mcmc_analysis_Denmark_M_1890_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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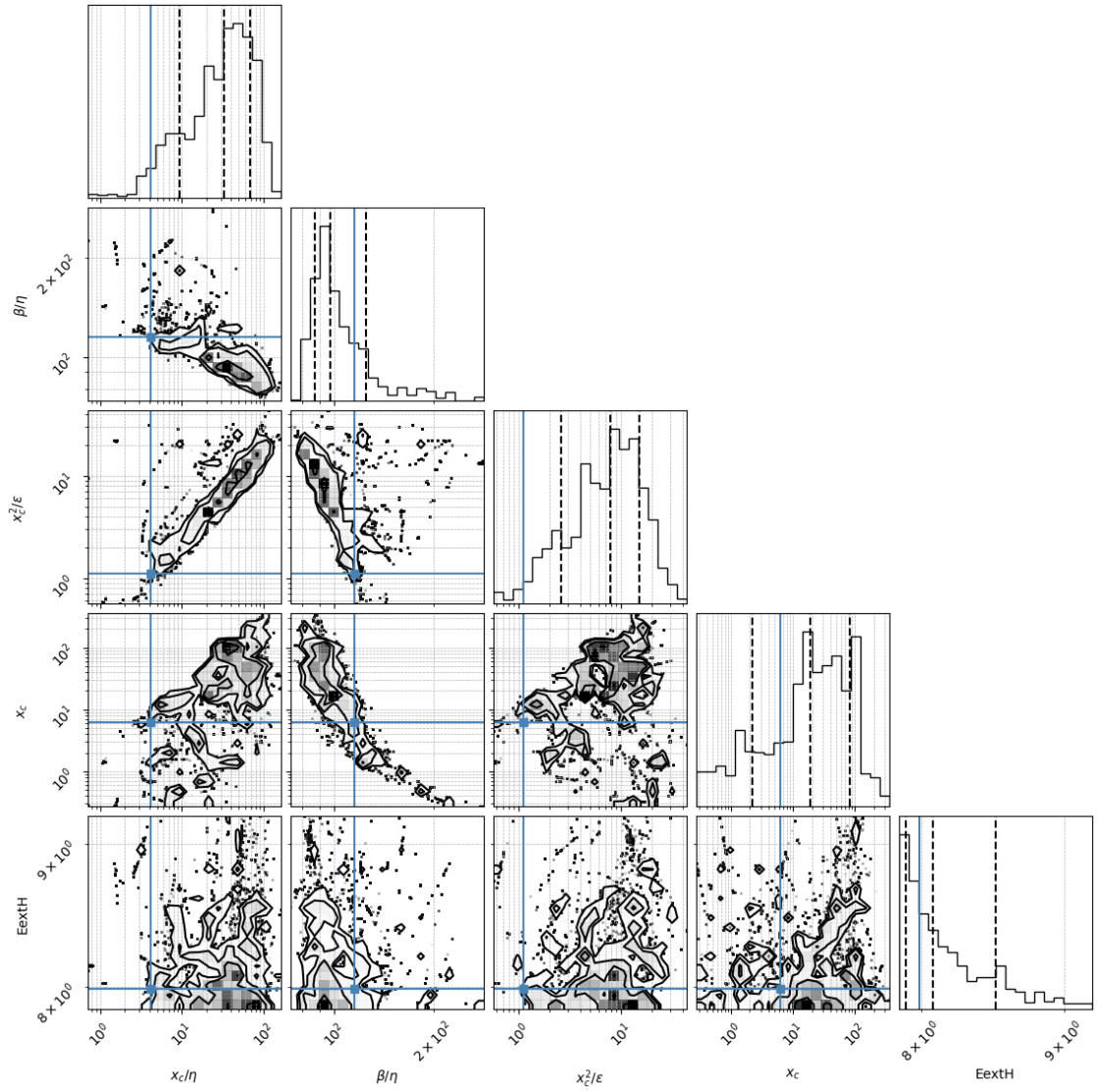
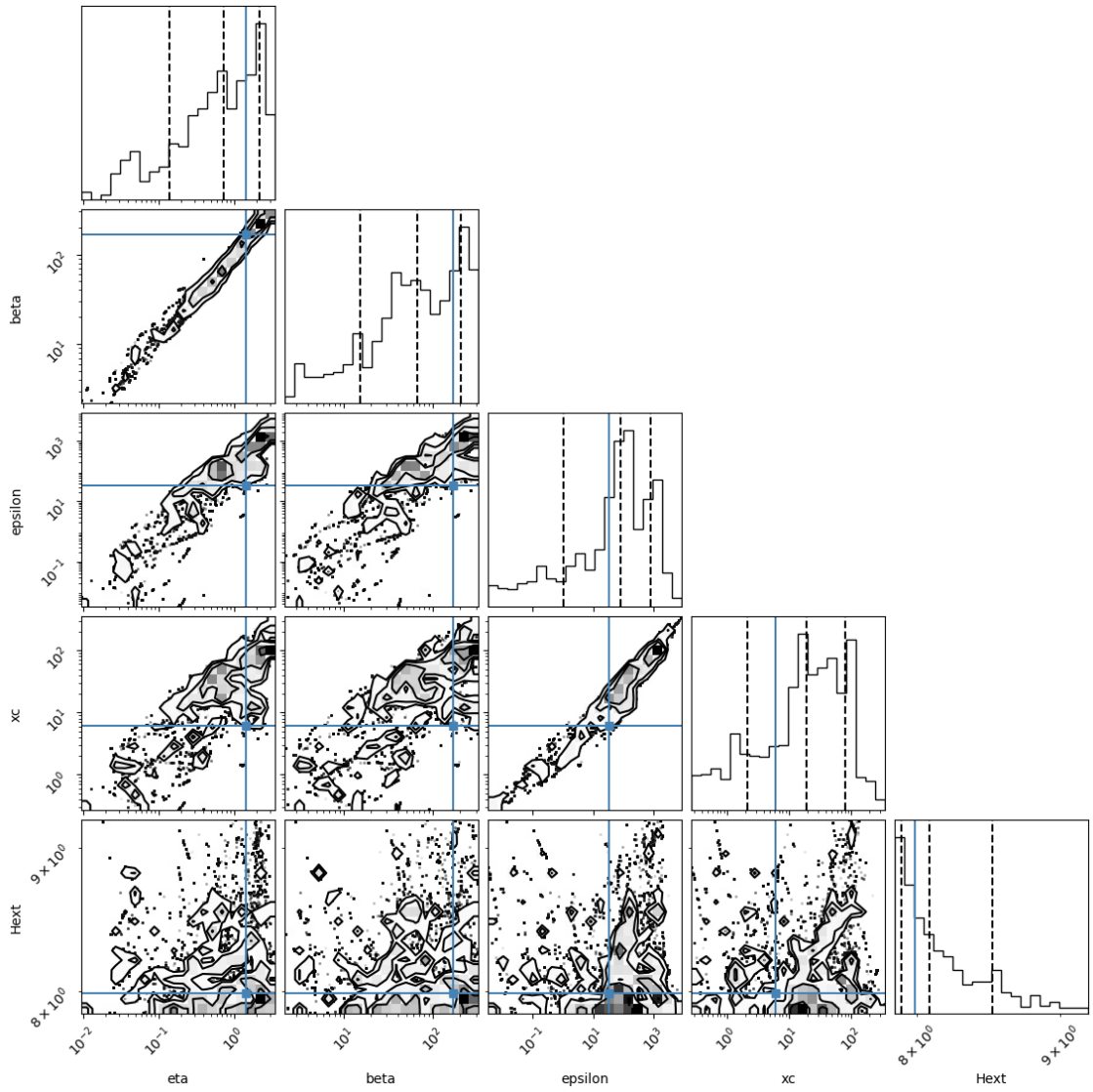
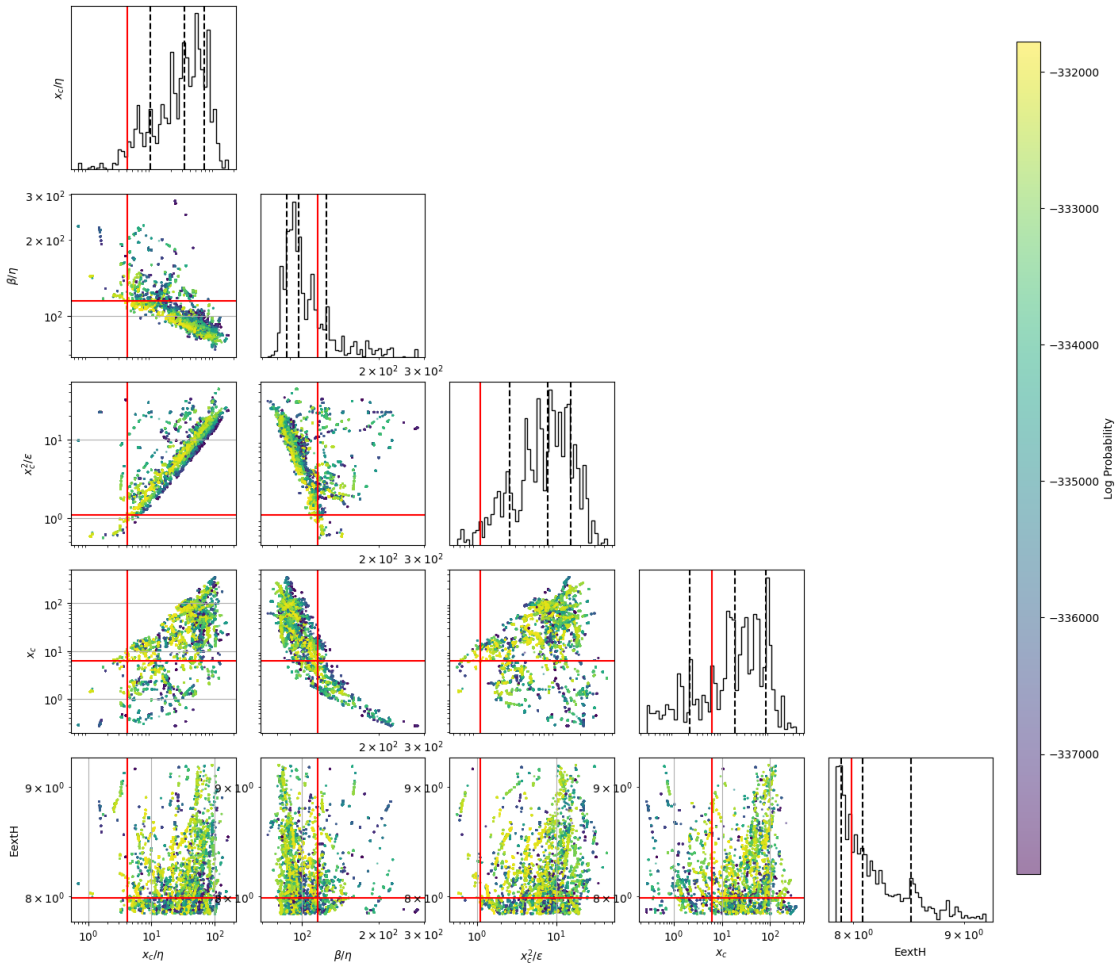

x_c/η
β/η
x_c^2/ε
x_c
EextH



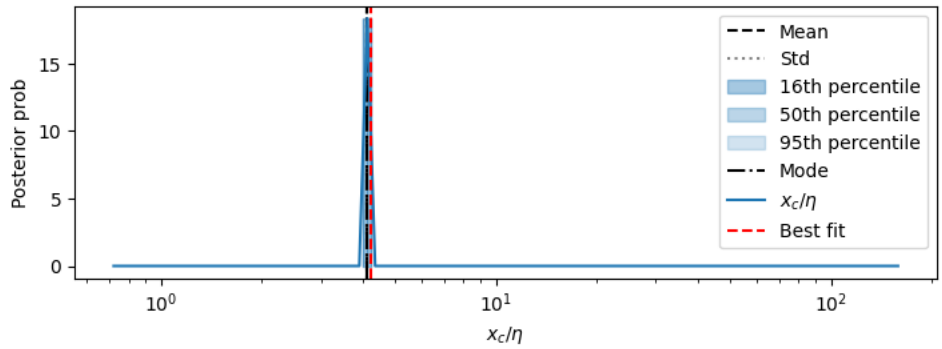
2 2. Heat map corner plot of raw samples

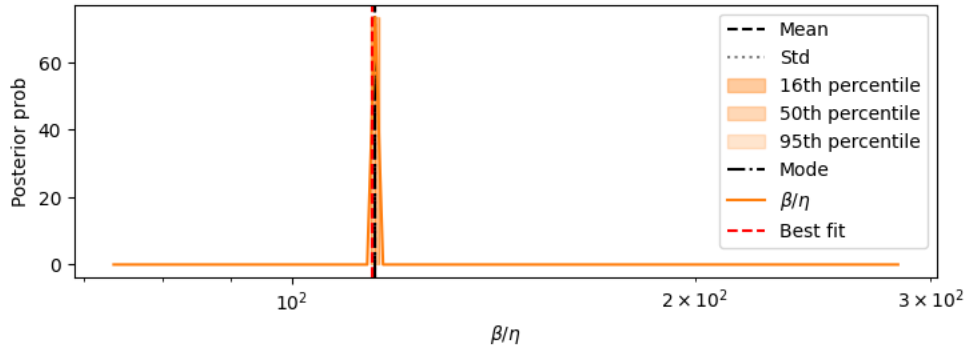
This plot shows all the raw sample points and their lnprobability

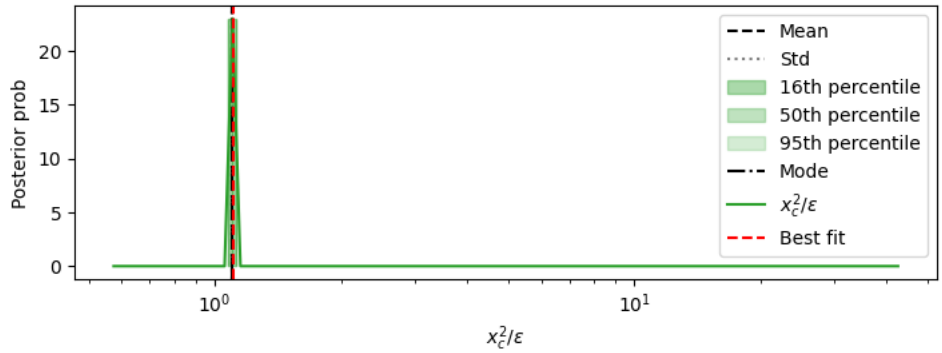


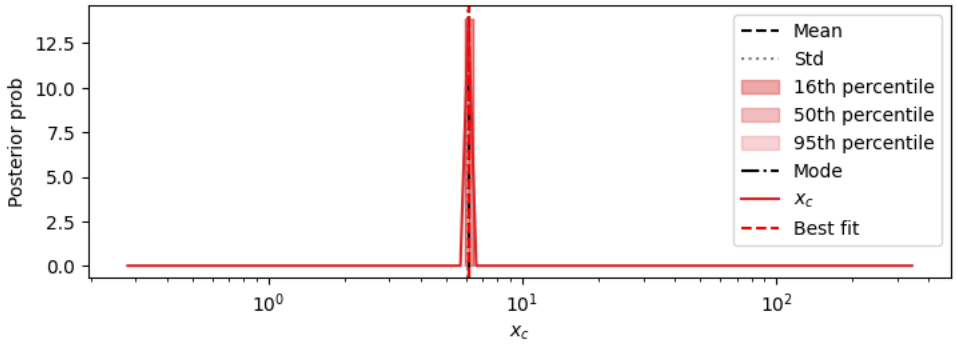
3 3. Posterior distributions of parameters

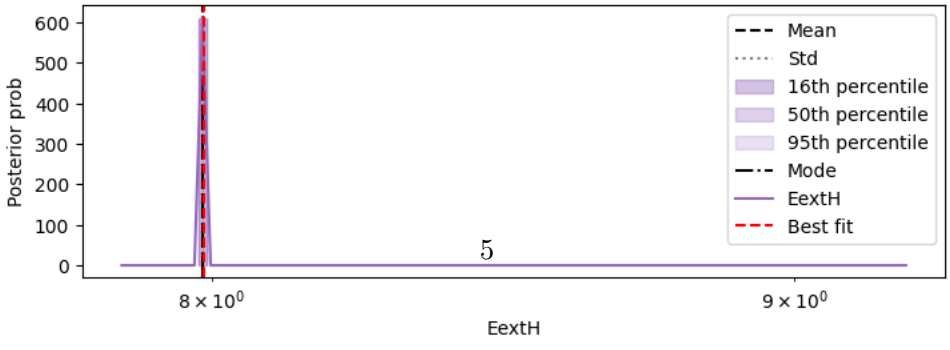
1d marginalizations of posterior distributions. we use a grid of size nbins=100-150


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


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

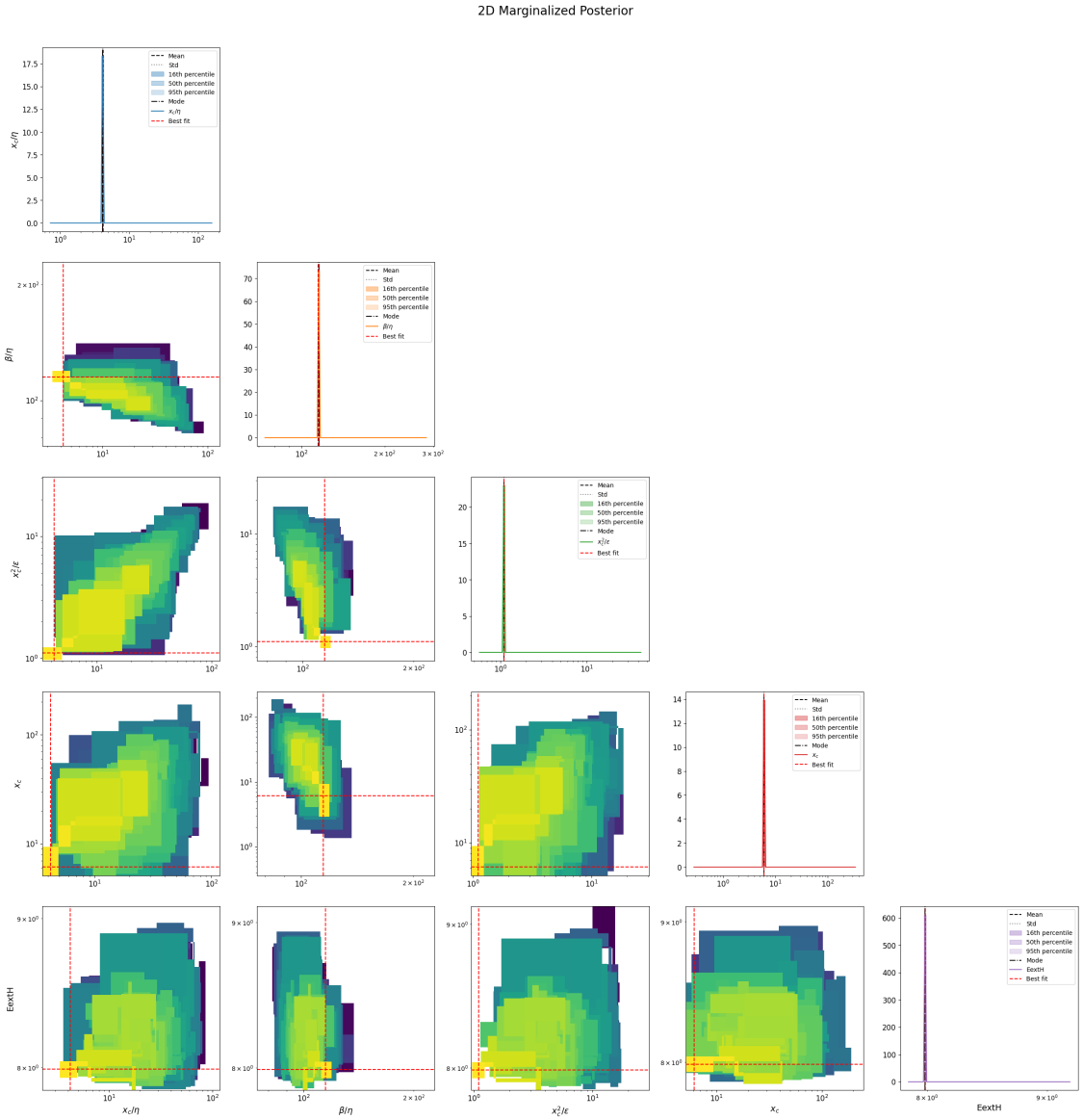

Mean
Std
16th percentile
50th percentile
95th percentile
Mode
x_c^2/ε
Best fit
Posterior prob
x_c^2/ε


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


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

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
```

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	4.126	
beta/eta	115.415	
xc^2/epsilon	1.102	
xc	6.134	
ExtH	7.985	
eta	1.49	
beta	171.573	
epsilon	33.87	
sqrt(xc/eta)	2.031	
s= eta^0.5*xc^1.5/epsilon	0.535	
beta*xc/epsilon	29.792	
eta*xc/epsilon	0.266	
Fx=beta^2/eta*xc	3097.715	
Dx =beta*epsilon/eta*xc^2	102.646	
Pk=beta*k/epsilon	2.41	
Fk=beta^2/eta*k	37767.593	
Dk =beta*epsilon/eta*k^2	14737.464	
Fk^2/Dk=beta^3/eta*epsilon	99338.349	
epsilon/beta^2	0.00126	
k/beta	0.00291	
k^2/epsilon	0.00737	
eta/xc	0.242	
beta/xc	27.044	
epsilon/xc^2	0.907	
k/xc	0.0815	
best fit no ext hazard_MedianLifetime	74.29	
best fit no ext hazard_MaxLifetime	103.16	
best fit_MedianLifetime	73.54	
best fit_MaxLifetime	102.76	
data_MedianLifetime	67.0	
data_MaxLifetime	108.5	
ML_lnprob	-331778.091171	

	std	\
xc/eta	[0.00127, 0.00127]	
beta/eta	[0.00741, 0.00741]	
xc^2/epsilon	[0.000227, 0.000227]	
xc	[0.00416, 0.00416]	
ExtH	[9.83e-05, 9.83e-05]	
eta	[1.02e-08, 1.02e-08]	

beta	[9.92e-07, 9.92e-07]
epsilon	[7.48e-07, 7.48e-07]
sqrt(xc/eta)	[0.000313, 0.000313]
s= eta^0.5*xc^1.5/epsilon	[2.02e-05, 2.02e-05]
beta*xc/epsilon	[0.00476, 0.00476]
eta*xc/epsilon	[3.58e-05, 3.58e-05]
Fx=beta^2/eta*xc	[1.306, 1.306]
Dx =beta*epsilon/eta*xc^2	[0.0229, 0.0229]
Pk=beta*k/epsilon	[0.00203, 0.00203]
Fk=beta^2/eta*k	[11.133, 11.136]
Dk =beta*epsilon/eta*k^2	[17.318, 17.338]
Fk^2/Dk=beta^3/eta*epsilon	[60.958, 60.996]
epsilon/beta^2	[1e-11, 1e-11]
k/beta	[1.68e-11, 1.68e-11]
k^2/epsilon	[1.63e-10, 1.63e-10]
eta/xc	[7.48e-05, 7.48e-05]
beta/xc	[0.00987, 0.00987]
epsilon/xc^2	[0.000186, 0.000187]
k/xc	[5.53e-05, 5.53e-05]
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	[-331778.0911707365, -331778.0911707365]

	mode \
xc/eta	4.126
beta/eta	115.415
xc^2/epsilon	1.102
xc	6.134
ExtH	7.985
eta	1.49
beta	171.573
epsilon	33.87
sqrt(xc/eta)	2.031
s= eta^0.5*xc^1.5/epsilon	0.535
beta*xc/epsilon	29.792
eta*xc/epsilon	0.266
Fx=beta^2/eta*xc	3097.716
Dx =beta*epsilon/eta*xc^2	102.646
Pk=beta*k/epsilon	2.41
Fk=beta^2/eta*k	37767.583
Dk =beta*epsilon/eta*k^2	14737.448
Fk^2/Dk=beta^3/eta*epsilon	99338.407
epsilon/beta^2	0.00126

k/beta	0.00291
k^2/epsilon	0.00737
eta/xc	0.242
beta/xc	27.044
epsilon/xc^2	0.907
k/xc	0.0815
best fit no ext hazard_MedianLifetime	74.29
best fit no ext hazard_MaxLifetime	103.16
best fit_MedianLifetime	73.54
best fit_MaxLifetime	102.76
data_MedianLifetime	67.0
data_MaxLifetime	108.5
ML_lnprob	-331778.091171

	percentile_16 \
xc/eta	[4.015, 4.24]
beta/eta	[114.632, 116.204]
xc^2/epsilon	[1.078, 1.126]
xc	[5.918, 6.359]
ExtH	[7.979, 7.992]
eta	[1.447, 1.535]
beta	[167.357, 175.896]
epsilon	[31.457, 36.468]
sqrt(xc/eta)	[2.004, 2.059]
s= eta^0.5*xc^1.5/epsilon	[0.525, 0.546]
beta*xc/epsilon	[28.963, 30.644]
eta*xc/epsilon	[0.26, 0.272]
Fx=beta^2/eta*xc	[2984.632, 3215.085]
Dx =beta*epsilon/eta*xc^2	[100.253, 105.097]
Pk=beta*k/epsilon	[2.262, 2.569]
Fk=beta^2/eta*k	[36796.555, 38764.235]
Dk =beta*epsilon/eta*k^2	[13751.606, 15793.963]
Fk^2/Dk=beta^3/eta*epsilon	[93085.976, 106010.803]
epsilon/beta^2	[0.00118, 0.00134]
k/beta	[0.00284, 0.00299]
k^2/epsilon	[0.00685, 0.00794]
eta/xc	[0.236, 0.249]
beta/xc	[26.187, 27.928]
epsilon/xc^2	[0.888, 0.927]
k/xc	[0.0786, 0.0844]
best fit no ext hazard_MedianLifetime	[73.80000000000001, 74.80000000000001]
best fit no ext hazard_MaxLifetime	[103.16, 103.16]
best fit_MedianLifetime	[73.05000000000001, 74.05000000000001]
best fit_MaxLifetime	[102.76, 102.76]
data_MedianLifetime	[66.5, 67.5]
data_MaxLifetime	[108.5, 108.5]

```
ML_lnprob                                [-331778.0911707365, -331778.0911707365]

                                                                      percentile_50
\
xc/eta                                                                   [4.015, 4.24]
beta/eta                                                               [114.632, 116.204]
xc^2/epsilon                                                             [1.078, 1.126]
xc                                                                       [5.918, 6.359]
ExtH                                                                     [7.979, 7.992]
eta                                                                      [1.447, 1.535]
beta                                                                   [167.357, 175.896]
epsilon                                                                  [31.457, 36.468]
sqrt(xc/eta)                                                             [2.004, 2.059]
s= eta^0.5*xc^1.5/epsilon                                                [0.525, 0.546]
beta*xc/epsilon                                                          [28.963, 30.644]
eta*xc/epsilon                                                             [0.26, 0.272]
Fx=beta^2/eta*xc                                                       [2984.632, 3215.085]
Dx =beta*epsilon/eta*xc^2                                                [100.253, 105.097]
Pk=beta*k/epsilon                                                          [2.262, 2.569]
Fk=beta^2/eta*k                                                      [36796.555, 38764.235]
Dk =beta*epsilon/eta*k^2                                             [13751.606, 15793.963]
Fk^2/Dk=beta^3/eta*epsilon                                           [93085.976, 106010.803]
epsilon/beta^2                                                           [0.00118, 0.00134]
k/beta                                                                   [0.00284, 0.00299]
k^2/epsilon                                                              [0.00685, 0.00794]
eta/xc                                                                     [0.236, 0.249]
beta/xc                                                                  [26.187, 27.928]
epsilon/xc^2                                                               [0.888, 0.927]
k/xc                                                                     [0.0786, 0.0844]
best fit no ext hazard_MedianLifetime    [73.80000000000001, 74.80000000000001]
best fit no ext hazard_MaxLifetime                                       [103.16, 103.16]
best fit_MedianLifetime                  [73.05000000000001, 74.05000000000001]
best fit_MaxLifetime                                                     [102.76, 102.76]
data_MedianLifetime                                                        [66.5, 67.5]
data_MaxLifetime                                                         [108.5, 108.5]
ML_lnprob                                [-331778.0911707365, -331778.0911707365]

                                                                      percentile_95
\
xc/eta                                                                   [4.015, 4.24]
beta/eta                                                               [114.632, 116.204]
xc^2/epsilon                                                             [1.078, 1.126]
xc                                                                       [5.918, 6.359]
ExtH                                                                     [7.979, 7.992]
eta                                                                      [1.447, 1.535]
beta                                                                   [167.357, 175.896]
epsilon                                                                  [31.457, 36.468]
```

sqrt(xc/eta)	[2.004, 2.059]
s= eta^0.5*xc^1.5/epsilon	[0.525, 0.546]
beta*xc/epsilon	[28.963, 30.644]
eta*xc/epsilon	[0.26, 0.272]
Fx=beta^2/eta*xc	[2984.632, 3215.085]
Dx =beta*epsilon/eta*xc^2	[100.253, 105.097]
Pk=beta*k/epsilon	[2.262, 2.569]
Fk=beta^2/eta*k	[36796.555, 38764.235]
Dk =beta*epsilon/eta*k^2	[13751.606, 15793.963]
Fk^2/Dk=beta^3/eta*epsilon	[93085.976, 106010.803]
epsilon/beta^2	[0.00118, 0.00134]
k/beta	[0.00284, 0.00299]
k^2/epsilon	[0.00685, 0.00794]
eta/xc	[0.236, 0.249]
beta/xc	[26.187, 27.928]
epsilon/xc^2	[0.888, 0.927]
k/xc	[0.0786, 0.0844]
best fit no ext hazard_MedianLifetime	[73.80000000000001, 74.80000000000001]
best fit no ext hazard_MaxLifetime	[103.16, 103.16]
best fit_MedianLifetime	[73.05000000000001, 74.05000000000001]
best fit_MaxLifetime	[102.76, 102.76]
data_MedianLifetime	[66.5, 67.5]
data_MaxLifetime	[108.5, 108.5]
ML_lnprob	[-331778.0911707365, -331778.0911707365]

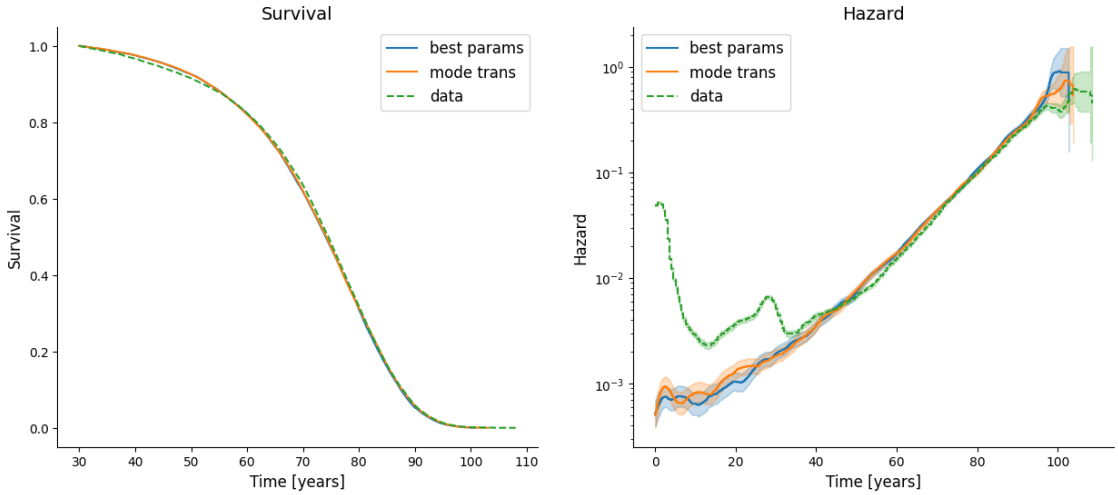
	max_likelihood	mode_overall
xc/eta	4.214	4.214
beta/eta	114.909	114.909
xc^2/epsilon	1.104	1.104
xc	6.154	6.154
ExtH	7.987	7.987
eta	1.46	1.46
beta	167.822	167.822
epsilon	34.32	34.32
sqrt(xc/eta)	2.053	2.053
s= eta^0.5*xc^1.5/epsilon	0.538	0.538
beta*xc/epsilon	30.093	30.093
eta*xc/epsilon	0.262	0.262
Fx=beta^2/eta*xc	3133.569	3133.569
Dx =beta*epsilon/eta*xc^2	104.129	104.129
Pk=beta*k/epsilon	2.445	2.445
Fk=beta^2/eta*k	38568.658	38568.658
Dk =beta*epsilon/eta*k^2	15774.7	15774.7
Fk^2/Dk=beta^3/eta*epsilon	94299.188	94299.188
epsilon/beta^2	0.00122	0.00122
k/beta	0.00298	0.00298
k^2/epsilon	0.00728	0.00728

eta/xc	0.237	0.237
beta/xc	27.27	27.27
epsilon/xc^2	0.906	0.906
k/xc	0.0812	0.0812
best fit no ext hazard_MedianLifetime	74.29	NaN
best fit no ext hazard_MaxLifetime	103.16	NaN
best fit_MedianLifetime	73.54	NaN
best fit_MaxLifetime	102.76	NaN
data_MedianLifetime	67.0	NaN
data_MaxLifetime	108.5	NaN
ML_lnprob	-331778.091171	-331778.091171

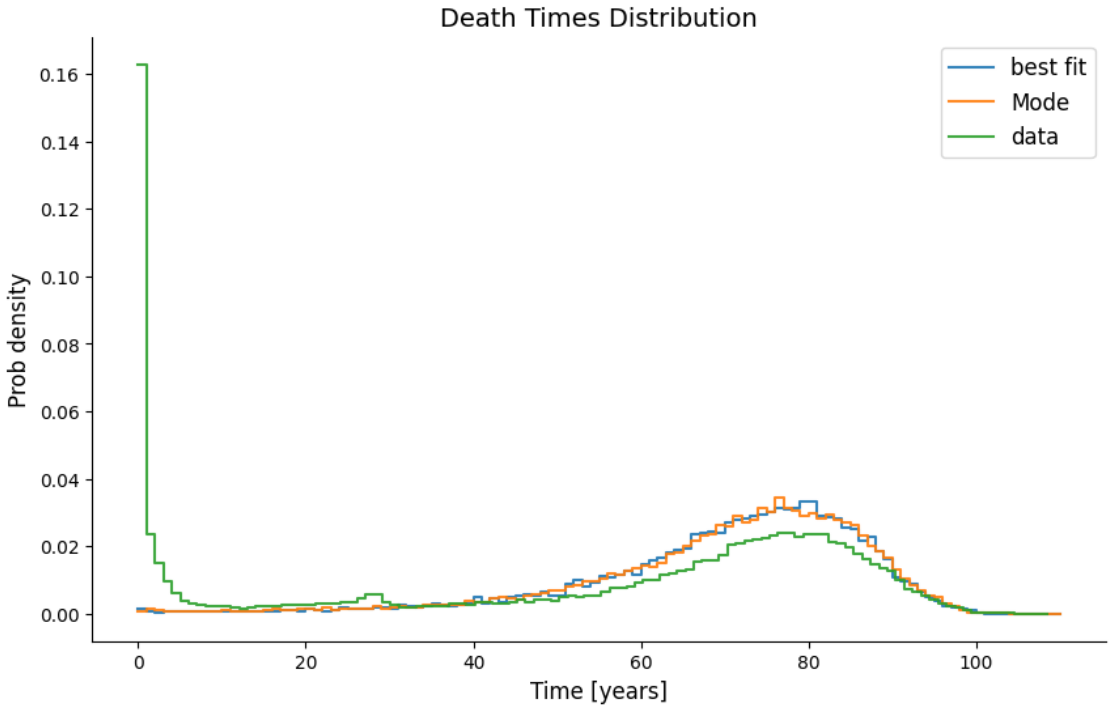
5 5. Fits of simulations to data

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]