mcmc_analysis_Denmark_M_1900_hetro_baysian

November 24, 2025

1 # 1. Density coner plot

A sample is 1 parameter set scanned. For the corner plot below, the quantiles (represented by the solid lines) are 0.16,0.5,0.84 of the samples. Dots represent individual samples (outside the line surrounding 0.84 of the samples) The parameter search is performed in the transformed space of x_c/η, β/η, x_c^2/ϵ, x_c but we also show the regular parameters

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(25,)
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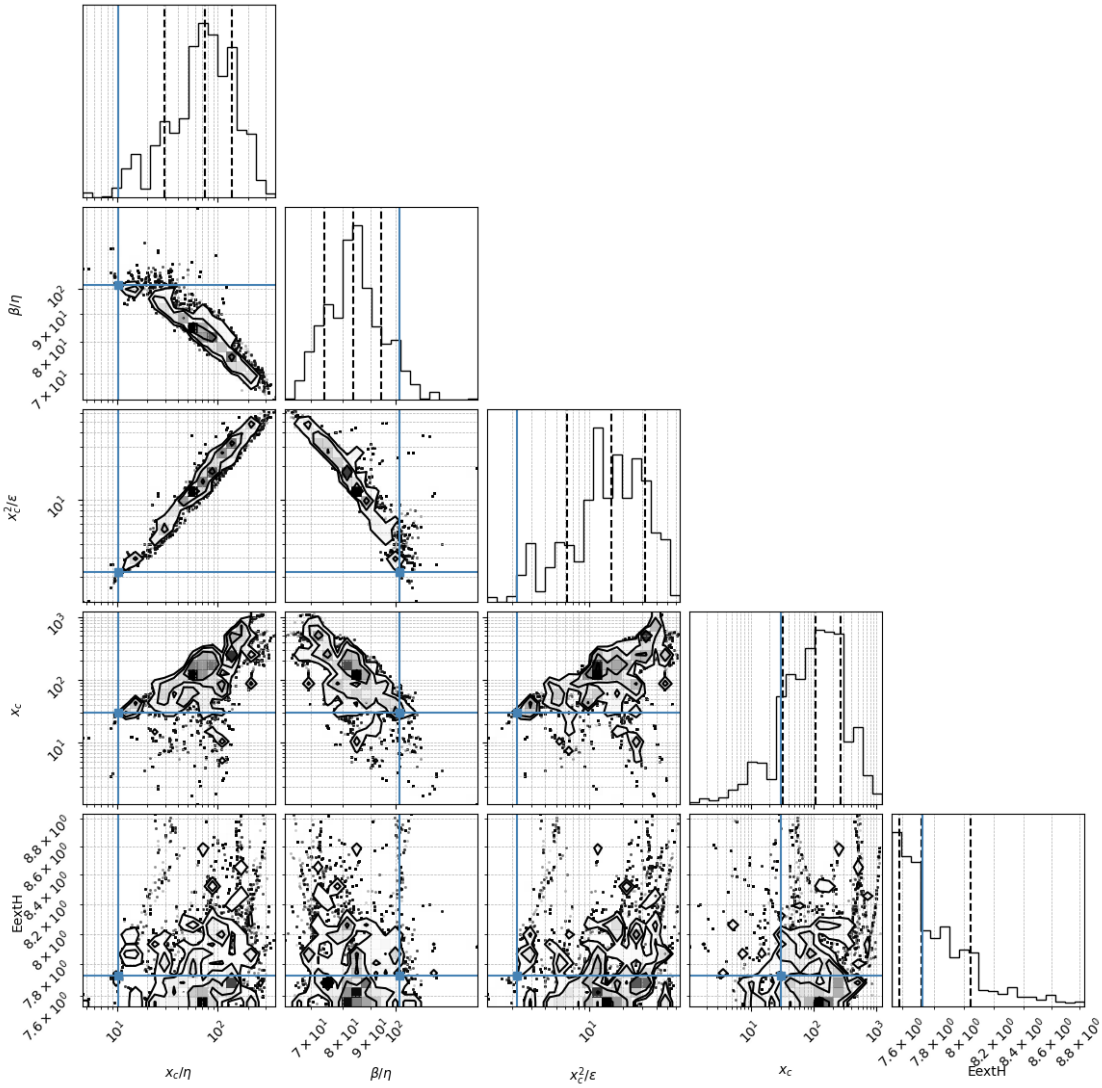
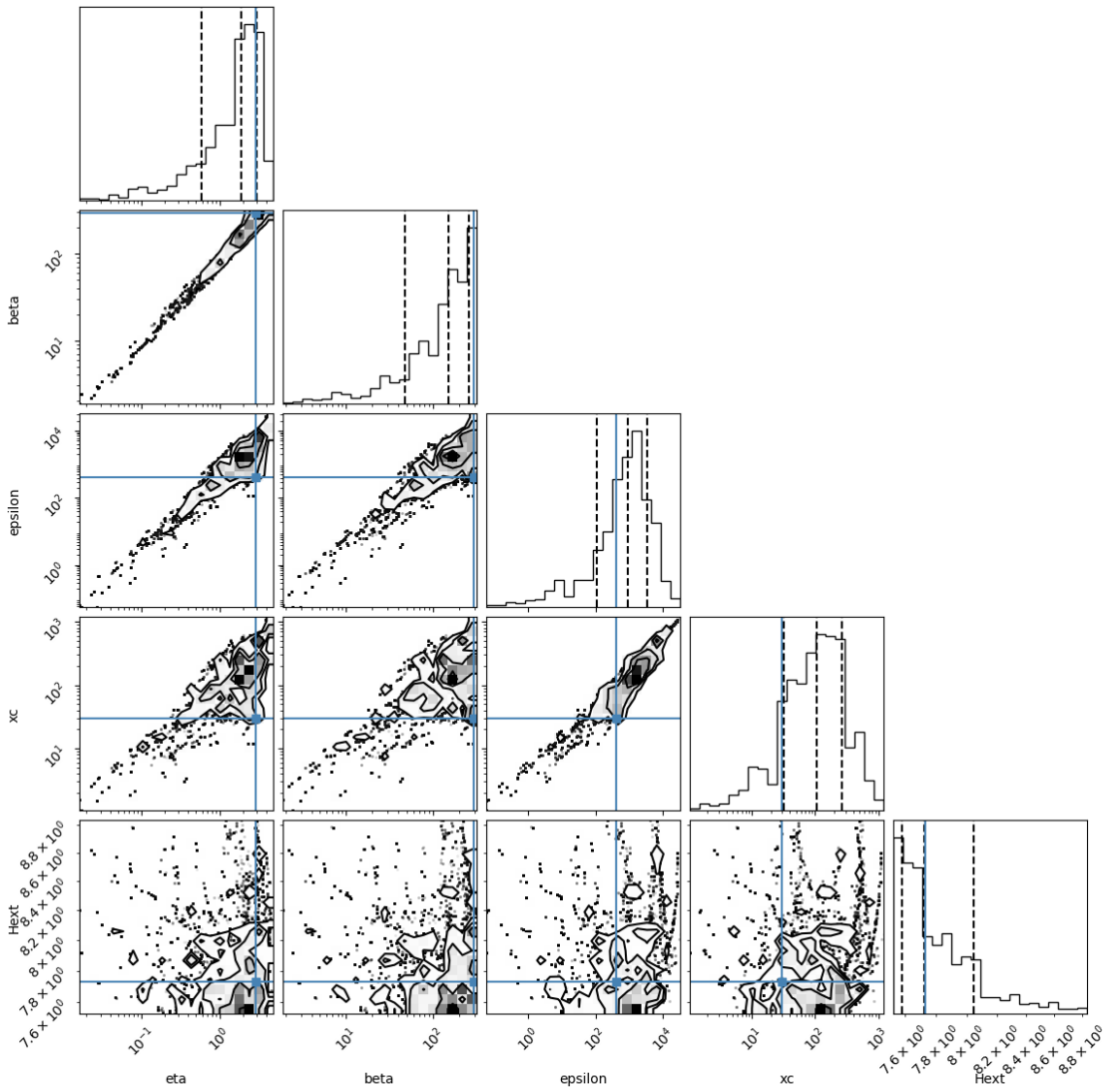
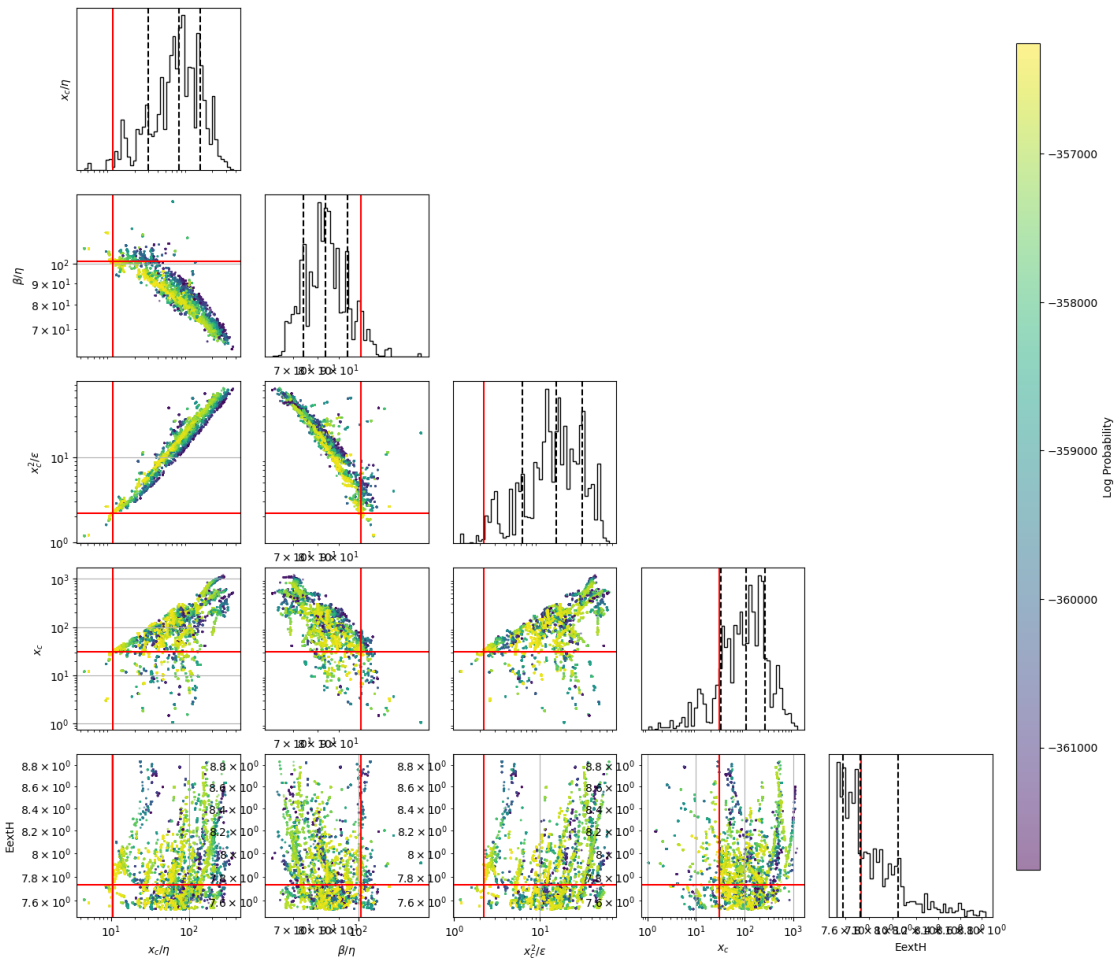

x_c/η
β/η
x_c^2/ε
x_c
EextH



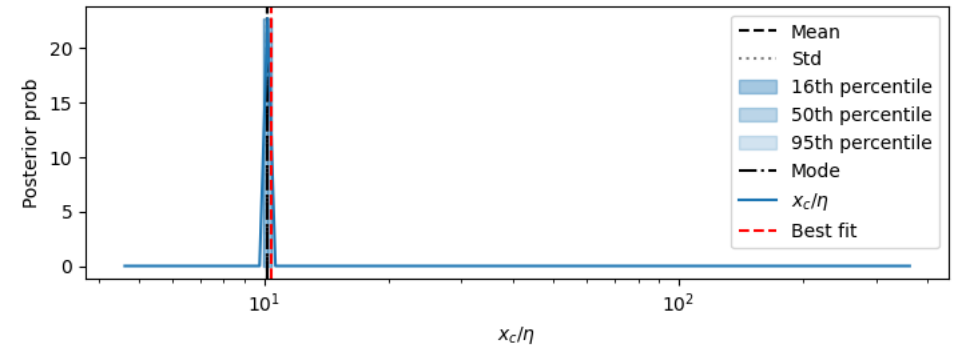
2 2. Heat map corner plot of raw samples

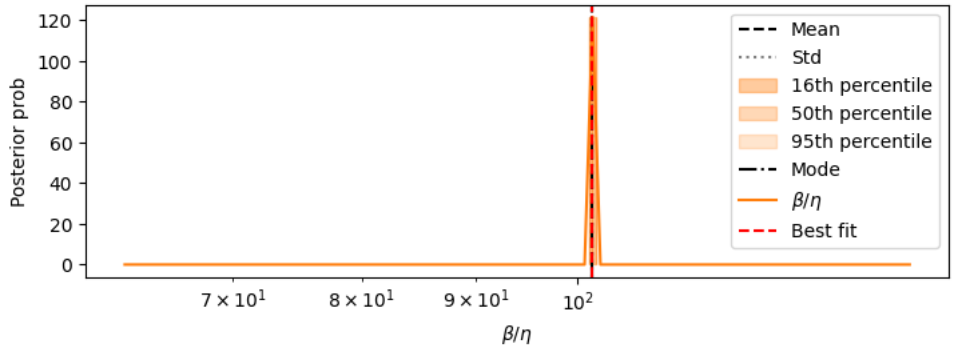
This plot shows all the raw sample points and their lnprobability

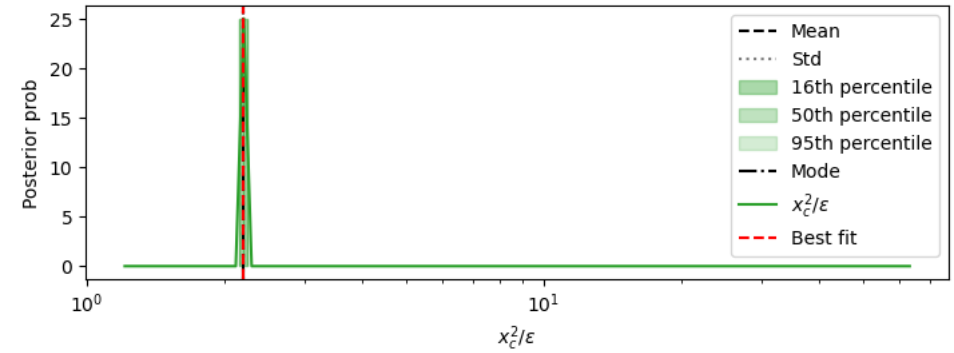


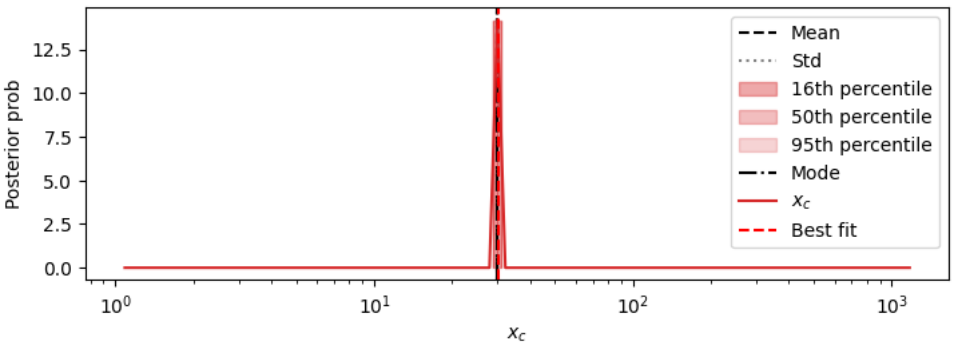
3 3. Posterior distributions of parameters

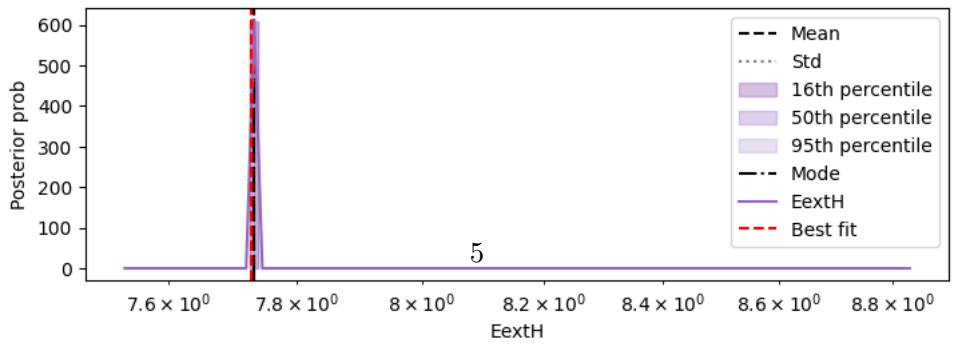
1d marginalizations of posterior distributions. we use a grid of size nbins=100-150


Posterior prob
x_c/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c/η
Best fit


Posterior prob
β/η
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
β/η
Best fit

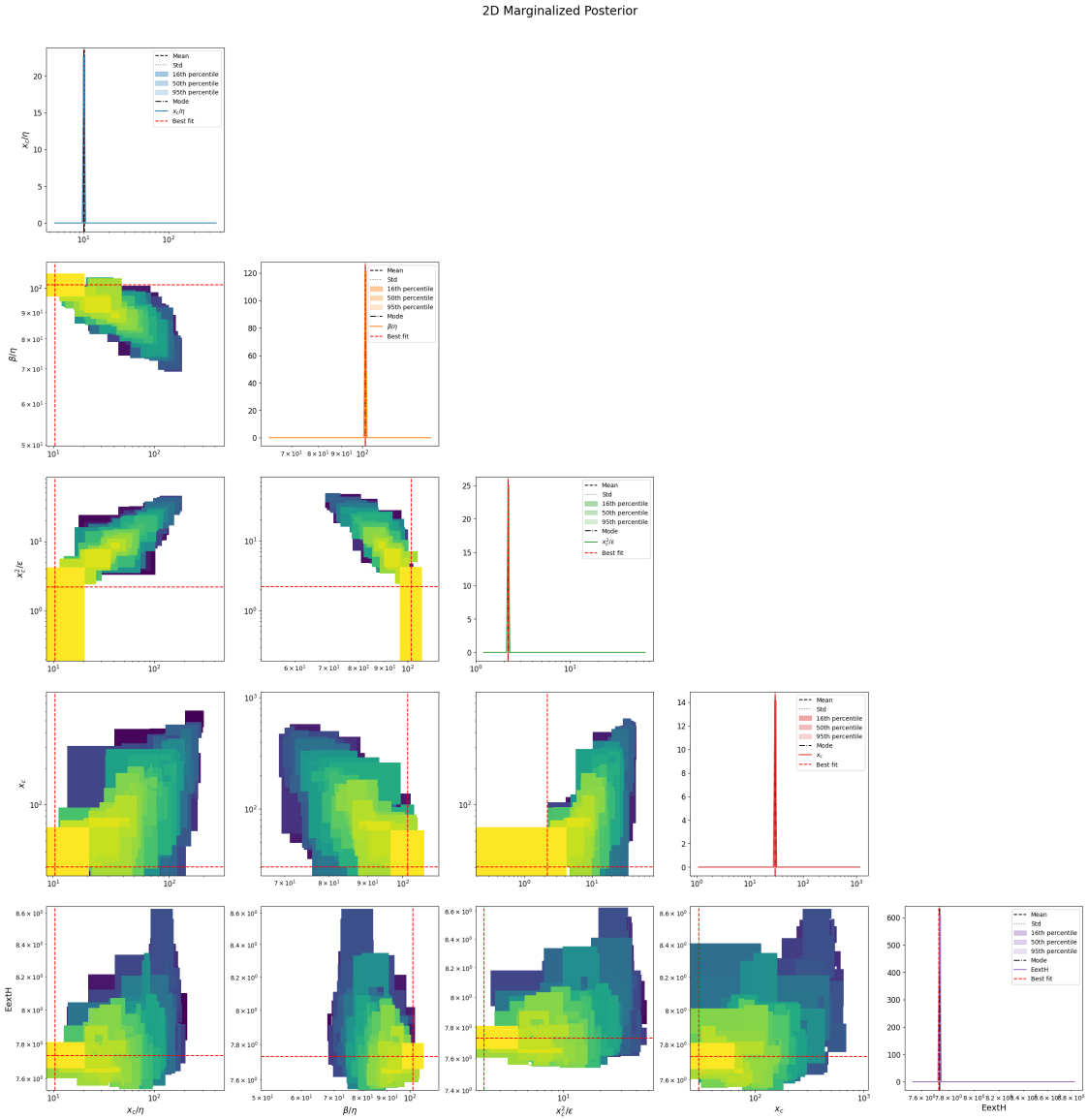

Posterior prob
x_c^2/ε
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c^2/ε
Best fit


Posterior prob
x_c
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c
Best fit


Posterior prob
EextH
Mean
Std
16th percentile
50th percentile
95th percentile
Mode
EextH
Best fit

2D marginalizations of posterior distributions

```
/Volumes/alon/navehr/SRtools/SRtools/samples_utils.py:474: UserWarning: The
input coordinates to pcolormesh are interpreted as cell centers, but are not
monotonically increasing or decreasing. This may lead to incorrectly calculated
cell edges, in which case, please supply explicit cell edges to pcolormesh.
  ax.pcolormesh(X, Y, Z, **kwargs)
```




```
Rescaling the samples TIME by 365
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4 4. Table of results

mode is the marginalized mode, max_likwlihood is the sample with highest likelihood mode_overall is the 4D posterior mode

	mean	\
xc/eta	10.199	
beta/eta	101.592	
xc^2/epsilon	2.205	
xc	29.925	
ExtH	7.733	
eta	2.835	
beta	296.124	
epsilon	389.647	
sqrt(xc/eta)	3.194	
s= eta^0.5*xc^1.5/epsilon	0.678	
beta*xc/epsilon	21.571	
eta*xc/epsilon	0.213	
Fx=beta^2/eta*xc	1011.585	
Dx =beta*epsilon/eta*xc^2	45.72	
Pk=beta*k/epsilon	0.364	
Fk=beta^2/eta*k	61354.735	
Dk =beta*epsilon/eta*k^2	166167.275	
Fk^2/Dk=beta^3/eta*epsilon	21472.358	
epsilon/beta^2	0.00484	
k/beta	0.00169	
k^2/epsilon	0.000641	
eta/xc	0.098	
beta/xc	9.682	
epsilon/xc^2	0.453	
k/xc	0.0167	
best fit no ext hazard_MedianLifetime	74.26	
best fit no ext hazard_MaxLifetime	104.26	
best fit_MedianLifetime	73.89	
best fit_MaxLifetime	103.93	
data_MedianLifetime	69.0	
data_MaxLifetime	103.5	
ML_lnprob	-356253.438867	

	std	\
xc/eta	[1.68e-08, 1.68e-08]	
beta/eta	[1.62e-08, 1.62e-08]	
xc^2/epsilon	[3.42e-09, 3.42e-09]	
xc	[5.33e-08, 5.33e-08]	
ExtH	[2.26e-10, 2.26e-10]	
eta	[5.52e-10, 5.52e-10]	

beta	[3.47e-08, 3.47e-08]
epsilon	[7.67e-07, 7.67e-07]
sqrt(xc/eta)	[2.62e-09, 2.62e-09]
s= eta^0.5*xc^1.5/epsilon	[5.25e-10, 5.25e-10]
beta*xc/epsilon	[4.44e-09, 4.44e-09]
eta*xc/epsilon	[1.04e-11, 1.04e-11]
Fx=beta^2/eta*xc	[1.99e-06, 1.99e-06]
Dx =beta*epsilon/eta*xc^2	[7.71e-08, 7.71e-08]
Pk=beta*k/epsilon	[7.48e-10, 7.48e-10]
Fk=beta^2/eta*k	[1.61e-05, 1.61e-05]
Dk =beta*epsilon/eta*k^2	[0.000284, 0.000284]
Fk^2/Dk=beta^3/eta*epsilon	[4.56e-05, 4.56e-05]
epsilon/beta^2	[9.4e-12, 9.4e-12]
k/beta	[1.98e-13, 1.98e-13]
k^2/epsilon	[1.26e-12, 1.26e-12]
eta/xc	[1.61e-10, 1.61e-10]
beta/xc	[1.71e-08, 1.71e-08]
epsilon/xc^2	[7.03e-10, 7.03e-10]
k/xc	[2.98e-11, 2.98e-11]
best fit no ext hazard_MedianLifetime	0.51
best fit no ext hazard_MaxLifetime	0
best fit_MedianLifetime	0.51
best fit_MaxLifetime	0
data_MedianLifetime	0.5
data_MaxLifetime	0
ML_lnprob	[-356253.4388665623, -356253.4388665623]

	mode \
xc/eta	10.199
beta/eta	101.592
xc^2/epsilon	2.205
xc	29.925
ExtH	7.733
eta	2.835
beta	296.124
epsilon	389.647
sqrt(xc/eta)	3.194
s= eta^0.5*xc^1.5/epsilon	0.678
beta*xc/epsilon	21.571
eta*xc/epsilon	0.213
Fx=beta^2/eta*xc	1011.585
Dx =beta*epsilon/eta*xc^2	45.72
Pk=beta*k/epsilon	0.364
Fk=beta^2/eta*k	61354.735
Dk =beta*epsilon/eta*k^2	166167.275
Fk^2/Dk=beta^3/eta*epsilon	21472.358
epsilon/beta^2	0.00484

k/beta	0.00169
k^2/epsilon	0.000641
eta/xc	0.098
beta/xc	9.682
epsilon/xc^2	0.453
k/xc	0.0167
best fit no ext hazard_MedianLifetime	74.26
best fit no ext hazard_MaxLifetime	104.26
best fit_MedianLifetime	73.89
best fit_MaxLifetime	103.93
data_MedianLifetime	69.0
data_MaxLifetime	103.5
ML_lnprob	-356253.438867

	percentile_16 \
xc/eta	[9.977, 10.426]
beta/eta	[101.175, 102.01]
xc^2/epsilon	[2.162, 2.25]
xc	[28.888, 30.999]
ExtH	[7.727, 7.74]
eta	[2.755, 2.917]
beta	[288.603, 303.842]
epsilon	[364.627, 416.384]
sqrt(xc/eta)	[3.159, 3.229]
s= eta^0.5*xc^1.5/epsilon	[0.67, 0.686]
beta*xc/epsilon	[21.359, 21.785]
eta*xc/epsilon	[0.211, 0.215]
Fx=beta^2/eta*xc	[984.195, 1039.737]
Dx =beta*epsilon/eta*xc^2	[44.698, 46.765]
Pk=beta*k/epsilon	[0.349, 0.381]
Fk=beta^2/eta*k	[59821.536, 62927.229]
Dk =beta*epsilon/eta*k^2	[155853.535, 177163.535]
Fk^2/Dk=beta^3/eta*epsilon	[20788.482, 22178.732]
epsilon/beta^2	[0.0047, 0.00499]
k/beta	[0.00164, 0.00173]
k^2/epsilon	[0.0006, 0.000685]
eta/xc	[0.0959, 0.1]
beta/xc	[9.445, 9.924]
epsilon/xc^2	[0.444, 0.463]
k/xc	[0.0161, 0.0173]
best fit no ext hazard_MedianLifetime	[73.77000000000001, 74.77000000000001]
best fit no ext hazard_MaxLifetime	[104.26, 104.26]
best fit_MedianLifetime	[73.4, 74.4]
best fit_MaxLifetime	[103.93, 103.93]
data_MedianLifetime	[68.51, 69.5]
data_MaxLifetime	[103.5, 103.5]

```
ML_lnprob                                [-356253.4388665623, -356253.4388665623]

                                                                    percentile_50
\
xc/eta                                                             [9.977, 10.426]
beta/eta                                                          [101.175, 102.01]
xc^2/epsilon                                                        [2.162, 2.25]
xc                                                                [28.888, 30.999]
ExtH                                                                [7.727, 7.74]
eta                                                               [2.755, 2.917]
beta                                                            [288.603, 303.842]
epsilon                                                         [364.627, 416.384]
sqrt(xc/eta)                                                        [3.159, 3.229]
s= eta^0.5*xc^1.5/epsilon                                            [0.67, 0.686]
beta*xc/epsilon                                                   [21.359, 21.785]
eta*xc/epsilon                                                      [0.211, 0.215]
Fx=beta^2/eta*xc                                                [984.195, 1039.737]
Dx =beta*epsilon/eta*xc^2                                          [44.698, 46.765]
Pk=beta*k/epsilon                                                   [0.349, 0.381]
Fk=beta^2/eta*k                                               [59821.536, 62927.229]
Dk =beta*epsilon/eta*k^2                                     [155853.535, 177163.535]
Fk^2/Dk=beta^3/eta*epsilon                                    [20788.482, 22178.732]
epsilon/beta^2                                                     [0.0047, 0.00499]
k/beta                                                          [0.00164, 0.00173]
k^2/epsilon                                                     [0.0006, 0.000685]
eta/xc                                                               [0.0959, 0.1]
beta/xc                                                             [9.445, 9.924]
epsilon/xc^2                                                        [0.444, 0.463]
k/xc                                                              [0.0161, 0.0173]
best fit no ext hazard_MedianLifetime    [73.77000000000001, 74.77000000000001]
best fit no ext hazard_MaxLifetime                                [104.26, 104.26]
best fit_MedianLifetime                                               [73.4, 74.4]
best fit_MaxLifetime                                              [103.93, 103.93]
data_MedianLifetime                                                 [68.51, 69.5]
data_MaxLifetime                                                  [103.5, 103.5]
ML_lnprob                                [-356253.4388665623, -356253.4388665623]

                                                                    percentile_95
\
xc/eta                                                             [9.977, 10.426]
beta/eta                                                          [101.175, 102.01]
xc^2/epsilon                                                        [2.162, 2.25]
xc                                                                [28.888, 30.999]
ExtH                                                                [7.727, 7.74]
eta                                                               [2.755, 2.917]
beta                                                            [288.603, 303.842]
epsilon                                                         [364.627, 416.384]
```

sqrt(xc/eta)	[3.159, 3.229]
s= eta^0.5*xc^1.5/epsilon	[0.67, 0.686]
beta*xc/epsilon	[21.359, 21.785]
eta*xc/epsilon	[0.211, 0.215]
Fx=beta^2/eta*xc	[984.195, 1039.737]
Dx =beta*epsilon/eta*xc^2	[44.698, 46.765]
Pk=beta*k/epsilon	[0.349, 0.381]
Fk=beta^2/eta*k	[59821.536, 62927.229]
Dk =beta*epsilon/eta*k^2	[155853.535, 177163.535]
Fk^2/Dk=beta^3/eta*epsilon	[20788.482, 22178.732]
epsilon/beta^2	[0.0047, 0.00499]
k/beta	[0.00164, 0.00173]
k^2/epsilon	[0.0006, 0.000685]
eta/xc	[0.0959, 0.1]
beta/xc	[9.445, 9.924]
epsilon/xc^2	[0.444, 0.463]
k/xc	[0.0161, 0.0173]
best fit no ext hazard_MedianLifetime	[73.77000000000001, 74.77000000000001]
best fit no ext hazard_MaxLifetime	[104.26, 104.26]
best fit_MedianLifetime	[73.4, 74.4]
best fit_MaxLifetime	[103.93, 103.93]
data_MedianLifetime	[68.51, 69.5]
data_MaxLifetime	[103.5, 103.5]
ML_lnprob	[-356253.4388665623, -356253.4388665623]

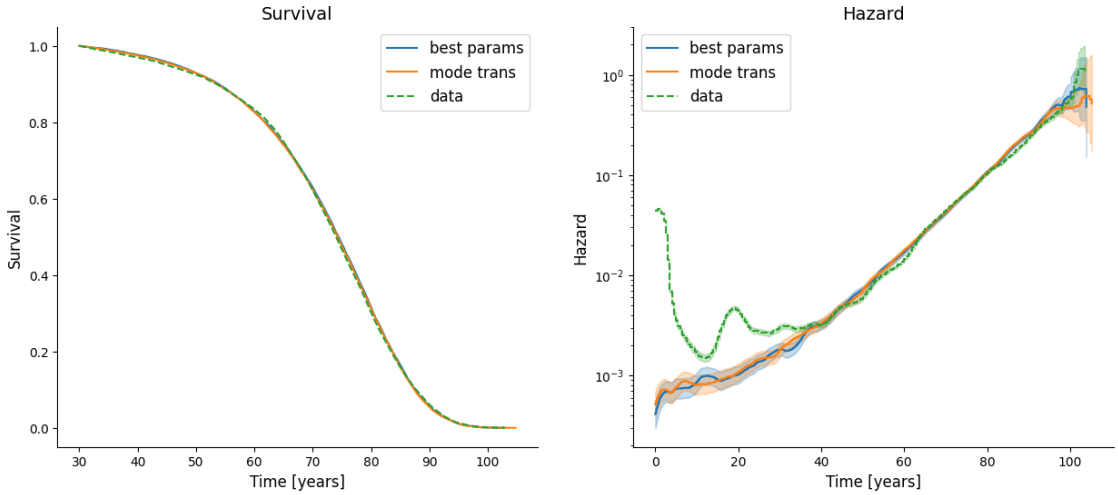
	max_likelihood	mode_overall
xc/eta	10.393	10.393
beta/eta	101.566	101.566
xc^2/epsilon	2.203	2.203
xc	30.275	30.275
ExtH	7.729	7.729
eta	2.913	2.913
beta	295.865	295.865
epsilon	416.159	416.159
sqrt(xc/eta)	3.224	3.224
s= eta^0.5*xc^1.5/epsilon	0.683	0.683
beta*xc/epsilon	21.524	21.524
eta*xc/epsilon	0.212	0.212
Fx=beta^2/eta*xc	992.55	992.55
Dx =beta*epsilon/eta*xc^2	46.113	46.113
Pk=beta*k/epsilon	0.355	0.355
Fk=beta^2/eta*k	60099.789	60099.789
Dk =beta*epsilon/eta*k^2	169070.585	169070.585
Fk^2/Dk=beta^3/eta*epsilon	21363.767	21363.767
epsilon/beta^2	0.00475	0.00475
k/beta	0.00169	0.00169
k^2/epsilon	0.000601	0.000601

eta/xc	0.0962	0.0962
beta/xc	9.772	9.772
epsilon/xc^2	0.454	0.454
k/xc	0.0165	0.0165
best fit no ext hazard_MedianLifetime	74.26	NaN
best fit no ext hazard_MaxLifetime	104.26	NaN
best fit_MedianLifetime	73.89	NaN
best fit_MaxLifetime	103.93	NaN
data_MedianLifetime	69.0	NaN
data_MaxLifetime	103.5	NaN
ML_lnprob	-356253.438867	-356253.438867

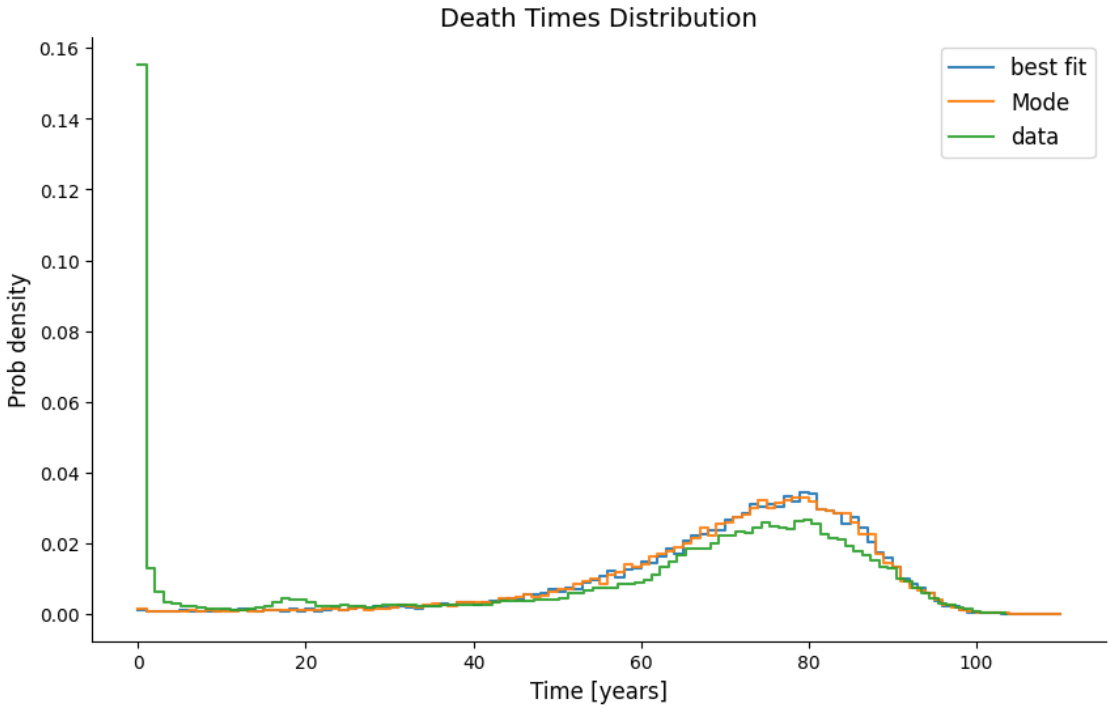
5 5. Fits of simulations to data

best params is the sample with highest likelihood. mode trans is the 4D posterior mode in the transformed space of x_c/η, β/η, x_c^2/ϵ, x_c

```
Text(0, 0.5, 'Hazard')
```




```
Text(0, 0.5, 'Prob density')
```


Death Times Distribution
best fit
Mode
data
Prob density
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
20
40
60
80
100
Time [years]