Appendix 2 - Validation of the microclimate model

Urtzi Enriquez-Urzelai & Lumír Gvoždík

2023-02-26

In this document we run NicheMapR's microclimate model at the Institute of Vertebrate Biology, Studenec (Czechia) using NCEP data as forcing variables. We compare model results with logged data for the period XXX to XXX.

Humidity and temperature dataloggers were placed outdoors of the institute at different depths.

Note:: If you want to reproduce this script make sure you are in the same directory as the weather and data logger data.

```
# It should be something like this
setwd("/ThermHydroBehav/data/micro_studenec")
```

Load packages:

```
library(NicheMapR)
library(microclima)
library(raster)
```

```
## Loading required package: sp
```

```
lon <- 16.056838 # Institute of Vertebrate Biology, Studenec, Czechia
lat <- 49.224799 # Institute of Vertebrate Biology, Studenec, Czechia
dstart <- "01/08/2020"
dfinish <- "31/07/2021"
minshade <- 0
maxshade <- 90
rainmult <- 1.5
Thcond <- 2.8 # 2.5
SpecHeat <- 870
Density <- 2.56
BulkDensity <- 2.5
windfac <- 1
REFL <- 0.2
cap <- FALSE
SLE <- 0.95
warm <- 0
Usrhyt <- 0.01
clearsky <- FALSE
soilgrids <- 0
spatial <- NA
ERR <- 1.5
```

```
#dem <- microclima::get_dem(r = NA, lat = lat, lon = lon, resolution = 30, zmin = -20, xdims = 100, ydi
load("dem.Rda")

elev <- raster::extract(dem, cbind(lon, lat))[1]
```

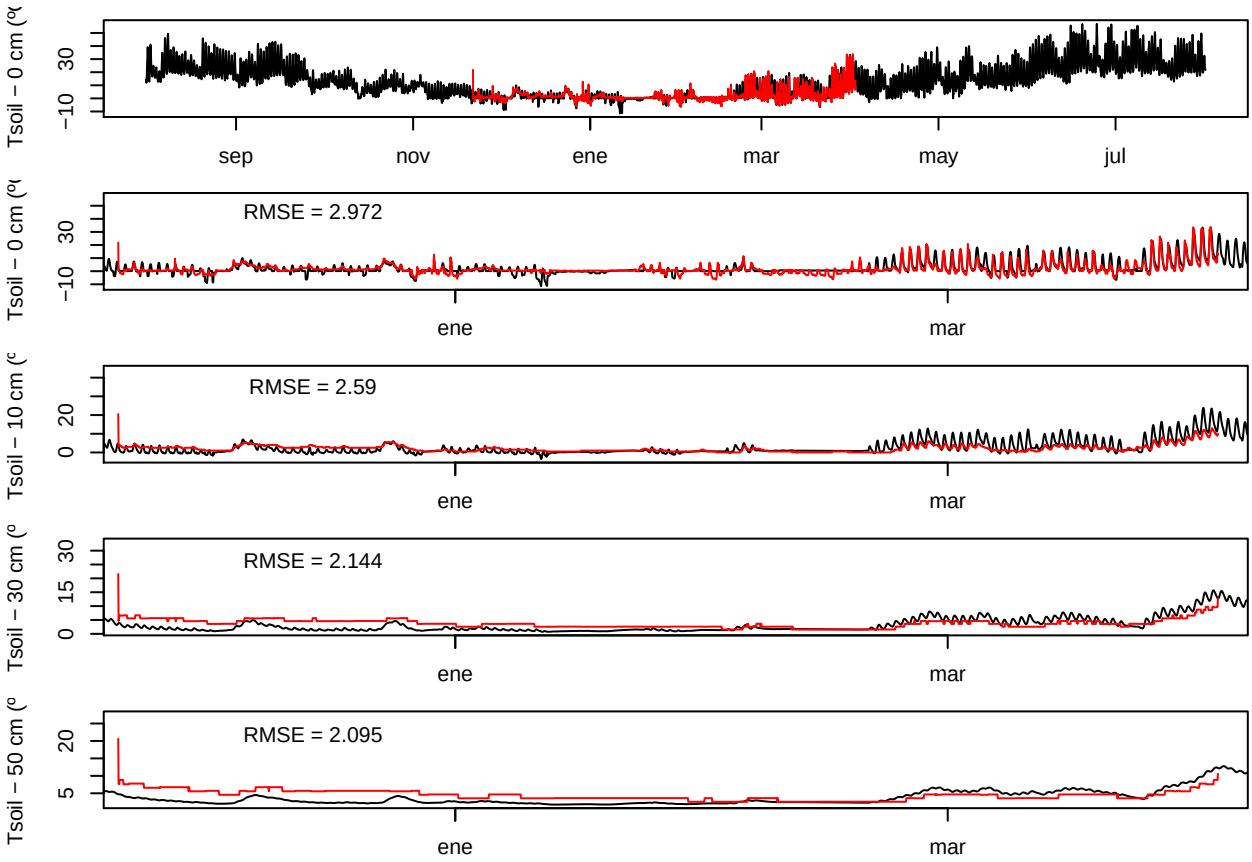
```
xy <- data.frame(x = lon, y = lat)
sp::coordinates(xy) = ~x + y
sp::proj4string(xy) = "+init=epsg:4326"
xy <- as.data.frame(sp::spTransform(xy, raster::crs(dem)))
slope <- raster::terrain(dem, unit = "degrees")
slope <- raster::extract(slope, xy)
aspect <- raster::terrain(dem, opt = "aspect", unit = "degrees")
aspect <- raster::extract(aspect, xy)
ha36 <- 0
for (i in 0:35) {
  har <- microclima::horizonangle(dem, i * 10, raster::res(dem)[1])
  ha36[i + 1] <- atan(raster::extract(har, xy)) * (180/pi)
}
hori <- spline(x = ha36, n = 24, method =  'periodic')$y
hori[hori < 0] <- 0
hori[hori > 90] <- 90
```

```
micro <- micro_ncep(SLE = SLE, warm = warm, soilgrids = soilgrids, dstart = dstart, dfinish = dfinish,
                    Usrhyt = Usrhyt, slope = slope, aspect = aspect, REFL = REFL,
                    hori = hori, minshade = minshade, maxshade = maxshade, rainmult = rainmult,
                    loc = c(lon, lat), runshade = 1, run.gads = 1, snowmodel = 1, runmoist = 1,
                    BulkDensity =  BulkDensity, cap = cap,
                    Density = Density, Thcond = Thcond, SpecHeat = SpecHeat,
                    windfac = windfac, spatial = spatial, ERR = ERR, dem = dem,
                    save = 2)
```

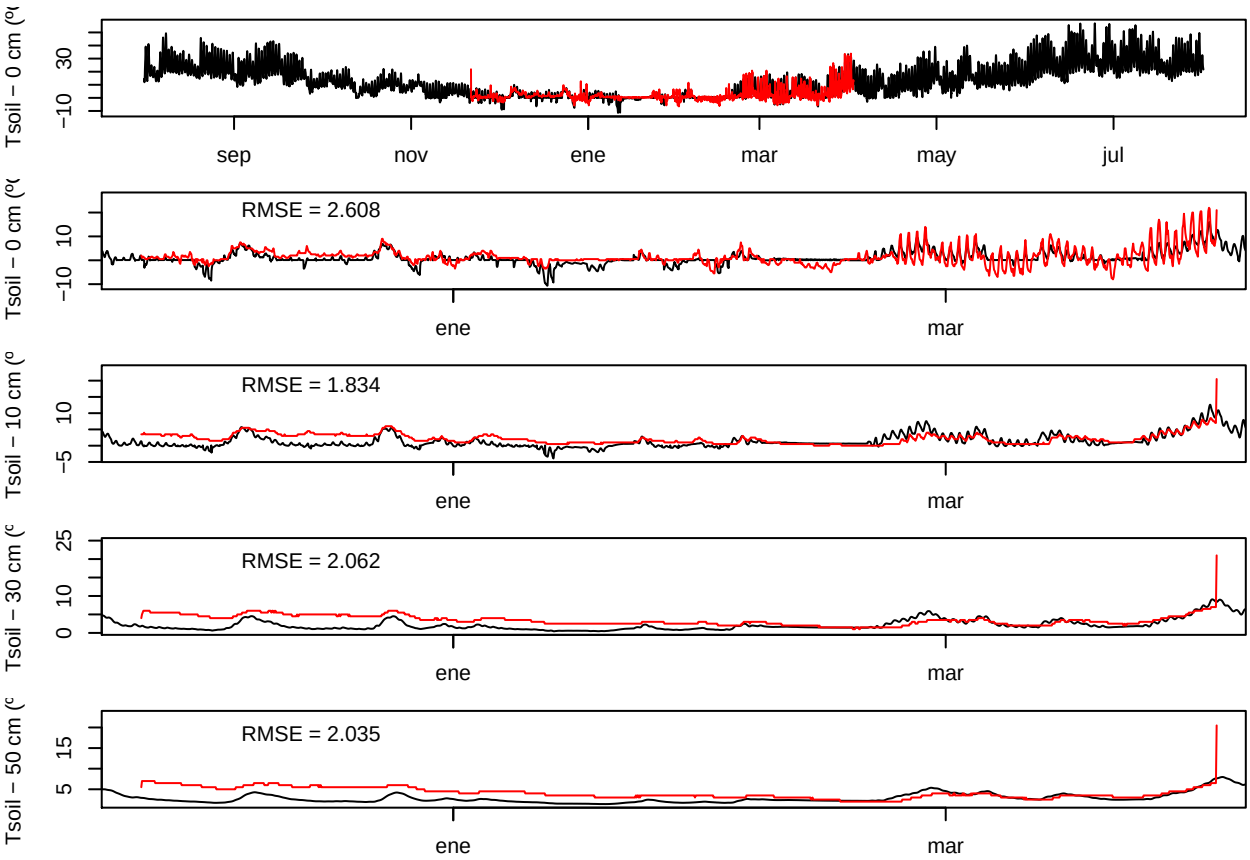
Retrieve output

```
soil <- data.frame(micro$soil) # explain each output
shadsoil <- data.frame(micro$shadsoil)
humid <- data.frame(micro$humid)
shadhumid <- data.frame(micro$shadhumid)
```

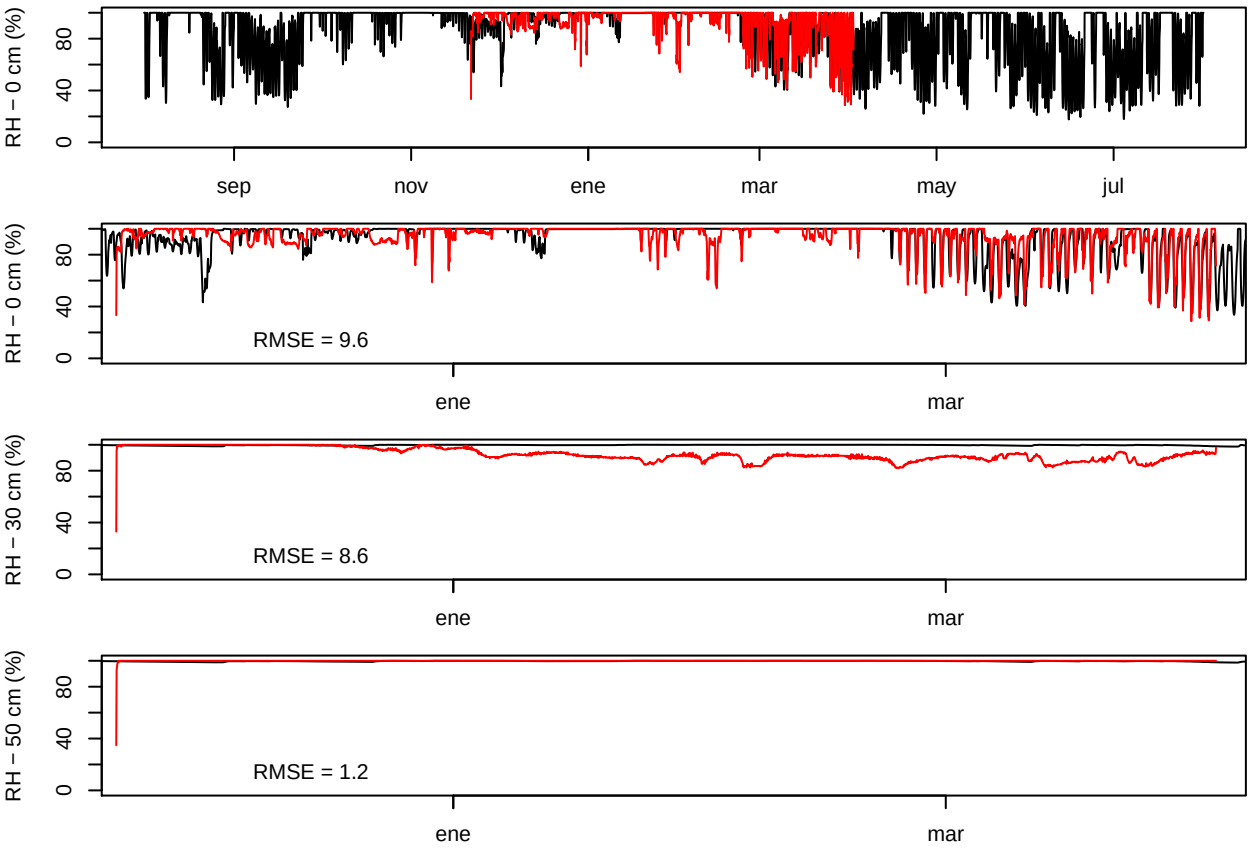
Temperature at full sun



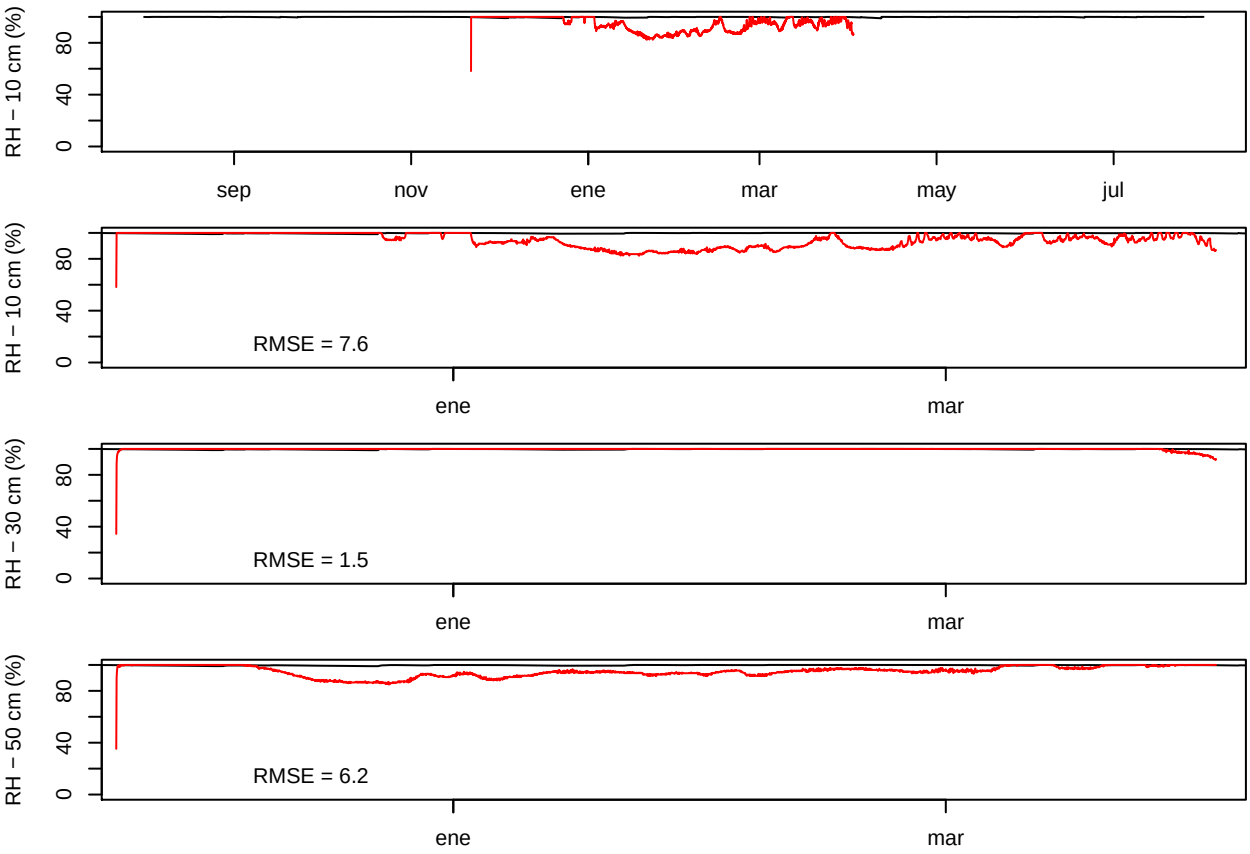
Temperature at shade (90%)



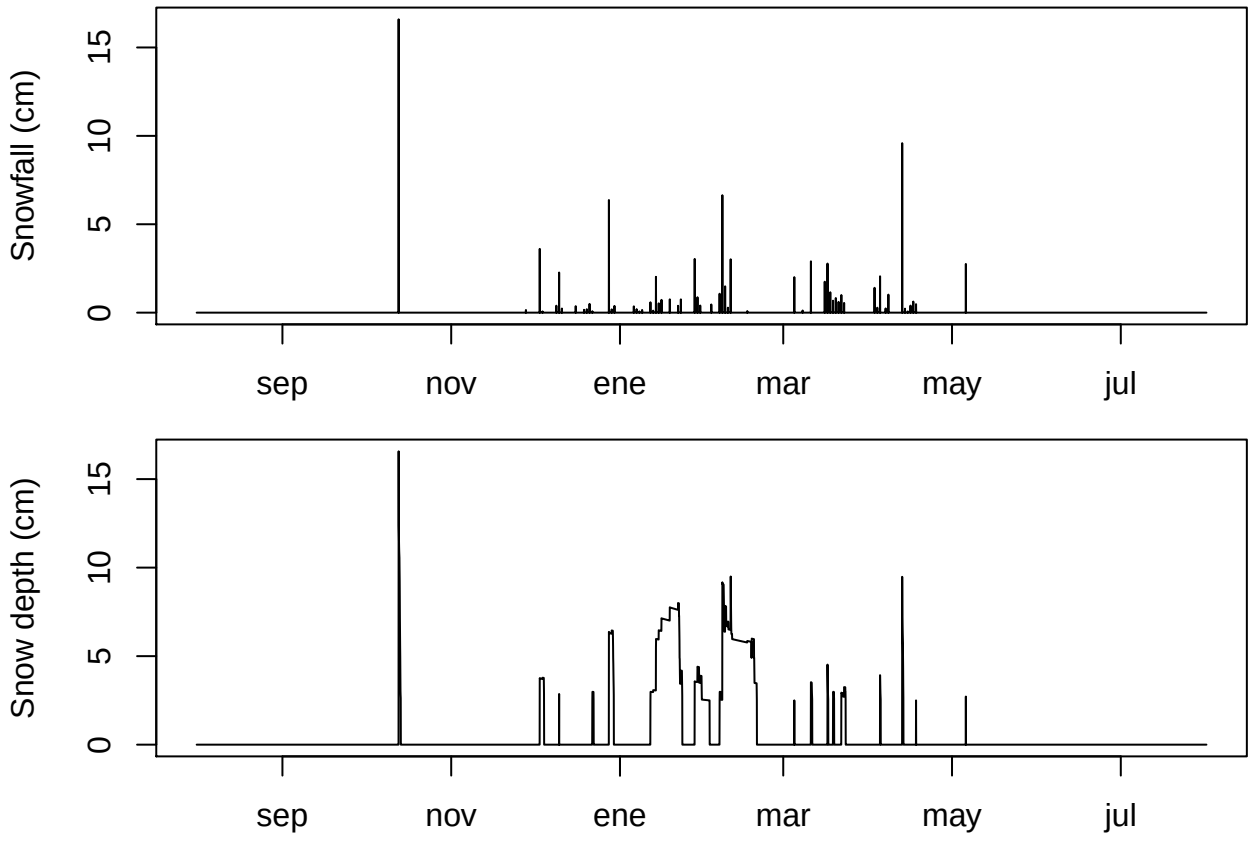
Humidity at full sun



Humidity at shade (90%)



Snow cover


Snowfall (cm)
0
5
10
15
sep
nov
ene
mar
may
jul
Snow depth (cm)
0
5
10
15
sep
nov
ene
mar
may
jul