

*

April 17, 2020

The results below are generated from an R script.

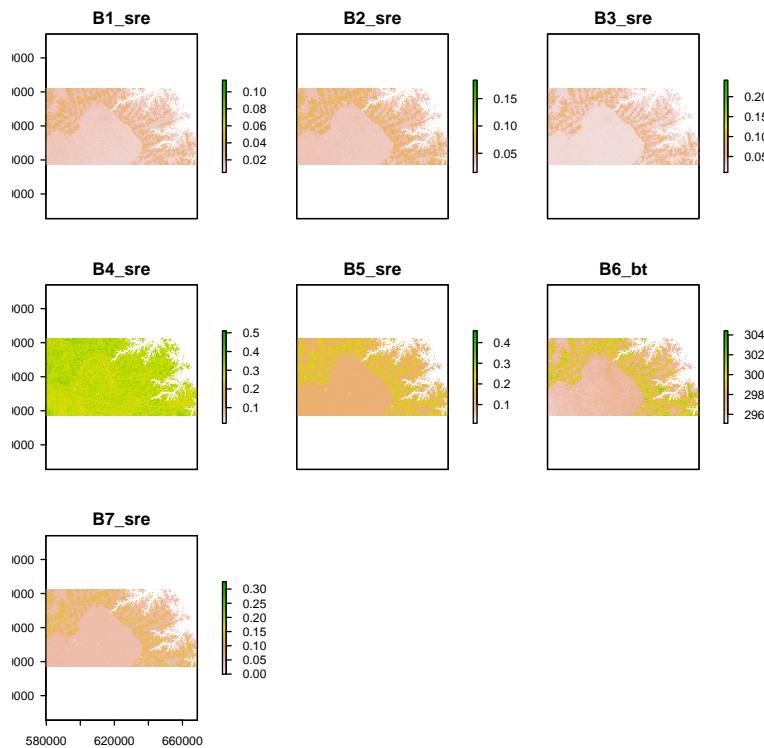
```
# R code for RS

# install.packages("raster")
library(raster)

setwd("~/lab/")
# setwd("C:/lab/")
# windows
# setwd("/Users/name/lab/")

p224r63_2011 <- brick("p224r63_2011_masked.grd")

plot(p224r63_2011)
```

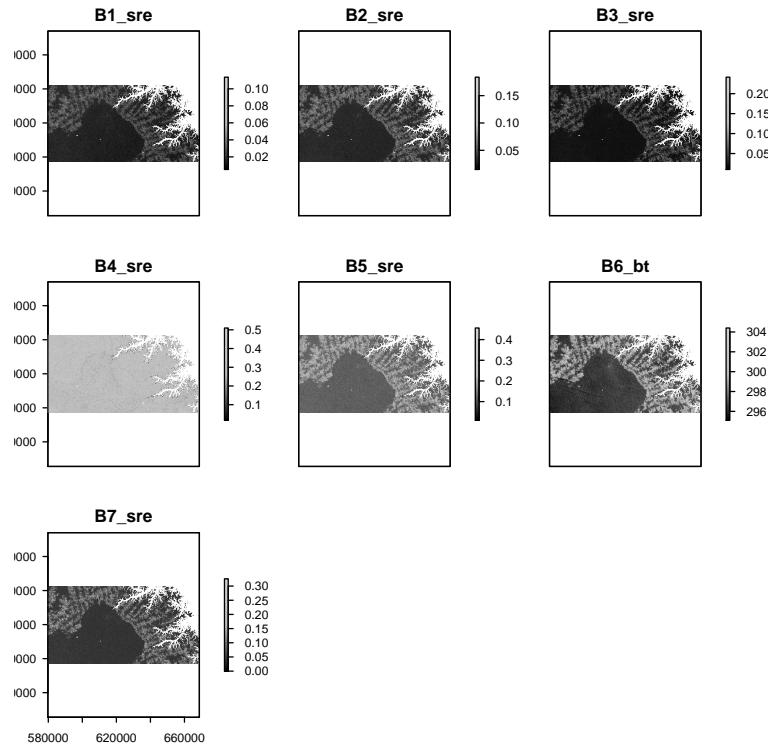


```
# B1: blue
# B2: green
# B3: red
```

*This report is automatically generated with the R package **knitr** (version 1.28).

```
# B4: NIR

cl <- colorRampPalette(c('black','grey','light grey'))(100) #
plot(p224r63_2011, col=cl)
```



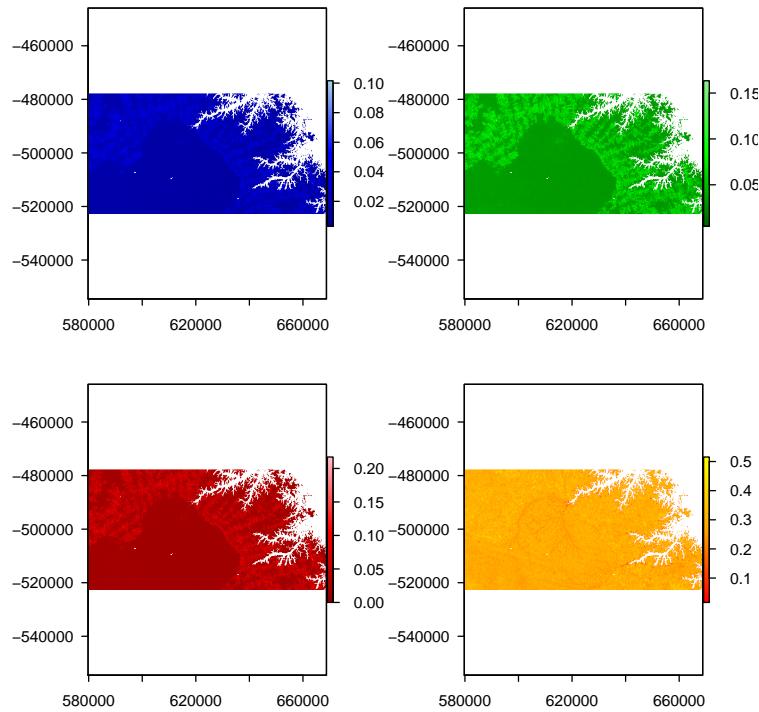
```
par(mfrow=c(2,2))

clb <- colorRampPalette(c('dark blue','blue','light blue'))(100) #
plot(p224r63_2011$B1_sre, col=clb)

clg <- colorRampPalette(c('dark green','green','light green'))(100) #
plot(p224r63_2011$B2_sre, col=clg)

clr <- colorRampPalette(c('dark red','red','pink'))(100) #
plot(p224r63_2011$B3_sre, col=clr)

cln <- colorRampPalette(c('red','orange','yellow'))(100) #
plot(p224r63_2011$B4_sre, col=cln)
```

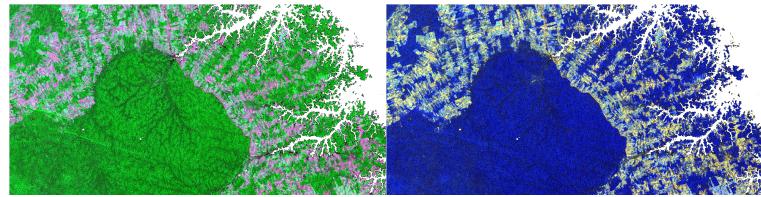
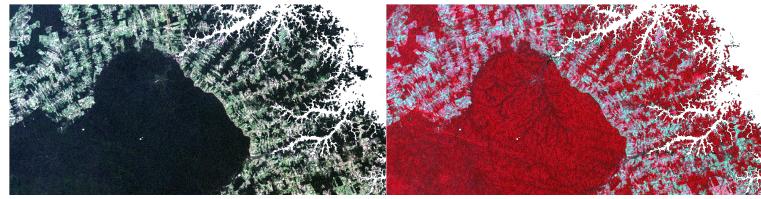


```
# RGB

plotRGB(p224r63_2011, r=3, g=2, b=1, stretch="Lin")
plotRGB(p224r63_2011, r=4, g=3, b=2, stretch="Lin")

# Exercise: mount NIR ontop the G of RGB

plotRGB(p224r63_2011, r=3, g=4, b=2, stretch="Lin")
plotRGB(p224r63_2011, r=3, g=2, b=4, stretch="Lin")
```

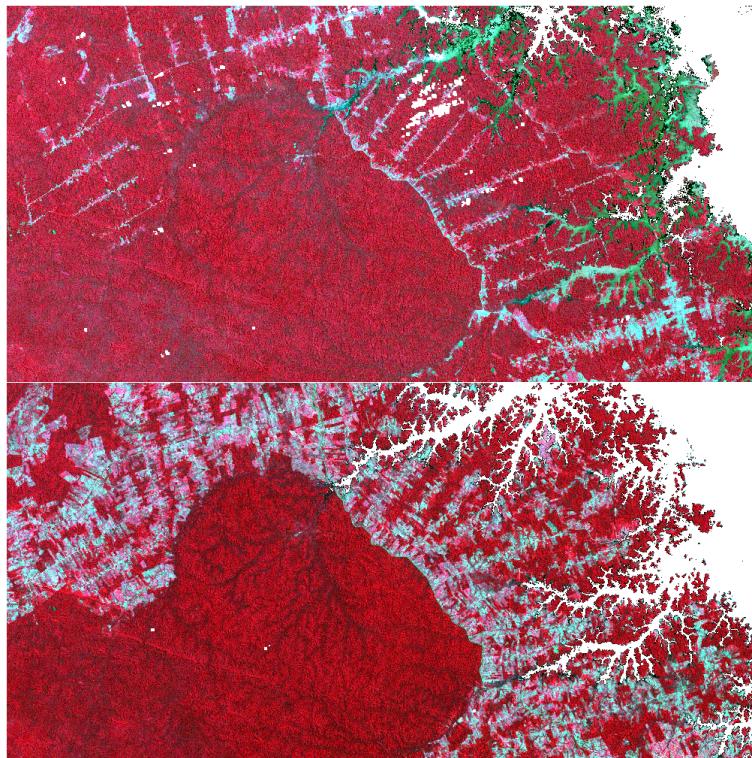


```
# 1988 image
p224r63_1988_masked

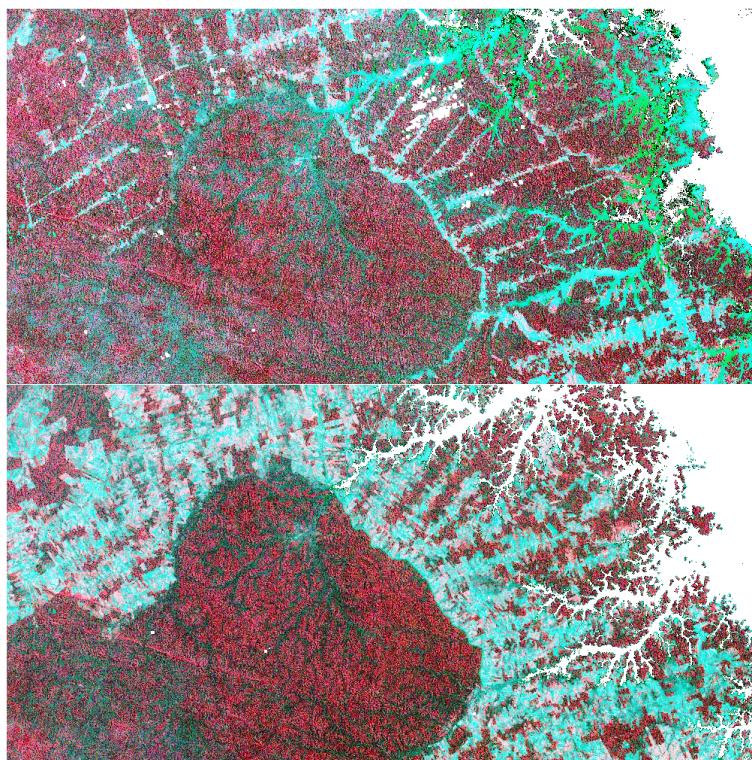
## Error in eval(expr, envir, enclos): object 'p224r63_1988_masked' not found

p224r63_1988 <- brick("p224r63_1988_masked.grd")

par(mfrow=c(2,1))
plotRGB(p224r63_1988, r=4, g=3, b=2, stretch="Lin")
plotRGB(p224r63_2011, r=4, g=3, b=2, stretch="Lin")
```



```
par(mfrow=c(2,1))
plotRGB(p224r63_1988, r=4, g=3, b=2, stretch="hist")
plotRGB(p224r63_2011, r=4, g=3, b=2, stretch="hist")
```



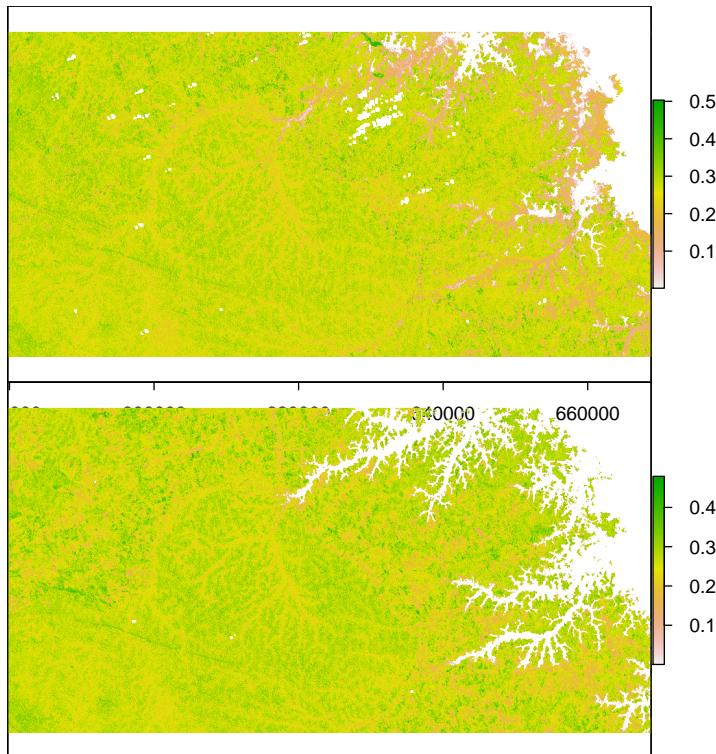
```

# DVI for the two years: compare with a difference in time
# NIR - RED
# NDVI = (NIR - RED) / (NIR + RED)

dvi1988 <- p224r63_1988$B4_sre - p224r63_1988$B3_sre
dvi2011 <- p224r63_2011$B4_sre - p224r63_2011$B3_sre

par(mfrow=c(2,1))
plot(dvi1988)
plot(dvi2011)

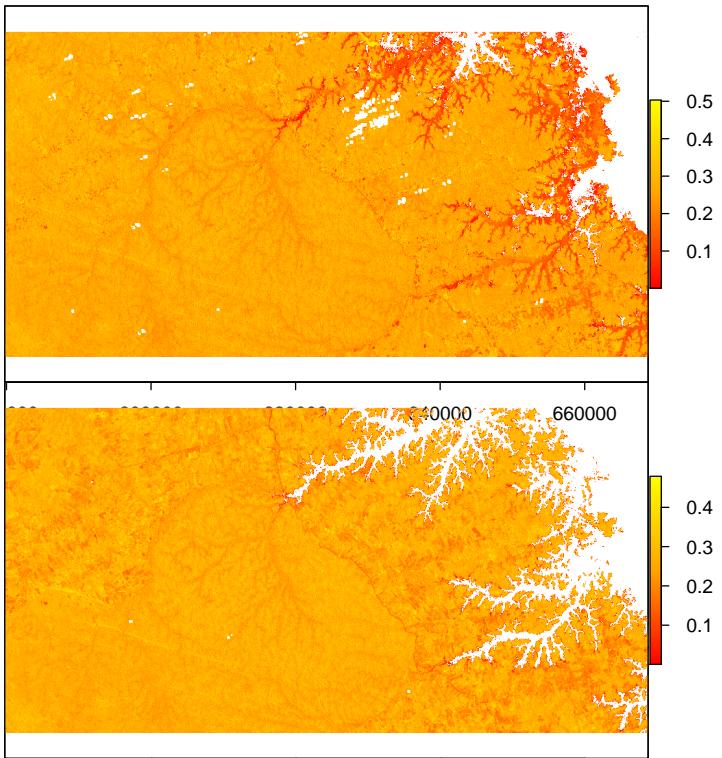
```



```

par(mfrow=c(2,1))
cldvi <- colorRampPalette(c('red','orange','yellow'))(100) #
plot(dvi1988, col=cldvi)
plot(dvi2011, col=cldvi)

```

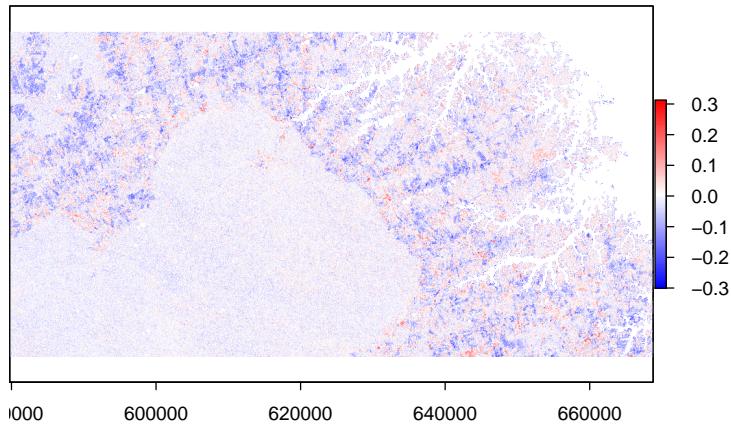


```
# difference in time
difdvi <- dvi2011 - dvi1988
cldif <- colorRampPalette(c('blue','white','red'))(100) #
plot(difdvi, col=cldif)

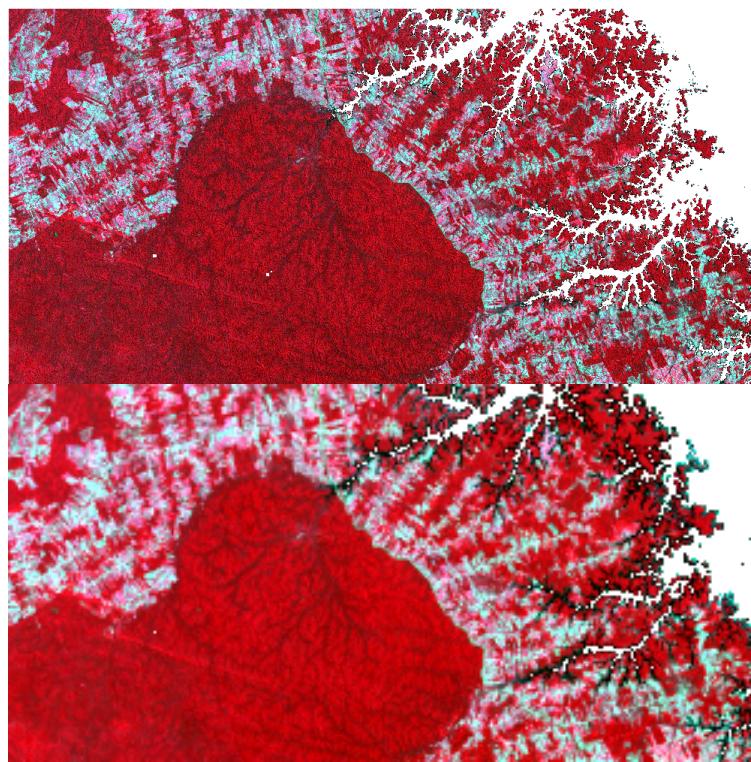
# install.packages("RStoolbox")
library(RStoolbox)

# PCA
p224r63_2011res <- aggregate(p224r63_2011, fact=10)

par(mfrow=c(2,1))
```



```
plotRGB(p224r63_2011, r=4, g=3, b=2, stretch="Lin")
plotRGB(p224r63_2011res, r=4, g=3, b=2, stretch="Lin")
```



```

p224r63_2011_pca <- rasterPCA(p224r63_2011res)

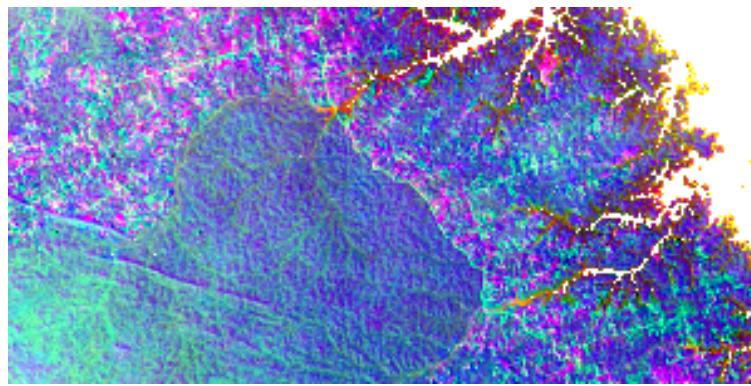
summary(p224r63_2011_pca$model)

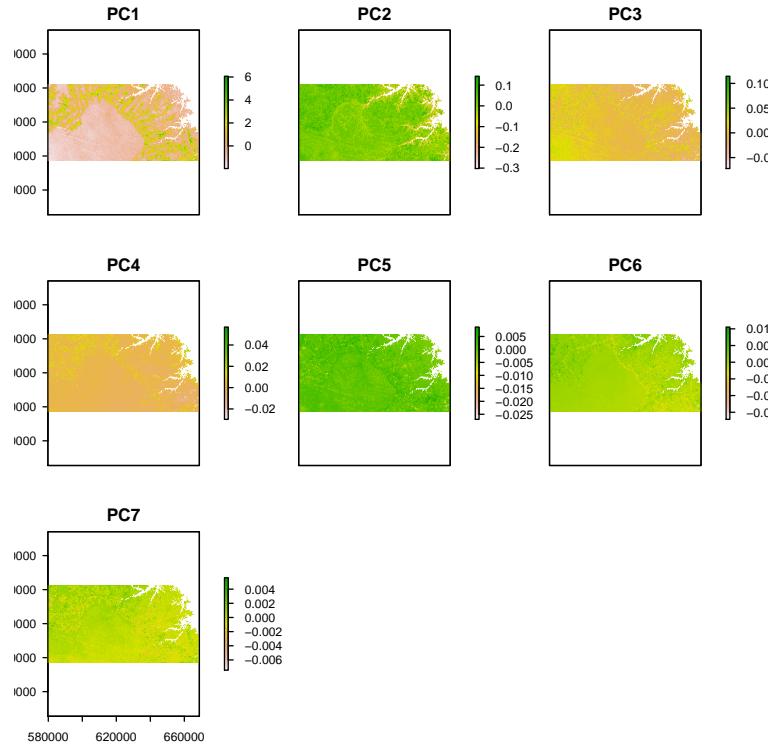
## Importance of components:
##          Comp.1      Comp.2      Comp.3      Comp.4      Comp.5
## Standard deviation 1.2050671 0.046154880 0.0151509526 4.575220e-03 1.841357e-03
## Proportion of Variance 0.9983595 0.001464535 0.0001578136 1.439092e-05 2.330990e-06
## Cumulative Proportion 0.9983595 0.999824022 0.9999818357 9.999962e-01 9.999986e-01
##          Comp.6      Comp.7
## Standard deviation 1.233375e-03 7.595368e-04
## Proportion of Variance 1.045814e-06 3.966086e-07
## Cumulative Proportion 9.999996e-01 1.000000e+00

plotRGB(p224r63_2011_pca$map, r=4, g=3, b=2, stretch="Lin")

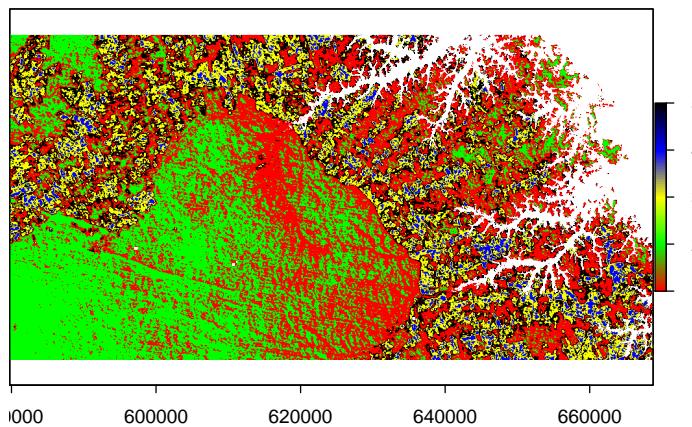
plot(p224r63_2011_pca$map)

```





```
# land cover
p224r63_2011c <- unsuperClass(p224r63_2011, nClasses=5)
clclass <- colorRampPalette(c('red', 'green', 'yellow', 'blue', 'black'))(100)
plot(p224r63_2011c$map, col=clclass)
```



The R session information (including the OS info, R version and all packages used):

```

sessionInfo()

## R version 3.6.1 (2019-07-05)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Running under: Ubuntu 19.10
##
## Matrix products: default
## BLAS:    /usr/lib/x86_64-linux-gnublas/libblas.so.3.8.0
## LAPACK:  /usr/lib/x86_64-linux-gnulapack/liblapack.so.3.8.0
##
## locale:
## [1] LC_CTYPE=en_US.UTF-8      LC_NUMERIC=C          LC_TIME=en_US.UTF-8
## [4] LC_COLLATE=en_US.UTF-8   LC_MONETARY=en_US.UTF-8  LC_MESSAGES=en_US.UTF-8
## [7] LC_PAPER=en_US.UTF-8     LC_NAME=C            LC_ADDRESS=C
## [10] LC_TELEPHONE=C         LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] stats      graphics   grDevices utils      datasets   methods   base
##
## other attached packages:
## [1] RStoolbox_0.2.6 raster_3.0-12 sp_1.4-1       knitr_1.28
##
## loaded via a namespace (and not attached):
## [1] tidyselect_1.0.0      xfun_0.12        purrr_0.3.3      reshape2_1.4.3
## [5] splines_3.6.1        lattice_0.20-38   colorspace_1.4-1  generics_0.0.2
## [9] stats4_3.6.1         XML_3.99-0.3     survival_2.44-1.1 prodlim_2019.11.13
## [13] rlang_0.4.5          ModelMetrics_1.2.2.2 pillar_1.4.3      glue_1.3.2
## [17] withr_2.1.2          foreach_1.4.8     lifecycle_0.2.0   plyr_1.8.6
## [21] lava_1.6.7           stringr_1.4.0     rgeos_0.5-2      timeDate_3043.102
## [25] munsell_0.5.0        gtable_0.3.0     recipes_0.1.10  codetools_0.2-16
## [29] evaluate_0.14        doParallel_1.0.15 caret_6.0-86     parallel_3.6.1
## [33] class_7.3-15         highr_0.8        Rcpp_1.0.4       geosphere_1.5-10
## [37] scales_1.1.0          ipred_0.9-9     ggplot2_3.3.0   stringi_1.4.6
## [41] dplyr_0.8.5          grid_3.6.1       rgdal_1.4-8     tools_3.6.1
## [45] magrittr_1.5          tibble_2.1.3     crayon_1.3.4   pkgconfig_2.0.3
## [49] MASS_7.3-51.4         Matrix_1.2-17   data.table_1.12.8 pROC_1.16.2
## [53] lubridate_1.7.4       gower_0.2.1     assertthat_0.2.1 iterators_1.0.12
## [57] R6_2.4.1              rpart_4.1-15    nnet_7.3-12    nlme_3.1-141
## [61] compiler_3.6.1

Sys.time()

## [1] "2020-04-17 13:17:29 WAT"

```