Temp Exposure Data

```
library(ncdf4) # package for netcdf manipulation
library(raster) # package for raster manipulation
```

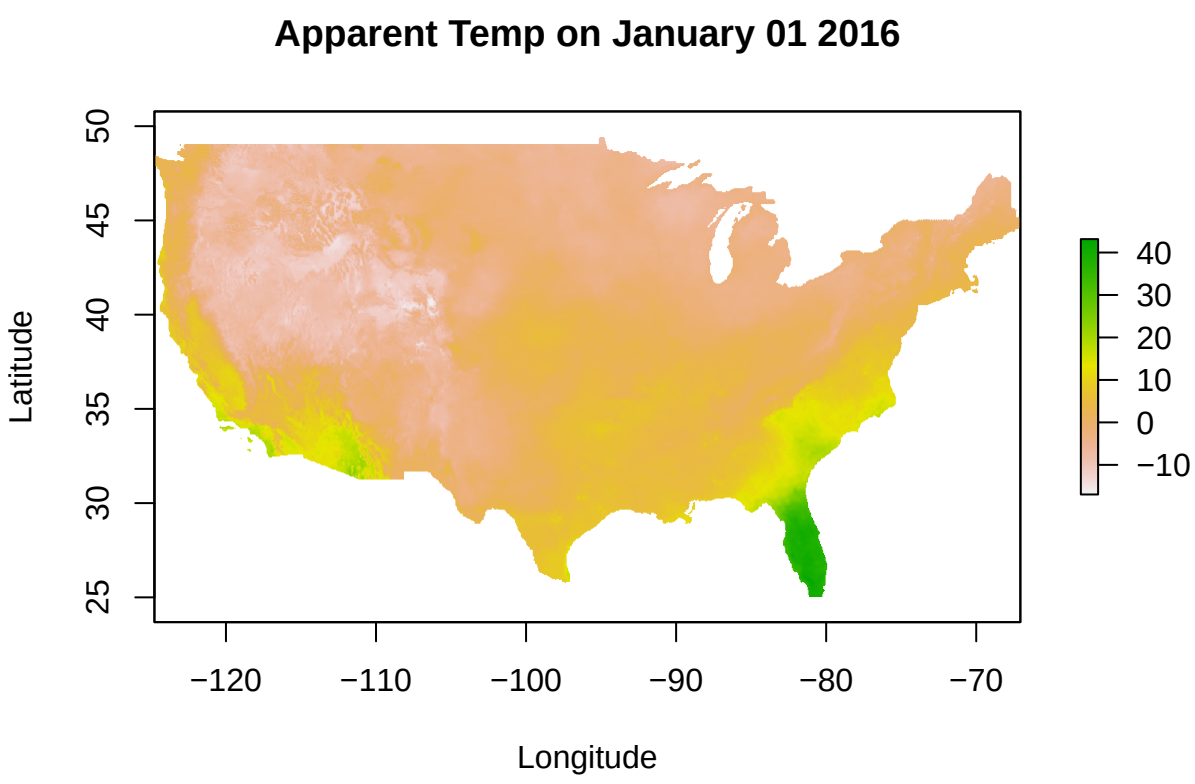
```
## Loading required package: sp
```

```
library(rgdal) # package for geospatial analysis
```

```
## Please note that rgdal will be retired by the end of 2023,
## plan transition to sf/stars/terra functions using GDAL and PROJ
## at your earliest convenience.
##
## rgdal: version: 1.5-27, (SVN revision 1148)
## Geospatial Data Abstraction Library extensions to R successfully loaded
## Loaded GDAL runtime: GDAL 3.2.1, released 2020/12/29
## Path to GDAL shared files: C:/Users/jorda/Documents/R/win-library/4.1/rgdal/gdal
## GDAL binary built with GEOS: TRUE
## Loaded PROJ runtime: Rel. 7.2.1, January 1st, 2021, [PJ_VERSION: 721]
## Path to PROJ shared files: C:/Users/jorda/Documents/R/win-library/4.1/rgdal/proj
## PROJ CDN enabled: FALSE
## Linking to sp version:1.4-5
## To mute warnings of possible GDAL/OSR exportToProj4() degradation,
## use options("rgdal_show_exportToProj4_warnings"="none") before loading sp or rgdal.
## Overwritten PROJ_LIB was C:/Users/jorda/Documents/R/win-library/4.1/rgdal/proj
```

```
library(ggplot2) # package for plotting
library(weathermetrics) #rhum to dew


temp_data <- nc_open("tmmx_2016.nc")
# {
#     sink('tmmx_2016.txt')
#  print(nc_data)
#     sink()
# }

hum_data <- nc_open("rmax_2016.nc")
# {
#     sink('rmax_2016.txt')
#  print(hum_data)
#     sink()
# }

lon_list <- ncvar_get(temp_data, "lon")
lat_list <- ncvar_get(temp_data, "lat", verbose = F)
```

```
t_list <- ncvar_get(temp_data, "day")

# lon_hum <- ncvar_get(hum_data, "lon")
# lat_hum <- ncvar_get(hum_data, "lat")
# t_hum <- ncvar_get(hum_data, "day")
#
# sum(lon_hum != lon_list)
# sum(lat_hum != lat_list)
# sum(t_hum != t_list)

temp_array <- ncvar_get(temp_data, "air_temperature")
hum_array <- ncvar_get(hum_data, "relative_humidity")

fillvalue_temp <- ncatt_get(temp_data, "air_temperature", "_FillValue")
nc_close(temp_data)
temp_array[temp_array == fillvalue_temp$value] <- NA

fillvalue_hum <- ncatt_get(hum_data, "relative_humidity", "_FillValue")
nc_close(hum_data)
hum_array[hum_array == fillvalue_hum$value] <- NA

temp_array <- convert_temperature(temp_array,old_metric = "k", new_metric = "c")
dew_array <-  humidity.to.dewpoint(hum_array,temp_array,temperature.metric = "celsius")

at_array <- -2.653 + (.994 * temp_array) + (.0153 * dew_array^2)

day <- 1

# temp_slice <- temp_array[,,day]
# hum_slice <- hum_array[,,day]
# dew_slice <- dew_array[,,day]
at_slice <- at_array[,,day]


# r <- raster(t(temp_slice), xmn=min(lon_temp), xmx=max(lon_temp), ymn=min(lat_temp), ymx=max(lat_temp)
# plot(r)
#
# r <- raster(t(hum_slice), xmn=min(lon_temp), xmx=max(lon_temp), ymn=min(lat_temp), ymx=max(lat_temp),
# plot(r)
#
# r <- raster(t(dew_slice), xmn=min(lon_temp), xmx=max(lon_temp), ymn=min(lat_temp), ymx=max(lat_temp),
# plot(r)

day <- as.Date("2016-01-01") + day - 1

r <- raster(t(at_slice), xmn=min(lon_list), xmx=max(lon_list), ymn=min(lat_list), ymx=max(lat_list), cr
plot(r,
     main = paste0("Apparent Temp on ",format(day, format="%B %d %Y")),
     xlab = "Longitude",
     ylab = "Latitude")
```




```
rm(temp_array)
rm(dew_array)
rm(hum_array)
gc()
```

```
##             used   (Mb) gc trigger    (Mb)   max used    (Mb)
## Ncells   1663955   88.9    2675862   143.0    2675862   143.0
## Vcells 300782212 2294.8 1610187127 12284.8 1634518858 12470.4
```

```
r_brick <- brick(at_array, xmn=min(lat_list), xmx=max(lat_list), ymn=min(lon_list), ymx=max(lon_list), 

# r_brick <- flip(t(r_brick), direction='y')
r_brick <- t(r_brick)
```

```
GrabAT <- function(r_brick, lon_list, lat_list, lon, lat){

  lon_adj <- lon_list[which(abs(lon_list-lon)==min(abs(lon_list-lon)))]
  lat_adj <- lat_list[which(abs(lat_list-lat)==min(abs(lat_list-lat)))]

  at_series <- extract(r_brick, SpatialPoints(cbind(lon_adj,lat_adj)), method='simple')

  at_temp_df <- data.frame(day = seq(as.Date("2016-01-01"),as.Date("2016-12-31"), by = "day"),
                           temp = c(at_series))

  return(at_temp_df)
```

```
}

miami_lon <- -80.1918
miami_lat <- 25.7617

mpls_lon <- -93.2650
mpls_lat <- 44.9778



at_df1 <- GrabAT(r_brick, lon_list, lat_list,miami_lon,miami_lat)
at_df2 <- GrabAT(r_brick, lon_list, lat_list,mpls_lat,mpls_lat)



ggplot() +
  geom_line(data=at_df1, aes(x=day, y=temp, color="Miami")) +
  geom_line(data=at_df2, aes(x=day, y=temp, color="Minneapolis ")) +
  scale_x_date(date_breaks = "3 month", date_labels =  "%b") +
  theme(axis.text.x=element_text(angle=60, hjust=1)) +
  labs(x = "Month", y = "Apparent Temp (C)", title = "Daily AT Highs in 2016")
```