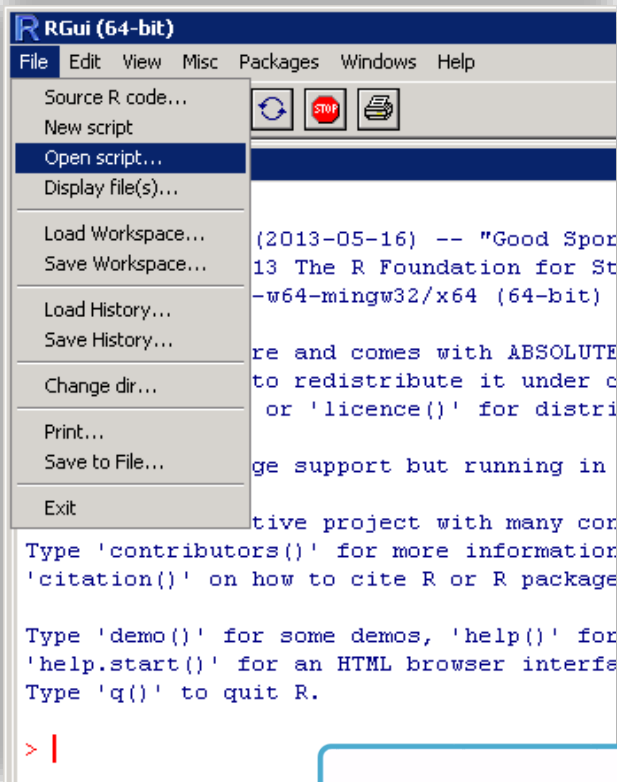# Implementation of Extreme Loads Estimation Using Bayesian MARS model

Industrial and Systems Engineering

Texas A&M University
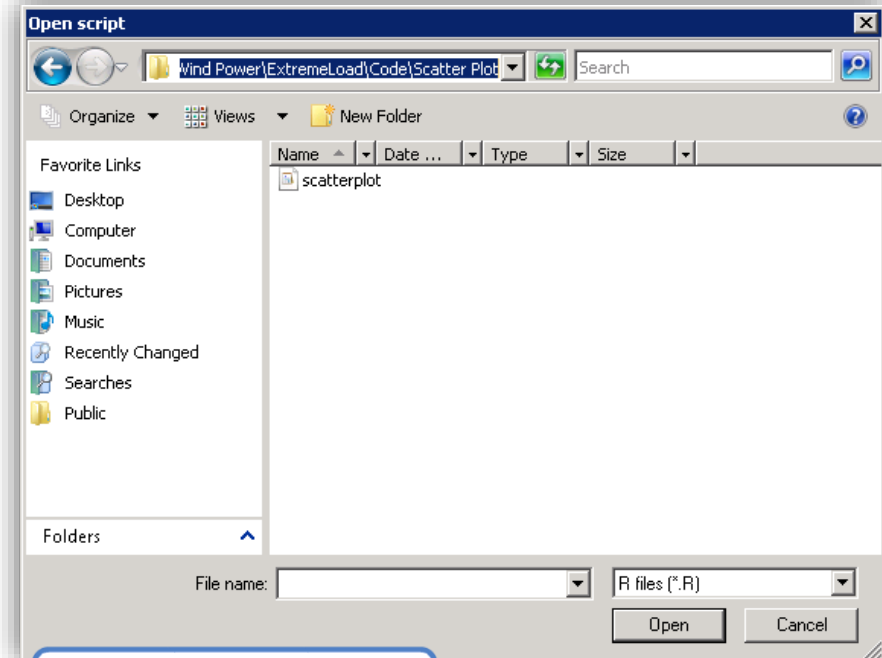
Prepared by Dr. Hoon Hwangbo

How to open R scripts

1. Run R program

2. Click "File"-"Open script"

3. Browse to the folder where the codes are located

4. Select the code you want to open, and click "Open"

How to execute R scripts

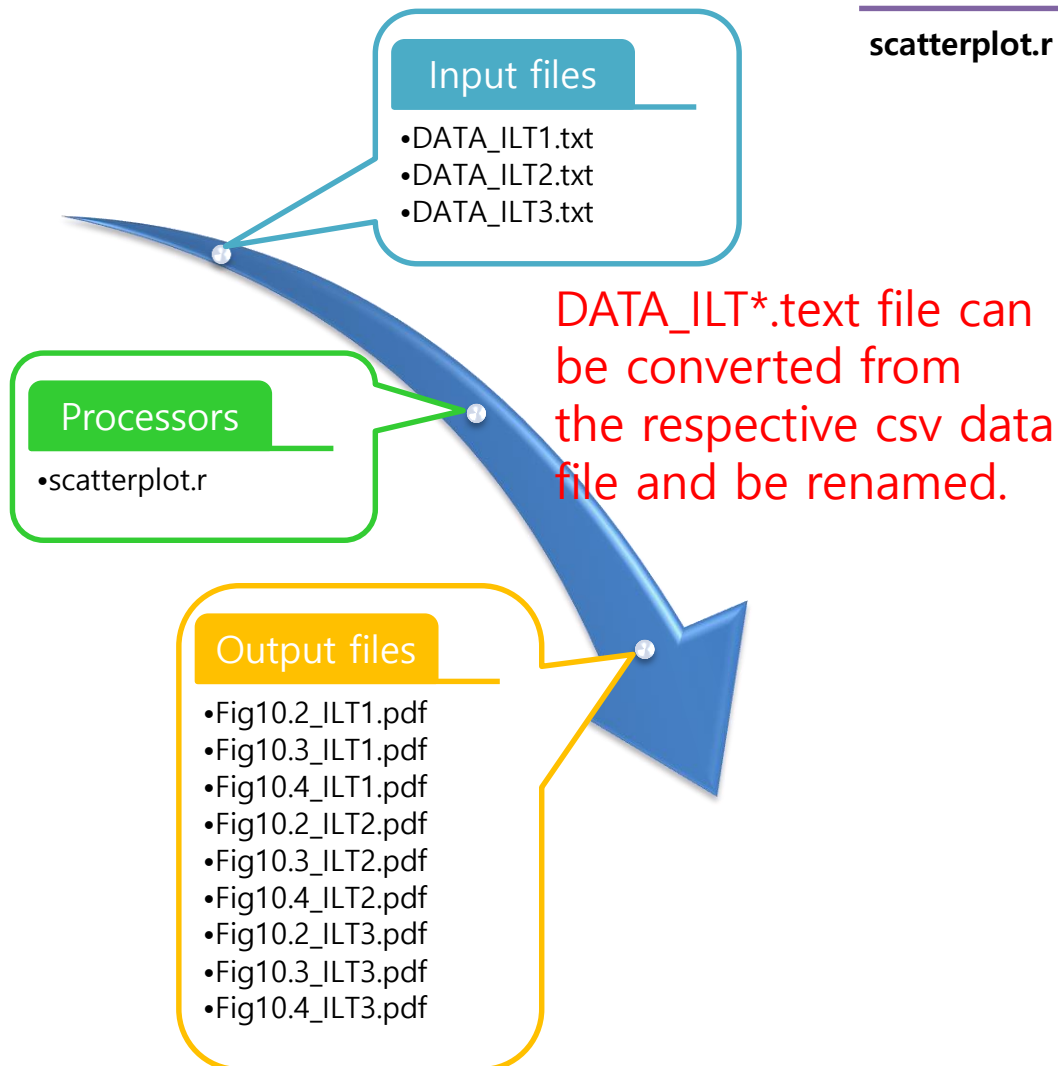2. Click "Edit"-"Run all"

1. Activate the script window by clicking it

How to install the required R packages

1. Open packageInstall.r

2. Click "Edit"-"Run all"

3. Choose any closest CRAN mirror server and click "OK"

Scatter plots (Figure 10.2, 10.3, and 10.4)

Input files

- DATA_ILT1.txt
- DATA_ILT2.txt
- DATA_ILT3.txt

Processors

- scatterplot.r

Output files

- Fig10.2_ILT1.pdf
- Fig10.3_ILT1.pdf
- Fig10.4_ILT1.pdf
- Fig10.2_ILT2.pdf
- Fig10.3_ILT2.pdf
- Fig10.4_ILT2.pdf
- Fig10.2_ILT3.pdf
- Fig10.3_ILT3.pdf
- Fig10.4_ILT3.pdf

DATA_ILT*.text file can be converted from the respective csv data file and be renamed.

scatterplot.r

1. Open "scatterplot.r" on RGui.

2. Change the "path.id" on the line 2 to the path where you store this reference.

* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.

Wind speed model selection (Table 10.2)

Input files
- DATA_ILT1.txt
- DATA_ILT2.txt
- DATA_ILT3.txt

Processors
- mleComp.r
- getSIC.r

Output files
- Table10.2.txt

getSIC.r

1. Open "getSIC.r" on RGui.

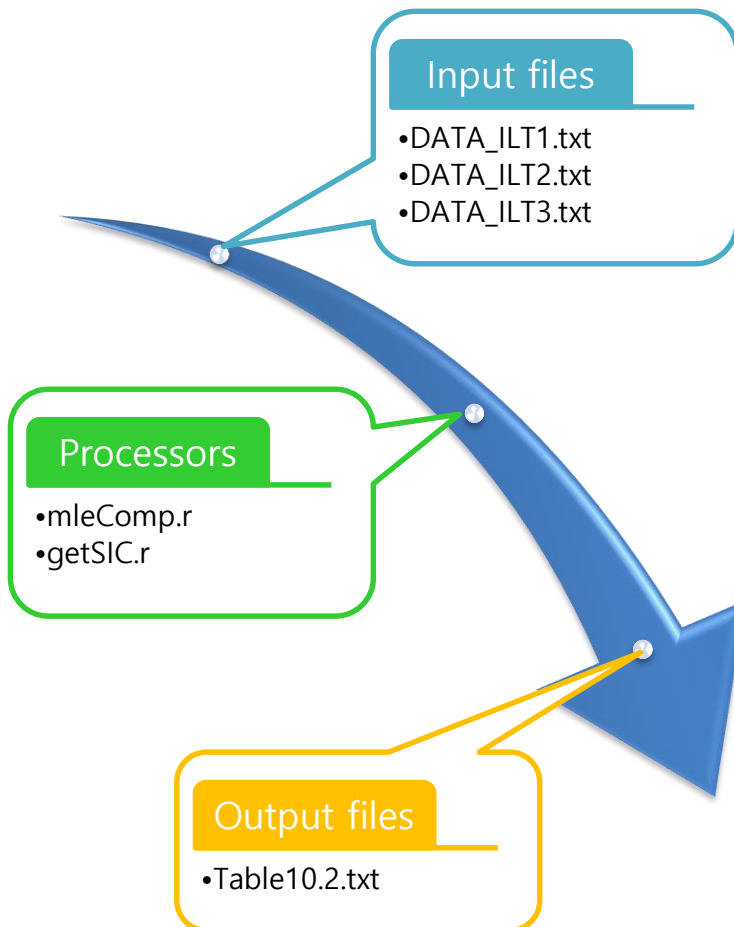2. Change the "path.id" on the line 2 to the path where you store this reference.

* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.

95% point-wise credible intervals (Figure 10.6 and 10.7)

Input files
- DATA_ILT1.txt

Processors
- basisFn.r
- mle_y.r
- pointCI_ILT1.r

Output files
- Fig10.6_ILT1.pdf
- Fig10.7_ILT1.pdf

pointCI_ILT1.r

1. Open "pointCI_ILT1.r" on RGui.

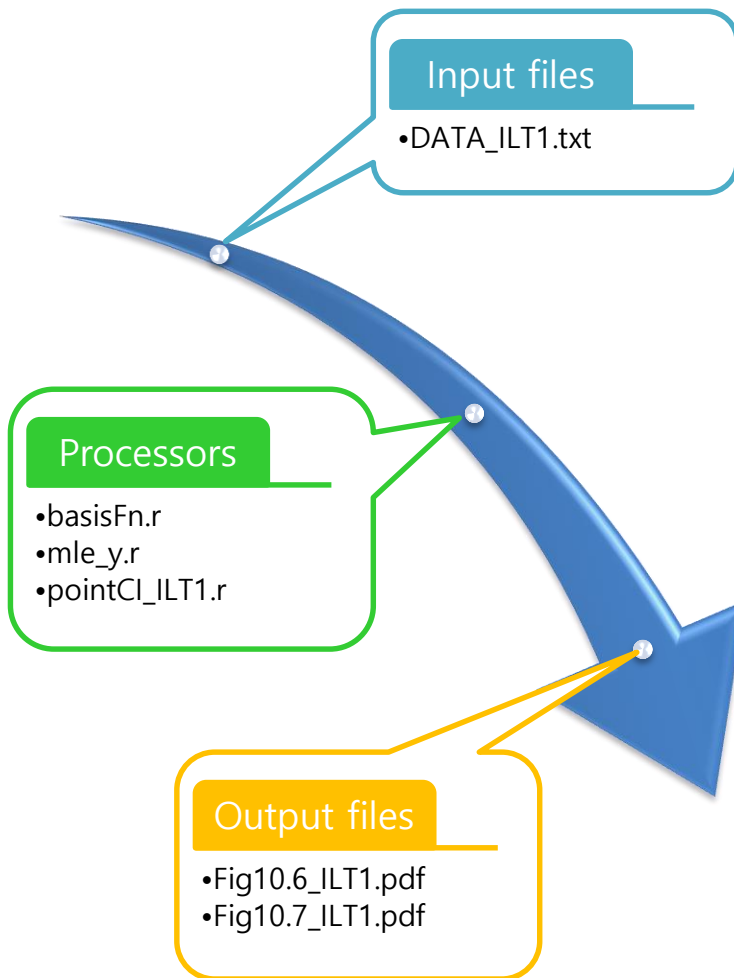2. Change the "path.id" on the line 5 to the path where you store this reference.

* Make sure using "\\" to denote the sub folder (or sub path).

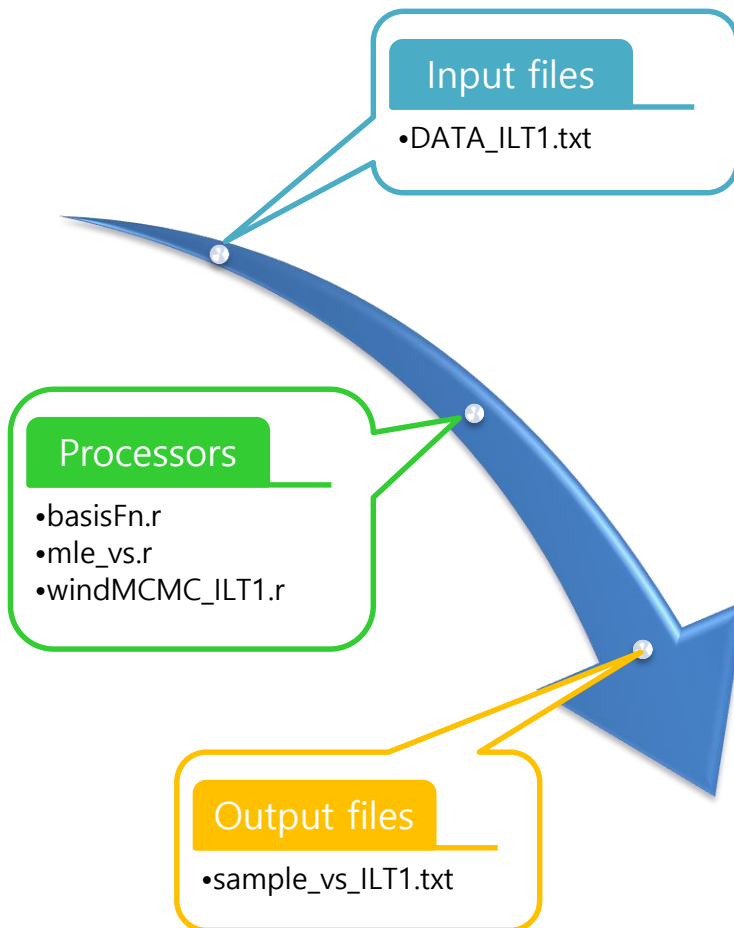3. Run the code by clicking "Edit"–"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.

* The same procedures can be applied for ILT2 and ILT3 as well.

* It takes quite long time to get the result; roughly 2.6 hours, 1.5 hours, and 7.9 hours for ILT1, ILT2, and ILT3, respectively.

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Samples of wind characteristics

Input files
- DATA_ILT1.txt

Processors
- basisFn.r
- mle_vs.r
- windMCMC_ILT1.r

Output files
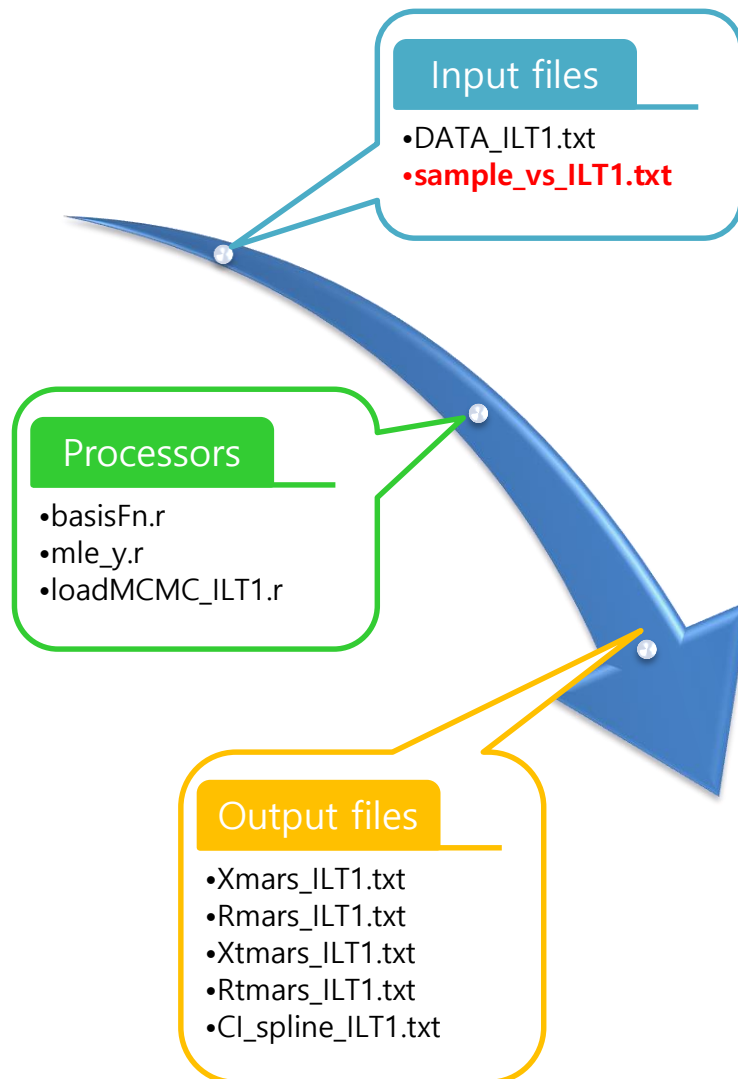- sample_vs_ILT1.txt

windMCMC _ILT1.r

1. Open "windMCMC_ILT1.r" on RGui.

2. Change the "path.id" on the line 4 to the path where you store this reference.

3. Run the code by clicking "Edit"-"Run all".

* If any error occurs during the run, resume by running the while statement from "tic()" to "toc()".

4. Now, you have "sample_vs_ILT1.txt", which will be used to get Figure 10.9 and Table 10.5 and 10.6.

* The same procedures can be applied for ILT2 and ILT3 as well.

* This step should precede the processes on the following slides

* It takes quite long time to get the result; roughly 1.1 hours, 1 hour, and 1.9 hours for ILT1, ILT2, and ILT3, respectively.

Estimates of extreme load levels using spline (Table 10.5 and 10.6)

Input files
- DATA_ILT1.txt
- **sample_vs_ILT1.txt**

Processors
- basisFn.r
- mle_y.r
- loadMCMC_ILT1.r

Output files
- Xmars_ILT1.txt
- Rmars_ILT1.txt
- Xtmars_ILT1.txt
- Rtmars_ILT1.txt
- CI_spline_ILT1.txt

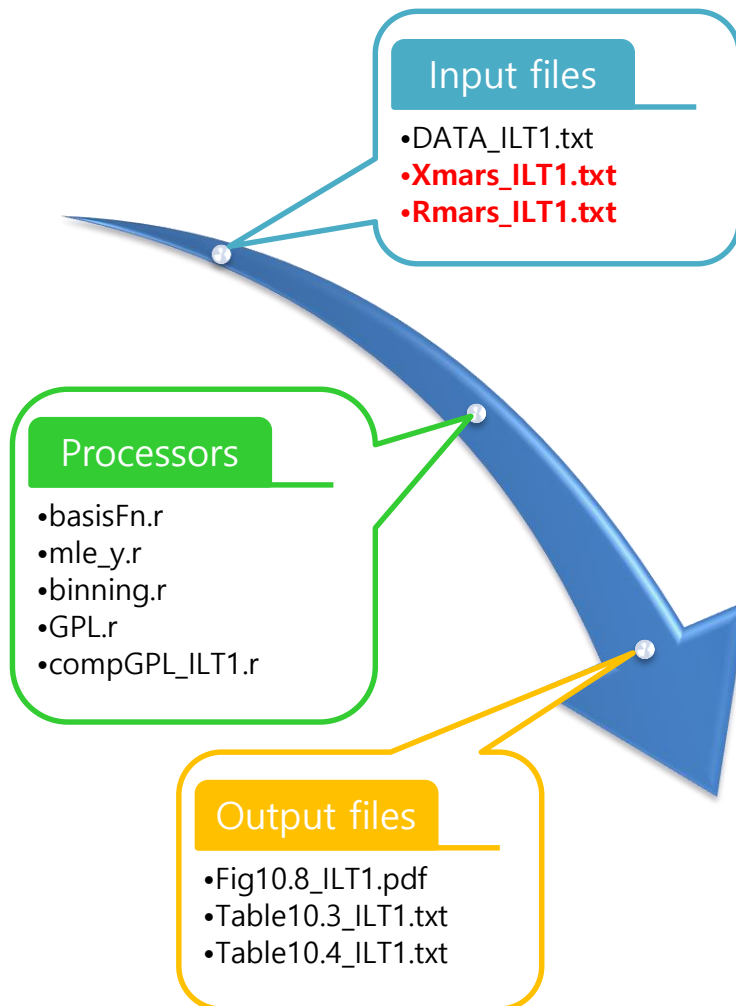| **loadMCMC_ ILT1.r**	
	1. Open "loadMCMC_ILT1.r" on RGui.
	2. Change the "path.id" on the line 4 to the path where you store this reference.
	3. Run the code by clicking "Edit"-"Run all". *** If any error occurs during the run, resume by running the while statement from "tic()" to "toc()".**
	4. "CI_spline_ILT1.txt" will be the part of Table 5 and 6, and "Xmars_ILT1.r" and "Rmars_ILT1.r" will be used for Figure 10.8 and Table 10.3 and 10.4.

* The same procedures can be applied for ILT2 and ILT3 as well.

* This step should precede the processes on the following slides

* It takes quite long time to get the result; roughly 1.9 days, 1.5 days, and 3.9 days for ILT1, ILT2, and ILT3, respectively.

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Comparison of PL function (Figure 10.8 and Table 10.3 and 10.4)

Input files

- DATA_ILT1.txt
- **Xmars_ILT1.txt**
- **Rmars_ILT1.txt**

Processors

- basisFn.r
- mle_y.r
- binning.r
- GPL.r
- compGPL_ILT1.r

Output files

- Fig10.8_ILT1.pdf
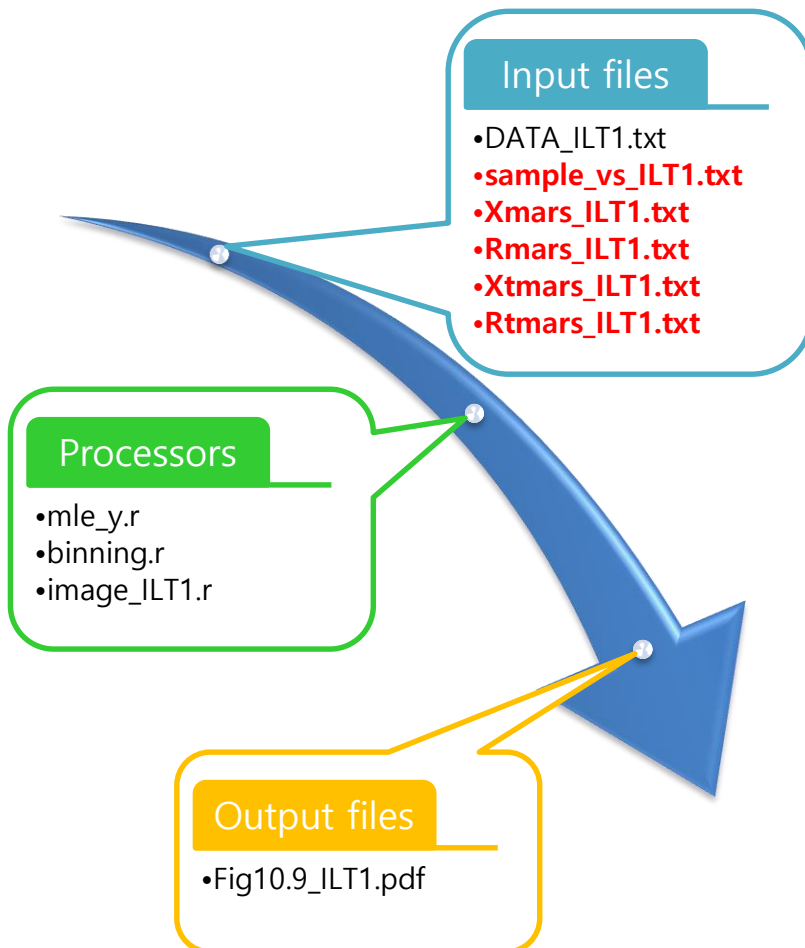- Table10.3_ILT1.txt
- Table10.4_ILT1.txt

compGPL_ILT1.r

1. Open "compGPL_ILT1.r" on RGui.

2. Change the "path.id" on the line 4 to the path where you store this reference.

* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.

* The same procedures can be applied for ILT2 and ILT3 as well.

Comparison of the 0.99-quantiles (Figure 10.9)

Input files
- DATA_ILT1.txt
- **sample_vs_ILT1.txt**
- **Xmars_ILT1.txt**
- **Rmars_ILT1.txt**
- **Xtmars_ILT1.txt**
- **Rtmars_ILT1.txt**

Processors
- mle_y.r
- binning.r
- image_ILT1.r

Output files
- Fig10.9_ILT1.pdf

image_ILT1.r

1. Open "image_ILT1.r" on RGui.

2. Change the "path.id" on the line 7 to the path where you store this reference.

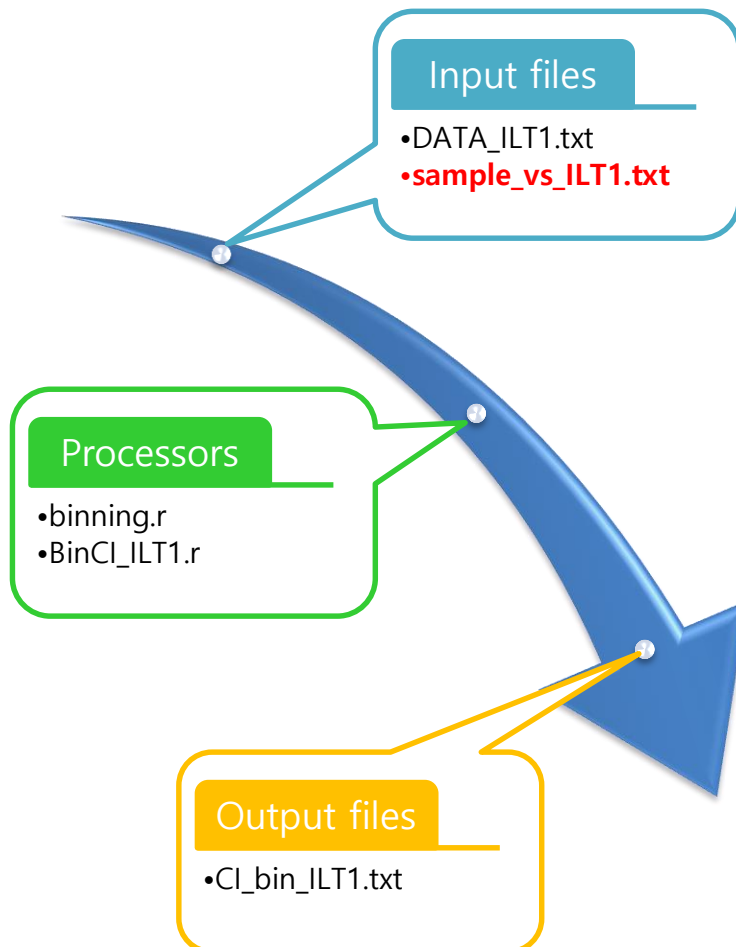* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.

* The same procedures can be applied for ILT2 and ILT3 as well.

Estimates of extreme load levels using binning (Table 10.5 and 10.6)

Input files
- DATA_ILT1.txt
- **sample_vs_ILT1.txt**

Processors
- binning.r
- BinCI_ILT1.r

Output files
- CI_bin_ILT1.txt

BinCI_ILT1.r

1. Open "BinCI_ILT1.r" on RGui.

2. Change the "path.id" on the line 3 to the path where you store this reference.

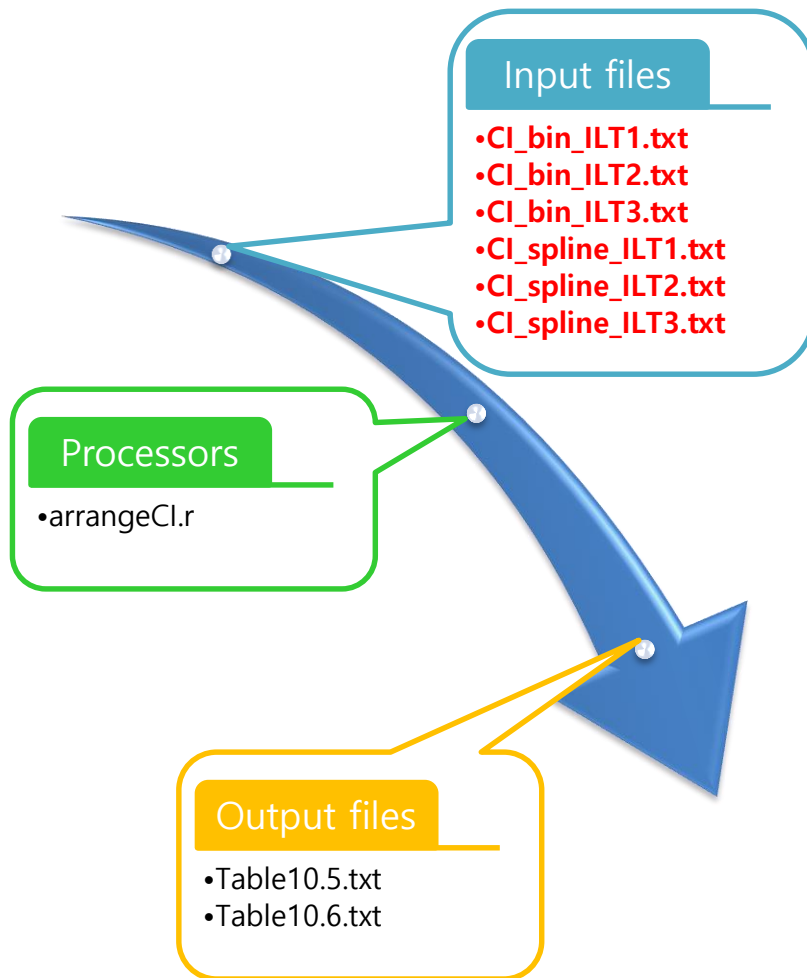* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. The output file "CI_bin_ILT1.txt" along with "CI_spline_ILT1.txt" obtained at slide 8 completes the ILT1 part of table 10.5 and 10.6.

* The same procedures can be applied for ILT2 and ILT3 as well.

Estimates of extreme load levels (Table 10.5 and 10.6)

Input files

- **CI_bin_ILT1.txt**
- **CI_bin_ILT2.txt**
- **CI_bin_ILT3.txt**
- **CI_spline_ILT1.txt**
- **CI_spline_ILT2.txt**
- **CI_spline_ILT3.txt**

Processors

- arrangeCI.r

Output files

- Table10.5.txt
- Table10.6.txt

arrangeCI.r

1. Open "arrangeCI.r" on RGui.

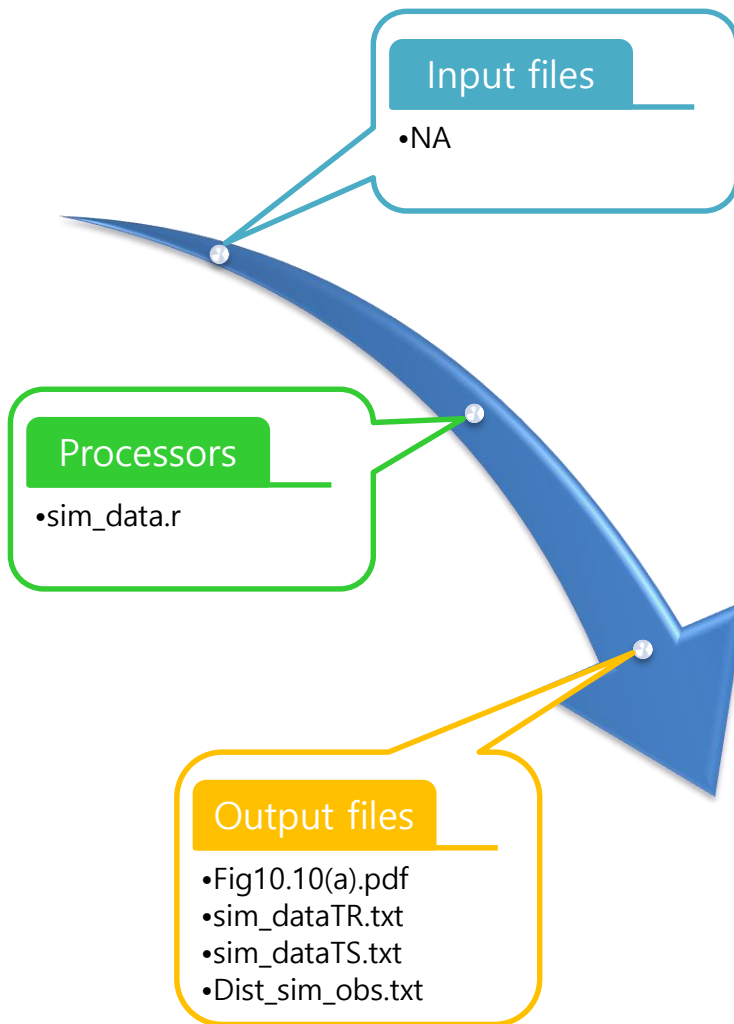2. Change the "path.id" on the line 1 to the path where you store this reference.

* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.

by Hoon Hwangbo

Simulation dataset (Figure 10.10 (a))

Input files
- NA

Processors
- sim_data.r

Output files
- Fig10.10(a).pdf
- sim_dataTR.txt
- sim_dataTS.txt
- Dist_sim_obs.txt

sim_data.r

1. Open "sim_data.r" on RGui.

2. Change the "path.id" on the line 5 to the path where you store this reference.

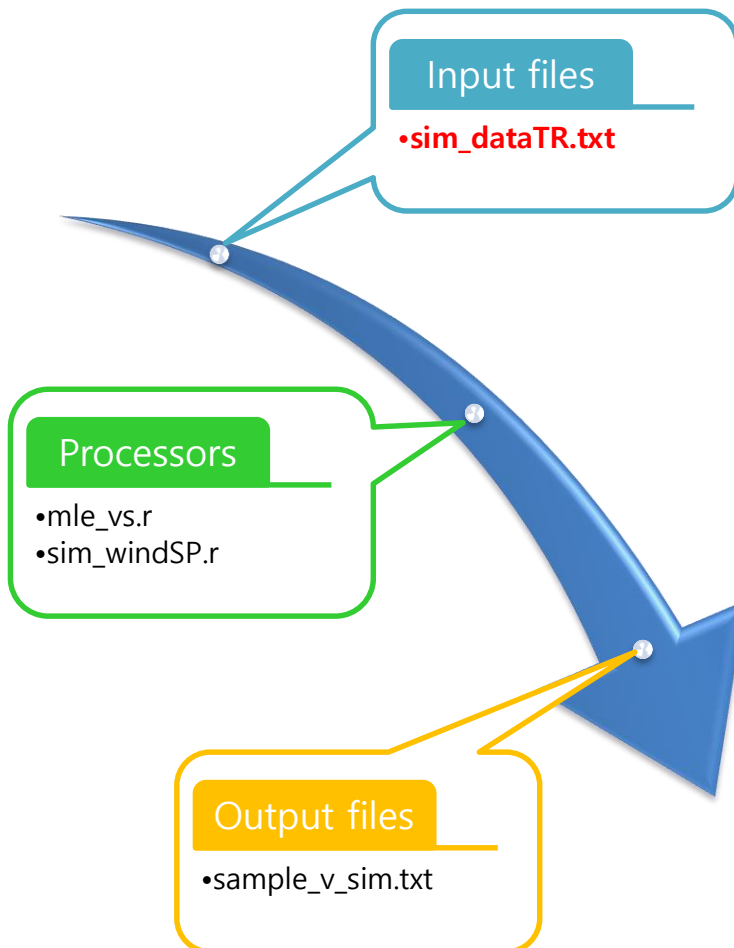* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. "sim_dataTR.txt" and "Dist_sim_obs.txt" will be used to get Figure 10.9 (b) and (c).

* This step should precede the processes on the following slides

Samples of simulated wind characteristics

Input files

•**sim_dataTR.txt**

Processors

•mle_vs.r
•sim_windSP.r

Output files

•sample_v_sim.txt

sim_windSP.r

1. Open "sim_windSP.r" on RGui.

2. Change the "path.id" on the line 4 to the path where you store this reference.

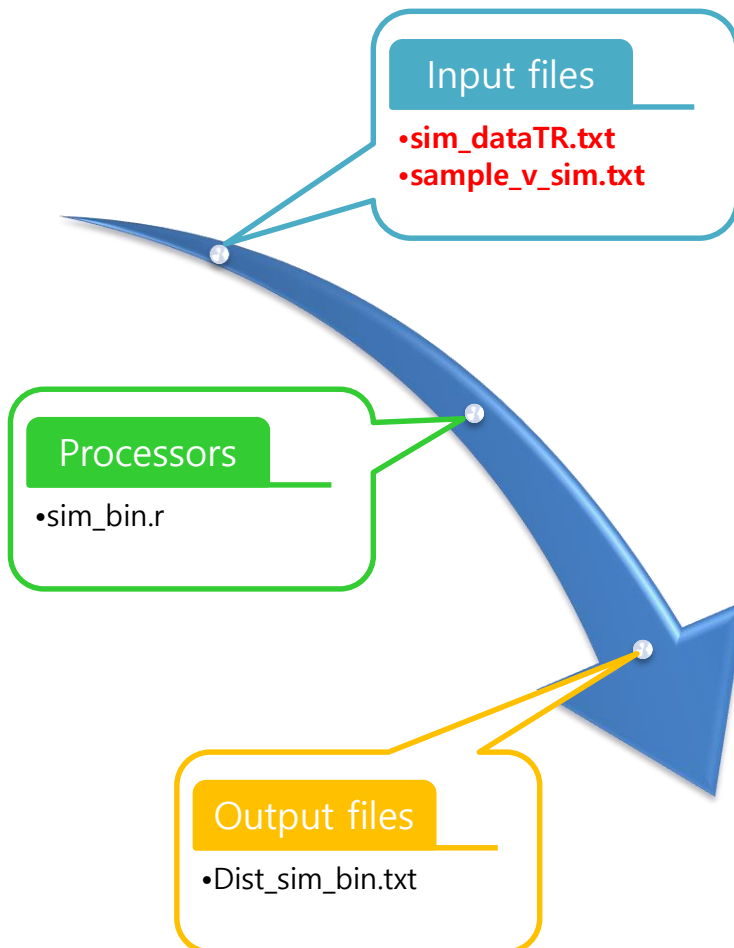* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. "sample_v_sim.txt" will be used to get Figure 10.10 (b) and (c).

* This step should precede the processes on the following slides

Simulated distribution of the binning estimate

Input files
- **sim_dataTR.txt**
- **sample_v_sim.txt**

Processors
- sim_bin.r

Output files
- Dist_sim_bin.txt

sim_bin.r

1. Open "sim_bin.r" on RGui.

2. Change the "path.id" on the line 5 to the path where you store this reference.

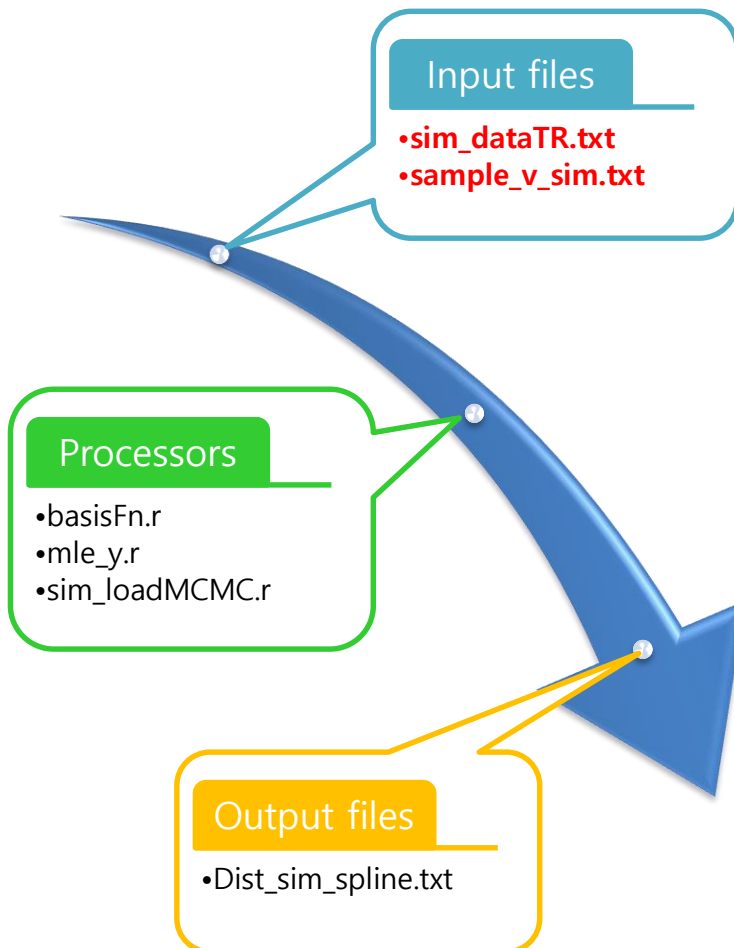   * Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

   * Note that the R editor should be activated to perform this.

4. "Dist_sim_bin.txt" will be used to get Figure 10.10 (b) and (c).

* It takes quite long time to get the result; roughly 12.2 hours.

Simulated distribution of the spline estimate

Input files
- **sim_dataTR.txt**
- **sample_v_sim.txt**

Processors
- basisFn.r
- mle_y.r
- sim_loadMCMC.r

Output files
- Dist_sim_spline.txt

sim_loadMCMC.r

1. Open "sim_loadMCMC.r" on RGui.

2. Change the "path.id" on the line 4 to the path where you store this reference.

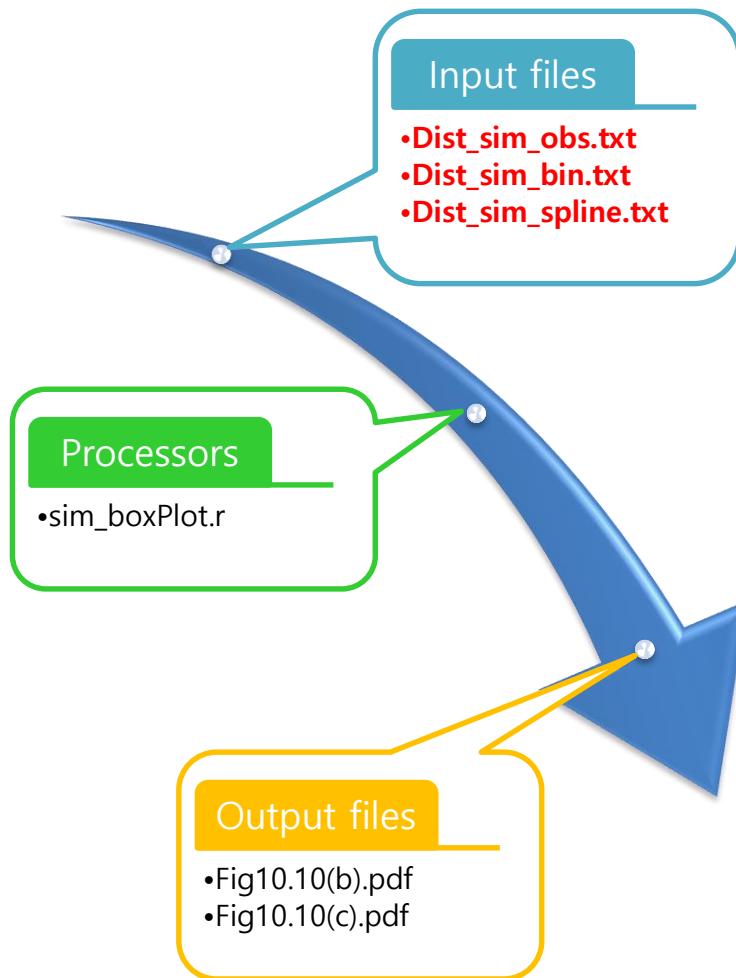* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. "Dist_sim_spline.txt" will be used to get Figure 10.10 (b) and (c).

* It takes quite long time to get the result; roughly 1.3 days.

Boxplots for the distribution of the estimates (Figure 10.10 (b) and (c))

Input files

- **Dist_sim_obs.txt**
- **Dist_sim_bin.txt**
- **Dist_sim_spline.txt**

Processors

- sim_boxPlot.r

Output files

- Fig10.10(b).pdf
- Fig10.10(c).pdf

sim_boxPlot.r

1. Open "sim_boxPlot.r" on RGui.

2. Change the "path.id" on the line 1 to the path where you store this reference.

* Make sure using "\\" to denote the sub folder (or sub path).

3. Run the code by clicking "Edit"-"Run all".

* Note that the R editor should be activated to perform this.

4. Output files are stored in the "Output" folder, the subfolder of your "path.id" folder.