

# **Validation process for CALDAS**

**The epidemiology research group, EAFIT**

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# Table of Contents

|  |    |
|--|----|
| <a href="#">Chapter 1. Extension number1</a>                   | 1  |
| <a href="#">1.1. Basic information</a>                         | 1  |
| <a href="#">1.2. Estimated parameters with their intervals</a> | 1  |
| <a href="#">1.3. Identifiability analysis</a>                  | 2  |
| <a href="#">1.4. Uncertainty analysis</a>                      | 5  |
| <a href="#">Chapter 2. Extension number2</a>                   | 6  |
| <a href="#">2.1. Basic information</a>                         | 6  |
| <a href="#">2.2. Estimated parameters with their intervals</a> | 6  |
| <a href="#">2.3. Identifiability analysis</a>                  | 7  |
| <a href="#">2.4. Uncertainty analysis</a>                      | 10 |
| <a href="#">Chapter 3. Extension number3</a>                   | 11 |
| <a href="#">3.1. Basic information</a>                         | 11 |
| <a href="#">3.2. Estimated parameters with their intervals</a> | 11 |
| <a href="#">3.3. Identifiability analysis</a>                  | 12 |
| <a href="#">3.4. Uncertainty analysis</a>                      | 15 |
| <a href="#">Chapter 4. Extension number4</a>                   | 16 |
| <a href="#">4.1. Basic information</a>                         | 16 |
| <a href="#">4.2. Estimated parameters with their intervals</a> | 16 |
| <a href="#">4.3. Identifiability analysis</a>                  | 17 |
| <a href="#">4.4. Uncertainty analysis</a>                      | 20 |
| <a href="#">Chapter 5. Extension number5</a>                   | 21 |
| <a href="#">5.1. Basic information</a>                         | 21 |
| <a href="#">5.2. Estimated parameters with their intervals</a> | 21 |
| <a href="#">5.3. Identifiability analysis</a>                  | 22 |
| <a href="#">5.4. Uncertainty analysis</a>                      | 25 |
| <a href="#">Chapter 6. Extension number6</a>                   | 26 |
| <a href="#">6.1. Basic information</a>                         | 26 |
| <a href="#">6.2. Estimated parameters with their intervals</a> | 26 |
| <a href="#">6.3. Identifiability analysis</a>                  | 27 |
| <a href="#">6.4. Uncertainty analysis</a>                      | 30 |
| <a href="#">Chapter 7. Extension number7</a>                   | 31 |
| <a href="#">7.1. Basic information</a>                         | 31 |
| <a href="#">7.2. Estimated parameters with their intervals</a> | 31 |
| <a href="#">7.3. Identifiability analysis</a>                  | 32 |
| <a href="#">7.4. Uncertainty analysis</a>                      | 35 |
| <a href="#">Chapter 8. Extension number8</a>                   | 36 |
| <a href="#">8.1. Basic information</a>                         | 36 |
| <a href="#">8.2. Estimated parameters with their intervals</a> | 36 |
| <a href="#">8.3. Identifiability analysis</a>                  | 37 |
| <a href="#">8.4. Uncertainty analysis</a>                      | 40 |
| <a href="#">Chapter 9. Extension number9</a>                   | 41 |
| <a href="#">9.1. Basic information</a>                         | 41 |
| <a href="#">9.2. Estimated parameters with their intervals</a> | 41 |

|   |    |
|---|----|
| 9.3. Identifiability analysis                   | 42 |
| 9.4. Uncertainty analysis                       | 45 |
| Chapter 10. Extension number10                  | 46 |
| 10.1. Basic information                         | 46 |
| 10.2. Estimated parameters with their intervals | 46 |
| 10.3. Identifiability analysis                  | 47 |
| 10.4. Uncertainty analysis                      | 50 |
| Chapter 11. Extension number11                  | 51 |
| 11.1. Basic information                         | 51 |
| 11.2. Estimated parameters with their intervals | 51 |
| 11.3. Identifiability analysis                  | 52 |
| 11.4. Uncertainty analysis                      | 55 |
| Chapter 12. Extension number12                  | 56 |
| 12.1. Basic information                         | 56 |
| 12.2. Estimated parameters with their intervals | 56 |
| 12.3. Identifiability analysis                  | 57 |
| 12.4. Uncertainty analysis                      | 60 |
| Chapter 13. Extension number13                  | 61 |
| 13.1. Basic information                         | 61 |
| 13.2. Estimated parameters with their intervals | 61 |
| 13.3. Identifiability analysis                  | 62 |
| 13.4. Uncertainty analysis                      | 65 |
| Chapter 14. Extension number14                  | 66 |
| 14.1. Basic information                         | 66 |
| 14.2. Estimated parameters with their intervals | 66 |
| 14.3. Identifiability analysis                  | 67 |
| 14.4. Uncertainty analysis                      | 70 |
| Chapter 15. Extension number15                  | 71 |
| 15.1. Basic information                         | 71 |
| 15.2. Estimated parameters with their intervals | 71 |
| 15.3. Identifiability analysis                  | 72 |
| 15.4. Uncertainty analysis                      | 75 |
| Chapter 16. Extension number16                  | 76 |
| 16.1. Basic information                         | 76 |
| 16.2. Estimated parameters with their intervals | 76 |
| 16.3. Identifiability analysis                  | 77 |
| 16.4. Uncertainty analysis                      | 80 |

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## Chapter 1. Extension number1

### 1.1. Basic information

The extension to be validated consists of the time series from the data1 to the 132. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

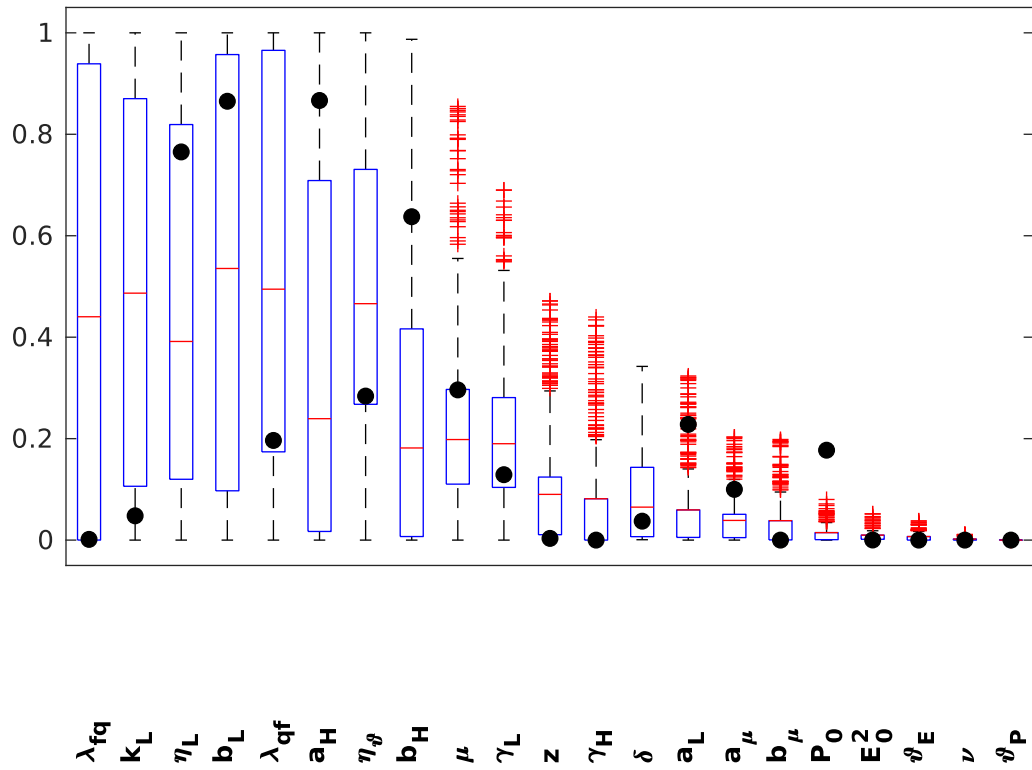
### 1.2. Estimated parameters with their intervals

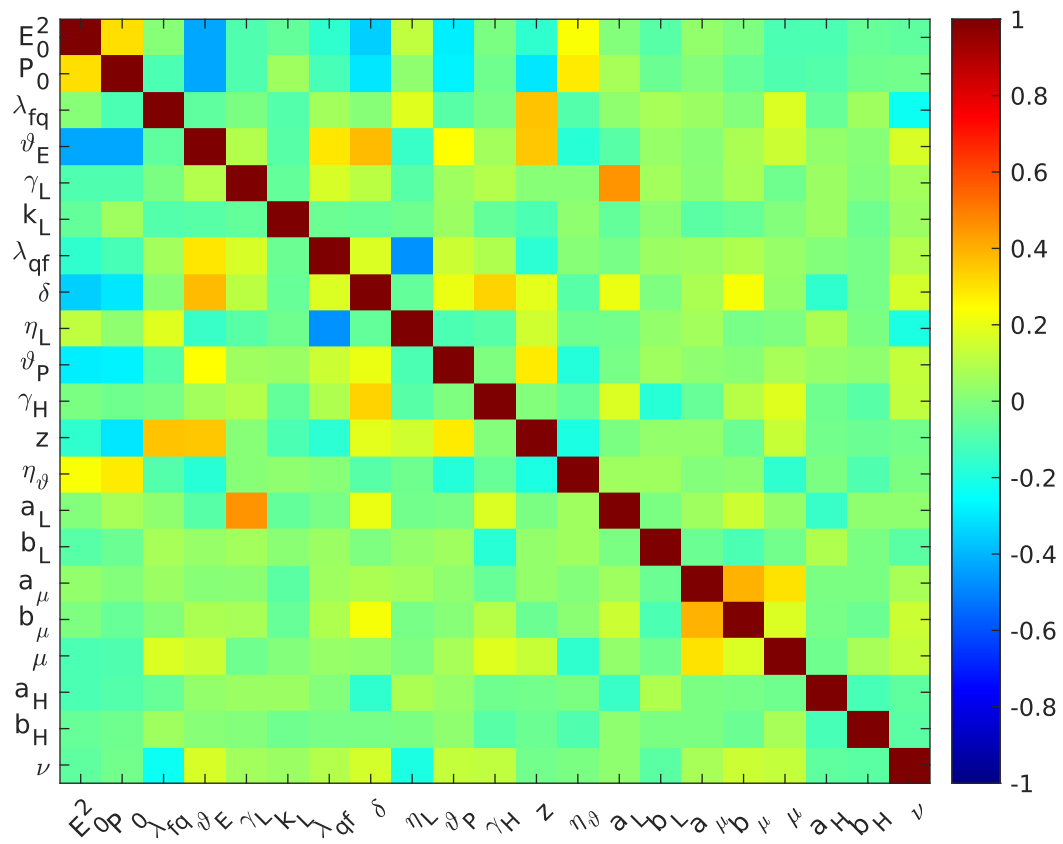
It was necessary to fix 0 parameters of 11 that could be fixed to complete validation.

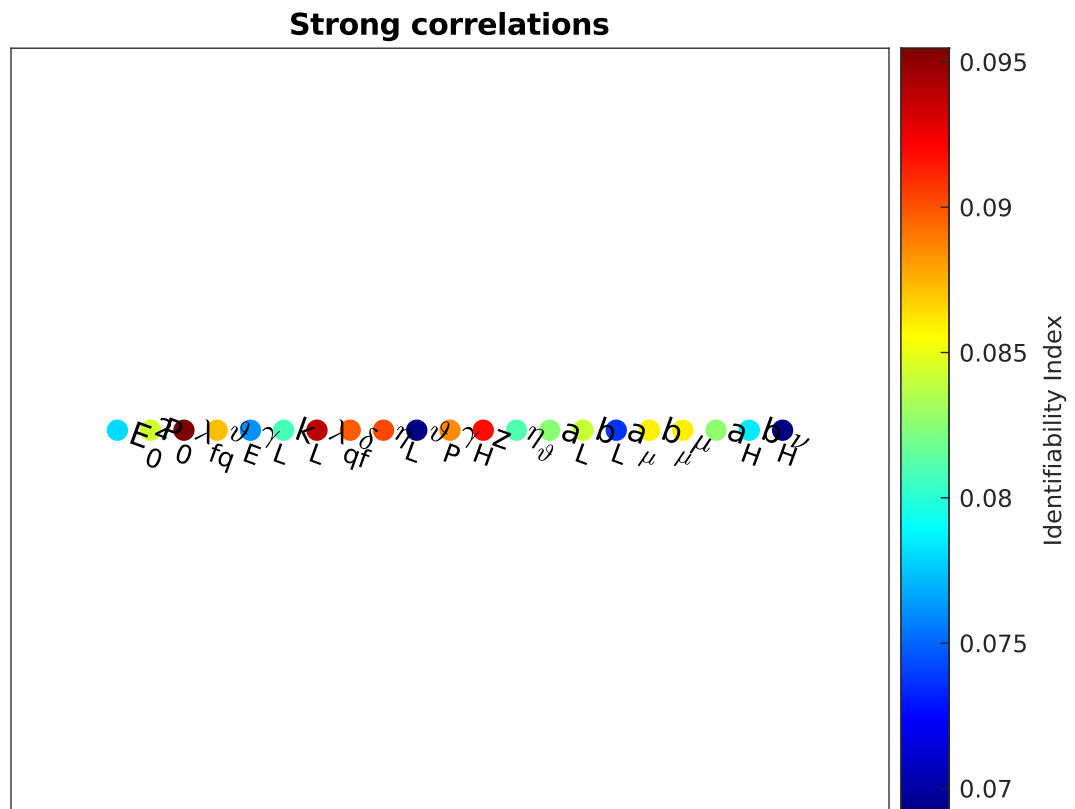
Due to a deviation from the median the CSB method was activated to obtain the parameter intervals.

|                  | Rango     |           | Nominal   | Mejor     | Index    |
|------------------|-----------|-----------|-----------|-----------|----------|
| E^2_0            | '0'       | '0.7315'  | '19.6383' | '0.4014'  | '0.078'  |
| P_0              | '67.592'  | '82.5468' | '5.9046'  | '70.8895' | '0.0843' |
| \lambda_{fq}     | '0.0002'  | '0.0028'  | '0.4403'  | '0.0014'  | '0.0955' |
| \vartheta_E      | '0'       | '0'       | '0.007'   | '0'       | '0.0872' |
| \gamma_L         | '0.1191'  | '0.1296'  | '0.19'    | '0.1289'  | '0.0762' |
| k_L              | '1.2031'  | '9.1225'  | '5.3813'  | '1.431'   | '0.0808' |
| \lambda_{qf}     | '0.1126'  | '0.3968'  | '0.4947'  | '0.1965'  | '0.0939' |
| \delta           | '0.005'   | '0.0071'  | '0.0097'  | '0.0056'  | '0.0898' |
| \eta_L           | '0.679'   | '0.9402'  | '0.3916'  | '0.7652'  | '0.0903' |
| \vartheta_P      | '0'       | '0'       | '0'       | '0'       | '0.0692' |
| \gamma_H         | '0'       | '0'       | '0.0815'  | '0'       | '0.0886' |
| z                | '0.0962'  | '0.1062'  | '2.7039'  | '0.1009'  | '0.0919' |
| \eta_{\vartheta} | '0.2837'  | '0.3149'  | '0.4661'  | '0.2839'  | '0.081'  |
| a_L              | '2.9238'  | '4.2759'  | '1.8332'  | '4.1932'  | '0.0826' |
| b_L              | '11.2152' | '14.8108' | '8.4964'  | '13.1112' | '0.0841' |
| a_{\mu}          | '2.3275'  | '7.7282'  | '1.5431'  | '2.4003'  | '0.0737' |
| b_{\mu}          | '1'       | '7.845'   | '1.5367'  | '1'       | '0.086'  |
| \mu              | '0.1017'  | '0.6029'  | '0.1982'  | '0.2961'  | '0.086'  |
| a_H              | '1.7'     | '15'      | '4.3511'  | '13.1329' | '0.0826' |
| b_H              | '1.35'    | '15'      | '3.5427'  | '9.9247'  | '0.0785' |
| \nu              | '0'       | '0'       | '1.0683'  | '0'       | '0.0692' |

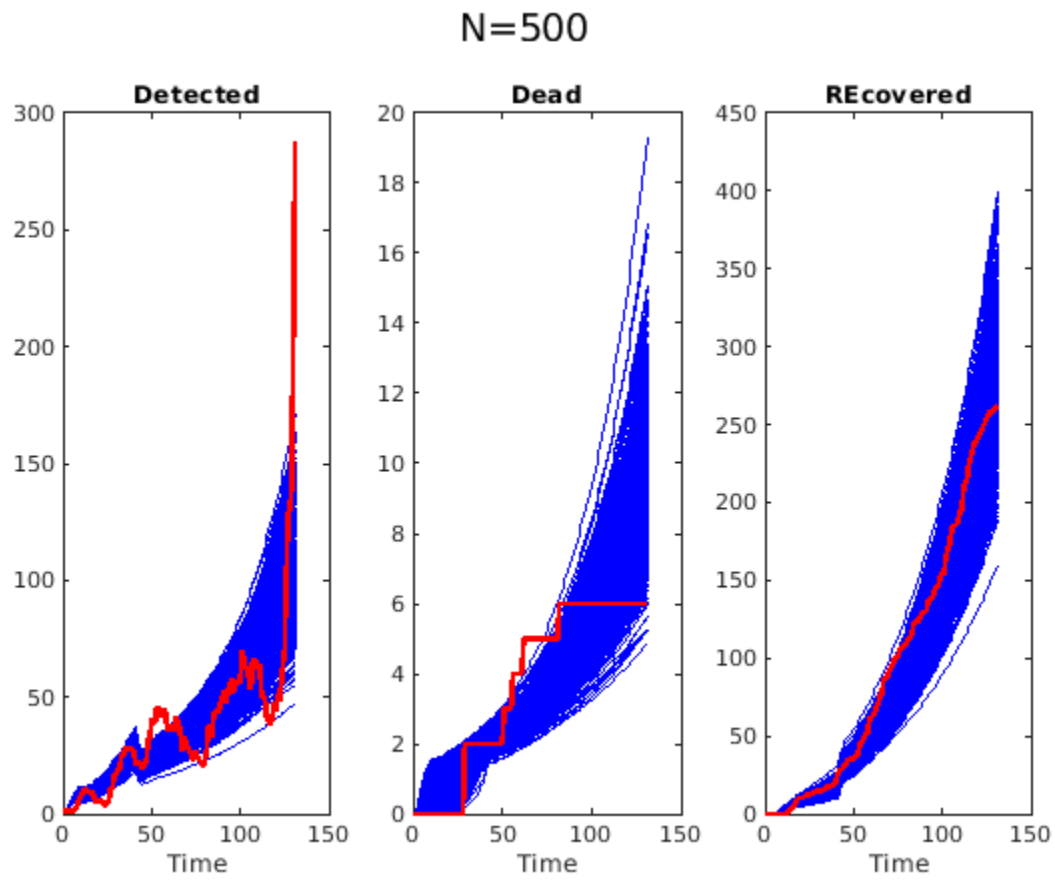
### 1.3. Identifiability analysis







## 1.4. Uncertainty analysis





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## Chapter 2. Extension number2

### 2.1. Basic information

The extension to be validated consists of the time series from the data132 to the 200. The status of the validation is: COMPLETED.

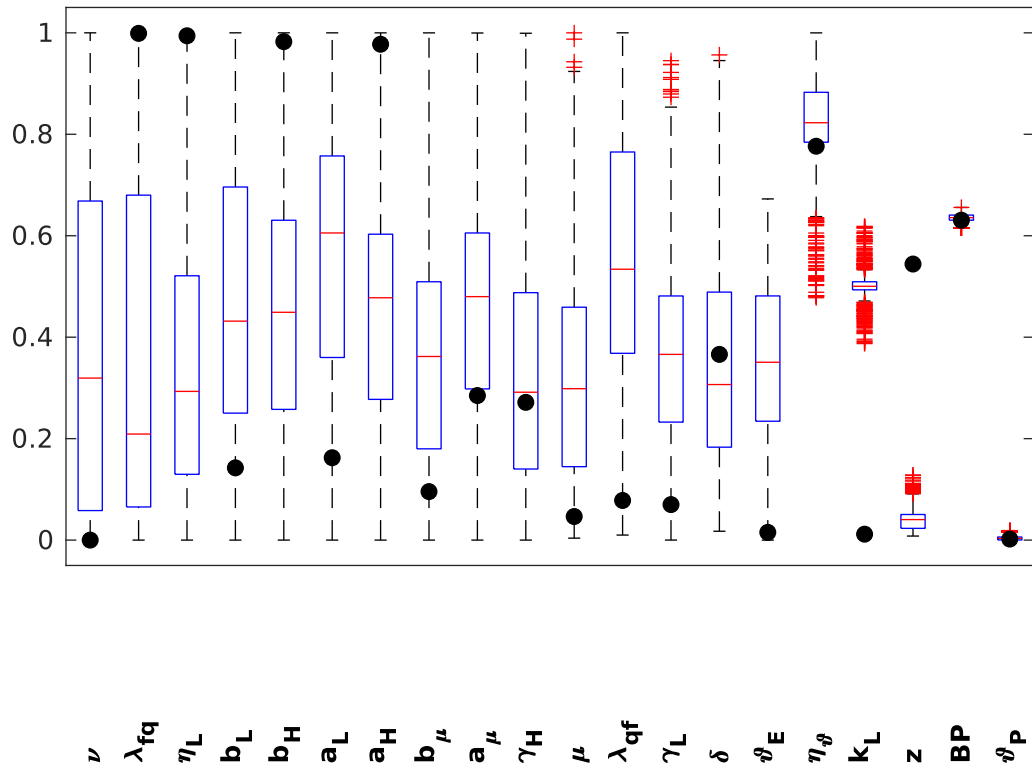
The number of estimations needed to perform the validation was1000.

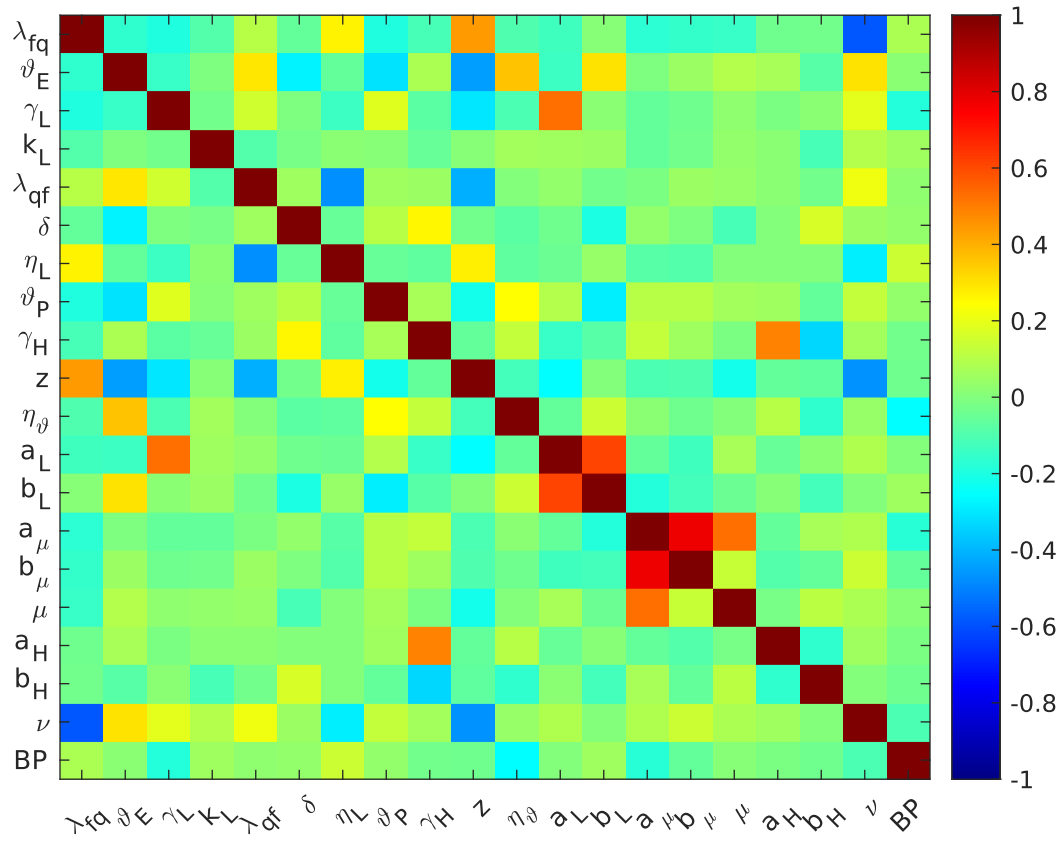
### 2.2. Estimated parameters with their intervals

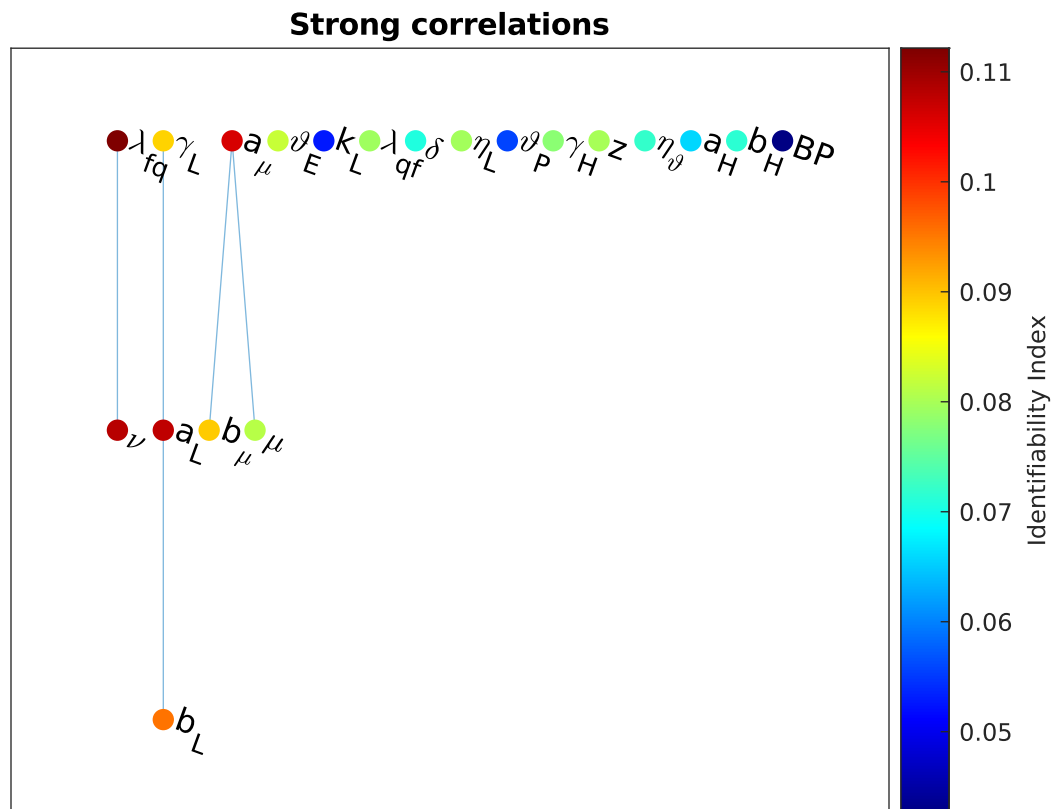
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

|                    | Rango      |            | Nominal   | Mejor      | Index    |
|--------------------|------------|------------|-----------|------------|----------|
| $\lambda_{fq}$     | '0.1723'   | '0.2457'   | '0.209'   | '0.9989'   | '0.1121' |
| $\vartheta_E$      | '0.3333'   | '0.3679'   | '0.3506'  | '0.0153'   | '0.0822' |
| $\gamma_L$         | '0.3444'   | '0.3878'   | '0.3661'  | '0.07'     | '0.0891' |
| $k_L$              | '5.3541'   | '5.6525'   | '5.5033'  | '1.1051'   | '0.0529' |
| $\lambda_{qf}$     | '0.5062'   | '0.5617'   | '0.534'   | '0.0781'   | '0.0796' |
| $\delta$           | '0.0421'   | '0.0499'   | '0.046'   | '0.0549'   | '0.0707' |
| $\eta_L$           | '0.2656'   | '0.3207'   | '0.2931'  | '0.9942'   | '0.0797' |
| $\vartheta_P$      | '0.0023'   | '0.0047'   | '0.0035'  | '0.0021'   | '0.056'  |
| $\gamma_H$         | '0.2672'   | '0.3158'   | '0.2915'  | '0.2715'   | '0.0781' |
| $z$                | '0.9153'   | '1.5105'   | '1.2129'  | '16.3261'  | '0.08'   |
| $\eta_{\vartheta}$ | '0.8017'   | '0.8439'   | '0.8228'  | '0.7764'   | '0.0722' |
| $a_L$              | '9.1152'   | '9.8378'   | '9.4765'  | '3.2734'   | '0.1076' |
| $b_L$              | '6.6365'   | '7.4497'   | '7.0431'  | '2.9939'   | '0.0955' |
| $a_{\mu}$          | '7.4094'   | '8.0295'   | '7.7195'  | '4.9894'   | '0.1059' |
| $b_{\mu}$          | '5.7304'   | '6.4042'   | '6.0673'  | '2.3386'   | '0.0895' |
| $\mu$              | '0.2768'   | '0.3202'   | '0.2985'  | '0.0465'   | '0.0812' |
| $a_H$              | '7.3497'   | '8.0262'   | '7.688'   | '14.6851'  | '0.0659' |
| $b_H$              | '6.919'    | '7.6556'   | '7.2873'  | '14.7568'  | '0.0716' |
| $\nu$              | '143.1468' | '176.2491' | '159.698' | '0.004'    | '0.1081' |
| BP                 | '127.329'  | '127.671'  | '127.5'   | '126.4999' | '0.0427' |

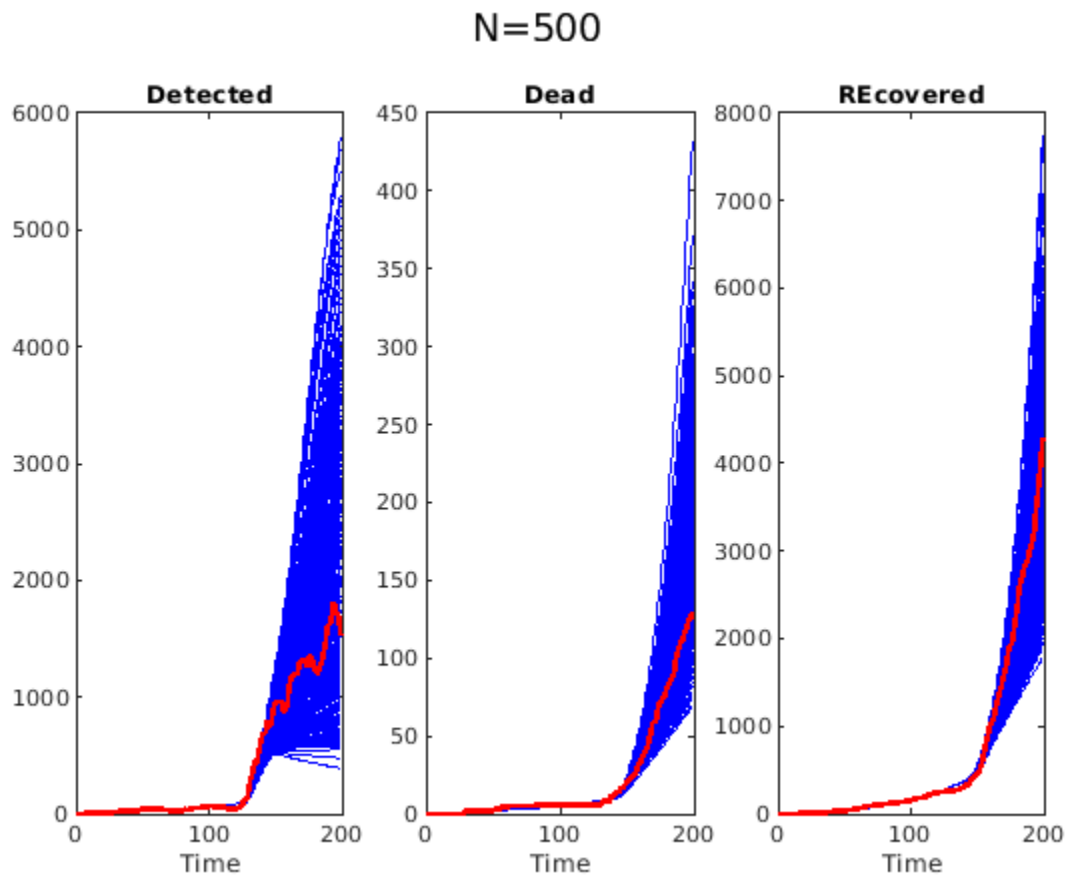
### 2.3. Identifiability analysis







## 2.4. Uncertainty analysis



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## Chapter 3. Extension number3

### 3.1. Basic information

The extension to be validated consists of the time series from the data200 to the 241. The status of the validation is: COMPLETED.

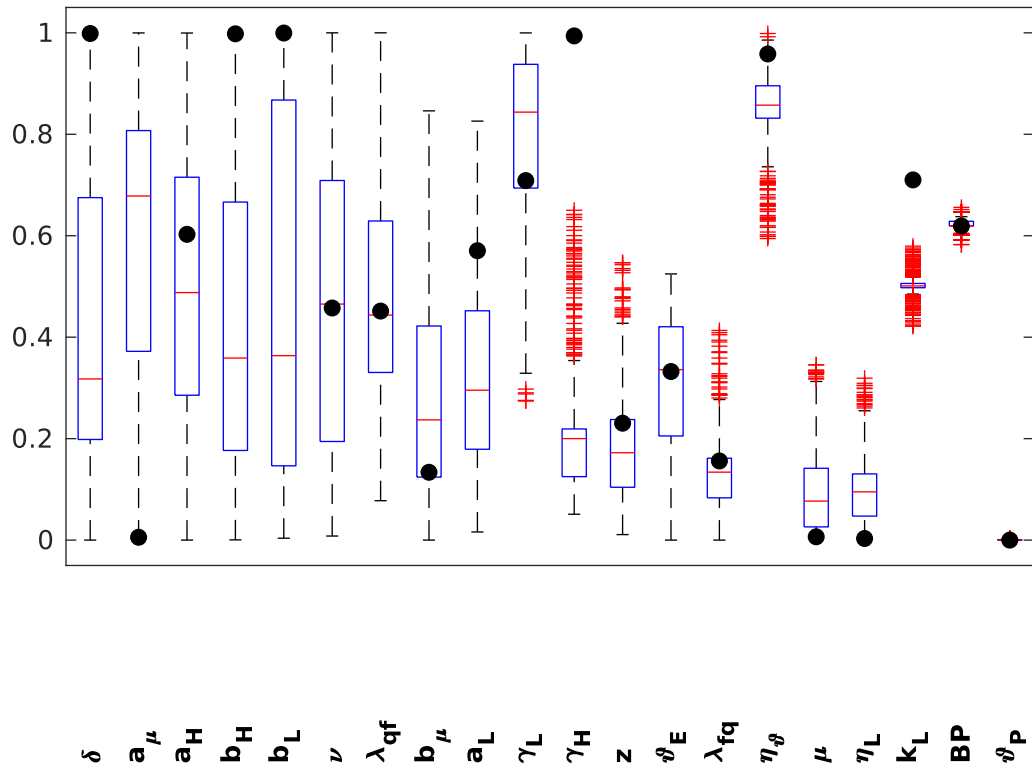
The number of estimations needed to perform the validation was1000.

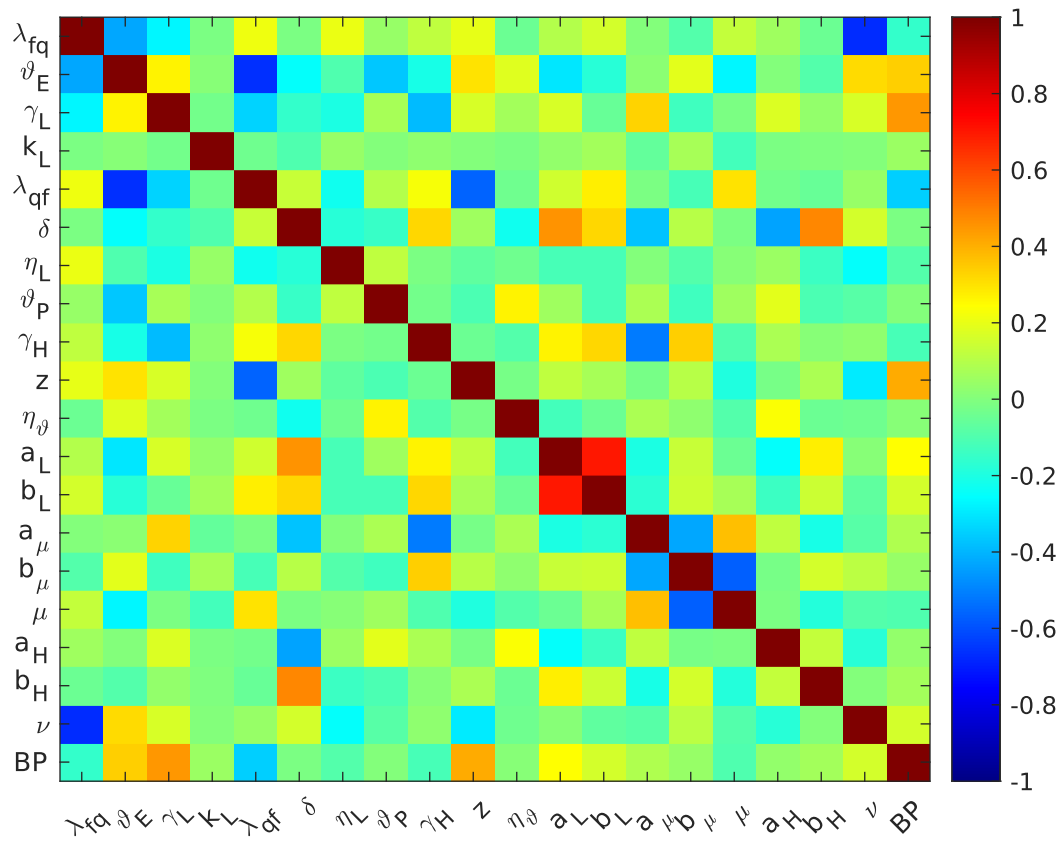
### 3.2. Estimated parameters with their intervals

It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

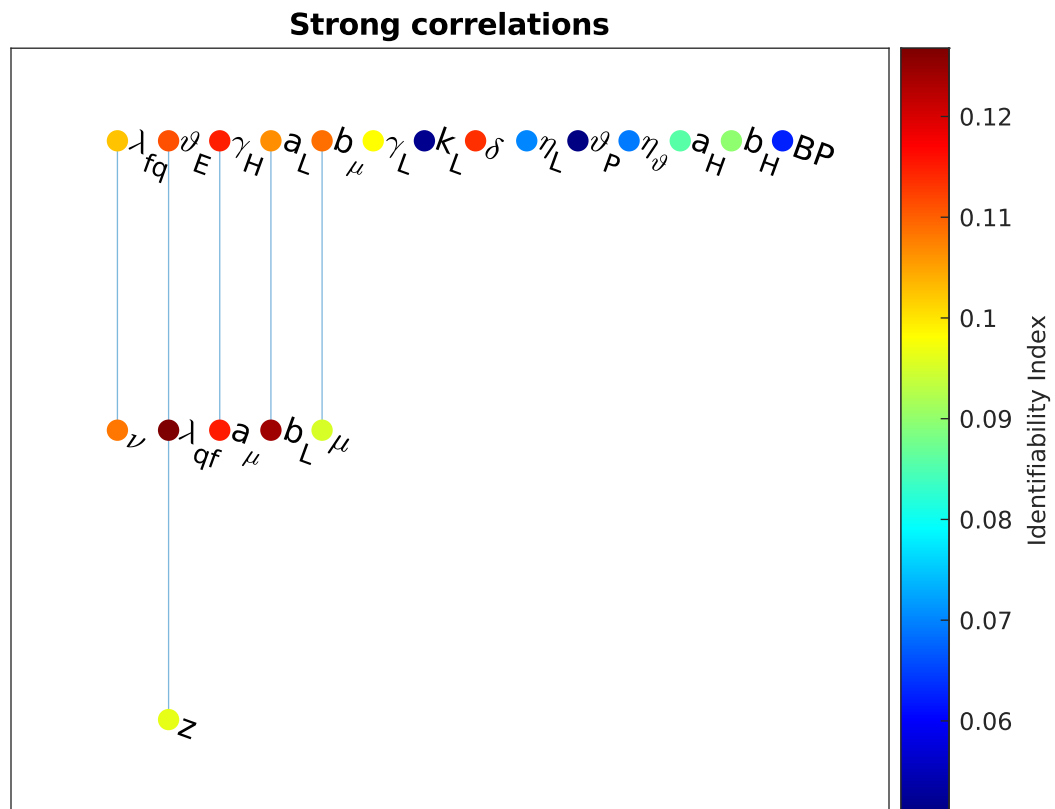
|                    | Rango      |            | Nominal    | Mejor      | Index    |
|--------------------|------------|------------|------------|------------|----------|
| $\lambda_{fq}$     | '0.1058'   | '0.1626'   | '0.1342'   | '0.156'    | '0.1027' |
| $\vartheta_E$      | '0.3183'   | '0.354'    | '0.3361'   | '0.3323'   | '0.1112' |
| $\gamma_L$         | '0.8138'   | '0.8733'   | '0.8435'   | '0.7087'   | '0.0982' |
| $k_L$              | '5.3486'   | '5.6705'   | '5.5095'   | '7.3905'   | '0.0519' |
| $\lambda_{qf}$     | '0.4151'   | '0.4723'   | '0.4437'   | '0.4515'   | '0.1268' |
| $\delta$           | '0.0417'   | '0.0536'   | '0.0477'   | '0.1498'   | '0.1136' |
| $\eta_L$           | '0.0751'   | '0.1152'   | '0.0951'   | '0.0032'   | '0.0704' |
| $\vartheta_P$      | '0.0003'   | '0.0007'   | '0.0005'   | '0'        | '0.0509' |
| $\gamma_H$         | '0.1637'   | '0.237'    | '0.2004'   | '0.994'    | '0.1147' |
| $z$                | '4.4778'   | '5.8702'   | '5.174'    | '6.9134'   | '0.0965' |
| $\eta_{\vartheta}$ | '0.8336'   | '0.8811'   | '0.8574'   | '0.9584'   | '0.0696' |
| $a_L$              | '4.8375'   | '5.4557'   | '5.1466'   | '8.9867'   | '0.1066' |
| $b_L$              | '5.4567'   | '6.7244'   | '6.0905'   | '14.9945'  | '0.1243' |
| $a_{\mu}$          | '9.963'    | '11.0309'  | '10.497'   | '1.078'    | '0.1151' |
| $b_{\mu}$          | '3.8457'   | '4.7931'   | '4.3194'   | '2.8719'   | '0.109'  |
| $\mu$              | '0.0531'   | '0.101'    | '0.0771'   | '0.0065'   | '0.0953' |
| $a_H$              | '7.359'    | '8.3033'   | '7.8311'   | '9.4391'   | '0.0858' |
| $b_H$              | '5.5088'   | '6.5397'   | '6.0243'   | '14.9731'  | '0.0899' |
| $\nu$              | '214.3385' | '250.9299' | '232.6342' | '228.7689' | '0.1084' |
| BP                 | '199.3349' | '199.6651' | '199.5'    | '199.5'    | '0.0625' |

### 3.3. Identifiability analysis

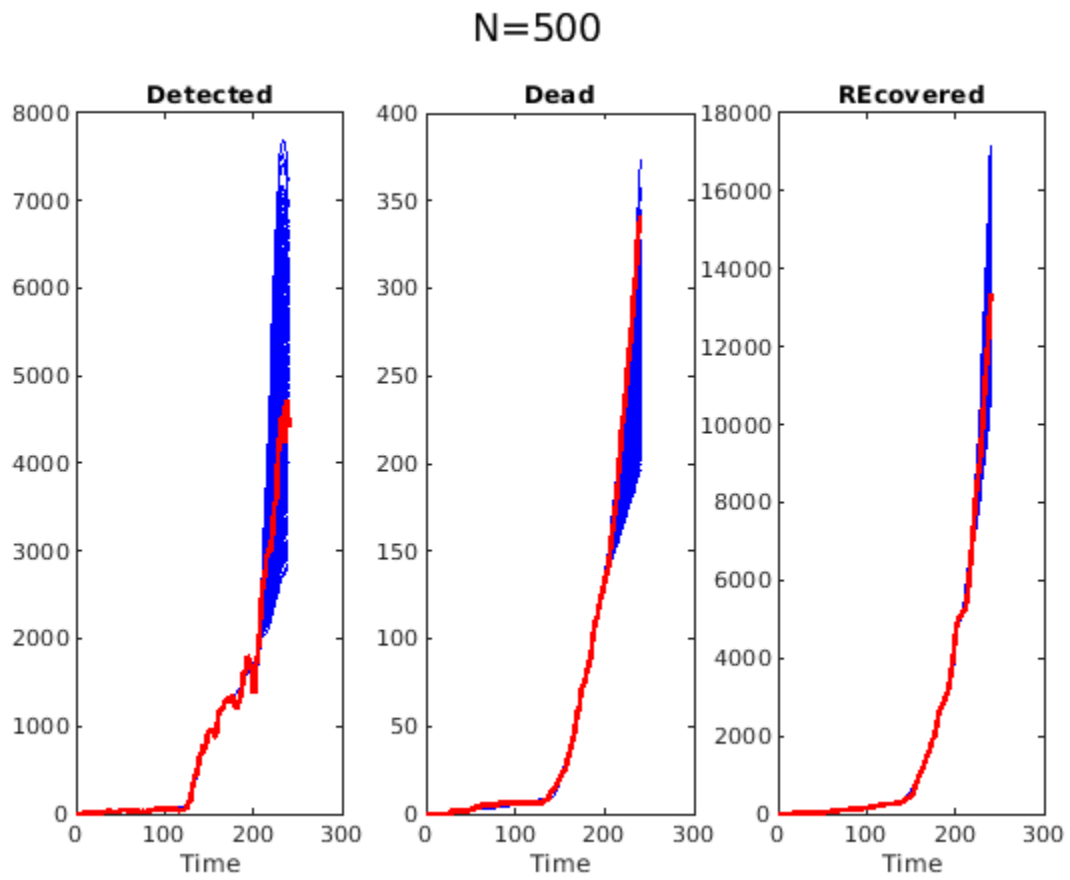








### 3.4. Uncertainty analysys



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## Chapter 4. Extension number4

### 4.1. Basic information

The extension to be validated consists of the time series from the data241 to the 269. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

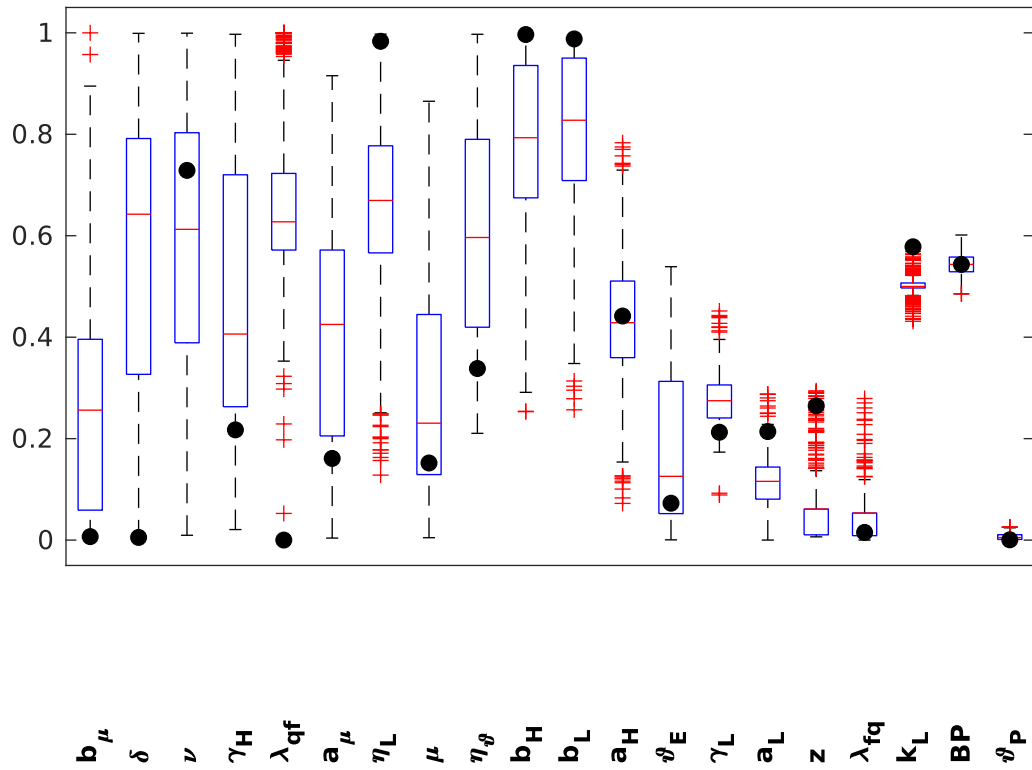
### 4.2. Estimated parameters with their intervals

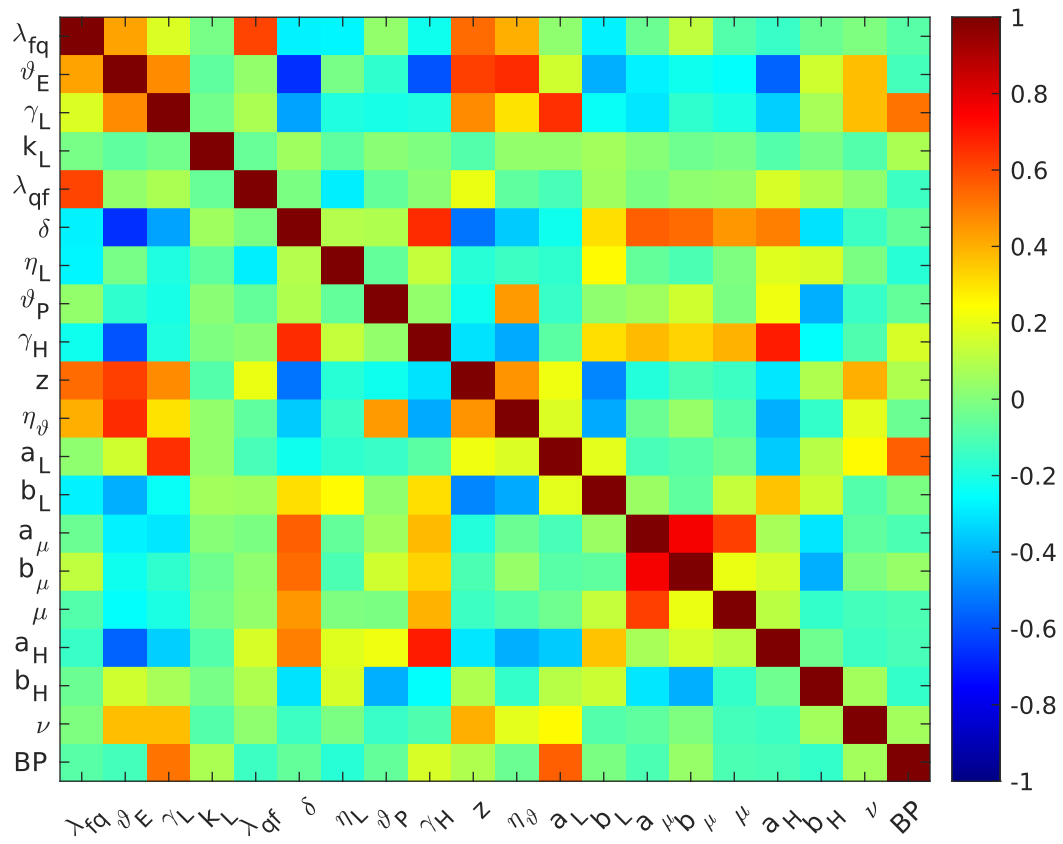
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

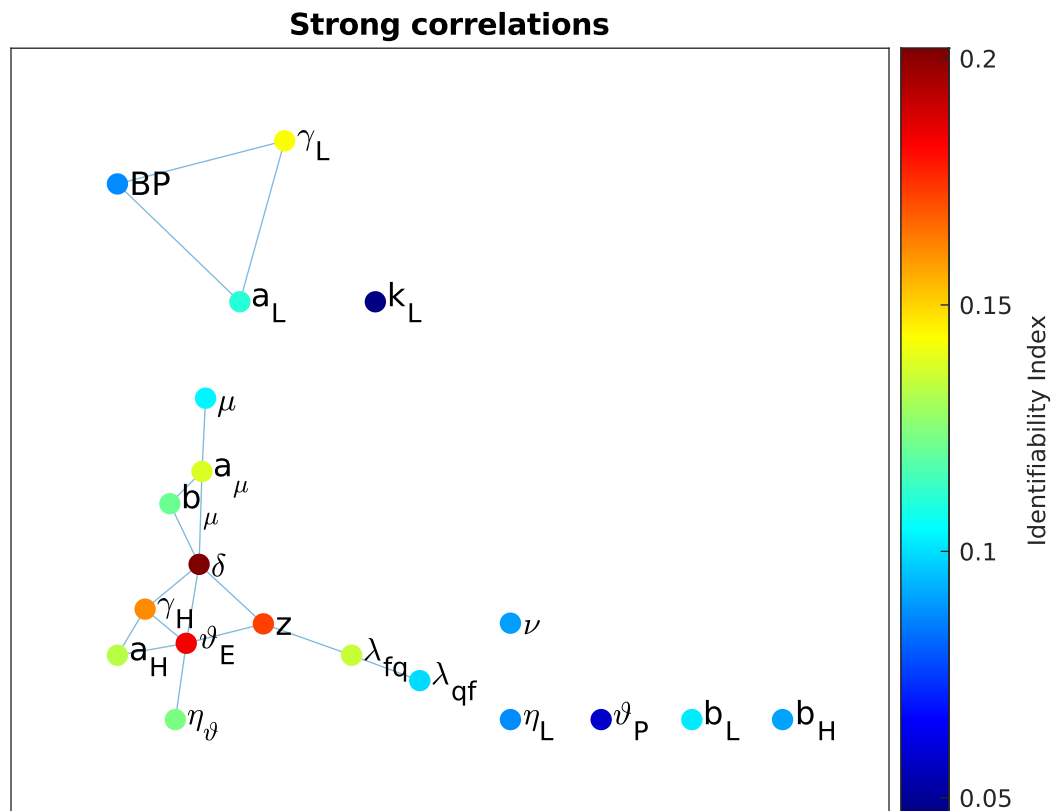
Due to a deviation from the median the CSB method was activated to obtain the parameter intervals.

|                    | Rango      |            | Nominal    | Mejor      | Index    |
|--------------------|------------|------------|------------|------------|----------|
| $\lambda_{fq}$     | '0.0046'   | '0.4807'   | '0.0533'   | '0.0152'   | '0.135'  |
| $\vartheta_E$      | '0'        | '0.1636'   | '0.1257'   | '0.0727'   | '0.184'  |
| $\gamma_L$         | '0.1671'   | '0.2157'   | '0.2748'   | '0.2126'   | '0.1432' |
| $k_L$              | '1'        | '10'       | '5.5003'   | '6.2039'   | '0.0471' |
| $\lambda_{qf}$     | '0'        | '0.0002'   | '0.6275'   | '0.0001'   | '0.0996' |
| $\delta$           | '0'        | '0.0018'   | '0.0964'   | '0.0008'   | '0.2021' |
| $\eta_L$           | '0.02'     | '1'        | '0.6696'   | '0.9833'   | '0.0871' |
| $\vartheta_P$      | '0.0005'   | '0.0037'   | '0.0051'   | '0.0006'   | '0.0584' |
| $\gamma_H$         | '0.1219'   | '1'        | '0.4062'   | '0.2173'   | '0.1611' |
| $z$                | '0'        | '17.8641'  | '1.8356'   | '7.9396'   | '0.1728' |
| $\eta_{\vartheta}$ | '0.3087'   | '0.4249'   | '0.5965'   | '0.3382'   | '0.1238' |
| $a_L$              | '2.6596'   | '4.1472'   | '2.6213'   | '3.995'    | '0.111'  |
| $b_L$              | '11.5122'  | '15'       | '12.5877'  | '14.8309'  | '0.1021' |
| $a_{\mu}$          | '3.1994'   | '15'       | '6.9523'   | '3.2537'   | '0.1383' |
| $b_{\mu}$          | '1'        | '1.9001'   | '4.5865'   | '1.0956'   | '0.1215' |
| $\mu$              | '0'        | '0.342'    | '0.2305'   | '0.152'    | '0.1036' |
| $a_H$              | '1'        | '8.448'    | '7.0001'   | '7.1844'   | '0.1325' |
| $b_H$              | '4.8475'   | '15'       | '12.1049'  | '14.9527'  | '0.091'  |
| $\nu$              | '238.3492' | '500'      | '306.3065' | '364.4135' | '0.0903' |
| BP                 | '236.9495' | '245.5003' | '237.5'    | '237.5'    | '0.0876' |

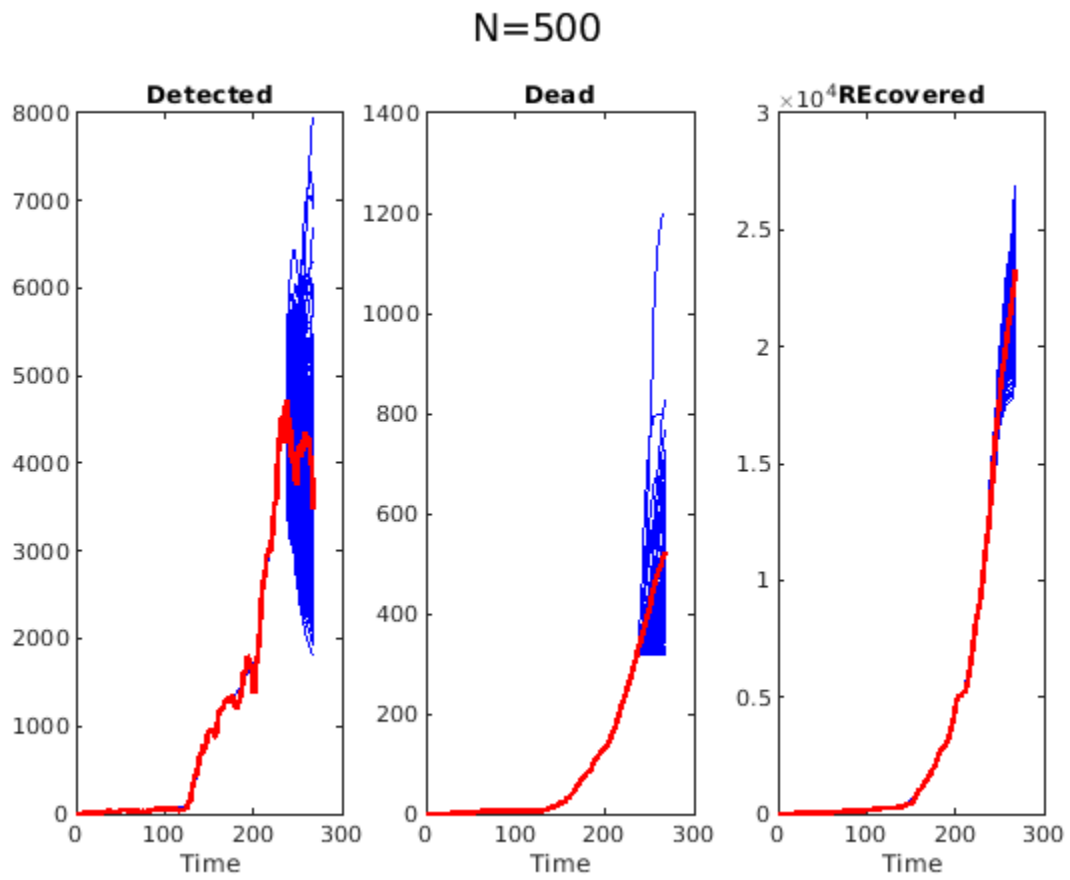
### 4.3. Identifiability analysis







#### 4.4. Uncertainty analysis



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## Chapter 5. Extension number5

### 5.1. Basic information

The extension to be validated consists of the time series from the data269 to the 299. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

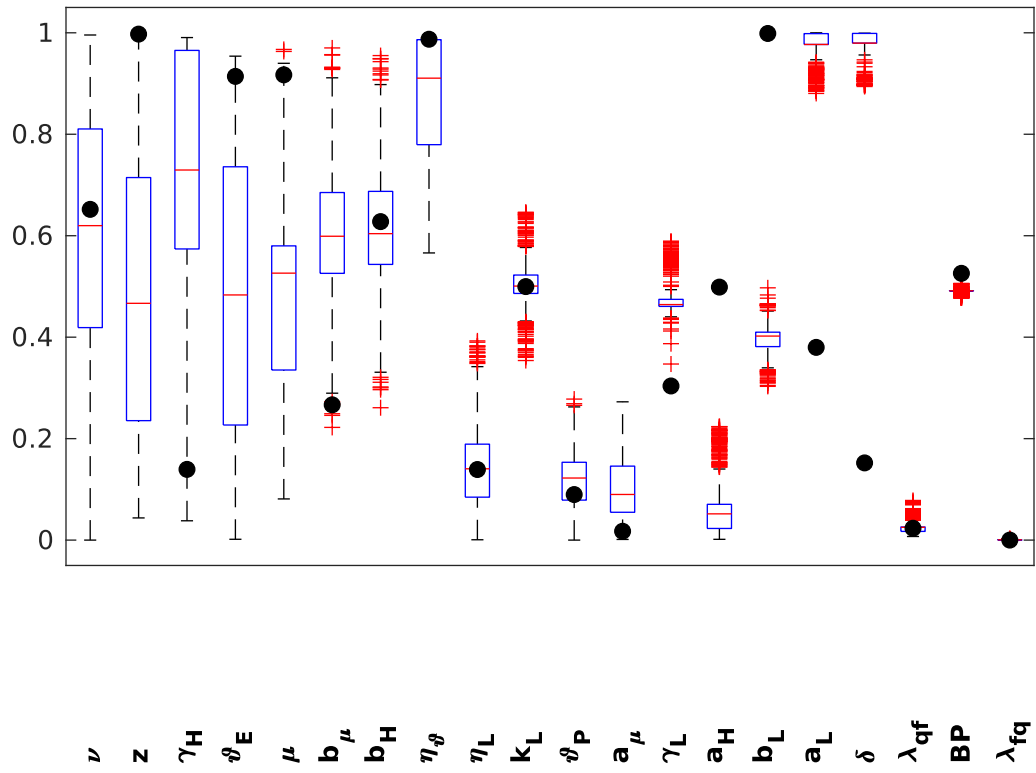
### 5.2. Estimated parameters with their intervals

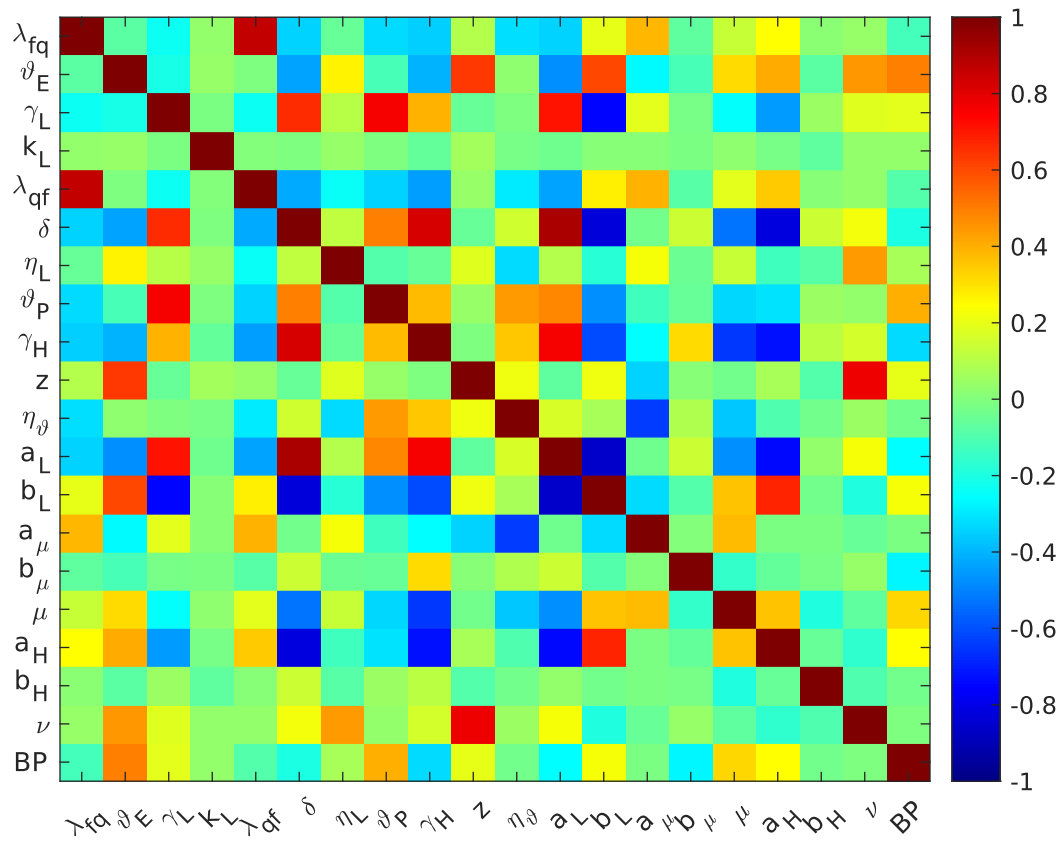
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

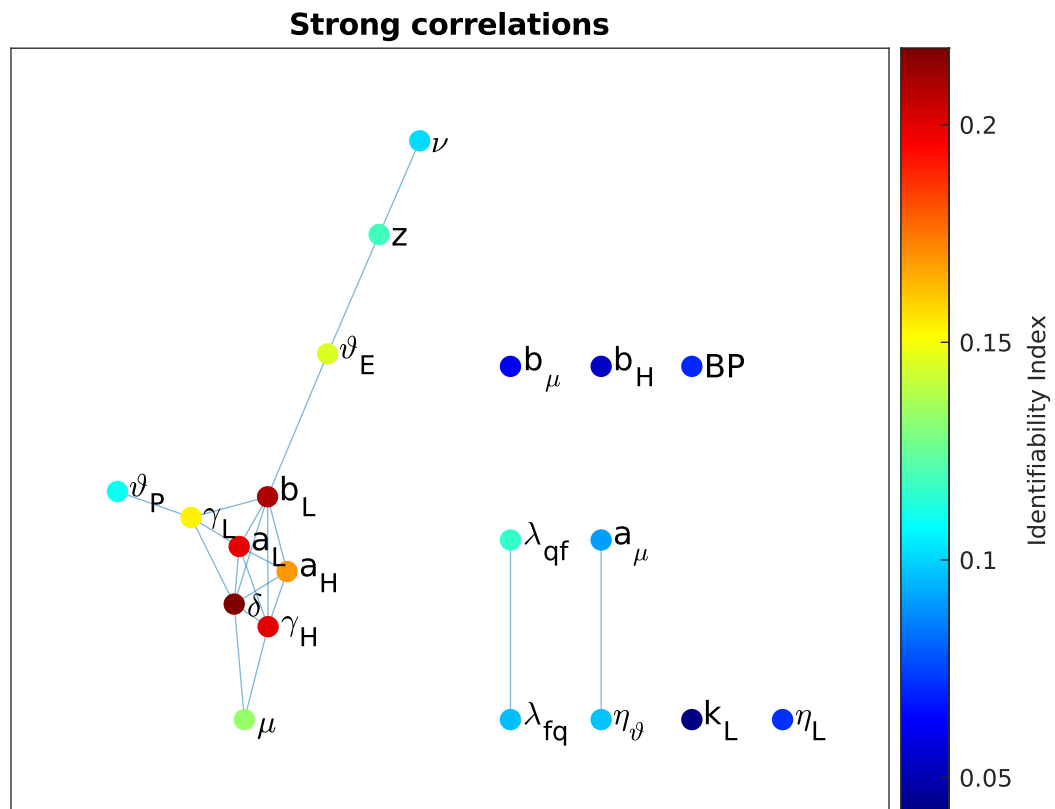
|                    | Rango      |            | Nominal    | Mejor      | Index    |
|--------------------|------------|------------|------------|------------|----------|
| $\lambda_{fq}$     | '0'        | '0.012'    | '0.0005'   | '0'        | '0.0964' |
| $\vartheta_E$      | '0.4558'   | '0.5107'   | '0.4833'   | '0.9141'   | '0.1451' |
| $\gamma_L$         | '0.454'    | '0.4745'   | '0.4643'   | '0.3038'   | '0.1533' |
| $k_L$              | '5.4137'   | '5.5994'   | '5.5065'   | '5.4975'   | '0.042'  |
| $\lambda_{qf}$     | '0.0054'   | '0.045'    | '0.0252'   | '0.0234'   | '0.1164' |
| $\delta$           | '0.1422'   | '0.15'     | '0.1469'   | '0.0228'   | '0.2176' |
| $\eta_L$           | '0.1296'   | '0.1515'   | '0.1406'   | '0.1391'   | '0.072'  |
| $\vartheta_P$      | '0.116'    | '0.1287'   | '0.1224'   | '0.0898'   | '0.1097' |
| $\gamma_H$         | '0.7067'   | '0.7523'   | '0.7295'   | '0.1394'   | '0.1999' |
| $z$                | '13.1491'  | '14.8552'  | '14.0022'  | '29.9216'  | '0.1185' |
| $\eta_{\vartheta}$ | '0.8967'   | '0.9244'   | '0.9106'   | '0.9873'   | '0.0975' |
| $a_L$              | '14.3783'  | '14.9774'  | '14.6779'  | '6.3187'   | '0.1995' |
| $b_L$              | '6.3197'   | '6.9409'   | '6.6303'   | '14.9811'  | '0.2092' |
| $a_{\mu}$          | '2.1582'   | '2.3605'   | '2.2594'   | '1.2439'   | '0.0909' |
| $b_{\mu}$          | '9.1665'   | '9.6041'   | '9.3853'   | '4.7332'   | '0.0621' |
| $\mu$              | '0.5081'   | '0.5444'   | '0.5262'   | '0.9171'   | '0.1339' |
| $a_H$              | '1.448'    | '2.0006'   | '1.7243'   | '7.9818'   | '0.169'  |
| $b_H$              | '9.2525'   | '9.661'    | '9.4568'   | '9.7892'   | '0.0542' |
| $\nu$              | '298.3002' | '321.5509' | '309.9255' | '325.9827' | '0.1016' |
| BP                 | '269.4154' | '269.5846' | '269.5'    | '271.5'    | '0.0708' |



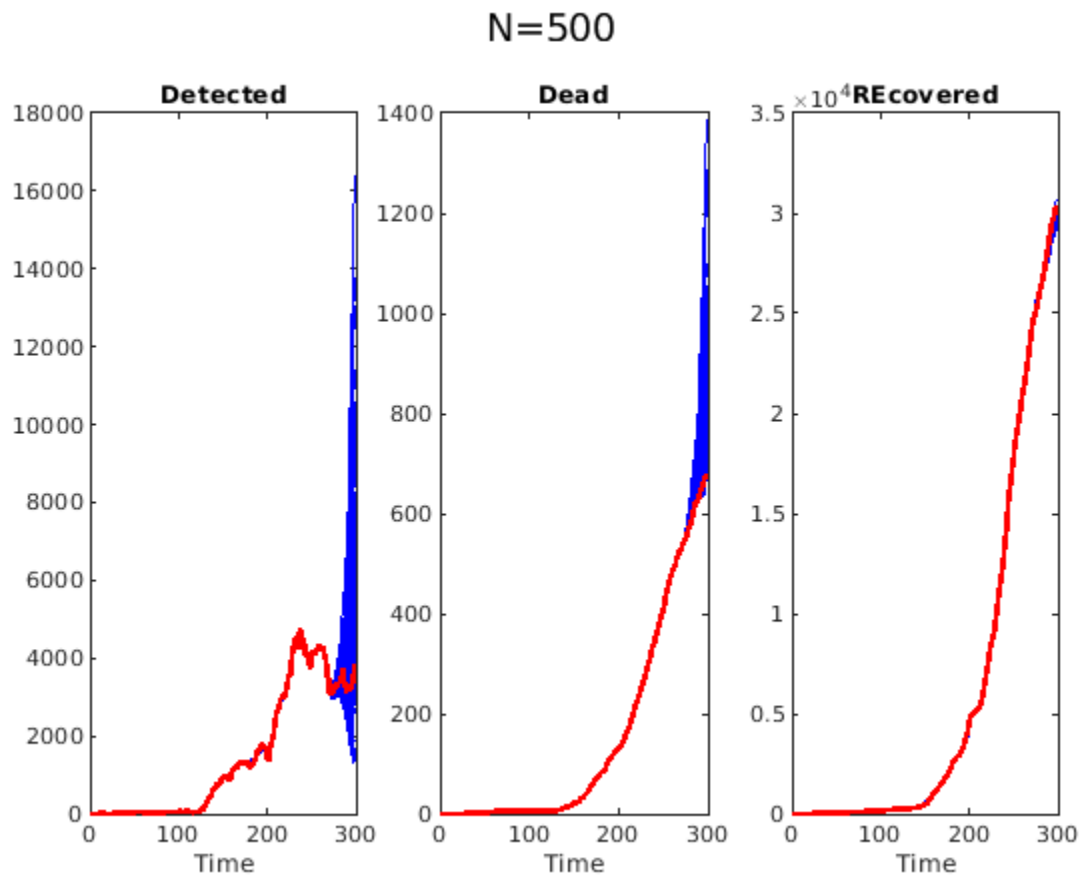
### 5.3. Identifiability analysis







## 5.4. Uncertainty analysis



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## Chapter 6. Extension number6

### 6.1. Basic information

The extension to be validated consists of the time series from the data299 to the 321. The status of the validation is: COMPLETED.

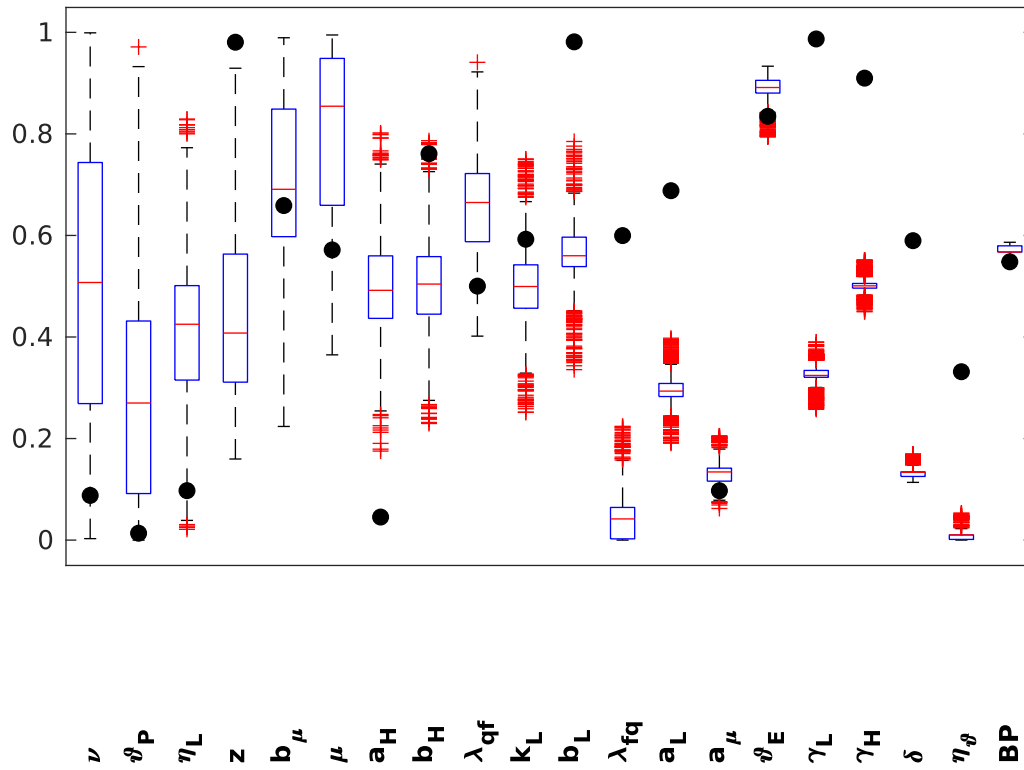
The number of estimations needed to perform the validation was1000.

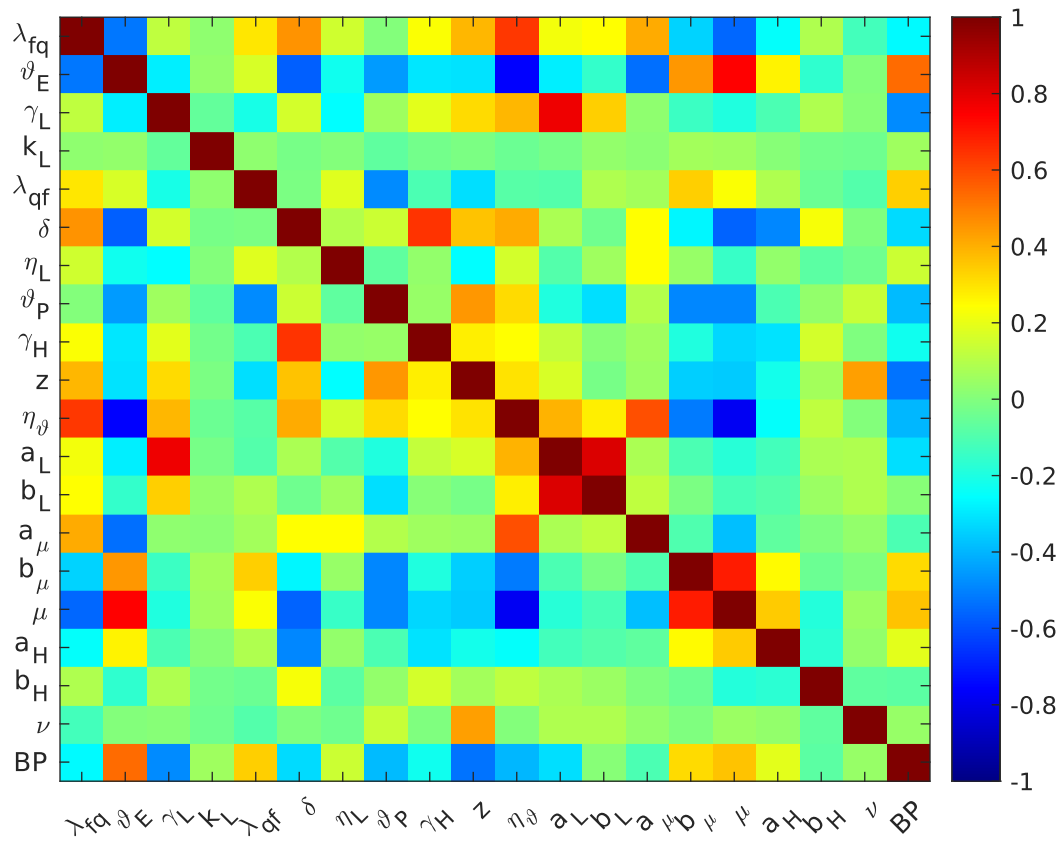
### 6.2. Estimated parameters with their intervals

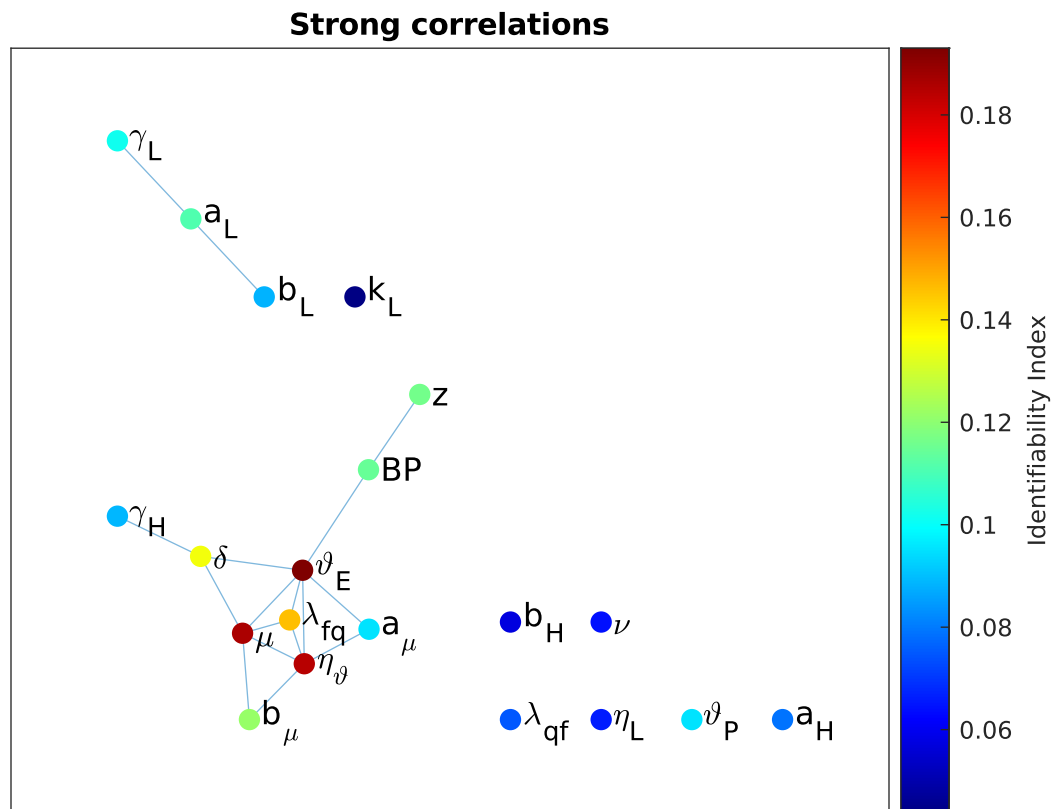
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

|                    | Rango      |            | Nominal    | Mejor     | Index    |
|--------------------|------------|------------|------------|-----------|----------|
| $\lambda_{fq}$     | '0.0246'   | '0.0588'   | '0.0417'   | '0.5997'  | '0.1462' |
| $\vartheta_E$      | '0.8827'   | '0.9'      | '0.8913'   | '0.8346'  | '0.193'  |
| $\gamma_L$         | '0.3121'   | '0.3365'   | '0.3243'   | '0.987'   | '0.1021' |
| $k_L$              | '5.3988'   | '5.5912'   | '5.495'    | '6.3329'  | '0.0439' |
| $\lambda_{qf}$     | '0.6558'   | '0.674'    | '0.6649'   | '0.5002'  | '0.0748' |
| $\delta$           | '0.0187'   | '0.0214'   | '0.02'     | '0.0885'  | '0.1352' |
| $\eta_L$           | '0.4123'   | '0.4379'   | '0.4251'   | '0.0974'  | '0.0664' |
| $\vartheta_P$      | '0.2533'   | '0.2866'   | '0.27'     | '0.0136'  | '0.0957' |
| $\gamma_H$         | '0.4935'   | '0.508'    | '0.5008'   | '0.9098'  | '0.0889' |
| $z$                | '11.8008'  | '12.6651'  | '12.2329'  | '29.4164' | '0.1165' |
| $\eta_{\vartheta}$ | '0'        | '0.028'    | '0.0102'   | '0.3316'  | '0.1848' |
| $a_L$              | '4.9896'   | '5.2264'   | '5.108'    | '10.6337' | '0.1113' |
| $b_L$              | '8.631'    | '9.0496'   | '8.8403'   | '14.7382' | '0.0885' |
| $a_{\mu}$          | '2.8083'   | '2.9505'   | '2.8794'   | '2.3614'  | '0.0955' |
| $b_{\mu}$          | '10.4903'  | '10.8542'  | '10.6722'  | '10.2241' | '0.1218' |
| $\mu$              | '0.8399'   | '0.8691'   | '0.8545'   | '0.5715'  | '0.1863' |
| $a_H$              | '7.7221'   | '8.0511'   | '7.8866'   | '1.6353'  | '0.0792' |
| $b_H$              | '7.9138'   | '8.2049'   | '8.0593'   | '11.6535' | '0.0574' |
| $\nu$              | '242.0132' | '265.3475' | '253.6804' | '44.0167' | '0.0644' |
| BP                 | '298.4365' | '298.5635' | '298.5'    | '297.5'   | '0.1149' |

### 6.3. Identifiability analysis

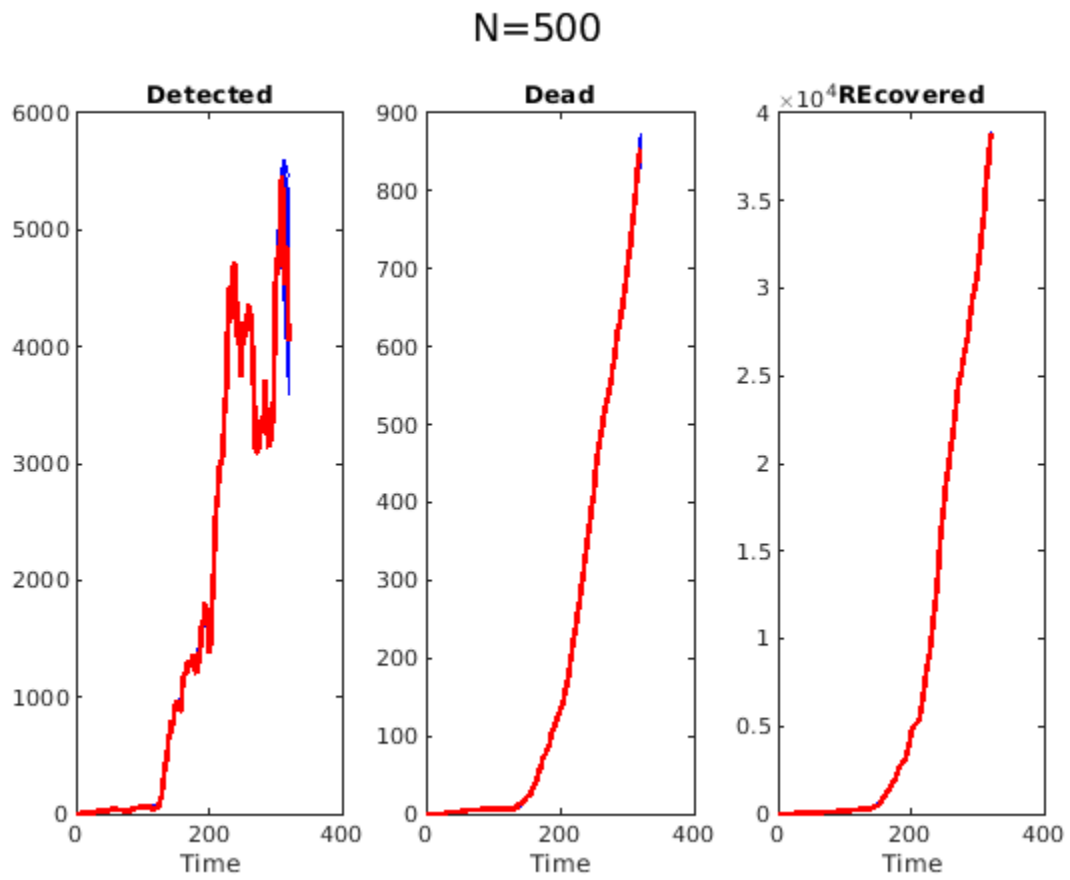








## 6.4. Uncertainty analysis



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## Chapter 7. Extension number7

### 7.1. Basic information

The extension to be validated consists of the time series from the data321 to the 363. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

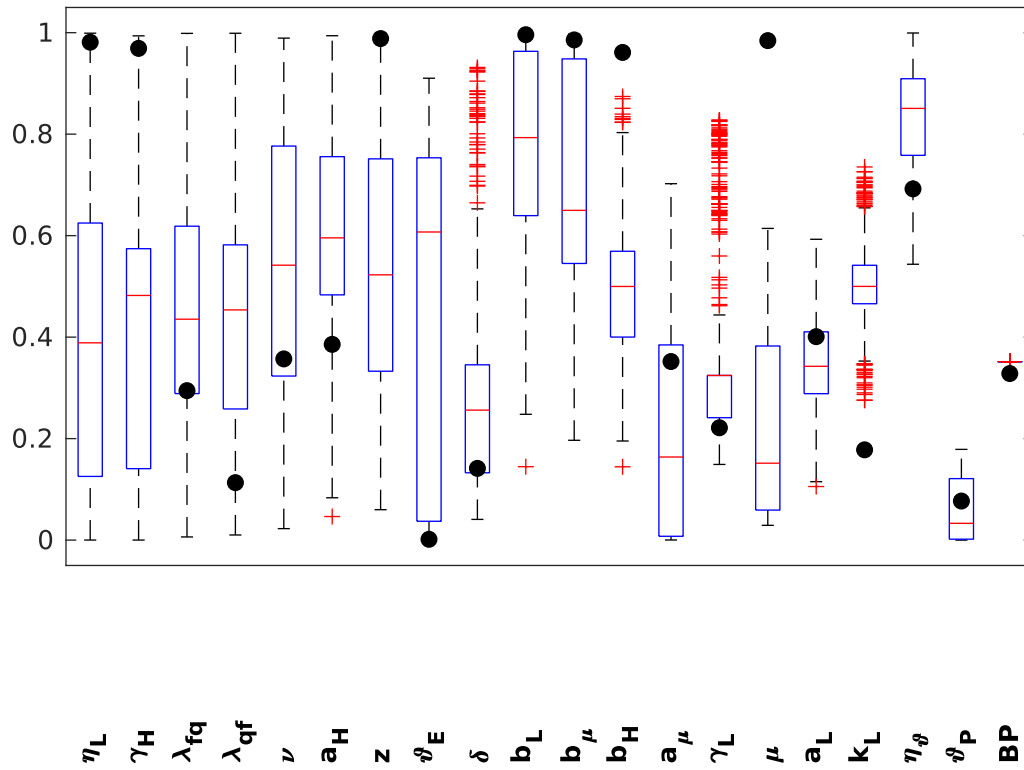
### 7.2. Estimated parameters with their intervals

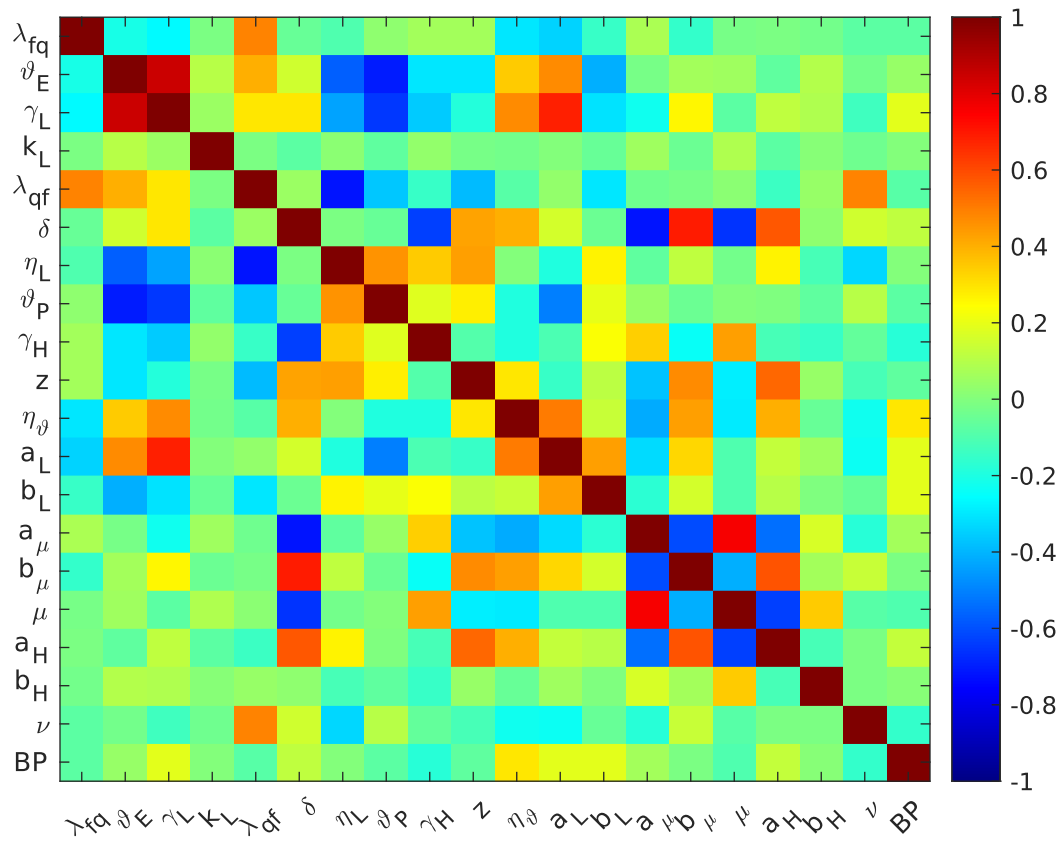
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

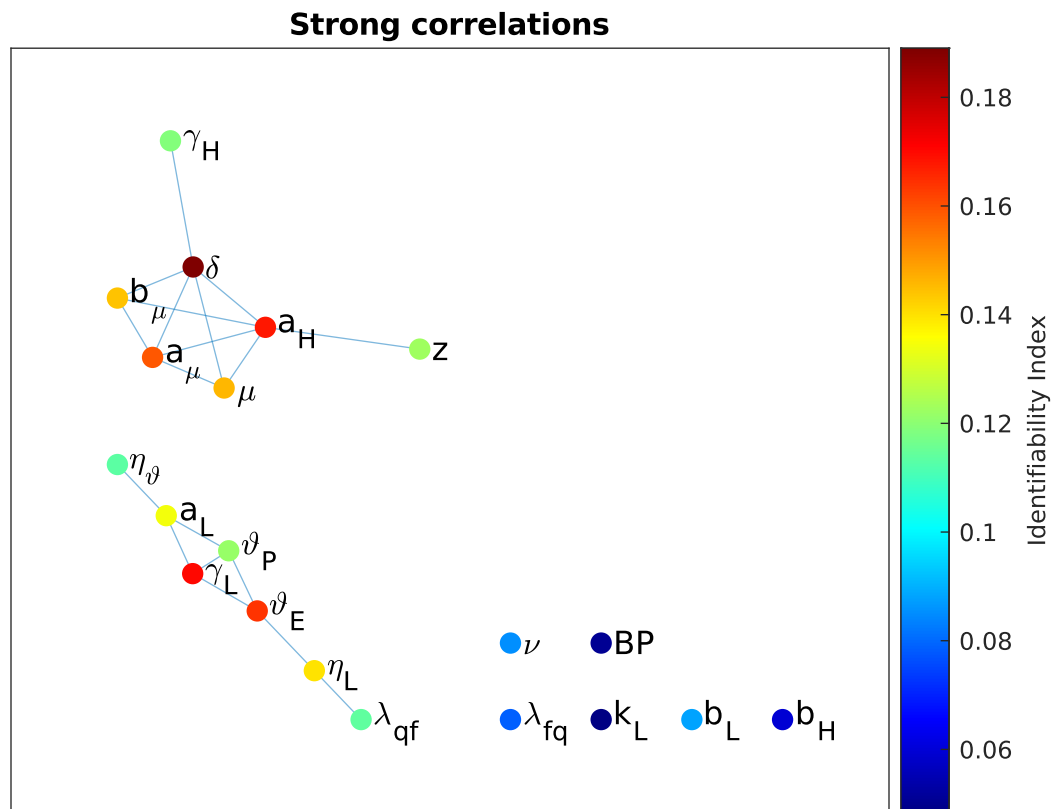
Due to a deviation from the median the CSB method was activated to obtain the parameter intervals.

|                    | Rango      |           | Nominal    | Mejor      | Index    |
|--------------------|------------|-----------|------------|------------|----------|
| $\lambda_{fq}$     | '0.2225'   | '1'       | '0.4353'   | '0.2945'   | '0.079'  |
| $\vartheta_E$      | '0'        | '0.0036'  | '0.6072'   | '0.0016'   | '0.1639' |
| $\gamma_L$         | '0.1868'   | '0.3377'  | '0.3245'   | '0.2214'   | '0.1703' |
| $k_L$              | '1'        | '10'      | '5.4996'   | '2.6013'   | '0.0484' |
| $\lambda_{qf}$     | '0'        | '0.1387'  | '0.4537'   | '0.1132'   | '0.1139' |
| $\delta$           | '0'        | '0.0477'  | '0.0384'   | '0.0212'   | '0.189'  |
| $\eta_L$           | '0'        | '1'       | '0.3888'   | '0.9812'   | '0.1399' |
| $\vartheta_P$      | '0.0028'   | '0.9601'  | '0.0331'   | '0.077'    | '0.1218' |
| $\gamma_H$         | '0'        | '1'       | '0.4821'   | '0.9691'   | '0.1189' |
| $z$                | '0'        | '30'      | '15.6829'  | '29.6495'  | '0.1226' |
| $\eta_{\vartheta}$ | '0'        | '1'       | '0.8507'   | '0.6922'   | '0.1135' |
| $a_L$              | '5.0572'   | '6.6347'  | '5.7952'   | '6.6128'   | '0.1342' |
| $b_L$              | '11.2874'  | '15'      | '12.1045'  | '14.9433'  | '0.0883' |
| $a_{\mu}$          | '1'        | '15'      | '3.2923'   | '5.927'    | '0.1593' |
| $b_{\mu}$          | '1'        | '15'      | '10.0971'  | '14.7999'  | '0.1444' |
| $\mu$              | '0'        | '1'       | '0.1516'   | '0.9843'   | '0.1459' |
| $a_H$              | '1'        | '15'      | '9.3387'   | '6.4005'   | '0.1677' |
| $b_H$              | '1'        | '15'      | '7.9977'   | '14.4546'  | '0.0598' |
| $\nu$              | '105.0601' | '500'     | '270.8756' | '178.5408' | '0.0853' |
| BP                 | '319.723'  | '328.144' | '321.5'    | '320.0068' | '0.0507' |

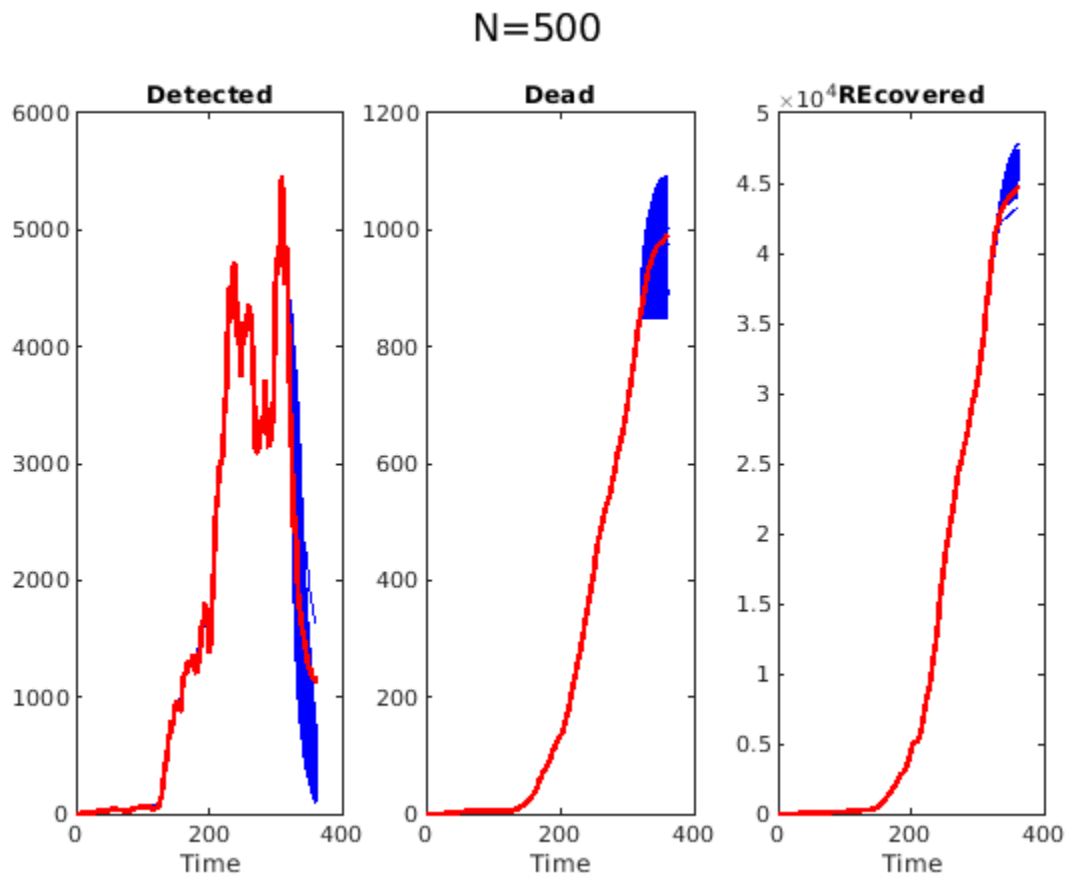
### 7.3. Identifiability analysis







## 7.4. Uncertainty analysis



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## Chapter 8. Extension number8

### 8.1. Basic information

The extension to be validated consists of the time series from the data363 to the 393. The status of the validation is: COMPLETED.

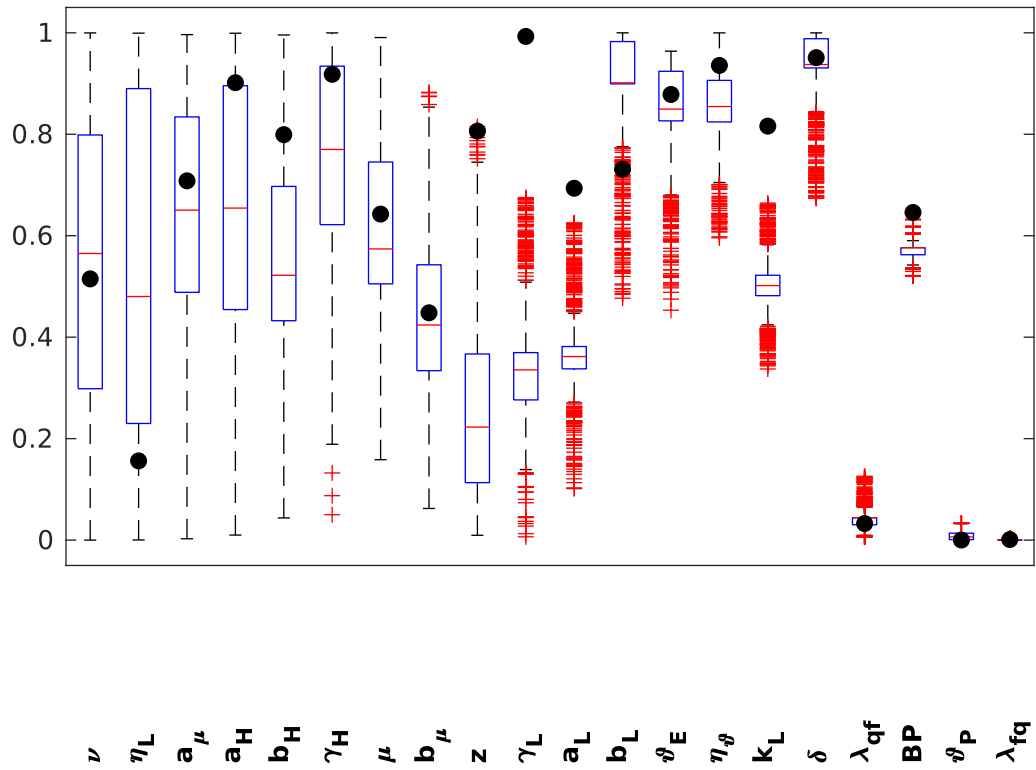
The number of estimations needed to perform the validation was1000.

### 8.2. Estimated parameters with their intervals

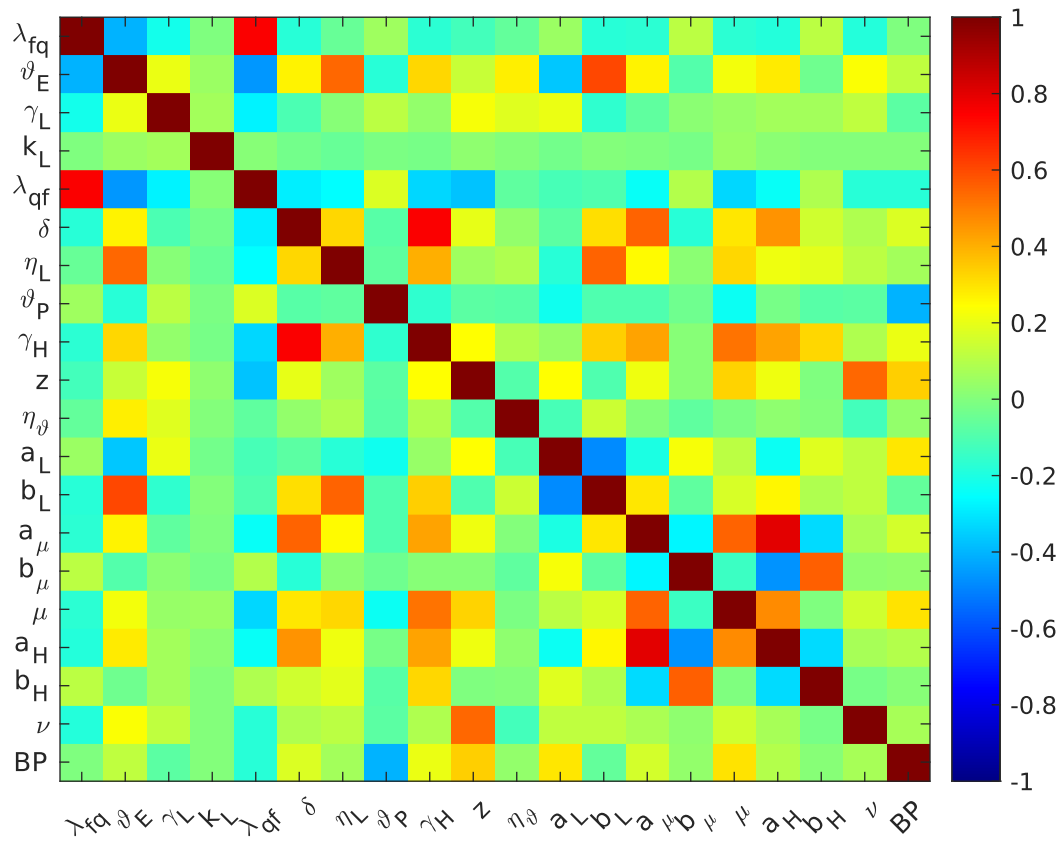
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

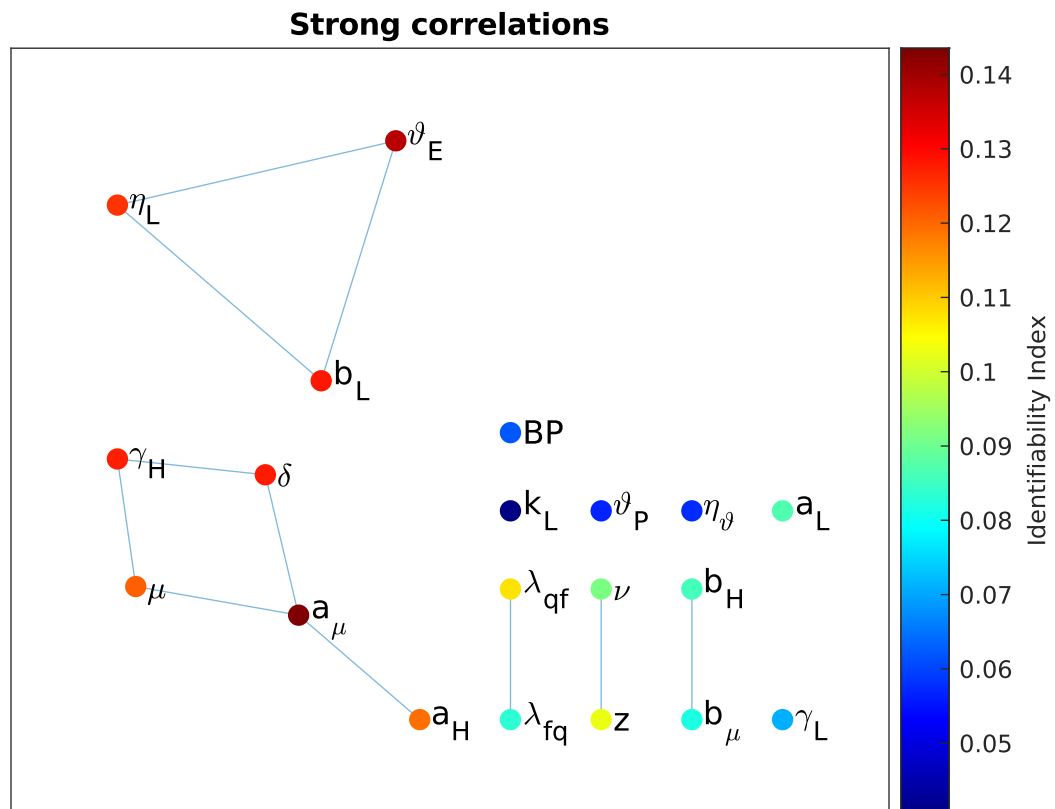
|                    | Rango      |            | Nominal    | Mejor      | Index    |
|--------------------|------------|------------|------------|------------|----------|
| $\lambda_{fq}$     | '0'        | '0.0128'   | '0.0008'   | '0.0011'   | '0.0835' |
| $\vartheta_E$      | '0.8251'   | '0.8737'   | '0.8494'   | '0.8785'   | '0.1378' |
| $\gamma_L$         | '0.3177'   | '0.3533'   | '0.3355'   | '0.9928'   | '0.071'  |
| $k_L$              | '5.4205'   | '5.6097'   | '5.5151'   | '8.3445'   | '0.0407' |
| $\lambda_{qf}$     | '0.0309'   | '0.0573'   | '0.0441'   | '0.0327'   | '0.1075' |
| $\delta$           | '0.1375'   | '0.1438'   | '0.1406'   | '0.1427'   | '0.1278' |
| $\eta_L$           | '0.4519'   | '0.5085'   | '0.4802'   | '0.1562'   | '0.1254' |
| $\vartheta_P$      | '0.0028'   | '0.0099'   | '0.0063'   | '0.0001'   | '0.057'  |
| $\gamma_H$         | '0.754'    | '0.7859'   | '0.77'     | '0.9182'   | '0.1274' |
| $z$                | '6.0754'   | '7.3167'   | '6.696'    | '24.1854'  | '0.1026' |
| $\eta_{\vartheta}$ | '0.8405'   | '0.8686'   | '0.8546'   | '0.9357'   | '0.0578' |
| $a_L$              | '5.8037'   | '6.3278'   | '6.0658'   | '10.71'    | '0.0871' |
| $b_L$              | '13.2422'  | '13.9863'  | '13.6143'  | '11.2353'  | '0.1282' |
| $a_{\mu}$          | '9.843'    | '10.3696'  | '10.1063'  | '10.9147'  | '0.1435' |
| $b_{\mu}$          | '6.7467'   | '7.1266'   | '6.9366'   | '7.2732'   | '0.0818' |
| $\mu$              | '0.5583'   | '0.5896'   | '0.574'    | '0.6427'   | '0.121'  |
| $a_H$              | '9.8727'   | '10.4524'  | '10.1626'  | '13.6231'  | '0.1193' |
| $b_H$              | '8.0771'   | '8.5382'   | '8.3077'   | '12.1895'  | '0.086'  |
| $\nu$              | '270.6178' | '294.3558' | '282.4868' | '257.4445' | '0.0917' |
| BP                 | '362.206'  | '362.7939' | '362.5'    | '367.5'    | '0.0621' |

## 8.3. Identifiability analysys

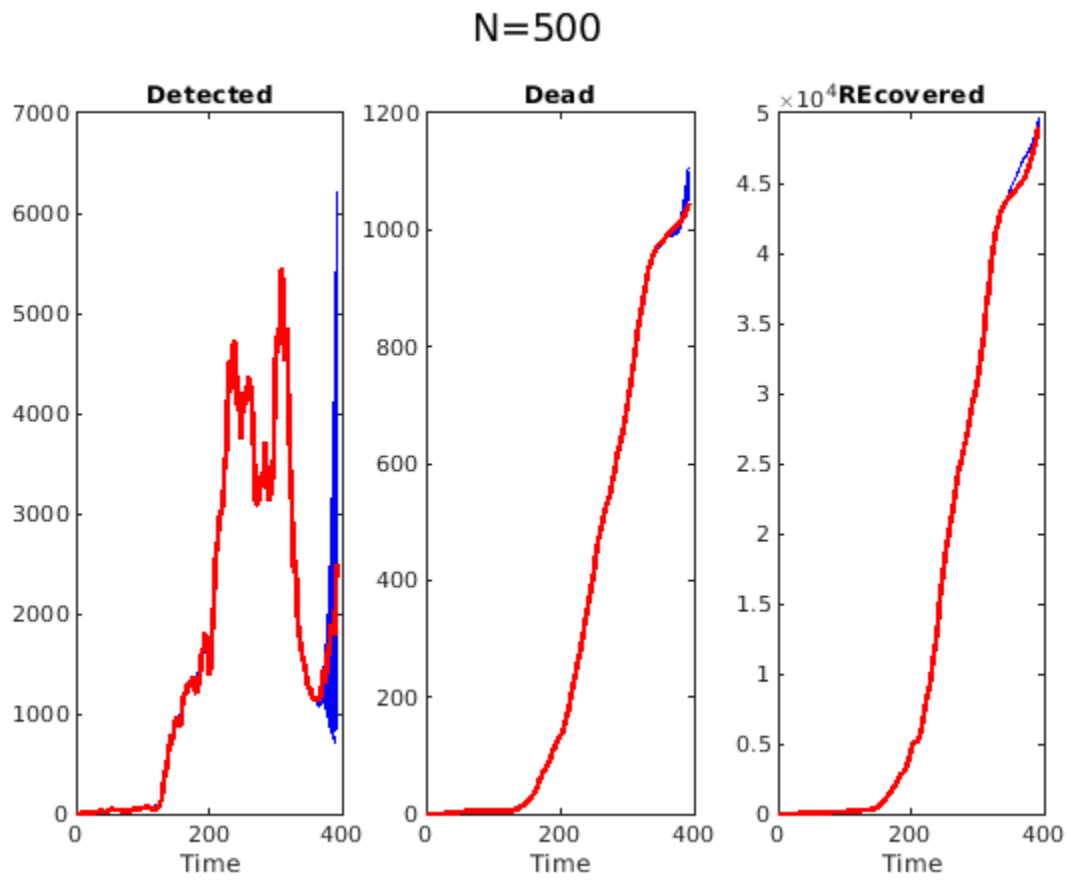








## 8.4. Uncertainty analysis



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## Chapter 9. Extension number9

### 9.1. Basic information

The extension to be validated consists of the time series from the data393 to the 406. The status of the validation is: COMPLETED.

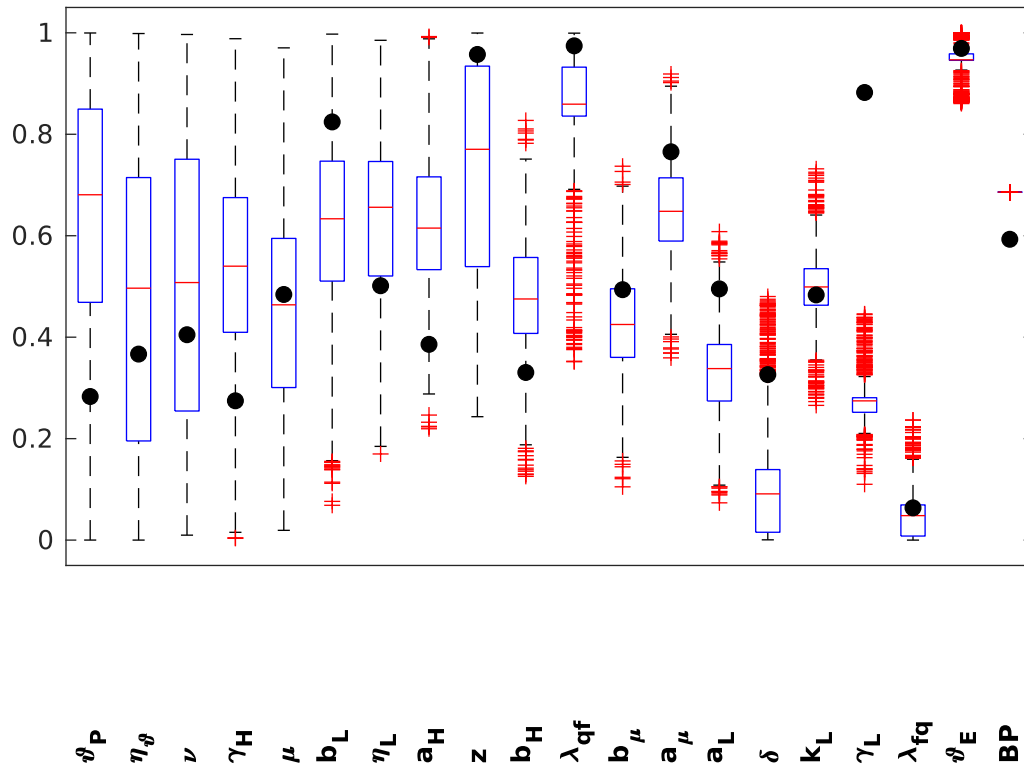
The number of estimations needed to perform the validation was1000.

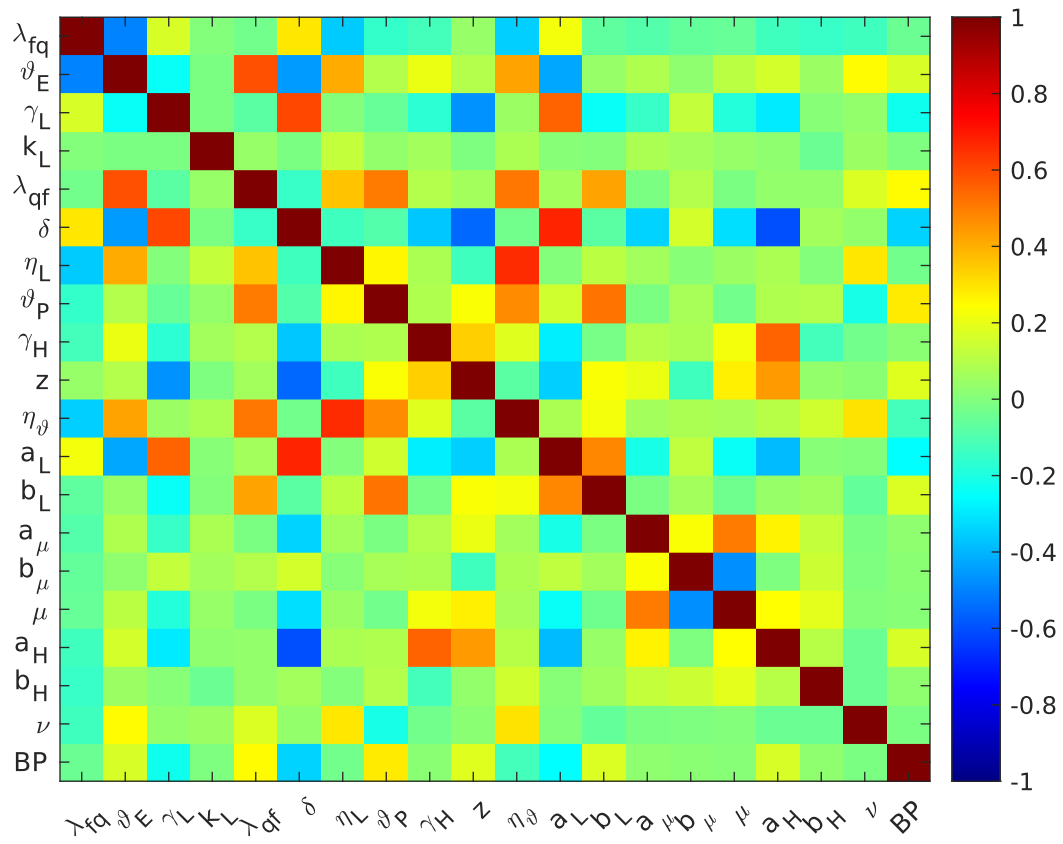
### 9.2. Estimated parameters with their intervals

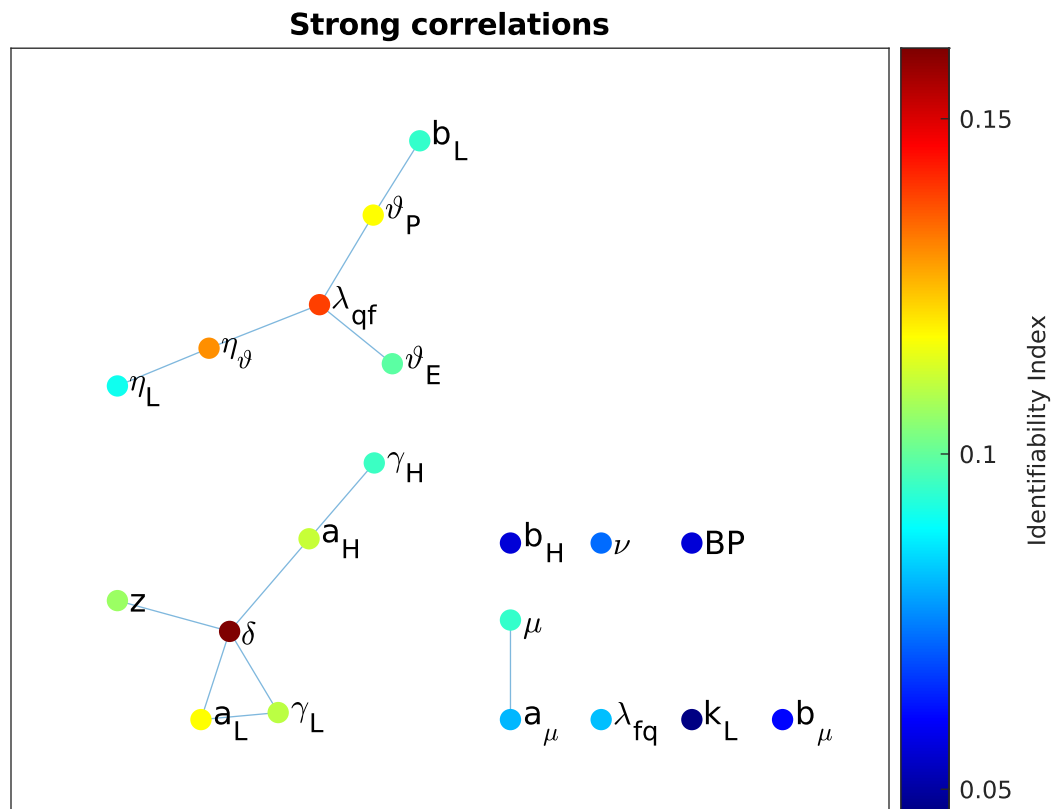
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

|                    | Rango      |            | Nominal    | Mejor     | Index    |
|--------------------|------------|------------|------------|-----------|----------|
| $\lambda_{fq}$     | '0.0278'   | '0.0687'   | '0.0482'   | '0.0635'  | '0.0821' |
| $\vartheta_E$      | '0.9394'   | '0.9541'   | '0.9467'   | '0.9693'  | '0.0992' |
| $\gamma_L$         | '0.26'     | '0.2889'   | '0.2745'   | '0.8824'  | '0.1099' |
| $k_L$              | '5.3782'   | '5.6048'   | '5.4915'   | '5.3501'  | '0.0466' |
| $\lambda_{qf}$     | '0.8269'   | '0.8918'   | '0.8593'   | '0.9743'  | '0.139'  |
| $\delta$           | '0.0107'   | '0.0166'   | '0.0137'   | '0.0489'  | '0.1605' |
| $\eta_L$           | '0.6424'   | '0.6698'   | '0.6561'   | '0.5014'  | '0.091'  |
| $\vartheta_P$      | '0.6562'   | '0.7053'   | '0.6808'   | '0.2831'  | '0.1177' |
| $\gamma_H$         | '0.521'    | '0.5589'   | '0.54'     | '0.2746'  | '0.0958' |
| $z$                | '22.4983'  | '23.7243'  | '23.1113'  | '28.7209' | '0.1063' |
| $\eta_{\vartheta}$ | '0.4672'   | '0.526'    | '0.4966'   | '0.3667'  | '0.13'   |
| $a_L$              | '5.5781'   | '5.8883'   | '5.7332'   | '7.9331'  | '0.1175' |
| $b_L$              | '9.5691'   | '10.1666'  | '9.8678'   | '12.5409' | '0.095'  |
| $a_{\mu}$          | '9.9211'   | '10.2268'  | '10.0739'  | '11.7163' | '0.081'  |
| $b_{\mu}$          | '6.7941'   | '7.1069'   | '6.9505'   | '7.911'   | '0.0611' |
| $\mu$              | '0.4447'   | '0.4829'   | '0.4638'   | '0.4842'  | '0.0949' |
| $a_H$              | '9.4134'   | '9.8079'   | '9.6106'   | '6.4024'  | '0.1112' |
| $b_H$              | '7.4779'   | '7.8314'   | '7.6546'   | '5.6265'  | '0.056'  |
| $\nu$              | '240.5734' | '267.1193' | '253.8463' | '202.429' | '0.0727' |
| BP                 | '392.4404' | '392.5596' | '392.5'    | '388.5'   | '0.056'  |

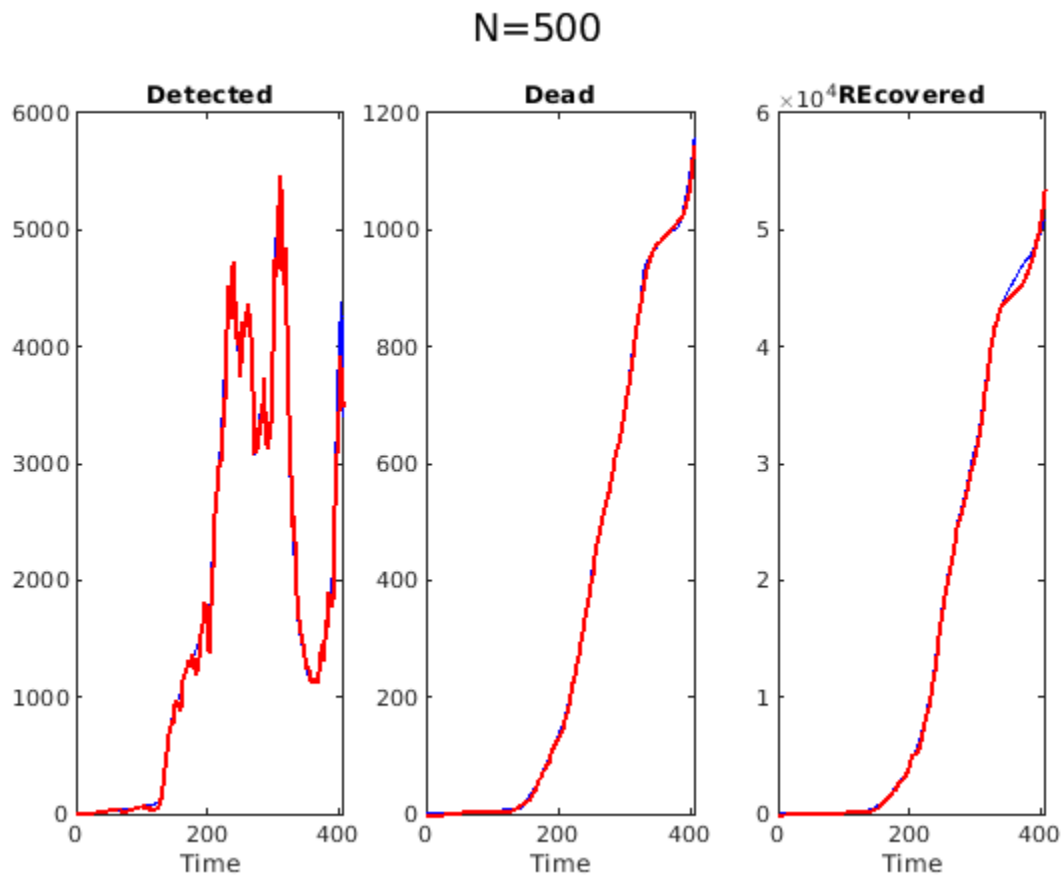
### 9.3. Identifiability analysys







## 9.4. Uncertainty analysys





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## Chapter 10. Extension number10

### 10.1. Basic information

The extension to be validated consists of the time series from the data406 to the 437. The status of the validation is: COMPLETED.

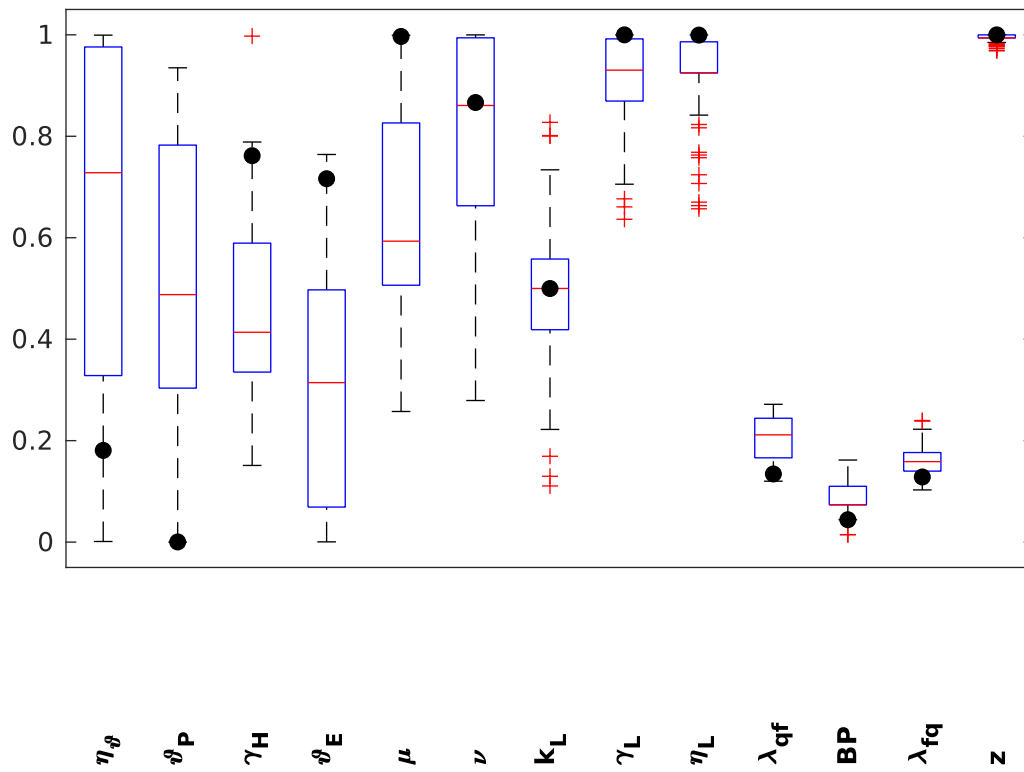
The number of estimations needed to perform the validation was27000.

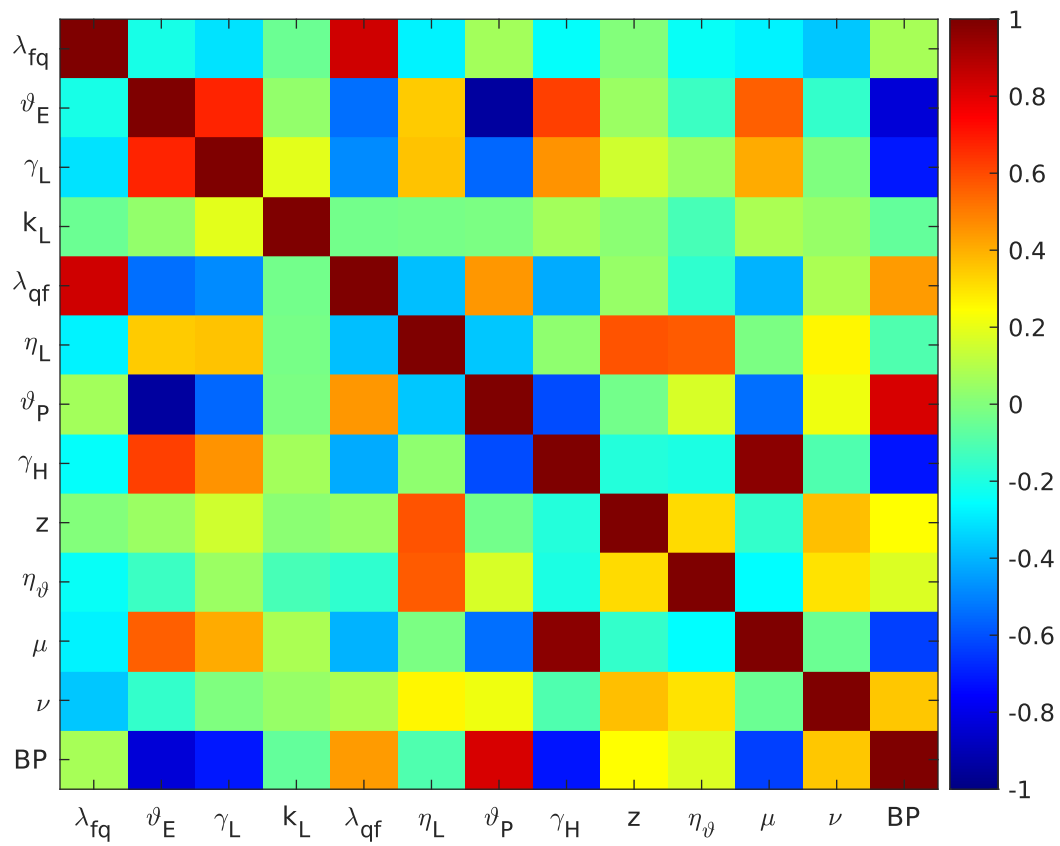
### 10.2. Estimated parameters with their intervals

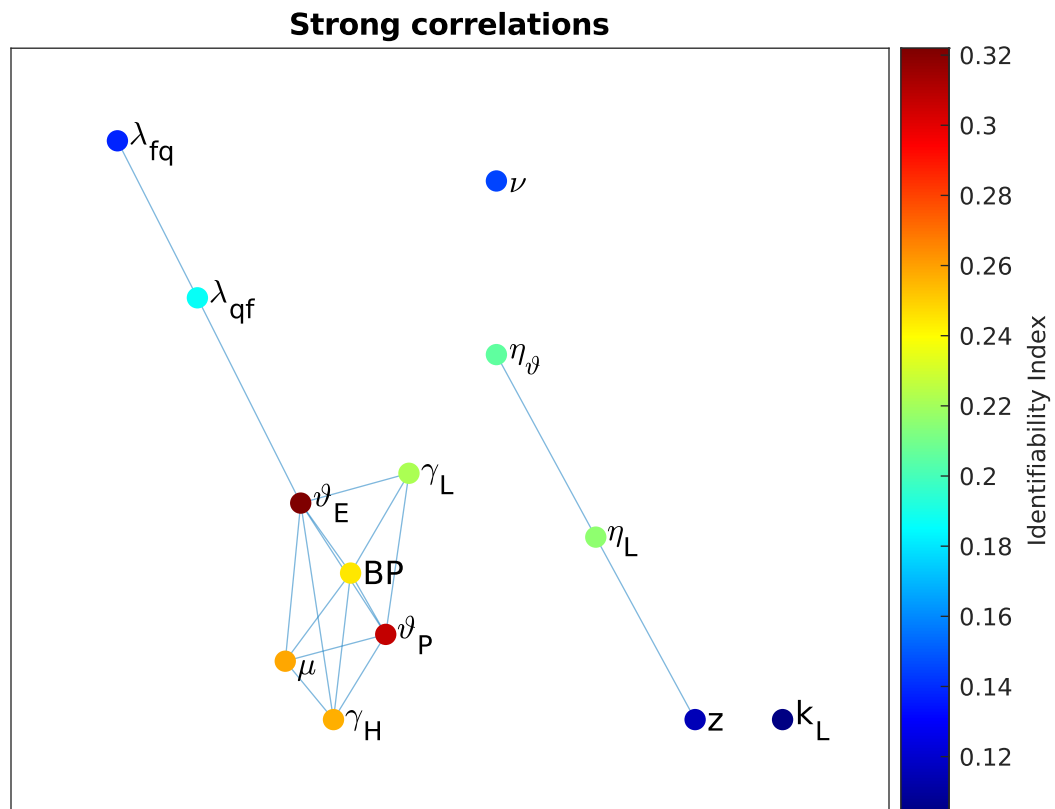
It was necessary to fix 7 parameters of 10 that could be fixed to complete validation.

|                  | Rango      |            | Nominal    | Mejor      | Index    |
|------------------|------------|------------|------------|------------|----------|
| \lambda_{fq}     | '0.1349'   | '0.1823'   | '0.1586'   | '0.1284'   | '0.1383' |
| \vartheta_E      | '0.2441'   | '0.3846'   | '0.3144'   | '0.7163'   | '0.322'  |
| \gamma_L         | '0.8878'   | '0.9728'   | '0.9303'   | '0.9999'   | '0.2222' |
| k_L              | '5.032'    | '5.9682'   | '5.5001'   | '5.4985'   | '0.1042' |
| \lambda_{qf}     | '0.1831'   | '0.2397'   | '0.2114'   | '0.1343'   | '0.1872' |
| \delta           | '0.0419'   | '0.0419'   | '0.0419'   | '0.0419'   | '0'      |
| \eta_L           | '0.8478'   | '1'        | '0.9249'   | '0.9995'   | '0.2163' |
| \vartheta_P      | '0.4067'   | '0.5689'   | '0.4878'   | '0.0003'   | '0.3073' |
| \gamma_H         | '0.3604'   | '0.4669'   | '0.4136'   | '0.7617'   | '0.2572' |
| z                | '29.0216'  | '30'       | '29.8137'  | '29.9964'  | '0.1153' |
| \eta_{\vartheta} | '0.631'    | '0.8253'   | '0.7281'   | '0.1808'   | '0.2062' |
| a_L              | '7.213'    | '7.213'    | '7.213'    | '7.213'    | '0'      |
| b_L              | '11.3396'  | '11.3396'  | '11.3396'  | '11.3396'  | '0'      |
| a_{\mu}          | '11.1595'  | '11.1595'  | '11.1595'  | '11.1595'  | '0'      |
| b_{\mu}          | '5.5431'   | '5.5431'   | '5.5431'   | '5.5431'   | '0'      |
| \mu              | '0.5332'   | '0.6531'   | '0.5932'   | '0.9967'   | '0.2585' |
| a_H              | '7.8376'   | '7.8376'   | '7.8376'   | '7.8376'   | '0'      |
| b_H              | '3.5794'   | '3.5794'   | '3.5794'   | '3.5794'   | '0'      |
| \nu              | '398.8586' | '461.8298' | '430.3442' | '433.2671' | '0.1457' |
| BP               | '395.1353' | '395.8647' | '395.5'    | '394.4998' | '0.2446' |

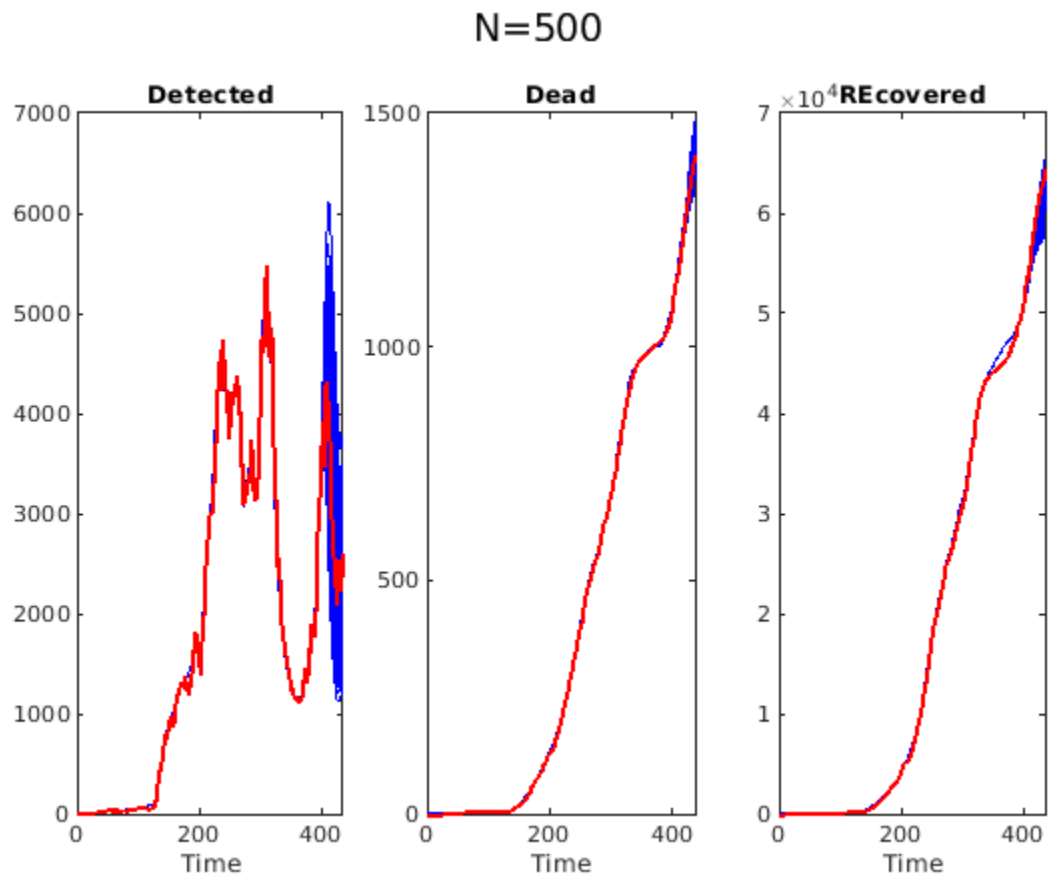
### 10.3. Identifiability analysis







## 10.4. Uncertainty analysis



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## Chapter 11. Extension number11

### 11.1. Basic information

The extension to be validated consists of the time series from the data437 to the 457. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

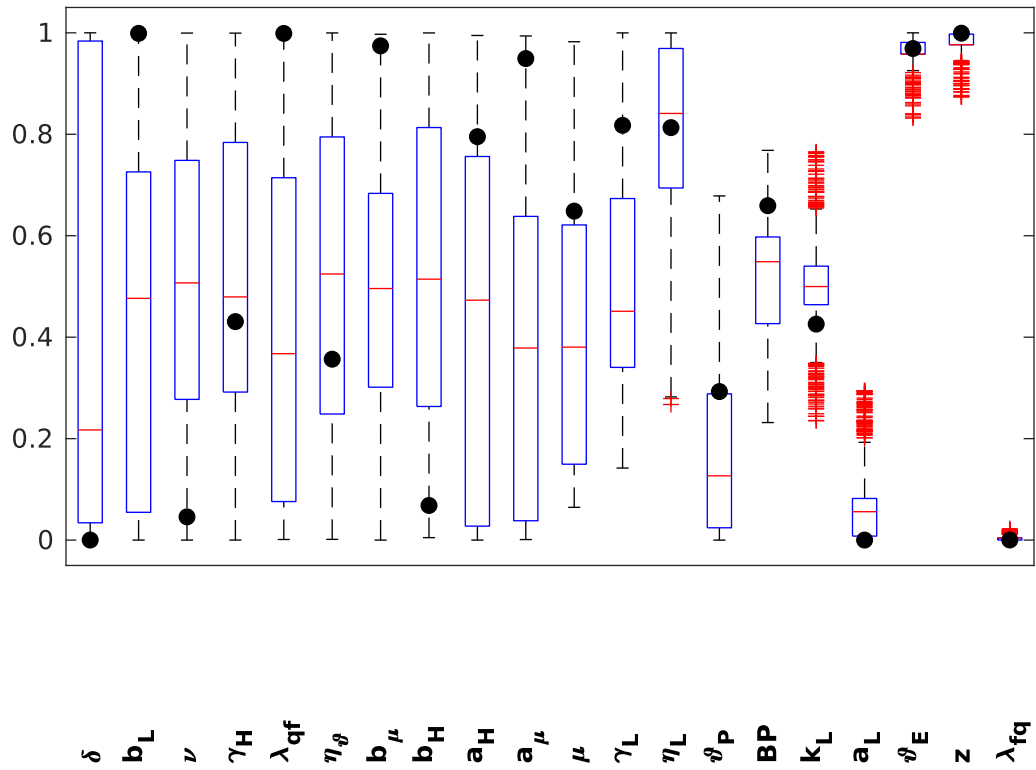
### 11.2. Estimated parameters with their intervals

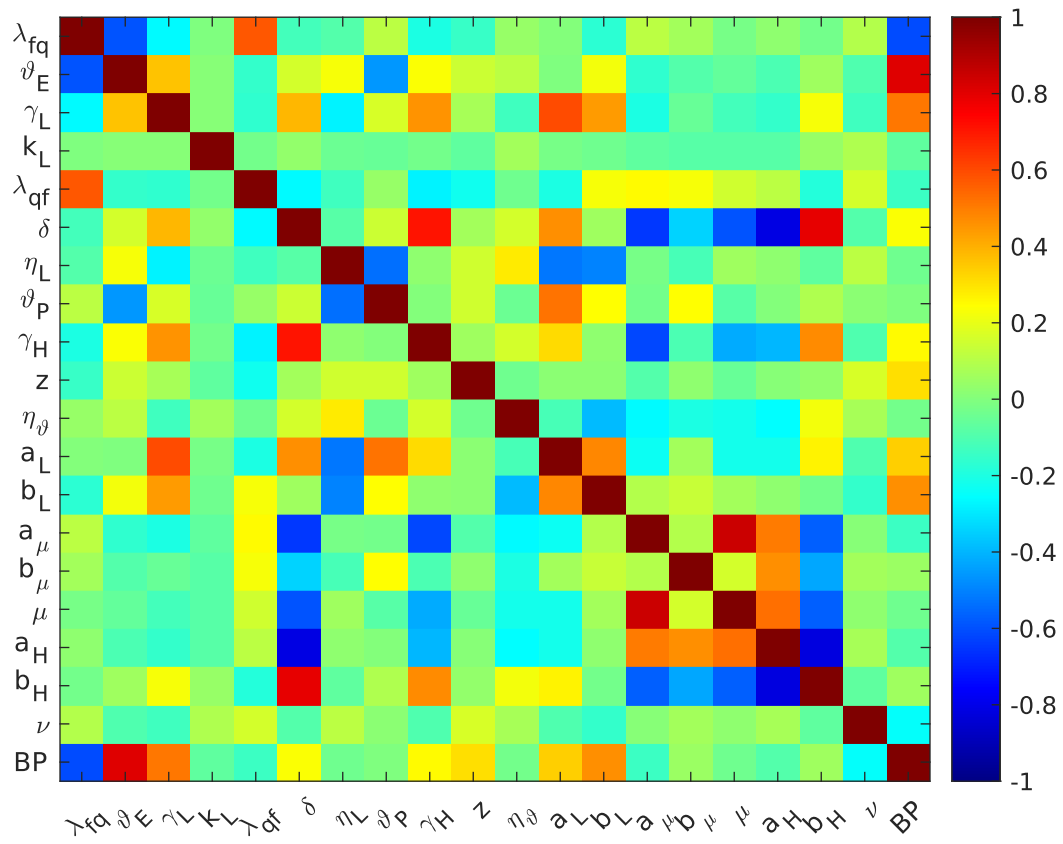
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

Due to a deviation from the median the CSB method was activated to obtain the parameter intervals.

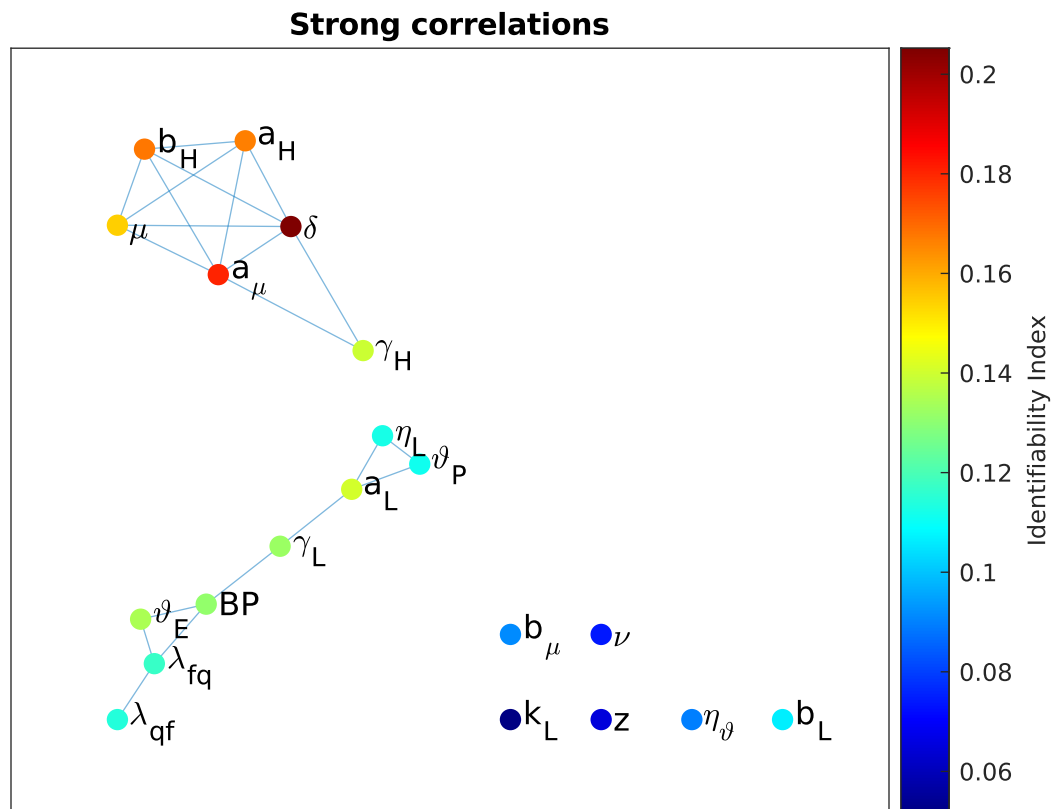
|                  | Rango      |            | Nominal    | Mejor      | Index    |
|------------------|------------|------------|------------|------------|----------|
| \lambda_{fq}     | '0'        | '0.0005'   | '0.0043'   | '0.0002'   | '0.1173' |
| \vartheta_E      | '0.9587'   | '0.973'    | '0.9578'   | '0.969'    | '0.1347' |
| \gamma_L         | '0.6581'   | '0.8267'   | '0.4511'   | '0.8176'   | '0.1322' |
| k_L              | '1'        | '9.1'      | '5.4986'   | '4.8318'   | '0.0518' |
| \lambda_{qf}     | '0.5316'   | '1'        | '0.3675'   | '0.9988'   | '0.1144' |
| \delta           | '0'        | '0'        | '0.0326'   | '0'        | '0.2052' |
| \eta_L           | '0.1509'   | '1'        | '0.8409'   | '0.8131'   | '0.1127' |
| \vartheta_P      | '0.1928'   | '0.3246'   | '0.1268'   | '0.2928'   | '0.1115' |
| \gamma_H         | '0'        | '0.9691'   | '0.4794'   | '0.4307'   | '0.1399' |
| z                | '24.1578'  | '30'       | '29.2965'  | '29.9774'  | '0.0654' |
| \eta_{\vartheta} | '0.3175'   | '0.7278'   | '0.5246'   | '0.3566'   | '0.0899' |
| a_L              | '1'        | '2.5357'   | '1.7838'   | '1.0006'   | '0.1407' |
| b_L              | '7.711'    | '15'       | '7.6723'   | '14.9853'  | '0.1064' |
| a_{\mu}          | '1'        | '15'       | '6.3006'   | '14.2893'  | '0.1802' |
| b_{\mu}          | '2.4'      | '15'       | '7.9427'   | '14.6404'  | '0.0914' |
| \mu              | '0'        | '0.9'      | '0.3803'   | '0.6485'   | '0.1547' |
| a_H              | '2.7376'   | '15'       | '7.621'    | '12.1334'  | '0.1668' |
| b_H              | '1'        | '13.9024'  | '8.2016'   | '1.9562'   | '0.1675' |
| \nu              | '0'        | '36.2604'  | '253.5249' | '22.8982'  | '0.0743' |
| BP               | '432.3245' | '435.2262' | '428.5'    | '433.0281' | '0.1314' |

### 11.3. Identifiability analysis

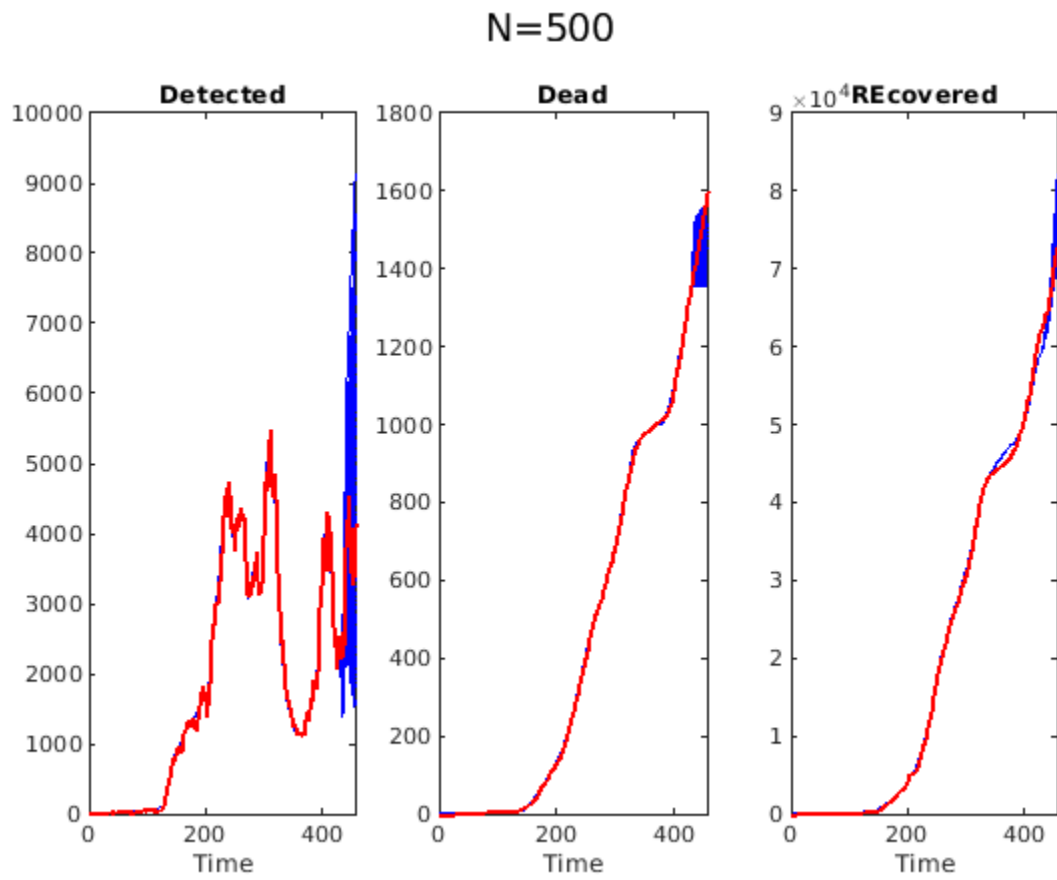








## 11.4. Uncertainty analysis



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## Chapter 12. Extension number12

### 12.1. Basic information

The extension to be validated consists of the time series from the data457 to the 458. The status of the validation is: COMPLETED.

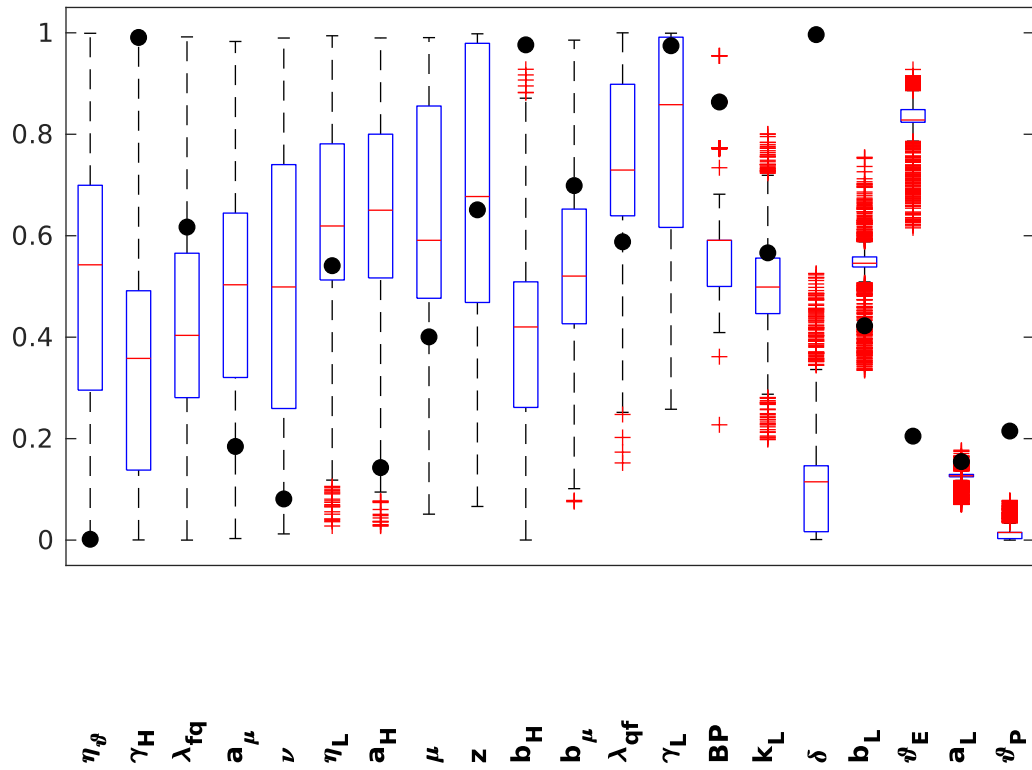
The number of estimations needed to perform the validation was1000.

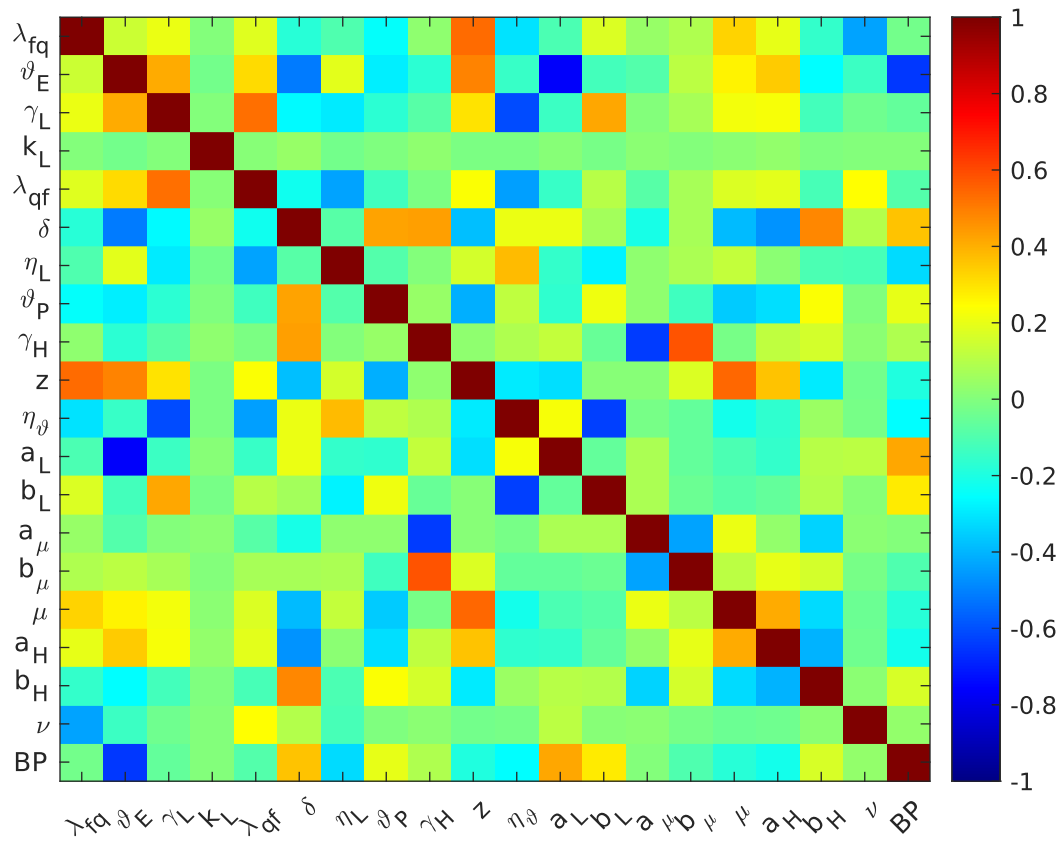
### 12.2. Estimated parameters with their intervals

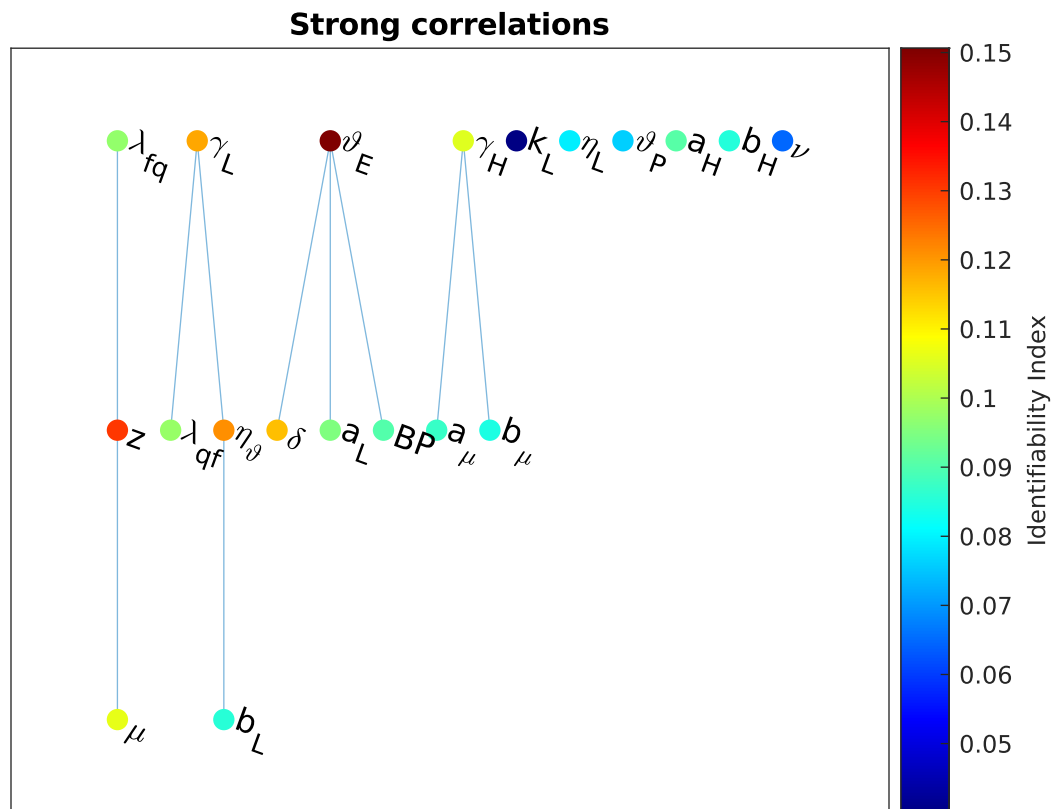
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

|                    | Rango      |            | Nominal    | Mejor      | Index    |
|--------------------|------------|------------|------------|------------|----------|
| $\lambda_{fq}$     | '0.3872'   | '0.4199'   | '0.4036'   | '0.6171'   | '0.0973' |
| $\vartheta_E$      | '0.8076'   | '0.8486'   | '0.8281'   | '0.2049'   | '0.1506' |
| $\gamma_L$         | '0.8418'   | '0.8748'   | '0.8583'   | '0.9745'   | '0.1185' |
| $k_L$              | '5.3879'   | '5.5914'   | '5.4896'   | '6.0963'   | '0.0401' |
| $\lambda_{qf}$     | '0.7157'   | '0.7432'   | '0.7294'   | '0.588'    | '0.0978' |
| $\delta$           | '0.015'    | '0.0195'   | '0.0172'   | '0.1495'   | '0.116'  |
| $\eta_L$           | '0.6019'   | '0.6365'   | '0.6192'   | '0.5409'   | '0.0797' |
| $\vartheta_P$      | '0.0087'   | '0.0214'   | '0.0151'   | '0.215'    | '0.0759' |
| $\gamma_H$         | '0.3368'   | '0.3795'   | '0.3582'   | '0.9909'   | '0.1054' |
| $z$                | '19.685'   | '20.951'   | '20.318'   | '19.5315'  | '0.1306' |
| $\eta_{\vartheta}$ | '0.5244'   | '0.5609'   | '0.5427'   | '0.0016'   | '0.1211' |
| $a_L$              | '2.5719'   | '2.9764'   | '2.7741'   | '3.1666'   | '0.0949' |
| $b_L$              | '8.4545'   | '8.8259'   | '8.6402'   | '6.9148'   | '0.0857' |
| $a_{\mu}$          | '7.7591'   | '8.3334'   | '8.0463'   | '3.584'    | '0.0874' |
| $b_{\mu}$          | '8.0852'   | '8.4872'   | '8.2862'   | '10.7835'  | '0.0842' |
| $\mu$              | '0.5737'   | '0.6082'   | '0.591'    | '0.4006'   | '0.1063' |
| $a_H$              | '9.8797'   | '10.3288'  | '10.1042'  | '3.0006'   | '0.0908' |
| $b_H$              | '6.6666'   | '7.098'    | '6.8823'   | '14.6677'  | '0.0852' |
| $\nu$              | '238.4567' | '260.5556' | '249.5061' | '40.5641'  | '0.0649' |
| BP                 | '443.4183' | '443.5817' | '443.5'    | '446.4997' | '0.0903' |

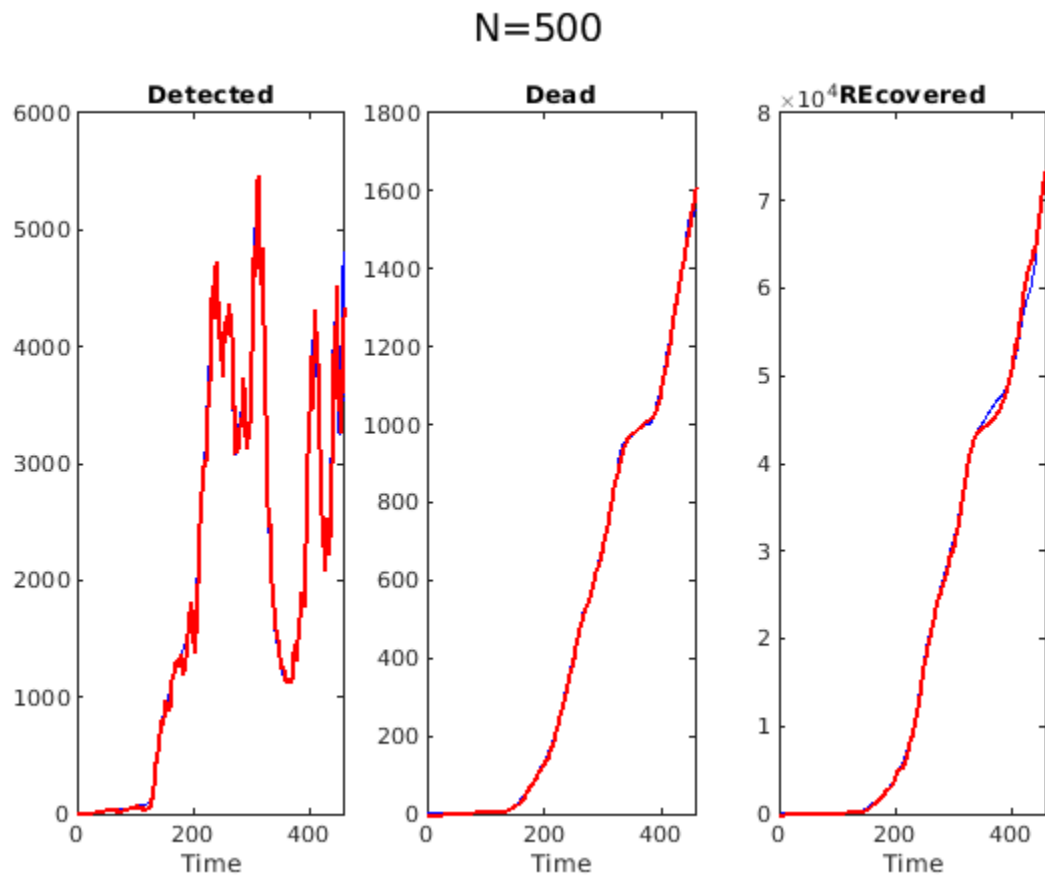
### 12.3. Identifiability analysis







## 12.4. Uncertainty analysys



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## Chapter 13. Extension number13

### 13.1. Basic information

The extension to be validated consists of the time series from the data458 to the 470. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

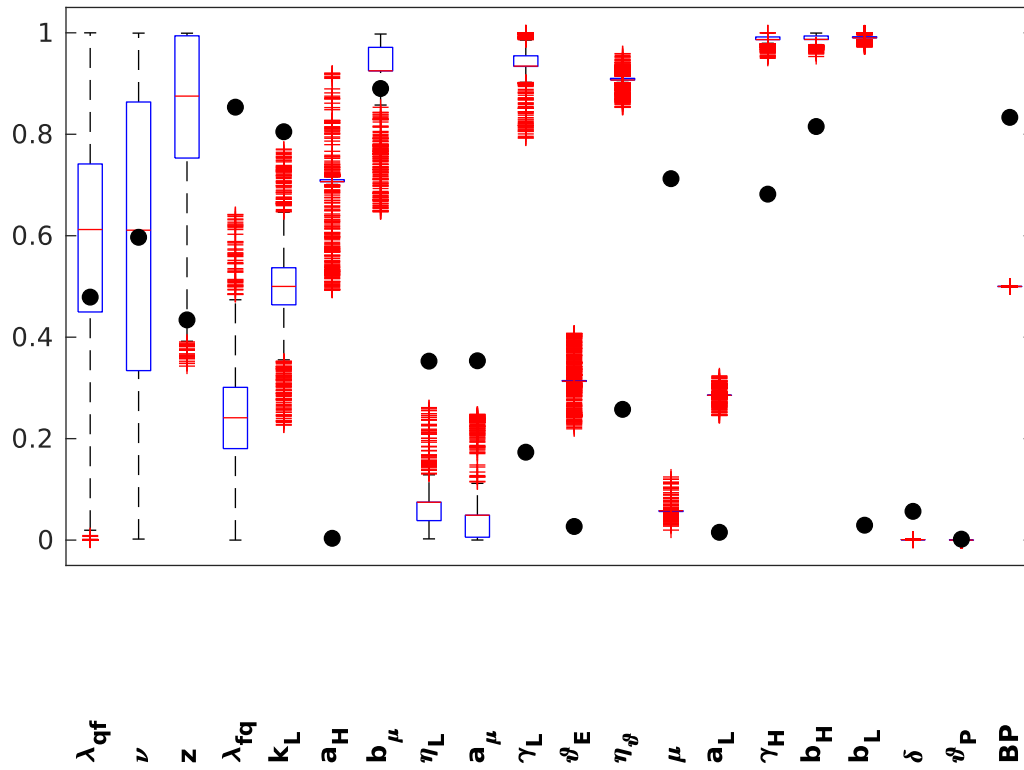
### 13.2. Estimated parameters with their intervals

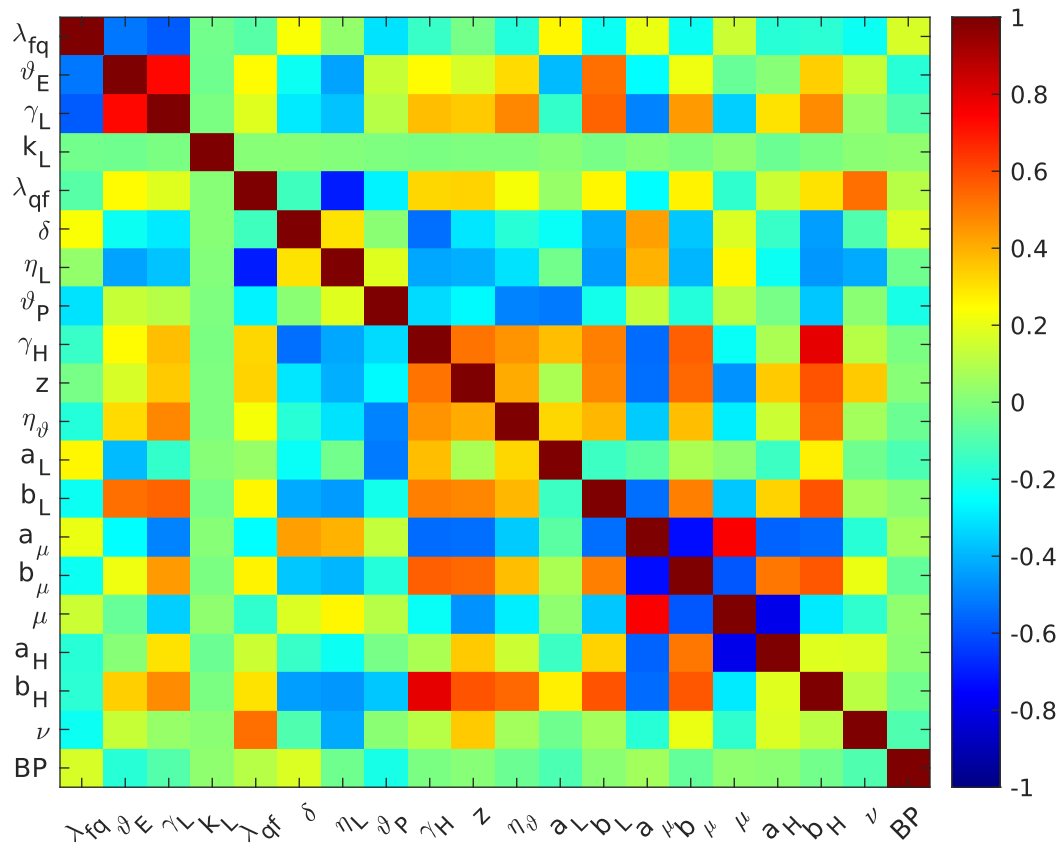
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

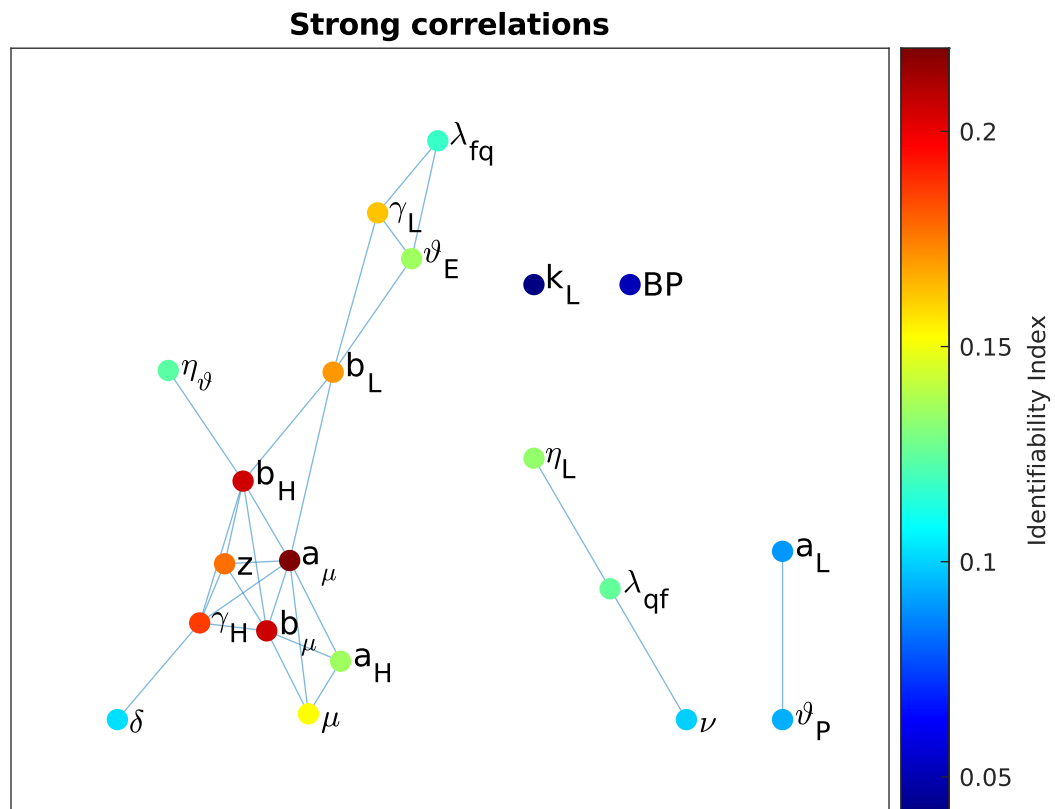
|                  | Rango      |            | Nominal    | Mejor      | Index    |
|------------------|------------|------------|------------|------------|----------|
| \lambda_{fq}     | '0.2231'   | '0.2593'   | '0.2412'   | '0.8534'   | '0.1174' |
| \vartheta_E      | '0.3047'   | '0.3216'   | '0.3132'   | '0.0269'   | '0.1355' |
| \gamma_L         | '0.9132'   | '0.9555'   | '0.9344'   | '0.1733'   | '0.1631' |
| k_L              | '5.384'    | '5.617'    | '5.5005'   | '8.2449'   | '0.0418' |
| \lambda_{qf}     | '0.5943'   | '0.6301'   | '0.6122'   | '0.479'    | '0.1253' |
| \delta           | '0'        | '0.0018'   | '0.0001'   | '0.0085'   | '0.1027' |
| \eta_L           | '0.0517'   | '0.0979'   | '0.0748'   | '0.3528'   | '0.1333' |
| \vartheta_P      | '0'        | '0.017'    | '0'        | '0.0018'   | '0.0944' |
| \gamma_H         | '0.9664'   | '1'        | '0.9866'   | '0.682'    | '0.1865' |
| z                | '25.5026'  | '27.0059'  | '26.2542'  | '13.0229'  | '0.1773' |
| \eta_{\vartheta} | '0.8901'   | '0.9237'   | '0.9069'   | '0.2577'   | '0.124'  |
| a_L              | '4.8391'   | '5.1537'   | '4.9964'   | '1.2148'   | '0.09'   |
| b_L              | '14.6224'  | '15'       | '14.8603'  | '1.4111'   | '0.1705' |
| a_{\mu}          | '1.4244'   | '1.9504'   | '1.6874'   | '5.9489'   | '0.2193' |
| b_{\mu}          | '13.6579'  | '14.2385'  | '13.9482'  | '13.4626'  | '0.206'  |
| \mu              | '0.034'    | '0.0817'   | '0.0579'   | '0.7125'   | '0.1521' |
| a_H              | '10.6254'  | '11.1584'  | '10.8919'  | '1.0496'   | '0.136'  |
| b_H              | '14.5322'  | '15'       | '14.8159'  | '12.4137'  | '0.205'  |
| \nu              | '293.3602' | '317.5591' | '305.4597' | '298.4523' | '0.0999' |
| BP               | '458.4772' | '458.5228' | '458.5'    | '459.5'    | '0.051'  |



### 13.3. Identifiability analysis

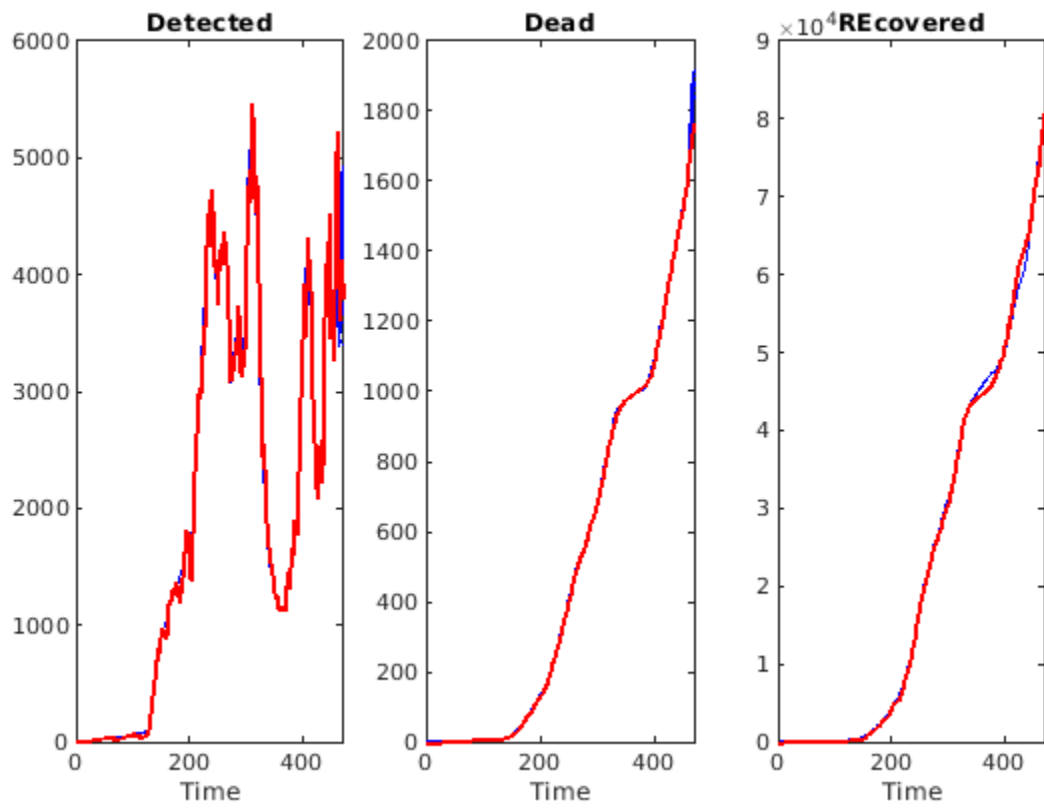






### 13.4. Uncertainty analysis

N=500



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## Chapter 14. Extension number14

### 14.1. Basic information

The extension to be validated consists of the time series from the data470 to the 515. The status of the validation is: COMPLETED.

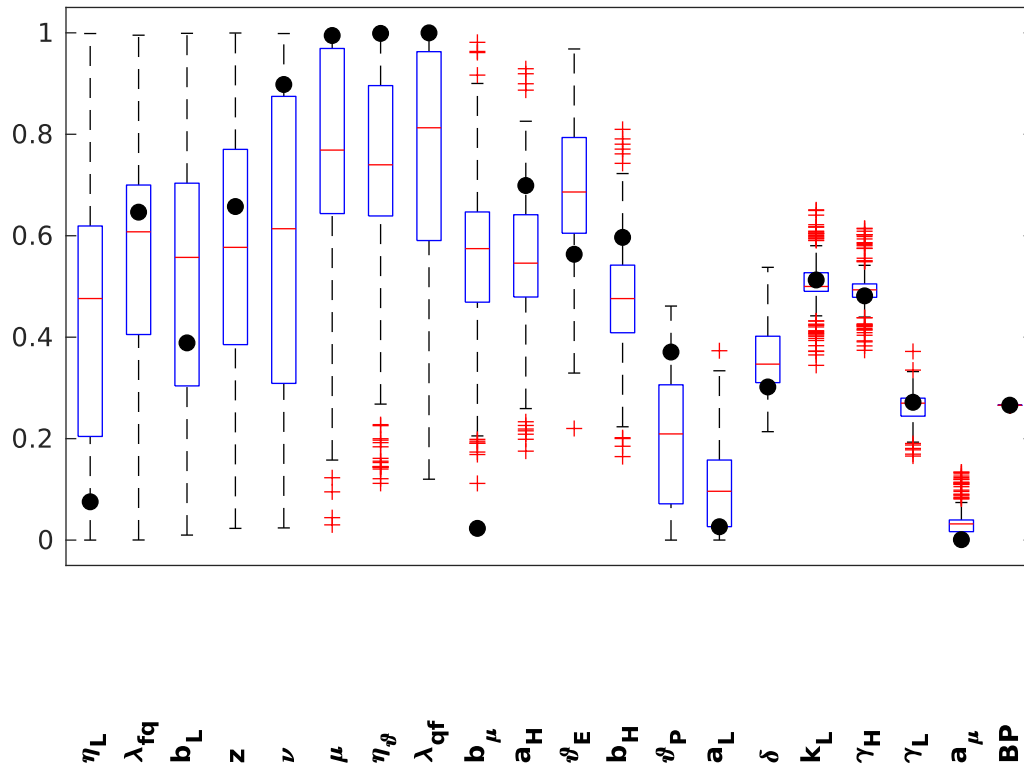
The number of estimations needed to perform the validation was1000.

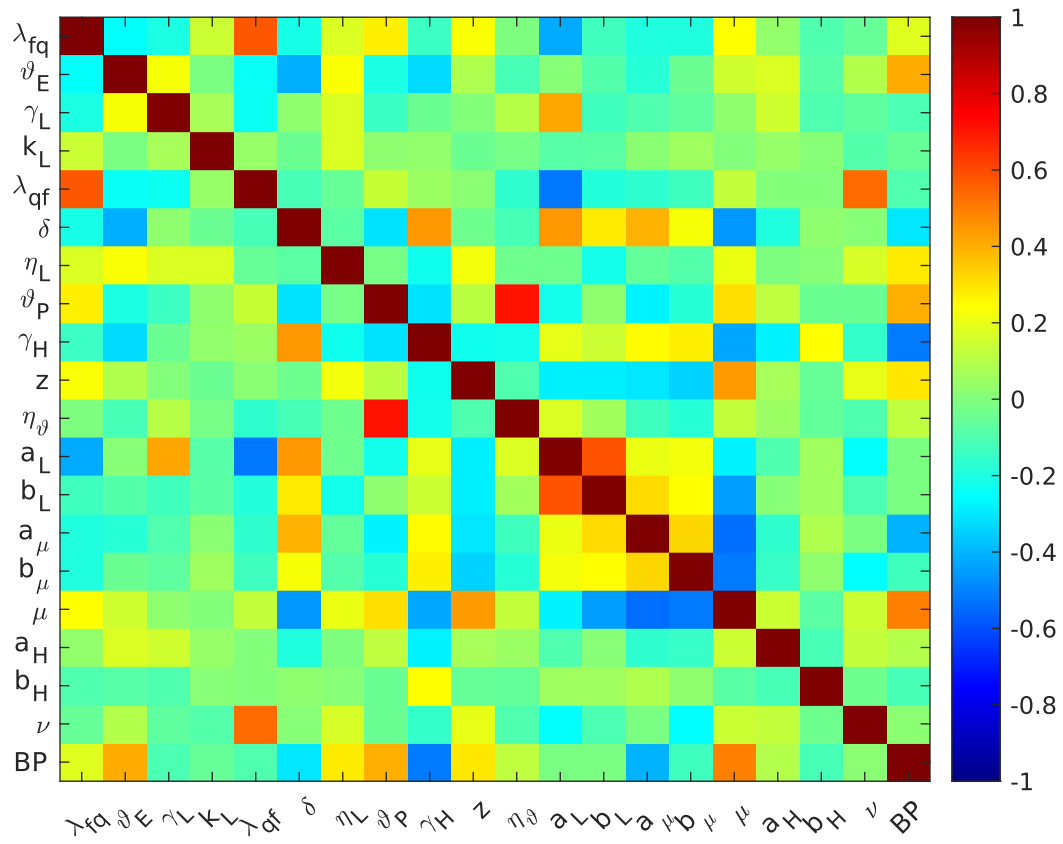
### 14.2. Estimated parameters with their intervals

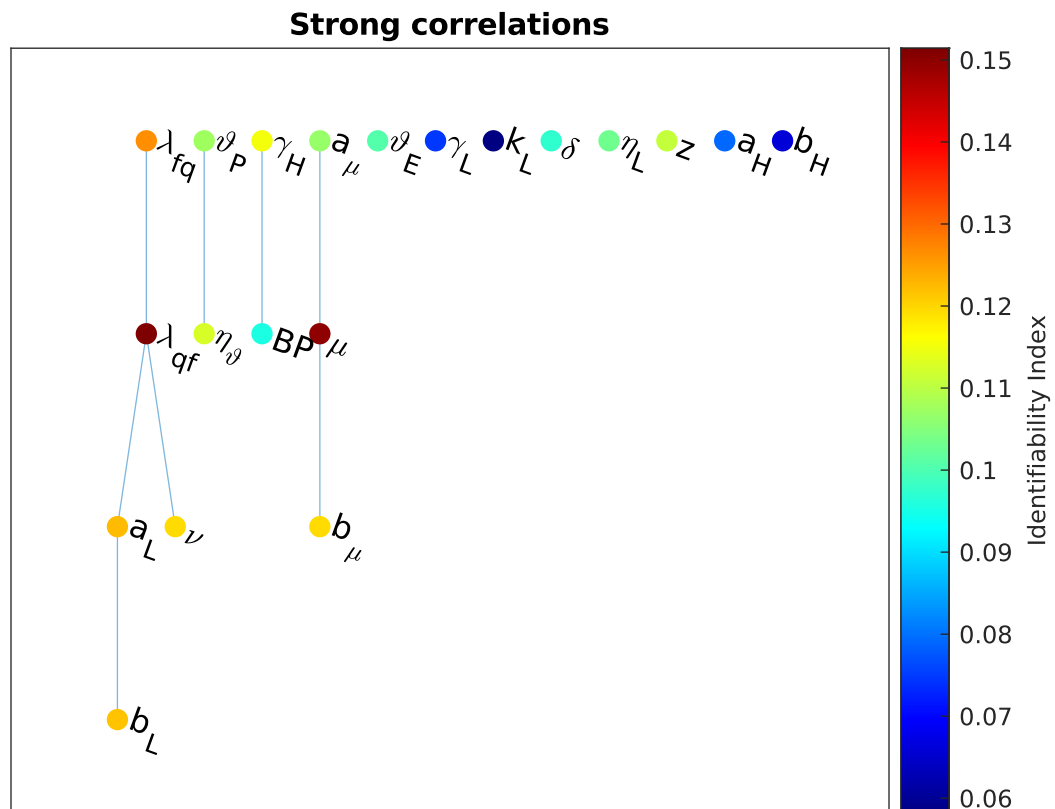
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

|                  | Rango      |            | Nominal    | Mejor      | Index    |
|------------------|------------|------------|------------|------------|----------|
| \lambda_{fq}     | '0.5658'   | '0.6496'   | '0.6077'   | '0.6465'   | '0.1264' |
| \vartheta_E      | '0.6522'   | '0.72'     | '0.6861'   | '0.5635'   | '0.1008' |
| \gamma_L         | '0.2499'   | '0.29'     | '0.2699'   | '0.2717'   | '0.0749' |
| k_L              | '5.32'     | '5.6801'   | '5.5001'   | '5.6151'   | '0.0583' |
| \lambda_{qf}     | '0.7658'   | '0.859'    | '0.8124'   | '0.9999'   | '0.1514' |
| \delta           | '0.049'    | '0.0552'   | '0.0521'   | '0.0453'   | '0.0973' |
| \eta_L           | '0.4287'   | '0.5237'   | '0.4762'   | '0.0755'   | '0.1032' |
| \vartheta_P      | '0.1874'   | '0.2313'   | '0.2093'   | '0.3707'   | '0.1077' |
| \gamma_H         | '0.4719'   | '0.5147'   | '0.4933'   | '0.4815'   | '0.1151' |
| z                | '15.986'   | '18.6392'  | '17.3126'  | '19.7265'  | '0.111'  |
| \eta_{\vartheta} | '0.6965'   | '0.7826'   | '0.7395'   | '0.9989'   | '0.1125' |
| a_L              | '2.1401'   | '2.589'    | '2.3645'   | '1.3691'   | '0.1225' |
| b_L              | '8.2196'   | '9.3847'   | '8.8021'   | '6.443'    | '0.1218' |
| a_{\mu}          | '1.1964'   | '1.7025'   | '1.4495'   | '1.0121'   | '0.107'  |
| b_{\mu}          | '8.532'    | '9.5493'   | '9.0407'   | '1.3238'   | '0.1194' |
| \mu              | '0.7334'   | '0.8043'   | '0.7688'   | '0.9947'   | '0.1499' |
| a_H              | '8.2376'   | '9.0484'   | '8.643'    | '10.7861'  | '0.0793' |
| b_H              | '7.3143'   | '8.0167'   | '7.6655'   | '9.3547'   | '0.0662' |
| \nu              | '281.1672' | '332.6485' | '306.9079' | '449.0773' | '0.1196' |
| BP               | '470.1464' | '470.8536' | '470.5'    | '470.4999' | '0.0954' |

### 14.3. Identifiability analysis

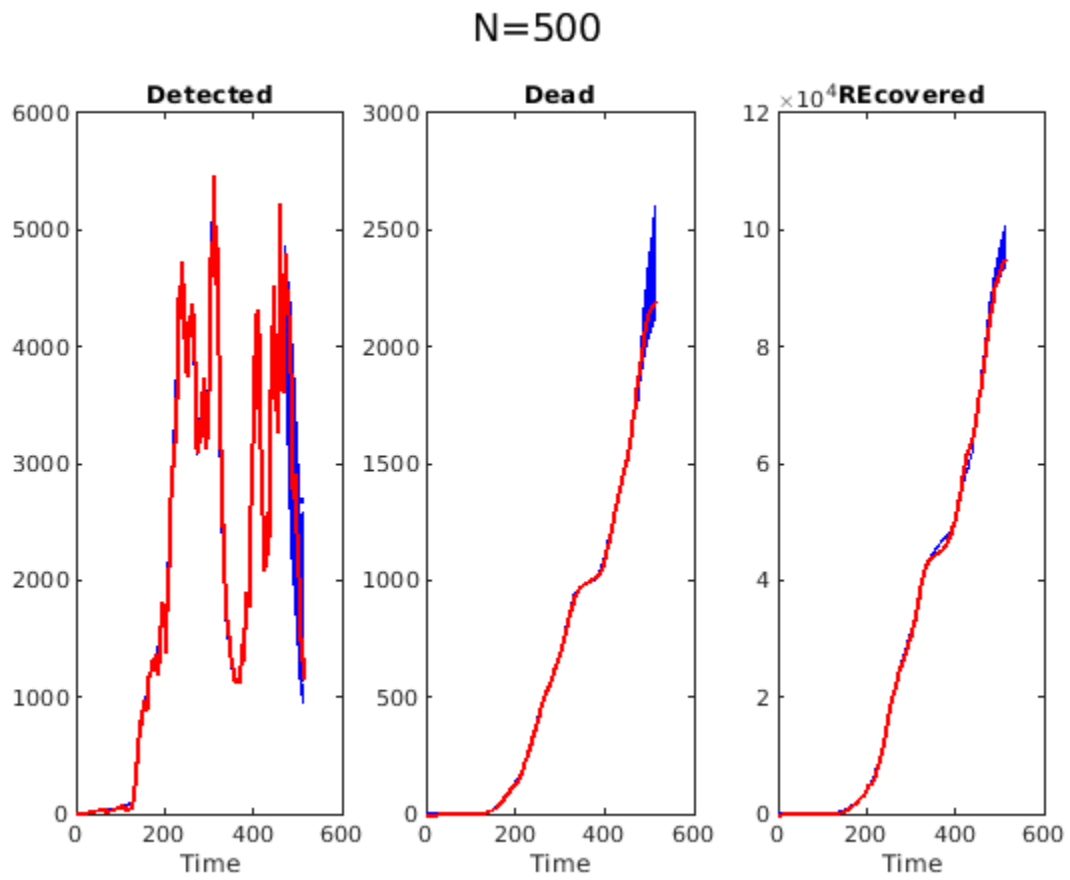








## 14.4. Uncertainty analysys



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## Chapter 15. Extension number15

### 15.1. Basic information

The extension to be validated consists of the time series from the data515 to the 559. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

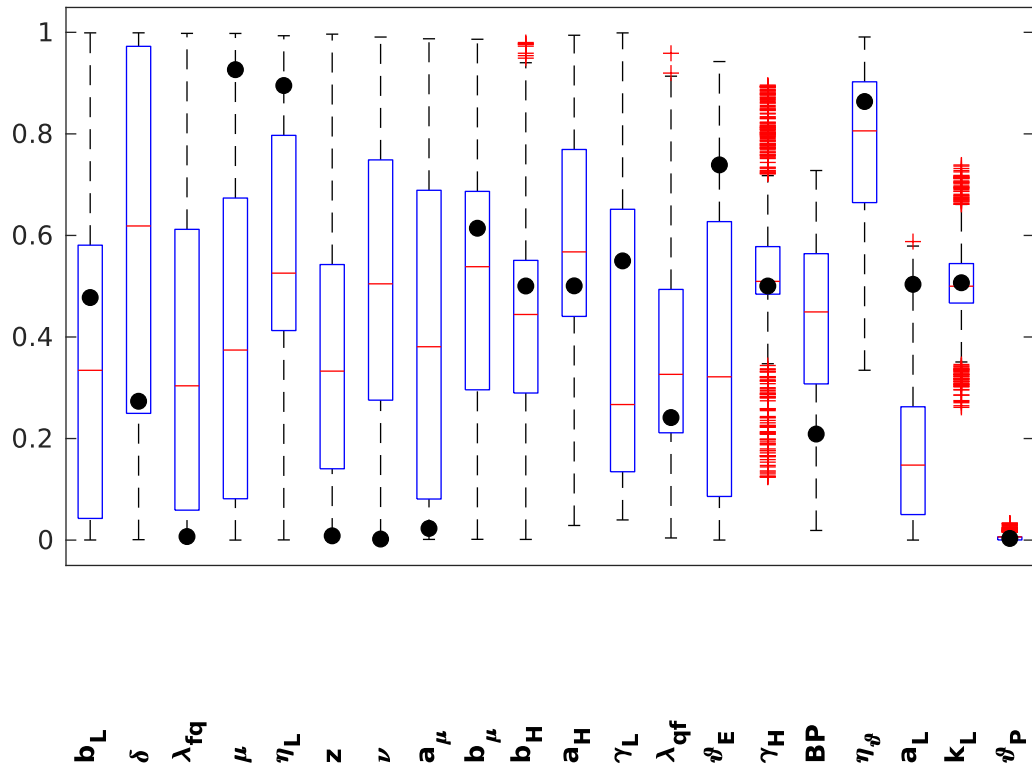
### 15.2. Estimated parameters with their intervals

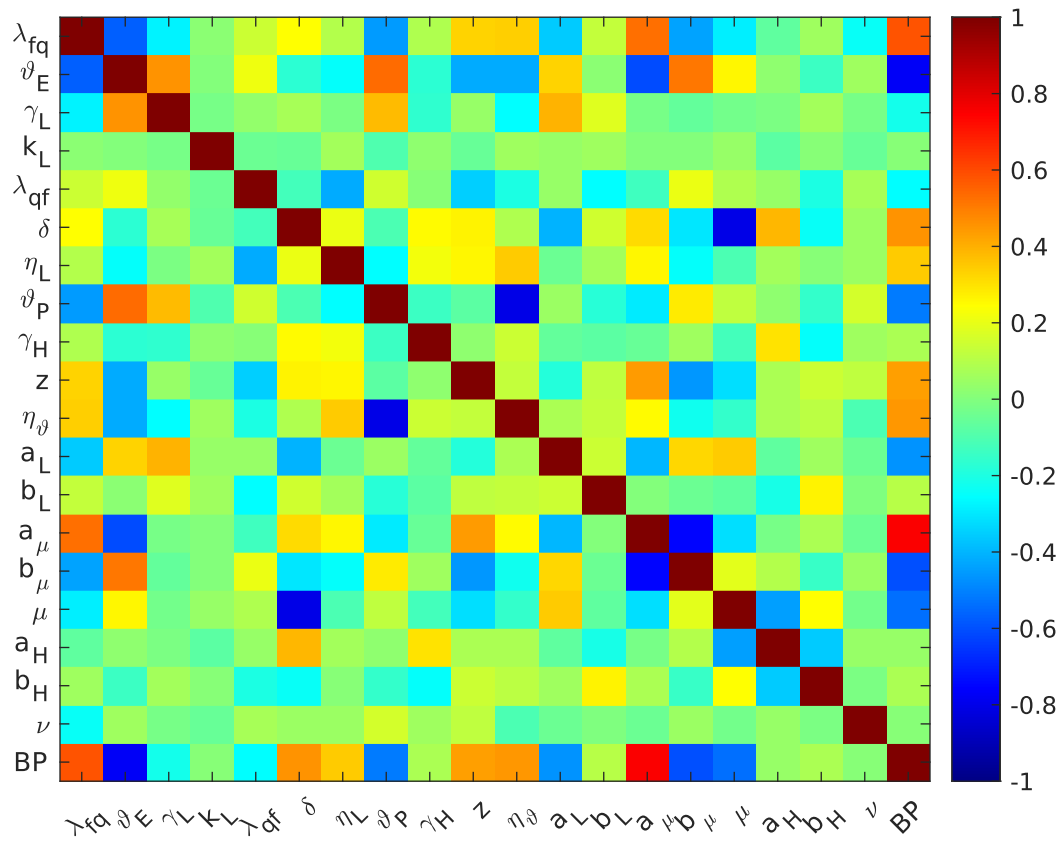
It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

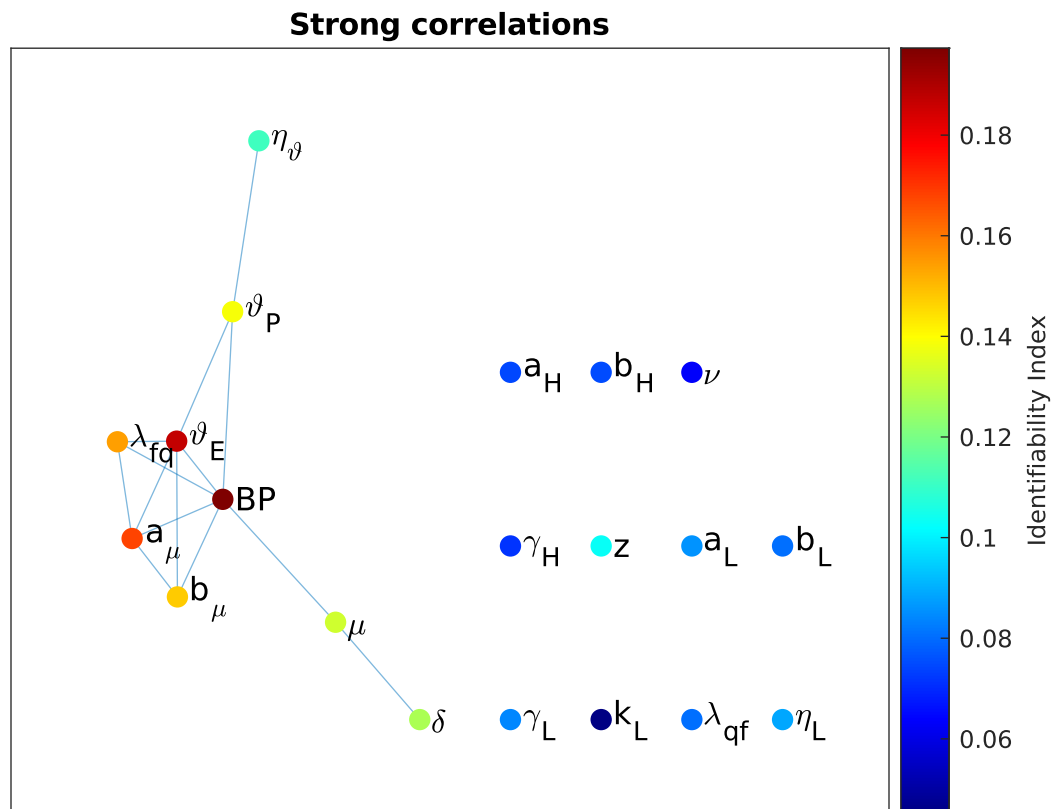
Due to a deviation from the median the CSB method was activated to obtain the parameter intervals.

|                    | Rango      |            | Nominal    | Mejor    | Index    |
|--------------------|------------|------------|------------|----------|----------|
| $\lambda_{fq}$     | '0'        | '0.0151'   | '0.3038'   | '0.007'  | '0.154'  |
| $\vartheta_E$      | '0.6827'   | '0.7769'   | '0.3216'   | '0.739'  | '0.1867' |
| $\gamma_L$         | '0.3894'   | '0.8681'   | '0.267'    | '0.5499' | '0.084'  |
| $k_L$              | '1.18'     | '10'       | '5.5003'   | '5.5615' | '0.0454' |
| $\lambda_{qf}$     | '0.202'    | '0.827'    | '0.3264'   | '0.2413' | '0.0807' |
| $\delta$           | '0.0016'   | '0.0753'   | '0.0928'   | '0.041'  | '0.1273' |
| $\eta_L$           | '0.5967'   | '0.9798'   | '0.5257'   | '0.8952' | '0.0892' |
| $\vartheta_P$      | '0.0002'   | '0.0068'   | '0.0063'   | '0.0032' | '0.1386' |
| $\gamma_H$         | '0'        | '0.95'     | '0.5095'   | '0.5004' | '0.0721' |
| $z$                | '0.202'    | '0.2729'   | '9.9833'   | '0.2524' | '0.1032' |
| $\eta_{\vartheta}$ | '0.5788'   | '1'        | '0.8059'   | '0.8637' | '0.1116' |
| $a_L$              | '7.6524'   | '9.3179'   | '3.0683'   | '8.0523' | '0.0862' |
| $b_L$              | '6.0861'   | '8.5775'   | '5.6812'   | '7.6875' | '0.0805' |
| $a_{\mu}$          | '1'        | '13.768'   | '6.3312'   | '1.3222' | '0.1678' |
| $b_{\mu}$          | '1'        | '15'       | '8.5379'   | '9.5984' | '0.1479' |
| $\mu$              | '0.0636'   | '1'        | '0.3743'   | '0.9265' | '0.1331' |
| $a_H$              | '1.5303'   | '13.7926'  | '8.9465'   | '8.0103' | '0.0749' |
| $b_H$              | '1.35'     | '14.454'   | '7.2233'   | '8.006'  | '0.0754' |
| $\nu$              | '0.1147'   | '2.2338'   | '252.3403' | '1.032'  | '0.0638' |
| BP                 | '485.4397' | '498.3524' | '505.5'    | '486.5'  | '0.1973' |

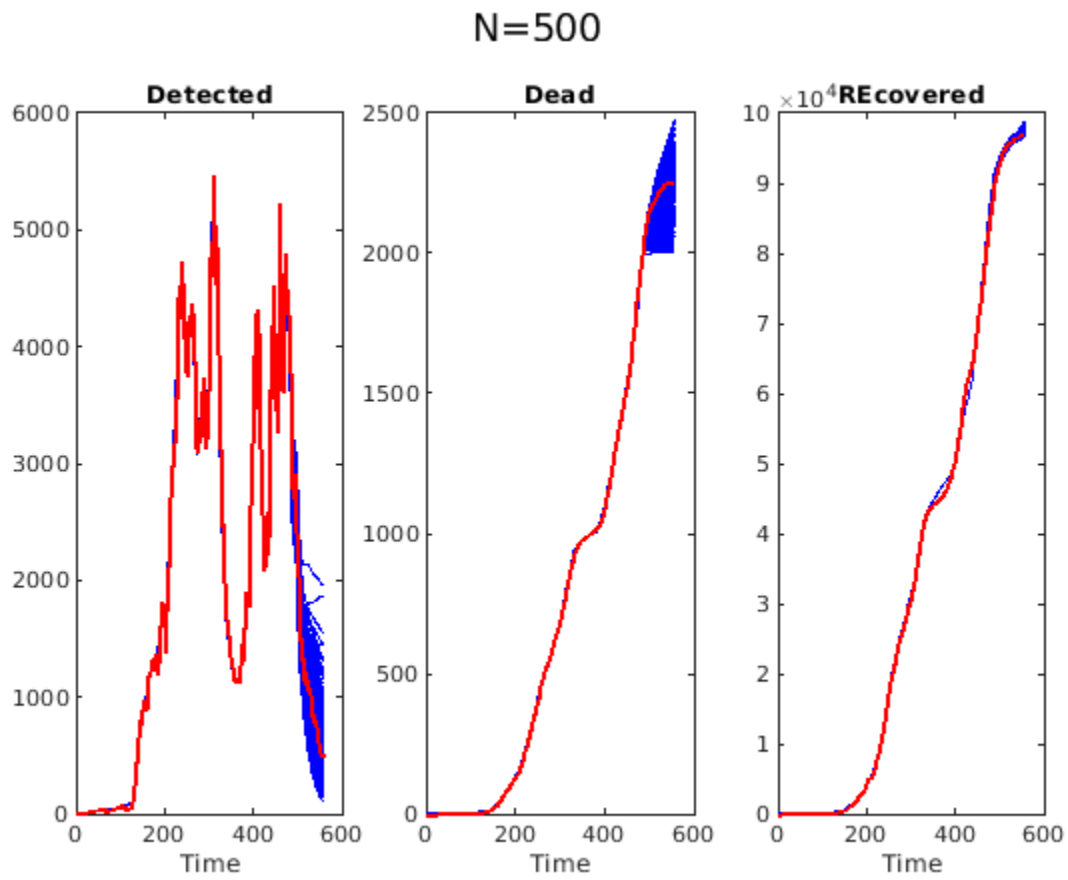
### 15.3. Identifiability analysis







## 15.4. Uncertainty analysys



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## Chapter 16. Extension number16

### 16.1. Basic information

The extension to be validated consists of the time series from the data559 to the 721. The status of the validation is: COMPLETED.

The number of estimations needed to perform the validation was1000.

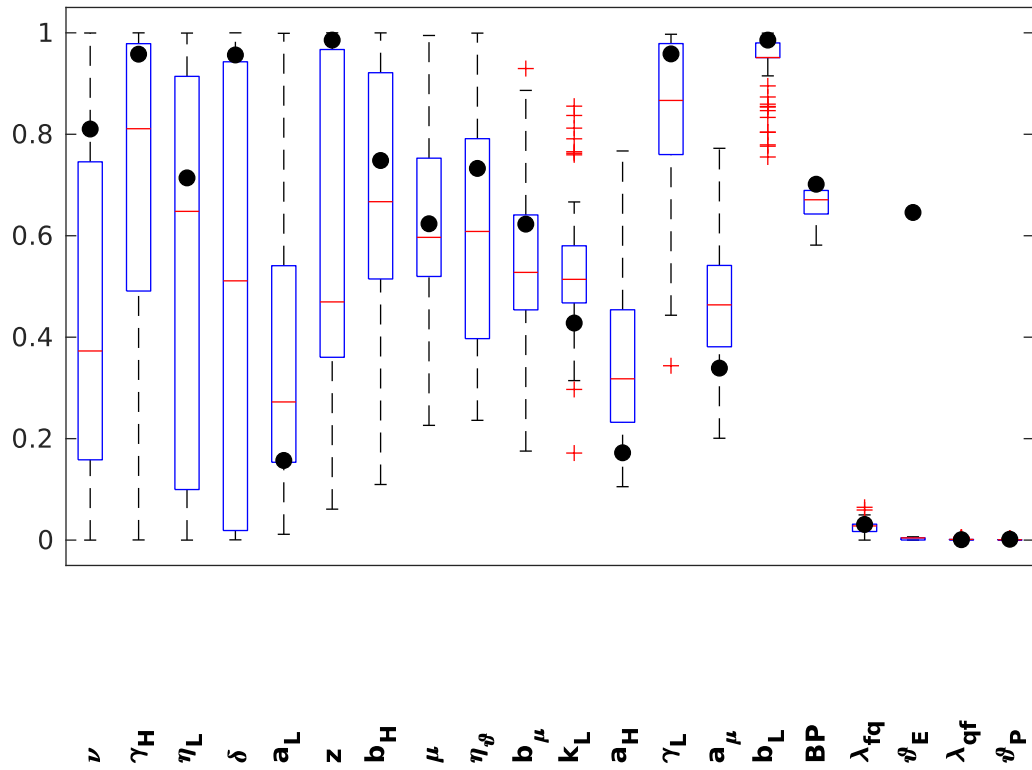
### 16.2. Estimated parameters with their intervals

It was necessary to fix 0 parameters of 10 that could be fixed to complete validation.

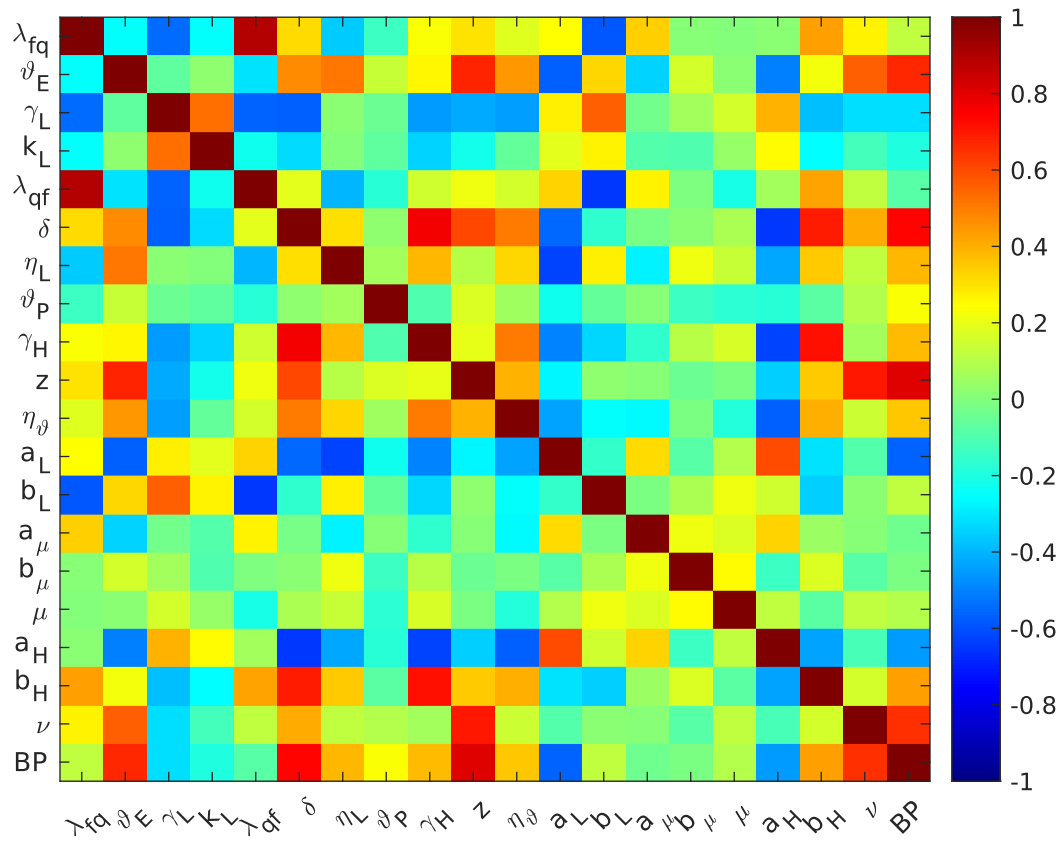
Due to a deviation from the median the CSB method was activated to obtain the parameter intervals.

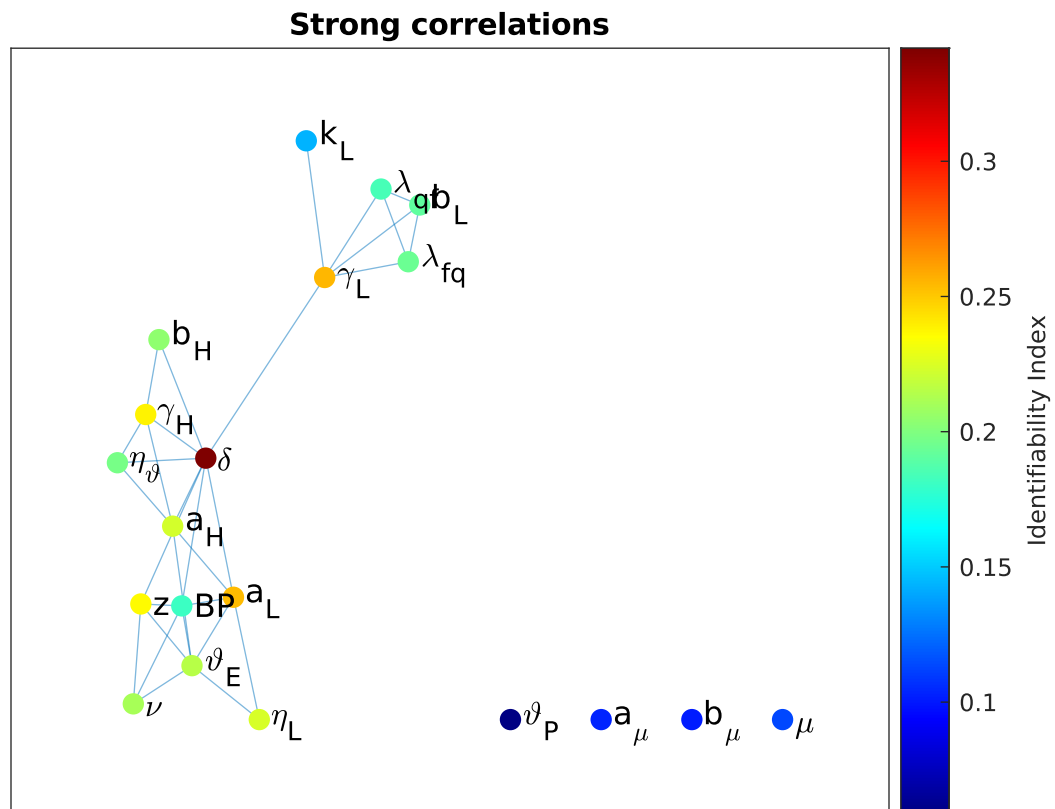
|                    | Rango      |            | Nominal    | Mejor      | Index    |
|--------------------|------------|------------|------------|------------|----------|
| $\lambda_{fq}$     | '0.0307'   | '0.034'    | '0.0279'   | '0.0308'   | '0.194'  |
| $\vartheta_E$      | '0.4134'   | '0.663'    | '0.0044'   | '0.6458'   | '0.215'  |
| $\gamma_L$         | '0.7312'   | '0.9654'   | '0.8644'   | '0.9585'   | '0.2551' |
| $k_L$              | '3.7357'   | '5.7195'   | '5.6263'   | '4.8513'   | '0.1439' |
| $\lambda_{qf}$     | '0.0004'   | '0.0009'   | '0.0013'   | '0.0008'   | '0.185'  |
| $\delta$           | '0.0958'   | '0.1447'   | '0.0767'   | '0.1435'   | '0.3418' |
| $\eta_L$           | '0.515'    | '0.7258'   | '0.648'    | '0.714'    | '0.2241' |
| $\vartheta_P$      | '0.0009'   | '0.0017'   | '0.0007'   | '0.0017'   | '0.0593' |
| $\gamma_H$         | '0.6524'   | '0.9813'   | '0.811'    | '0.9579'   | '0.2381' |
| $z$                | '27.9652'  | '29.6112'  | '14.0866'  | '29.5704'  | '0.2368' |
| $\eta_{\vartheta}$ | '0.4769'   | '0.7626'   | '0.6084'   | '0.7327'   | '0.1983' |
| $a_L$              | '2.3221'   | '3.1992'   | '4.813'    | '3.1981'   | '0.2544' |
| $b_L$              | '11.9365'  | '15'       | '14.3157'  | '14.7991'  | '0.1914' |
| $a_{\mu}$          | '5.4524'   | '9.725'    | '7.492'    | '5.7466'   | '0.1037' |
| $b_{\mu}$          | '5.0525'   | '9.8648'   | '8.3884'   | '9.7203'   | '0.1023' |
| $\mu$              | '0.3366'   | '0.6277'   | '0.5956'   | '0.6236'   | '0.1141' |
| $a_H$              | '2.2621'   | '3.5878'   | '5.4938'   | '3.4097'   | '0.2237' |
| $b_H$              | '8.5569'   | '11.505'   | '10.3395'  | '11.4761'  | '0.2041' |
| $\nu$              | '401.4378' | '464.4169' | '186.4133' | '405.1695' | '0.2106' |
| BP                 | '648.5'    | '711'      | '646.5'    | '652.5'    | '0.1811' |

### 16.3. Identifiability analysis









## 16.4. Uncertainty analysis

N=500

