heatload

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The function uses aspect, slope and latitude of the plot and calculates potential annual direct incident radiation and heat load, according to equations published by McCune & Keon (2002).

Note: prior to 4/16/2019, the definition of this function had a bug and returned incorrect values; thanks to Tsung-Yi Lin (林宗儀) for noticing the problem and fixing it!

Arguments:

- `aspect` - aspect of the plot, vector (either in degrees, or radians)
- `slope` - the inclination of the plot, vector (either in degrees, or radians)
- `latitude` - latitude of the plot, either a vector of the same length as aspect or slope, or a single value (in case that all plots are from the same relatively small region)
- `method` - default is “heatload”, alternative is “radiation”
- `units` - default is “degrees”, alternative is “radians”
- `equation` - the equation number (1, 2 or 3); default is 1 (the most general one). The three equations have slightly different uses. **Eq. 1** (default in the function below) is broadest in the application, covering all slopes <= 90° in steepness at latitudes 0-60°N, but has the lowest precision. **Eq. 2** increases the precision by excluding slopes steeper than 60°, an inconsequential omission for almost all data sets. **Eq. 3** uses only three parameters to produce a slightly stronger model but is applicable only to latitudes 30-60°N (ie not for the tropical and subtropical region).

heatload.r

```
# Function "heatload"
# Calculates heat load or potential annual direct incident radiation, using
the formulas published in
# McCune & Keon (2002) based on aspect, slope and latitude.

heatload <- function (aspect, slope, latitude, method = 'heatload', units =
'degrees', equation = 1)
{
  if (units == 'degrees')   # convert degrees to radians
    {
    aspect <- aspect/180*pi
    slope <- slope/180*pi
    aspect[slope == 0] <- 0
    latitude <- latitude/180*pi
    }
  A <- if (method == 'heatload') abs (pi - abs (aspect - (5*pi/4))) else pi -
abs (aspect-pi)
  S <- slope
  L <- if (length (latitude) == 1) rep (latitude, length (A)) else latitude
  if (equation == 1) res <- exp (-1.467 +1.582*cos(L)*cos(S)
-1.500*cos(A)*sin(S)*sin(L) -0.262*sin(L)*sin(S) +0.607*sin(A)*sin(S))
  if (equation == 2) res <- exp (-1.236 +1.350*cos(L)*cos(S)
-1.376*cos(A)*sin(S)*sin(L) -0.331*sin(L)*sin(S) +0.375*sin(A)*sin(S))
  if (equation == 3) res <-      +0.339 +0.808*cos(L)*cos(S)
-0.196*sin(L)*sin(S)                      - 0.482*cos(A)*sin(S)
  return (res)
}
```

Example of the use on the dataset `grasslands.env` (acidophilous grasslands in Třebíč region, Czech Republic). The `grasslands.env` contains variables `aspect`, `slope` and `latitude`, all in degrees. Dataset represents small plots (16-25m2) located on convex outcrops in the agricultural landscape, covered by seminatural grassland vegetation.

```
source
('http://anadat-r.davidzeleny.net/doku.php/en:customized_functions:heatload?do=expo
rt_code&codeblock=0') # reads the function definition from above
grasslands.env <- read.delim
('https://raw.githubusercontent.com/zdealveindy/anadat-r/master/data/grasslands-env
.txt') # loads the file
# Calculate heat load and add it to the grasslands.env data.frame:
grasslands.env$heatload <- heatload (aspect = grasslands.env$aspect, slope =
grasslands.env$slope, latitude = grasslands.env$latitude, equation = 3)
```

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