LKMR – Case Study

Overview:

We present lagged kernel machine regression (LKMR) for identifying time windows of susceptibility to exposures of complex metal mixtures. LKMR identifies critical exposure windows of chemical mixtures, and accounts for complex nonlinear and non-additive effects of the mixture at any given exposure window.

This page presents an overview of using LKMR code to run a case study of simulated data.

We simulate data for a sample size of N = 100. For each individual, 5 environmental exposures are measured at 3 time windows, for a total of 15 time-varying environmental exposures per individual. This simulated data structure is similar to the real data application in the manuscript. In this simulated dataset, Z_1 and Z_2 exert an effect at all three time windows, while Z_4 exerts an effect at the third time window.

Case study example:

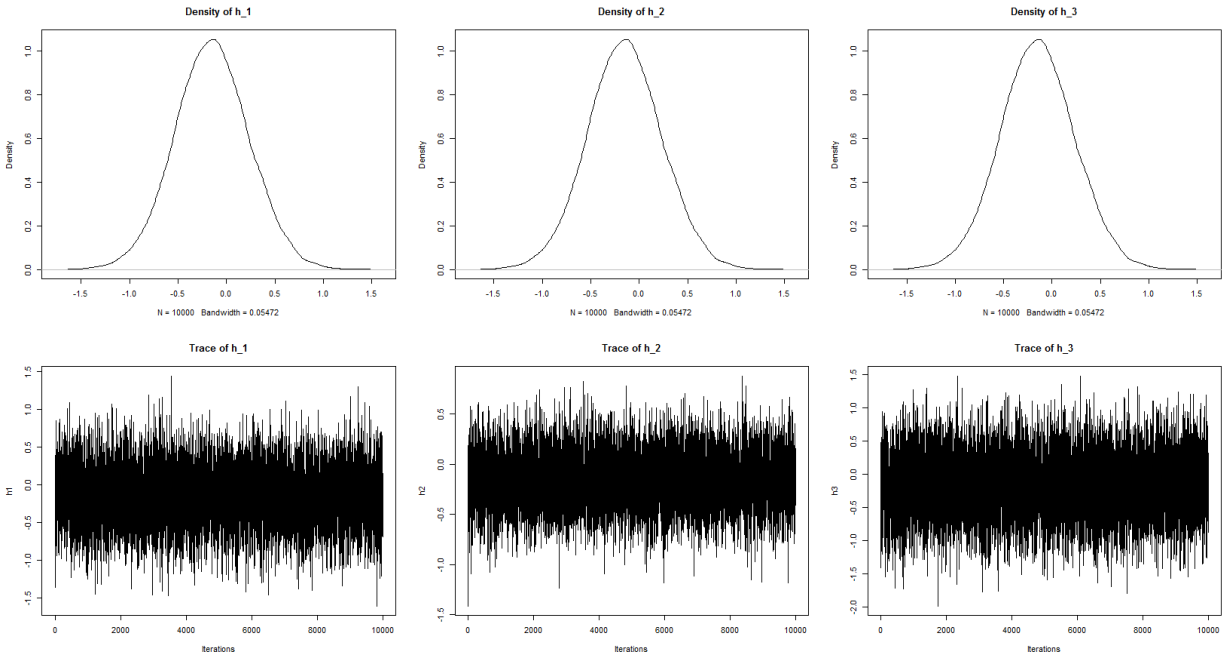
1) Open the dataset and run the MCMC.

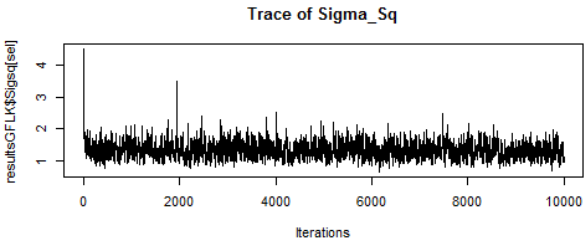
Run `*AnalysisCode.R*`, which calls `*DataExtraction.R*` to create the dataset, and then calls `*MCMC.R*` to run the algorithm.

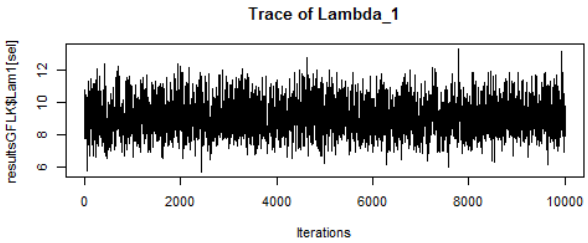
Alternatively, load the data and MCMC chain by running `*OpenRData.R*` if the MCMC algorithm has already been run for a dataset.

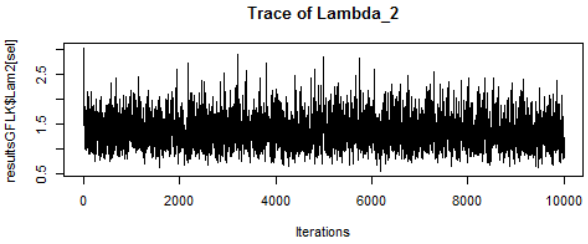
2) Assess model convergence.

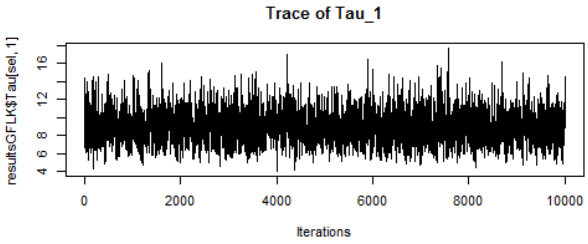
Create trace plots and marginal density plots, using the code in `*MCMCDiagnosticPlots.R*`.

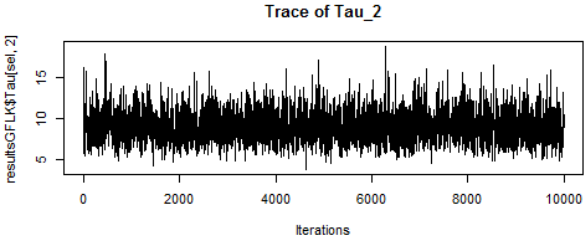


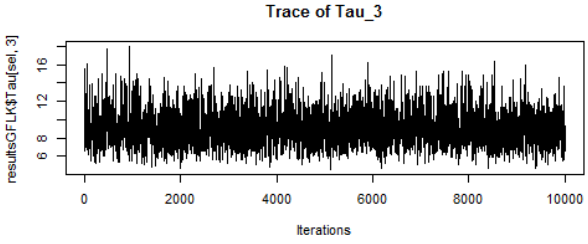

Trace of Sigma_Sq
resultsGFLK$Sigsq[sel]
Iterations

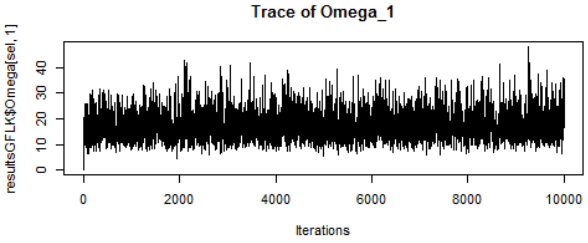

Trace of Lambda_1
resultsGFLK$Lam1[sel]
Iterations

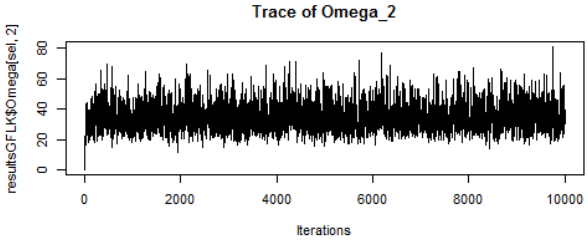

Trace of Lambda_2
resultsGFLK$Lam2[sel]
Iterations

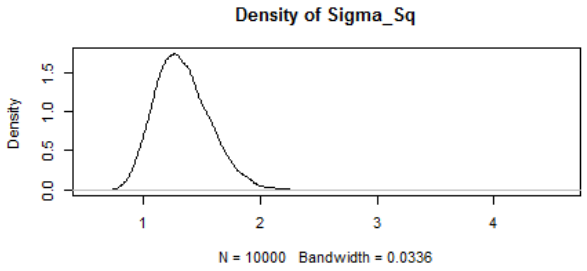

Trace of Tau_1
resultsGFLK$Tau[sel, 1]
Iterations

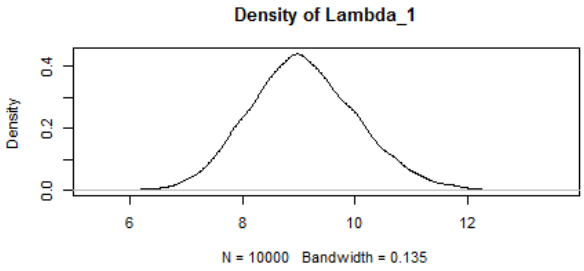

Trace of Tau_2
resultsGFLK$Tau[sel, 2]
Iterations

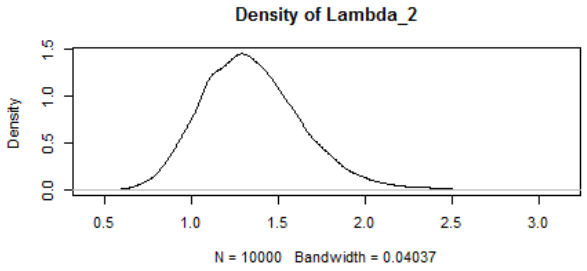

Trace of Tau_3
resultsGFLK$Tau[sel, 3]
Iterations

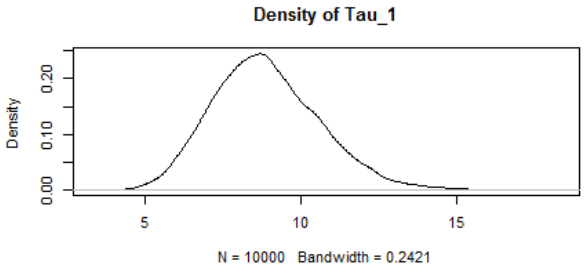

Trace of Omega_1
resultsGFLK$Omega[sel, 1]
Iterations

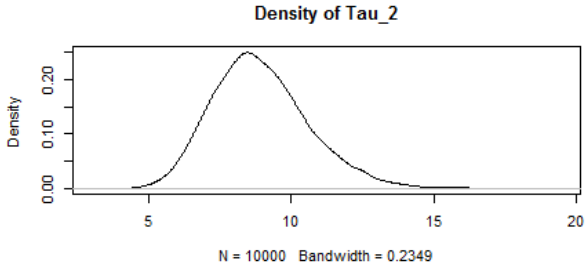

Trace of Omega_2
resultsGFLK$Omega[sel, 2]
Iterations

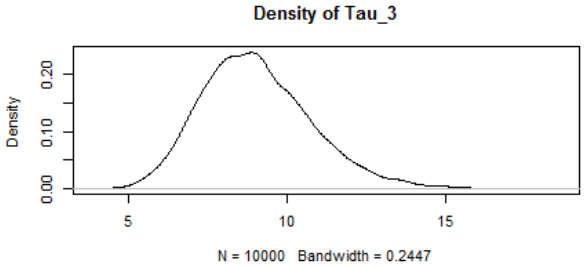

Density of Sigma_Sq
Density
0.0
0.5
1.0
1.5
1
2
3
4
N = 10000 Bandwidth = 0.0336

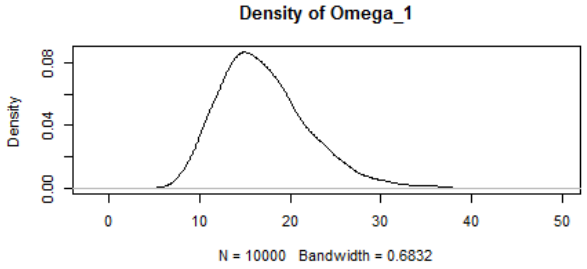

Density of Lambda_1
Density
0.0
0.2
0.4
6
8
10
12
N = 10000 Bandwidth = 0.135

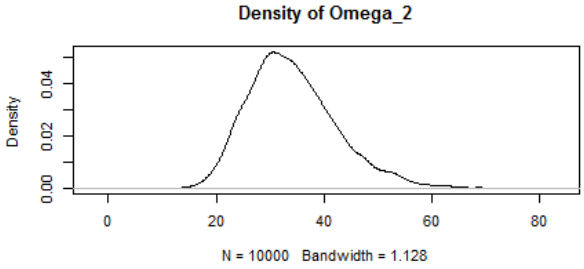

Density of Lambda_2
Density
0.0
0.5
1.0
1.5
0.5
1.0
1.5
2.0
2.5
3.0
N = 10000 Bandwidth = 0.04037


Density of Tau_1
Density
0.00
0.10
0.20
5
10
15
N = 10000 Bandwidth = 0.2421


Density of Tau_2
Density
0.00
0.10
0.20
5
10
15
20
N = 10000 Bandwidth = 0.2349

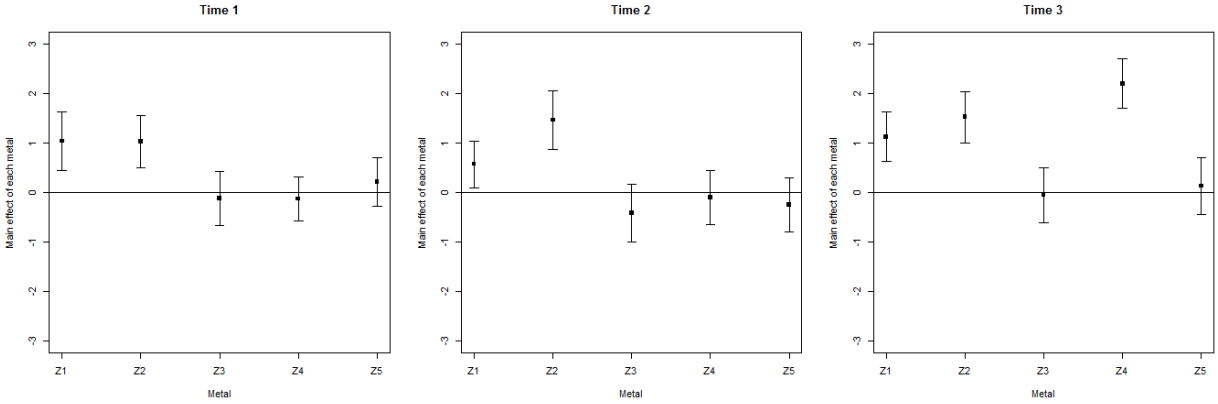

Density of Tau_3
Density
0.00
0.10
0.20
5
10
15
N = 10000 Bandwidth = 0.2447


Density of Omega_1
Density
0.00
0.04
0.08
0
10
20
30
40
50
N = 10000 Bandwidth = 0.6832

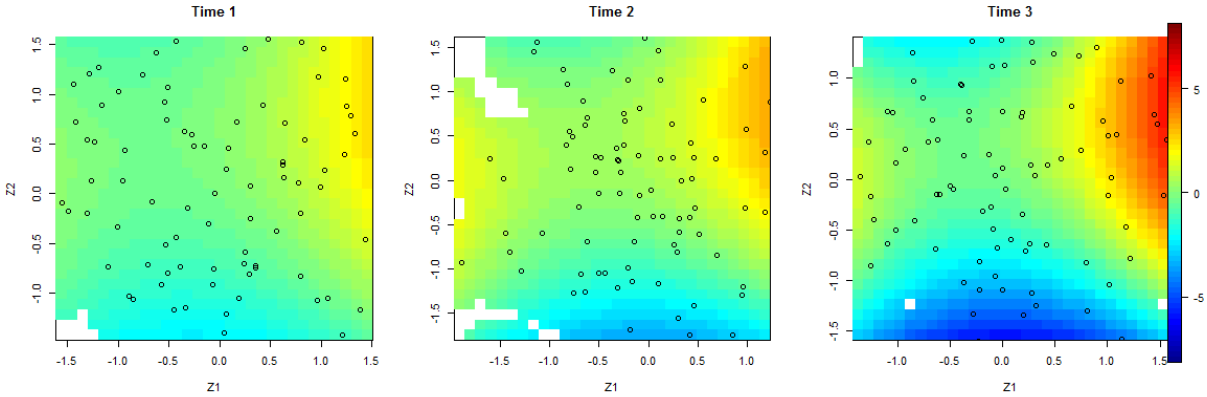

Density of Omega_2
Density
0.00
0.02
0.04
0
20
40
60
80
N = 10000 Bandwidth = 1.128

3) Make plots, analogous to Figures 1-4 of the manuscript.

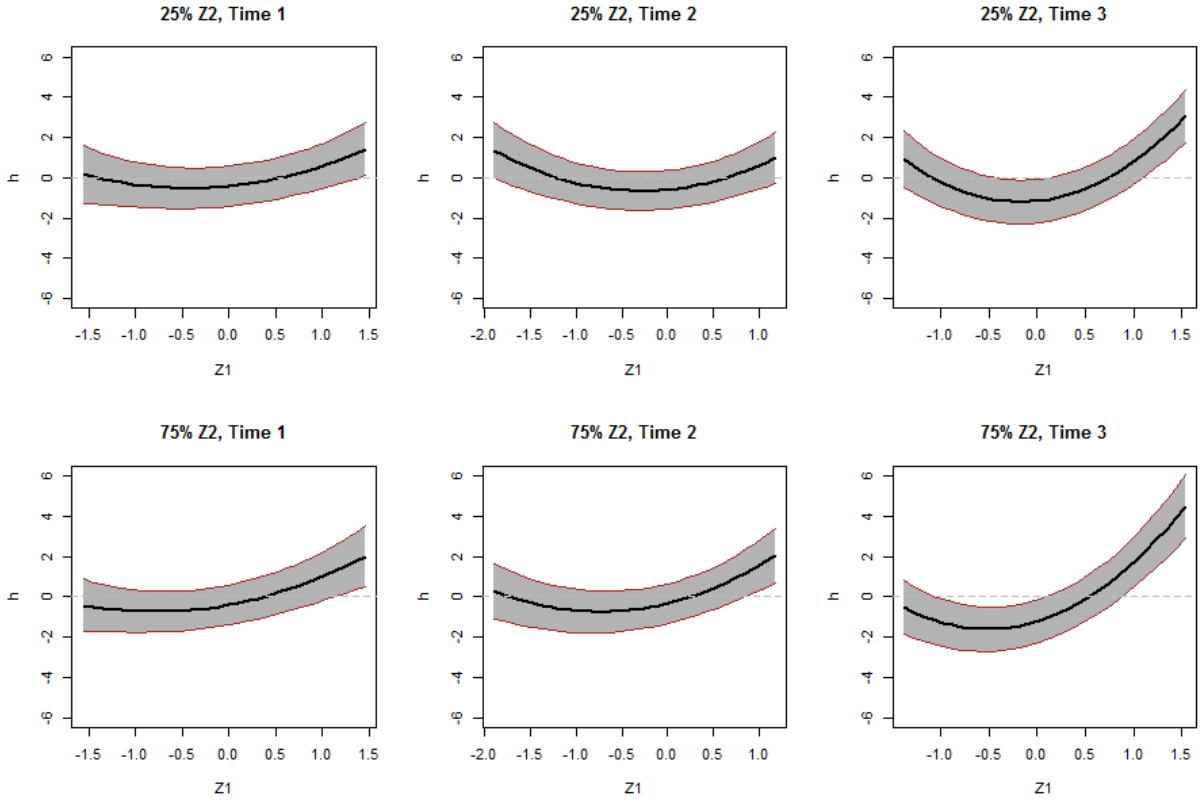
Run `*RelativeImportance.R*` to create the 1x3 panel of main effects of five metals at 3 time points.



Run `*Heatmap.R*` to create the 1x3 panel of Z_1-Z_2 effects for 3 time points.



Run `*CrossSections.R*` to create the 2x3 panel of Z_1 effects at low/high Z_2 for 3 time points.



Run `*Interaction.R*` to create the plot of the overall interaction between Z_1-Z_2 at 3 time points.