

Supplementary Materials to “Summer compound drought-heat extremes amplify fire-weather risk and burned area beyond historical thresholds in Chong-qing Region, subtropical China.”

Kriging model (spatial interpolation)

```
library(gstat)
library(sp)
library(raster)
library(rgdal)
library(lattice)
library(rasterVis)
library(sf)
library(GSODR)

# Loop through each date and interpolate precipitation values
for (date in unique(vpd2001_2022$date)) {
  # Subset the data for the current date
  data1 <- vpd2001_2022[vpd2001_2022$date == date, ]

  # Remove rows with missing values
  data1 <- data1[complete.cases(data1),]

  # We compute the daily kriging model ONLY when there is a minimum number above 30 weather stations (i.e., 31, or 32, or 33, or 34, or 35 stations).
  # This means that if, in a given day, there are only 30 weather stations or below, we will not compute kriging.
  # There were available data (n > 30 weather stations) for more than 99% of cases.
  if(nrow(data1) > 30){
    out_dir <- "VPD_inter/"
    date_ch <- data1$date[1]
    date_ch <- as.Date(date_ch)
    file_name <- paste0("VPD_", date_ch, ".tif")
    file_path <- file.path(out_dir, file_name)
    data1 <- data1[,-c(4:6)]

    # Convert the data to a SpatialPointsDataFrame
    coordinates(data1) <- c("x", "y")
    proj4string(data1) <- proj4string(grid_pixels)
    data1@bbox <- as.matrix(extent(grid_pixels))

    # Interpolate using ordinary kriging. These are the variogram and krig model steps inside the for loop.
    v <- variogram(vpd ~ 1, data = data1)
    vgm.model <- vgm(psil = 0.5, model = "Exp", range = 25)
    kriged <- krige(
      formula = vpd ~ 1,
```

```

locations = data1,
newdata = grid_pixels,
model = vgm.model)

kriged_raster <- raster(kriged)

# Set a minimum threshold for the interpolated data
kriged_raster <- clamp(kriged_raster, lower = 0)

# Save the interpolated raster as a TIFF file
writeRaster(kriged_raster, filename = file_path, format = "GTiff", overwrite = TRUE)

cv.o <- krige.cv(vpd ~ 1,data1,model = vgm.model,nfold = nrow(data1), verbose = FALSE)
cvo_krigresult_list[date] <- sqrt(mean((cv.o$residual)^2))
}

else { #This part refers to cases when number of weather stations are 30 or below: they are excluded since a minimum of 30 stations is a common
      # requirement to conduct a spatial krig interpolation.

      # Assign "NA" values to the kriged raster
      out_dir <- "VPD_inter"
      date_ch <- data1$date[1]
      date_ch <- as.Date(date_ch)
      file_name <- paste0("VPD_", date_ch, ".tif")
      file_path <- file.path(out_dir, file_name)
      kriged_raster <- raster(ncol = ncol(grid_pixels), nrow = nrow(grid_pixels))
      kriged_raster[] <- NA
      # Save the kriged raster as a TIFF file
      writeRaster(kriged_raster, filename = file_path, format = "GTiff", overwrite = TRUE)
      #cvo_krig_df[cvo_krig_df$date == date,]$residual <- NA
    }
}

```

Total MSRE = 0.342392, reaching an acceptable goodness of fit.

Below an example of the krig interpolation, conducted for 18th of August 2022.

