PSCF demo

1 Preliminaries

There are two steps for PSCF analysis:

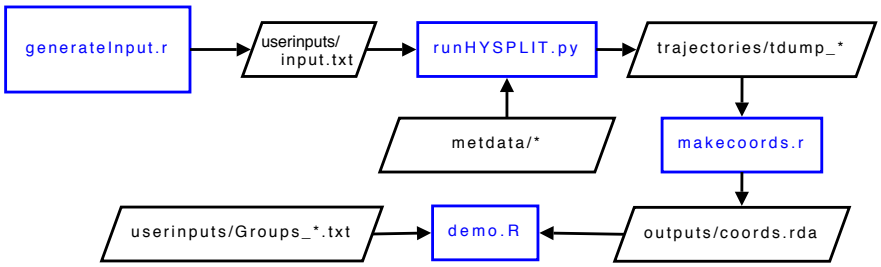
1. Generate back-trajectories using HYSPLIT
2. Create a grid over your domain and overlay HYSPLIT backtrajectories for the PSCF analysis.

Two important things to consider:

1. Regarding trajectory generation: how often to generate, time resolution, how far back in time
2. For PSCF or density calculation: spacing of grid points, whether to count each point in trajectory or the trajectory itself which passes over a given grid cell.

2 Part 1: Running HYSPLIT

Code diagram (note, `demo.R` may now be called `PSCFdemo.R`):



1. Download and place meteorological files in `metdata/`.
2. Edit the desired conditions in `generateInput.r`

```
## === user input ===
Start_lat <- 32.12
Start_lon <- -116.97
Start_alt <- c(1000,1200)
Start_times <- seq.chron(from=strptime2chron("4/25/09 00:00:00"),
                         to=strptime2chron("4/26/09 00:00:00"),
                         by=times("02:00:00"))
                                      # alternatively: by="hour"
                                      # and so on
Run_hours <- -5
Vert_coord <- 0
Model_top <- 1000000
```

This will generate a file called `input.txt` which is a table containing the inputs (by row) for HYSPLIT. `input.txt` is a tab-delimited file with the following format:

```
Latitude  Longitude  Altitude  Time  Run_hours  Vert_coord  Model_top
32.1200  -116.9700  1000.0000  04/25/09 00:00:00  -5  0  1000000.0000
32.1200  -116.9700  1200.0000  04/25/09 00:00:00  -5  0  1000000.0000
32.1200  -116.9700  1000.0000  04/25/09 02:00:00  -5  0  1000000.0000
32.1200  -116.9700  1200.0000  04/25/09 02:00:00  -5  0  1000000.0000
32.1200  -116.9700  1000.0000  04/25/09 04:00:00  -5  0  1000000.0000
```

If you generate `input.txt` with your own script or program, please make certain the the "Time" format is exactly as shown (each field is 2-digits).

3. Execute `runHYSPLIT.py`, which will read `input.txt` and [create a CONTROL file and] run HYSPLIT for each specified location/time. Trajectories are saved in a folder called `trajectories/`. Each trajectory is saved in a file with the format of `tdump-%y_%m_%d_%H-Alt`.

   You may have to specify the location of directories containing the met files and name of executable file if they are different from the following (hymoldelt.exe was from HYSPLIT Version 4.6):

```
Input_file = 'input.txt'
Exec_file = './hymodelt.exe'
Meteo_path = './metdata/'
Output_path = './trajectories/'
Output_base = 'tdump'
Control = 'CONTROL'
```

3 Part 2: PSCF analysis

1. Run `makecoords.r`, which will read files in the trajectories directory and create a binary file called `coords.rda` in a folder called `outputs/`.

2. Use the script, `PSCFdemo.R` to load `coords.rda` and run the PSCF functions. Note: `PSCFdemo.R` is extracted from `PSCFdemo.Rnw` with `Stangle("demo.Rnw")` in R, so the code contained in the `PSCFdemo.R` file is exactly the same as that which produced the output and graphics in the `PSCFdemo.pdf` file.