rPALM

rPALM provides R6 classes to create and edit static drivers for the urban climate model PALM-4U.

Installation

Right now, rPALM is only available via GitHub:

```
# install.packages("devtools")
devtools::install_github("SebaStad/rPALM")
```

Example

A simple example to create a static driver from scratch. Lots of information about what and why is yet missing!

```
library(rPALM)
```

```
## Warning: package 'R6' was built under R version 4.0.3
```

```
## Warning: package 'ncdf4' was built under R version 4.0.3
```

```
## Warning: package 'sp' was built under R version 4.0.3
```

```
## Warning: package 'rgdal' was built under R version 4.0.3
```

```
## Warning: package 'ggplot2' was built under R version 4.0.3
```

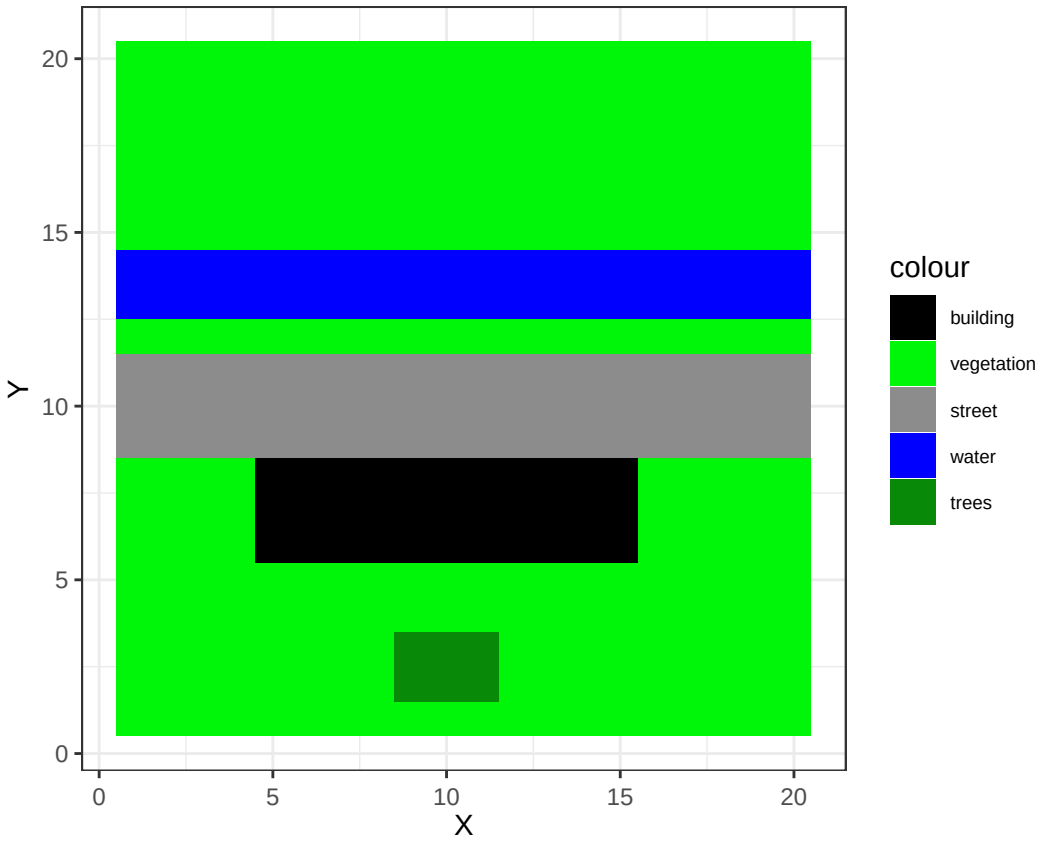
```
## Warning: package 'reshape2' was built under R version 4.0.3
```

```
## Warning: package 'imager' was built under R version 4.0.3
```

```
## Warning: package 'magrittr' was built under R version 4.0.3
```

```
# First:
# Define a headclass
manual_headclass <- palm_global$new(title = "GIT Example",
                                    author = "sest",
                                    institute = "IBP",
                                    location = "Hoki",
                                    x0 = 0,   # only important for visualization on a map later on
                                    y0 = 0,   # only important for visualization on a map later on
                                    z0 = 0,
                                    t0 = "2018-06-21 12:00:00 +00", # Character with Date in this forma
                                    # might be important to have correct in later releases of PALM!
                                    lat = 52.502302,   # important for solar radiation
                                    lon = 13.364862,   # important for solar radiation
                                    dx = 5)
```

```
manual_class <- palm_ncdf_manual$new(nx = 20, ny = 20, dx = 5,
                                     headclass = manual_headclass)

# Manually set vegetation to short grass
manual_class$data$vegetation_type$vals <- array(3,dim = c(20,20))
# Set one Tree
manual_class$data$vegetation_type$vals[9:11,2:3] <- 6

# Pavement
manual_class$data$pavement_type$vals[,9:11] <- 2

# water
manual_class$data$water_type$vals[,13:14] <- 2

# buildings
manual_class$data$buildings_2d$vals[5:15, 6:8] <- 20
manual_class$data$building_id$vals[5:15, 6:8]  <- 1
manual_class$data$building_type$vals[5:15, 6:8] <- 3


#Sort Data
manual_class$SortOverlayingdata("BPWV")

# plot
manual_class$plot_area(1,1,20,20)
```



While basically all data is now available, some cleanup functions have to be called to create the static driver:

```
# First, create the 3D Buidlings data. It does not do anything different from buildings_2d BUT:
#       1. enables 3D visualization in ParaView (so it is mandatory)
#       2. enables the creation of bridges and gates (has to be done manually, time expensive)
manual_class$createbuilding3D(TRUE, FALSE)

# Second, create soil and surface fraction
# Both are mandatory for the simulation
manual_class$addsoilandsurfacefraction(type_soil = 2)


# Third generate LAD
manual_class$generate_lai_array(dz = 5, fixed_tree_height = 15)
# That function has a lot of variables, but these are enough. dz is mandatory

# Fourth, set water temperature to 288K
# Create "water_pars" data
manual_class$add_lod2_variable("water")
manual_class$data$water_pars$vals[,,1][manual_class$data$water_type$vals>=0] <- 288

# Further functions, that can be useful, but are not needed in this example:

# manual_class$downscale_resolution(factor = 2)
# downscales the resolution by a factor of 2, i.e. from 5 to 10 m

# manual_class$quickplot("vegetation_type")
# allows a quick look at 2D data in the class

# manual_class$savedplots[[1]]
# All plot calls with $plot_area are saved in the list $savedplots

# Count of plots can be called via
# manual_class$plotcntr


# Finally: set an eportname of the file
manual_class$exportname <- "quicktest.nc"

manual_class
```

```
## PALM Class
## Gridpoints in x:20
## Gridpoints in y:20
## Resolution:5
## Available data:
## zt
## buildings_2d
## building_id
## building_type
## vegetation_type
## water_type
## pavement_type
## buildings_3d
```

```
## soil_type
## surface_fraction
## lad
## water_pars
```

```
# manual_class$exportncdf()
# Exports the static driver in the current work directory
```

Data

Data and Dimensions are hold in seperate lists

```
names(manual_class$data)
```

```
##  [1] "zt"              "buildings_2d"     "building_id"      "building_type"
##  [5] "vegetation_type" "water_type"       "pavement_type"    "buildings_3d"
##  [9] "soil_type"       "surface_fraction" "lad"              "water_pars"
```

```
names(manual_class$dims)
```

```
## [1] "x"                 "y"                 "z"
## [4] "nsurface_fraction" "zlad"              "nwater_pars"
```

```
# Every data has its own sublist
names(manual_class$data$buildings_2d)
```

```
## [1] "_FillValue" "units"      "long_name"  "res_origin" "source"
## [6] "lod"        "vals"       "type"
```

The data itself is saved in *vals*, other variables are important for correct settings in the static driver. The connection between dimensions is done via

```
manual_class$vardimensions
```

```
## $zt
## [1] 1 2
##
## $buildings_2d
## [1] 1 2
##
## $building_id
## [1] 1 2
##
## $building_type
## [1] 1 2
##
## $vegetation_type
## [1] 1 2
##
## $water_type
```

```
## [1] 1 2
##
## $pavement_type
## [1] 1 2
##
## $buildings_3d
## [1] 1 2 3
##
## $soil_type
## [1] 1 2
##
## $surface_fraction
## [1] 1 2 4
##
## $lad
## [1] "x"    "y"    "zlad"
##
## $water_pars
## [1] "x"           "y"           "nwater_pars"
```

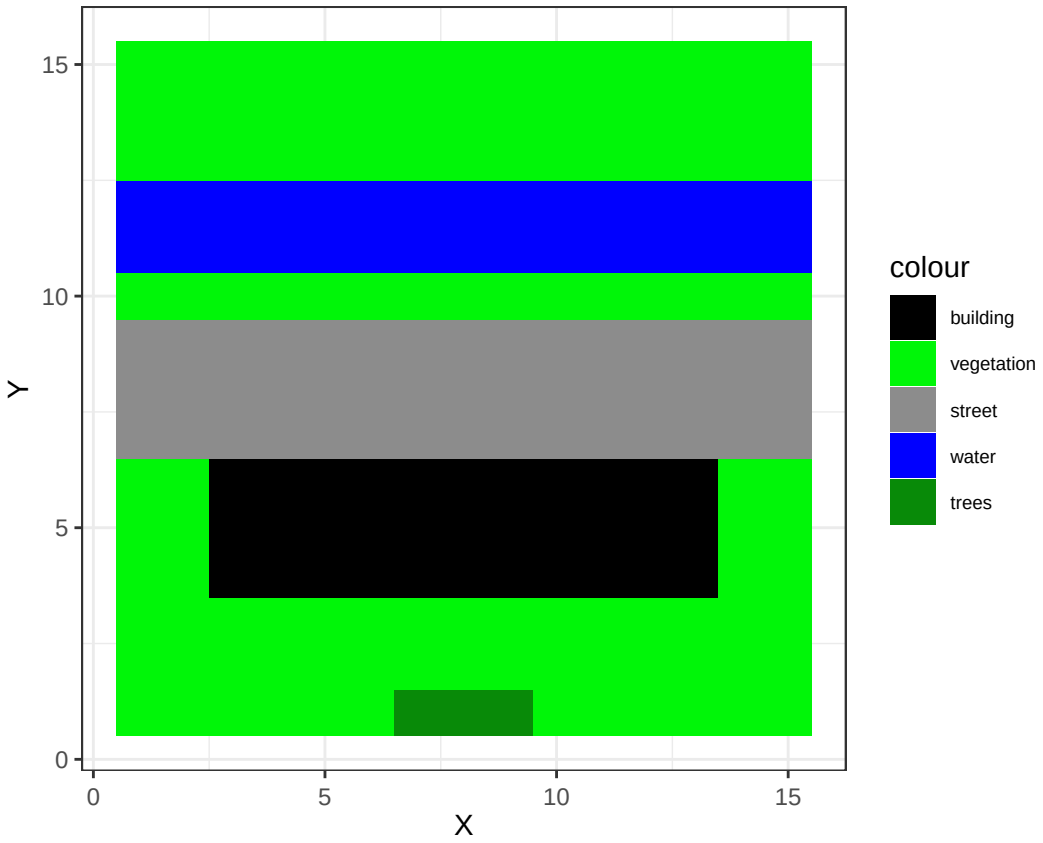
Here, for every dataset the corresponding dimensions have to be saved!

Cut Out

New function: cutout_static ; enables to cut out a certain domain of the existing domain. DELETES the remaining domain!

One solution is to make a copy via clone(deep = TRUE)

```
cutout_static <- manual_class$clone(deep = TRUE)
cutout_static$cutout_static(startp = c(3,3), endp = c(18,18), sure = T)

cutout_static$plot_area(1,1,15,15)
```



PIDS

PIDS should be callable via

```
# rPALM:::PIDS
rPALM:::PIDS$soil$predefined_type
```

```
##   ID         Name
## 1  0 user defined
## 2  1       coarse
## 3  2       medium
## 4  3  medium-fine
## 5  4         fine
## 6  5    very fine
## 7  6      organic
```

Also contains building pars now!