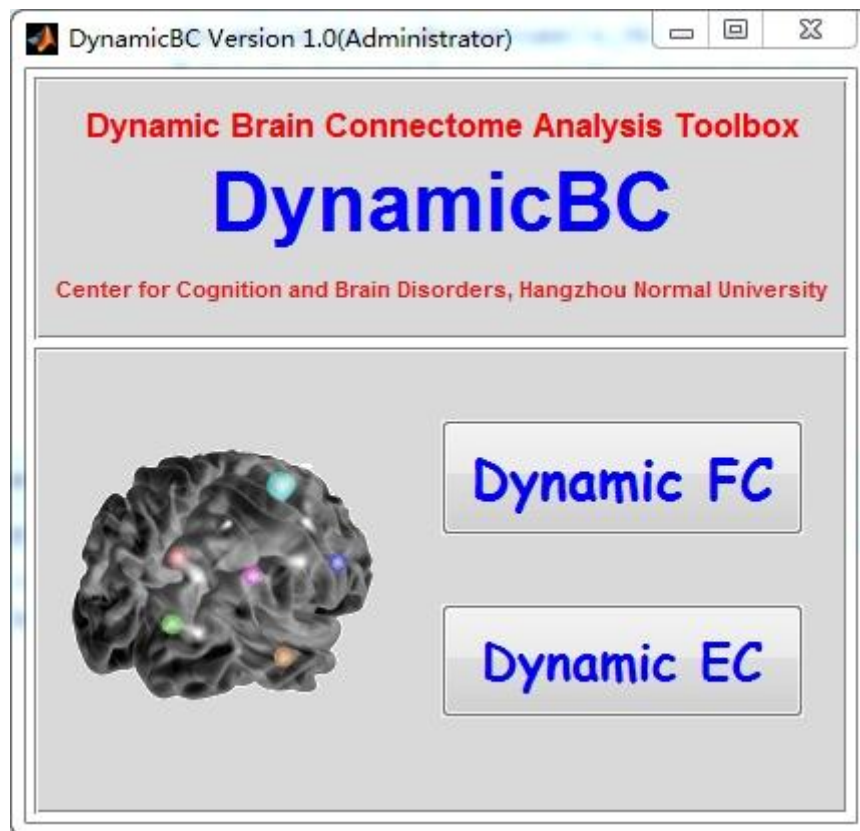


Dynamic Brain Connectome Analysis Toolbox Manual



Created by Center for Cognition and Brain Disorder, Hangzhou Normal University.

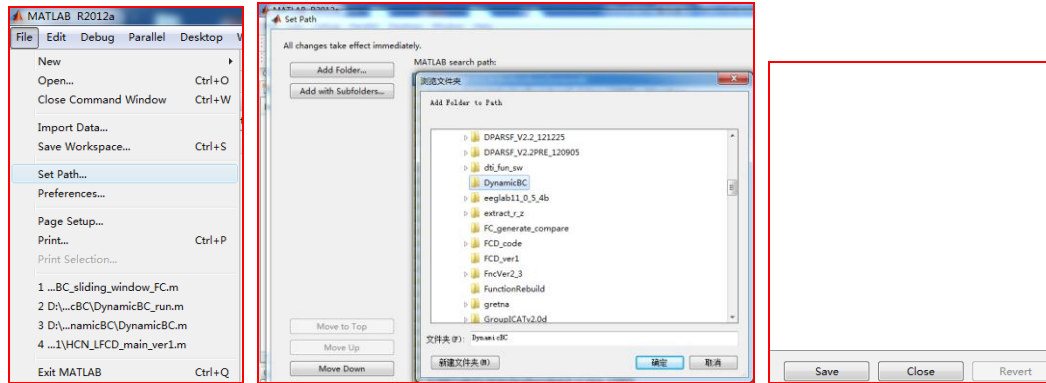
Users would ask questions and give comments by email (dynamicbrainconn@gmail.com) and online forum (<http://www.restfmri.net/forum/>).

Content

1	Set Up.....	3
2	Dynamic FC	4
2.1	'Voxel wise' module:	4
2.1.1	Seed(MNI)	5
2.1.2	ROI-Mask.....	10
2.2	'ROI wise' module:	19
2.2.1	Nifti Label	20
2.2.2	TXT	22
2.2.3	Mat	25
2.3	'FCD' module:	28
3	Dynamic EC.....	31
3.1	'Voxel wise' module:	32
3.1.1	Seed(MNI)	32
3.1.2	ROI-Mask.....	36
3.2	'ROI wise' module	38
3.2.1	Nifti Label	38
3.2.2	TXT	40
3.2.3	Mat	42
3.3	GCD	43
4	Result	45
4.1	Dynamic FC	45
4.1.1	Dynamic FC: Voxel wise: Seed(MNI).....	45
4.1.2	Dynamic FC: Voxel wise: ROI-mask	47
4.1.3	Dynamic FC: ROI wise: Nifti Label	48
4.1.4	Dynamic FC: ROI wise: TXT	51
4.1.5	Dynamic FC: ROI wise: MAT	52
4.1.6	Dynamic FC: FCD	53
4.2	Dynamic EC	57
4.2.1	Dynamic EC: Voxel wise: Seed(MNI).....	57
4.2.2	Dynamic EC: Voxel wise: ROI-mask	59
4.2.3	Dynamic EC: ROI wise: Nifti Label	60
4.2.4	Dynamic EC: ROI wise: TXT	62
4.2.5	Dynamic EC: ROI wise: MAT	63
4.2.6	Dynamic EC: GCD	64

1 Set Up

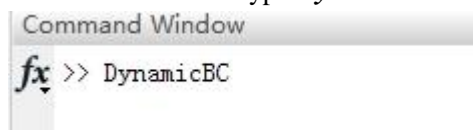
Download the software from www.restfmri.net/, unzip and add path in Matlab.



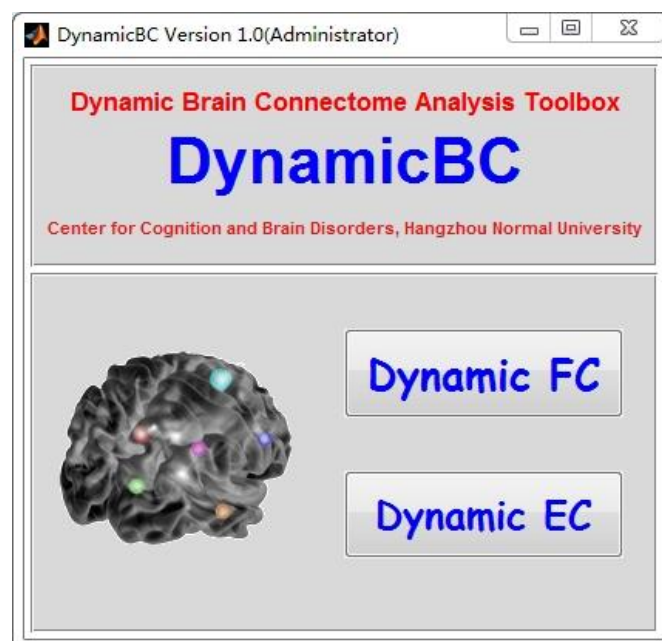
Matlab: '**File**' -> '**Set Path**' -> '**Add folder**' -> select the folder '**DynamicBC**' -> '**save**' -> '**close**'
Then the DynamicBC toolbox has been set up.

Open the toolbox

Command Window: type **DynamicBC** and Enter



Then the Main Window of the Toolbox will appear:



The Main Window of Dynamic Toolbox

There are two buttons on the main window: '**Dynamic FC**' & '**Dynamic EC**'. These two buttons are linked to the different connectivity module of the toolbox, which '**Dynamic FC**' is for the

dynamic functional connectivity (FC) analysis, while '*Dynamic EC*' is for the dynamic effective connectivity (EC) (Granger Causality analysis used for computing EC in this toolbox).

2 Dynamic FC

Click the button '*Dynamic FC*', and the window for Dynamic FC module will appear.

The screenshot shows a 'Parameter Setup' window for the Dynamic FC module. The window is titled 'Configurations (FC)' and contains several sections:

- Set ROI:** Includes radio buttons for 'Voxel wise' (selected), 'ROI wise', and 'FCD'. Below these are input fields for 'x:', 'y:', 'z:', and 'radius:'. The 'Seed(MNI)' option is also visible.
- TV mode:** Includes radio buttons for 'Sliding-window' and 'FLS' (selected).
- Mask:** Includes radio buttons for 'Default mask' and 'User-Defined Mask' (selected).
- FLS Parameter:** Includes radio buttons for 'Default' and 'Fixed' (selected) with a value of 100.
- Mask:** A text field showing 'not selected' with a dropdown arrow.
- Data Directory:** A text field showing 'not selected' with a dropdown arrow.
- Prefix(Output):** A text field showing 'TV'.
- Dynamic FC:** A dropdown menu showing 'Dynamic FC'.
- Parallel Workers #:** A text field showing '0'.
- Out Directory:** A text field showing 'not selected' with a dropdown arrow.
- Buttons:** 'Reset' and 'RUN' buttons.

The window for the Dynamic FC module

This window is for the parameter setup of the Dynamic FC module.

There are three modules of the Dynamic FC: '*Voxel wise*', '*ROI wise*' and '*FCD*', and there are two types of the time-varying mode: 'Sliding-window' and 'FLS'. 'FLS' is short for Flexible Least Squares.

2.1 'Voxel wise' module:

The voxel wise (seed-to-voxel) analysis calculated the bivariate FC and/or EC

between seed brain region and every voxel in the whole brain.

2.1.1 Seed(MNI)

Setting: MNI center: 0 -63 39, radius 10 mm, TV mode: FLS, Default mask, FLS
Parameter: Fixed 80

Seed information input: Input the MNI coordinate in the box 'x: = ' 'y: = ' & 'z: = '
Input the Radius of the mask ball in the box 'radius: = '

Here we set the centre of the ball in the Precuneus: 0 -63 39 (MNI), and the radius 10mm:



The screenshot shows a 'Set ROI' window. On the left, there are three radio buttons: 'Voxel wise' (selected), 'ROI wise', and 'FCD'. On the right, there is a sub-panel with two radio buttons: 'ROI-Mask' and 'Seed(MNI)' (selected). Below these, there are input fields for 'x: = 0', 'y: = -63', 'z: = 39', and 'radius: = 10'.

Set up the Seed centre and the radius.

Time-Varying (TV) mode selection: Since the setup of the 'Sliding-window' and 'FLS' in all three modules of the Dynamic FC is the same. Here we use the 'FLS' method here and we will use the 'Sliding-window' method later:

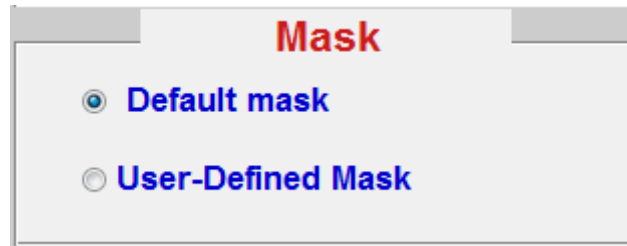


The screenshot shows a 'TV mode' window with two radio buttons: 'Sliding-window' and 'FLS' (selected).

Time-varying mode selection

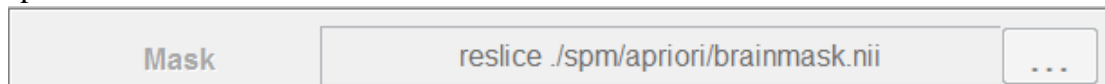
Mask selection: two kinds of mask could be selected in the toolbox, the 'Default mask' & the 'User-Defined Mask'. This selection is suit for the 'Voxel wise' module and the 'FCD' module.

Here we select the 'Default Mask' for the analysis, and later we will use the 'User-Defined Mask'.



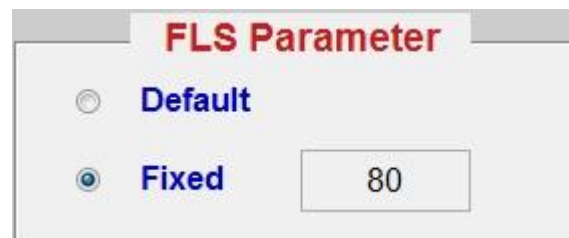
The mask selection window

If we select the '*Default Mask*', the mask selection will be gray. The toolbox will reslice the brainmask in the SPM toolbox (./spm/apriori/brainmask.nii) into the data space.



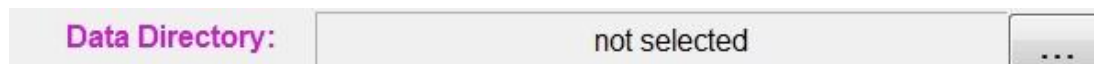
the Mask selection

FLS mode selection: The Default value is 100, while a Fixed value could change with your data or hypothesis. Here we use the Fixed value 80.

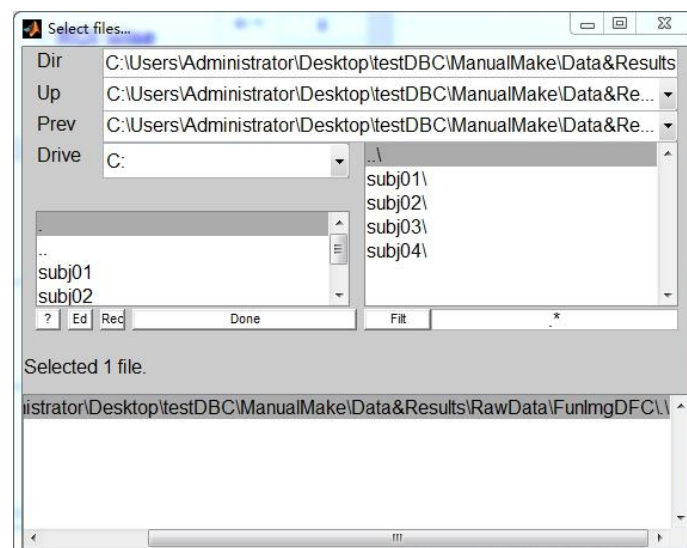


The FLS Parameter selection

Data Selection: Click the button '...' and select the data folder, which contained the subfolders for each subject.



Data selection window 1.



Data selection window 2.

Output Setup Parameter:

Prefix: the default prefix is '*TV*', and we can change it. Here we use the default value

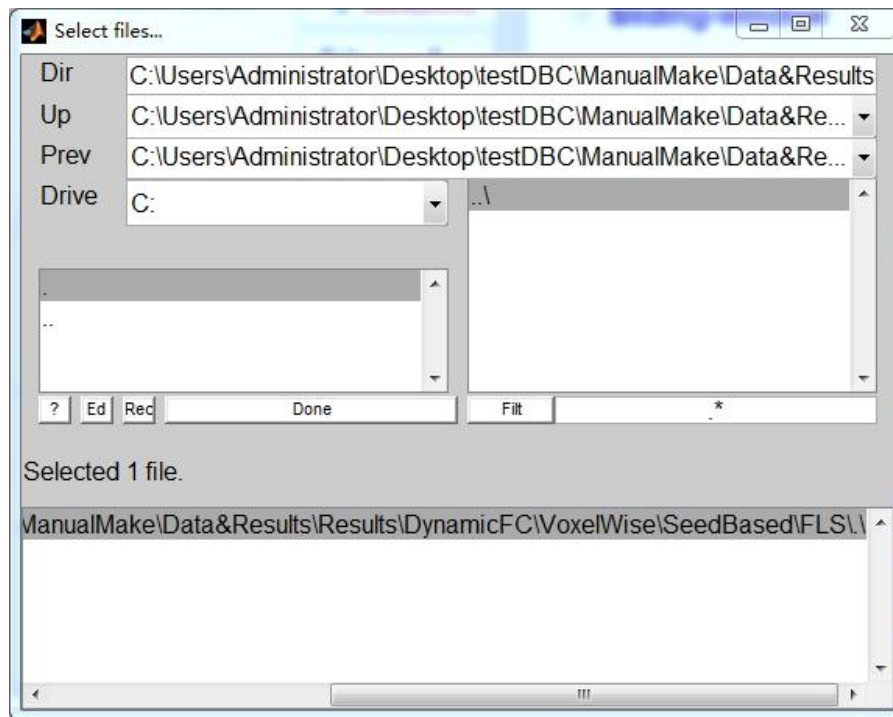
of the setting up, and later we will change it.



Output Directory selection: click the '...' and select the output directory,

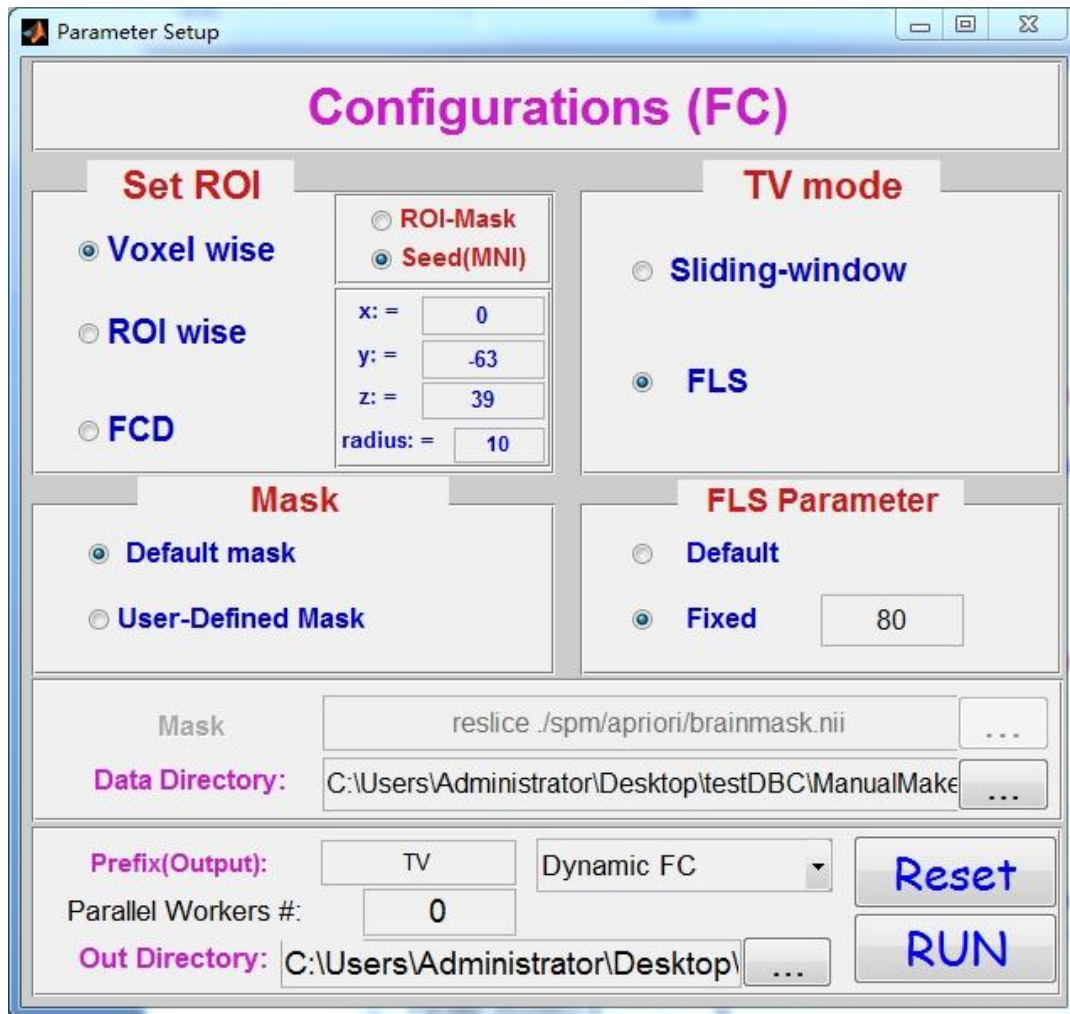


Output directory selection window 1



Output directory selection window 2

After all parameter selection, the window for the Dynamic FC module has been changed.



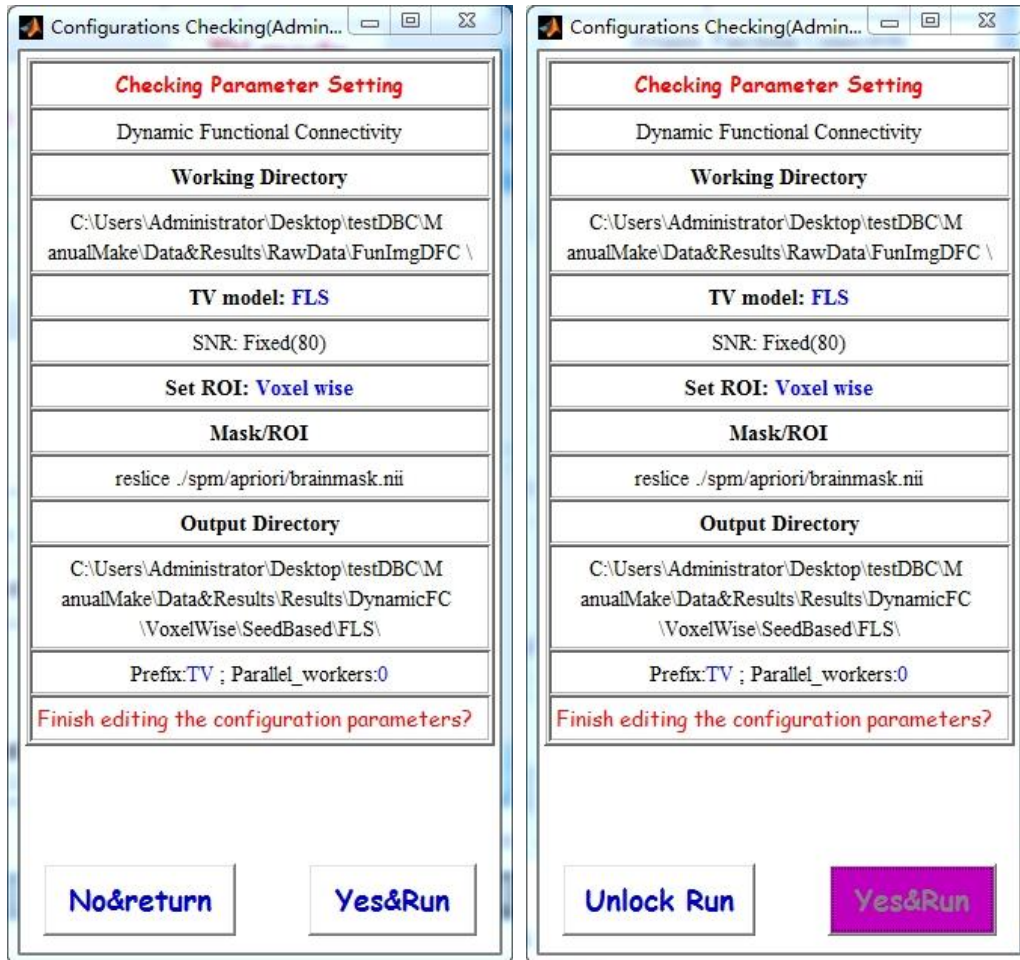
The changed window for the Dynamic FC module

Then:

Click '**RUN**' and we will get the third window for the parameter check and run.

Click '**Reset**', the selected parameter will disappear and return the default setting.

Click '**RUN**':



The parameter check&run window.

The Running state

The parameter check window will show some setting parameter before.

After checking, if there are some mistake, click '**No&return**', and return to reset the parameter. If it is correct, then click '**Yes&Run**', and the toolbox will compute the dynamic FC.

The running state: when running, the parameter check window will lock the '**Yes&Run**' button and the command window will appear the current state of the toolbox:

```
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Generate Human brain mask from SPM default mask...
Brain mask: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\Results\DynamicFC\VoxelWise\SeedBased\FLS\brain_ma
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 104388 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
```

The command window running state 1.

```

Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Generate Human brain mask from SPM default mask...
Brain mask: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\Results\DynamicFC\VoxelWise\SeedBased\FLS\brain_m
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 104388 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02

```

The command window running state 2

```

Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Generate Human brain mask from SPM default mask...
Brain mask: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\Results\DynamicFC\VoxelWise\SeedBased\FLS\brain_m
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 104388 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
====Finish ALL!^_^====

```

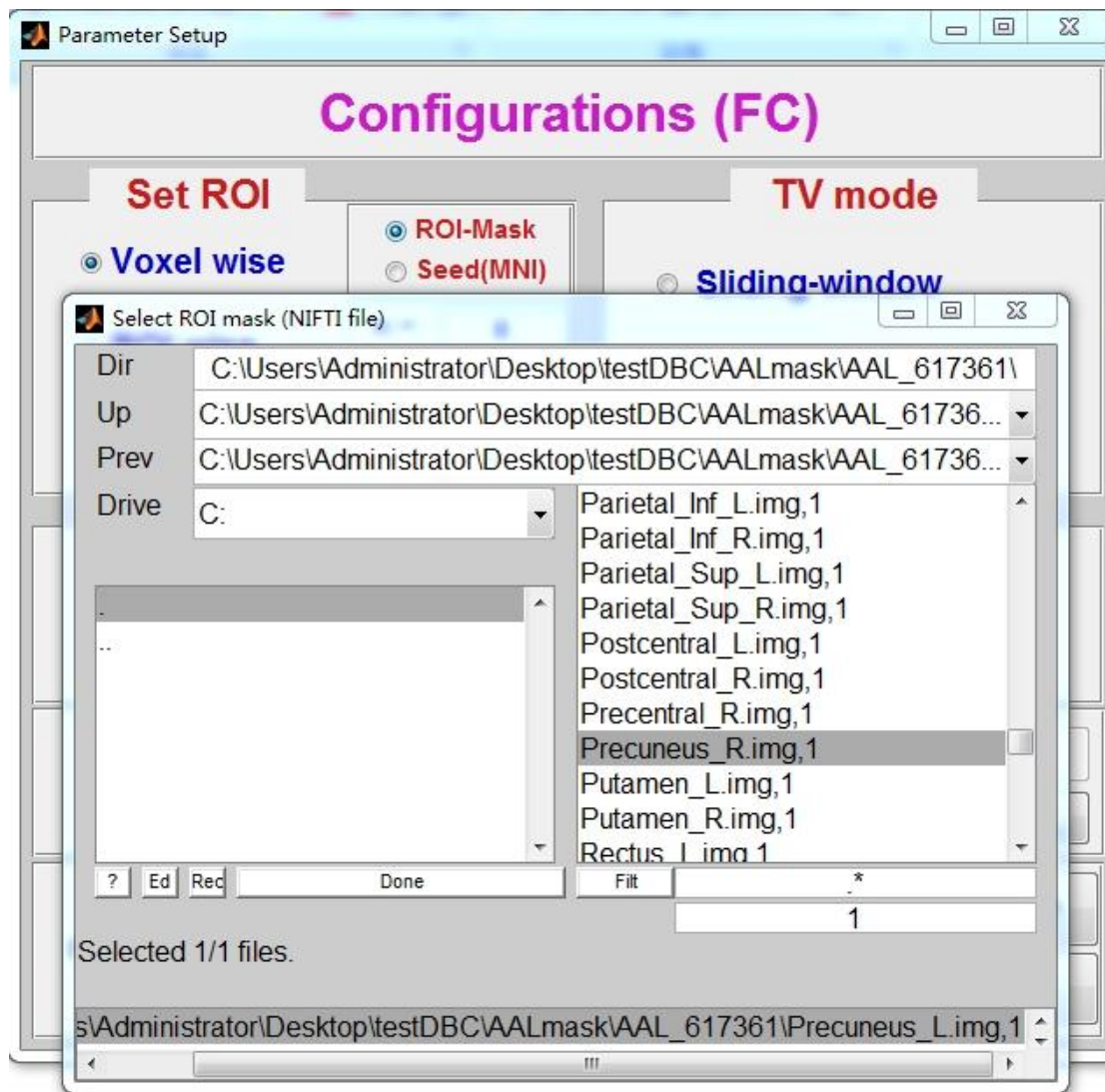
The Finish state in the command window

When the computation finished, the parameter check&run window will disappear, and the command window will print '====**Finish ALL!**^_^===='.

2.1.2 ROI-Mask

Setting: ROI: Precuneus_L, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: roi_TV

Select the '**ROI-Mask**' module, and the ROI selection window will appear. Here we select the Precuneus_L from AAL template. *Note: the information of the ROI will be not shown in the parameter check&run window.*



Selection of the ROI-Mask

Time-Varying (TV) mode selection: here we select the 'sliding-window' mode for the current analysis. The '**Window Size**' is the length of time window. Here we use 50 time points. '**Overlap**' means the how much time points were overlapped between the one window and the next. Here we use the 0.6, which means that if the first start time point is 1, the second window starts from 21 ($\text{floor}(1+(1-0.6)*50)$).

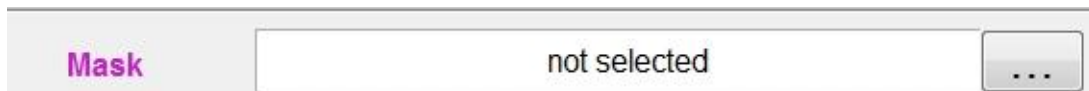


The parameter for Sliding-window

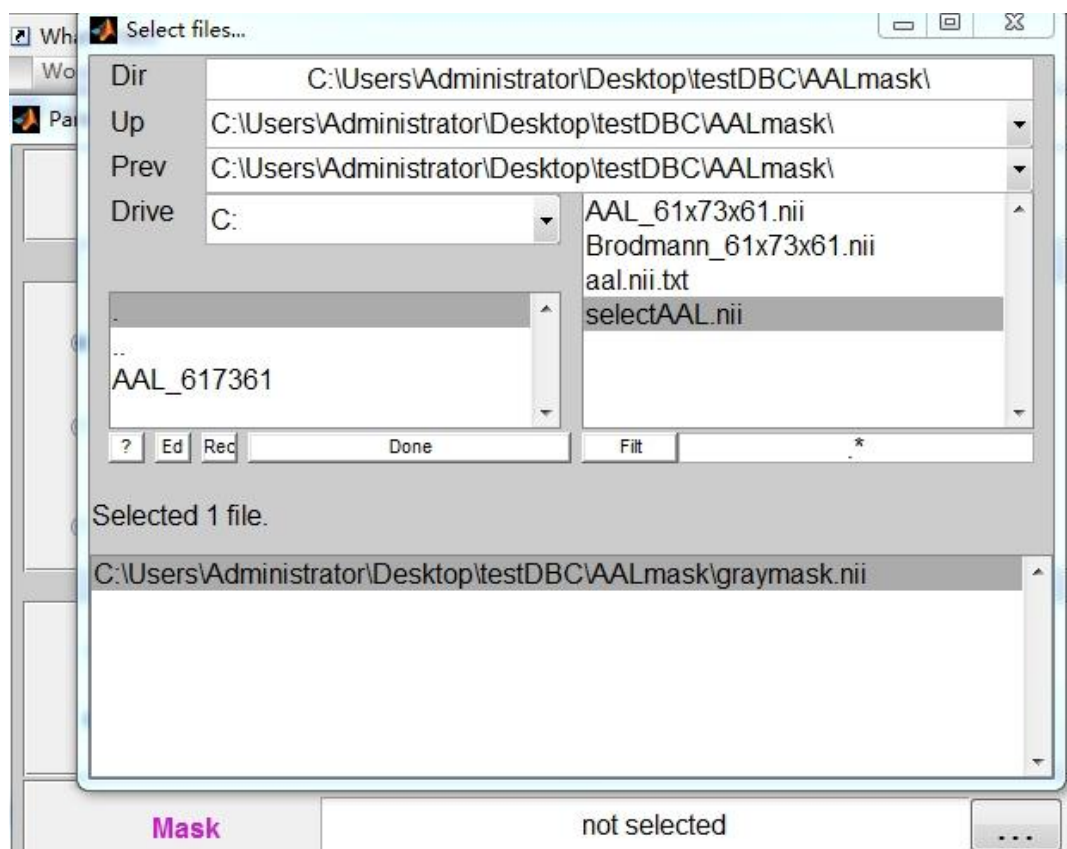
Mask selection: here we select the '*User-defined Mask*', then click the button '...'. Here we use the preestablished mask.



Mask selection window 1



Mask selection window 2



Mask selection window 3

Time Alignment: '*Ahead*' & '*Middle*'.

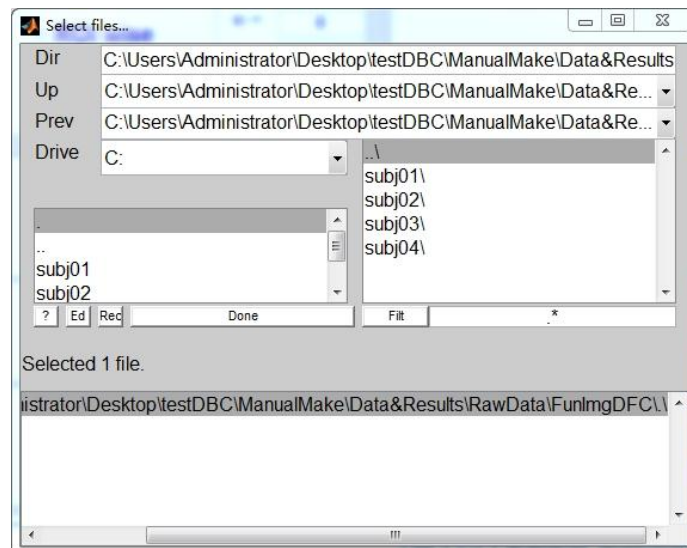


time alignment selection window

Data Selection: Click the button '...' and select the data folder, which contained the subfolders for subjects.

Data Directory:	not selected	...
------------------------	--------------	-----

Data selection window 1.



Data selection window 2.

Output Setup Parameter:

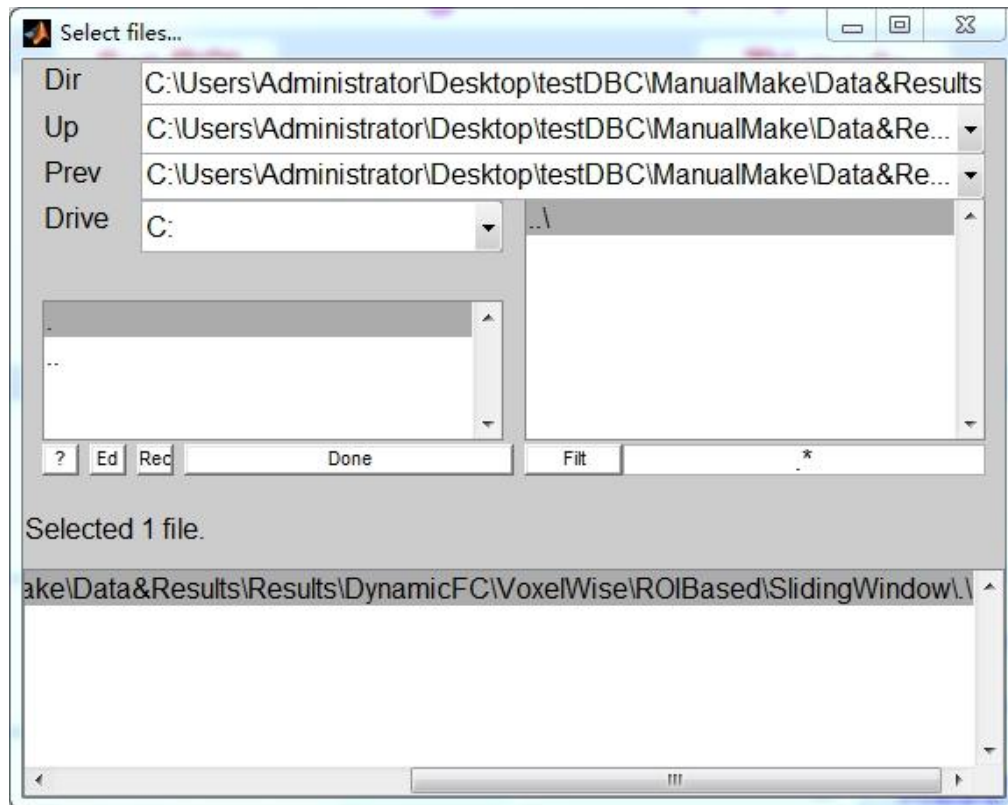
Prefix: the default prefix is 'TV', and we change it to be '*roi_TV*'.

Prefix(Output):	roi_TV
------------------------	--------

Output Directory selection: click the '...' and select the output directory,

Out Directory:	not selected	...
-----------------------	--------------	-----

Output directory selection window 1



Output directory selection window 2

After all parameter selection, the window for the Dynamic FC module has been changed.

Parameter Setup

Configurations (FC)

Set ROI

☒ Voxel wise

☐ ROI wise

☐ FCD

☒ ROI-Mask

☐ Seed(MNI)

x: =

y: =

z: =

radius: =

TV mode

☒ Sliding-window

Window Size:

Overlap: ☐ FLS

Mask

☐ Default mask

☒ User-Defined Mask

Time Alignment

☒ Ahead ☐ Middle

Connectivity p-value

☐ FWE ☒ Fixed

Mask ...

Data Directory: ...

Prefix(Output):

Parallel Workers #:

Out Directory: ...

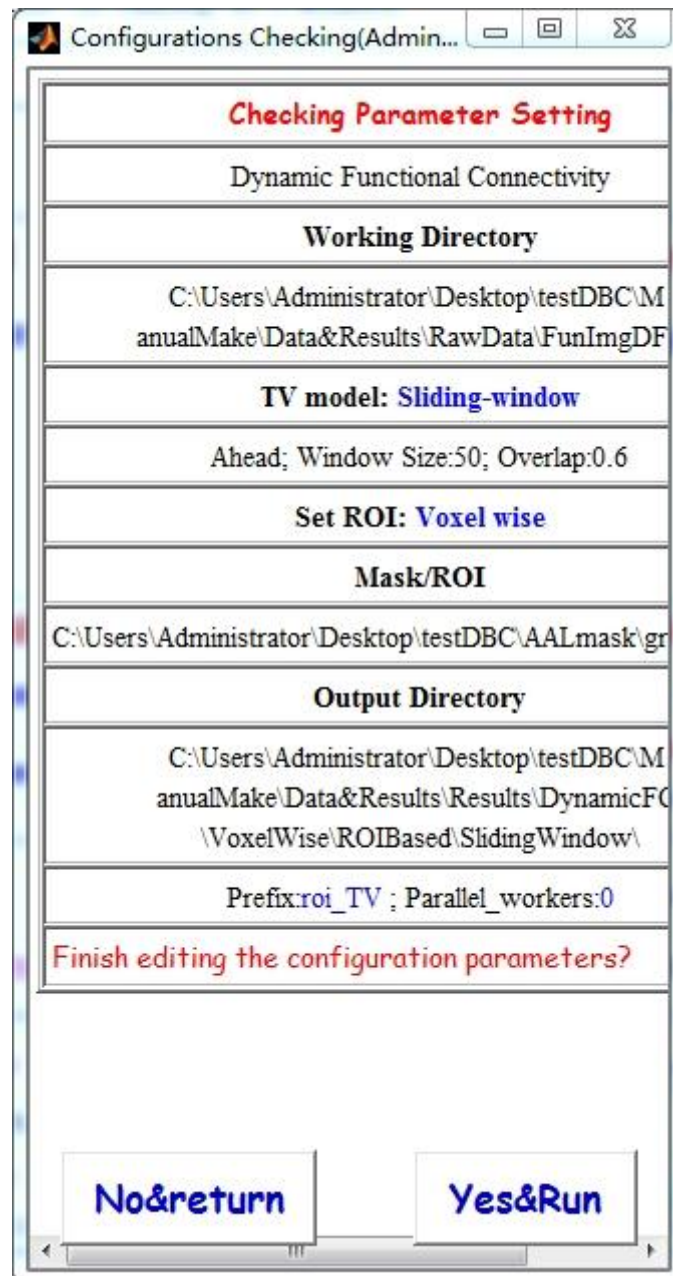
Dynamic FC

Reset

RUN

The changed window for the Dynamic FC module

Then:
Click '**RUN**'



The parameter check&run window
you can pull the right edge to see the whole setting information

Configurations Checking(Administrator)	
Checking Parameter Setting	
Dynamic Functional Connectivity	
Working Directory	
C:\Users\Administrator\Desktop\testDBC\M anualMake\Data&Results\RawData\FunImgDFC \	
TV model: Sliding-window	
Ahead; Window Size:50; Overlap:0.6	
Set ROI: Voxel wise	
Mask/ROI	
C:\Users\Administrator\Desktop\testDBC\AALmask\graymask.nii	
Output Directory	
C:\Users\Administrator\Desktop\testDBC\M anualMake\Data&Results\Results\DynamicFC \VoxelWise\ROIBased\SlidingWindow\	
Prefix:roi_TV ; Parallel_workers:0	
Finish editing the configuration parameters?	
<div>No&return</div> <div>Yes&Run</div>	

The parameter check&run window
After check, Click '**Yes&Run**'

Configurations Checking(Administrator)

Checking Parameter Setting
Dynamic Functional Connectivity
Working Directory
C:\Users\Administrator\Desktop\testDBC\M anualMake\Data&Results\RawData\FunImgDFC \
TV model: Sliding-window
Ahead; Window Size:50; Overlap:0.6
Set ROI: Voxel wise
Mask/ROI
C:\Users\Administrator\Desktop\testDBC\AALmask\graymask.nii
Output Directory
C:\Users\Administrator\Desktop\testDBC\M anualMake\Data&Results\Results\DynamicFC \VoxelWise\ROIBased\SlidingWindow\
Prefix:roi_TV ; Parallel_workers:0
Finish editing the configuration parameters?
<div>Unlock Run</div> <div>Yes&Run</div>

The running state: when running, the parameter check window will lock the 'Yes&Run' button and the command window will appear the current state of the toolbox:

```

Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIfTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
>>

```

The command window running state

```

>> DynamicBC
Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIfTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
====Finish ALL!^_^====

```

The Finish state in the command window

When the computation finished, the parameter check&run window will disappear, and the command window will print '====**Finish ALL!**^_^===='.

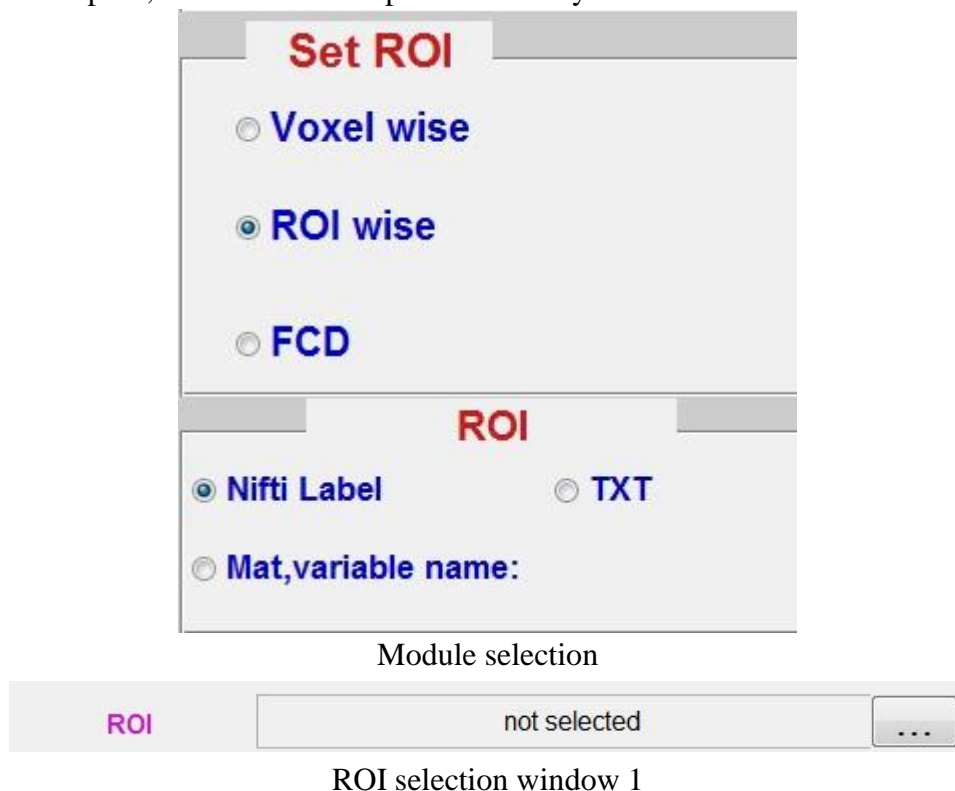
2.2 'ROI wise' module:

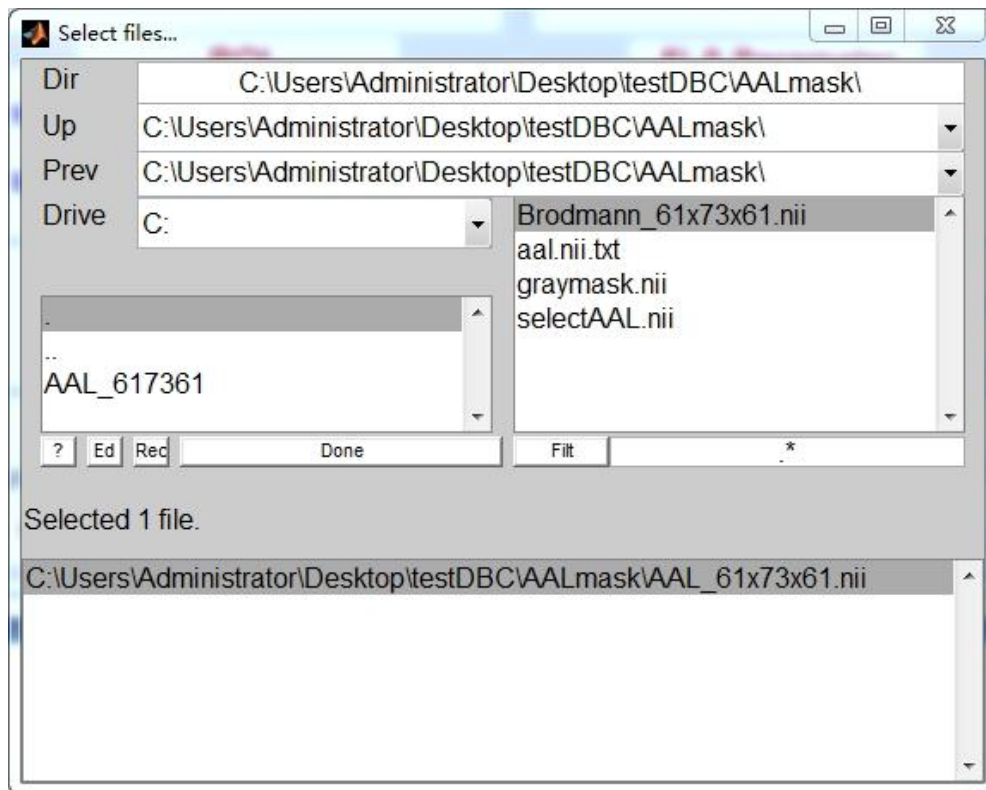
ROI-to-ROI (ROI-wise) analysis computed the bivariate FC/EC between each pair of ROIs, resulting brain connectivity matrix (network) allows users to further perform graph theoretical analysis.

2.2.1 Nifti Label

Setting: ROI template: AAL template, TV mode: FLS, FLS Parameter: Fixed 100, Prefix: TV

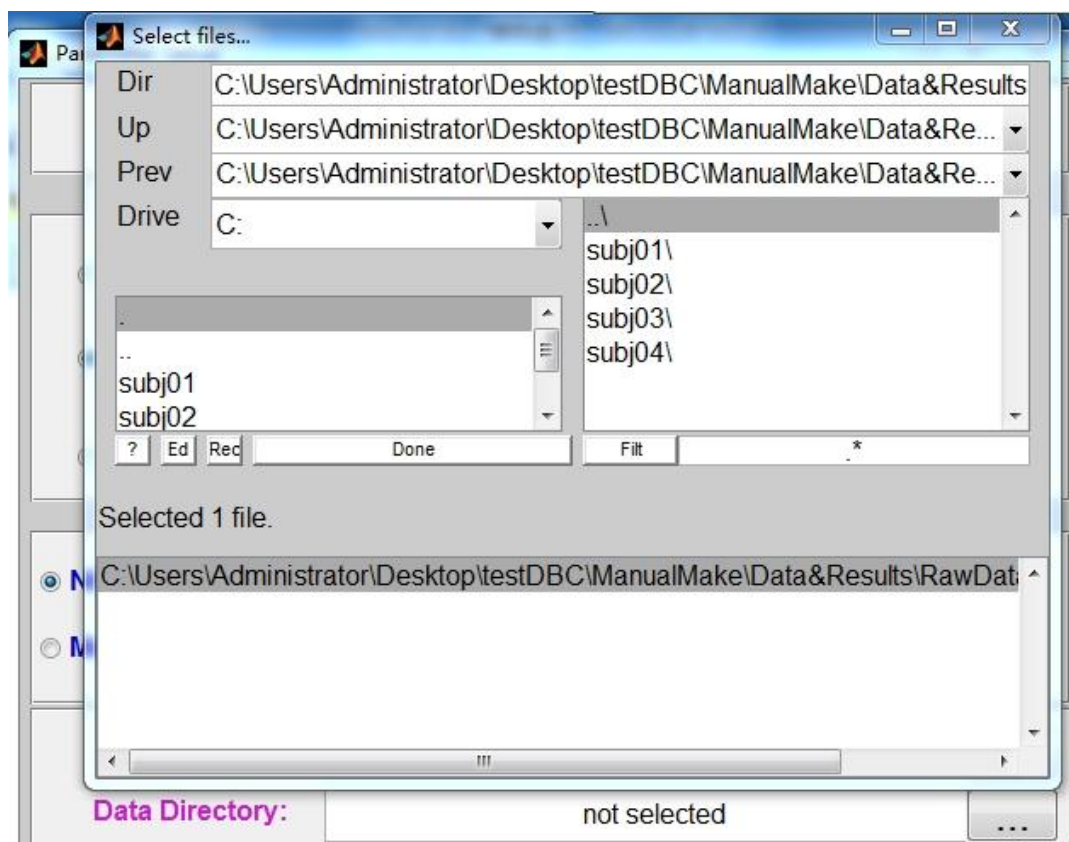
Model selection: select '*Nifti Label*', then click the '...' in the ROI selection window, and select the ROI-template. This ROI-template should be a multi-valued Nifti images in the data space, such as AAL template offered by REST software.





ROI selection window 2

Data Selection: Data selection is like the former selection.



Data selection window

Here we select the '*FLS*' for the TV mode. The setting is the same as the former.

The output setting is like the former setting.
Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```
Dynamic Effective Connectivity---setting
Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Running subject    1 (all    4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Warning: Directory already exists.
> In DynamicBC_run at 250
    In DynamicBC>wgr_run_check at 1105
c>>
```

```
Running subject    4 (all    4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
Warning: Directory already exists.
> In DynamicBC_run at 250
    In DynamicBC>wgr_run_check at 1105
??? Warning: Struct field assignment overwrites a value with class "cell".
See MATLAB 7.0.4 Release Notes, Assigning Nonstructure Variables As Structures Displays Warning for details.
> In DynamicBC_fls_FC at 59
    In DynamicBC_run at 267
    In DynamicBC>wgr_run_check at 1105
====Finish ALL! ^_ ^====
```

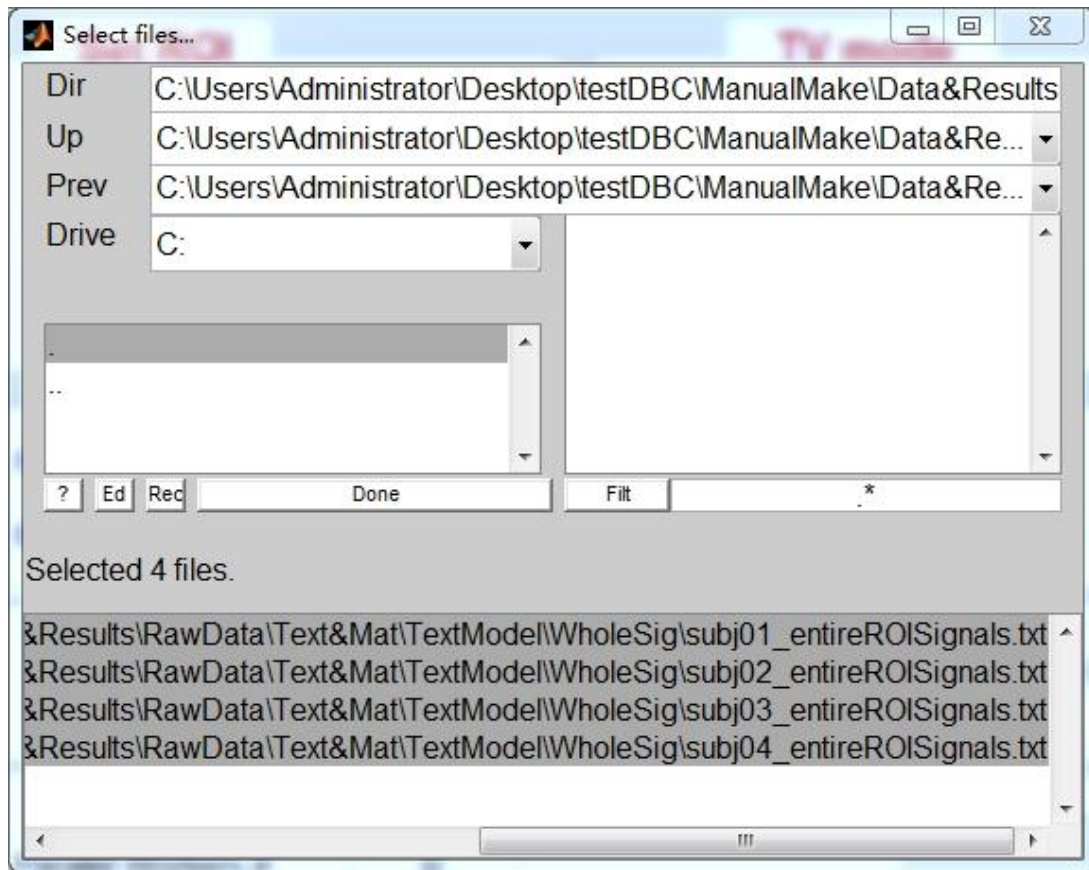
The finish state in the command window

2.2.2 TXT

Setting: 116(ROIs) * 240(timepoints), **TV mode:** sliding-window, **Window Size:** 50, **Overlap:** 0.6, **Prefix:** TV

Model selection: select '**TXT**', then click the '...' in the ROI selection window, then select the TXT, each txt file contains N (roi number) * M (time points) matrix.

Here we need not select the Data Directory.



Here we select the '*sliding-window*' for the TV mode. The setting is the same as the former one.

Parameter Setup

Configurations (FC)

Set ROI

☐ Voxel wise

☒ ROI wise

☐ FCD

TV mode

☒ Sliding-window

Window Size:

Overlap: ☐ FLS

ROI

☐ Nifti Label ☒ TXT

☐ Mat, variable name:

Time Alignment

☒ Ahead ☐ Middle

Connectivity p-value

☐ FWE ☒ Fixed

ROI ...

Data Directory: ...

Prefix(Output):

Parallel Workers #:

Out Directory: ...

Reset

RUN

The changed window for the Dynamic FC module

Then

Click '**RUN**', check, and click '**Yes&Run**'.

Configurations Checking(Administrator)

Checking Parameter Setting

Dynamic Functional Connectivity

Working Directory

select files in above line

TV model: Sliding-window

Ahead; Window Size:50; Overlap:0.6

Set ROI: ROI wise

Mask/ROI

C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\Text&Mat\TextModel\WholeSig\subj01_entireROISignals.txt;
C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\Text&Mat\TextModel\WholeSig\subj02_entireROISignals.txt;
C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\Text&Mat\TextModel\WholeSig\subj03_entireROISignals.txt;
C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\Text&Mat\TextModel\WholeSig\subj04_entireROISignals.txt

Output Directory

C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\Results\DynamicFC\ROIWise\TextModel\SlidingWindow\

Prefix:TV ; Parallel_workers:0

Finish editing the configuration parameters?

No&return Yes&Run

The running state:

```
Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC run at 23
In DynamicBC>wgr_run_check at 1105
Running subject    1 (all    4 subjects)
Running subject    2 (all    4 subjects)
Running subject    3 (all    4 subjects)
Running subject    4 (all    4 subjects)
====Finish ALL! ^_^====
```

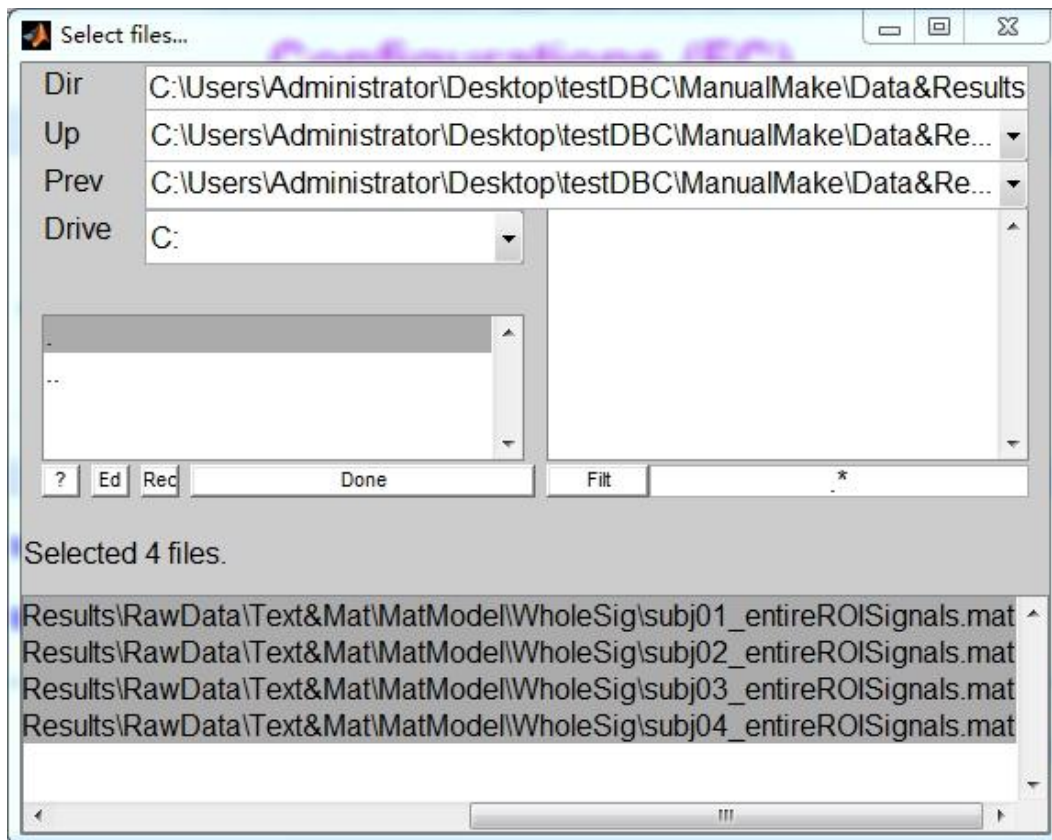
2.2.3 Mat

Setting: 116(ROIs) * 240(timepoints), **TV mode:** FLS, **FLS Parameter:** Fixed 100, **Prefix:** TV

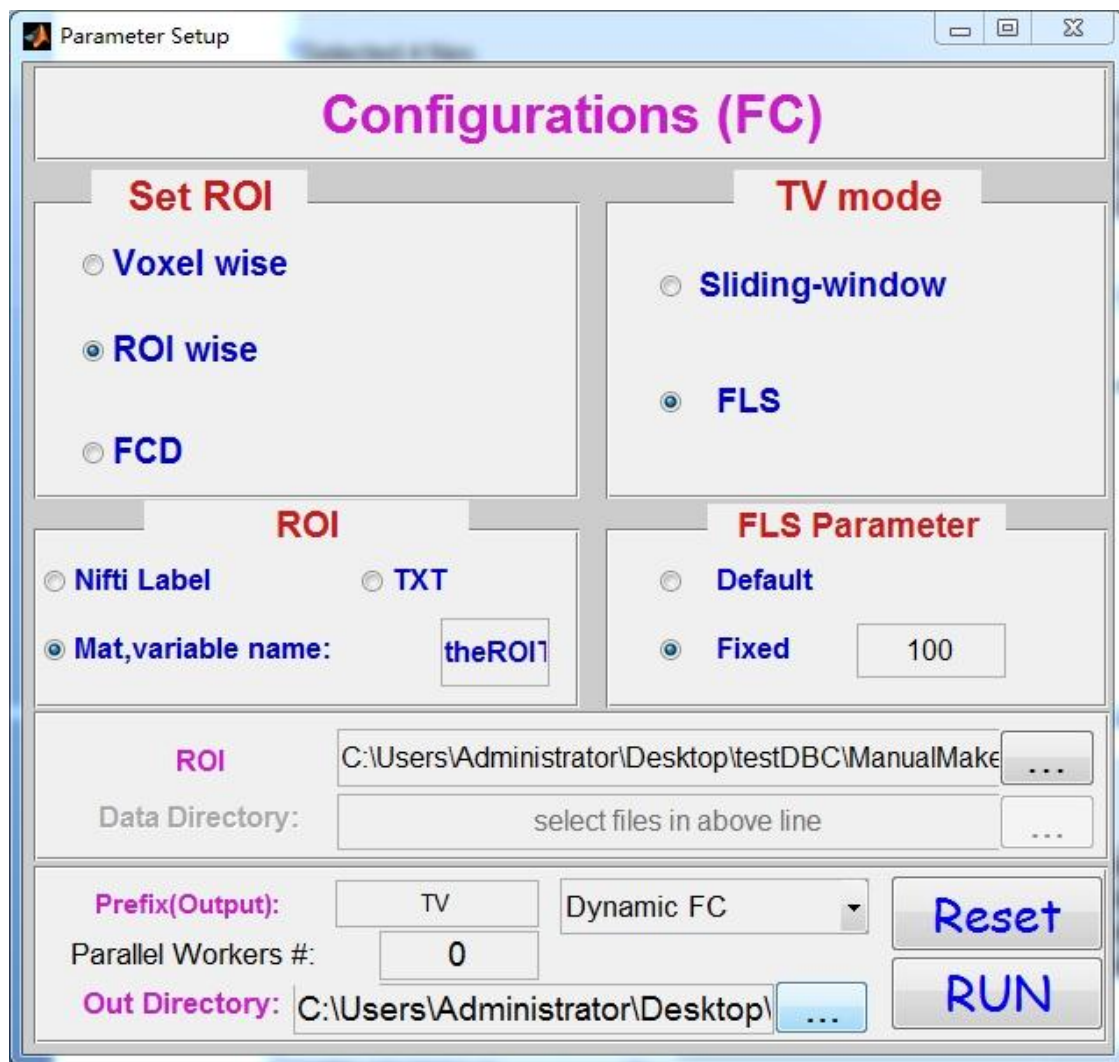
Model selection: select '**Mat**', then input the variable name for the signal saved mat. Here we select the REST generated mat of signal, the name of variable is '**theROITimeCoursesTotal**'

then click the '.' in the ROI selection window, then select the mat, each mat file contains N (roi number) * M (time points) matrix.

Here we need not select the Data Directory.



Here we select the '*FLS*' for the TV mode. The setting is the same as the former one.



The changed window for the Dynamic FC module

Then

Click '**RUN**', check, and click '**Yes&Run**'.

The running state:

```
Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
   In DynamicBC>wgr_run_check at 1105
Running subject    1 (all    4 subjects)
```

```

Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Running subject 1 (all 4 subjects)
??? Warning: Struct field assignment overwrites a value with class "cell".
See MATLAB 7.0.4 Release Notes, Assigning Nonstructure Variables As Structures Displays Warning for details.
> In DynamicBC_fls_FC at 59
  In DynamicBC_run at 330
  In DynamicBC>wgr_run_check at 1105
Running subject 2 (all 4 subjects)
??? Warning: Struct field assignment overwrites a value with class "cell".
See MATLAB 7.0.4 Release Notes, Assigning Nonstructure Variables As Structures Displays Warning for details.
> In DynamicBC_fls_FC at 59
  In DynamicBC_run at 330
  In DynamicBC>wgr_run_check at 1105
Running subject 3 (all 4 subjects)
??? Warning: Struct field assignment overwrites a value with class "cell".
See MATLAB 7.0.4 Release Notes, Assigning Nonstructure Variables As Structures Displays Warning for details.
> In DynamicBC_fls_FC at 59
  In DynamicBC_run at 330
  In DynamicBC>wgr_run_check at 1105
Running subject 4 (all 4 subjects)
??? Warning: Struct field assignment overwrites a value with class "cell".
See MATLAB 7.0.4 Release Notes, Assigning Nonstructure Variables As Structures Displays Warning for details.
> In DynamicBC_fls_FC at 59
  In DynamicBC_run at 330
  In DynamicBC>wgr_run_check at 1105
====Finish ALL!""====

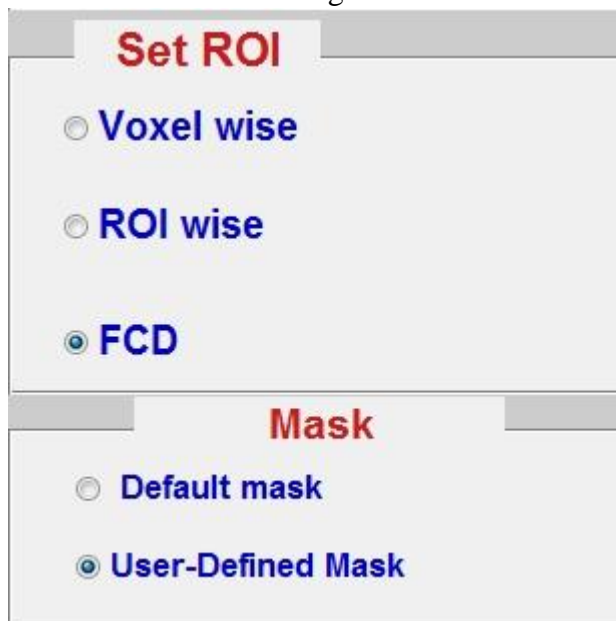
```

2.3 'FCD' module:

Voxel-to-voxel computed the bivariate FC between every pair of voxels without using a priori seed/ROI to mapping whole-brain connectome. And then, the toolbox provides the connectivity degree (functional CD) that counts total number of connections of a given voxel, while the connectivity strength (functional CS) that sums of weights of all the connections of a given voxel.

Setting: Mask: gray mask, TV mode: Sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV, pvalue: fixed 0.001

Here we select the '*User-Defined Mask*' for mask selection, which the mask is the same as the former setting.



The TV mode is '*Sliding-window*', '*Window Size*' is 50, '*Overlap*' is 0.6

The '*Data Directory*' selection is the same as the former selection, select the folder with subfolders which represent the subjects.

New module for FCD

The FCD need to set the threshold for the cut-off of Functional connectivity.

The toolbox have two kinds of p value: Uncorrected P value ('*Fixed*') and FWE corrected P value ('*FWE*'). Select one of these two kinds of Pvalue. Here we use the Fixed $p < 0.001$.



Also we select the '*Sliding-window*' TV mode for the FCD analysis. The FCD using '*FLS*' mode is not suit for the large mask. If the mask contains less than 1500 voxel, then the '*FLS*' mode could be used.

Parameter Setup

Configurations (FC)

Set ROI

☐ Voxel wise

☐ ROI wise

☒ FCD

TV mode

☒ Sliding-window

Window Size:

Overlap: ☐ FLS

Mask

☐ Default mask

☒ User-Defined Mask

Time Alignment

☒ Ahead ☐ Middle

Connectivity p-value

☐ FWE ☒ Fixed

Mask

Data Directory:

...

...

Prefix(Output):

Parallel Workers #:

Out Directory: ...

Reset

RUN

Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```
Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIfTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject    1 (all    4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
```



```

Dynamic Functional Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
====Finish ALL!^'====

```

3 Dynamic EC

Click the button '*Dynamic EC*', and the window for Dynamic EC module will appear.

Parameter Setup

Configurations (EC)

Set ROI

☒ **Voxel wise**

☐ **ROI wise**

☐ **GCD**

☐ **ROI-Mask**

☒ **Seed(MNI)**

x: =

y: =

z: =

radius: =

TV mode

☒ **Sliding-window**

Window Size:

Overlap: (GC)Order:

Mask

☐ **Default mask**

☒ **User-Defined Mask**

Time Alignment

☒ **Ahead** ☐ **Middle**

Connectivity p-value

☐ **FWE** ☒ **Fixed**

Mask ...

Data Directory: ...

Prefix(Output): **Dynamic EC** ▼

Parallel Workers #:

Out Directory: ...

Reset

RUN

The window for the Dynamic EC module

This window is for the parameter setup of the Dynamic EC module.

There are three modules of the Dynamic EC: '*Voxel wise*', '*ROI wise*' and '*GCD*'. Unlike the Dynamic FC, there is only one kind of the TV mode: '*Sliding-window*' for the Dynamic analysis.

3.1 'Voxel wise' module:

3.1.1 Seed(MNI)

Setting: MNI center: 0 -63 39, radius 10 mm, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: TV

Seed information input: Input the MNI coordinate in the box 'x: = ' 'y: = ' & 'z: = '

Input the Radius of the mask ball in the box '*radius*: = '

Here we set the centre of the ball in the Precuneus: **0 -63 39 (MNI)**, and the radius **10mm**, like the FC module.



Set ROI	
<input checked="" type="radio"/> Voxel wise	<input type="radio"/> ROI-Mask
<input type="radio"/> ROI wise	<input checked="" type="radio"/> Seed(MNI)
<input type="radio"/> GCD	
x: =	0
y: =	-63
z: =	39
radius: =	10

Set up the Seed centre and the radius.

Since the Dynamic EC module only have the 'Sliding-window' TV mode, the later TV mode setting will be the same and will not be discussed. Here we set the value like the Dynamic FC module: '*Window Size*': 50, '*Overlap*': 0.6. '*GC order*': 1.

Note: For Resting-State fMRI Data, we advise that the GC order to be 1, while the other kinds of data, such as EEG/MEG data, the order always should be changed.

Mask selection: the selection of Mask in '*Dynamic EC*' module is the same as the '*Dynamic FC*'. We will not discuss the selection of the mask. In the whole test of '*Dynamic EC*', we use the '*User-defined Mask*' for the '*Voxel wise*' and '*GCD*'. The mask in the '*Voxel wise*' is preestablished mask: graymask.nii, and the mask in the '*GCD*' is Cingulum_Ant_R region from AAL template for the consider of time consuming and computer memory.

Also, the Data selection is the same as the former '*Dynamic FC*' module.

Therefore, we will give the final parameter selection window in later module demonstration.

Parameter Setup

Configurations (EC)

Set ROI

☒ **Voxel wise**

☐ **ROI wise**

☐ **GCD**

☐ ROI-Mask

☒ **Seed(MNI)**

x: =

y: =

z: =

radius: =

TV mode

☒ **Sliding-window**

Window Size:

Overlap: (GC)Order:

Mask

☐ Default mask

☒ **User-Defined Mask**

Time Alignment

☒ **Ahead** ☐ Middle

Connectivity p-value

☐ FWE ☒ Fixed

Mask ...

Data Directory: ...

Prefix(Output):

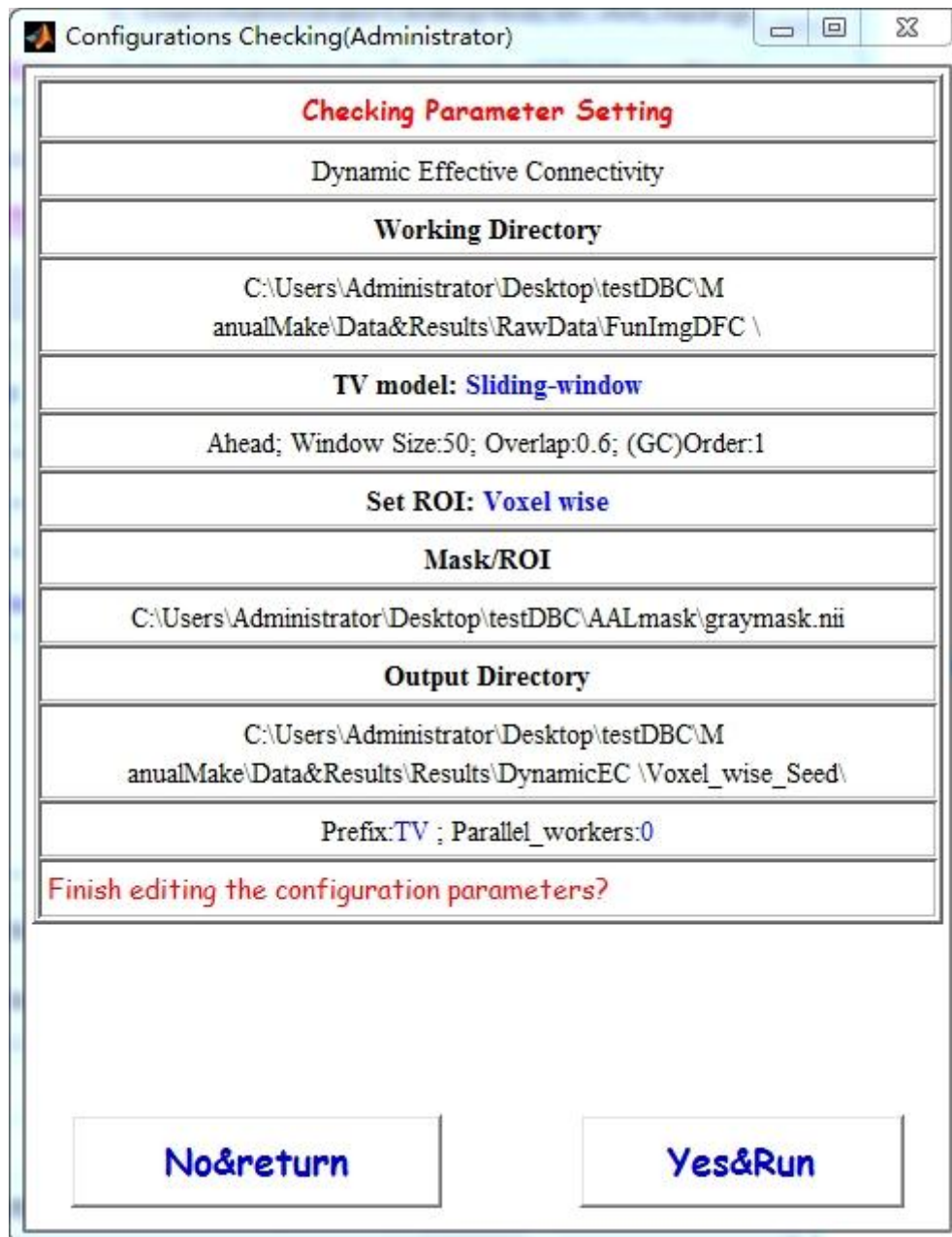
Parallel Workers #:

Out Directory: ...

Reset

RUN

The changed window for the Dynamic EC module (Seed(MNI))



Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```
Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
```

```

Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
   In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
====Finish ALL! ^ _====

```

3.1.2 ROI-Mask

Setting: ROI: Precuneus_L, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: TV

Like the '**ROI-Mask**' in the '**Dynamic FC**' module, select the '**ROI-Mask**' and the ROI selection window will appear. Also, we select the Precuneus_L from AAL template.

Parameter Setup

Configurations (EC)

Set ROI

☒ Voxel wise

☐ ROI wise

☐ GCD

☒ ROI-Mask

☐ Seed(MNI)

x: =

y: =

z: =

radius: =

TV mode

☒ Sliding-window

Window Size:

Overlap: (GC)Order:

Mask

☐ Default mask

☒ User-Defined Mask

Time Alignment

☒ Ahead ☐ Middle

Connectivity p-value

☐ FWE ☒ Fixed

Mask: ...

Data Directory: ...

Prefix(Output): Dynamic EC

Parallel Workers #:

Out Directory: ...

Reset

RUN

The changed window for the Dynamic EC module (ROI)

Then Click 'RUN', check, and click 'Yes&Run'

The running state:

```
Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 54837 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
====Finish ALL!^_^====
```

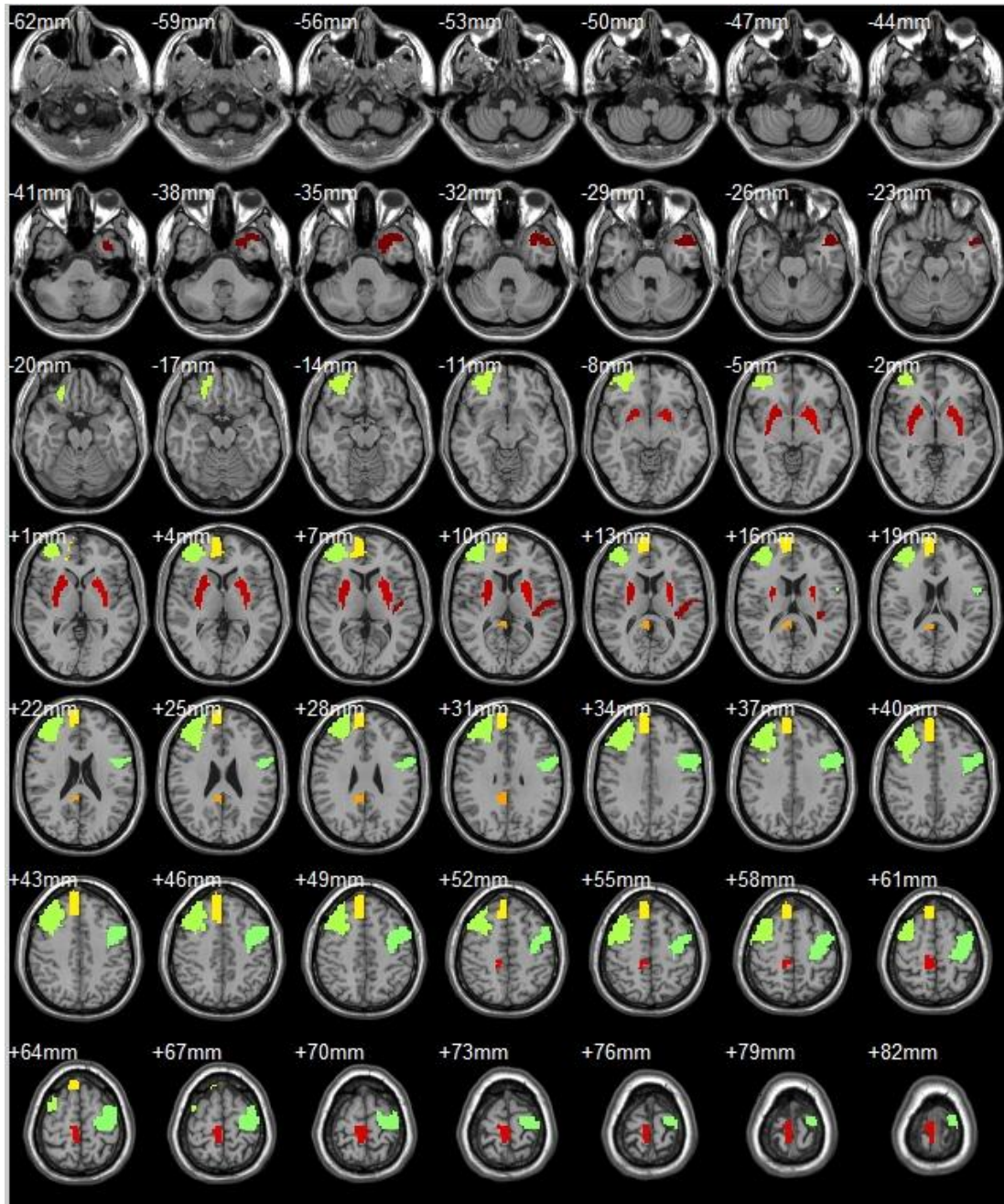

3.2 'ROI wise' module

3.2.1 Nifti Label

Setting: template: random select 10 AAL regions, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: TV

Like the 'Nifti Label' in the 'Dynamic FC' module, we randomly select 10 AAL Regions into a multi-value template. Here we use this template for analysis.

The other settings are the same as the former setting.



The random select AAL regions combined template.

The changed window for the Dynamic EC module (ROI wise Nifti label)

Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```
Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
```

```

Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunIngDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunIngDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunIngDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunIngDFC\subj04
====Finish ALL!^_^====

```

3.2.2 TXT

Setting: 116(ROIs) * 240(timepoints), TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV

The settings are similar to the '*TXT*' in the '*Dynamic FC*' module, each TXT file contains N (roi number) * M (time points) matrix.

The changed window for the Dynamic EC module (ROI wise TXT)

Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```
Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Running subject    1 (all    4 subjects)
Running subject    2 (all    4 subjects)
Running subject    3 (all    4 subjects)
Running subject    4 (all    4 subjects)
====Finish ALL!^_^====
```

3.2.3 Mat

Setting: 116(ROIs) * 240(timepoints), TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV

The settings are similar to the '**Mat**' in the '**Dynamic FC**' module, each mat file contains N (roi number) * M (time points) matrix. Like the former setting, we need to point out the matrix variable name. Here we also used the REST generated mat file. The name of variable is '**theROITimeCoursesTotal**'.

The other settings are similar to former one.

Parameter Setup

Configurations (EC)

Set ROI

- ☐ Voxel wise
- ☒ ROI wise
- ☐ GCD

TV mode

- ☒ Sliding-window
- Window Size:
- Overlap: (GC)Order:

ROI

- ☐ Nifti Label
- ☐ TXT
- ☒ Mat, variable name:

Time Alignment

- ☒ Ahead ☐ Middle
- Connectivity p-value
 - ☐ FWE ☒ Fixed

ROI ...

Data Directory: ...

Prefix(Output): Dynamic EC

Parallel Workers #:

Out Directory: ...

The changed window for the Dynamic EC module (ROI wise Mat)

Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```

Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Running subject    1 (all    4 subjects)
Running subject    2 (all    4 subjects)
Running subject    3 (all    4 subjects)
Running subject    4 (all    4 subjects)
====Finish ALL!^_^====

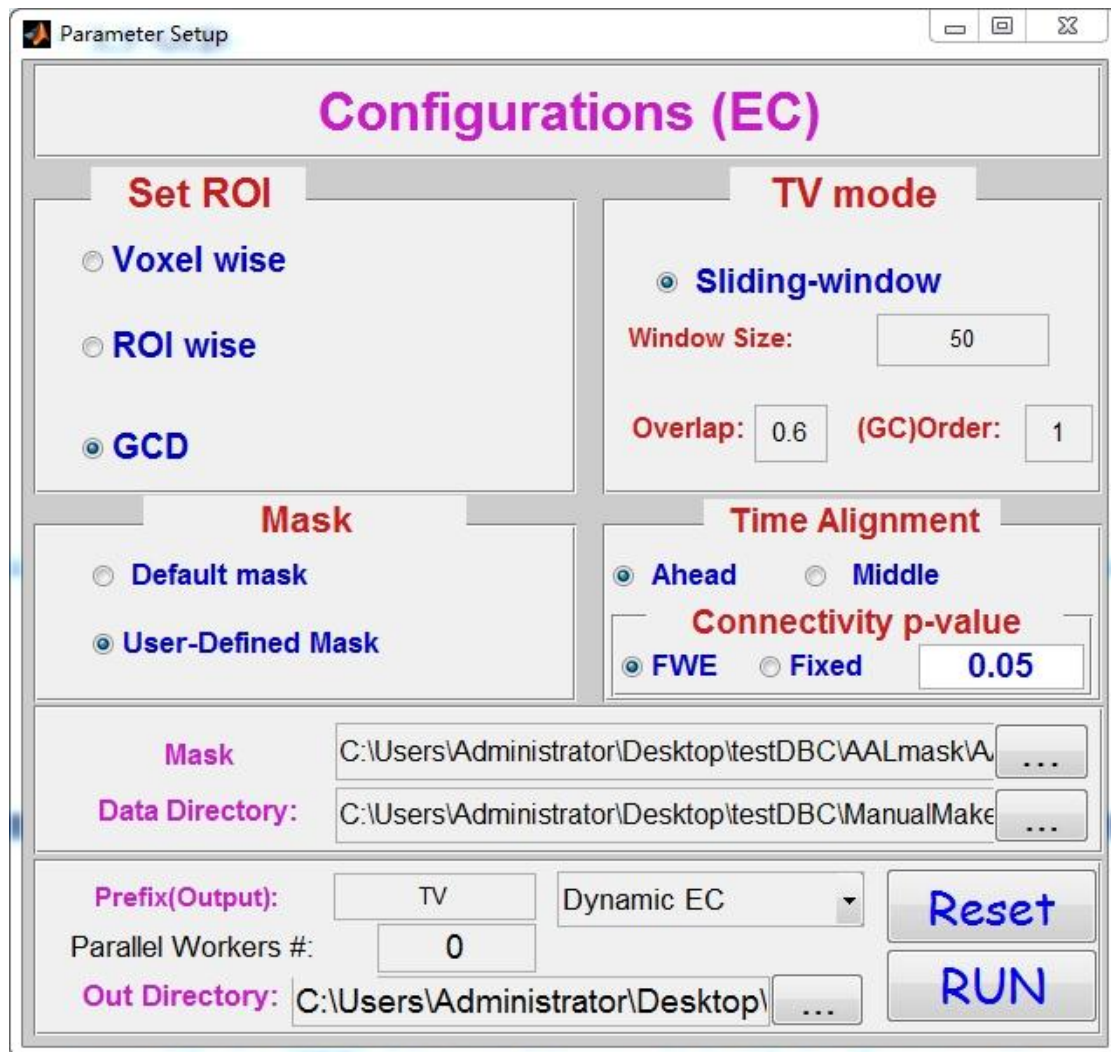
```

3.3 GCD

Voxel-to-voxel computed the bivariate Granger causality between every pair of voxels to mapping whole-brain effective connectome. The toolbox provides the Granger causality density that counts total number of incoming and outgoing connectivity of a given voxel.

Setting: Mask: Cingulum_Ant_L from AAL template, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV, pvalue: $p < 0.05$ FWE corrected

As described before, here we select the 'Cingulum_Ant_L' in AAL template for the '***User-Defined Mask***' selection. The other setting is similar to the '***FCD***' in '***Dynamic FC***' module. The difference between '***GCD***' and '***FCD***' settings is that we use the '***FWE***' mode for the p value selection. Here we use the FWE corrected $p < 0.05$ ($p < 0.05$ FWE corrected).



The changed window for the Dynamic EC module (ROI wise Mat)

Then Click '**RUN**', check, and click '**Yes&Run**'

The running state:

```
Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
    In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 426 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDBC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
```



```

Dynamic Effective Connectivity---setting
Now DynamicBC is running on 0 workers.
Running now!
Warning: Directory already exists.
> In DynamicBC_run at 23
  In DynamicBC>wgr_run_check at 1105
Default mode: fMRI(reading from NIFTI image), if not? choose "Set ROI/ ROI wise"
Default value 0/NaN is not in the mask/label!
Default value>0 is inside the mask!
There are 426 voxels inside the mask
Running subject 1 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDEC\ManualMake\Data&Results\RawData\FunImgDFC\subj01
Running subject 2 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDEC\ManualMake\Data&Results\RawData\FunImgDFC\subj02
Running subject 3 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDEC\ManualMake\Data&Results\RawData\FunImgDFC\subj03
Running subject 4 (all 4 subjects)
Only one file in: C:\Users\Administrator\Desktop\testDEC\ManualMake\Data&Results\RawData\FunImgDFC\subj04
====Finish ALL!^_^====

```

4 Result

4.1 Dynamic FC

4.1.1 Dynamic FC: Voxel wise: Seed(MNI)

Setting: MNI center: 0 -63 39, radius 10 mm, TV mode: FLS, Default mask, FLS
Parameter: Fixed 80, Prefix: TV

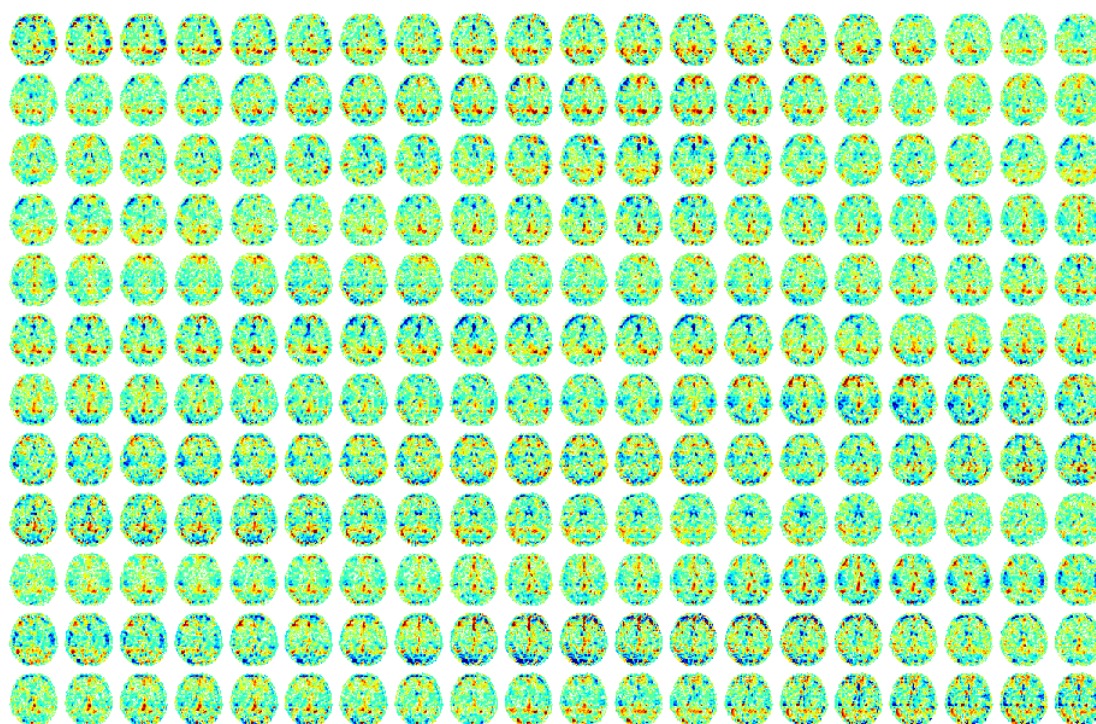
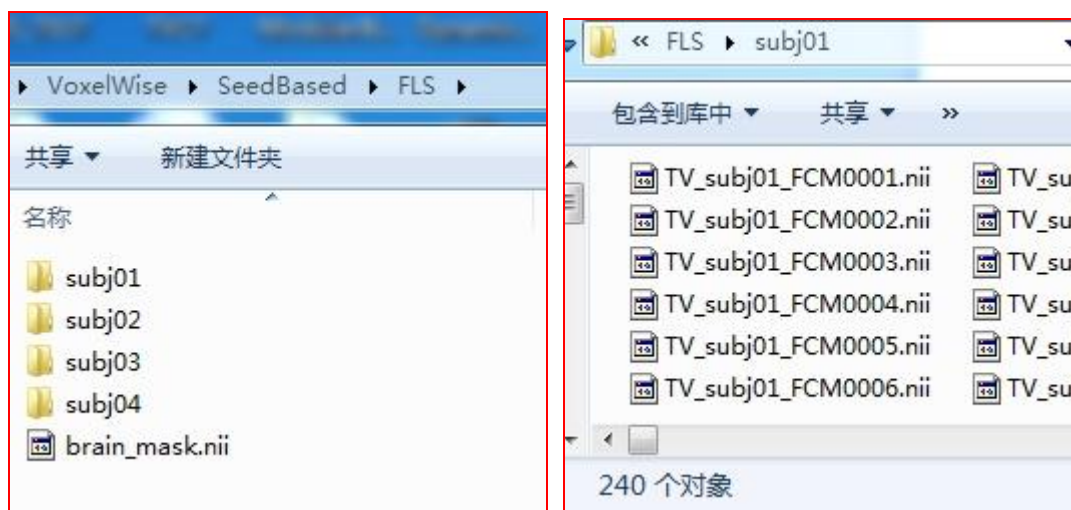
Result Folder:

The result folder contains n+1 items, n subfolders and one resliced mask file. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders and 1 mask file.

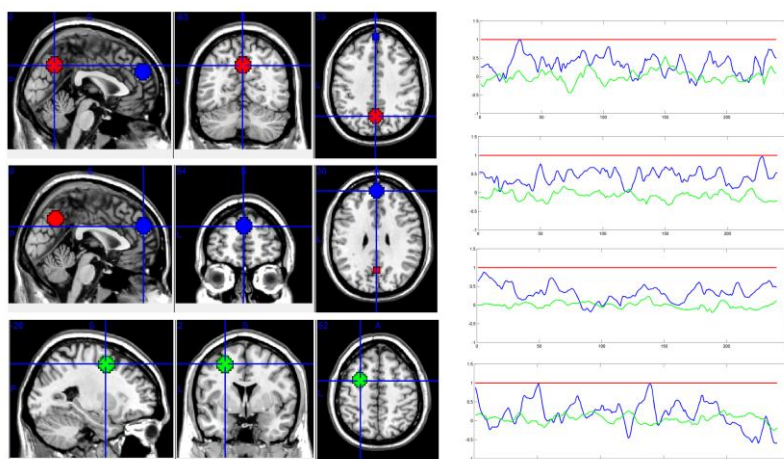
Each subject contains N Nifti_1 files. In our demonstration, the signal length is 240. Then in our result subfolder, it contains 240 items.

The rule of the output filename: **<Prefix>_<subject name>_FCM####.nii.**

Therefore, the output filename of our demonstration is like this:
 TV_subj0#_FCM0001.nii ~ TV_subj0#_FCM0240.nii.



ROI: seed(red), DMPFC(blue)&FEF(green)



4.1.2 Dynamic FC: Voxel wise: ROI-mask

Setting: ROI: Precuneus_L, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: roi_TV

Result Folder:

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders.

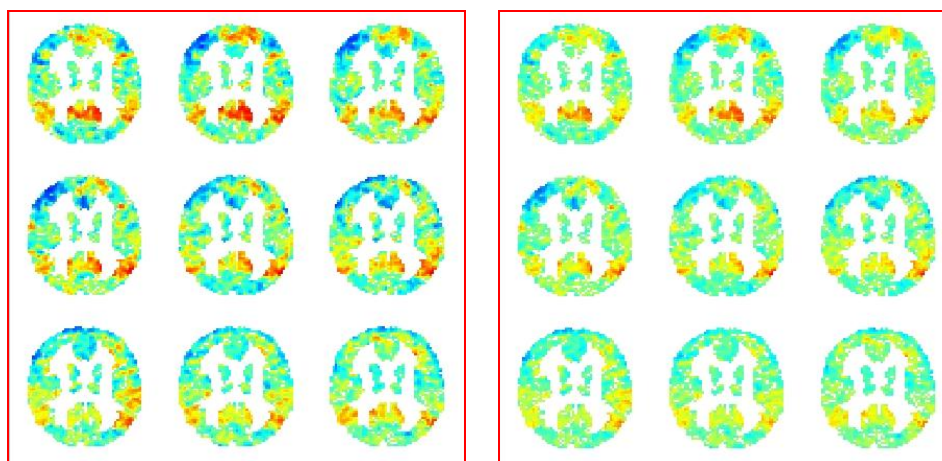
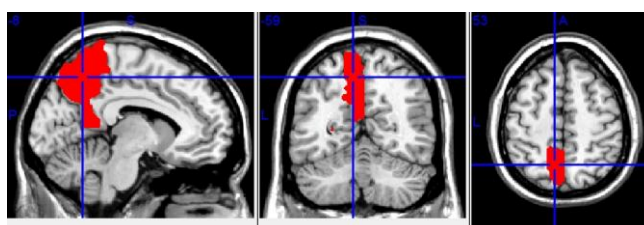
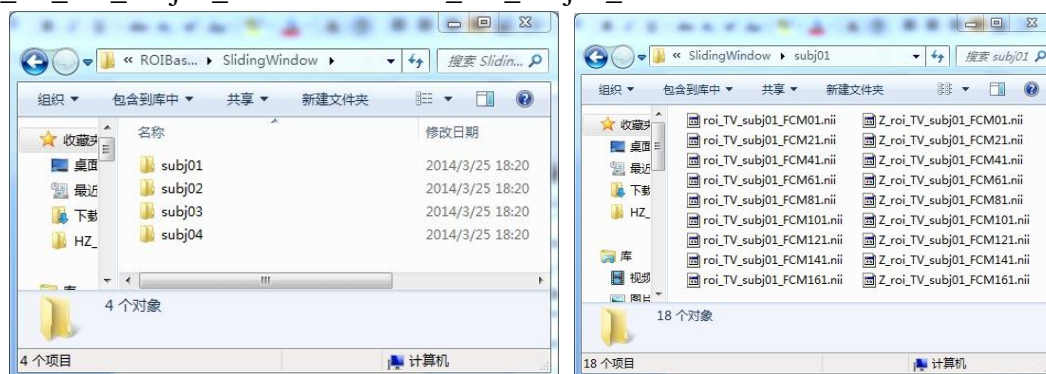
Each subject contains $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap}))$ Rmaps and $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap}))$ Zmaps. In our demonstration, the signal length is 240. Then in our result subfolder, it contains 9 Rmap and 9 Zmap.

The rule of the output filename: **<Prefix>_<subject name>_FCM???.nii** and **Z_<Prefix>_<subject name>_FCM???.nii**

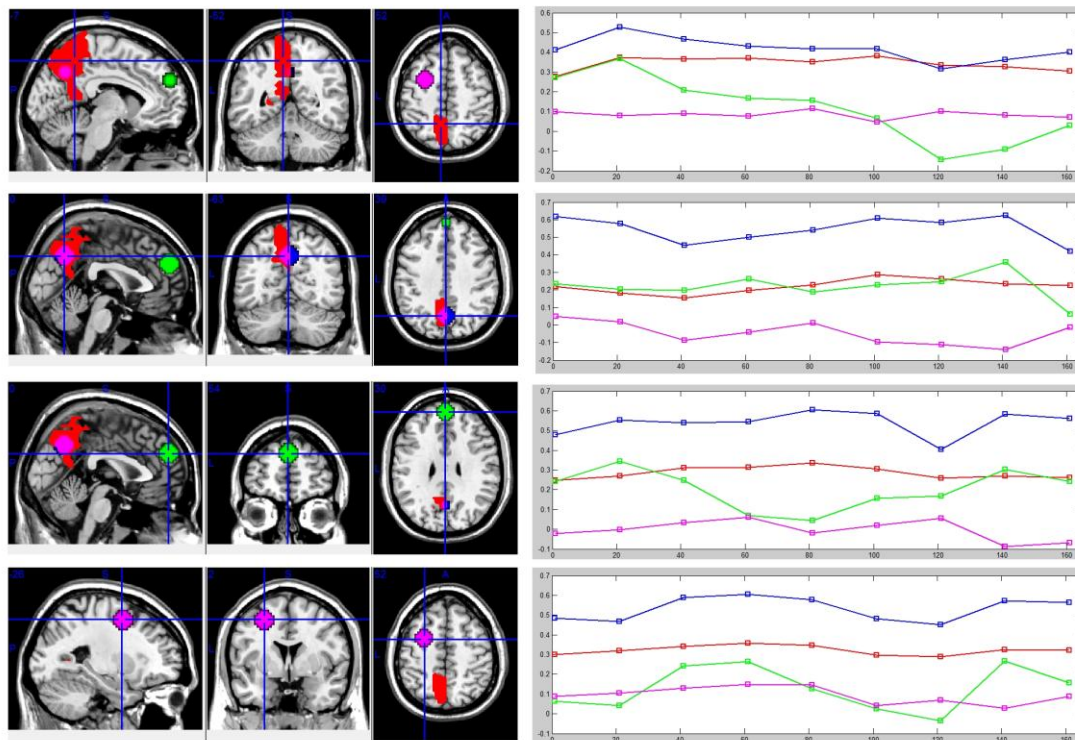
Therefore, the output filename of our demonstration is like this:

roi_TV_subj0#_FCM21.nii ~ TV_subj0#_FCM161.nii

Z_roi_TV_subj0#_FCM21.nii ~ Z_TV_subj0#_FCM161.nii.



ROI: Precuneus_L(red), PCC/PCUN(blue), DMPFC(green), FEF(violet)



4.1.3 Dynamic FC: ROI wise: Nifti Label

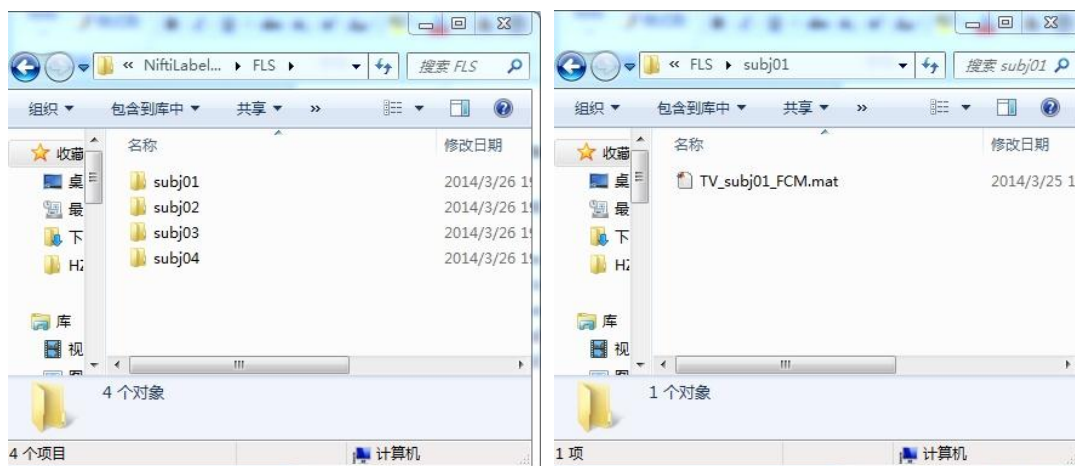
Setting: ROI template: AAL template, TV mode: FLS, FLS Parameter: Fixed 100,
Prefix: TV

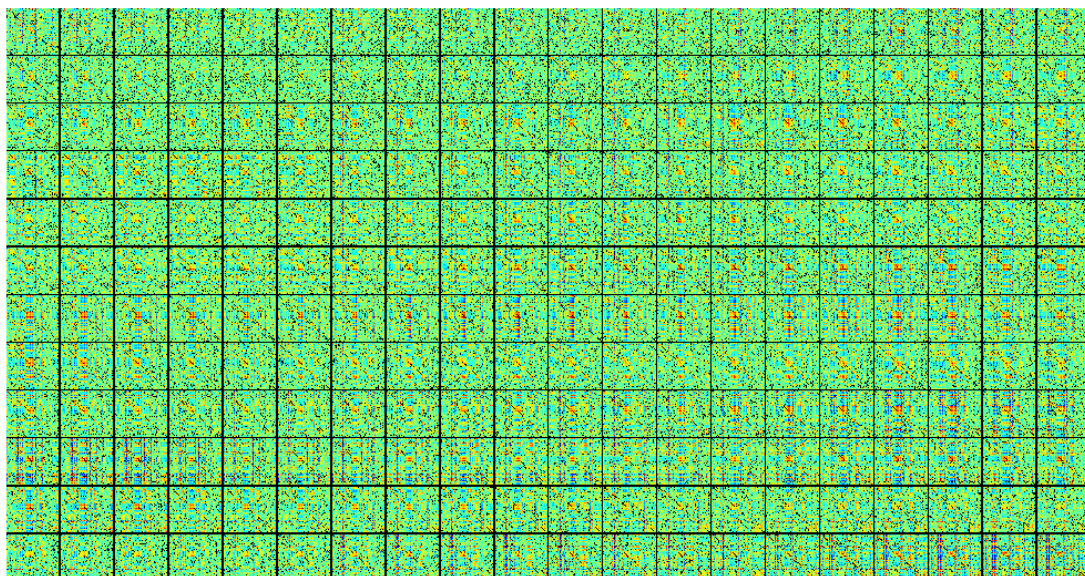
Result Folder:

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders.

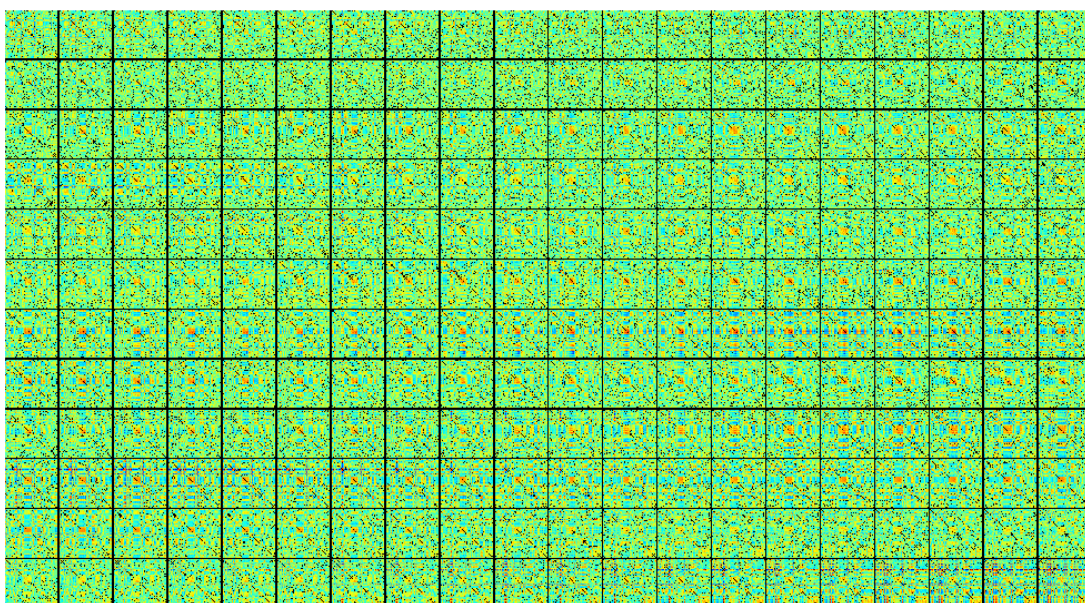
Each subfolder contains a MAT file, which kept the dynamic FC matrix in a struct.

Output name : <Prefix>_<subject name>_FCM.mat



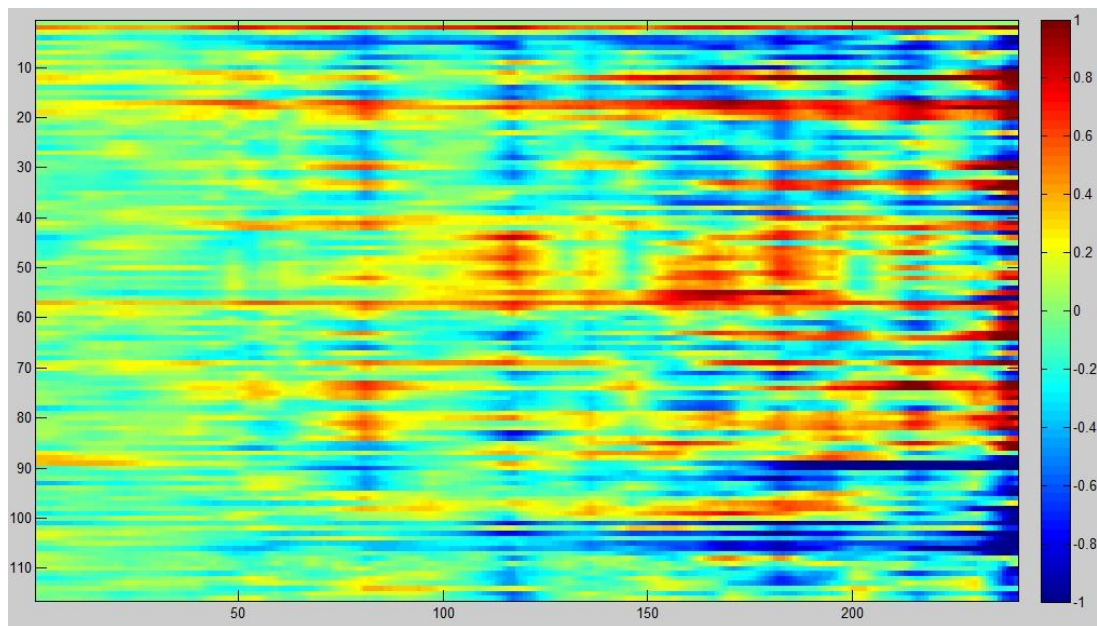


FLS

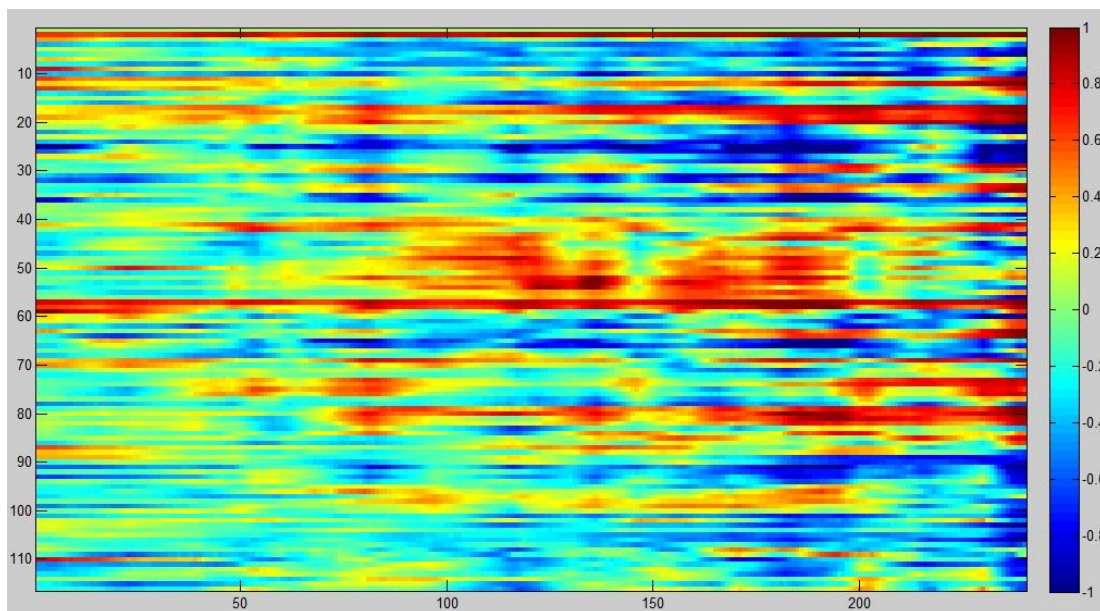


$(\text{FLS} + \text{FLS}^T)/2$

ROI 1 to ROI 1-116:

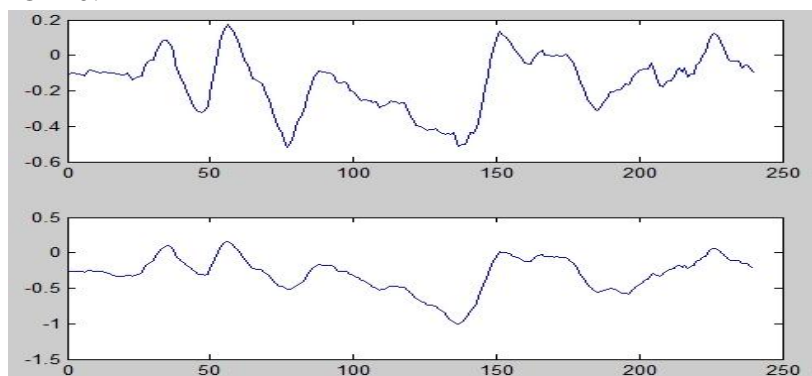


FLS



$(\text{FLS} + \text{FLS}^T)/2$

ROI 10 to ROI 40:



4.1.4 Dynamic FC: ROI wise: TXT

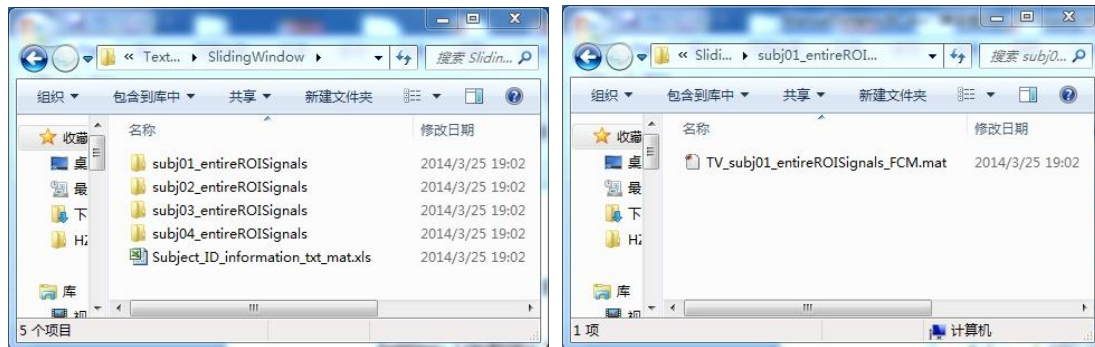
*Setting: 116(ROIs) * 240(timepoints), TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV*

Result Folder:

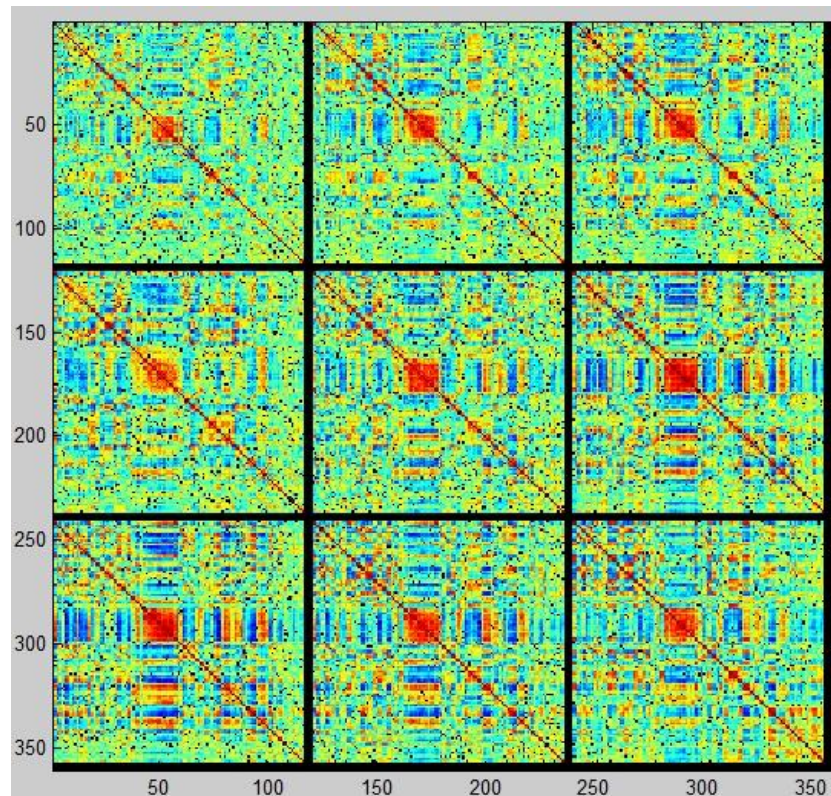
The result folder contains n+1 items, n subfolders and one Excel file. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders and 1 Excel file.

Each subfolder contains a MAT file, which kept the dynamic FC matrix in a struct.

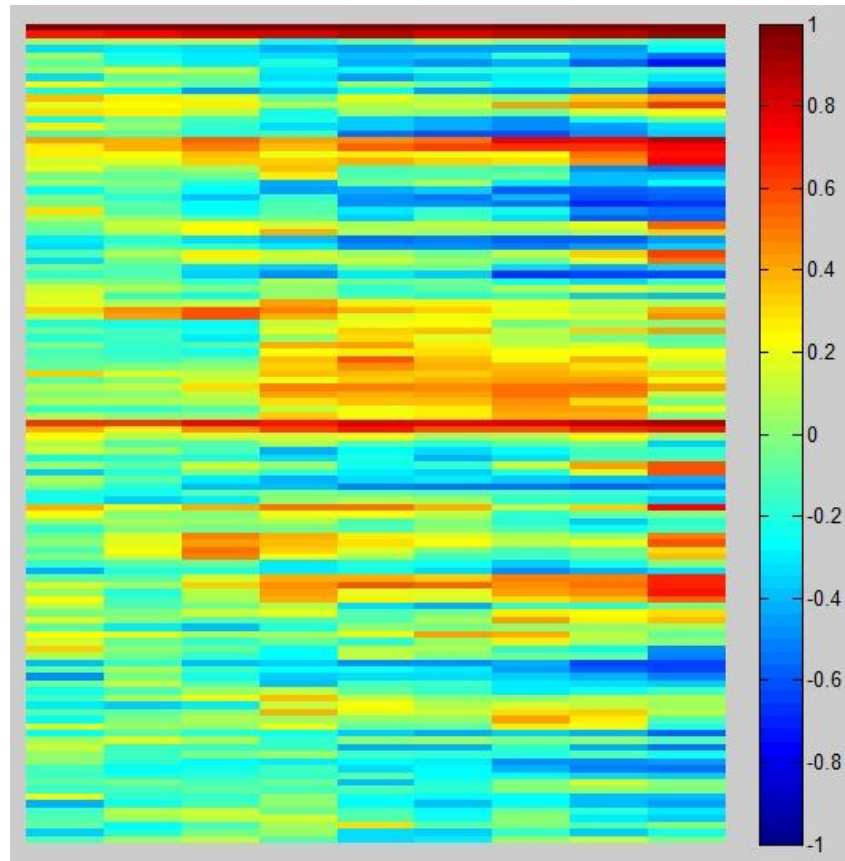
Output name : *<Prefix>_<subject name>_FCM.mat*



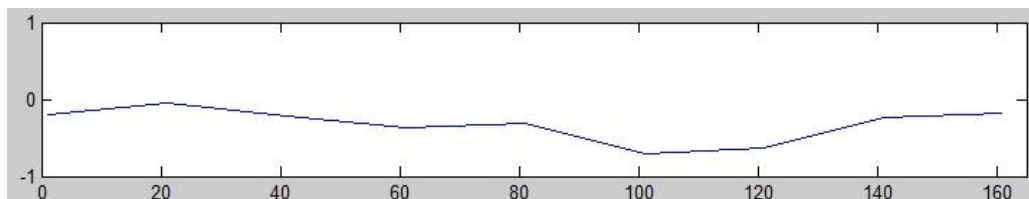
The following show is only Subj01:



ROI 1 to ROI 1-116:



ROI 10 to ROI 40:



4.1.5 Dynamic FC: ROI wise: MAT

Setting: 116(ROIs) * 240(timepoints), **TV mode:** FLS, **FLS Parameter:** Fixed 100, **Prefix:** TV

Result Folder:

The result folder contains n+1 items, n subfolds and one Excel file. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result fold contains 4 subfolders and 1 Excel file.

Each subfolder contains a MAT file, which kept the dynamic FC matrix in a struct.

Output name : <Prefix>_<subject name>_FCM.mat



The result matrices are the same as 4.1.3

4.1.6 Dynamic FC: FCD

Setting: Mask: gray mask, TV mode: Sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV, pvalue: fixed 0.001, Time Alignment: 'Ahead'

Result Folder:

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders.

Each subject contains $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap})) * 4$ Maps (Positive only/Absolute & Weight/Binary). In our demonstration, the signal length is 240. Then in our result subfolder, it contains 36 maps.

The rule of the output filename:

<Prefix>_<subject name>_FCM_pos_wei??_nii

<Prefix>_<subject name>_FCM_abs_wei??_nii

<Prefix>_<subject name>_FCM_pos_bin??_nii

<Prefix>_<subject name>_FCM_abs_bin??_nii

Therefore, the output filename of our demonstration is like this:

TV_subj0#_FCM_pos_wei01.nii ~ TV_subj0#_FCM_pos_wei161.nii

TV_subj0#_FCM_abs_wei01.nii ~ TV_subj0#_FCM_abs_wei161.nii

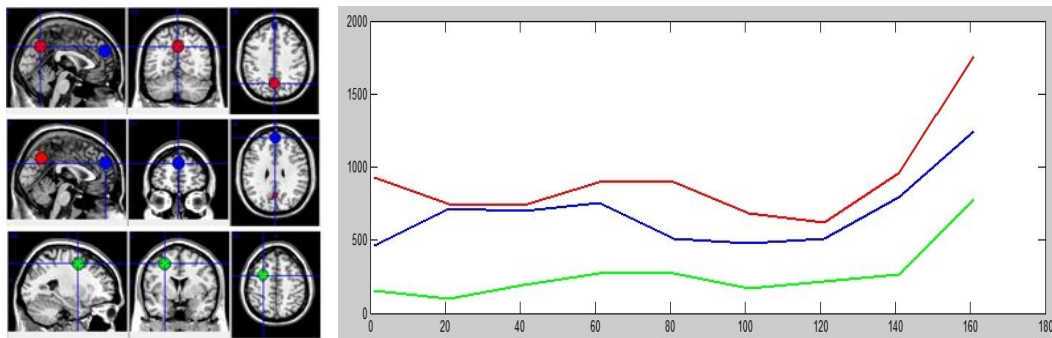
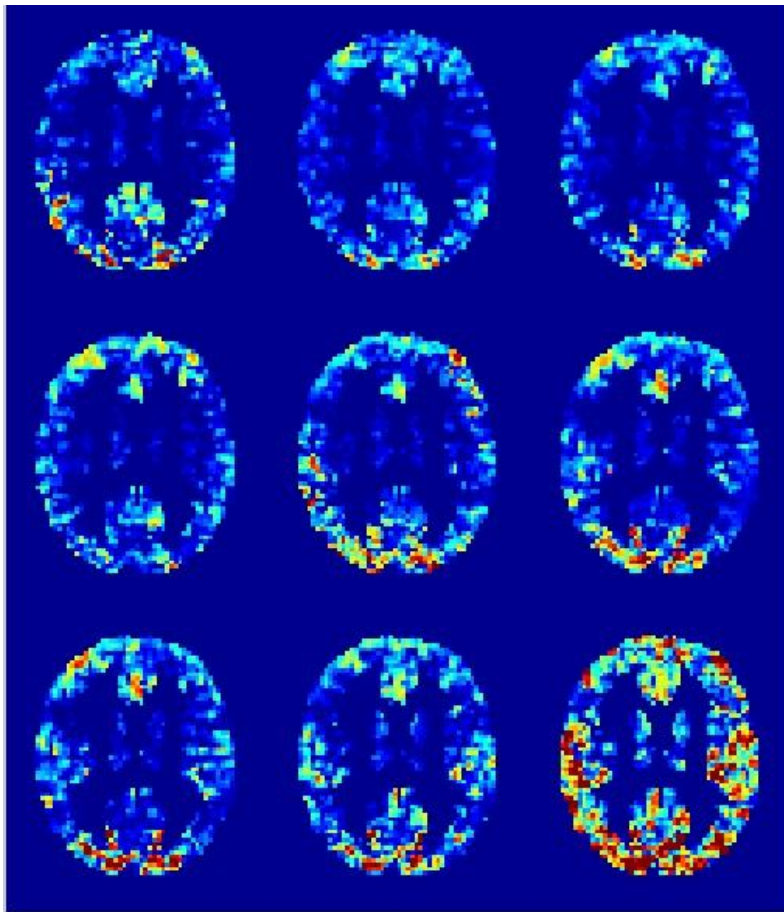
TV_subj0#_FCM_pos_bin01.nii ~ TV_subj0#_FCM_pos_bin161.nii

TV_subj0#_FCM_abs_bin01.nii ~ TV_subj0#_FCM_abs_bin161.nii



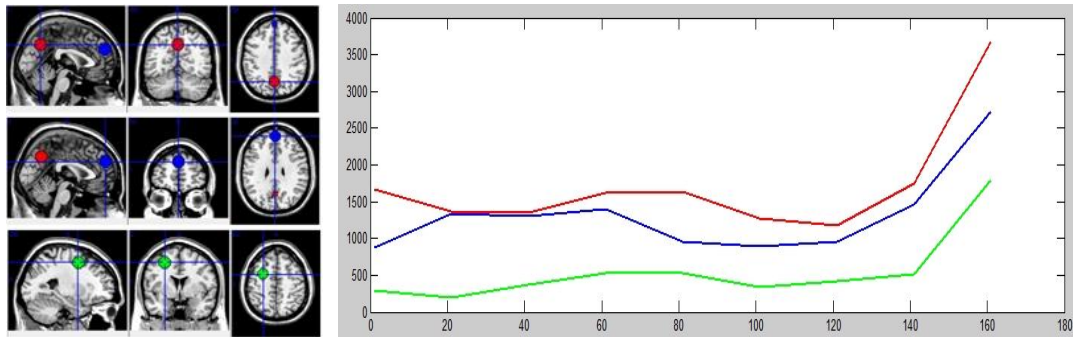
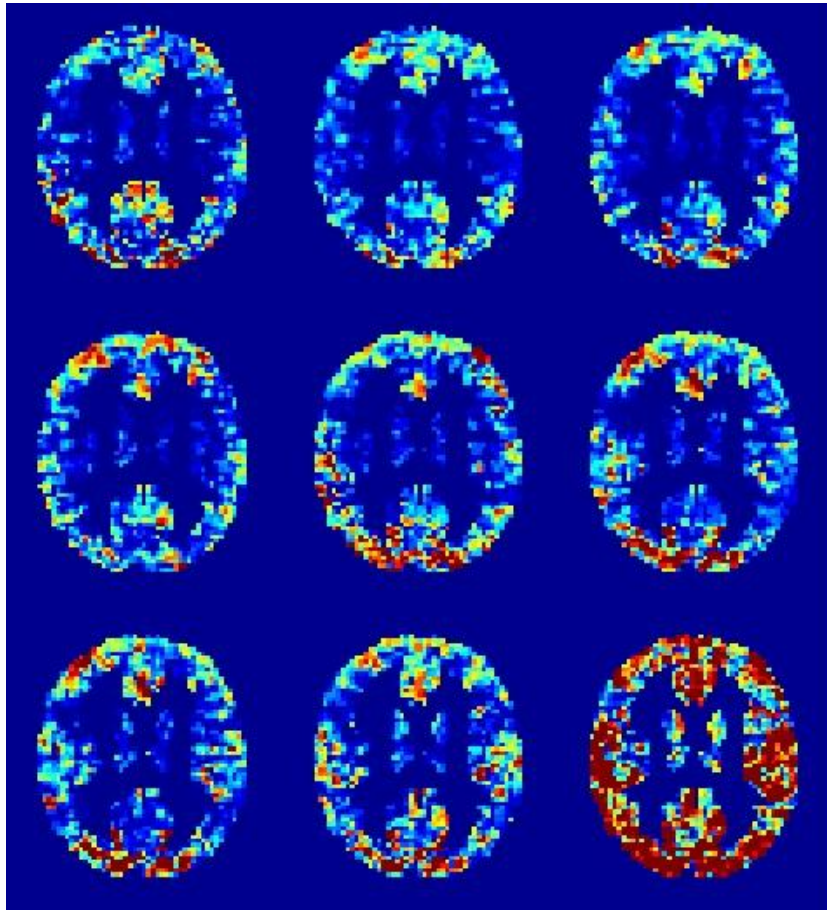
The following figures of Subj01 are:

Positive Weight:



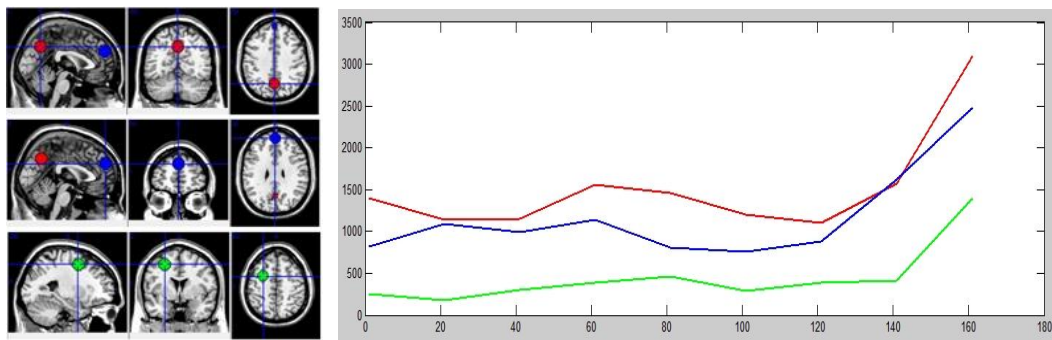
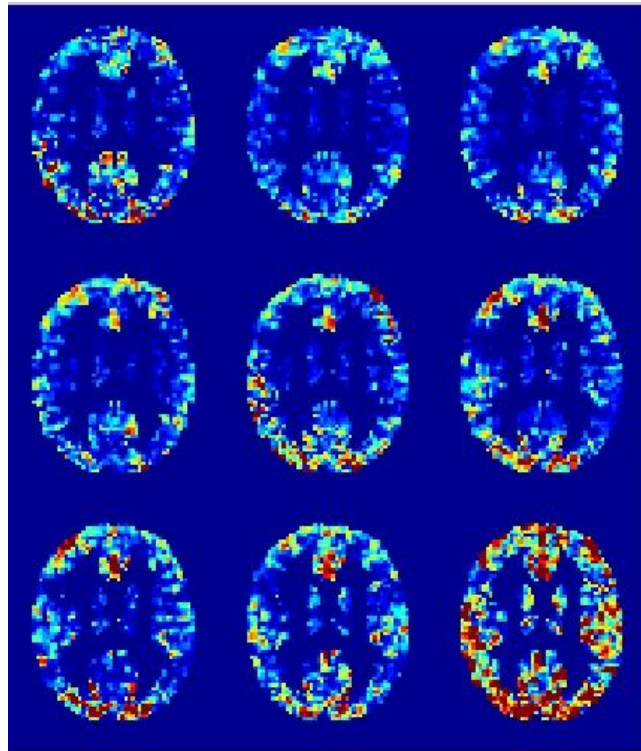
ROI: PCC/PCUN (red), DMPFC(blue)&FEF(green)

Positive Binary:



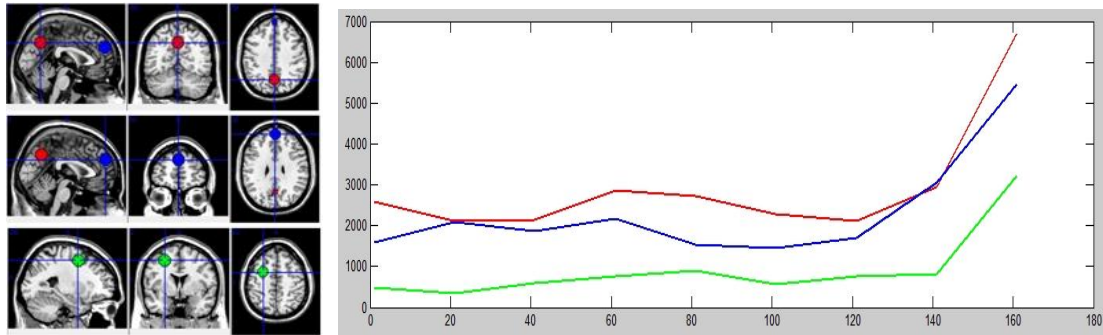
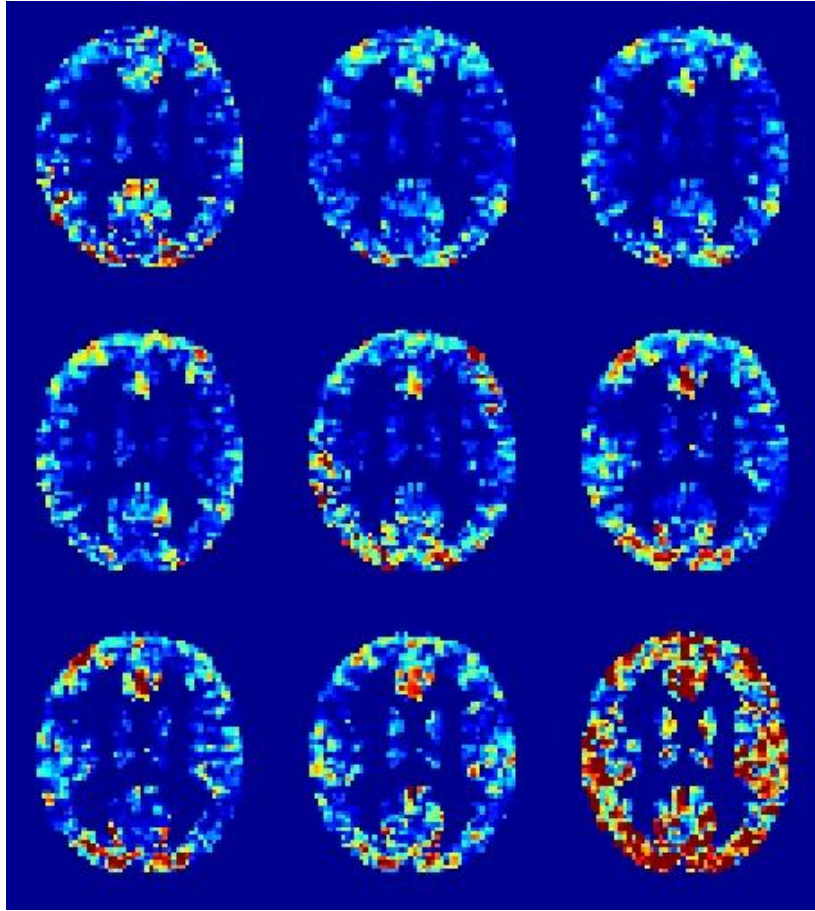
ROI: PCC/PCUN (red), DMPFC(blue)&FEF(green)

Absolute Weight:



ROI: PCC/PCUN (red), DMPFC(blue)&FEF(green)

Absolute Binary:



ROI: PCC/PCUN (red), DMPFC(blue)&FEF(green)

4.2 Dynamic EC

4.2.1 Dynamic EC: Voxel wise: Seed(MNI)

Setting: MNI center: 0 -63 39, radius 10 mm, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: TV

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result fold contains 4 subfolders.

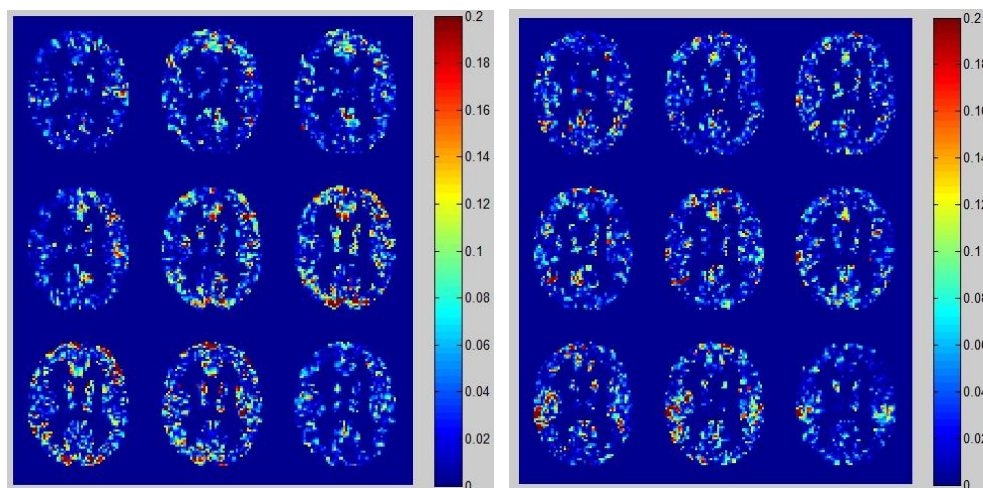
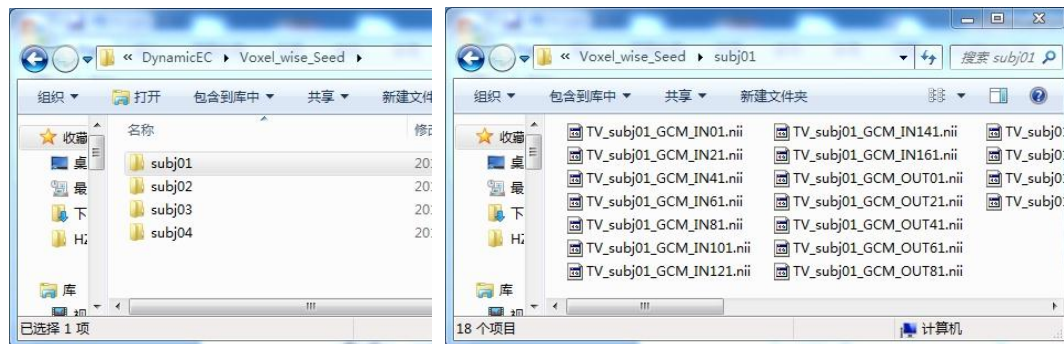
Each subject contains $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap}))$ INmaps and $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap}))$ OUTmaps. In our demonstration, the signal length is 240. Then in our result subfolder, it contains 9 INmap and 9 OUTmap.

The rule of the output filename: **<Prefix>_<subject name>_ GCM_IN???.nii** and **<Prefix>_<subject name>_ GCM_OUT???.nii**

Therefore, the output filename of our demonstration is like this:

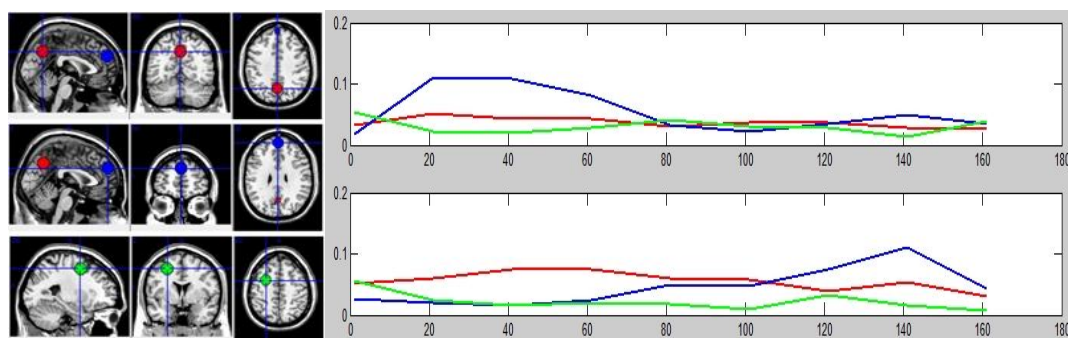
TV_subj0#_GCM_IN01.nii ~ TV_subj0#_GCM_IN161.nii

TV_subj0#_GCM_OUT01.nii ~ TV_subj0#_GCM_OUT161.nii.



IN

OUT



ROI: Seed (red), DMPFC(blue)&FEF(green)

4.2.2 Dynamic EC: Voxel wise: ROI-mask

Setting: ROI: Precuneus_L, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: TV

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders.

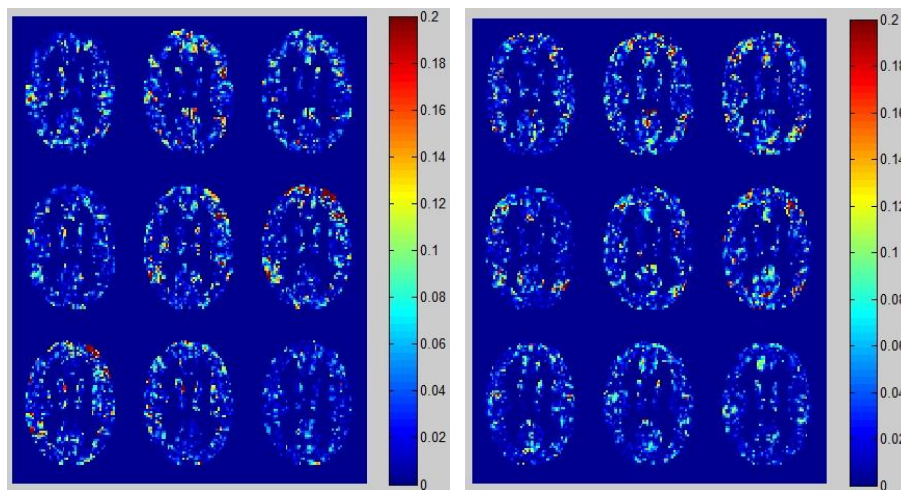
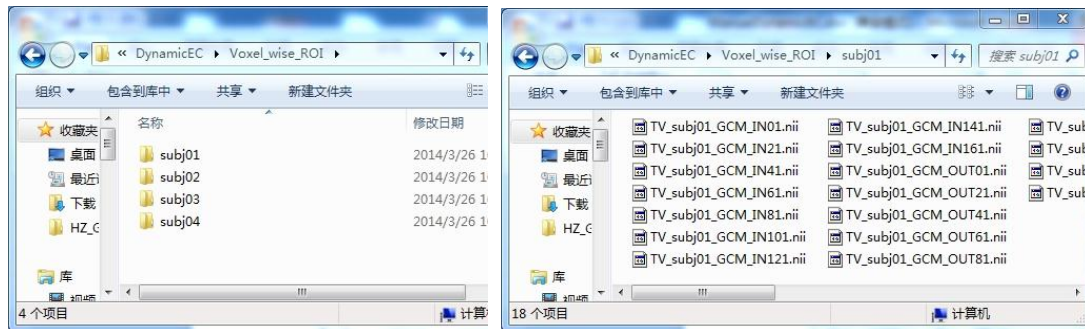
Each subject contains $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap}))$ INmaps and $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap}))$ OUTmaps. In our demonstration, the signal length is 240. Then in our result subfolder, it contains 9 INmap and 9 OUTmap.

The rule of the output filename: **<Prefix>_<subject name>_GCM_IN???.nii** and **<Prefix>_<subject name>_GCM_OUT???.nii**

Therefore, the output filename of our demonstration is like this:

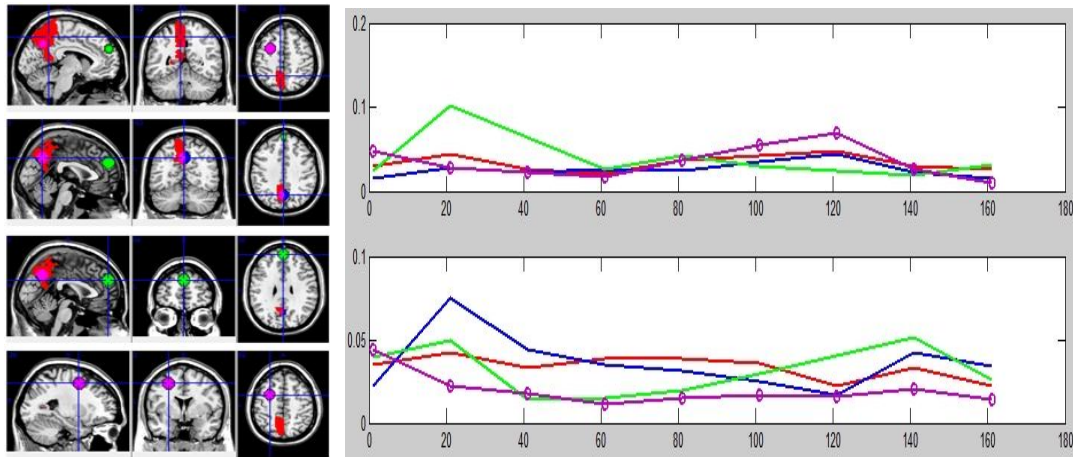
TV_subj0#_GCM_IN01.nii ~ TV_subj0#_GCM_IN161.nii

TV_subj0#_GCM_OUT01.nii ~ TV_subj0#_GCM_OUT161.nii.



IN

OUT



4.2.3 Dynamic EC: ROI wise: Nifti Label

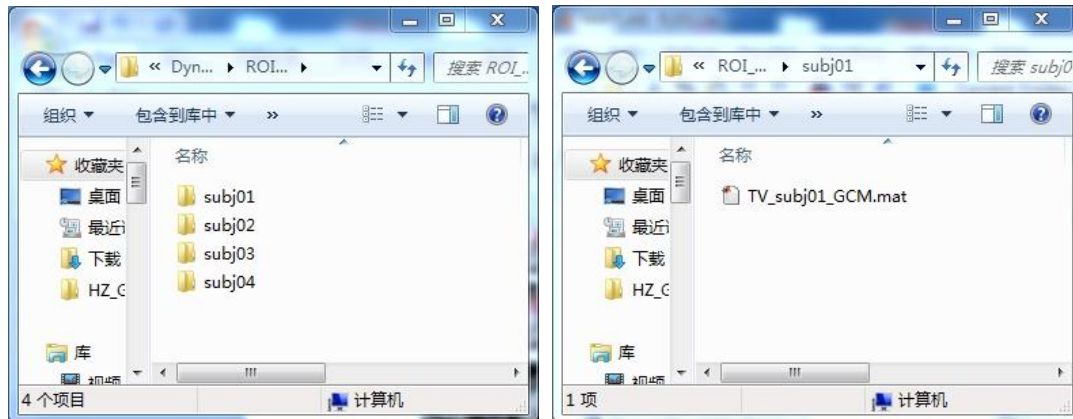
Setting: template: random select 10 AAL regions, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Mask: gray mask, Prefix: TV

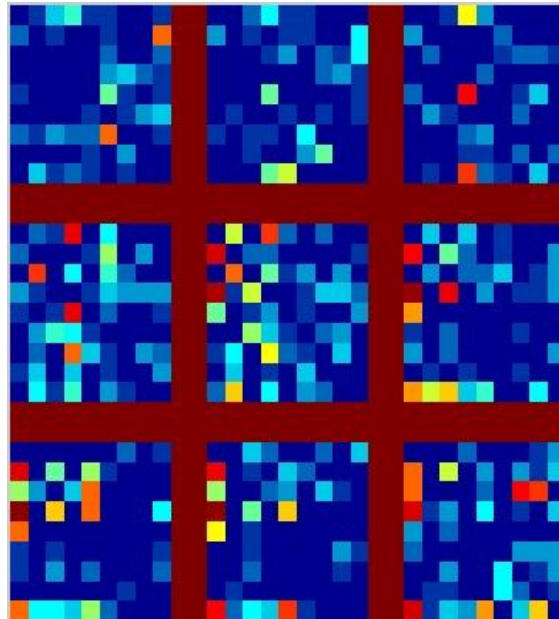
Result Folder:

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result fold contains 4 subfolders.

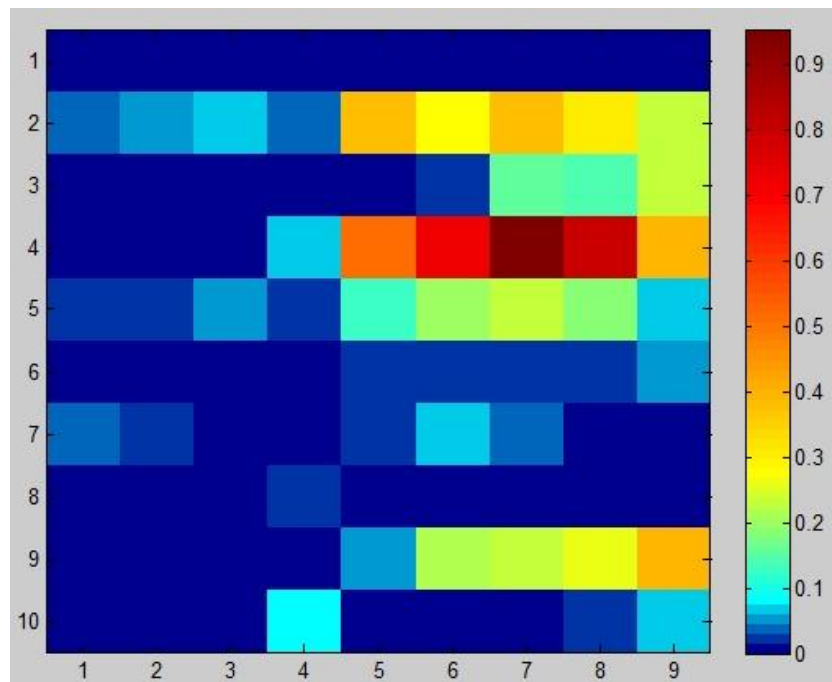
Each subfolder contains a MAT file, which kept the dynamic FC matrix in a struct.

Output name : **<Prefix>_<subject name>_GCM.mat**

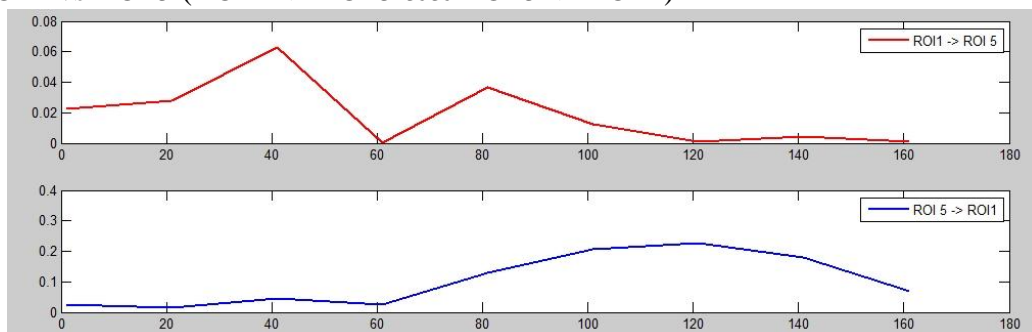




ROI 1 -> ROI 1-10



ROI 1 vs ROI 5 (ROI 1 -> ROI 5 & ROI 5 -> ROI 1)



4.2.4 Dynamic EC: ROI wise: TXT

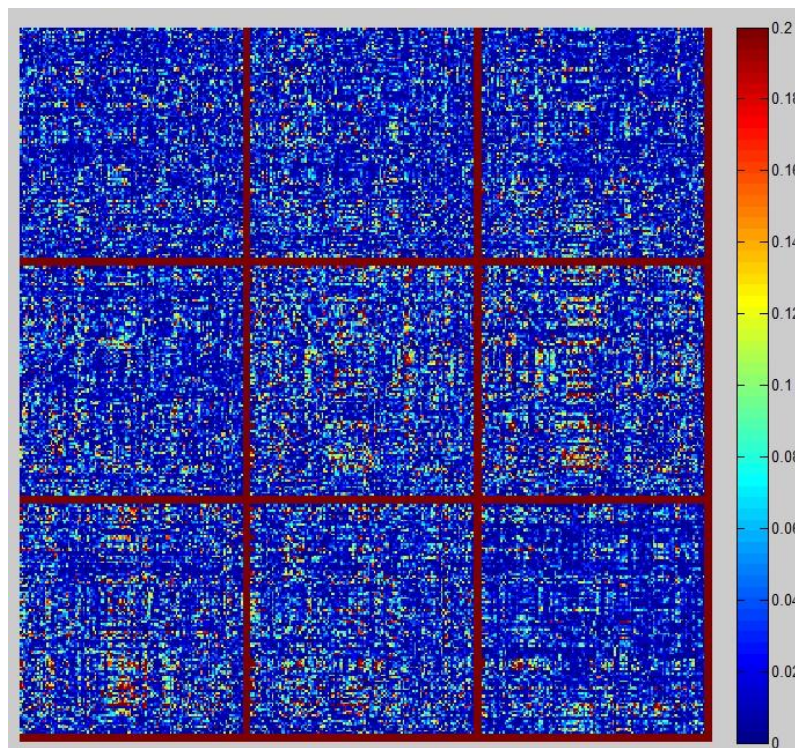
*Setting: 116(ROIs) * 240(timepoints), TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV*

Result Folder:

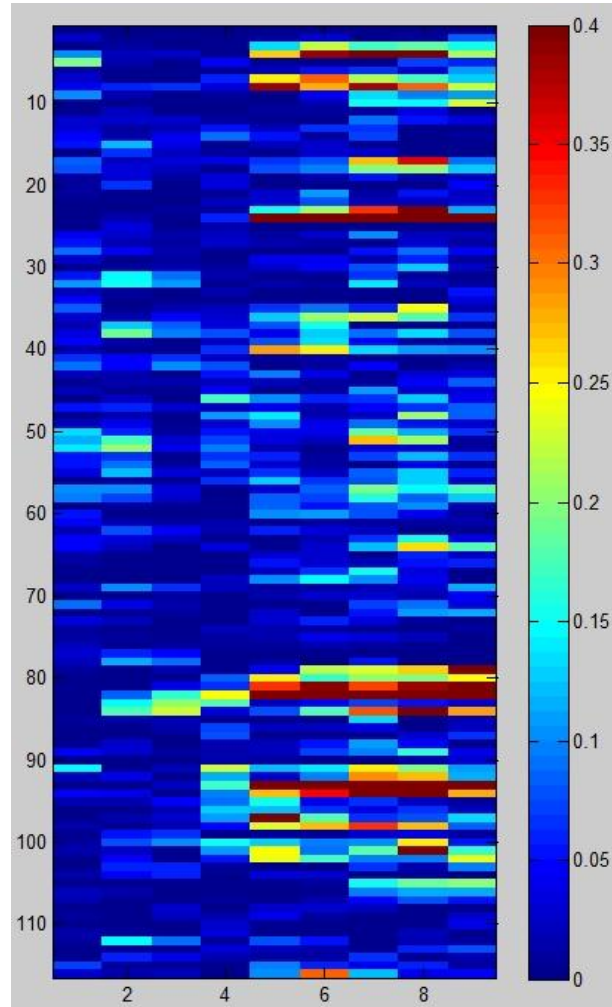
The result folder contains n+1 items, n subfolders and one Excel file. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result fold contains 4 subfolders and 1 Excel file.

Each subfolder contains a MAT file, which kept the dynamic FC matrix in a struct.

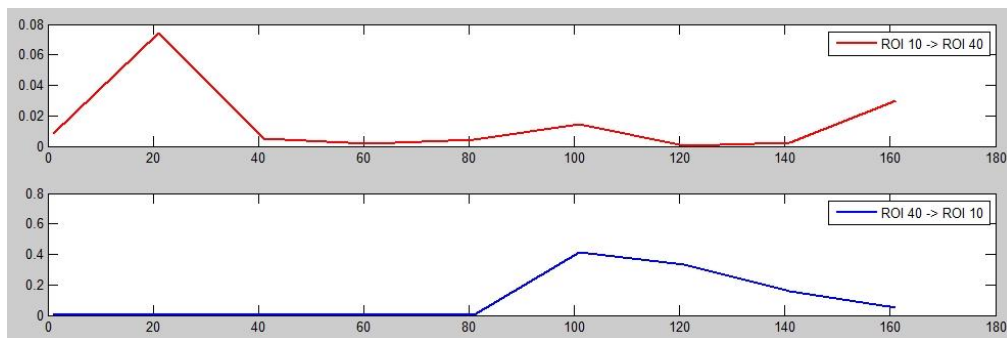
Output name : *<Prefix>_<subject name>_GCM.mat*



ROI 1 -> ROI 1-116



ROI 10 vs ROI 40 (ROI 10 -> ROI 40 && ROI 40 -> ROI 10)



4.2.5 Dynamic EC: ROI wise: MAT

Setting: 116(ROIs) * 240(timepoints), **TV mode:** sliding-window, **Window Size:** 50, **Overlap:** 0.6, **Prefix:** TV

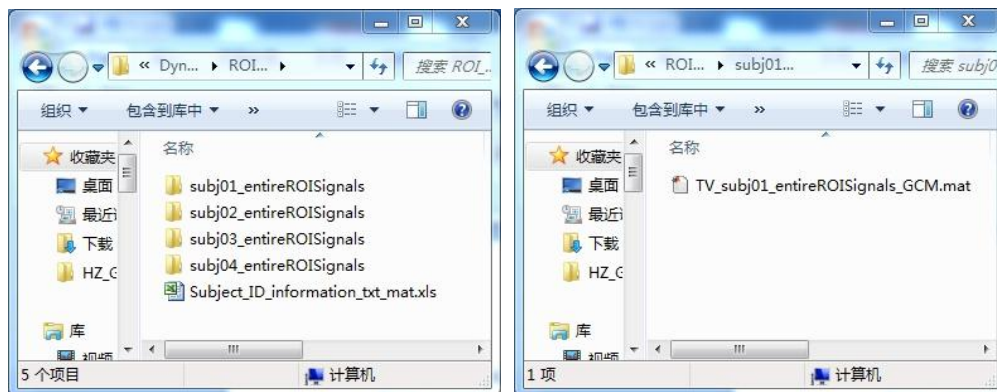
Result Folder:

The result folder contains n+1 items, n subfolders and one Excel file. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis,

and the result fold contains 4 subfolders and 1 Excel file.

Each subfolder contains a MAT file, which kept the dynamic FC matrix in a struct.

Output name : **<Prefix>_<subject name>_FCM.mat**



The result matrices are the same as 4.2.4

4.2.6 Dynamic EC: GCD

Setting: Mask: Cingulum_Ant_L from AAL template, TV mode: sliding-window, Window Size: 50, Overlap: 0.6, Prefix: TV, pvalue: $p < 0.05$ FWE corrected

The result folder contains n items, n subfolders. Each subfolder represent a subject. In our test demonstration, there are 4 subjects used in the analysis, and the result folder contains 4 subfolders.

Each subject contains $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap})) * 2$ INmaps (binary& weight) and $(N - \text{Winlen}) / (\text{Winlen} * (1 - \text{Overlap})) * 2$ OUTmaps (binary& weight). In our demonstration, the signal length is 240. Then in our result subfolder, it contains 18 INmap and 18 OUTmap.

The rule of the output filename:

<Prefix>_<subject name>_ GCM_IN_bin??nii

<Prefix>_<subject name>_ GCM_OUT_bin??nii

<Prefix>_<subject name>_ GCM_IN_wei??nii

<Prefix>_<subject name>_ GCM_OUT_wei??nii

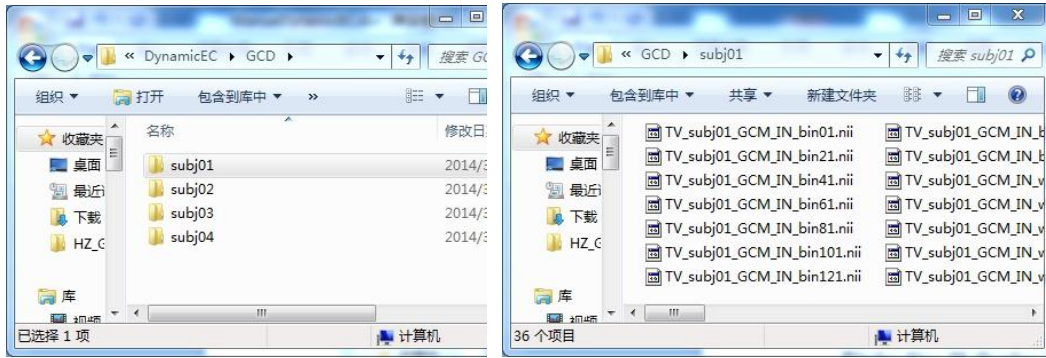
Therefore, the output filename of our demonstration is like this:

TV_subj0#_GCM_IN_bin01.nii ~ TV_subj0#_GCM_IN_bin161.nii

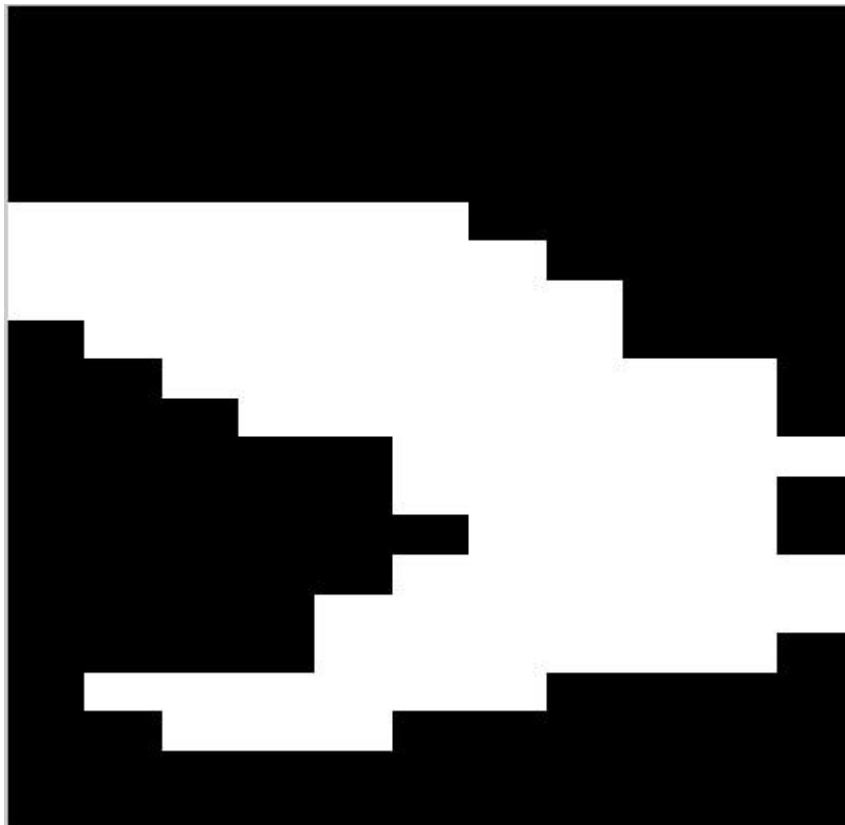
TV_subj0#_GCM_IN_wei01.nii ~ TV_subj0#_GCM_IN_wei 161.nii

TV_subj0#_GCM_OUT_bin01.nii ~ TV_subj0#_GCM_OUT_bin161.nii.

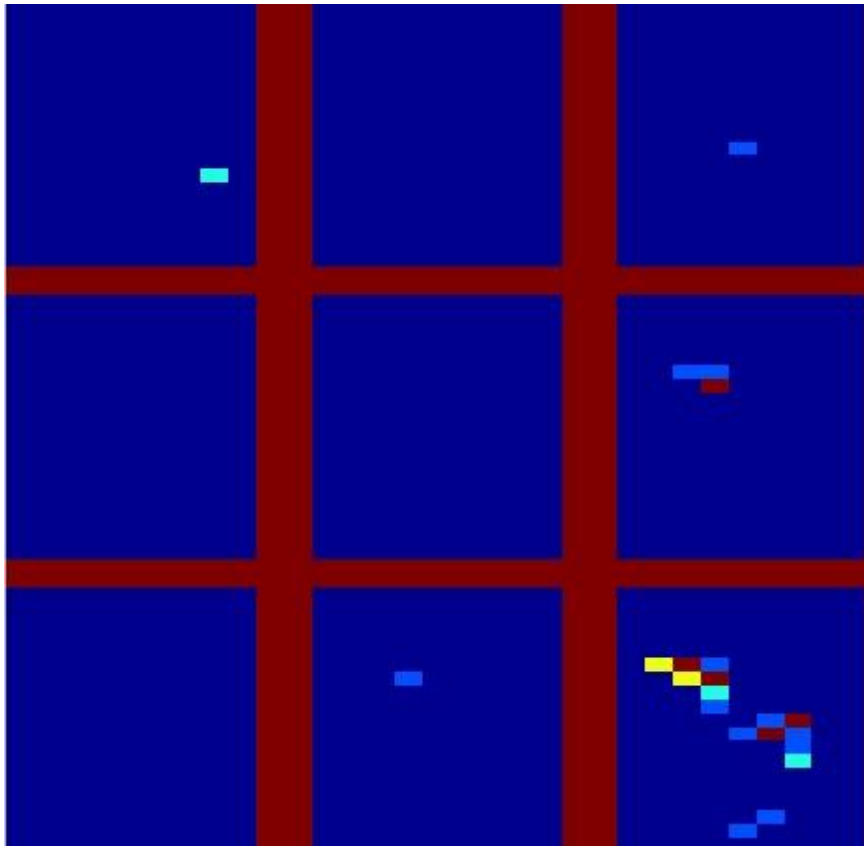
TV_subj0#_GCM_OUT_wei01.nii ~ TV_subj0#_GCM_OUT_wei161.nii.



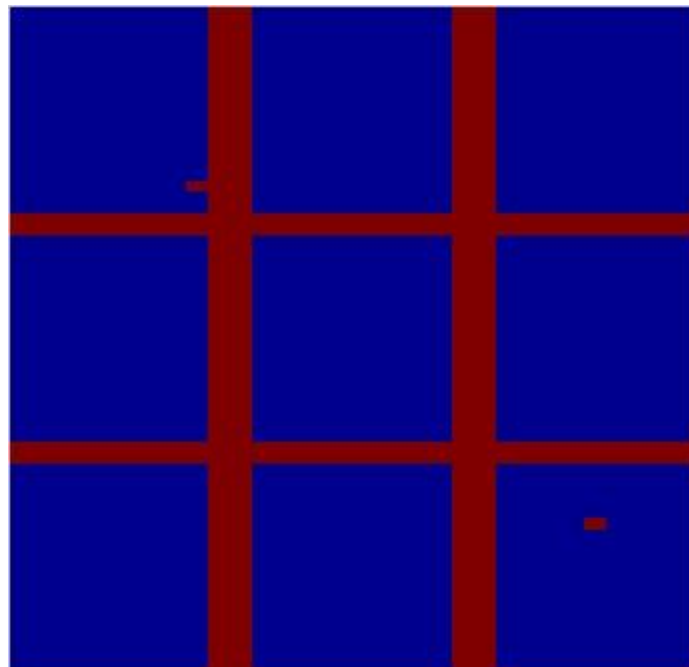
Mask:



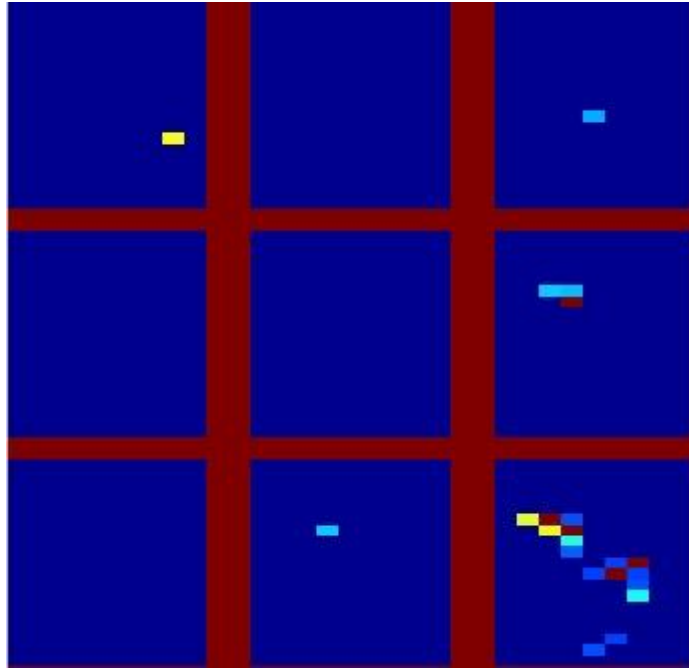
IN Binary:



OUT Binary:



IN weight:



OUT weight:

