# Appendix 2 - Validation of the microclimate model in Studenec, Czechia

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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)
```

```
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 <- 1.1
Thcond <- 1.5 # 2.5
SpecHeat <- 870
Density <- 2.56
BulkDensity <- 2.45 # 1.3
windfac <- 1
REFL <- 0.2
cap <- FALSE
SLE <- 0.95
warm <- 0
Usrhyt <- 0.01
clearsky <- FALSE
soilgrids <- 0
spatial <- NA
ERR <- 1
```

```
#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]
```

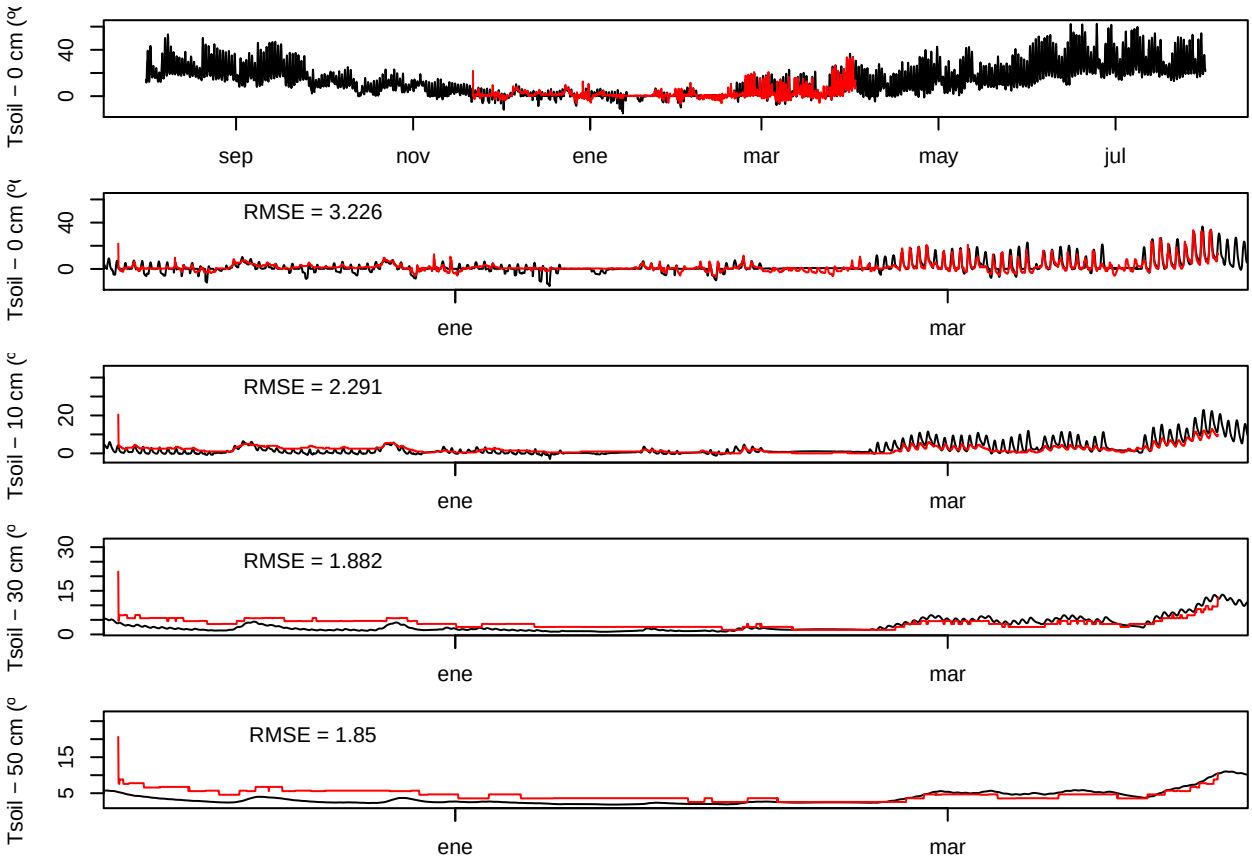
```
xy <- data.frame(x = lon, y = lat)
sp::coordinates(xy) = ~x + y
sp::proj4string(xy) = "+init=epsg:4326"
xy <- as.data.frame(sp::spTransform(xy, raster::crs(dem)))
slope <- raster::terrain(dem, unit = "degrees")
slope <- raster::extract(slope, xy)
aspect <- raster::terrain(dem, opt = "aspect", unit = "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)
```

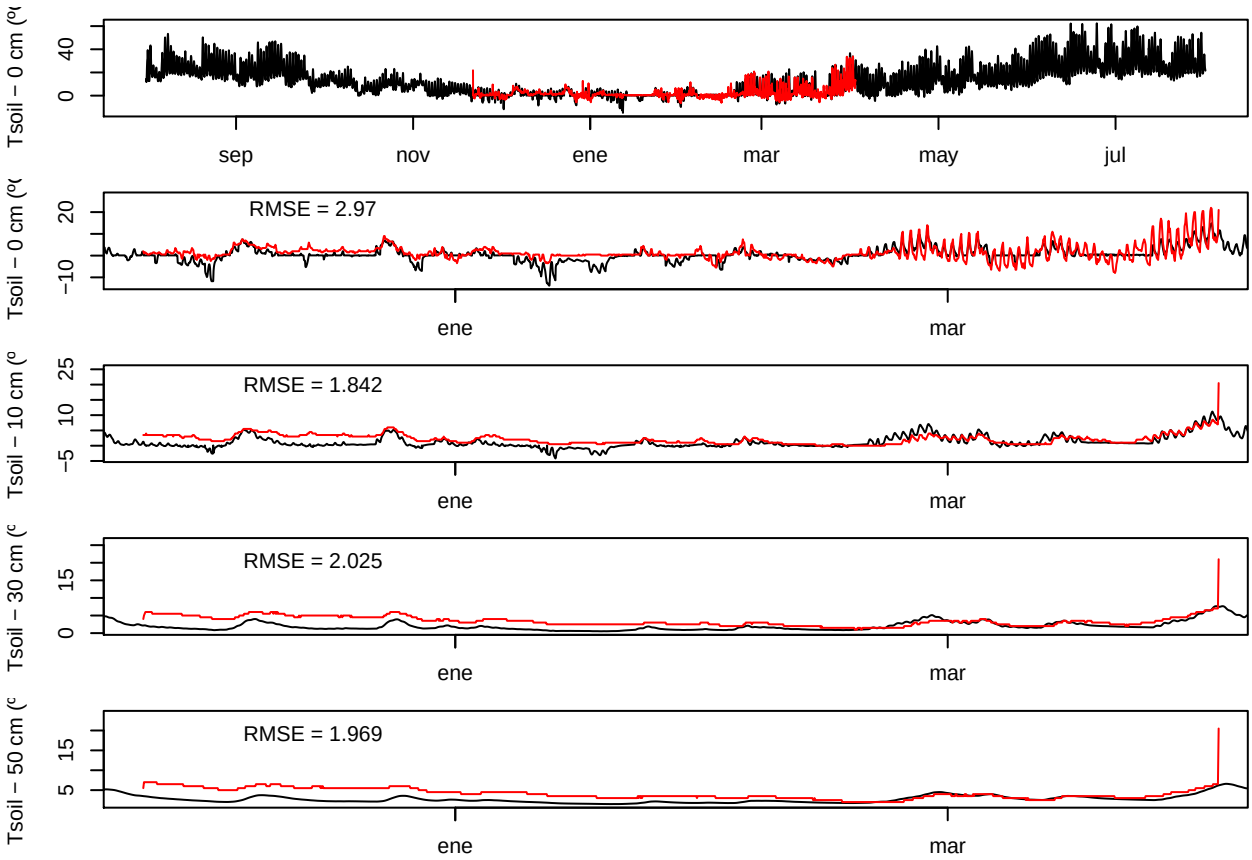
Retrieve output

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

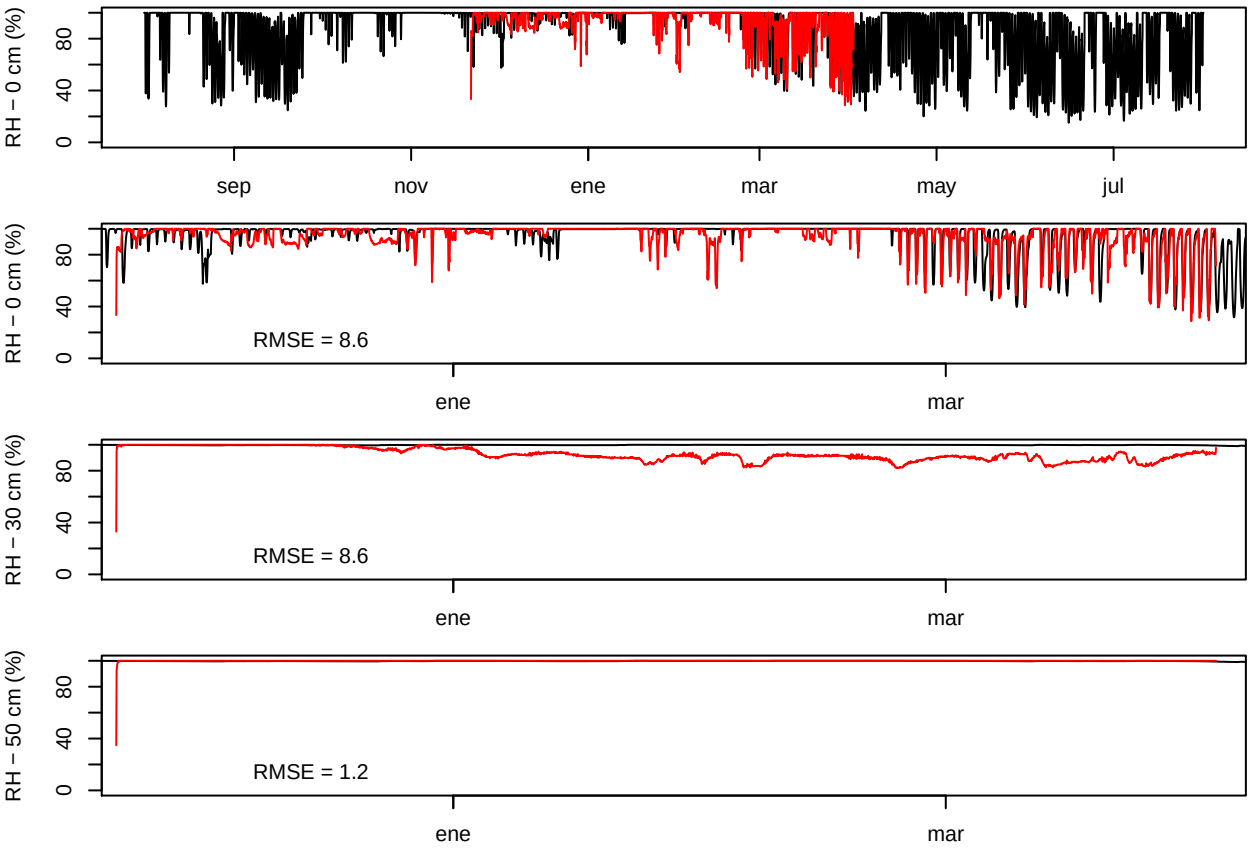
### Temperature at full sun



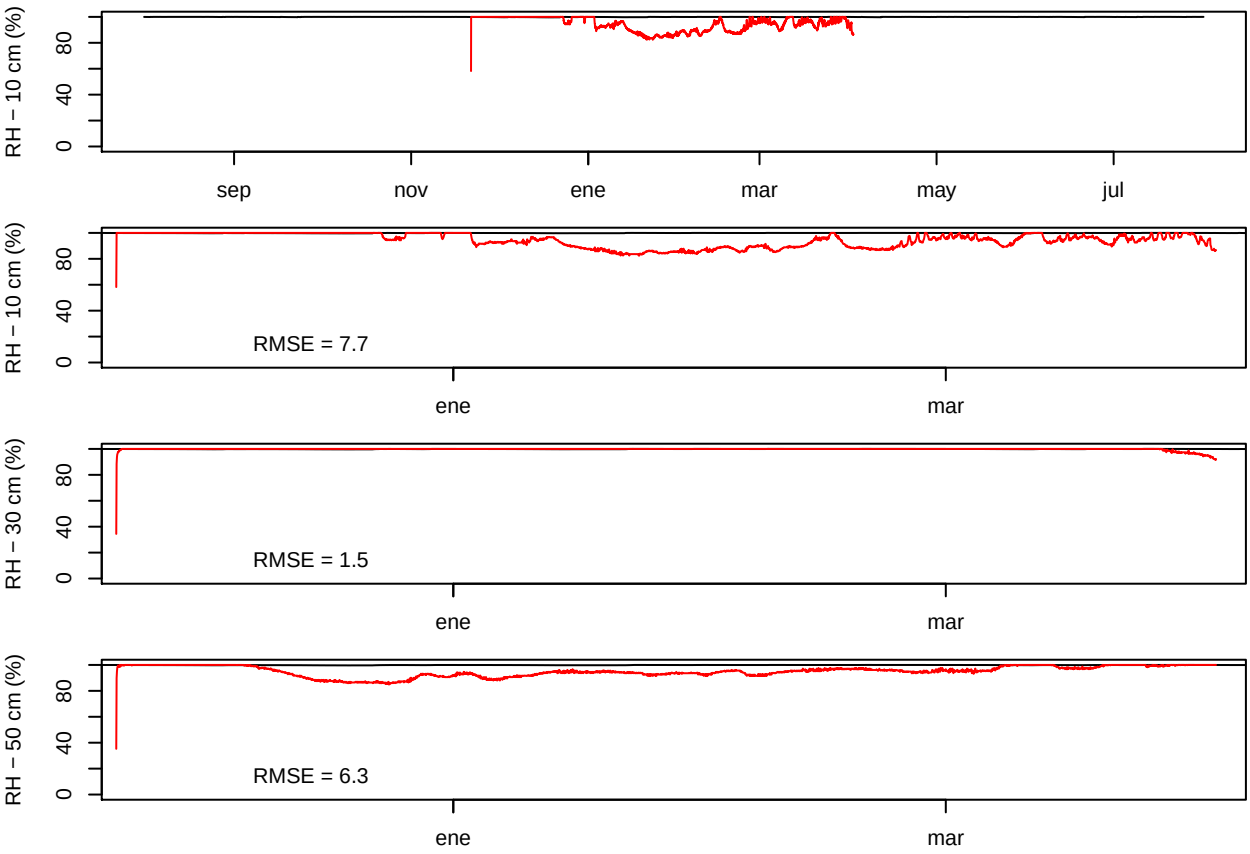
**Temperature at shade (90%)**



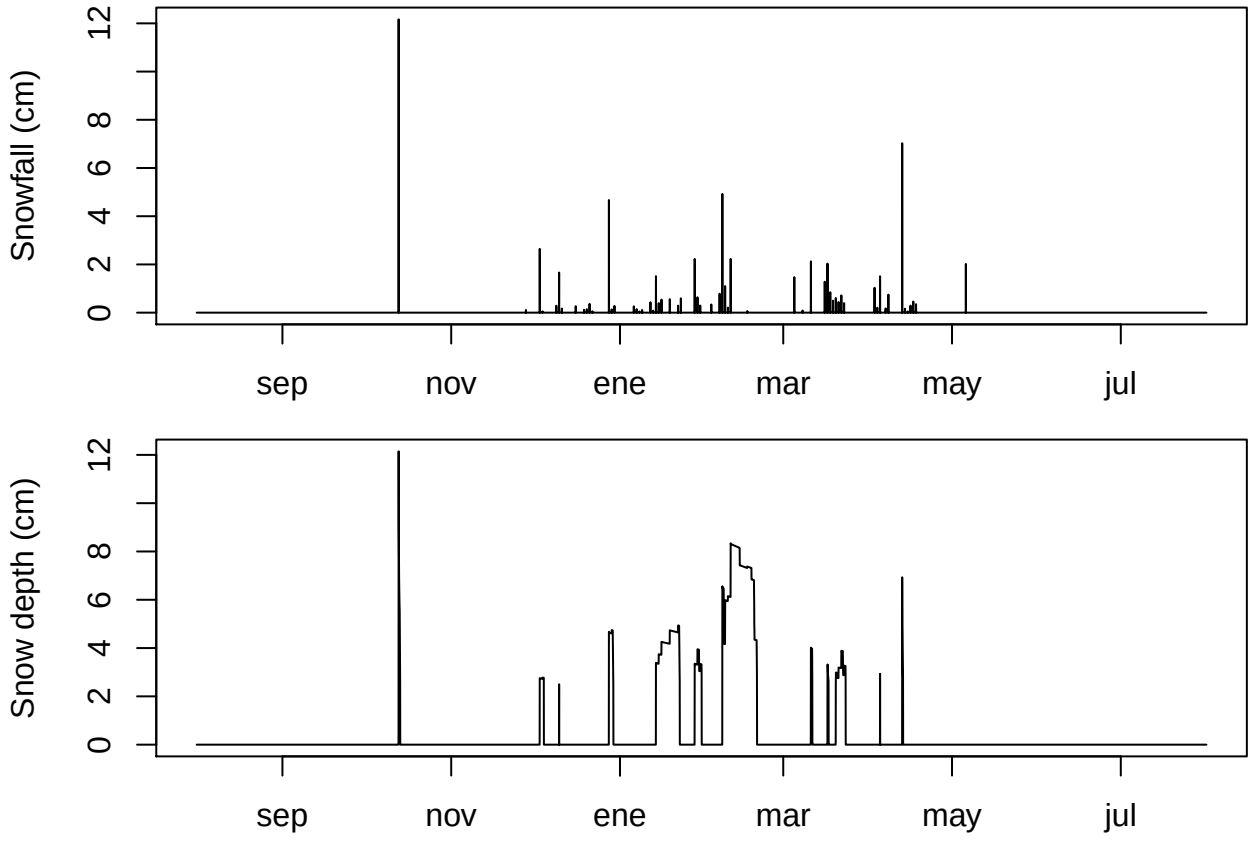
**Humidity at full sun**



**Humidity at shade (90%)**



**Snow cover**


Snowfall (cm)
0
2
4
6
8
12
sep
nov
ene
mar
may
jul
Snow depth (cm)
0
2
4
6
8
12
sep
nov
ene
mar
may
jul