

Mô hình HYSPLIT

Sử dụng R & Openair package

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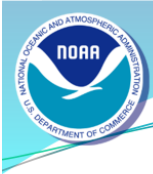
<https://tuanvvu.github.io/>

Aims

- Introduction to Hysplit Model
 - Installation
 - Run online
- Analysis of backtrajectories from Hysplit using ***openair*** package
- Tasks

“We can only see a short distance ahead, but we can see plenty there that needs to be done”- Alan Turning

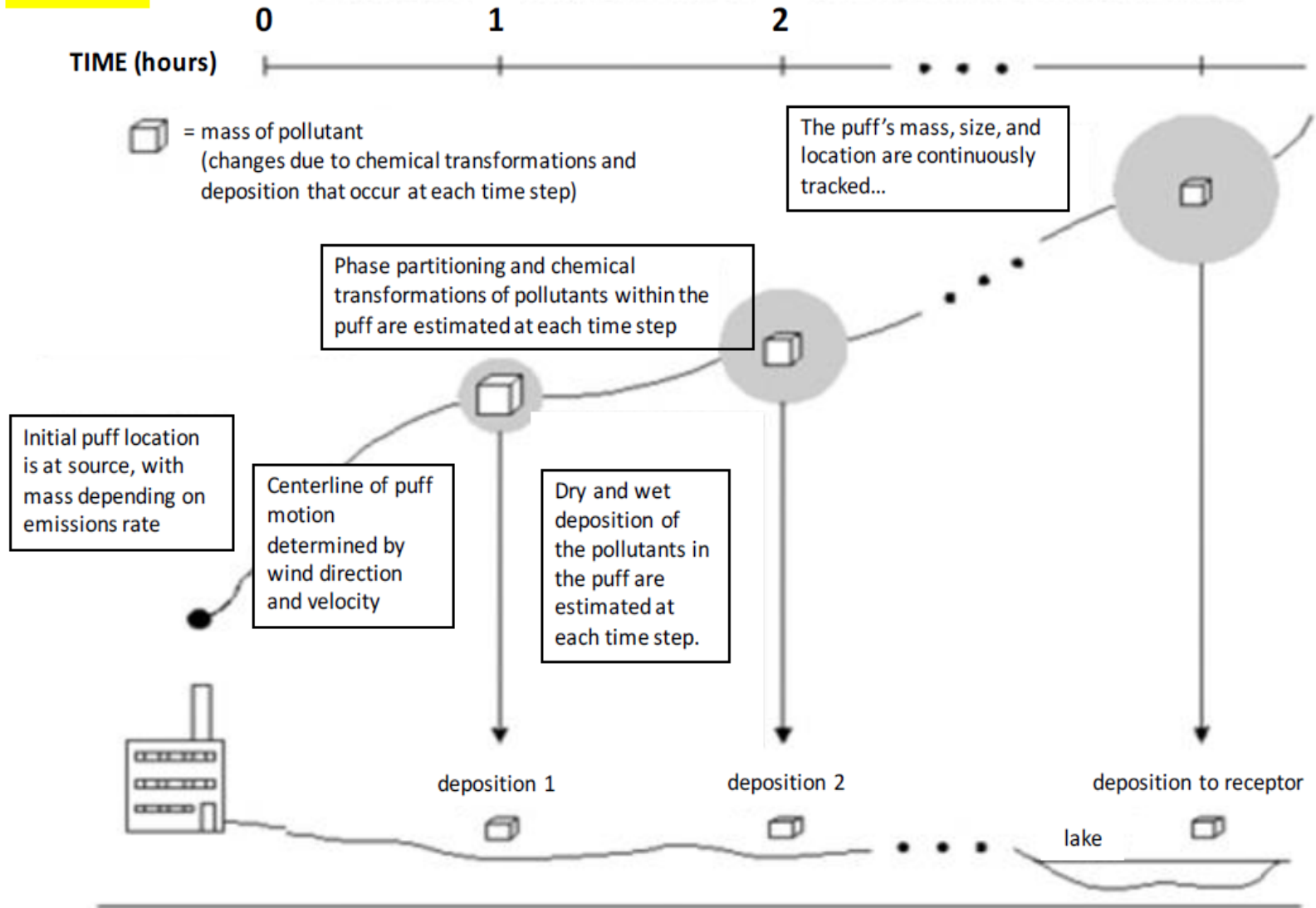
I. Introduction to HYSPLIT model



HYSPLIT Overview

- HYSPLIT is not just a transport and dispersion model but a complete system for computing trajectories, dispersion, and deposition
- Can be applied to different air quality problems
- Specific applications depend upon configuration of input files and the use of pre- and post-processing executables
- Executable library contains over 100 applications
- This presentation is a highly technical focus on configuring the model for radiological applications
- This presentation was developed as a reference document

Lagrangian Puff Atmospheric Fate and Transport Model



- Installation

https://www.ready.noaa.gov/HYSPLIT_hytrial.php

https://www.arl.noaa.gov/documents/reports/hysplit_user_guide.pdf

- Run online

https://www.ready.noaa.gov/HYSPLIT_traj.php

- Analysis back-trajectories using “openair” package

R data analysis software

1. Downloading and installing R/ Rstudio

<https://rstudio.com/products/rstudio/download/>

2. General approach to data analysis

- Use scripts: save all objects in the current R sessions as an .RData file
- Leave the data alone: as much as you can
- Coding style
- Simple R and vectors: R cheat sheet

2. Useful packages

- lubridate/dplyr/plyr
- ggplot2
- openair/worldmet

Introduction to “*openair*”

https://bookdown.org/david_carshaw/openair/

Useful *openair* functions

1. Summary data: Understand your data
2. Merging data sets
3. Selecting data by date
4. Averaging data to different time intervals
5. The *ScatterPlot*
6. ***Back-trajectories analysis***

Thực hành

1. Lấy dữ liệu trajectories từ Hysplit qua openair

```
setwd("E:/NOAA/") ### Set the working directory
```

```
workingDirectory<-"E:/NOAA/" ### Shortcut for the working directory
```

```
1. hy.path<-"c:/hysplit4/"
```

```
2. Add MET data
```

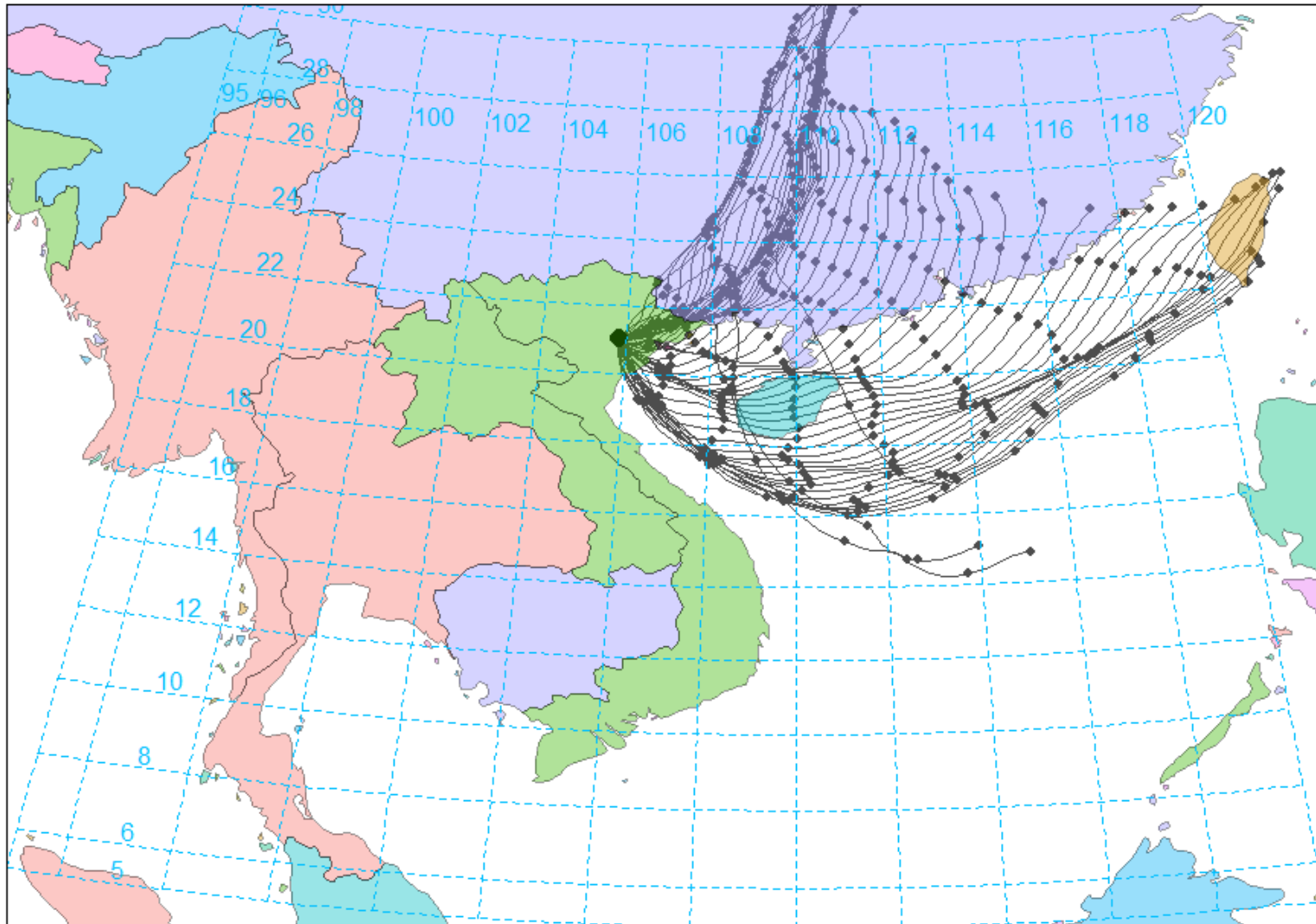
```
add.met <- function(month, Year, met, bat.file)
```

```
3. Produce theTRAJ
```

```
procTraj <- function(lat = 21.03, lon = 105.80, year = 2020, name = "Hanoi_120m",  
  met = "E:/NOAA/TrajData/", out = "E:/NOAA/TrajProc/",  
  hours = 96, height = 120, hy.path = "C:/hysplit4/")
```

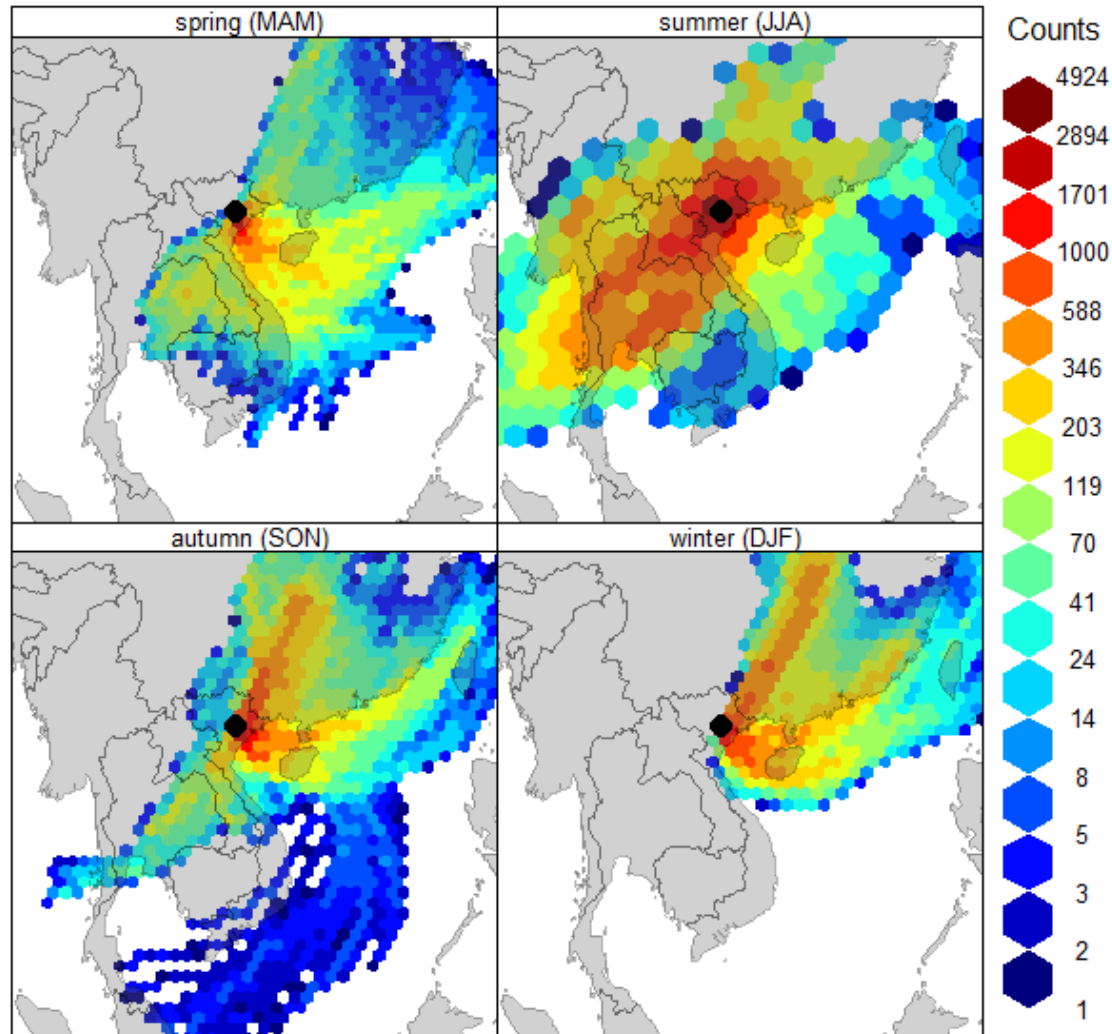

Plot traj

```
trajPlot(selectByDate(traj_hn, start = "15/4/2018", end = "21/4/2018"),  
  map.cols = openColours("hue", 10), orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30),  
  col = "grey30")
```



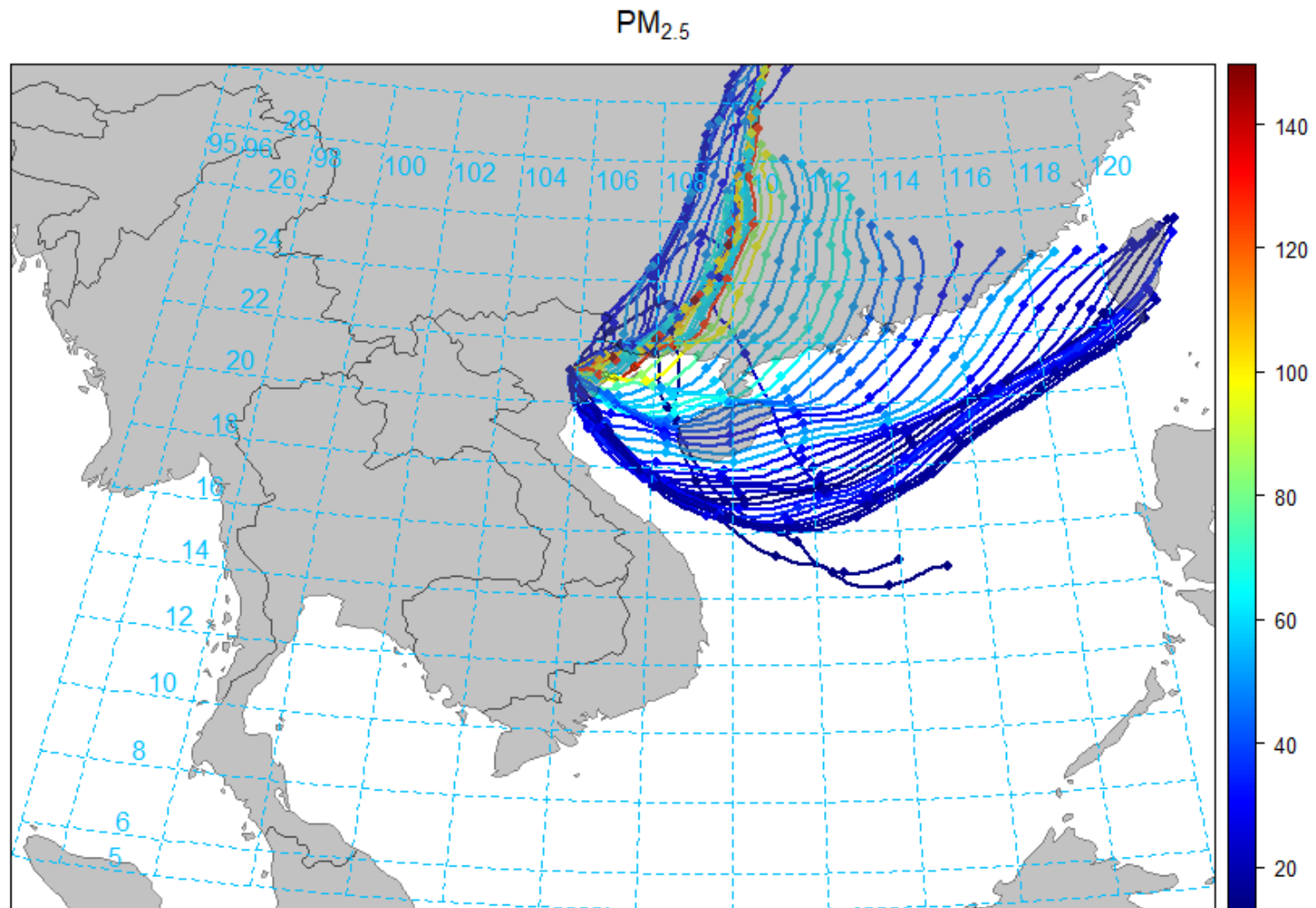
Trajectory gridded frequencies

```
trajLevel(traj_hn, statistic = "frequency", type="season",orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30))  
trajLevel(traj_hn,orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30), method = "hexbin",  
col = "jet",xbin = 40,type="season",grid.col="transparent")
```



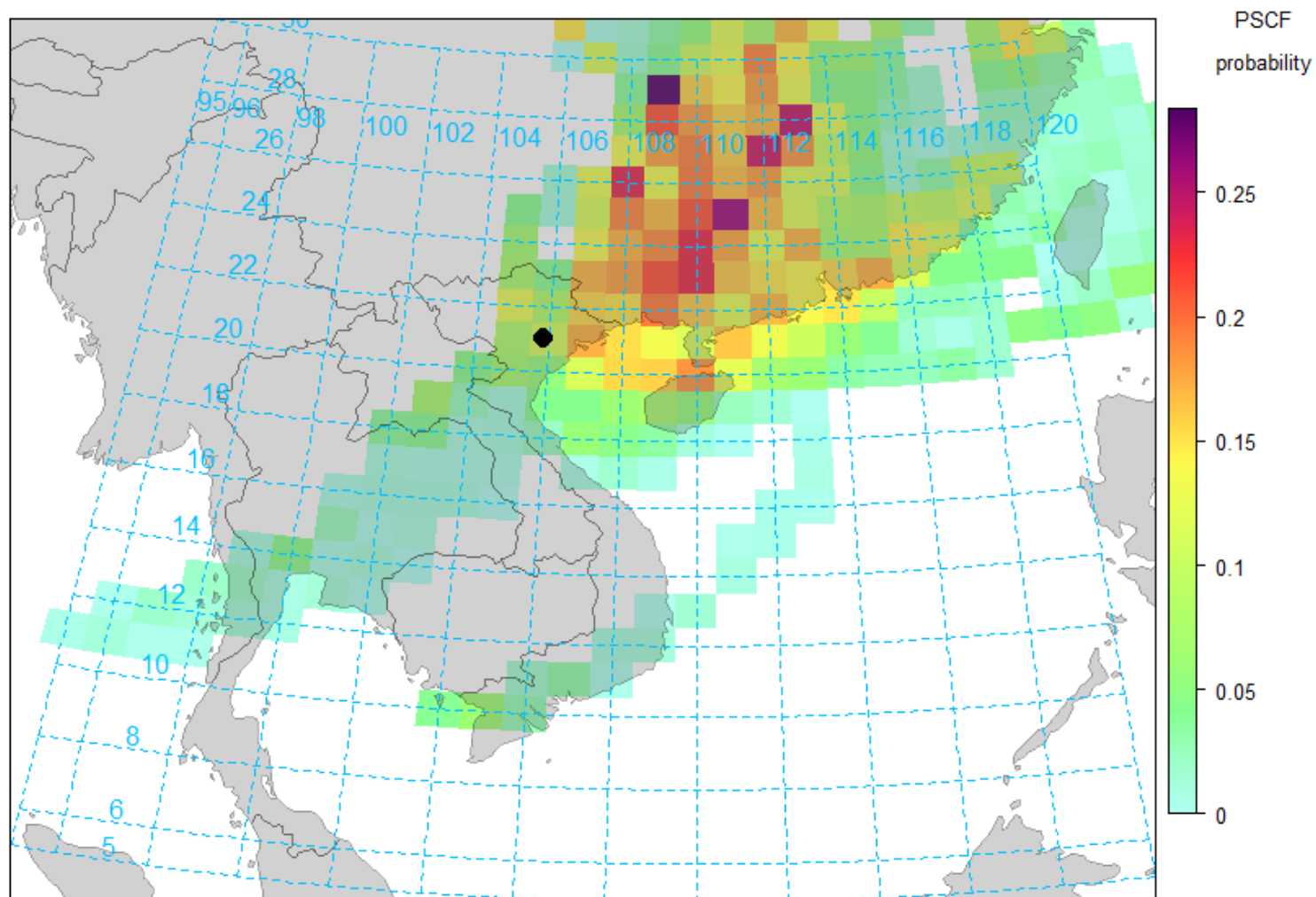
Trajectory source contribution functions

```
trajLevel(traj_hn, pollutant = "pm2.5", statistic = "difference",  
col = c("skyblue", "white", "tomato"), min.bin = 50, border = NA,  
orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30))
```



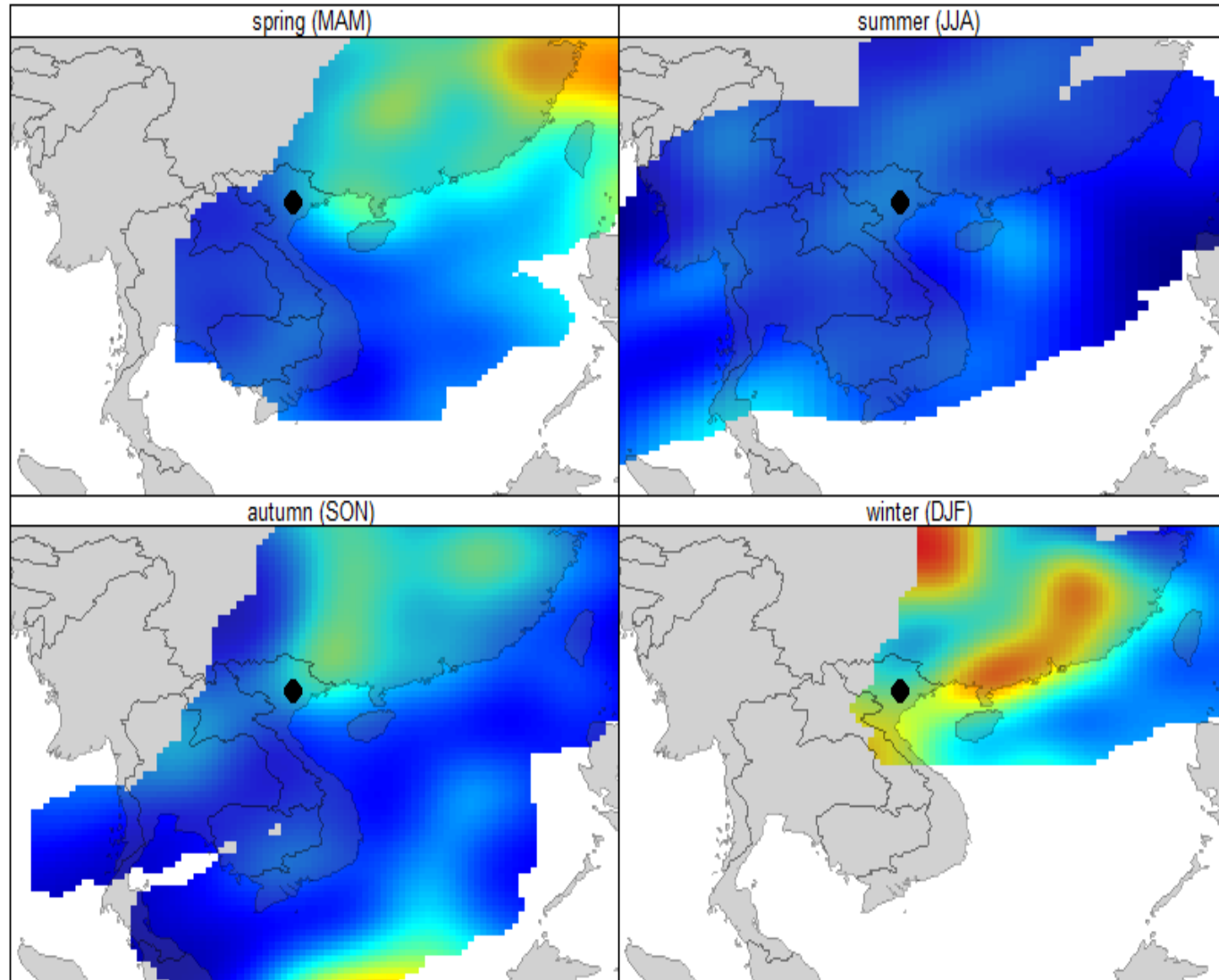
Potential Source Contribution Function (PSCF)

```
trajLevel(traj_hn, pollutant = "pm2.5", statistic = "pscf", col = "increment",  
orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30), border = NA)
```



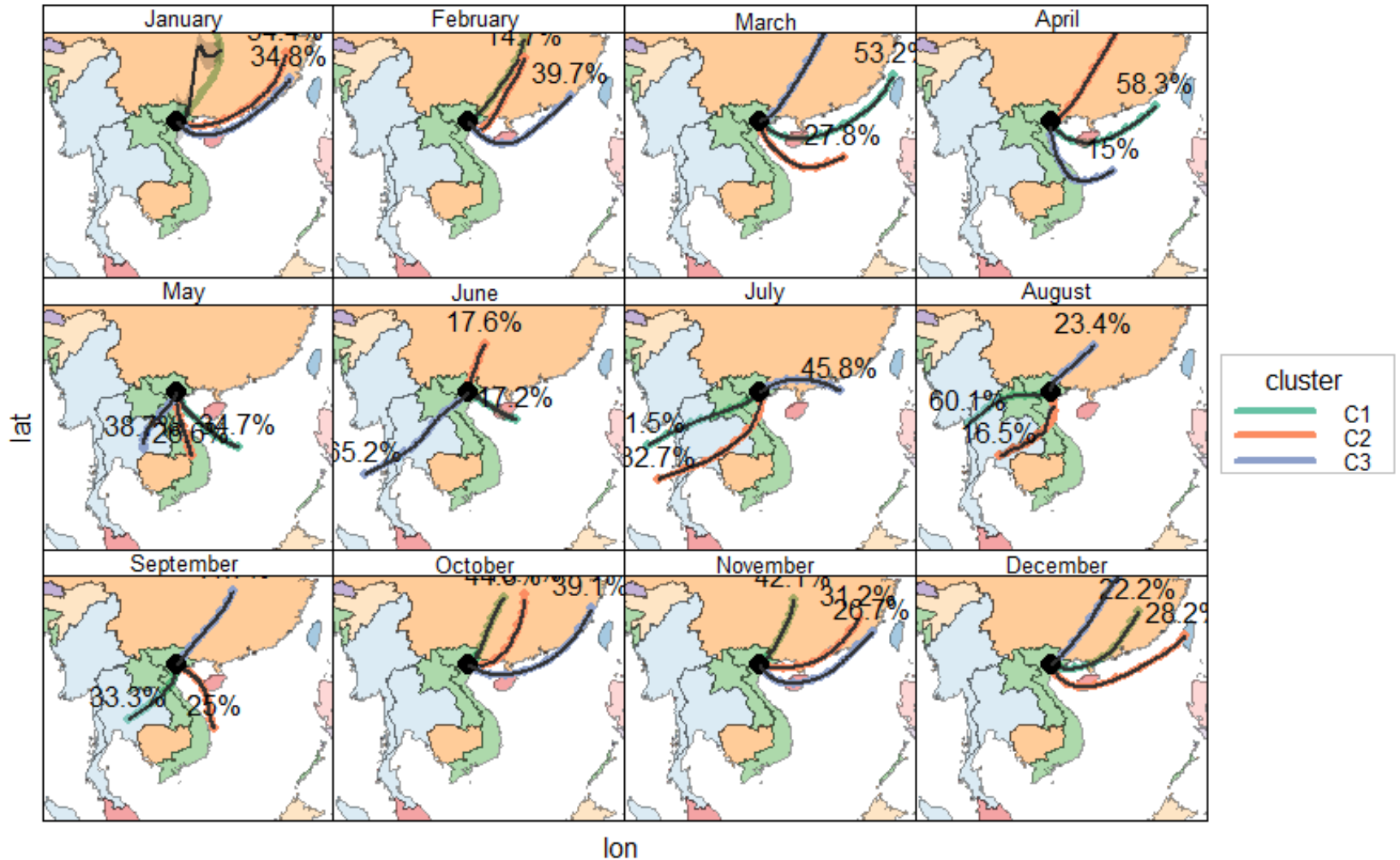
Concentration Weighted Trajectory (CWT)

```
trajLevel(traj_hn, pollutant = "pm2.5", statistic = "ctw", col = "jet", smooth=TRUE, type="season", orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30), border = NA,grid.col="transparent")
```



Trajectory clustering

```
clust <- trajCluster(traj_hn, method = "Angle", n.cluster = 3, smooth=TRUE, type="month",  
  col = "Set2",orientation=c(90,0,110),xlim=c(95,120),ylim=c(5,30),grid.col="transparent",  
  map.cols = openColours("Paired", 10))
```



Key task

- Practise basic coding more as you can
- Other R/Python/Software for back-trajectories

Câu hỏi nghiên cứu

1. Nghiên cứu ảnh hưởng của đốt sinh khối/cháy rừng tới chất lượng ONKK. Gợi ý: Kết hợp với MODIS data.
2. Ảnh hưởng của bụi từ sa mạc (vd. Gobi/ Asian dust) có ảnh hưởng tới chất lượng không khí ở Hà Nội?