Package 'Rwofost'

March 25, 2020

Description An implementation of the WOFOST (``World Food Studies'') crop growth model. WOFOST is a dynamic simulation model that uses daily weather data, and crop, soil and management parameters to simulate crop growth and development. See De Wit et al. (2019) <doi:10.1016/j.agsy.2018.06.018> for a recent review of the history and use of the model.

Type Package

Title WOFOST Crop Growth Simulation Model

Version 0.6-3

Date 2020-03-24

LinkingTo Rcpp

Imports meteor, methods (>= 0.2-2), Rcpp (>= 0.12.4)

Depends R (>= 3.5.0)

URL https://github.com/cropmodels/Rwofost

SystemRequirements C++11

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License GPL (>= 3)

NeedsCompilation yes

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Repository CRAN

Date/Publication 2020-03-25 18:20:12 UTC

R topics documented:

`Rwofost-package` *WOFOST Crop Growth Simulation Model*

Description

This package provides a R interface to the WOFOST crop growth simulation model.

This is the first release. Please consider this version unstable. It needs more work to simplify its use.

More detailed documentation is also forthcoming, but there is ample general documentation available on-line. The documentation for the FORTRAN version 7.1 is most applicable. For example, this manual https://www.wur.nl/en/show/WOFOST-7.1-User-Manual.htm

The WOFOST model that this R package uses is written in C++ and it can also be compiled and run as a stand-alone program (see the github repository at https://github.com/cropmodels/Rwofost. It was derived from the original FORTRAN implementation. It passes the tests cases developed for the PCSE/python version. This suggests that you safely can use the model for "standard" computation of potential and water-limited production.

`wofost` *WOFOST crop growth model*

Description

Run the WOFOST crop growth model. Through this interface, you provide weather data, and crop, soil and control parameters to run the model once. For multiple runs it might be preferable to use `wofost_model` instead.

Usage

```
wofost(crop, weather, soil, control)
```

Arguments

`crop`	list. Crop parameters
`weather`	data.frame with weather data
`soil`	list. Soil parameters
`control`	list. Model control options

Details

The weather data must be passed as a data.frame with the following variables and units.

variable	description	class / unit
date	"Date" class variable	-
srad	Solar radiation	kJ m-2 day-1
tmin	Minimum temperature	degrees C
tmax	Maximum temperature	degrees C
vapr	Vapor pressure	kPa
wind	Wind speed	m s-1
prec	Precipitation	mm day-1

Note that there should not be any time gaps between the days in the data.frame

Value

matrix

References

Van Diepen, C.A., J. Wolf, and H van Keulen, 1989. WOFOST: a simulation model of crop production. Soil Use and Management, 5: 16-24

Van Keulen, H. and J. Wolf, 1986. Modelling of agricultural production : weather, soils and crops. http://edepot.wur.nl/168025

See Also

wofost_model

Examples

```
# weather data
f <- system.file("extdata/Netherlands_Swifterbant.csv", package="meteor")
w <- read.csv(f)
w$date <- as.Date(w$date)
head(w)

# crop and soil parameters
crop <- wofost_crop("barley")
soil <- wofost_soil("ec1")

# "control" parameters
contr <- wofost_control()
contr$modelstart <- as.Date("1980-02-06")
contr$latitude=52.57
contr$elevation=50
```

```
# run model
d <- wofost(crop, w, soil, contr)

# output
head(d)
tail(d)
plot(d[,"step"], d[, "LAI"])


## Another example
crop <- wofost_crop("rapeseed_1001")
soil <- wofost_soil("soil_5")
contr$modelstart <- as.Date("1977-01-01")

rp <- wofost(crop, w, soil, contr)
plot(rp[,"step"], rp[, "LAI"])

# yield
plot(rp[, 1], rp[,"WSO"])


## water limited
contr$water_limited <- TRUE
contr$modelstart <- as.Date("1985-01-01")

crop <- wofost_crop("maize_1")
f <- system.file("extdata/Philippines_IRRI.csv", package="meteor")
wth <- read.csv(f)
wth$date <- as.Date(wth$date)
contr$elevation <- 21
contr$latitude <- 14.18

ma <- wofost(crop, wth, soil, contr)
plot(ma[,"step"], ma[, "LAI"])
```

`wofost_control` *WOFOST control parameters*

Description

This functions returns a list of "control" parameters to run the WOFOST model. Either a default list, or from a file. See this manual https://www.wur.nl/en/show/WOFOST-7.1-User-Manual.htm for the interpretation of the parameters.

Usage

```
wofost_control(filename='')
```

Arguments

filename	character. Filename

Value

list

See Also

wofost

Examples

```
contr <- wofost_control()
str(contr)
```

---

wofost_crop *WOFOST crop parameters*

Description

This function returns a list of crop parameters for the WOFOST model. See this manual https://www.wur.nl/en/show/WOFOST-7.1-User-Manual.htm for their interpretation.

Usage

```
wofost_crop(name="", describe=FALSE)
```

Arguments

name	character. Either the name of a crop that comes with the package (see examples) or a filename of a similarly formatted file
describe	logical. If TRUE avaialble metadata is printed

Value

list

References

van Heemst

See Also

wofost

Examples

```
wofost_crop('')
crop <- wofost_crop('barley')
str(crop)
```

`wofost_model` *WOFOST crop growth model*

Description

Create a WOFOST crop growth model object. Trhough this interface, you first create a model object and then you run it. The advantage is that you can easily change single parameters of the model and run the model again.

Usage

```
wofost_model(crop, weather, soil, control)
run(x, ...)
crop(x) <- value
soil(x) <- value
control(x) <- value
weather(x) <- value
force(x) <- value
```

Arguments

`crop`	list. Crop parameters
`weather`	data.frame with weather data. See Details
`soil`	list. Soil parameters
`control`	list. Model control options
`value`	crop, weather, soil, or control data, as above; or a data.frame for "force"
`x`	WOFOST model
`...`	additiontal arguments. `stopError`(logica). If an error occurs and `stopError` is `TRUE`, and error message is given. Otherwise, a warning is given and some simulation data (up till when the error occurred) may be returned

Details

The weather data must be passed as a data.frame with the following variables and units.

variable	description	class / unit
`date`	"Date" class variable	-
`srad`	Solar radiation	kJ m-2 day-1
`tmin`	Minimum temperature	degrees C
`tmax`	Maximum temperature	degrees C

vapr	Vapor pressure	kPa
wind	Wind speed	m s-1
prec	Precipitation	mm day-1

Note that there should not be any time gaps between the days in the data.frame

Value

WofostModel object

References

Van Diepen, C.A., J. Wolf, and H van Keulen, 1989. WOFOST: a simulation model of crop production. Soil Use and Management, 5: 16-24

Van Keulen, H. and J. Wolf, 1986. Modelling of agricultural production : weather, soils and crops. http://edepot.wur.nl/168025

Examples

```
# weather data
f <- system.file("extdata/Netherlands_Swifterbant.csv", package="meteor")
w <- read.csv(f)
w$date <- as.Date(w$date)

crop <- wofost_crop("barley")
soil <- wofost_soil("ec1")
contr <- wofost_control()

contr$modelstart <- as.Date("1980-02-06")
contr$latitude=52.57
contr$elevation=50

# create model
m <- wofost_model(crop, w, soil, contr)

# run model
x <- run(m)
plot(x[,"date"], x[, "LAI"], cex=.5)

# make a change
m$control$modelstart = as.Date("1980-02-20")

# run model again
y <- run(m)
lines(y[,"date"], y[, "LAI"], col="red")

# change the crop
crop(m) <- wofost_crop("potato_704")
p <- run(m)
```

```
lines(p[,"date"], p[, "LAI"], col="blue")
```

`wofost_soil` *WOFOST soil parameters*

Description

This function returns a list with soil parameters for the WOFOST model. See this manual https://www.wur.nl/en/show/WOFOST-7.1-User-Manual.htm for their interpretation.

Usage

```
wofost_soil(name='')
```

Arguments

`name`	character. Either the name of a soil that comes with the package (see examples) or a filename of a similarly formatted file

Value

list

See Also

`wofost`

Examples

```
wofost_soil('')
soil <- wofost_soil('ec1')
str(soil)
```

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