Package 'RadioSonde'

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Title Tools for Plotting Skew-T Diagrams and Wind Profiles

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Description A
collection of programs for
plotting SKEW-T,log p diagrams and wind profiles for data
collected by radiosondes (the typical weather balloon-borne
instrument). The format of this plot with companion lines to
assess atmospheric stability are both standard in meteorology
and difficult to create from basic graphics functions. Hence
this package. One novel feature is being able add several
profiles to the same plot for comparison.
Use ``help(ExampleSonde)" for an explanation of the variables
needed and how they should be named in a data frame. See
<https://github.com/dnychka/Radiosonde> for the package home page.

License GPL (>= 2)

Depends R (>= 4.0), fields

Repository CRAN

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Contents

`ExampleSonde` *Examples of radiosonde observations*

Description

The R data frames `sonde1` and `sonde2` are examples of high resolution (vertical) soundings of the atmosphere. The balloons were launched on July 4, 2015 02:59:33 and 04:59:23 (UTC) as part of the PECAN field study lead by the National Center for Atmospheric Research (see https://www.eol.ucar.edu/field_projects/pecan. Refer to the Data Access tab on the PECAN home page to download the data collected during this study where "upper air" indexes radiosonde observations. The interest in this close spacing was to compare how the vertical structure of the atmosphere changed at this location in the Northwest corner of Kansas (-101.370712,39.357468) over a short amount of time.

These data frames contain the following named components:

time	Time in seconds from the ballon's release, a numeric vector.
press	Pressure (mb), a numeric vector
temp	Dry-bulb Temperature (deg. C), a numeric vector
dewpt	Dew point temperaure (deg. C), a numeric vector
rh	Relative humidity (%), a numeric vector
uwind	East-West component of the wind, a numeric vector
vwind	North-South component of the wind, a numeric vector
wspd	wind speed (m/s), a numeric vector
dir	Wind direction, a numeric vector
dz	rate of ascent in m/s
lon	Longitude, a numeric vector
lat	Latitude, a numeric vector
az	azimuth (angle along horizon), a numeric vector
alt	altitude (m), a numeric vector
qp	QC flag for pressure, a numeric vector
qt	QC flag for temperature, a numeric vector
qh	QC flag for humidity, a numeric vector
qu	QC flag for U component, a numeric vector
qv	QC flag for V component, a numeric vector
quv	QC flag for ascension rate, a numeric vector

Details

Raw (ascii/text) data files are in the github RadioSonde R package repository https://github.com/dnychka/Radiosonde. along with the R script that converts to a data frame useful in R. The NCAR/PECAN original data files are those ending in the extention `.eol` and are the standard format for radiosonde profiles collected by this lab. Note that in this proccess the original variable names were converted to those used in this package. E.g. `Press` changes to `press`. Also the metadata units that are in the header of the original file is included as an *attribute* in the R versions.

Examples

```
data(sonde1)

# look at the metadata
cat( attributes( sonde1)$metaData, fill=TRUE)

# and the units
cat( attributes( sonde1)$units, fill=TRUE)


skewtPlot( sonde1, winds=TRUE)

data(sonde2)
# skewt with wind barbs.

skewtPlot( sonde1, sonde2, winds=TRUE)
```

`plotWind` *Winds Profile Plot*

Description

Creates a wind profile in the standard atmospheric notation. Each full barb = 10 m/s, half barb = 5 m/s, and a filled triangle for 50 m/s. The maximum wind speed that can be plotted without amending the program is 65 m/s.

Usage

```
plotWind(sondeData, sizeBarb = NULL, ylim = c(1050, 100),
         thin=NULL, legend = FALSE, lwd=1, col="green4",
         axis=TRUE)
```

Arguments

`sondeData`	Data frame for sounding data, must have components for wind speed `wspd`, wind direction `dir`, and pressure `press`.
`sizeBarb`	change the thickness of the plotted lines
`thin`	Max number of wind barbs to draw.
`axis`	If TRUE add an axis in pressure.
`col`	Color of barbs
`lwd`	Line width for barbs
`ylim`	Plot extent, in units of pressure. Note this is a reversed axis.
`legend`	explains wind barb convention

Details

the dataframe must have components for wind speed `wspd`, wind direction `dir`, and pressure `press`. Missing values may be coded as either NA or 999. and are not plotted.
The standard atmospheric wind sybmol is a vector of fixed length with barbs proportional to wind speed. A full barb for each 10 m/s, half barbs for 5 m/s and a triangular barb for 50 m/s.

Value

None – creates a plot.

Author(s)

Doug Nychka, Eric Gilleland

See Also

`skewtPlot`, `station.symbol`

Examples

```
# Example 1:
data(sonde1)

plotWind(sonde1, sizeBarb =1.0, legend=TRUE )
```

`skewt.lines` *Overlays data on a SKEW-T, log p axis*

Description

Overlays observations as lines on a SKEW-T, log p axis (as created by `skewt.axis`).

Usage

```
skewt.lines(temp, pressure, ...)
```

Arguments

`temp`	Temperature in degrees C.
`pressure`	Pressure in millibars
`...`	Any graphical arguments

Details

`skewt.lines` overlays observations on a SKEW-T, log p axis

See Also

skewtPlot

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skewtPlot *A skewt plot wind wind barbs.*

Description

Creates a SKEW-T, log p diagram with dry-bulb temperature and dewpoint temperature traces versus (log) pressure. Optionally plots the vertical wind profile using wind barbs.

Usage

```
skewtPlot(
..., winds = FALSE, colTemp = c("grey40", "blue2"),
                colDew = colTemp, lty = c(1, 1), lwd = 1.5, windplot =
                NULL, windAxis = FALSE, sizeBarb = NULL, thin = NULL,
                magicRatio = 13, skewplot = NULL, mar.skewt = c(3.1,
                5.1, 4.1, 2.1)
)
```

Arguments

...	One or more data frames where rows indexes the time (or height) and the columns are the variables measured. The variables must be names as: c("press", "temp", "dewpt") corresponding to pressure (hPa), temperature (C) and dew point temperature (C).
winds	If TRUE will add wind barbs to the side of the skewt plot.
colTemp	Colors(s) to plot temperature.
colDew	Colors(s) to plot dew point temperature.
lty	Line type for the plotted curves.
lwd	Line width for the curves.
skewplot	Vector of 4 figure coordinates that define the skewt plot portion of figure. By default c(0, magicRatio/(magicRatio + L), 0,1).
windplot	A matrix of the 4 figure coodinates where each row defines the figure region for the wind barbs.
windAxis	If TRUE include a height axis alongside the wind barbs.
sizeBarb	Controls relative size of the wind barbs.
thin	Total number of equally select3ed wind barbs to plots. This avoids too much overplotting.
mar.skewt	Margins for the labels of the skewt plot.
magicRatio	Relative space in horizontal for the skewt plot and the panel with vertical wind barbs.

Details

We recommend that the plots be drawn using the the pdf output devide with a 8 by 6 inch size.

Author(s)

Doug Nychka, Eric Gilleland, Tim Hoar, Kate Young

References

1. Department of Defense, 1969, "USAF SKEW-T, log p DIAGRAM," DOD-WPC-9-16-1, Aeronautical Chart and Information Center, United States Air Force, St. Louis, Missouri 63118.

2. List, R.J. (editor), 1958, *Smithsonian Meteorological Tables*, Smithsonian Institute, Washington, D.C.

3. Nordquist, W.S., 1973, "Numerical Approximations of Selected Meteorological Parameters for Cloud Physics Problems," ECOM-5475, Atmospheric Sciences Laboratory, US Army Electronics Command, White Sands Missile Range, New Mexico 88002.

4. Stipanuk, G.S., 1973, "Algorithms for Generating a SKEW-T, log p Diagram and Computing Selected Meteorological Quantities," American Sciences Laboratory, US Army Electronics Command, White Sands Missile Range, New Mexico 88002.

See Also

skewt.lines

Examples

```
data(sonde1)
# skewt with wind barbs.

skewtPlot( sonde1, winds=TRUE)

# mulitple profiles

data(sonde2)
skewtPlot( sonde1, sonde2)
```

`station.symbol` *Adds a meteorological surface station annotation to a plot.*

Description

Adds a meteorological surface station annotation at the given coordinates. The annotation includes speed and direction of the wind, temperature, pressure, dewpoint ... to a given plot.

Usage

```
station.symbol(
cx, cy, direction = 0, speed = NA, fill = rep(0,
                 length(cx)), temp = NA, press = NA, dewpt = NA, circle
                 = TRUE, cex = 1, spdcolor = "green", lwd = 2
  )
```

Arguments

cx	x coordinate for location of the annotation.
cy	y coordinate for the annotation.
direction	Wind direction.
speed	Wind speed.
fill	Fill for visibility: 0 = clear skies, 1 = 25% obscured, 2 = 50% obscured, 3 = 75% obscured, 4 = no visibility
temp	Temperature value to plot symbol (must be a scalar). If NULL then no temperature value will be annotated.
press	Pressure value to plot symbol (must be a scalar). If NULL then no pressure value will be annotated.
dewpt	Dewpoint Temperature value to plot symbol (must be a scalar). If NULL then no dewpoint value will be annotated.
circle	If TRUE, will plot the usual station symbol with a circle at its base.
cex	Usual plotting parameter.
spdcolor	Glyph color
lwd	barb line width

Author(s)

Doug Nychka, Eric Gilleland

See Also

plotWind

Examples

```
plot(0:1, 0:1, type="n")
station.symbol(0.5, 0.5, direction=130, speed=30, fill=3,
               temp=31, press=987, dewpt=26, cex=5)
title("Wind Barb")
```

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