Étude MCMC - MixtureOfUniforms

Alaa, Amadou, Rayen

1er avril 2025

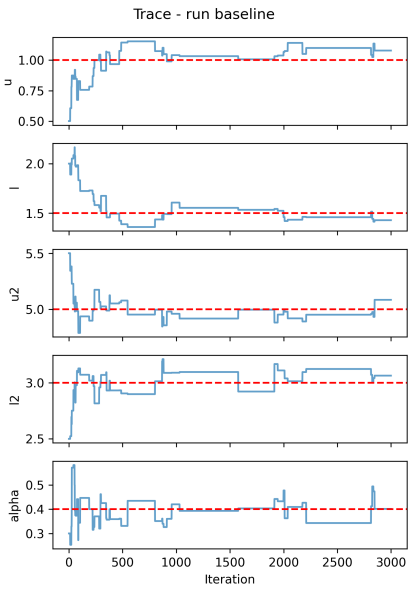
1 Explication de l'Expérience

Nous considérons un mélange de deux lois Uniform. Les paramètres (u, l) définissent la première loi Uniform$(u, u + l)$, tandis que $(u2, l2)$ définissent la seconde loi Uniform$(u2, u2 + l2)$. Une observation est tirée de la première loi avec probabilité α, et de la seconde loi sinon. Nous cherchons à estimer $(u, l, u2, l2, \alpha)$ par MCMC et à mesurer l'erreur de convergence.

2 Baseline

Si un run est étiqueté `baseline`, nous le présentons ci-dessous, puis comparons les autres runs qui ne diffèrent de `baseline` que par un seul paramètre.

Run baseline	
N	200
bandwidth	0.05
n_sim	2000
proposal_scale	0.1
n_iter	3000
pm_u	1.06
pm_l	1.49
pm_u2	4.96
pm_l2	3.06
pm_alpha	0.38
err_u	0.065
err_l	0.011
err_u2	0.041
err_l2	0.063
err_alpha	0.016
err_global	0.101



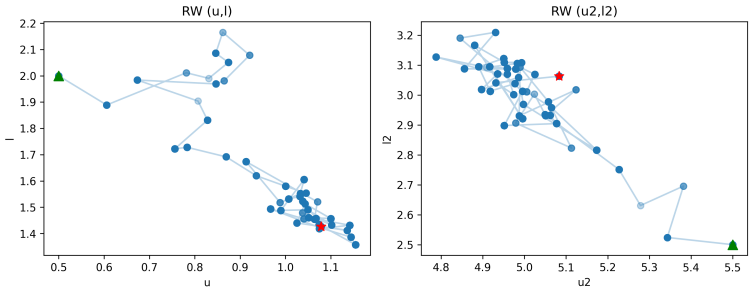
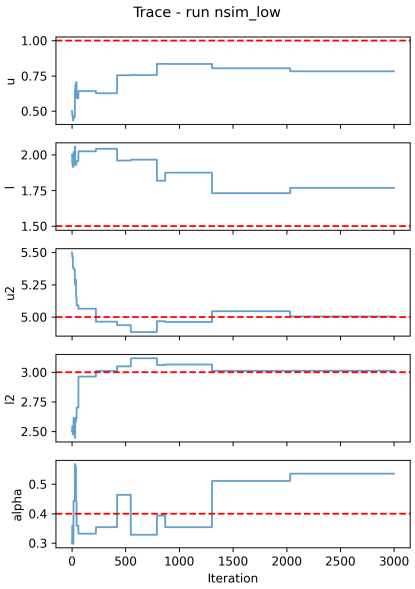


FIGURE 1 – Random-walk pour run `baseline`

Variation de n_sim

Run nsim_low	
N	200
bandwidth	0.05
n_sim	500
proposal_scale	0.1
n_iter	3000
pm_u	0.79
pm_l	1.76
pm_u2	5.02
pm_l2	3.02
pm_alpha	0.51
err_u	0.205
err_l	0.259
err_u2	0.017
err_l2	0.015
err_alpha	0.115
err_global	0.351



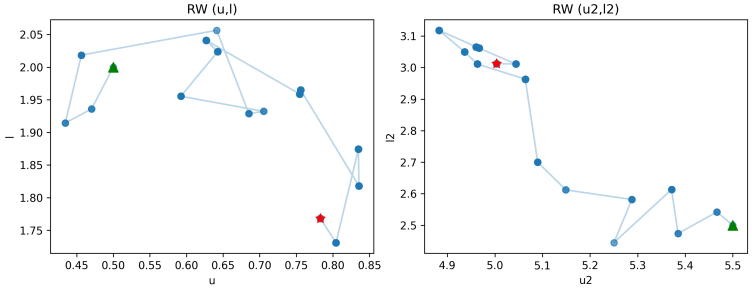


FIGURE 2 – Random-walk pour run `nsim_low`

Run nsim_high	
N	200
bandwidth	0.05
n_sim	5000
proposal_scale	0.1
n_iter	3000
pm_u	0.99
pm_l	1.56
pm_u2	4.95
pm_l2	2.99
pm_alpha	0.34
err_u	0.013
err_l	0.056
err_u2	0.050
err_l2	0.015
err_alpha	0.056
err_global	0.096

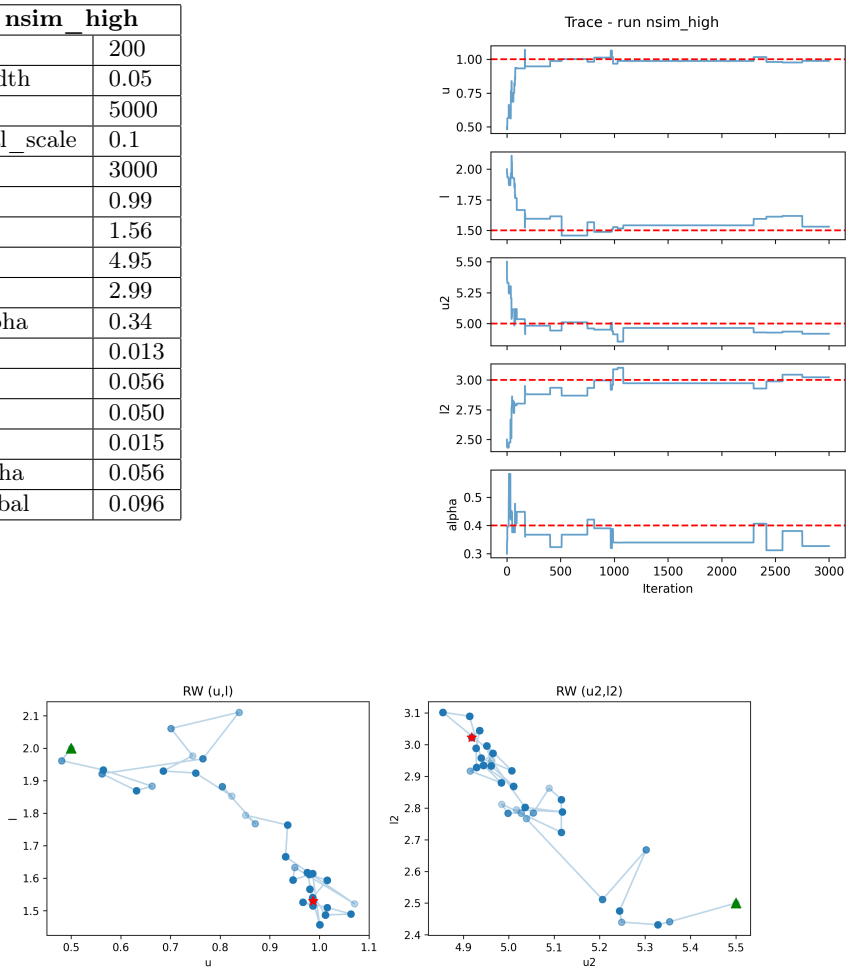


FIGURE 3 – Random-walk pour run `nsim_high`

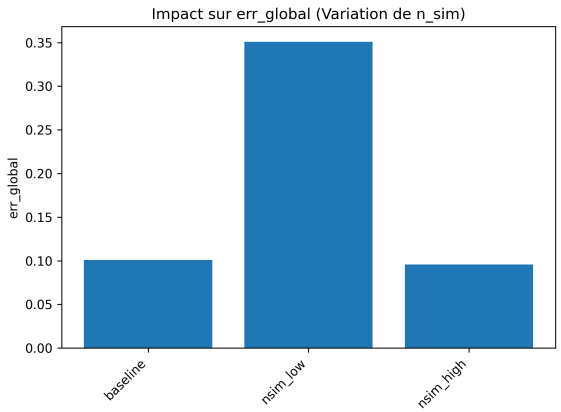
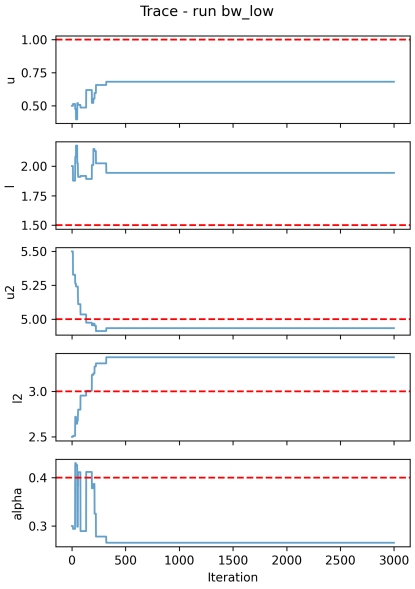


FIGURE 4 – Comparaison de err_global (baseline vs variations de n_sim)

Variation de bandwidth

Run bw_low	
N	200
bandwidth	0.01
n_sim	2000
proposal_scale	0.1
n_iter	3000
pm_u	0.68
pm_l	1.94
pm_u2	4.93
pm_l2	3.38
pm_alpha	0.27
err_u	0.318
err_l	0.443
err_u2	0.067
err_l2	0.375
err_alpha	0.135
err_global	0.678



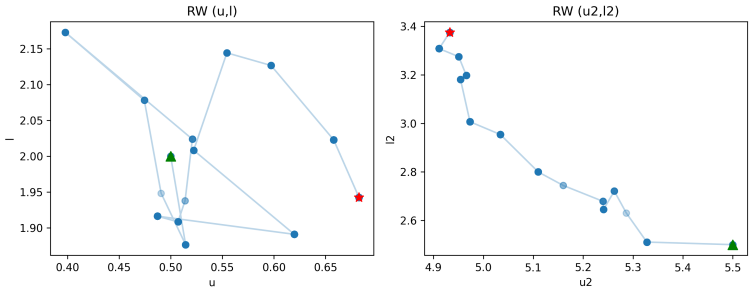
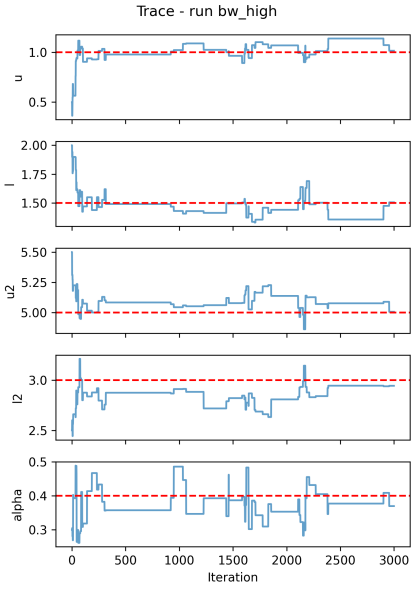


FIGURE 5 – Random-walk pour run `bw_low`

Run bw_high	
N	200
bandwidth	0.1
n_sim	2000
proposal_scale	0.1
n_iter	3000
pm_u	1.06
pm_l	1.43
pm_u2	5.09
pm_l2	2.85
pm_alpha	0.38
err_u	0.057
err_l	0.069
err_u2	0.092
err_l2	0.155
err_alpha	0.024
err_global	0.203



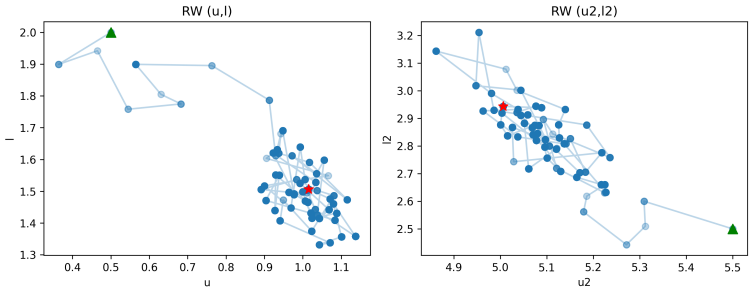


FIGURE 6 – Random-walk pour run `bw_high`

Run bw_higher	
N	200
bandwidth	0.5
n_sim	2000
proposal_scale	0.1
n_iter	3000
pm_u	1.39
pm_l	1.27
pm_u2	4.95
pm_l2	2.38
pm_alpha	0.46
err_u	0.389
err_l	0.229
err_u2	0.047
err_l2	0.618
err_alpha	0.058
err_global	0.769

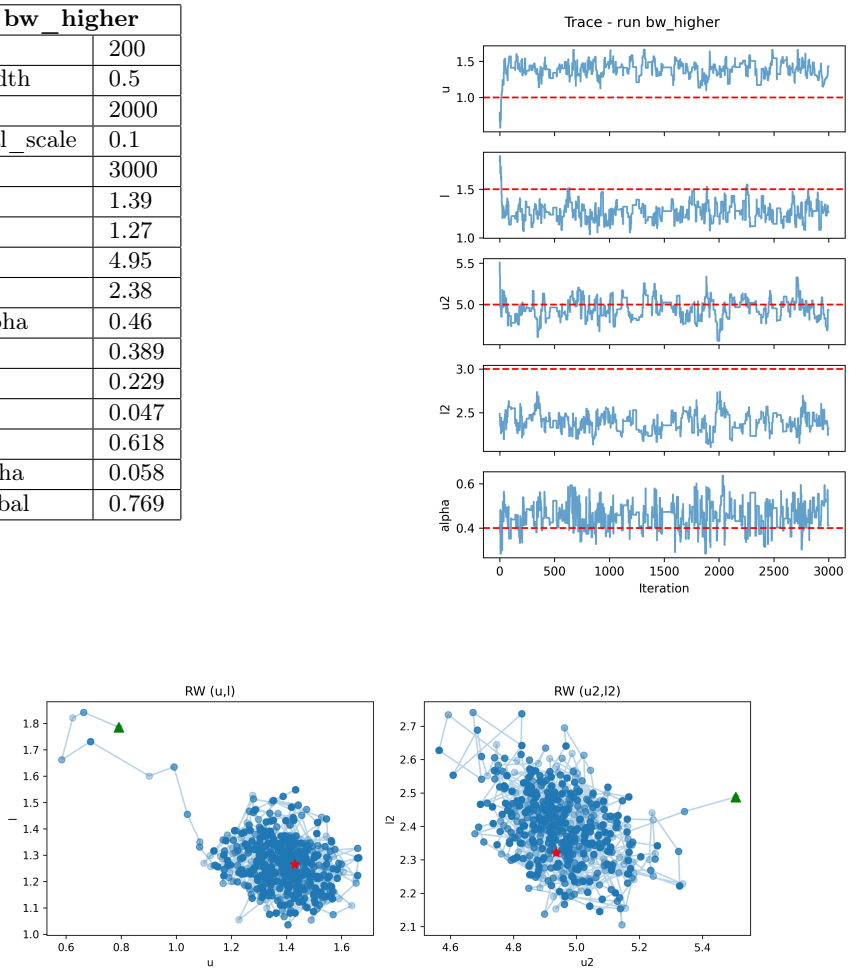


FIGURE 7 – Random-walk pour run `bw_higher`

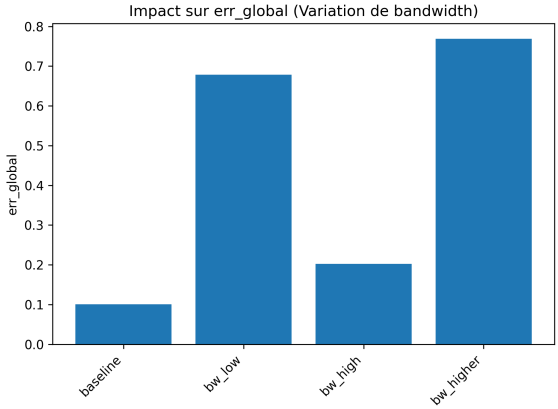
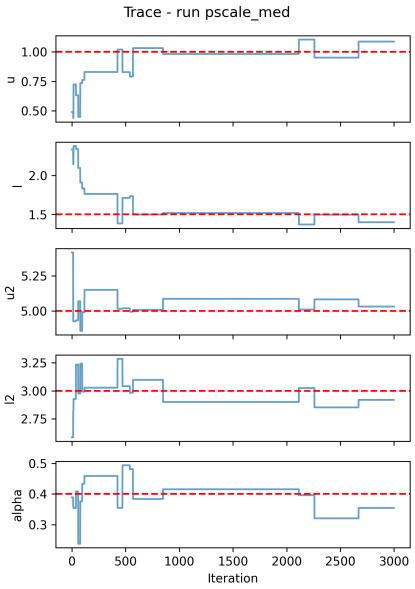


FIGURE 8 – Comparaison de err_global (baseline vs variations de bandwidth)

Variation de proposal_scale

Run pscale_med	
N	200
bandwidth	0.05
n_sim	2000
proposal_scale	0.3
n_iter	3000
pm_u	1.00
pm_l	1.48
pm_u2	5.07
pm_l2	2.90
pm_alpha	0.38
err_u	0.004
err_l	0.021
err_u2	0.070
err_l2	0.097
err_alpha	0.019
err_global	0.123



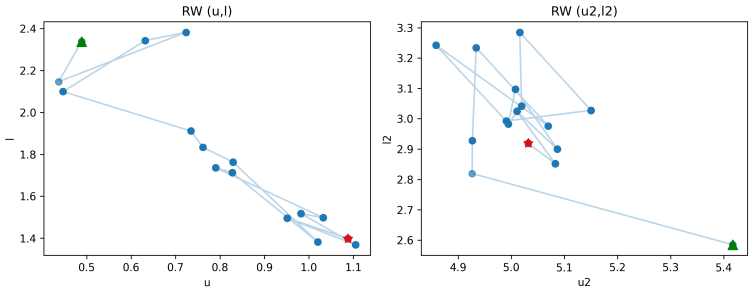
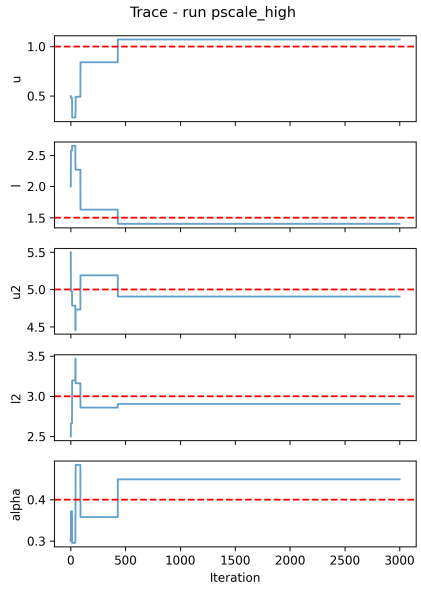


FIGURE 9 – Random-walk pour run `pscale_med`

Run pscale_high	
N	200
bandwidth	0.05
n_sim	2000
proposal_scale	0.5
n_iter	3000
pm_u	1.07
pm_l	1.40
pm_u2	4.91
pm_l2	2.90
pm_alpha	0.45
err_u	0.072
err_l	0.101
err_u2	0.094
err_l2	0.095
err_alpha	0.049
err_global	0.189



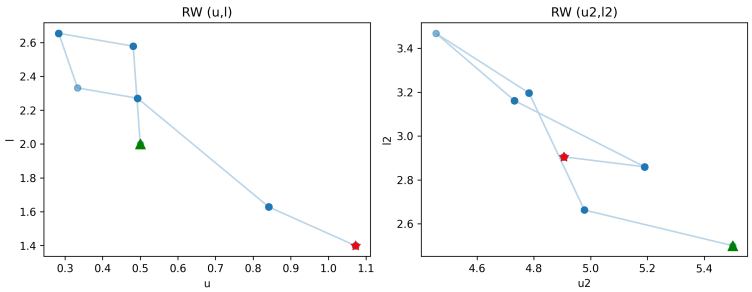


FIGURE 10 – Random-walk pour run `pscale_high`

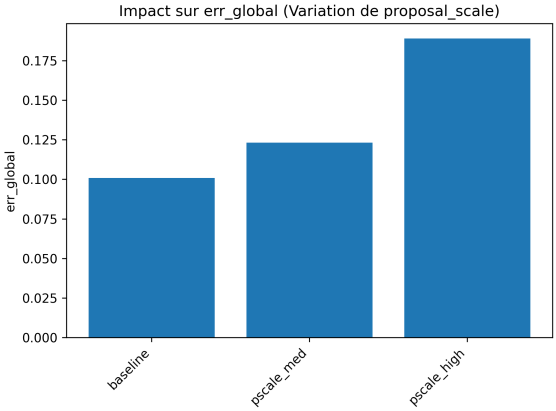
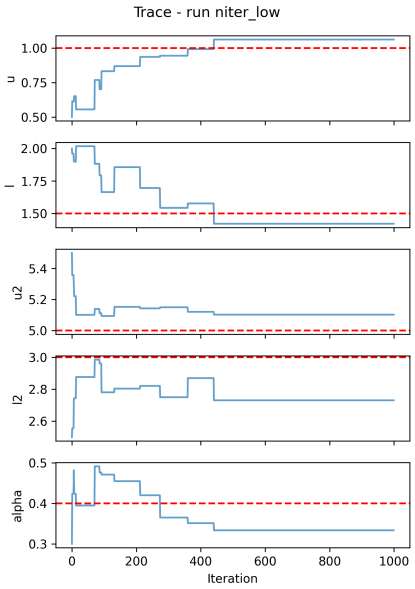


FIGURE 11 – Comparaison de err_global (baseline vs variations de proposal_scale)

Variation de n_iter

Run niter_low	
N	200
bandwidth	0.05
n_sim	2000
proposal_scale	0.1
n_iter	1000
pm_u	1.06
pm_l	1.43
pm_u2	5.10
pm_l2	2.74
pm_alpha	0.33
err_u	0.056
err_l	0.068
err_u2	0.103
err_l2	0.260
err_alpha	0.065
err_global	0.300



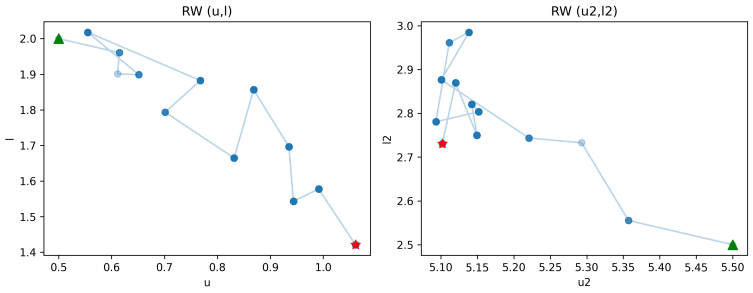
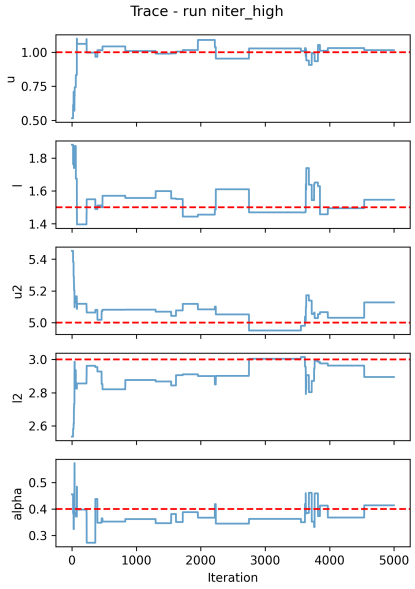


FIGURE 12 – Random-walk pour run `niter_low`

Run niter_high	
N	200
bandwidth	0.05
n_sim	2000
proposal_scale	0.1
n_iter	5000
pm_u	1.01
pm_l	1.52
pm_u2	5.04
pm_l2	2.95
pm_alpha	0.37
err_u	0.013
err_l	0.021
err_u2	0.037
err_l2	0.054
err_alpha	0.025
err_global	0.074



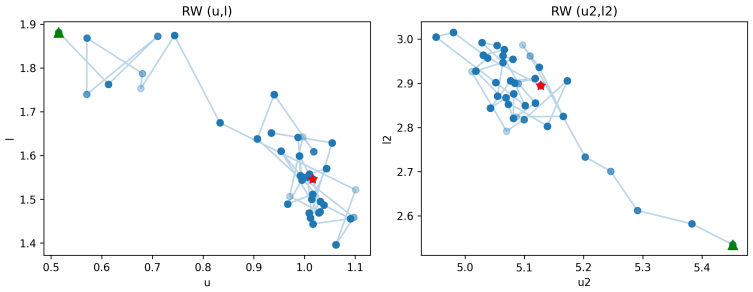


FIGURE 13 – Random-walk pour run `niter_high`

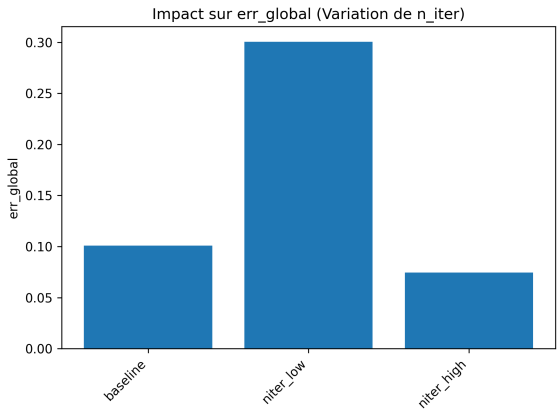
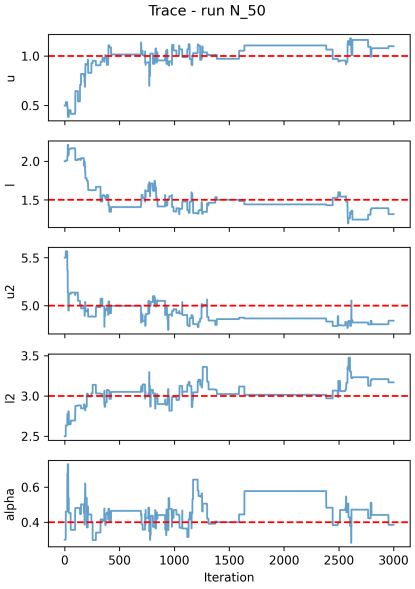


FIGURE 14 – Comparaison de err_global (baseline vs variations de n_iter)

Variation de N

Run N_50	
N	50
bandwidth	0.05
n_sim	2000
proposal_scale	0.1
n_iter	3000
pm_u	1.07
pm_l	1.42
pm_u2	4.85
pm_l2	3.09
pm_alpha	0.50
err_u	0.071
err_l	0.078
err_u2	0.148
err_l2	0.088
err_alpha	0.097
err_global	0.224



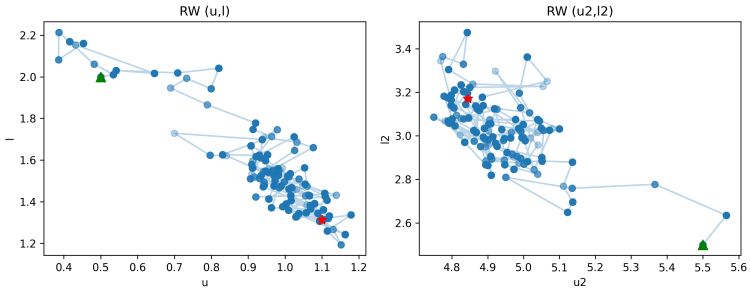
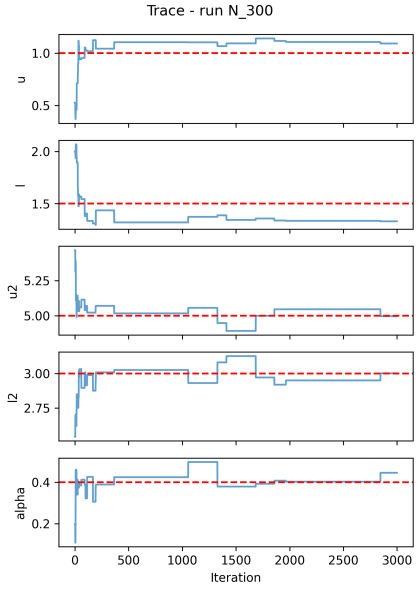


FIGURE 15 – Random-walk pour run `N_50`

Run N_300	
N	300
bandwidth	0.05
n_sim	2000
proposal_scale	0.1
n_iter	3000
pm_u	1.11
pm_l	1.34
pm_u2	5.01
pm_l2	2.99
pm_alpha	0.41
err_u	0.106
err_l	0.158
err_u2	0.009
err_l2	0.013
err_alpha	0.008
err_global	0.191



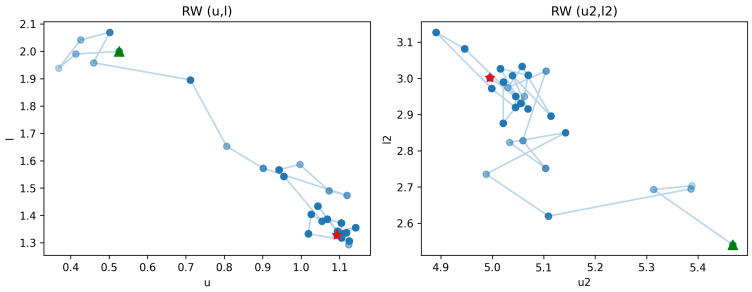


FIGURE 16 – Random-walk pour run `N_300`

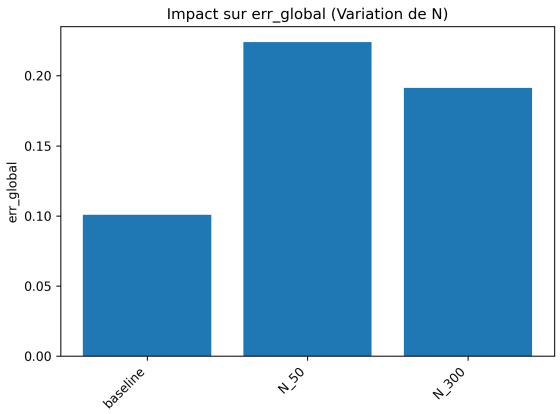


FIGURE 17 – Comparaison de err_global (baseline vs variations de N)