flat areas.
... Optional arguments to be passed to rsaga.geoprocessor, including the env

Details

The Analytical Hillshading algorithm is based on the angle between the surface and the incoming light beams, measured in radians.

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

Note

While the default azimuth of 315 degree (northwest) is not physically meaningful on the northern hemisphere, a northwesterly light source is required to properly depict relief in hillshading images. Physically correct southerly light sources results a hillshade that would be considered by most people as inverted: hills look like depressions, mountain chains like troughs.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

rsaga.solar.radiation, rsaga.insolation

Examples

## Not run: rsaga.hillshade("dem.sgrd","hillshade")
Description

This function opens SAGA’s HTML documentation for the specified library or module. Works with SAGA GIS 2.1.0(+), for earlier versions a web page with the SAGA GIS wiki is displayed.

Usage

```r
rsaga.html.help(lib, module = NULL, use.program.folder = TRUE, 
    env = rsaga.env(), ...) 
```

Arguments

- **lib**: name of the SAGA library, or one of the `rsaga.` module functions such as `rsaga.hillshade`
- **module**: name or numeric identifier of SAGA module in library `lib`; module=NULL takes you to the main help page of the SAGA library `lib`
- **use.program.folder**: logical; if TRUE (the default), attempt to write SAGA GIS documentation to a "help" subfolder of `env$path`; the "help" folder is created if it doesn’t exist. If FALSE, create SAGA GIS documentation files in this R session’s temporary folder as obtained using `tempdir()`
- **env**: a SAGA geoprocessing environment as created by `rsaga.env`
- **...**: additional arguments to `browseURL`

Details

Requires SAGA GIS 2.1.0(+), with earlier versions use `rsaga.get.usage`.

See Also

`rsaga.get.usage, rsaga.geoprocessor, rsaga.env`

Examples

```r
## Not run:
# Requires SAGA GIS 2.1.0+:
rsaga.html.help("io_grid")
rsaga.html.help("io_grid",0)
rsaga.html.help("io_grid","Import ESRI Arc/Info Grid")

## End(Not run)
```
Import Grid Files to SAGA grid format using GDAL

Description

These functions provide simple interfaces for reading and writing grids from/to ASCII grids and Rd files. Grids are stored in matrices, their headers in lists.

Usage

rsaga.import.gdal(in.grid, out.grid, env = rsaga.env(), ...)

Arguments

in.grid file name of a grid in a format supported by GDAL
out.grid output SAGA grid file name; defaults to in.grid with the file extension being removed; file extension should not be specified, it defaults to .sgrd
env RSAGA geoprocessing environment created by rsaga.env
... additional arguments to be passed to rsaga.geoprocessor

Details

The GDAL Raster Import module of SAGA imports grid data from various file formats using the Geospatial Data Abstraction Library (GDAL) by Frank Warmerdam. GDAL Versions are specific to SAGA versions:

- SAGA 2.0.7 - 2.0.8: GDAL v.1.8.0
- SAGA 2.1.0 - 2.1.1: GDAL v.1.10.0
- SAGA 2.1.2 - 2.2.0: GDAL v.1.11.0
- SAGA 2.2.1 - 2.2.3: GDAL v.2.1.0 dev

More information is available at http://www.gdal.org/.

If in.grid has more than one band (e.g. RGB GEOTIFF), then output grids with file names of the form in.grid_01.sgrd, in.grid_02.sgrd etc. are written, one for each band.

The following raster formats are currently supported. Last updated for SAGA GIS 2.2.3; for a list for a specific SAGA GIS version call rsaga.html.help("io_gdal","GDAL: Import Raster", env = rsaga.env(path="SAGA"))

- BAG - Bathymetry Attributed Grid
- ECW - ERDAS Compressed Wavelets (SDK 3.x)
- JP2ECW - ERDAS JPEG2000 (SDK 3.x)
- FITS - Flexible Image Transport System
- GMT - GMT NetCDF Grid Format
- HDF4 - Hierarchical Data Format Release 4
- HDF4Image - HDF4 Dataset
• HDF5 - Hierarchical Data Format Release 5
• HDF5Image - HDF5 Dataset
• KEA - KEA Image Format (.kea)
• MG4Lidar - MrSID Generation 4 / Lidar (.sid)
• MrSID - Multi-resolution Seamless Image Database (MrSID)
• netCDF - Network Common Data Format
• PostgreSQL - PostgreSQL/PostGIS
• VRT - Virtual Raster
• GTiff - GeoTIFF
• NITF - National Imagery Transmission Format
• RPFTOC - Raster Product Format TOC format
• ECRGTOC - ECRG TOC format
• HFA - Erdas Imagine Images (.img)
• SAR_CEOS - CEOS SAR Image
• CEOS - CEOS Image
• JAXAPALSAR - JAXA PALSAR Product Reader (Level 1.1/1.5)
• GFF - Ground-based SAR Applications Testbed File Format (.gff)
• ELAS - ELAS
• AIG - Arc/Info Binary Grid
• AAIGrid - Arc/Info ASCII Grid
• GRASSASCIIGrid - GRASS ASCII Grid
• SDTS - SDTS Raster
• DTED - DTED Elevation Raster
• PNG - Portable Network Graphics
• JPEG - JPEG JFIF
• MEM - In Memory Raster
• JDEM - Japanese DEM (.mem)
• GIF - Graphics Interchange Format (.gif)
• BIGGIF - Graphics Interchange Format (.gif)
• ESAT - Envisat Image Format
• BSB - Maptech BSB Nautical Charts
• XPM - X11 PixMap Format
• BMP - MS Windows Device Independent Bitmap
• DIMAP - SPOT DIMAP
• AirSAR - AirSAR Polarimetric Image
• RS2 - RadarSat 2 XML Product
• SAFE - Sentinel SAFE Product
• PCIDSK - PCIDSK Database File
• PCRaster - PCRaster Raster File
• ILWIS - ILWIS Raster Map
• SGI - SGI Image File Format 1.0
• SRTMHGT - SRTMHGT File Format
• Leveller - Leveller heightfield
• Terragen - Terragen heightfield
• ISIS3 - USGS Astrogeology ISIS cube (Version 3)
• ISIS2 - USGS Astrogeology ISIS cube (Version 2)
• PDS - NASA Planetary Data System
• VICAR - MIPL VICAR file
• TIL - EarthWatch .TIL
• ERS - ERMapper .ers Labelled
• JP2OpenJPEG - JPEG-2000 driver based on OpenJPEG library
• L1B - NOAA Polar Orbiter Level 1b Data Set
• FIT - FIT Image
• GRIB - GRIdded Binary (.grb)
• RMF - Raster Matrix Format
• WCS - OGC Web Coverage Service
• WMS - OGC Web Map Service
• MSGN - EUMETSAT Archive native (.nat)
• RST - Idrisi Raster A.1
• INGR - Intergraph Raster
• GSAG - Golden Software ASCII Grid (.grd)
• GSBG - Golden Software Binary Grid (.grd)
• GS7BG - Golden Software 7 Binary Grid (.grd)
• COSAR - COSAR Annotated Binary Matrix (TerraSAR-X)
• TSX - TerraSAR-X Product
• COASP - DRDC COASP SAR Processor Raster
• R - R Object Data Store
• MAP - OziExplorer .MAP
• PNM - Portable Pixmap Format (netpbm)
• DOQ1 - USGS DOQ (Old Style)
• DOQ2 - USGS DOQ (New Style)
• ENVI - ENVI .hdr Labelled
• EHdr - ESRI .hdr Labelled
• GenBin - Generic Binary (.hdr Labelled)
• PAux - PCI .aux Labelled
• MFF - Vexcel MFF Raster
• MFF2 - Vexcel MFF2 (HKV) Raster
• FujiBAS - Fuji BAS Scanner Image
• GSC - GSC Geogrid
• FAST - EOSAT FAST Format
• BT - VTP .bt (Binary Terrain) 1.3 Format
• LAN - Erdas .LAN/.GIS
• CPG - Convair PolGASP
• IDA - Image Data and Analysis
• NDF - NLAPS Data Format
• EIR - Erdas Imagine Raw
• DIPEx - DIPEx
• LCP - FARSITE v.4 Landscape File (.lcp)
• GTX - NOAA Vertical Datum .GTX
• LOSLAS - NADCON .los/.las Datum Grid Shift
• NTv2 - NTv2 Datum Grid Shift
• CTable2 - CTable2 Datum Grid Shift
• ACE2 - ACE2
• SNODAS - Snow Data Assimilation System
• KRO - KOLOR Raw
• ROI_PAC - ROI_PAC raster
• ISCE - ISCE raster
• ARG - Azavea Raster Grid format
• RIK - Swedish Grid RIK (.rik)
• USGSDEM - USGS Optional ASCII DEM (and CDED)
• GXF - GeoSoft Grid Exchange Format
• NWT_GRD - Northwood Numeric Grid Format .grd/.tab
• NWT_GRC - Northwood Classified Grid Format .grc/.tab
• ADRG - ARC Digitized Raster Graphics
• SRP - Standard Raster Product (ASRP/USRP)
• BLX - Magellan topo (.blx)
• Rasterlite - Rasterlite
• PostGISRaster - PostGIS Raster driver
• SAGA - SAGA GIS Binary Grid (.sdat)
• KMLSUPEROVERLAY - Kml Super Overlay
• XYZ - ASCII Gridded XYZ
• HF2 - HF2/HFZ heightfield raster
• PDF - Geospatial PDF
• OZI - OziExplorer Image File
• CTG - USGS LULC Composite Theme Grid
• E00GRID - Arc/Info Export E00 GRID
• ZMap - ZMap Plus Grid
• NGSGEOID - NOAA NGS Geoid Height Grids
• MBTiles - MBTiles
• IRIS - IRIS data (.PPI, .CAPPi etc)
• PLMOSAIC - Planet Labs Mosaic
• CALS - CALS (Type 1)
• WMTS - OGC Web Map Tile Service
• ESRI Shapefile - ESRI Shapefile
• MapInfo File - MapInfo File
• UK .NTF - UK .NTF
• OGD_SDTS - SDTS
• S57 - IHO S-57 (ENC)
• DGN - Microstation DGN
• OGR_VRT - VRT - Virtual Datasource
• REC EPIInfo .REC
• Memory - Memory
• BNA - Atlas BNA
• CSV - Comma Separated Value (.csv)
• NAS - NAS - ALKIS
• GML - Geography Markup Language
• GPX - GPX
• LIBKML - Keyhole Markup Language (LIBKML)
• KML - Keyhole Markup Language (KML)
• GeoJSON - GeoJSON
• Interlis 1 - Interlis 1
• Interlis 2 - Interlis 2
• OGR_GMT - GMT ASCII Vectors (.gmt)
• GPKG - GeoPackage
• SQLite - SQLite / Spatialite
• ODBC - ODBC
• WAsP - WAsP .map format
• PGeo - ESRI Personal GeoDatabase
• MSSQLSpatial - Microsoft SQL Server Spatial Database
• MySQL - MySQL
• OpenFileGDB - ESRI FileGDB
• XPlane - X-Plane/Flightgear aeronautical data
• DXF - AutoCAD DXF
• Geoconcept - Geoconcept
• GeoRSS - GeoRSS
• GPSTrackMaker - GPSTrackMaker
• VFK - Czech Cadastral Exchange Data Format
• PGDUMP - PostgreSQL SQL dump
• OSM - OpenStreetMap XML and PDF
• GPSBabel - GPSBabel
• SUA - Tim Newport-Peace’s Special Use Airspace Format
• OpenAir - OpenAir
• OGR_PDS - Planetary Data Systems TABLE
• WFS - OGC WFS (Web Feature Service)
• HTF - Hydrographic Transfer Vector
• AeronavFAA - Aeronav FAA
• Geomedia - Geomedia .mdb
• EDIGEO - French EDIGEO exchange format
• GFT - Google Fusion Tables
• GME - Google Maps Engine
• SVG - Scalable Vector Graphics
• CouchDB - CouchDB / GeoCouch
• Cloudant - Cloudant / CouchDB
• Idrisi - Idrisi Vector (.vct)
• ARCGEN - Arc/Info Generate
• SEGUKOOA - SEG-P1 / UKOOGA P1/90
• SEG-Y - SEG-Y
• ODS - Open Document/ LibreOffice / OpenOffice Spreadsheet
• XLSX - MS Office Open XML spreadsheet
• ElasticSearch - Elastic Search
• Walk - Walk
• CartoDB - CartoDB
• SXF - Storage and eXchange Format
• Selafin - Selafin
• JML - OpenJUMP JML
rsaga.insolation

- PLSCENES - Planet Labs Scenes API
- CSW - OGC CSW (Catalog Search for the Web)
- IDF - INTREST Data Format
- TIGER - U.S. Census TIGER/Line
- AVCBin - Arc/Info Binary Coverage
- AVCE00 - Arc/Info E00 (ASCII) Coverage
- HTTP - HTTP Fetching Wrapper

Author(s)

Alexander Brenning (R interface), Olaf Conrad / Andre Ringeler (SAGA module), Frank Warmerdam (GDAL)

References

GDAL website: http://www.gdal.org/

See Also

read.ascii.grid, rsaga.esri.to.sgrd, read.sgrd, read.Rd.grid

rsaga.insolation  

_Incoming Solar Radiation (Insolation)_

Description

This function calculates the amount of incoming solar radiation (insolation) depending on slope, aspect, and atmospheric properties. Module not available in SAGA GIS 2.0.6 and 2.0.7.

Usage

rsaga.insolation(in.dem, in.vapour, in.latitude, in.longitude, out.direct, out.diffuse, out.total, horizontal = FALSE, solconst = 8.164, atmosphere = 12000, water.vapour.pressure = 10, type = c("moment", "day", "range.of.days", "same.moment.range.of.days"), time.step = 1, day.step = 5, days, moment, latitude, bending = FALSE, radius = 6366737.96, lat.offset = "user", lat.ref.user = 0, lon.offset = "center", lon.ref.user = 0, ...)
Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>in.dem</strong></td>
<td>Name of input digital elevation model (DEM) grid in SAGA grid format (default extension: .sgrd)</td>
</tr>
<tr>
<td><strong>in.vapour</strong></td>
<td>Optional input: SAGA grid file giving the water vapour pressure in mbar</td>
</tr>
<tr>
<td><strong>in.latitude</strong></td>
<td>Optional input: SAGA grid file giving each pixel the latitude in degree</td>
</tr>
<tr>
<td><strong>in.longitude</strong></td>
<td>Optional input: SAGA grid file giving each pixel the longitude in degree</td>
</tr>
<tr>
<td><strong>out.direct</strong></td>
<td>Optional output grid file for direct insolation</td>
</tr>
<tr>
<td><strong>out.diffuse</strong></td>
<td>Optional output grid file for diffuse insolation</td>
</tr>
<tr>
<td><strong>out.total</strong></td>
<td>Optional output grid file for total insolation, i.e. the sum of direct and diffuse insolation</td>
</tr>
<tr>
<td><strong>horizontal</strong></td>
<td>logical; project radiation onto a horizontal surface? (default: FALSE, i.e. use the actual inclined surface as a reference area)</td>
</tr>
<tr>
<td><strong>solconst</strong></td>
<td>solar constant in Joule; default: 8.164 J/cm²/min (=1360.7 kWh/m²; the more commonly used solar constant of 1367 kWh/m² corresponds to 8.202 J/cm²/min)</td>
</tr>
<tr>
<td><strong>atmosphere</strong></td>
<td>height of atmosphere in m; default: 12000m</td>
</tr>
<tr>
<td><strong>water.vapour.pressure</strong></td>
<td>if no water vapour grid is given, this argument specifies a constant water vapour pressure that is uniform in space; in mbar, default 10 mbar</td>
</tr>
<tr>
<td><strong>type</strong></td>
<td>type of time period: &quot;moment&quot; (equivalent: 0) for a single instant, &quot;day&quot; (or 1) for a single day, &quot;range.of.days&quot; (or 2), or &quot;same.moment.range.of.days&quot; (or 3) for the same moment in a range of days; default: &quot;moment&quot;</td>
</tr>
<tr>
<td><strong>time.step</strong></td>
<td>time resolution in hours for discretization within a day</td>
</tr>
<tr>
<td><strong>day.step</strong></td>
<td>time resolution in days for a range of days</td>
</tr>
<tr>
<td><strong>days</strong></td>
<td>numeric vector of length 2, specifying the first and last day of a range of days (for types 2 and 3)</td>
</tr>
<tr>
<td><strong>moment</strong></td>
<td>if type=&quot;moment&quot; or &quot;same.moment.range.of.days&quot;, moment specifies the time of the day (hour between 0 and 24) for which the insolation is to be calculated</td>
</tr>
<tr>
<td><strong>latitude</strong></td>
<td>if no in.latitude grid is given, this will specify a fixed geographical latitude for the entire grid</td>
</tr>
<tr>
<td><strong>bending</strong></td>
<td>should planetary bending be modeled? (default: FALSE)</td>
</tr>
<tr>
<td><strong>radius</strong></td>
<td>planetary radius</td>
</tr>
<tr>
<td><strong>lat.offset</strong></td>
<td>latitude relates to grids &quot;bottom&quot;(equivalent code: 0), &quot;center&quot; (1), &quot;top&quot; (2), or &quot;user&quot;-defined reference (default: &quot;user&quot;); in the latter case, lat.ref.user defines the reference</td>
</tr>
<tr>
<td><strong>lat.ref.user</strong></td>
<td>if in.latitude is missing and lat.offset=&quot;user&quot;, then this numeric value defines the latitudinal reference (details??)</td>
</tr>
<tr>
<td><strong>lon.offset</strong></td>
<td>local time refers to grid’s &quot;left&quot; edge (code 0), &quot;center&quot; (1), &quot;right&quot; edge (2), or a &quot;user&quot;-defined reference.</td>
</tr>
<tr>
<td><strong>lon.ref.user</strong></td>
<td>if in.longitude is missing and lon.offset=&quot;user&quot;, then this numeric value defines the reference of the local time (details??)</td>
</tr>
<tr>
<td>...</td>
<td>optional arguments to be passed to rsaga.geoprocessor, including the env RSAGA geoprocessing environment</td>
</tr>
</tbody>
</table>
Details

Calculation of incoming solar radiation (insolation). Based on the SADO (System for the Analysis of Discrete Surfaces) routines developed by Boehner & Trachinow.

Value

The type of object returned depends on the `intern` argument passed to the `rsaga.geoprocessor`. For `intern=FALSE` it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

Note

This function uses module Insolation (code: 3) from SAGA library `ta_lighting`. It is available in SAGA GIS 2.0.4 and 2.0.5 but not 2.0.6 and 2.0.7; see `rsaga.pisr`.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

`rsaga.solar.radiation`, `rsaga.pisr`, `rsaga.hillshade`

________________________

`rsaga.inverse.distance`

_Spatial Interpolation Methods_

________________________

Description

Spatial interpolation of point data using inverse distance to a power (inverse distance weighting, IDW), nearest neighbors, or modified quadratic shephard.

Usage

```r
rsaga.inverse.distance(in.shapefile, out.grid, field, power = 1, maxdist, nmax = 100, target, env = rsaga.env(), ...)
rsaga.nearest.neighbour(in.shapefile, out.grid, field, target, env = rsaga.env(), ...)
rsaga.modified.quadratic.shephard(in.shapefile, out.grid, field, quadratic.neighbors = 13, weighting.neighbors = 19, target, env = rsaga.env(), ...)
rsaga.triangulation(in.shapefile, out.grid, field, target, env = rsaga.env(), ...)
```
Arguments

in.shapefile  Input: point shapefile (default extension: .shp).
out.grid     Output: filename for interpolated grid (SAGA grid file). Existing files will be overwritten!
field        numeric or character: number or name of attribute in the shapefile’s attribute table to be interpolated; the first attribute is represented by a zero.
power        numeric (>0): exponent used in inverse distance weighting (usually 1 or 2)
maxdist      numeric: maximum distance of points to be used for inverse distance interpolation (search radius); no search radius is applied when this argument is missing or equals Inf
nmax         Maximum number of nearest points to be used for interpolation; nmax=Inf is a valid value (no upper limit)
target       required argument of type list: parameters identifying the target area, e.g. the x/y extent and cellsize, or name of a reference grid; see rsaga.target.
env          RSAGA geoprocessing environment created by rsaga.env, required because module(s) depend(s) on SAGA version
...          Optional arguments to be passed to rsaga.geoprocessor, including the env
quadratic.neighbors  integer >=5; default 13.
weighting.neighbors  integer >=3; default 19.

Details

These functions use modules from the grid_gridding SAGA GIS library. They do not support SAGA GIS 2.0.4, which differs in some argument names and parameterizations. Target grid parameterization by grid filename does not work with SAGA GIS 2.1.0 Release Candidate 1 (see also rsaga.target); stay tuned for future updates and fixes.

Note

The 'Inverse Distance Weighted' module of SAGA GIS not only supports inverse-distance weighted interpolation, but also exponential and other weighting schemes (command line argument WEIGHTING); these are however not accessible through this function, but only through the rsaga.geoprocessor, if needed. See rsaga.get.usage("grid_gridding","Inverse Distance Weighted") for details.

See the example section in the help file for write.shapefile in package shapefiles to learn how to apply these interpolation functions to a shapefile exported from a data.frame.

Modified Quadratic Shephard method: based on module 660 in TOMS (see references).

Author(s)

Alexander Brenning (R interface), Andre Ringeler and Olaf Conrad (SAGA modules)
rsaga.lib.prefix

References


See Also

rsaga.target; idw in package gstat.

rsaga.lib.prefix Determine prefix for SAGA GIS library names

Description

Internal function that determines the possible prefix for SAGA GIS library names - relevant for non-Windows SAGA GIS pre-2.1.0.

Usage

rsaga.lib.prefix(env)

Arguments

env list, setting up a SAGA geoprocessing environment as created by rsaga.env.

Details

Some non-Windows versions of saga_cmd require library names with a "lib" prefix, e.g. libio_grid instead of io_grid. This function, which is called by rsaga.env tries to guess this behaviour based on the operating system and SAGA GIS version.

Value

A character string, either "" or "lib".

See Also

rsaga.env

Examples

## Not run:
env = rsaga.env()
# obtained by a call to rsaga.lib.prefix:
env$lib.prefix

# more explicitly:
rsaga.lib.prefix(env=env)

## End(Not run)
Local Morphometry

Description

Calculates local morphometric terrain attributes (i.e. slope, aspect and curvatures). Intended for use with SAGA versions 2.1.0 and older. Use rsaga.slope.asp.curv for SAGA 2.1.1+

Usage

rsaga.local.morphometry(in.dem, out.slope, out.aspect, out.curv, out.hcurv, out.vcurv, method = "poly2zeevenbergen", env = rsaga.env(), ...)

rsaga.slope(in.dem, out.slope, method = "poly2zeevenbergen", env = rsaga.env(), ...)

rsaga.aspect(in.dem, out.aspect, method = "poly2zeevenbergen", env = rsaga.env(), ...)

rsaga.curvature(in.dem, out.curv, method = "poly2zeevenbergen", env = rsaga.env(), ...)

rsaga.plan.curvature(in.dem, out.hcurv, method = "poly2zeevenbergen", env = rsaga.env(), ...)

rsaga.profile.curvature(in.dem, out.vcurv, method = "poly2zeevenbergen", env = rsaga.env(), ...)

Arguments

in.dem input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
out.slope optional output: slope (in radians)
out.aspect optional output: aspect (in radians; north=0, clockwise angles)
out.curv optional output: curvature
out.hcurv optional output: horizontal curvature (plan curvature)
out.vcurv optional output: vertical curvature (profile curvature)
method character (or numeric): algorithm (see References):
   0 Maximum Slope - Travis et al. (1975) ("maxslope", or 0)
   1 Max. Triangle Slope - Tarboton (1997) ("maxtriangleslope", or 1)
   2 Least Squares Fit Plane - Costa-Cabral and Burgess (1996) ("lsqfitplane", or 2)
   3 Fit 2nd Degree Polynomial - Bauer et al. (1985) ("poly2bauer", or 3)
4 Fit 2nd Degree Polynomial - Heerdegen and Beran (1982) ("poly2heerdegen", or 4)
5 default: Fit 2nd Degree Polynomial - Zevenbergen and Thorne (1987) ("poly2zevenbergen", or 5)
6 Fit 3rd Degree Polynomial - Haralick (1983) ("poly3haralick", or 6).

env list, setting up a SAGA geoprocessing environment as created by rsaga.env
... further arguments to rsaga.geoprocessor

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern = FALSE it is a numerical error code (0: success), or otherwise (default) a character vector with the module's console output.

Author(s)

Alexander Brenning and Donovan Bangs (R interface), Olaf Conrad (SAGA module)

References

For references and algorithm changes in SAGA GIS 2.1.1+ see rsaga.slope.asp.curv.

See Also

rsaga.slope.asp.curv, rsaga.parallel.processing, rsaga.geoprocessor, rsaga.env

Examples

## Not run:
# a simple slope algorithm:
rsaga.slope("lican.sgrd","slope","maxslope")
# same for ASCII grids (default extension .asc):
rsaga.esri.wrapper(rsaga.slope,in.dem="lican",out.slope="slope",method="maxslope")

## End(Not run)

rsaga.parallel.processing

Parallel Processing

Description

Calculate the size of the local catchment area (contributing area), the catchment height, catchment slope and aspect, and flow path length, using parallel processing algorithms including the recommended multiple flow direction algorithm. This set of algorithms processes a digital elevation model (DEM) downwards from the highest to the lowest cell. No longer supported with SAGA GIS 2.1.3+. See rsaga.topdown.processing.
Usage

rsaga.parallel.processing(in.dem, in.sinkroute, in.weight, out.carea, 
out.cheight, out.cslope, out.caspect, out.flowpath, step, method = "mfd", 
linear.threshold = Inf, convergence = 1.1, env = rsaga.env(), ...)

Arguments

in.dem input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
in.sinkroute optional input: SAGA grid with sink routes
in.weight optional input: SAGA grid with weights
out.carea output: catchment area grid
out.cheight optional output: catchment height grid
out.cslope optional output: catchment slope grid
out.caspect optional output: catchment aspect grid
out.flowpath optional output: flow path length grid
step integer >=1: step parameter
method character or numeric: choice of processing algorithm: Deterministic 8 ("d8" or 0), Rho 8 ("rho8" or 1), Braunschweiger Reliefmodell ("braunschweig" or 2), Deterministic Infinity ("dinf" or 3), Multiple Flow Direction ("mfd" or 4, the default), Multiple Triangular Flow Direction ("mtfd", or 5).
linear.threshold numeric (number of grid cells): threshold above which linear flow (i.e. the Deterministic 8 algorithm) will be used; linear flow is disabled for linear.threshold=Inf (the default)
convergence numeric >=0: a parameter for tuning convergent/ divergent flow; default value of 1.1 gives realistic results and should not be changed
env list, setting up a SAGA geoprocessing environment as created by rsaga.env
... further arguments to rsaga.geoprocessor

Details

Refer to the references for details on the available algorithms.

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (the default) a character vector with the module’s console output.
Note

This function uses module Parallel Processing (version 2.0.7+: Catchment Area (Parallel) from SAGA library ta_hydrology.

The SAGA GIS 2.0.6+ version of the module adds more (optional) input and output grids that are currently not supported by this wrapper function. Use rsaga.geoprocessor for access to these options, and see rsaga.get.usage("ta_hydrology","Catchment Area (Parallel)") for information on new arguments.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module), Thomas Grabs (MTFD algorithm)

References

Deterministic 8:

Rho 8:

Braunschweiger Relieffmodell:

Deterministic Infinity:

Multiple Flow Direction:


Multiple Triangular Flow Direction:

See Also

rsaga.topdown.processing, rsaga.wetness.index, rsaga.geoprocessor, rsaga.env
Examples

```r
## Not run:
# SAGA GIS 2.0.6+:
rsaga.get.usage("ta_hydrology","Catchment Area (Parallel)")
# earlier versions of SAGA GIS:
#rsaga.get.usage("ta_hydrology","Parallel Processing")
# execute model with typical settings:
rsaga.parallel.processing(in.dem = "dem", out.carea = "carea", out.cslope = "cslope")
# cslope is in radians - convert to degree:
fac = round(180/pi, 4)
formula = paste(fac, "*a", sep = "")
rsaga.grid.calculus("cslope", "cslondeg", formula)

## End(Not run)
```

---

rsaga.pisr | Potential incoming solar radiation

Description

This function calculates the potential incoming solar radiation in an area using different atmospheric models; module available in SAGA GIS 2.0.6+.

Usage

```r
rsaga.pisr(in.dem, in.svf.grid = NULL, in.vapour.grid = NULL, in.latitude.grid = NULL, out.longitude.grid = NULL, out.diffuse.grid, out.total.grid = NULL, out.ratio.grid = NULL, out.duration, out.sunrise, out.sunset, local.svf = TRUE, latitude, unit = c("kWh/m2", "kJ/m2", "J/cm2"), solconst = 1367, enable.bending = FALSE, bending.radius = 6366737.96, bending.lat.offset = "user", bending.lat.ref.user = 0, bending.lon.offset = "center", bending.lon.ref.user = 0, method = c("height", "components", "lumped"), hgt.atmosphere = 12000, hgt.water.vapour.pressure = 10, cmp.pressure = 1013, cmp.water.content = 1.68, cmp.dust = 100, lmp.transmittance = 70, time.range = c(0, 24), time.step = 0.5, start.date = list(day = 21, month = 3), end.date = NULL, day.step = 5, env = rsaga.env(), ...)```

Arguments

- **in.dem** name of input digital elevation model (DEM) grid in SAGA grid format (default extension: .sgrd)
- **in.svf.grid** Optional input grid in SAGA format: Sky View Factor; see also local.svf
- **in.vapour.grid** Optional input grid in SAGA format: Water vapour pressure (mbar); see also argument hgt.water.vapour.pressure
in.latitude.grid
Optional input grid in SAGA format: Latitude (degree) of each grid cell

in.longitude.grid
see in.latitude.grid

out.direct.grid
Output grid: Direct insolation (unit selected by unit argument)

out.diffuse.grid
Output grid: Diffuse insolation

out.total.grid
Optional output grid: Total insolation, i.e. sum of direct and diffuse incoming solar radiation

out.ratio.grid
Optional output grid: Direct to diffuse ratio

out.duration
Optional output grid: Duration of insolation

out.sunrise
Optional output grid: time of sunrise; only calculated if time span is set to single day

out.sunset
Time of sunset; see out.sunrise

local.svf
logical (default: TRUE; if TRUE, use sky view factor based on local slope (after Oke, 1988), if no sky view factor grid is provided in in.svf.grid

latitude
Geographical latitude in degree North (negative values indicate southern hemisphere)

unit
unit of insolation output grids: "kWh/m2" (default) "kJ/m2", or "J/cm2"

solconst
solar constant, defaults to 1367 W/m2

enable.bending
logical (default: FALSE): incorporate effects of planetary bending?

bending.radius
Planetary radius, default 6366737.96

bending.lat.offset
if bending is enabled: latitudinal reference is "user"-defined (default), or relative to "top", "center" or "bottom" of grid?

bending.lat.ref.user
user-defined lat. reference for bending, see bending.lat.offset

bending.lon.offset
longitudinal reference, i.e. local time, is "user"-defined, or relative to "top", "center" (default) or "bottom" of grid?

bending.lon.ref.user
user-defined reference for local time (Details??)

method
specifies how the atmospheric components should be accounted for: either based on the height of atmosphere and vapour pressure ("height", or numeric code 0), or air pressure, water and dust content ("components", code 1), or lumped atmospheric transmittance ("lumped", code 0)

hgt.atmosphere
Height of atmosphere (in m); default 12000 m

hgt.water.vapour.pressure
Water vapour pressure in mbar (default 10 mbar); This value is used if no vapour pressure grid is given in argument in.vapour.grid

cmp.pressure
atmospheric pressure in mbar, defaults to 1013 mbar
rsaga.pisr

**cmp.water.content**

Water content of a vertical slice of the atmosphere in cm: between 1.5 and 1.7cm, average 1.68cm (default)

**cmp.dust**

Dust factor in ppm; defaults to 100 ppm

**lmp.transmittance**

Transmittance of the atmosphere in percent; usually between 60 (humid areas) and 80 percent (deserts)

**time.range**

Numeric vector of length 2: time span (hours of the day) for numerical integration

**time.step**

Time step in hours for numerical integration

**start.date**

List of length two, giving the start date in day and month components as numbers; these numbers are one-based (SAGA_CMD uses zero-based numbers internally), i.e. Jan. 1st is list(day=1, month=1)

**end.date**

See **start.date**

**day.step**

If days indicates a range of days, this specifies the time step (number of days) for calculating the incoming solar radiation

**env**

RSAGA geoprocessing environment obtained with **rsaga.env**; this argument is required for version control (see Note)

... optional arguments to be passed to **rsaga.geoprocessor**

---

**Details**

According to SAGA GIS 2.0.7 documentation, "Most options should do well, but TAPES-G based diffuse irradiance calculation ("Atmospheric Effects" methods 2 and 3) needs further revision!" I.e. be careful with method = "components" and method = "lumped".

**Note**

This module is computationally very intensive (depending on the size of the grid and the time resolution, of course). The performance seems to have much improved in SAGA GIS 2.1.0, which by default runs this module in multicore mode (at the release candidate 1 for Windows does).

SAGA_CMD uses zero-based days and months, but this R function uses the standard one-based days and months (e.g. day 1 is the first day of the month, month 1 is January) and translates to the SAGA system.

This function uses module Potential Incoming Solar Radiation from SAGA library ta_lighting in SAGA version 2.0.6+.

**Author(s)**

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

**References**


See Also

rsaga.hillshade; for similar modules in older SAGA versions (pre-2.0.6) see rsaga.solar.radiation and rsaga.insolation

---

**rsaga.pisr2**

*Potential incoming solar radiation SAGA 2.2.2+

**Description**

This function calculates the potential incoming solar radiation in an area using different atmospheric models; This function reflects changes to the module with SAGA 2.2.2+. For SAGA versions 2.0.6 to 2.2.1 please see rsaga.pisr.

**Usage**

rsaga.pisr2(in.dem, in.svf.grid = NULL, in.vapour.grid = NULL, in.linke.grid = NULL, out.direct.grid, out.diffuse.grid, out.total.grid = NULL, out.ratio.grid = NULL, out.duration, out.sunrise, out.sunset, local.svf = TRUE, location = c("latitude", "grid"), latitude = 53, unit = c("kWh/m2", "kJ/m2", "J/cm2"), solconst = 1367, method = c("height", "components", "lumped", "hofierka"), hgt.atmosphere = 12000, cmp.pressure = 1013, cmp.water.content = 1.68, cmp.dust = 100, lmp.transmittance = 70, time.range = c(0, 24), time.step = 0.5, start.date = list(day = 31, month = 10, year = 2015), end.date = NULL, day.step = 5, env = rsaga.env(), ...)

**Arguments**

- **in.dem**: name of input digital elevation model (DEM) grid in SAGA grid format (default extension: .sgrd)
- **in.svf.grid**: Optional input grid in SAGA format: Sky View Factor; see also local.svf
- **in.vapour.grid**: Optional input grid in SAGA format: Water vapour pressure (mbar), for use with method = "height"; default 10 mbar
- **in.linke.grid**: Optional input grid in SAGA format: Linke turbidity coefficient, for use with method = "hofierka"; default 3.0
- **out.direct.grid**: Output grid: Direct insolation (unit selected by unit argument)
- **out.diffuse.grid**: Output grid: Diffuse insolation
- **out.total.grid**: Optional output grid: Total insolation, i.e. sum of direct and diffuse incoming solar radiation
out.ratio.grid  Optional output grid: Direct to diffuse ratio
out.duration  Optional output grid: Duration of insolation
out.sunrise  Optional output grid: Time of sunrise; only calculated if time span is set to single day
out.sunset  Time of sunset; see out.sunrise
local.svf  logical (default: TRUE; if TRUE, use sky view factor based on local slope (after Oke, 1988), if no sky view factor grid is provided in in.svf.grid
location  specified whether to use constant latitude supplied by latitude below ("latitude" or code 0; default) or as calculated from the grid system ("grid" or code 1)
latitude  Geographical latitude in degree North (negative values indicate southern hemisphere)
unit  unit of insolation output grids: "kWh/m2" (default) "kJ/m2", or "J/cm2"
solconst  solar constant, defaults to 1367 W/m2
method  specifies how the atmospheric components should be accounted for: either based on the height of atmosphere and vapour pressure ("height", or numeric code 0), or air pressure, water and dust content ("components", code 1), or lumped atmospheric transmittance ("lumped", code 2), or by the method of Hofierka and Suri, 2009 ("hofierka", code 3). Default: "lumped".

hgt.atmosphere  Height of atmosphere (in m); default 12000 m. For use with method = "height"
cmp.pressure  atmospheric pressure in mbar, defaults to 1013 mbar. For use with method = "components"
cmp.water.content  water content of a vertical slice of the atmosphere in cm: between 1.5 and 1.7cm, average 1.68cm (default). For use with method = "components"
cmp.dust  dust factor in ppm; defaults to 100 ppm. For use with method = "components"
lump.transmittance  transmittance of the atmosphere in percent; usually between 60 (humid areas) and 80 percent (deserts)
time.range  numeric vector of length 2: time span (hours of the day) for numerical integration
time.step  time step in hours for numerical integration
start.date  list of length three, giving the start date in day, month, and year components as numbers; month is one-based (SAGA_CMD uses zero-based numbers internally), i.e. Jan. 1st 2015 is list(day=1, month=1, year=2015)
end.date  see start.date
day.step  if days indicates a range of days, this specifies the time step (number of days) for calculating the incoming solar radiation
env  RSAGA geoprocessing environment obtained with rsaga.env; this argument is required for version control (see Note)
...
optional arguments to be passed to rsaga.geoprocessor

Details
According to SAGA GIS 2.0.7 documentation, "Most options should do well, but TAPES-G based diffuse irradiance calculation ("Atmospheric Effects" methods 2 and 3) needs further revision!" I.e. be careful with method = "components" and method = "lumped".
Note

SAGA_CMD uses zero-based months, but this R function uses the standard one-based months (e.g. day 1 is the first day of the month, month 1 is January) and translates to the SAGA system.

This function uses module Potential Incoming Solar Radiation from SAGA library ta_lighting in SAGA version 2.0.6+. Changes to the module with SAGA 2.2.2+ include adding year to the *.date arguments to allow calculation across years. The method of Hofierka and Suri (2009) is added, which uses the Linke turbidity coefficient. Duration of insolation ("out.duration") is only calculated when the time period is set to a single day.

Author(s)

Alexander Brenning & Donovan Bangs (R interface), Olaf Conrad (SAGA module)

References


See Also

rsaga.pisr; for similar modules in older SAGA versions (pre-2.0.6) see rsaga.solar.radiation and rsaga.insolation; rsaga.hillshade

rsaga.sgrd.to.esri

Convert SAGA grids to ESRI ASCII/binary grids

Description

rsaga.sgrd.to.esri converts grid files from SAGA’s (version 2) grid format (.sgrd) to ESRI’s ASCII (.asc) and binary (.flt) format.

Usage

rsaga.sgrd.to.esri(in.sgrds, out.grids, out.path, format = "ascii", georef = "corner", prec = 5, ...)

rsaga.sgrd.to.esri
Arguments

in.sgrds character vector of SAGA grid files (.sgrd) to be converted; files are expected to be found in folder `rsaga.env()`$workspace, or, if an optional env argument is provided, in `env$workspace`

out.grids character vector of ESRI ASCII/float output file names; defaults to `in.sgrds` with the file extension being replaced by .asc or .flt, depending on `format`. Files will be placed in folder `out.path`, existing files will be overwritten

out.path folder for `out.grids`

format output file format, either "ascii" (default; equivalent: `format=1`) for ASCII grids or "binary" (equivalent: 0) for binary ESRI grids (.flt).

georef character: "corner" (equivalent numeric code: 0) or "center" (default; equivalent: 1). Determines whether the georeference will be related to the center or corner of its extreme lower left grid cell.

prec number of digits when writing floating point values to ASCII grid files; either a single number (to be replicated if necessary), or a numeric vector of length `length(in.grids)`

... optional arguments to be passed to `rsaga.geoprocessor`, including the env RSAGA geoprocessing environment

Value

The type of object returned depends on the `intern` argument passed to the `rsaga.geoprocessor`. For `intern=FALSE` it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

Note

This function uses module 0 from the SAGA library io_grid.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

`rsaga.esri.wrapper` for an efficient way of applying RSAGA to ESRI ASCII/binary grids; `rsaga.env`

---

rsaga.sink.removal Sink Removal Remove sinks from a digital elevation model by deepening drainage routes or filling sinks.

Description

Sink Removal Remove sinks from a digital elevation model by deepening drainage routes or filling sinks.
rsaga.sink.removal

Usage

rsaga.sink.removal(in.dem, in.sinkroute, out.dem, method = "fill", ...)

Arguments

in.dem input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
in.sinkroute optional input: sink route grid file
out.dem output: modified DEM
method character string or numeric value specifying the algorithm (partial string matching will be applied): "deepen drainage route" (or 0): reduce the elevation of pixels in order to achieve drainage out of the former sinks "fill sinks" (or 1): fill sinks until none are left
... optional arguments to be passed to rsaga.geoprocessor, including the env RSAGA geoprocessing environment

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

Note

This function uses module 1 from SAGA library ta_preprocessor.

Author(s)

Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also

rsaga.sink.route, rsaga.fill.sinks

Examples

## Not run: rsaga.sink.route("dem","sinkroute")
rsaga.sink.removal("dem","sinkroute","dem-preproc",method="deepen")
## End(Not run)
rsaga.sink.route  Sink Drainage Route Detection

Description
Sink drainage route detection.

Usage
rsaga.sink.route(in.dem, out.sinkroute, threshold, thrshheight = 100, ...)

Arguments
in.dem input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
out.sinkroute output: sink route grid file: non-sinks obtain a value of 0, sinks are assigned an integer between 0 and 8 indicating the direction to which flow from this sink should be routed
threshold logical: use a threshold value?
thrsheight numeric: threshold value (default: 100)
... optional arguments to be passed to rsaga.geoprocessor, including the env RSAGA geoprocessing environment

Value
The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

Note
I assume that flow directions are coded as 0 = north, 1 = northeast, 2 = east, ..., 7 = northwest, as in rsaga.fill.sinks.

Author(s)
Alexander Brenning (R interface), Olaf Conrad (SAGA module)

See Also
rsaga.sink.remove

Examples
## Not run: rsaga.sink.route("dem","sinkroute")
rsaga.sink.remove("dem","sinkroute","dem-preproc",method="deepen")
## End(Not run)
Description

Calculates local morphometric terrain attributes (i.e. slope, aspect, and curvatures). Intended for use with SAGA v 2.1.1+. For older versions use rsaga.local.morphometry.

Usage

rsaga.slope.asp.curv(in.dem, out.slope, out.aspect, out.cgene, out.cprof, out.cplan, out.ctang, out.clong, out.ccross, out.cmini, out.cmaxi, out.ctota, out.crotol, method = "poly2zevenbergen", unit.slope = "radians", unit.aspect = "radians", env = rsaga.env(), ...)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.dem</td>
<td>input: digital elevation model as SAGA grid file (.sgrd)</td>
</tr>
<tr>
<td>out.slope</td>
<td>optional output: slope</td>
</tr>
<tr>
<td>out.aspect</td>
<td>optional output: aspect</td>
</tr>
<tr>
<td>out.cgene</td>
<td>optional output: general curvature</td>
</tr>
<tr>
<td>out.cprof</td>
<td>optional output: profile curvature (vertical curvature; degrees)</td>
</tr>
<tr>
<td>out.cplan</td>
<td>optional output: plan curvature (horizontal curvature; degrees)</td>
</tr>
<tr>
<td>out.ctang</td>
<td>optional output: tangential curvature (degrees)</td>
</tr>
<tr>
<td>out.clong</td>
<td>optional output: longitudinal curvature (degrees) Zeverbergen &amp; Thorne (1987) refer to this as profile curvature</td>
</tr>
<tr>
<td>out.ccross</td>
<td>optional output: cross-sectional curvature (degrees) Zeverbergen &amp; Thorne (1987) refer to this as the plan curvature</td>
</tr>
<tr>
<td>out.cmini</td>
<td>optional output: minimal curvature (degrees)</td>
</tr>
<tr>
<td>out.cmaxi</td>
<td>optional output: maximal curvature (degrees)</td>
</tr>
<tr>
<td>out.ctota</td>
<td>optional output: total curvature (degrees)</td>
</tr>
<tr>
<td>out.crotol</td>
<td>optional output: flow line curvature (degrees)</td>
</tr>
<tr>
<td>method</td>
<td>character algorithm (see References):</td>
</tr>
</tbody>
</table>

0 Maximum Slope - Travis et al. (1975) ("maxslope")
1 Max. Triangle Slope - Tarboton (1997) ("maxtriangleslope")
2 Least Squares Fit Plane - Costa-Cabral & Burgess (1996) ("lsqfitplane")
3 Fit 2nd Degree Polynomial - Evans (1979) ("poly2evans")
4 Fit 2nd Degree Polynomial - Heerdegen and Beran (1982) ("poly2heerdegen")
5 Fit 2nd Degree Polynomial - Bauer et al. (1985) ("poly2bauer")
6 default: Fit 2nd Degree Polynomial - Zeverbergen & Thorne (1987) ("poly2zevenbergen")
7 Fit 3rd Degree Polynomial - Haralick (1983) ("poly3haralick")
unit.slope character or numeric (default \texttt{"radians"}):
\begin{itemize}
\item 0 \texttt{"radians"}
\item 1 \texttt{"degrees"}
\item 2 \texttt{"percent"}
\end{itemize}

unit.aspect character or numeric (default is 0, or \texttt{"radians"}):
\begin{itemize}
\item 0 \texttt{"radians"}
\item 1 \texttt{"degrees"}
\end{itemize}

e
list, setting up a SAGA geoprocessing environment as created by \texttt{rsaga.env}

Details

Profile and plan curvature calculation (\texttt{out.cprof}, \texttt{out.cplan}) changed in SAGA GIS 2.1.1+ compared to earlier versions. See the following thread on sourceforge.net for an ongoing discussion: 
\url{http://sourceforge.net/p/saga-gis/discussion/354013/thread/e9d07075/#5727}

Value

The type of object returned depends on the \texttt{intern} argument passed to the \texttt{rsaga.geoprocessor}. For \texttt{intern}=\texttt{FALSE} it is a numerical error code (0: success), or otherwise (default) a character vector with the module’s console output.

Author(s)

Alexander Brenning and Donovan Bangs (R interface), Olaf Conrad (SAGA module)

References

General references:


References on specific methods:

Maximum Slope:


Maximum Triangle Slope:


Least Squares or Best Fit Plane:


rsaga.solar.radiation

Fit 2nd Degree Polynomial:

Fit 3.Degree Polynomial:

For a discussion on the calculation of slope by ArcGIS check these links:

See Also
rsaga.local.morphometry, rsaga.parallel.processing, rsaga.geoprocessor, rsaga.env

Examples

```r
## Not run:
# Simple slope, aspect, and general curvature in degrees:
rsaga.slope.asp.curv("lican.sgrd", "slope", "aspect", "curvature",
  method = "maxslope", unit.slope = "degrees", unit.aspect = "degrees")
# same for ASCII grids (default extension .asc):
rsaga.esri.wrapper(rsaga.slope.asp.curv,
  in.dem="lican", out.slope="slope",
  out.aspect = "aspect", out.cgene = "curvature",
  method="maxslope", unit.slope = "degrees", unit.aspect = "degrees")
```

rsaga.solar.radiation  Potential incoming solar radiation

Description

This function calculates the potential incoming solar radiation in an area either using a lumped atmospheric transmittance model or estimating it based on water and dust content. Use rsaga.pisr instead with SAGA GIS 2.0.6+. 
Usage

rsaga.solar.radiation(in.dem, out.grid, out.duration, latitude, 
unit = c("kWh/m2", "J/m2"), solconst = 1367, method = c("lumped", 
"components"), transmittance = 70, pressure = 1013, 
water.content = 1.68, dust = 100, time.range = c(0, 24), 
time.step = 1, days = list(day = 21, month = 3), day.step = 5, 
env = rsaga.env(), ...)

Arguments

in.dem name of input digital elevation model (DEM) grid in SAGA grid format (default 
extension: .sgrd)
out.grid output grid file for potential incoming solar radiation sums 
out.duration Optional output grid file for duration of insolation 
latitude Geographical latitude in degree North (negative values indicate southern hemi-
sphere) 
unit unit of the out.grid output: "kWh/m2" (default) or "J/m2" 
solconst solar constant, defaults to 1367 W/m2 
method specifies how the atmospheric components should be accounted for: either based 
on a lumped atmospheric transmittance as specified by argument transmittance 
("lumped", or numeric code 0; default); or by calculating the components cor-
responding to water and dust ("components", code 1)
transmittance transmittance of the atmosphere in percent; usually between 60 (humid areas) 
and 80 percent (deserts)
pressure atmospheric pressure in mbar 
water.content water content of a vertical slice of the atmosphere in cm: between 1.5 and 1.7cm, 
average 1.68cm (default)
dust dust factor in ppm; defaults to 100ppm 
time.range numeric vector of length 2: time span (hours of the day) for numerical integra-
tion 
time.step time step in hours for numerical integration 
days either a list with components day and month specifying a single day of the year 
for radiation modeling; OR a numeric vector of length 2 specifying the start and 
end date (see Note below) 
day.step if days indicates a range of days, this specifies the time step (number of days) 
for calculating the incoming solar radiation 
env RSAGA geoprocessing environment obtained with rsaga.env; this argument is 
required for version control (see Note)
... optional arguments to be passed to rsaga.geoprocessor
Note
This module ceased to exist under SAGA GIS 2.0.6+, which has a similar (but more flexible) module Potential Solar Radiation that is interfaced by rsaga.pisr.

SAGA_CMD uses zero-based days and months, but this R function uses the standard one-based days and months (e.g. day 1 is the first day of the month, month 1 is January) and translates to the SAGA system.

In SAGA 2.0.2, solar radiation sums calculated for a range of days, say days=c(a,b) actually calculate radiation only for days a,...,b-1 (in steps of day.step - I used day.step=1 in this example). The setting a=b however gives the same result as b=a+1, and indeed b=a+2 gives twice the radiation sums and potential sunshine duration that a=b and b=a+1 both give.

The solar radiation module of SAGA 2.0.1 had a bug that made it impossible to pass a range of days of the year or a range of hours of the day (time.range) to SAGA. These options work in SAGA 2.0.1.

This function uses module Incoming Solar Radiation from SAGA GIS library ta_lighting.

Author(s)
Alexander Brenning (R interface), Olaf Conrad (SAGA module)

References

See Also
rsaga.hillshade, rsaga.insolation

Examples

```R
## Not run:
# potential solar radiation on Nov 7 in Southern Ontario...
rsaga.solar.radiation("dem","solrad","soldur",latitude=43,
  days=list(day=7,month=11),time.step=0.5)

## End(Not run)
```

rsaga.target Define target grid for interpolation

Description
Define the resolution and extent of a target grid for interpolation by SAGA modules based on (1) user-provided x/y coordinates, (2) an existing SAGA grid file, or (3) the header data of an ASCII grid. Intended to be used with RSAGA's interpolation functions.
Usage

rsaga.target(target = c("user_defined", "target.grid", "header"),
             user.cellsize = 100, user.x.extent, user.y.extent, target.grid, header,
             env = rsaga.env())

Arguments

taget character: method used for defining the target grid
user.cellsize Only for target="user_defined": raster resolution (in the grid’s map units)
user.x.extent See user.y.extent
user.y.extent Only for target="user_defined": numeric vectors of length 2: minimum and
                maximum coordinates of grid cell center points
target.grid Only for target="target.grid": character string giving the name of a SAGA
                grid file that specifies the extent and resolution of the target grid; this target grid
                file may be overwritten, depending on the specifics of the SAGA GIS module
                used.
header Only for target="header": list: ASCII grid header (as returned e.g. by read.ascii.grid.header)
           or defined manually; must at least have components ncols, nrows, cellsize,
           and either x/yllcorner or x/yllcenter.
env A SAGA geoprocessing environment, see rsaga.env.

Note

This function is to be used with RSAGA functions rsaga.inverse.distance, rsaga.nearest.neighbour
and rsaga.modified.quadratic.shephard. Note that these are currently only compatible with
SAGA GIS 2.0.5 and higher.

See Also

read.ascii.grid.header

Examples

## Not run:
# IDW interpolation of attribute "z" from the point shapefile
# 'points.shp' to a grid with the same extent and resolution
# as the (pre-existing) geology grid:
rsaga.inverse.distance("points", "dem", field = "z", maxdist = 1000,
                       target = rsaga.target(target="target.grid",
                       target.grid = "geology"))

## End(Not run)
Top-Down Processing

Description

Calculate the size of the local catchment area (contributing area), accumulated material, and flow path length, using top-down processing algorithms from the highest to the lowest cell. Top-Down Processing is new with SAGA GIS 2.1.3. See rsaga.parallel.processing with older versions.

Usage

rsaga.topdown.processing(in.dem, in.sinkroute, in.weight, in.mean, in.material, in.target, in.lin.val, in.lin.dir, out.carea, out.mean, out.tot.mat, out.acc.left, out.acc.right, out.flowpath, step, method = "mfd", linear.threshold = Inf, convergence = 1.1, env = rsaga.env(), ...)

Arguments

in.dem input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
in.sinkroute optional input: SAGA grid with sink routes
in.weight optional input: SAGA grid with weights
in.mean optional input: SAGA grid for mean over catchment calculation
in.material optional input: SAGA grid with material
in.target optional input: SAGA grid of accumulation target
in.lin.val optional input: SAGA grid providing values to be compared with linear flow threshold instead of catchment area
in.lin.dir optional input: SAGA grid to be used for linear flow routing, if the value is a valid direction (0-7 = N, NE, E, SE, S, SW, W, NW)
out.carea output: catchment area grid
out.mean optional output: mean over catchment grid
out.tot.mat optional output: total accumulated material grid
out.acc.left optional output: accumulated material from left side grid
out.acc.right optional output: accumulated material from right side grid
out.flowpath optional output: flow path length grid
step integer >=1: step parameter
method character or numeric: choice of processing algorithm (default "mfd", or 4):
  0 Deterministic 8 ("d8" or 0)
  1 Rho 8 ("rho8", or 1)
  2 Braunschweiger Reliefmodell ("braunschweig" or 2)
3 Deterministic Infinity ("dinf" or 3)
4 Multiple Flow Direction ("mfd" or 4)
5 Multiple Triangular Flow Direction ("mtfd", or 5)
6 Multiple Maximum Gradient Based Flow Direction ("mdg", or 6)

**linear.threshold**

numeric (number of grid cells): threshold above which linear flow (i.e. the Deterministic 8 algorithm) will be used; linear flow is disabled for `linear.threshold=Inf` (the default)

**convergence**

numeric \(\geq 0\): a parameter for tuning convergent/ divergent flow; default value of 1.1 gives realistic results and should not be changed

**env**

list, setting up a SAGA geoprocessing environment as created by `rsaga.env`

... further arguments to `rsaga.geoprocessor`

**Details**

Refer to the references for details on the available algorithms.

**Value**

The type of object returned depends on the `intern` argument passed to the `rsaga.geoprocessor`. For `intern=FALSE` it is a numerical error code (0: success), or otherwise (the default) a character vector with the module's console output.

**Author(s)**

Alexander Brenning and Donovan Bangs (R interface), Olaf Conrad (SAGA module), Thomas Grabs (MTFD algorithm)

**References**

Deterministic 8:

Rho 8:

Braunschweiger Reliefmodell:

Deterministic Infinity:

Multiple Flow Direction:


Multiple Triangular Flow Direction:


Multiple Flow Direction Based on Maximum Downslope Gradient:


See Also

rsaga.parallel.processing, rsaga.wetness.index, rsaga.geoprocessor, rsaga.env

Examples

## Not run:

# Calculation of contributing area with default settings:
rsaga.topdown.processing(in.dem = "dem", out.carea = "carea")
# Calculation of contributing area by maximum downslope gradient:
rsaga.topdown.processing(in.dem = "dem", out.carea = "carea",
                        method = "mdg")

## End(Not run)

---

rsaga.wetness.index    SAGA Modules SAGA Wetness Index

Description

Calculate the SAGA Wetness Index (SWI), a modified topographic wetness index (TWI)

Usage

rsaga.wetness.index(in.dem, out.wetness.index, out.carea, out.cslope,
                    out.mod.carea, suction, area.type, slope.type, slope.min, slope.offset,
                    slope.weight, t.param, env = rsaga.env(), ...)

rsaga.parallel.processing, rsaga.wetness.index, rsaga.geoprocessor, rsaga.env

Examples

## Not run:

# Calculation of contributing area with default settings:
rsaga.topdown.processing(in.dem = "dem", out.carea = "carea")
# Calculation of contributing area by maximum downslope gradient:
rsaga.topdown.processing(in.dem = "dem", out.carea = "carea",
                        method = "mdg")

## End(Not run)
Arguments

in.dem input: digital elevation model (DEM) as SAGA grid file (default file extension: .sgrd)
out.wetness.index output file (optional): wetness index grid file name. Existing files of the same name will be overwritten!
out.carea output file (optional): catchment area grid file name
out.cslope output file (optional): catchment slope grid file name
out.mod.carea output file (optional): file name of modified catchment area grid
suction SAGA GIS 2.1.0+: positive numeric value (optional): the lower this value is the stronger is the suction effect; defaults to a value of 10 (more detailed information is currently not available in the SAGA GIS documentation)
area.type character or numeric (optional): type of area: "absolute" (or numeric code 0): absolute catchment area; "square root" (code 1; the default): square root of catchment area; "specific" (code 2): specific catchment area
slope.type character or numeric (optional): type of slope: "local" (or numeric code 0): local slope; "catchment" (or code 1; the default): catchment slope.
slope.min numeric (optional): minimum slope; default: 0
slope.offset numeric (optional): offset slope; default: 0.1
slope.weight numeric (optional): weighting factor for slope in index calculation; default: 1
t.param SAGA GIS up to version 2.0.8: positive numeric value (optional): undocumented
env A SAGA geoprocessing environment, see rsaga.env)
... optional arguments to be passed to rsaga.geoprocessor

Details

The SAGA Wetness Index is similar to the Topographic Wetness Index (TWI), but it is based on a modified catchment area calculation (out.mod.carea), which does not treat the flow as a thin film as done in the calculation of catchment areas in conventional algorithms. As a result, the SWI tends to assign a more realistic, higher potential soil wetness than the TWI to grid cells situated in valley floors with a small vertical distance to a channel.

This module and its arguments changed substantially from SAGA GIS 2.0.8 to version 2.1.0. It appears to me that the new algorithm is similar (but not identical) to the old one when using area.type="absolute" and slope.type="local" but I haven’t tried out all possible options. This help file will be updated as soon as additional documentation becomes available.

Value

The type of object returned depends on the intern argument passed to the rsaga.geoprocessor. For intern=FALSE it is a numerical error code (0: success), or otherwise (the default) a character vector with the module’s console output.
set.file.extension

Author(s)

Alexander Brenning (R interface), Juergen Boehner and Olaf Conrad (SAGA module)

References


See Also

rsaga.parallel.processing, rsaga.geoprocessor, rsaga.env

Examples

## Not run:
# using SAGA grids:
rsaga.wetness.index("dem.sgrd","swi.sgrd")

## End(Not run)

---

**set.file.extension**  
*Determine or modify file name extensions*

### Description

Function get.file.extension determines the file extension, set.file.extension changes it, and default.file.extension changes it only if it is not already specified.

### Usage

```r
set.file.extension(filename, extension, fsep = .Platform$file.sep)
get.file.extension(filename, fsep = .Platform$file.sep)
default.file.extension(filename, extension, force = FALSE)
```

### Arguments

- **filename**: character vector: file name(s), possibly including paths and extensions; a file name ending with a "." is interpreted as having extension ".", while a file name that doesn’t contain a "." is interpreted as having no extension.
- **extension**: character string: file extension, without the dot
wind.shelter

Description

wind.shelter is a function to be used with `focal.function` to calculate a topographic wind shelter index from a digital elevation model, which is a proxy for snow accumulation on the lee side of topographic obstacles. `wind.shelter.prep` performs some preparatory calculations to speed up repeated calls to `wind.shelter`.

Usage

```
wind.shelter(x, prob = NULL, control)
wind.shelter.prep(radius, direction, tolerance, cellsize = 90)
```

Arguments

- **x**: square matrix of elevation data
- **prob**: numeric; quantile of slope values to be used in computing the wind shelter index; if NULL, use max (equivalent to prob=1)
- **control**: required argument: the result of a call to `wind.shelter.prep`
- **radius**: radius (>1) of circle segment to be used (number of grid cells, not necessarily an integer)
- **direction**: wind direction: direction from which the wind originates; North = 0 = 2*pi, clockwise angles.
- **tolerance**: directional tolerance
- **cellsize**: grid cellsize
wind.shelter implements a wind shelter index used by Plattner et al. (2004) for modeling snow accumulation patterns on a glacier in the Austrian Alps. It is a modified version of the algorithm of Winstral et al. (2002). The wind shelter index of Plattner et al. (2004) is defined as:

\[
\text{Shelter index}(S) = \arctan\left( \max\left( \frac{z(x_0) - z(x)}{|x_0 - x|} : x \in S \right) \right),
\]

where \( S = S(x_0, a, da, d) \) is the set of grid nodes within a distance \( <=d \) from \( x_0 \), only considering grid nodes in directions between \( a-da \) and \( a+da \) from \( x_0 \).

The present implementation generalizes this index by replacing \( \max \) by the quantile function; the \( \max \) function is used if \( \text{prob=}\text{NULL} \), and the same result is obtained for \( \text{prob=}1 \) using the quantile function.

**Value**

The function `wind.shelter` returns the wind shelter index as described above if a numeric matrix \( x \) is provided. If it is missing, it returns the character string "windshelter".

`wind.shelter.prep` returns a list with components `mask` and `dist`. Both are square matrices with \( 2 \times (\text{ceiling(radius)}+1) \) columns and rows:

- `mask` indicates which grid cell in the moving window is within the specified circle segment (value FALSE) or not (TRUE)
- `dist` the precomputed distances of a grid cell to the center of the moving window, in map units

**Note**

The wind shelter index only makes sense if elevation is measured in the same units as the horizontal map units used for the `cellsize` argument (i.e. usually meters).

`wind.shelter` and `wind.shelter.prep` do not restrict the calculation to a circular area; this is done by `focal.function` when used in combination with that function (assuming `search.mode=\"circle\"`).

Note that the present definition of the wind shelter index returns negative values for surfaces that are completely exposed toward the specified direction. This may make sense if interpreted as a "wind exposure index", or it might be appropriate to set negative wind shelter values to 0.

**Author(s)**

Alexander Brenning

**References**


See Also

focal.function, quantile

Examples

# Settings used by Plattner et al. (2004):
ctrl = wind.shelter.prep(6,-pi/4,pi/12,10)
## Not run: focal.function("dem.asc",fun=wind.shelter,control=ctrl,
## radius=6,search.mode="circle")
## End(Not run)
Index

*Topic file
  read.ascii.grid, 22
  rsaga.esri.to.sgrd, 34
  rsaga.import.gdal, 53
  rsaga.sgrd.to.esri, 73
  set.file.extension, 87

*Topic interface
  read.ascii.grid, 22
  rsaga.add.grid.values.to.points, 27
  rsaga.close.gaps, 28
  rsaga.contour, 29
  rsaga.copy.sgrd, 30
  rsaga.env, 31
  rsaga.esri.to.sgrd, 34
  rsaga.esri.wrapper, 35
  rsaga.fill.sinks, 37
  rsaga.filter.gauss, 39
  rsaga.filter.simple, 39
  rsaga.geoprocessor, 40
  rsaga.get.modules, 43
  rsaga.get.usage, 45
  rsaga.get.version, 46
  rsaga.grid.calculus, 47
  rsaga.grid.to.points, 49
  rsaga.hillshade, 50
  rsaga.html.help, 52
  rsaga.import.gdal, 53
  rsaga.insolation, 59
  rsaga.inverse.distance, 61
  rsaga.lib.prefix, 63
  rsaga.local.morphometry, 64
  rsaga.parallel.processing, 65
  rsaga.pisr, 68
  rsaga.pisr2, 71
  rsaga.sgrd.to.esri, 73
  rsaga.sink.removal, 74
  rsaga.sink.route, 76
  rsaga.slope.asp.curv, 77
  rsaga.solar.radiation, 79
  rsaga.target, 81
  rsaga.topdown.processing, 83
  rsaga.wetness.index, 85

*Topic spatial
  focal.function, 5
  grid.predict, 8
  grid.to.xyz, 10
  multi.focal.function, 14
  pick.from.points, 18
  read.ascii.grid, 22
  relative.position, 25
  resid.median, 26
  rsaga.add.grid.values.to.points, 27
  rsaga.close.gaps, 28
  rsaga.contour, 29
  rsaga.copy.sgrd, 30
  rsaga.env, 31
  rsaga.esri.to.sgrd, 34
  rsaga.esri.wrapper, 35
  rsaga.fill.sinks, 37
  rsaga.filter.gauss, 39
  rsaga.filter.simple, 39
  rsaga.geoprocessor, 40
  rsaga.get.modules, 43
  rsaga.get.usage, 45
  rsaga.get.version, 46
  rsaga.grid.calculus, 47
  rsaga.grid.to.points, 49
  rsaga.hillshade, 50
  rsaga.import.gdal, 53
  rsaga.insolation, 59
  rsaga.inverse.distance, 61
  rsaga.lib.prefix, 63
  rsaga.local.morphometry, 64
  rsaga.parallel.processing, 65
  rsaga.pisr, 68
  rsaga.pisr2, 71
rsaga.sgrd.to.esri, 73
rsaga.sink.removal, 74
rsaga.sink.route, 76
rsaga.slope.asp.curv, 77
rsaga.solar.radiation, 79
rsaga.target, 81
rsaga.topdown.processing, 83
rsaga.wetness.index, 85
wind.shelter, 88

+Topic utilities
  centervalue, 4
  create.variable.name, 4
  match.arg.ext, 13
  rsaga.html.help, 52
  set.file.extension, 87

abbreviate, 7
browseURL, 52
centervalue, 4, 25, 27
create.variable.name, 4, 7, 20
ddply, 20
default.file.extension
  (set.file.extension), 87
dem (landslides), 11
focal.function, 4, 5, 10, 17, 25–27, 49, 88–90
gapply (focal.function), 5
get.file.extension
  (set.file.extension), 87
grid.predict, 8, 14–17
grid.to.xyz, 10, 22
idw, 63
internal.pick.from.ascii.grid
  (pick.from.points), 18
krige, 19
landslides, 11
local.function, 49
local.function (focal.function), 5
match.arg, 13, 14
match.arg.ext, 13
median, 27
multi.focal.function, 7–10, 14, 49
multi.local.function, 7–10
multi.local.function
  (multi.focal.function), 14
na.exclude, 16
na.pass, 16
options, 33, 41
pick.from.ascii.grid, 11, 28, 32
pick.from.ascii.grid
  (pick.from.points), 18
pick.from.ascii.grids
  (pick.from.points), 18
pick.from.points, 18, 28
pick.from.saga.grid, 28
pick.from.saga.grid (pick.from.points), 18
pick.from.shapefile (pick.from.points), 18
pmatch, 13, 14
predict, 8, 9
quantile, 26, 27, 90
rank, 25
read.ascii.grid, 11, 22
read.ascii.grid.header, 82
read.Rd.grid (read.ascii.grid), 22
read.sgrd (read.ascii.grid), 22
relative.position, 7, 25
relative.rank, 7
relative.rank (relative.position), 25
resid.median, 4, 7, 26
resid.minmedmax, 7
resid.minmedmax (resid.median), 26
resid.quantile, 7
resid.quantile (resid.median), 26
resid.quartiles, 7
resid.quartiles (resid.median), 26
RSAGA-package, 3
rsaga.add.grid.values.to.points, 27, 50
rsaga.aspect (rsaga.local.morphometry), 64
rsaga.close.gaps, 28, 35
rsaga.close.one.cell.gaps
  (rsaga.close.gaps), 28
rsaga.contour, 29
INDEX

rsaga.copy.sgrd, 30
rsaga.curvature
  (rsaga.local.morphometry), 64
rsaga.default.modules.path
  (rsaga.default.path), 31
rsaga.default.path, 31
rsaga.esri.to.sgrd, 34, 36
rsaga.esri.wrapper, 35, 35, 43, 74
rsaga.fill.sinks, 37, 75, 76
rsaga.filter.gauss, 39, 40
rsaga.filter.simple, 39, 39
rsaga.get.lib.modules, 41
rsaga.get.lib.modules
  (rsaga.get.modules), 43
rsaga.get.binaries, 42, 43
rsaga.get.binaries
  (rsaga.get.modules), 43
rsaga.get.modules, 32, 42, 43, 43, 46
rsaga.get.usage, 42–45, 45, 52
rsaga.get.version, 32, 33, 46
rsaga.grid.calculus, 47
rsaga.grid.to.points, 28, 49
rsaga.hillshade, 35, 43, 45, 50, 52, 61, 71, 73, 81
rsaga.html.help, 44–46, 52
rsaga.import.gdal, 53
rsaga.insolation, 51, 59, 71, 73, 81
rsaga.inverse.distance, 30, 61, 82
rsaga.lib.prefix, 32, 63
rsaga.linear.combination
  (rsaga.grid.calculus), 47
rsaga.local.morphometry, 45, 64, 77, 79
rsaga.modified.quadratic.shephard, 82
rsaga.modifed.quadratic.shephard
  (rsaga.inverse.distance), 61
rsaga.module.exists, 41
rsaga.module.exists
  (rsaga.get.modules), 43
rsaga.nearest.neighbour, 82
rsaga.nearest.neighbour
  (rsaga.inverse.distance), 61
rsaga.parallel.processing, 65, 65, 79, 83, 85, 87
rsaga.pisr, 32, 41, 61, 68, 71, 73, 79, 81
rsaga.pisr2, 71
rsaga.plan.curvature
  (rsaga.local.morphometry), 64
rsaga.profile.curvature
  (rsaga.local.morphometry), 64
rsaga.search.modules, 42, 43
rsaga.search.modules
  (rsaga.get.modules), 43
rsaga.sgrd.to.esri, 36, 73
rsaga.sink.removal, 38, 74, 76
rsaga.sink.route, 38, 75, 76
rsaga.slope (rsaga.local.morphometry), 64
rsaga.slope.asp.curv, 64, 65, 77
rsaga.solar.radiation, 51, 61, 71, 73, 79
rsaga.target, 62, 63, 81
rsaga.topdown.processing, 65, 67, 83
rsaga.triangulation
  (rsaga.inverse.distance), 61
rsaga.wetness.index, 67, 85, 85

scan, 6, 16, 20, 23
set.file.extension, 87
Sys.info, 31
system, 20, 41, 42

vgm, 19

wind.shelter, 7, 88
write.ascii.grid (read.ascii.grid), 22
write.ascii.grid.header, 6, 16
write.Rd.grid (read.ascii.grid), 22
write.sgrd (read.ascii.grid), 22
write.shapefile, 62
writeAsciigrid, 25
writeGDAL, 24, 25