

COVID-19-ANALYSIS

February 27, 2021

FOR COUNTRY:

US (mid-term)

AS COMPARED TO COUNTRIES:

Israel

AUTHOR:

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COUNTRY COMPARISONS:

- SCENARIO: no change in Rt
- SCENARIO: seasonal changes
- SCENARIO: seasonal + lockdowns
- SCENARIO: seasonal + vaccination
- SCENARIO: seasonal + lockdowns + vaccination
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MODEL DESCRIPTION

KEY FINDINGS

1 COUNTRY ANALYSIS: US

```
*** WARNING: INVALID (NEGATIVE) RECOVERY RATE DATA ***
Clipping to 0.0
*** WARNING: NO RECOVERY DATA AVAILABLE ***
*** WARNING: NO TESTING DATA AVAILABLE ***
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

Data since 2020-02-21 to 2021-02-15 (361 days)
Scenario projections till 2021-10-12
Reference frame: infection date
Uncert.bands on plots of true cases denote (0.77, 1.30)*R

Population= 331002651
Natural mortality rate [per person per day]= 2.33e-05

Initial logarithmic growth rate [1/d]= 4.05e-01 +/- 1.70e-02
Initial incidence [1/d]= 3.89e+01 +/- 2.89e+00
Initially infected population= 1.17e+02 +/- 9.54e+00
Approx.date of first infection= 2020-02-10

Avg.duration of viral shedding=32.263 [d]
Avg.case duration=28.005 [d]
Avg.time to recovery=26.960 [d]
Avg.time to recovery (mild cases)=26.050 [d]
Avg.time to recovery (severe cases)=34.246 [d]
Avg.time to death=34.246 [d]
R0 (exp.model)=10.755
```

1.1 SCENARIO: no change in Rt

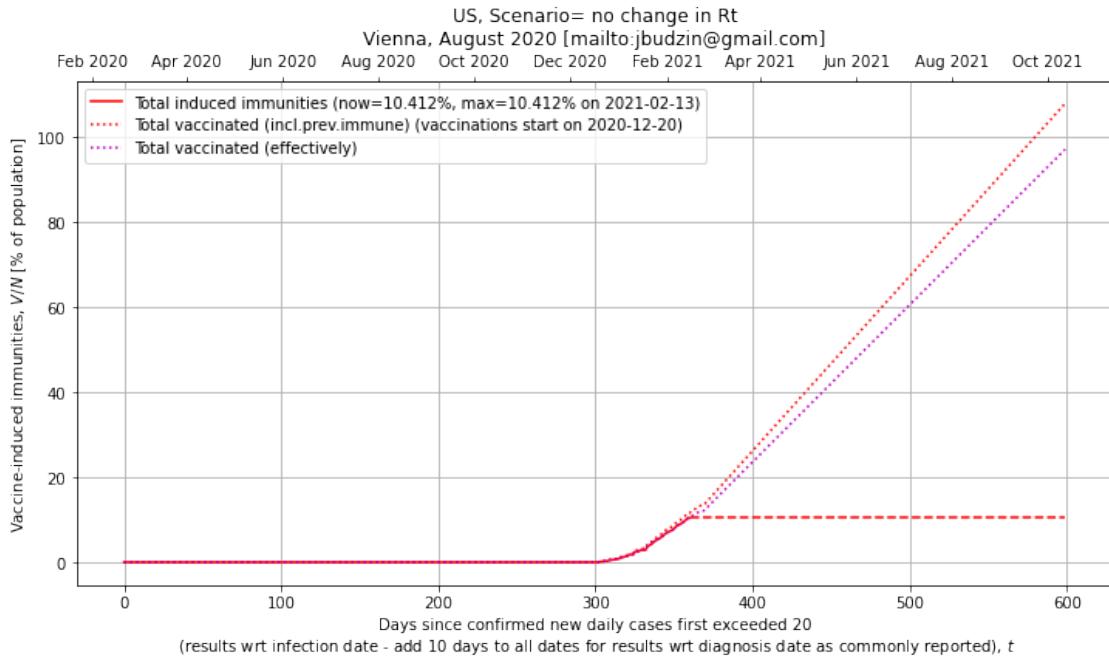
```
no change in Rt
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 150.062
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
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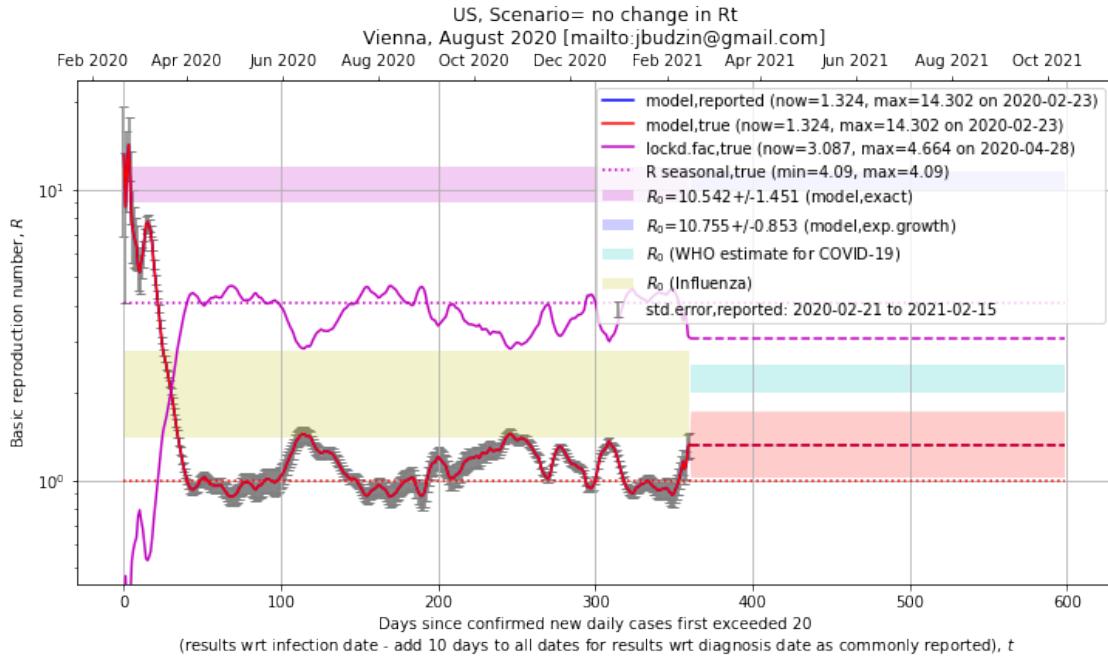
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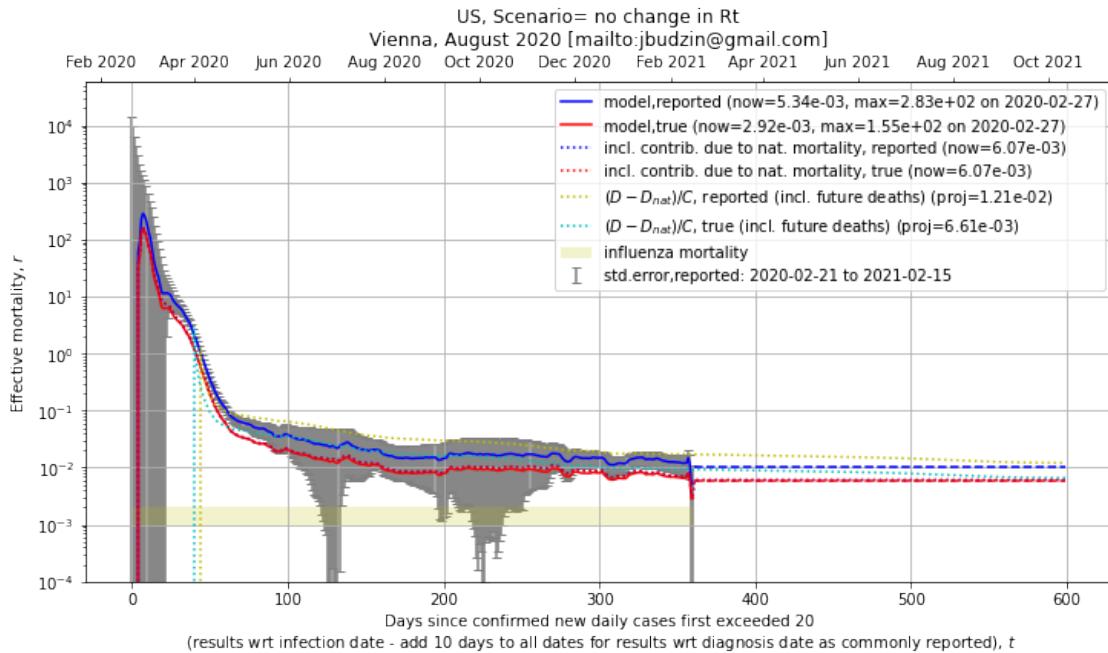
1.1.1 VACCINATED



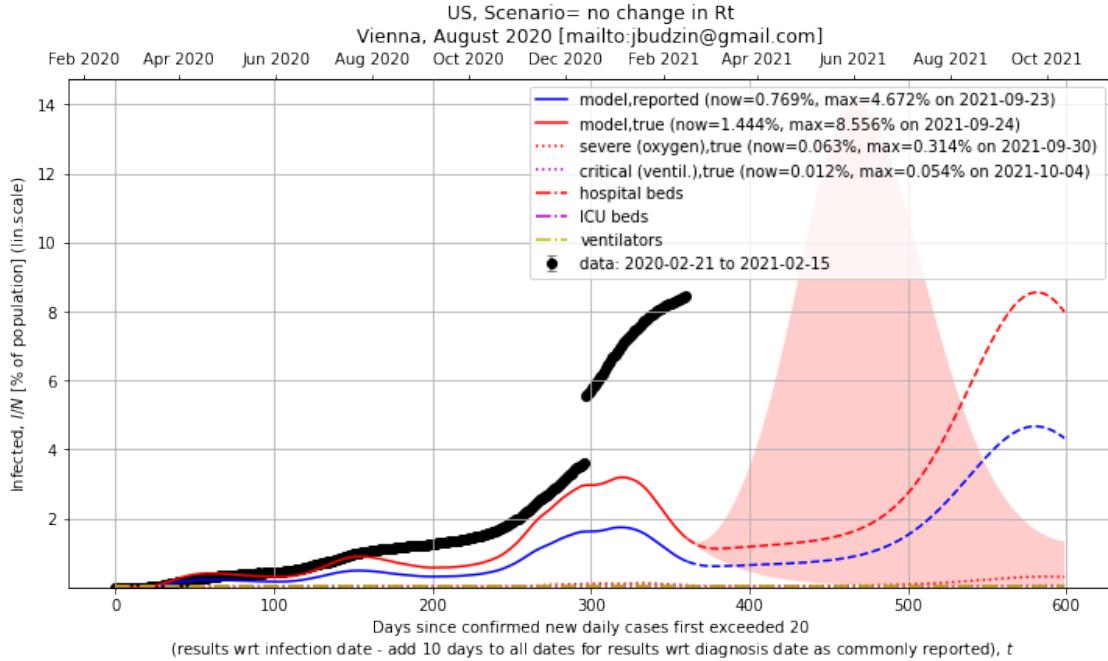
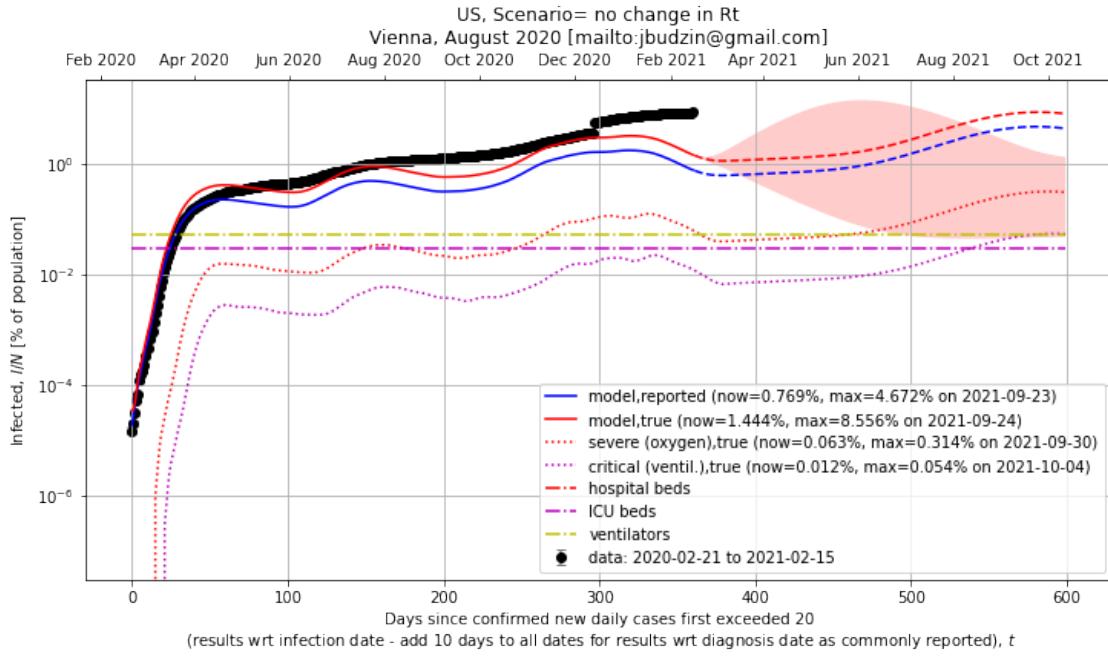
1.1.2 REPRODUCTION NUMBER



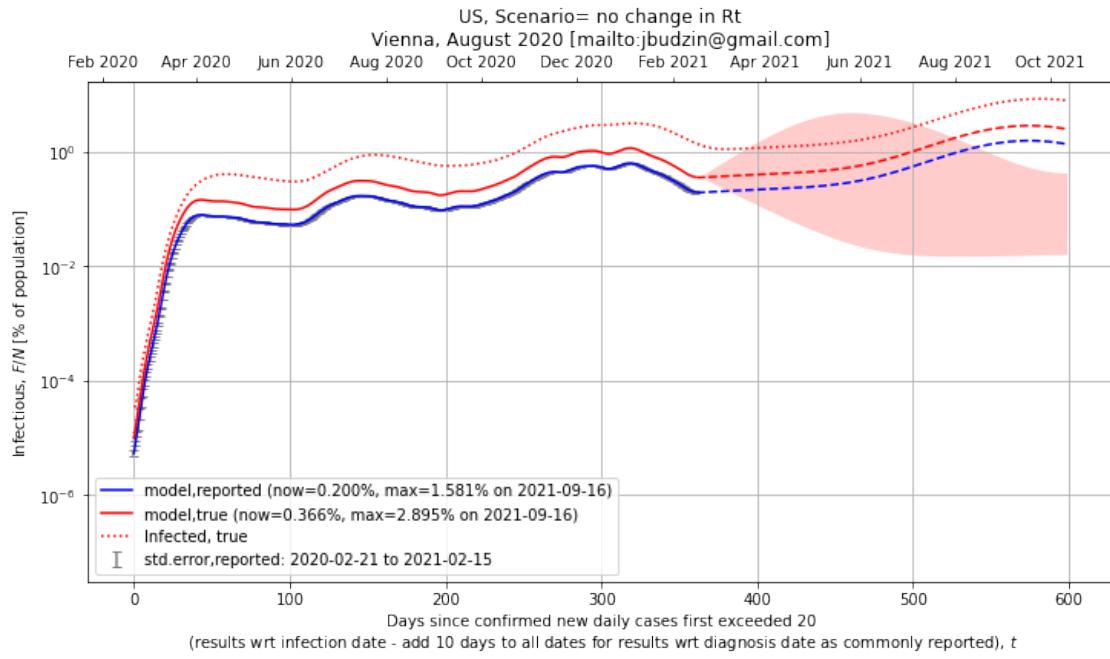
1.1.3 MORTALITY



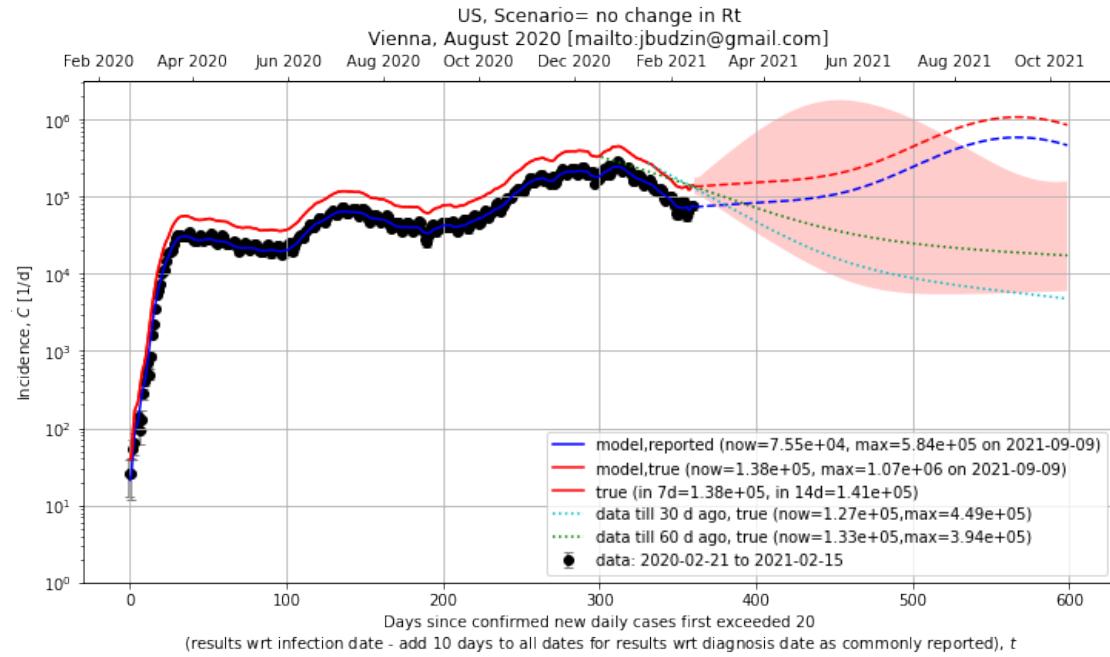
1.1.4 INFECTED

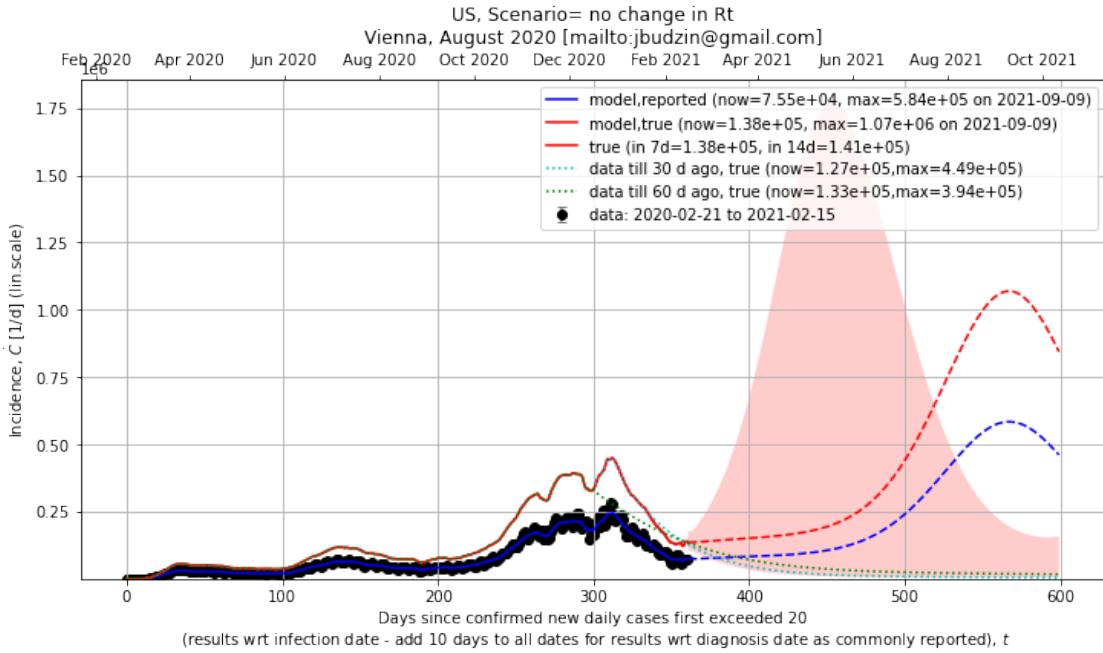


1.1.5 INFECTIOUS

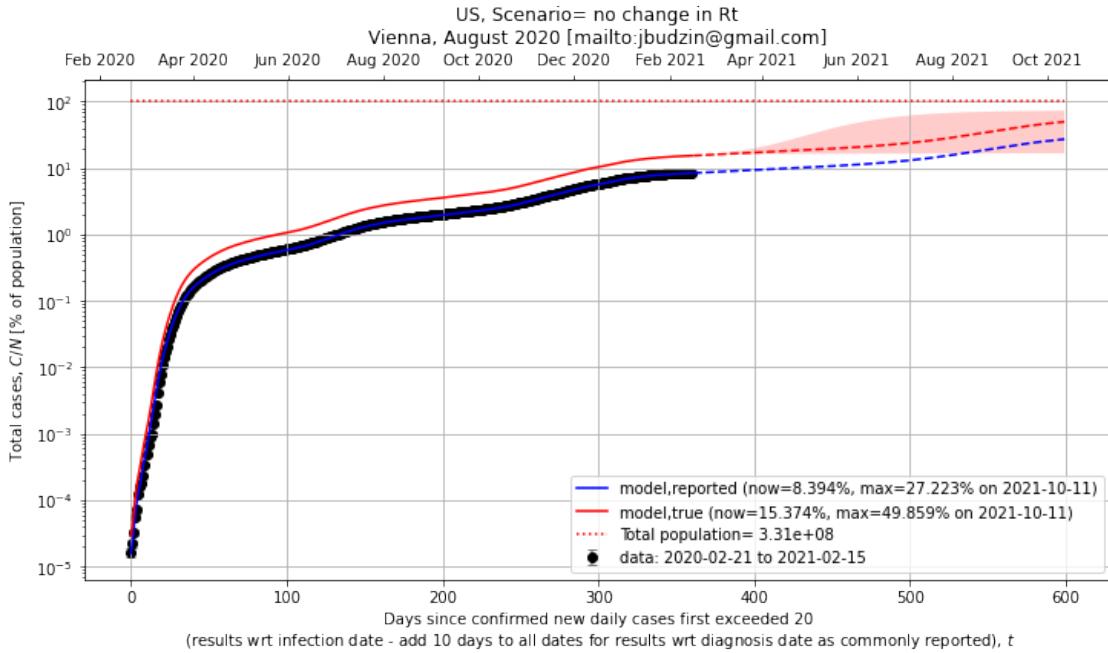


1.1.6 INCIDENCE

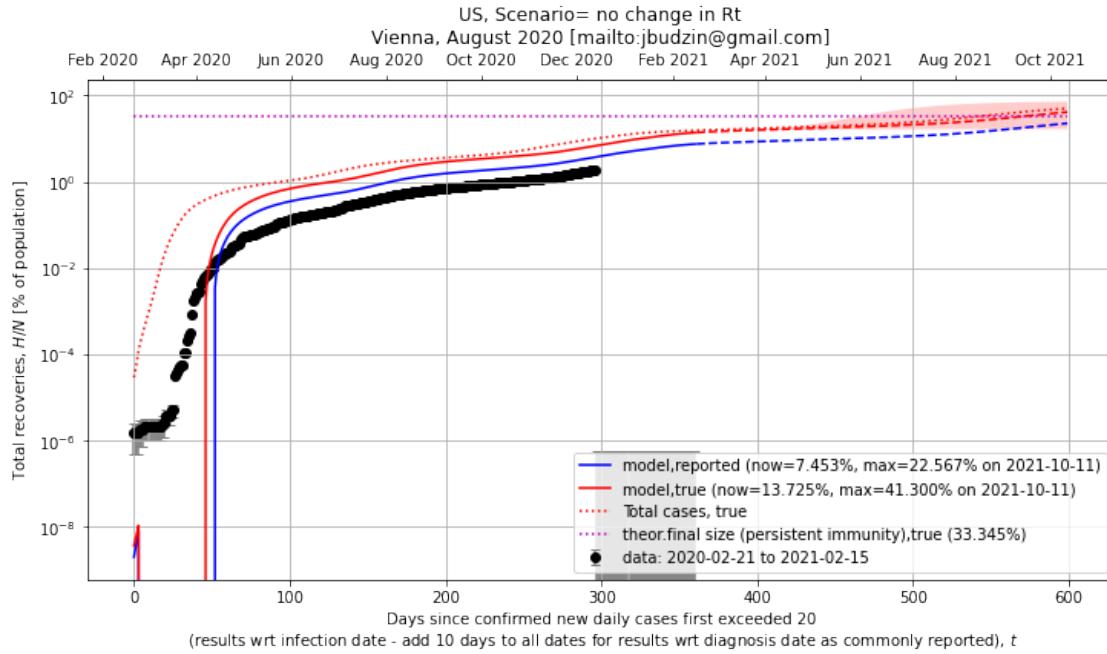




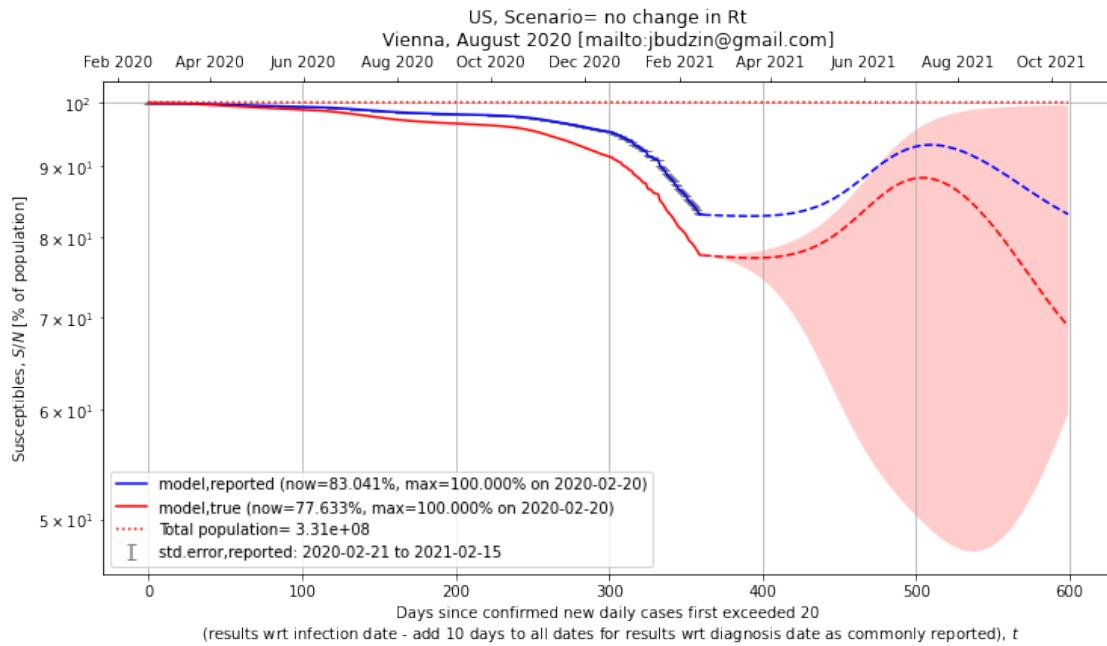
1.1.7 TOTAL CASES



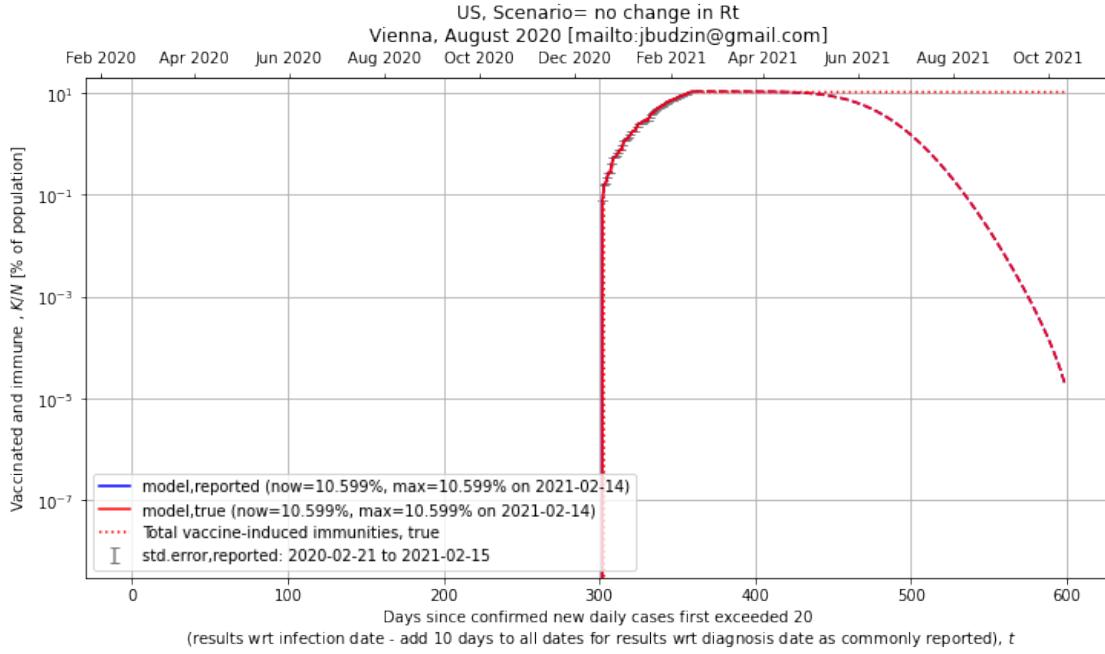
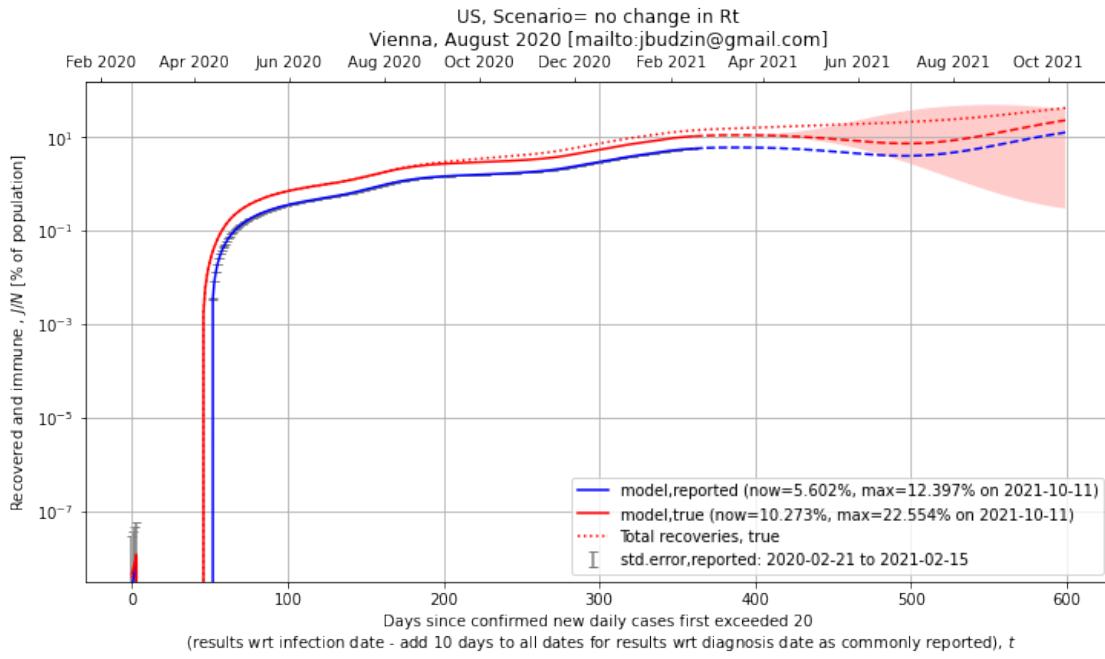
1.1.8 RECOVERED



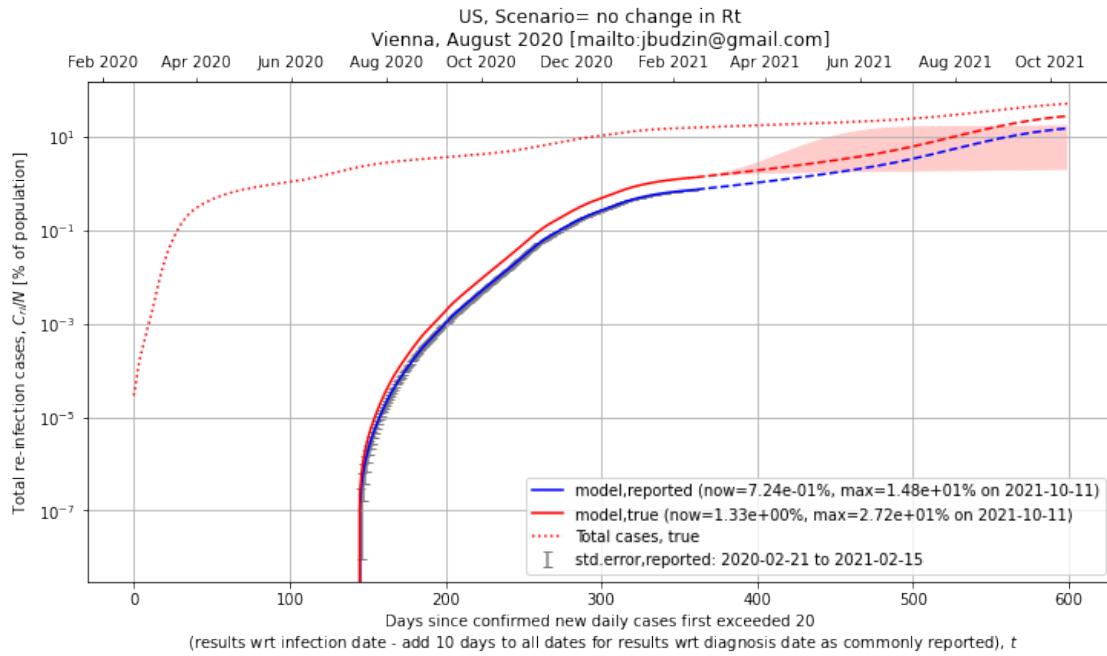
1.1.9 SUSCEPTIBLE



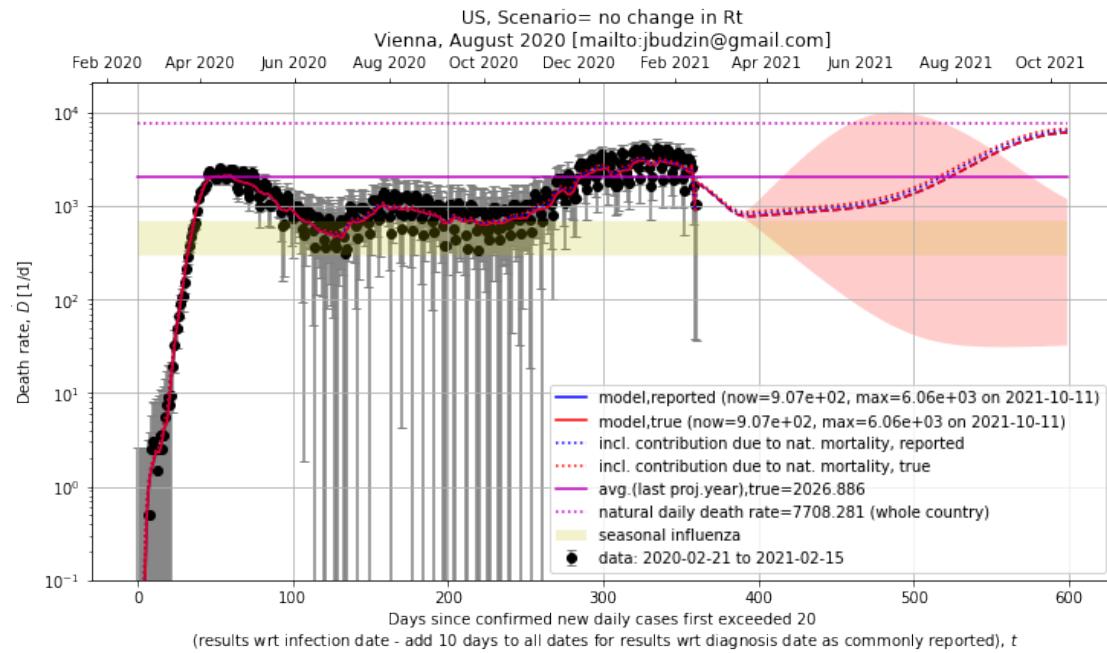
1.1.10 IMMUNE

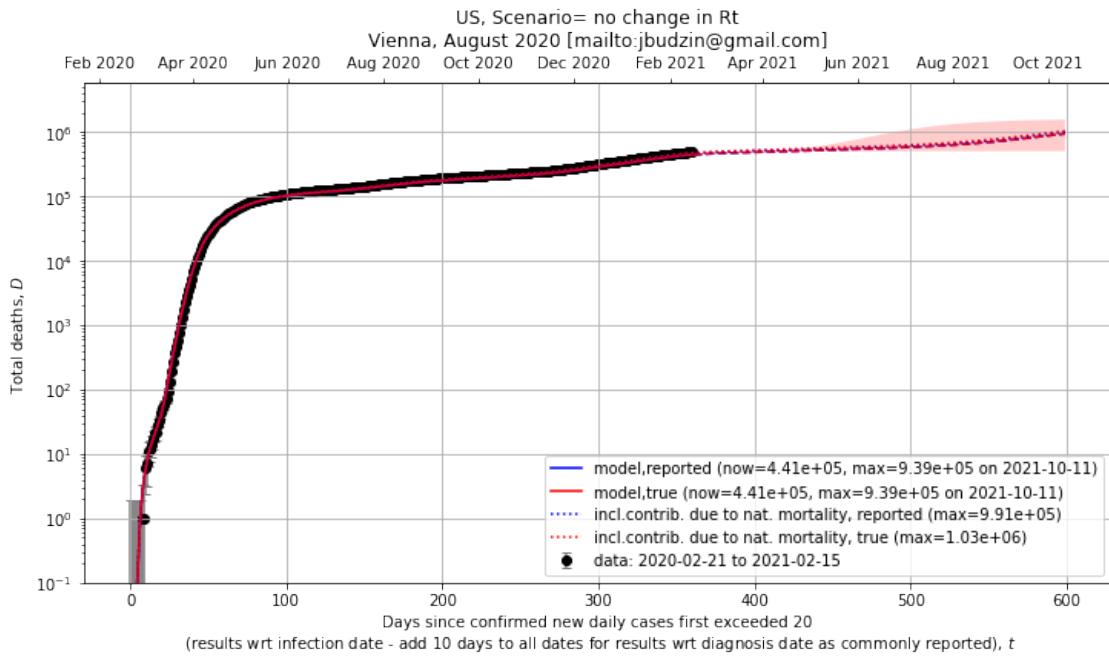
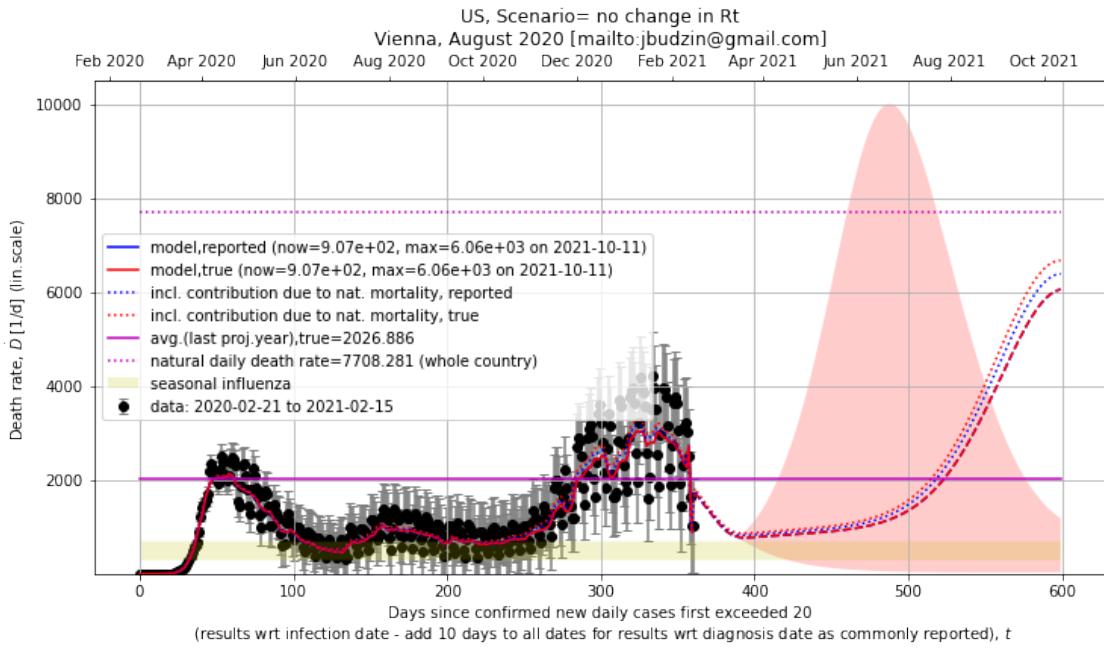


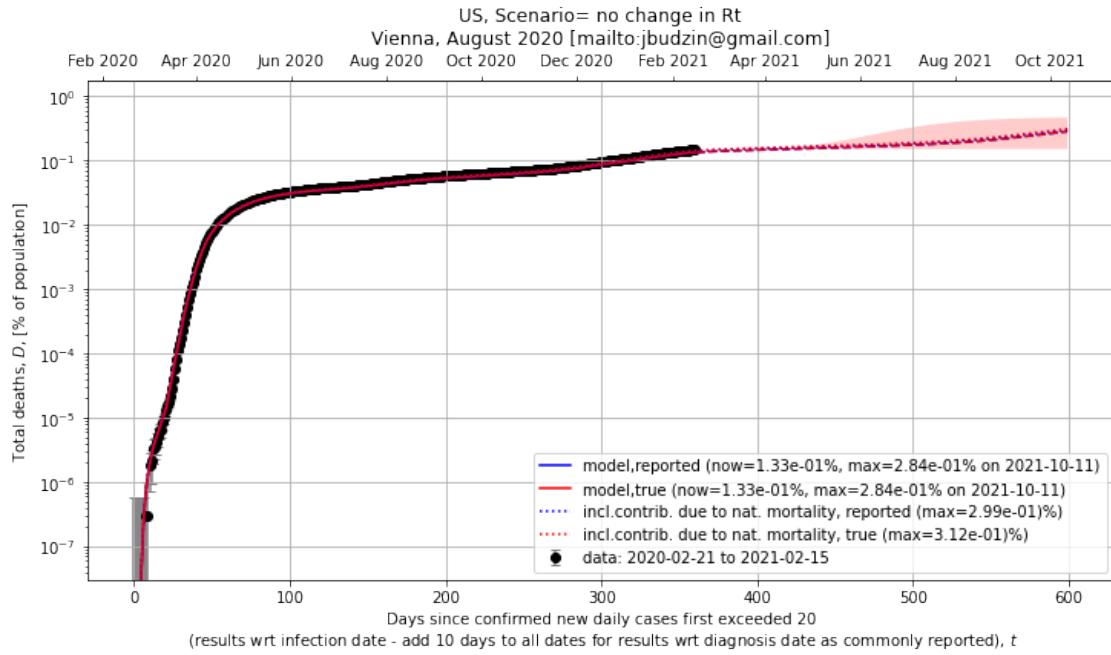
1.1.11 REINFECTIONS



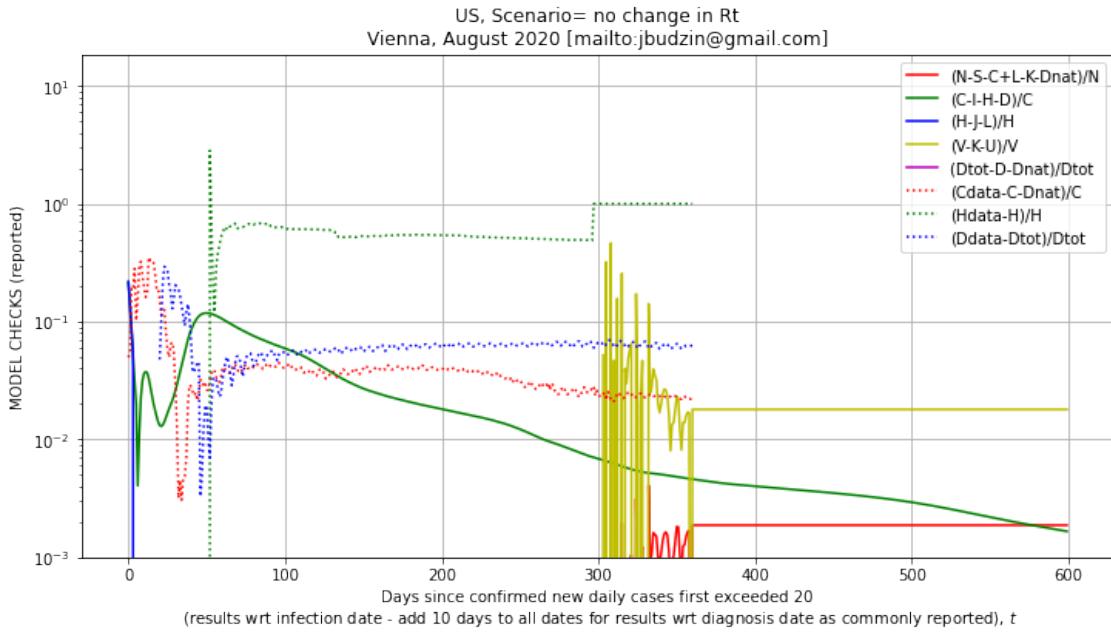
1.1.12 DEATHS



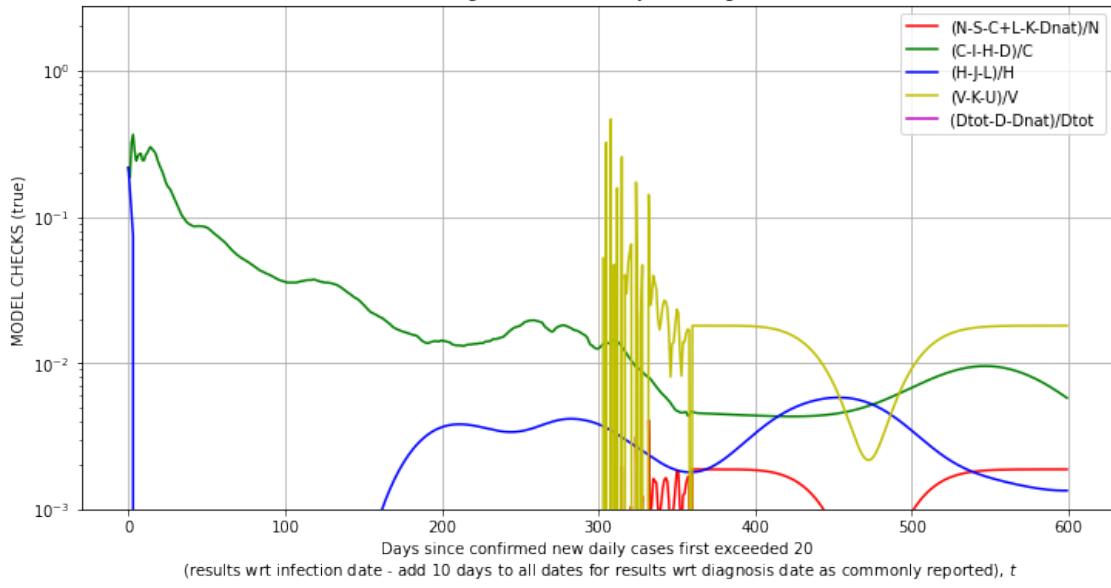




1.1.13 MODEL CHECKS



US, Scenario= no change in Rt
Vienna, August 2020 [mailto:jbudzin@gmail.com]



1.1.14 FORECAST FIGURES

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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (reported)
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| 2021-02-13 | 3631707 | 393823 | 293771 | 54819 | 26919397 | 414913 | 2760 | 79601 | 202 | |
| 2021-02-14 | 3521022 | 384254 | 286633 | 53409 | 26994681 | 417617 | 2703 | 75284 | 194 | |
| 2021-02-15 | 3412816 | 374760 | 279551 | 52135 | 27067977 | 420268 | 2651 | 73295 | 185 | |
| 2021-02-16 | 3308494 | 365194 | 272415 | 50910 | 27140784 | 422859 | 2591 | 72807 | 177 | |
| 2021-02-17 | 3206764 | 355550 | 265221 | 49751 | 27211907 | 425377 | 2518 | 71123 | 171 | |
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| 2021-02-19 | 3015501 | 336263 | 250834 | 47735 | 27353834 | 430173 | 2362 | 71356 | 158 | |
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| 2021-02-21 | 2844491 | 316620 | 236182 | 45548 | 27499633 | 434763 | 2266 | 73311 | 153 | |
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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (true)

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| 2021-03-26 | 3787616 | 180695 | 134788 | 23079 | 54965546 | 475679 | 787 | 146210 | 305 |
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| 2021-03-28 | 3808601 | 181457 | 135357 | 23140 | 55259167 | 477237 | 777 | 147010 | 307 |
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| 2021-04-24 | 4112468 | 195812 | 146065 | 24990 | 59393252 | 498706 | 824 | 159597 | 332 |
| 2021-04-25 | 4125030 | 196361 | 146474 | 25059 | 59553454 | 499533 | 826 | 160202 | 333 |
| 2021-04-26 | 4137791 | 196915 | 146888 | 25128 | 59714279 | 500362 | 828 | 160824 | 335 |

1.2 SCENARIO: seasonal changes

seasonal changes

Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 150.062

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

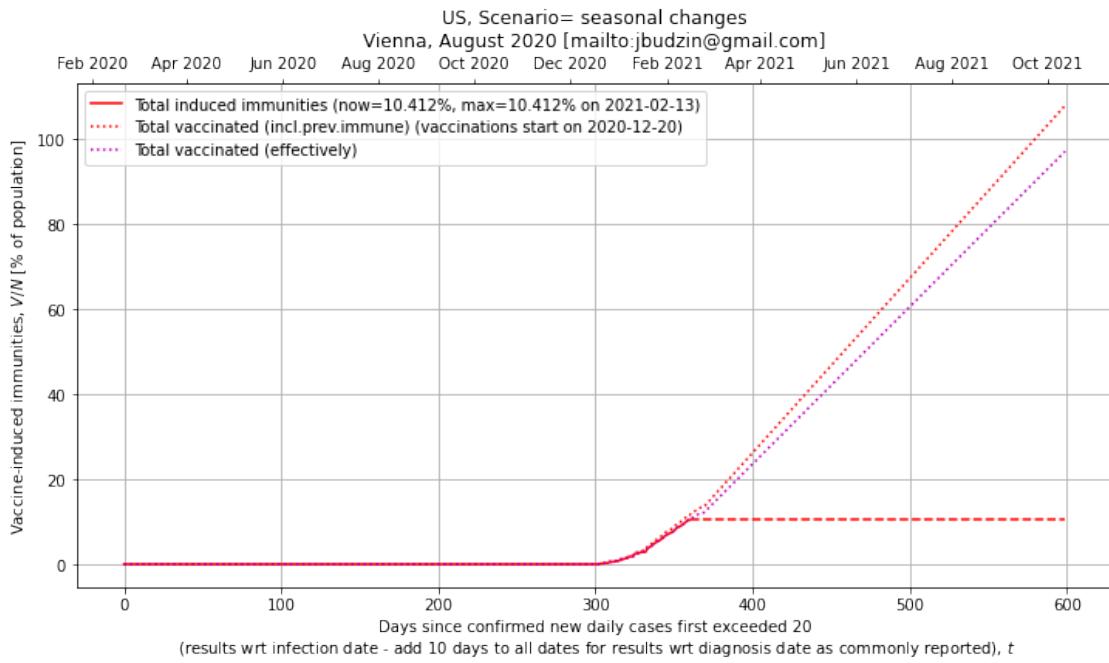
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

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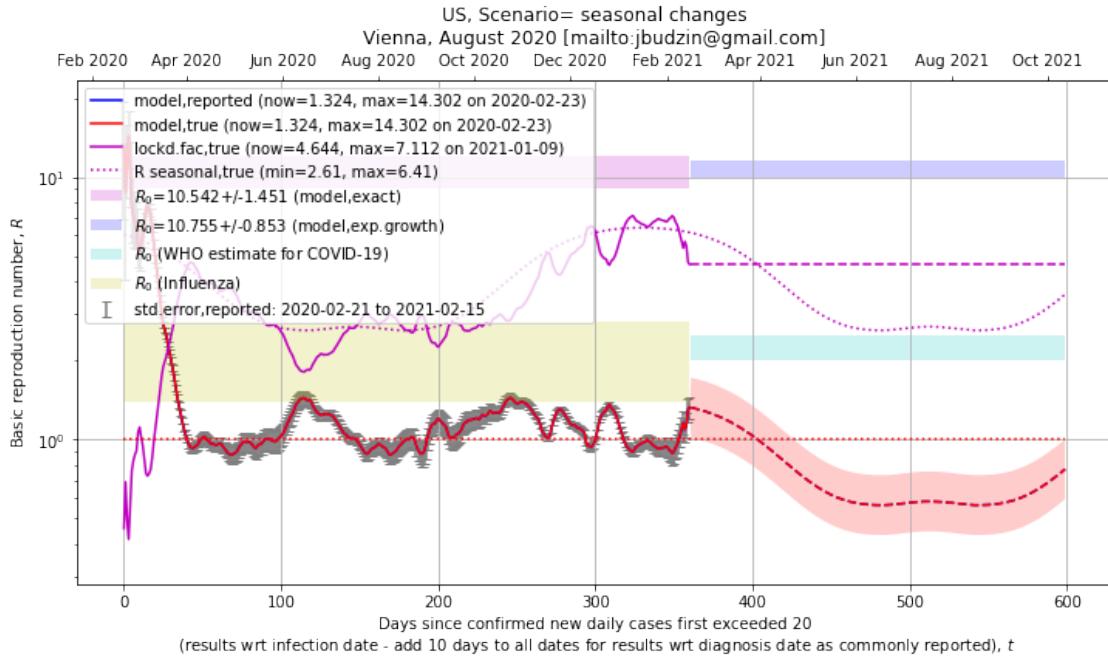
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V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
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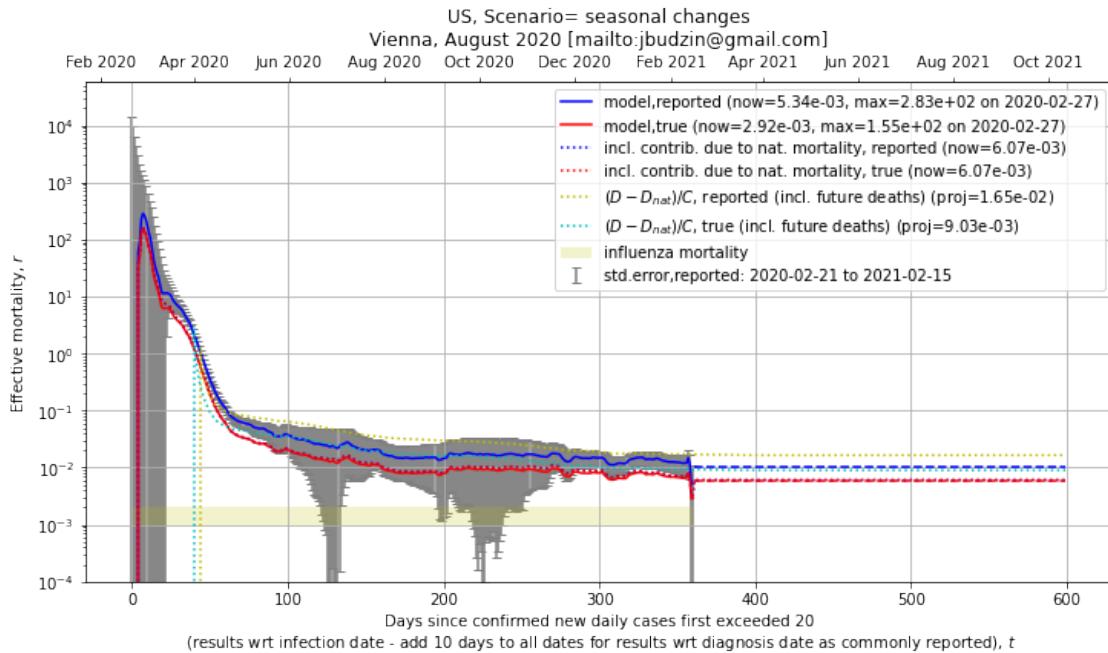
1.2.1 VACCINATED



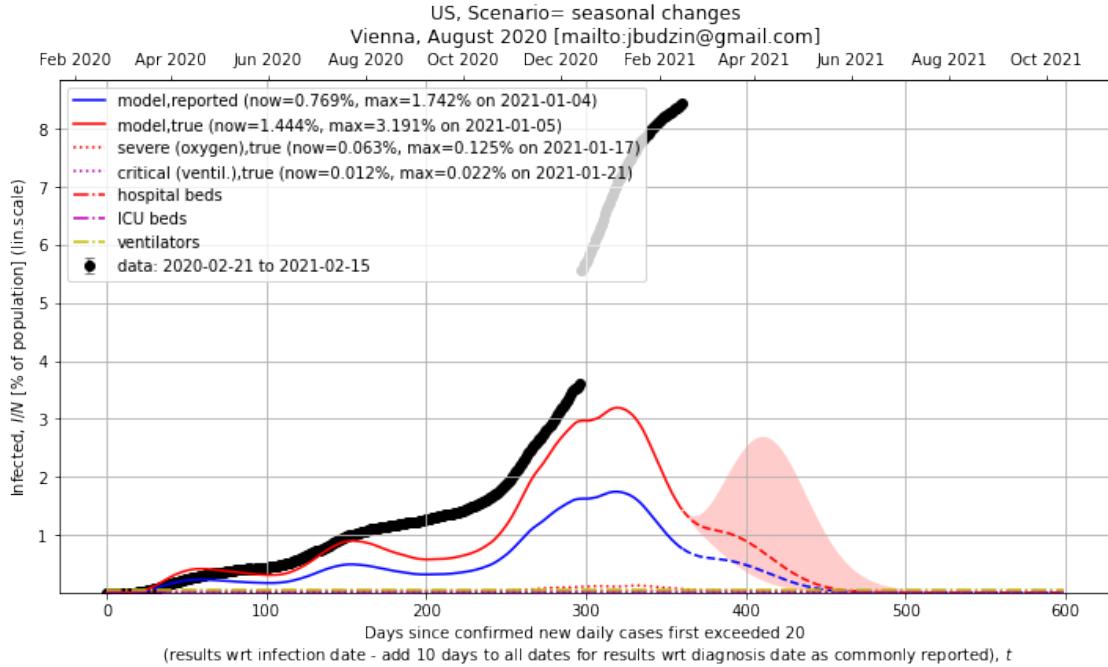
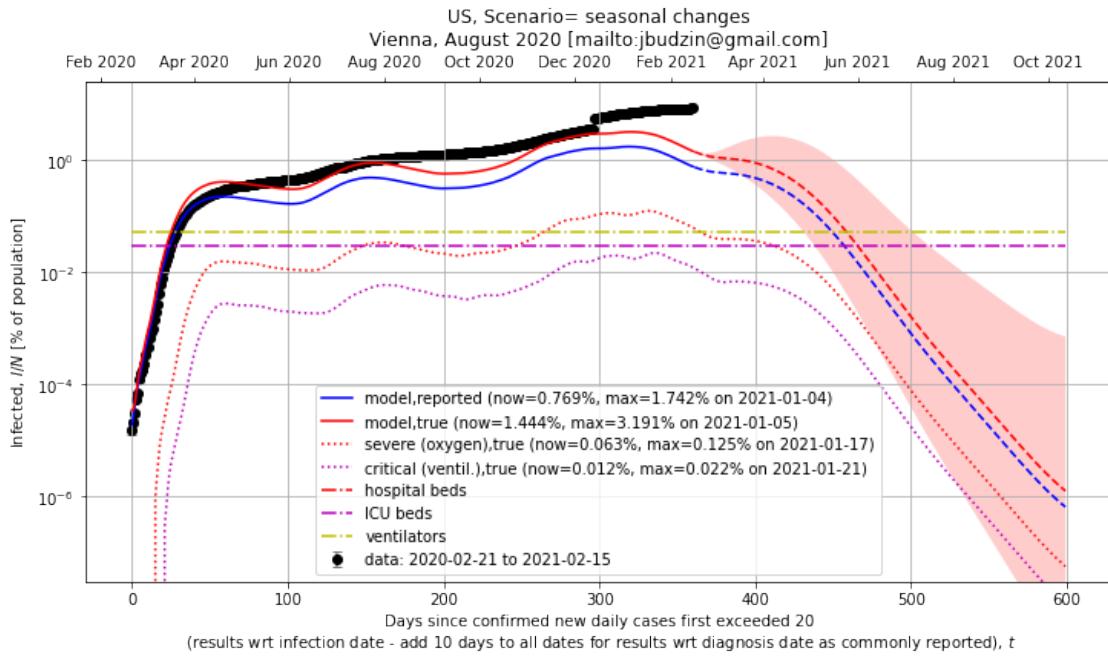
1.2.2 REPRODUCTION NUMBER



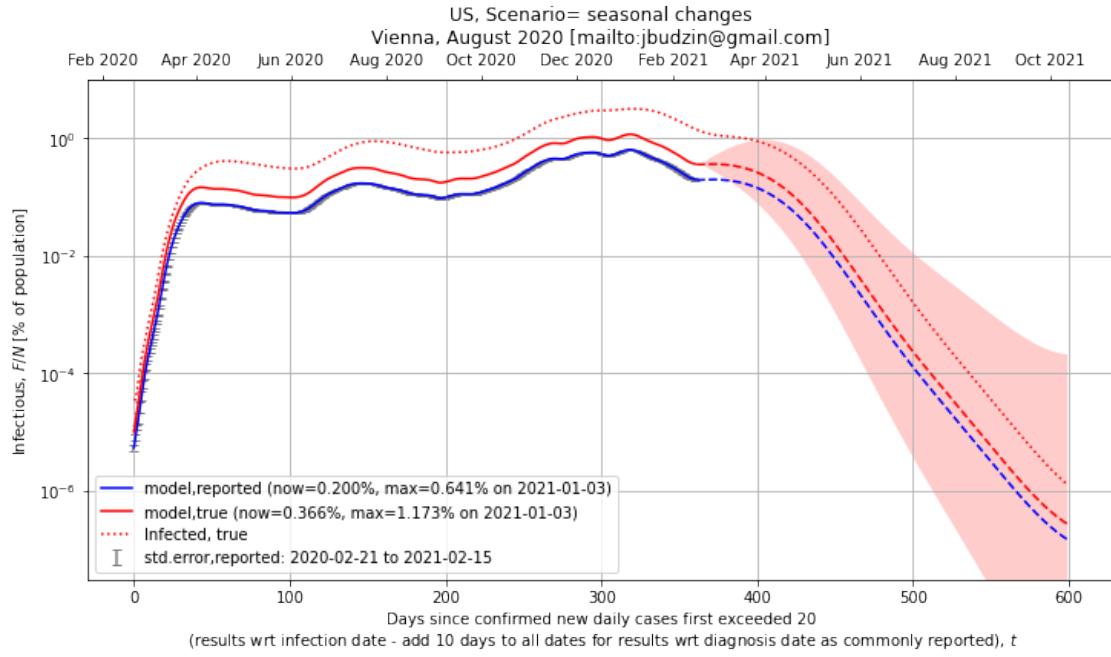
1.2.3 MORTALITY



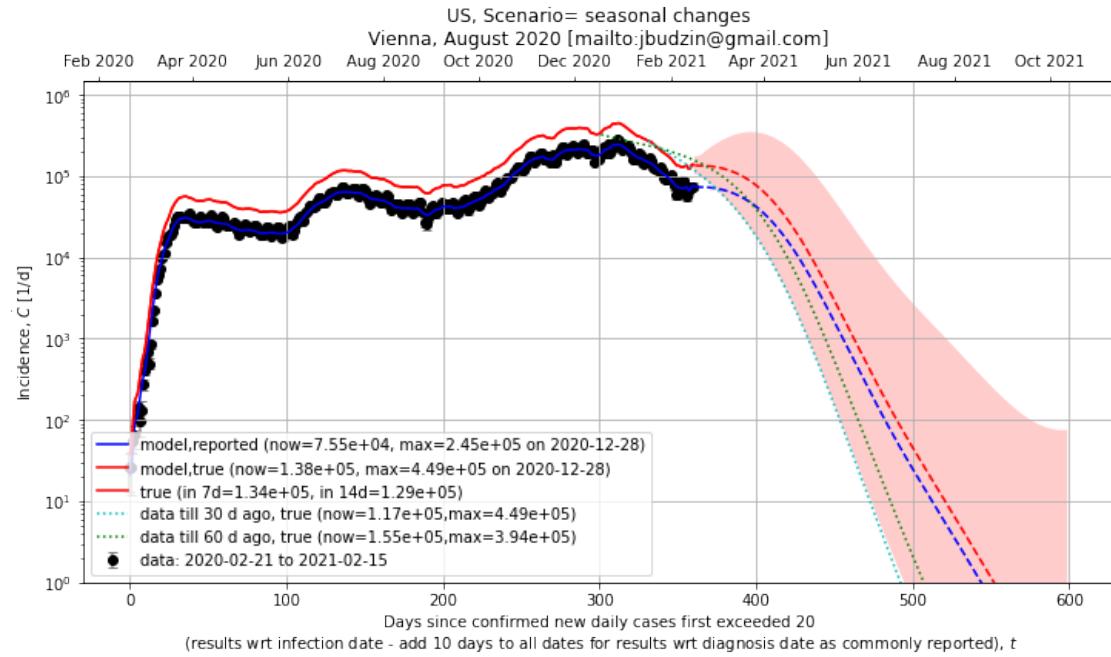
1.2.4 INFECTED

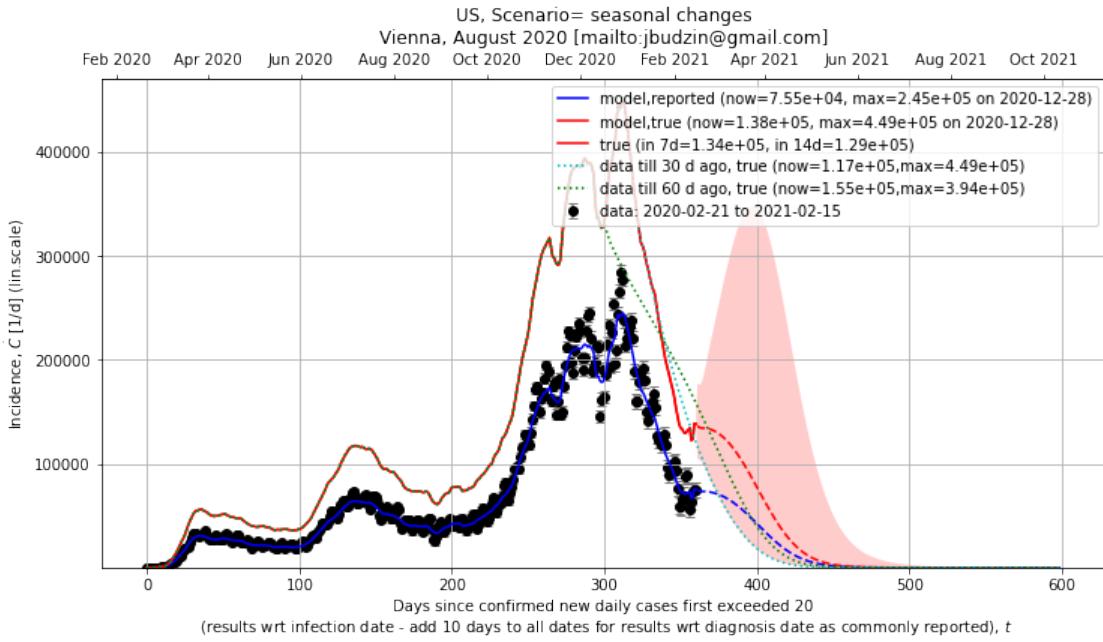


1.2.5 INFECTIOUS

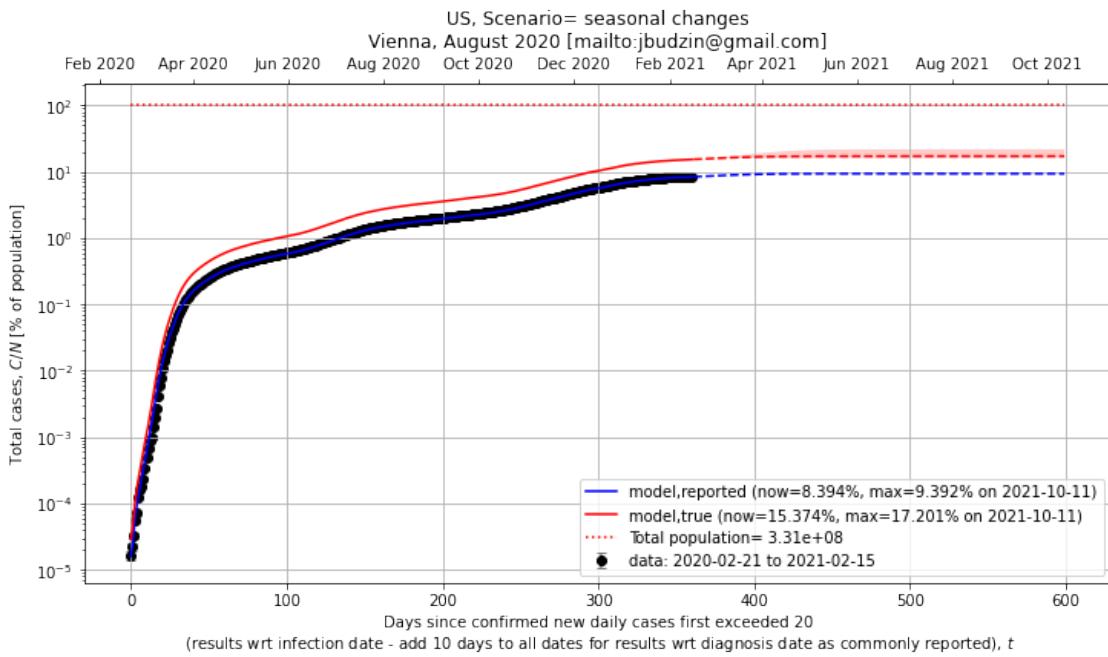


1.2.6 INCIDENCE

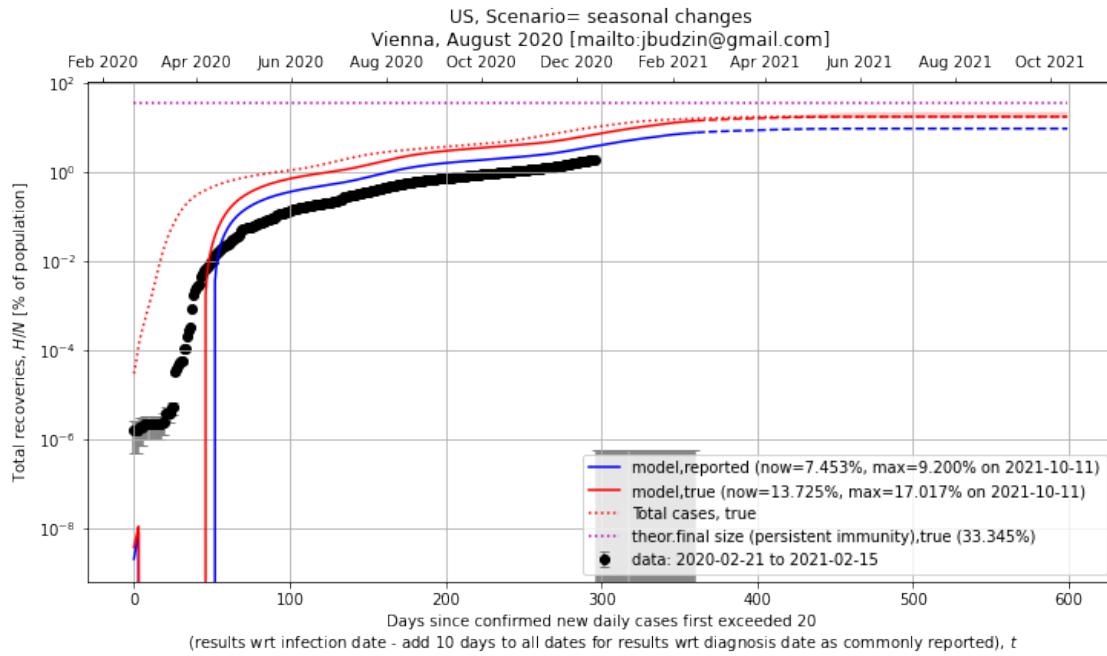




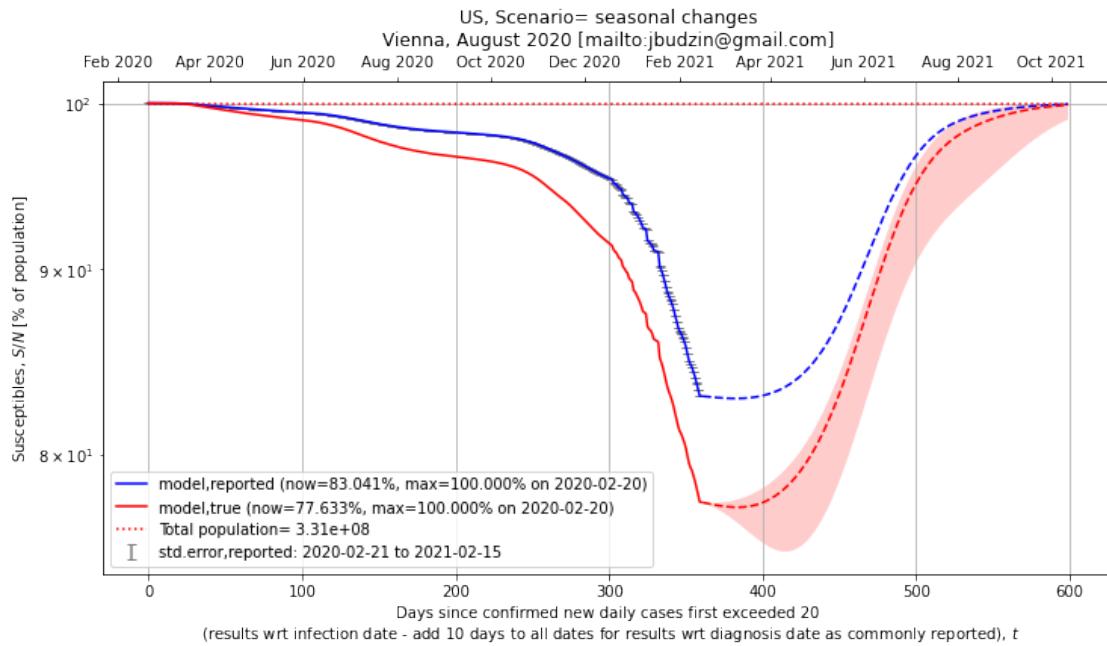
1.2.7 TOTAL CASES



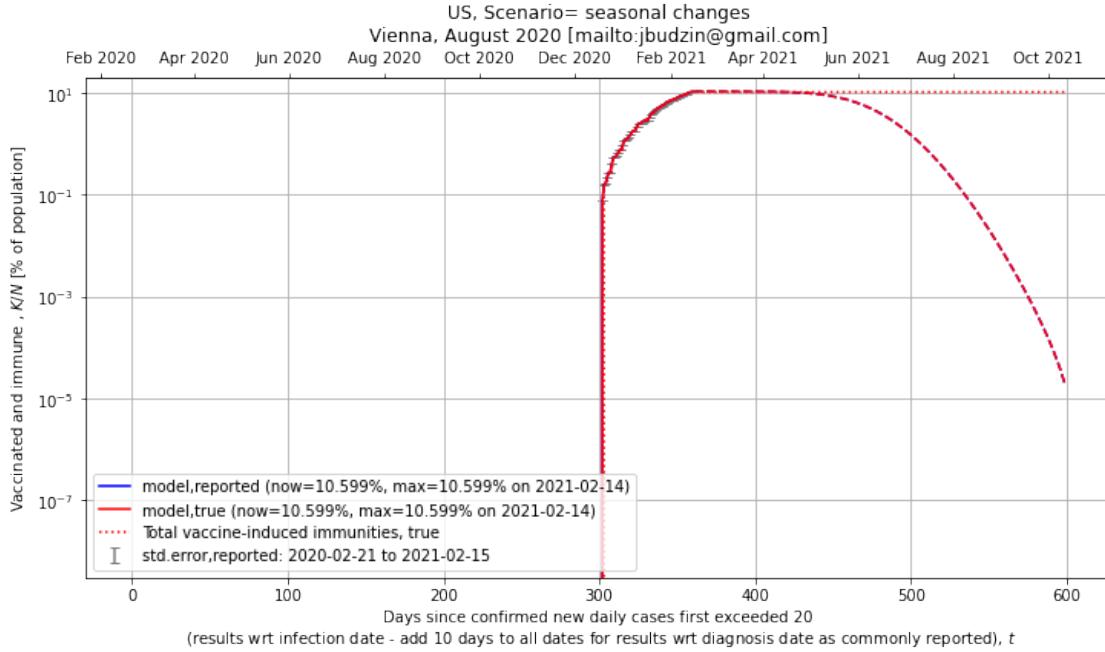
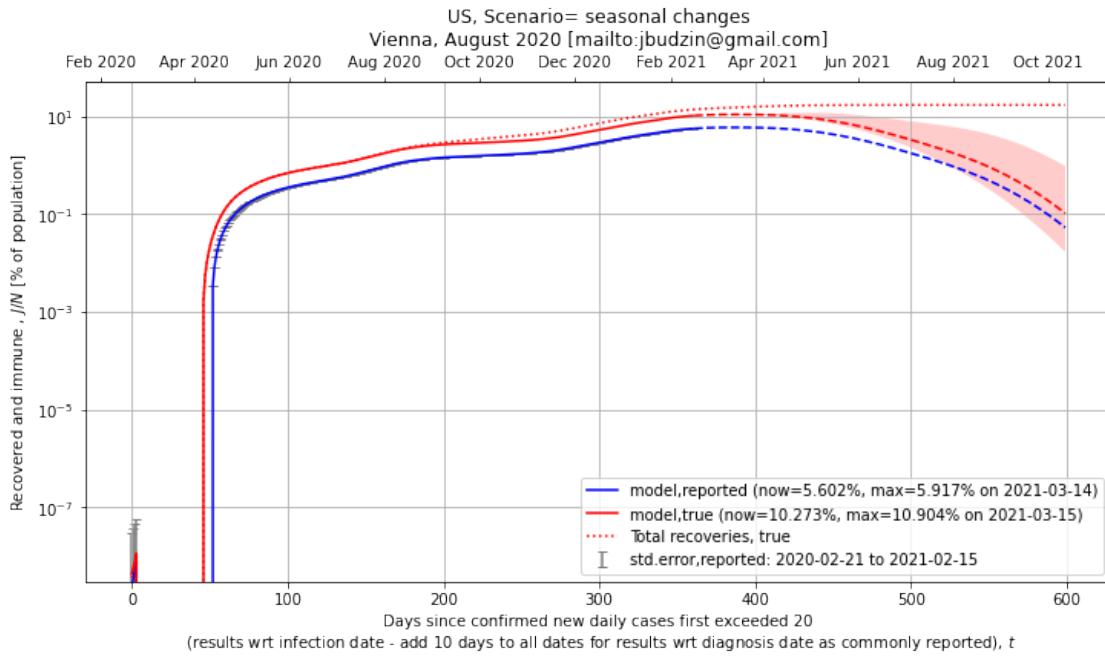
1.2.8 RECOVERED



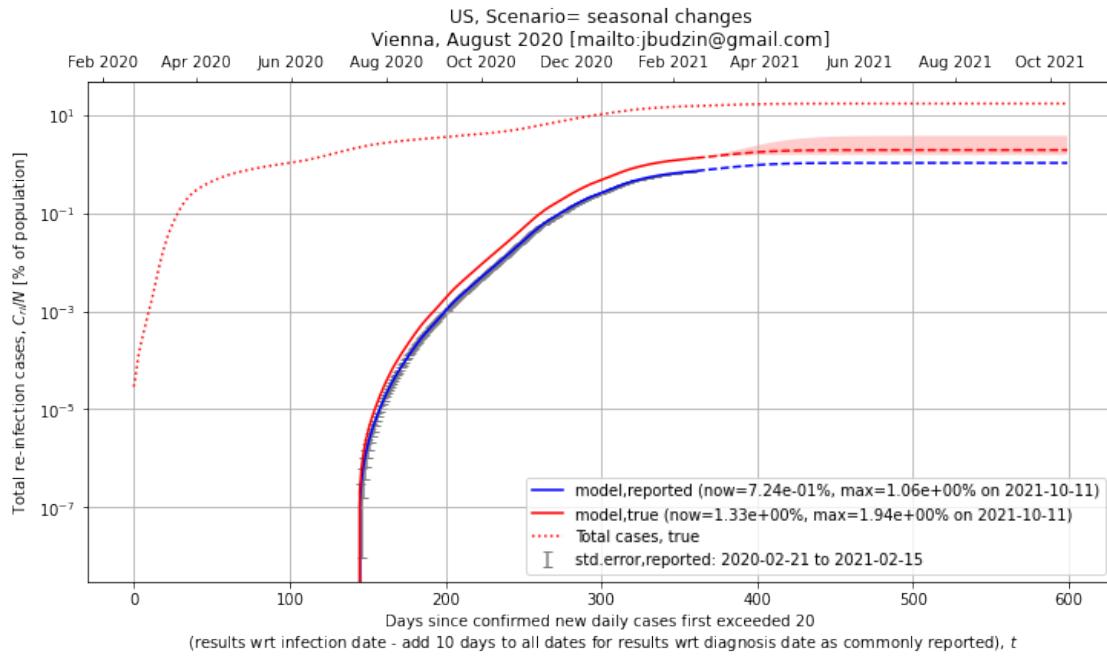
1.2.9 SUSCEPTIBLE



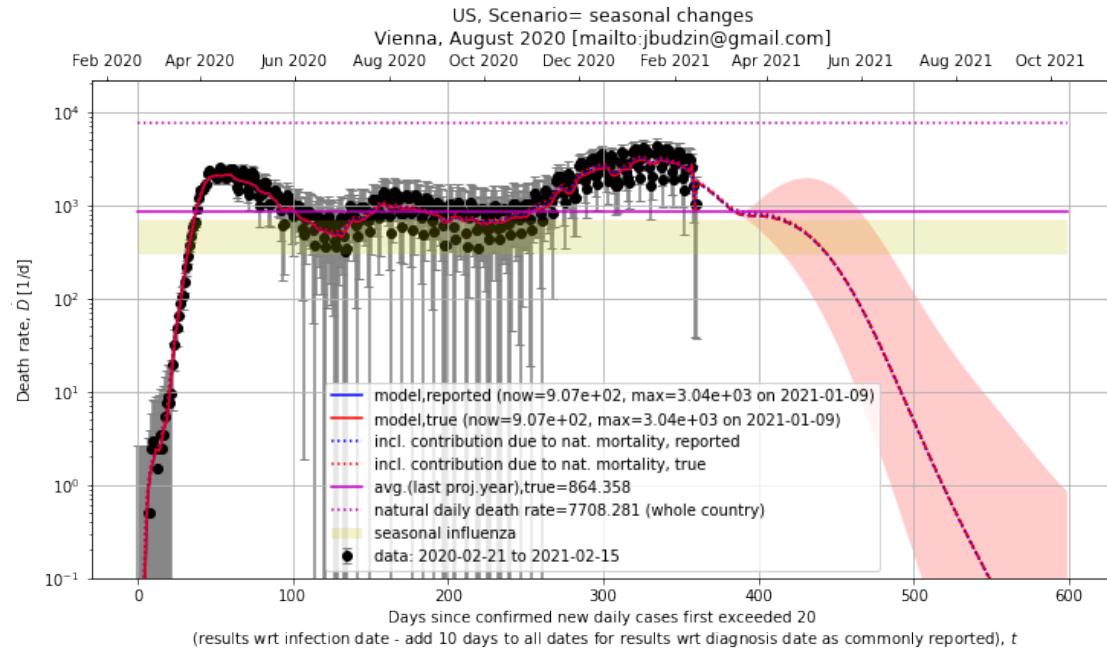
1.2.10 IMMUNE

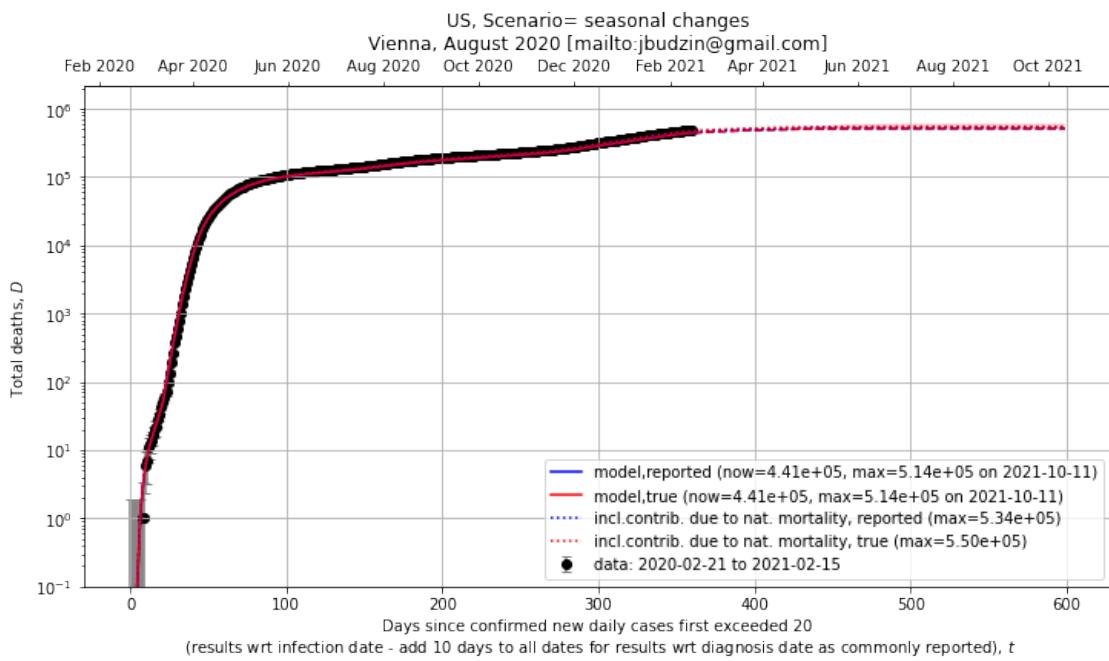
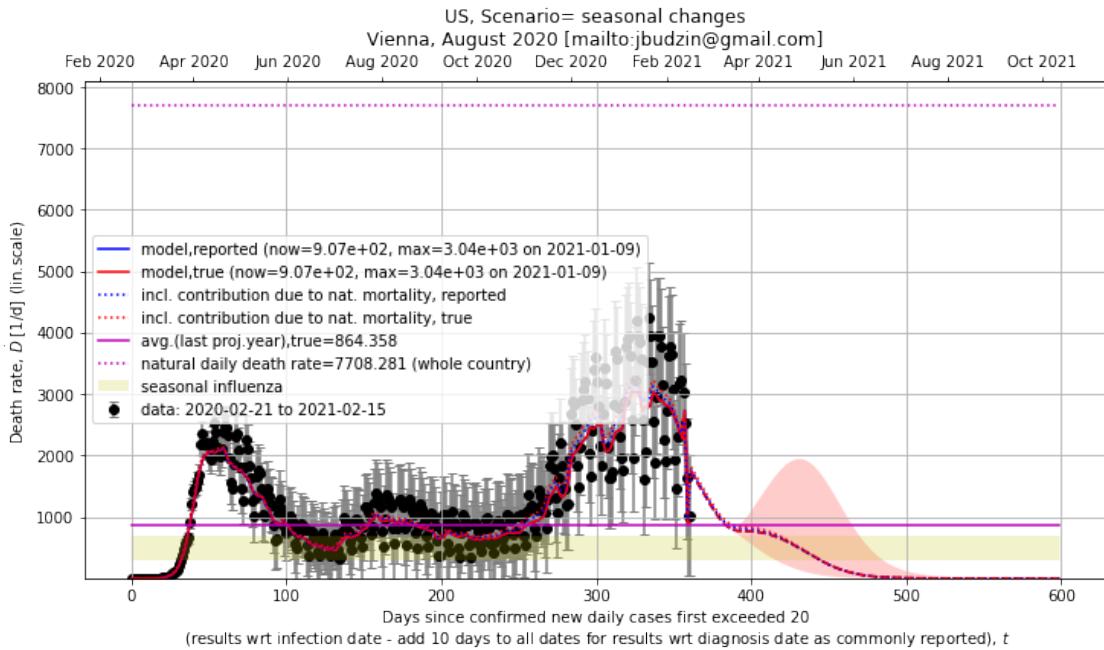


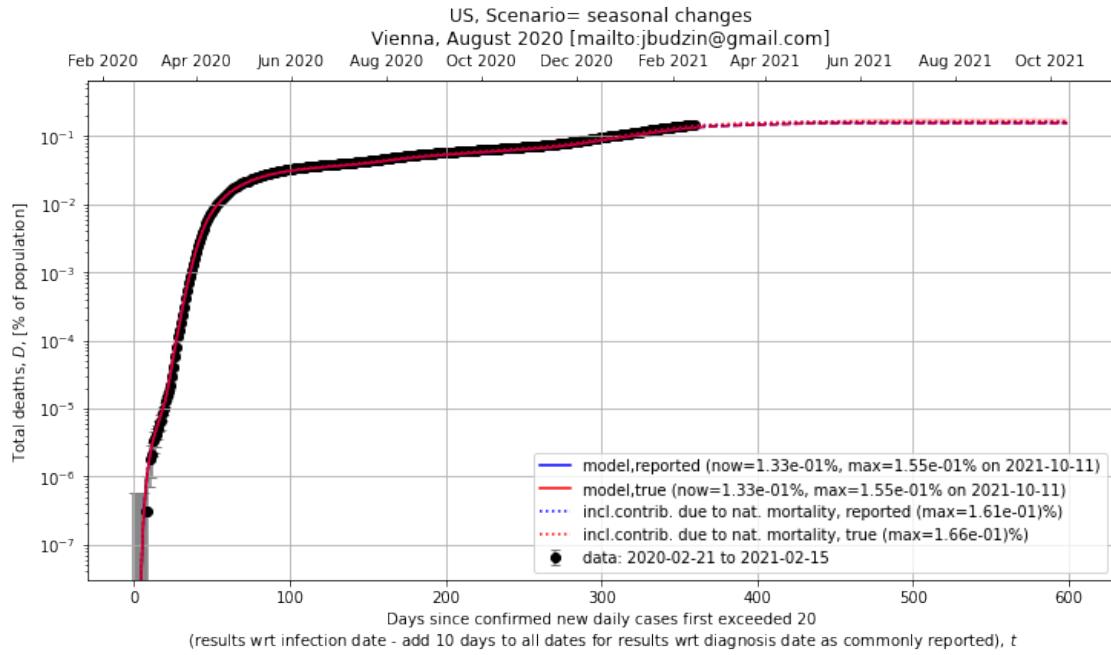
1.2.11 REINFECTIONS



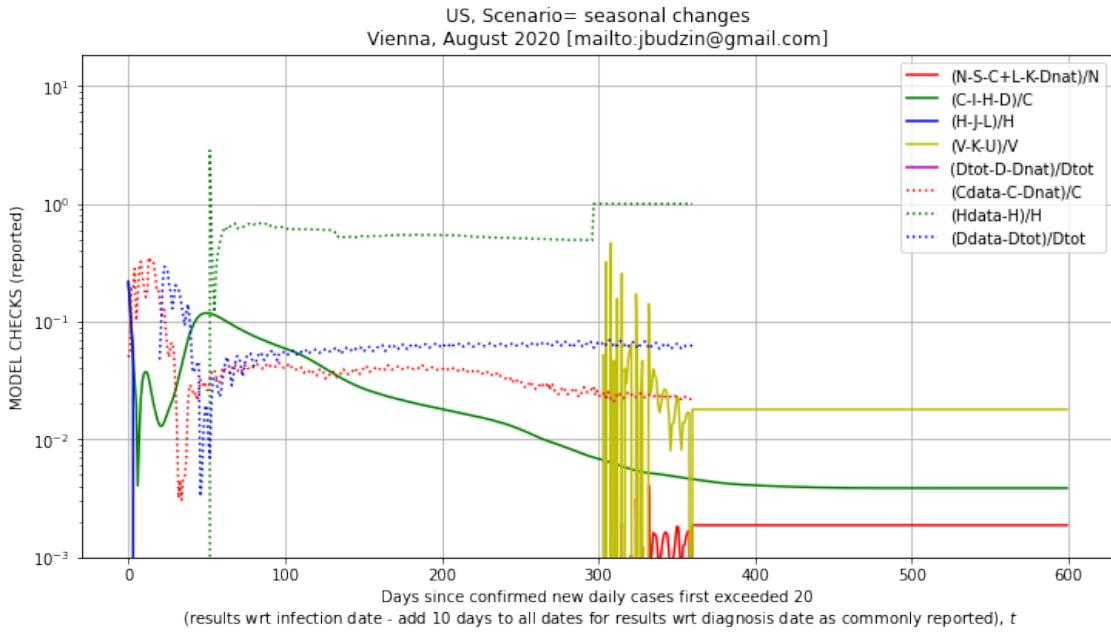
1.2.12 DEATHS



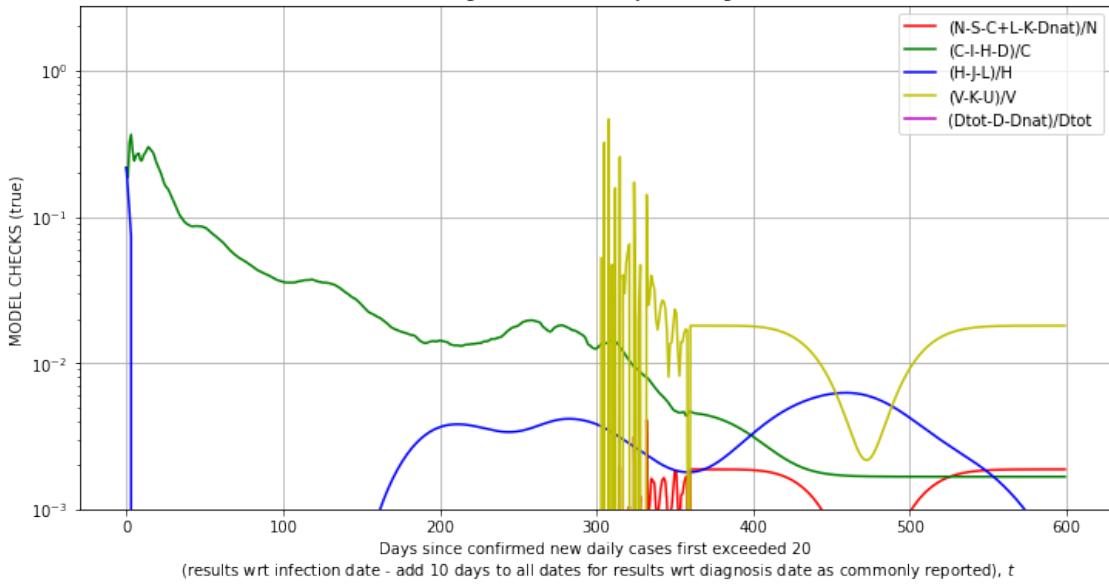




1.2.13 MODEL CHECKS



US, Scenario= seasonal changes
Vienna, August 2020 [mailto:jbudzin@gmail.com]



1.2.14 FORECAST FIGURES

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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (reported)
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2021-02-14 3521022 384254 286633 53409 26994681 417617 2703 75284 194
2021-02-15 3412816 374760 279551 52135 27067977 420268 2651 73295 185
2021-02-16 3308494 365194 272415 50910 27140784 422859 2591 72807 177
2021-02-17 3206764 355550 265221 49751 27211907 425377 2518 71123 171
2021-02-18 3108675 345960 258067 48691 27282477 427811 2434 70570 164
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2021-02-20 2927548 326460 243521 46701 27426322 432496 2323 72488 155
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2021-02-23 2678390 297183 221682 43007 27634036 439602 2106 67596 150
2021-02-24 2610038 287560 214504 41693 27709789 440506 904 75753 149
-> 2021-02-25 2545531 278110 207455 40332 27785268 441413 907 75479 150
2021-02-26 2484213 268608 200367 38954 27859812 443148 1735 74543 151
2021-02-27 2426244 258895 193122 37615 27933583 444840 1691 73771 152
2021-02-28 2371995 249138 185843 36313 28006970 446488 1648 73387 153
2021-03-01 2321710 239258 178473 35015 28080242 448093 1605 73271 153
2021-03-02 2275469 229915 171504 33772 28153515 449656 1562 73272 155
2021-03-03 2233225 221380 165138 32602 28226787 451175 1519 73271 156
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| 2021-03-06 | 2129119 | 199784 | 149028 | 29019 | 28445894 | 455478 | 1391 | 72838 | 155 |
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| 2021-03-08 | 2076805 | 190074 | 141785 | 26678 | 28590660 | 458133 | 1306 | 72213 | 154 |
| 2021-03-09 | 2055139 | 184998 | 137998 | 25691 | 28662485 | 459397 | 1264 | 71825 | 154 |
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| 2021-03-25 | 1856619 | 174893 | 130461 | 22715 | 29717596 | 474891 | 794 | 58750 | 133 |
| 2021-03-26 | 1840889 | 174691 | 130310 | 22772 | 29775130 | 475677 | 786 | 57533 | 131 |
| 2021-03-27 | 1824011 | 173922 | 129737 | 22701 | 29831410 | 476456 | 779 | 56280 | 128 |
| 2021-03-28 | 1805962 | 173093 | 129118 | 22630 | 29886401 | 477231 | 775 | 54991 | 126 |
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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (true)

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-> 2021-02-25 4780290 278110 207455 40332 50888770 441413 907 138240 275
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| 2021-04-23 | 1917790 | 115321 | 86023 | 16392 | 56451125 | 496423 | 666 | 35383 | 93 |
| 2021-04-24 | 1851248 | 111942 | 83503 | 15974 | 56484510 | 497079 | 656 | 33384 | 88 |
| 2021-04-25 | 1784995 | 108532 | 80959 | 15548 | 56515968 | 497725 | 645 | 31458 | 84 |
| 2021-04-26 | 1719157 | 105097 | 78396 | 15116 | 56545573 | 498360 | 634 | 29604 | 79 |

1.3 SCENARIO: seasonal + lockdowns

seasonal + lockdowns

Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 150.062

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

```

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True False

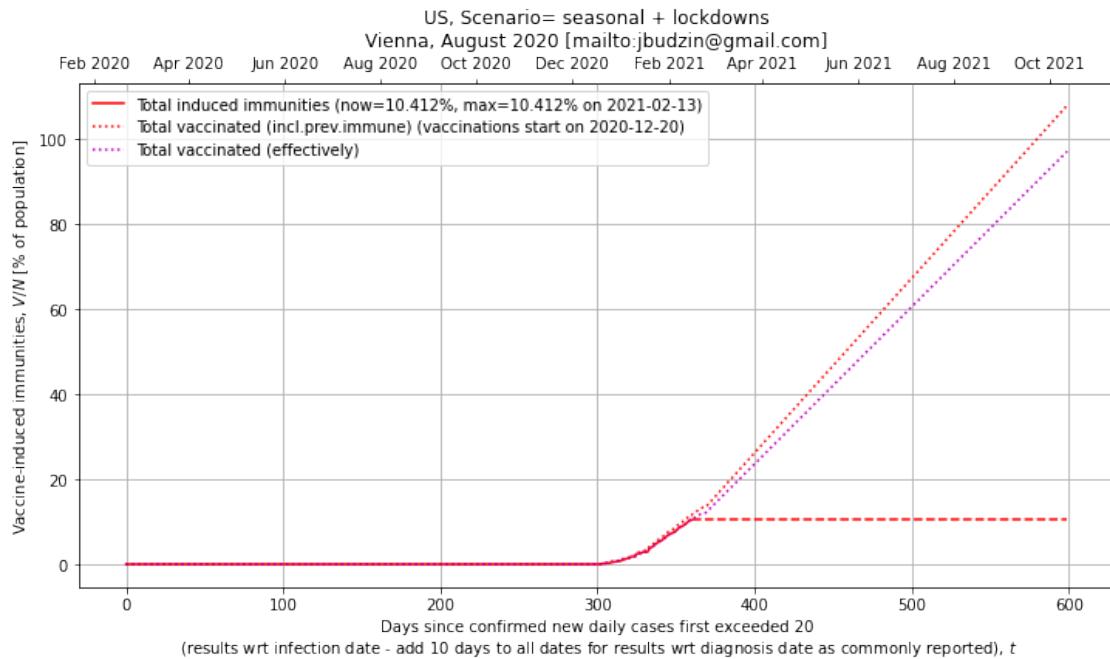
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LOCKDOWN #1: from 2021-02-16 to 2021-02-18 (62.54 perc. of full lockdown)

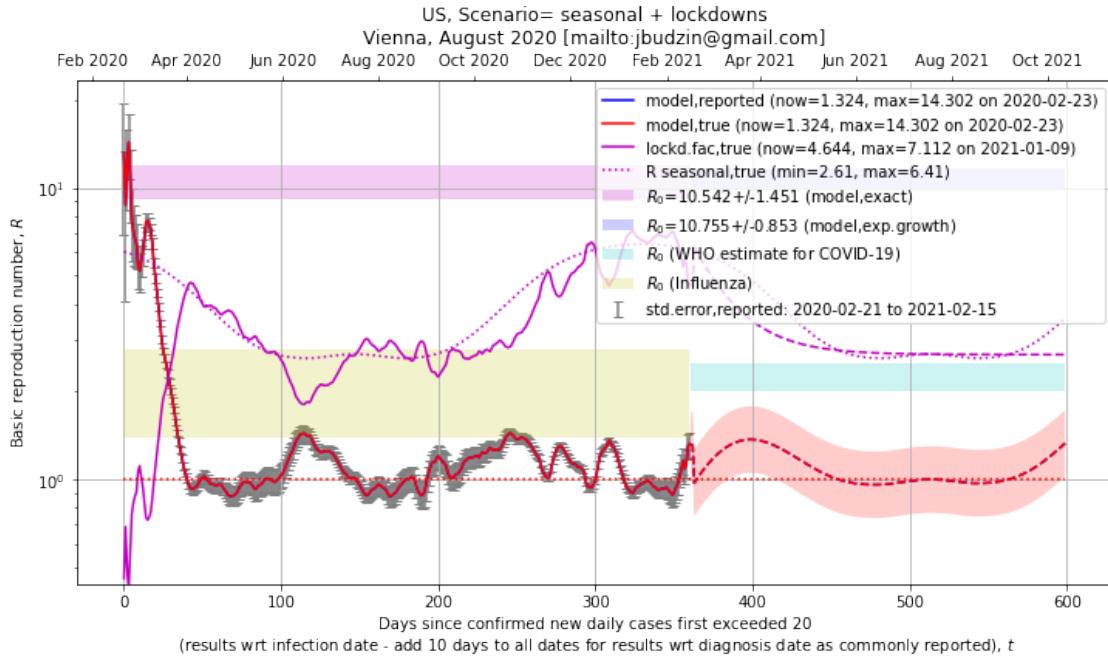
Total lockdown duration [d]= 2.0 (0.84%)
 Total cost [EUR BLN]= 15.762 (24.08 per year)

START/EXIT THRESHOLD = 2.55/0.99

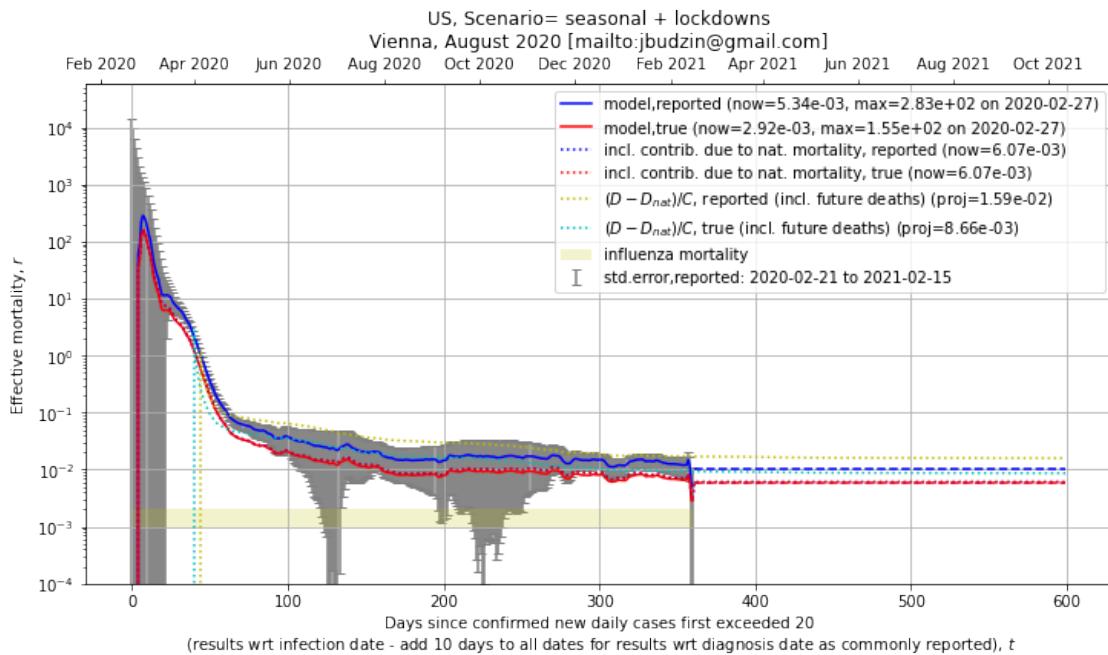
1.3.1 VACCINATED



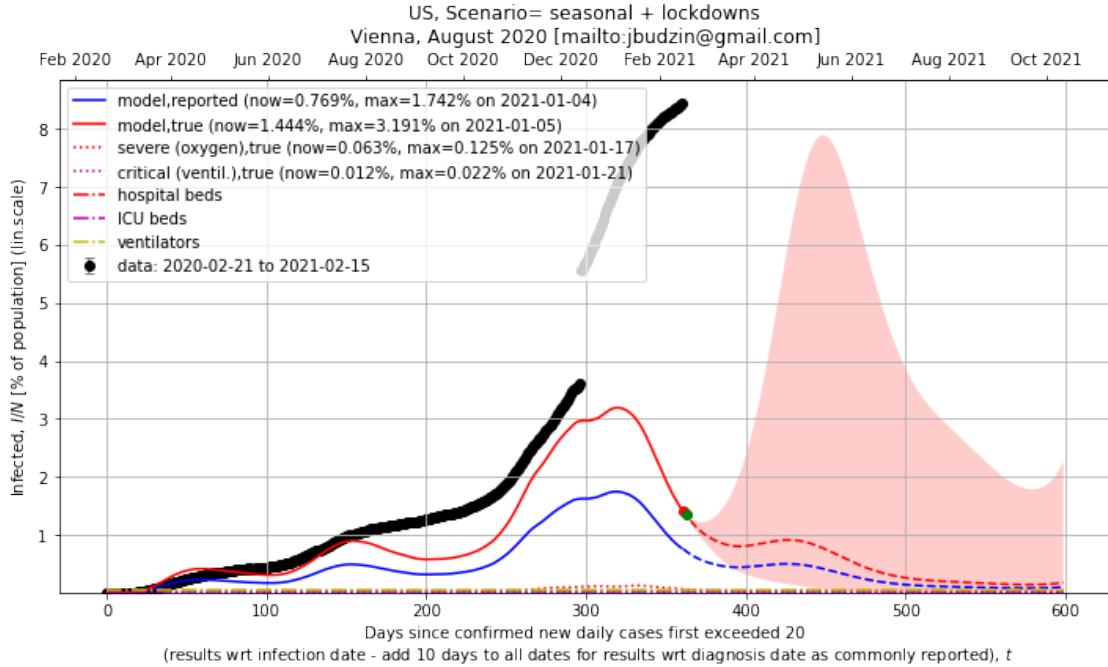
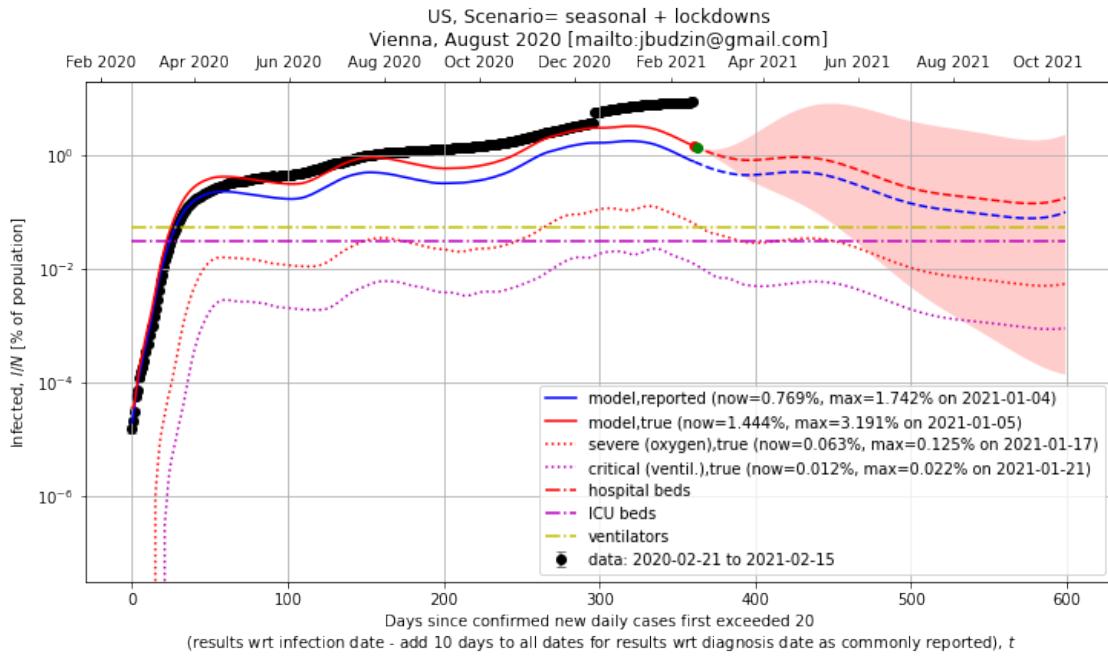
1.3.2 REPRODUCTION NUMBER



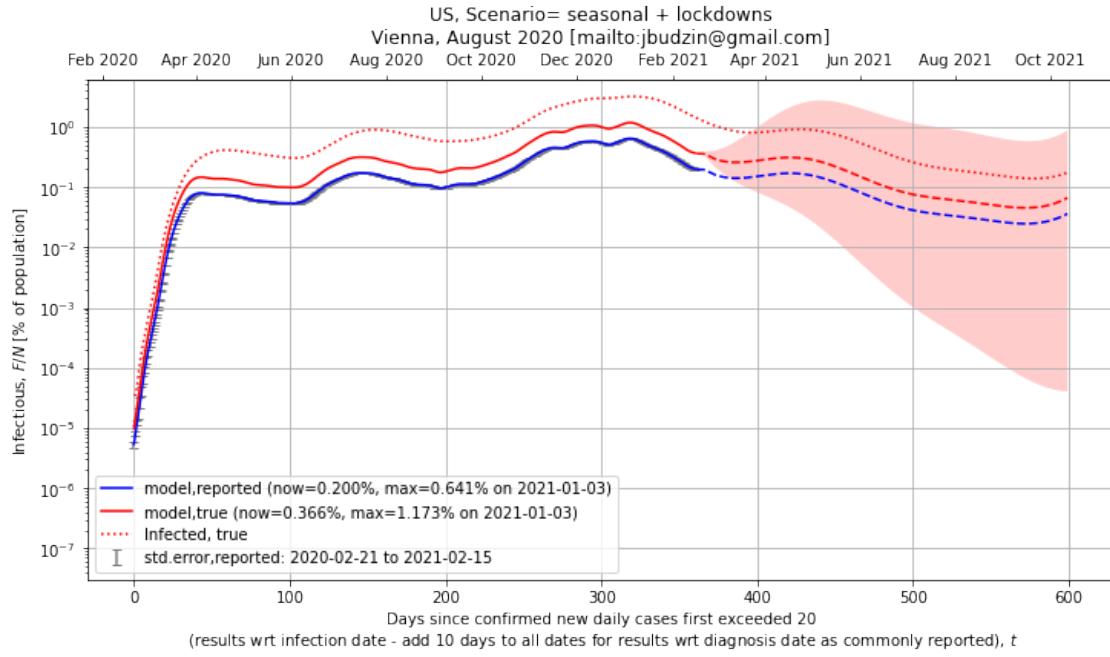
1.3.3 MORTALITY



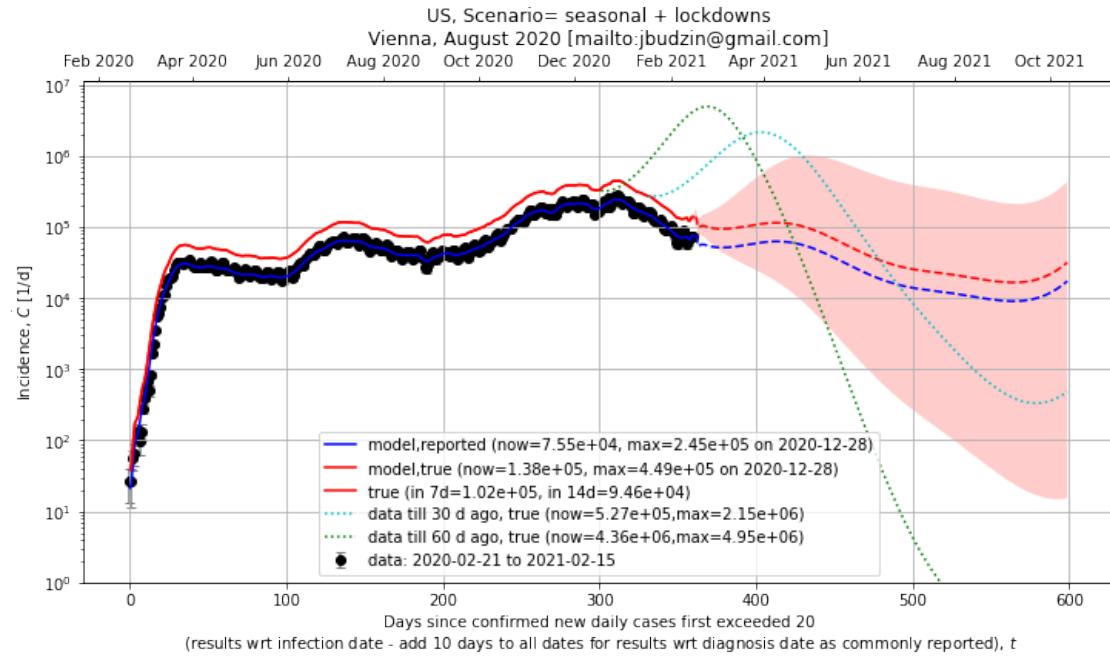
1.3.4 INFECTED

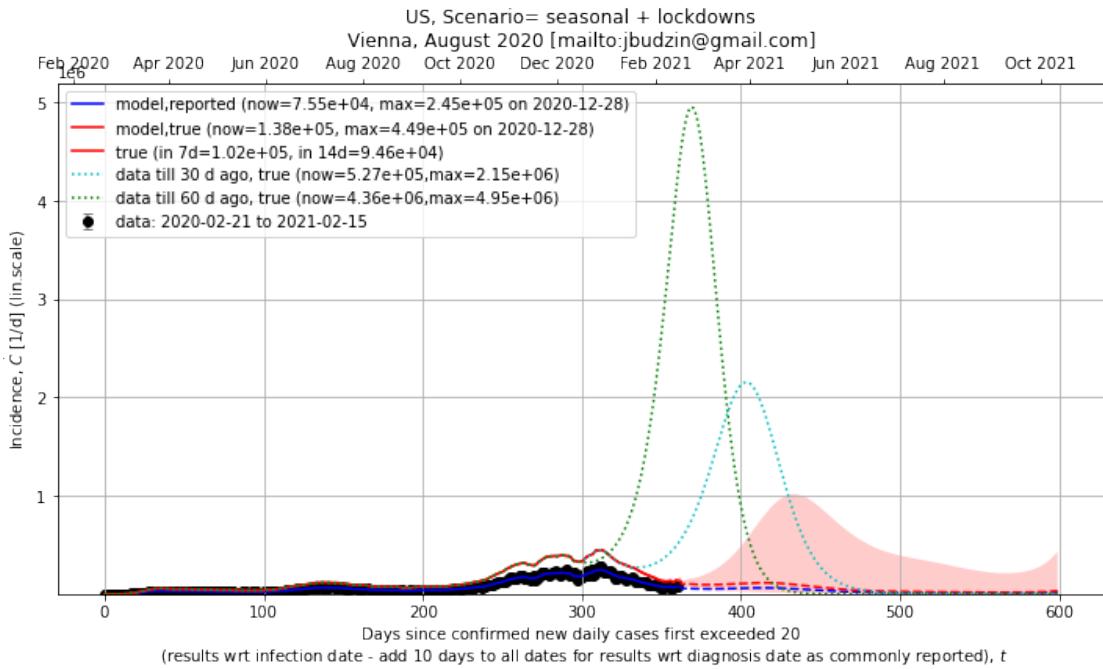


1.3.5 INFECTIOUS

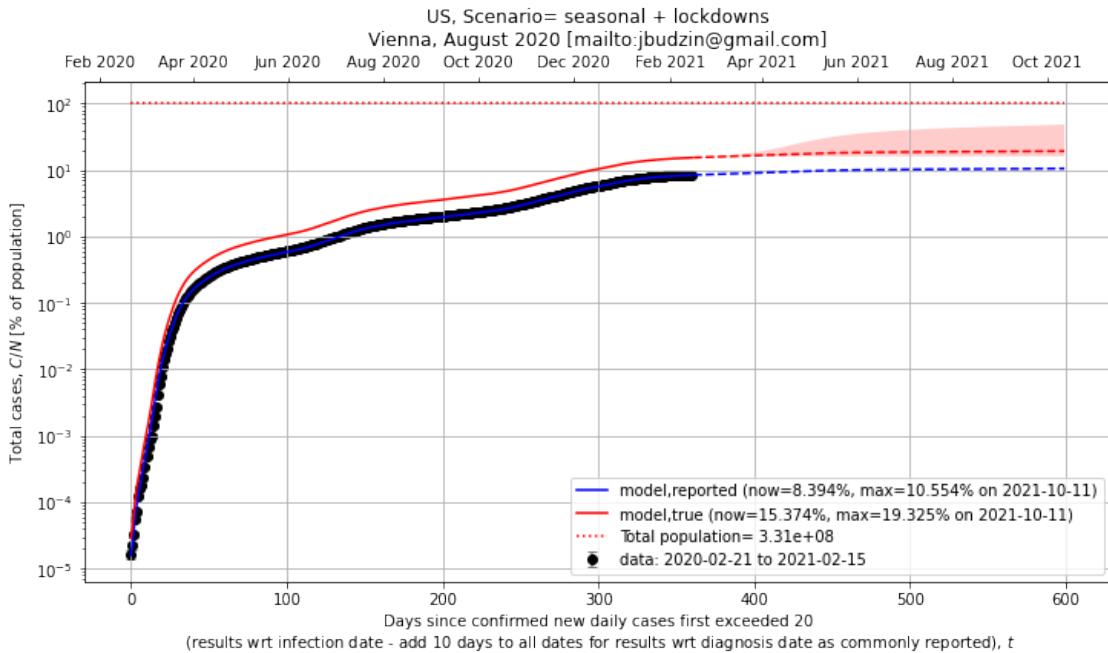


1.3.6 INCIDENCE

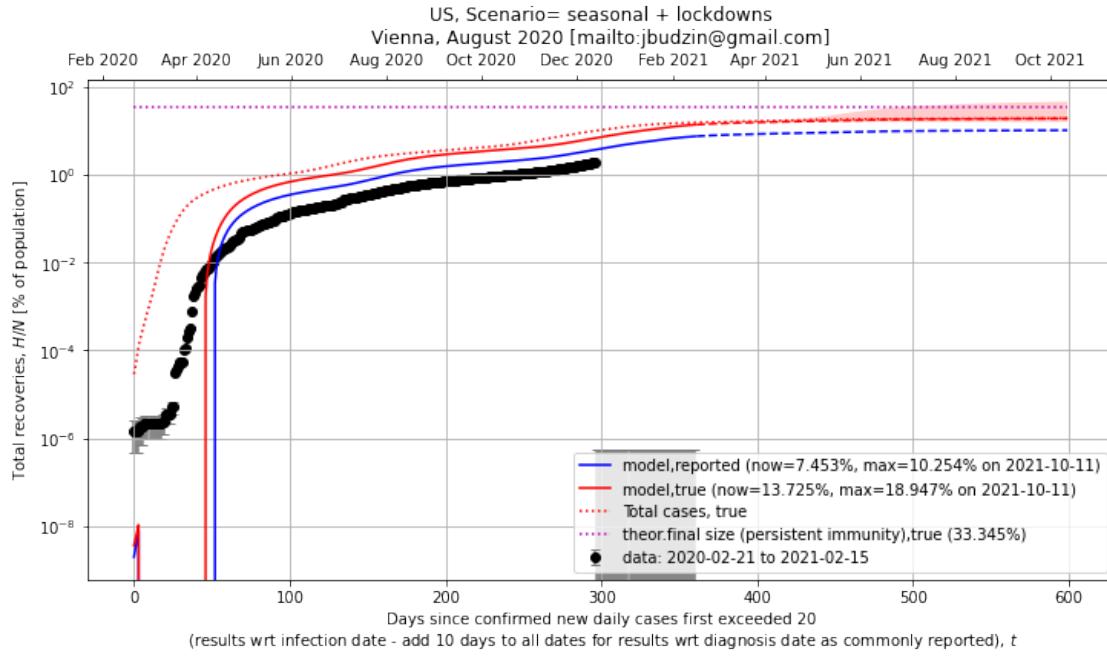




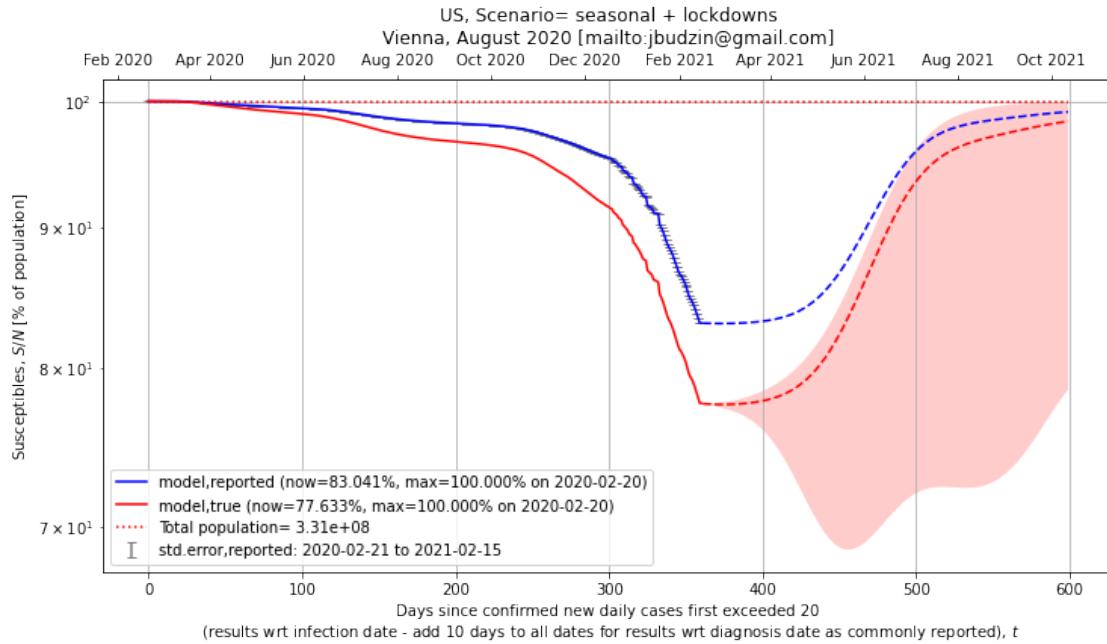
1.3.7 TOTAL CASES



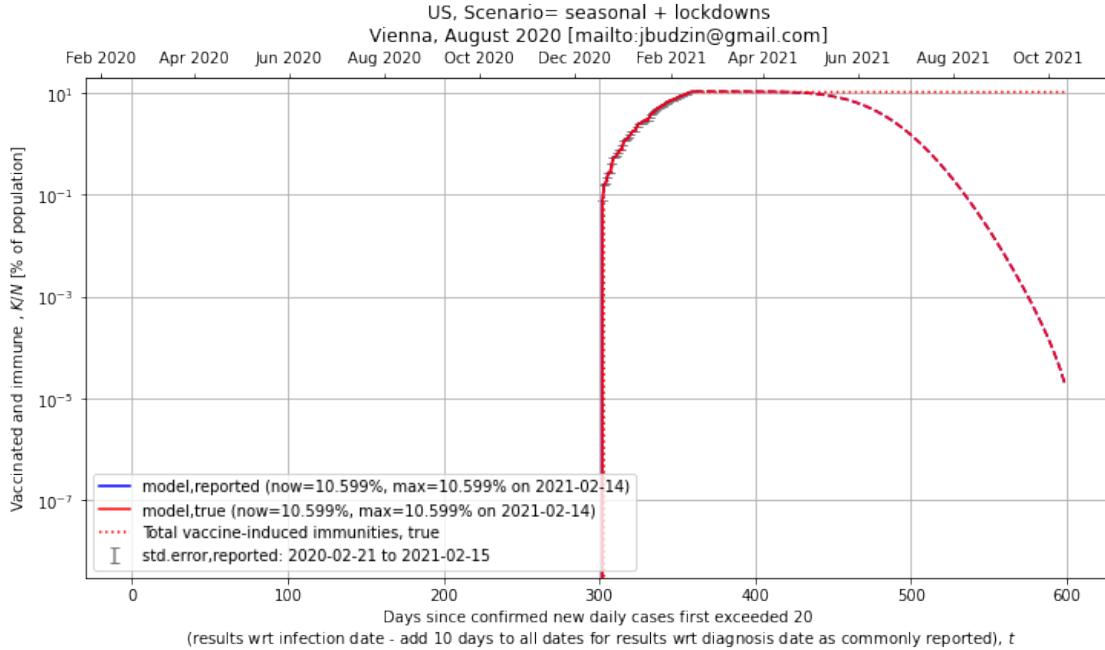
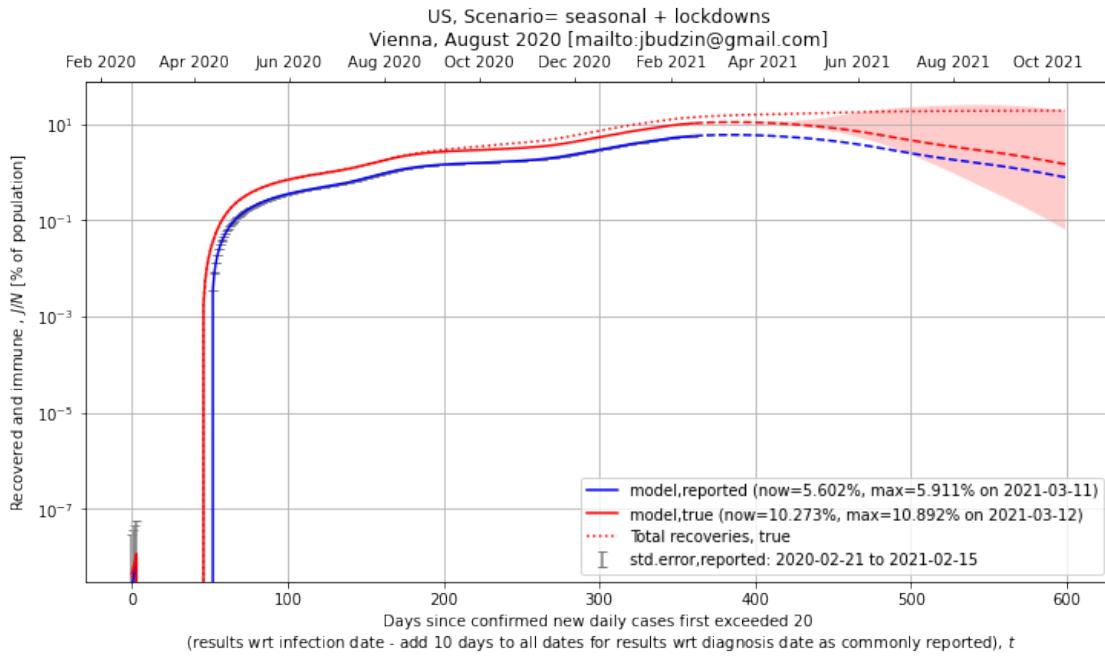
1.3.8 RECOVERED



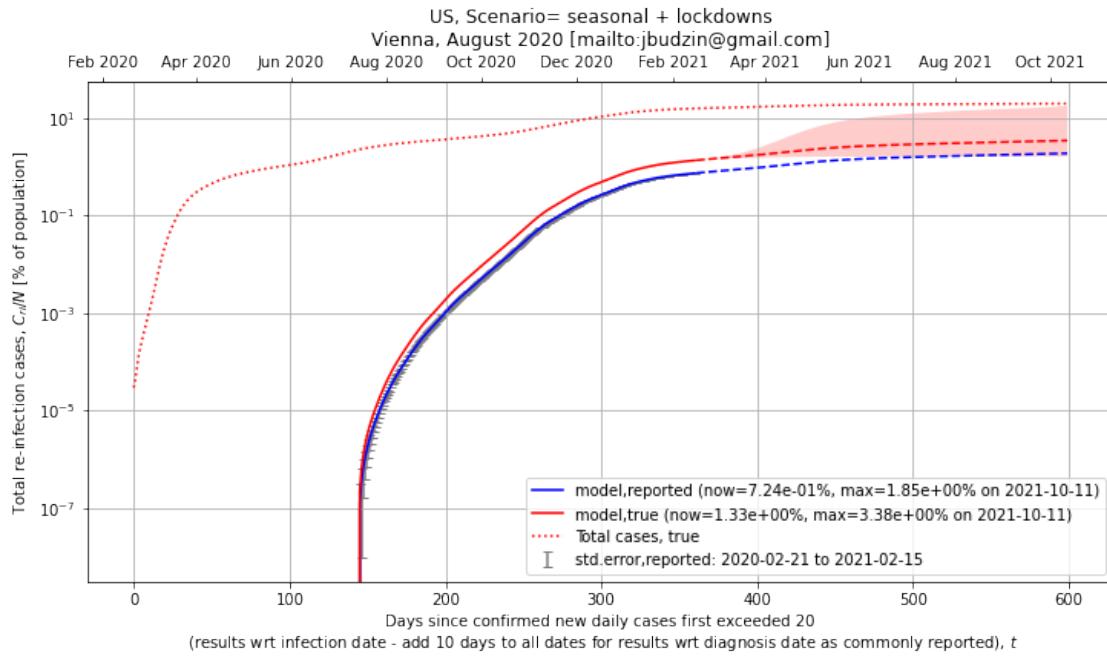
1.3.9 SUSCEPTIBLE



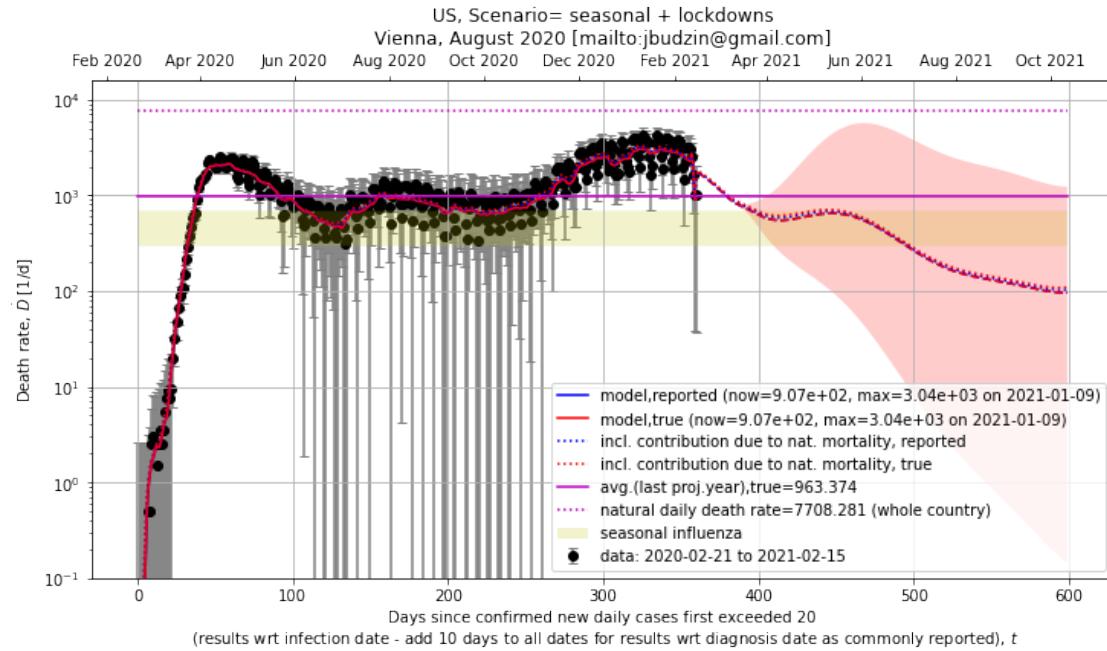
1.3.10 IMMUNE

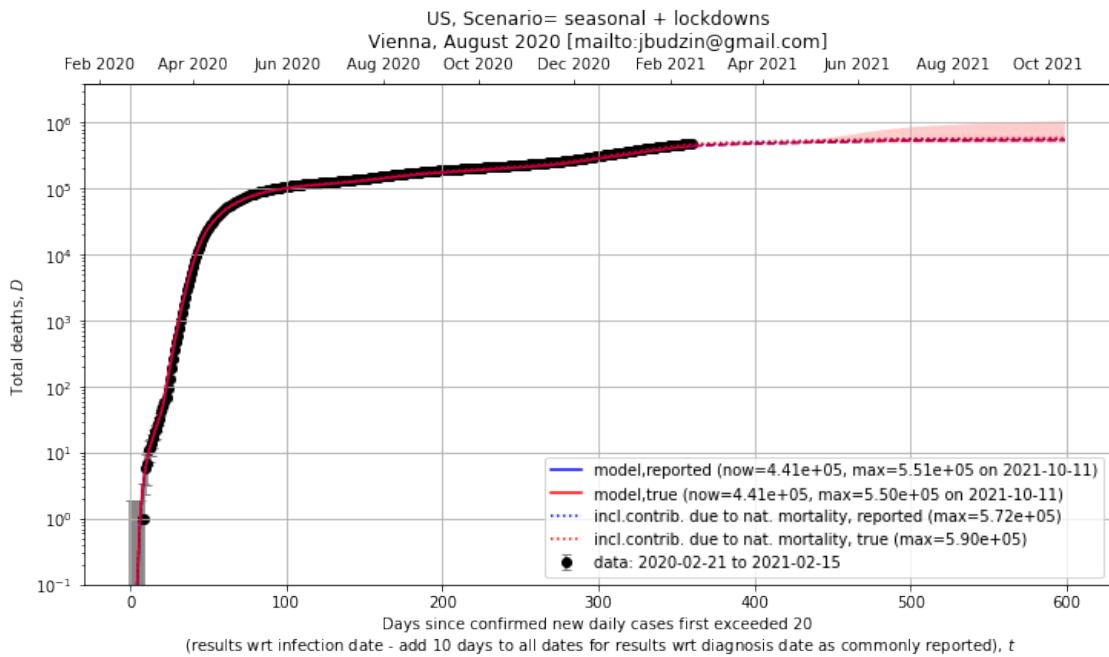
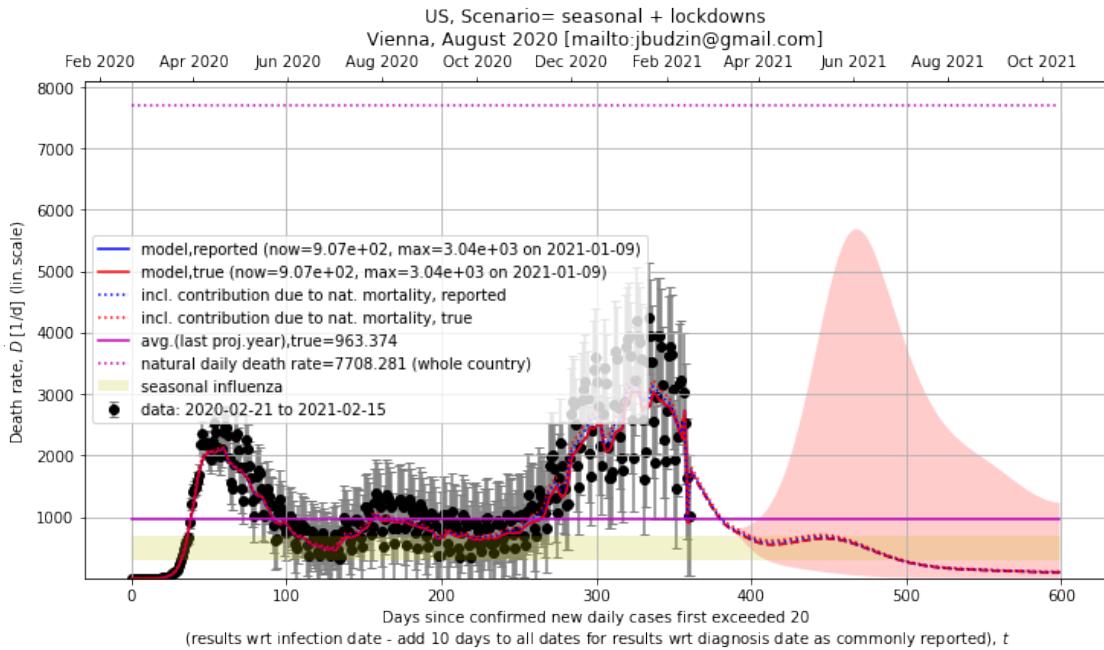


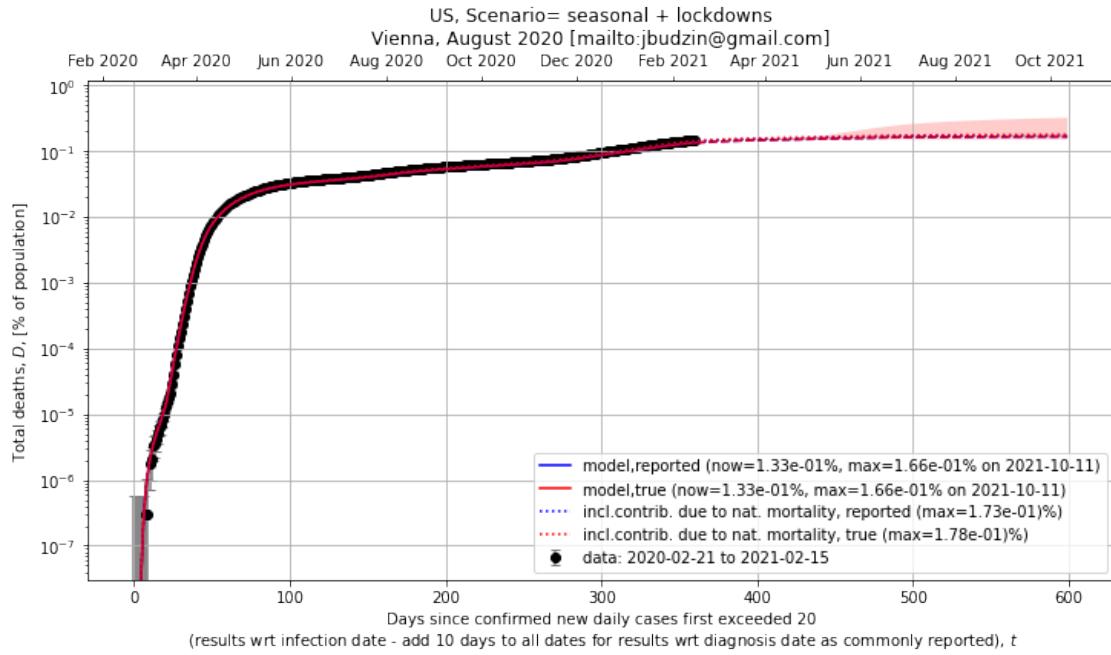
1.3.11 REINFECTIONS



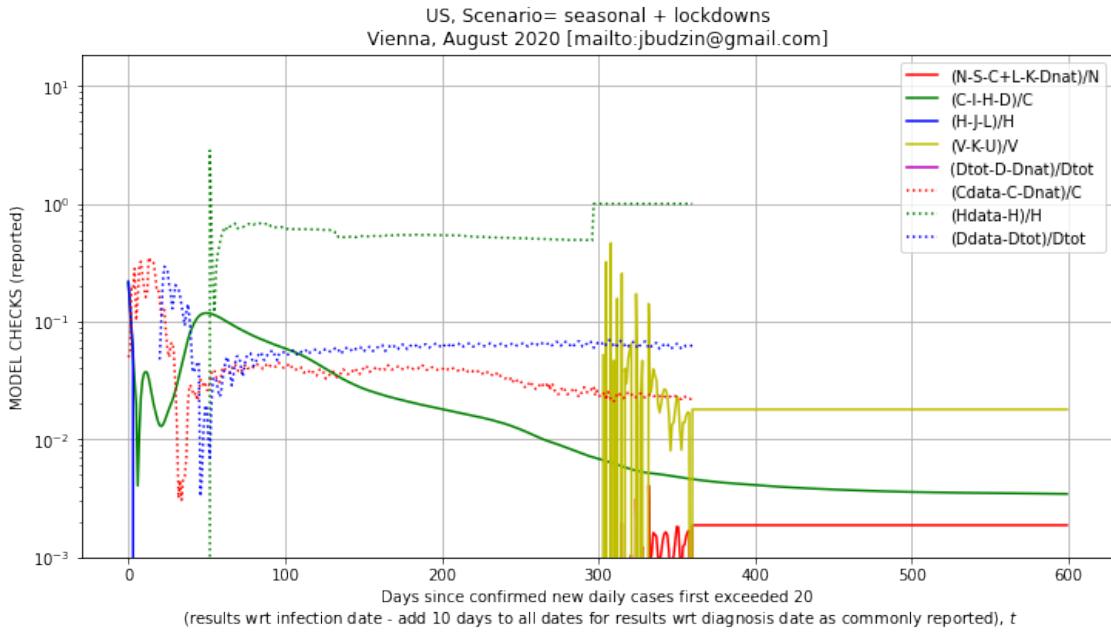
1.3.12 DEATHS

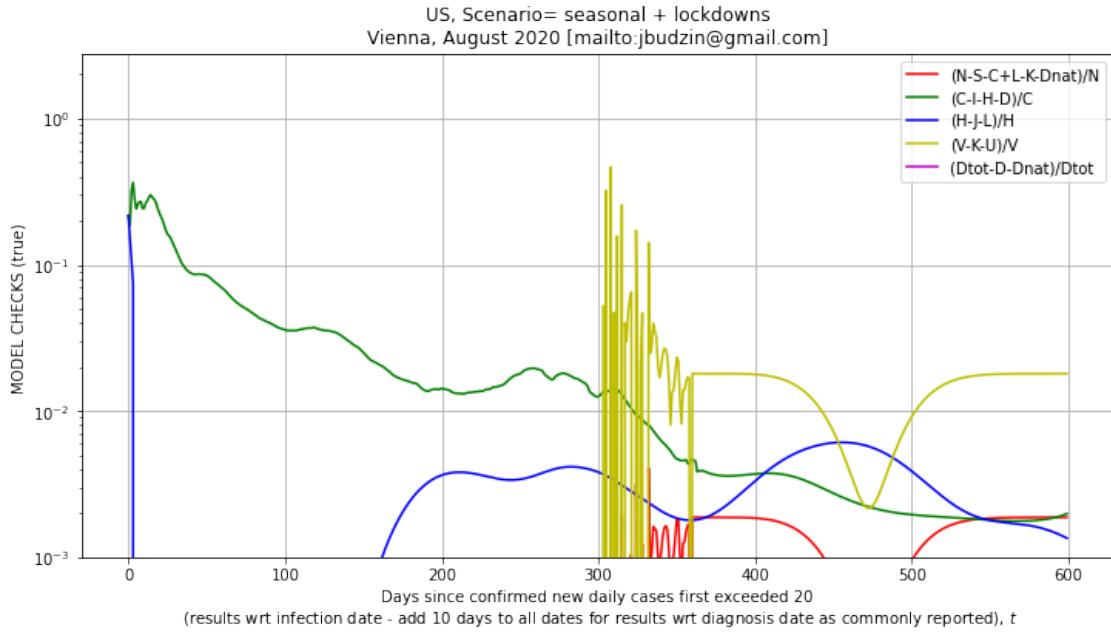






1.3.13 MODEL CHECKS





1.3.14 FORECAST FIGURES

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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (reported)
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2021-02-17 3206764 355550 265221 49751 27211907 425377 2518 71123 171
2021-02-18 3108675 345960 258067 48691 27282477 427811 2434 70570 164
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2021-02-21 2844491 316620 236182 45548 27499633 434763 2266 73311 153
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2021-02-24 2610038 287560 214504 41693 27709789 440506 904 75753 149
-> 2021-02-25 2545531 278110 207455 40332 27785268 441413 907 75479 150
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2021-03-03 2162899 221380 165138 32602 28156460 451175 1519 56729 140

```

| | | | | | | | | | |
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| 2021-03-04 | 2107813 | 213384 | 159172 | 31432 | 28212948 | 452652 | 1476 | 56487 | 134 |
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| 2021-03-09 | 1876577 | 184998 | 137998 | 25691 | 28483923 | 459397 | 1264 | 52764 | 117 |
| 2021-03-10 | 1838480 | 180694 | 134788 | 24780 | 28536237 | 460619 | 1222 | 52314 | 116 |
| 2021-03-11 | 1802877 | 178651 | 133264 | 23997 | 28588215 | 461800 | 1180 | 51977 | 114 |
| 2021-03-12 | 1769585 | 177110 | 132114 | 23393 | 28639942 | 462940 | 1140 | 51727 | 113 |
| 2021-03-13 | 1738395 | 175852 | 131176 | 22962 | 28691488 | 464041 | 1100 | 51546 | 112 |
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| 2021-03-15 | 1681488 | 170378 | 127092 | 22239 | 28794280 | 466130 | 1026 | 51364 | 110 |
| 2021-03-16 | 1655413 | 166566 | 124249 | 21921 | 28845638 | 467121 | 991 | 51358 | 109 |
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| 2021-03-25 | 1486205 | 139339 | 103939 | 19251 | 29315541 | 474864 | 784 | 53379 | 110 |
| 2021-03-26 | 1475670 | 136842 | 102077 | 18807 | 29369319 | 475635 | 770 | 53777 | 110 |
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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (true)

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-> 2021-02-25 4780290 278110 207455 40332 50888770 441413 907 138240 275
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| | | | | | | | | | |
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| 2021-04-15 | 2793233 | 128430 | 95802 | 16160 | 55925566 | 488458 | 556 | 113737 | 235 |
| 2021-04-16 | 2810961 | 129312 | 96459 | 16246 | 56039648 | 489011 | 552 | 114082 | 237 |
| 2021-04-17 | 2828789 | 130249 | 97159 | 16342 | 56153996 | 489562 | 550 | 114347 | 238 |
| 2021-04-18 | 2846557 | 131234 | 97894 | 16448 | 56268525 | 490110 | 548 | 114529 | 239 |
| 2021-04-19 | 2864108 | 132260 | 98658 | 16563 | 56383148 | 490658 | 547 | 114623 | 240 |
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1.4 SCENARIO: seasonal + vaccination

seasonal + vaccination

Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 150.062

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

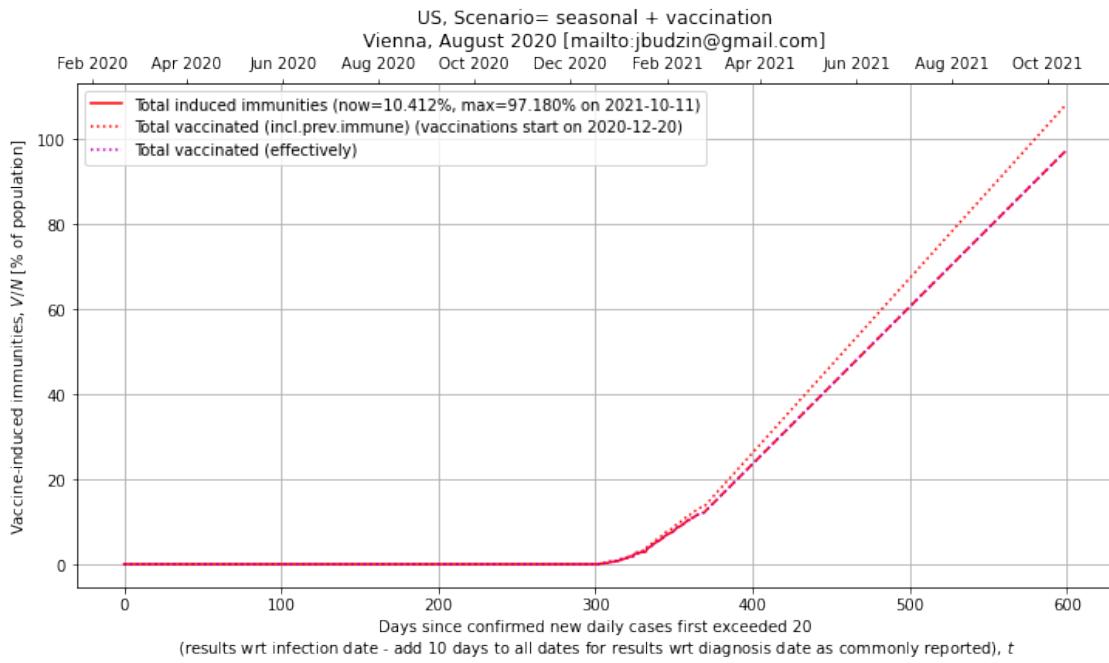
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

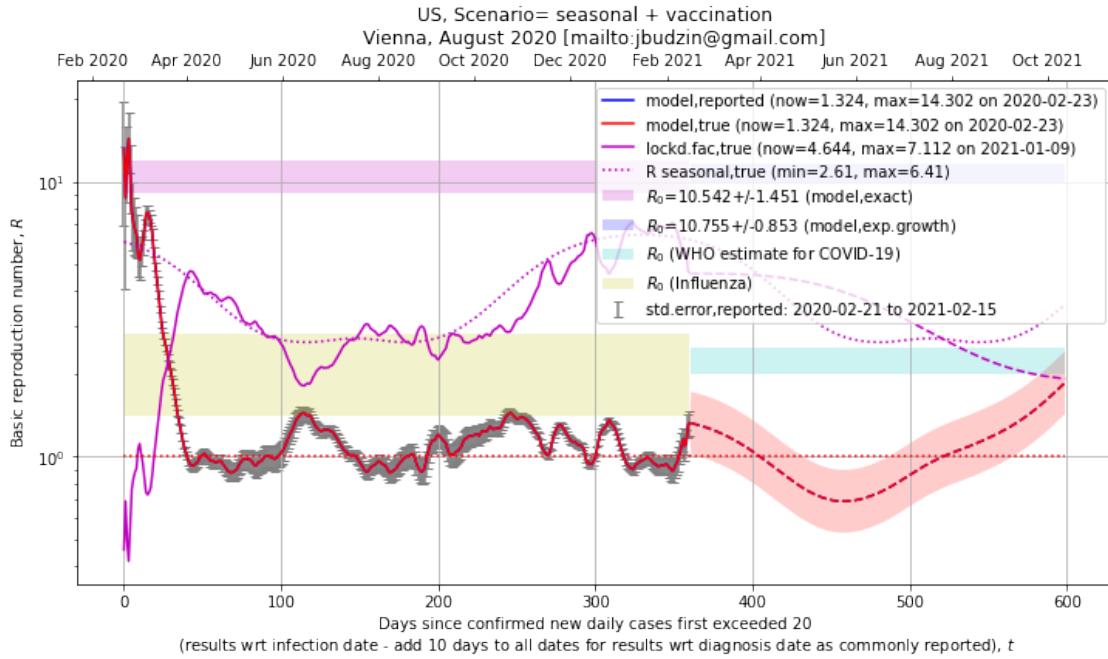
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V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True
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 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True
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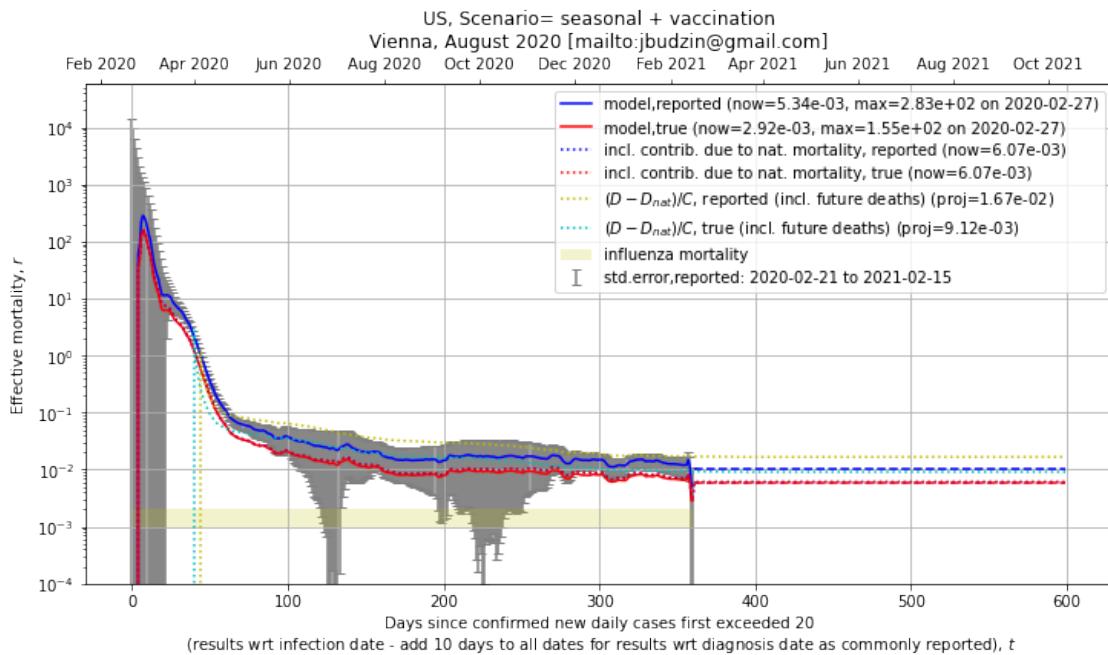
1.4.1 VACCINATED



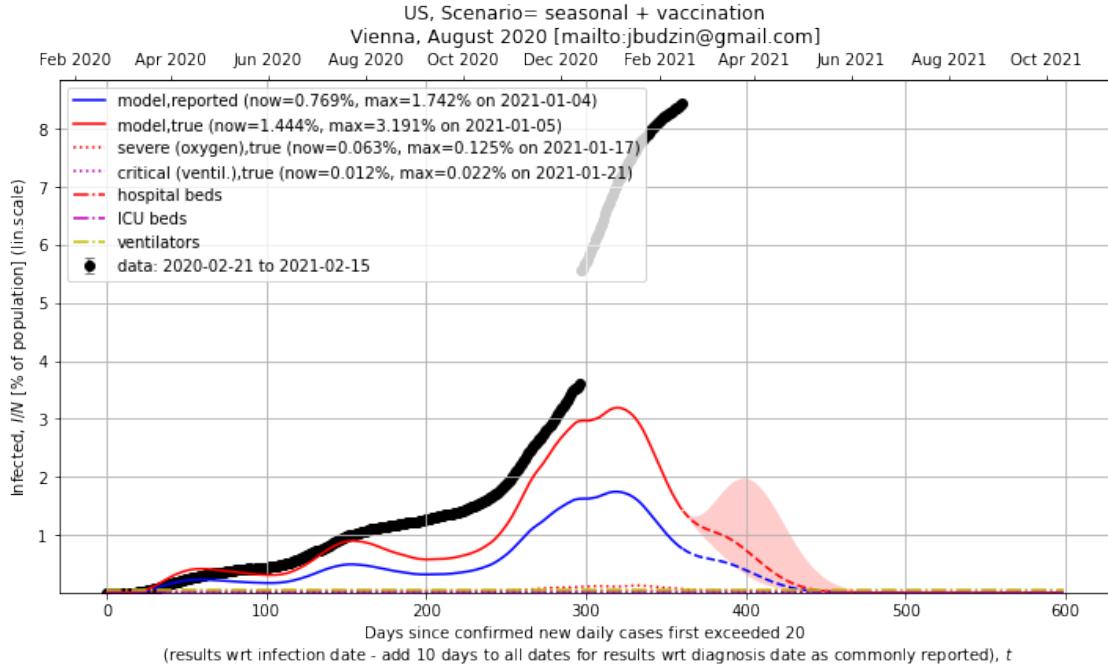
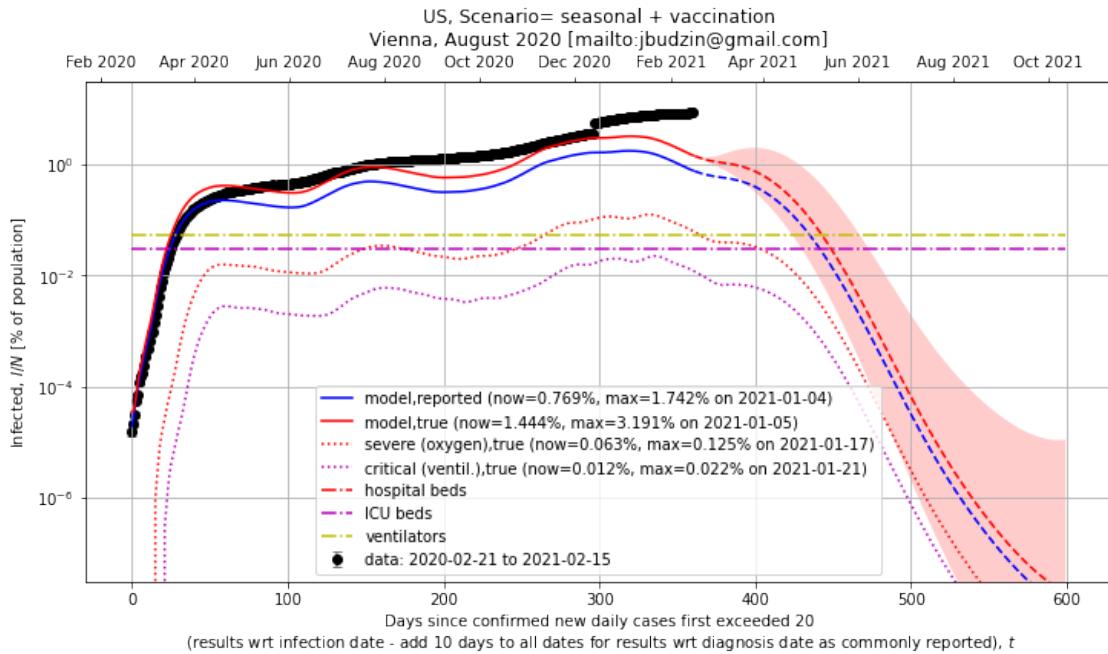
1.4.2 REPRODUCTION NUMBER



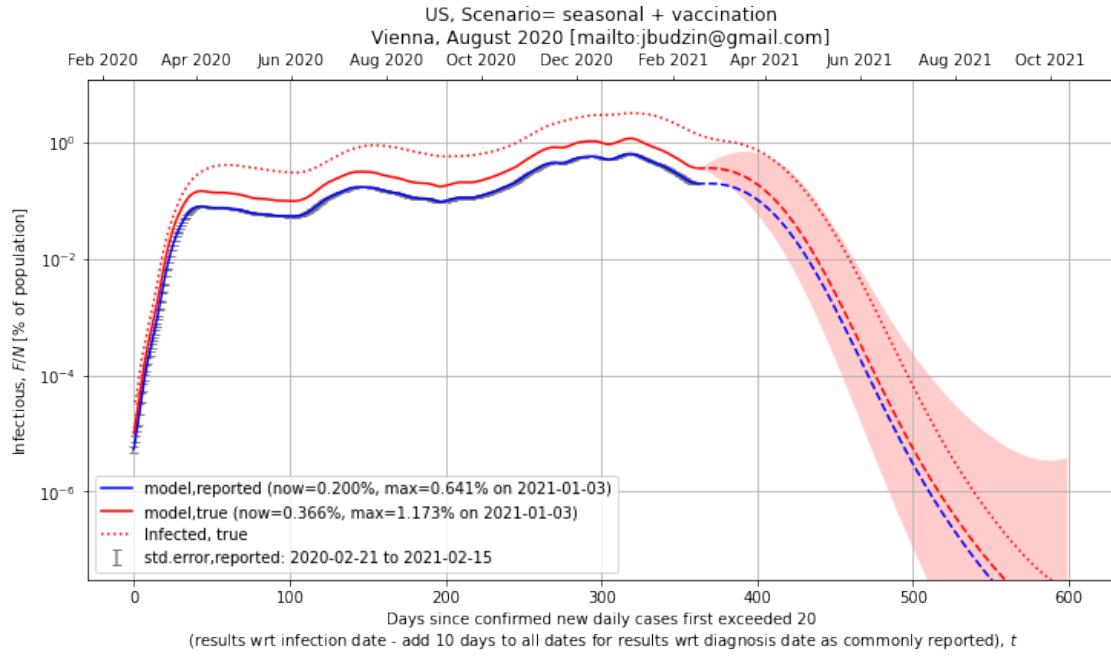
1.4.3 MORTALITY



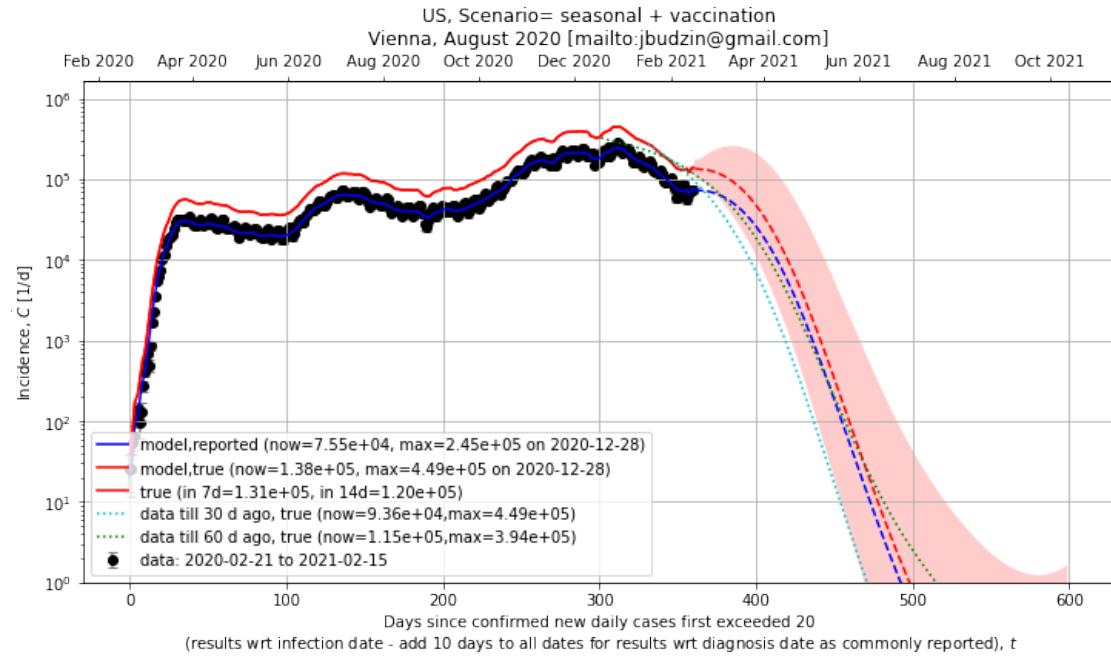
1.4.4 INFECTED

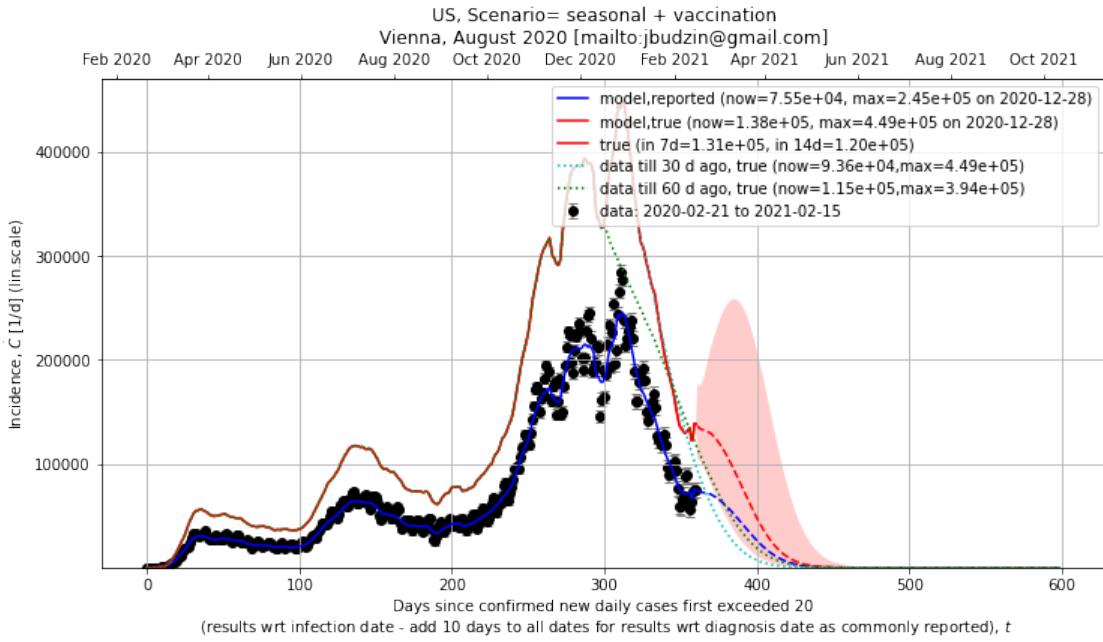


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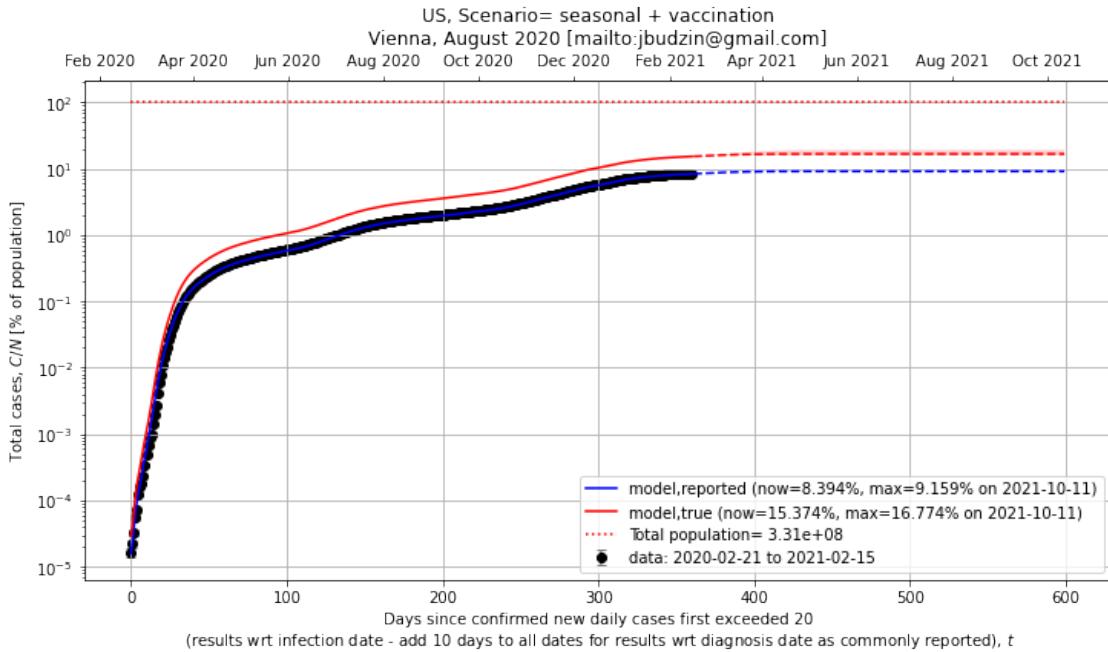


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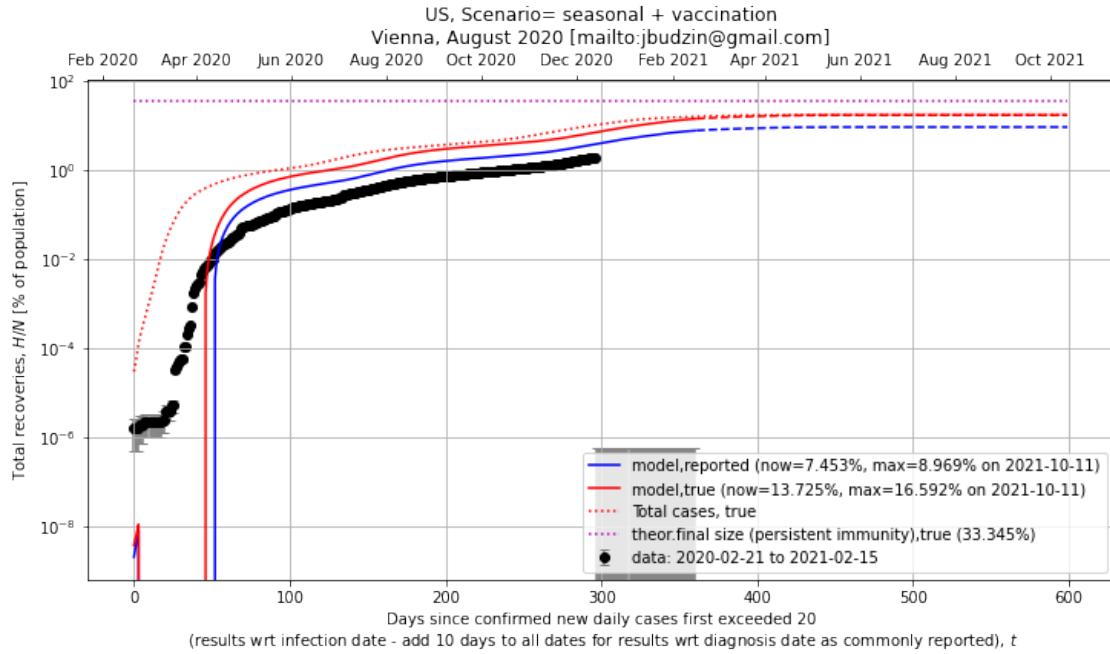




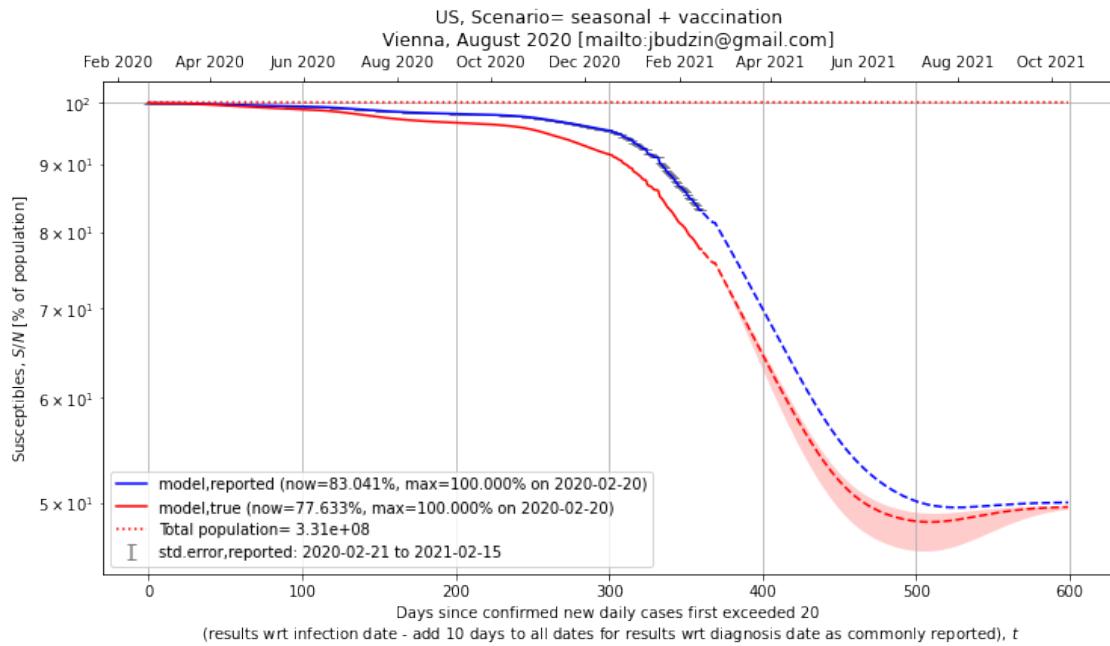
1.4.7 TOTAL CASES



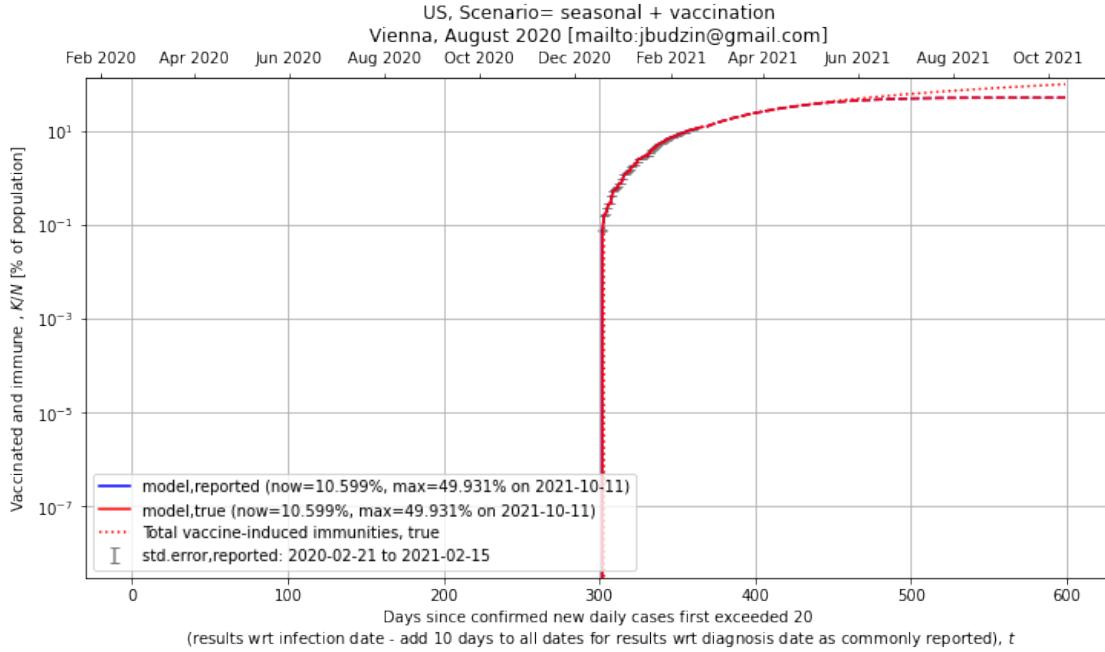
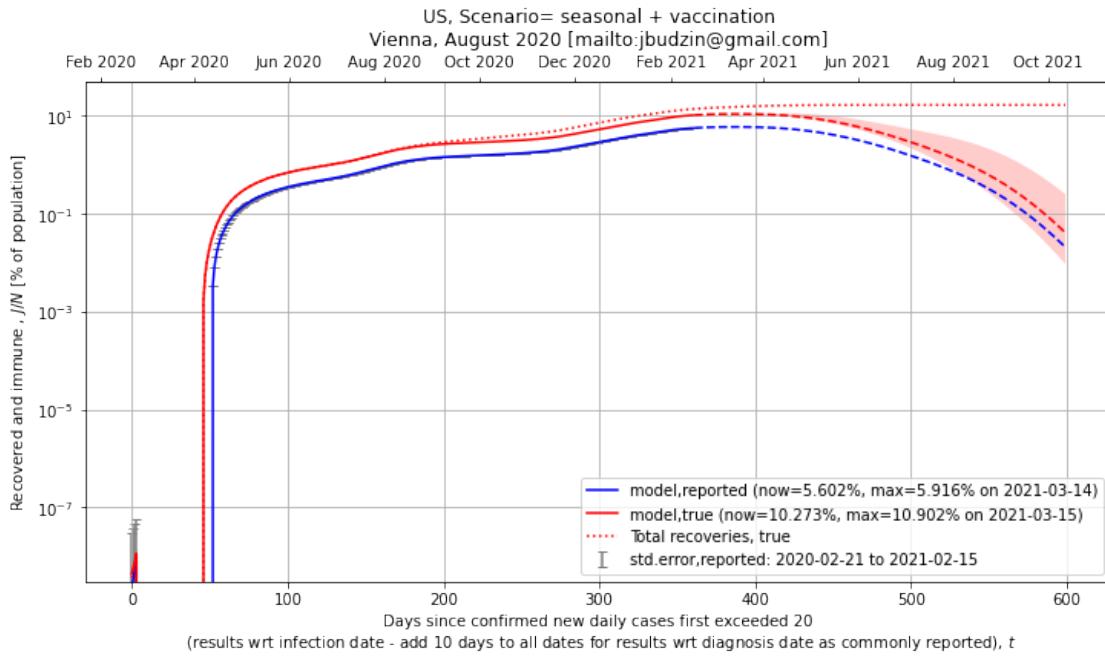
1.4.8 RECOVERED



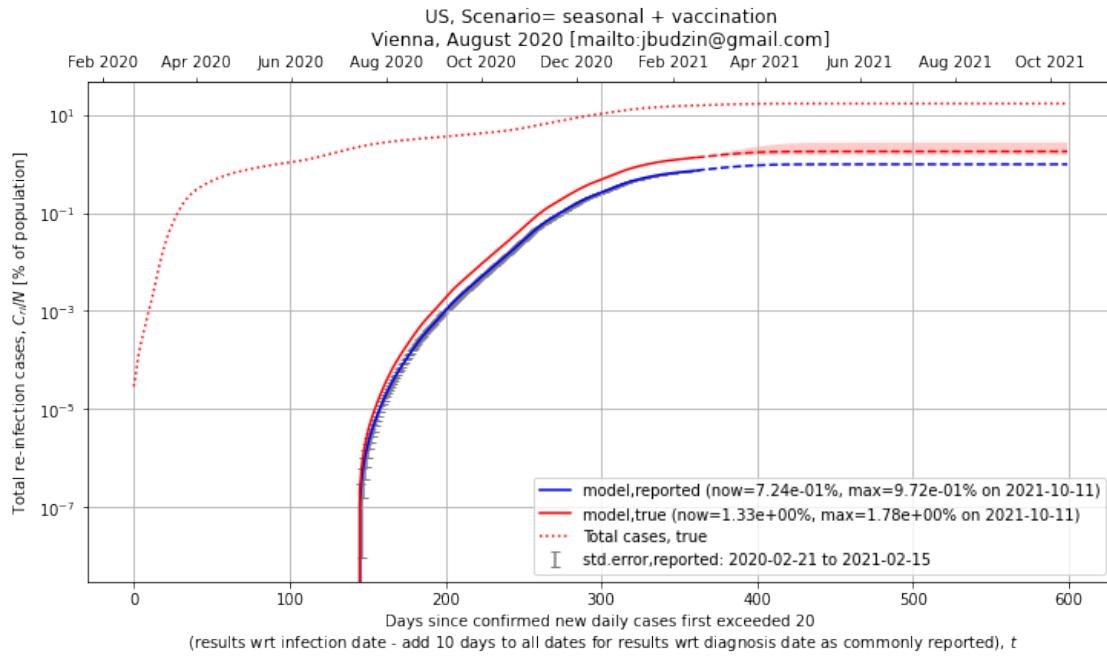
1.4.9 SUSCEPTIBLE



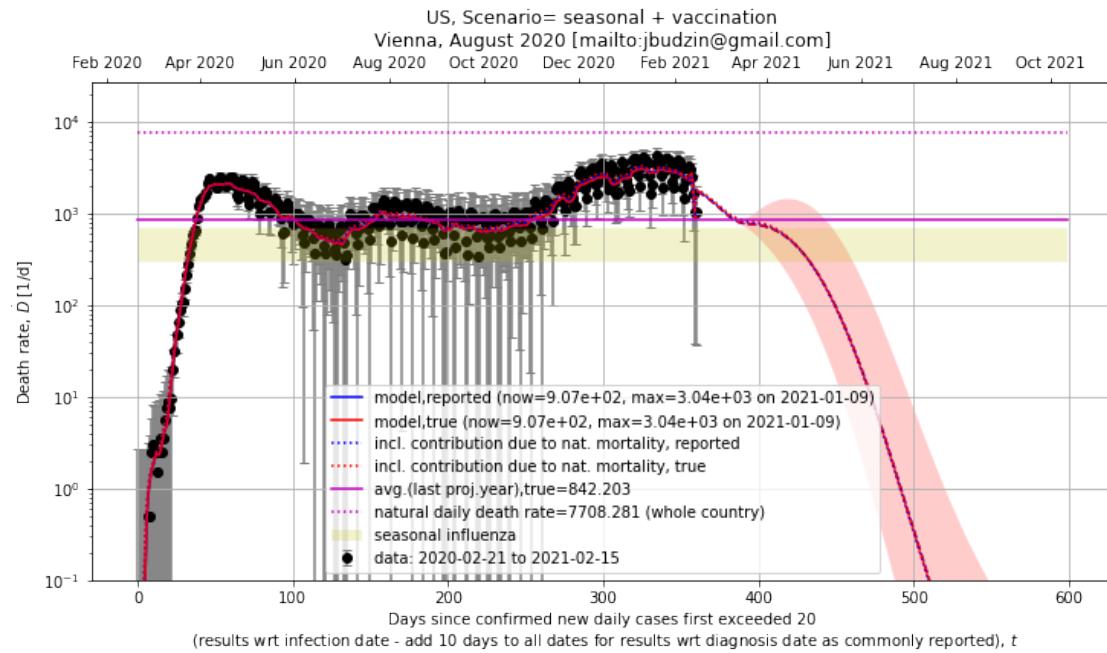
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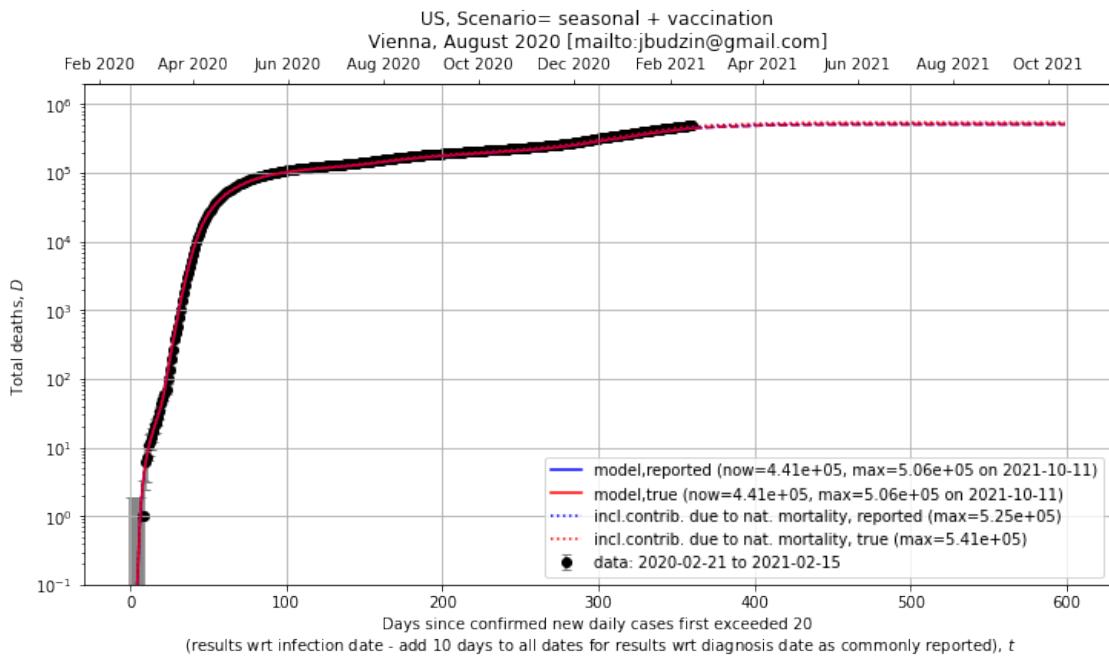
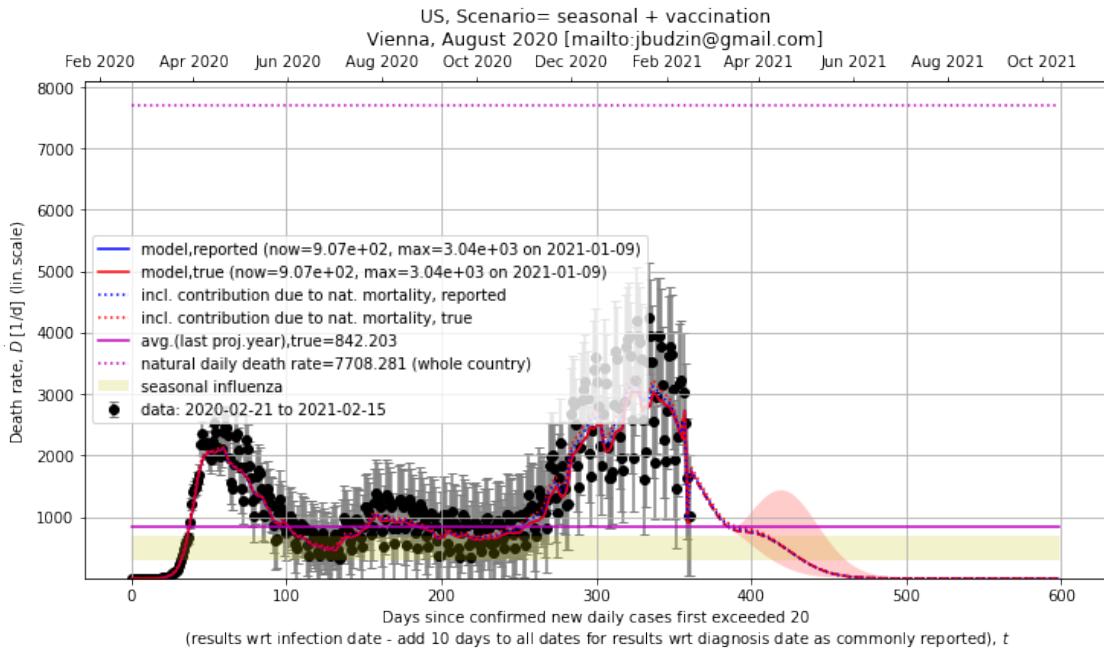


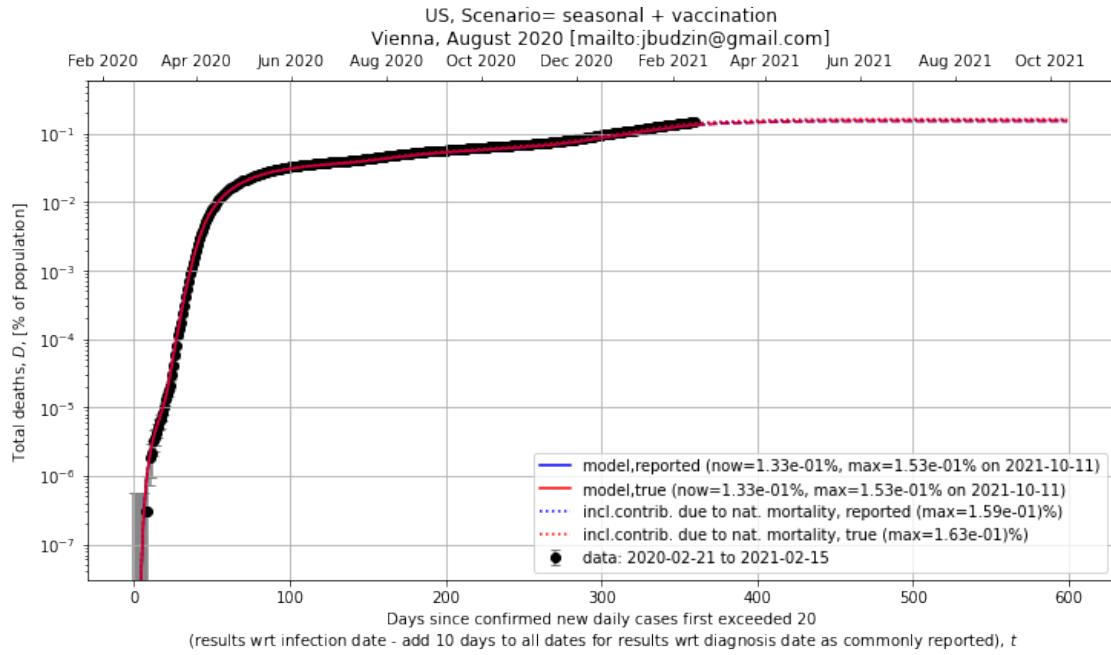
1.4.11 REINFECTIONS



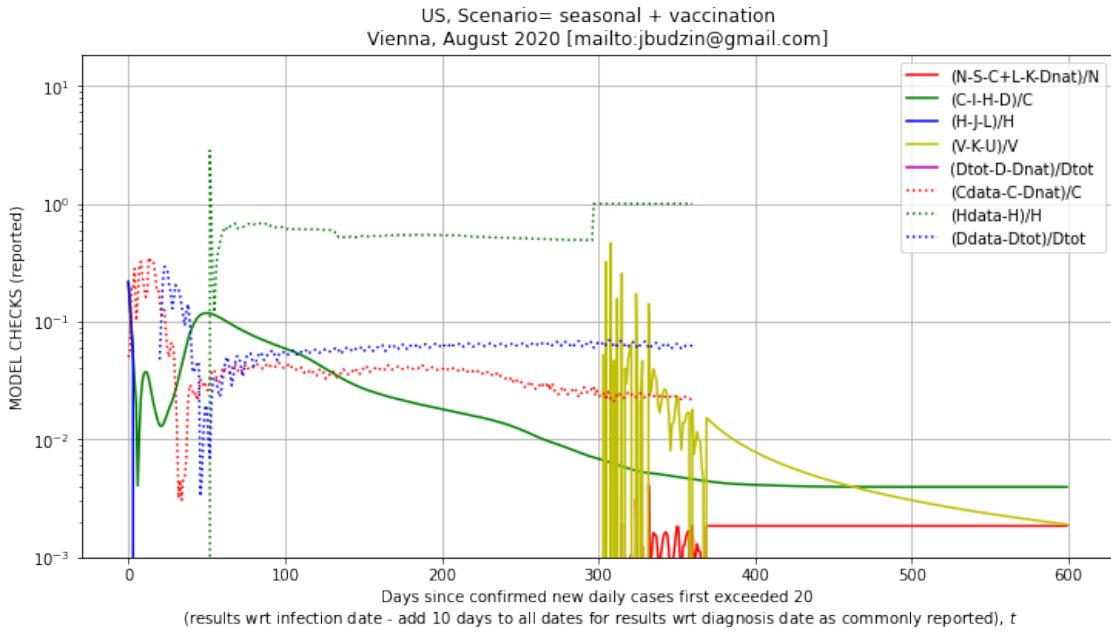
1.4.12 DEATHS

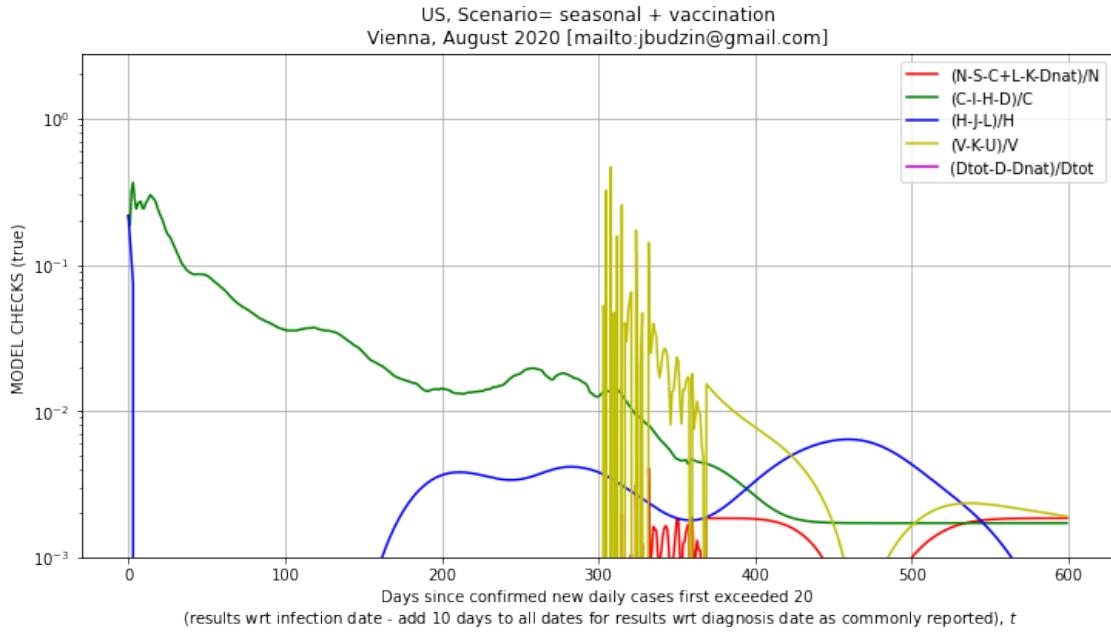






1.4.13 MODEL CHECKS





1.4.14 FORECAST FIGURES

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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (reported)
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2021-02-13 3631707 393823 293771 54819 26919397 414913 2760 79601 202
2021-02-14 3521022 384254 286633 53409 26994681 417617 2703 75284 194
2021-02-15 3412816 374760 279551 52135 27067977 420268 2651 73295 185
2021-02-16 3308494 365194 272415 50910 27140784 422859 2591 72807 177
2021-02-17 3206764 355550 265221 49751 27211907 425377 2518 71123 171
2021-02-18 3108675 345960 258067 48691 27282477 427811 2434 70570 164
2021-02-19 3015501 336263 250834 47735 27353834 430173 2362 71356 158
2021-02-20 2927548 326460 243521 46701 27426322 432496 2323 72488 155
2021-02-21 2844491 316620 236182 45548 27499633 434763 2266 73311 153
2021-02-22 2759001 306862 228902 44301 27566439 437495 2731 66806 152
2021-02-23 2678390 297183 221682 43007 27634036 439602 2106 67596 150
2021-02-24 2610038 287560 214504 41693 27709789 440506 904 75753 149
-> 2021-02-25 2545531 278110 207455 40332 27785268 441413 907 75479 150
2021-02-26 2484213 268608 200367 38954 27859812 443148 1735 74543 151
2021-02-27 2425888 258895 193122 37615 27933227 444840 1691 73415 152
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2021-03-01 2320136 239258 178473 35015 28078668 448093 1605 72562 153
2021-03-02 2272915 229915 171504 33772 28150961 449656 1562 72292 154
2021-03-03 2229431 221380 165138 32602 28222992 451175 1519 72031 156
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| | | | | | | | | | |
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| 2021-03-05 | 2153142 | 206114 | 153750 | 30226 | 28365983 | 454086 | 1434 | 71307 | 153 |
| 2021-03-06 | 2120064 | 199784 | 149028 | 29019 | 28436839 | 455478 | 1391 | 70855 | 152 |
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| 2021-03-08 | 2062980 | 190074 | 141785 | 26678 | 28576835 | 458133 | 1306 | 69574 | 151 |
| 2021-03-09 | 2038161 | 184998 | 137998 | 25691 | 28645507 | 459397 | 1264 | 68672 | 150 |
| 2021-03-10 | 2015468 | 180694 | 134788 | 24780 | 28713226 | 460619 | 1222 | 67719 | 149 |
| 2021-03-11 | 1994594 | 178651 | 133264 | 23997 | 28779934 | 461800 | 1180 | 66708 | 148 |
| 2021-03-12 | 1975198 | 177110 | 132114 | 23393 | 28845565 | 462940 | 1140 | 65631 | 146 |
| 2021-03-13 | 1956921 | 175852 | 131176 | 22962 | 28910048 | 464041 | 1100 | 64482 | 144 |
| 2021-03-14 | 1939395 | 174863 | 130438 | 22692 | 28973309 | 465104 | 1062 | 63260 | 142 |
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| 2021-03-19 | 1851108 | 173636 | 129523 | 22347 | 29268960 | 469908 | 900 | 56180 | 130 |
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| 2021-03-24 | 1739454 | 171660 | 128049 | 22466 | 29525520 | 474095 | 804 | 47958 | 115 |
| 2021-03-25 | 1712906 | 171006 | 127561 | 22500 | 29571756 | 474889 | 793 | 46235 | 111 |
| 2021-03-26 | 1684881 | 170069 | 126862 | 22494 | 29616256 | 475674 | 785 | 44500 | 108 |
| 2021-03-27 | 1655397 | 168488 | 125683 | 22355 | 29659013 | 476453 | 778 | 42757 | 104 |
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| 2021-03-29 | 1592193 | 164931 | 123029 | 22066 | 29739295 | 477995 | 769 | 39270 | 97 |
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| 2021-03-31 | 1523729 | 160849 | 119984 | 21723 | 29812649 | 479524 | 763 | 35817 | 90 |
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| 2021-04-12 | 1044515 | 122788 | 91593 | 17594 | 30119100 | 488396 | 706 | 17734 | 49 |
| 2021-04-13 | 1002866 | 118878 | 88677 | 17121 | 30135628 | 489094 | 697 | 16528 | 46 |
| 2021-04-14 | 961469 | 114910 | 85717 | 16635 | 30151005 | 489782 | 687 | 15376 | 43 |
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| 2021-04-19 | 761654 | 94643 | 70598 | 14061 | 30212500 | 493046 | 627 | 10426 | 30 |
| 2021-04-20 | 723728 | 90590 | 67575 | 13529 | 30222096 | 493660 | 613 | 9595 | 28 |

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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (true)

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| 2021-02-13 | 6854622 | 393823 | 293771 | 54819 | 49302925 | 414913 | 2760 | 145790 | 370 | |
| 2021-02-14 | 6651478 | 384254 | 286633 | 53409 | 49440808 | 417617 | 2703 | 137883 | 355 | |
| 2021-02-15 | 6448758 | 374760 | 279551 | 52135 | 49575050 | 420268 | 2651 | 134241 | 340 | |
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| 2021-02-18 | 5873195 | 345960 | 258067 | 48691 | 49967908 | 427811 | 2434 | 129249 | 301 | |
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| 2021-02-20 | 5522896 | 326460 | 243521 | 46701 | 50231360 | 432496 | 2323 | 132762 | 284 | |
| 2021-02-21 | 5361810 | 316620 | 236182 | 45548 | 50365629 | 434763 | 2266 | 134269 | 280 | |
| 2021-02-22 | 5209690 | 306862 | 228902 | 44301 | 50487985 | 437495 | 2731 | 122355 | 279 | |
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| 2021-02-24 | 4905476 | 287560 | 214504 | 41693 | 50750530 | 440506 | 904 | 138742 | 272 | |
| -> | 2021-02-25 | 4780290 | 278110 | 207455 | 40332 | 50888770 | 441413 | 907 | 138240 | 275 |
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| 2021-02-28 | 4443018 | 249138 | 185843 | 36313 | 51293234 | 446488 | 1648 | 133478 | 280 | |
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| 2021-03-03 | 4162849 | 221380 | 165138 | 32602 | 51690463 | 451175 | 1519 | 131925 | 286 | |
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| 2021-03-05 | 4010149 | 206114 | 153750 | 30226 | 51952351 | 454086 | 1434 | 130599 | 281 | |
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1.5 SCENARIO: seas. + vacc + variant (w/o imm.esc.)

seasonal + lockdowns + vaccination

Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 150.062

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

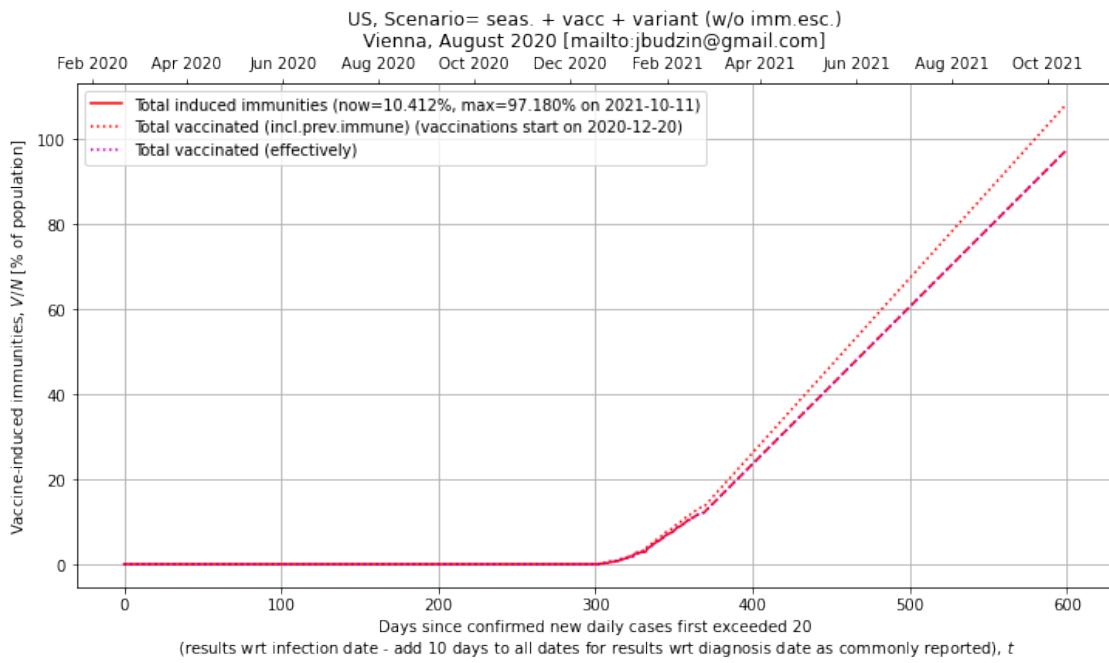
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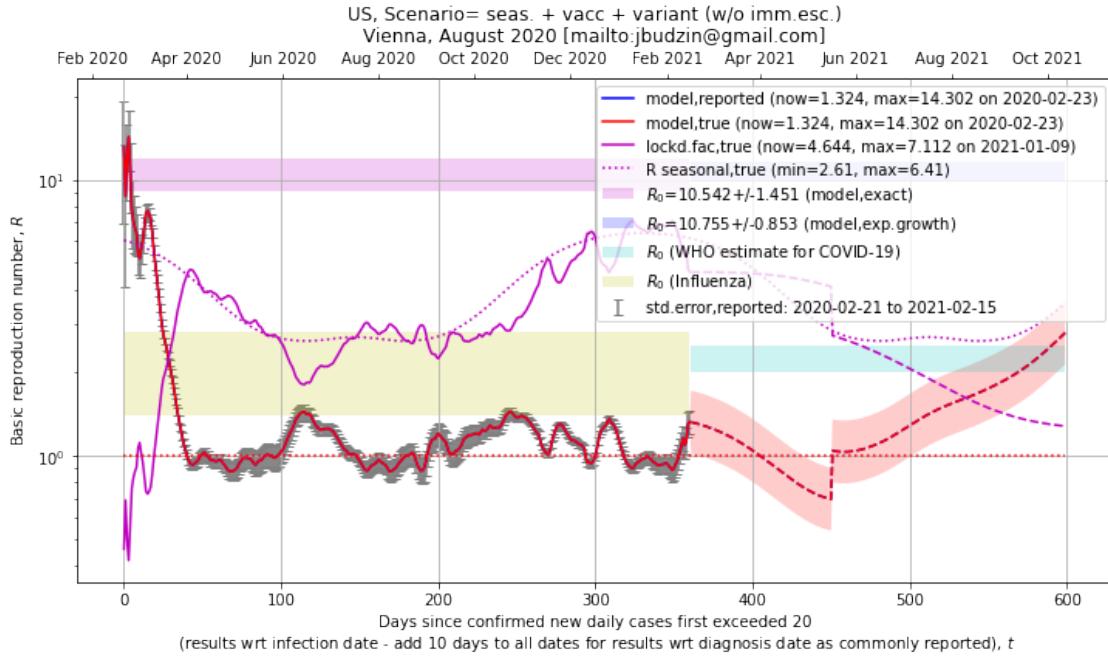
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 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True
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 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True
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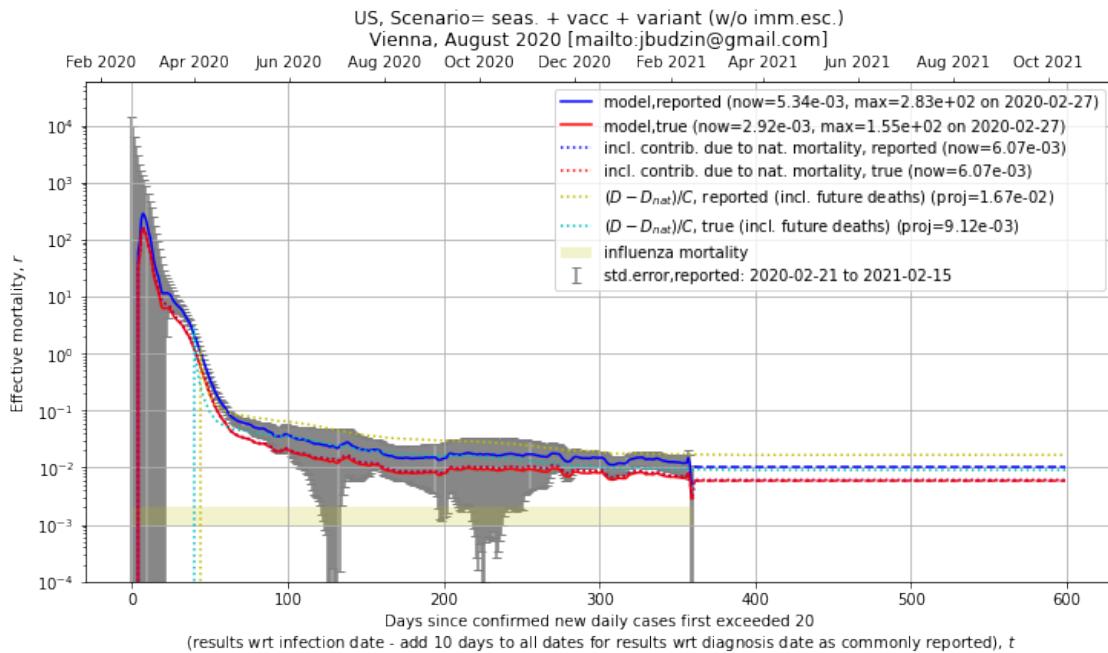
1.5.1 VACCINATED



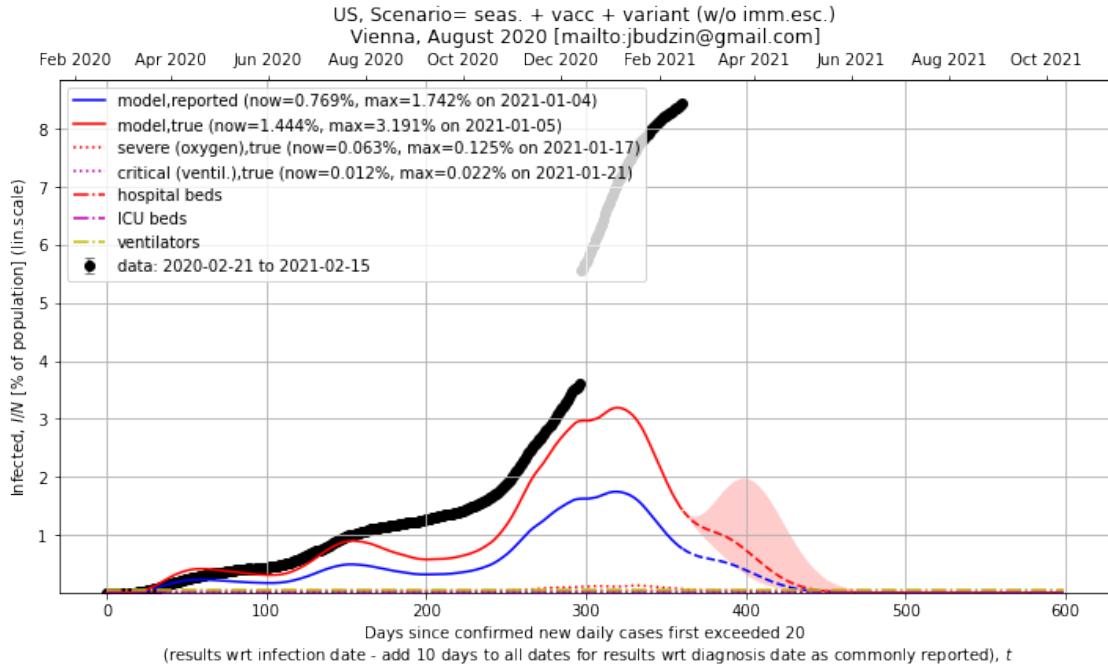
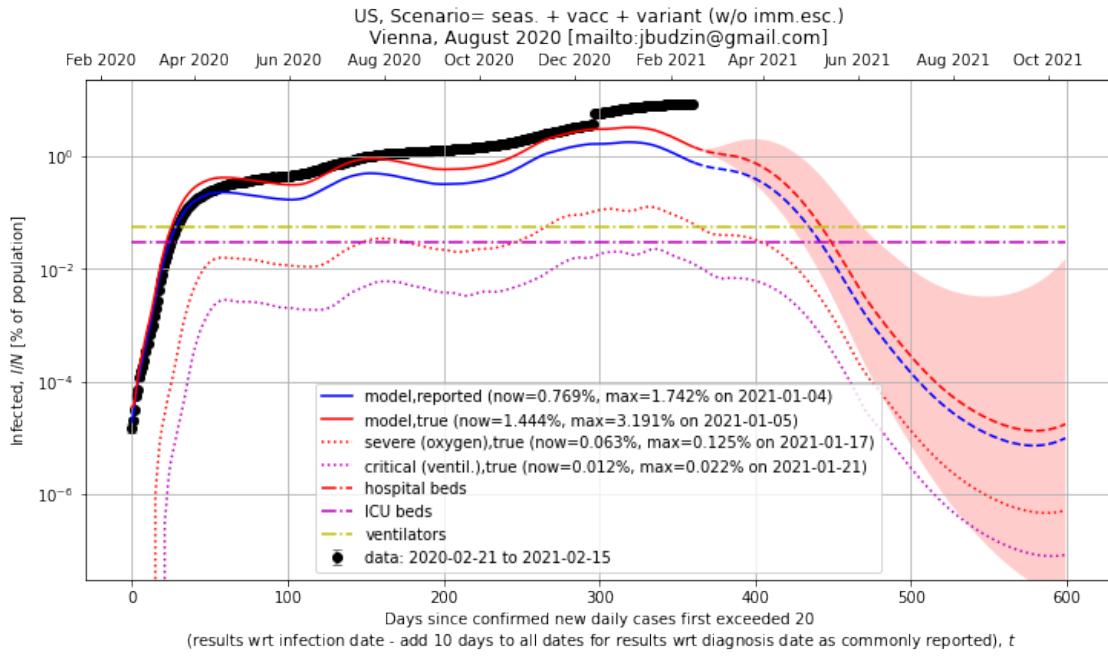
1.5.2 REPRODUCTION NUMBER



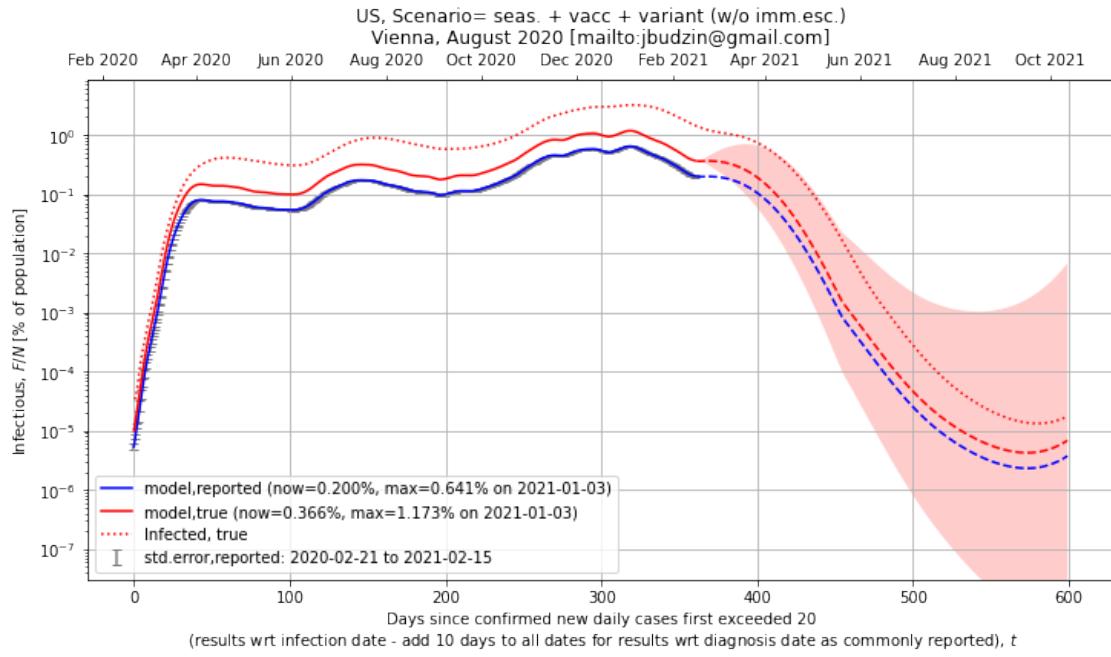
1.5.3 MORTALITY



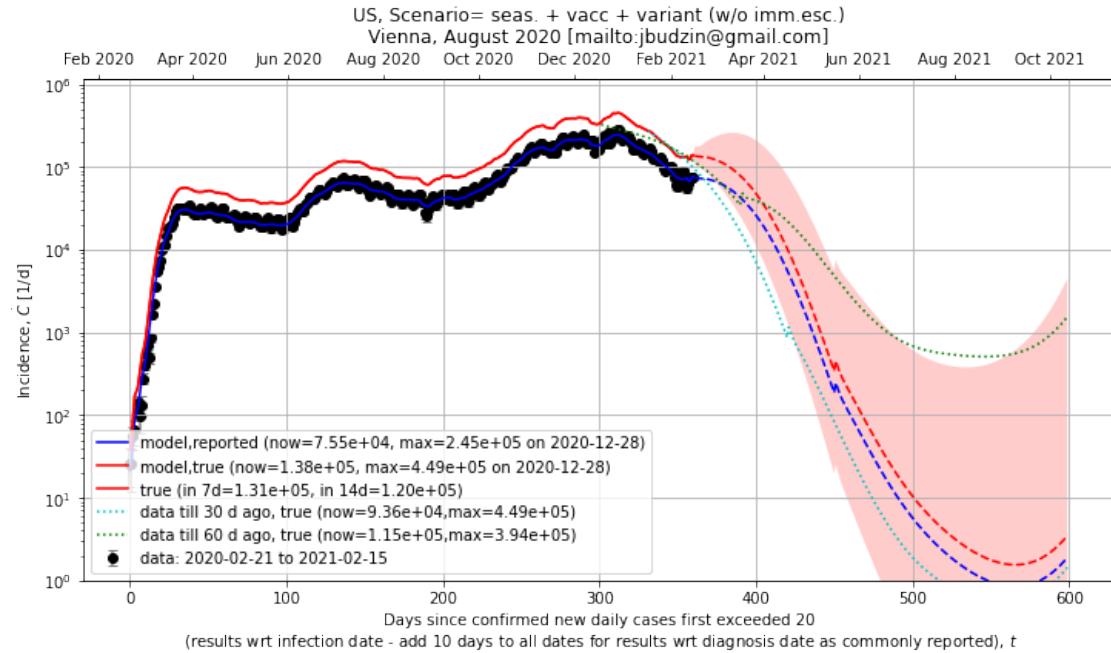
1.5.4 INFECTED

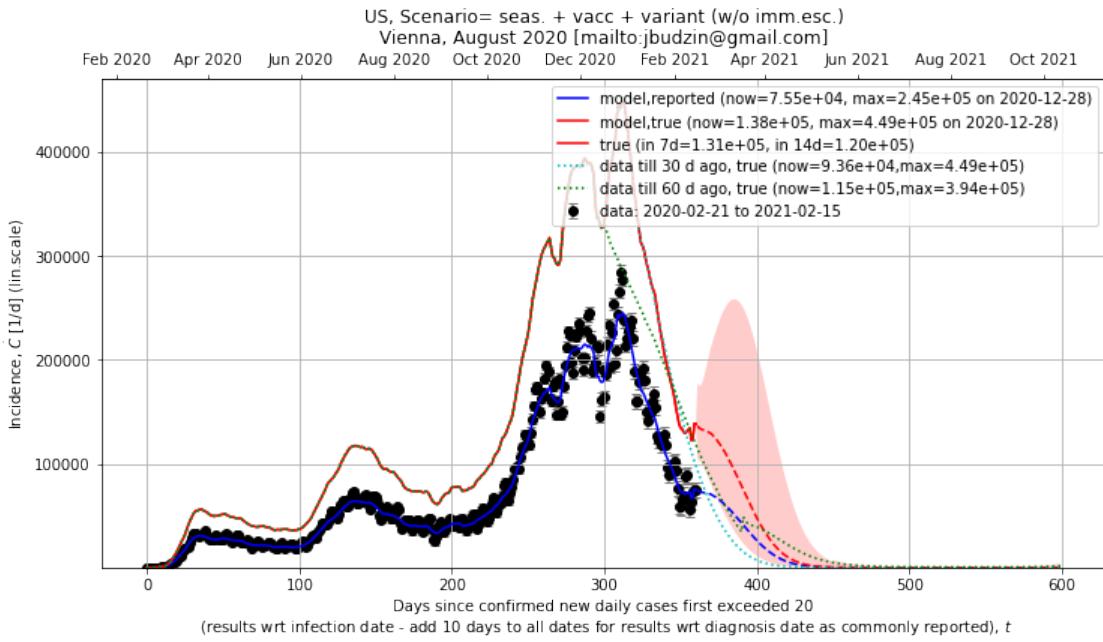


1.5.5 INFECTIOUS

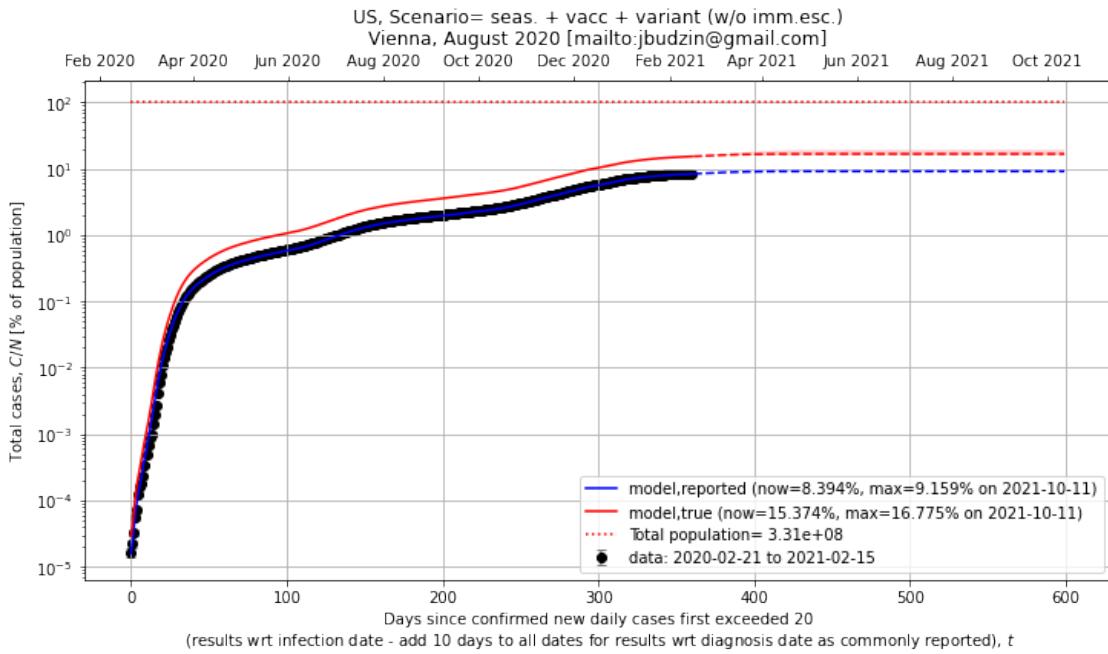


1.5.6 INCIDENCE

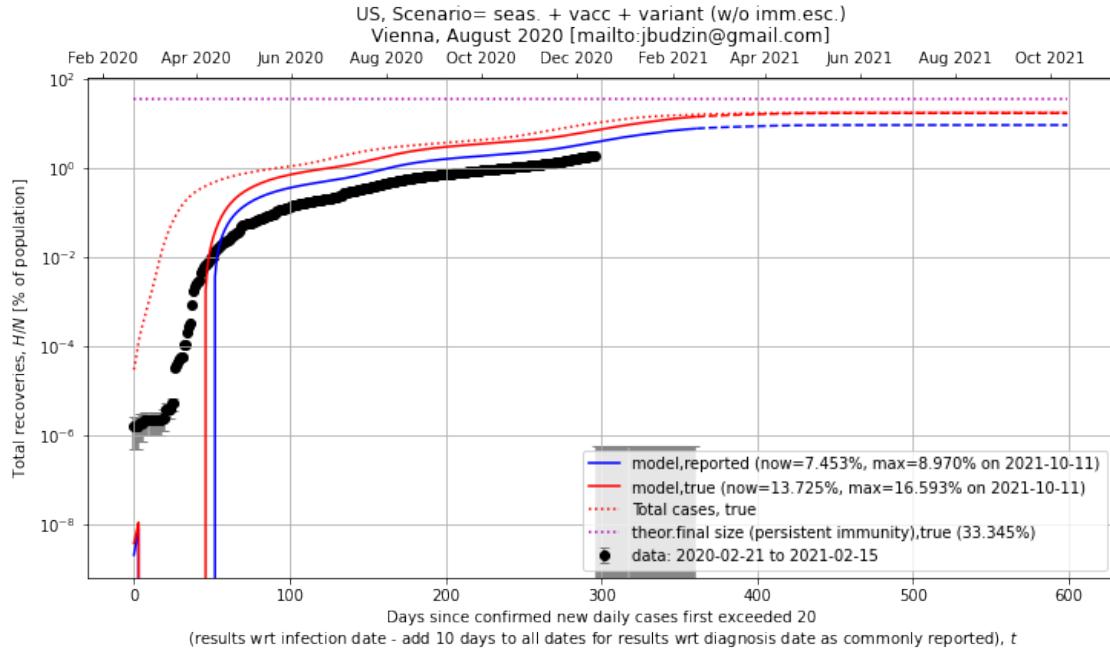




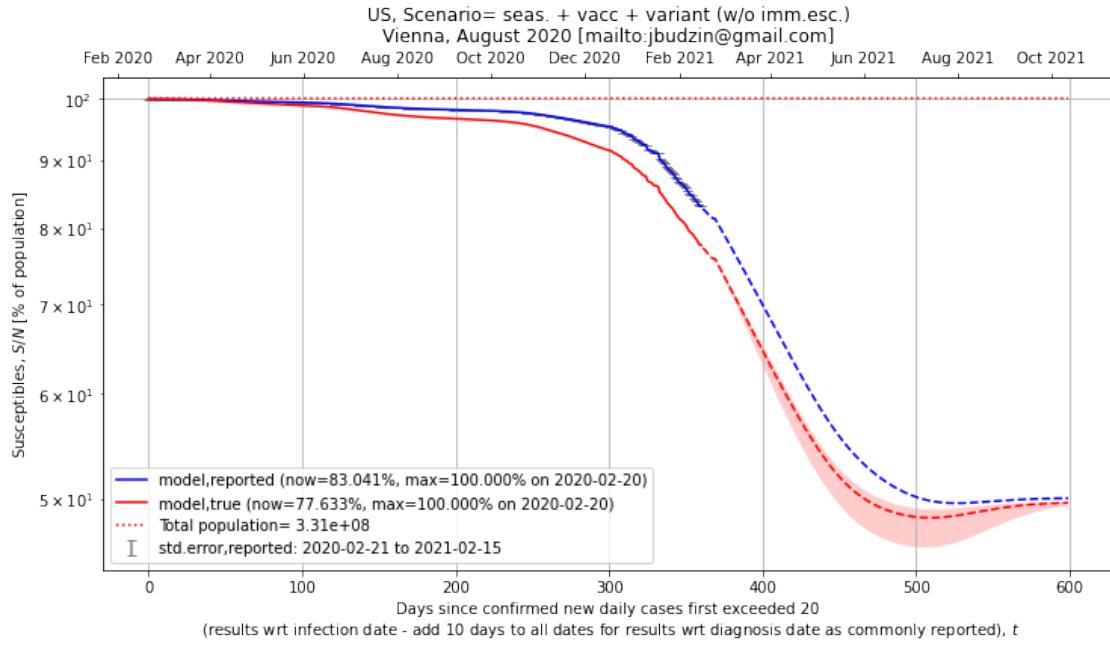
1.5.7 TOTAL CASES



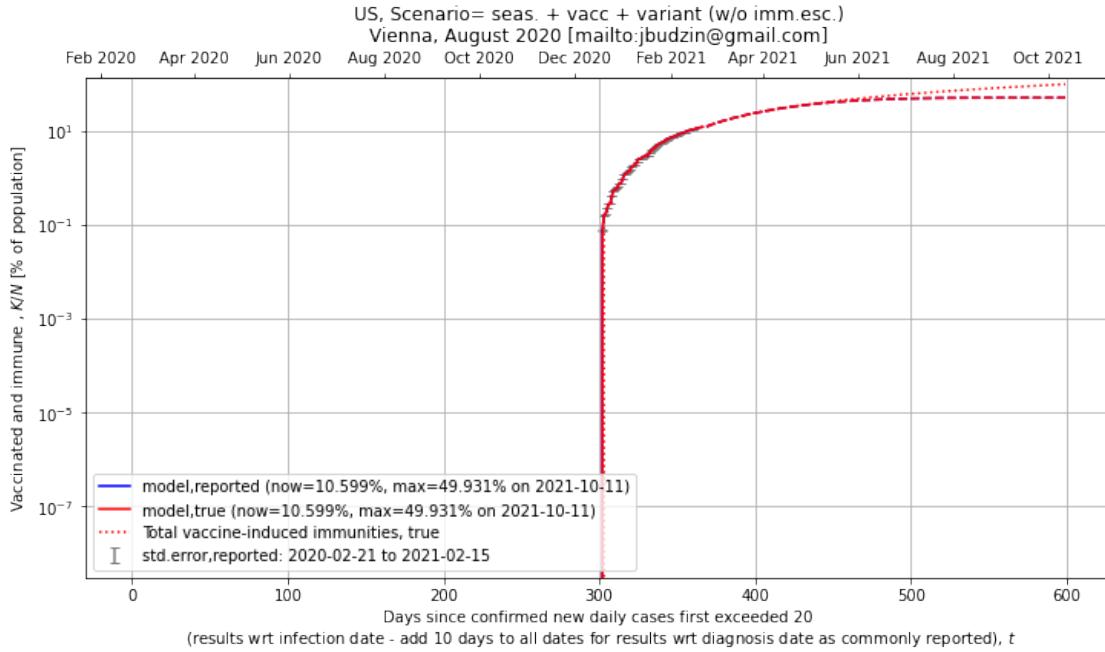
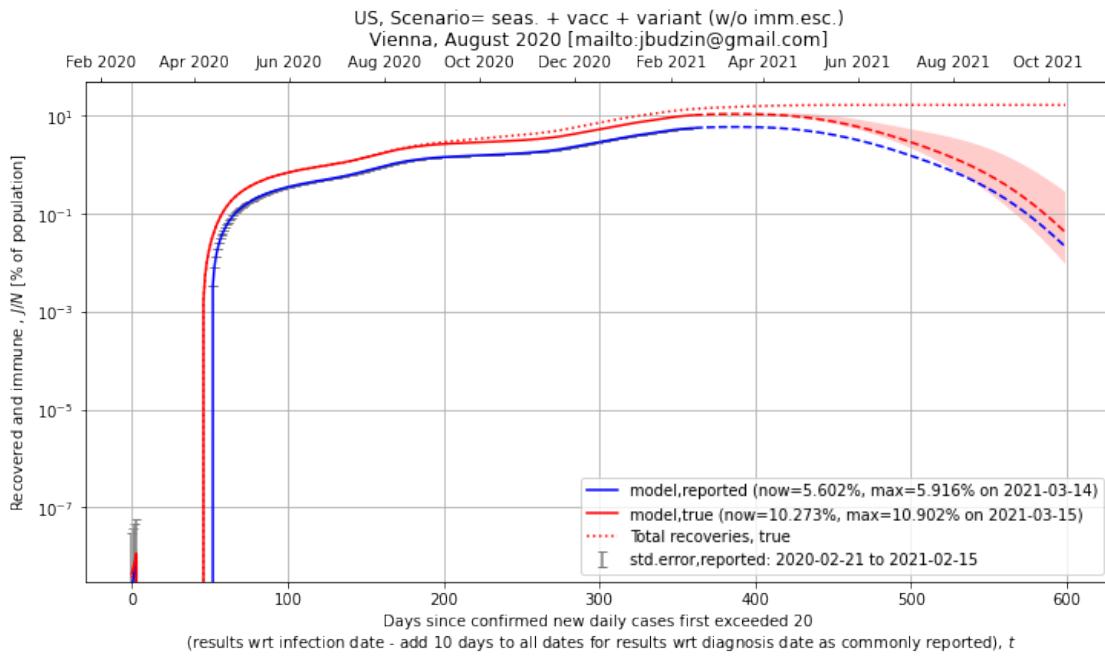
1.5.8 RECOVERED



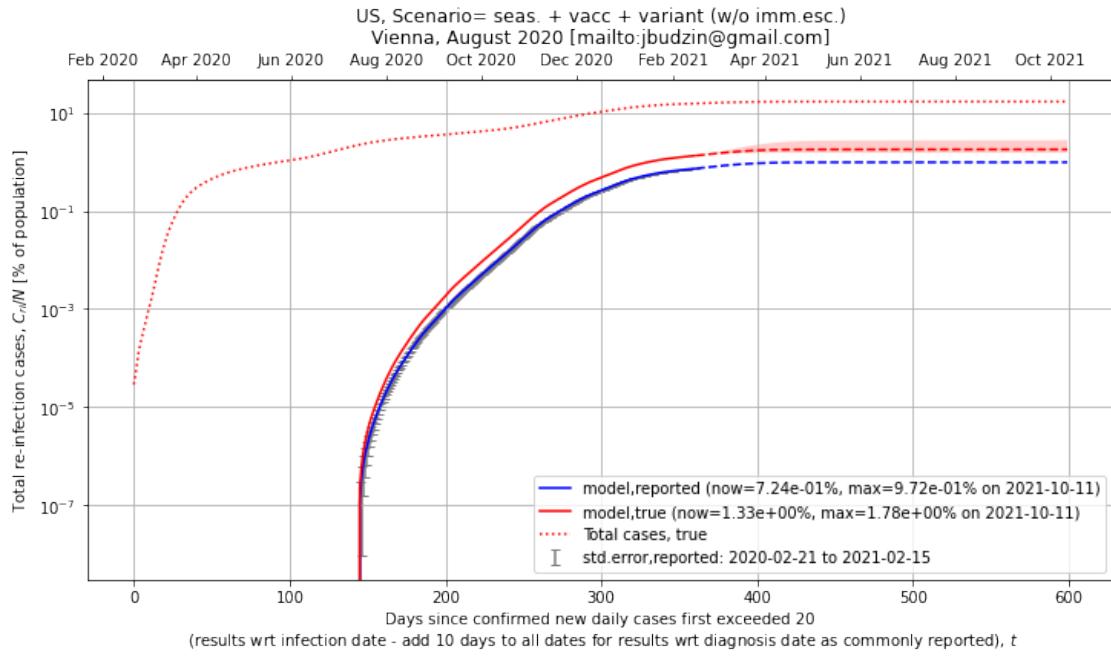
1.5.9 SUSCEPTIBLE



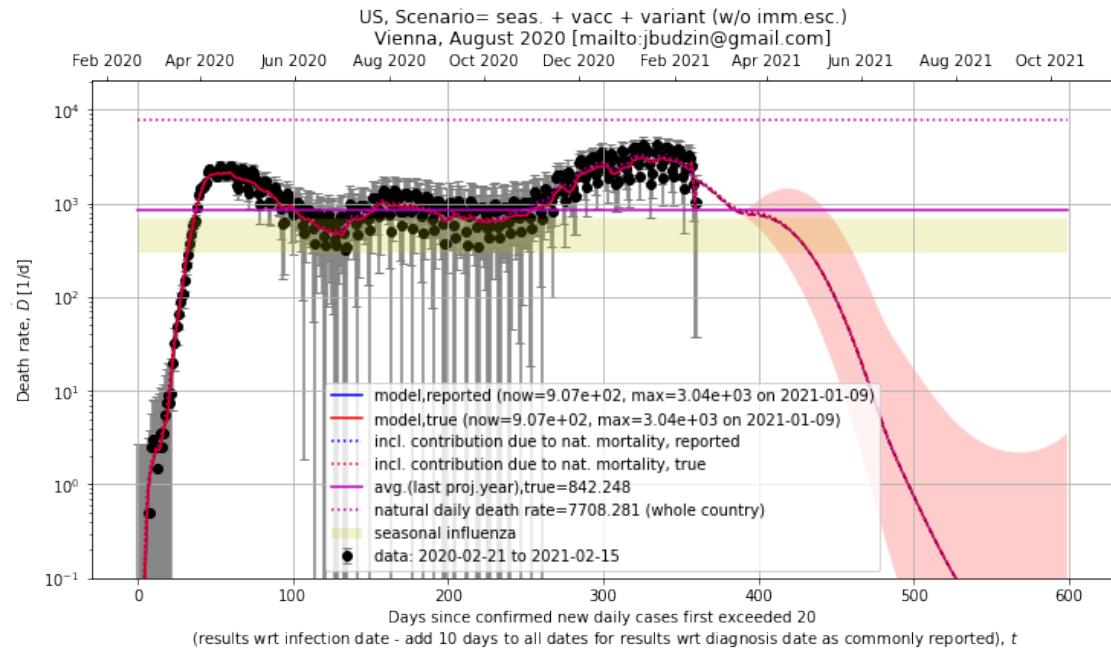
1.5.10 IMMUNE

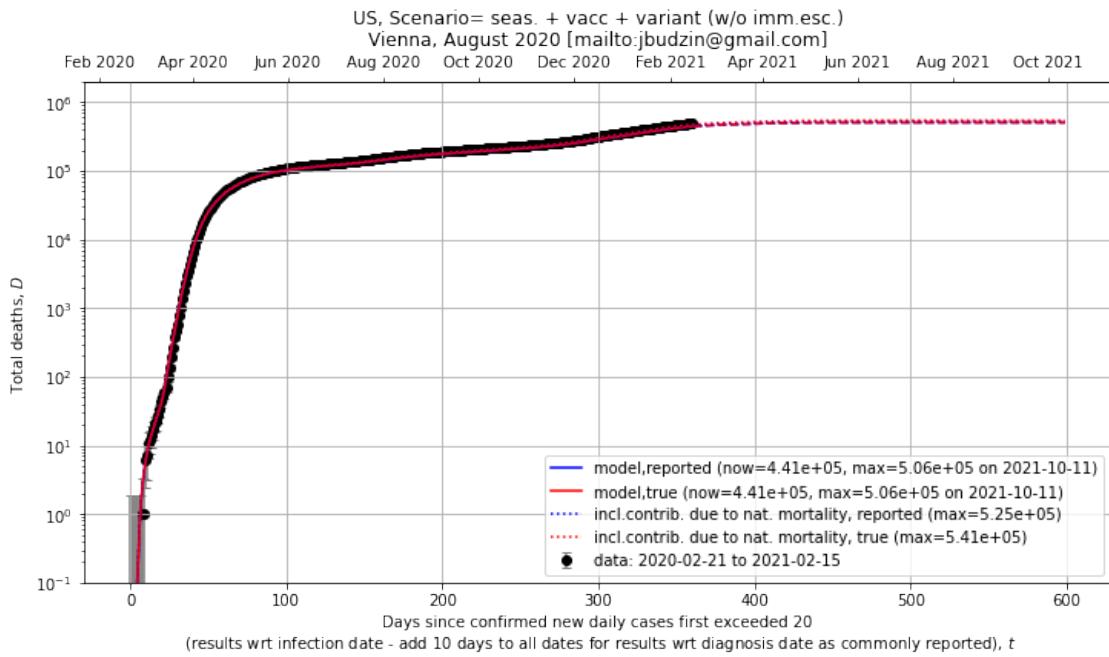
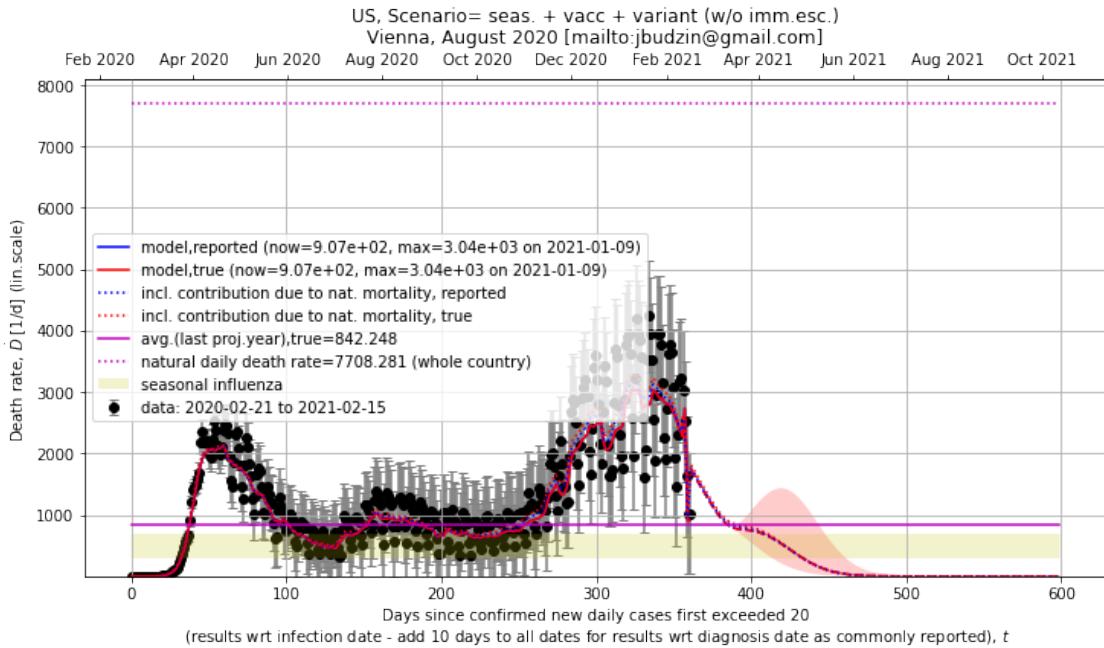


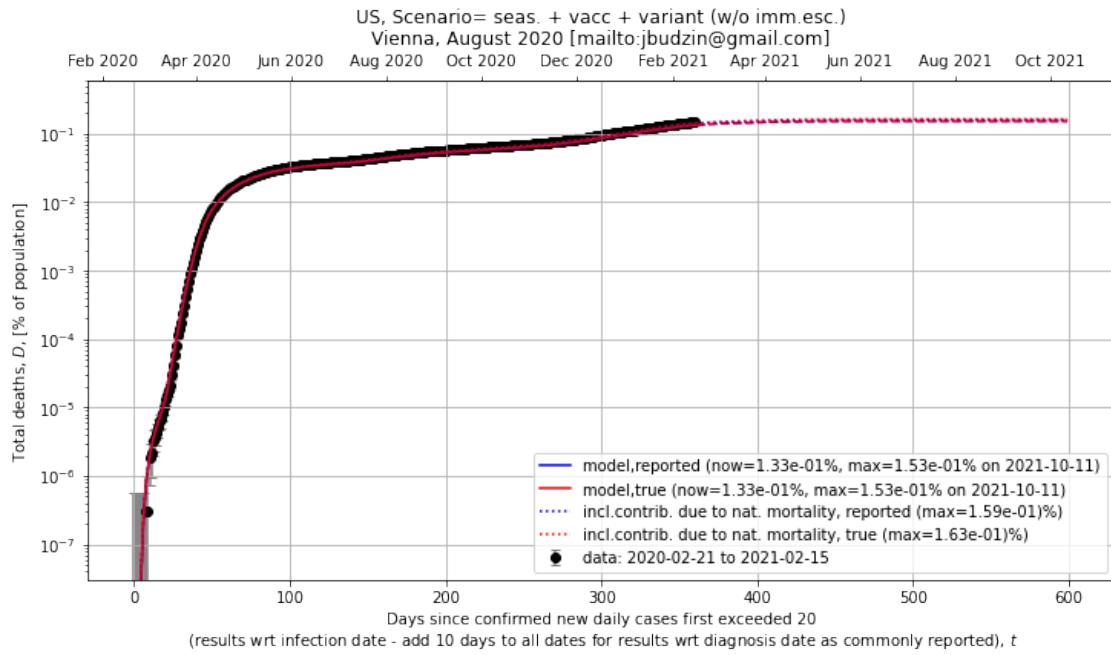
1.5.11 REINFECTIONS



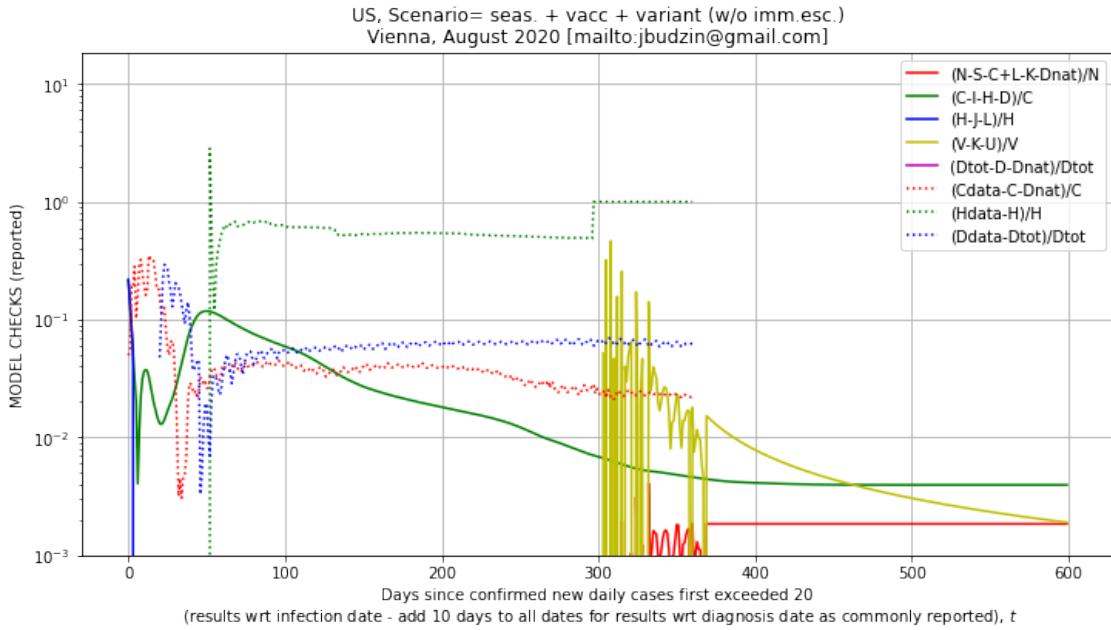
1.5.12 DEATHS



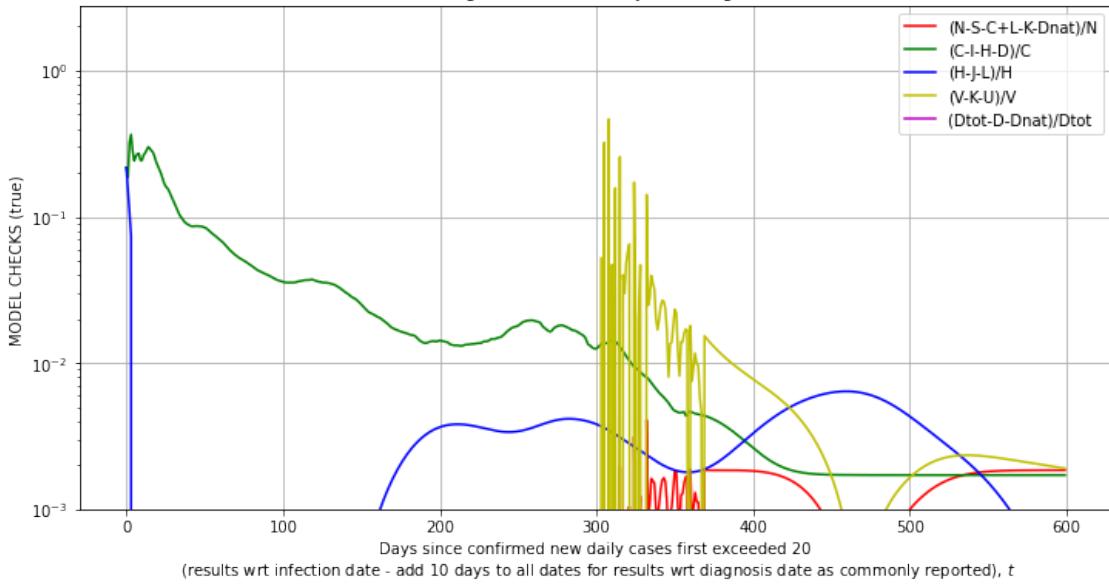




1.5.13 MODEL CHECKS



US, Scenario= seas. + vacc + variant (w/o imm.esc.)
Vienna, August 2020 [mailto:jbudzin@gmail.com]



1.5.14 FORECAST FIGURES

```
diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (reported)
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-> 2021-02-25 2545531 278110 207455 40332 27785268 441413 907 75479 150
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2021-03-03 2229431 221380 165138 32602 28222992 451175 1519 72031 156
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| 2021-03-16 | 1905163 | 173867 | 129695 | 21921 | 29095885 | 467121 | 991 | 60607 | 138 |
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| 2021-03-21 | 1810405 | 173379 | 129331 | 22488 | 29376558 | 471637 | 853 | 52991 | 124 |
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| 2021-03-23 | 1764530 | 172465 | 128650 | 22501 | 29477562 | 473290 | 818 | 49662 | 118 |
| 2021-03-24 | 1739454 | 171660 | 128049 | 22466 | 29525520 | 474095 | 804 | 47958 | 115 |
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diagnosis_date, I, I_hosp, I_sev, I_crit, C, D, dD, dC, dC(7d) (true)
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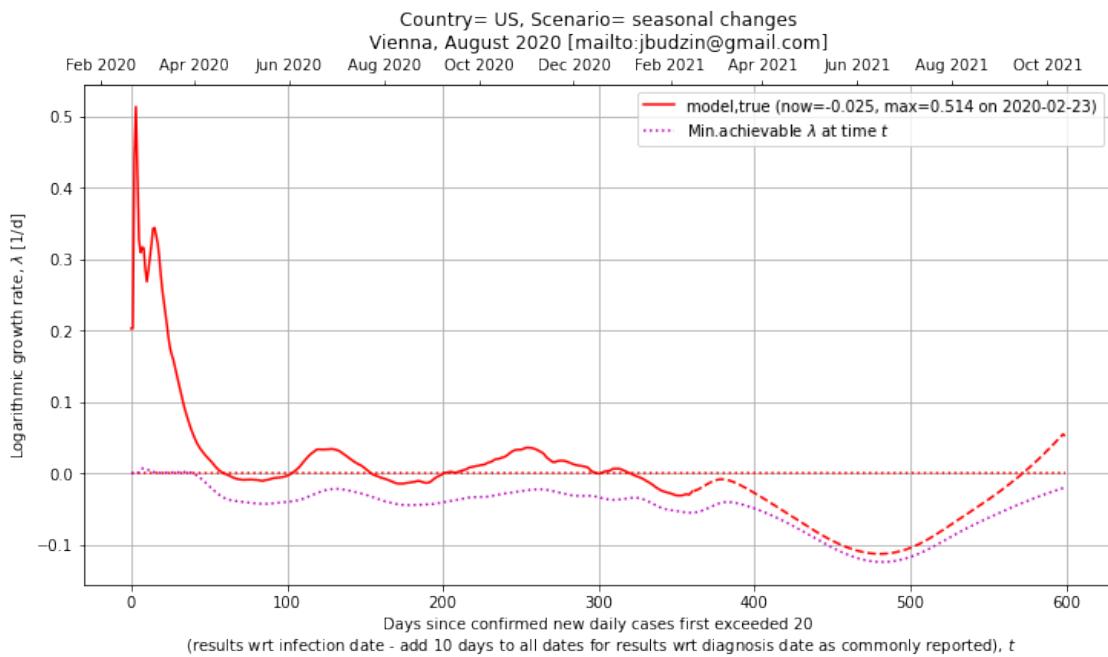
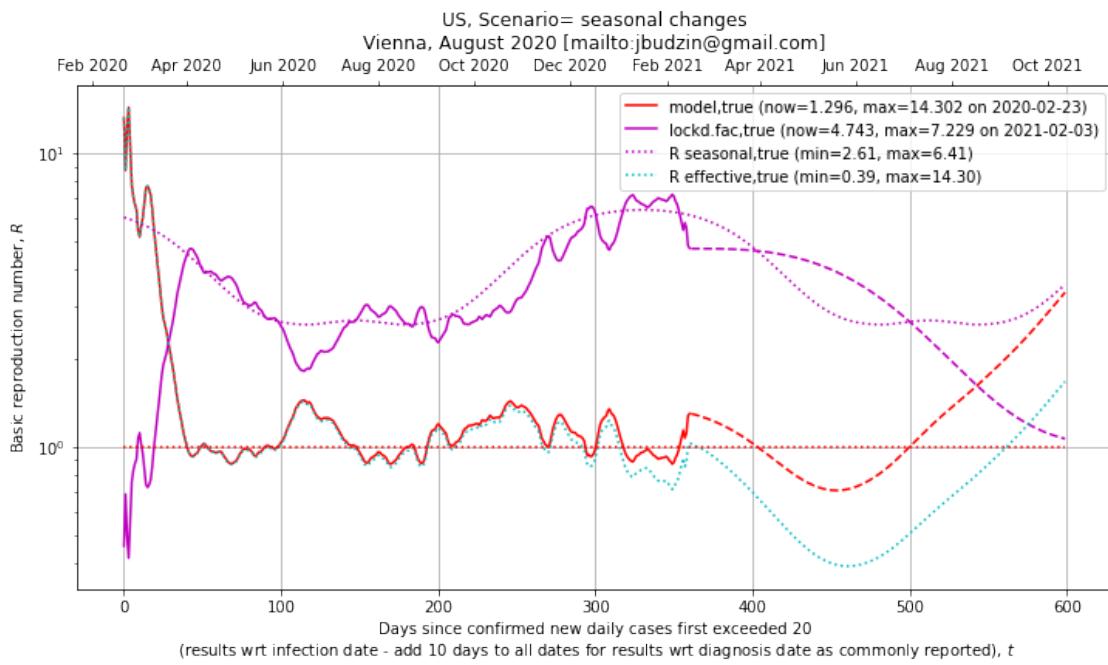
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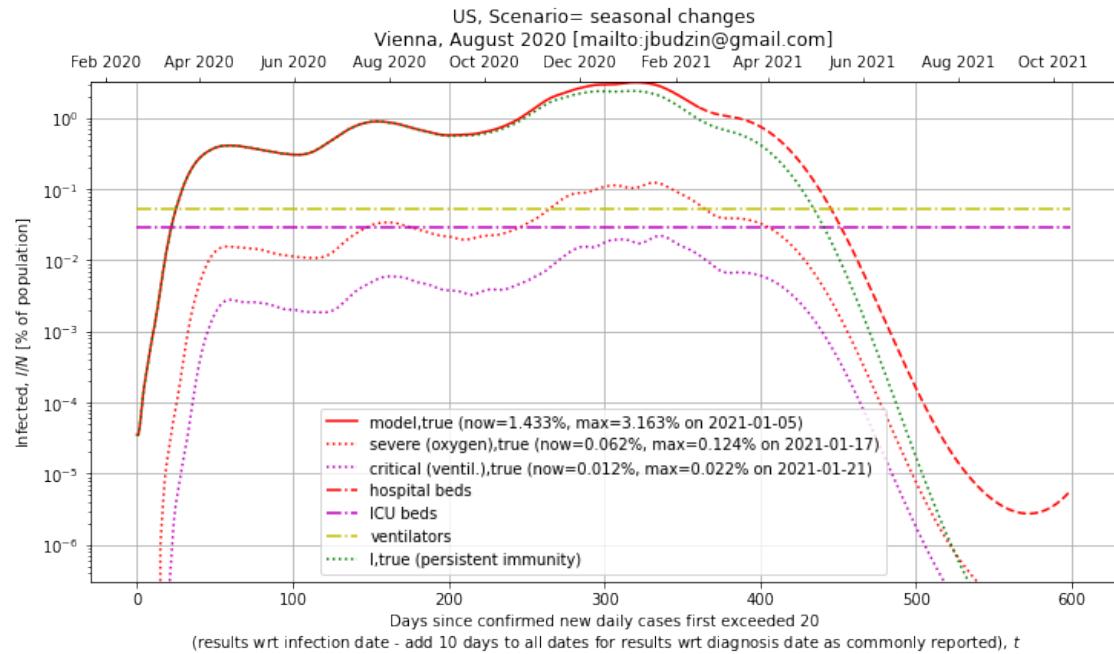
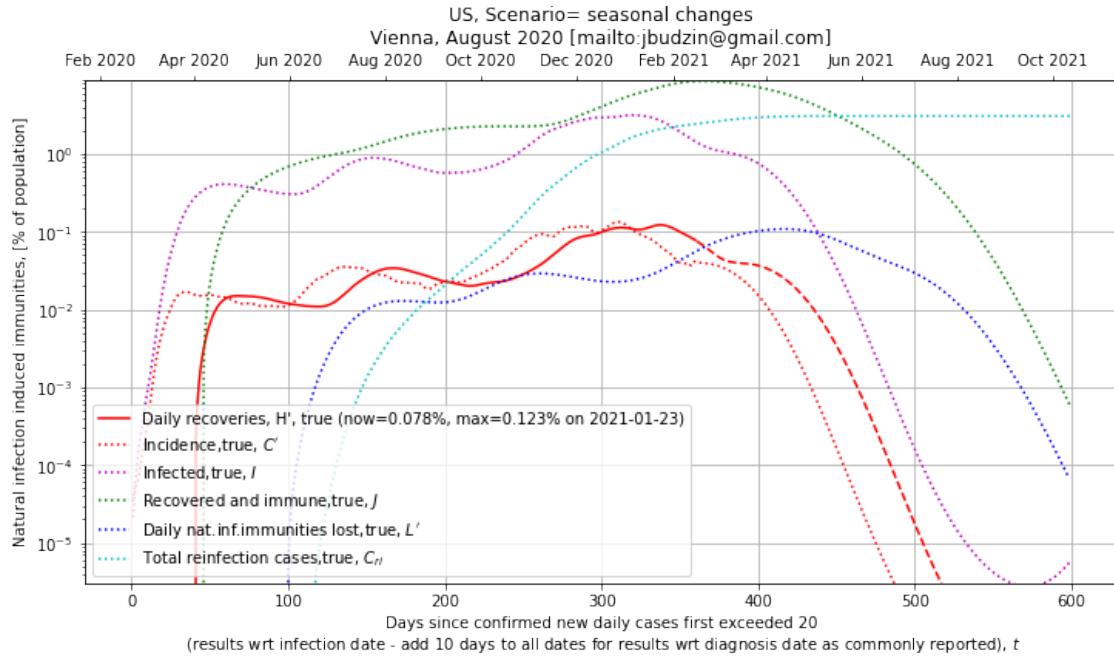
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 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
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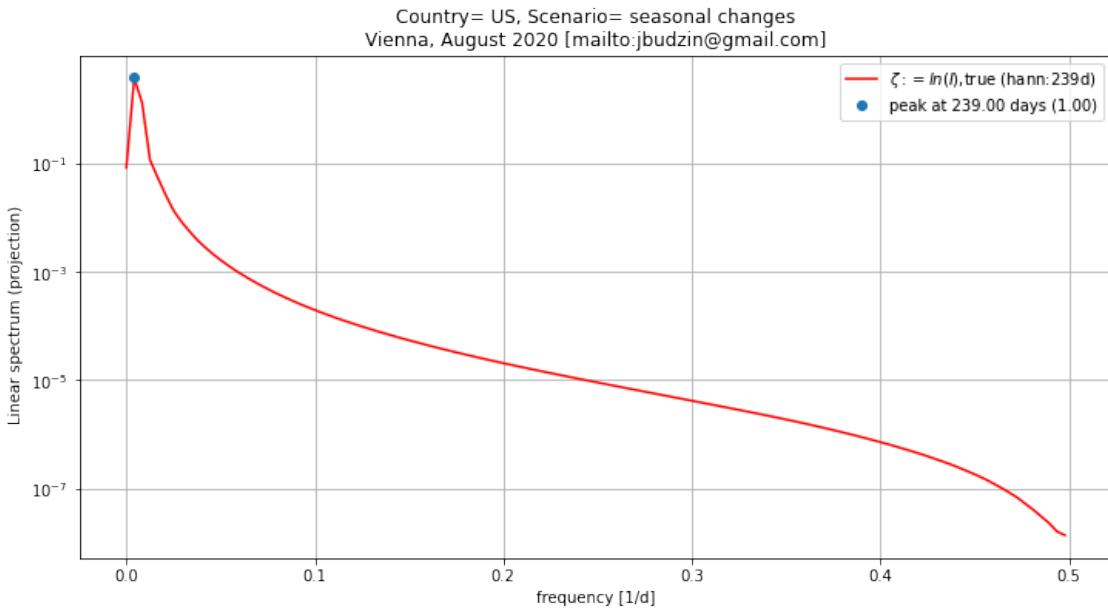
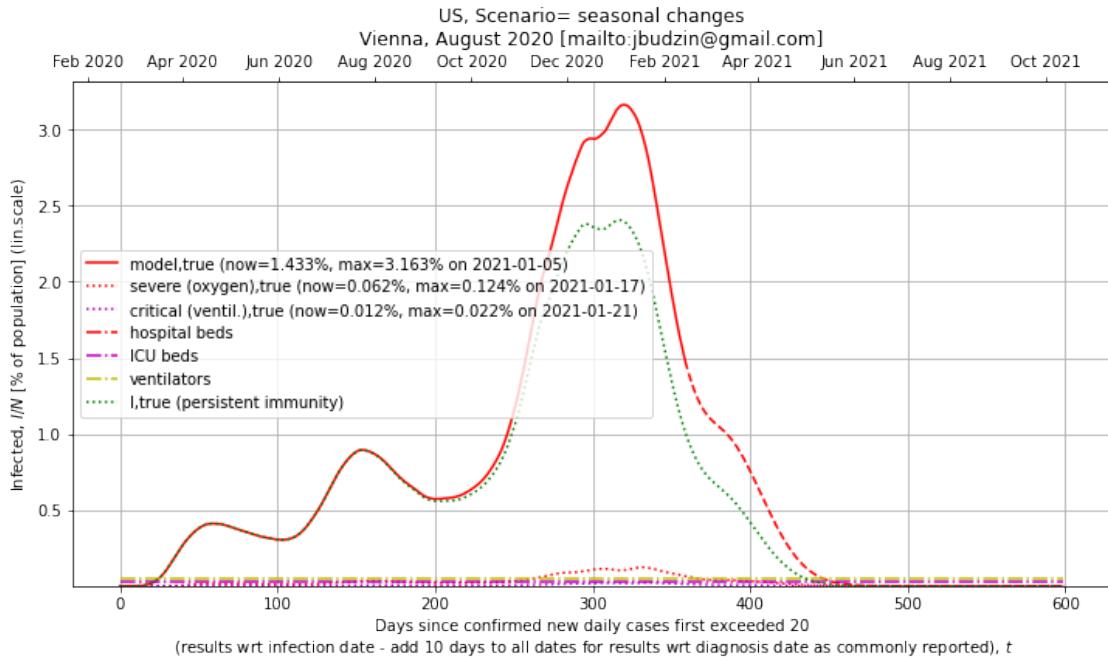
1.6 SEASONAL FORCING (at LDF_INF = 1.)

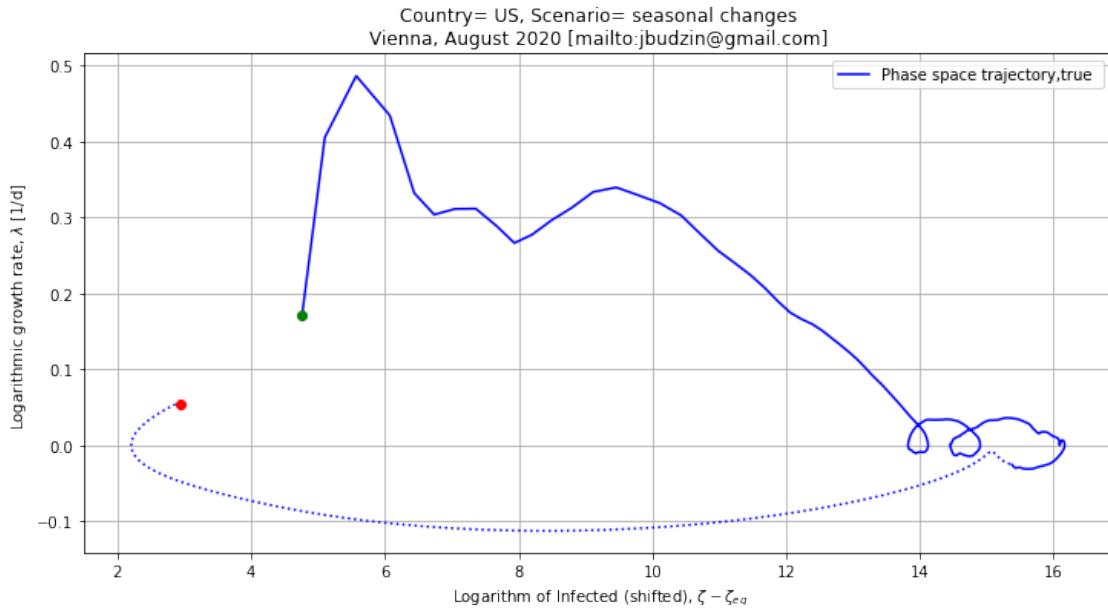
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Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

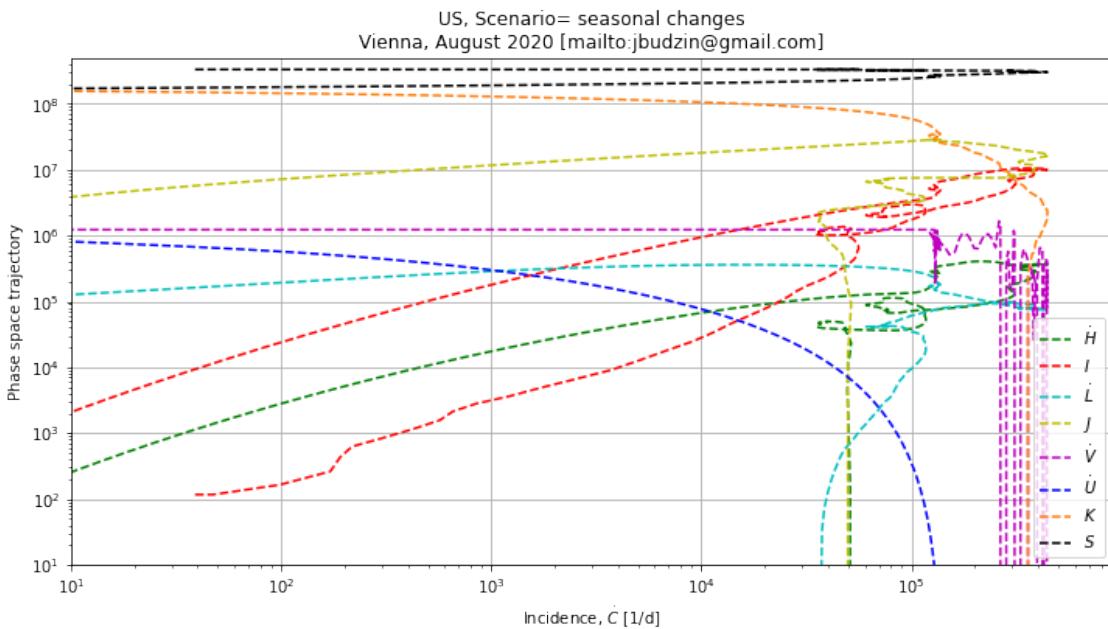
Avg. infection prevalence = 7.91e+05 / Perc of pop= 0.239

Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

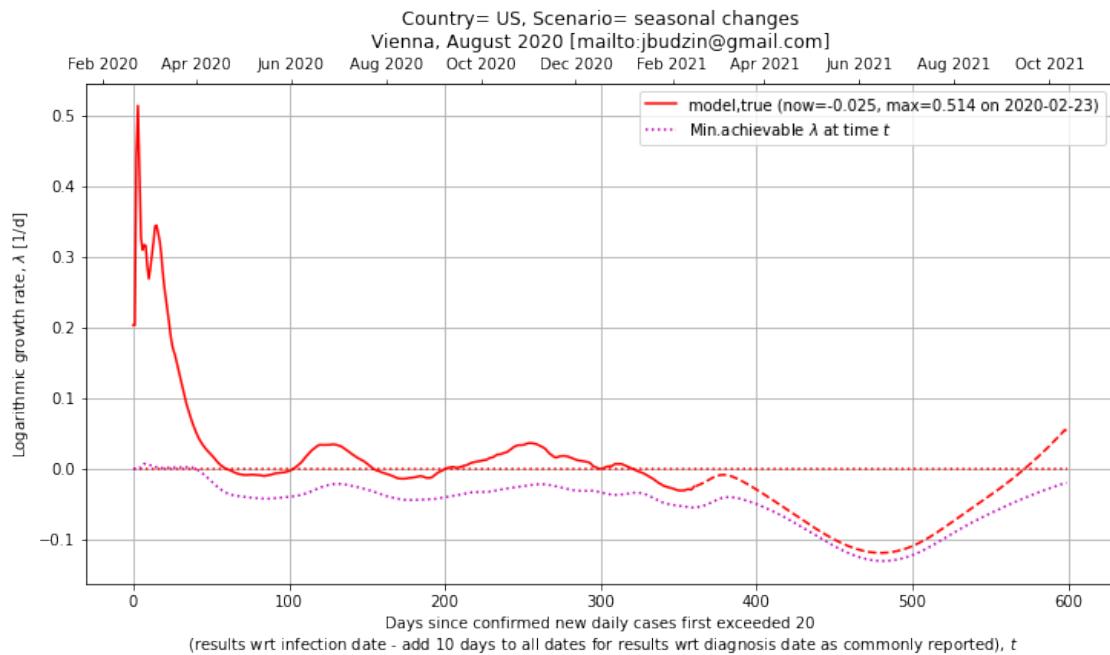
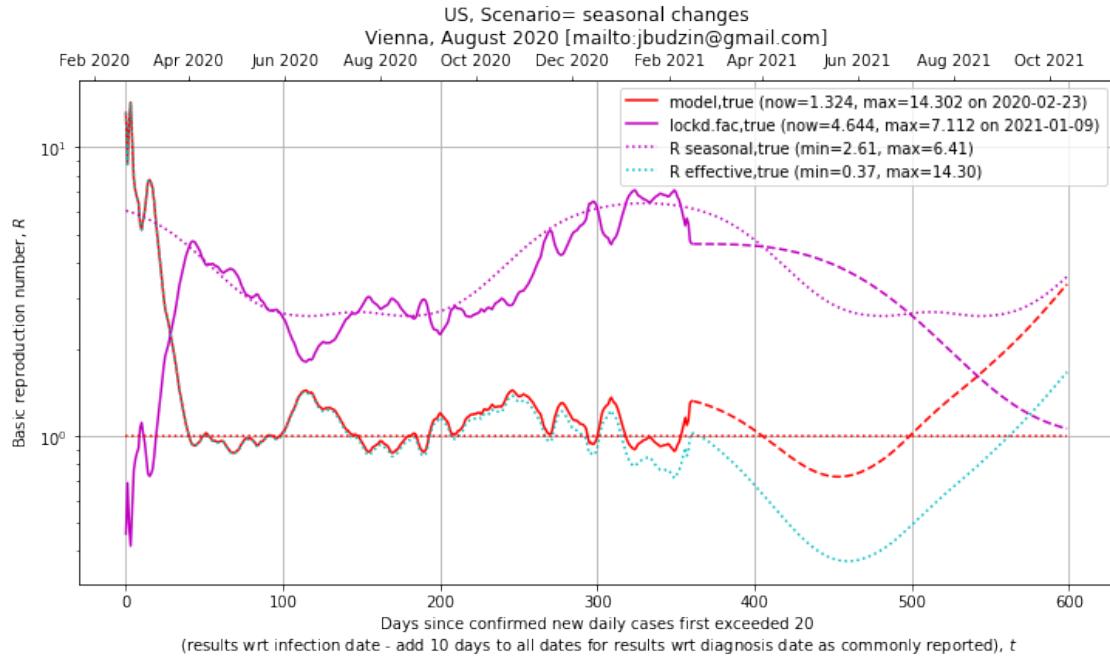
Time constant in Lyapunov function (data) [d]= 147.842

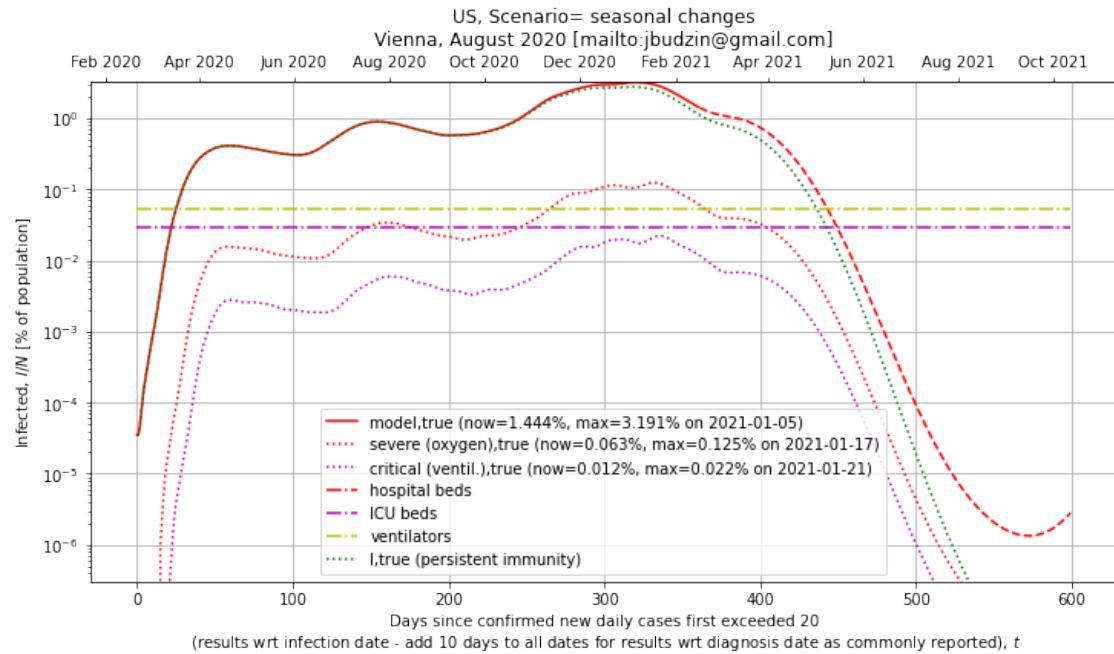
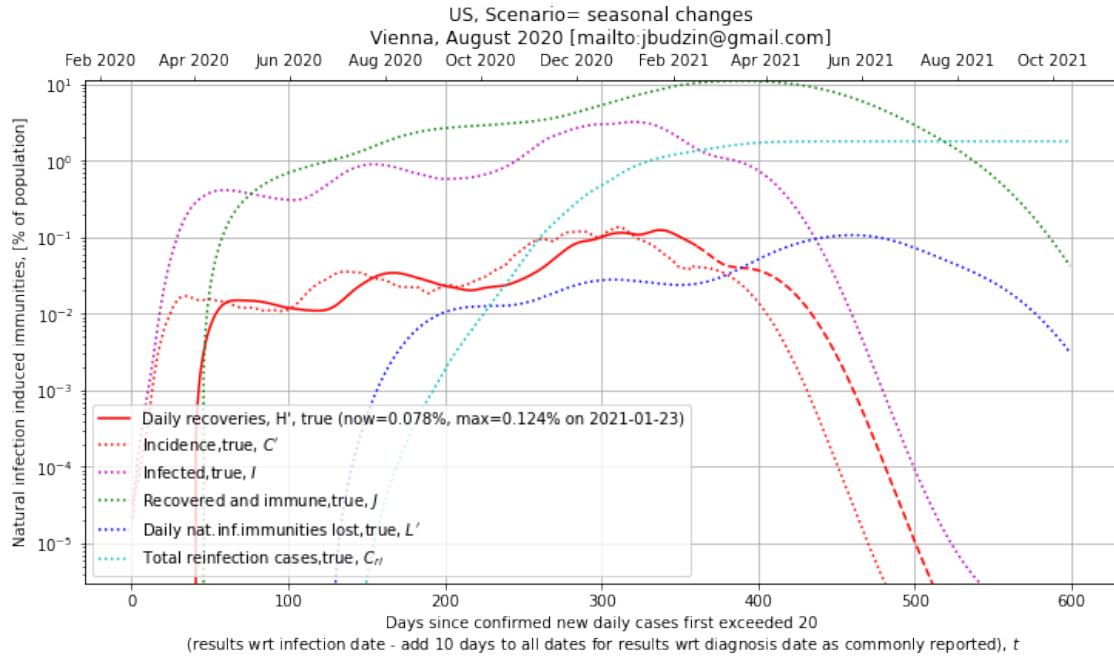
Time constant in Lyapunov function (proj) [d]= 129.457

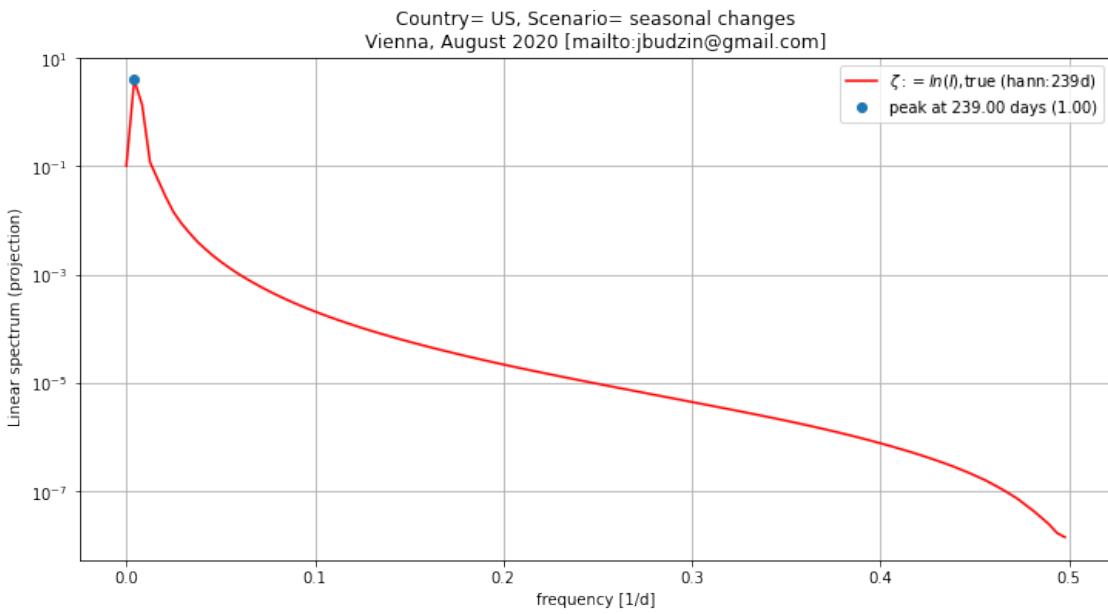
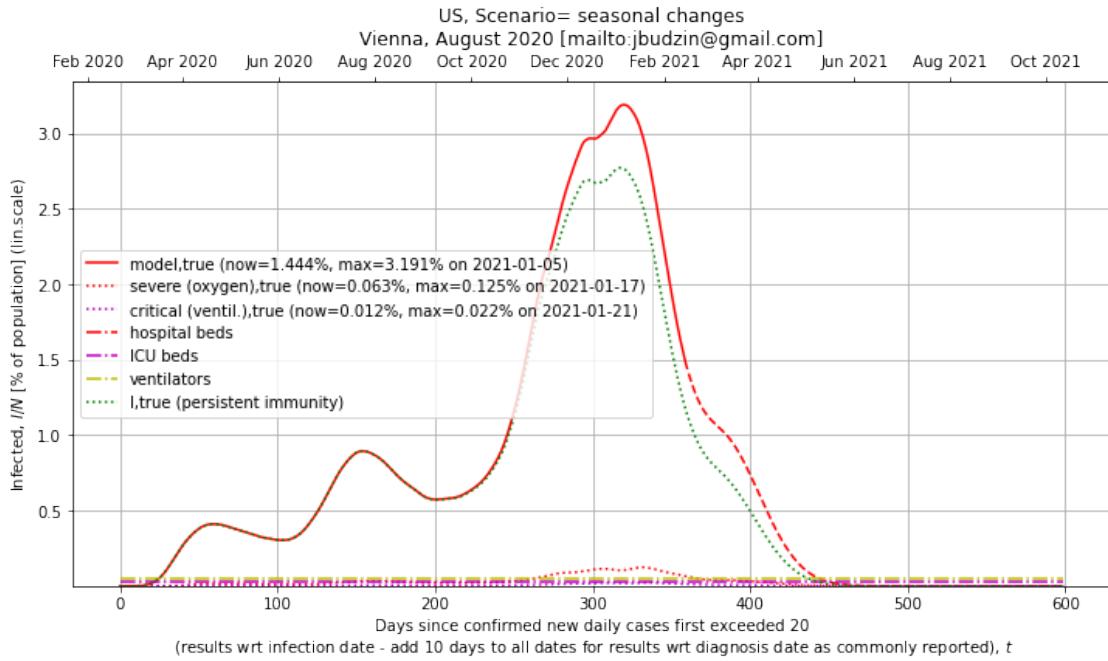


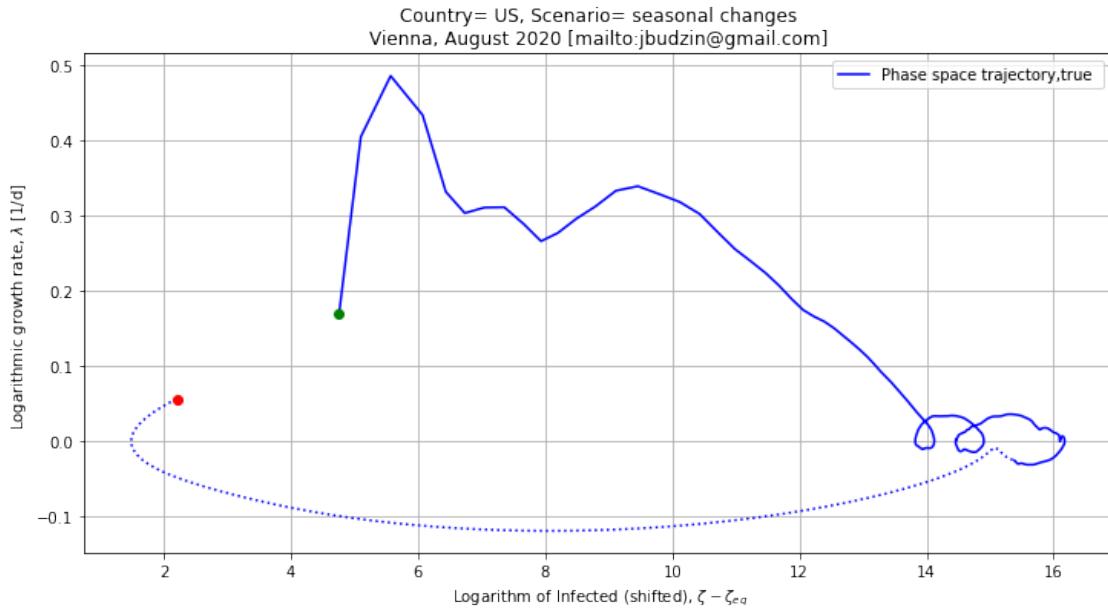
1.6.2 TAU_NU = 135.00 days

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True

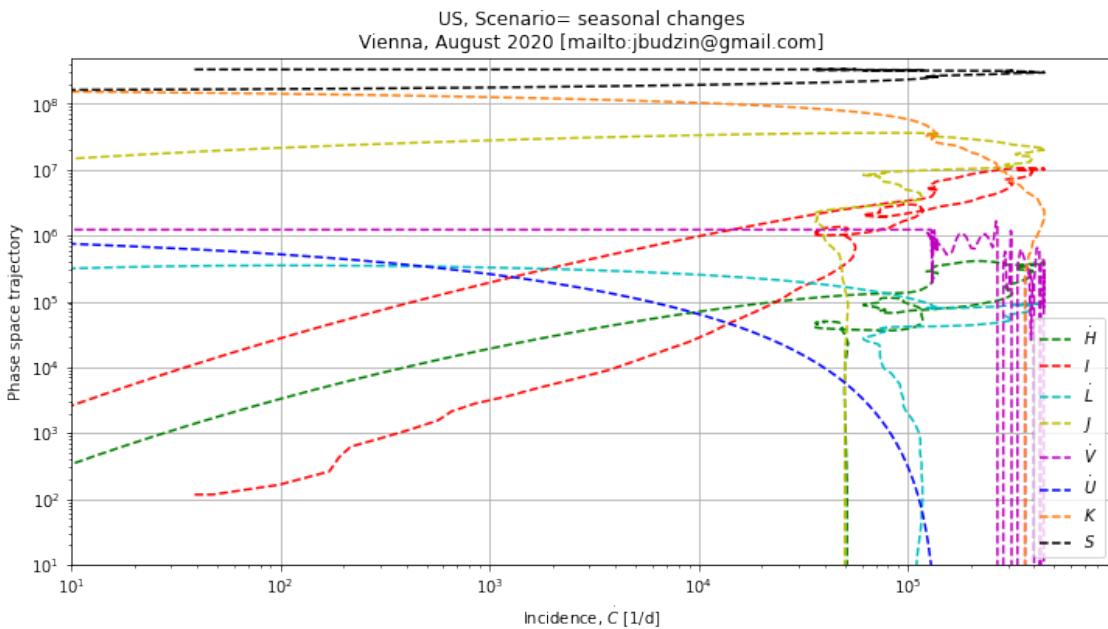






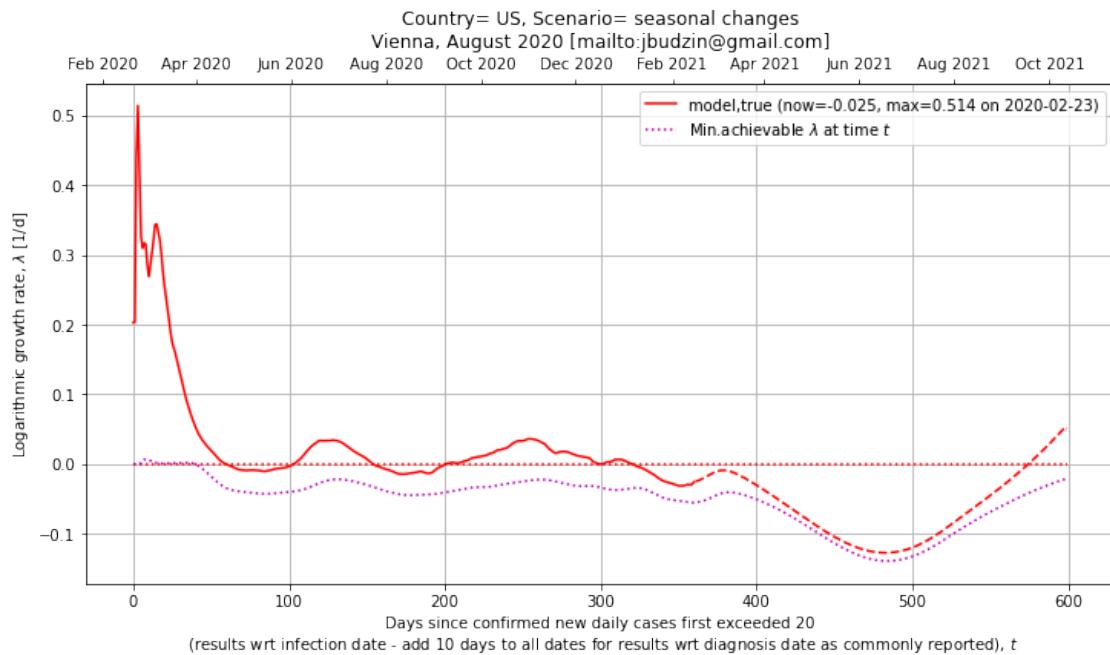
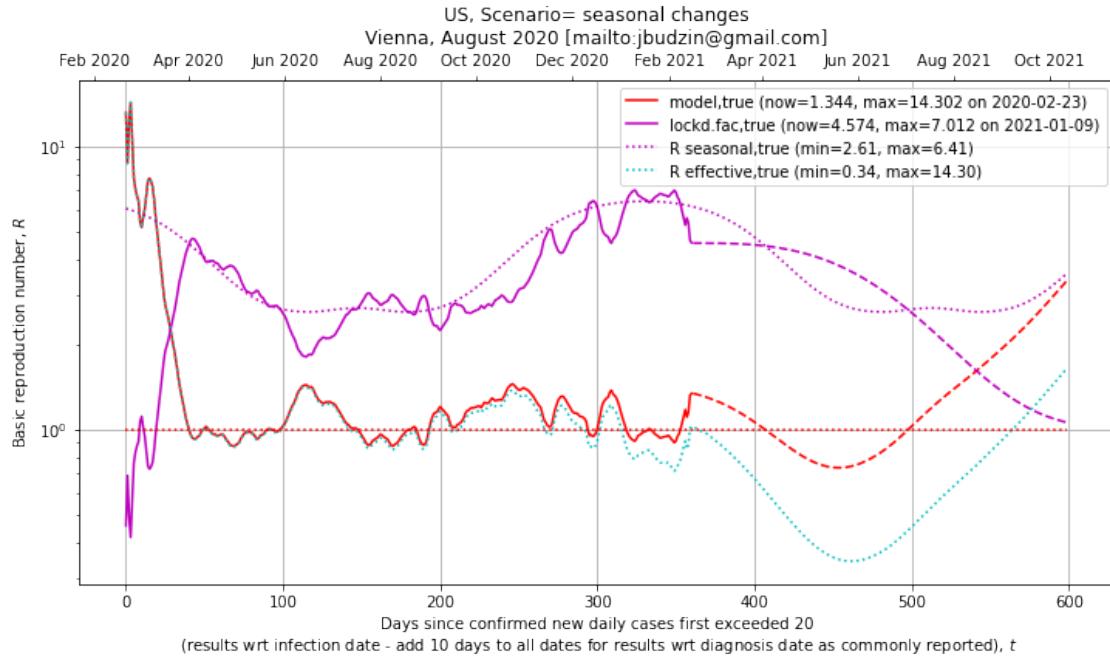


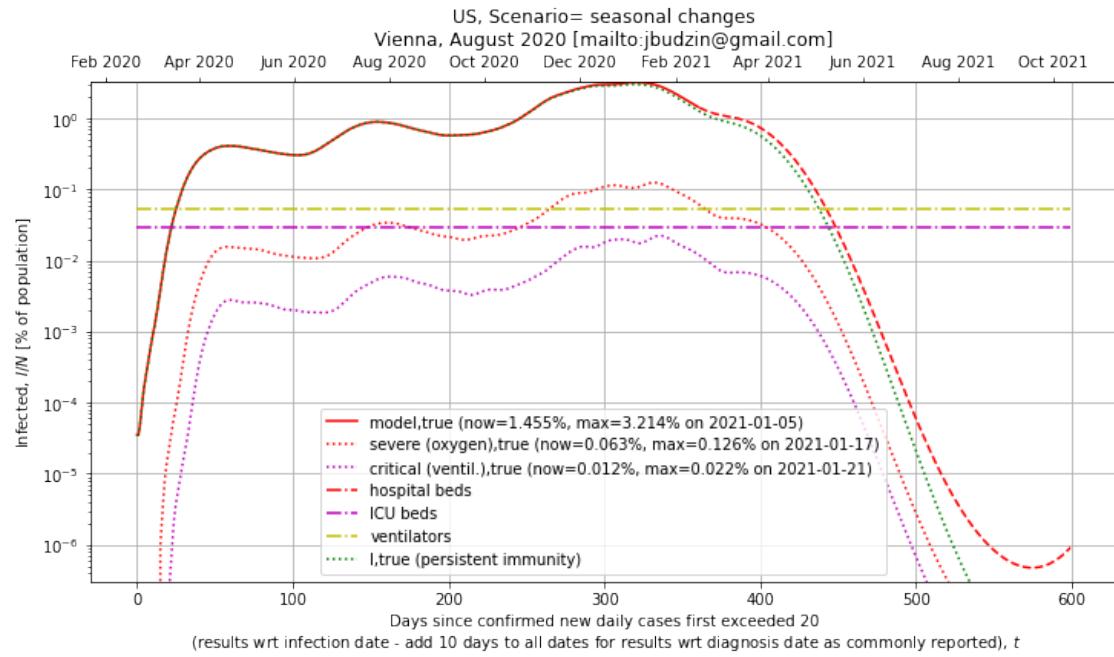
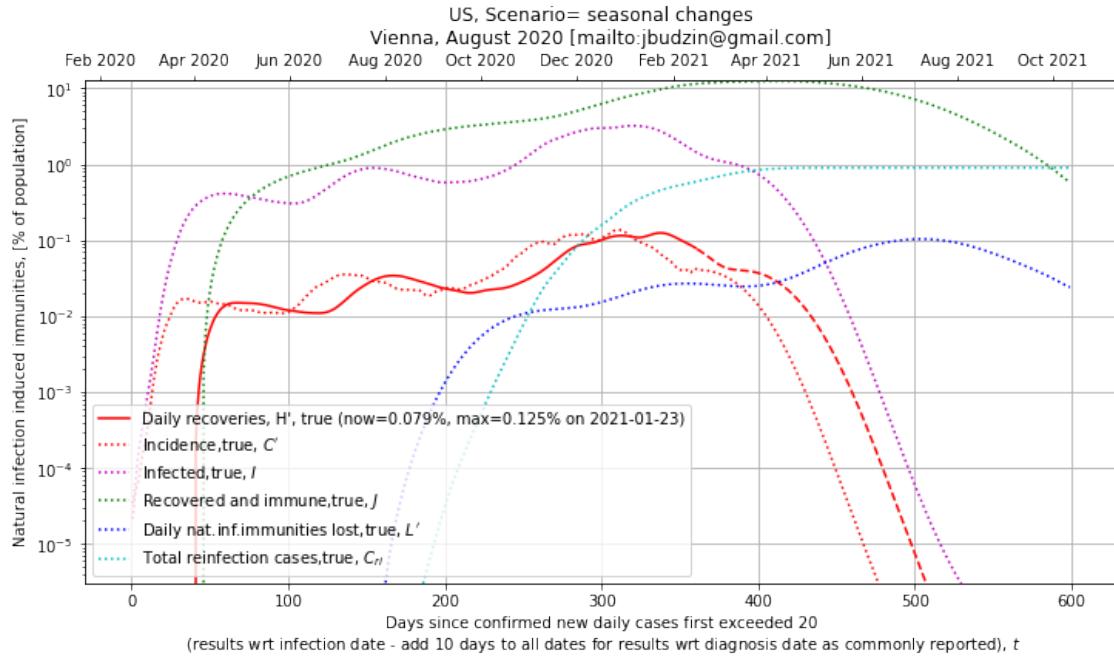
Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 7.76e+05 / Perc of pop = 0.235
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0
 Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 125.043

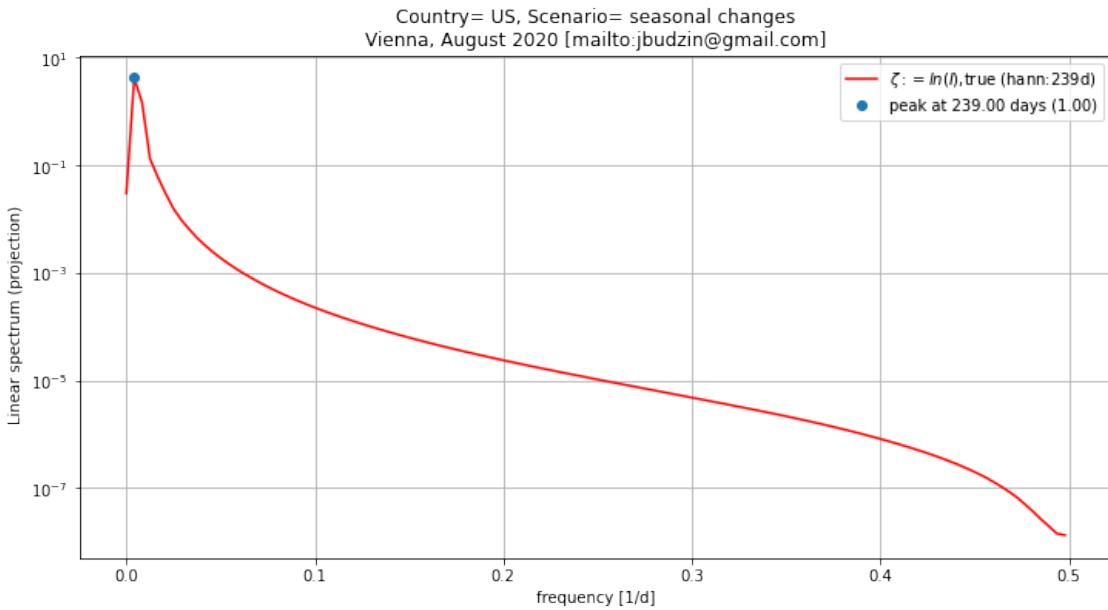
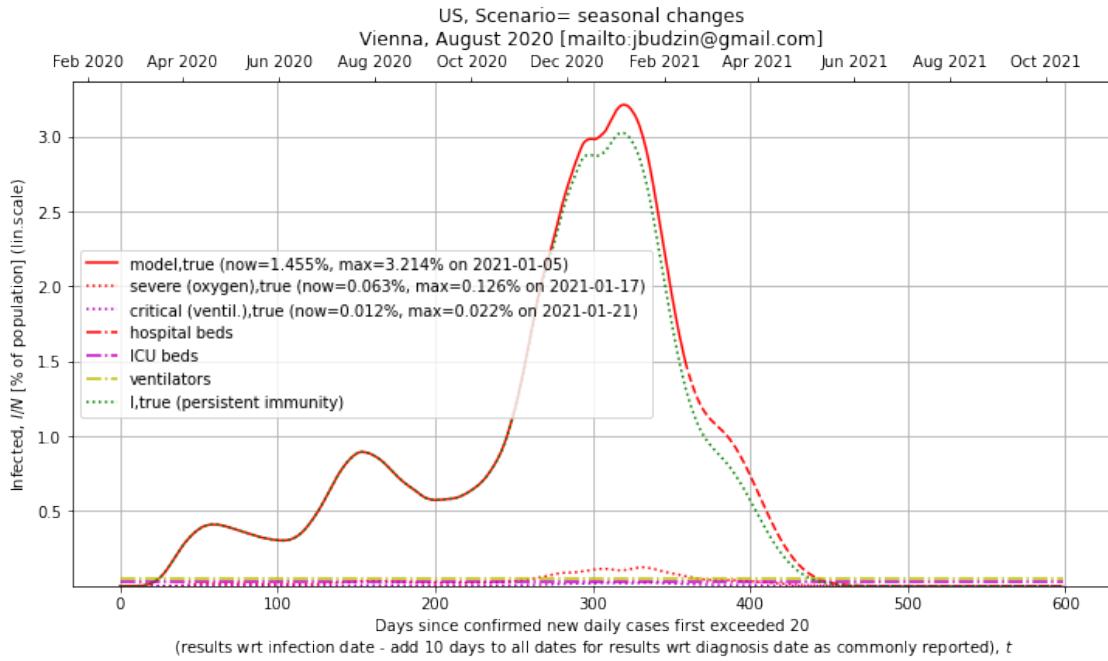


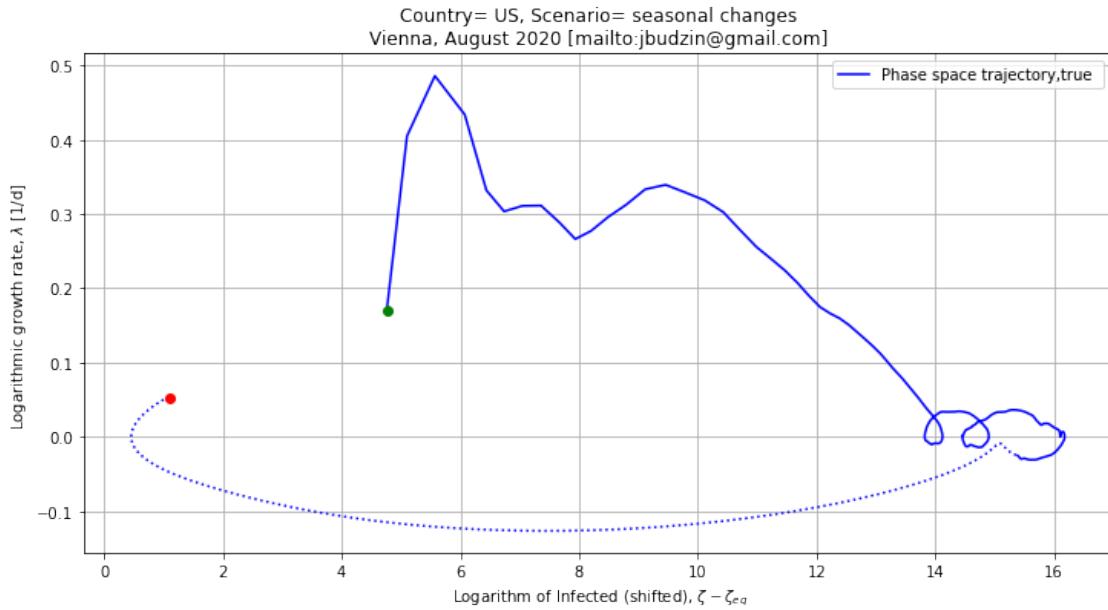
1.6.3 TAU_NU = 180.00 days

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True

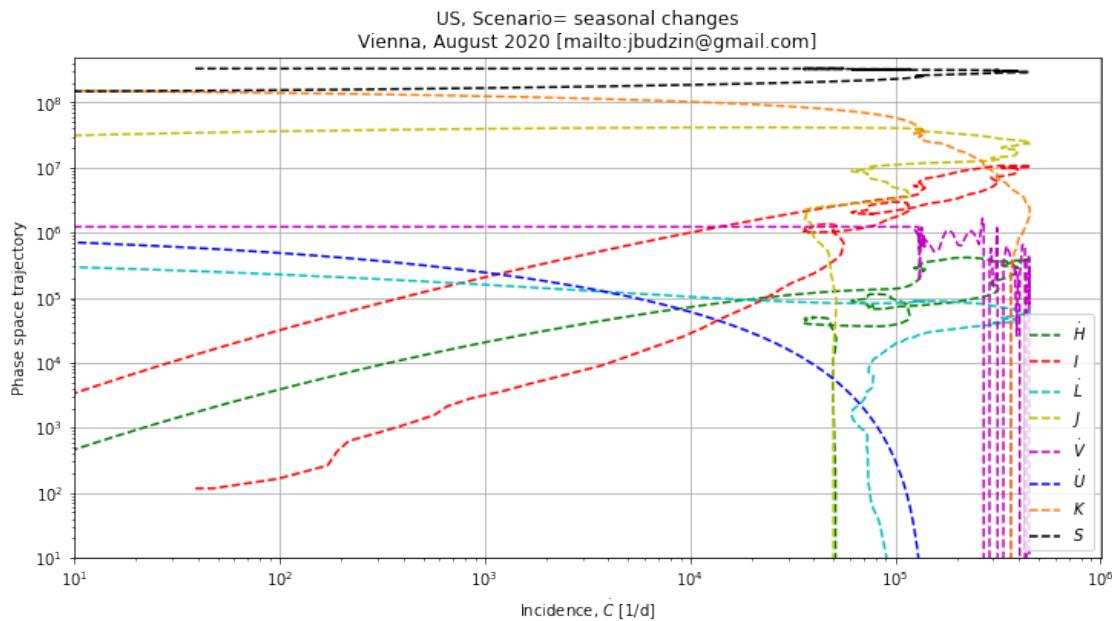






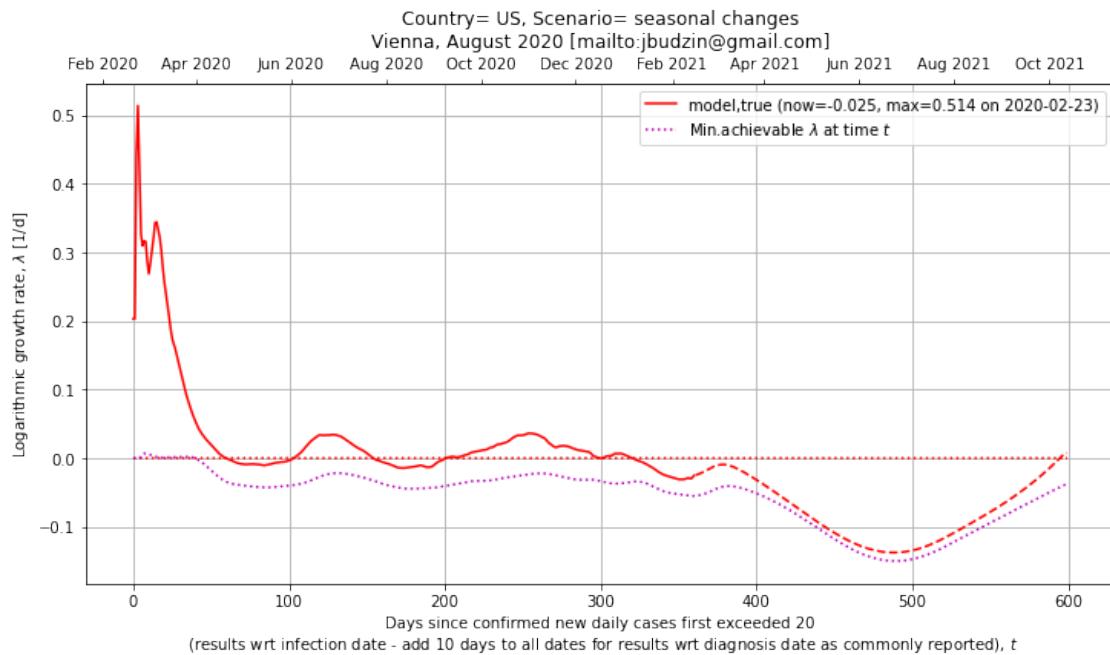
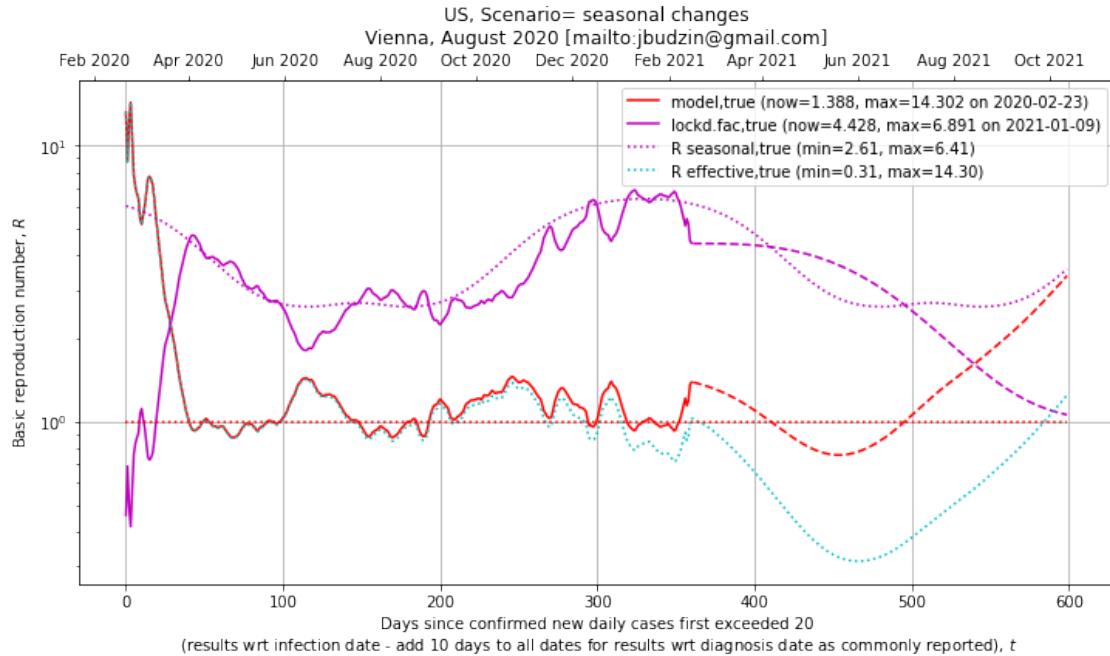


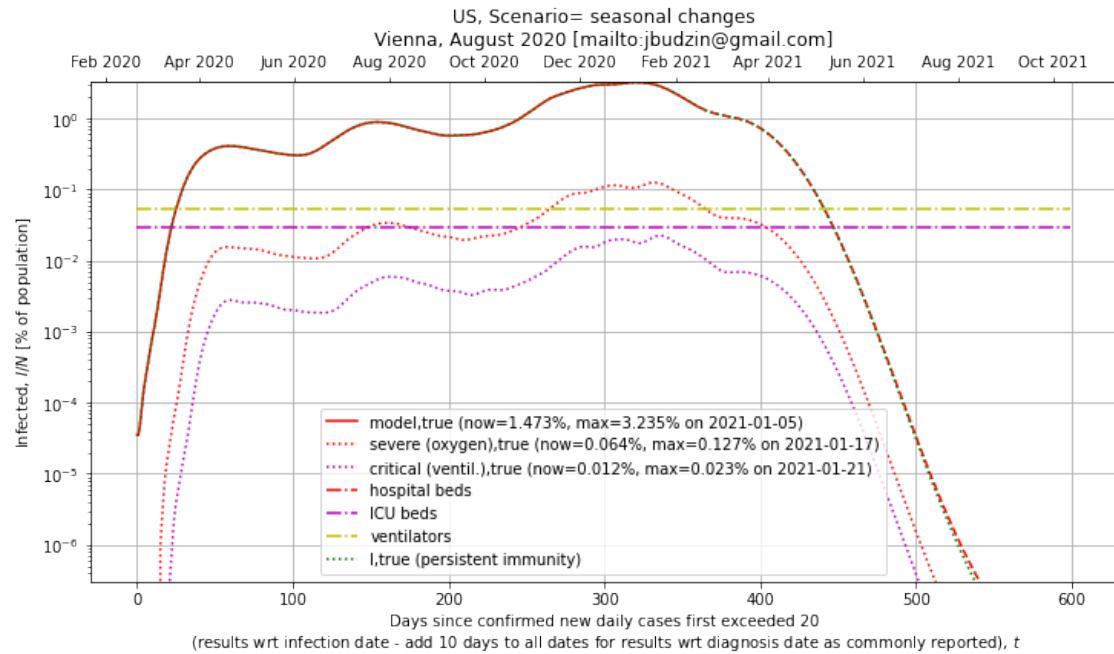
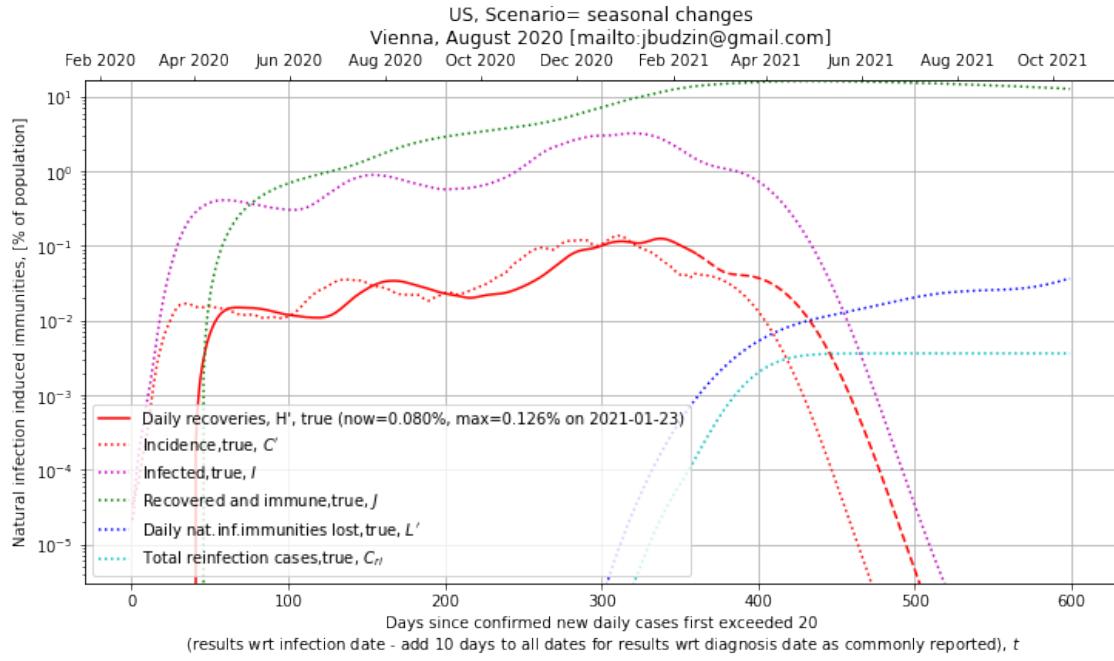
Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 7.76e+05 / Perc of pop = 0.235
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0
 Time constant in Lyapunov function (data) [d] = 147.093
 Time constant in Lyapunov function (proj) [d] = 121.844

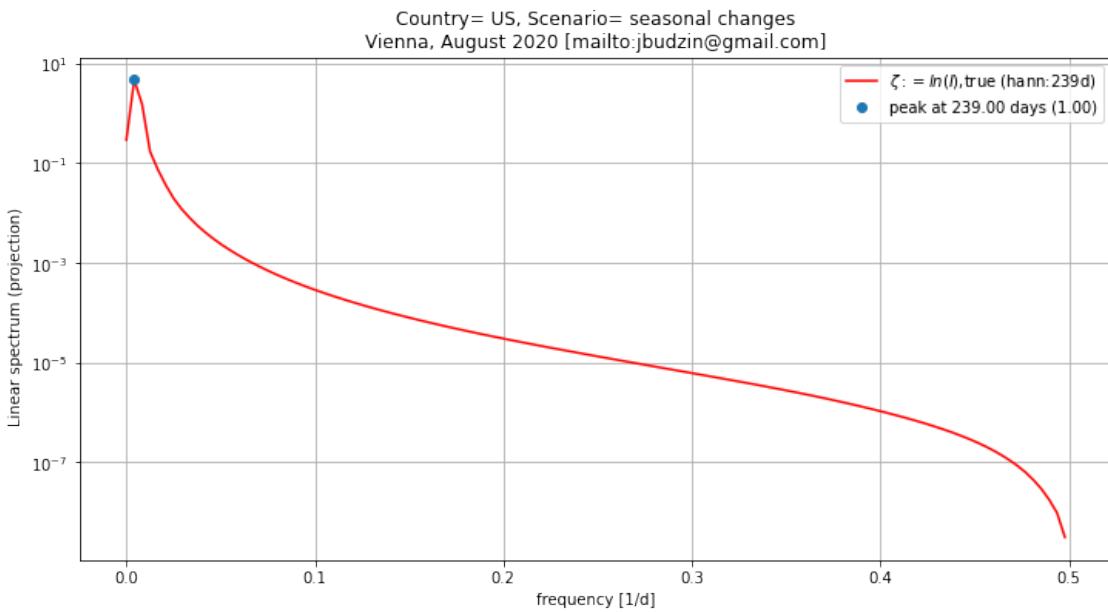
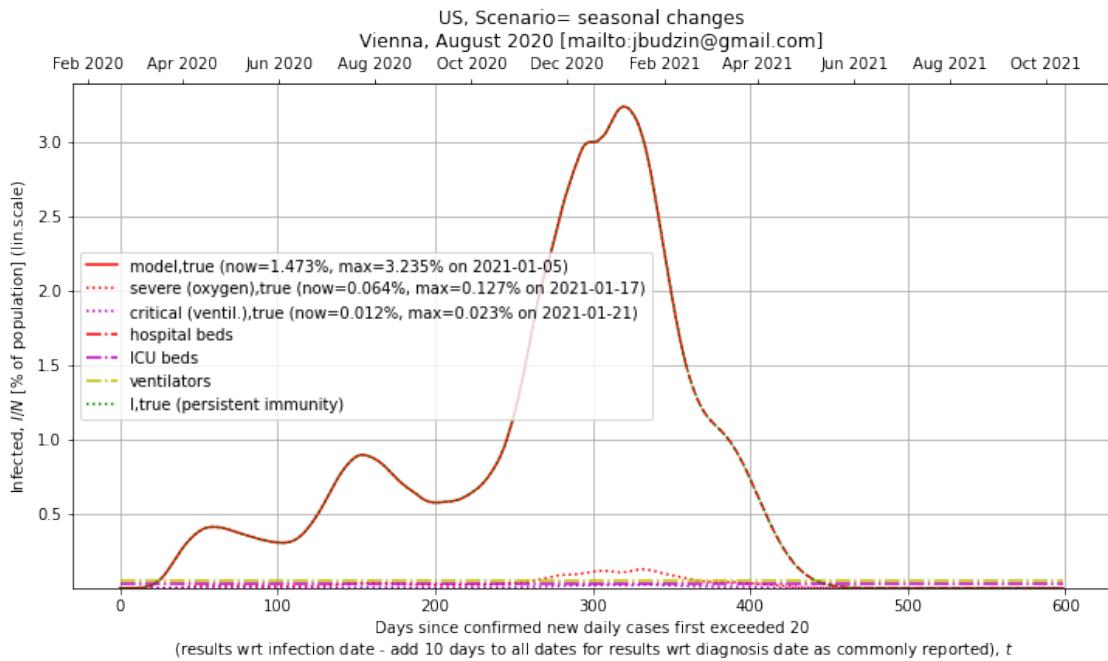


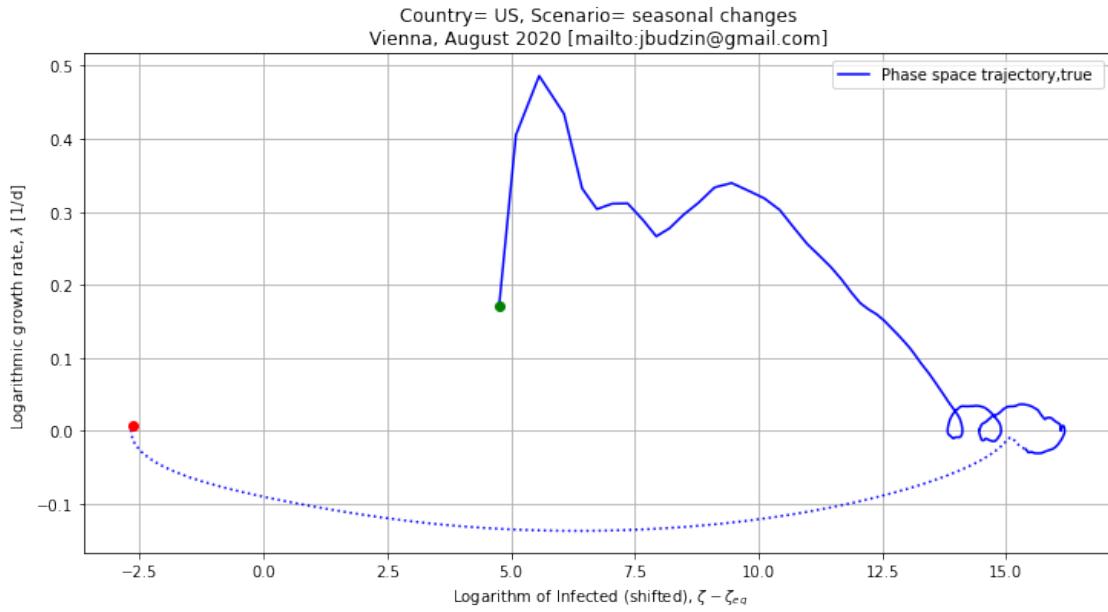
1.6.4 TAU_NU = 360.00 days

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True False True True









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

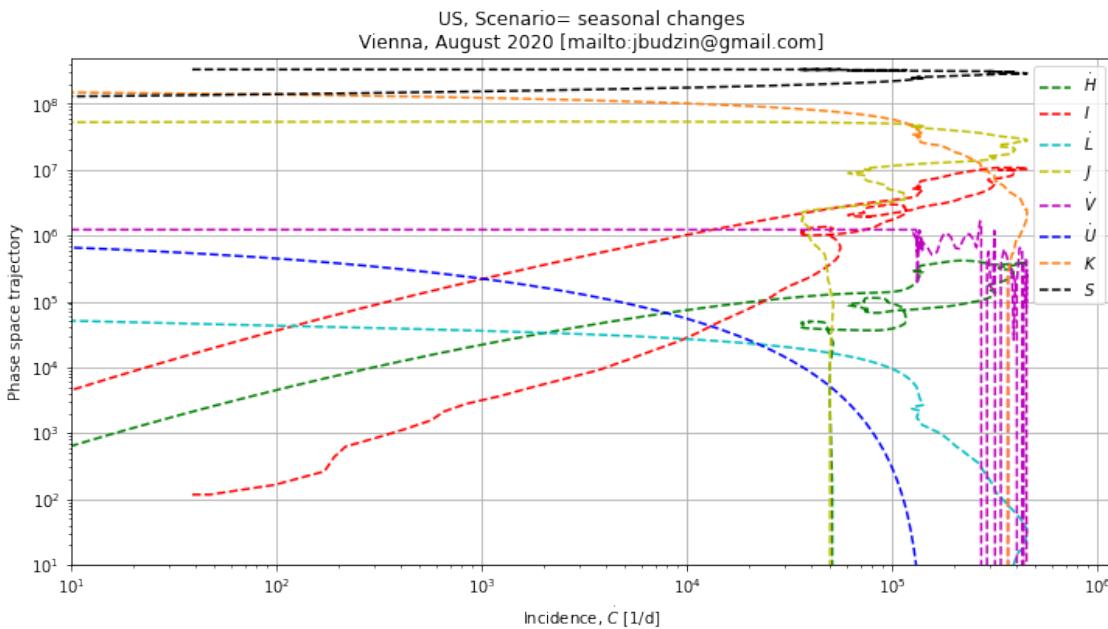
Avg. infection prevalence = 7.75e+05 / Perc of pop= 0.234

Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

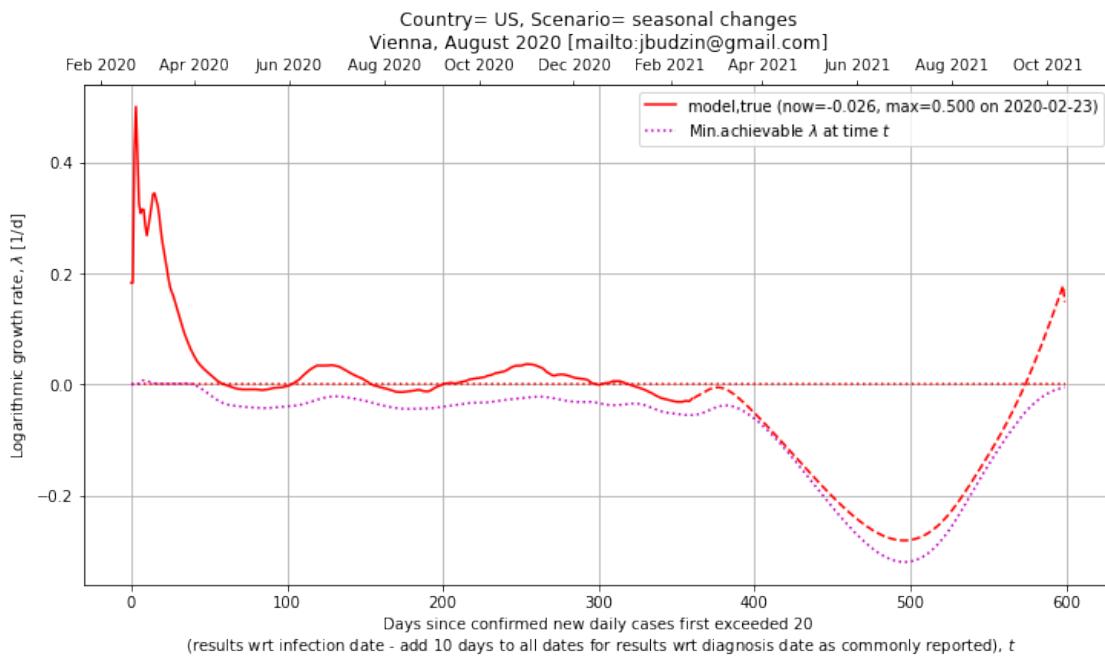
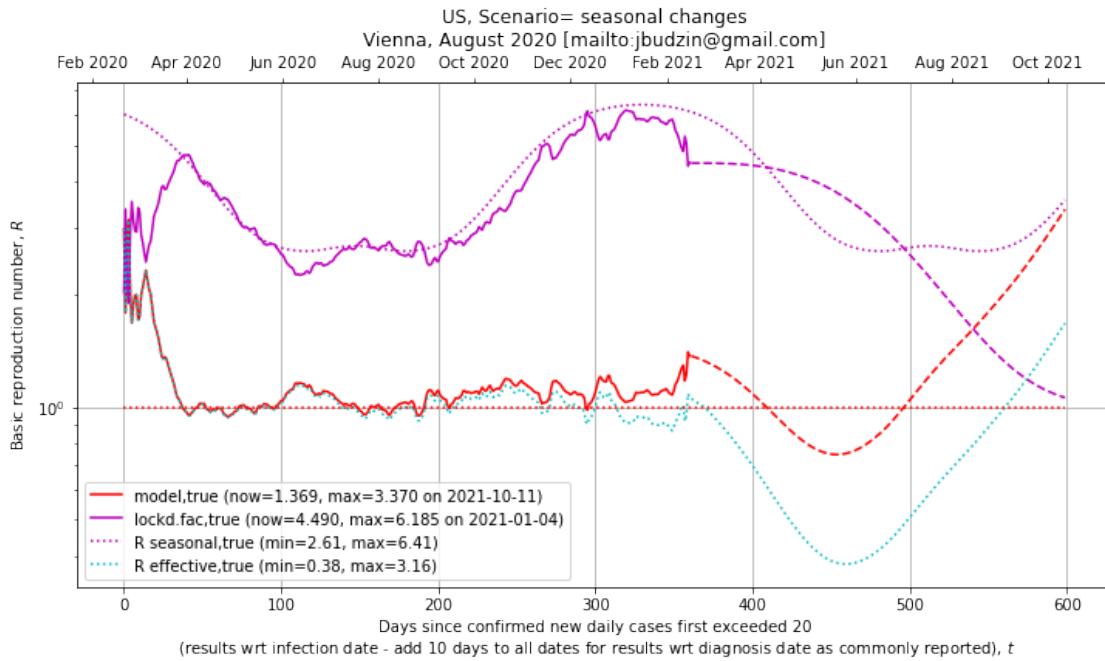
Time constant in Lyapunov function (data) [d]= 148.640

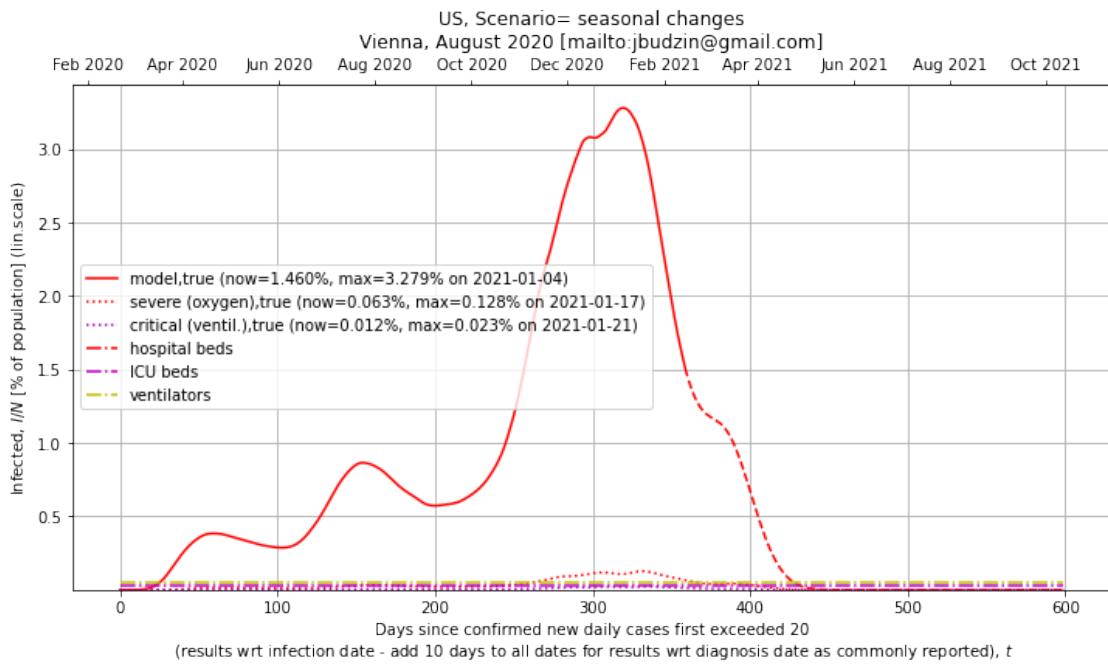
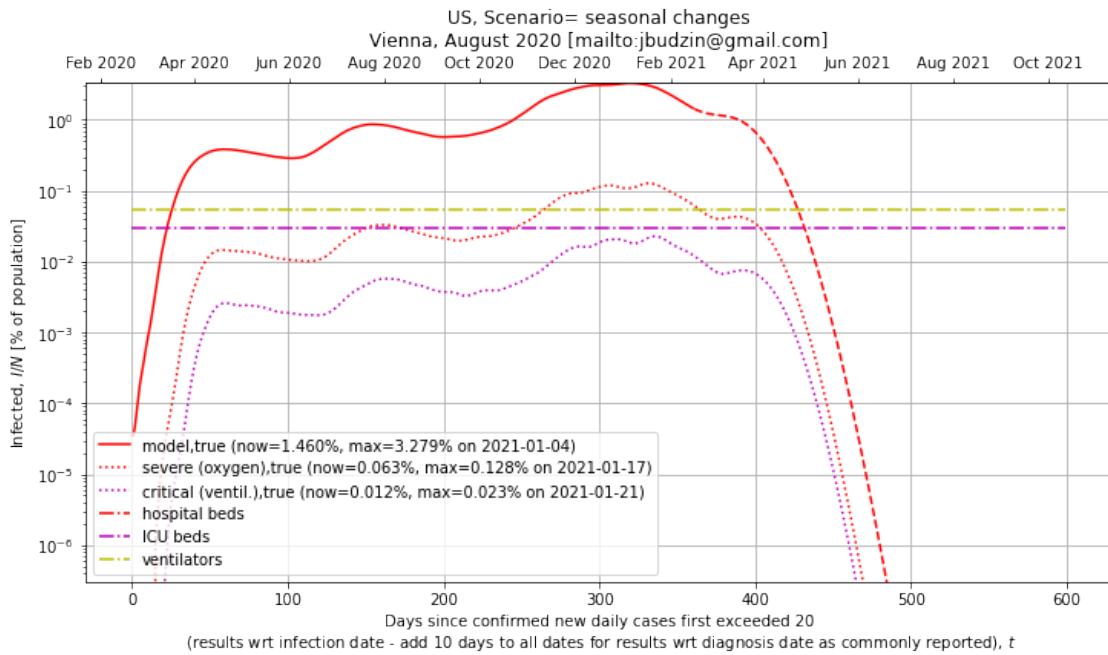
Time constant in Lyapunov function (proj) [d]= 85.016

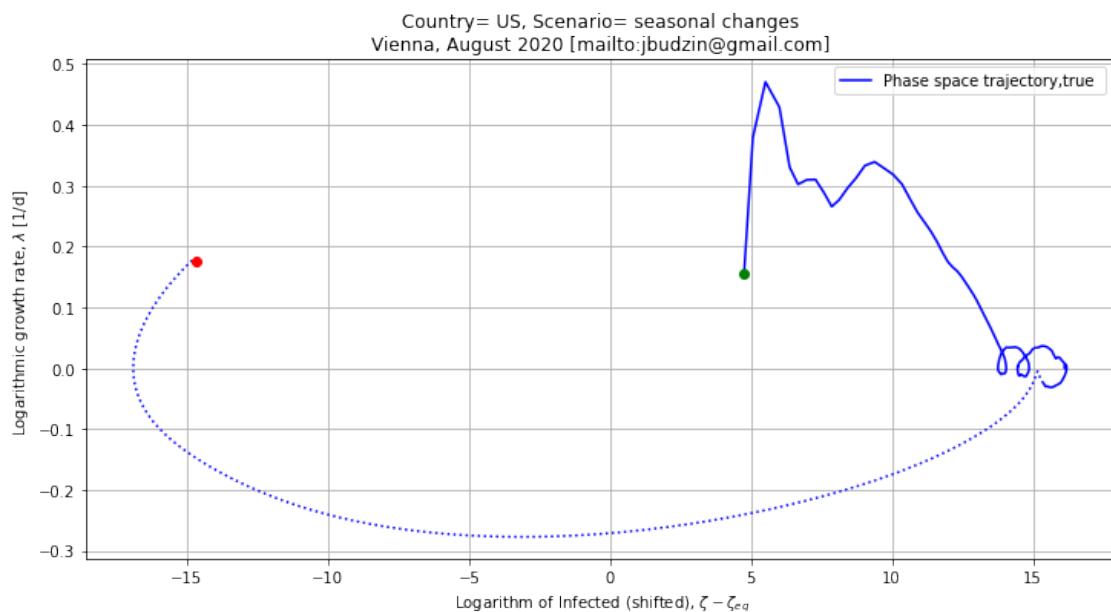
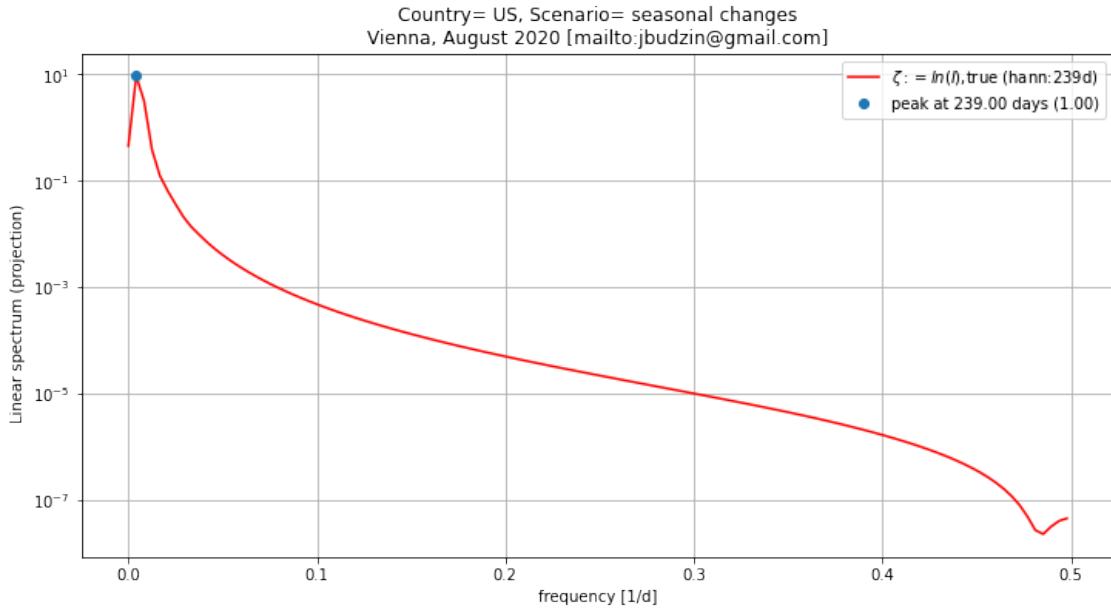


1.6.5 TAU_BETA = 2.50 days

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True



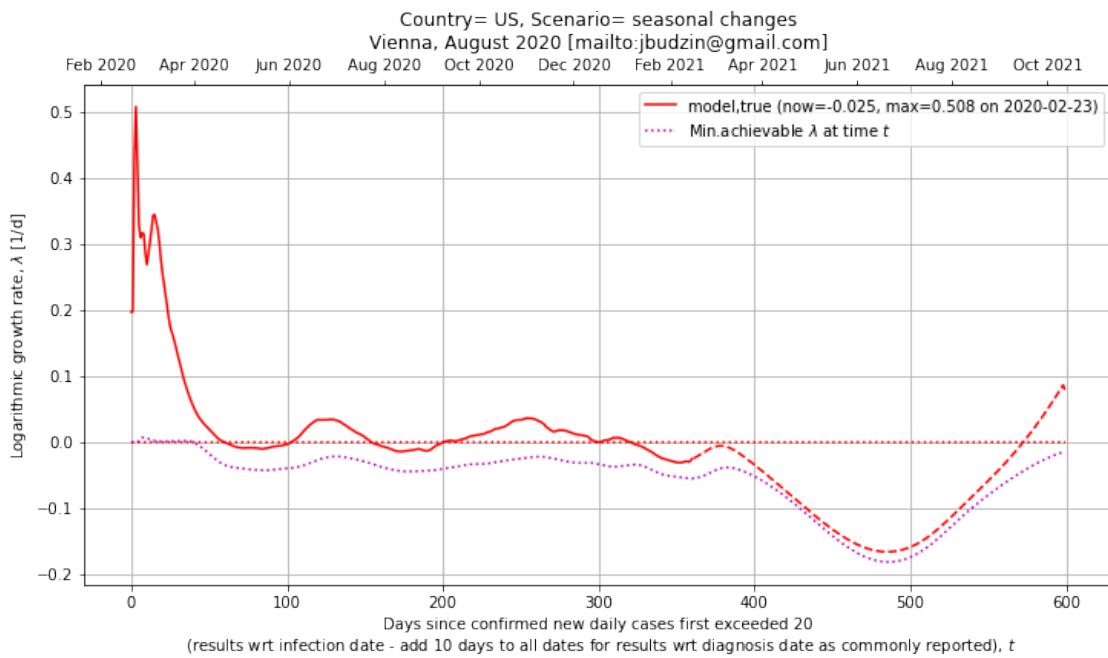
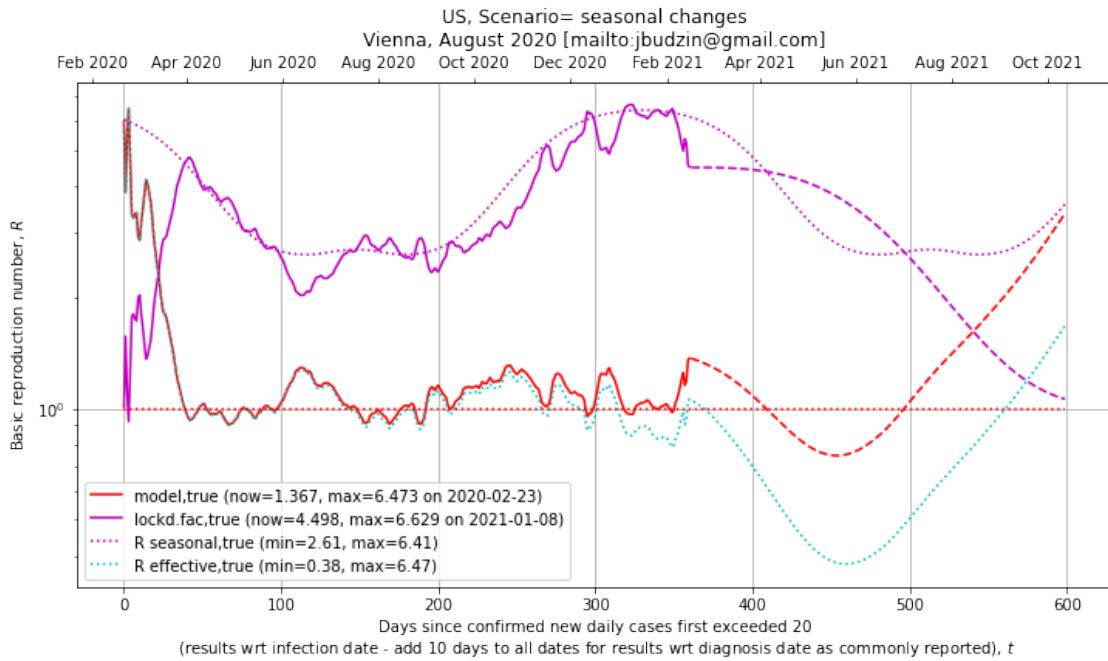


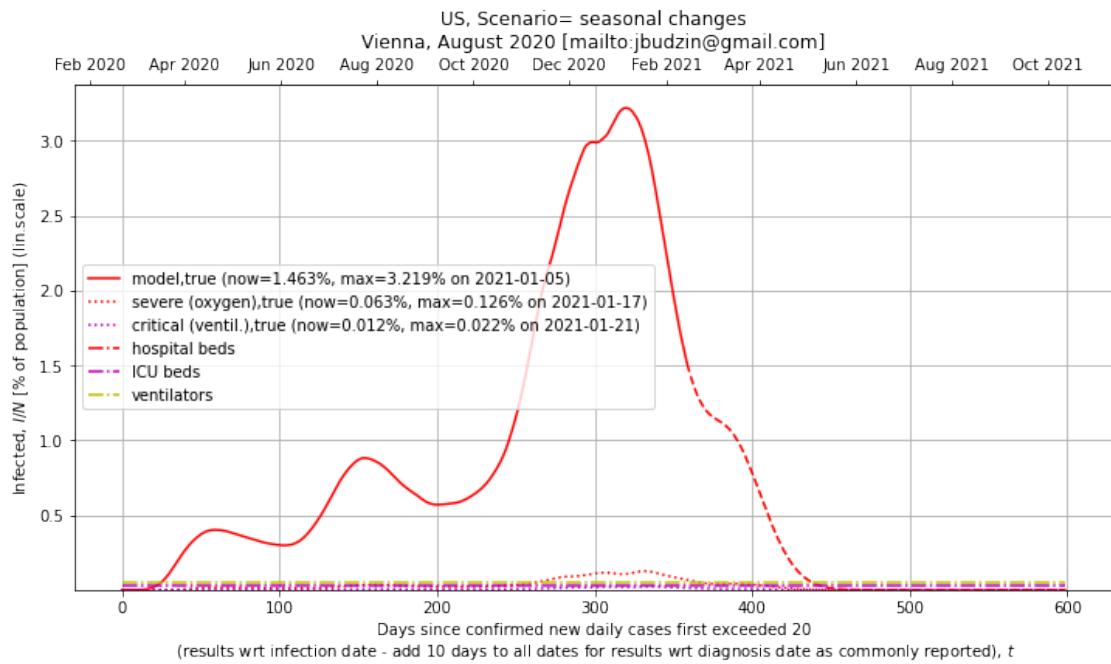
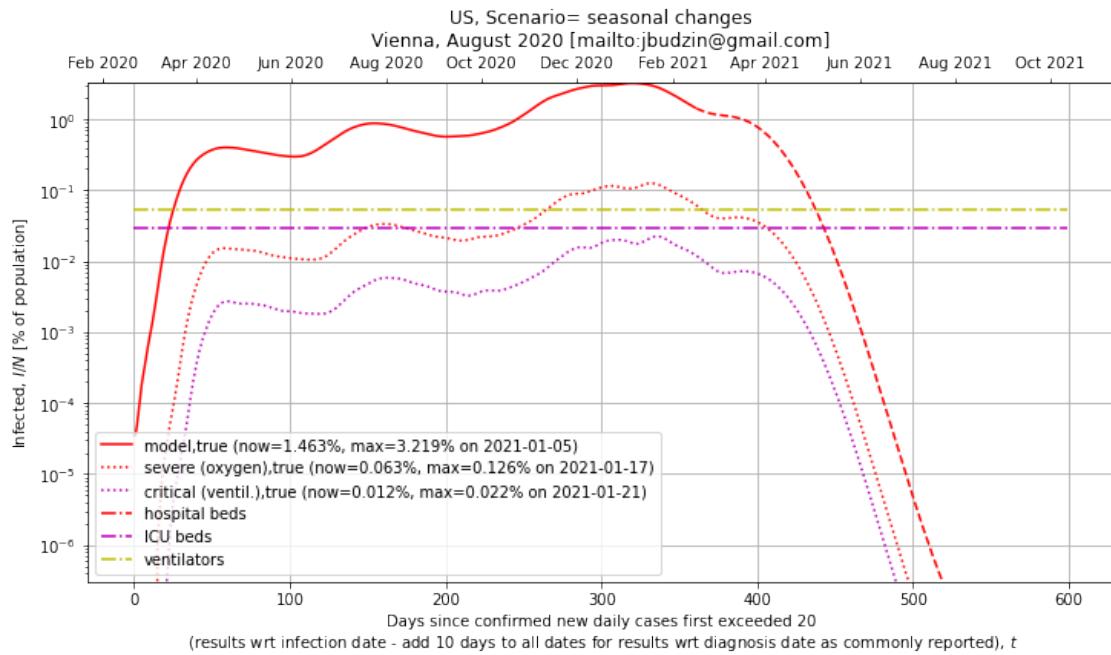


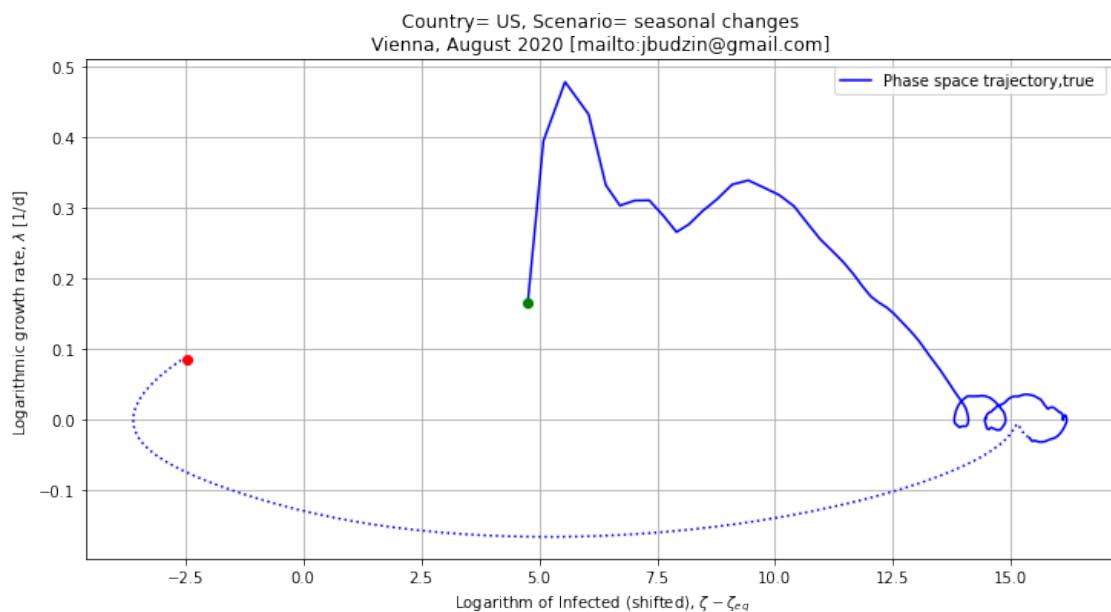
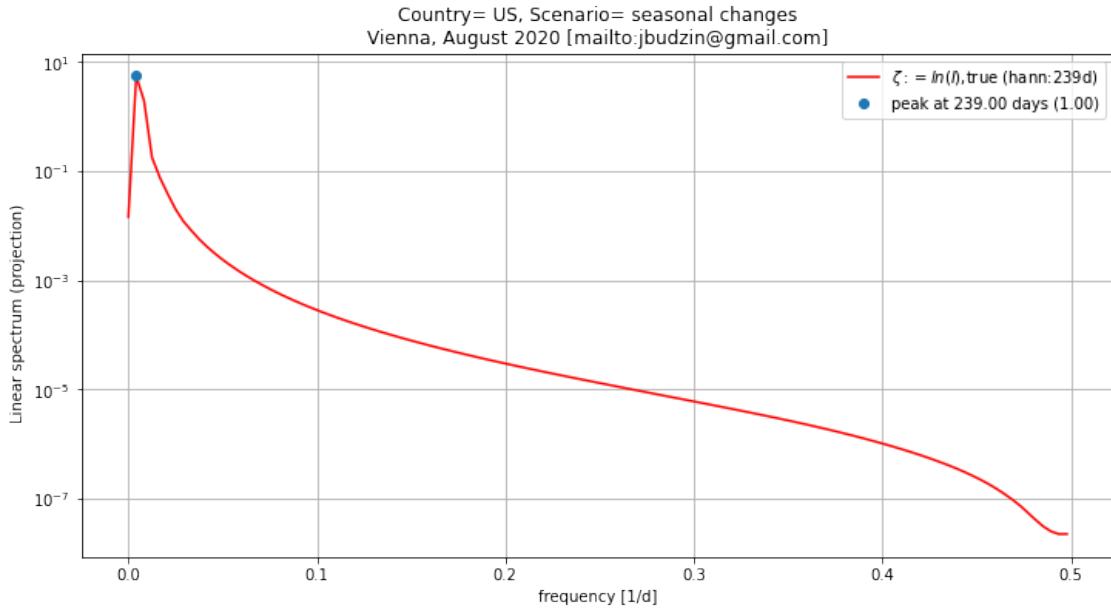
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.16e+05 / Perc of pop= 0.216
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 151.592
Time constant in Lyapunov function (proj) [d]= 63.700

1.6.6 TAU_BETA = 5.00 days

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True



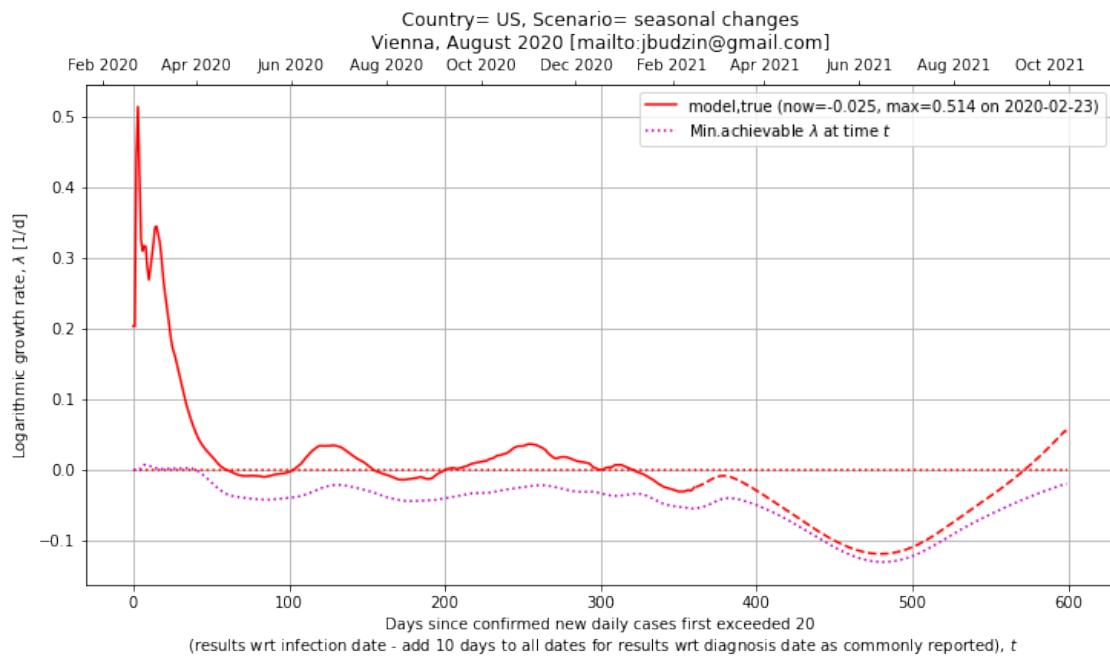
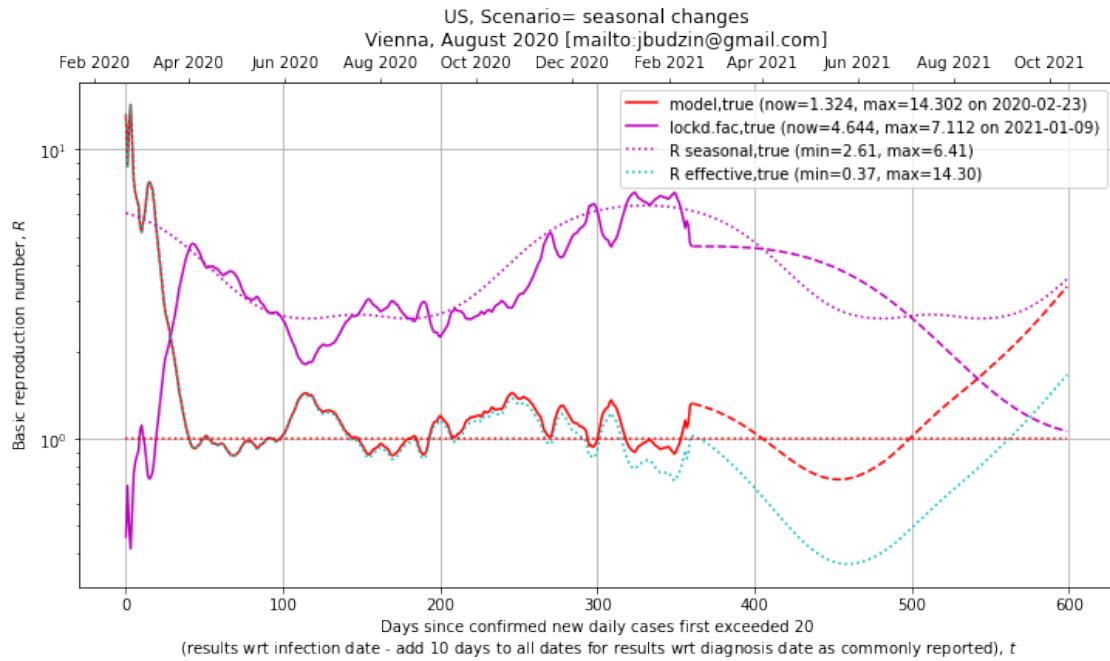


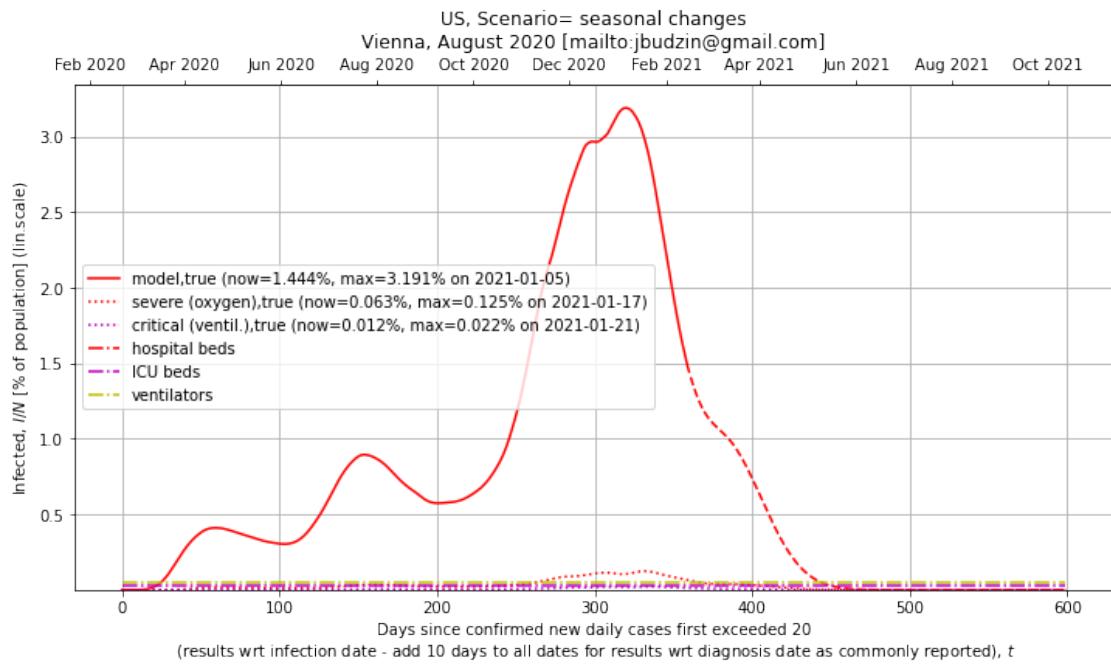
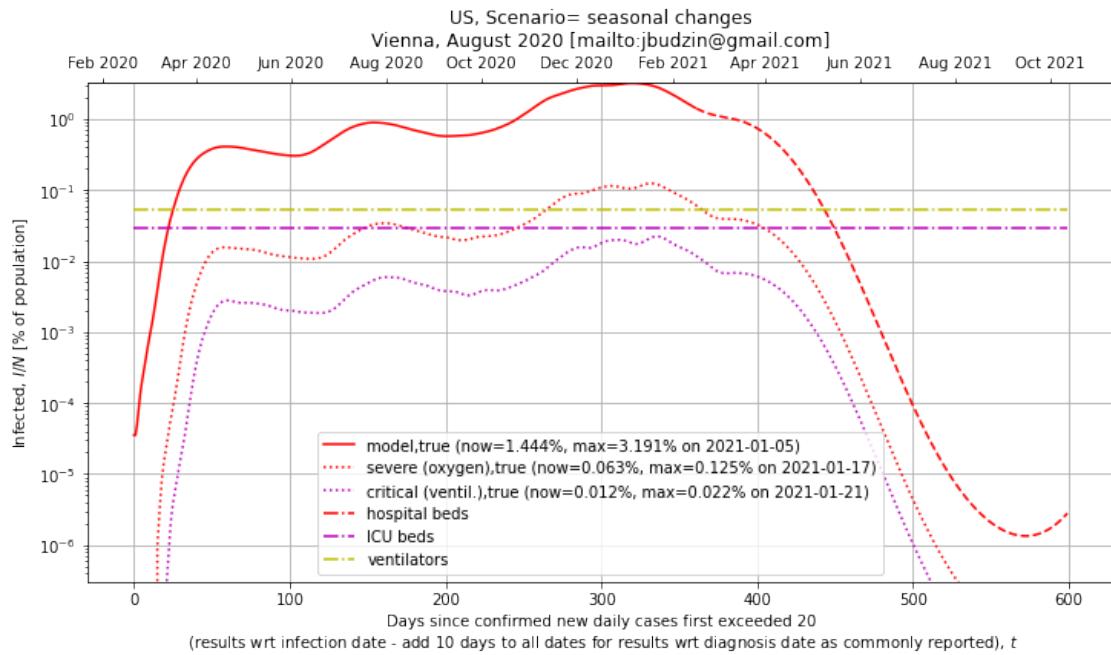


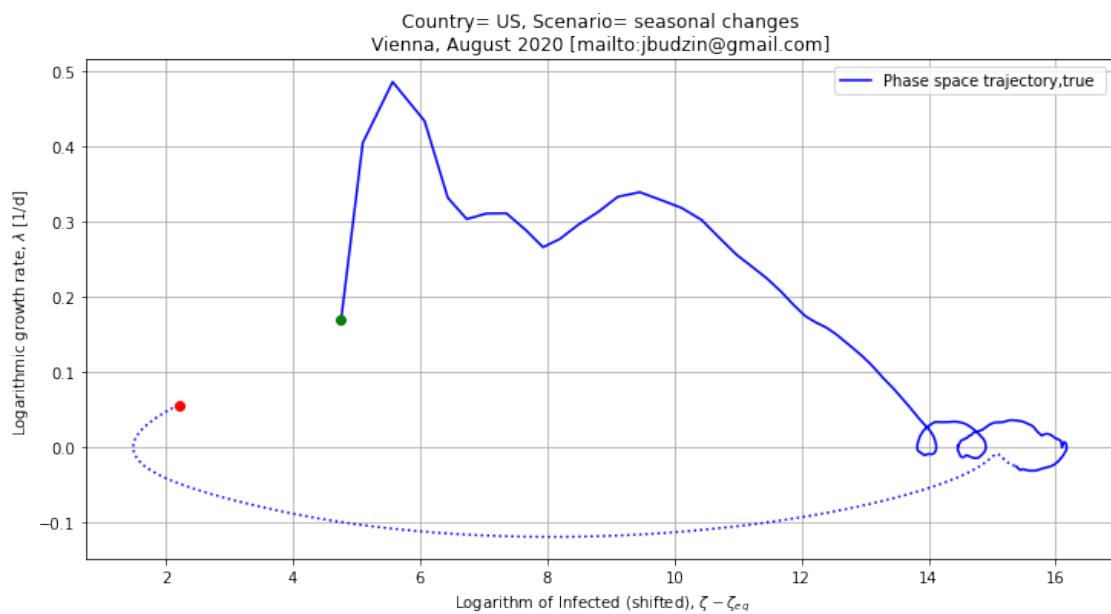
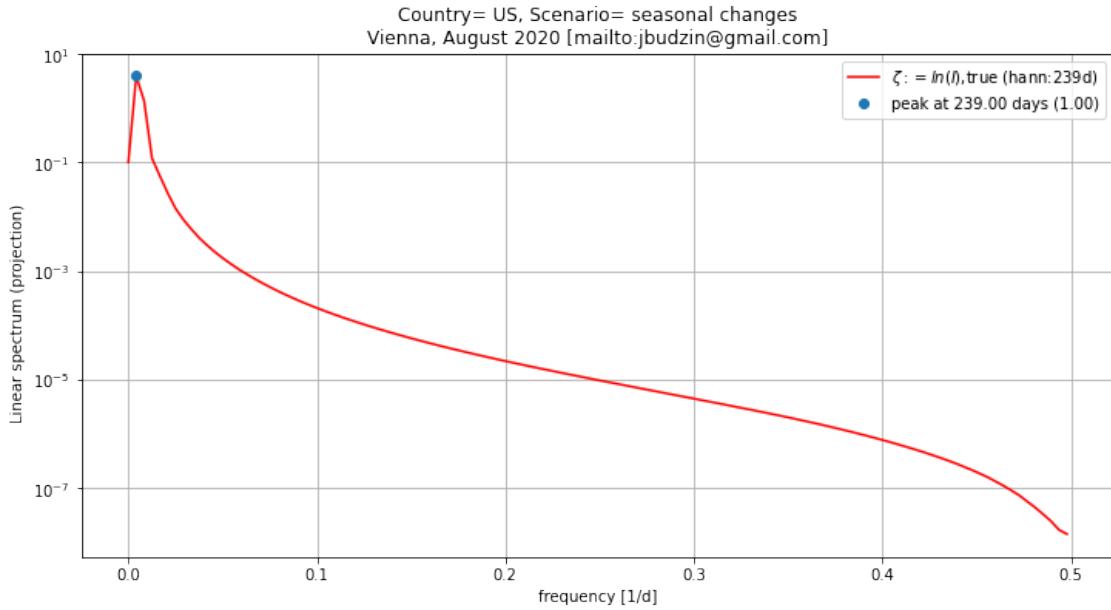
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
 Avg. infection prevalence = 7.88e+05 / Perc of pop= 0.238
 Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
 Time constant in Lyapunov function (data) [d]= 151.507
 Time constant in Lyapunov function (proj) [d]= 77.071

1.6.7 TAU_BETA = 7.50 days

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True







Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
 Avg. infection prevalence = 7.76e+05 / Perc of pop= 0.235
 Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
 Time constant in Lyapunov function (data) [d]= 148.076
 Time constant in Lyapunov function (proj) [d]= 125.043

1.7 VACCINATIONS (at LDF_INF = 1.88)

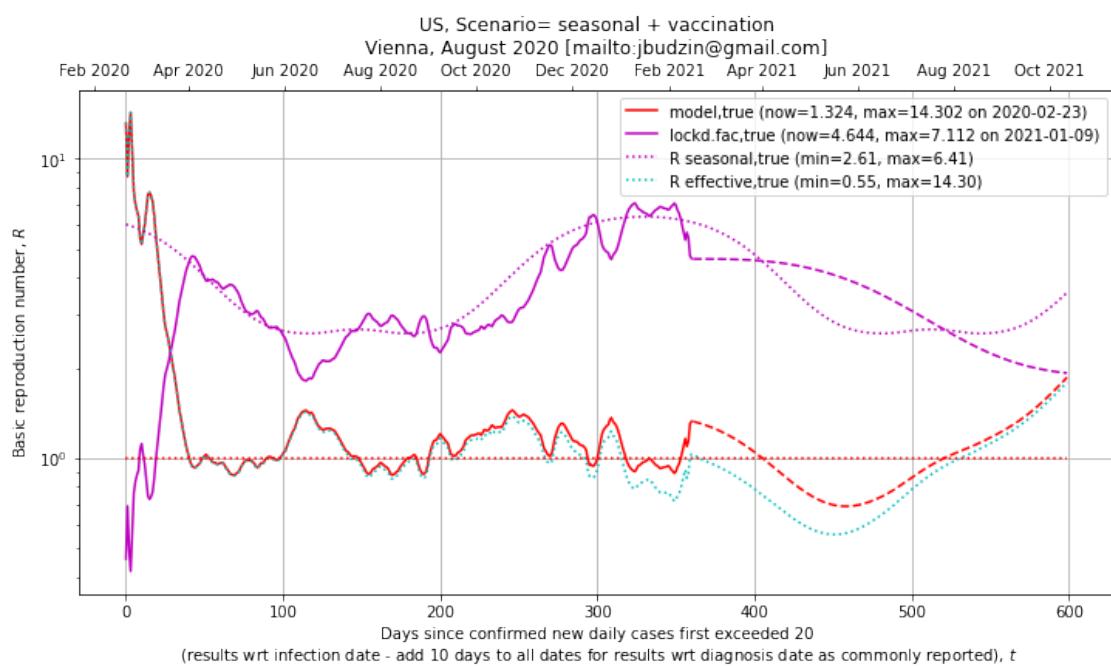
1.7.1 VACC_RATE = 0.10 [fraction of popul. per year]

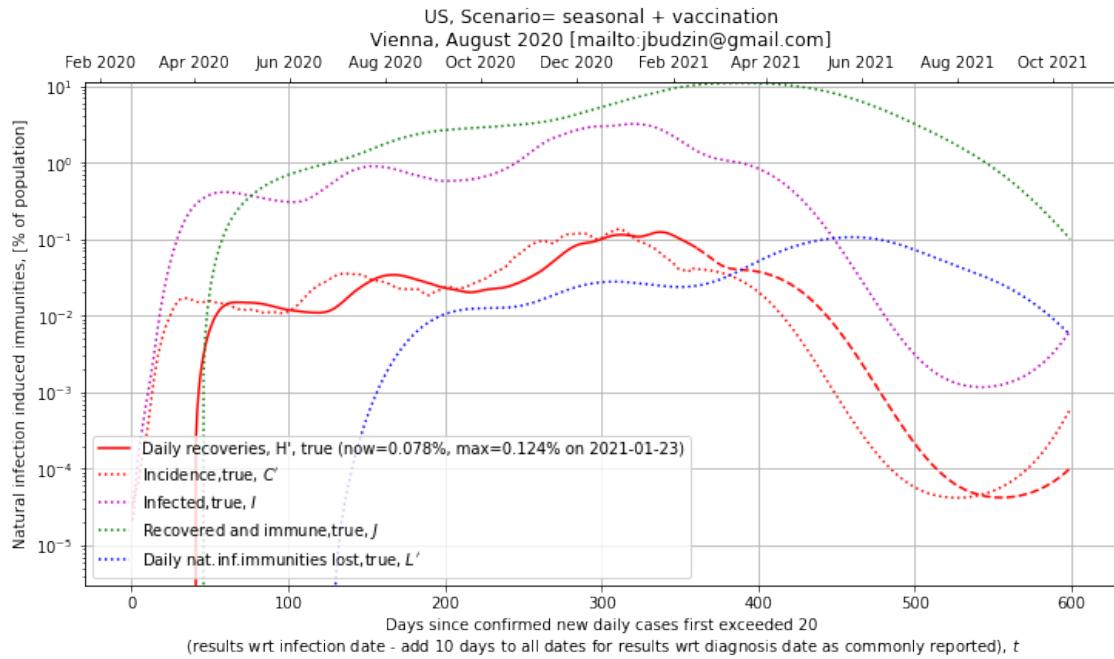
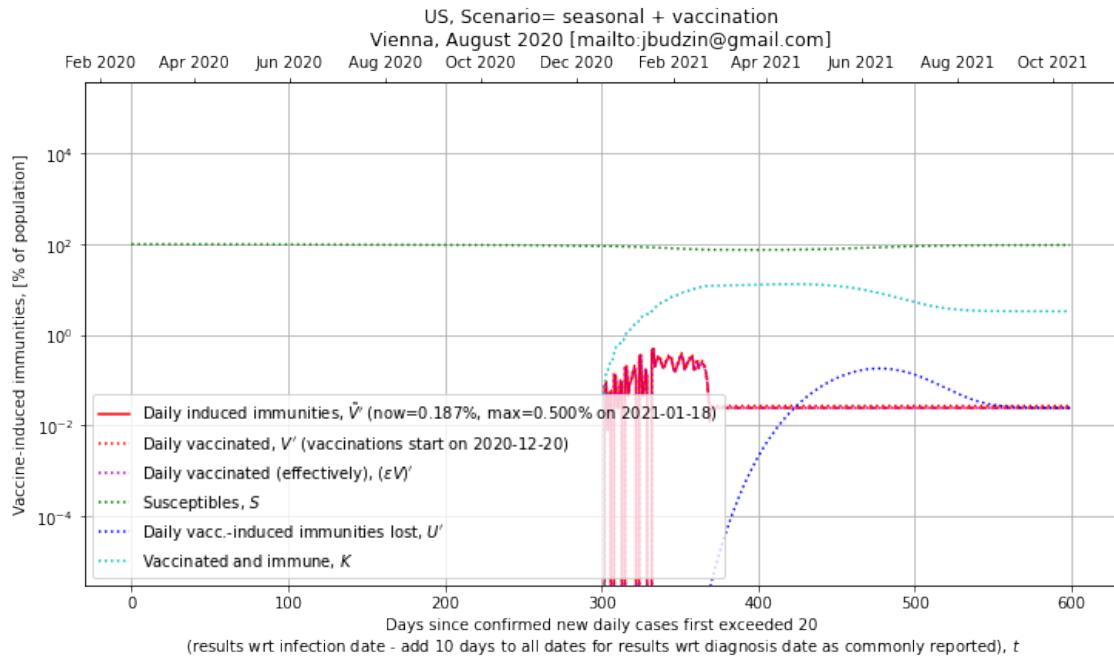
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True

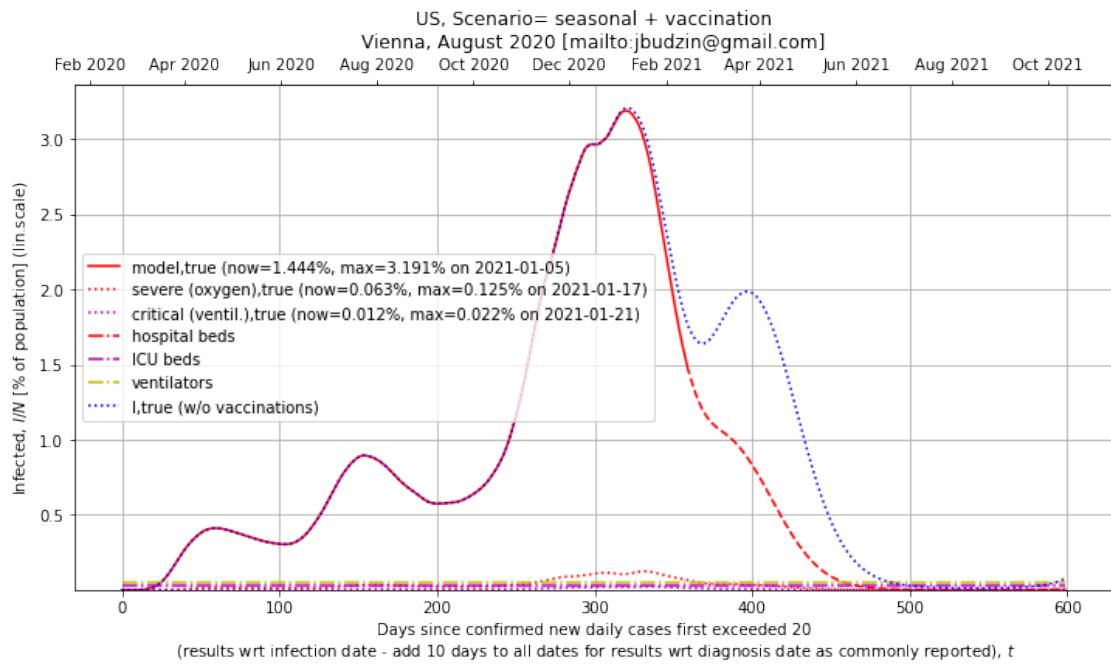
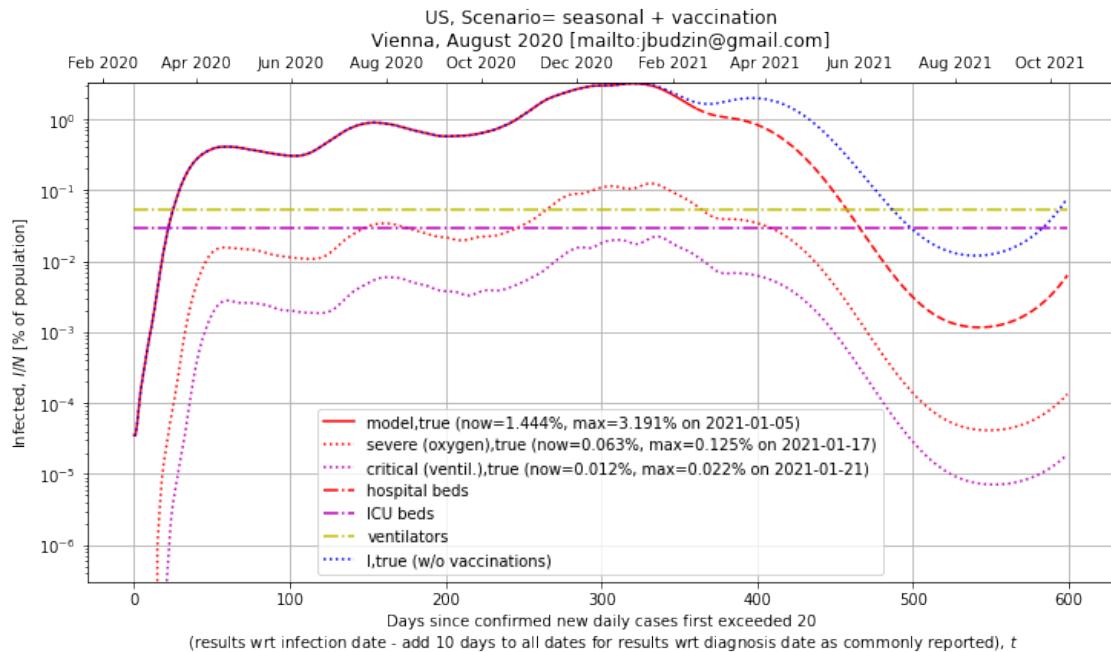
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True

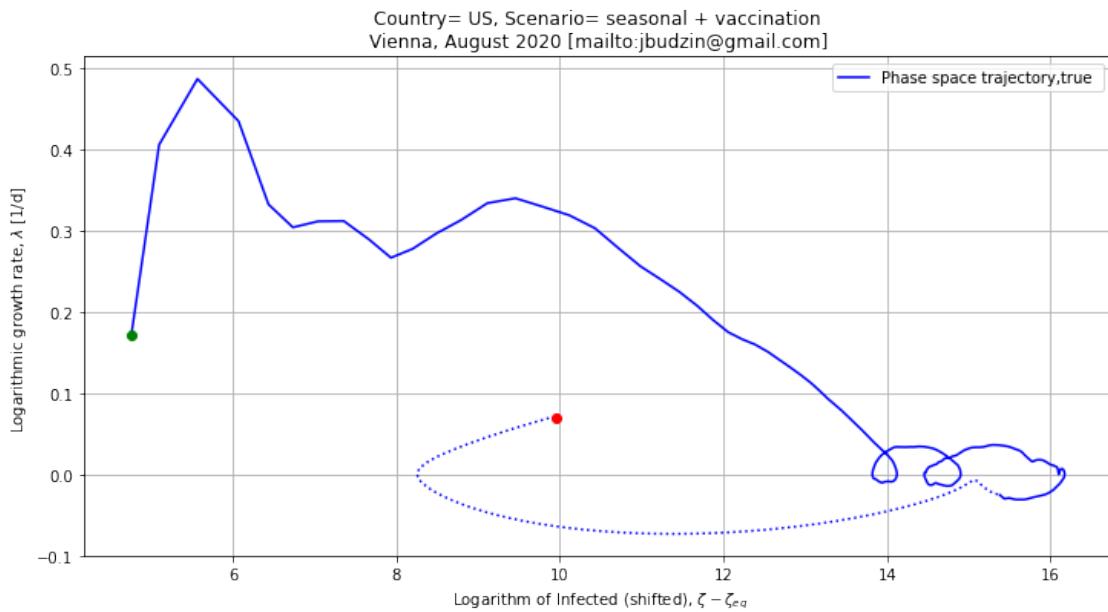
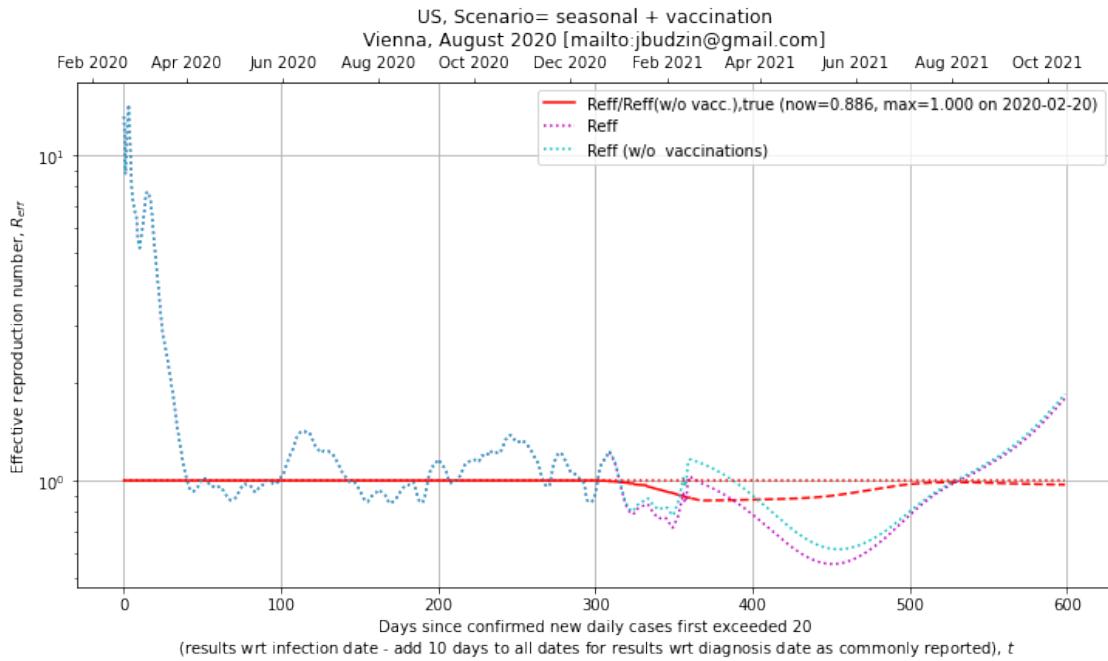
Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 10.004









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

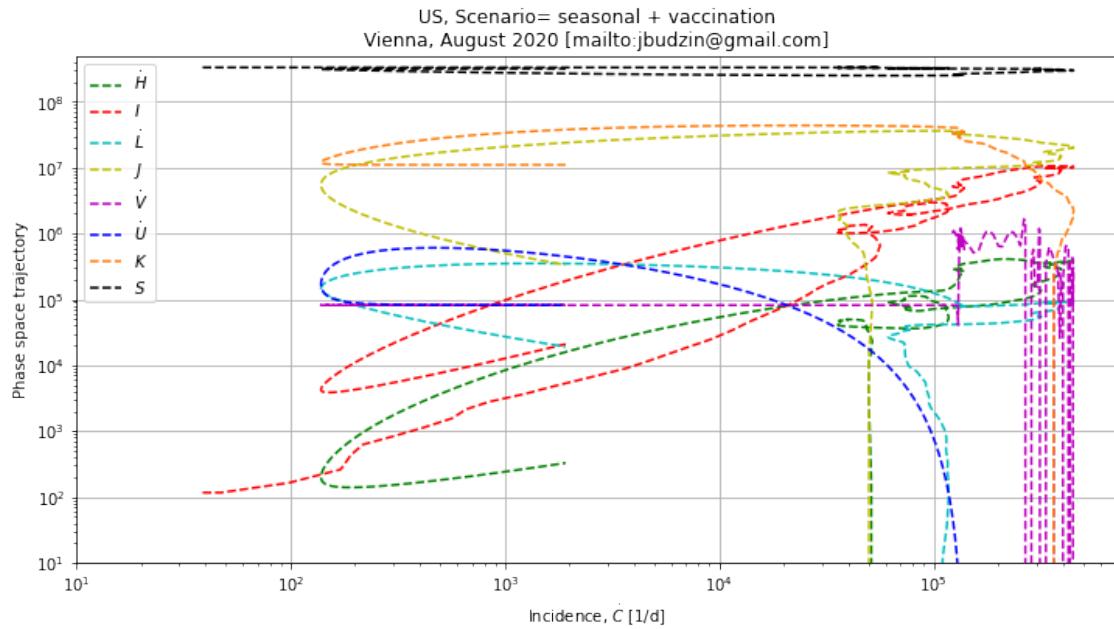
Avg. infection prevalence = 8.91e+05 / Perc of pop= 0.269

Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

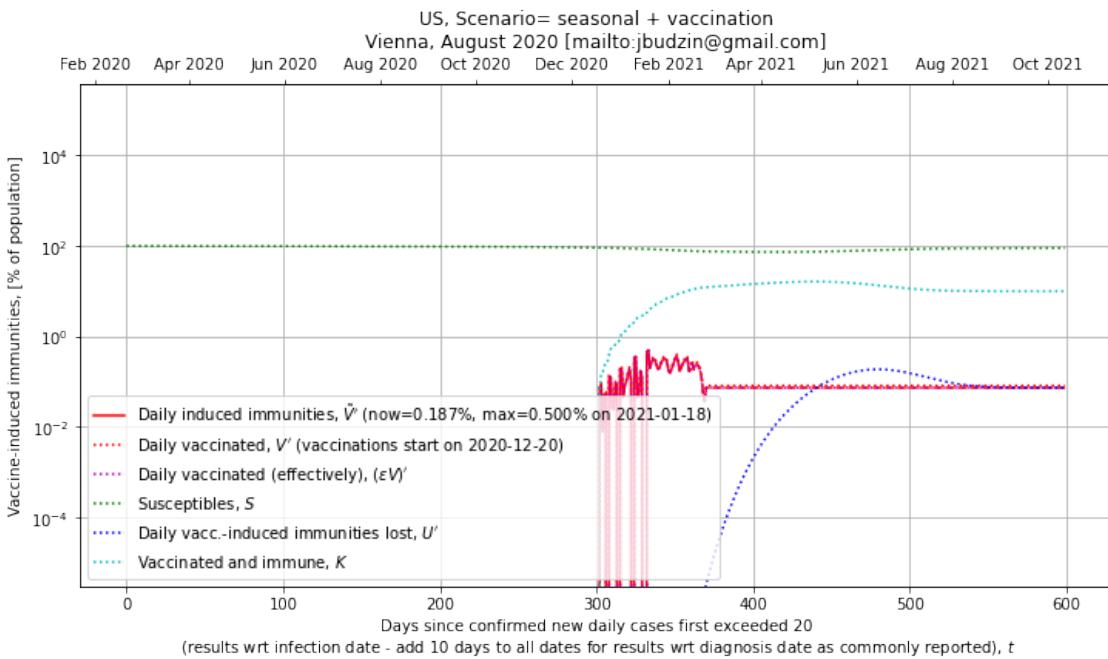
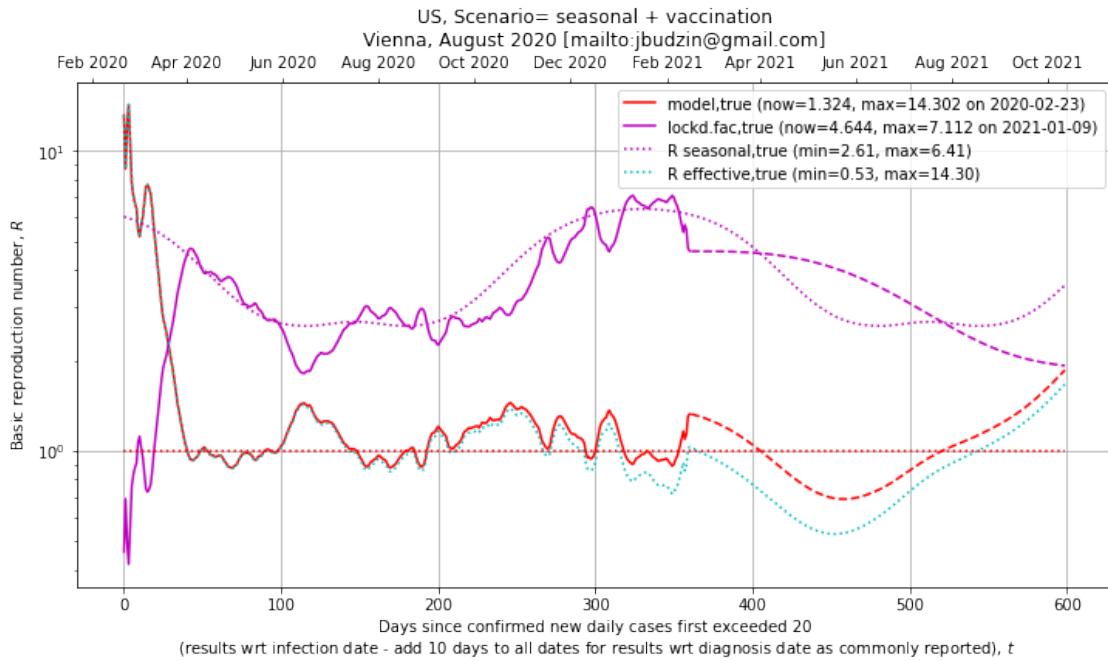
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 175.853

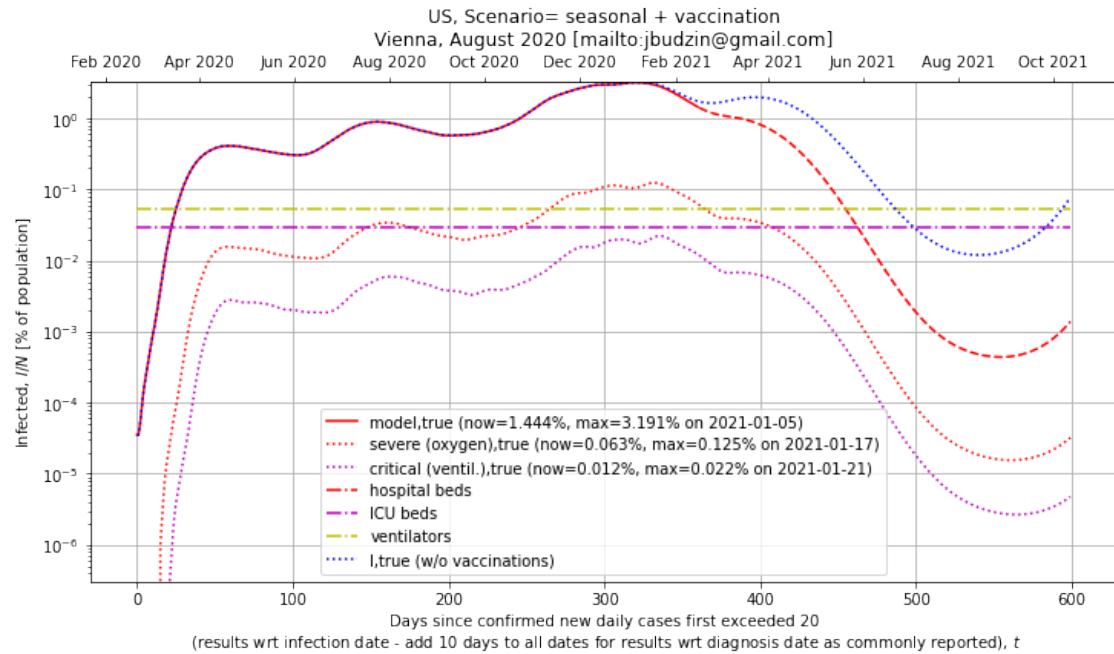
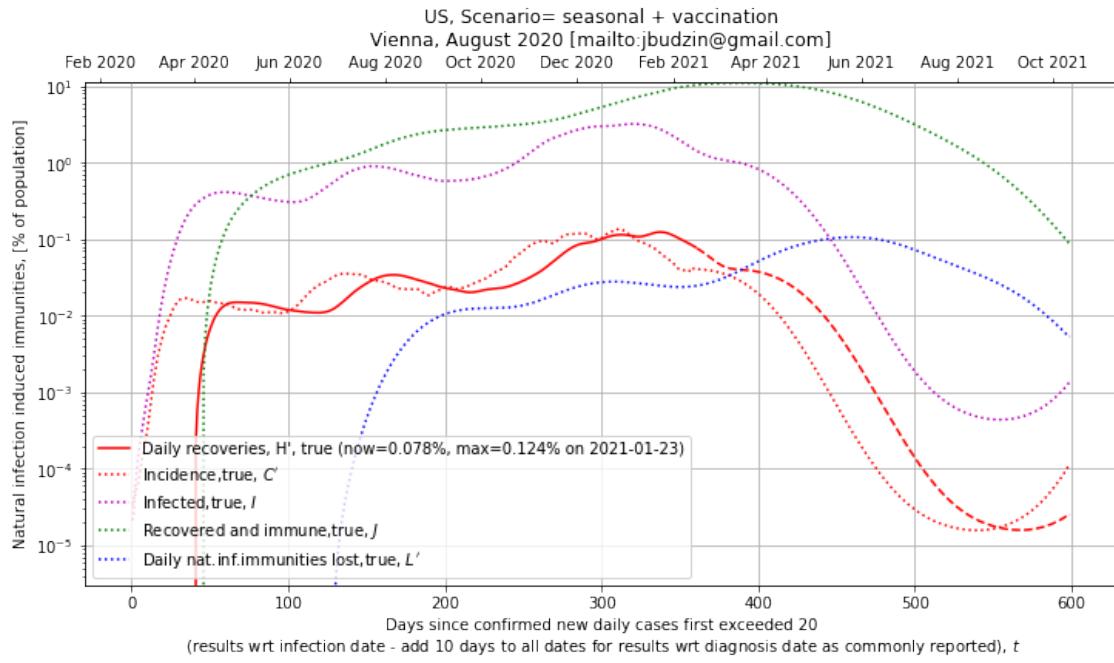
Approx. vaccination cost per year (projection) [EUR MLN] = 559.17

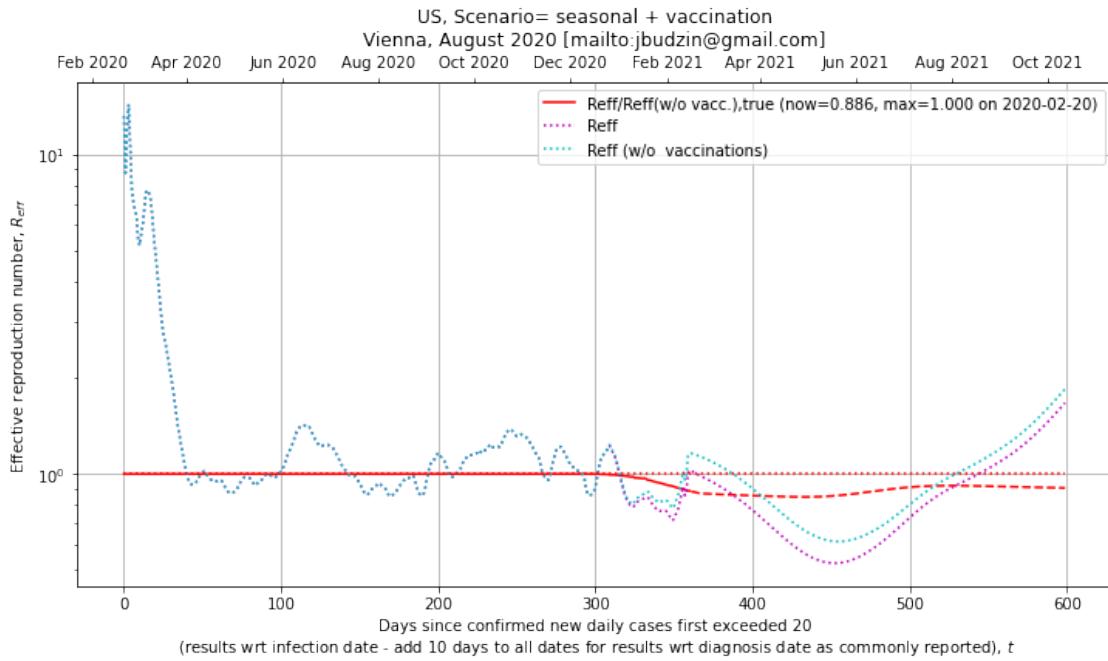
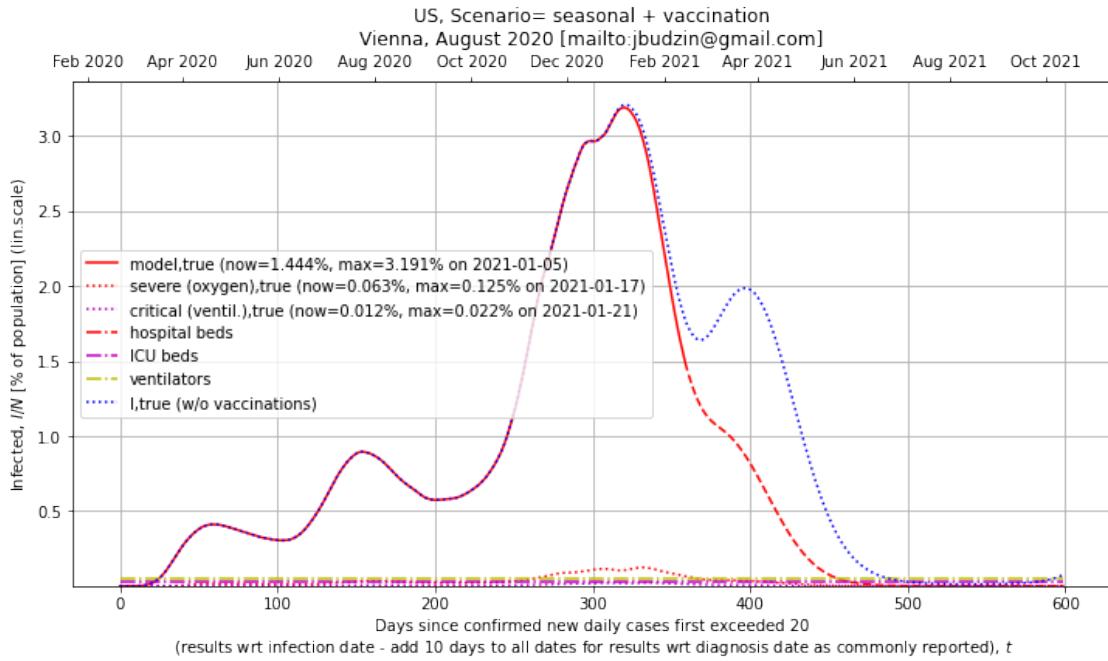


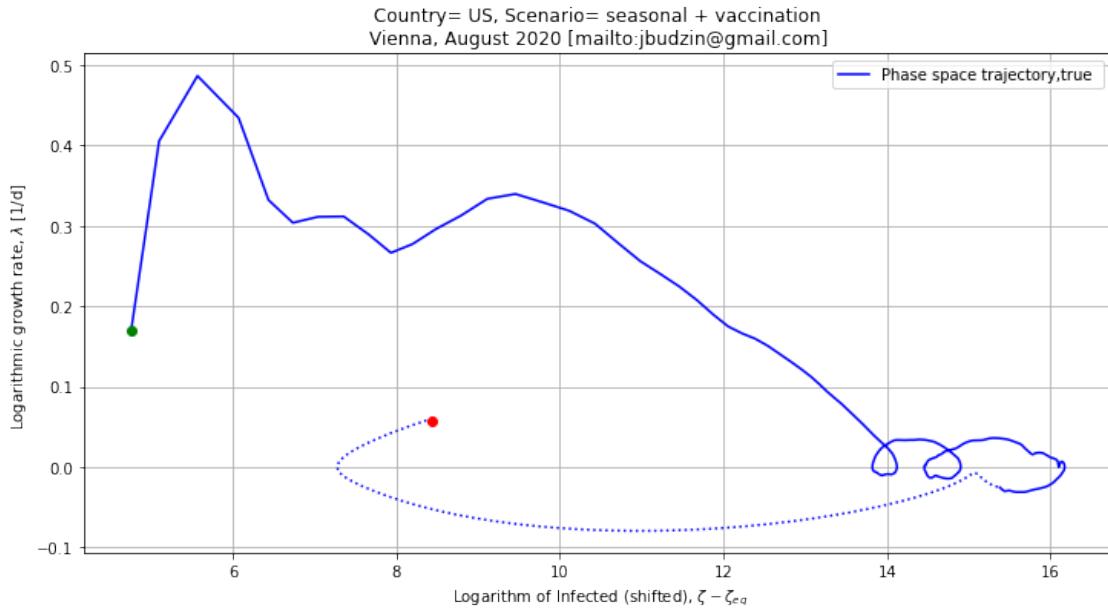
1.7.2 VACC_RATE = 0.30 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 30.012









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

Avg. infection prevalence = 8.68e+05 / Perc of pop= 0.262

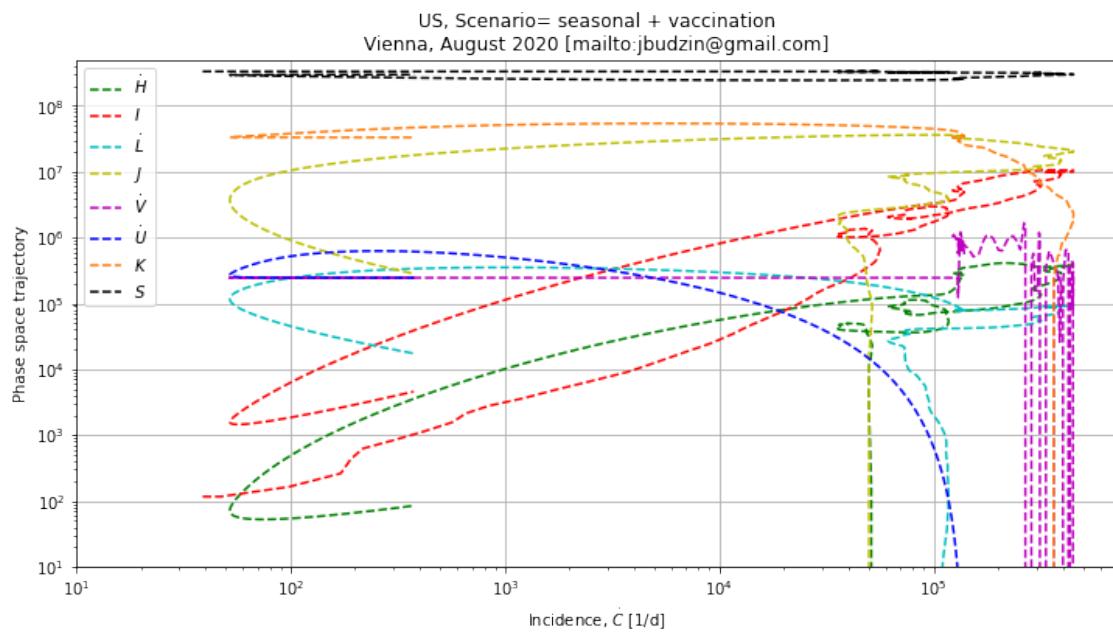
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

Time constant in Lyapunov function (data) [d]= 148.076

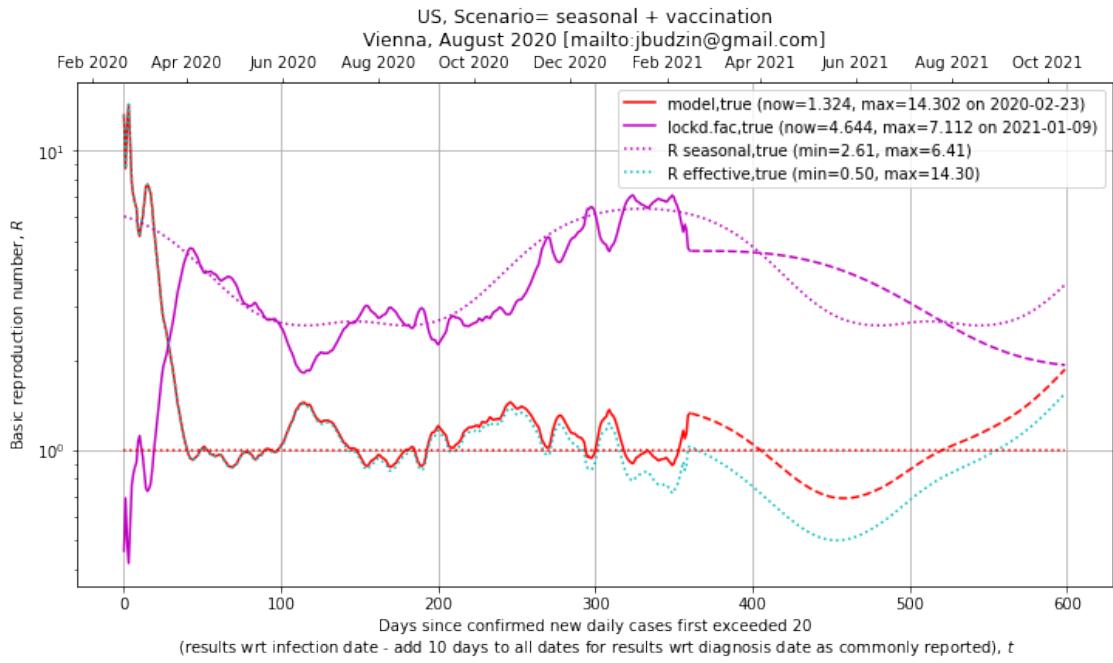
Time constant in Lyapunov function (proj) [d]= 145.002

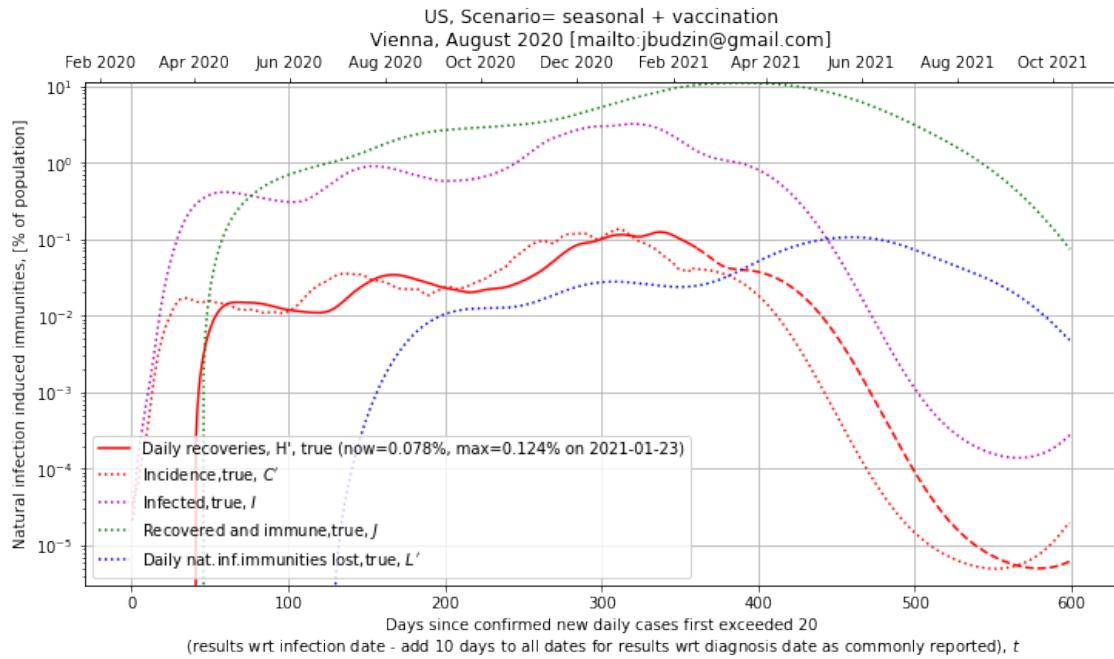
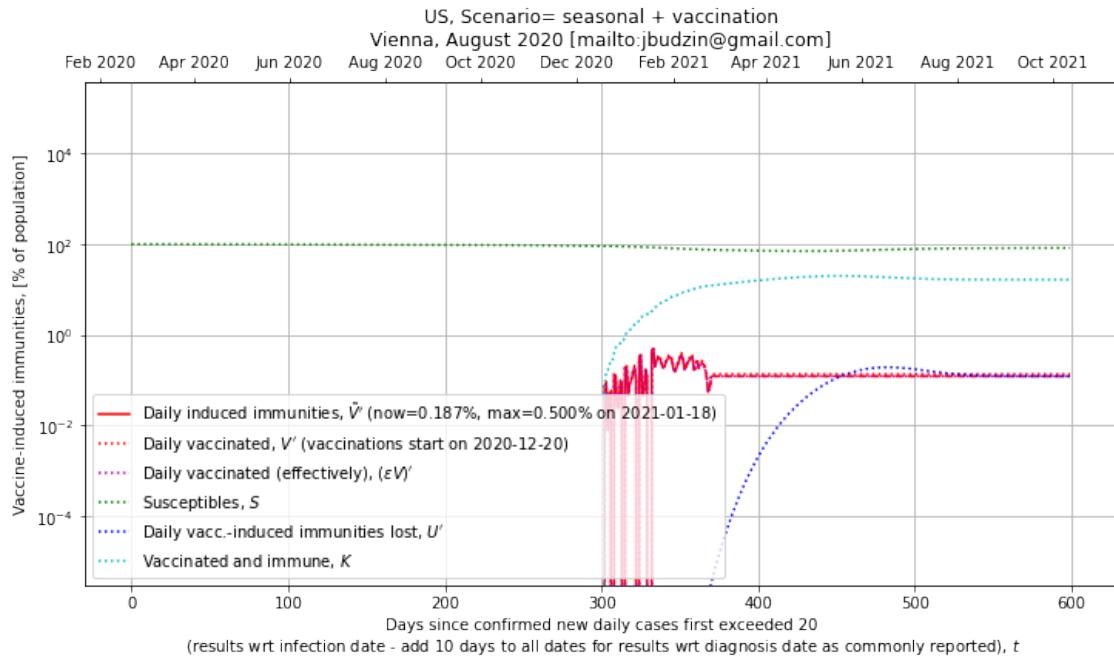
Approx. vaccination cost per year (projection) [EUR MLN] = 1419.58

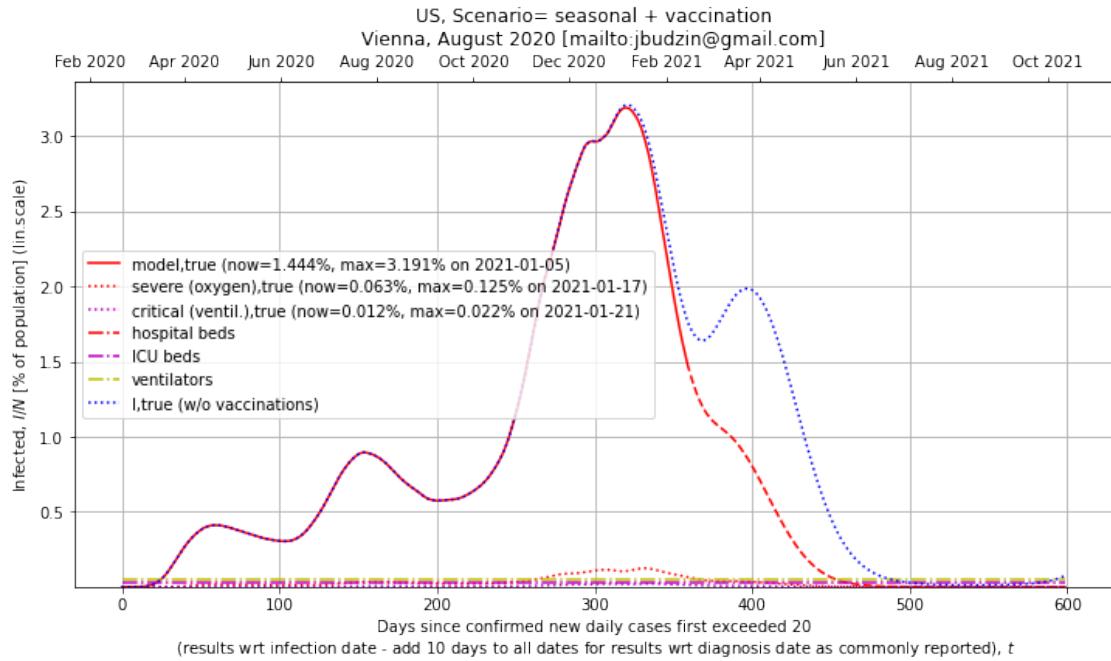
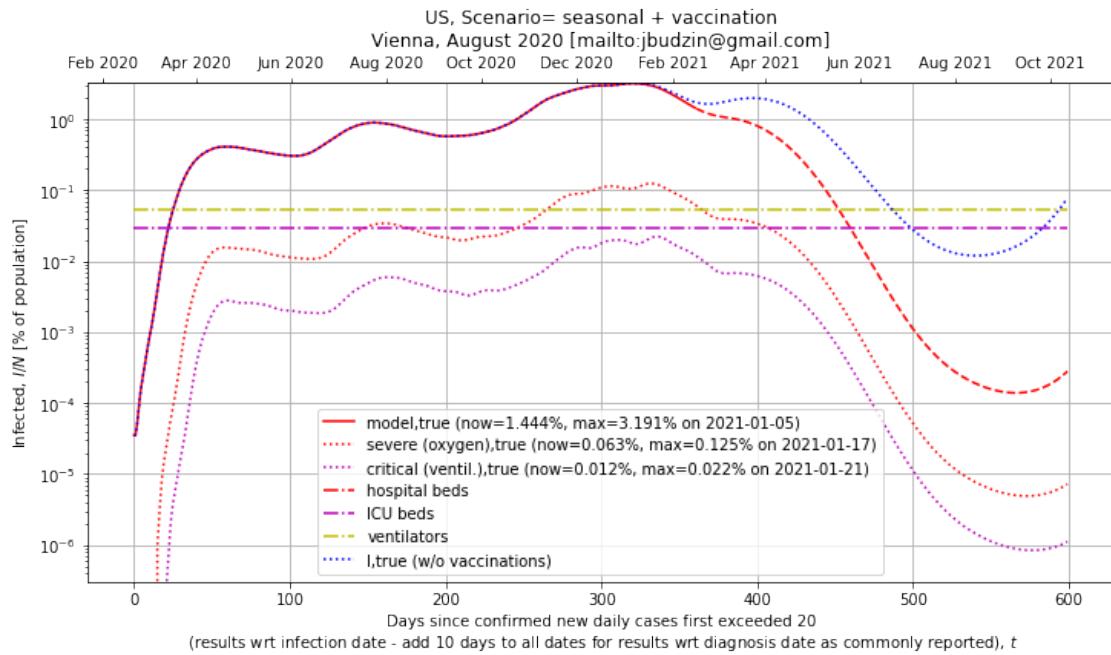


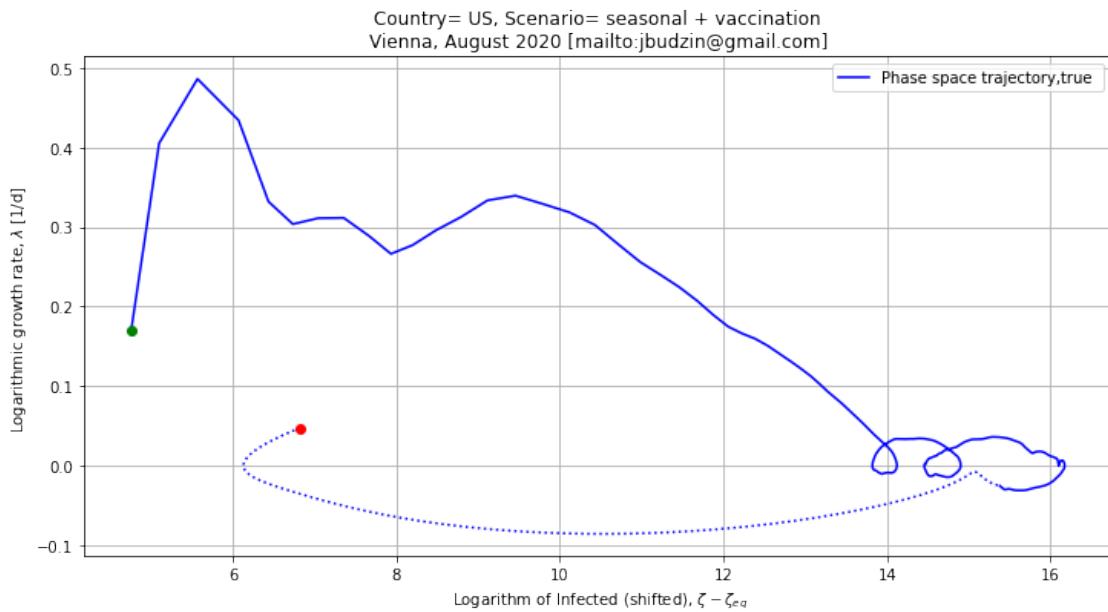
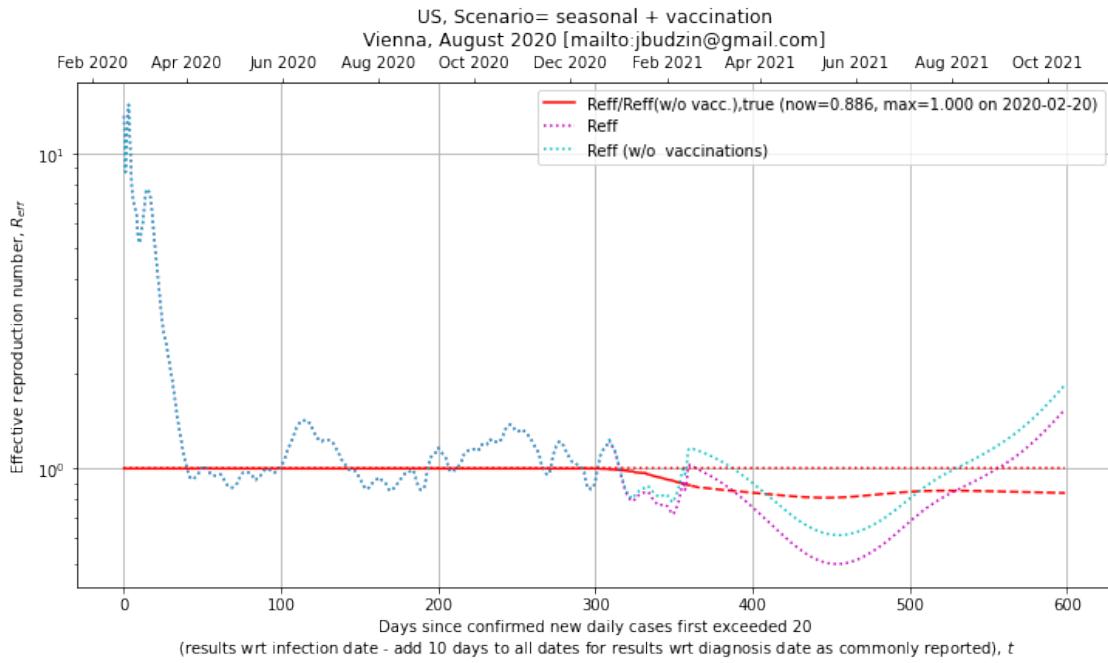
1.7.3 VACC_RATE = 0.50 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 50.021









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

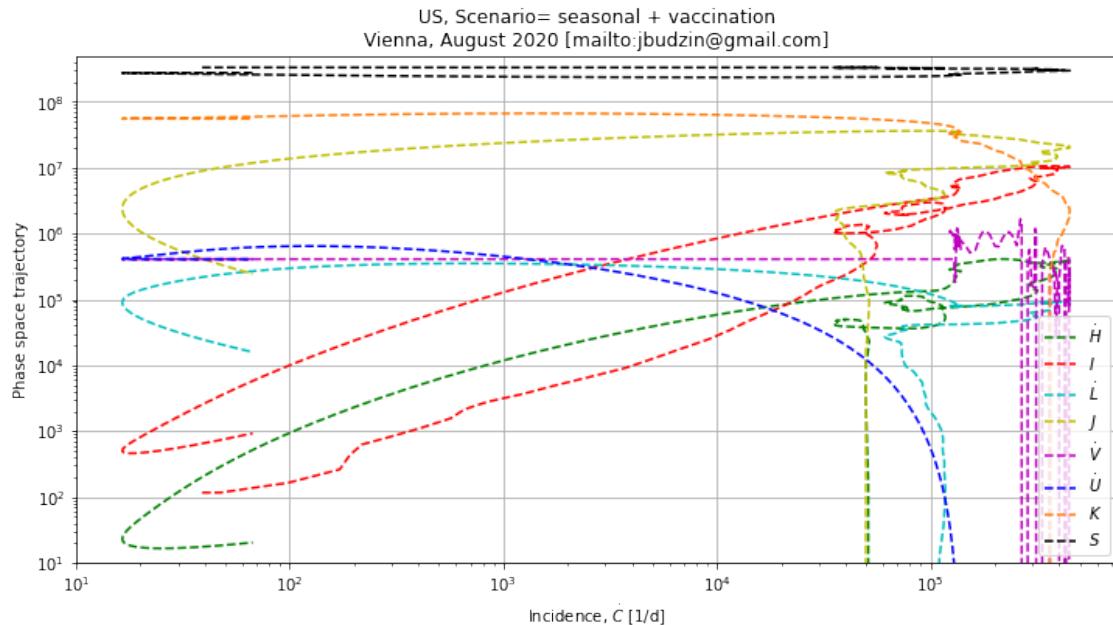
Avg. infection prevalence = 8.49e+05 / Perc of pop= 0.256

Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

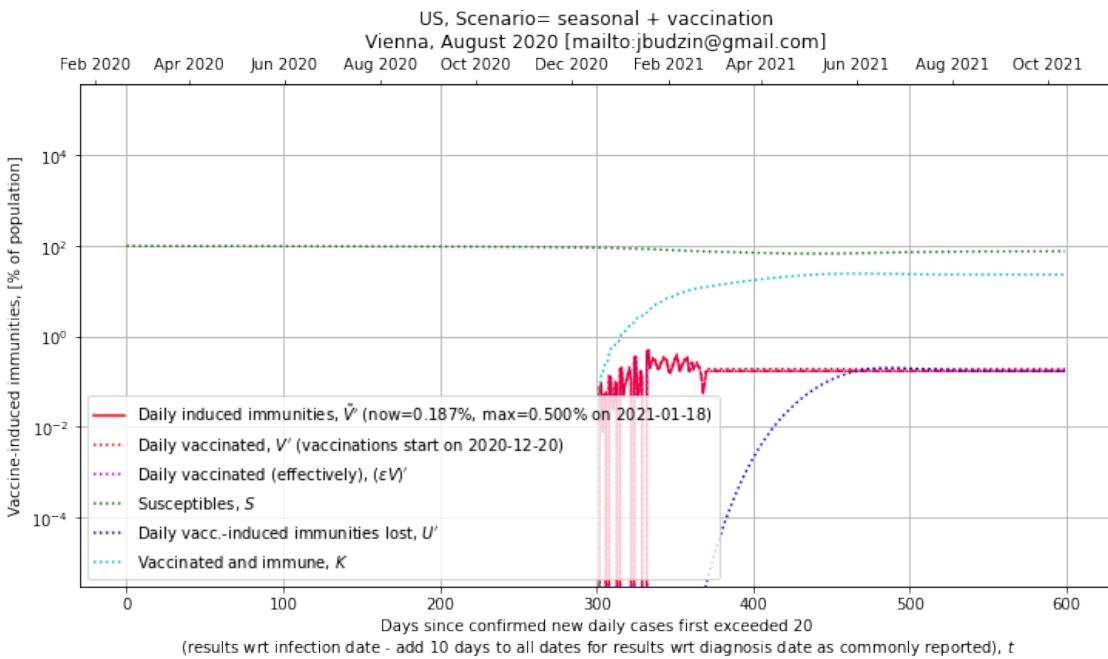
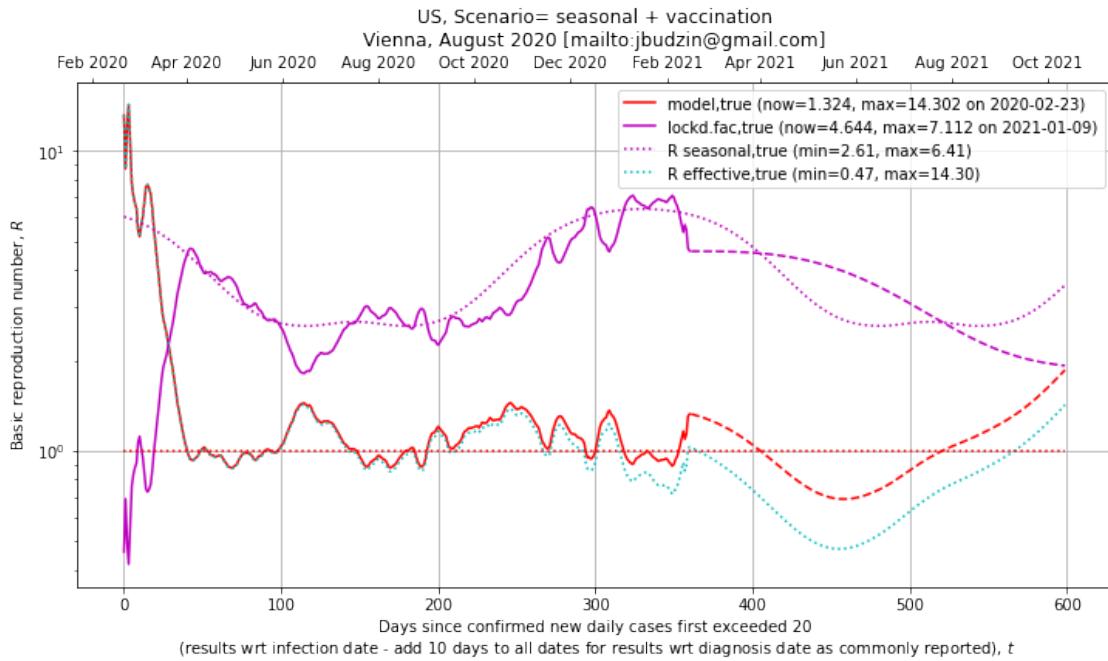
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 145.805

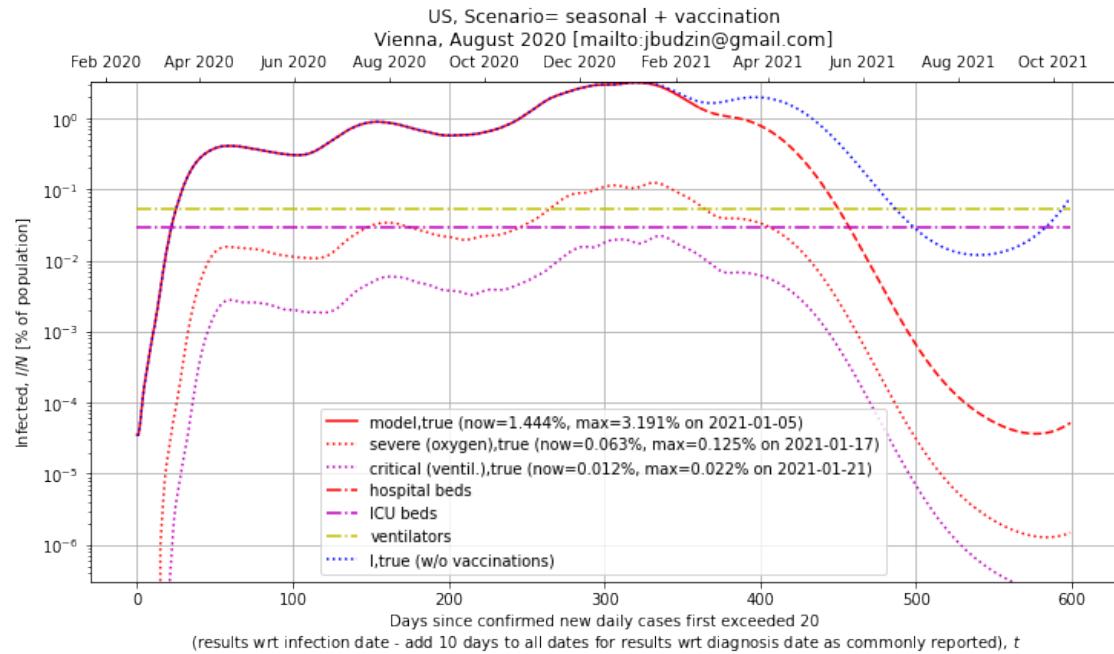
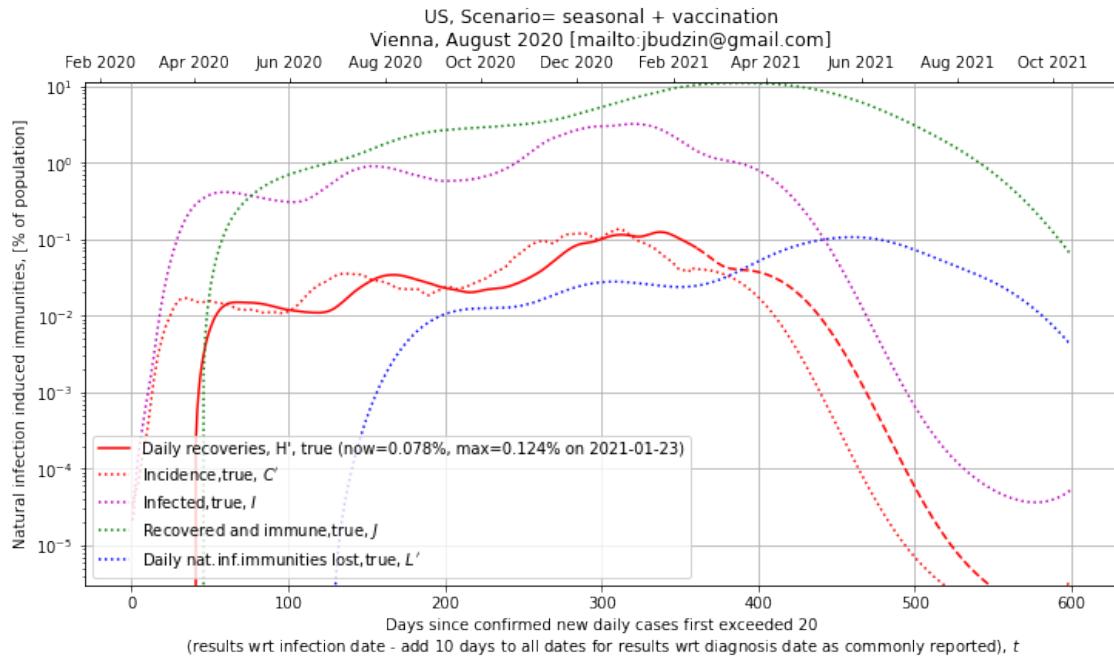
Approx. vaccination cost per year (projection) [EUR MLN] = 2279.98

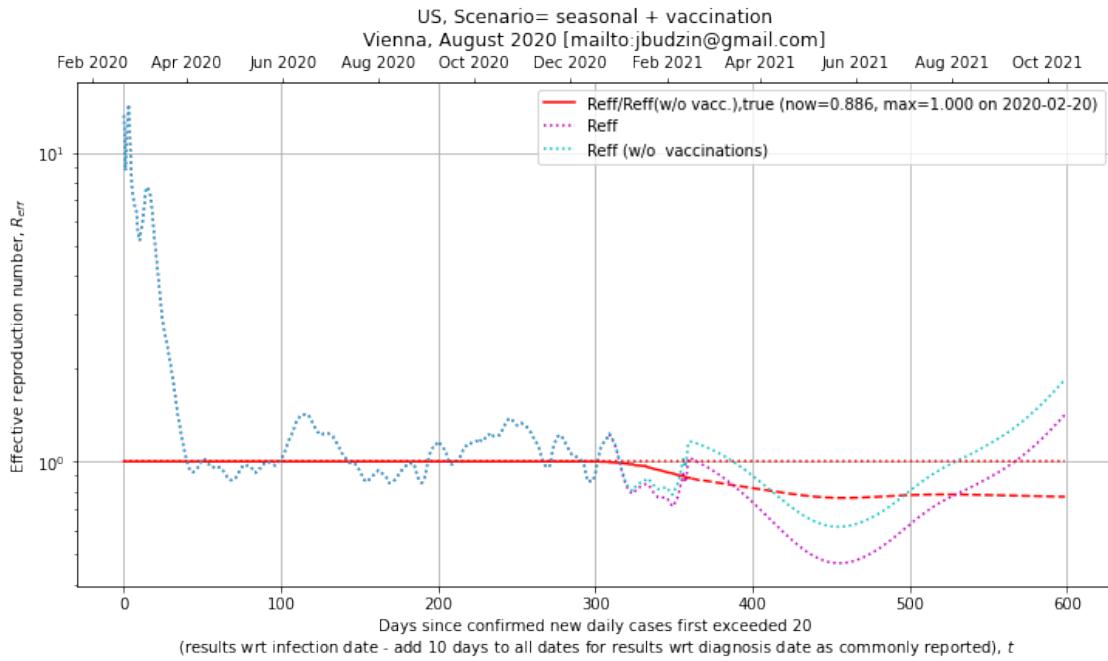
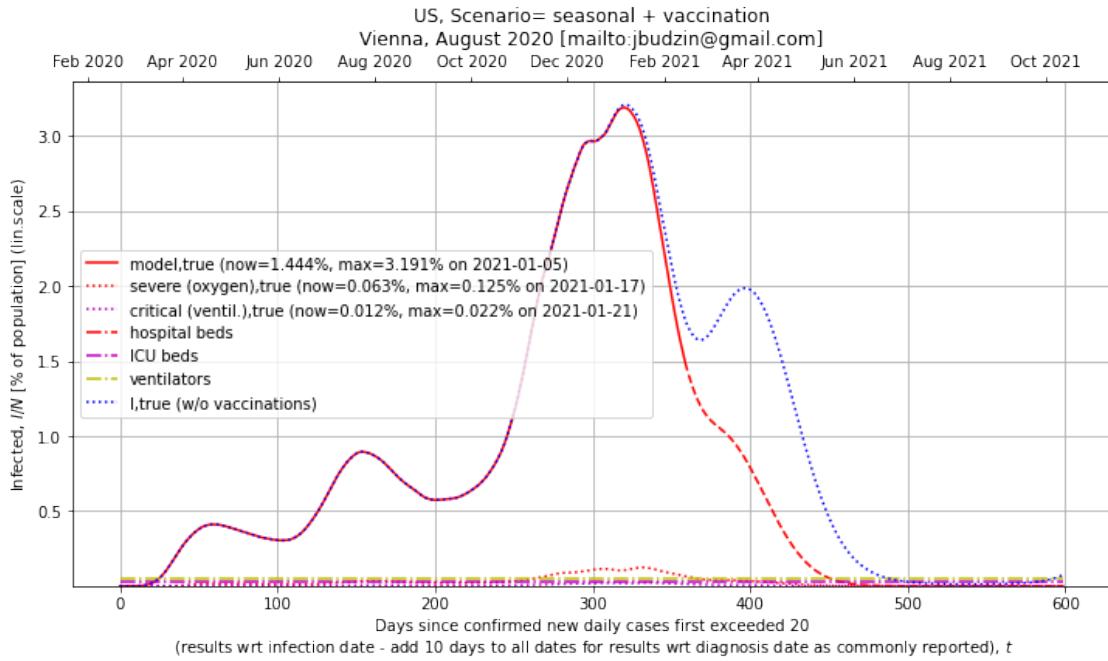


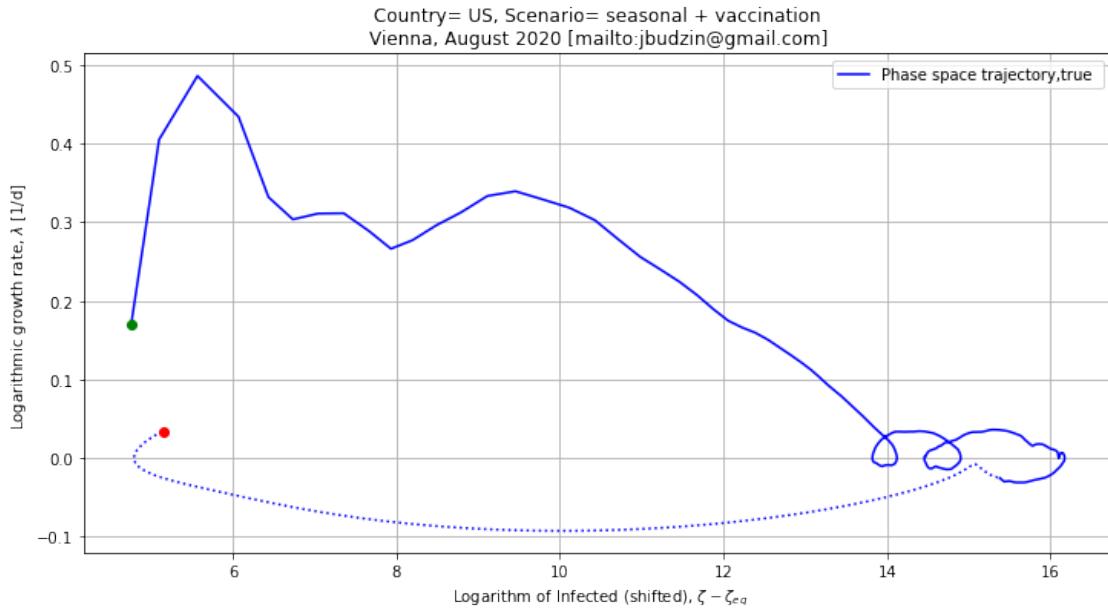
1.7.4 VACC_RATE = 0.70 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 70.029









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

Avg. infection prevalence = 8.31e+05 / Perc of pop= 0.251

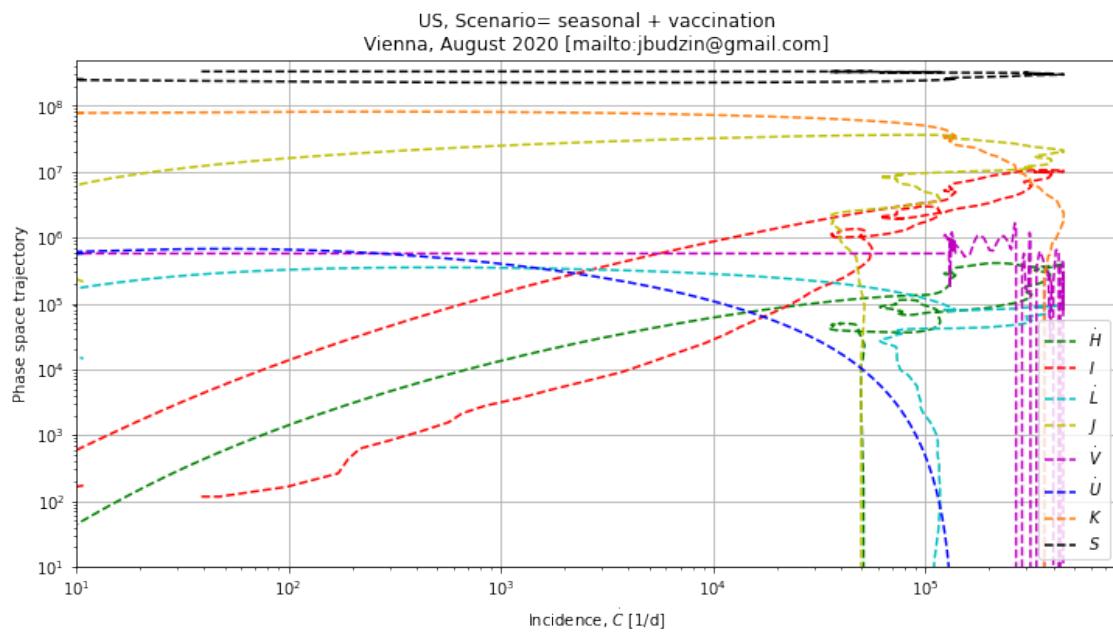
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

Time constant in Lyapunov function (data) [d]= 148.076

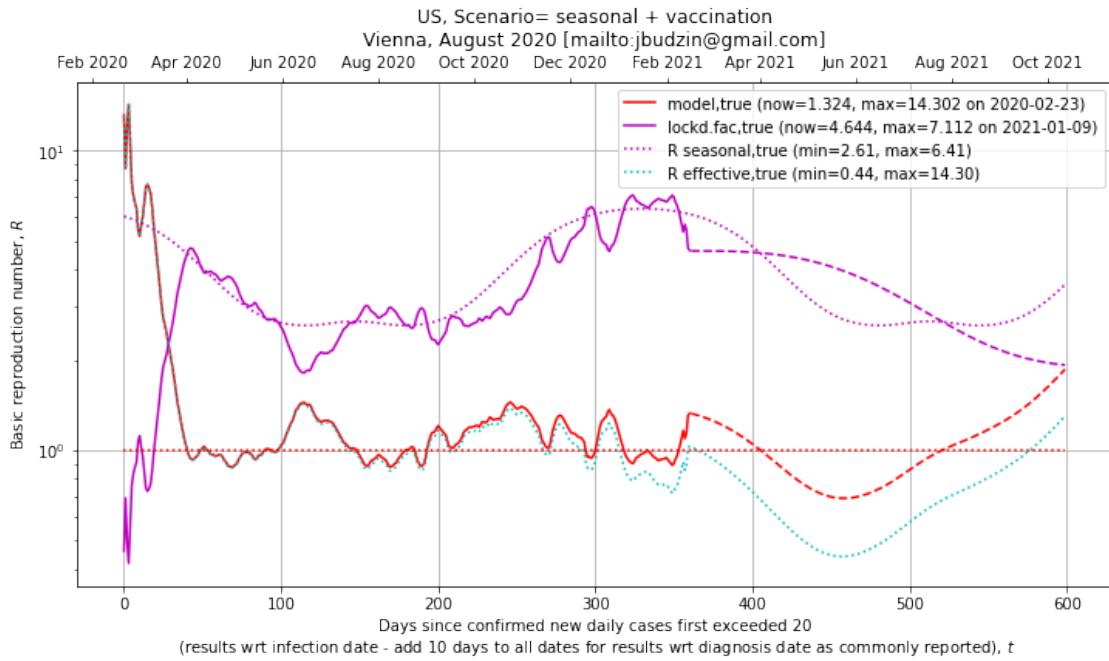
Time constant in Lyapunov function (proj) [d]= 146.330

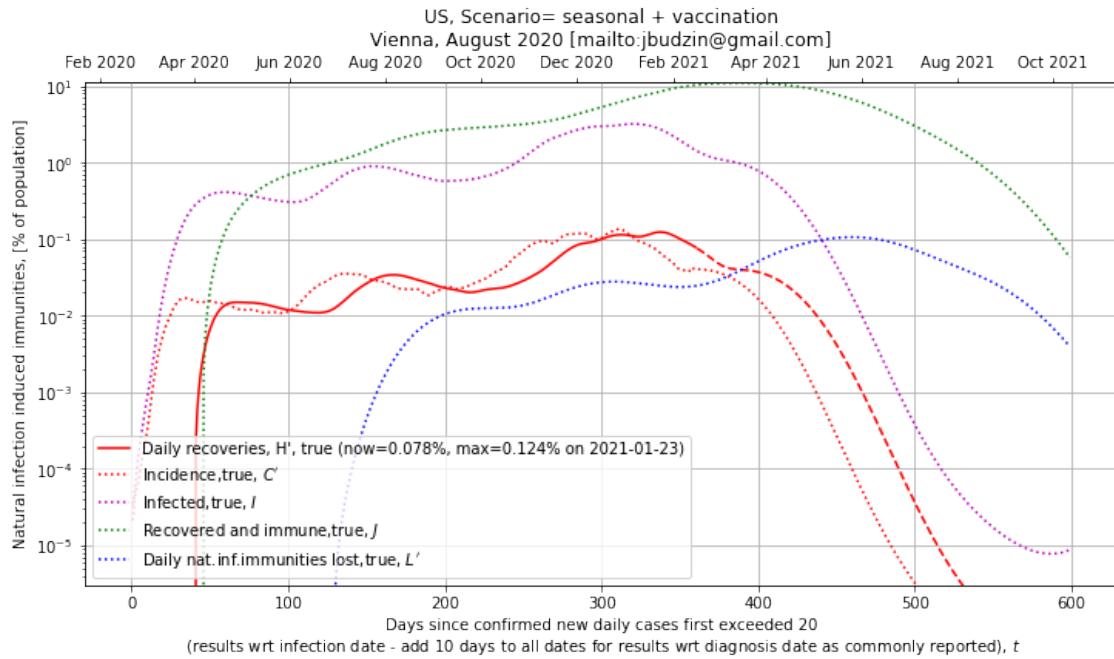
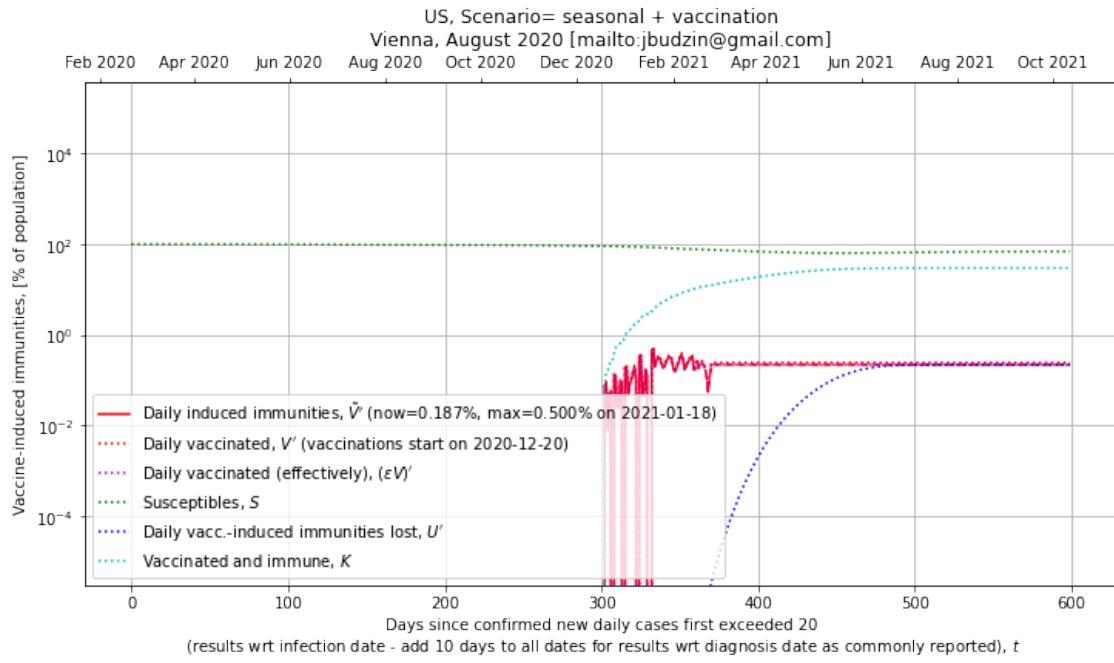
Approx. vaccination cost per year (projection) [EUR MLN] = 3140.39

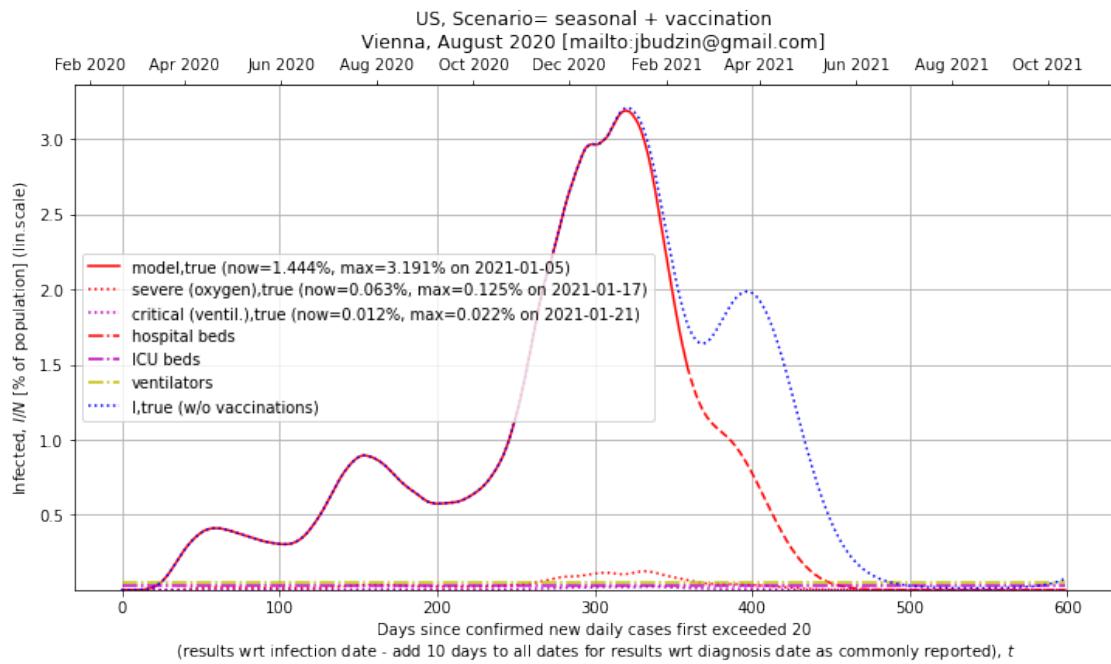
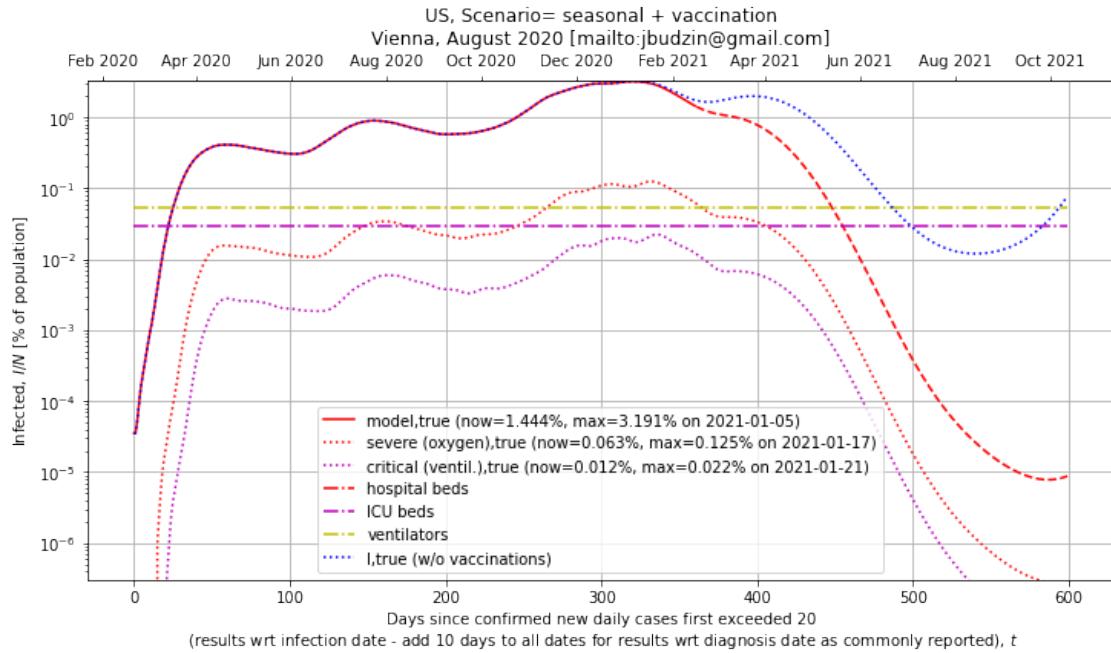


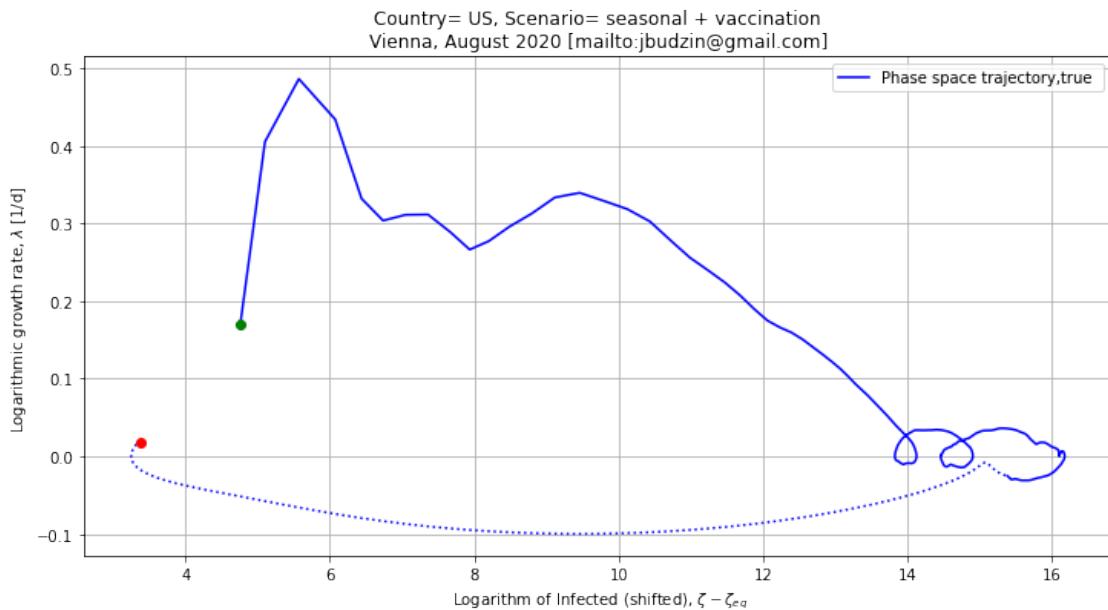
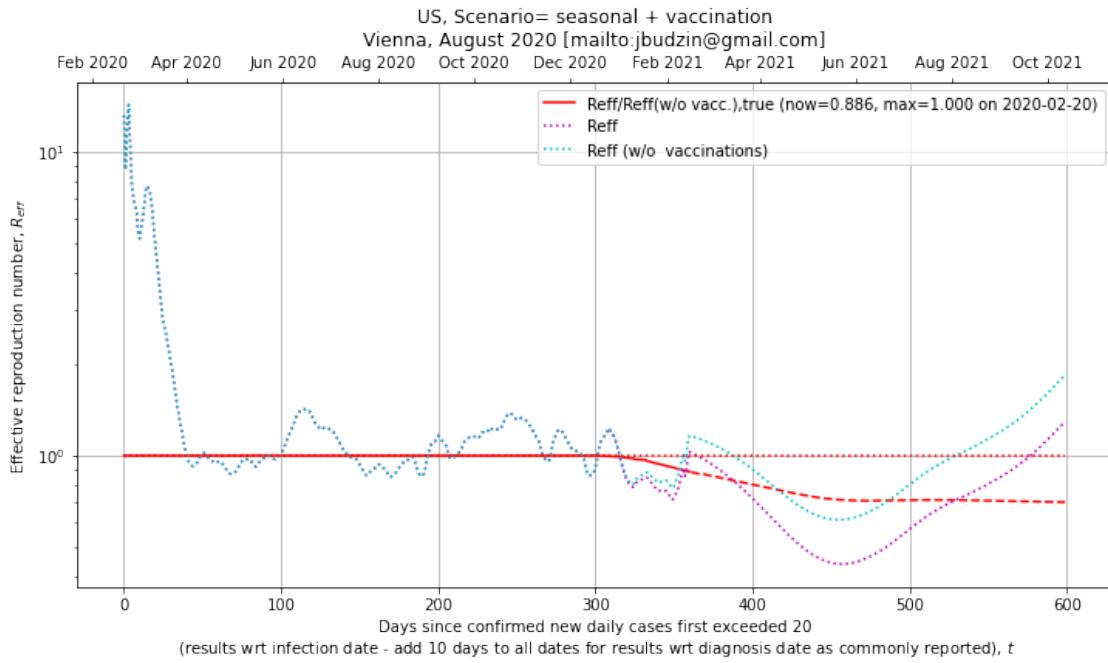
1.7.5 VACC_RATE = 0.90 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 90.037





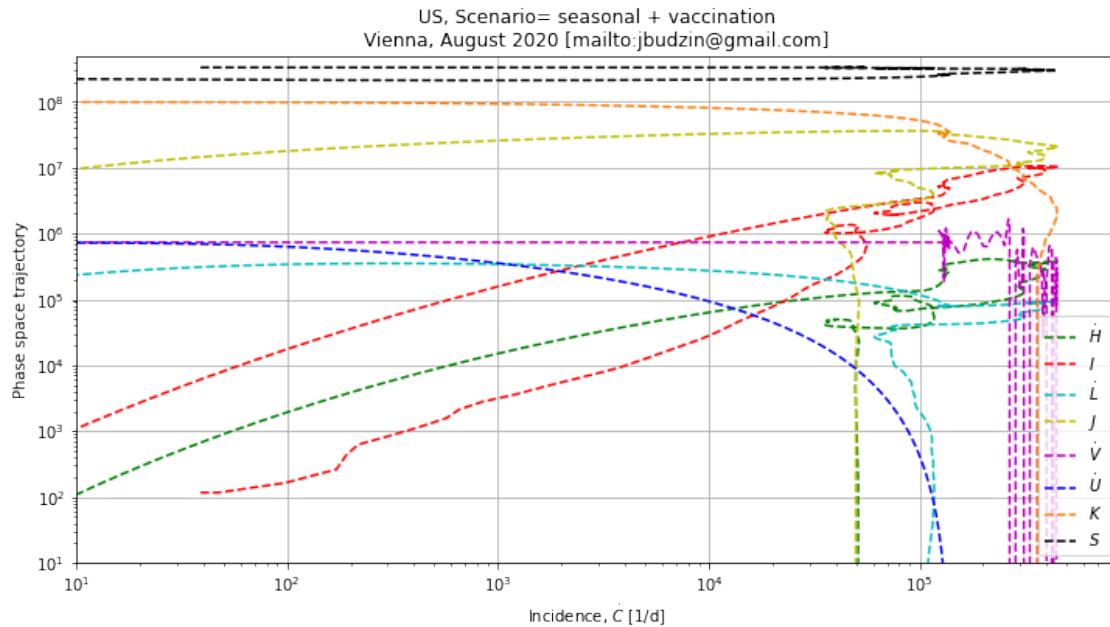




Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 8.15e+05 / Perc of pop= 0.246
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

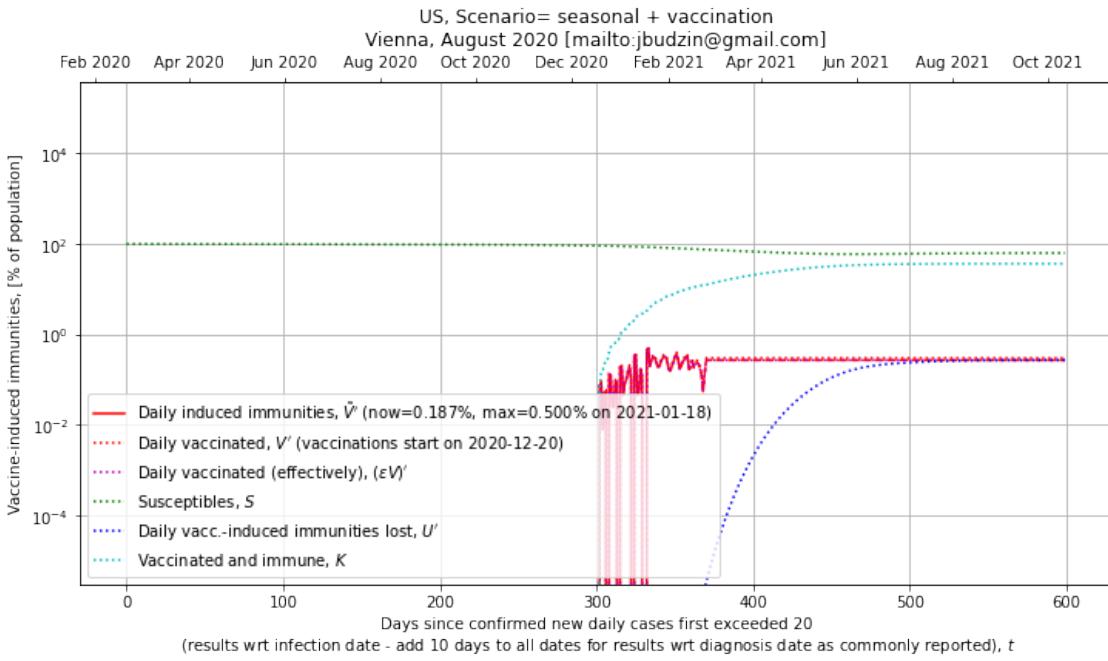
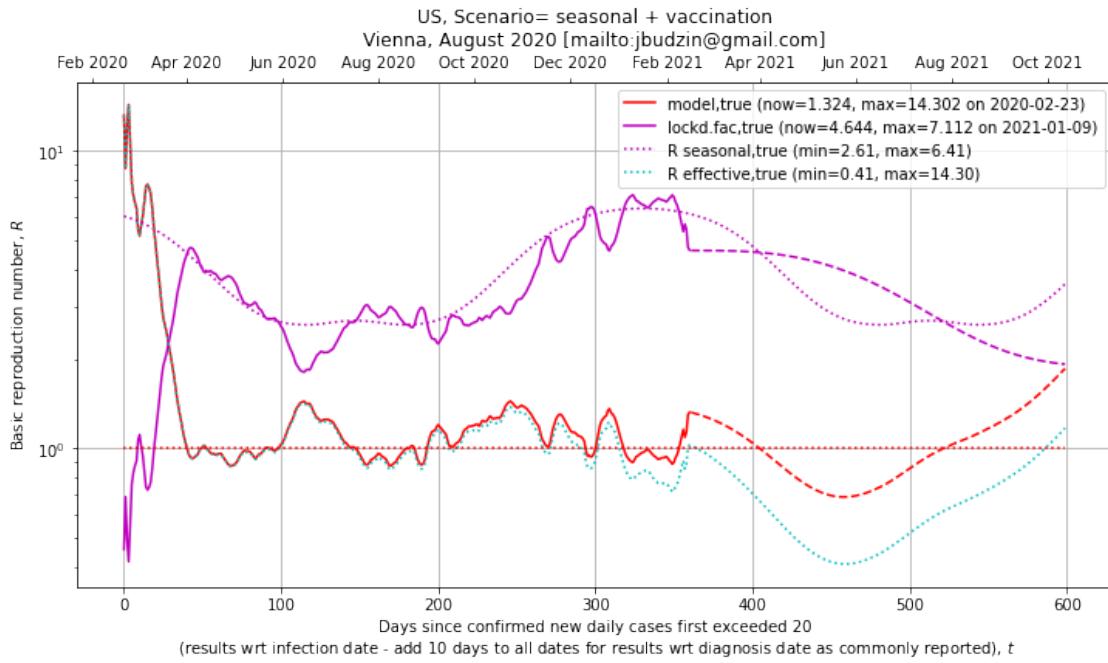
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 134.241

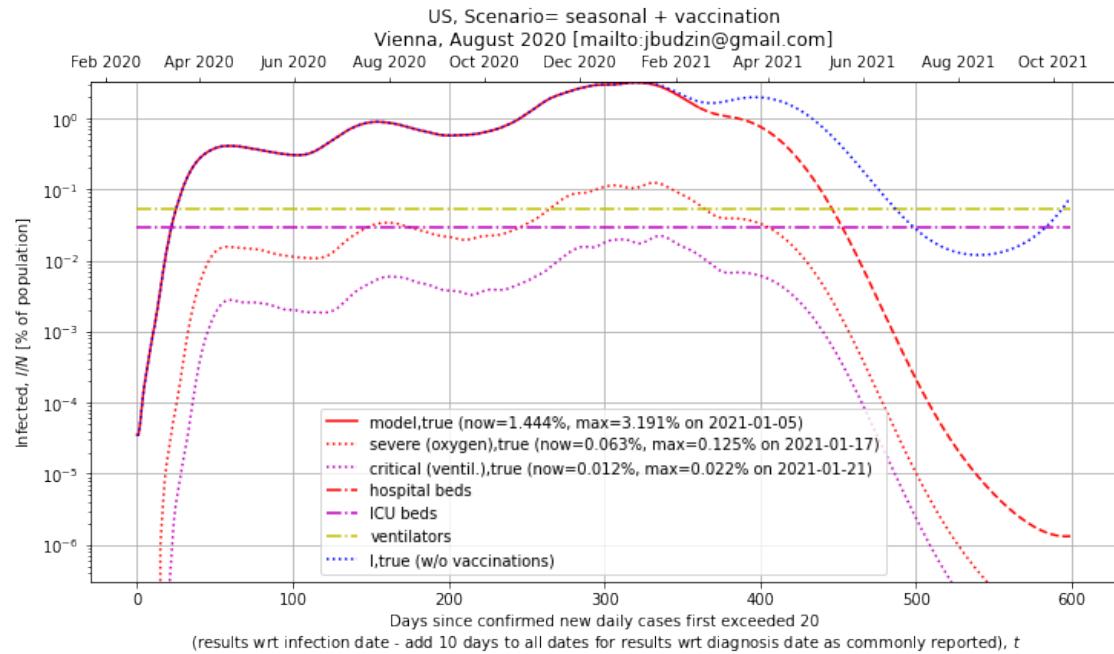
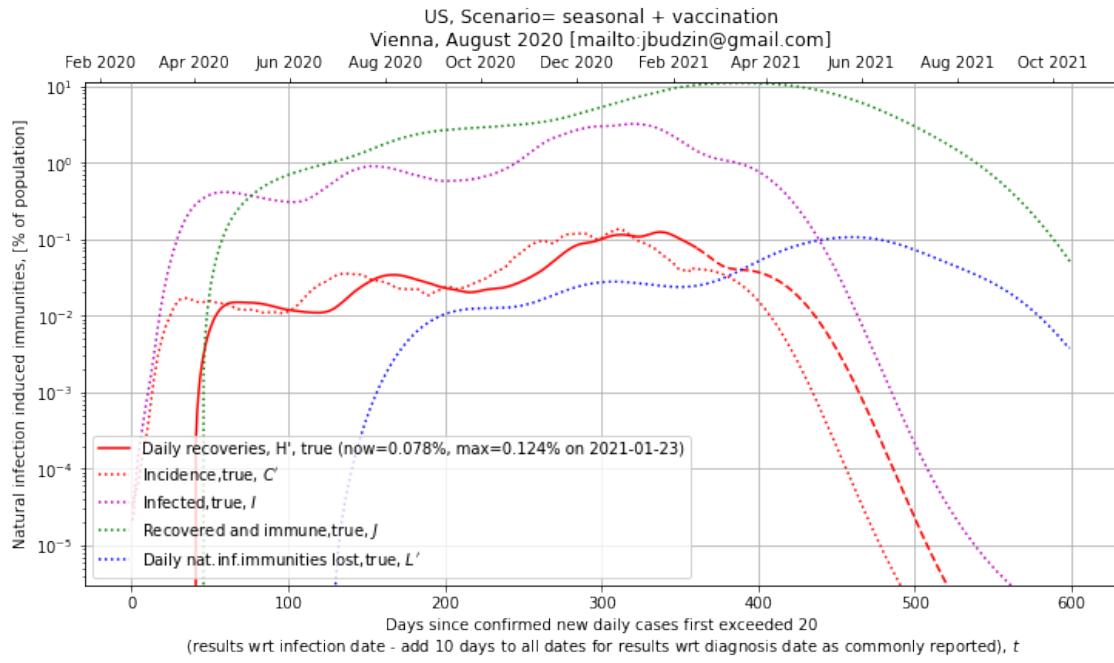
Approx. vaccination cost per year (projection) [EUR MLN] = 4000.79

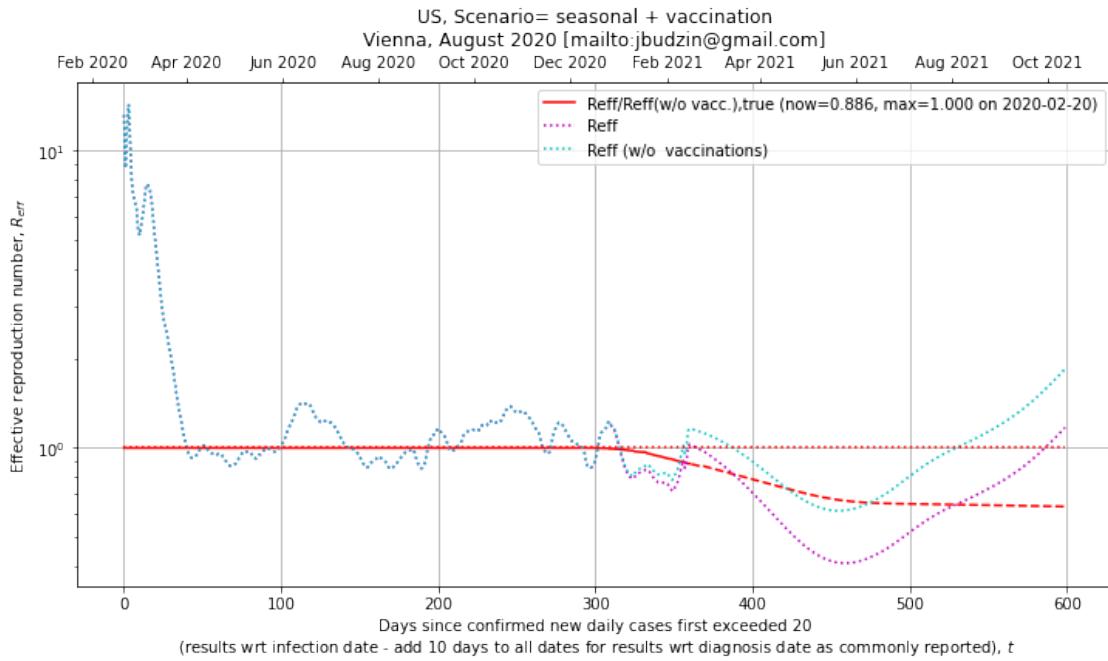
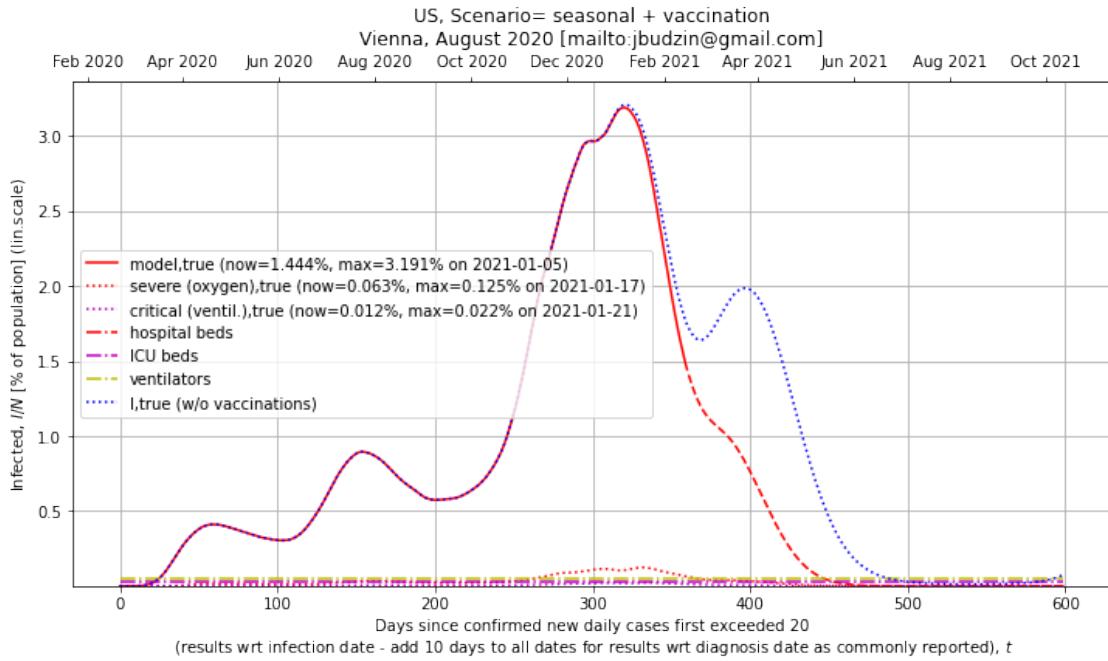


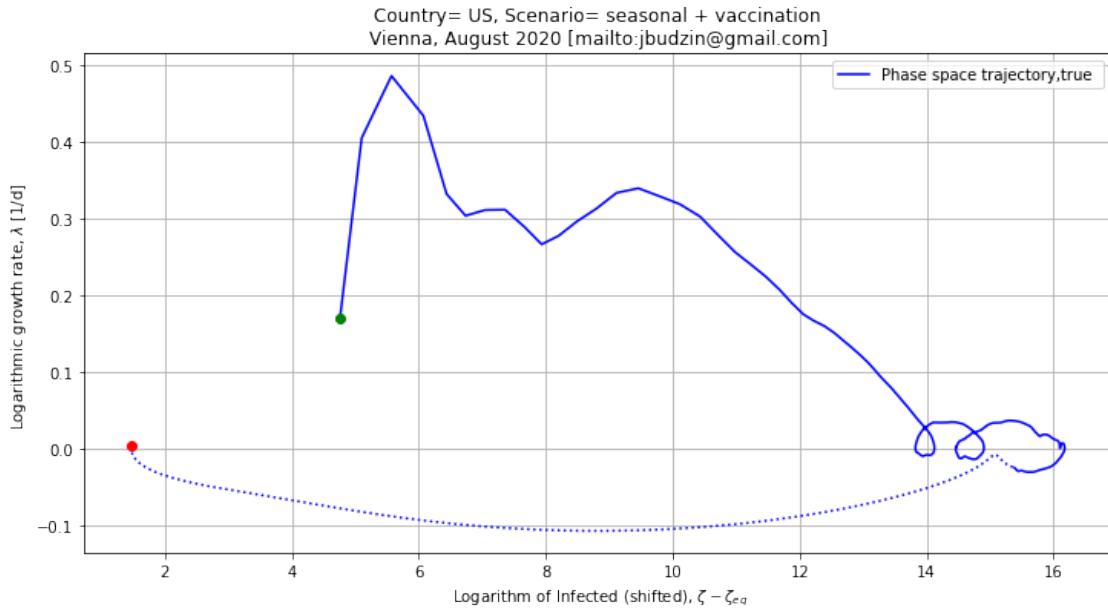
1.7.6 VACC_RATE = 1.10 [fraction of popul. per year]

`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in model: True True True True
`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 110.045









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

Avg. infection prevalence = 8.01e+05 / Perc of pop= 0.242

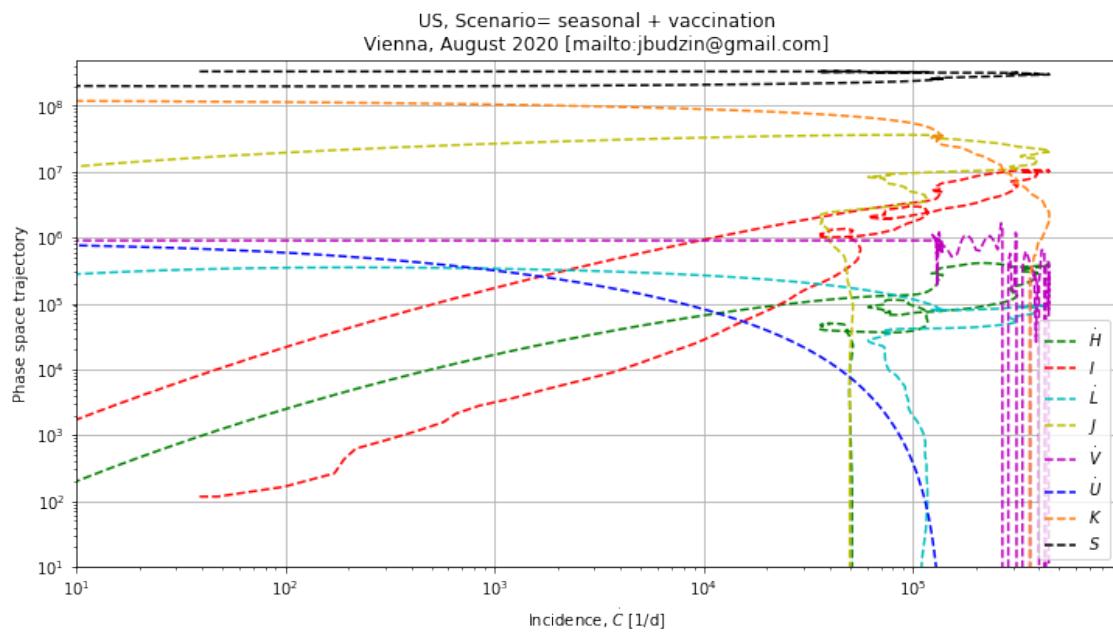
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

Time constant in Lyapunov function (data) [d]= 148.076

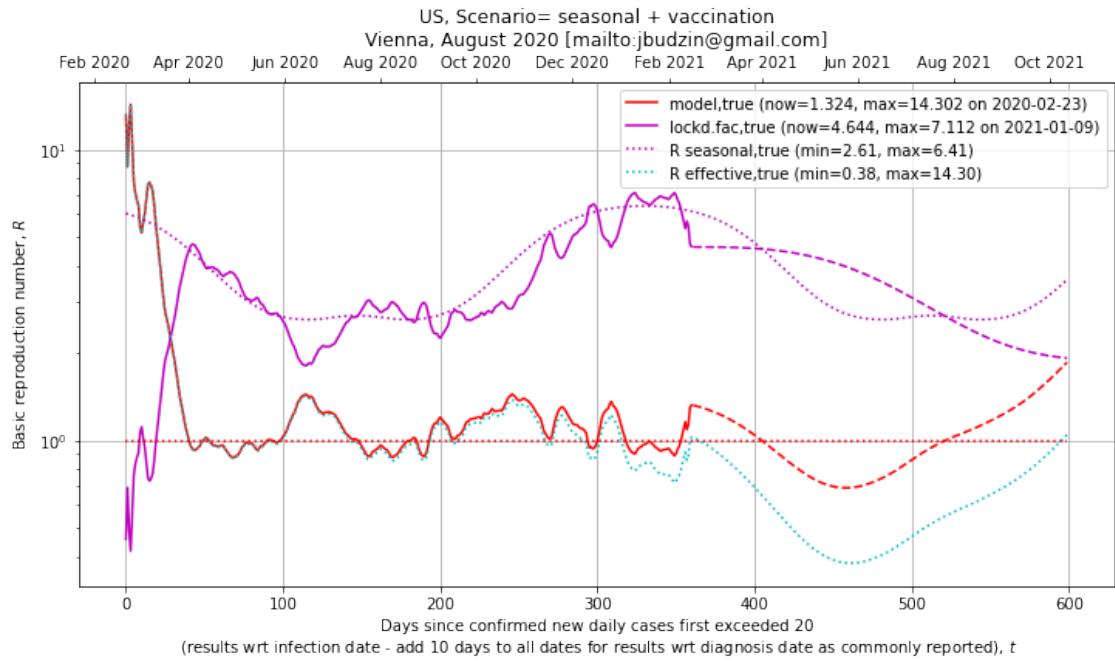
Time constant in Lyapunov function (proj) [d]= 131.310

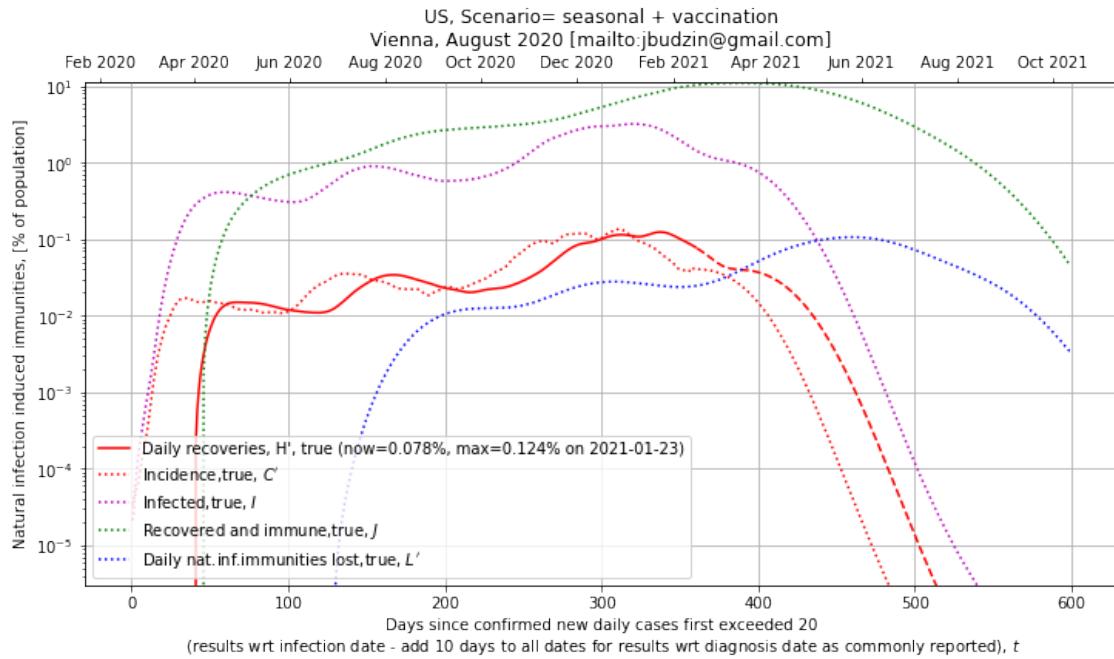
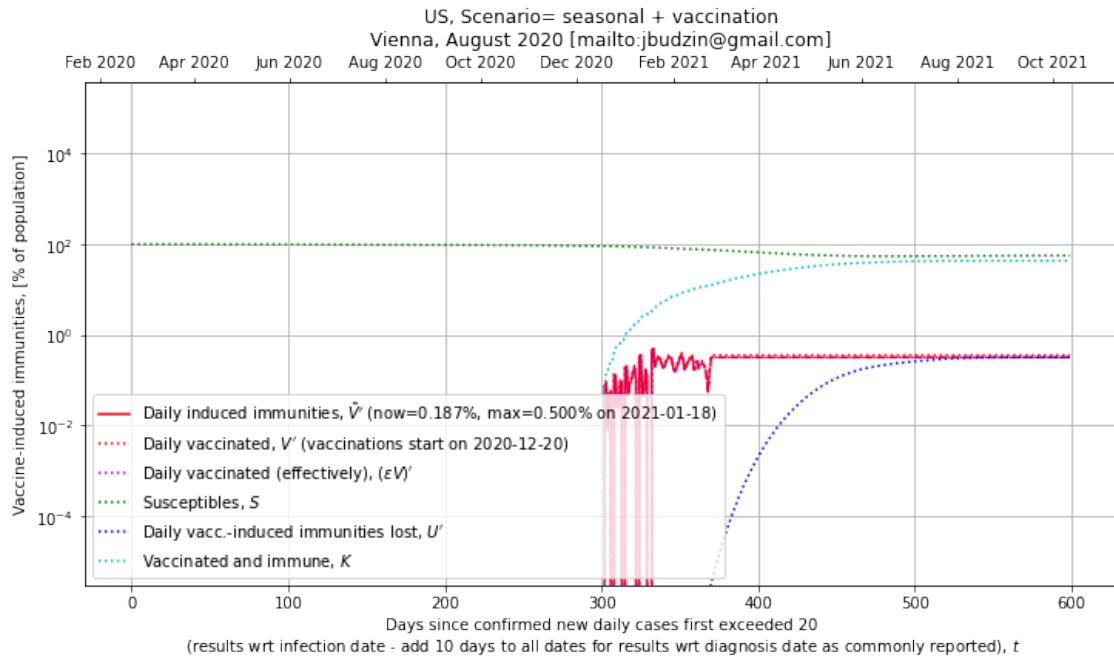
Approx. vaccination cost per year (projection) [EUR MLN] = 4861.20

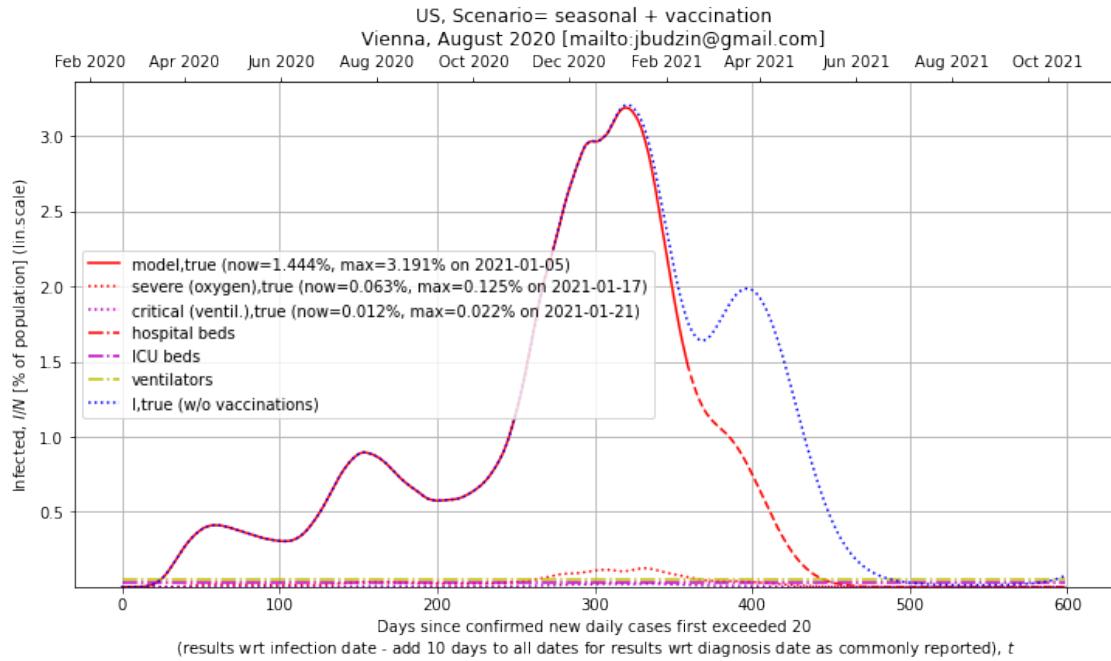
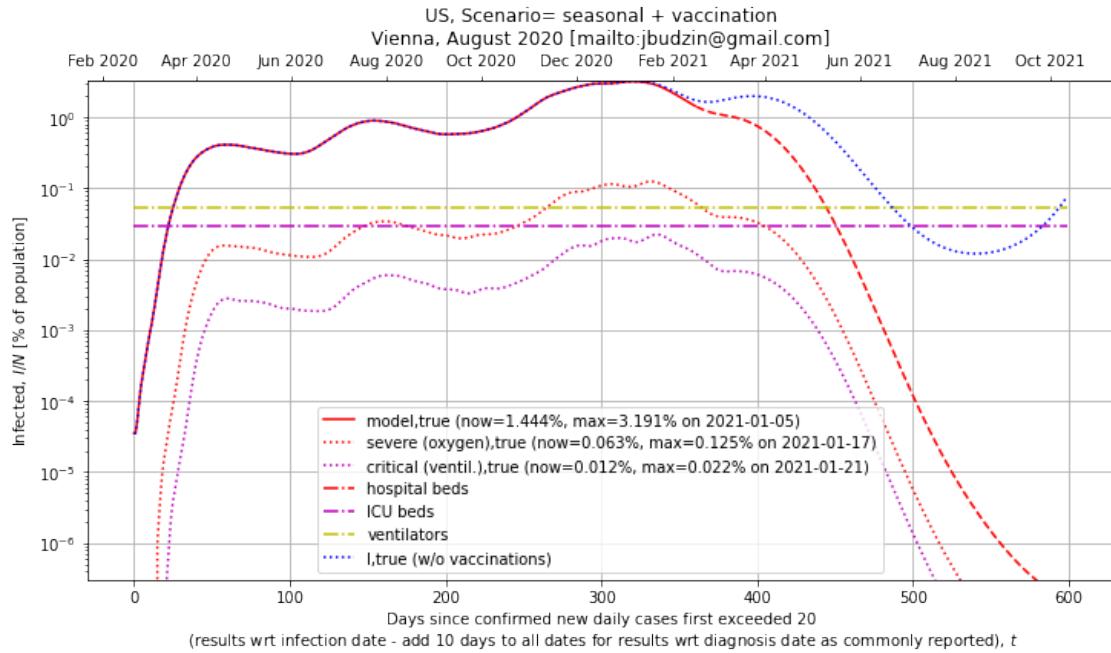


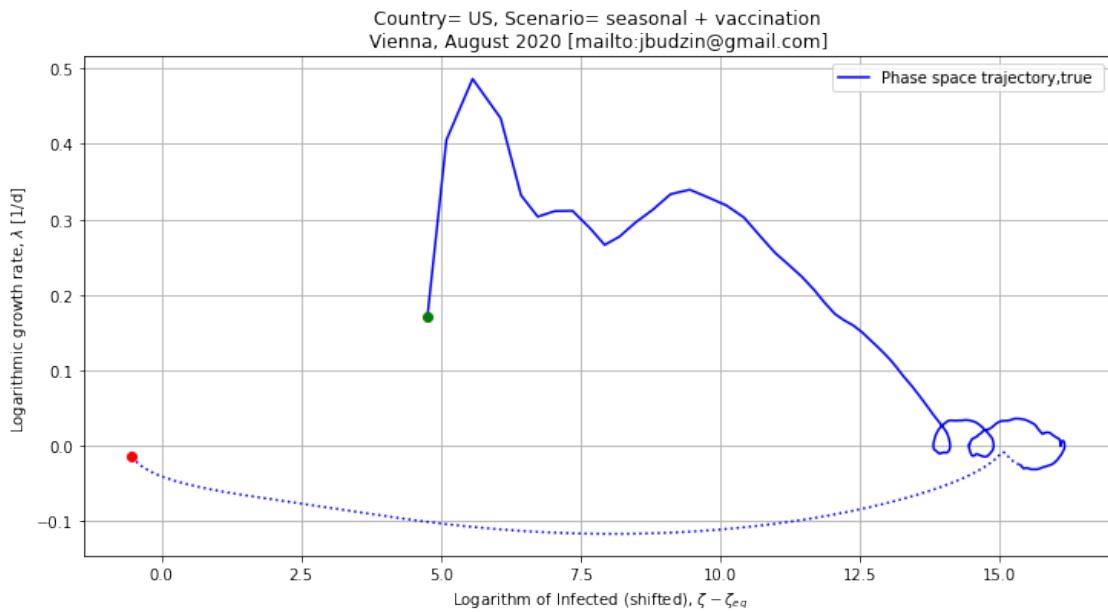
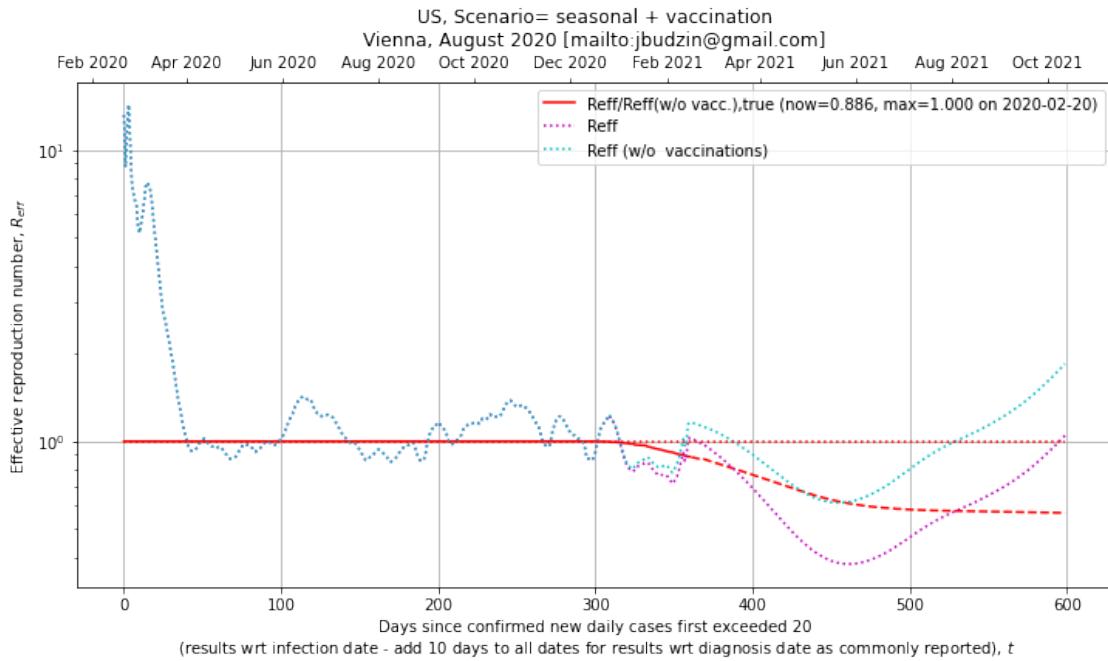
1.7.7 VACC_RATE = 1.30 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 130.053









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

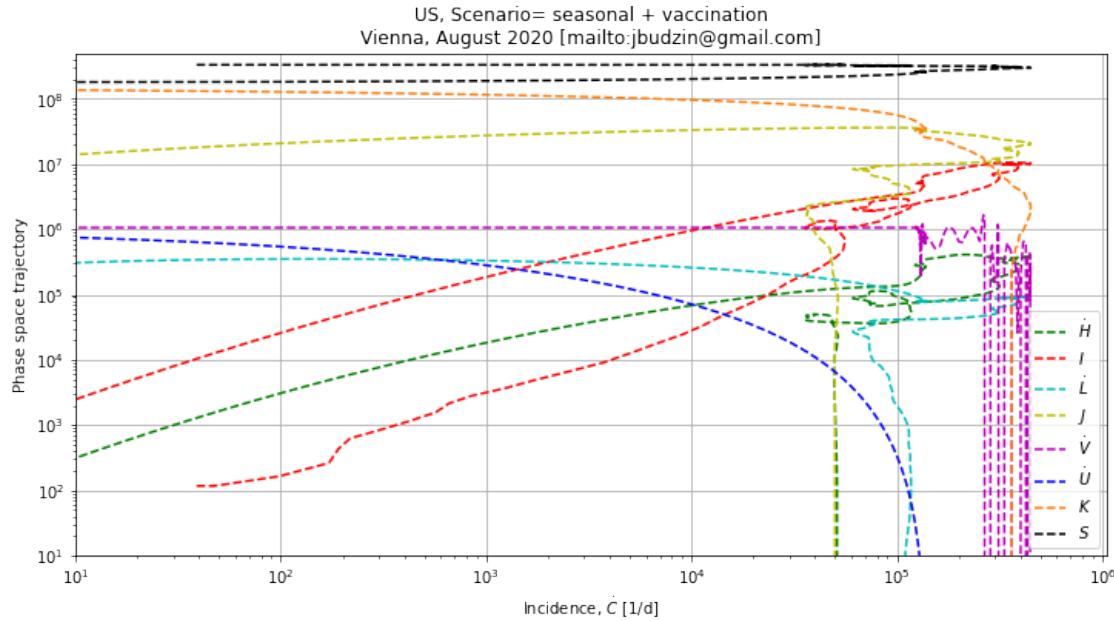
Avg. infection prevalence = 7.87e+05 / Perc of pop= 0.238

Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

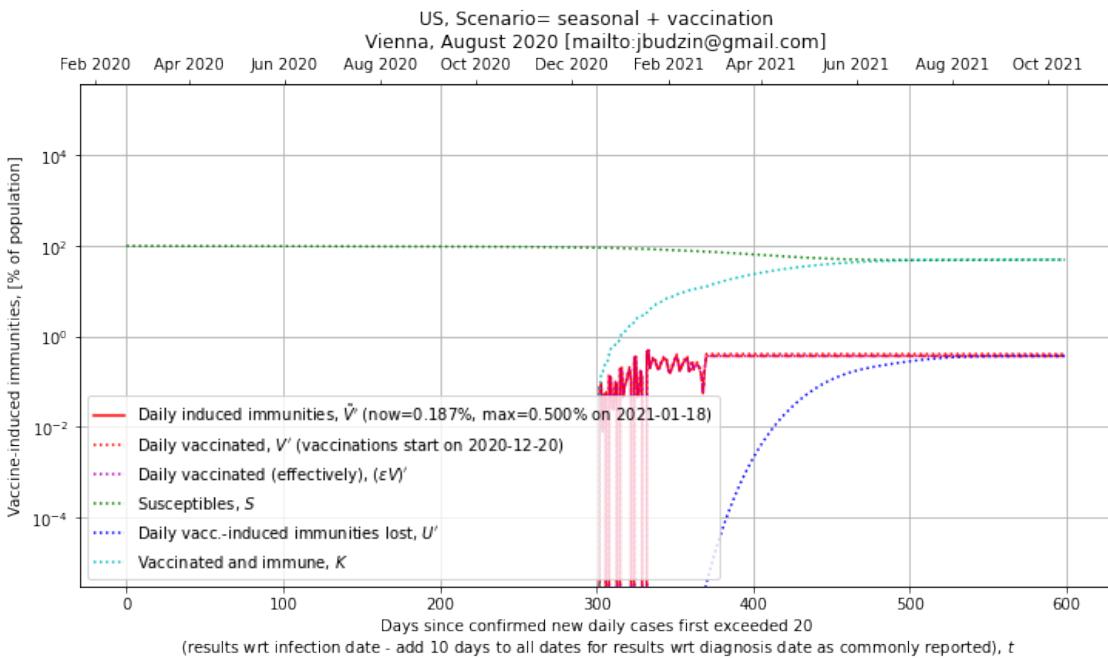
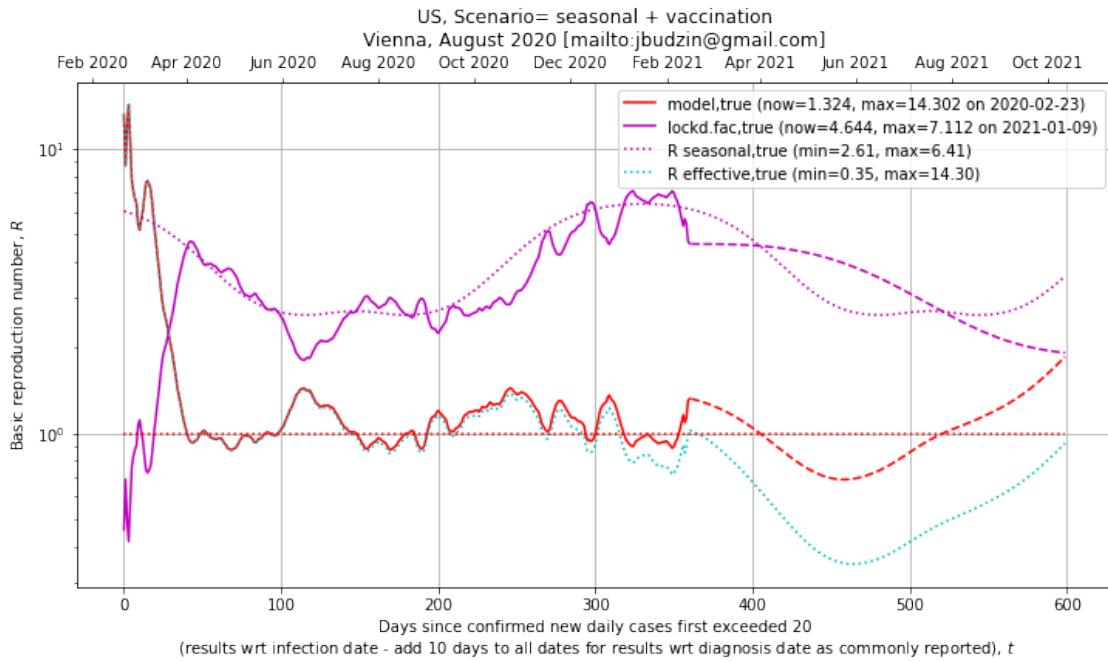
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 112.596

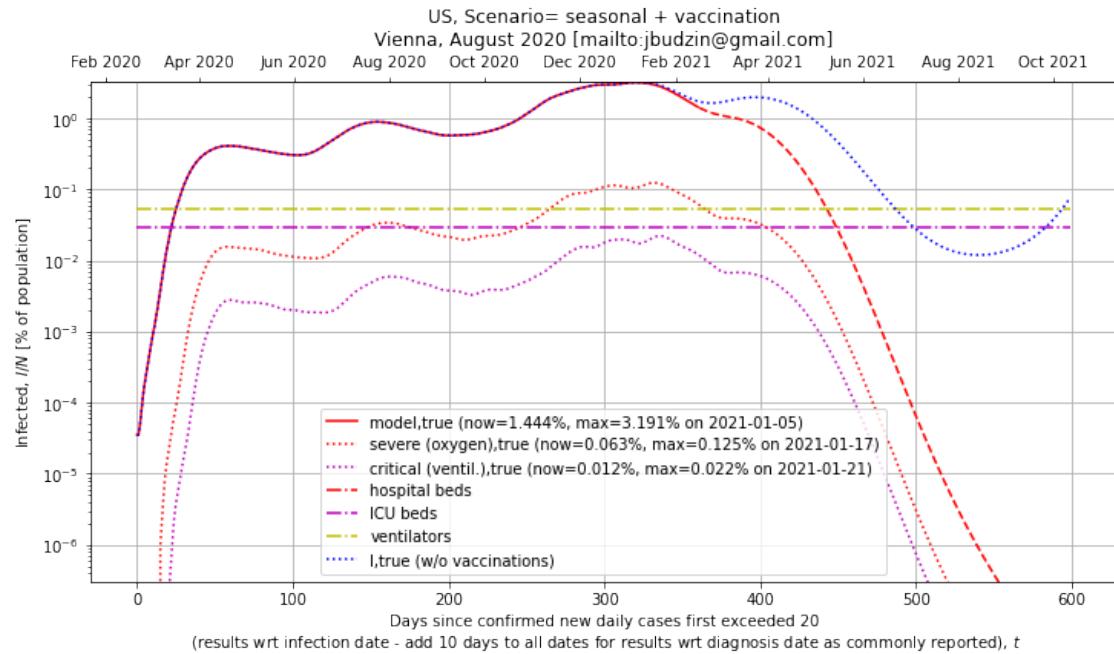
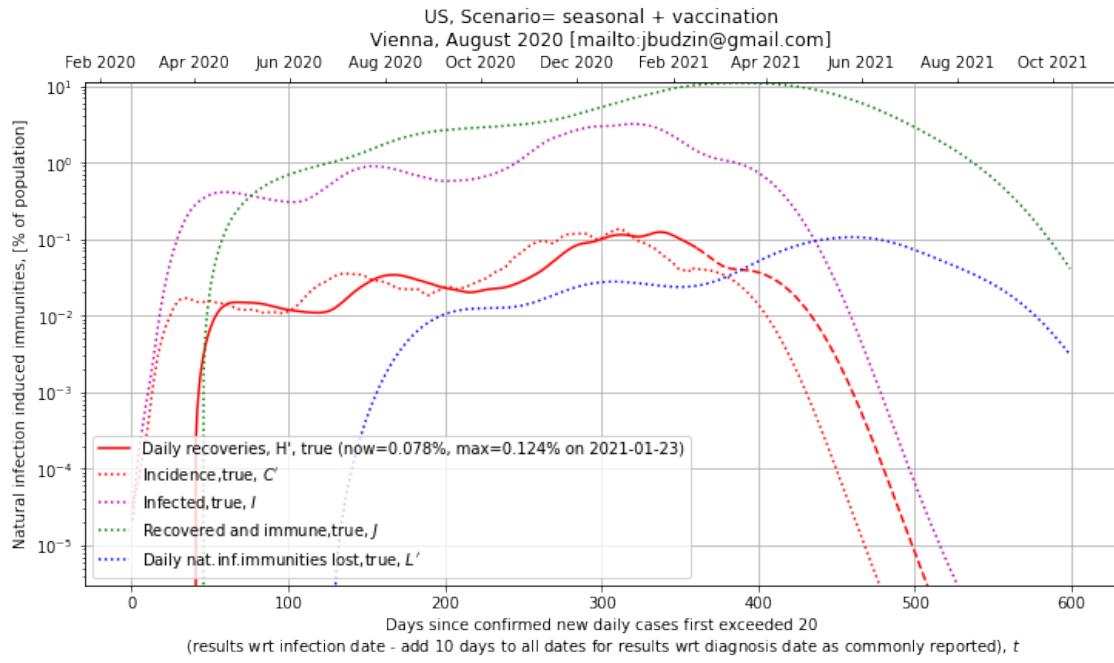
Approx. vaccination cost per year (projection) [EUR MLN] = 5721.61

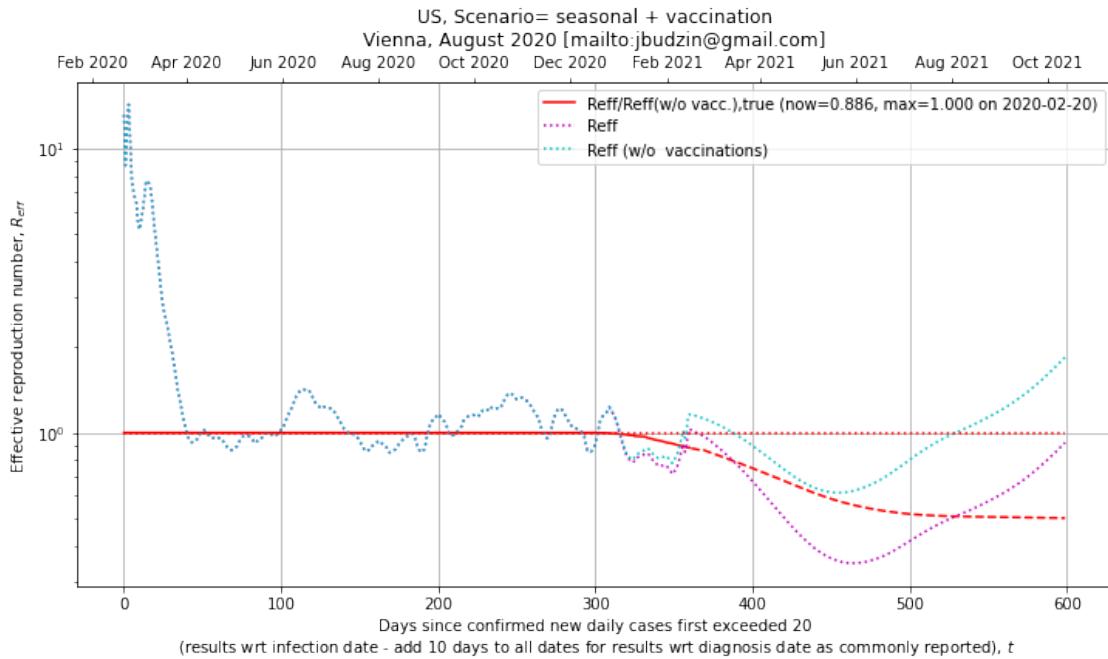
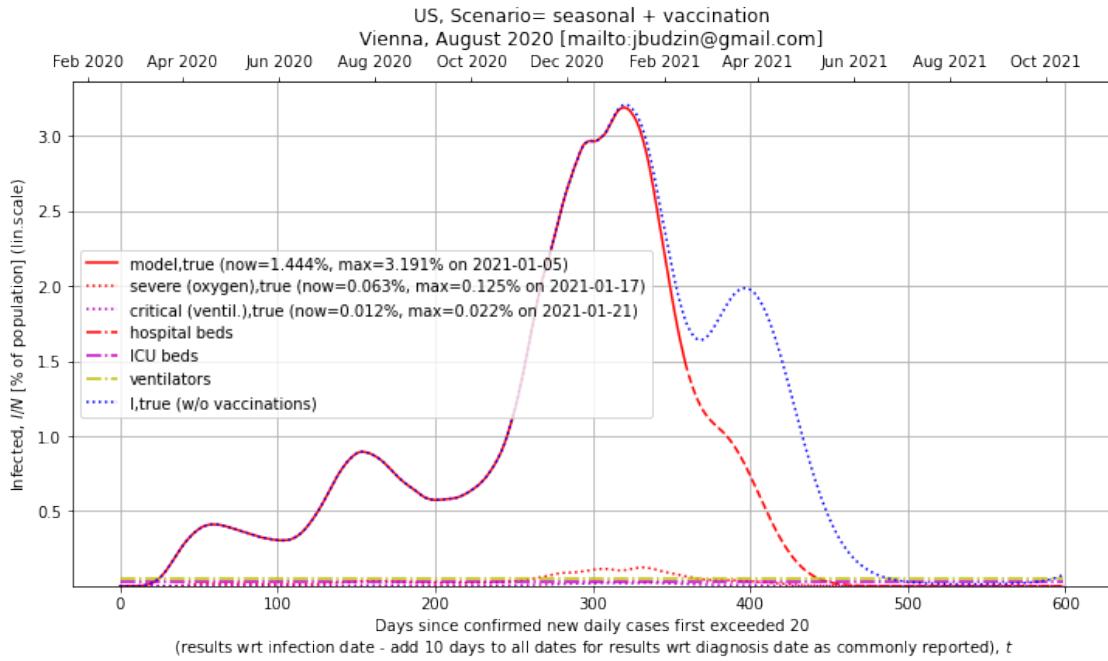


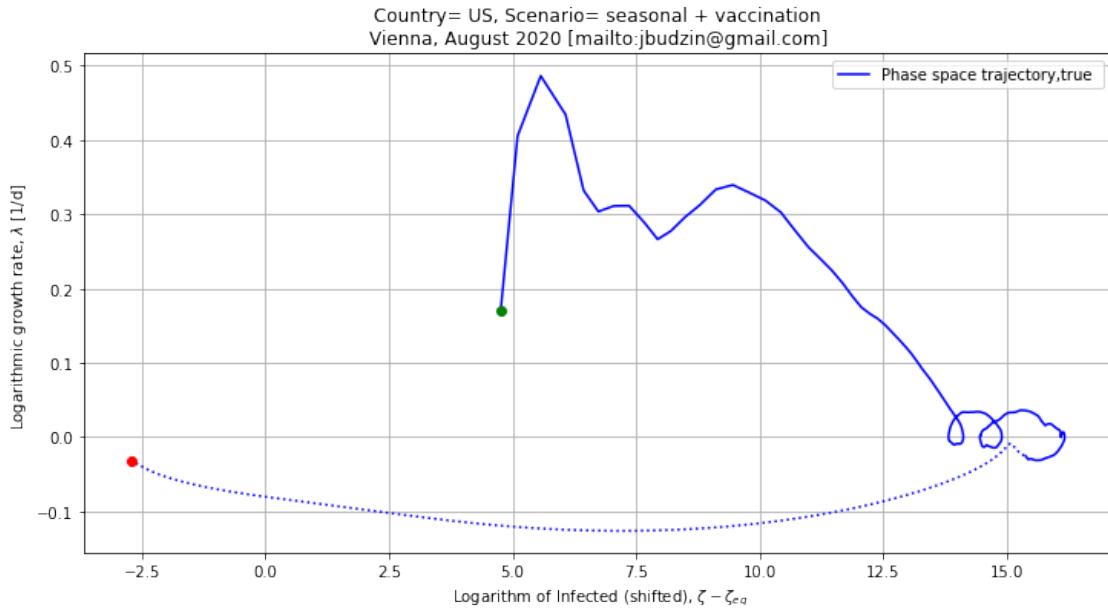
1.7.8 VACC_RATE = 1.50 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

Avg. infection prevalence = 7.74e+05 / Perc of pop = 0.234

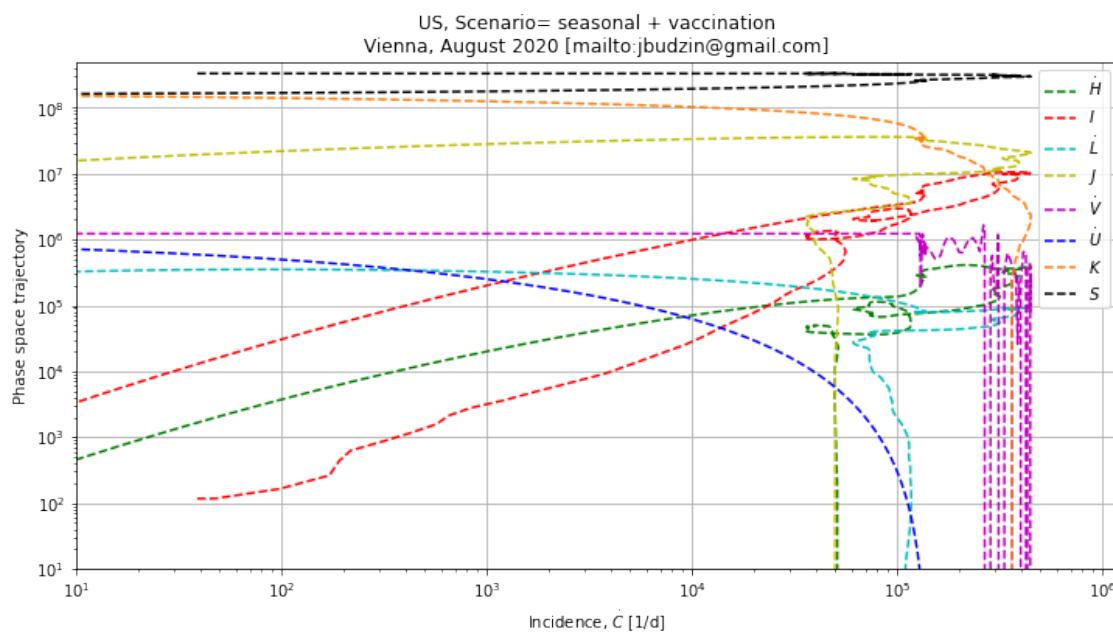
Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0

Time constant in Lyapunov function (data) [d] = 148.076

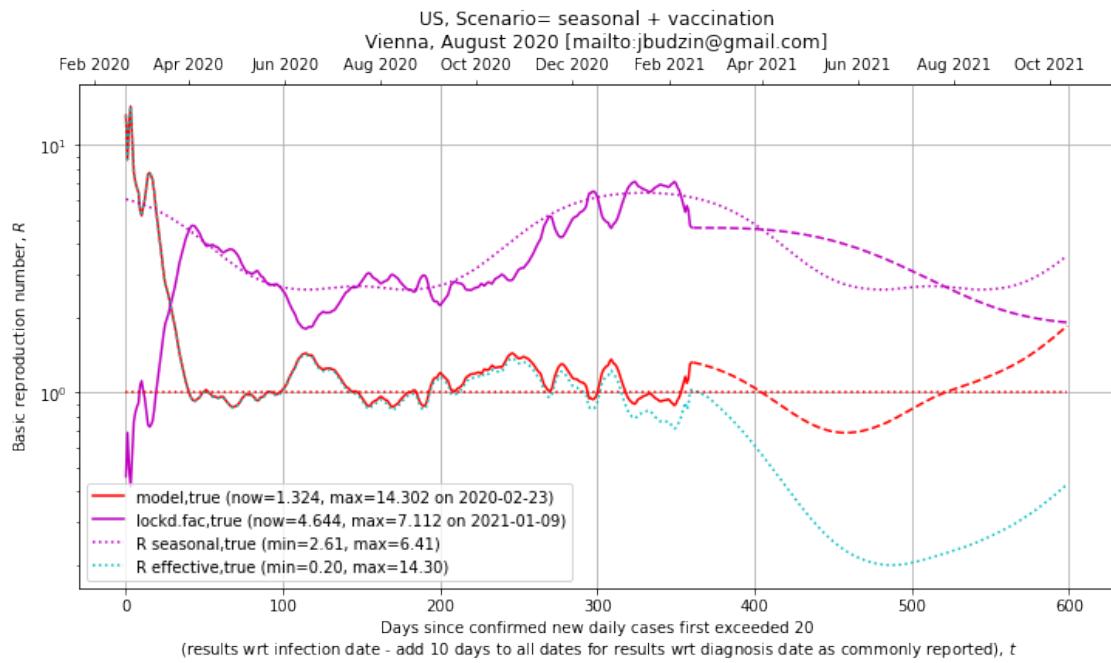
Time constant in Lyapunov function (proj) [d] = 99.966

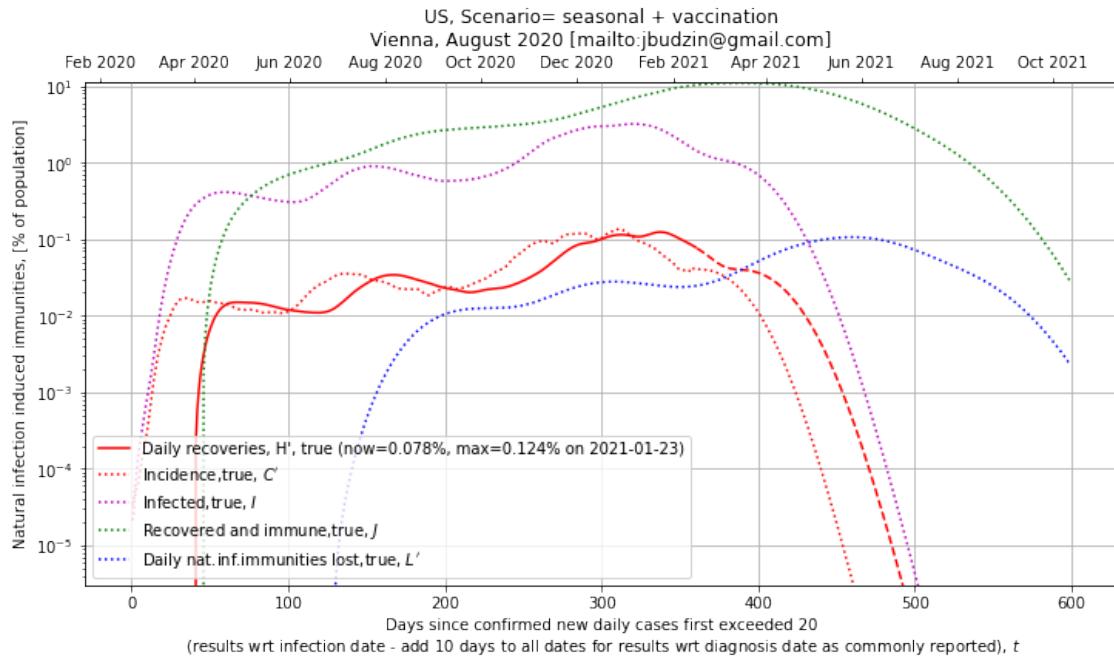
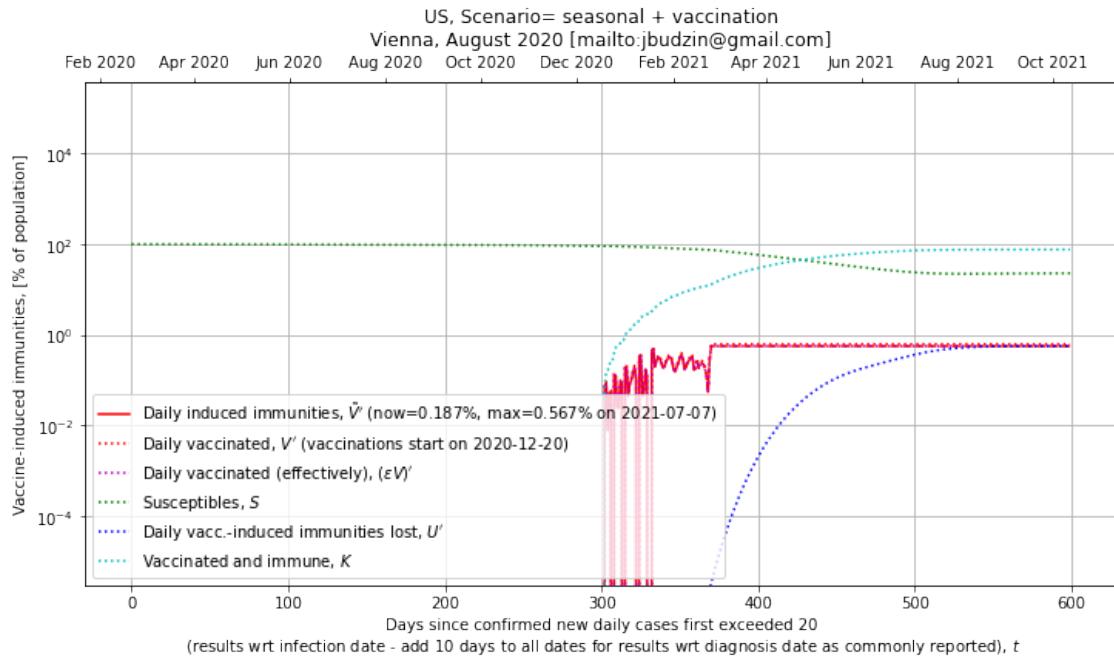
Approx. vaccination cost per year (projection) [EUR MLN] = 6582.01

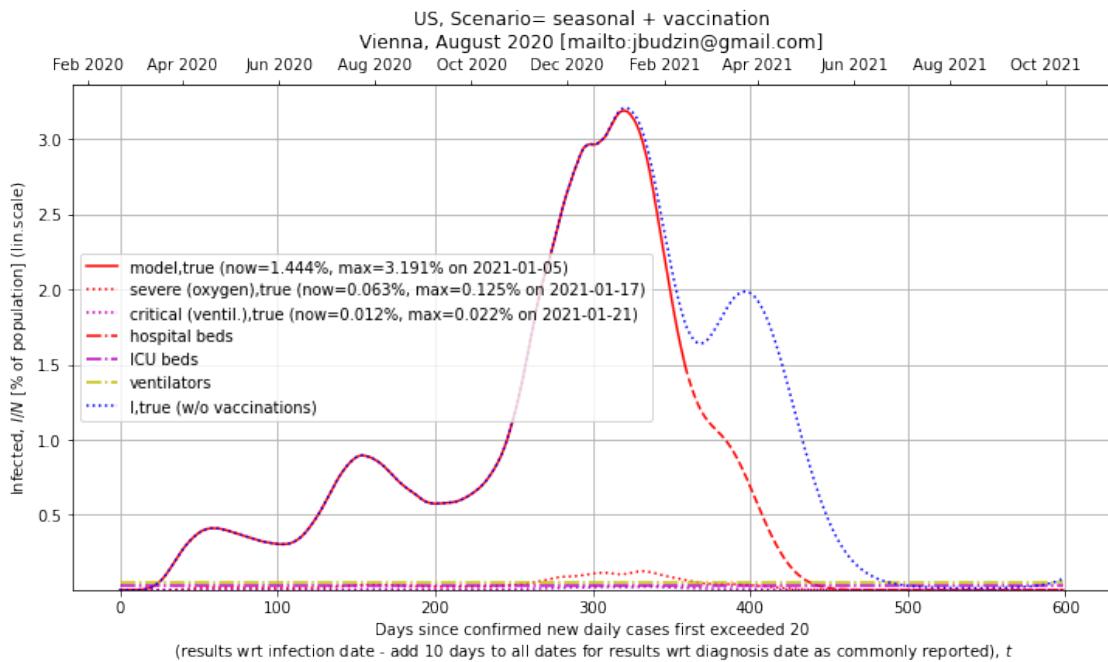
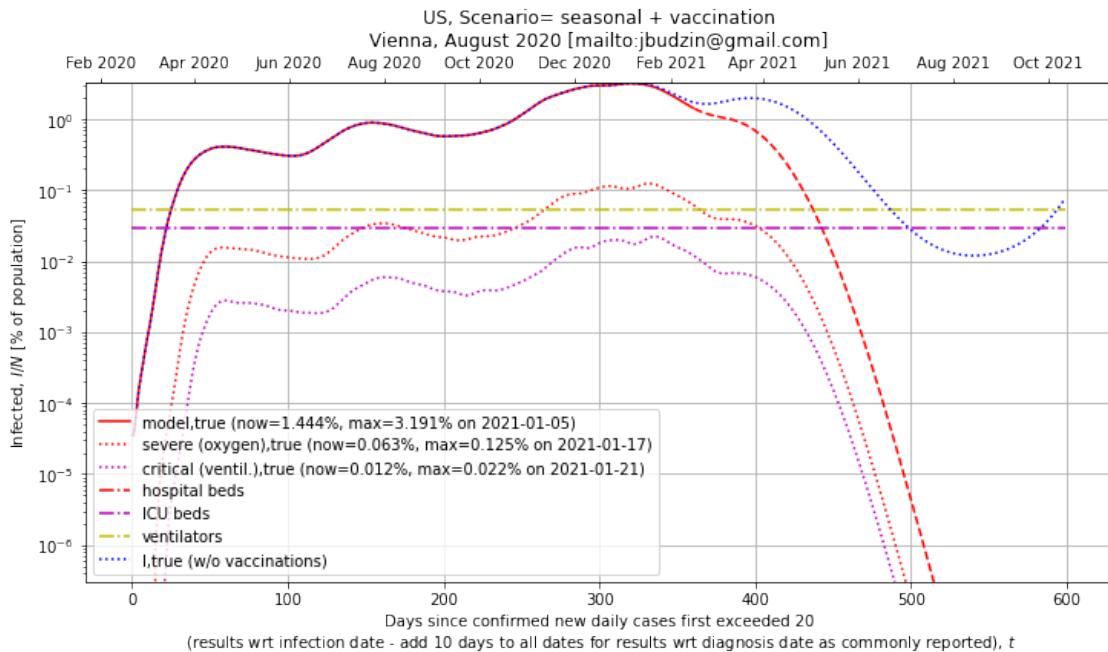


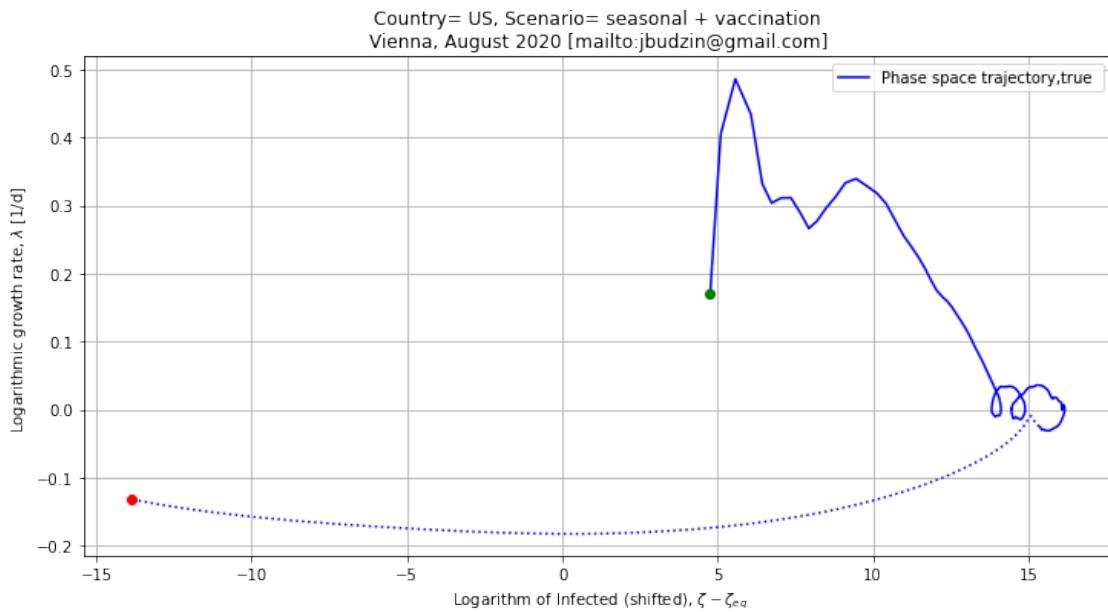
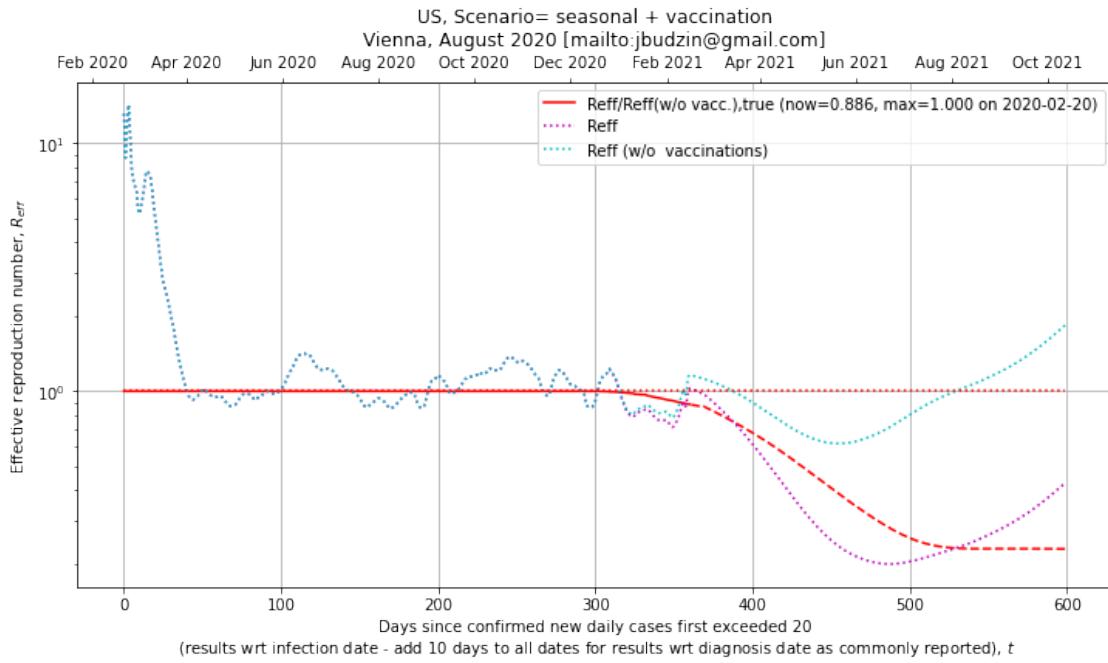
1.7.9 VACC_RATE = 2.30 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 230.095









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

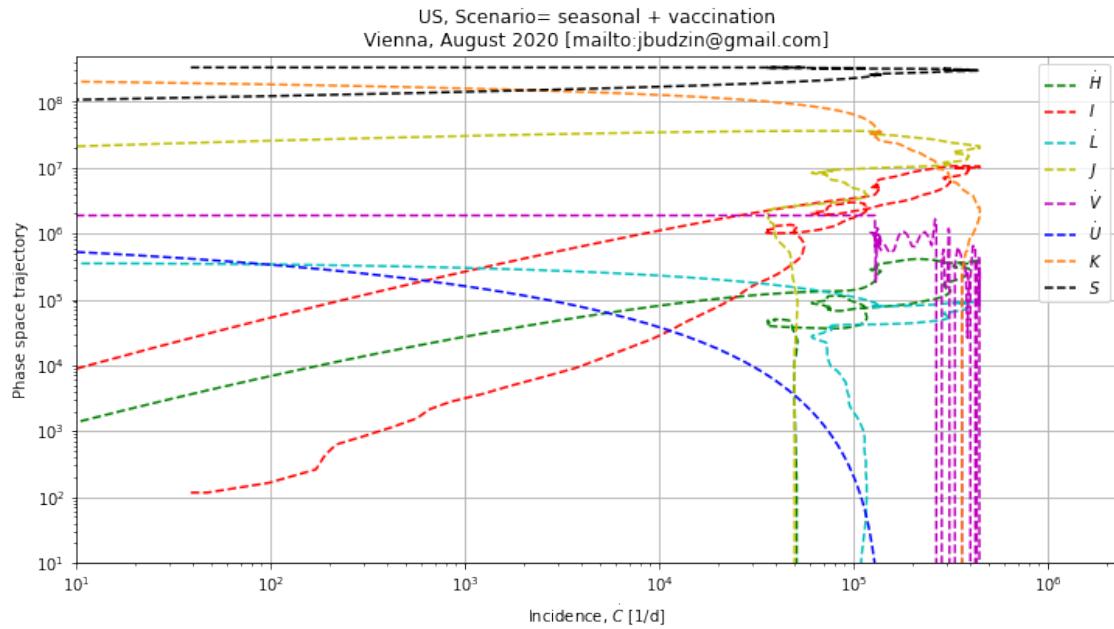
Avg. infection prevalence = 7.32e+05 / Perc of pop= 0.221

Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

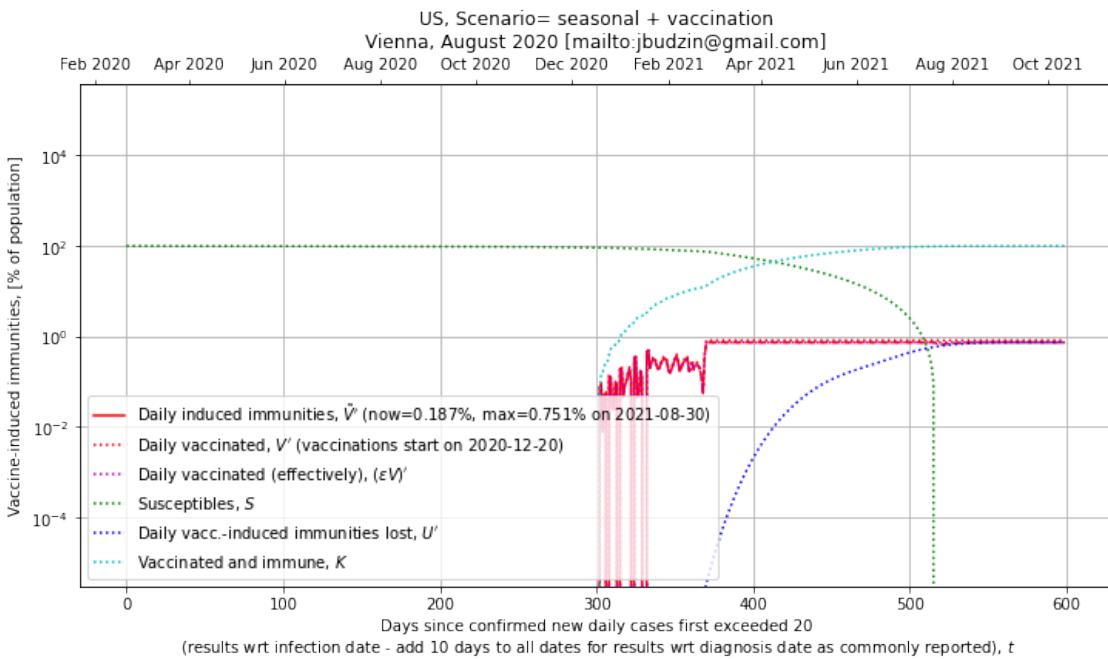
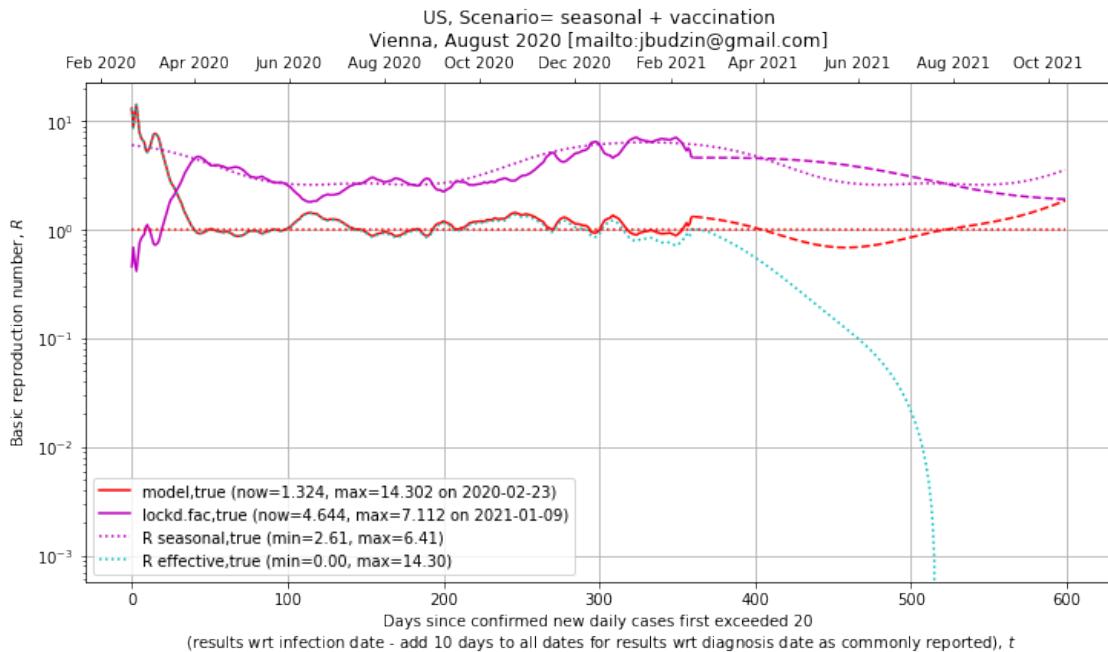
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 100.270

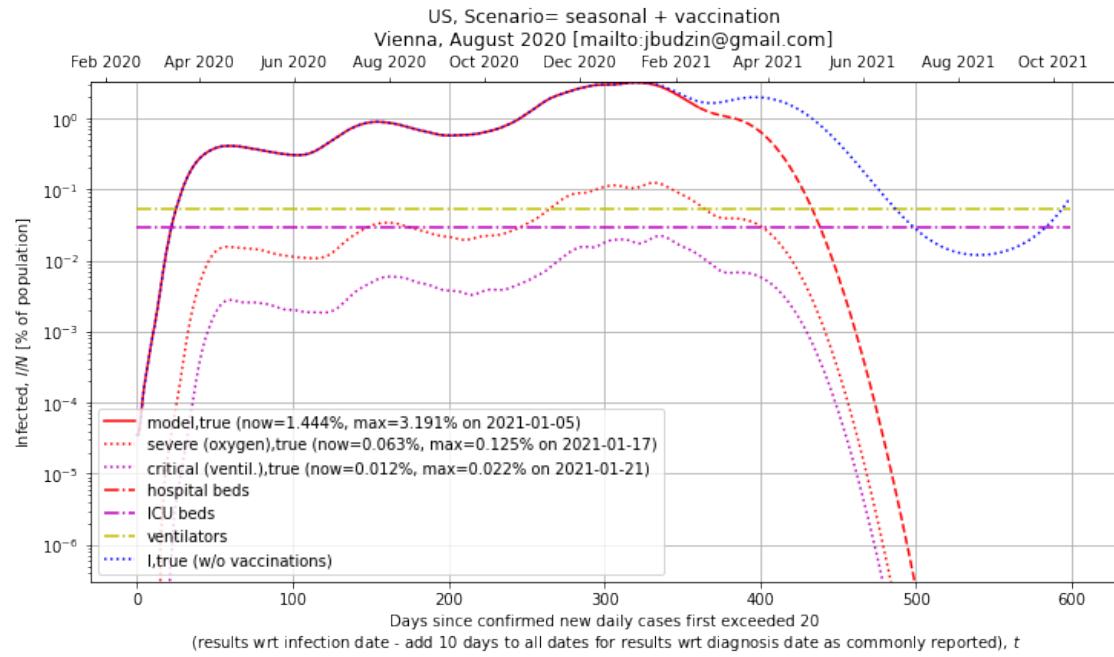
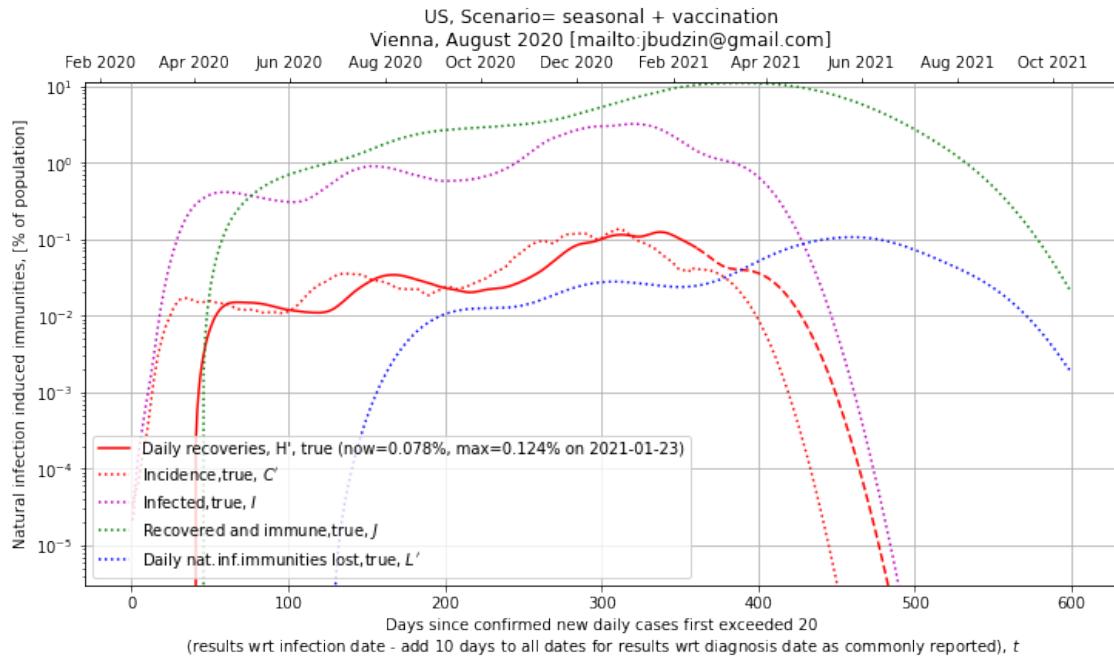
Approx. vaccination cost per year (projection) [EUR MLN] = 10023.64

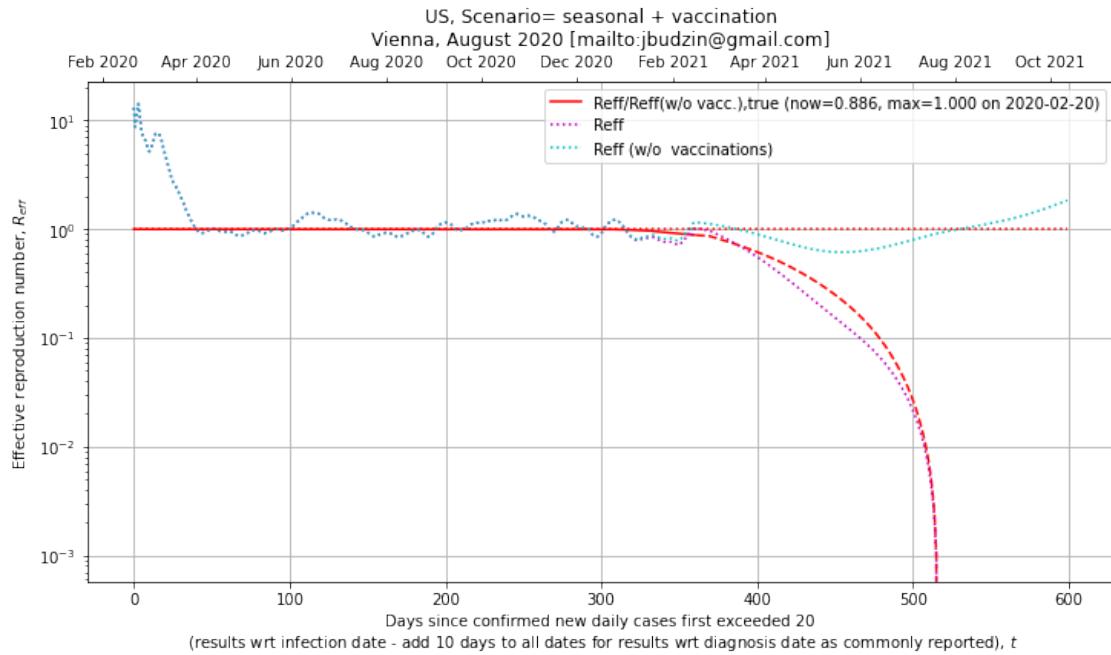
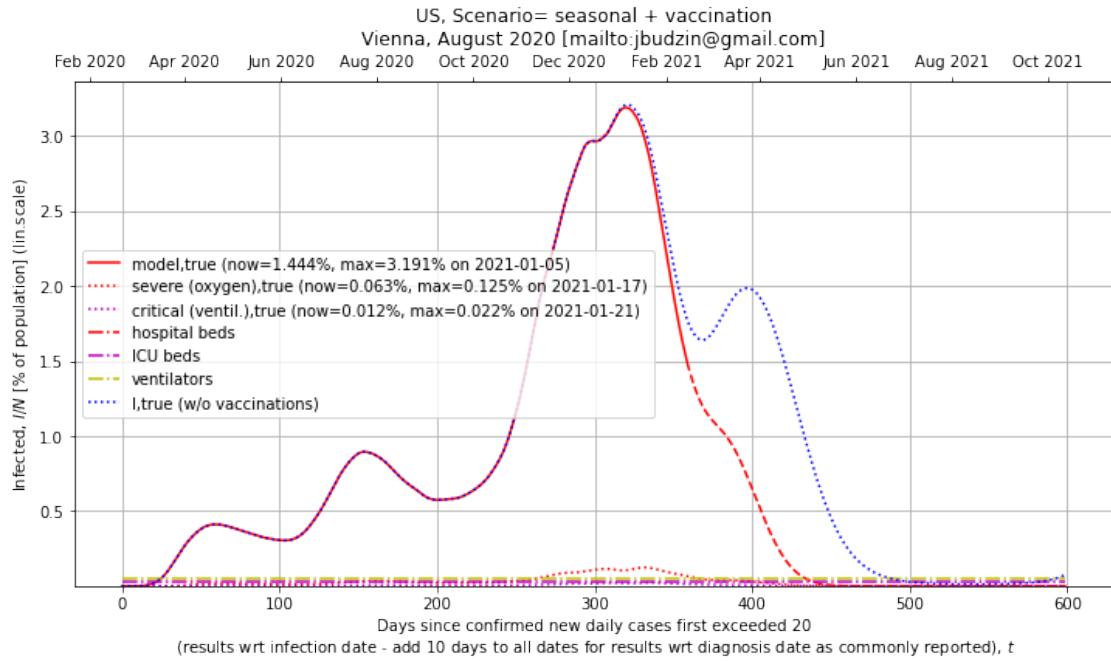


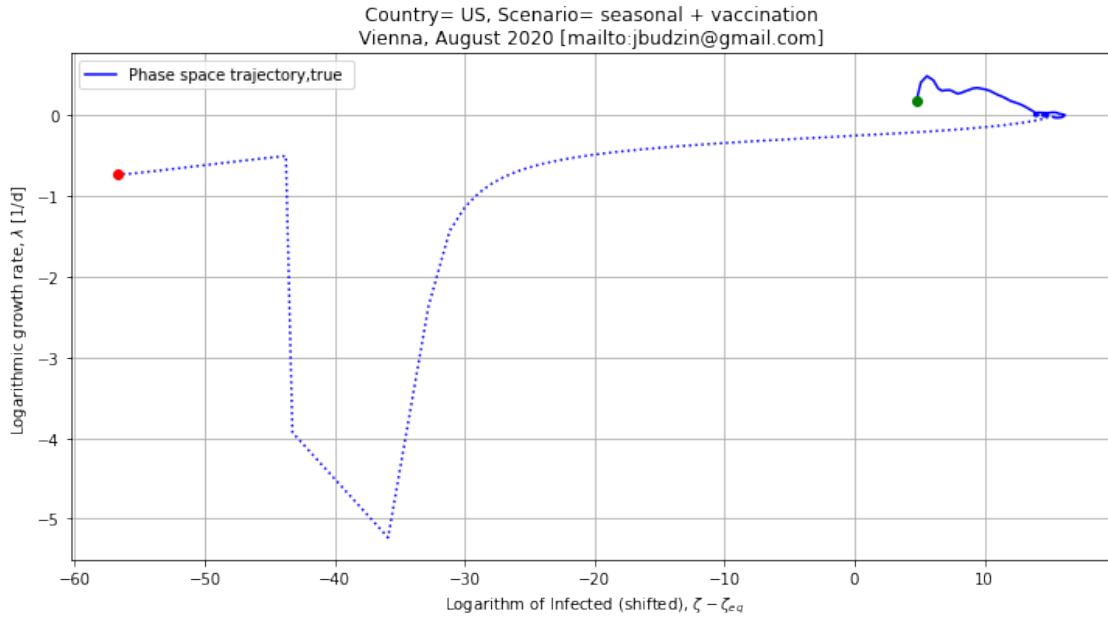
1.7.10 VACC_RATE = 3.00 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 300.123









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

Avg. infection prevalence = 7.02e+05 / Perc of pop = 0.212

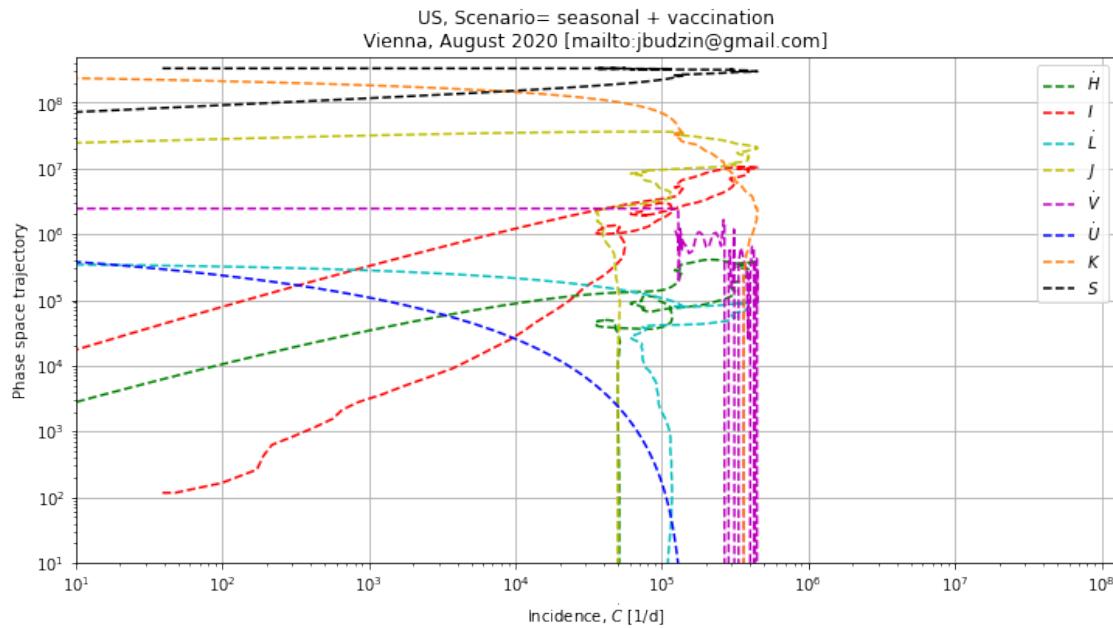
Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0

Time constant in Lyapunov function (data) [d] = 148.076

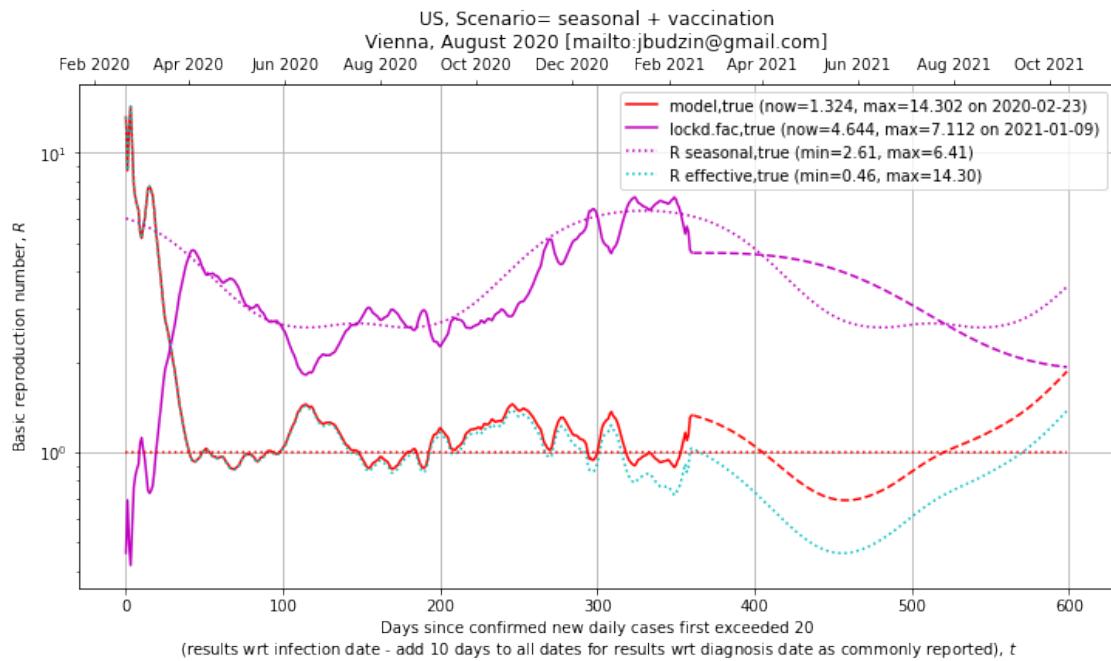
Time constant in Lyapunov function (proj) [d] = 71.735

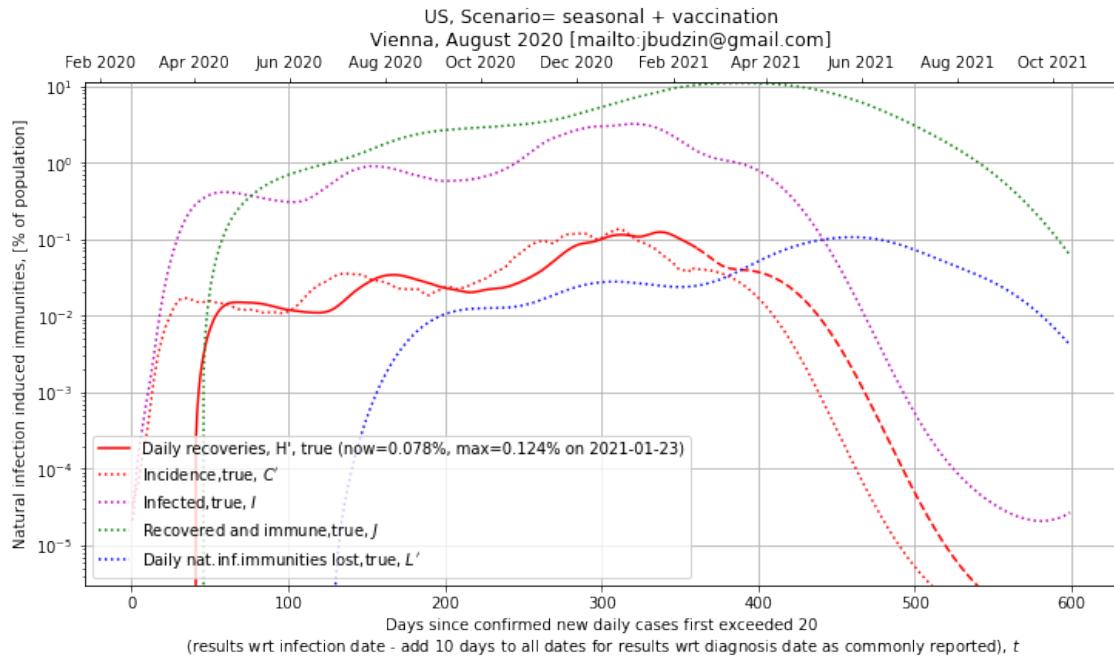
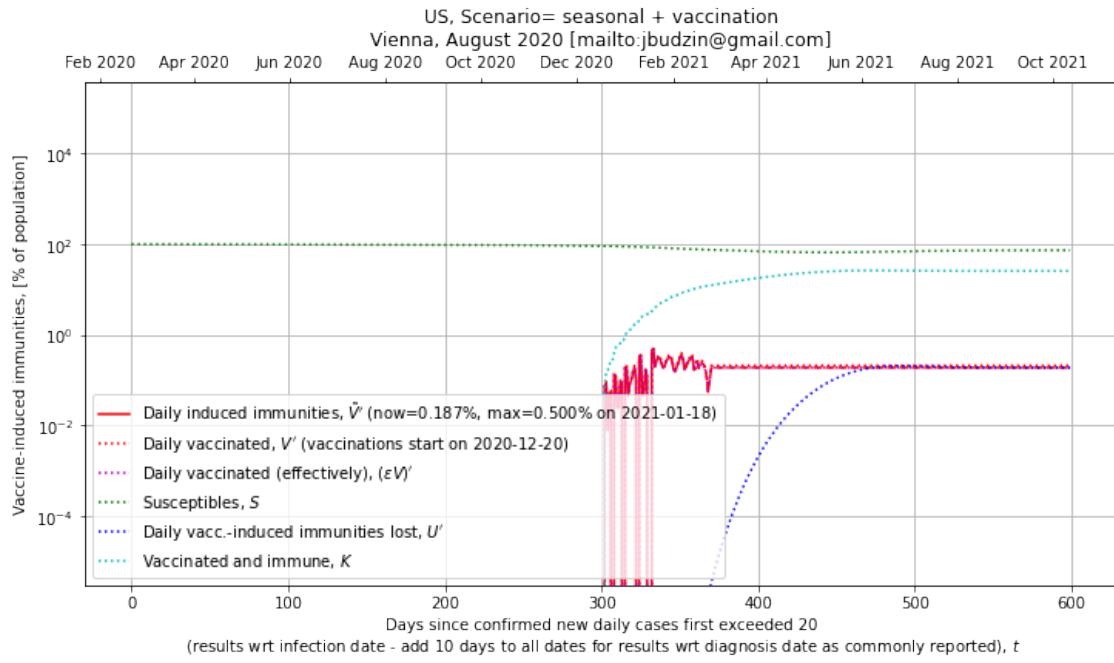
Approx. vaccination cost per year (projection) [EUR MLN] = 13035.06

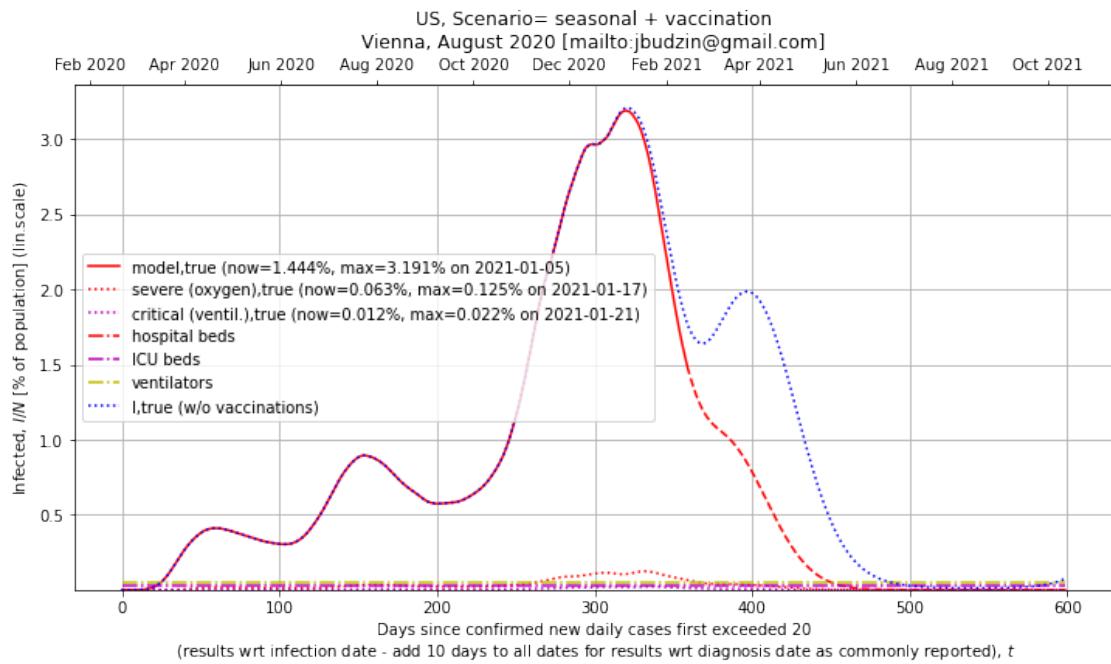
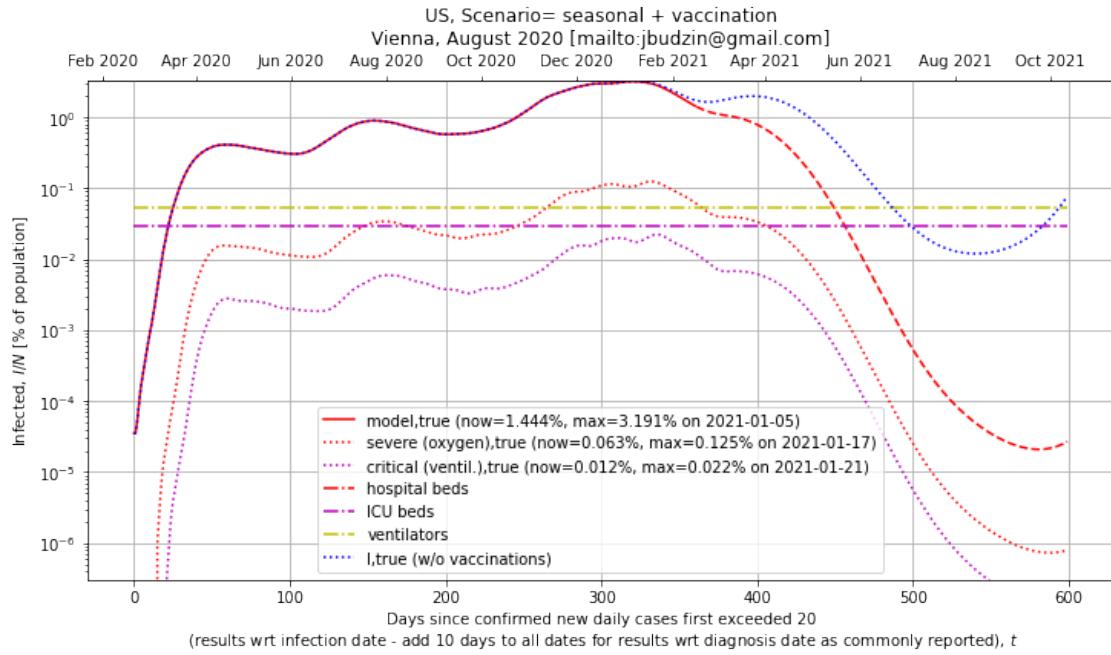


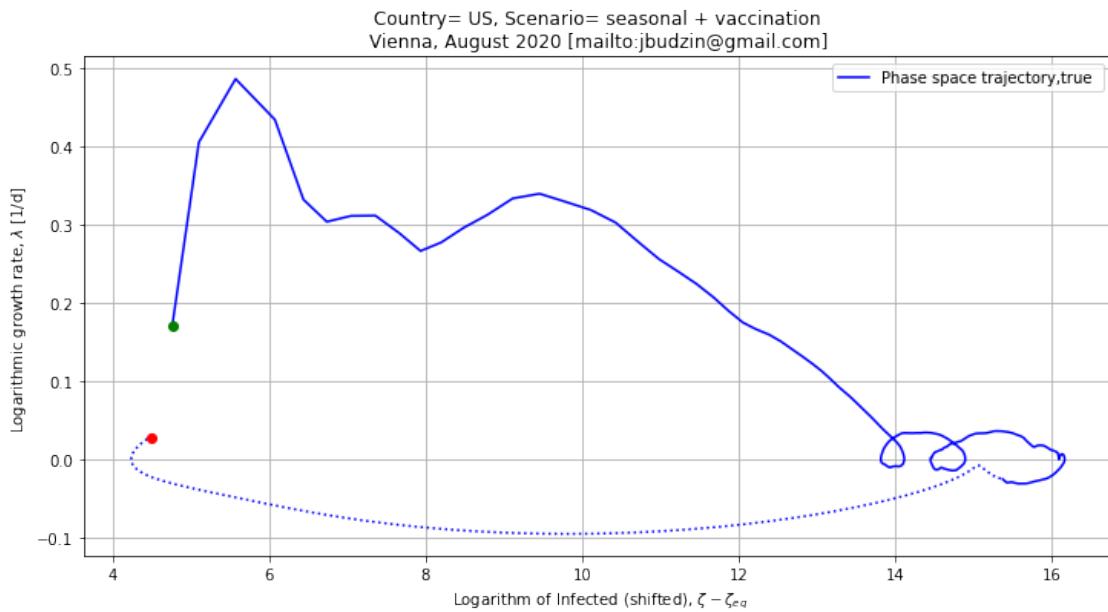
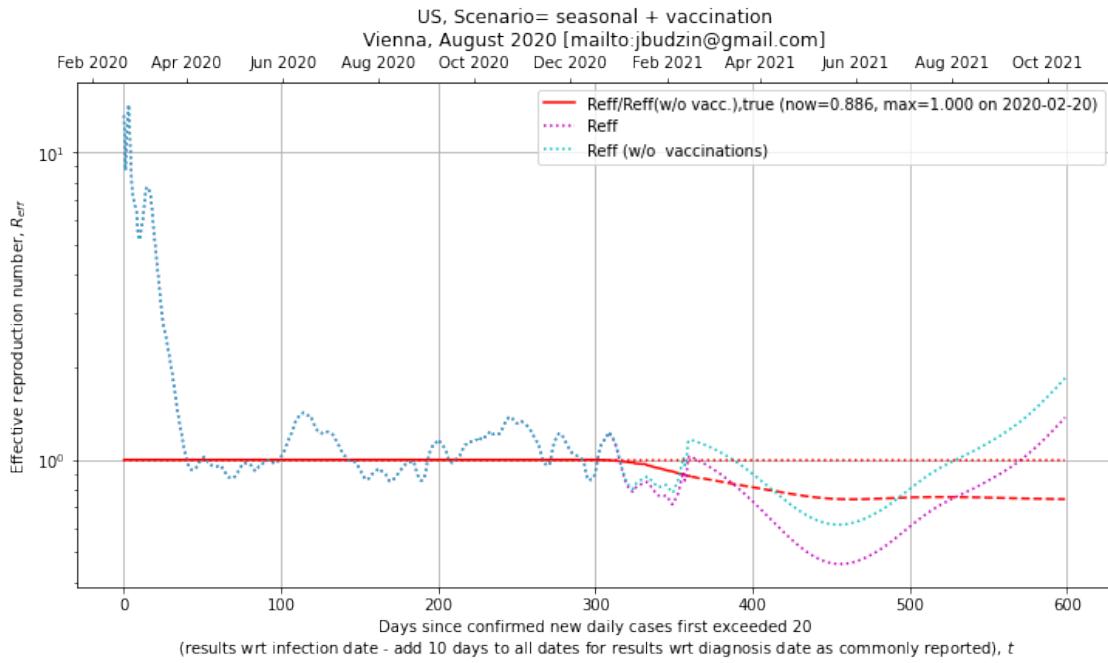
1.7.11 VACC_RATE = current vacc rate

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 77.596





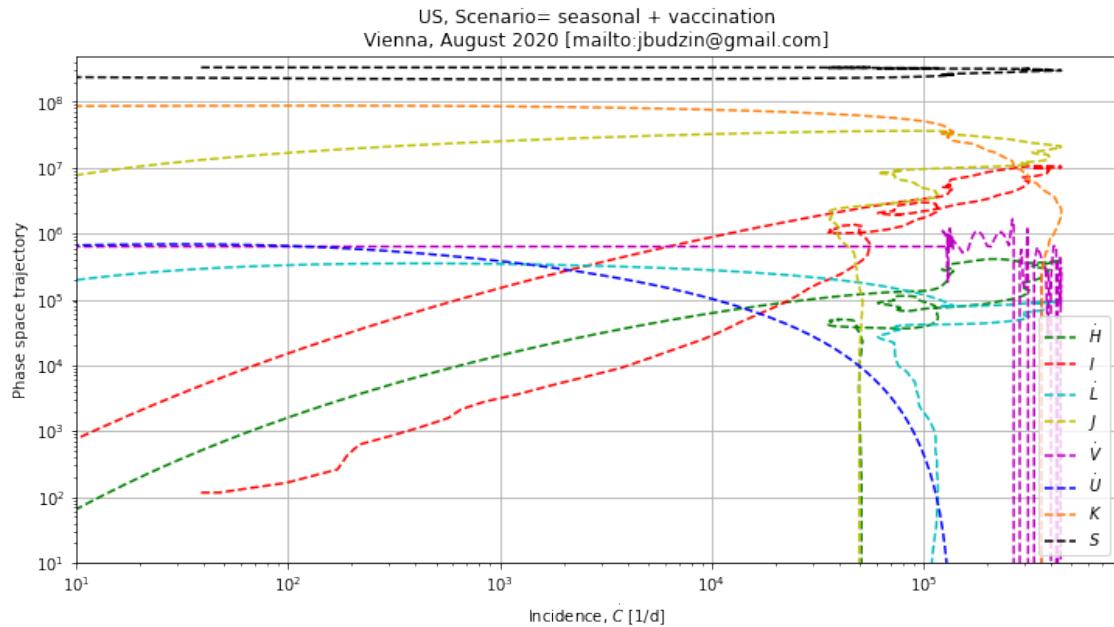




Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 8.25e+05 / Perc of pop= 0.249
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

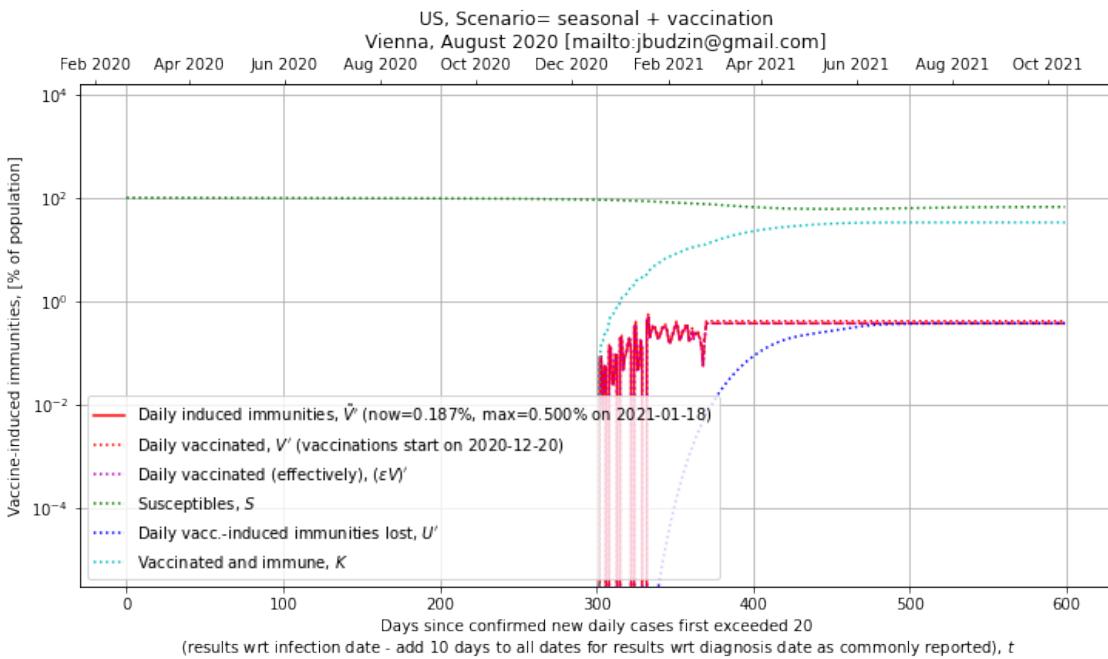
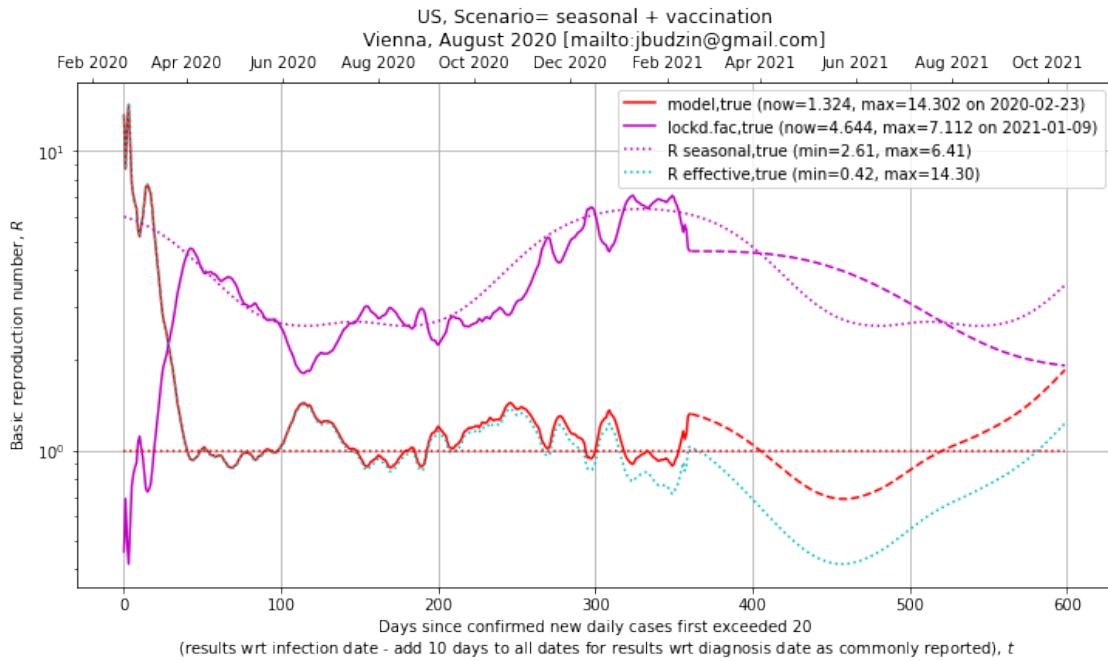
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 148.077

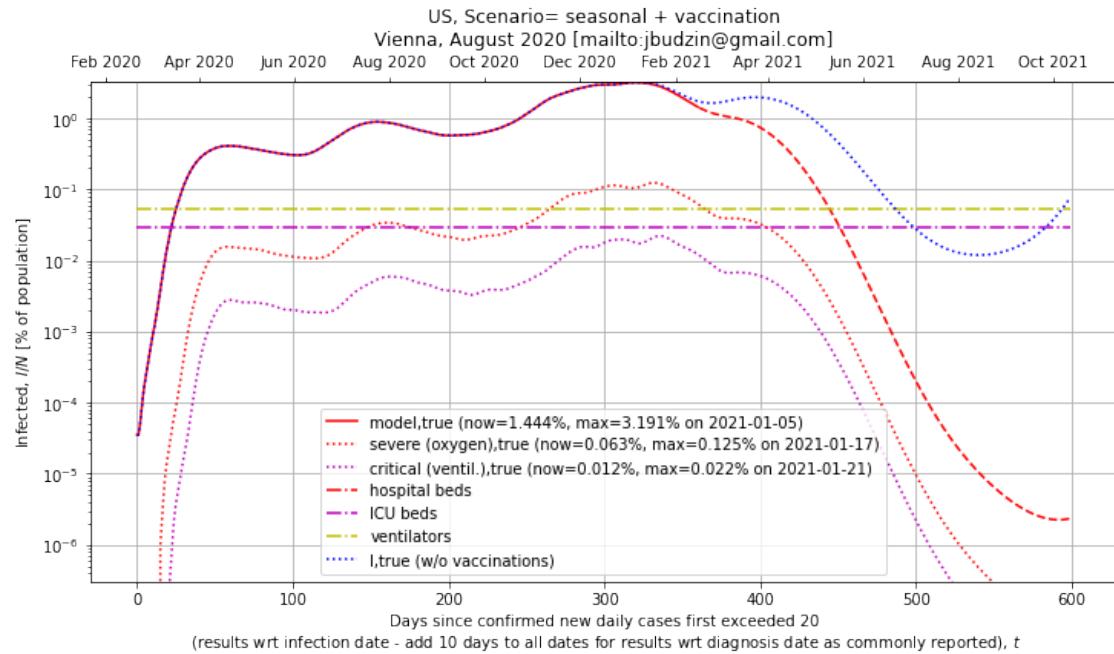
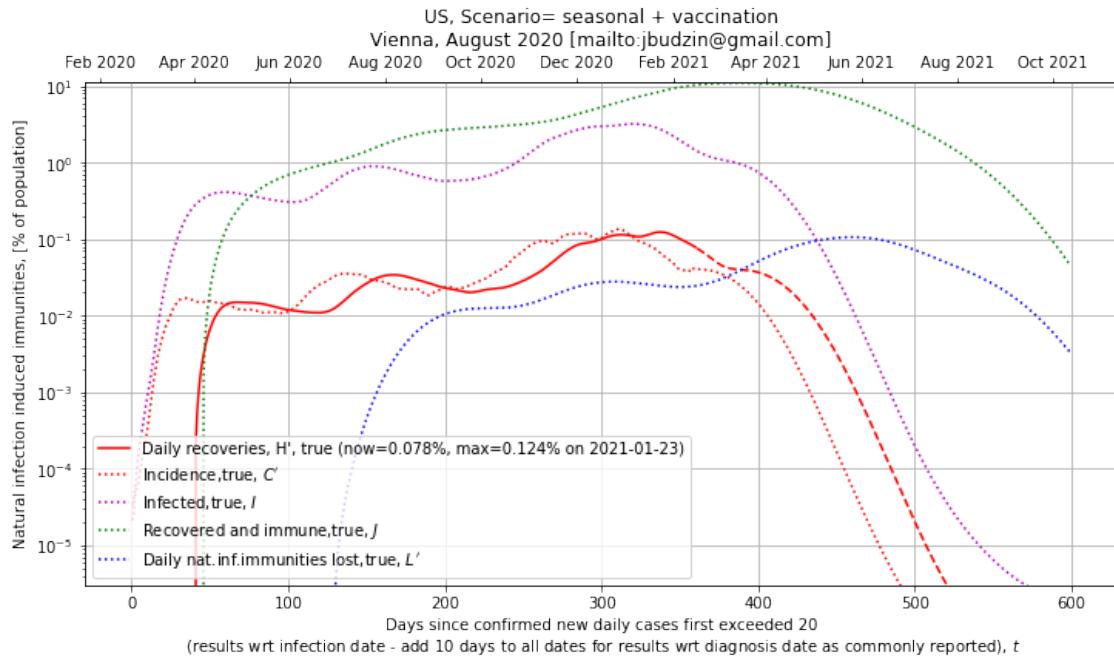
Approx. vaccination cost per year (projection) [EUR MLN] = 3465.82

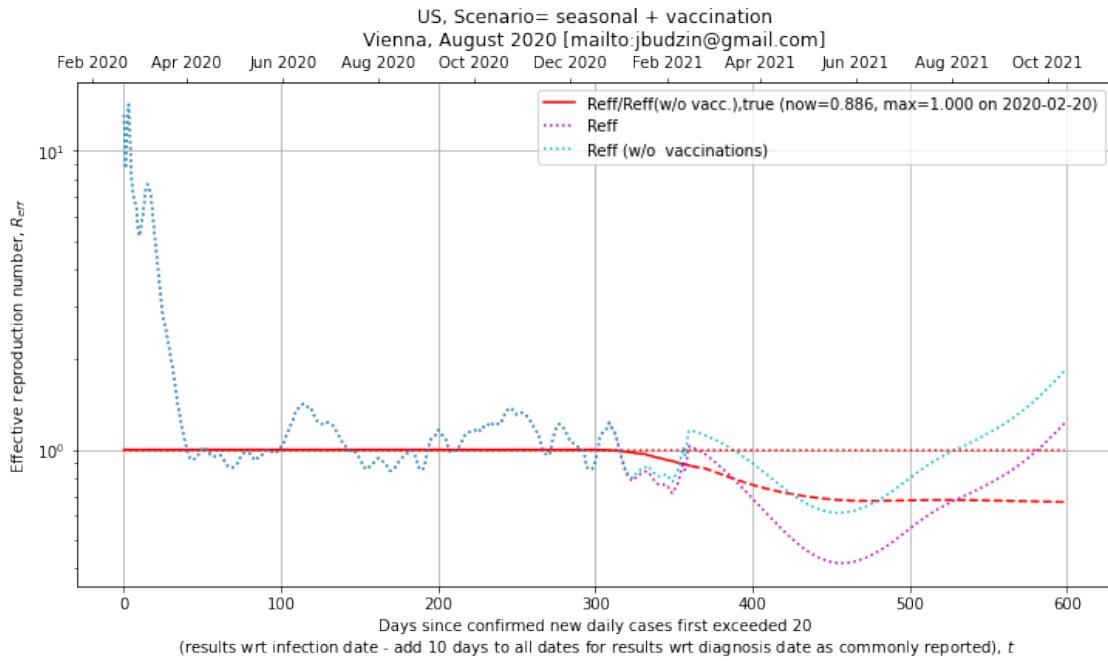
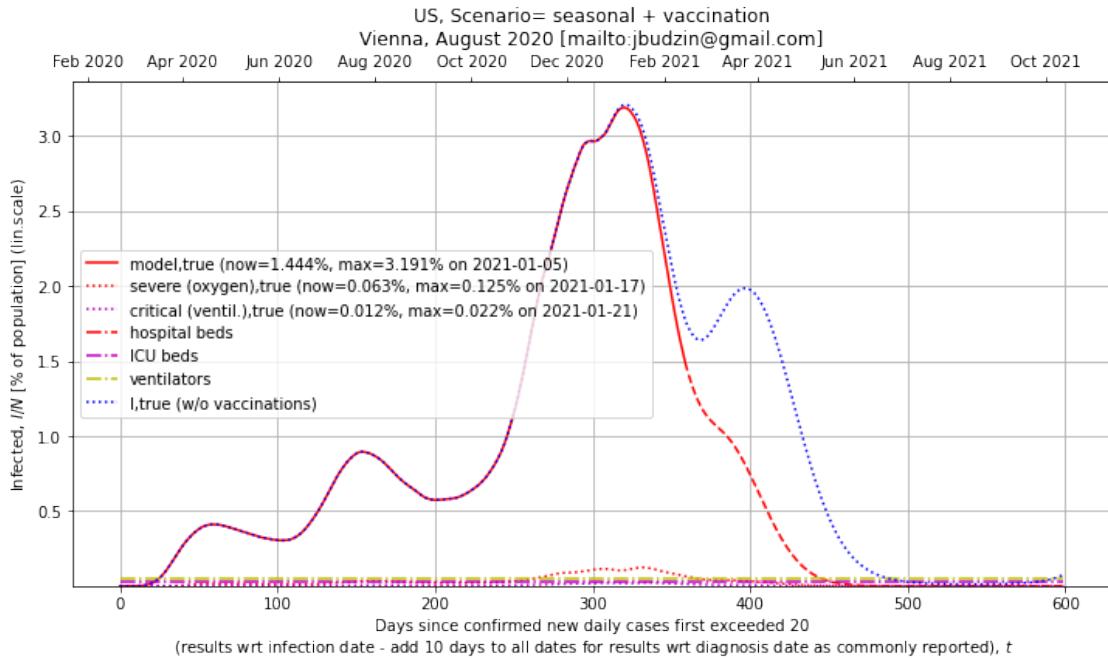


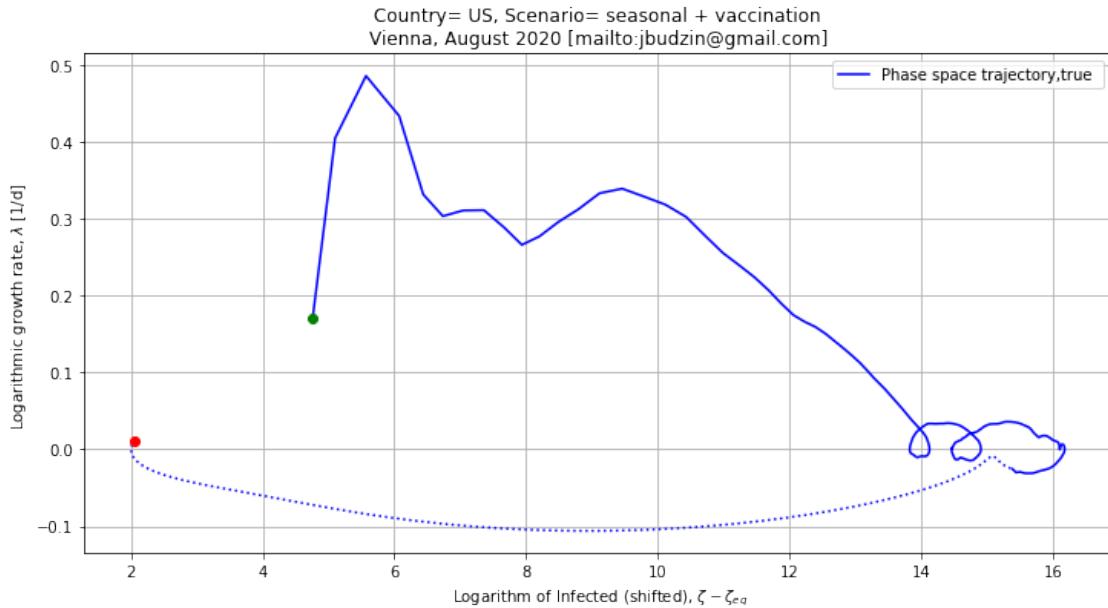
1.7.12 TAU_NU_VACC = 90.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062





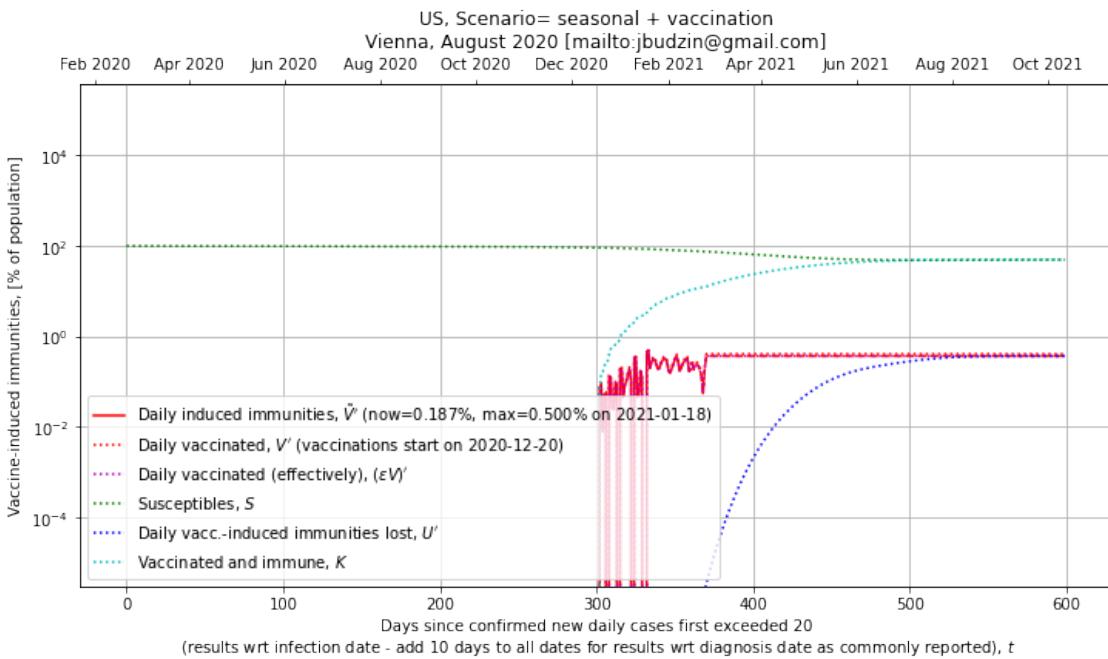
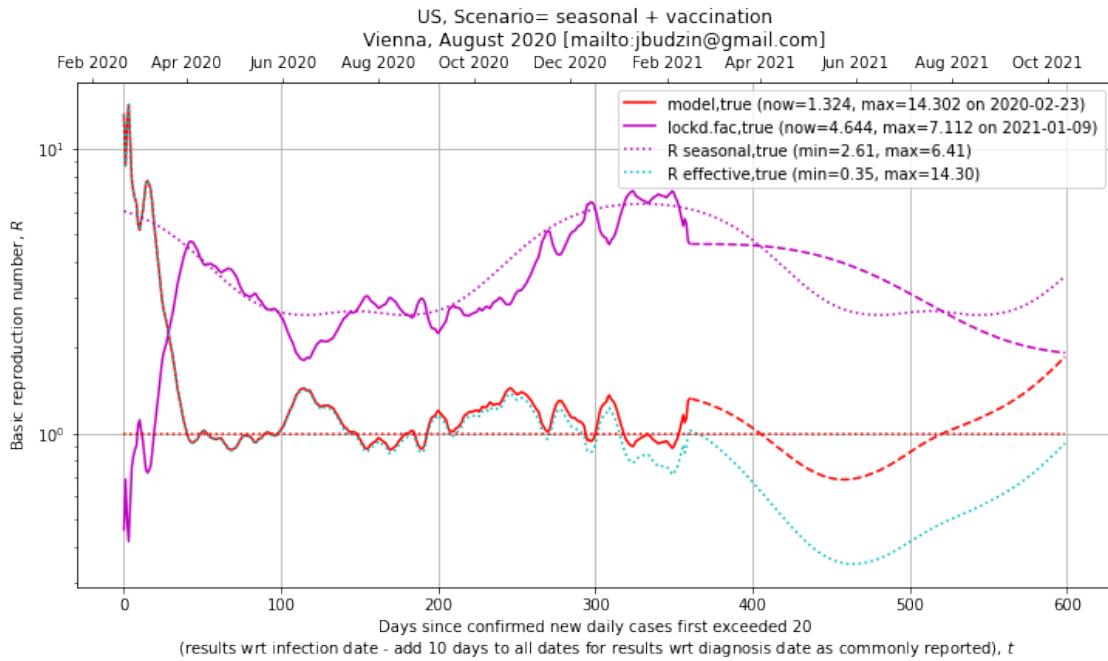


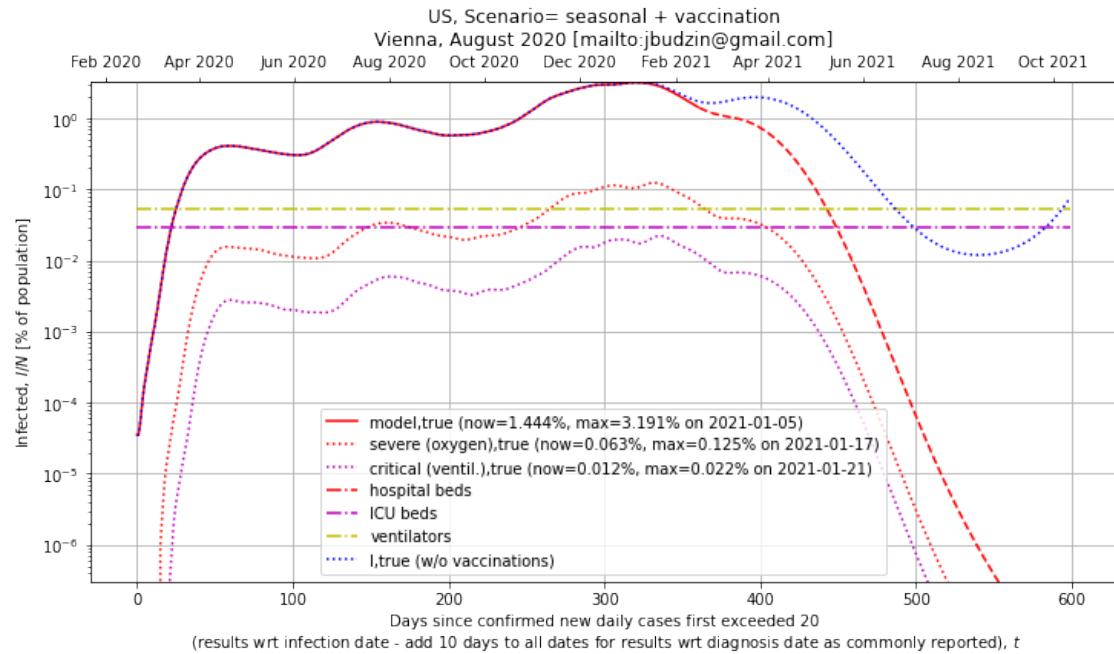
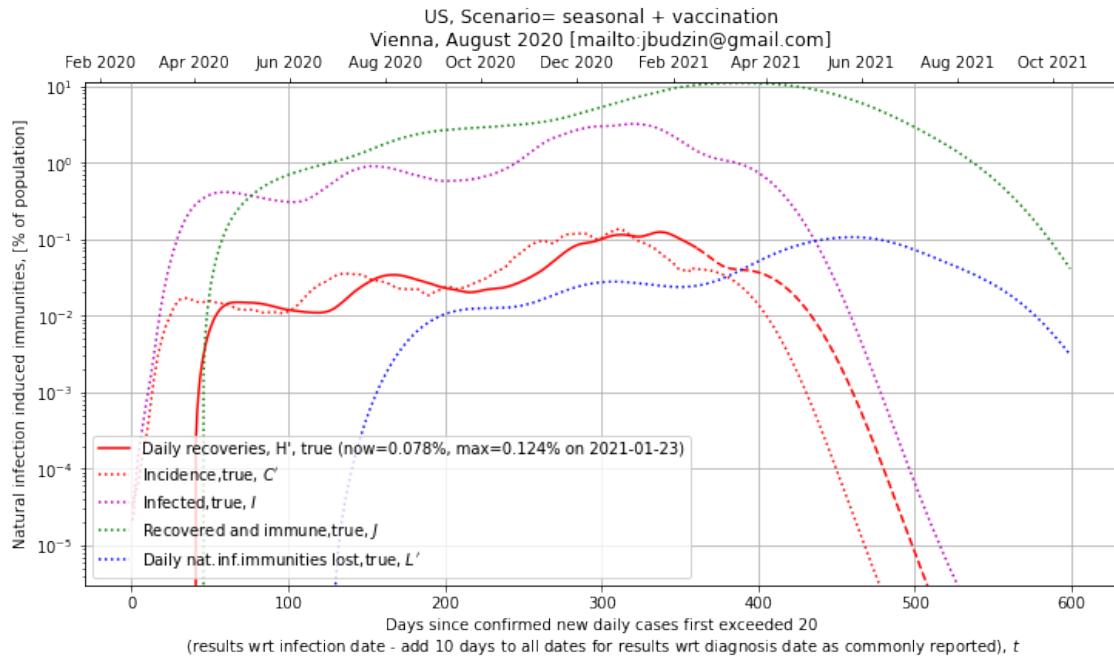


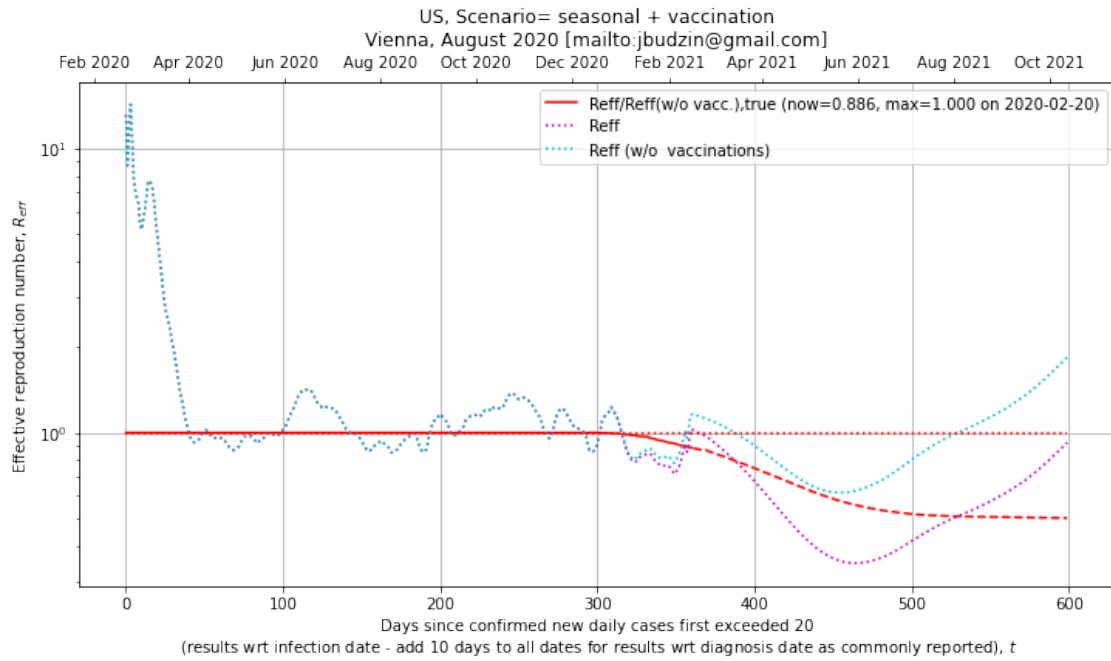
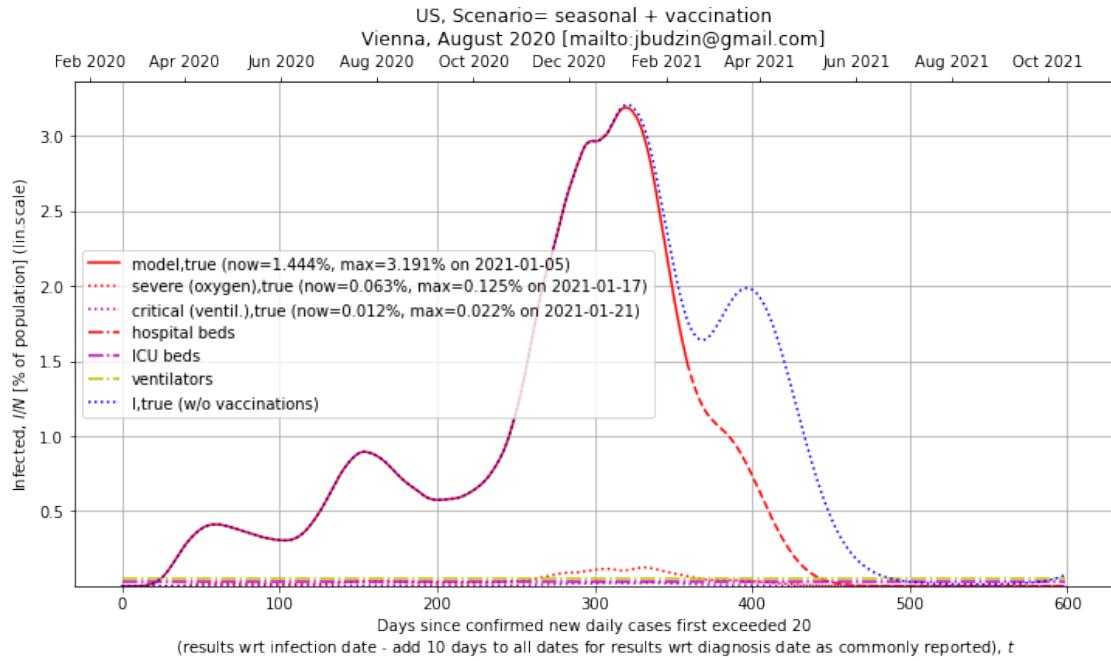
Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 7.83e+05 / Perc of pop = 0.237
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0
 Time constant in Lyapunov function (data) [d] = 148.061
 Time constant in Lyapunov function (proj) [d] = 320.280

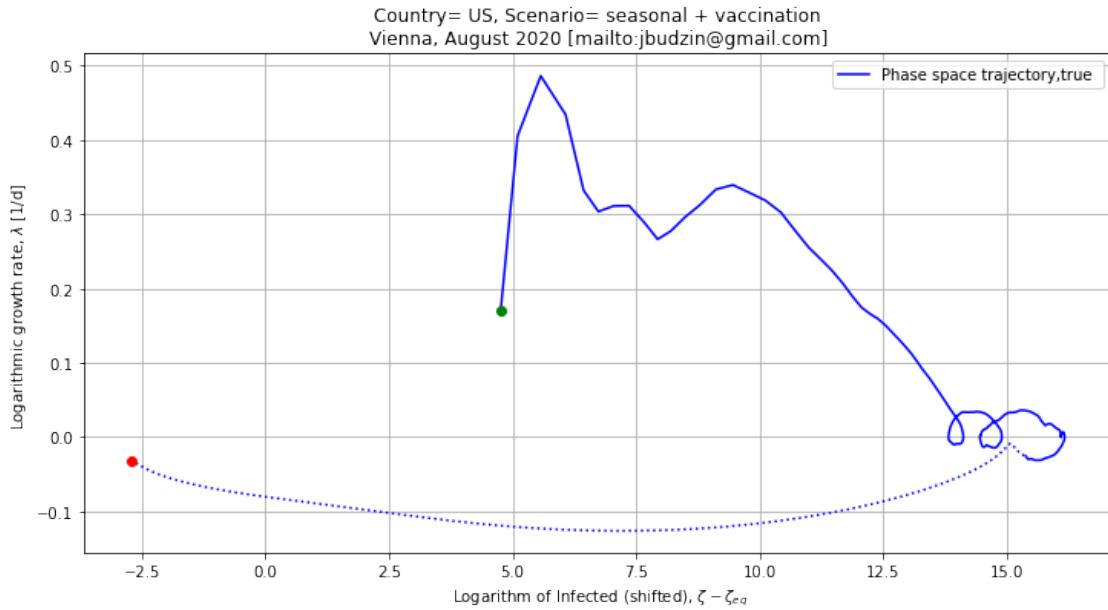
1.7.13 TAU_NU_VACC = 135.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062





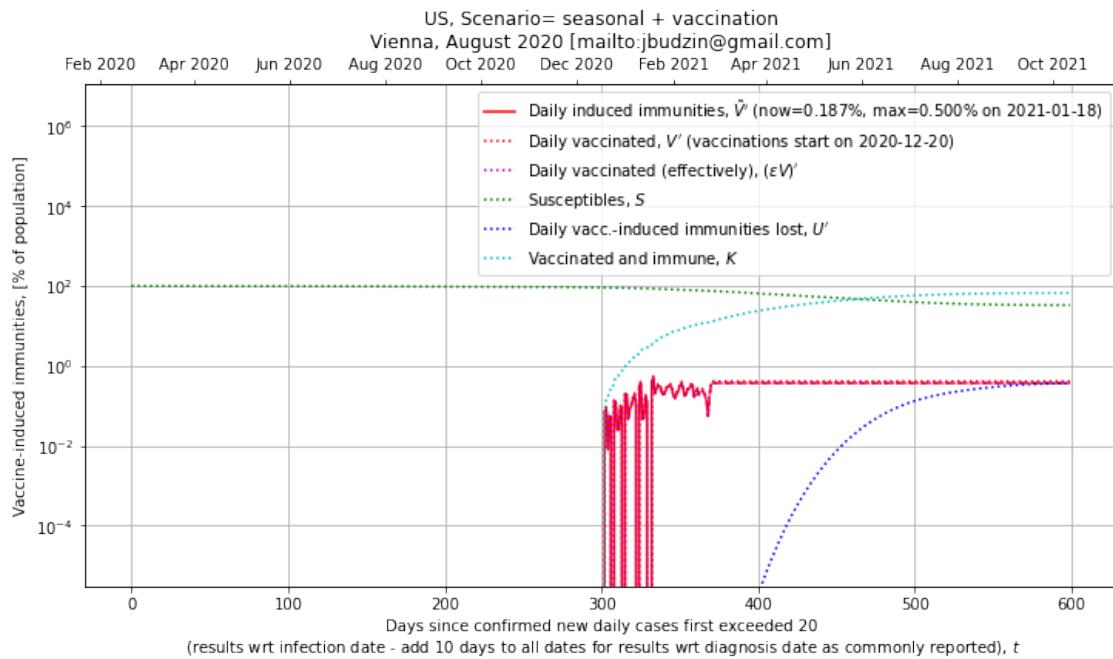
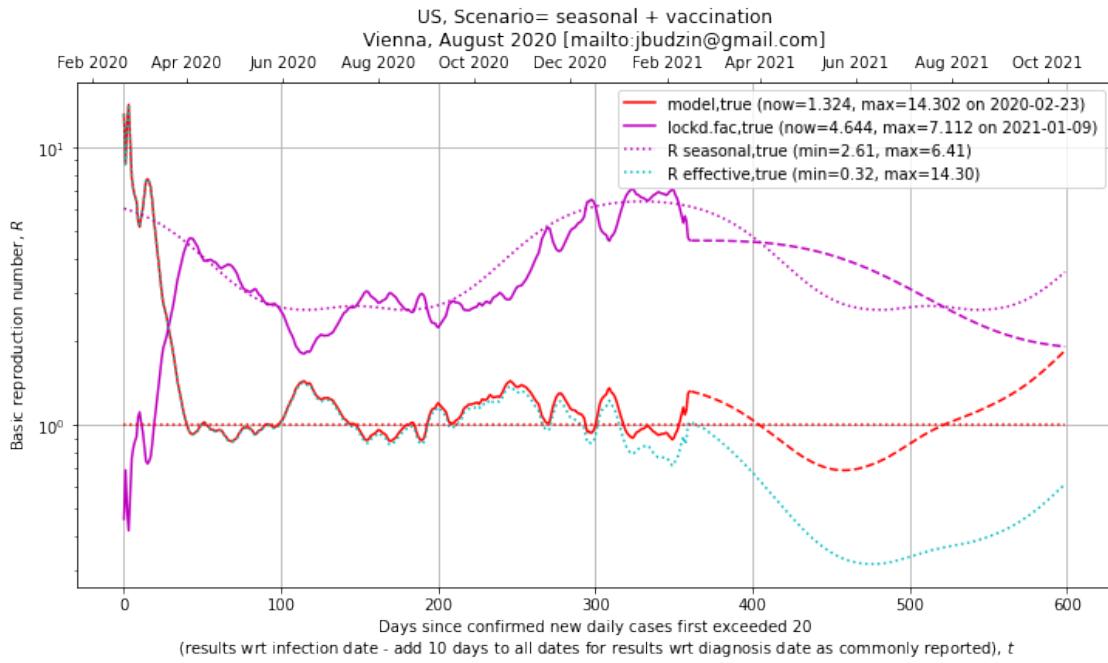


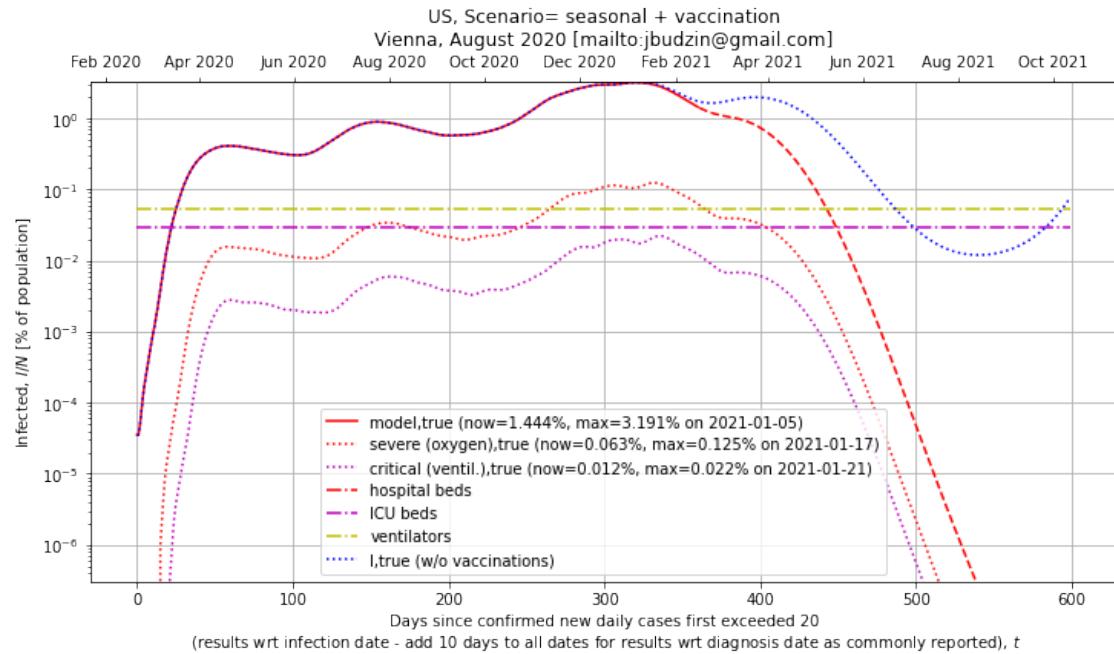
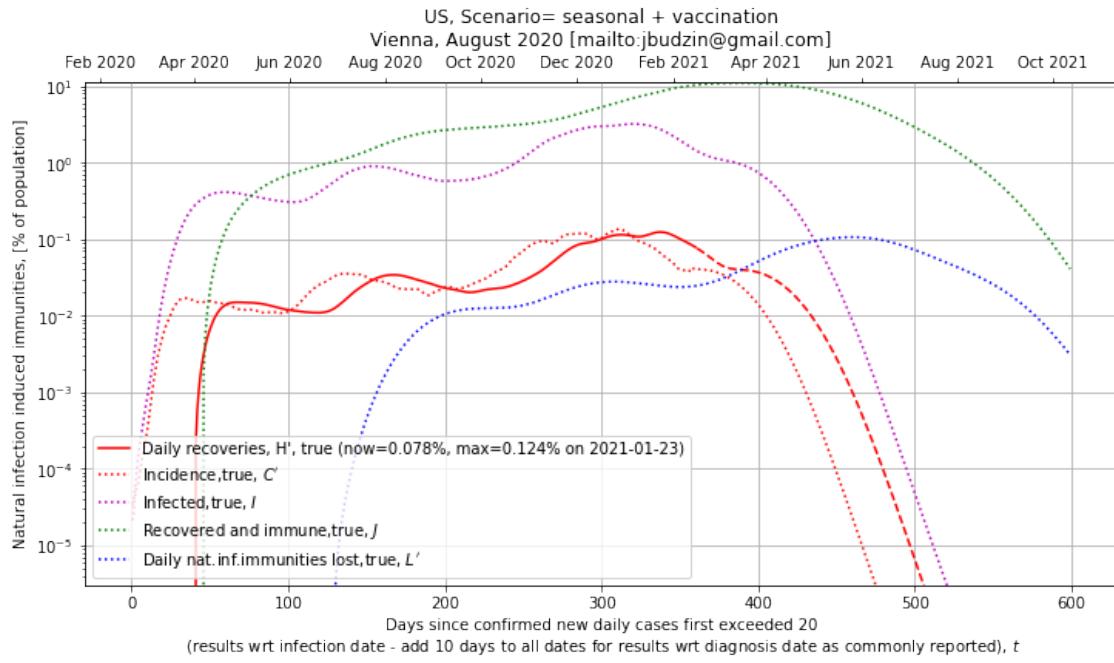


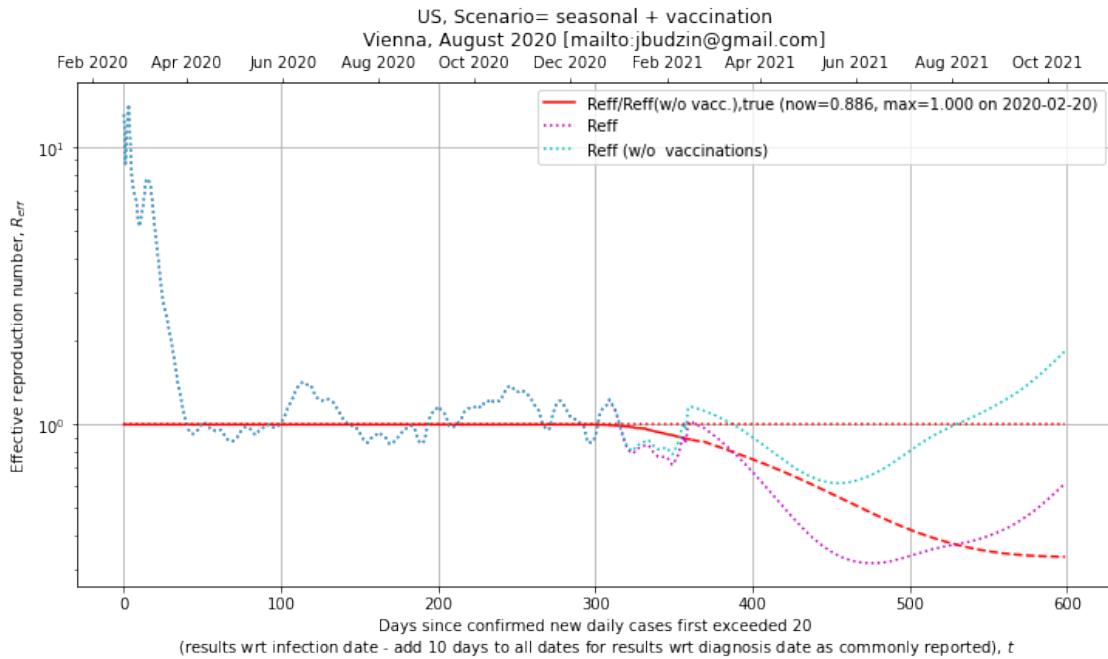
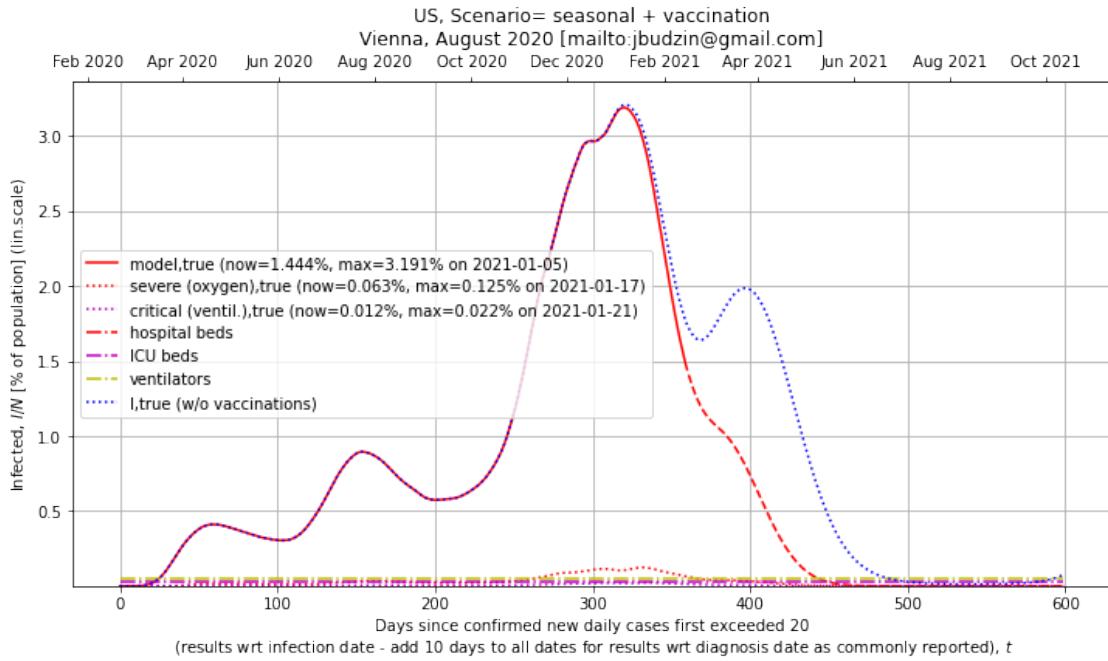
Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 7.74e+05 / Perc of pop = 0.234
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0
 Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 99.965

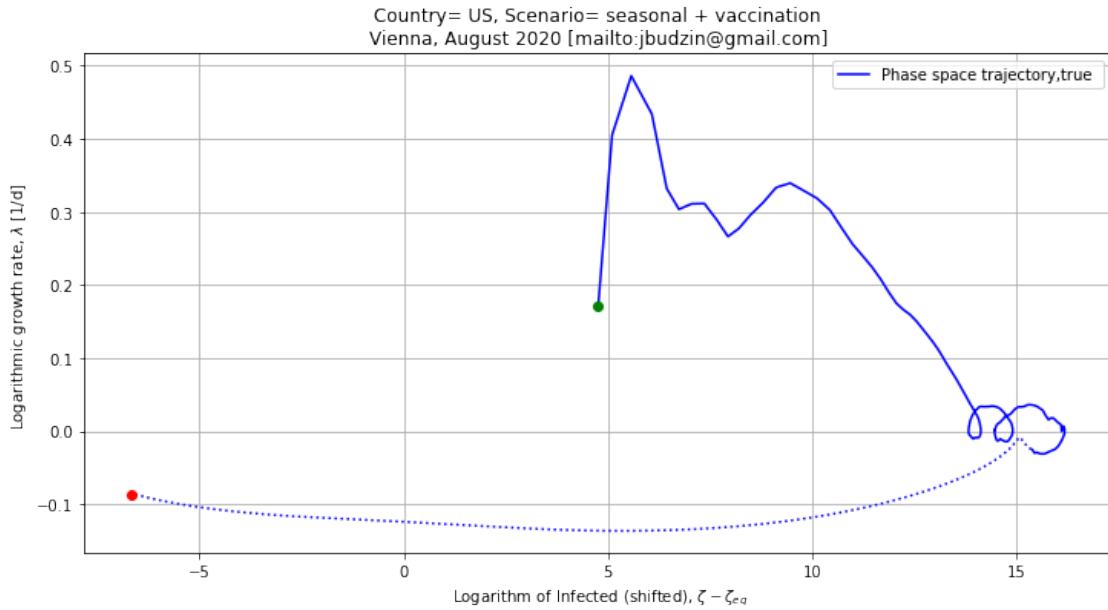
1.7.14 TAU_NU_VACC = 180.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062





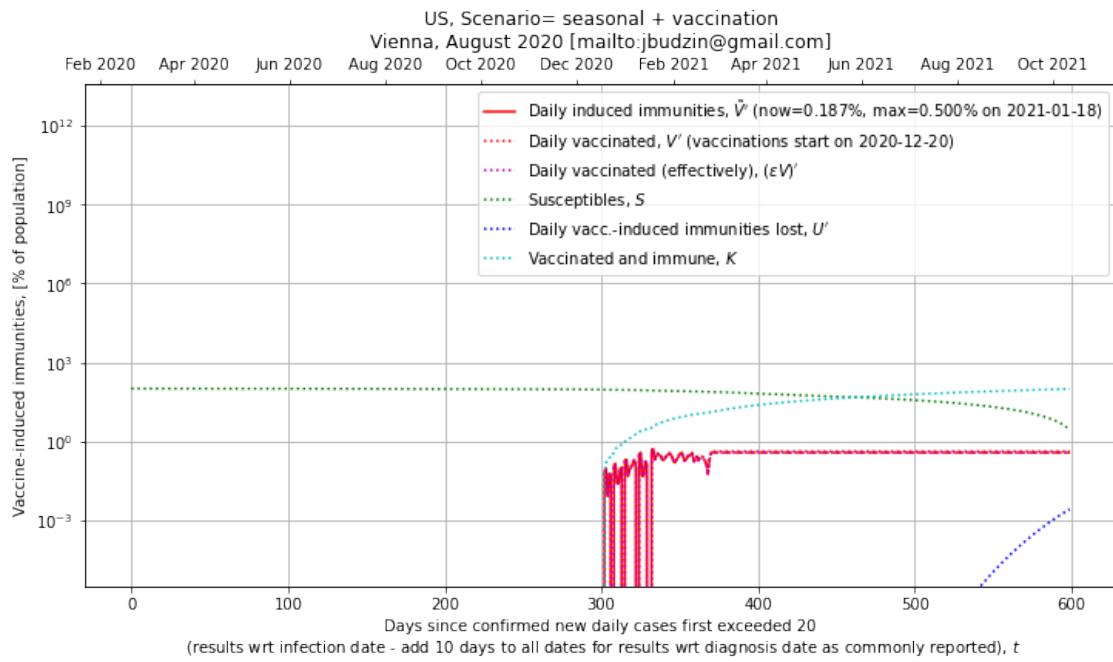
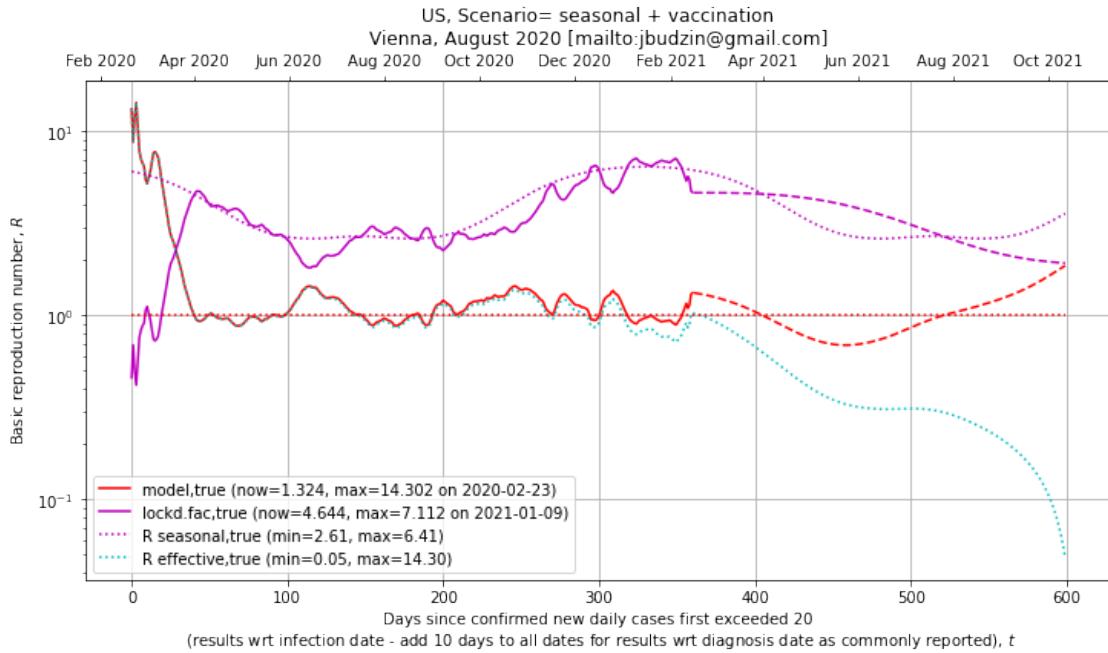


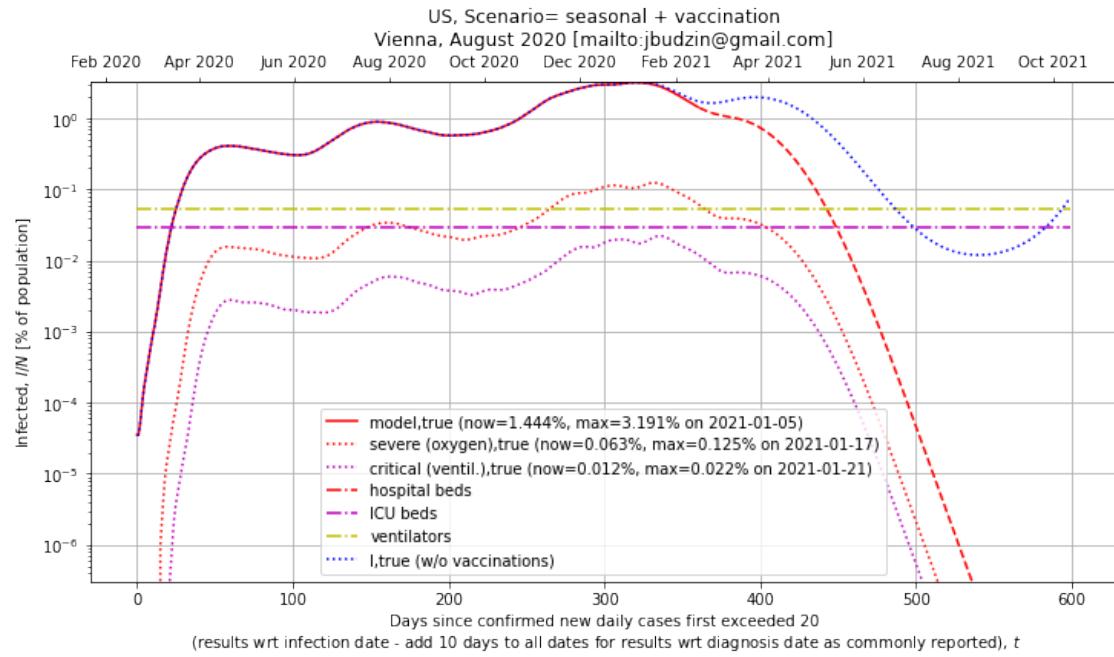
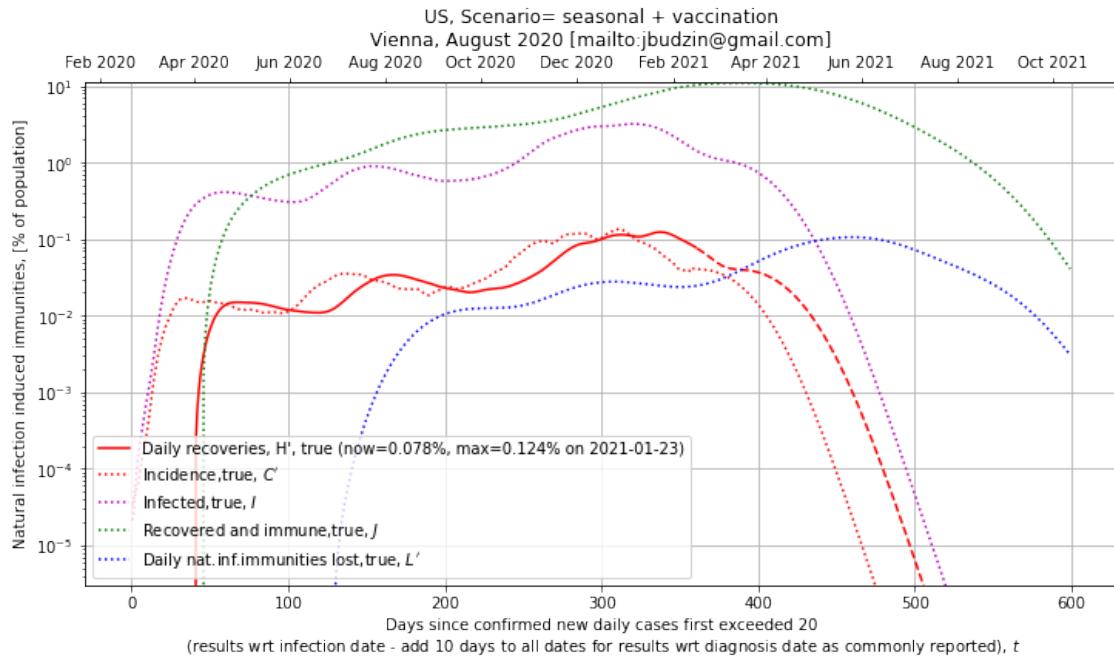


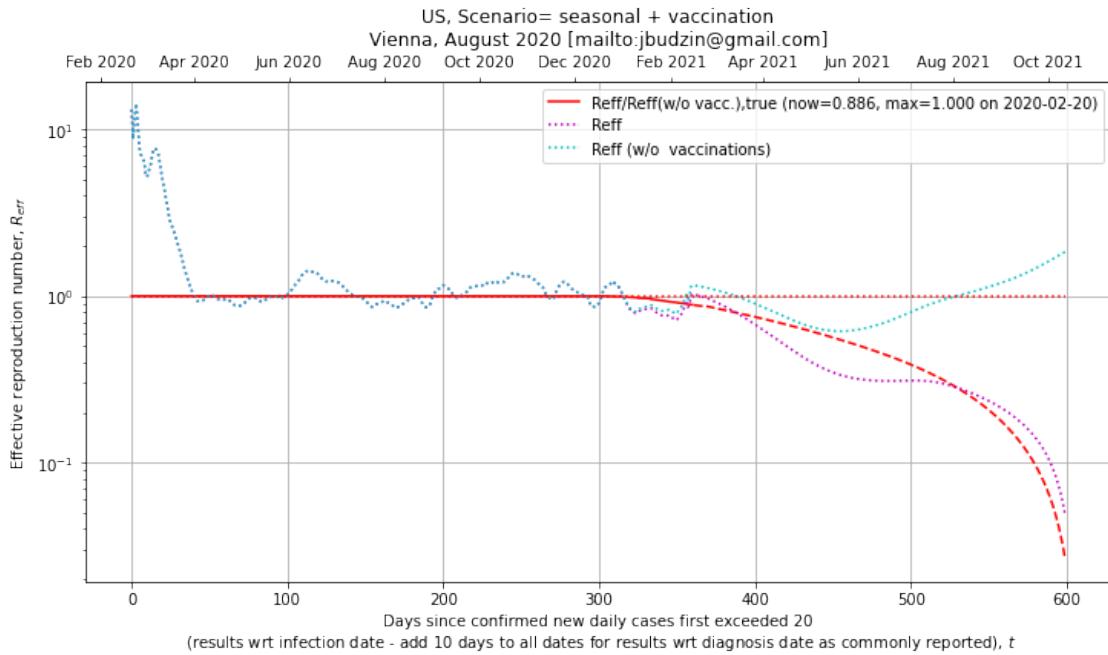
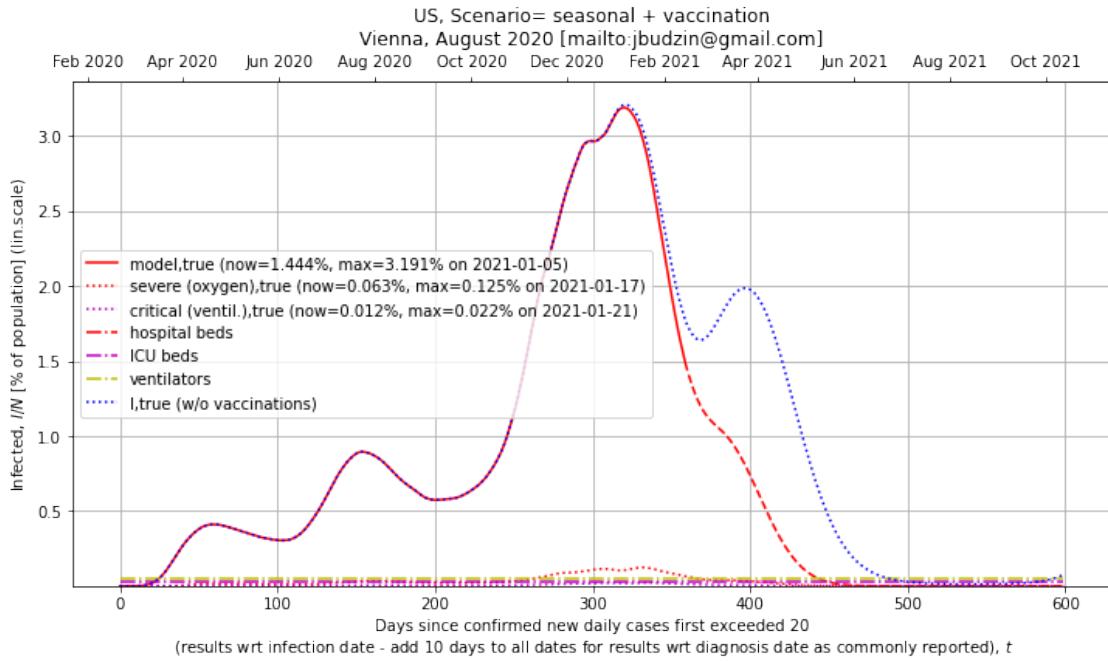
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.74e+05 / Perc of pop= 0.234
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 148.076
Time constant in Lyapunov function (proj) [d]= 104.502

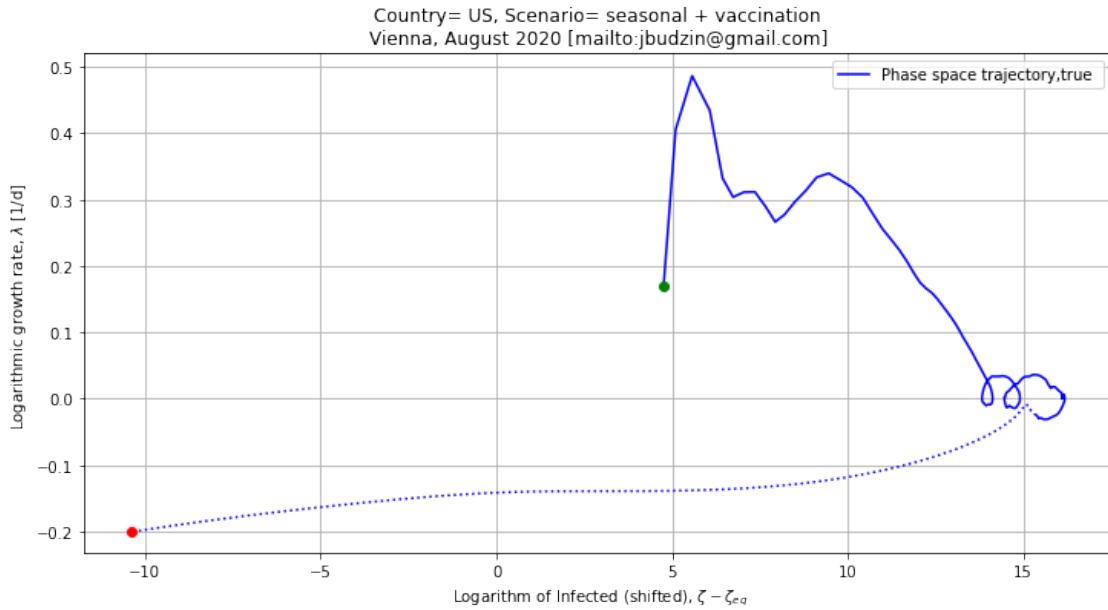
1.7.15 TAU_NU_VACC = 360.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 150.062





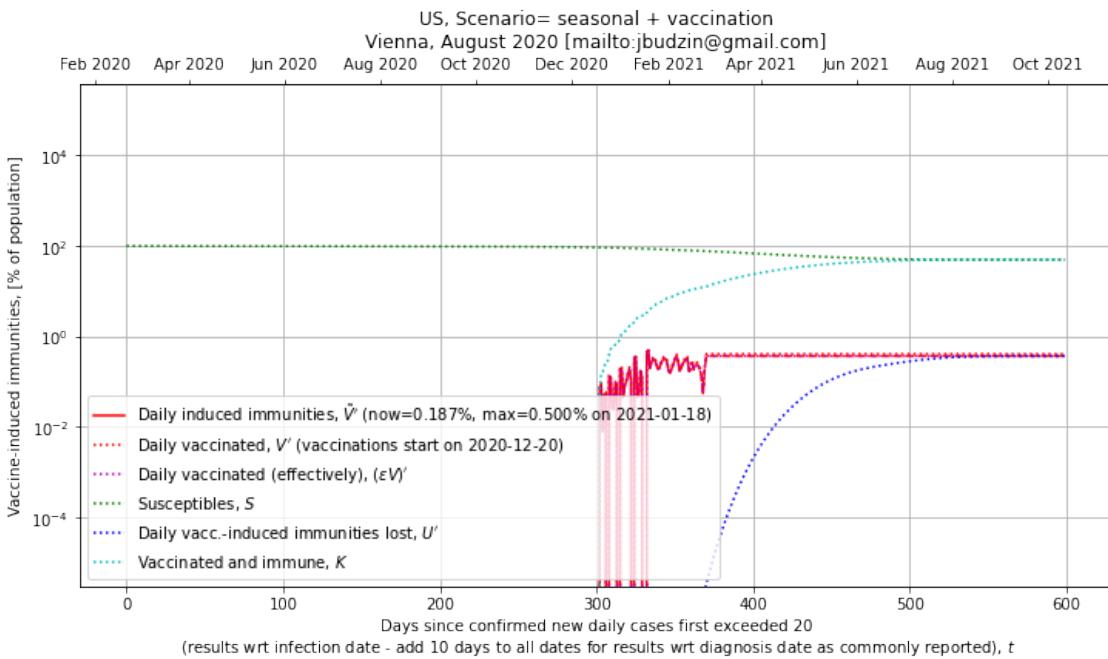
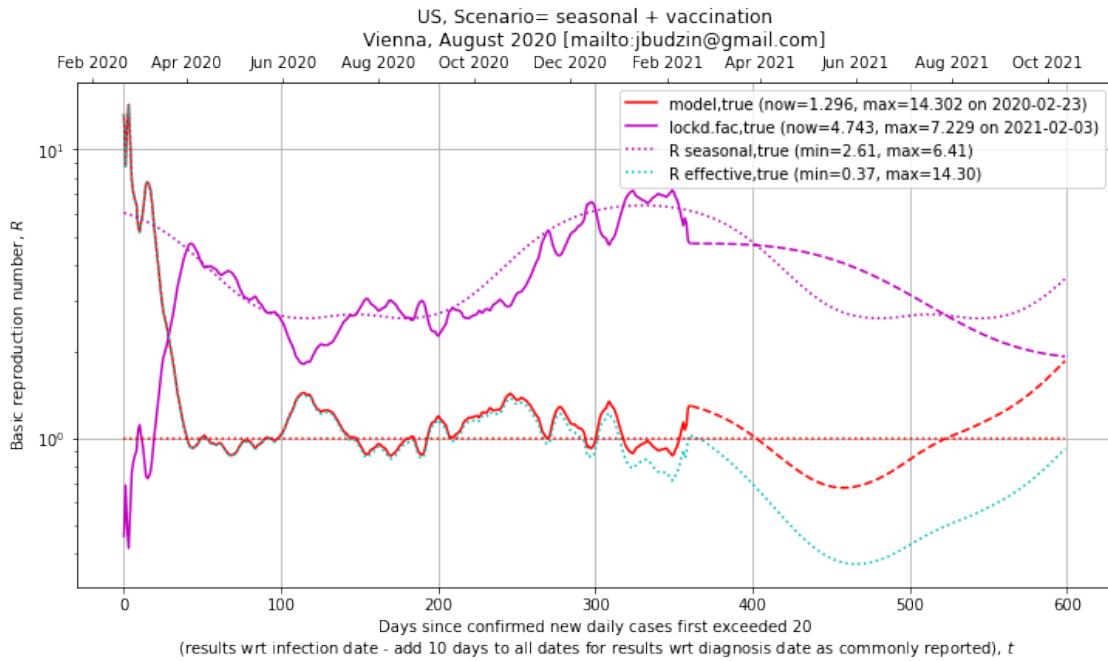


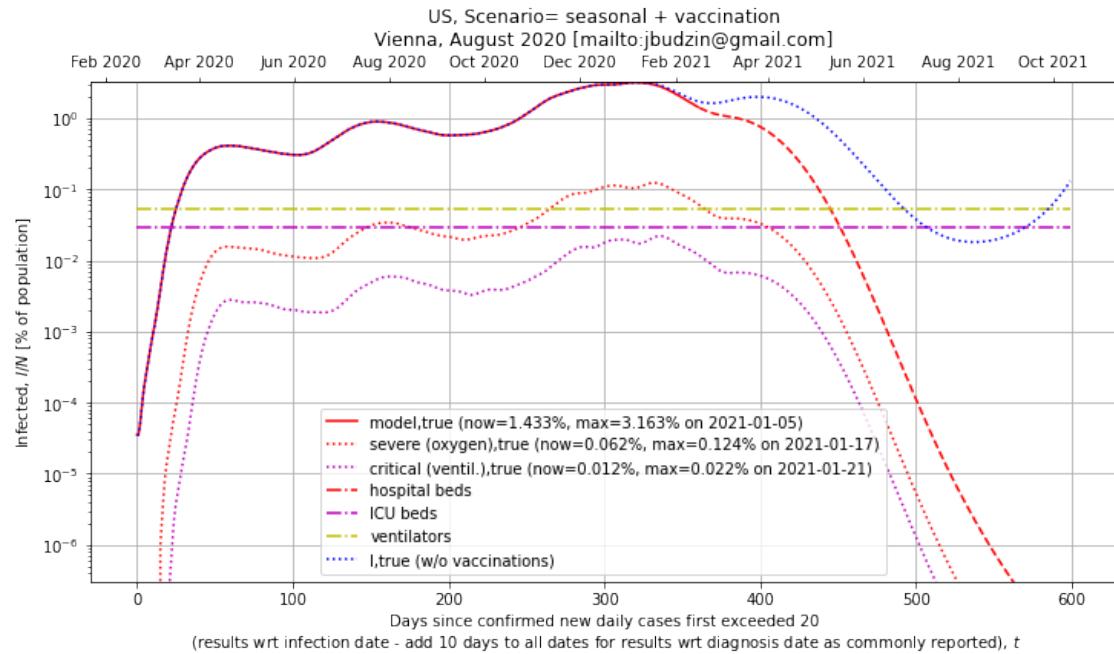
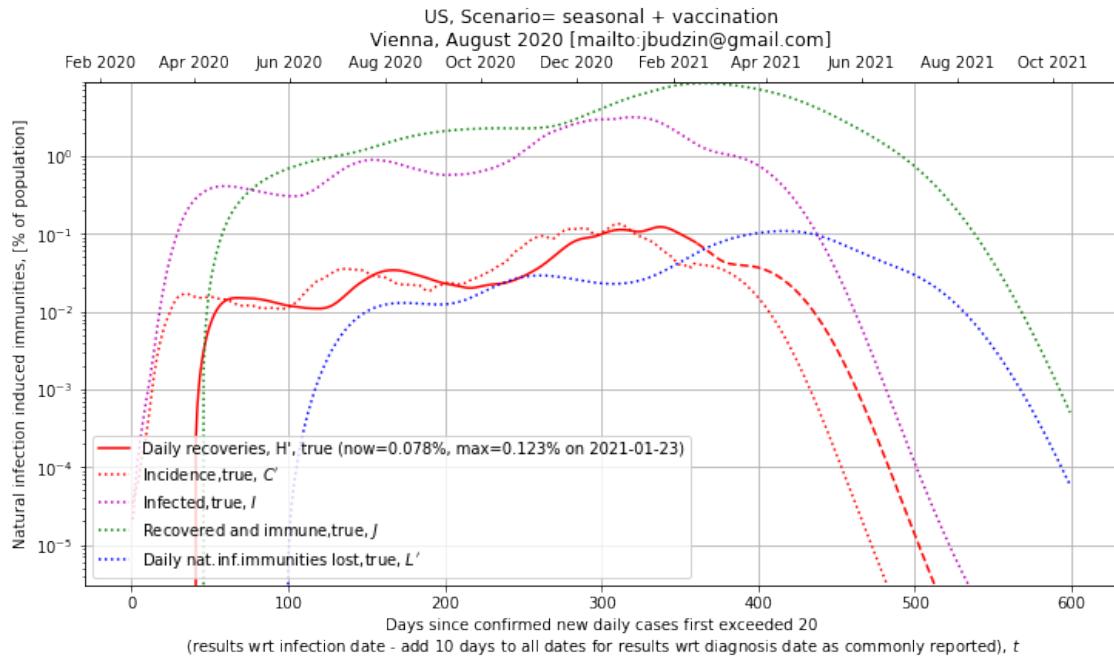


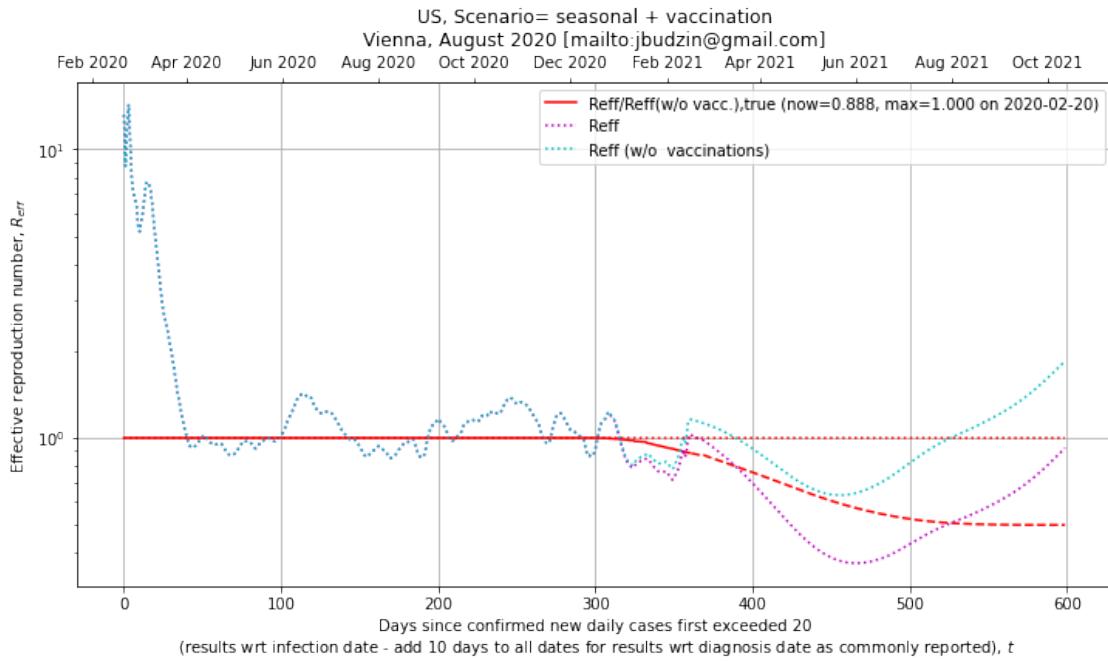
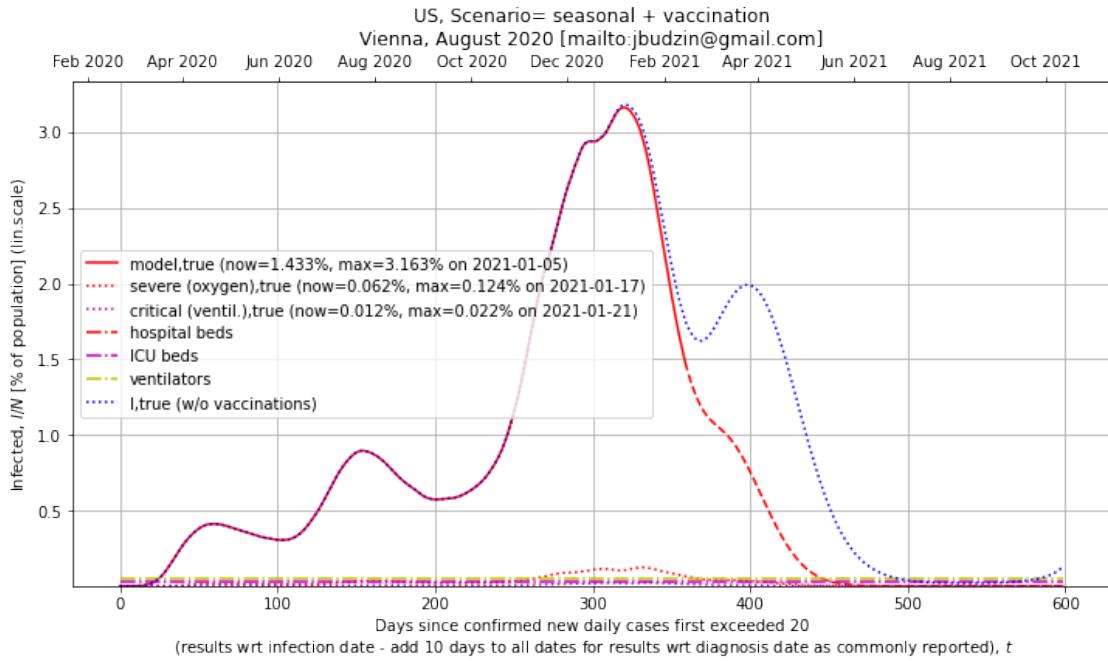
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.74e+05 / Perc of pop= 0.234
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 148.076
Time constant in Lyapunov function (proj) [d]= 155.240

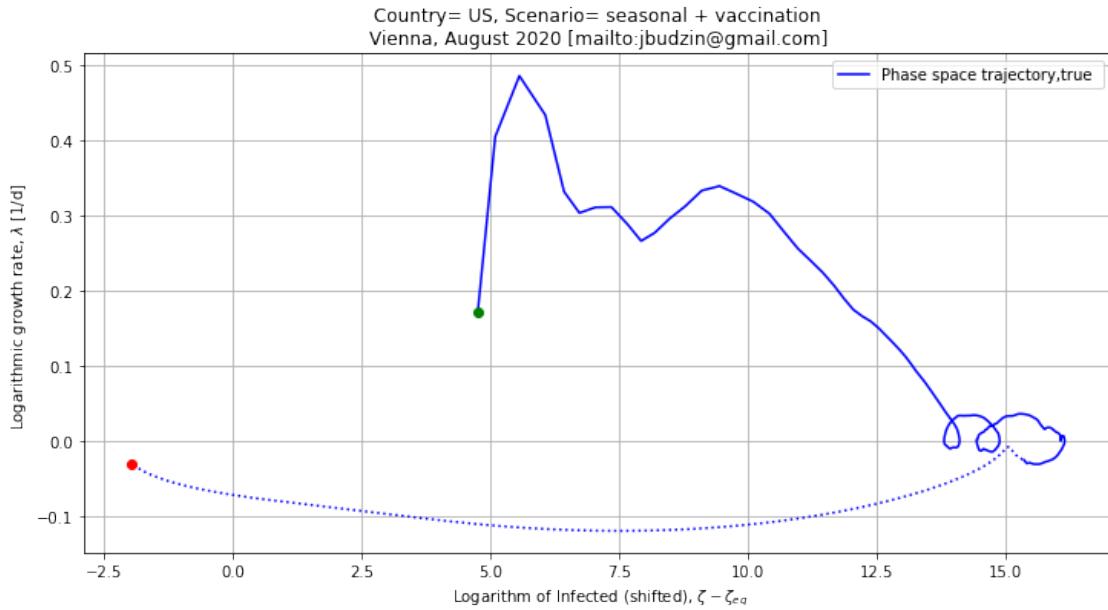
1.7.16 TAU_NU = 90.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 150.062





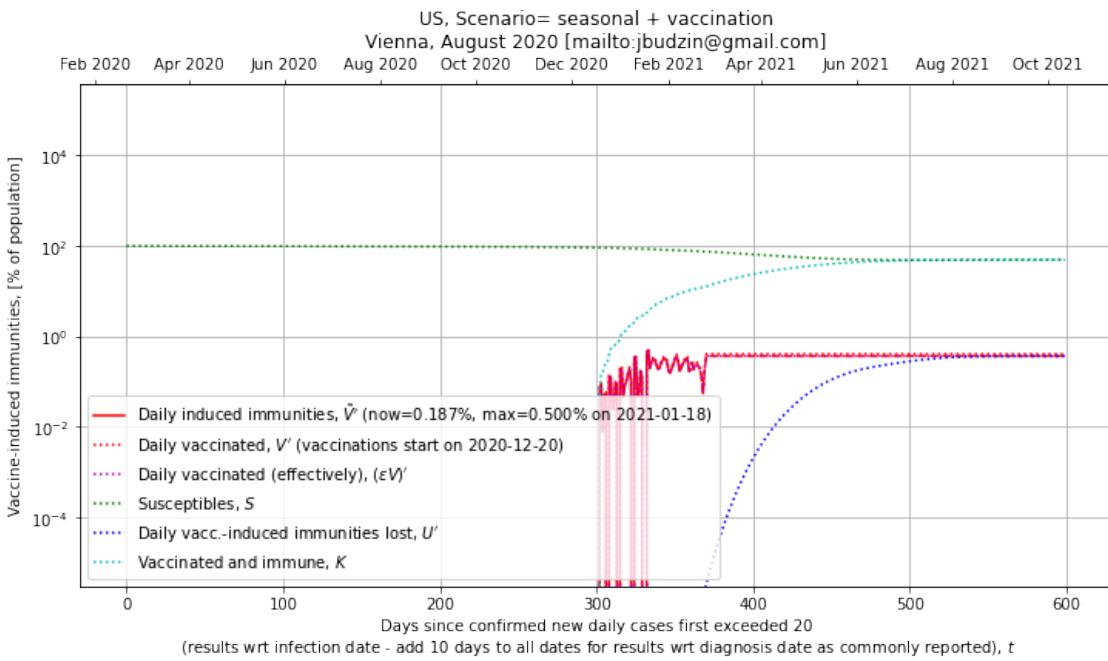
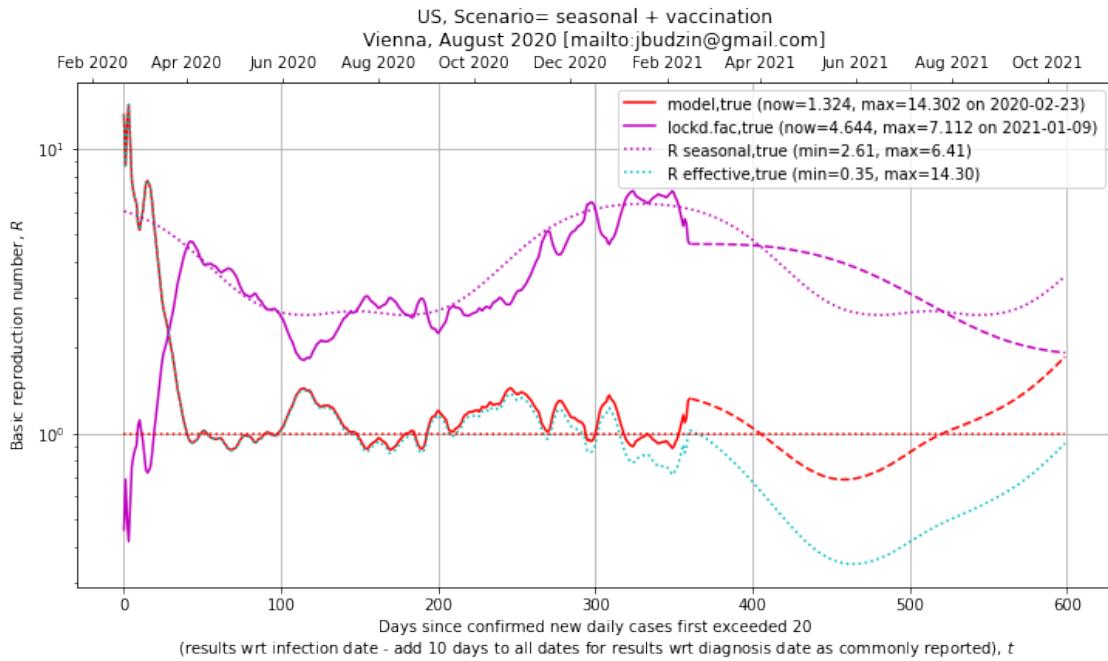


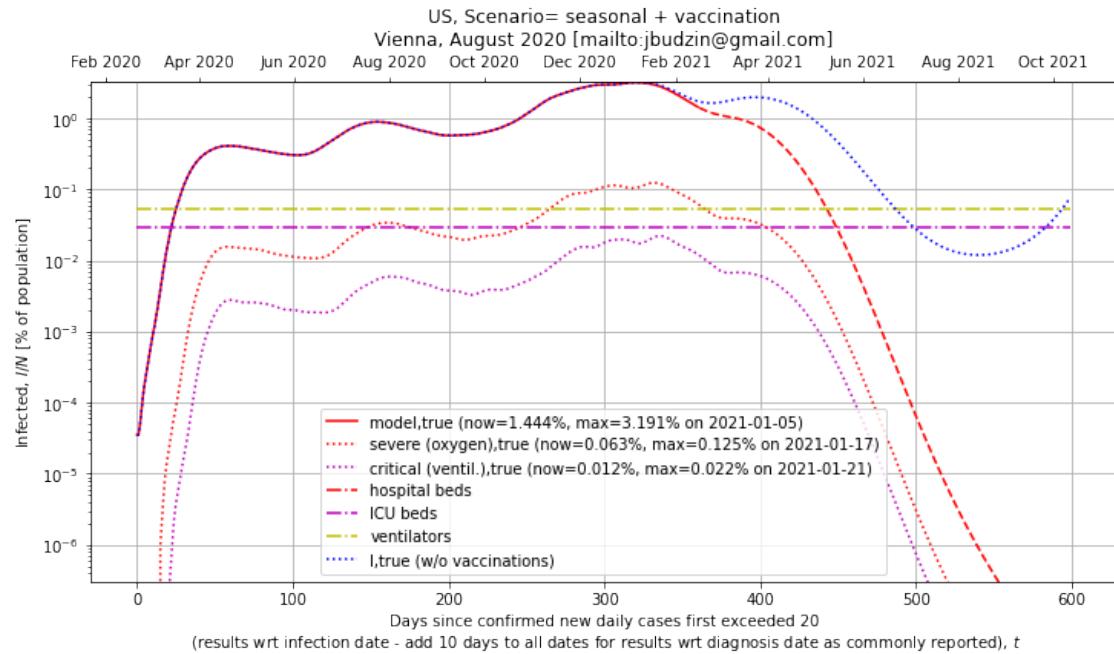
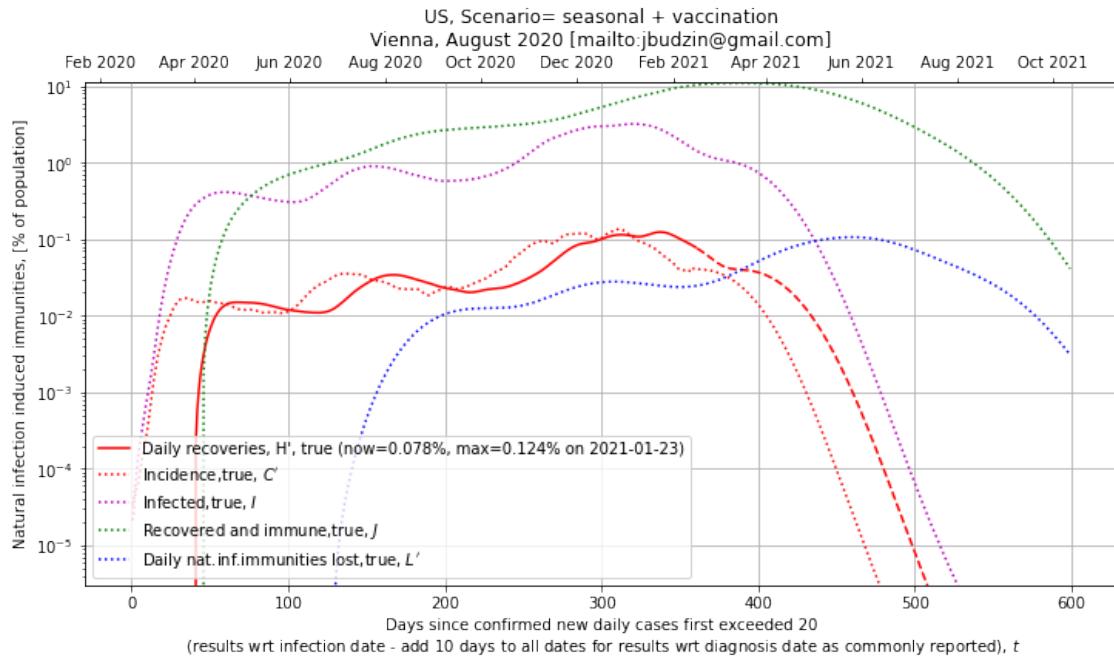


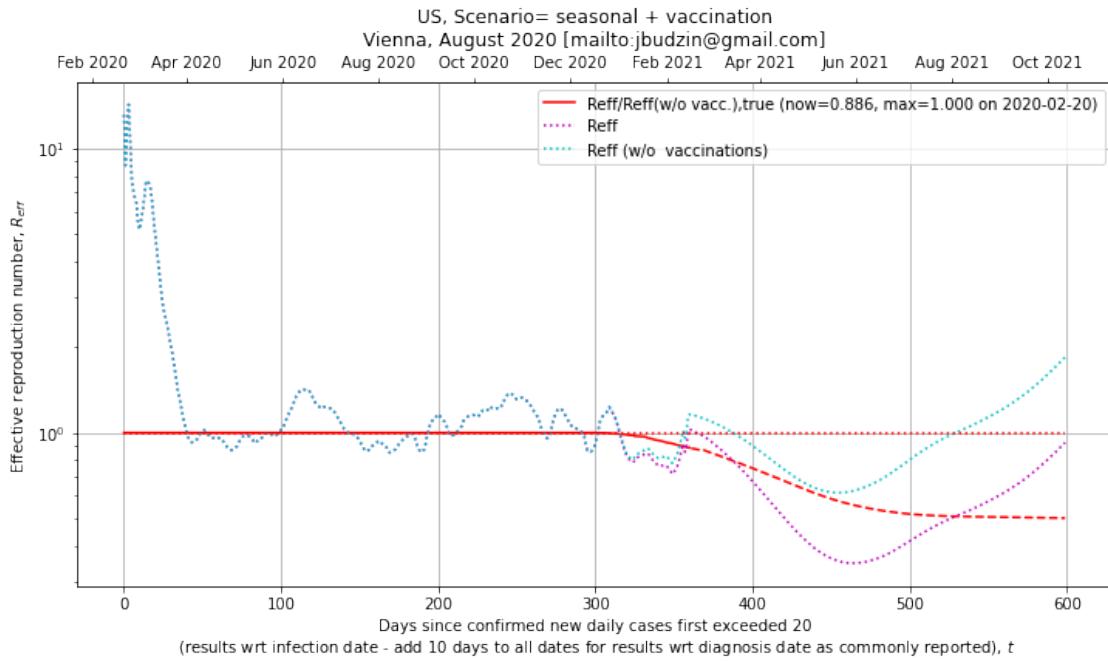
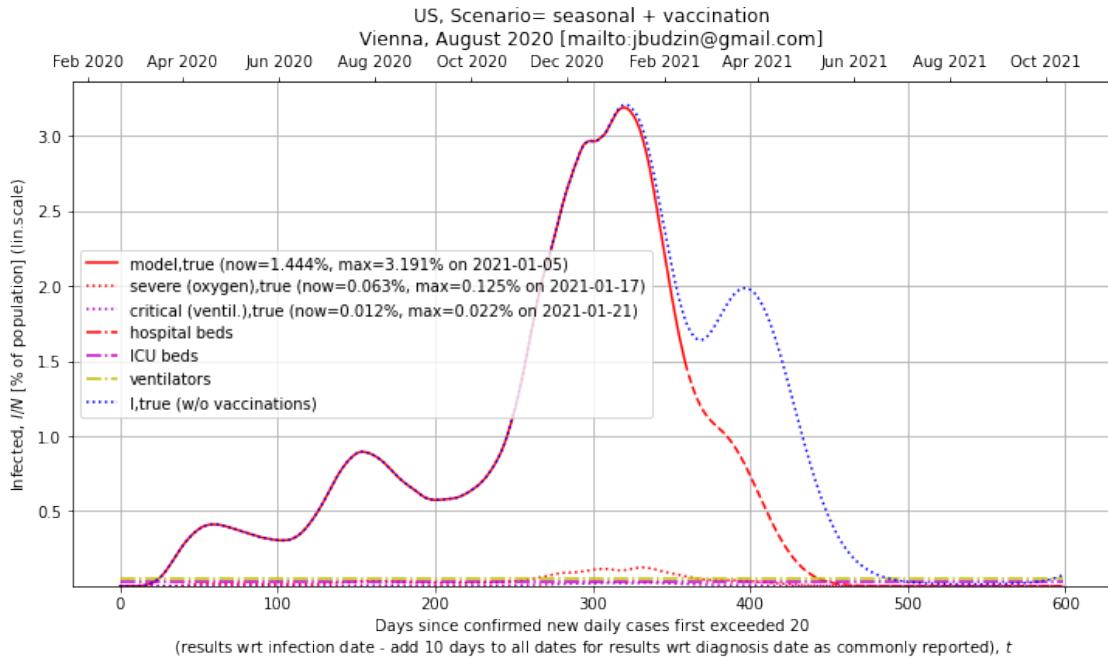
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.89e+05 / Perc of pop= 0.238
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 147.842
Time constant in Lyapunov function (proj) [d]= 101.553

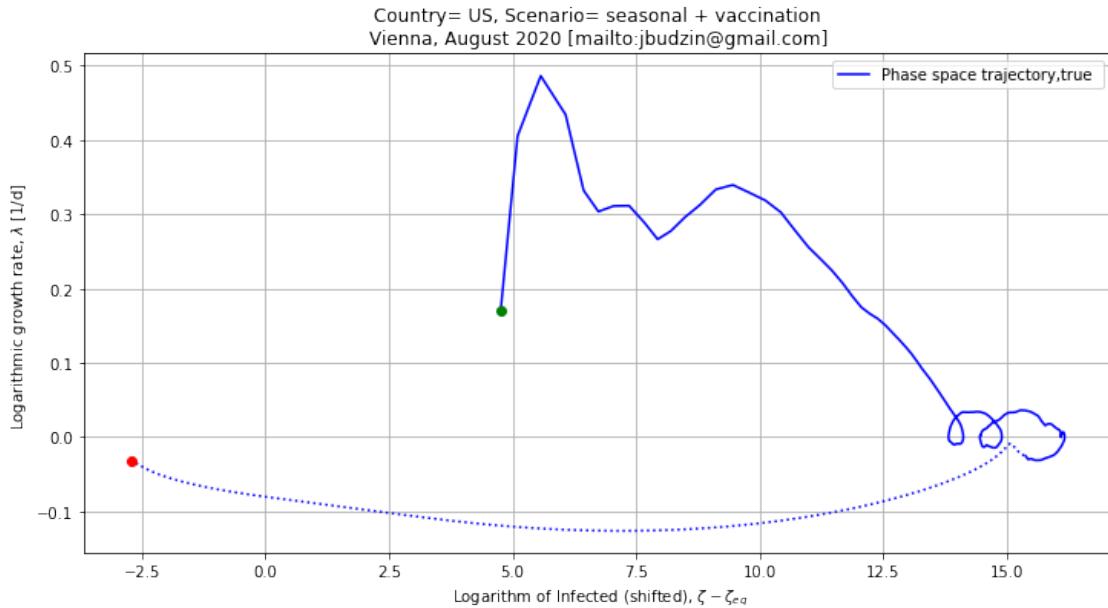
1.7.17 TAU_NU = 135.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 150.062





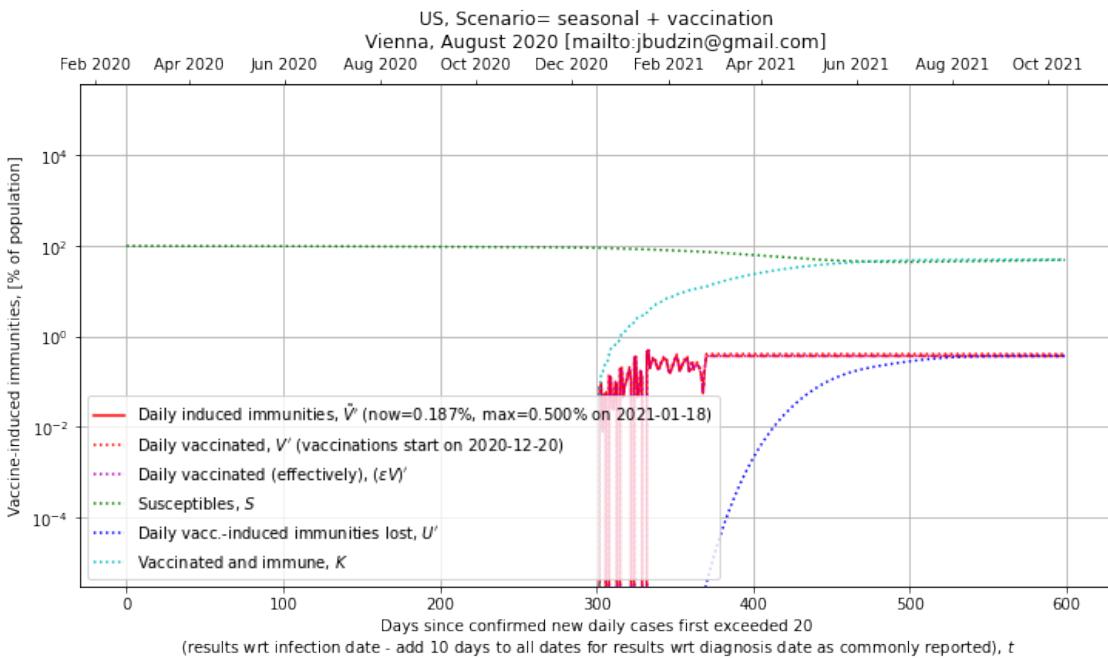
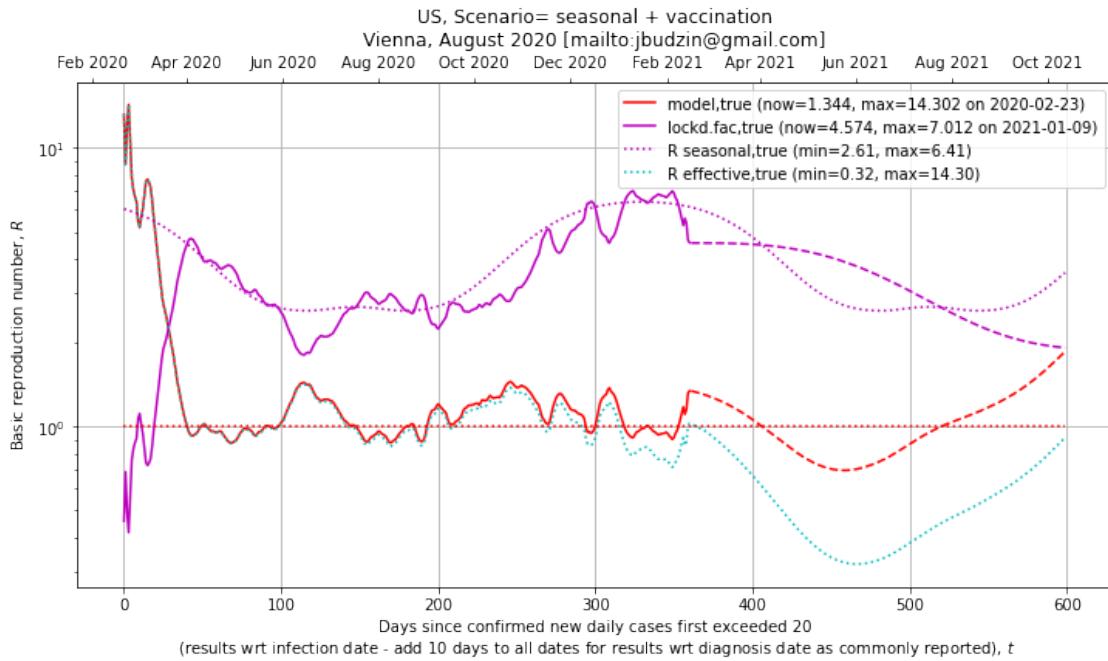


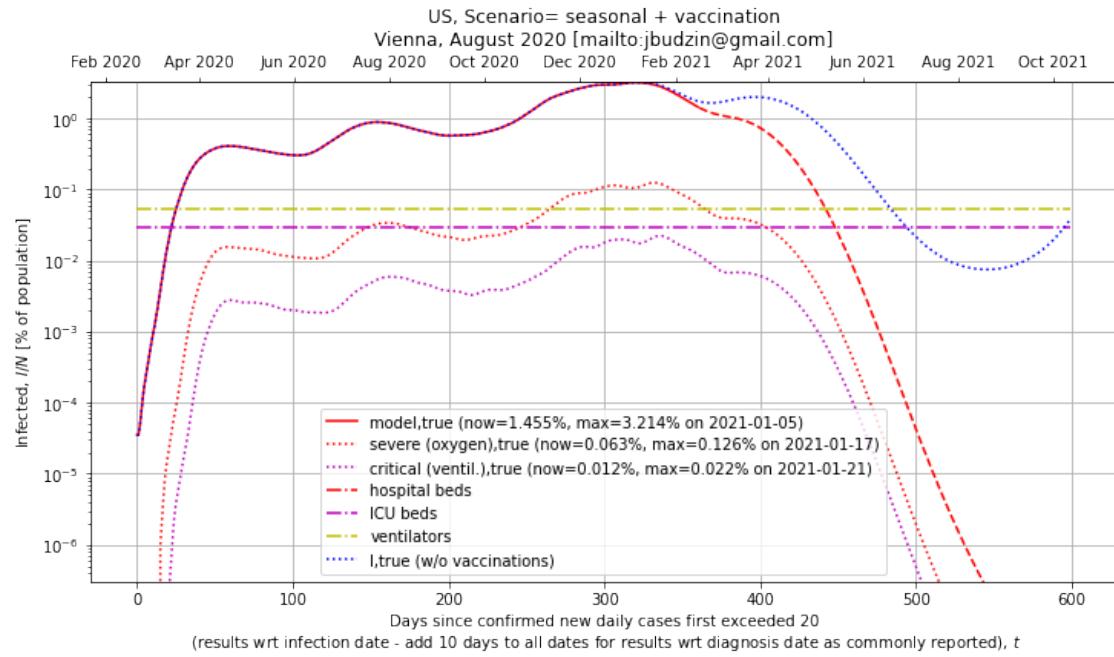
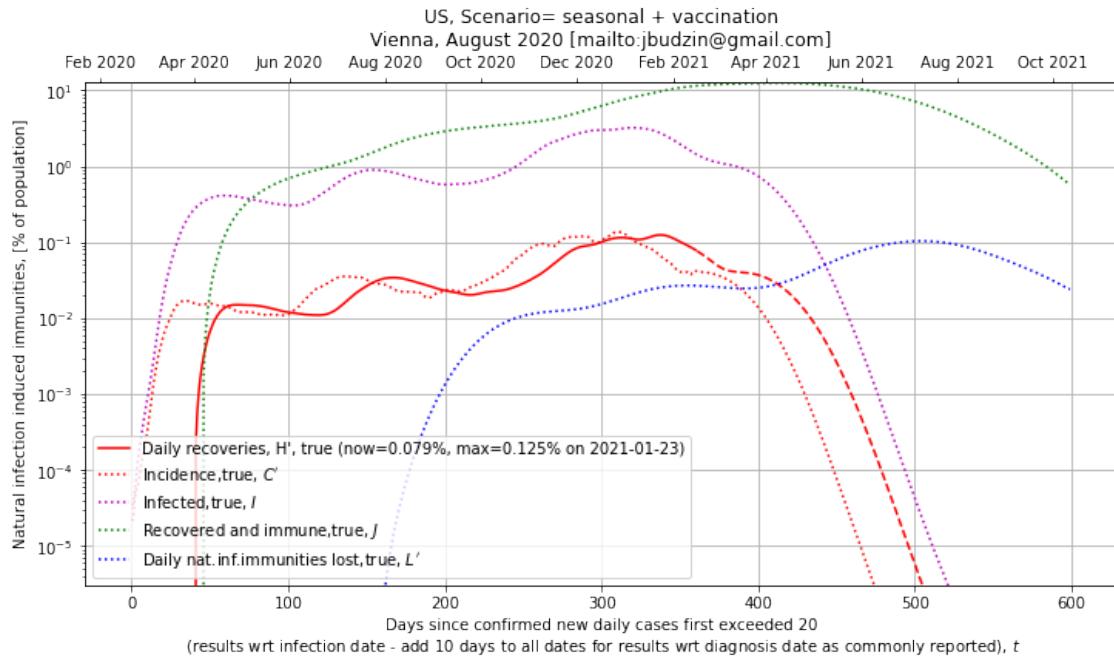


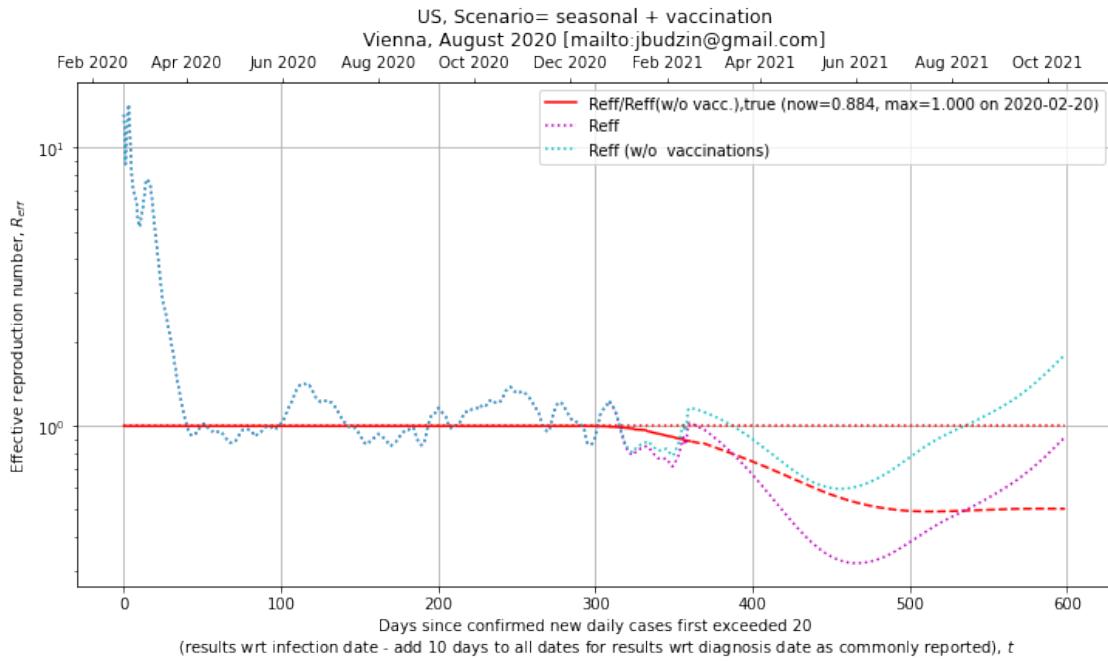
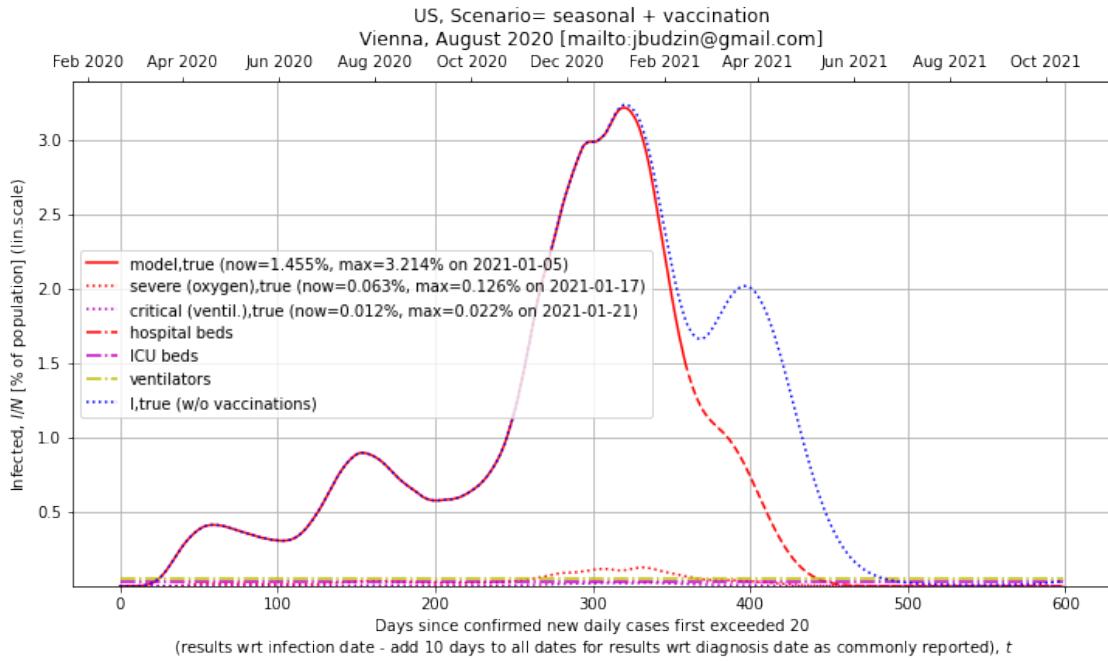
Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 7.74e+05 / Perc of pop = 0.234
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0
 Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 99.965

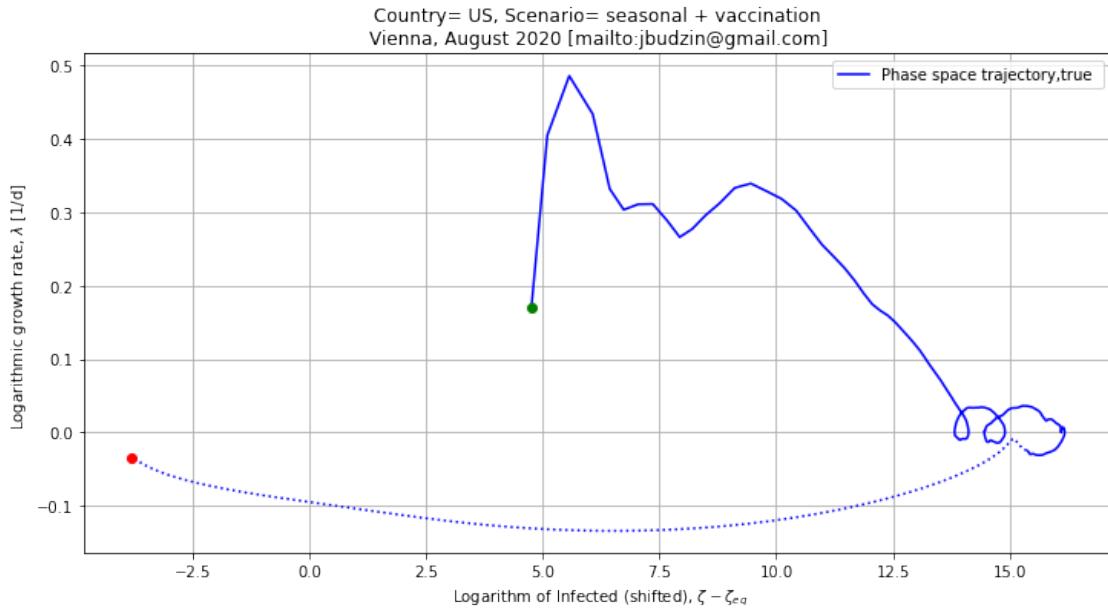
1.7.18 TAU_NU = 180.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062





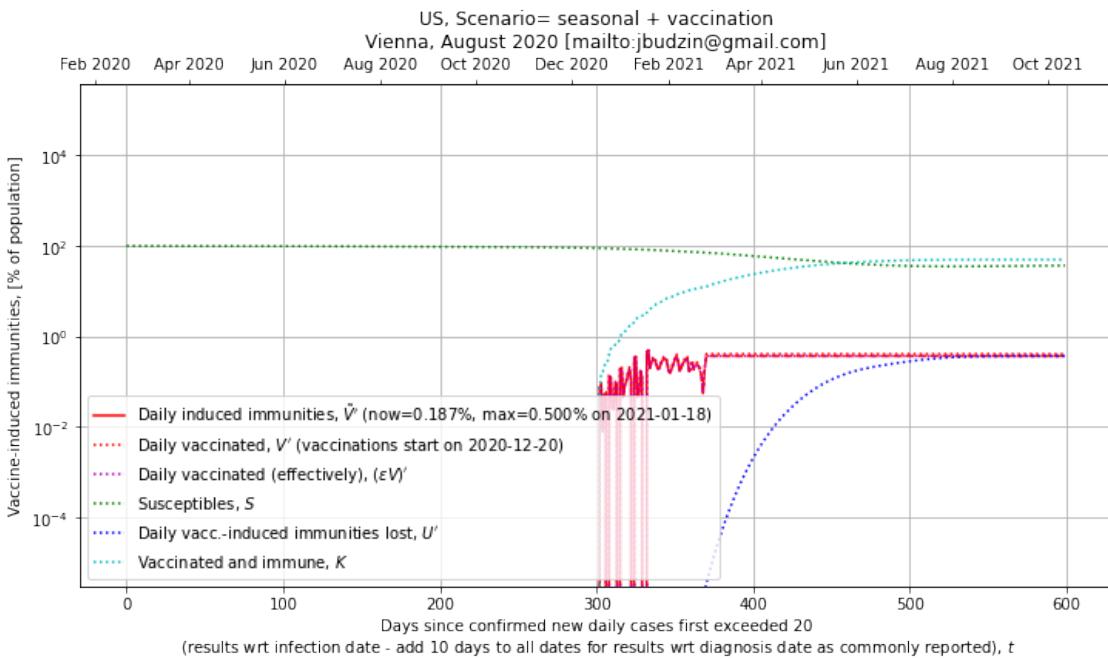
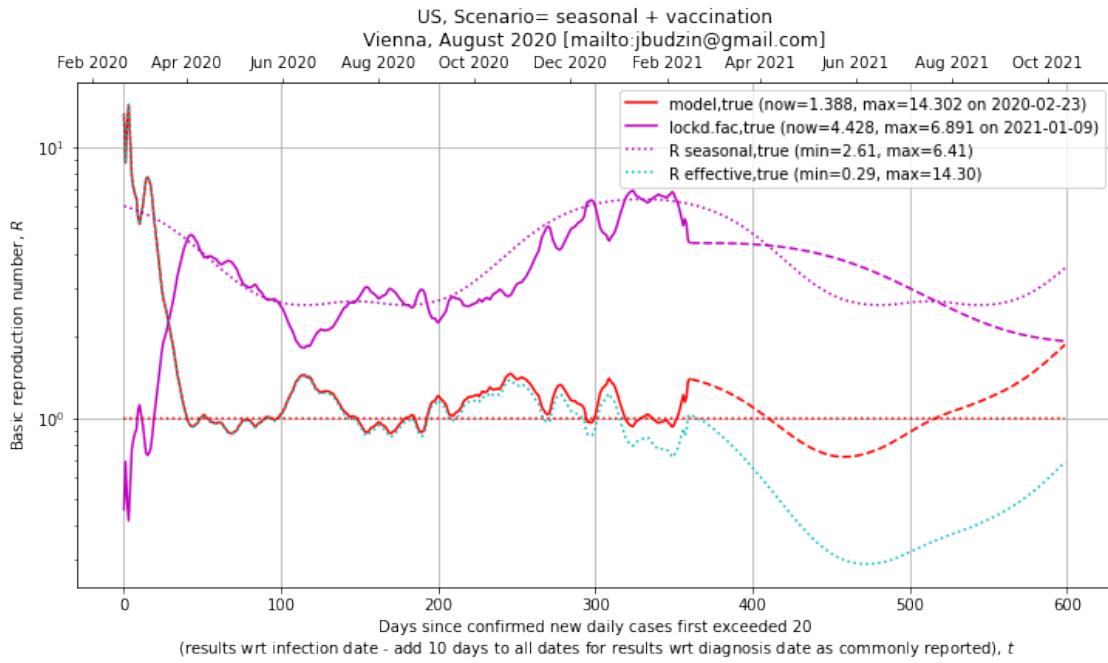


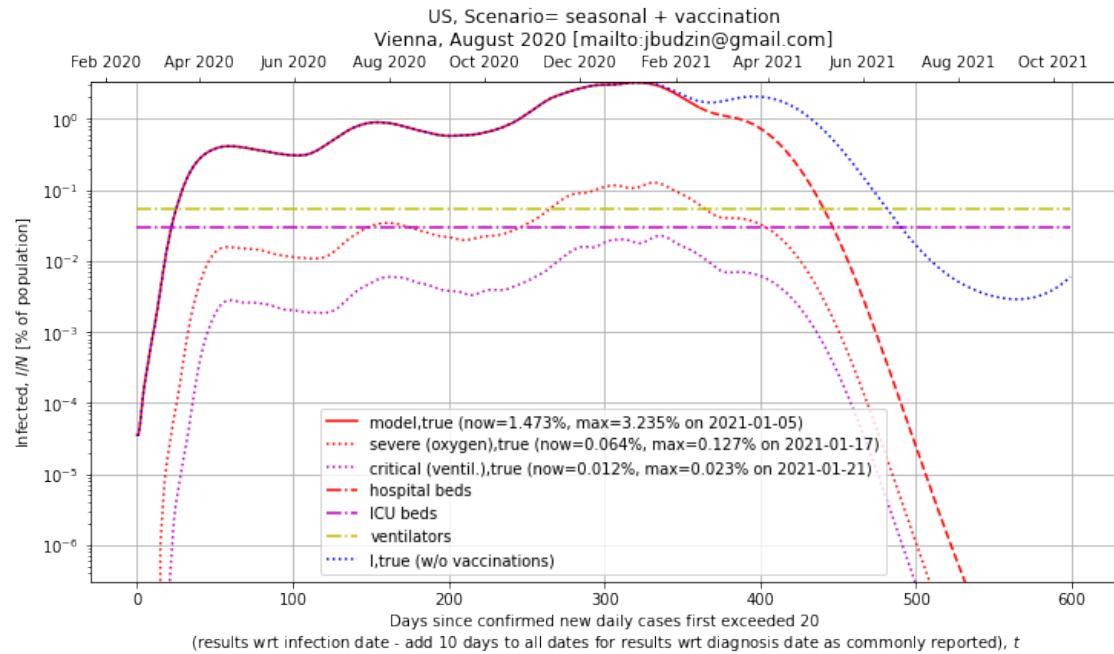
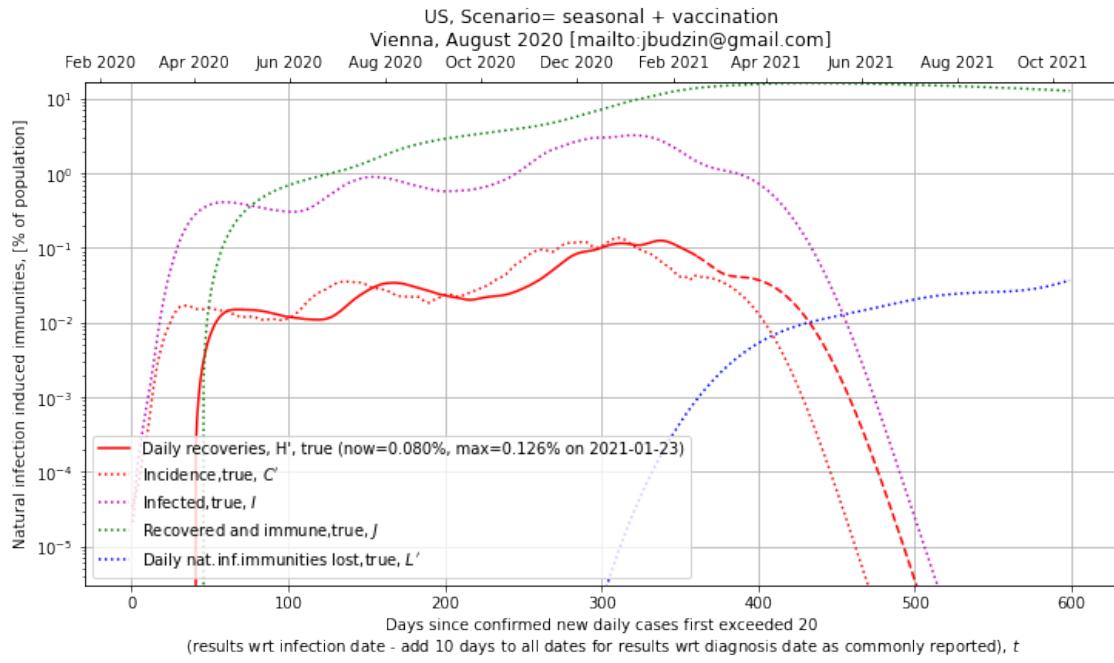


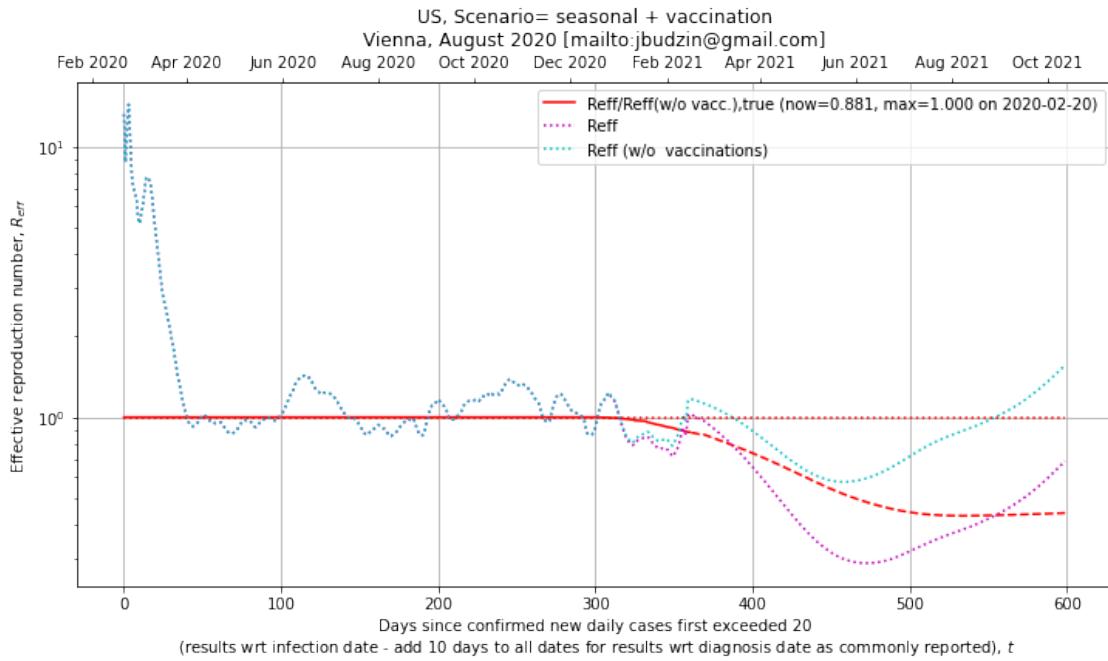
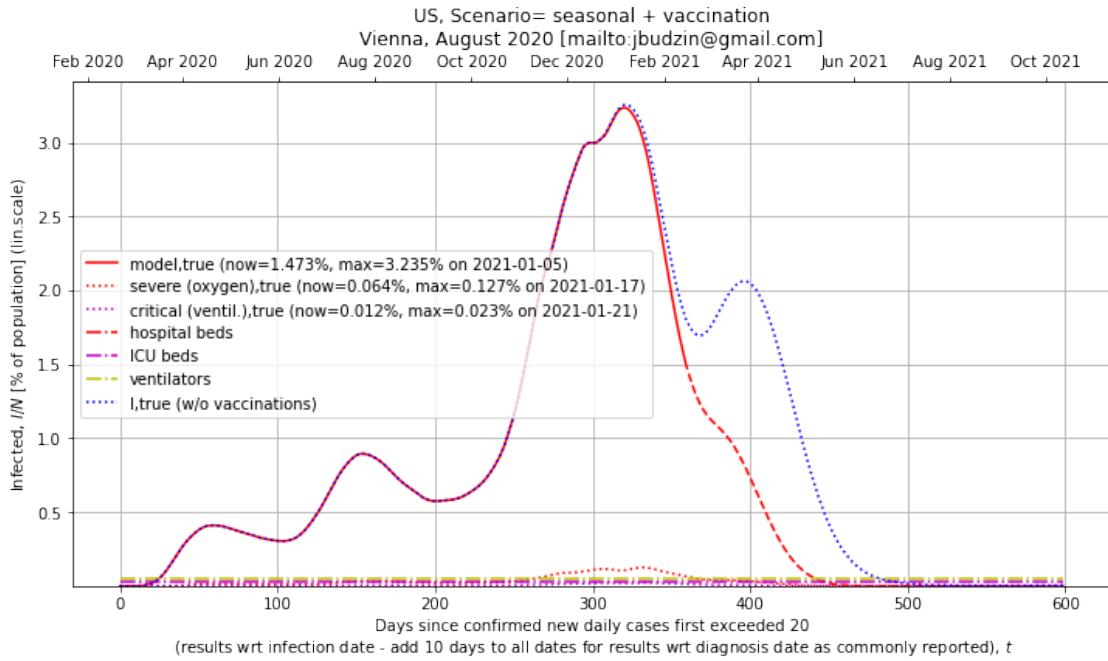
Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 7.75e+05 / Perc of pop = 0.234
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop = 0.0
 Time constant in Lyapunov function (data) [d] = 147.093
 Time constant in Lyapunov function (proj) [d] = 97.003

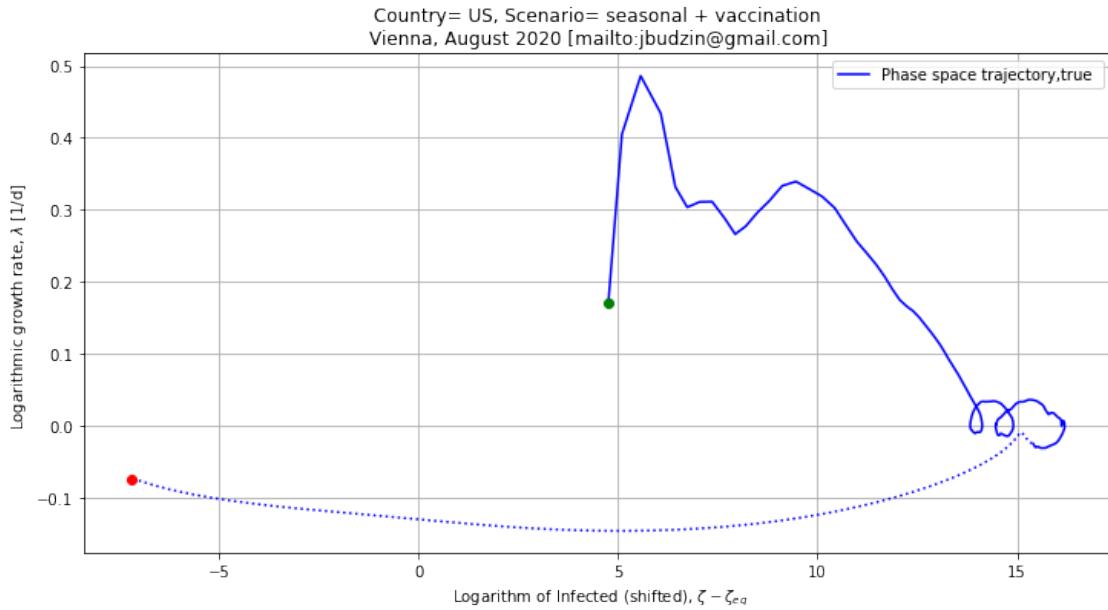
1.7.19 TAU_NU = 360.00 days (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062





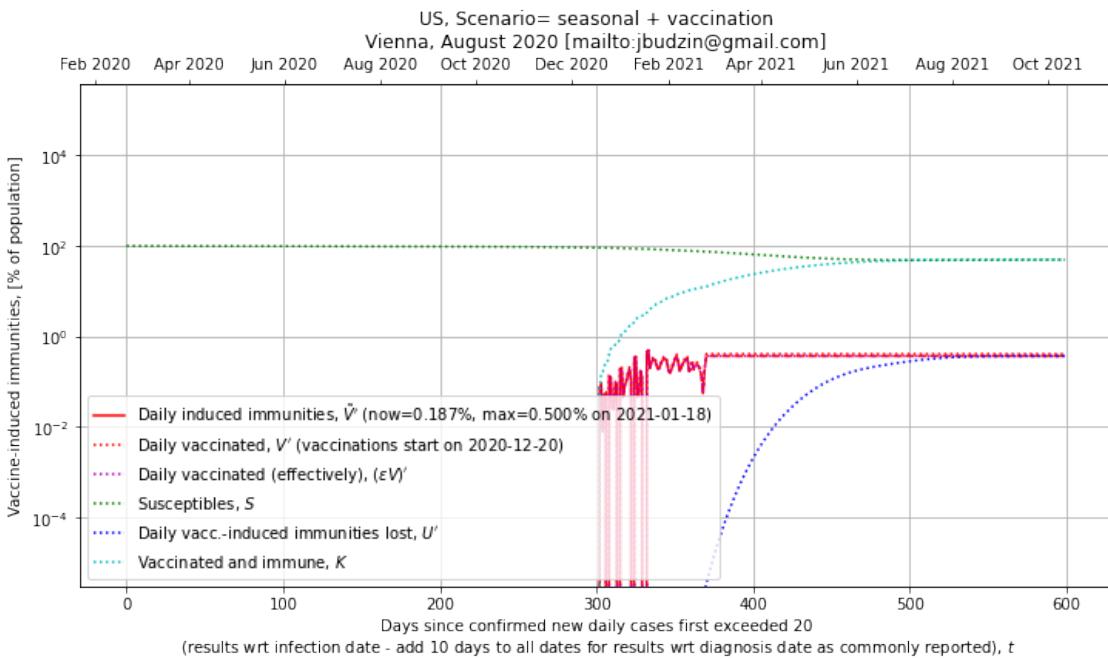
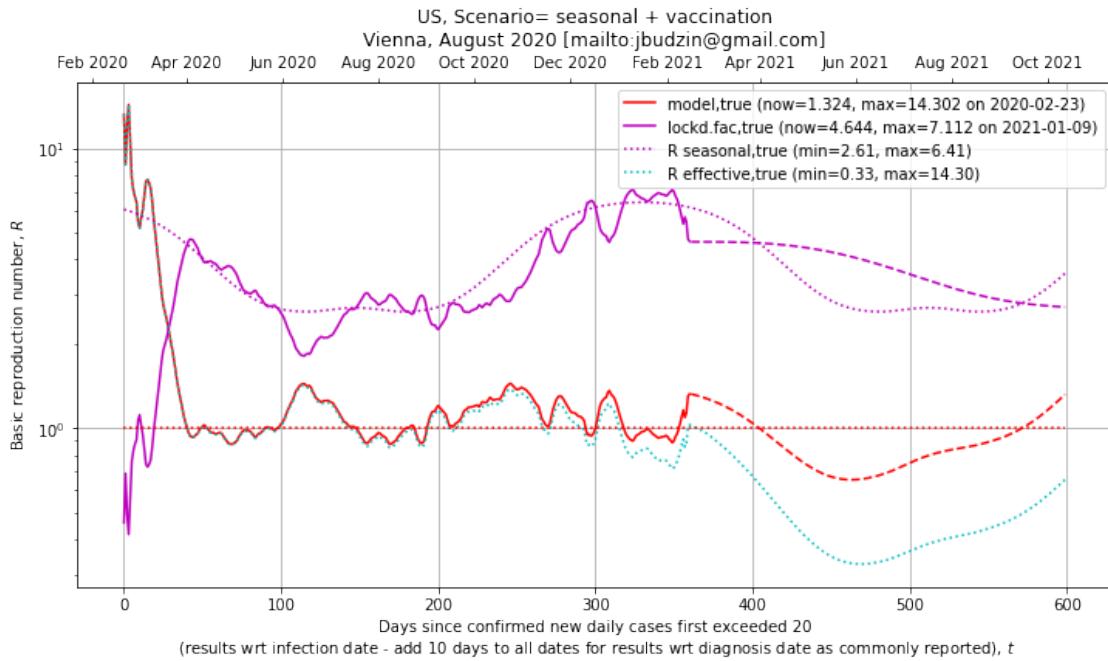


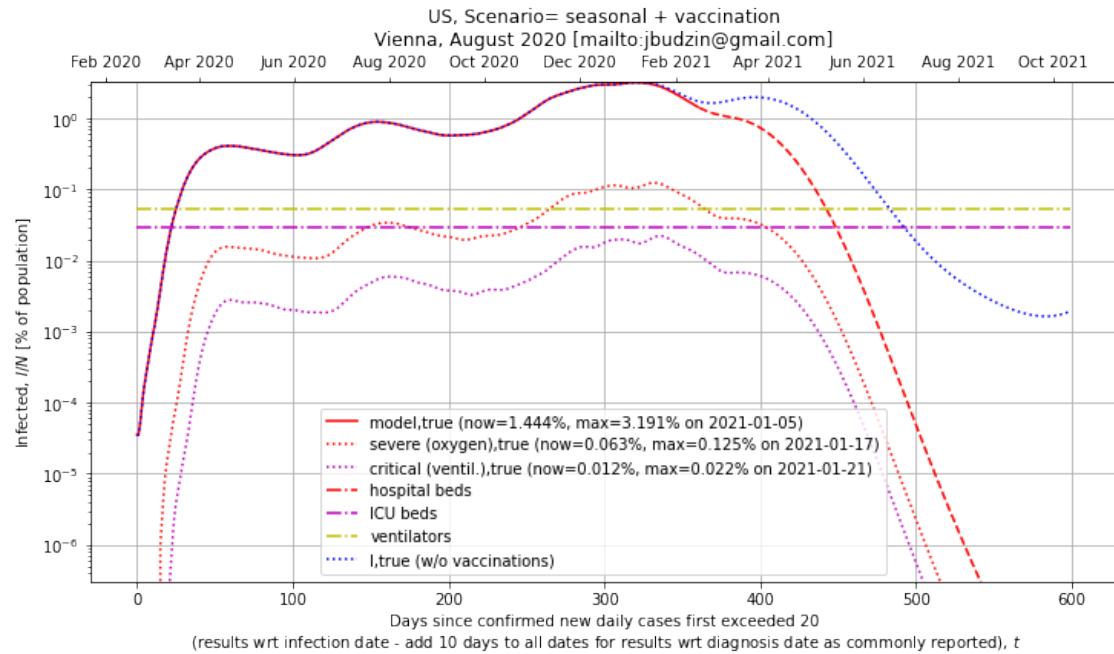
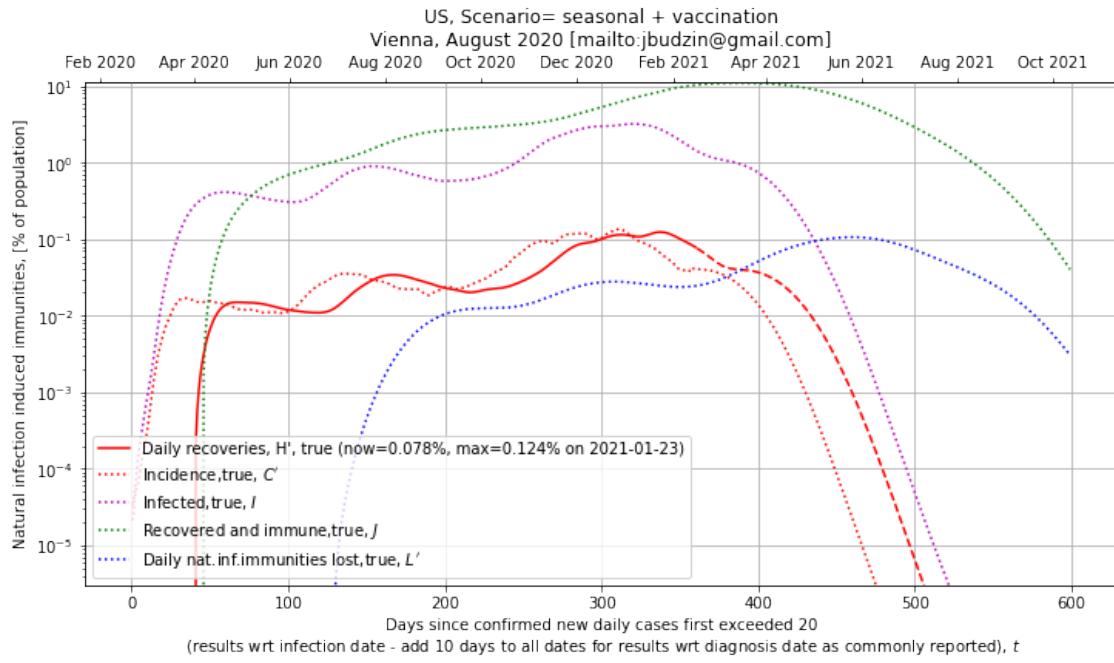


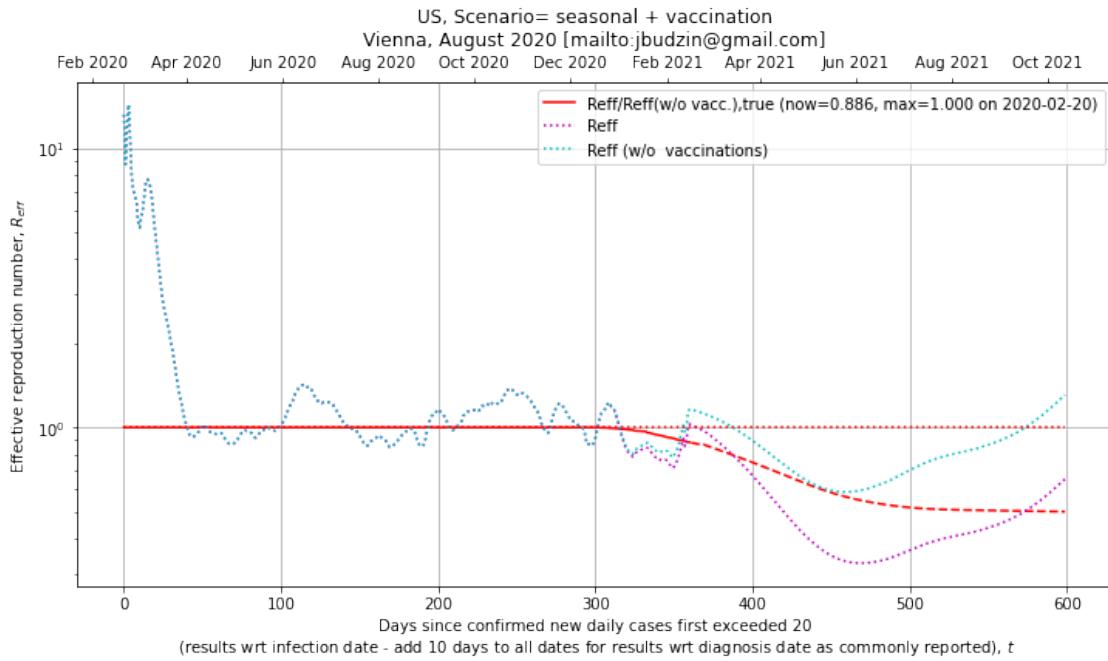
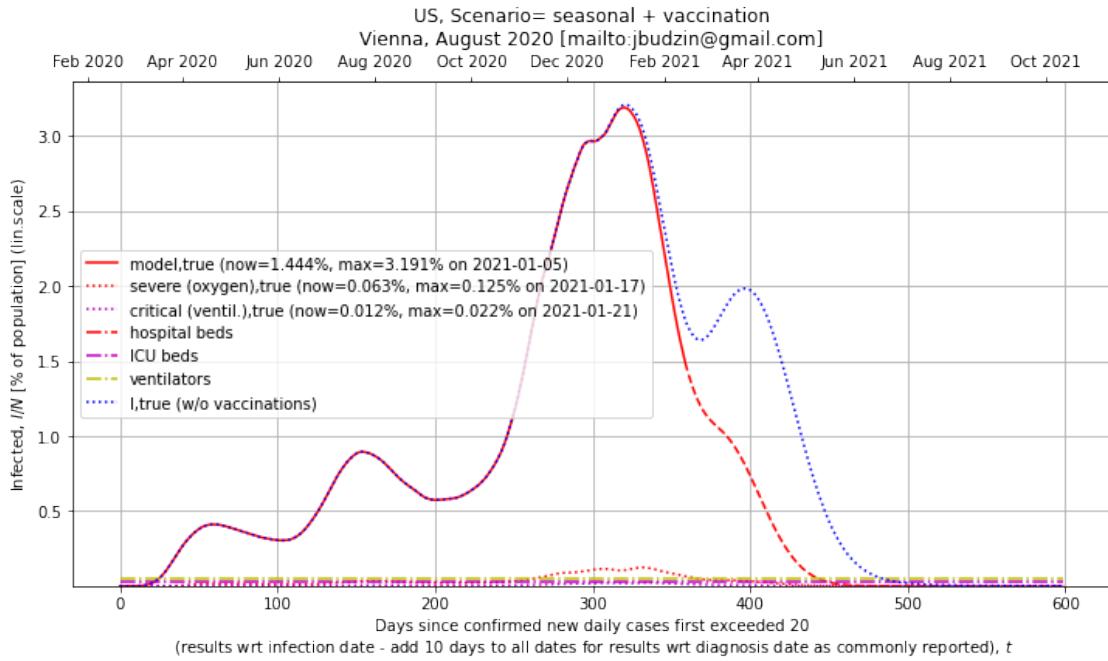
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.73e+05 / Perc of pop= 0.234
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 148.640
Time constant in Lyapunov function (proj) [d]= 97.061

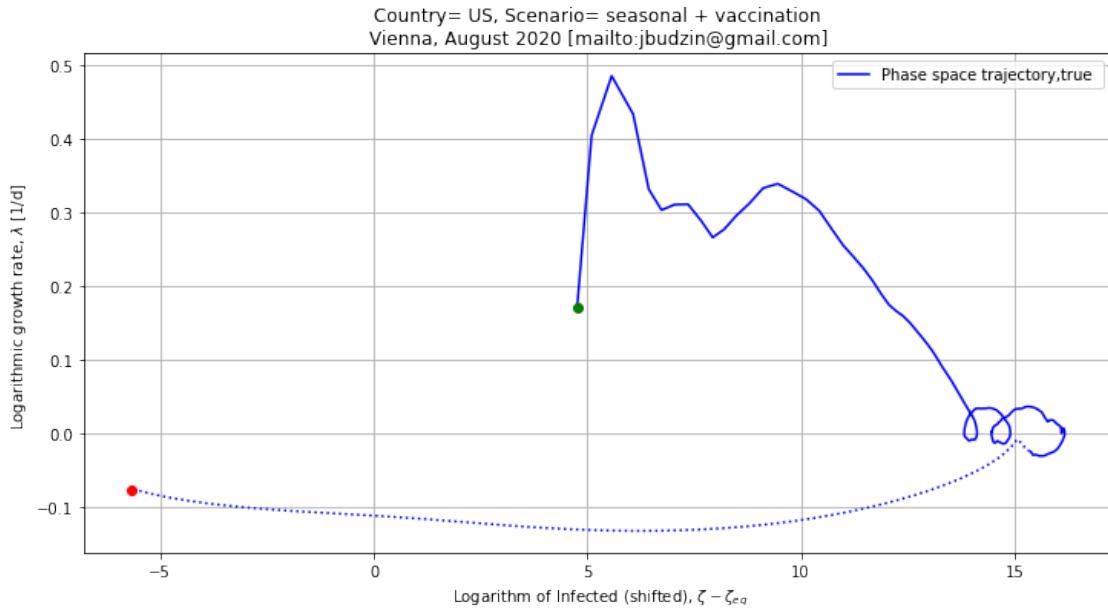
1.7.20 LDF_INF = 2.68 (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 150.062





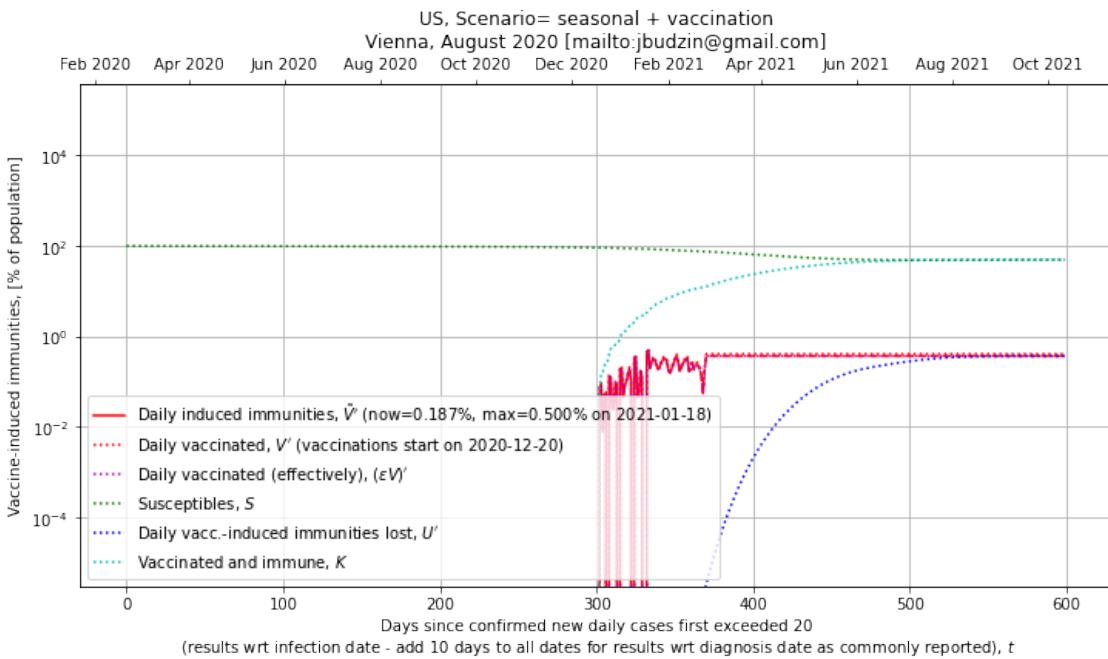
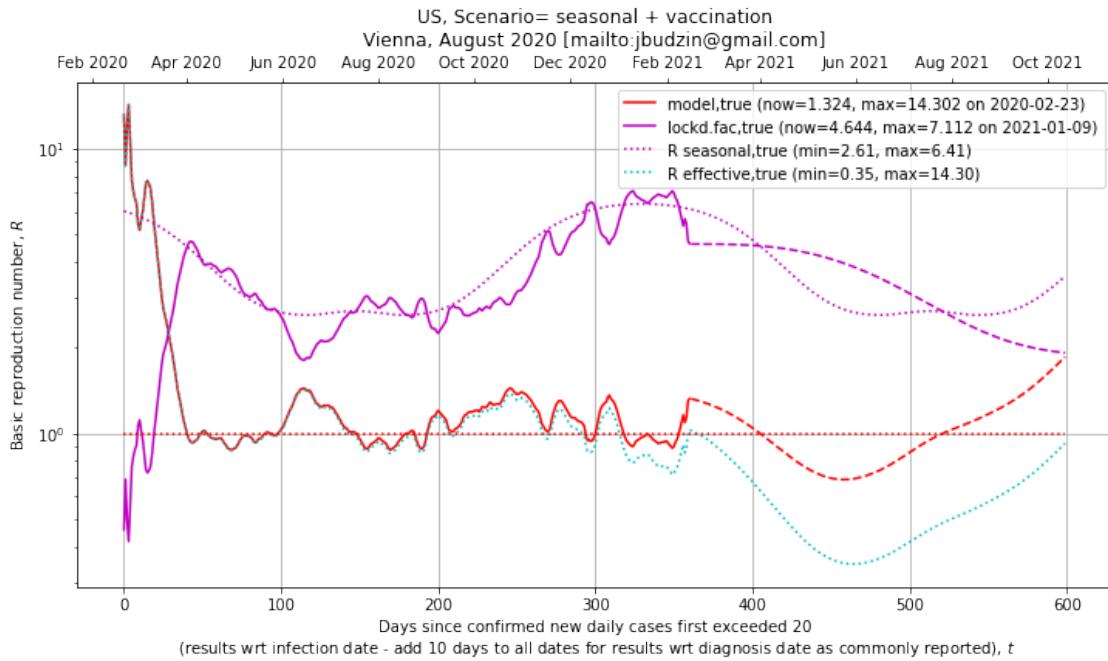


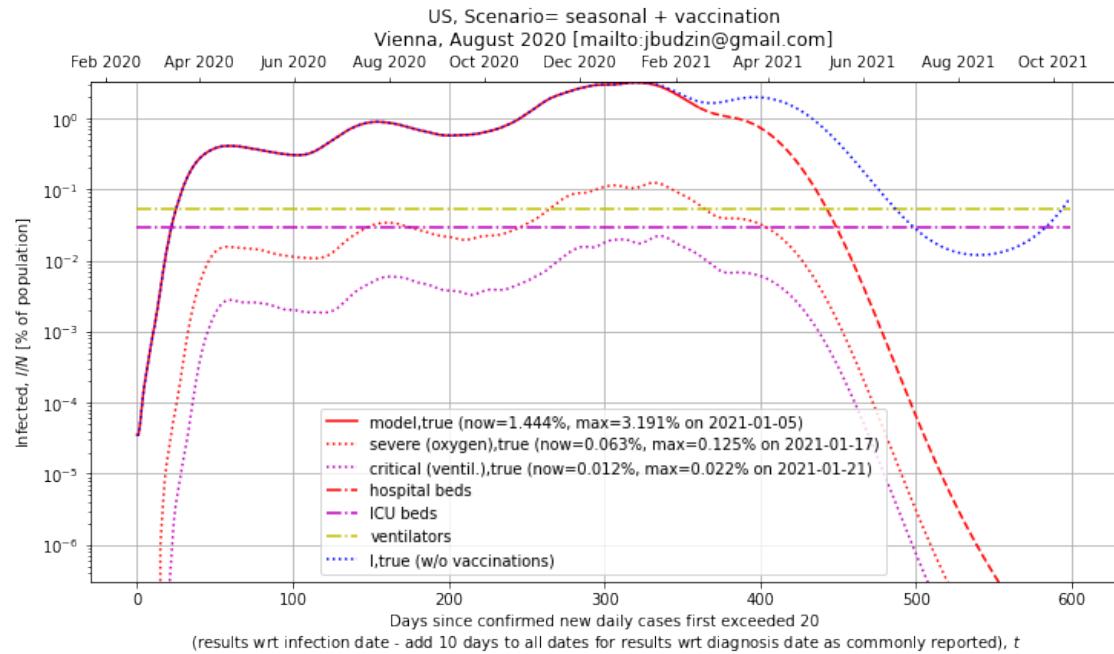
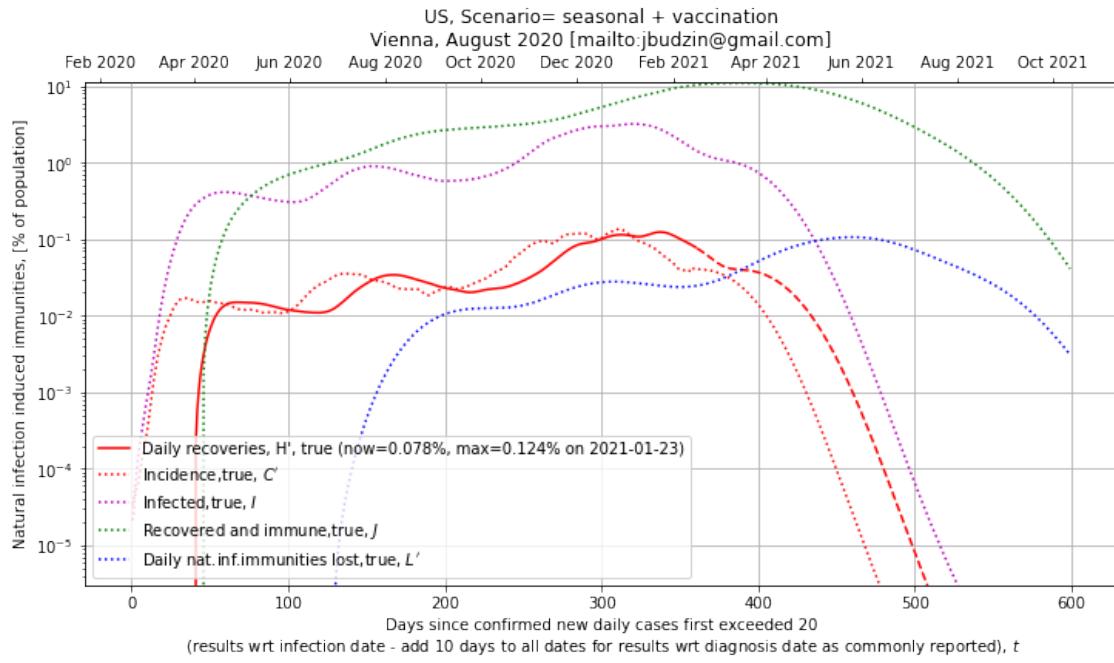


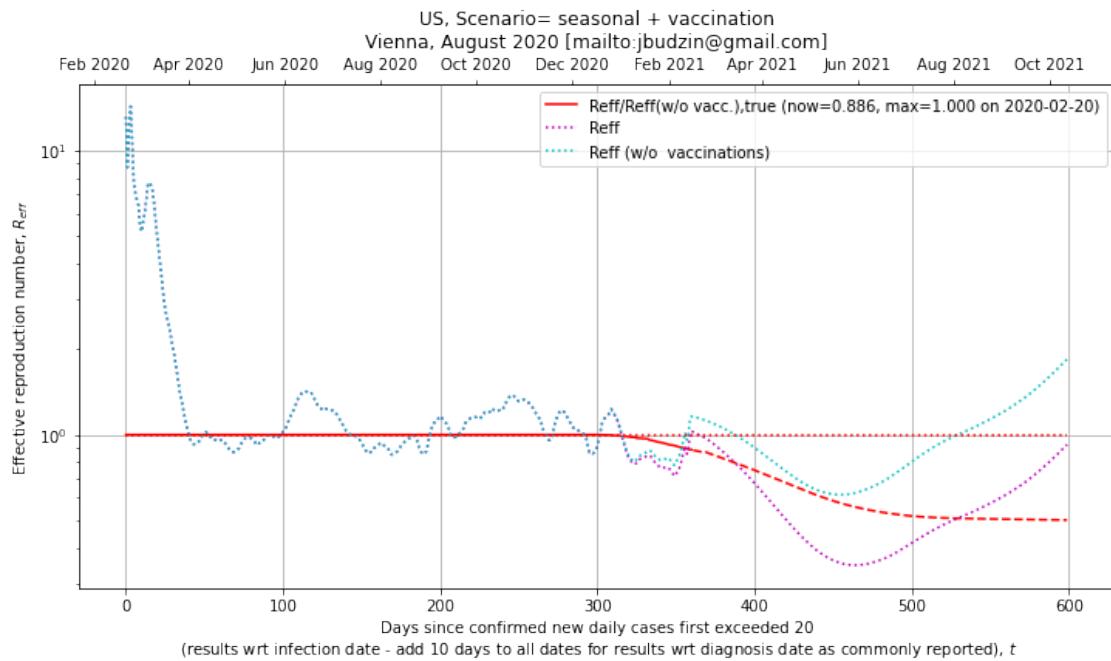
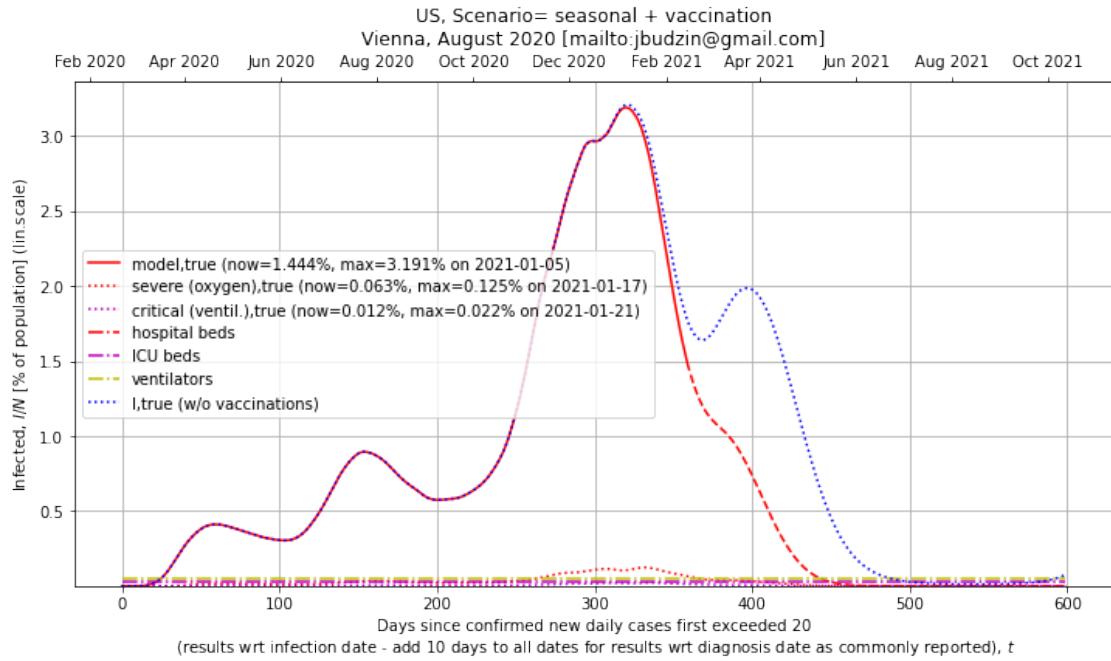
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.73e+05 / Perc of pop= 0.233
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 148.076
Time constant in Lyapunov function (proj) [d]= 107.764

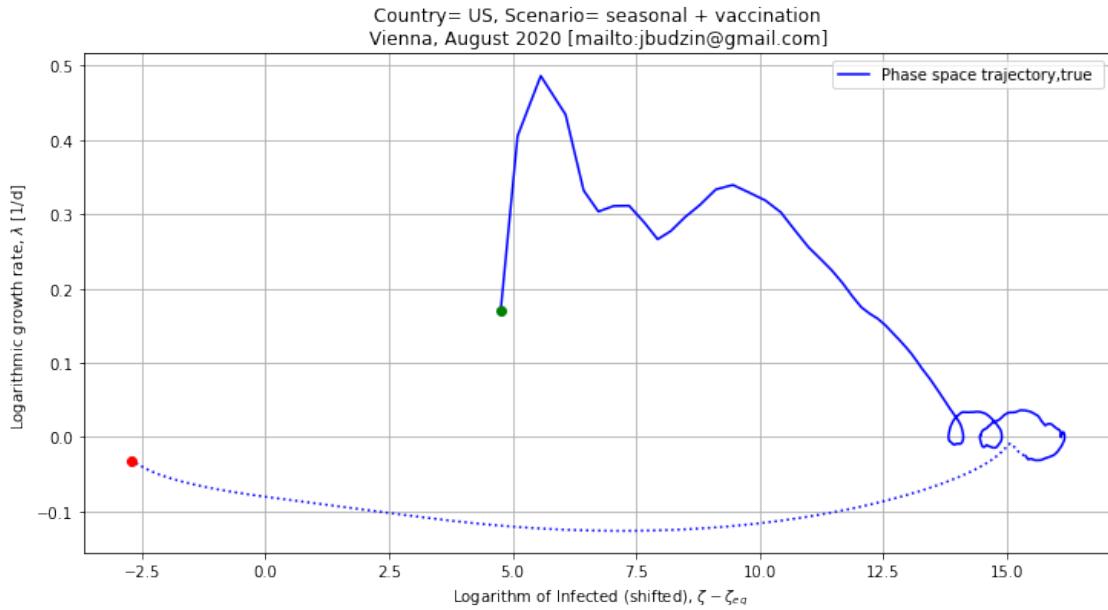
1.7.21 LDF_INF = 1.88 (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 150.062





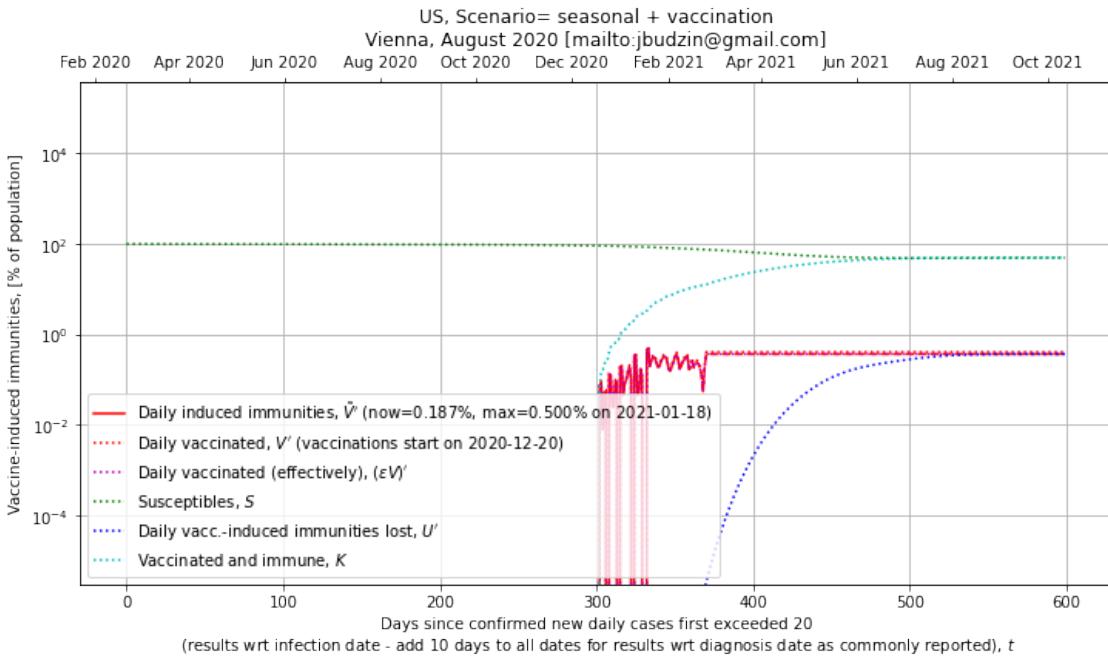
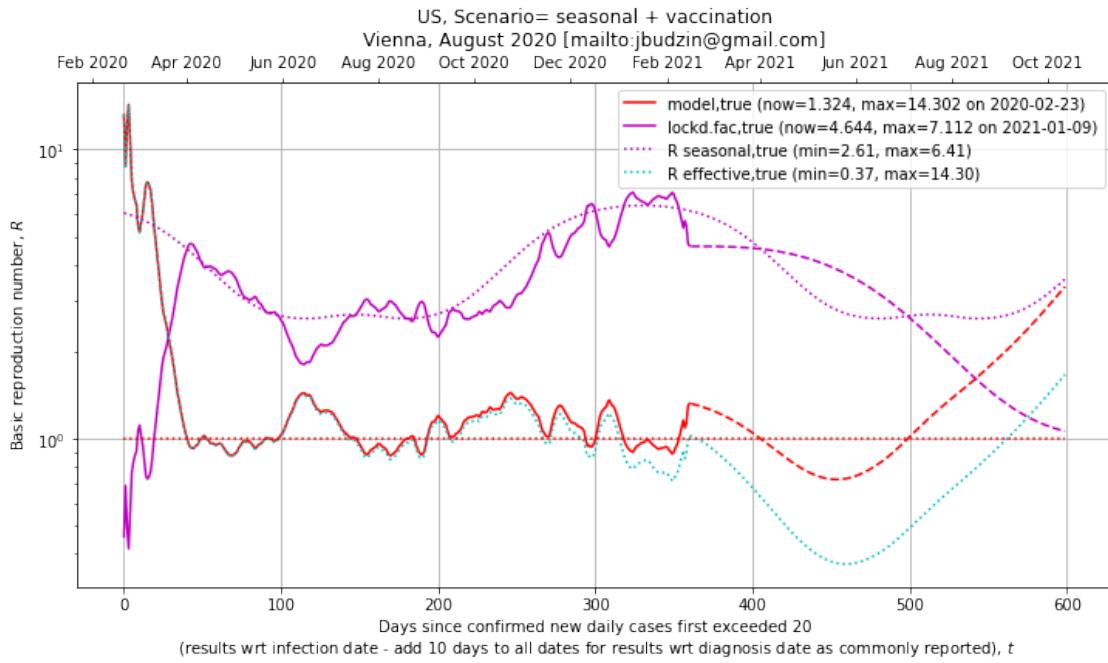


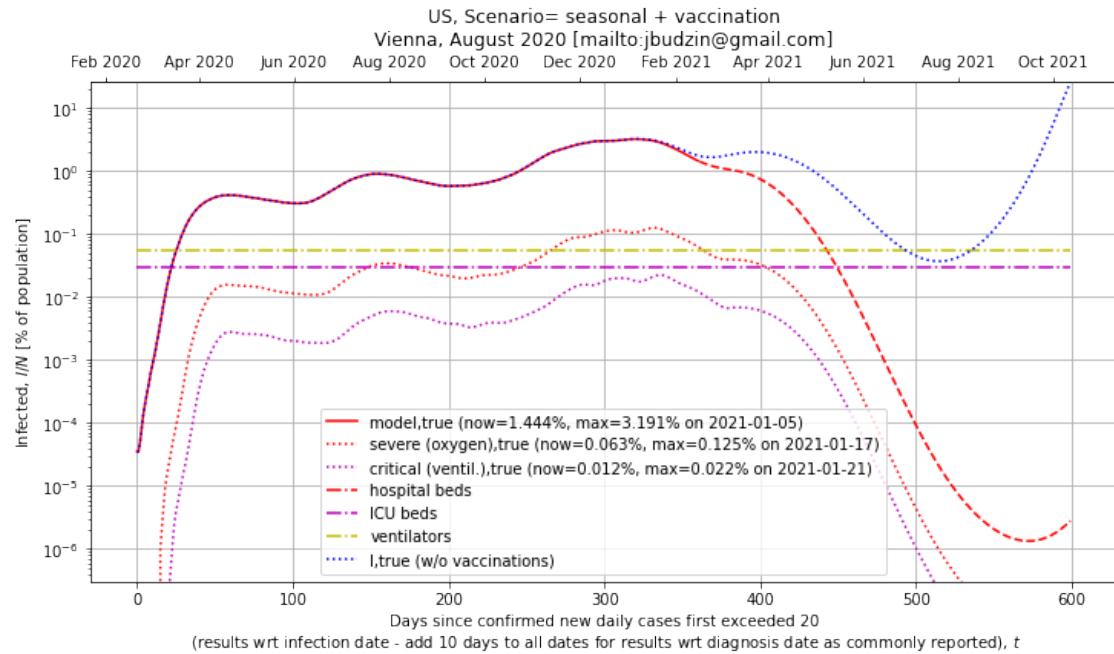
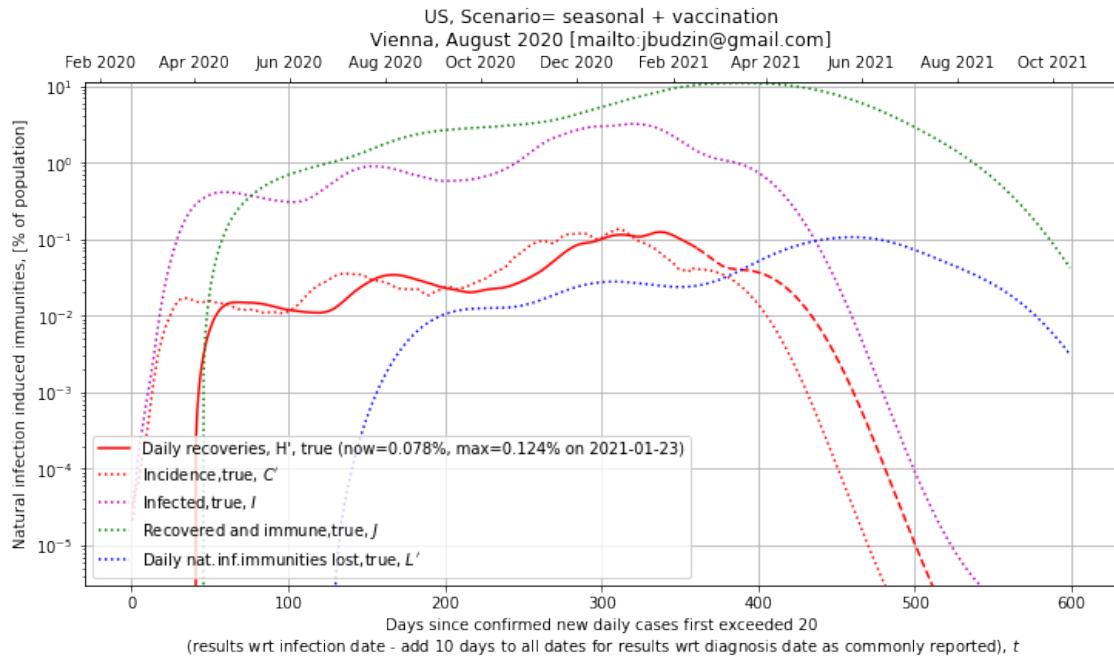


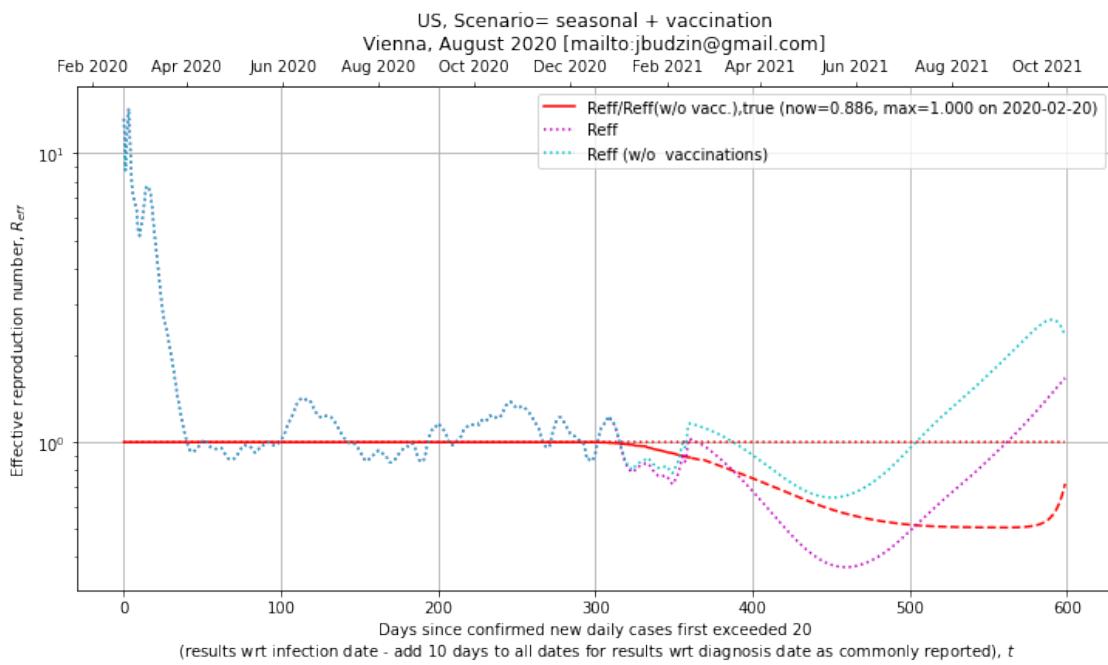
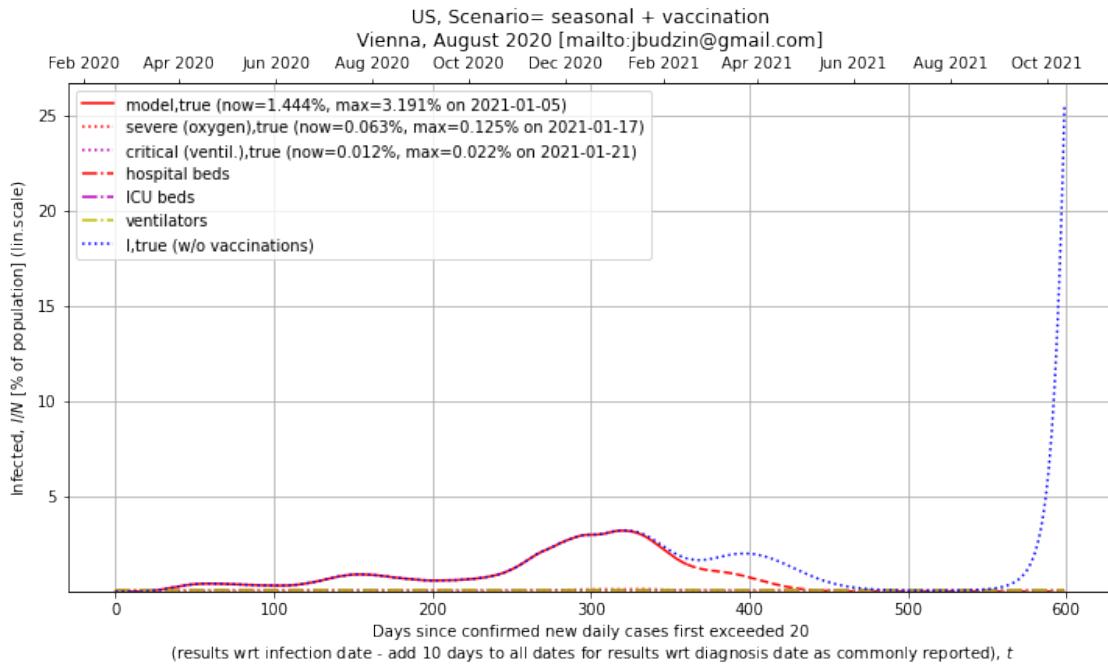
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
 Avg. infection prevalence = 7.74e+05 / Perc of pop= 0.234
 Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
 Time constant in Lyapunov function (data) [d]= 148.076
 Time constant in Lyapunov function (proj) [d]= 99.966

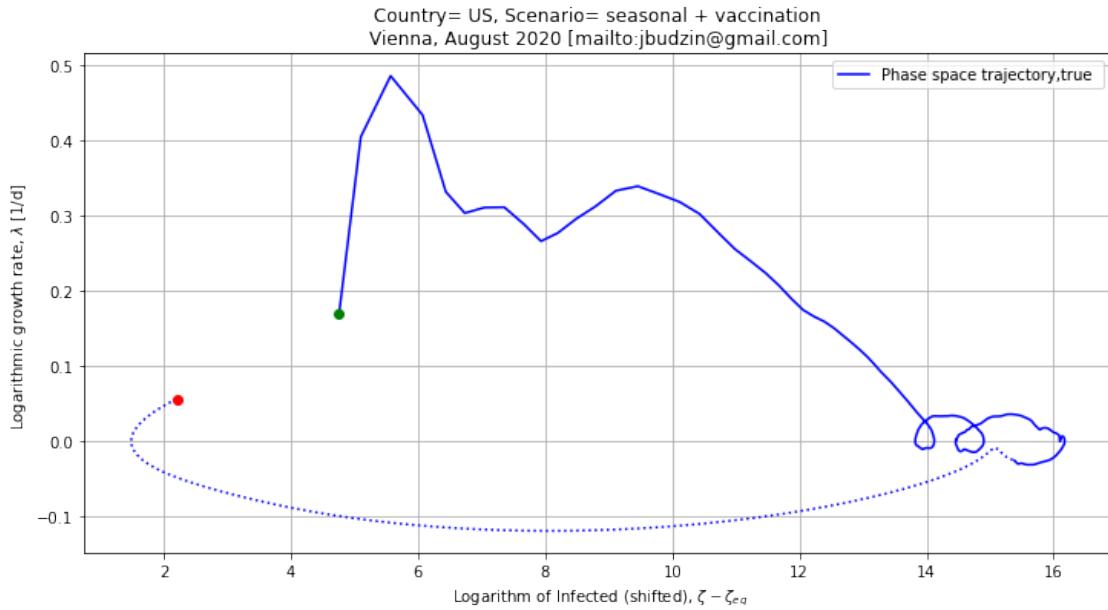
1.7.22 LDF_INF = 1.00 (at VACC_RATE = 1.50)

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 7.76e+05 / Perc of pop= 0.235
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 148.076
Time constant in Lyapunov function (proj) [d]= 125.043

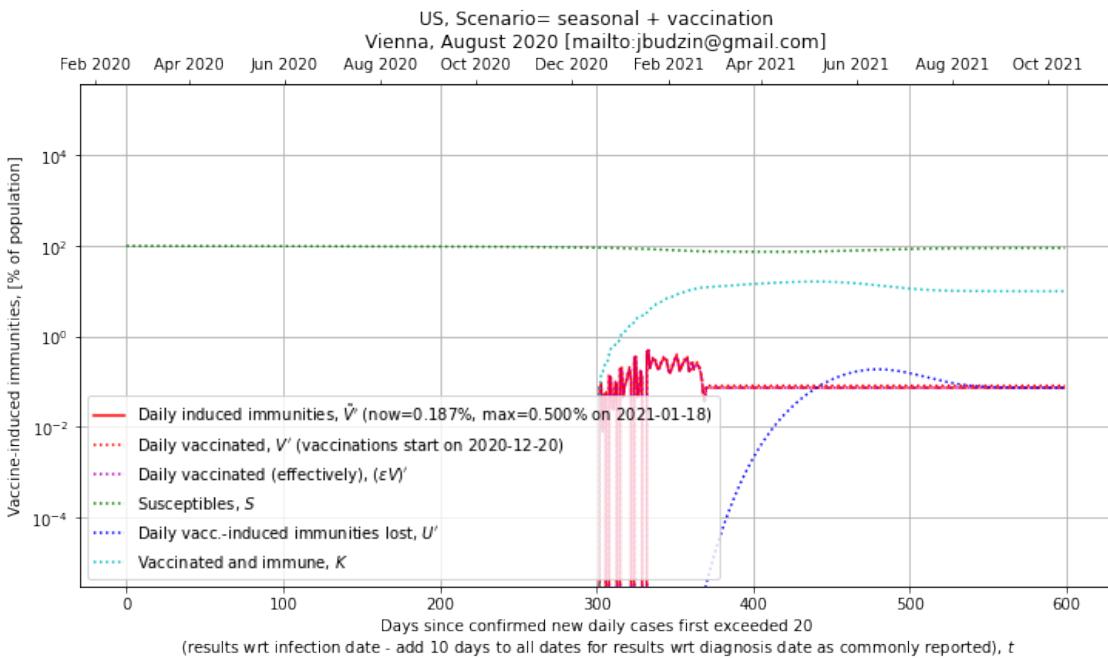
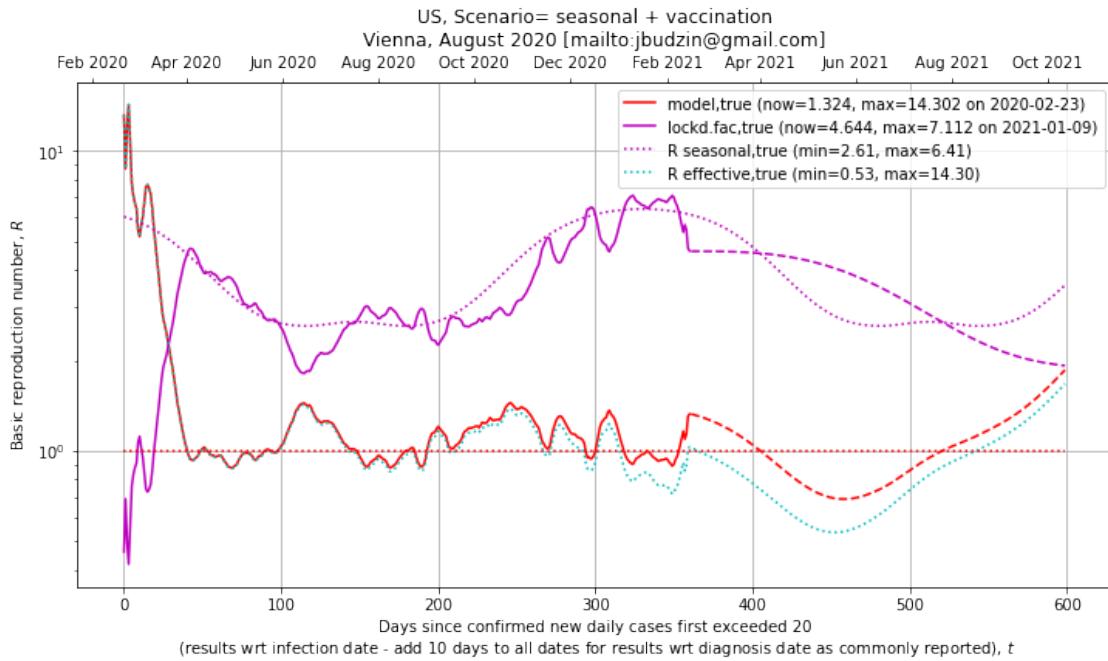
1.8 MINORS' TESTING + VACCINATIONS (at LDF_INF = 1.88)

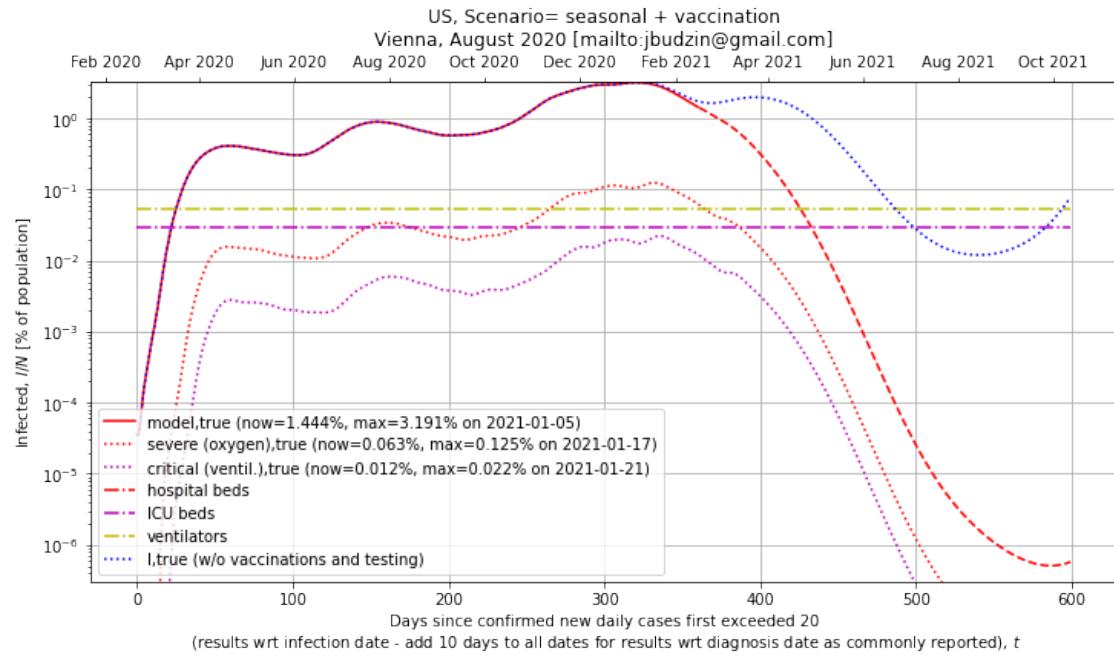
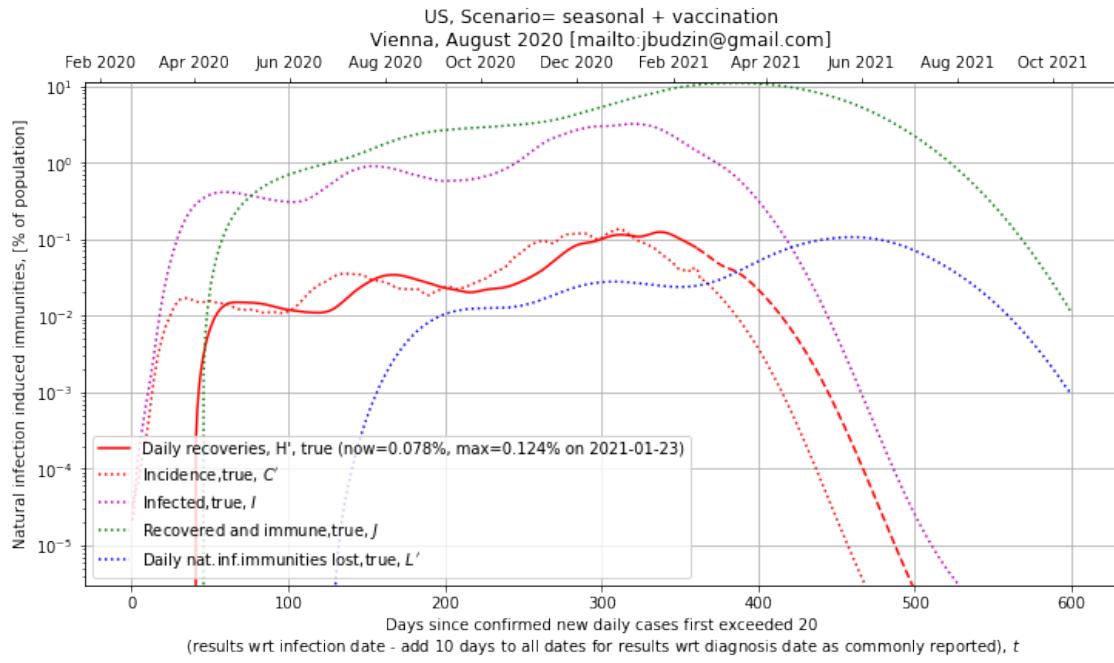
1.8.1 VACC_RATE = 0.30 [fraction of popul. per year]

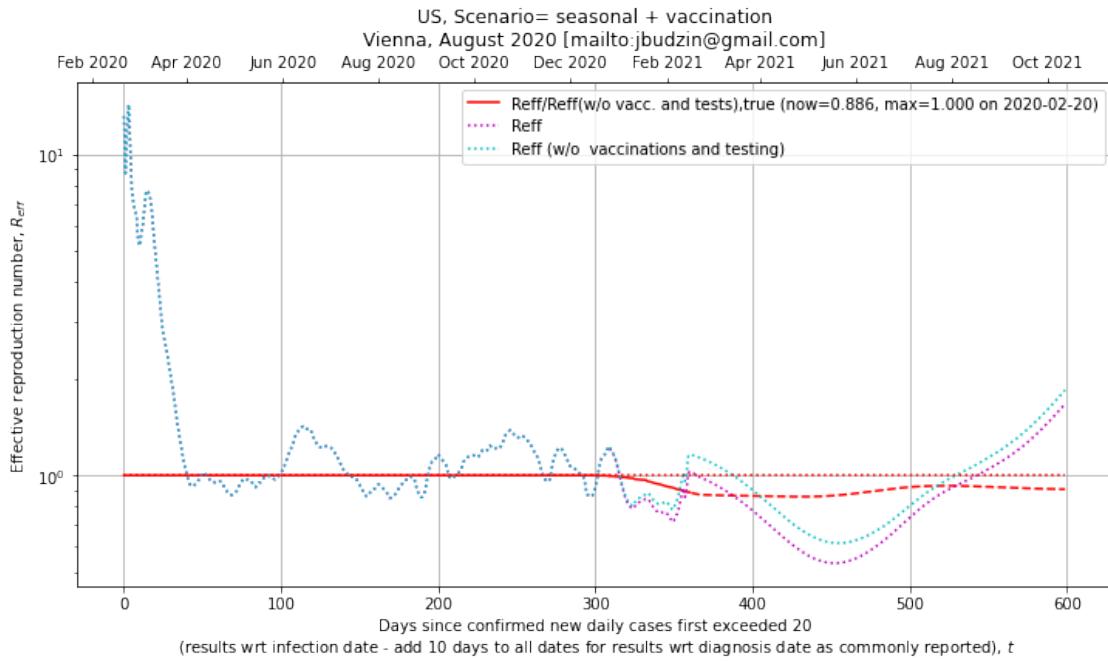
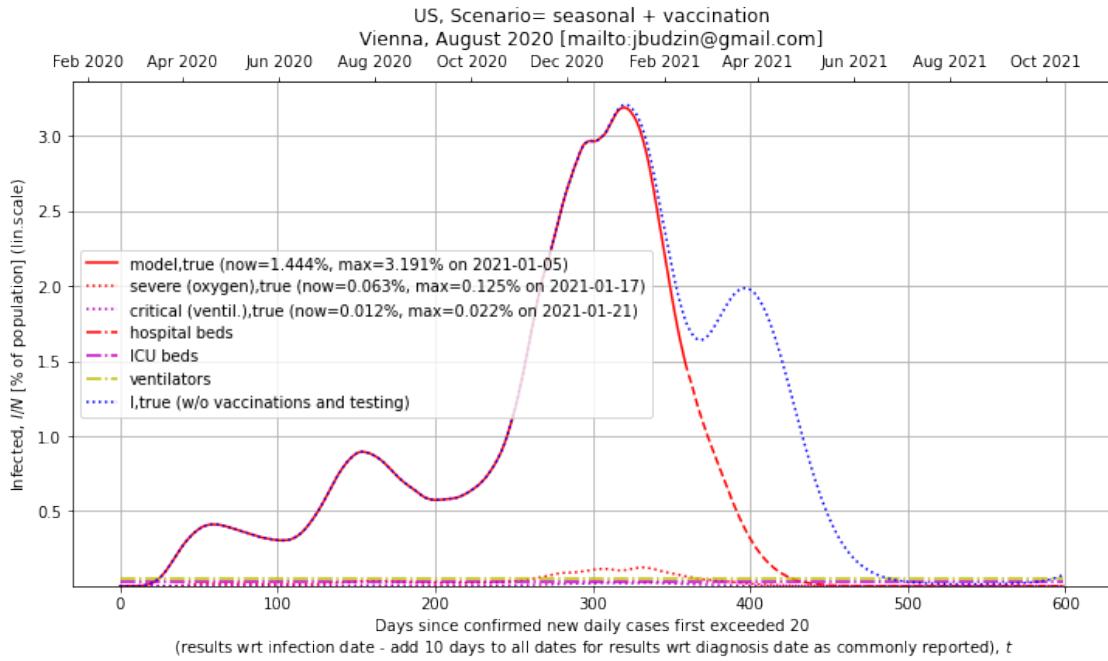
```

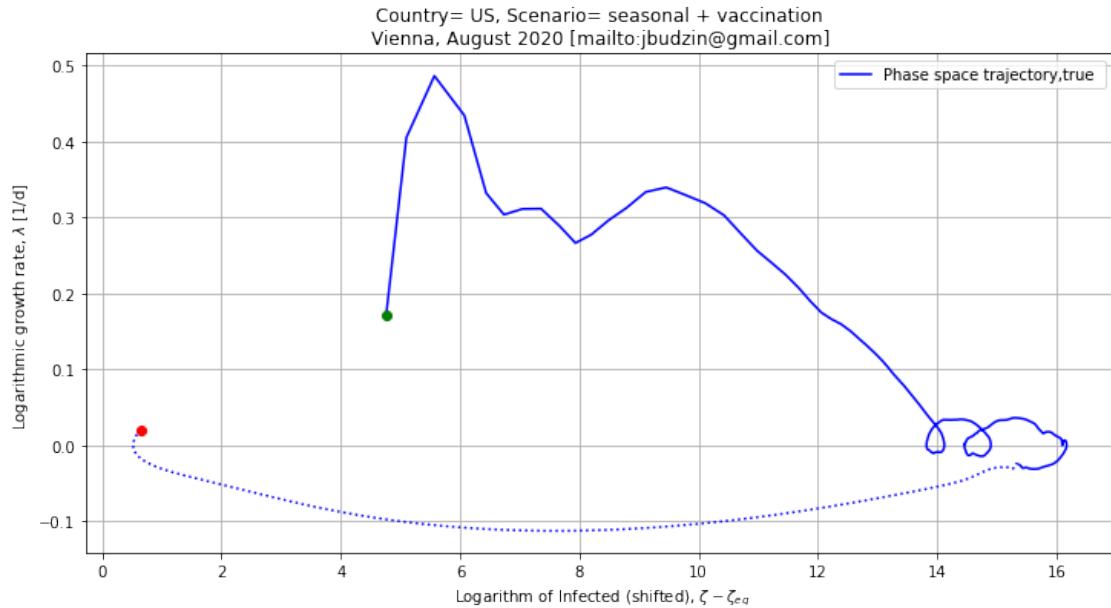
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
Current vaccination rate [perc. of popul. per year] = 77.565
Projection vaccination rate [perc. of popul. per year] = 30.012

```









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

Avg. infection prevalence = 5.11e+05 / Perc of pop= 0.154

Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

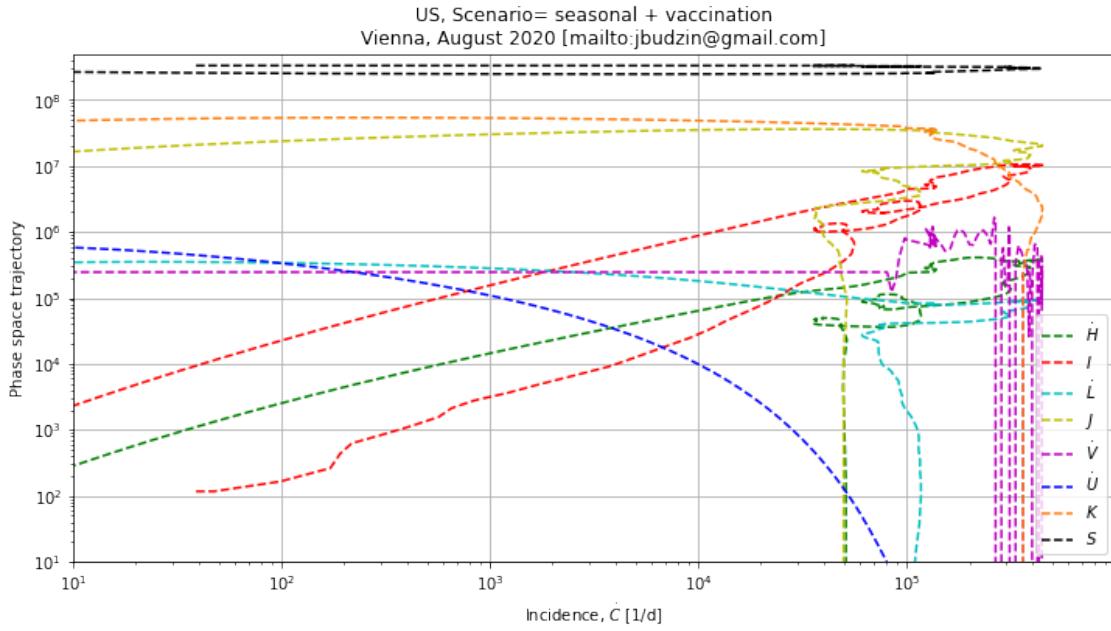
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

Time constant in Lyapunov function (data) [d]= 148.076

Time constant in Lyapunov function (proj) [d]= 162.620

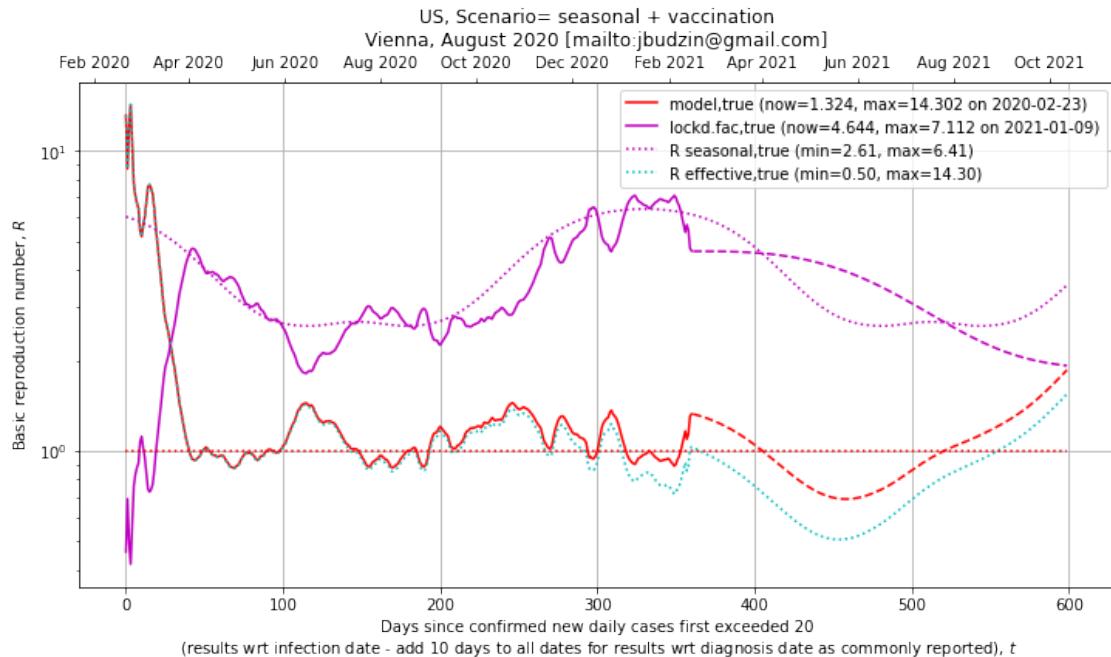
Approx. vaccination cost per year (projection) [EUR MLN] = 1419.58

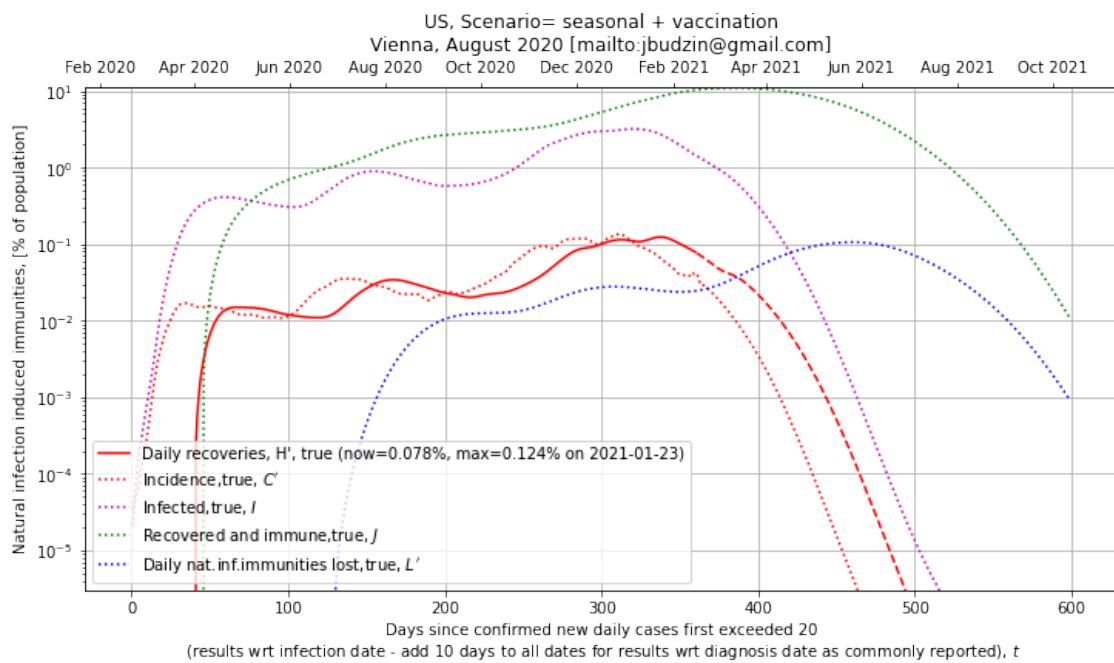
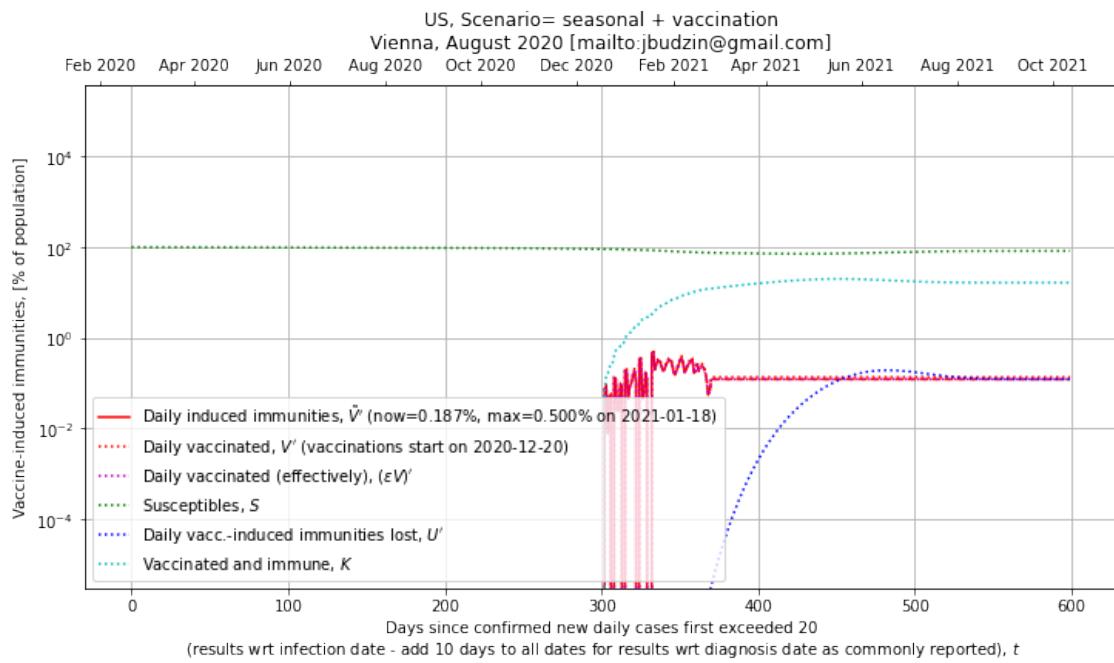
Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

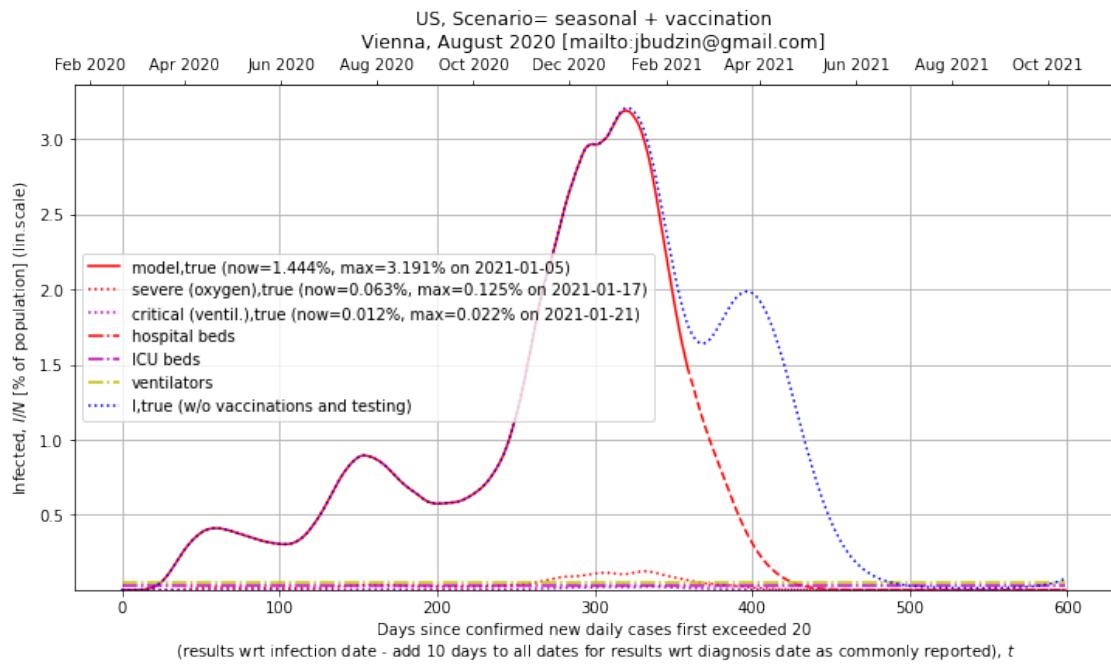
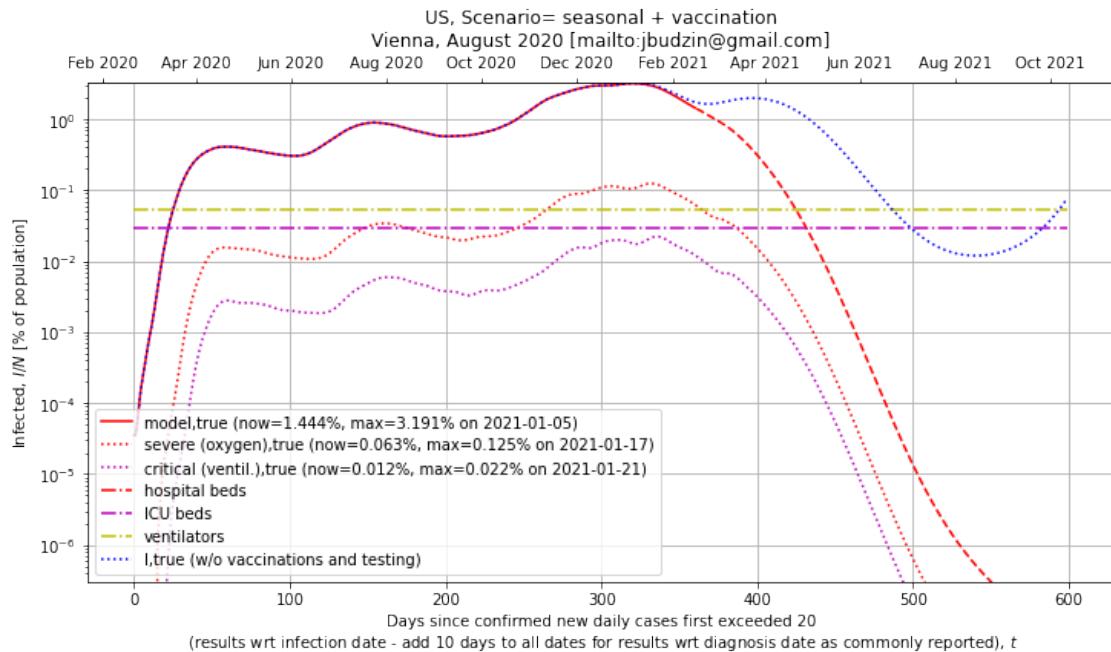


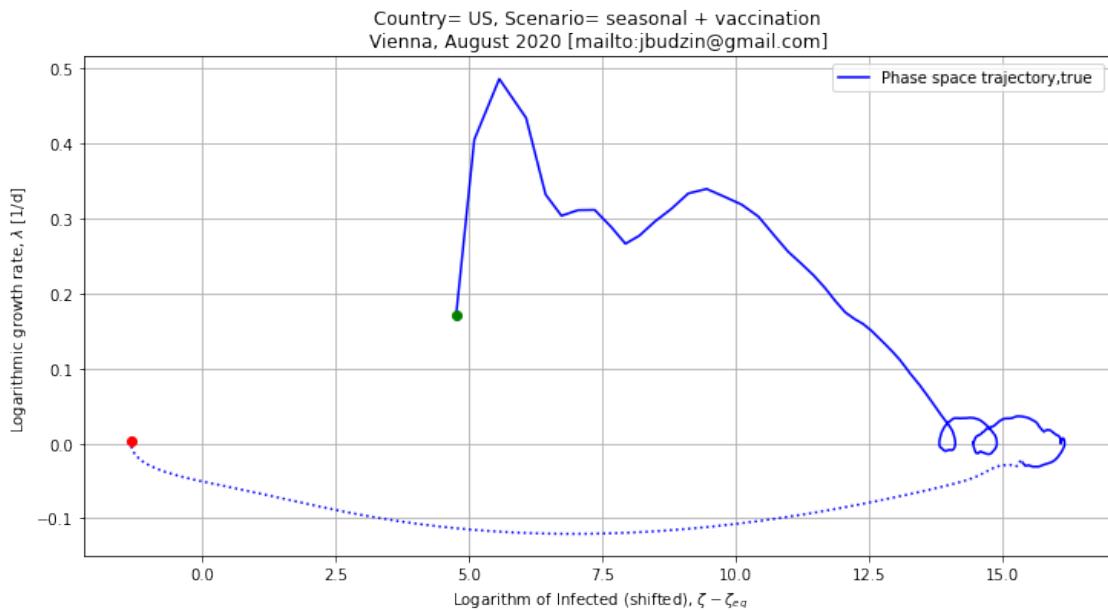
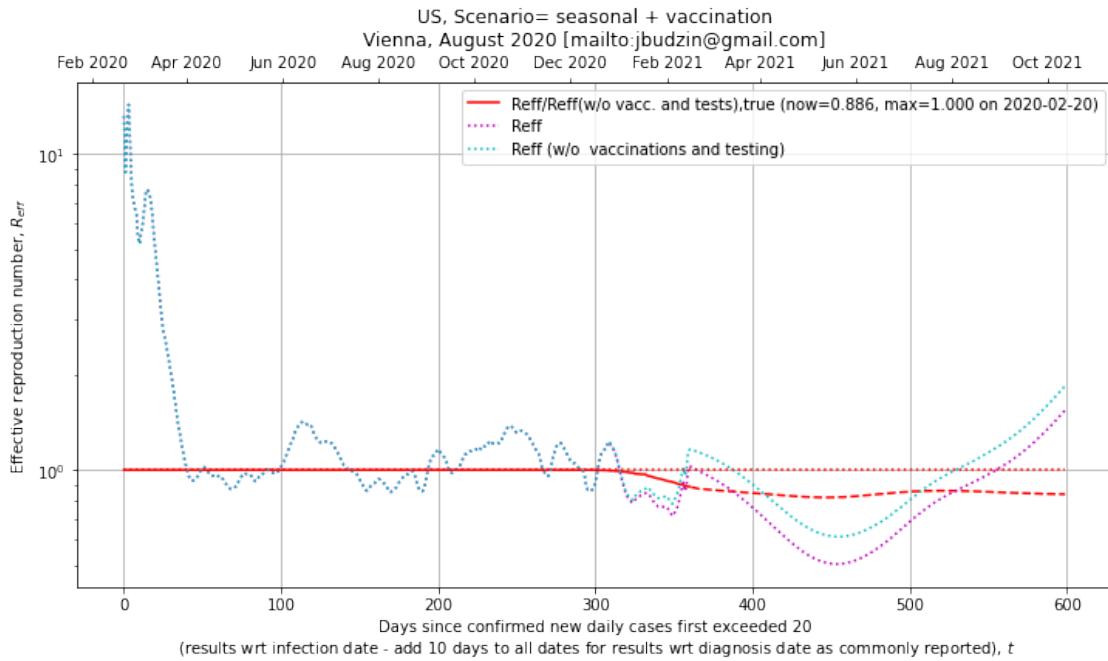
1.8.2 VACC_RATE = 0.50 [fraction of popul. per year]

`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in `model`: True True True True
`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in `model`: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 50.021









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

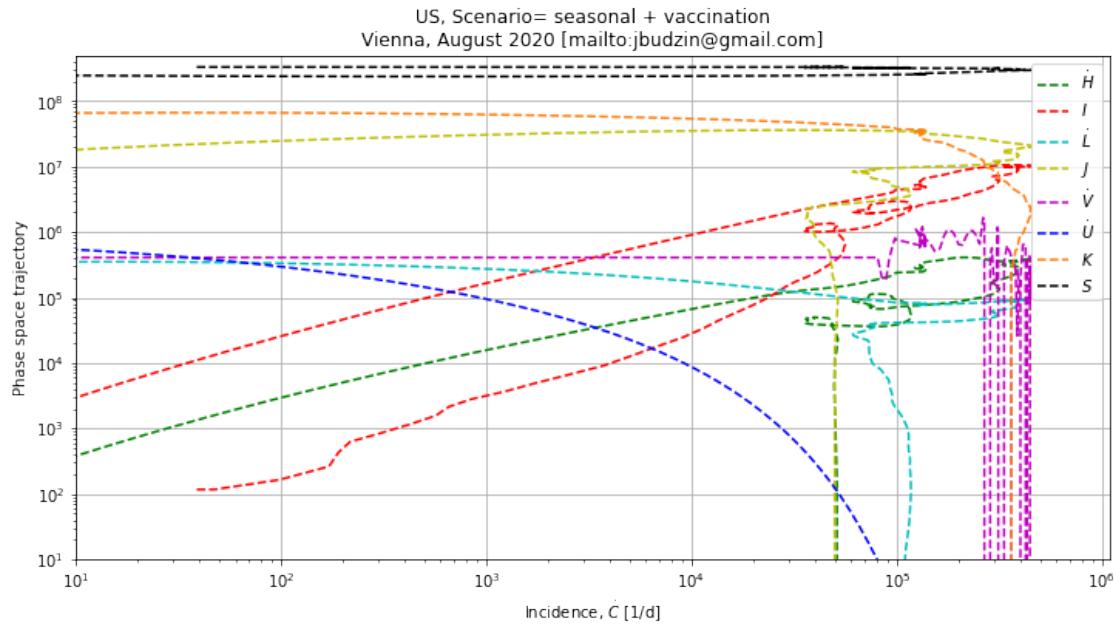
Avg. infection prevalence = 5.07e+05 / Perc of pop= 0.153

Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

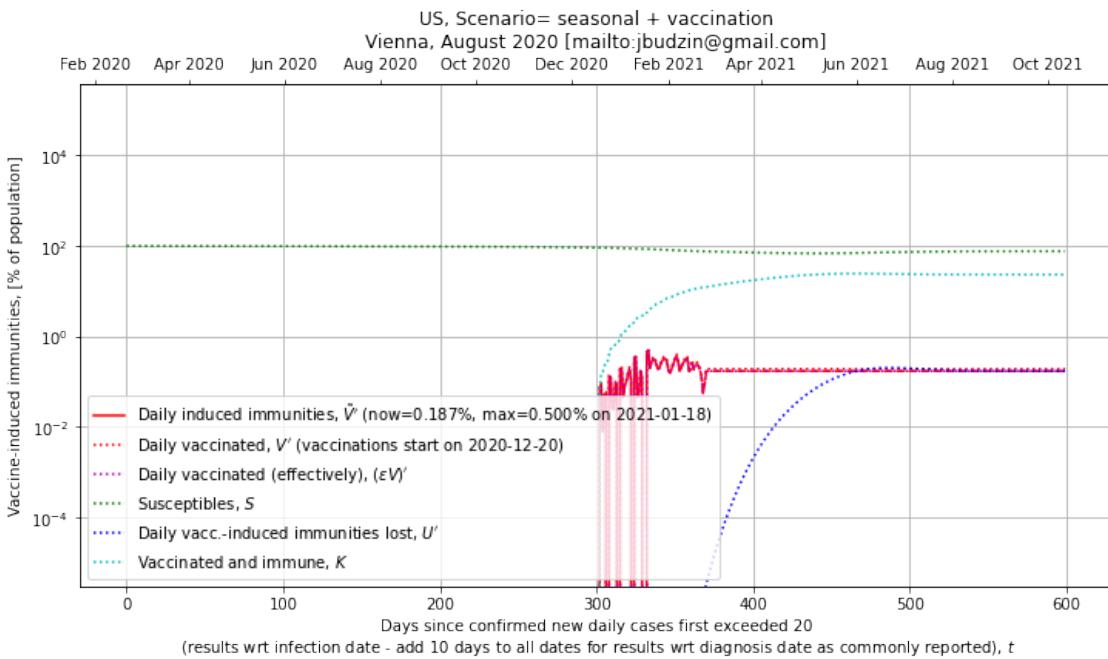
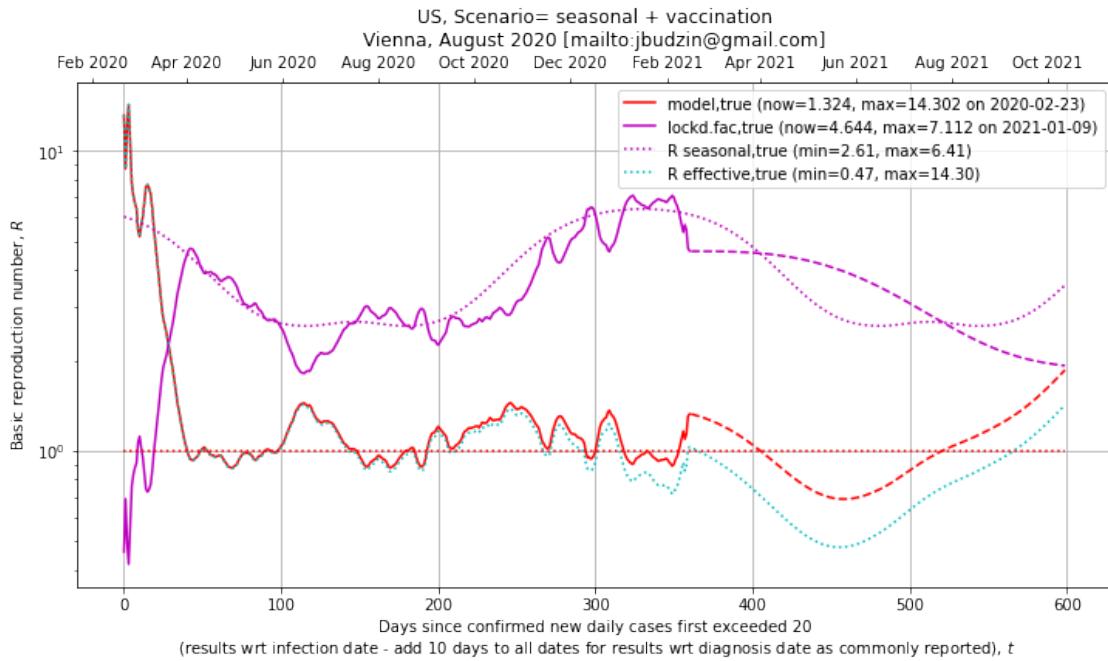
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 103.055

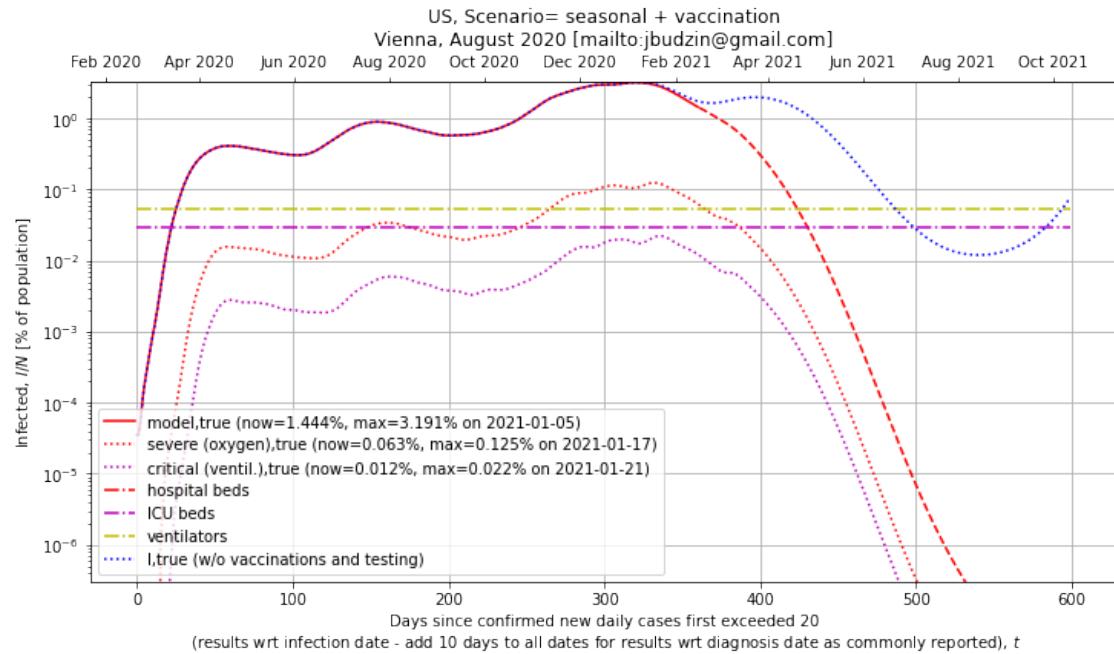
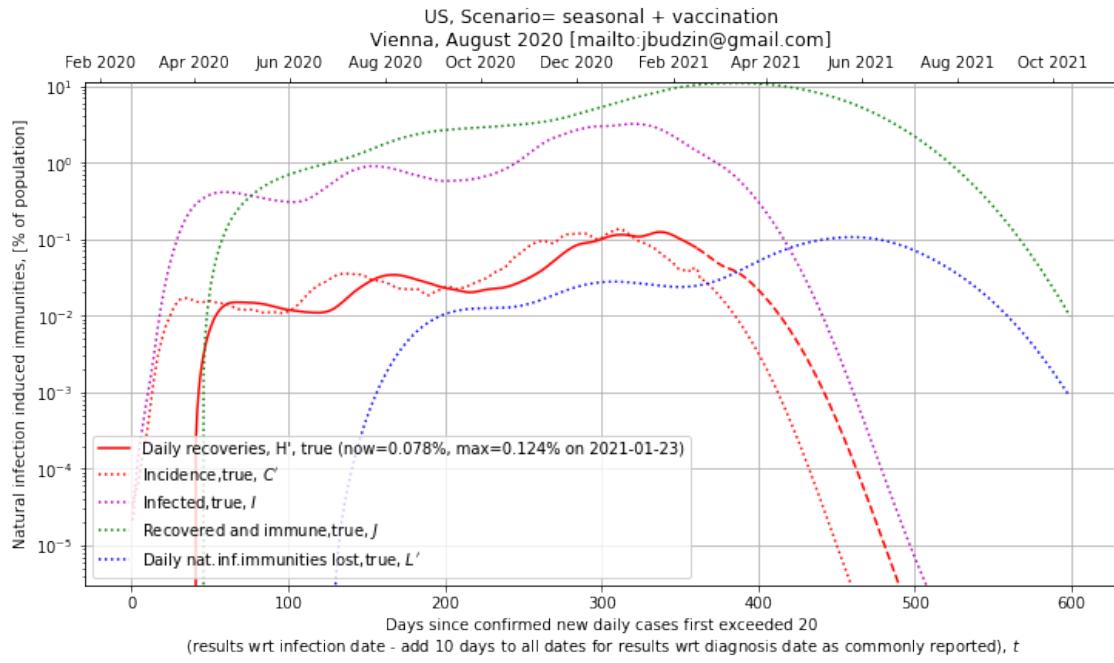
Approx. vaccination cost per year (projection) [EUR MLN] = 2279.98
 Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

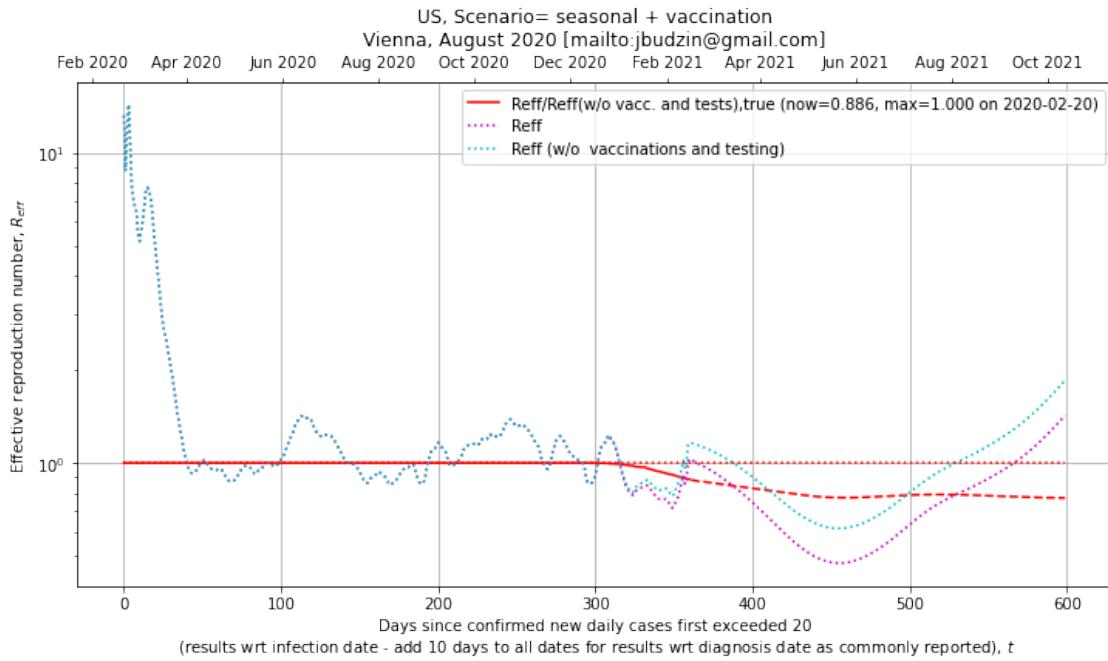
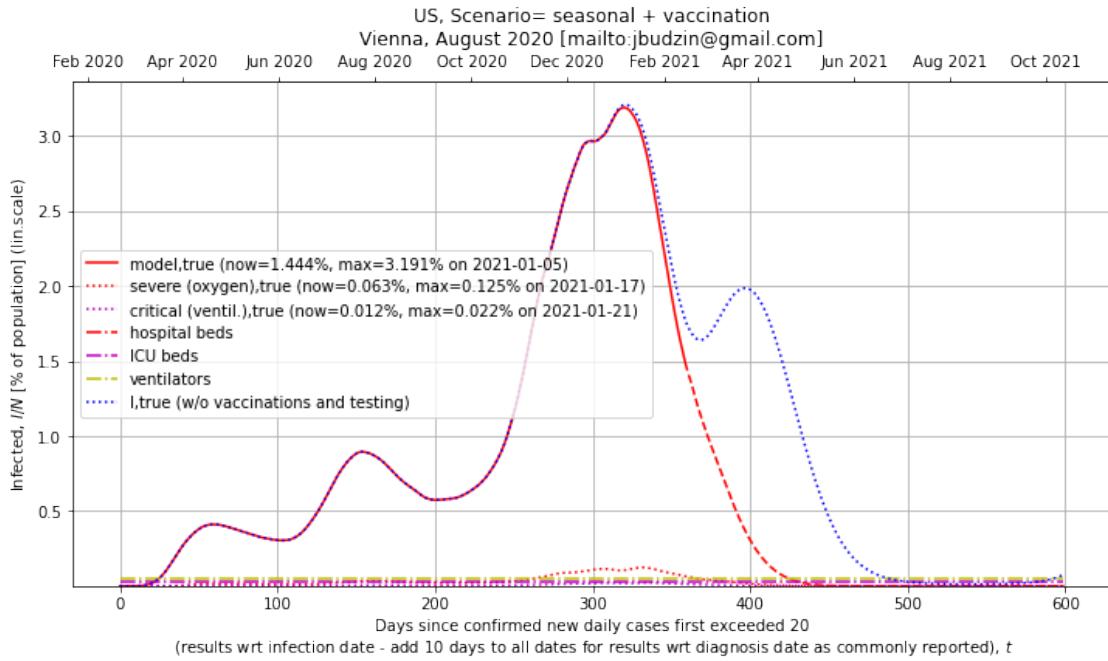


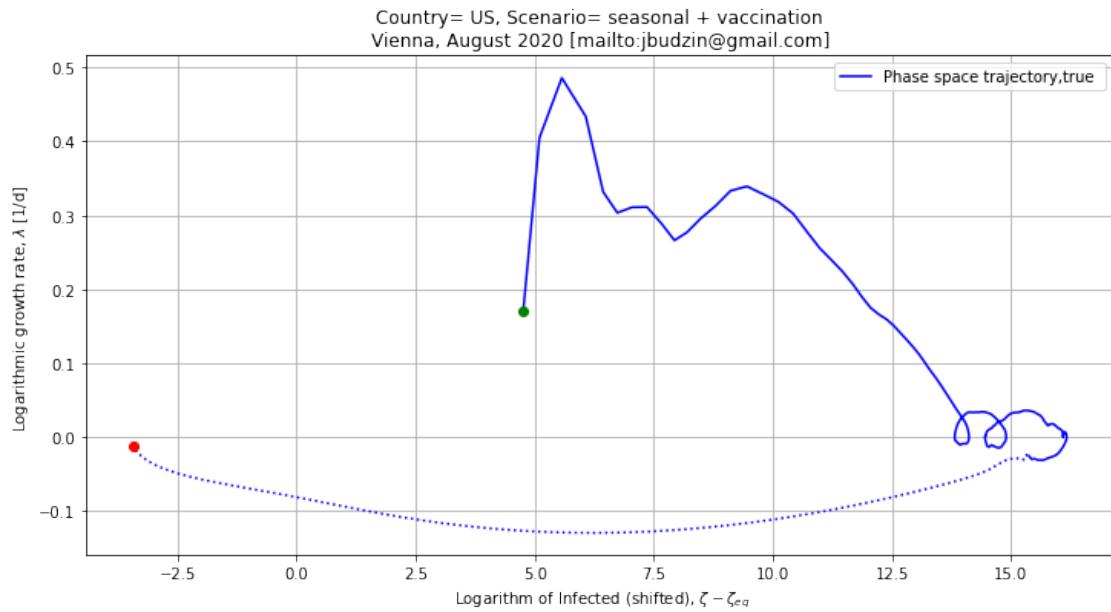
1.8.3 VACC_RATE = 0.70 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 70.029









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

Avg. infection prevalence = 5.03e+05 / Perc of pop= 0.152

Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

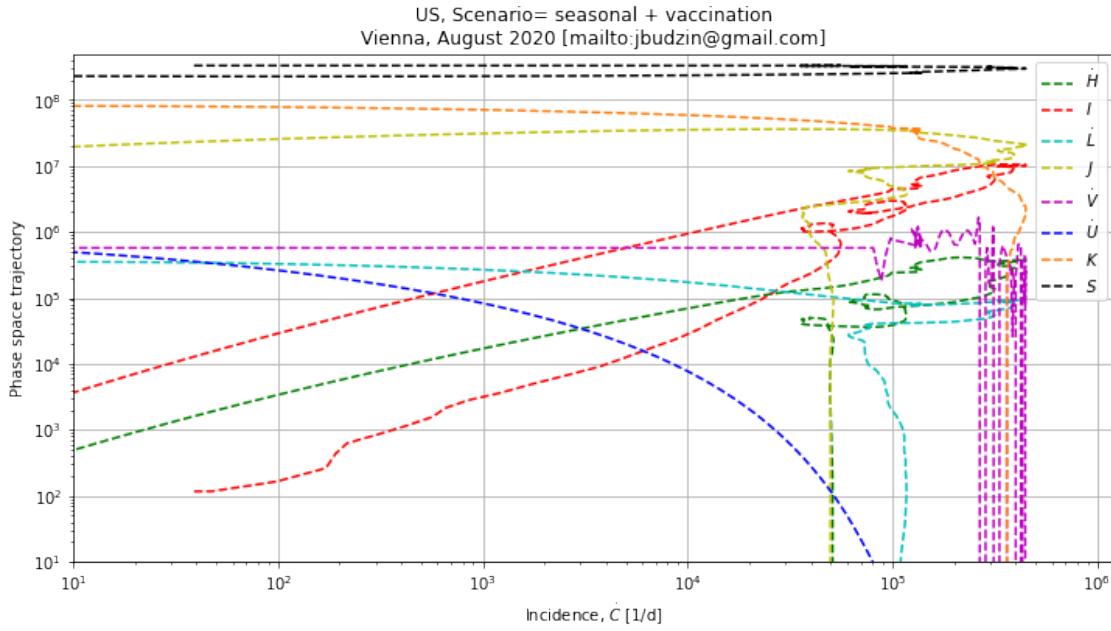
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

Time constant in Lyapunov function (data) [d]= 148.076

Time constant in Lyapunov function (proj) [d]= 98.862

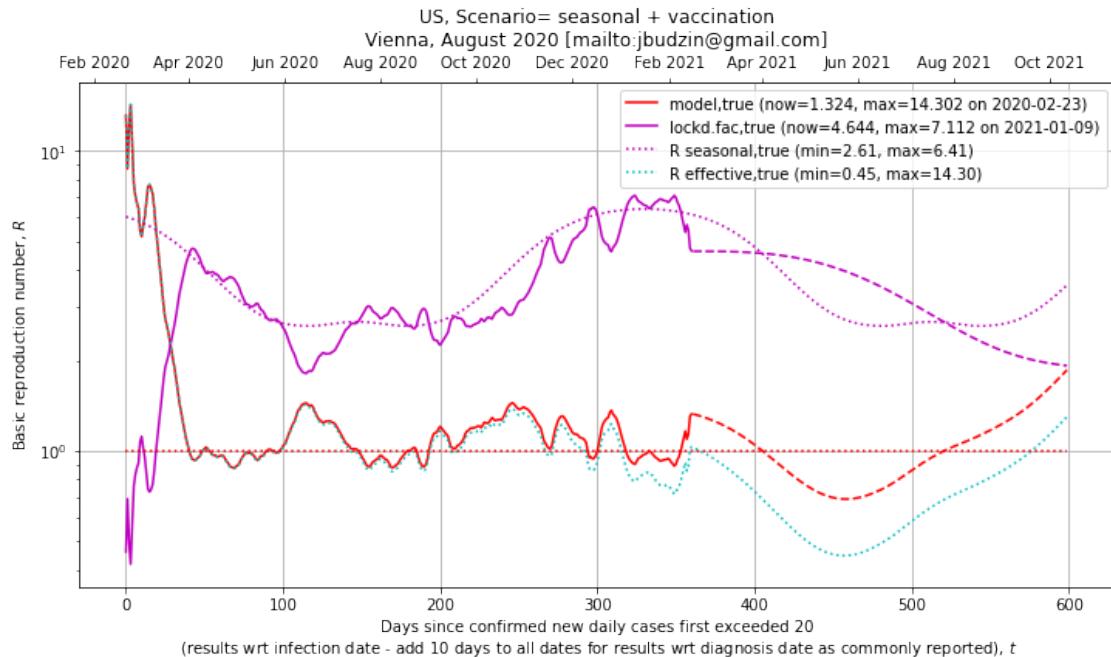
Approx. vaccination cost per year (projection) [EUR MLN] = 3140.39

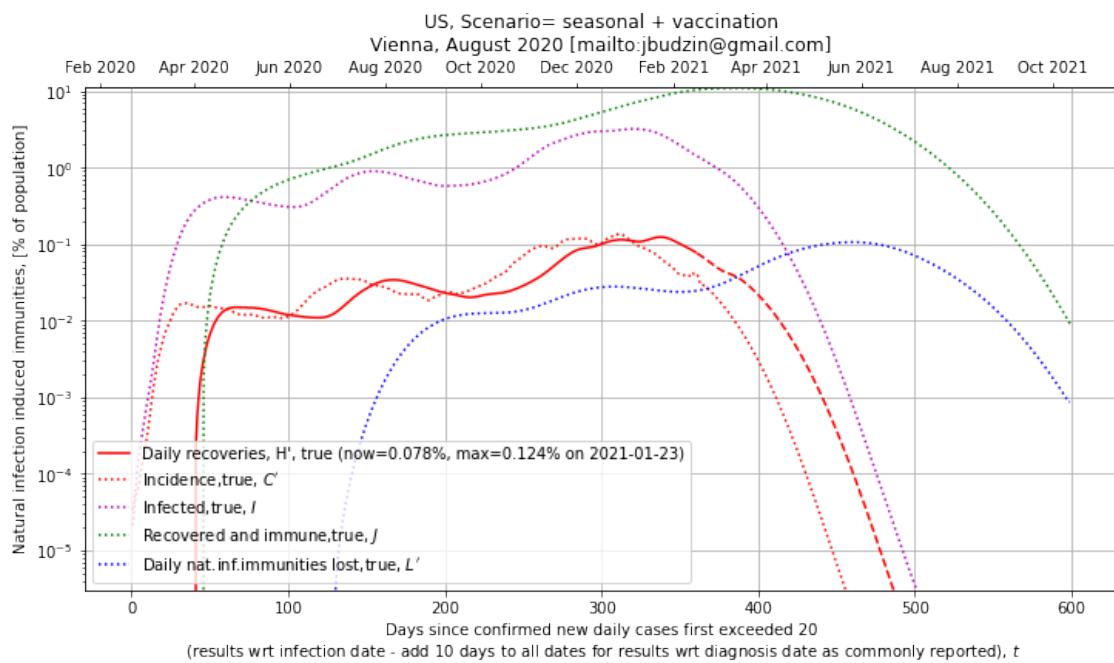
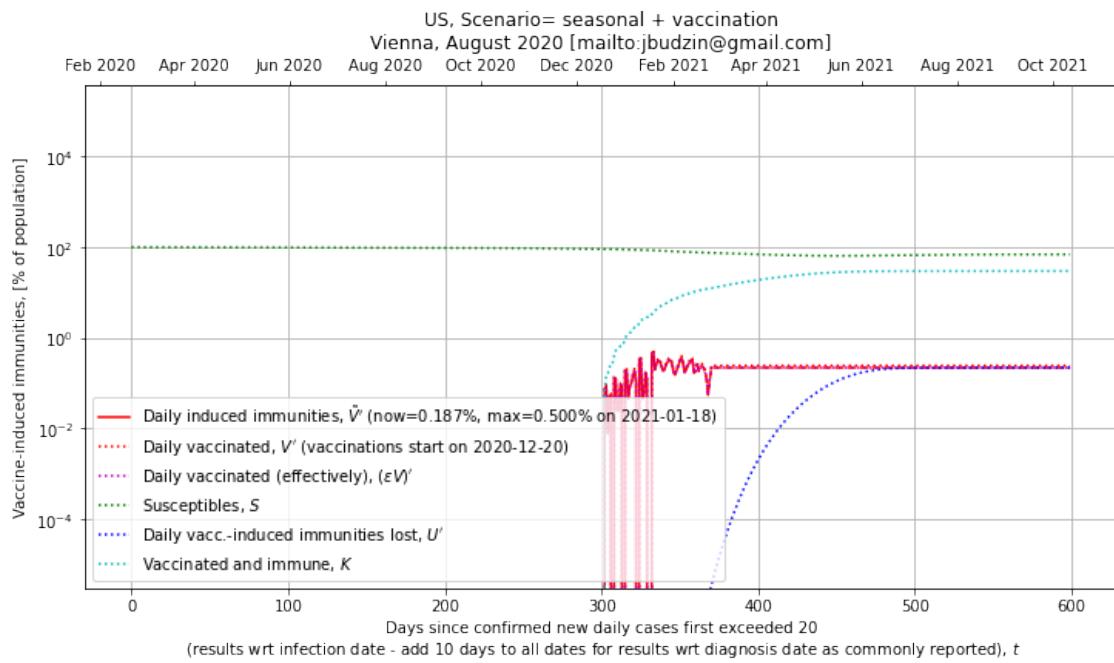
Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

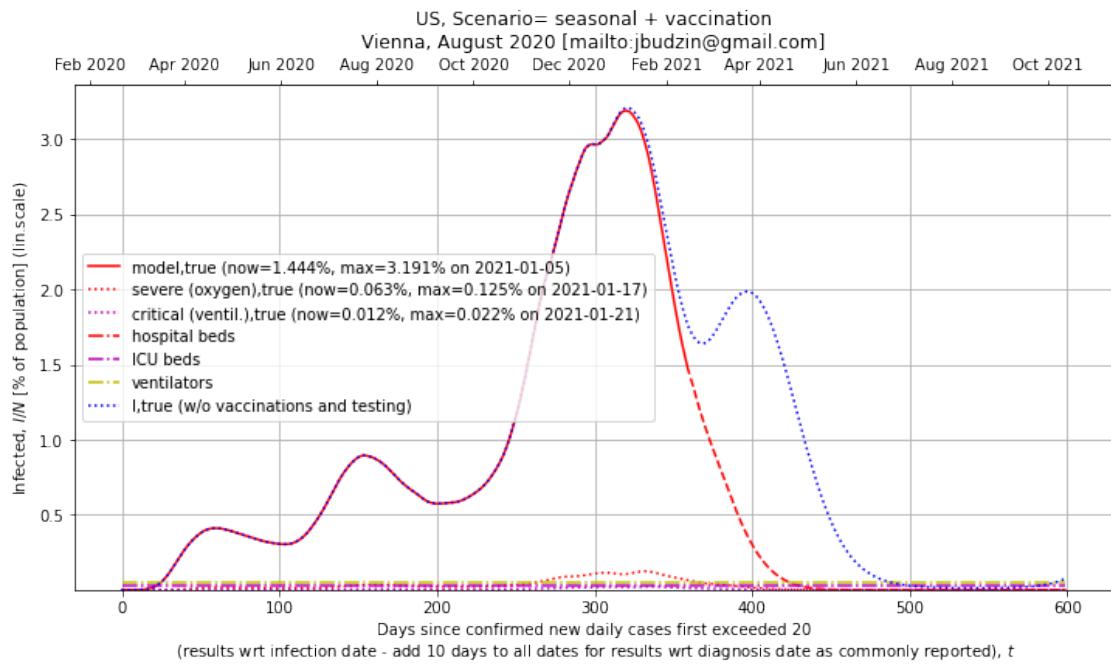
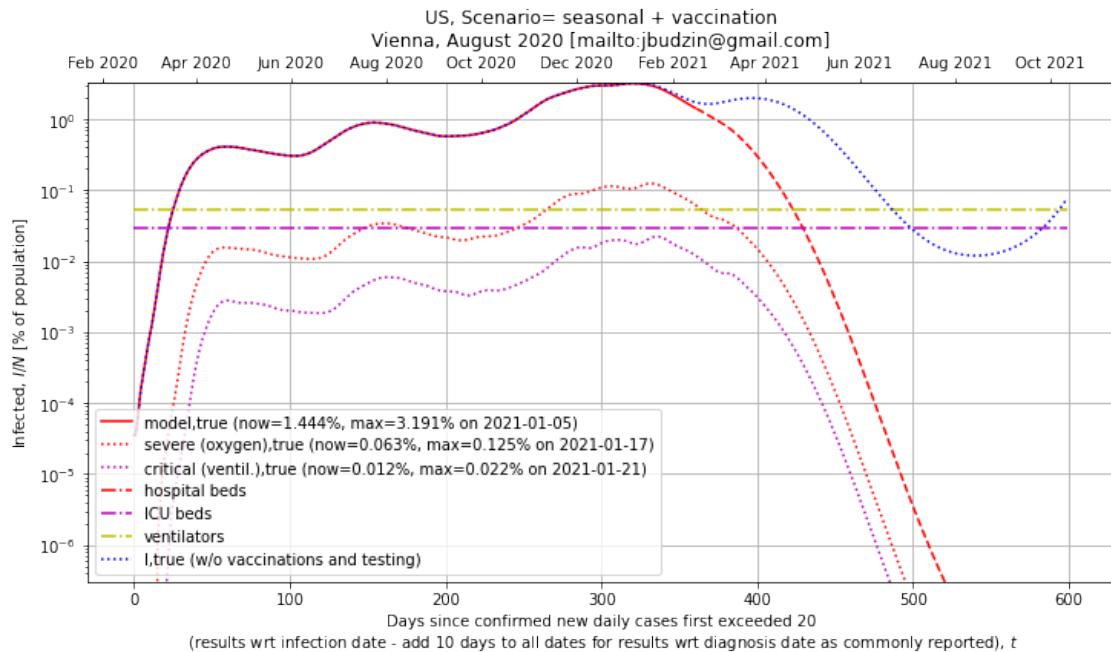


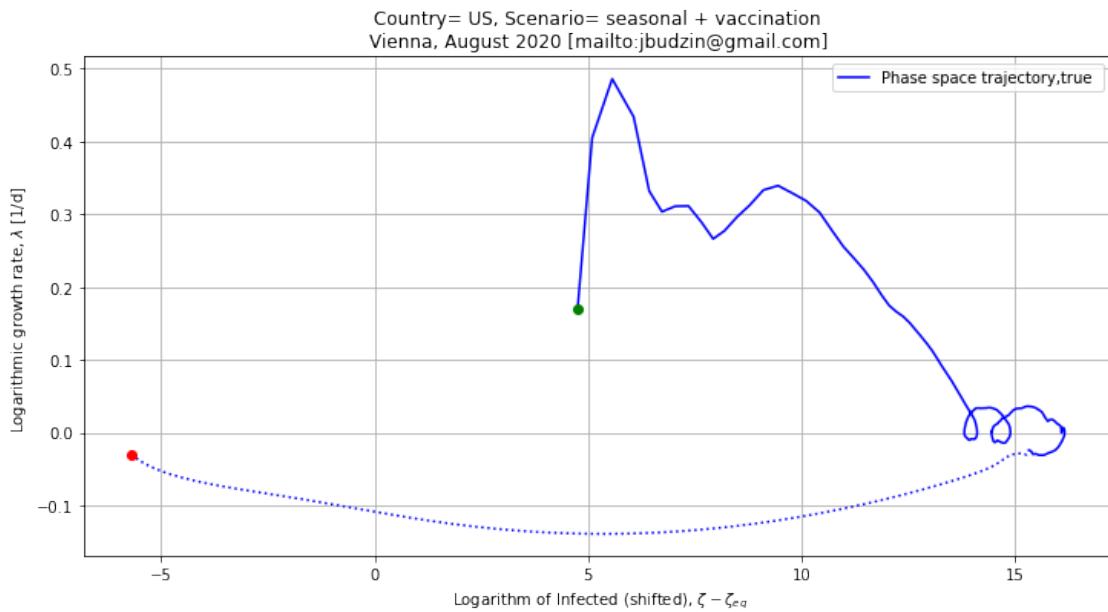
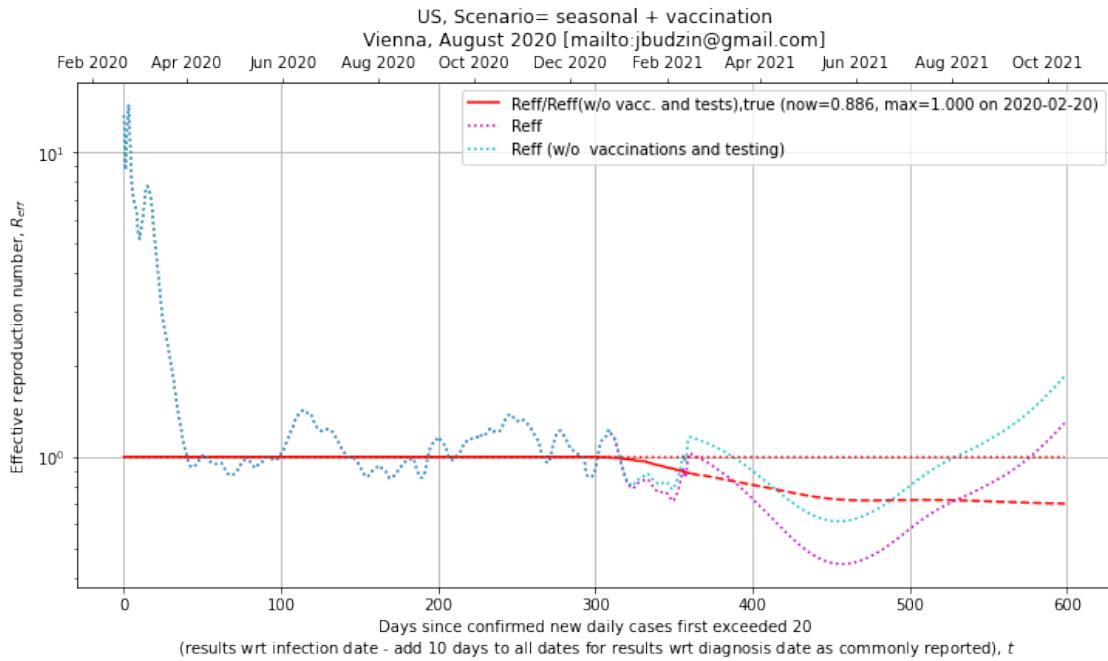
1.8.4 VACC_RATE = 0.90 [fraction of popul. per year]

V_{in_dyn} , L_{in_dyn} , NoL_NoV , V_{in_proj} in model: True True True True
 V_{in_dyn} , L_{in_dyn} , NoL_NoV , V_{in_proj} in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 90.037





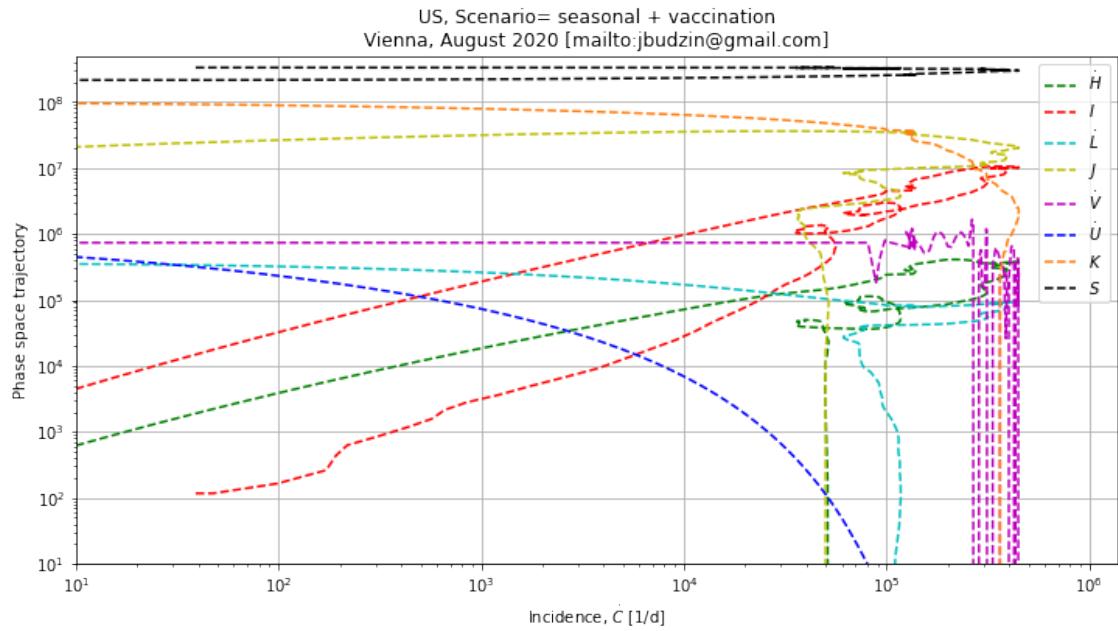




Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0
 Avg. infection prevalence = 5.00e+05 / Perc of pop= 0.151
 Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0
 Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

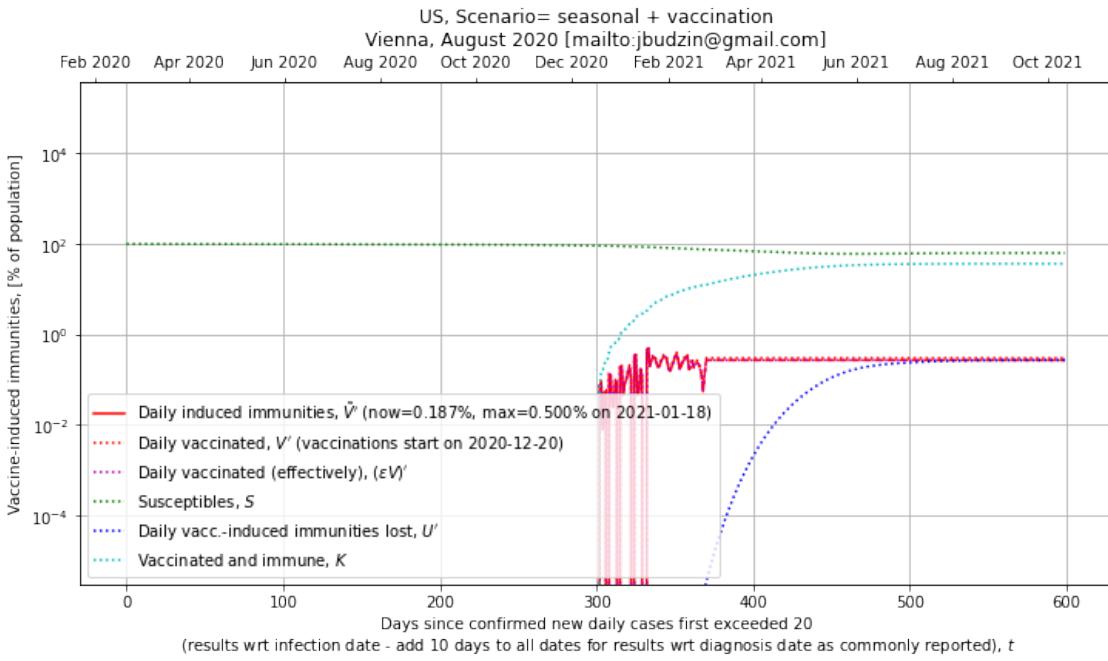
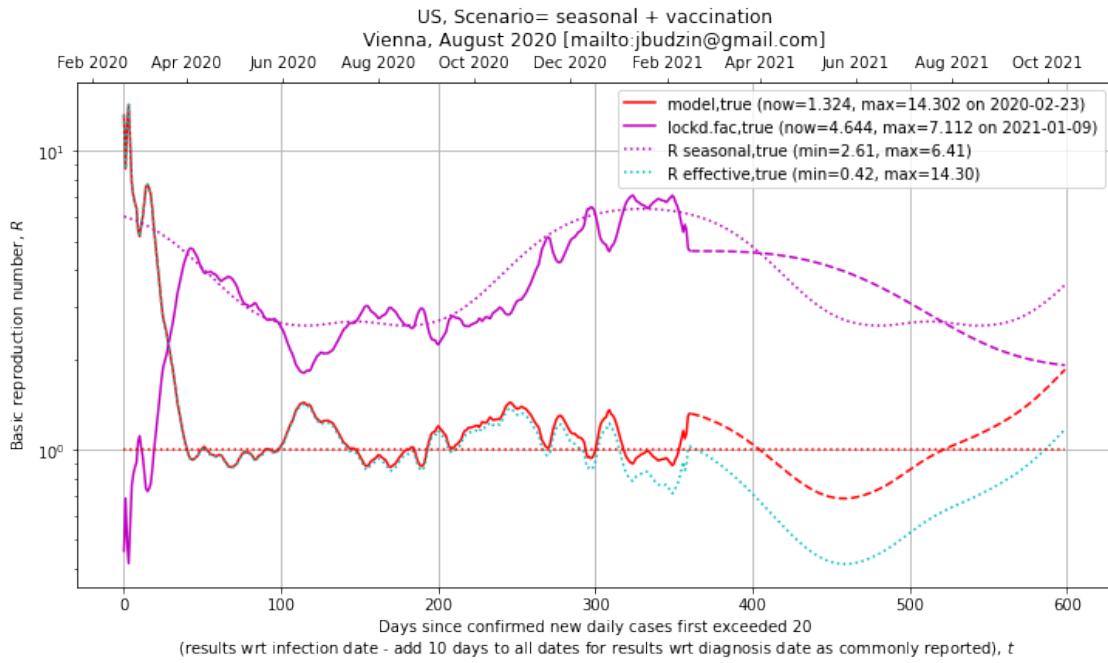
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 97.081

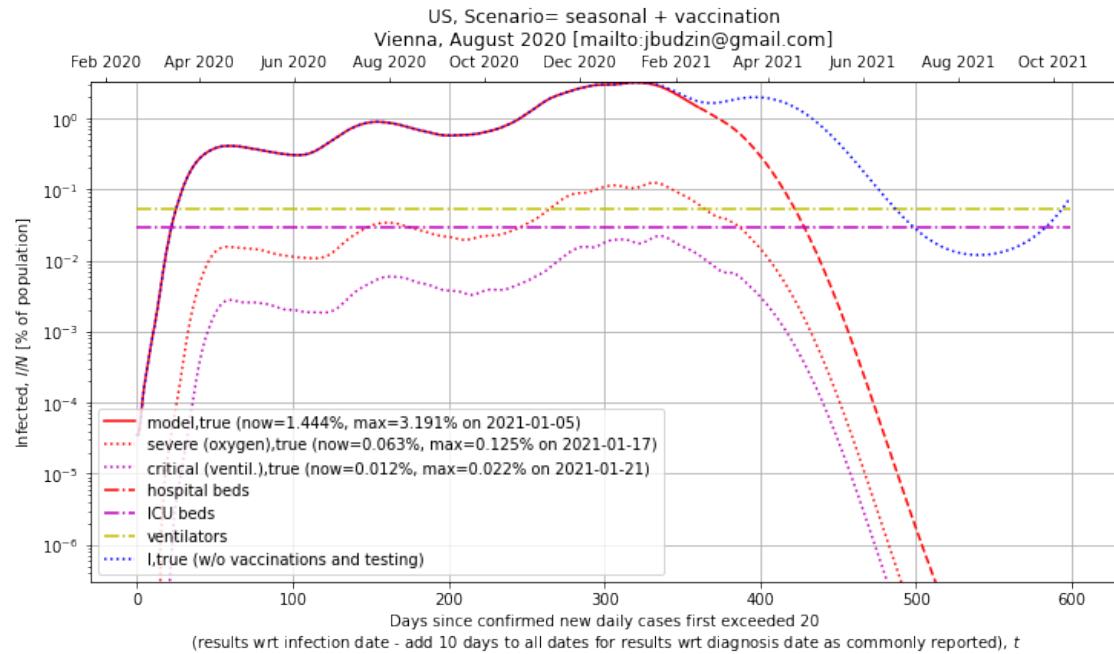
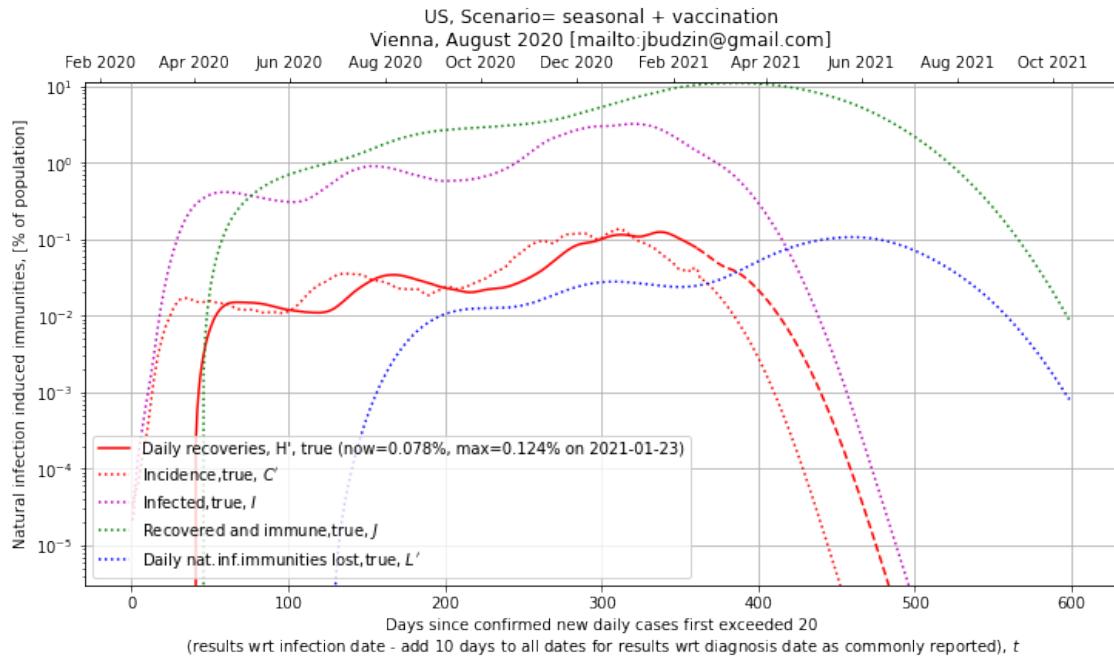
Approx. vaccination cost per year (projection) [EUR MLN] = 4000.79
 Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

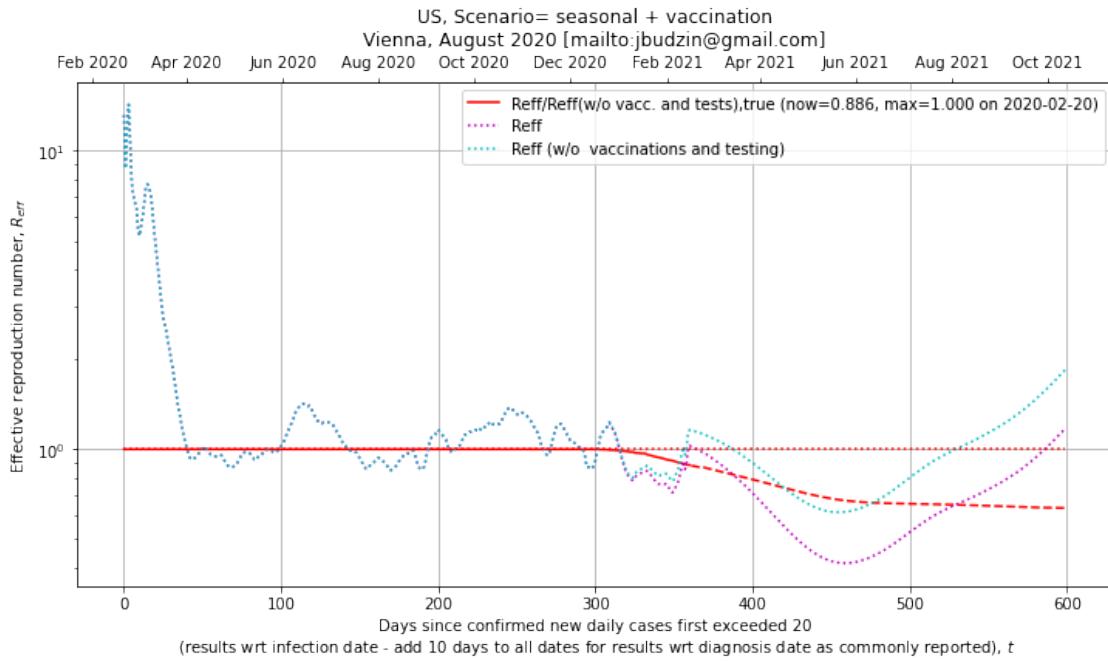
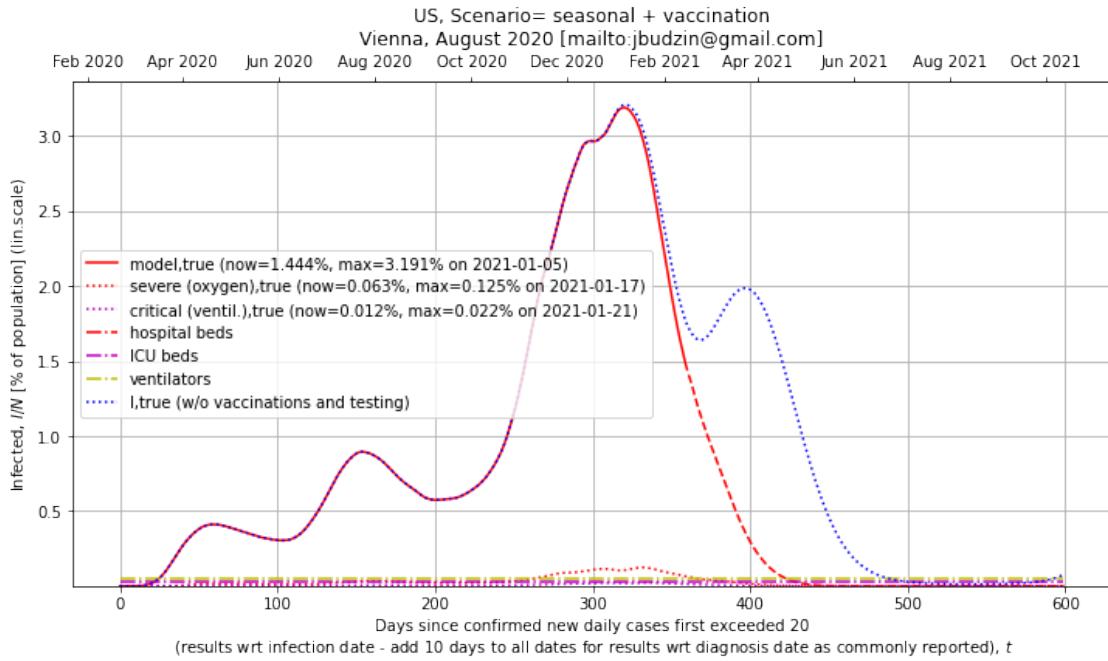


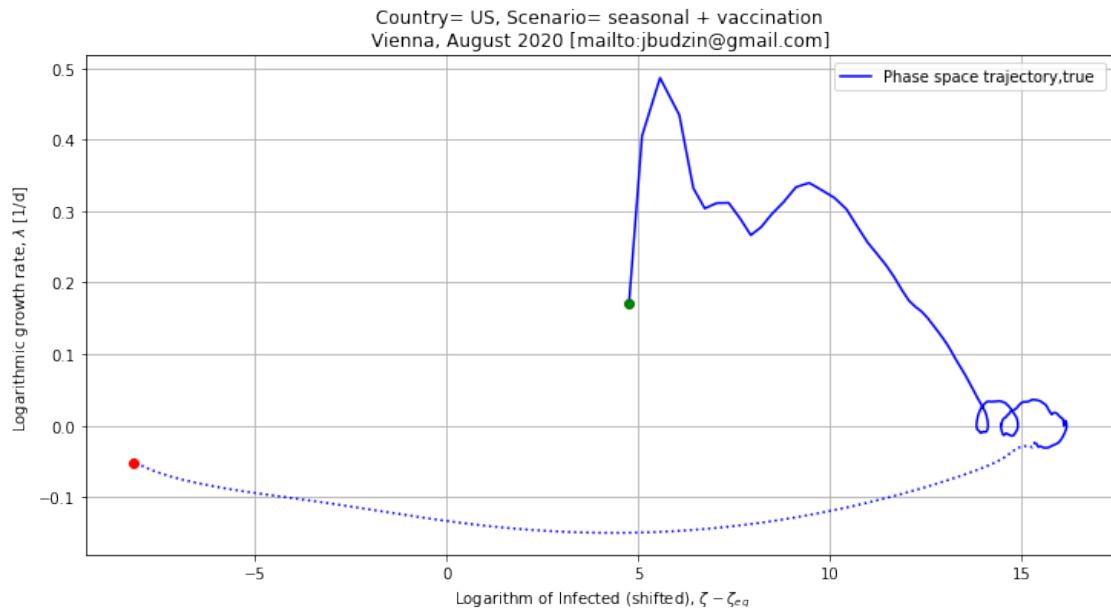
1.8.5 VACC_RATE = 1.10 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 110.045









Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0

Avg. infection prevalence = 4.96e+05 / Perc of pop= 0.150

Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0

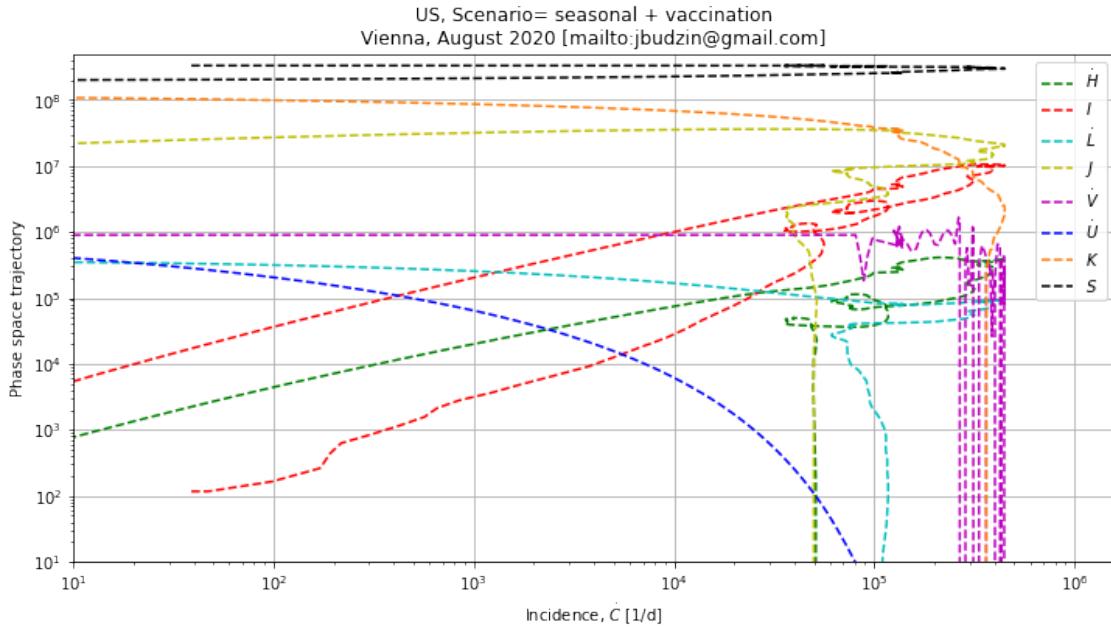
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

Time constant in Lyapunov function (data) [d]= 148.076

Time constant in Lyapunov function (proj) [d]= 98.527

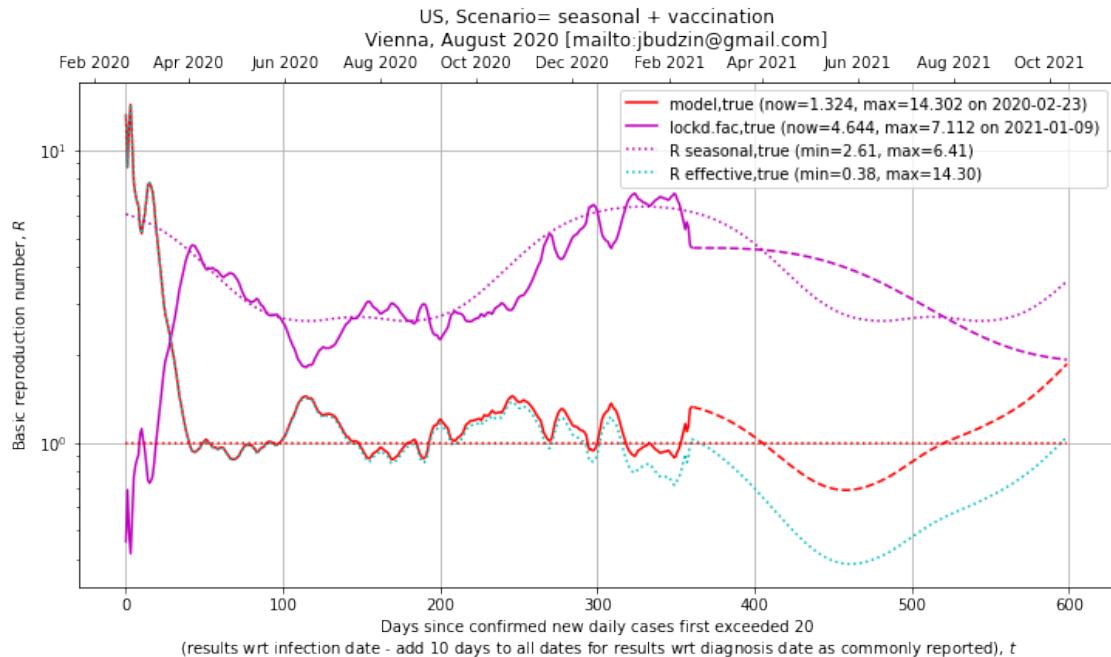
Approx. vaccination cost per year (projection) [EUR MLN] = 4861.20

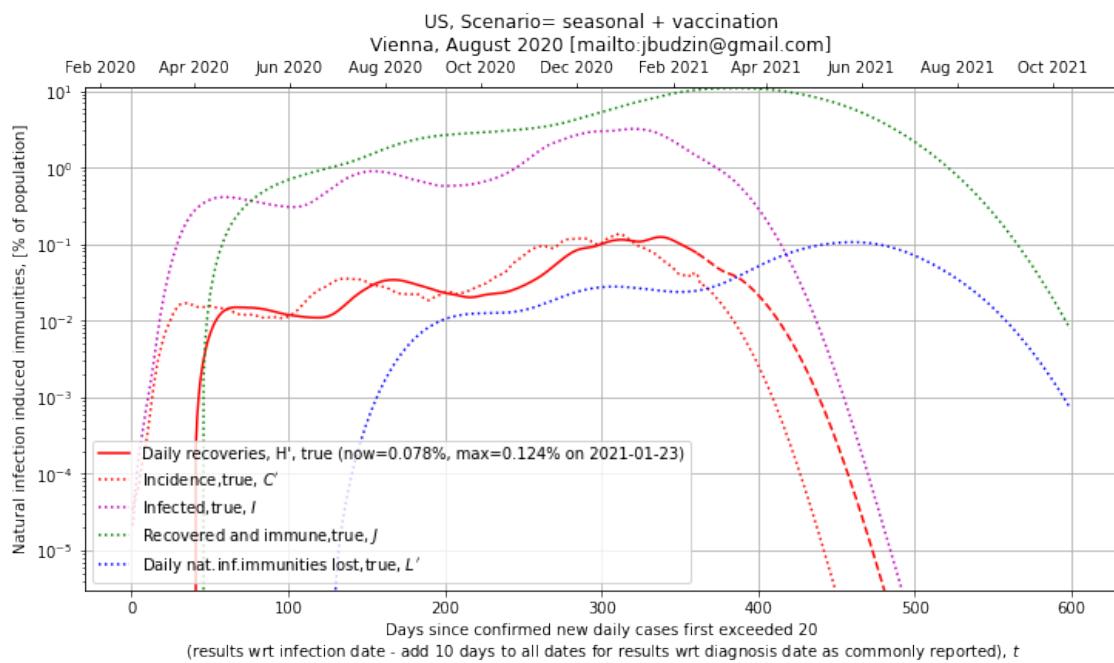
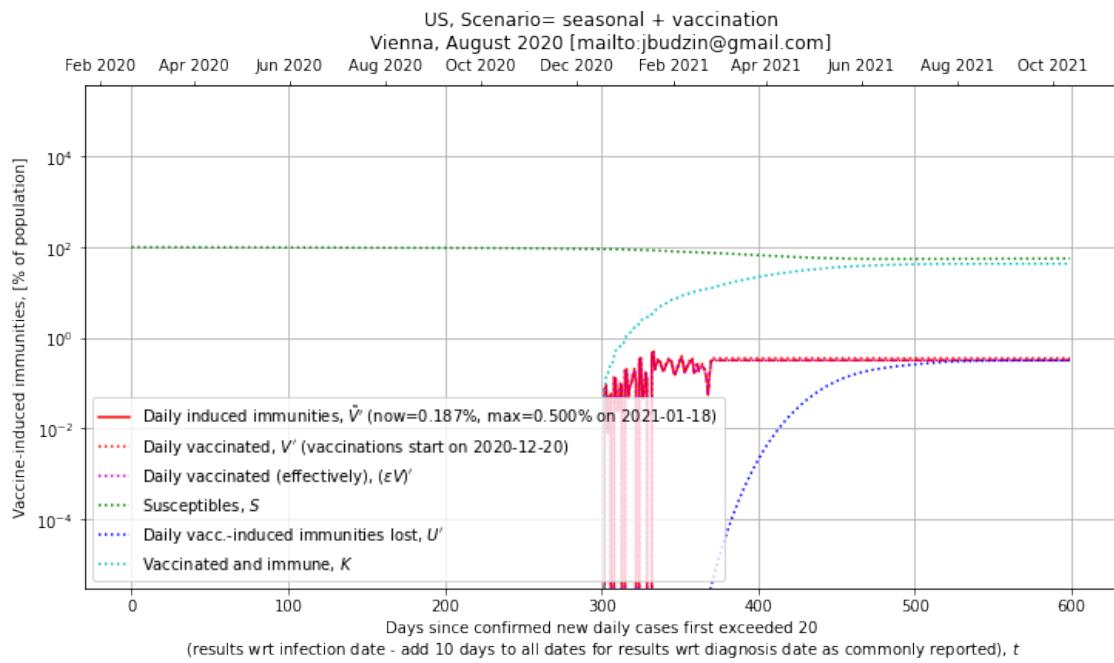
Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

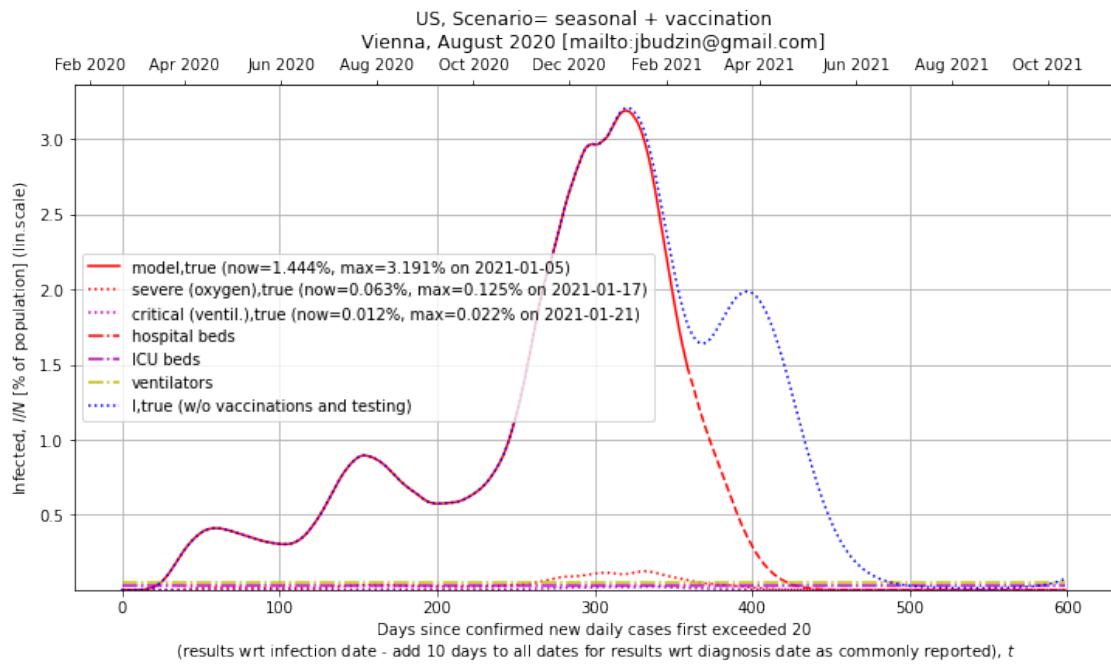
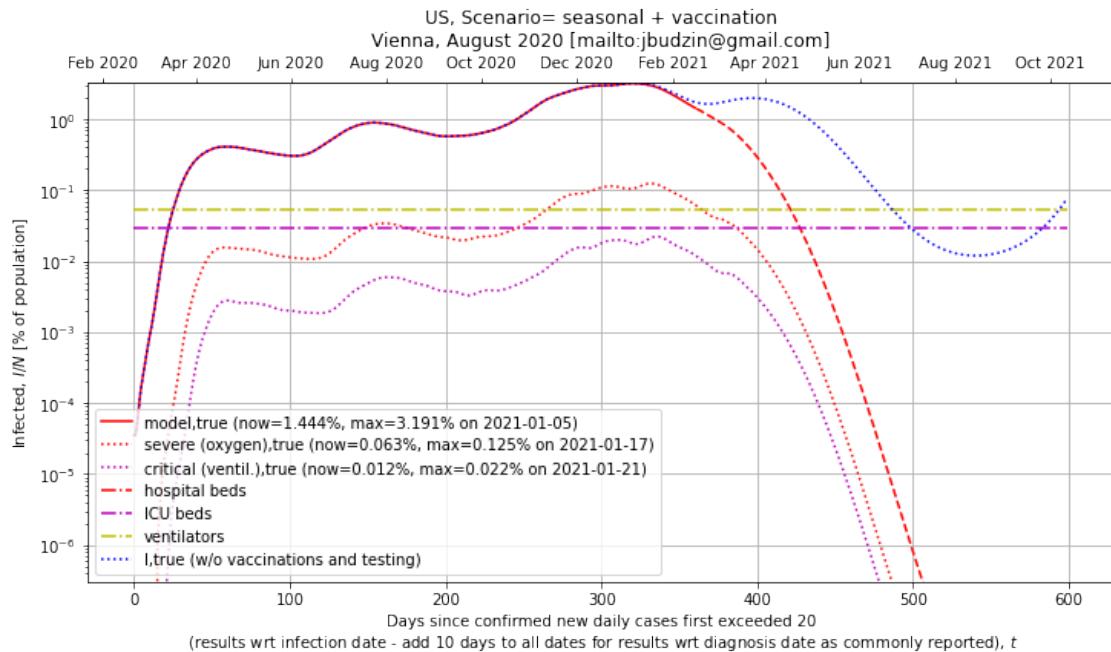


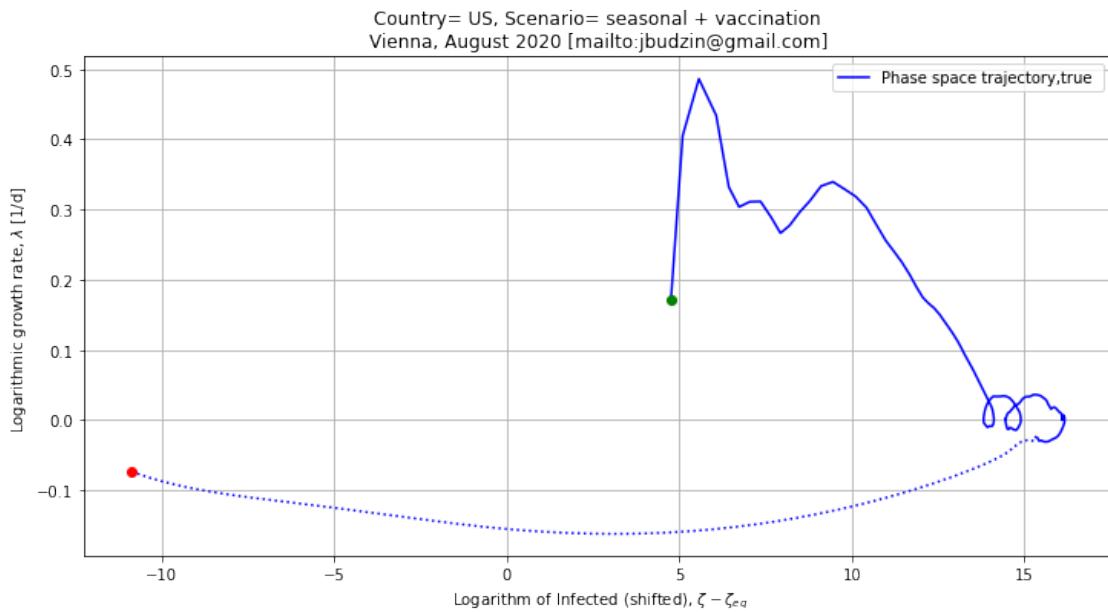
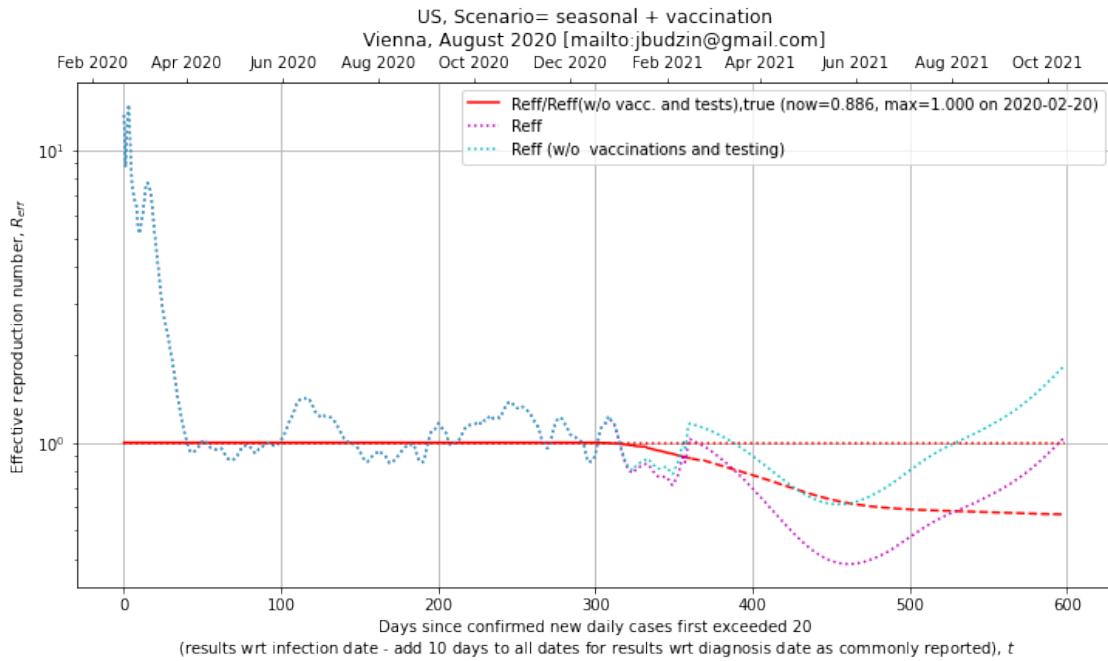
1.8.6 VACC_RATE = 1.30 [fraction of popul. per year]

`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in `model`: True True True True
`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in `model`: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 130.053









Avg. frequency [1/d] = 0.0 / Avg. T [d] = 0

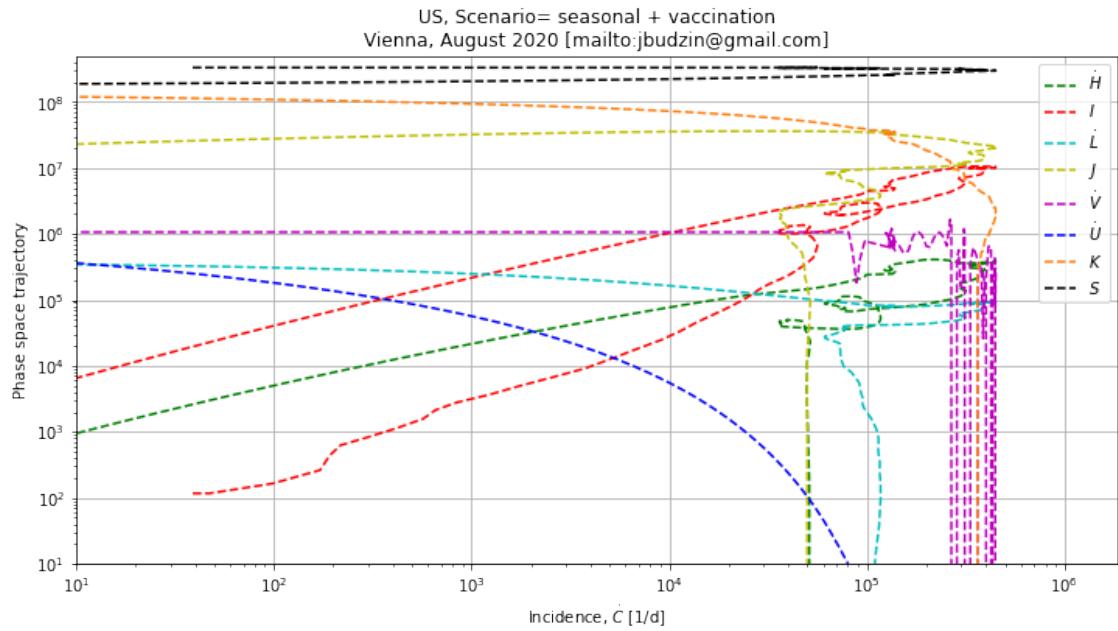
Avg. infection prevalence = 4.93e+05 / Perc of pop= 0.149

Avg. freq. of peaks above capacity threshold [1/d] = 0.000e+00 / Avg. T [d] = 0

Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0

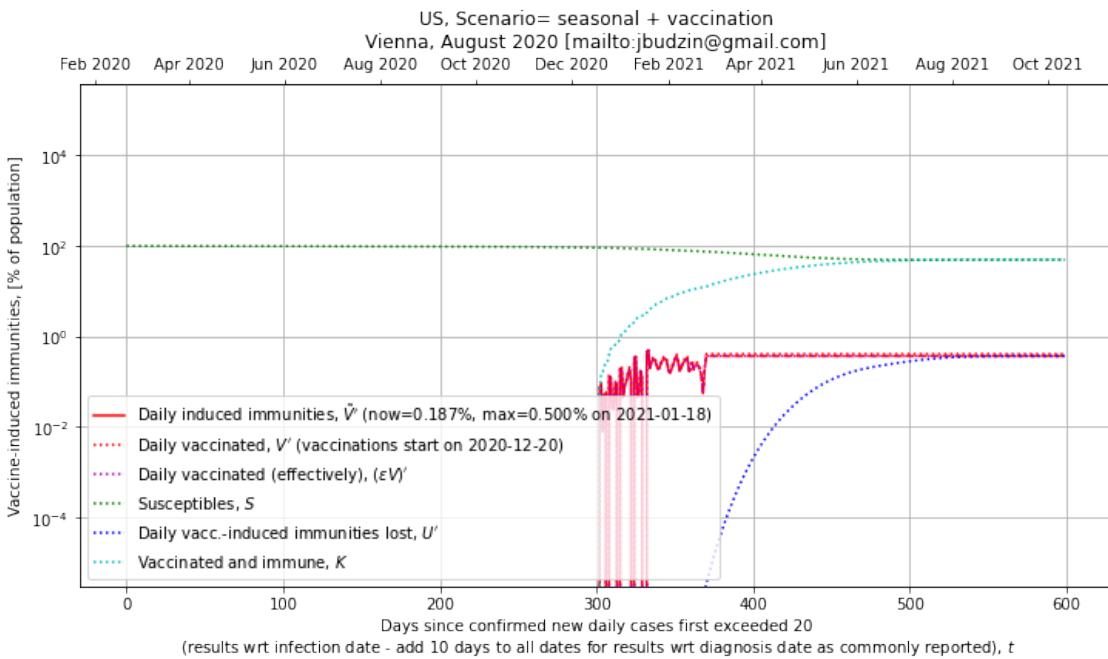
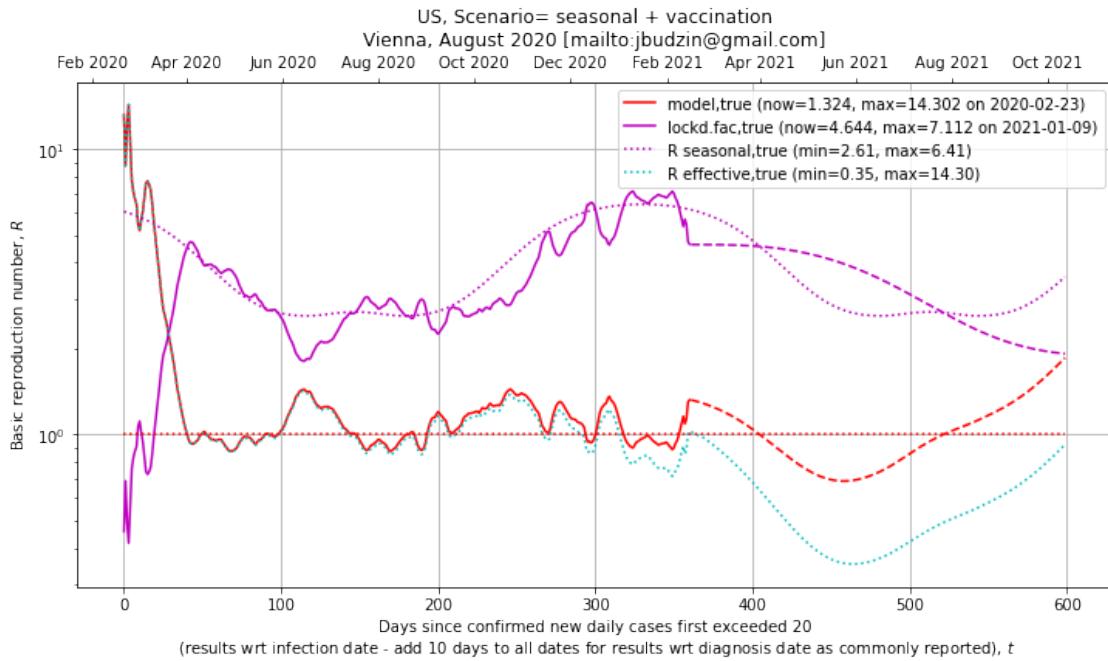
Time constant in Lyapunov function (data) [d] = 148.076
 Time constant in Lyapunov function (proj) [d] = 98.067

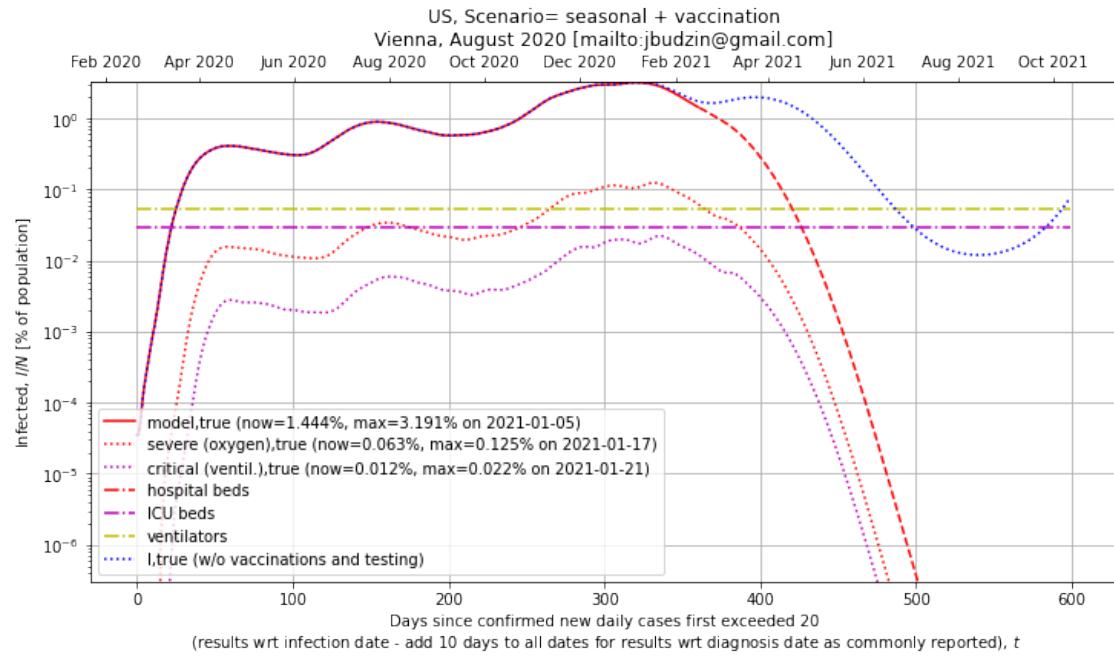
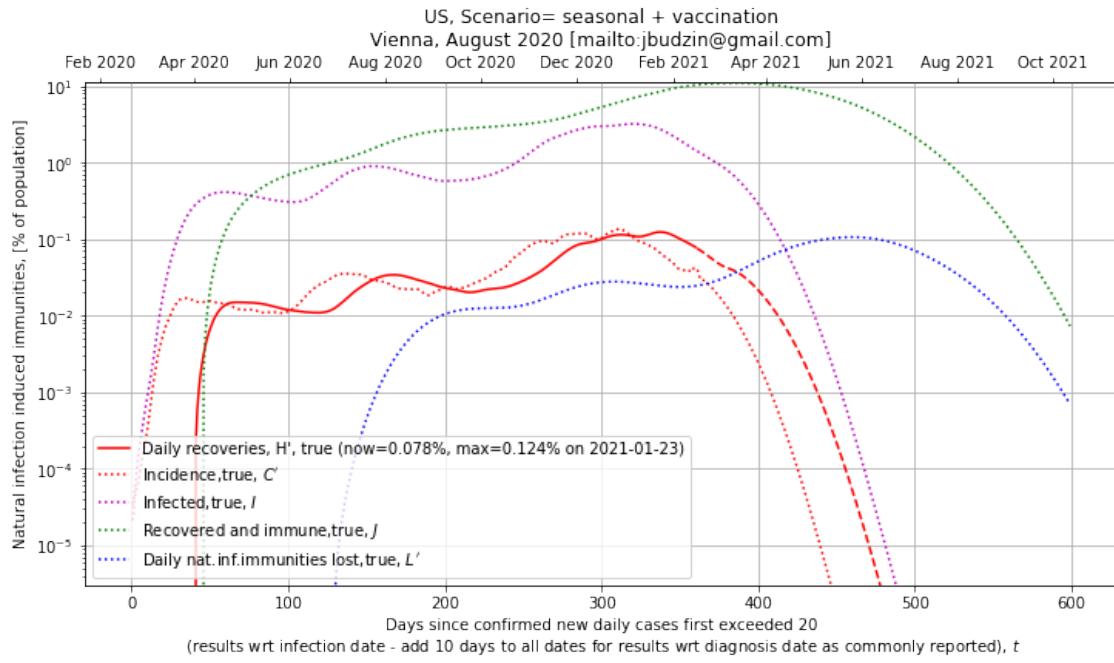
Approx. vaccination cost per year (projection) [EUR MLN] = 5721.61
 Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

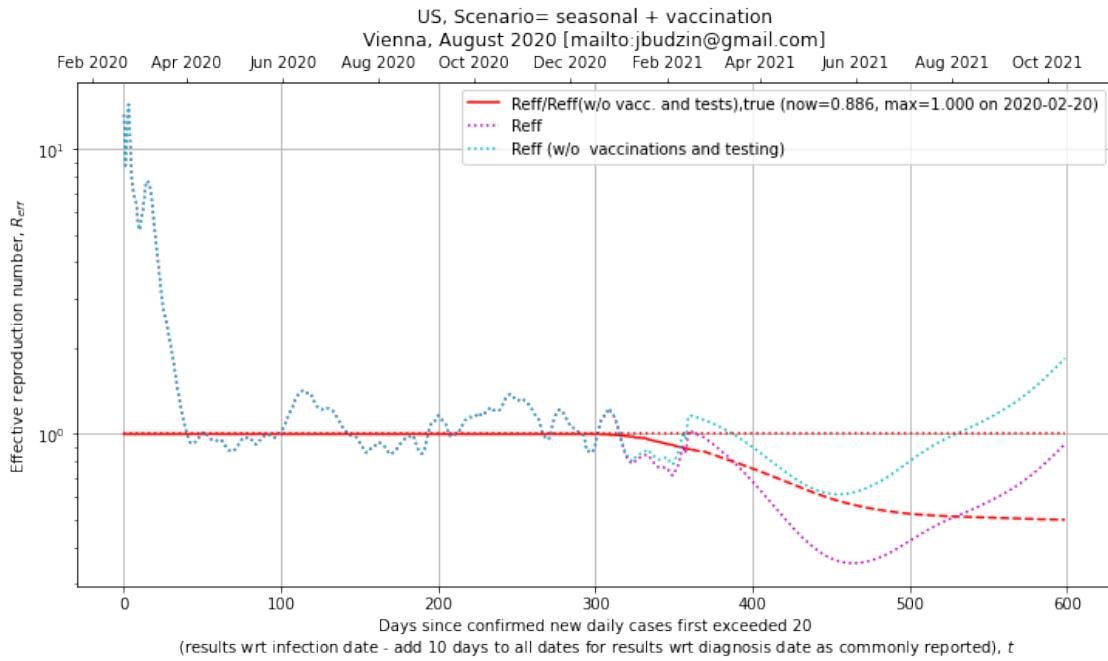
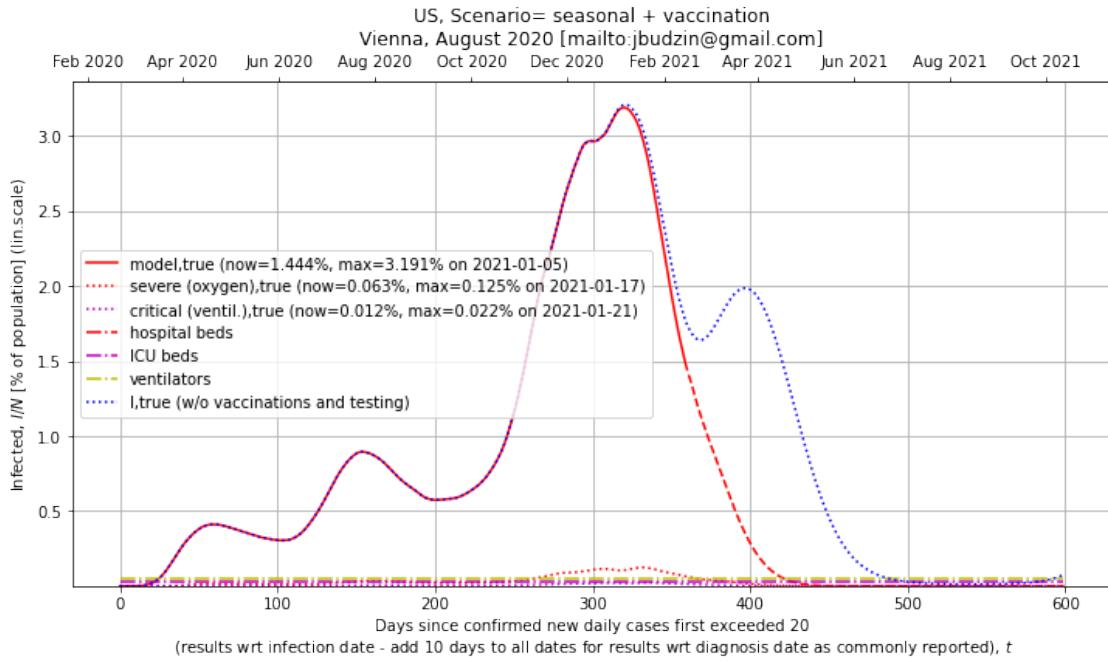


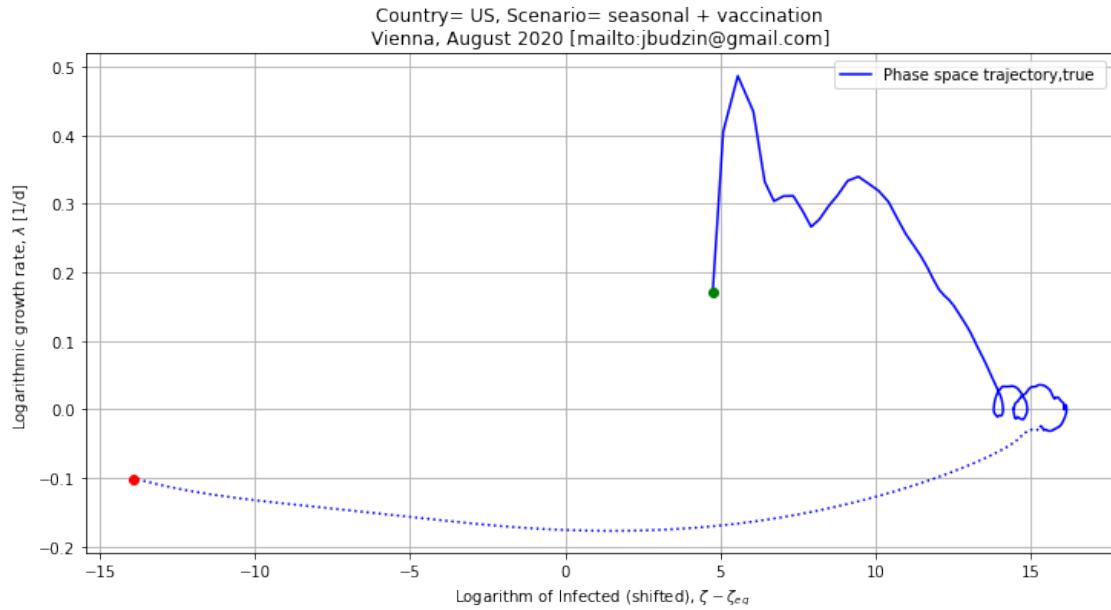
1.8.7 VACC_RATE = 1.50 [fraction of popul. per year]

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062



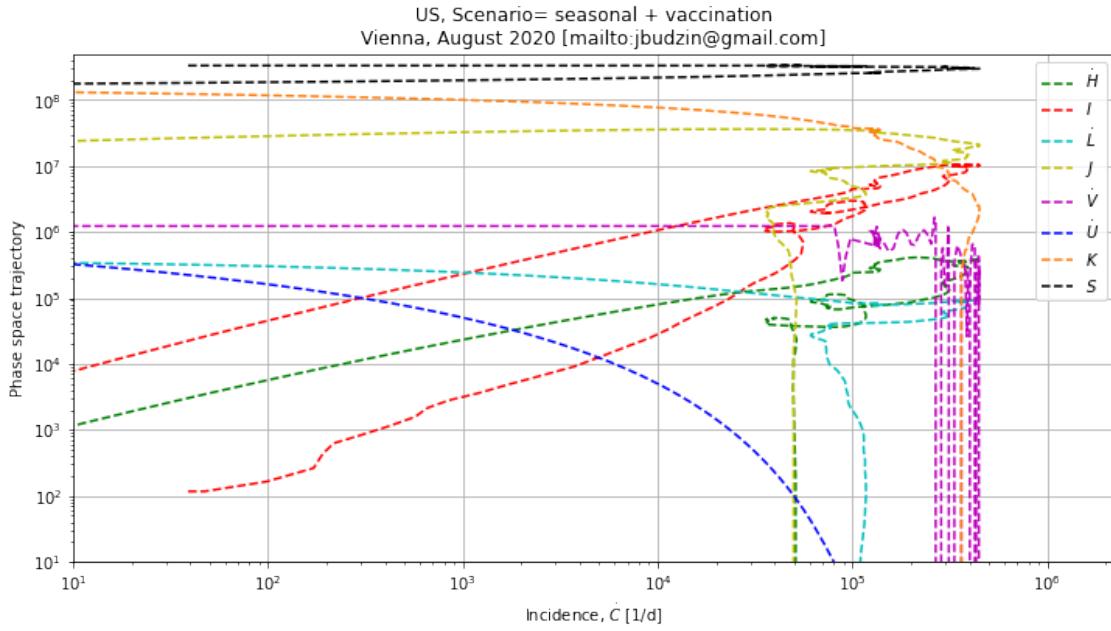






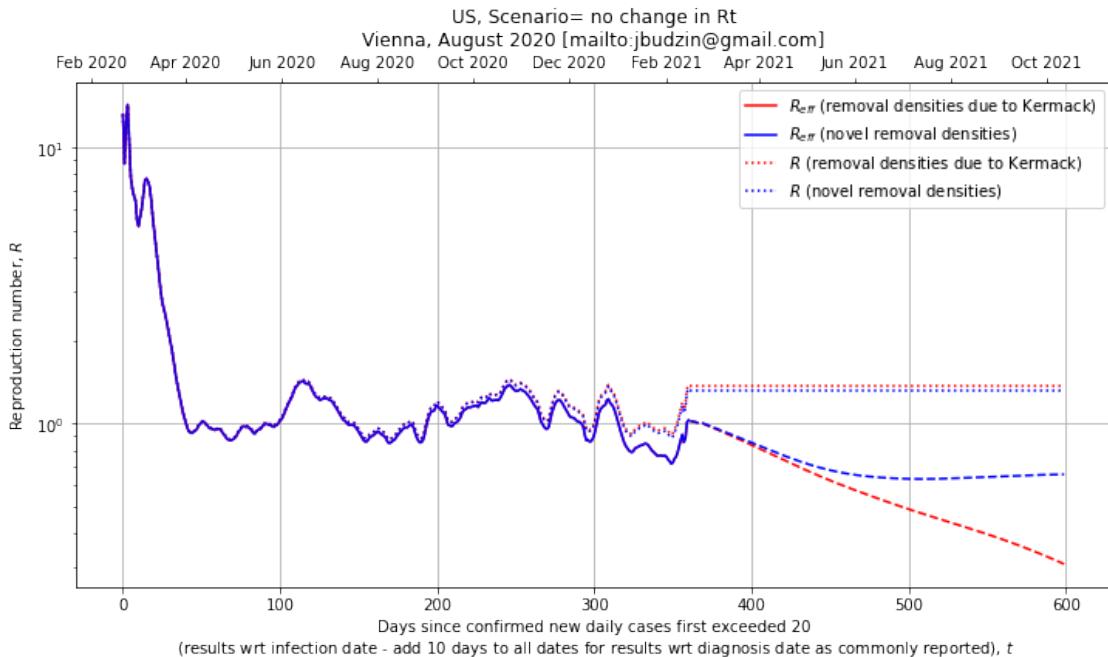
Avg. frequency [1/d]= 0.0 / Avg. T [d]= 0
Avg. infection prevalence = 4.90e+05 / Perc of pop= 0.148
Avg. freq. of peaks above capacity threshold [1/d]= 0.000e+00 / Avg. T [d]= 0
Avg. inf. prevalence above capacity threshold = 0.000e+00 / Perc of pop= 0.0
Time constant in Lyapunov function (data) [d]= 148.076
Time constant in Lyapunov function (proj) [d]= 99.704

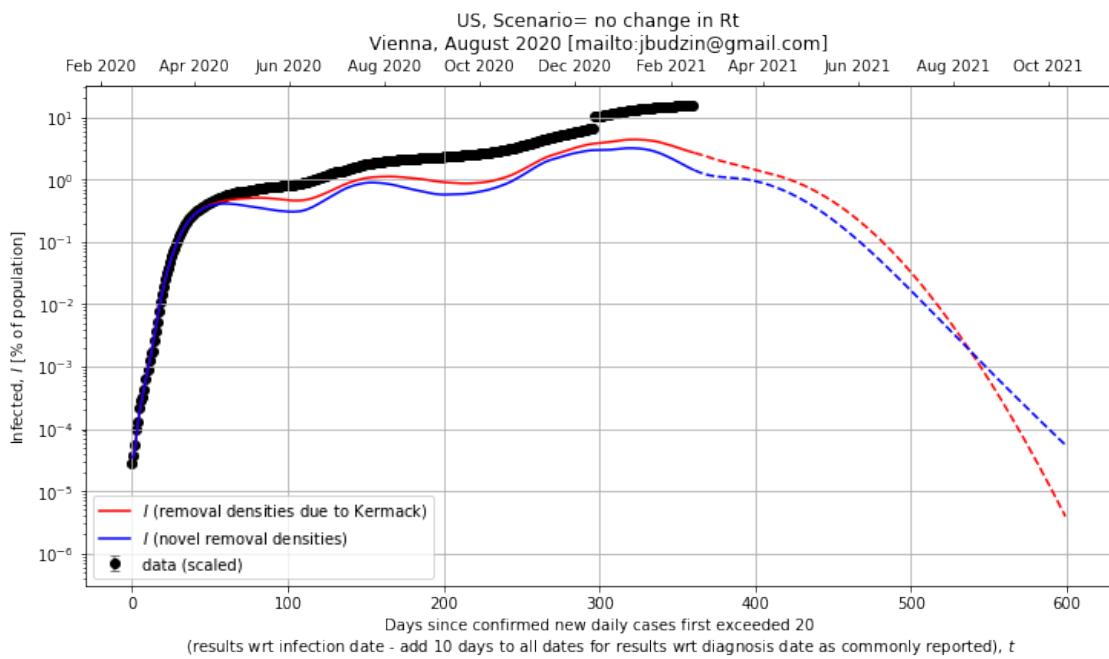
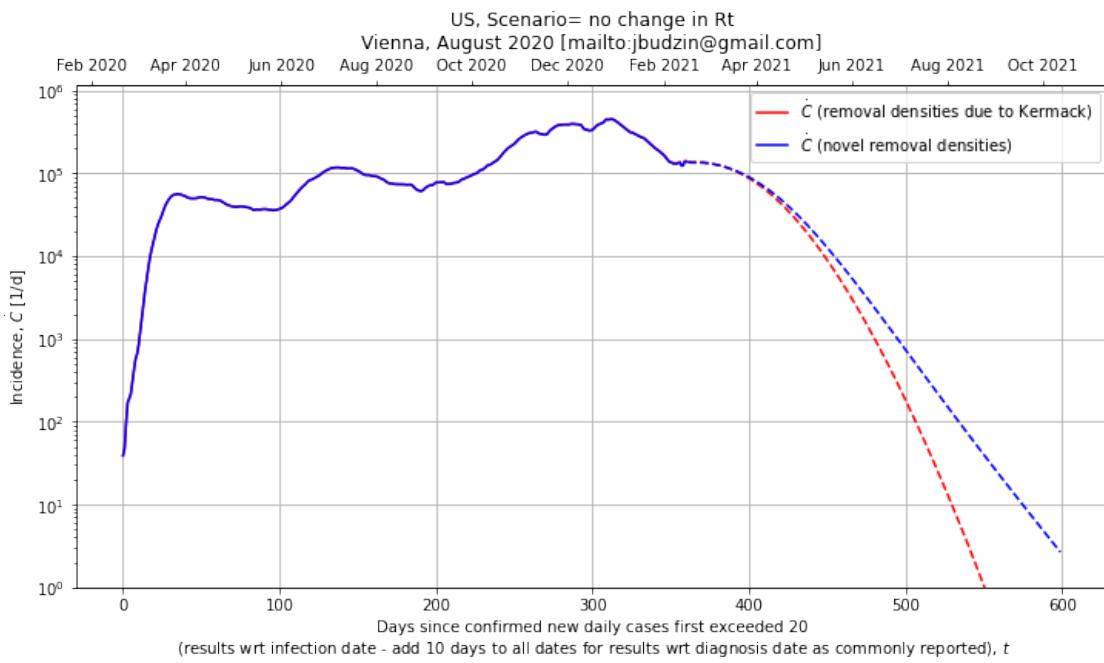
Approx. vaccination cost per year (projection) [EUR MLN] = 6582.01
Approx. cost of minors' everyday antigen testing per year [EUR MLN] = 120865.62

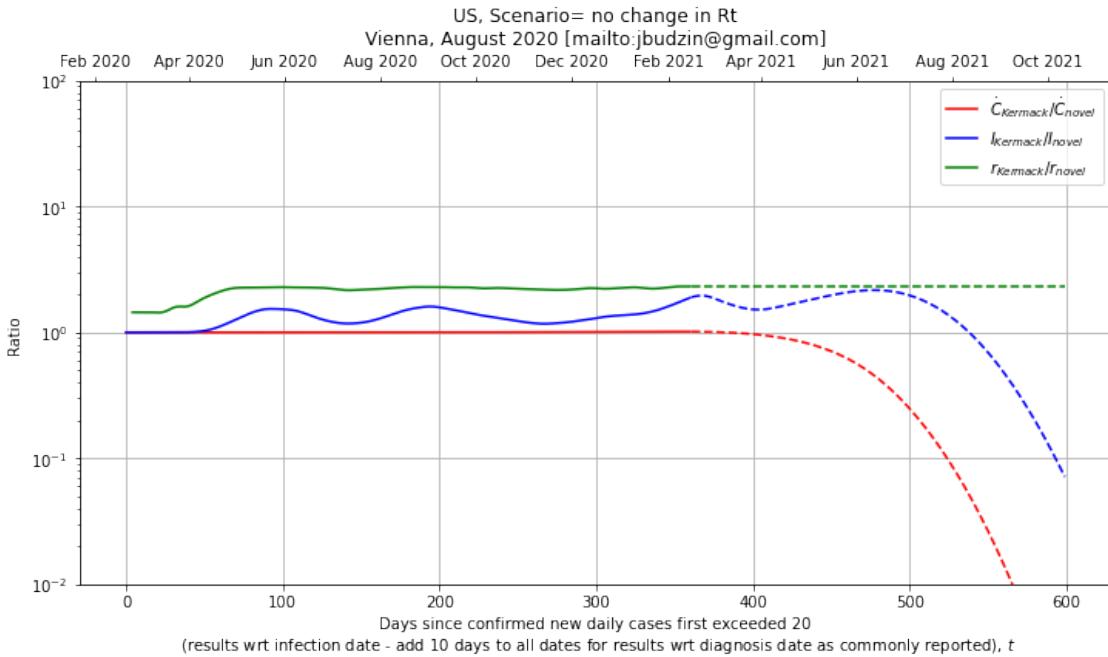
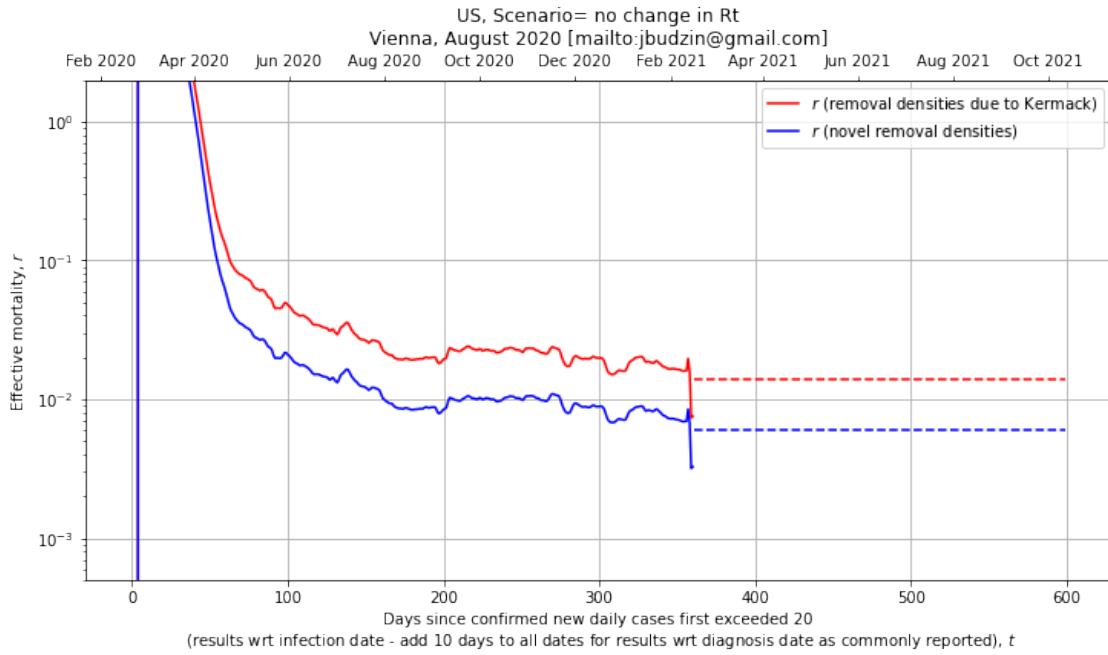


1.9 REMOVAL DENSITIES

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: True True True True
 Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 150.062



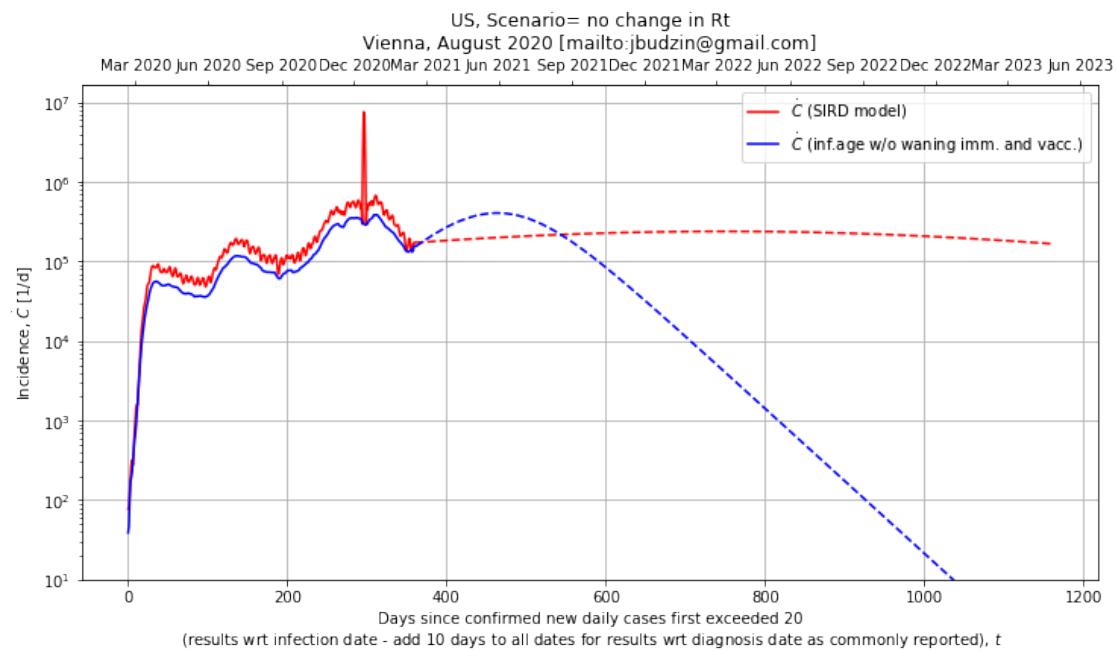
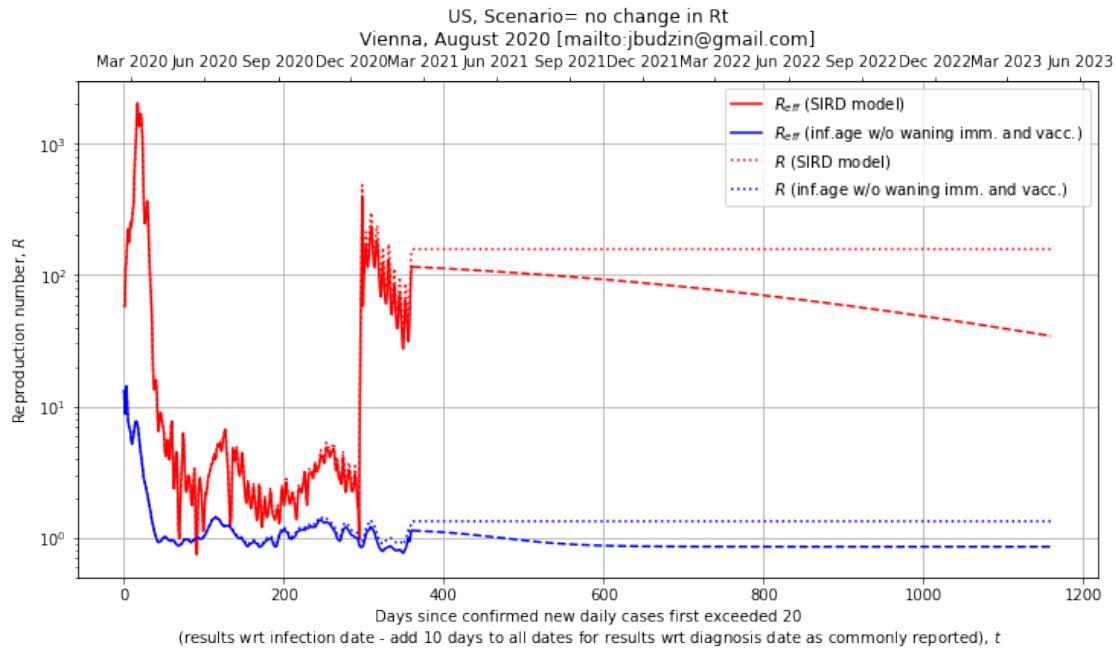


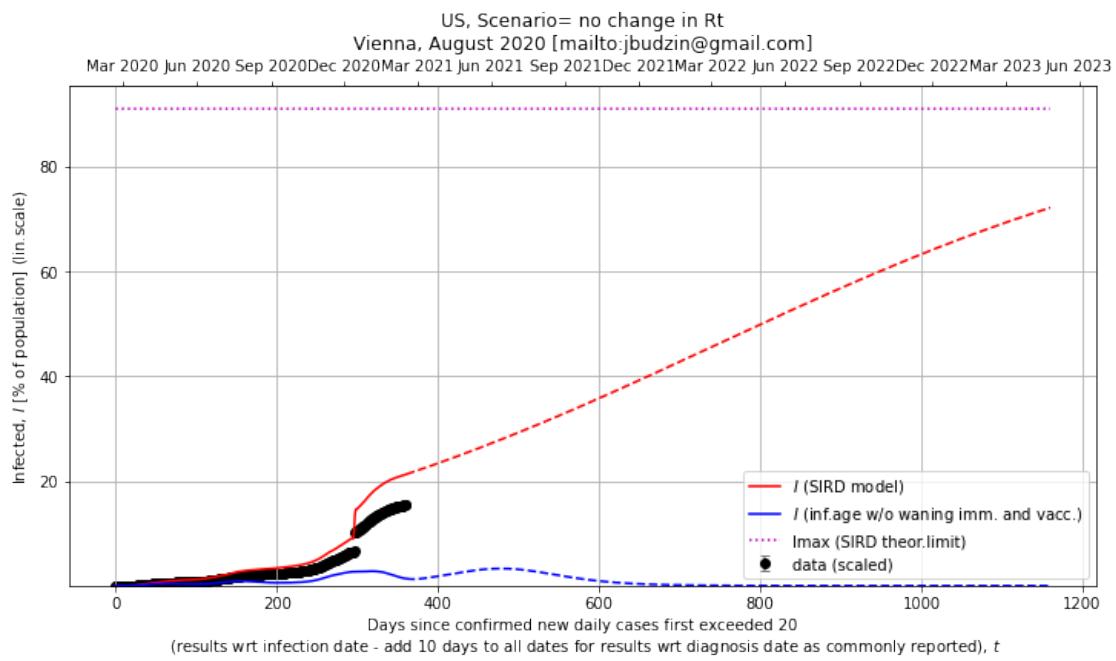
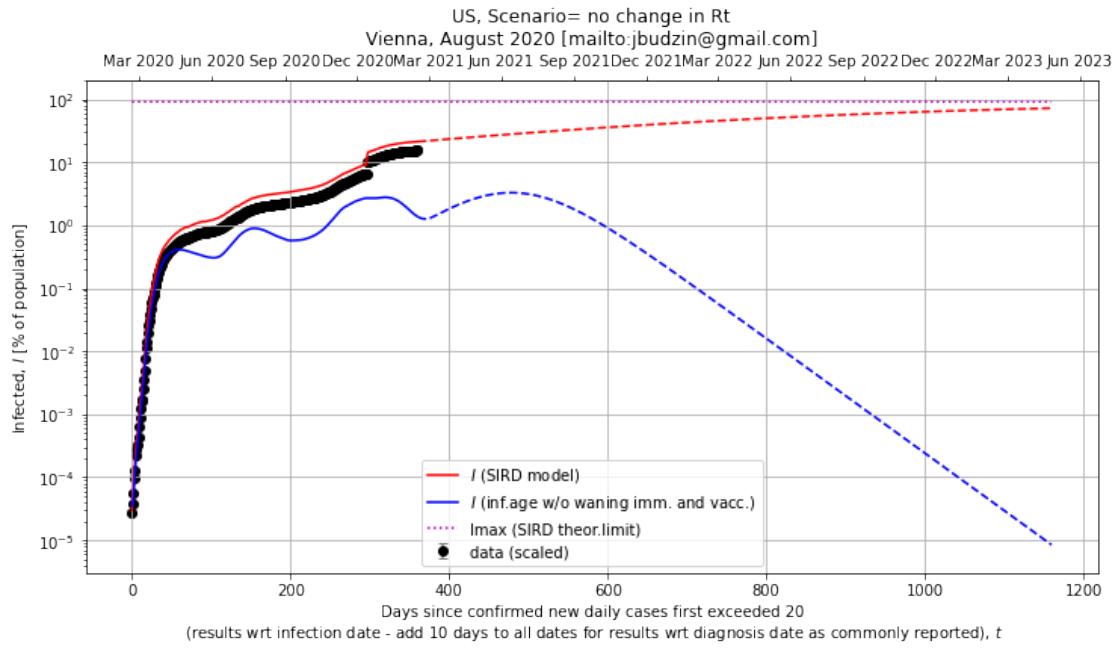


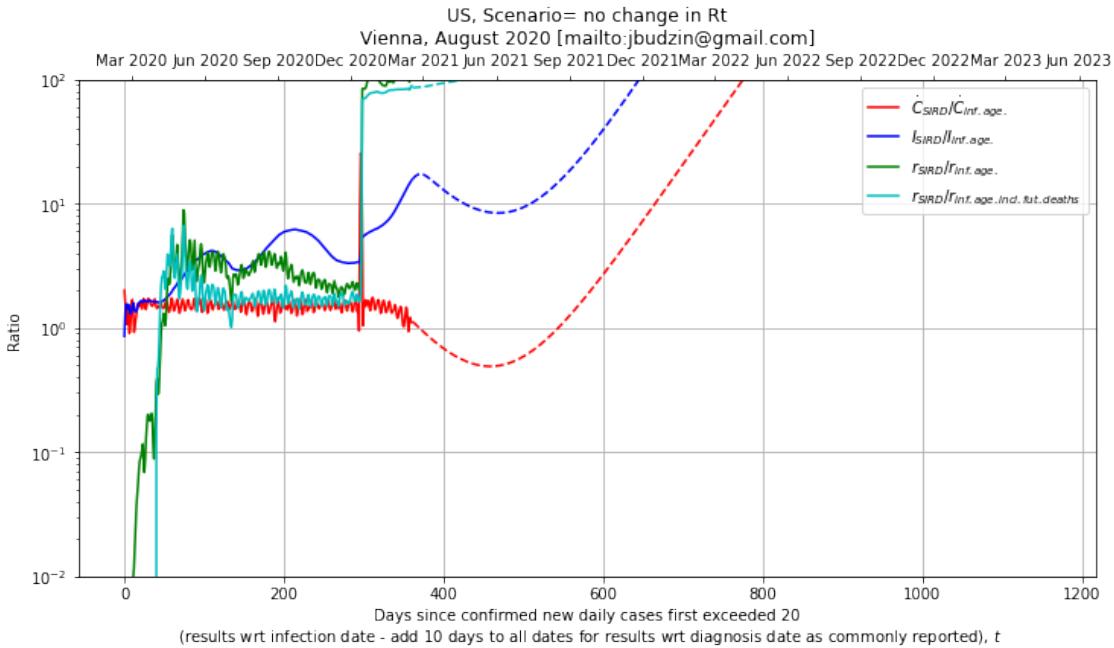
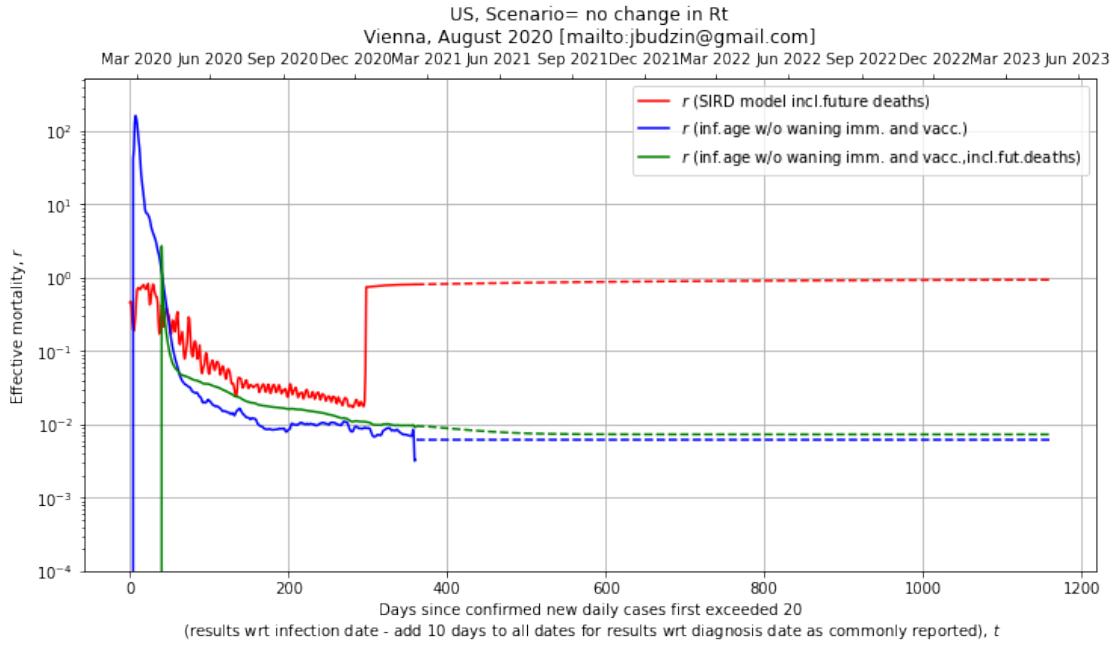
1.10 INFECTION AGE

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False False True True
True

Current vaccination rate [perc. of popul. per year] = 77.565
 Projection vaccination rate [perc. of popul. per year] = 0.000



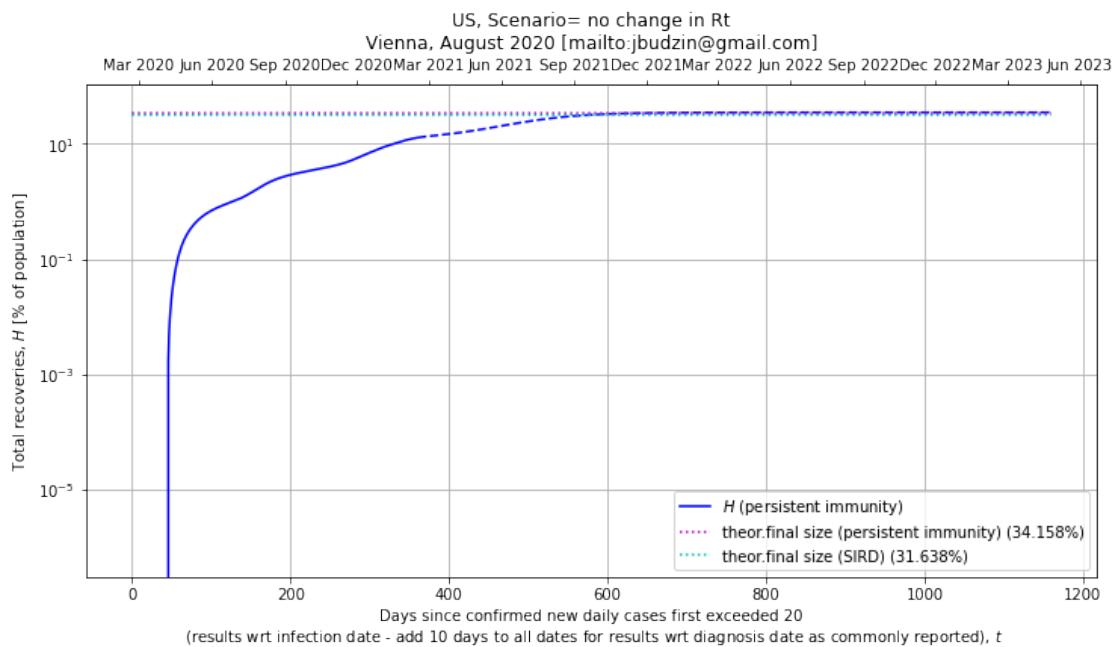
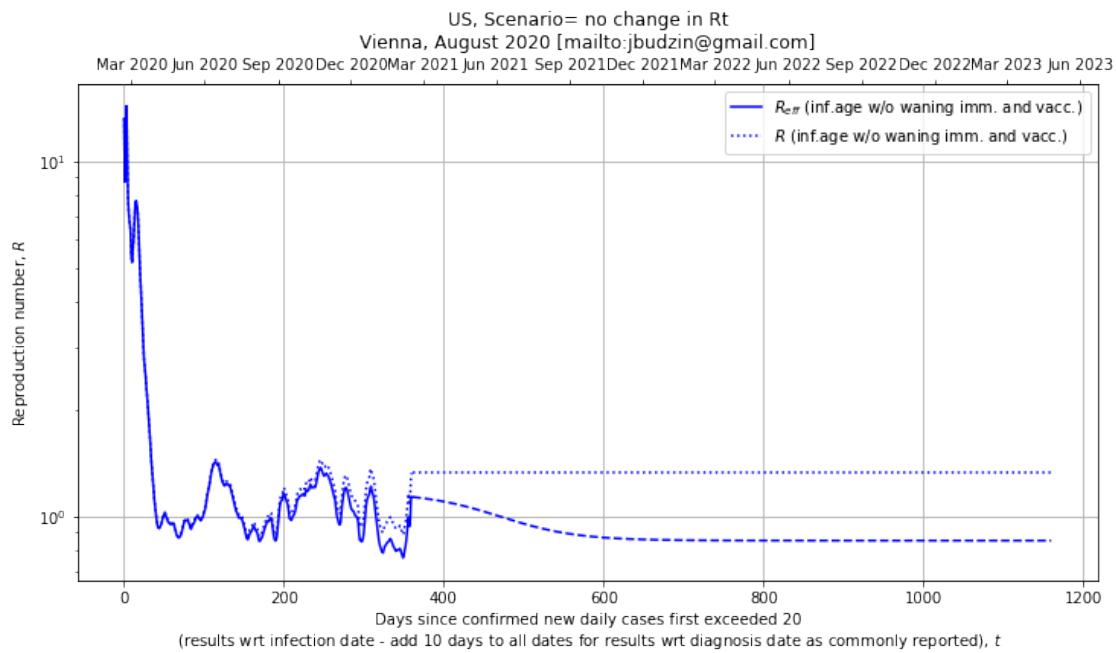


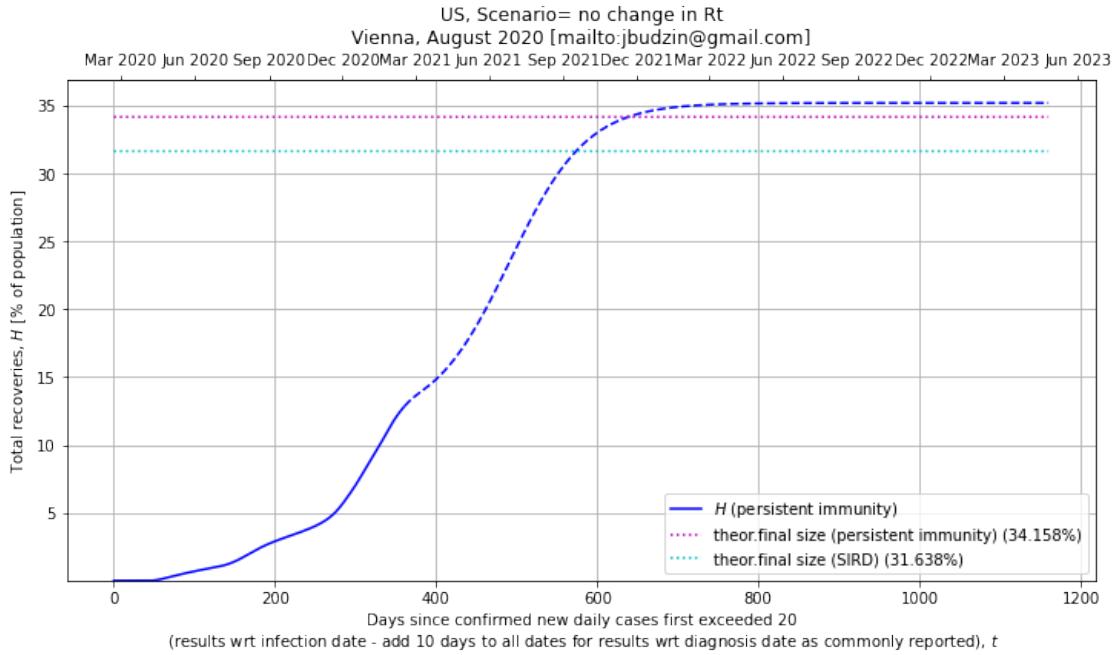


1.11 VALIDITY

V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj in model: False False True True
 Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 0.000





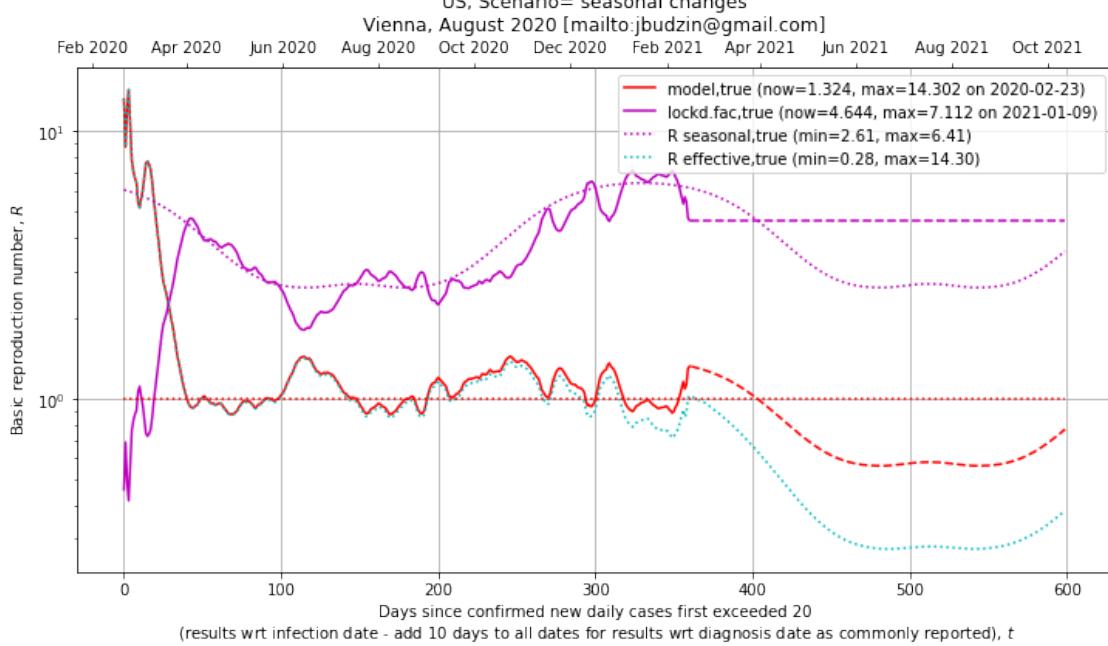
1.11.1 MODEL CHECKS

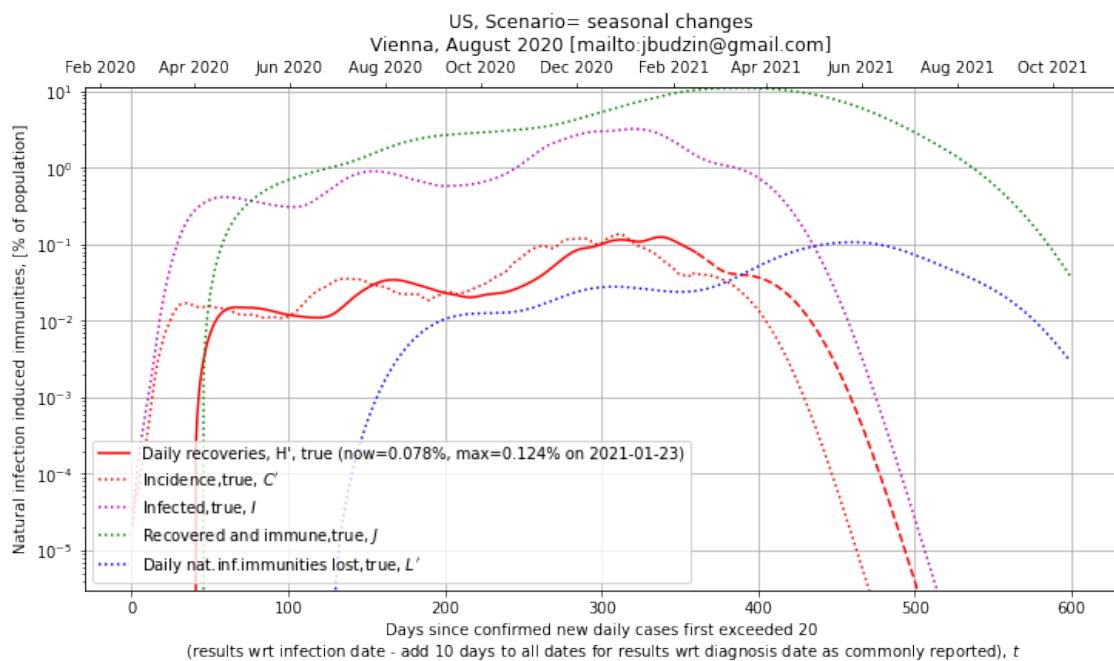
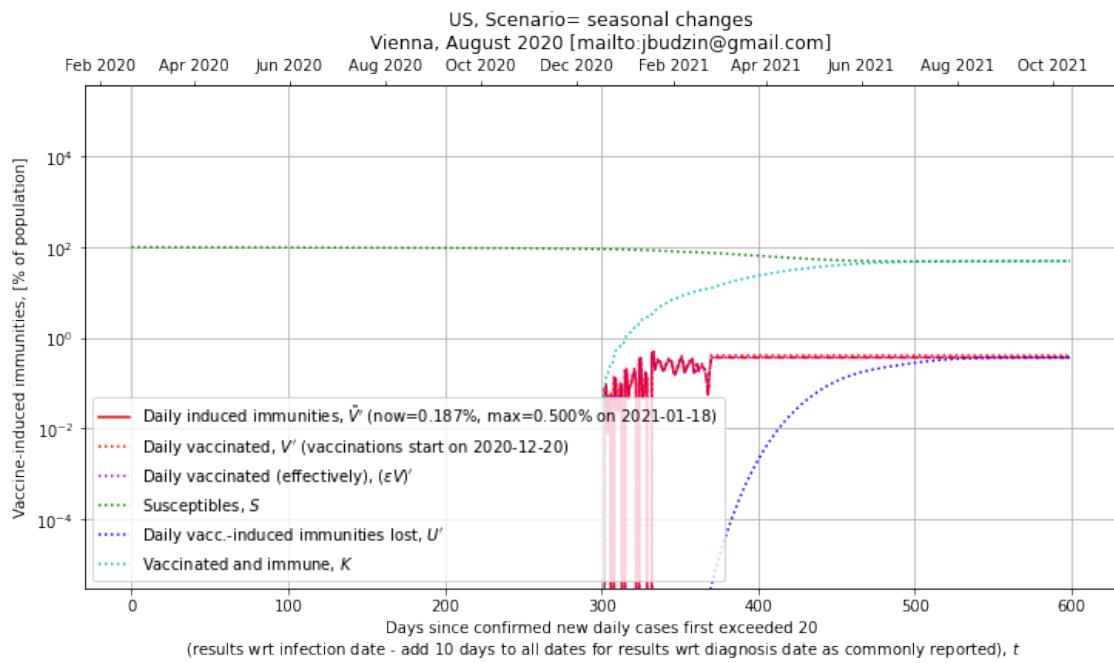
`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in `model`: True True True True

`V_in_dyn, L_in_dyn, NoL_NoV, V_in_proj` in `model`: True True True True

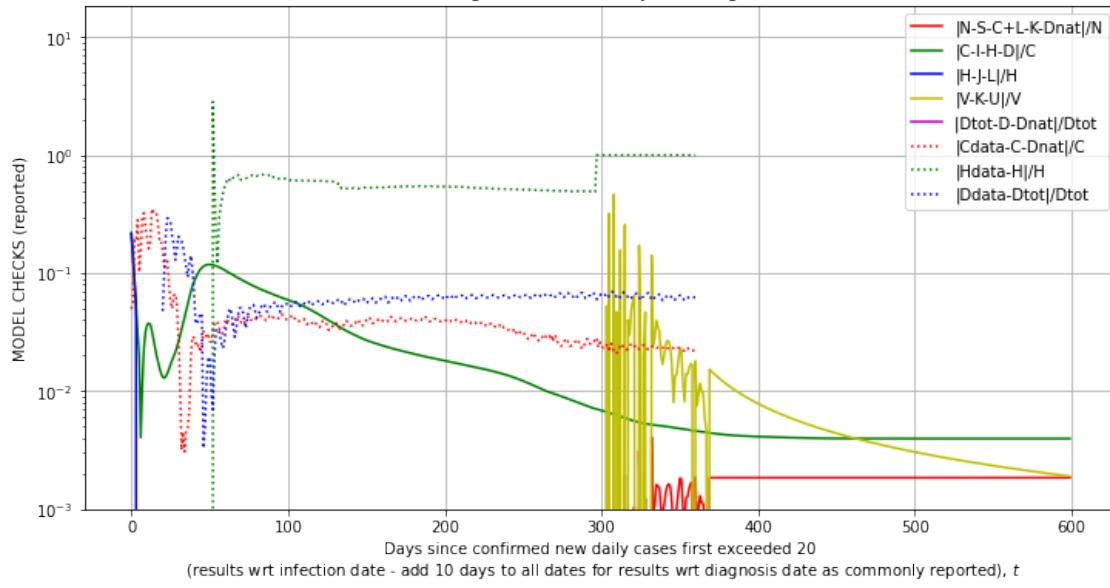
Current vaccination rate [perc. of popul. per year] = 77.565

Projection vaccination rate [perc. of popul. per year] = 150.062

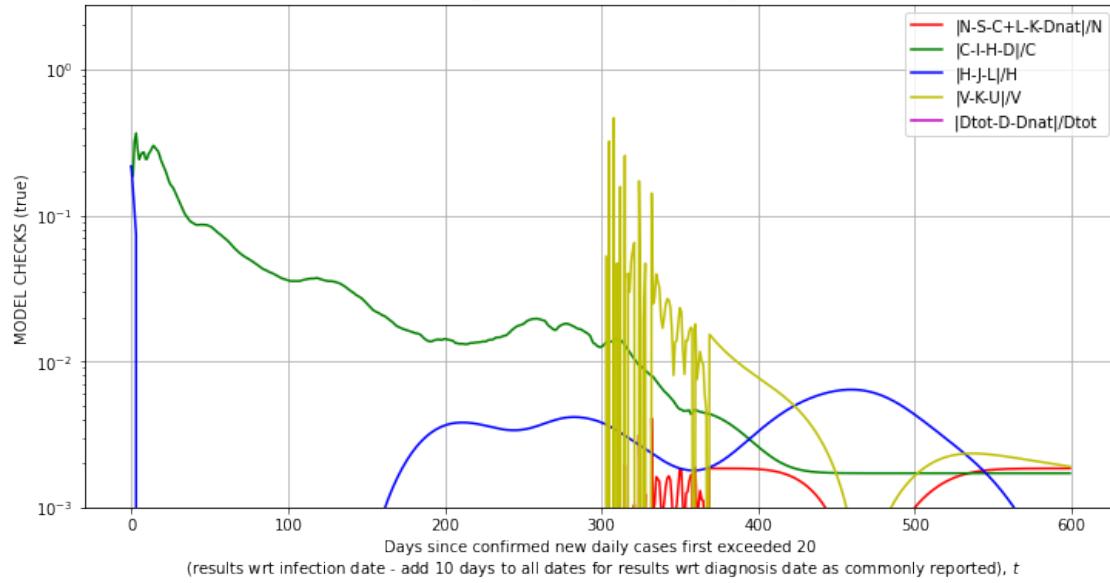




US, Scenario= seasonal changes
Vienna, August 2020 [mailto:jbudzin@gmail.com]



US, Scenario= seasonal changes
Vienna, August 2020 [mailto:jbudzin@gmail.com]



1.12 SENSITIVITY

2 COUNTRY ANALYSIS: Israel

Data since 2020-03-02 to 2021-02-15 (351 days)

Scenario projections till 2021-10-22

Reference frame: infection date

Uncert.bands on plots of true cases denote (0.77, 1.30)*R

Population= 8655535

Natural mortality rate [per person per day]= 1.40e-05

Initial logarithmic growth rate [1/d]= 2.73e-01 +/- 5.78e-03

Initial incidence [1/d]= 4.08e+01 +/- 1.21e+00

Initially infected population= 1.71e+02 +/- 5.95e+00

Approx.date of first infection= 2020-02-13

Avg.duration of viral shedding=23.242 [d]

Avg.case duration=28.005 [d]

Avg.time to recovery=26.960 [d]

Avg.time to recovery (mild cases)=26.050 [d]

Avg.time to recovery (severe cases)=34.246 [d]

Avg.time to death=34.246 [d]

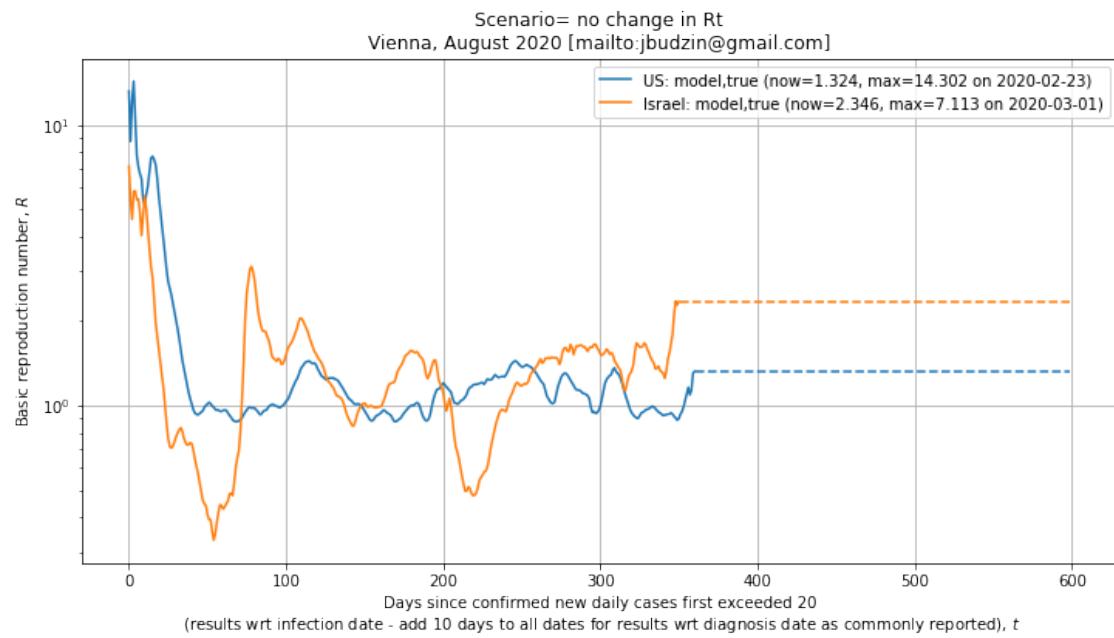
R0 (exp.model)=5.555

NOT INCLUDED

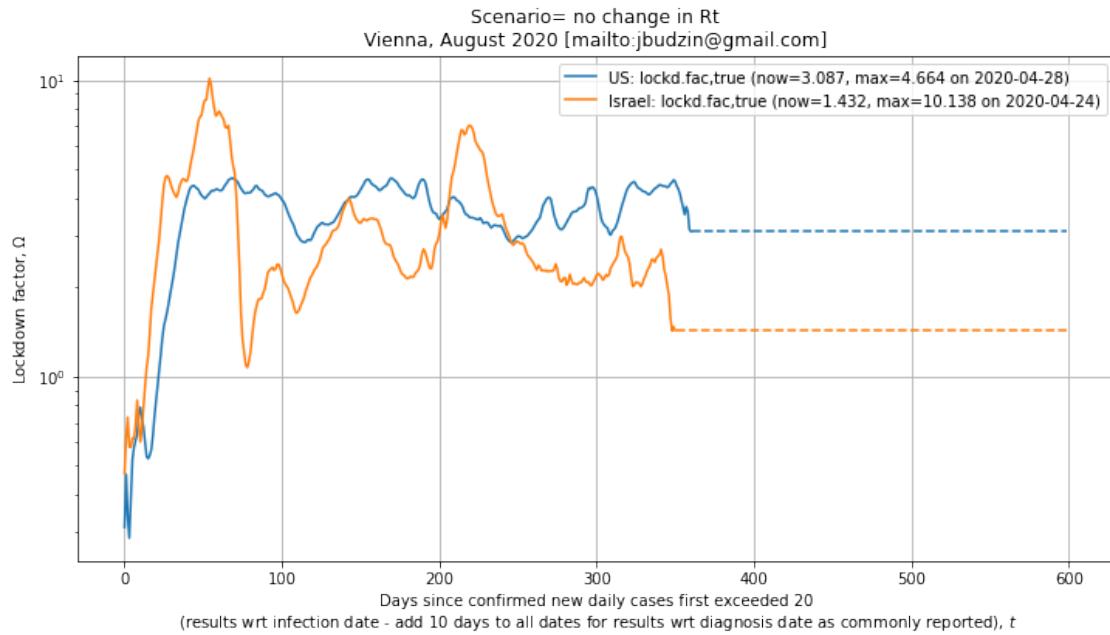
3 COUNTRY COMPARISONS

3.1 SCENARIO: no change in Rt

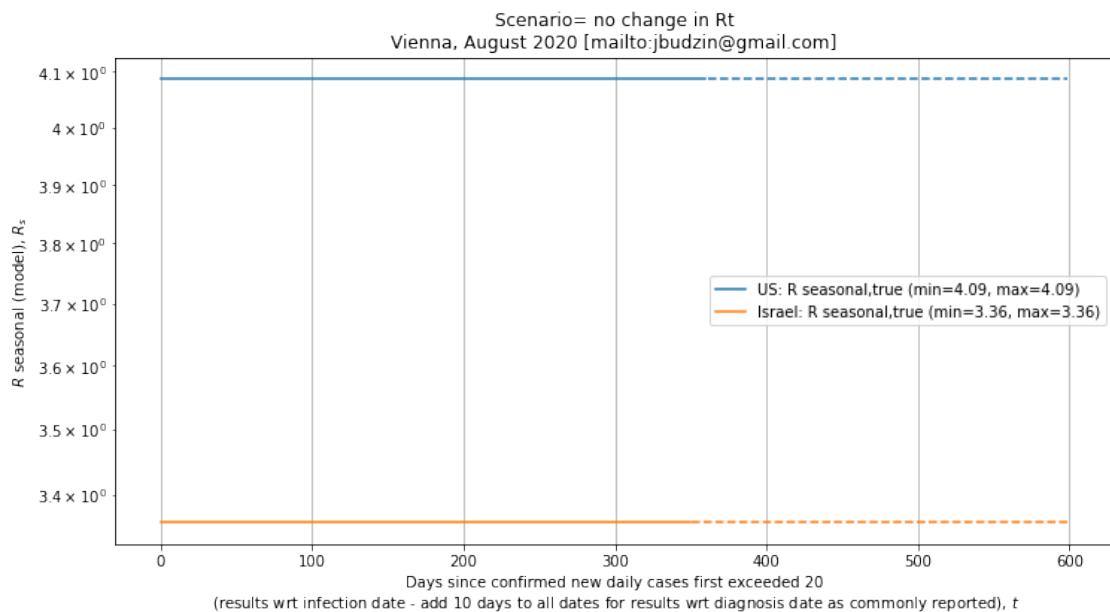
3.1.1 REPRODUCTION NUMBER



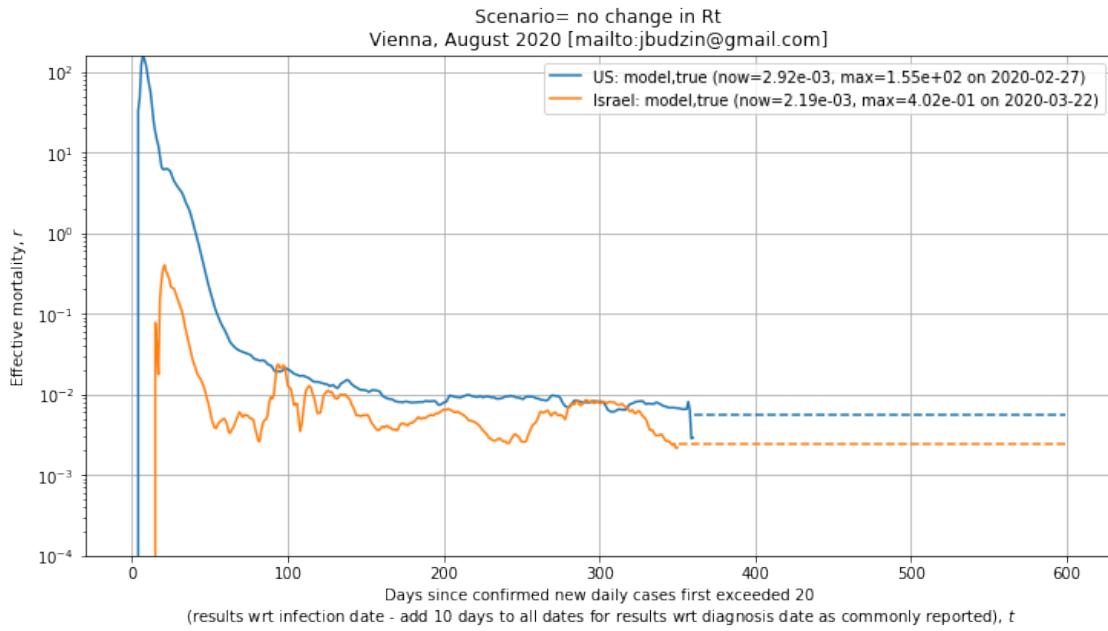
3.1.2 LOCKDOWN FACTOR



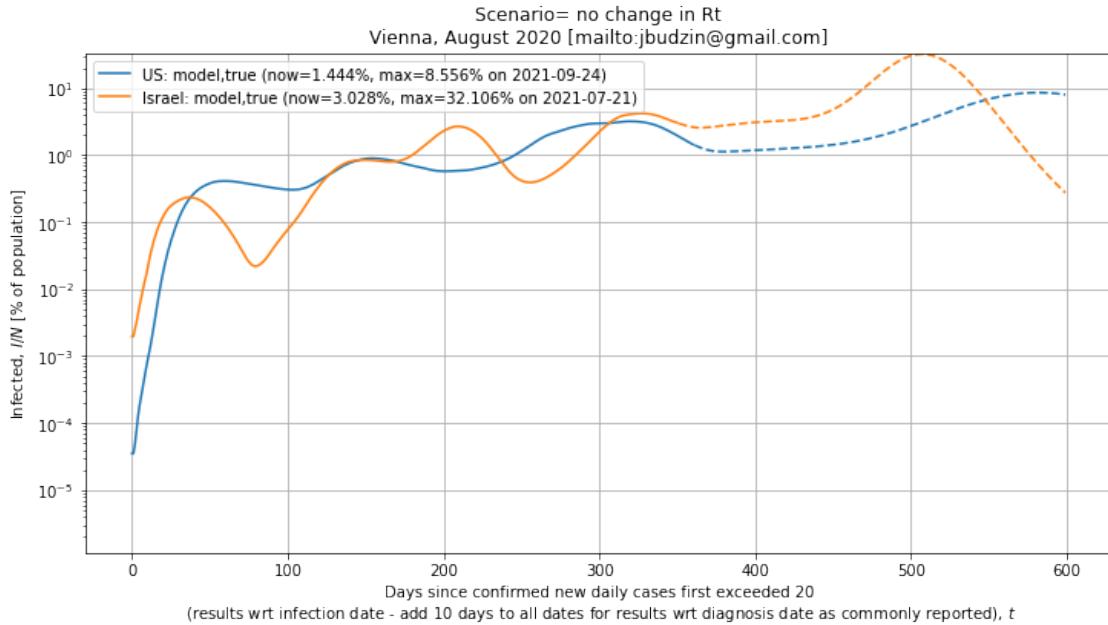
3.1.3 R SEASONAL

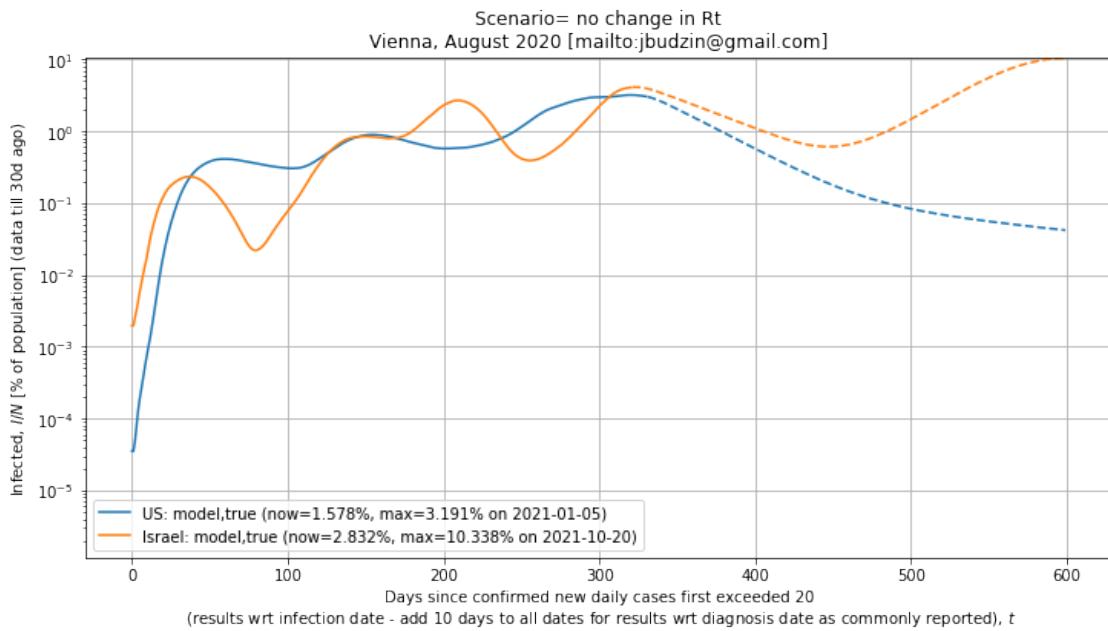
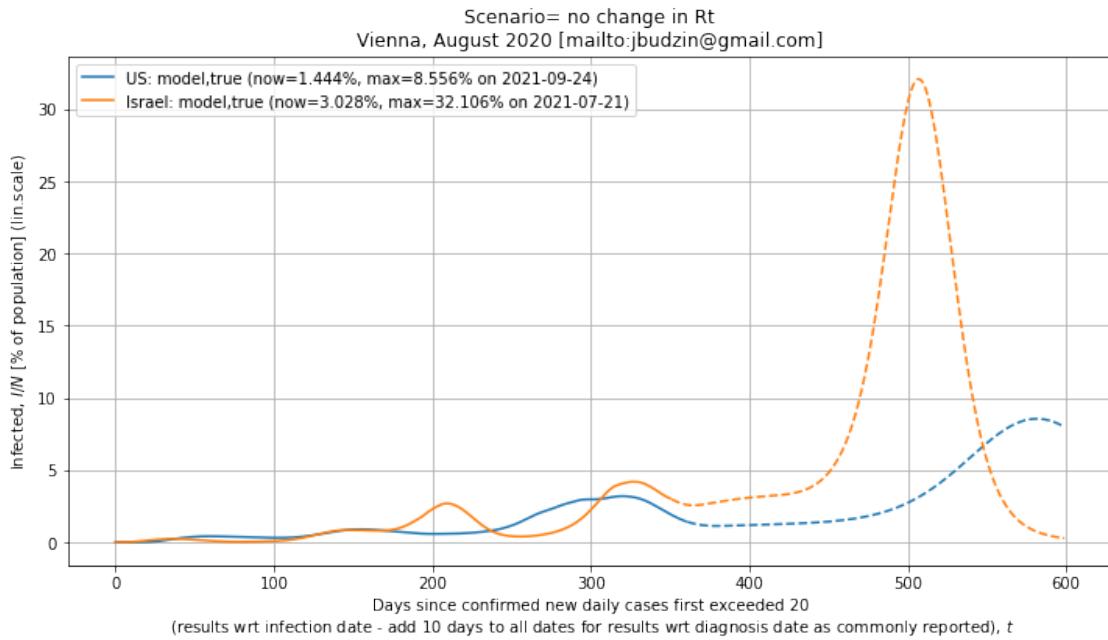


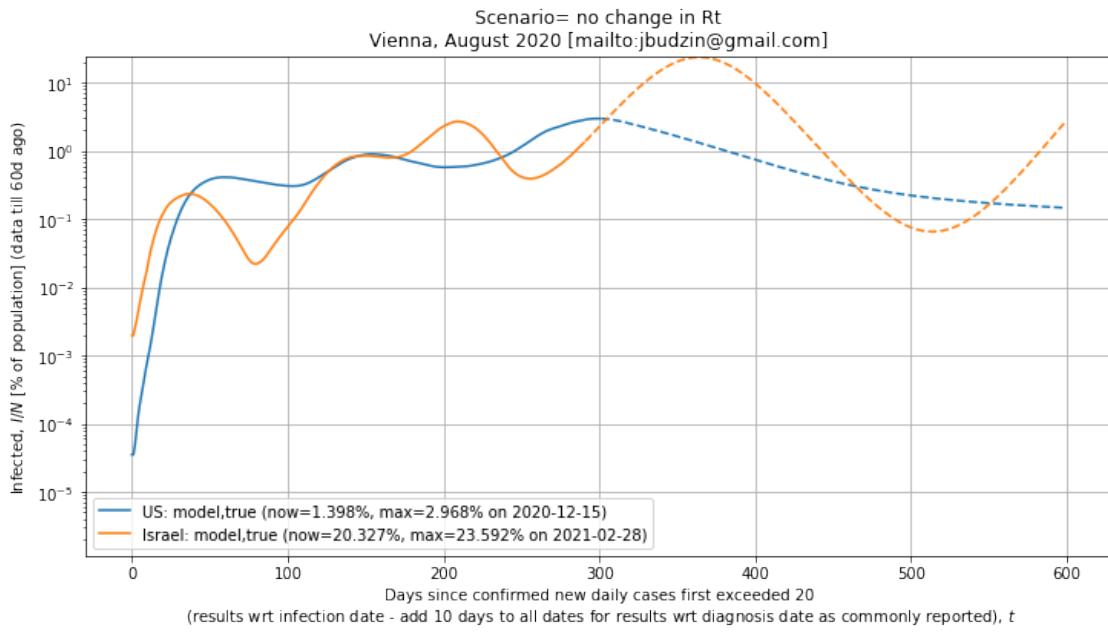
3.1.4 MORTALITY



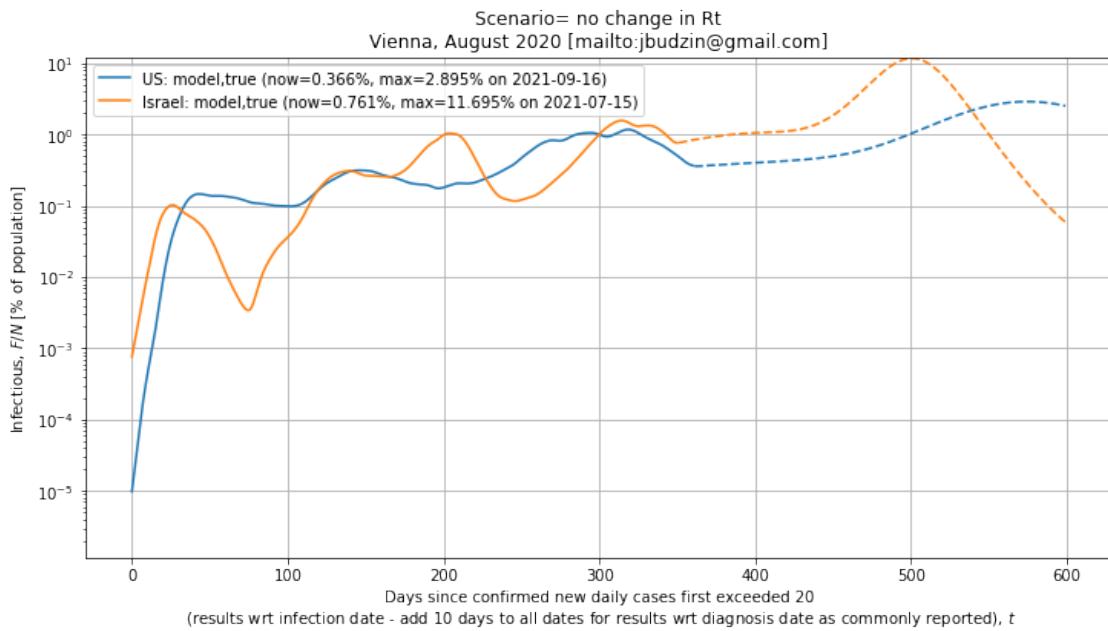
3.1.5 INFECTED



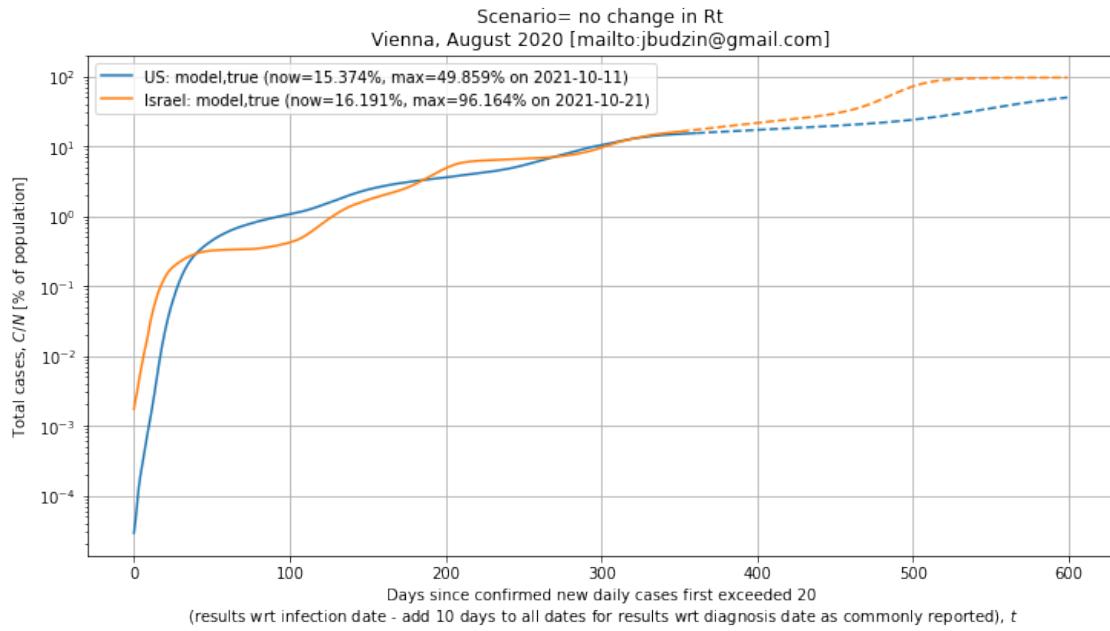




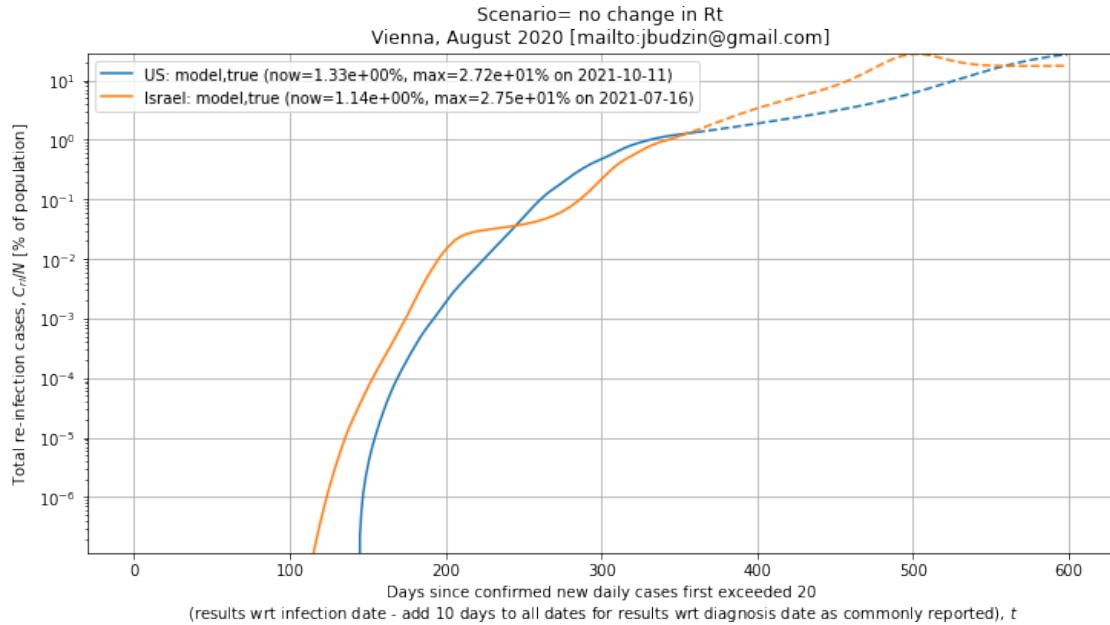
3.1.6 INFECTIOUS



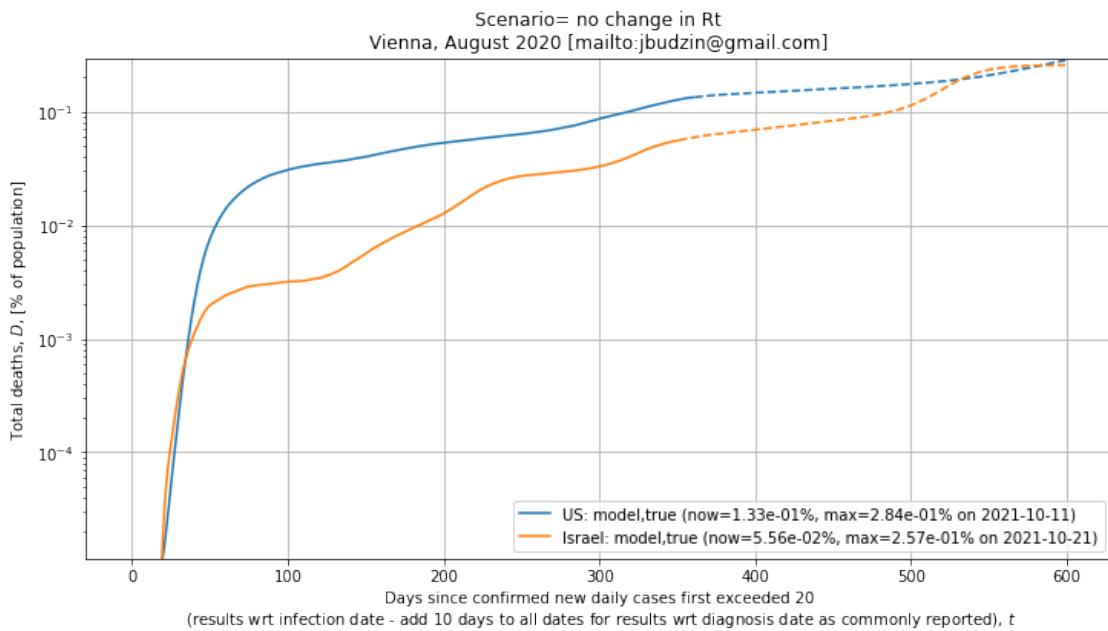
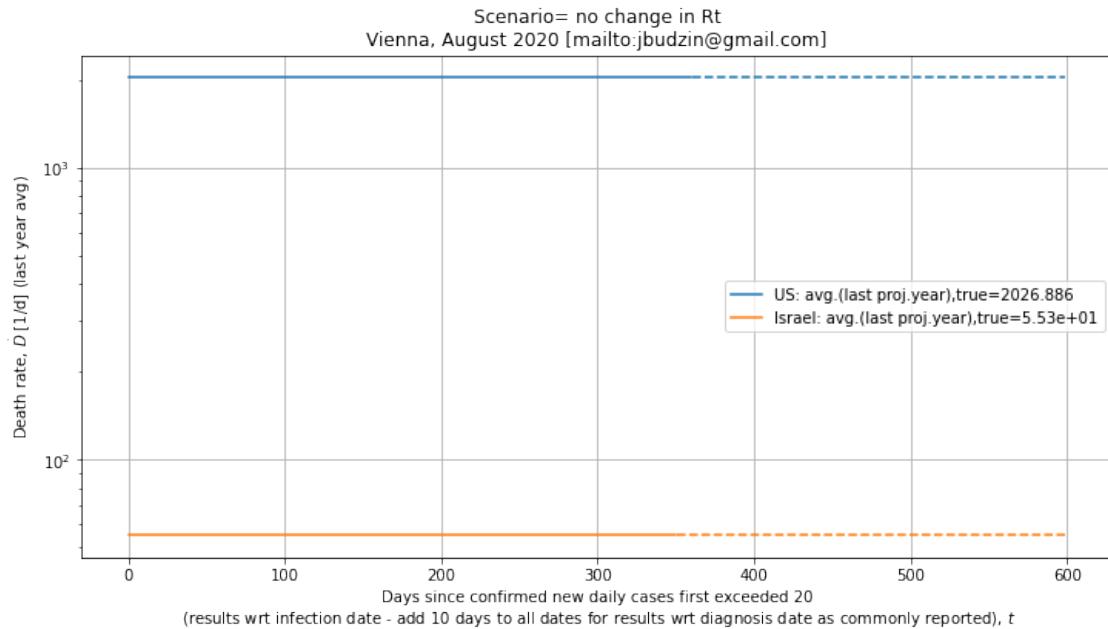
3.1.7 TOTAL CASES



3.1.8 REINFECTIONS

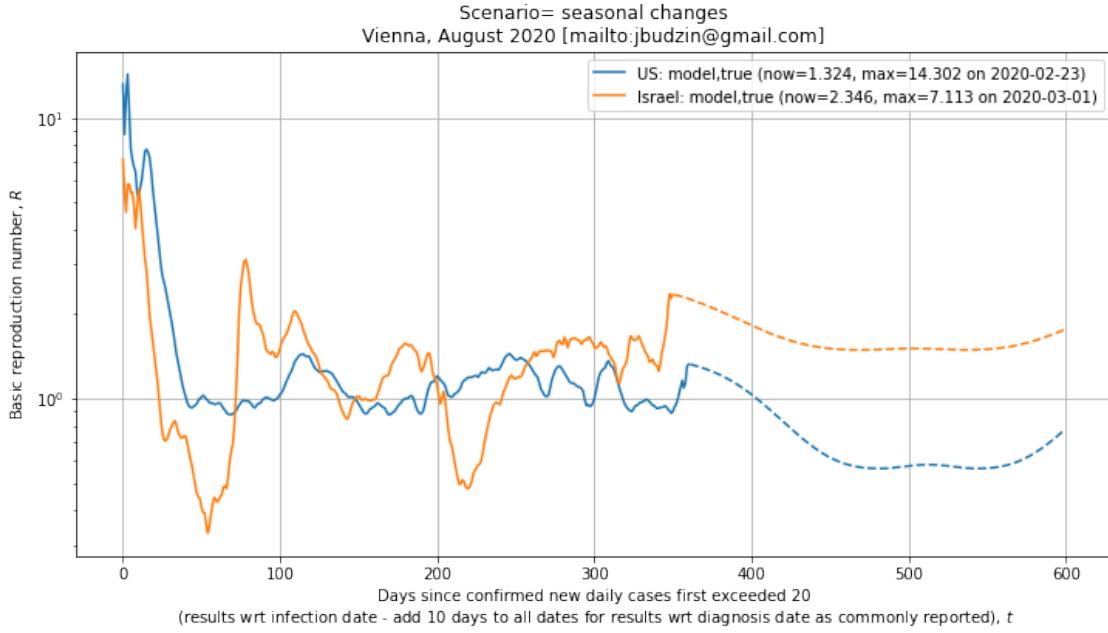


3.1.9 DEATHS

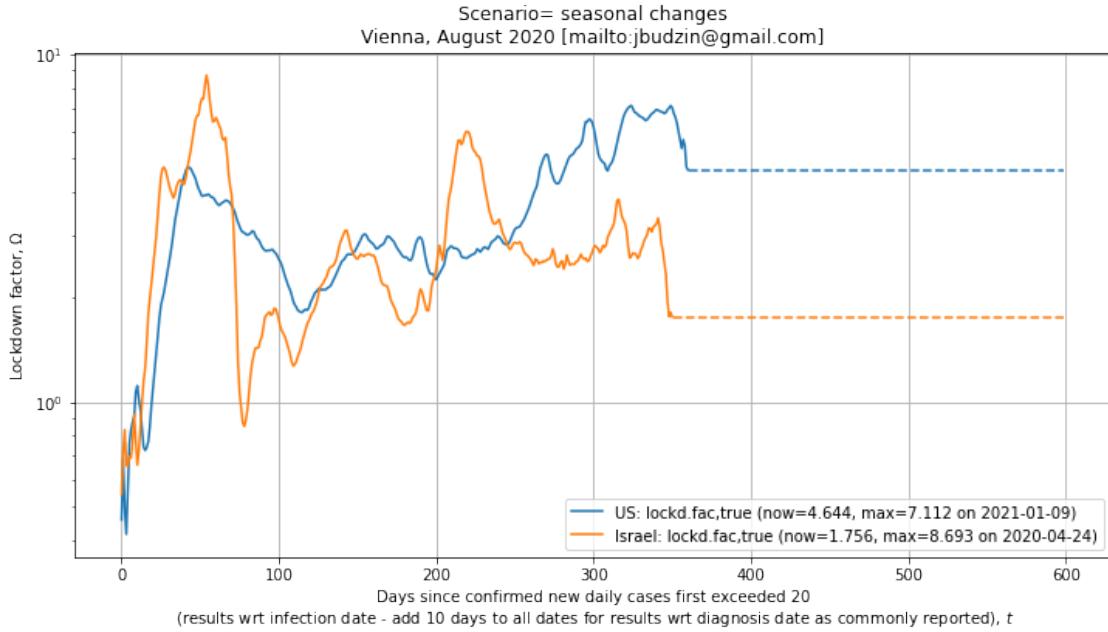


3.2 SCENARIO: seasonal changes

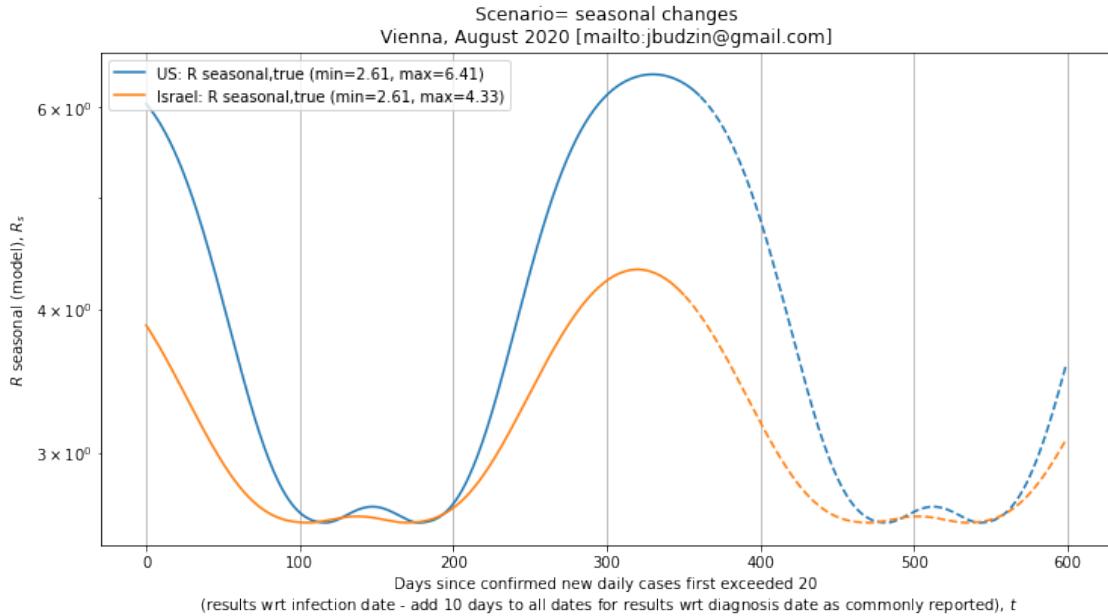
3.2.1 REPRODUCTION NUMBER



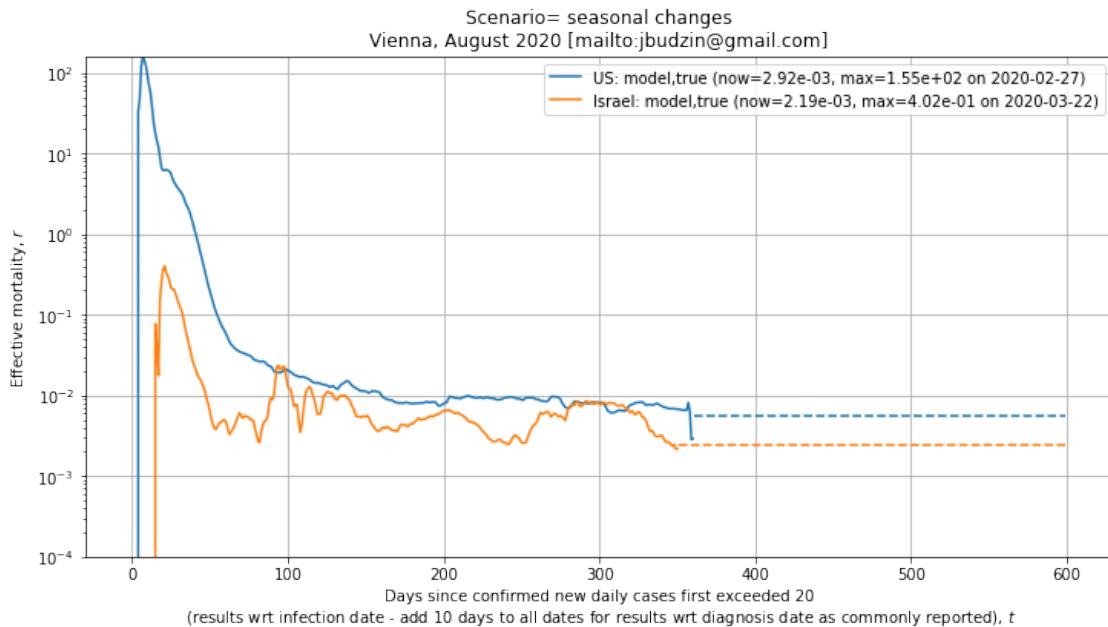
3.2.2 LOCKDOWN FACTOR



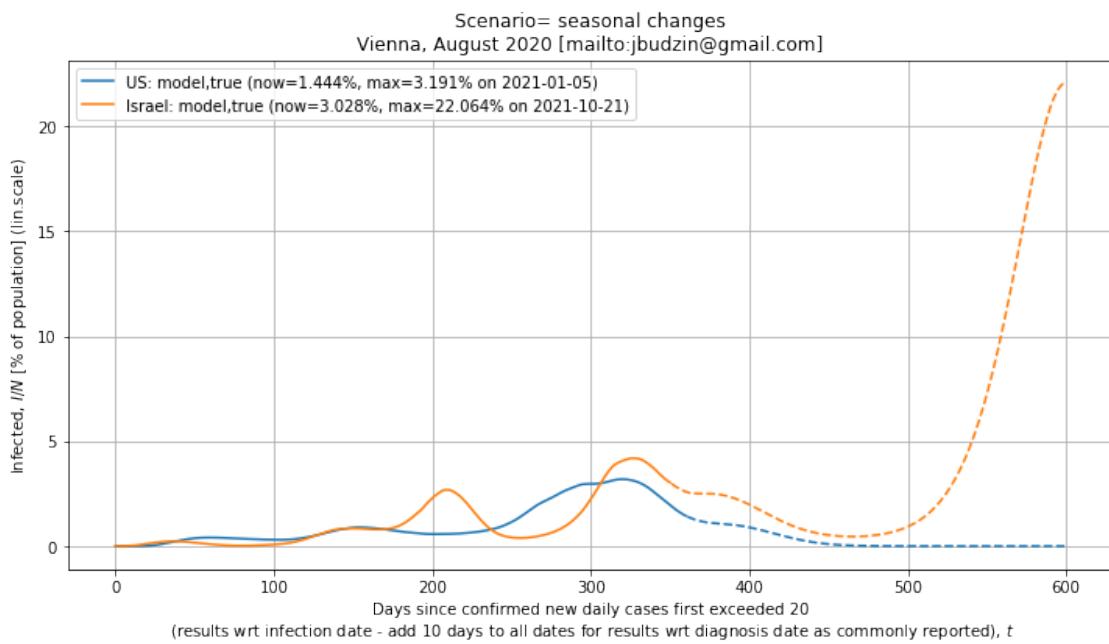
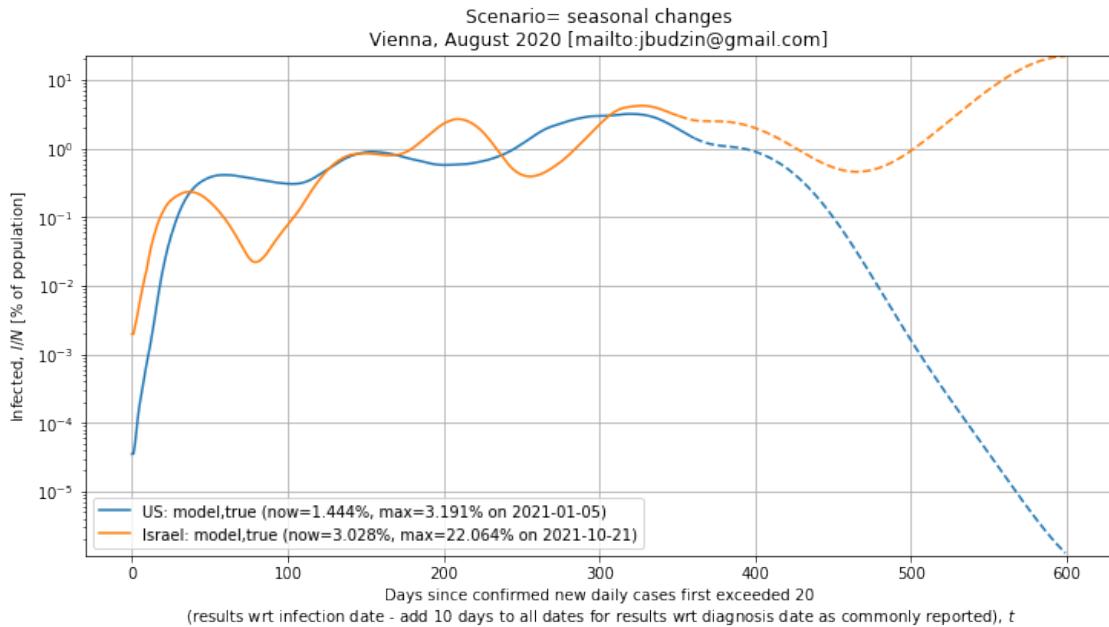
3.2.3 R SEASONAL

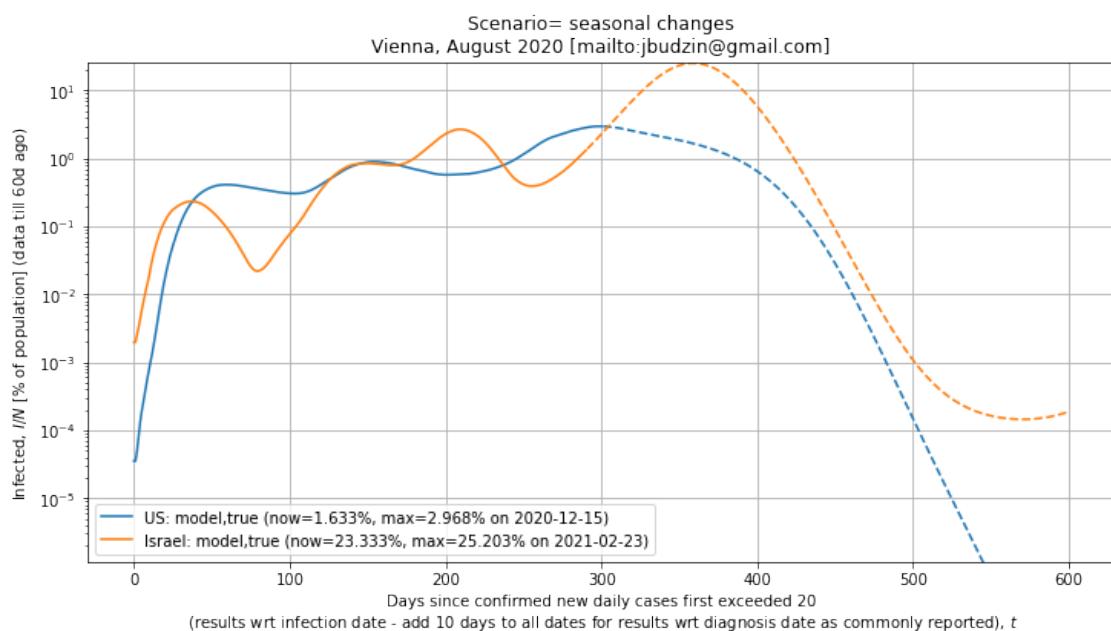
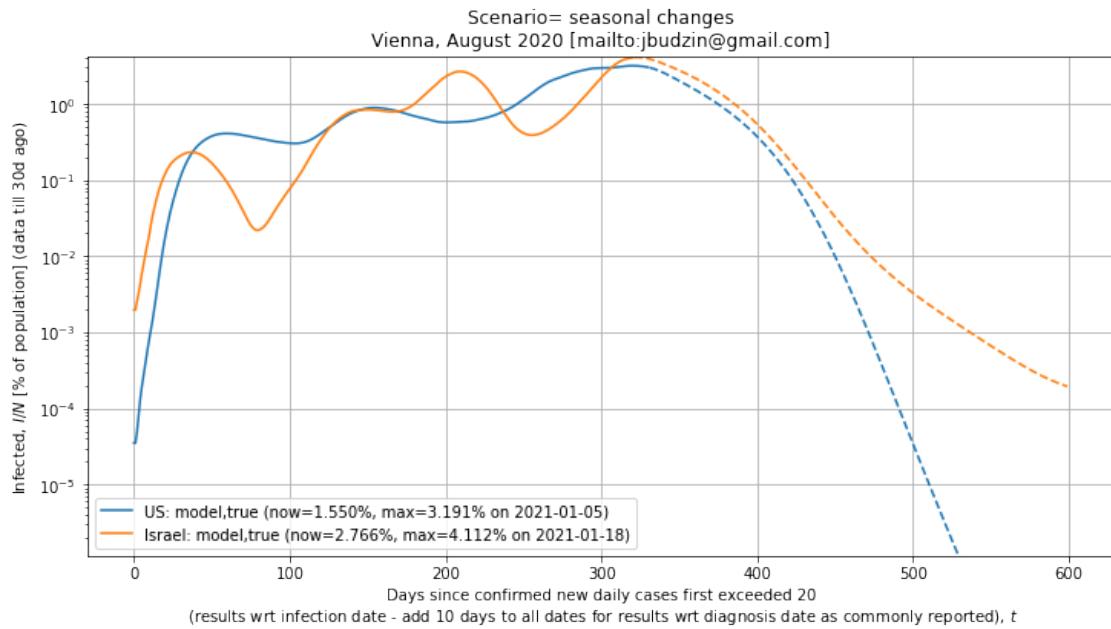


3.2.4 MORTALITY

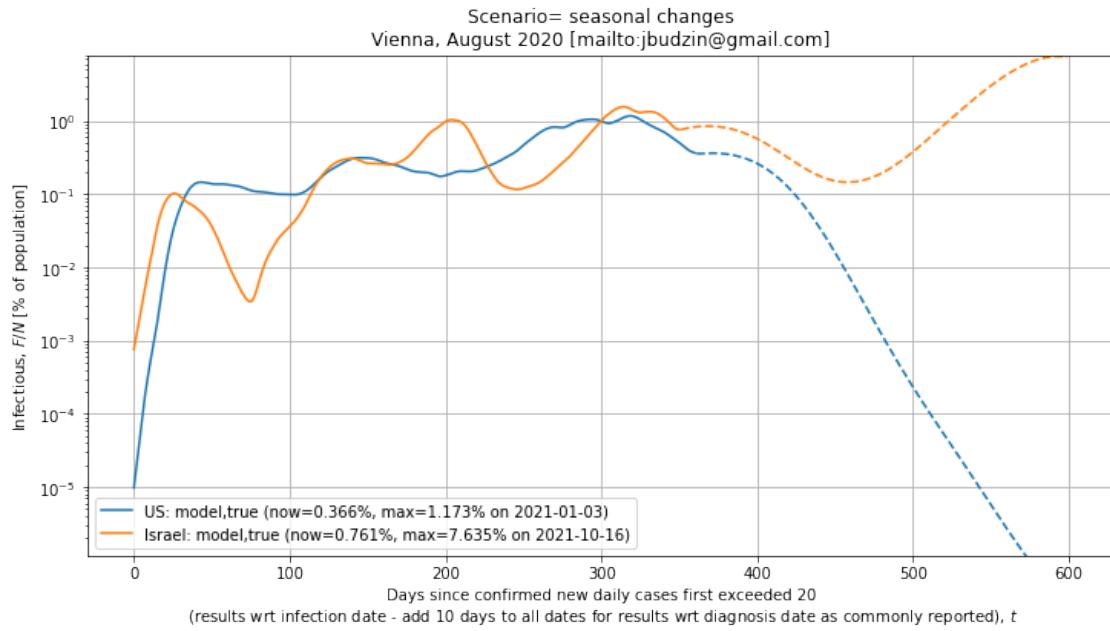


3.2.5 INFECTED

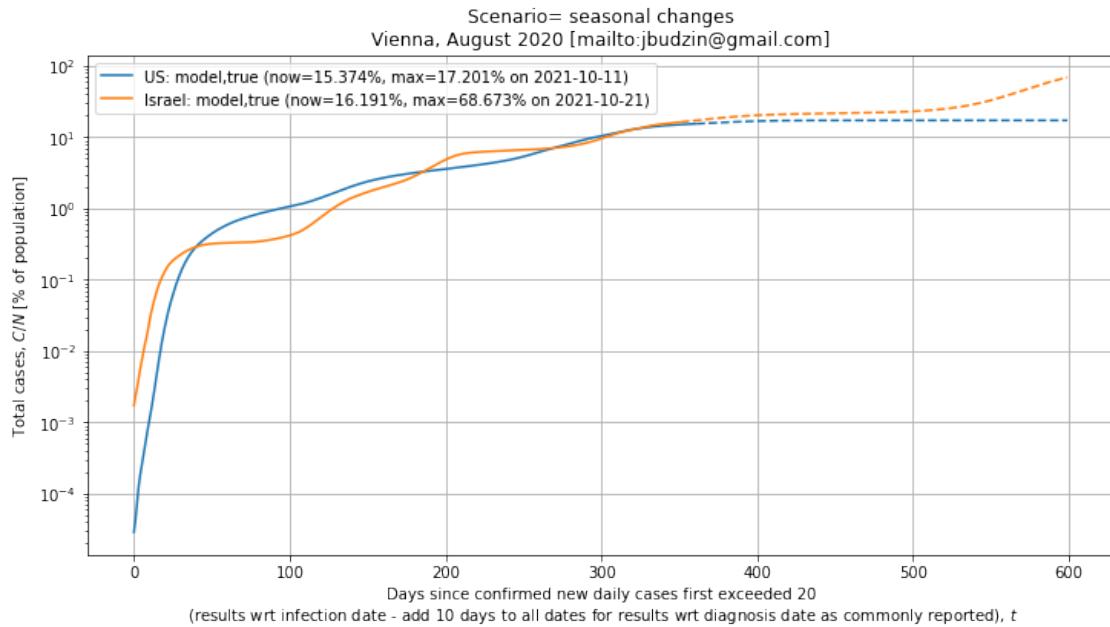




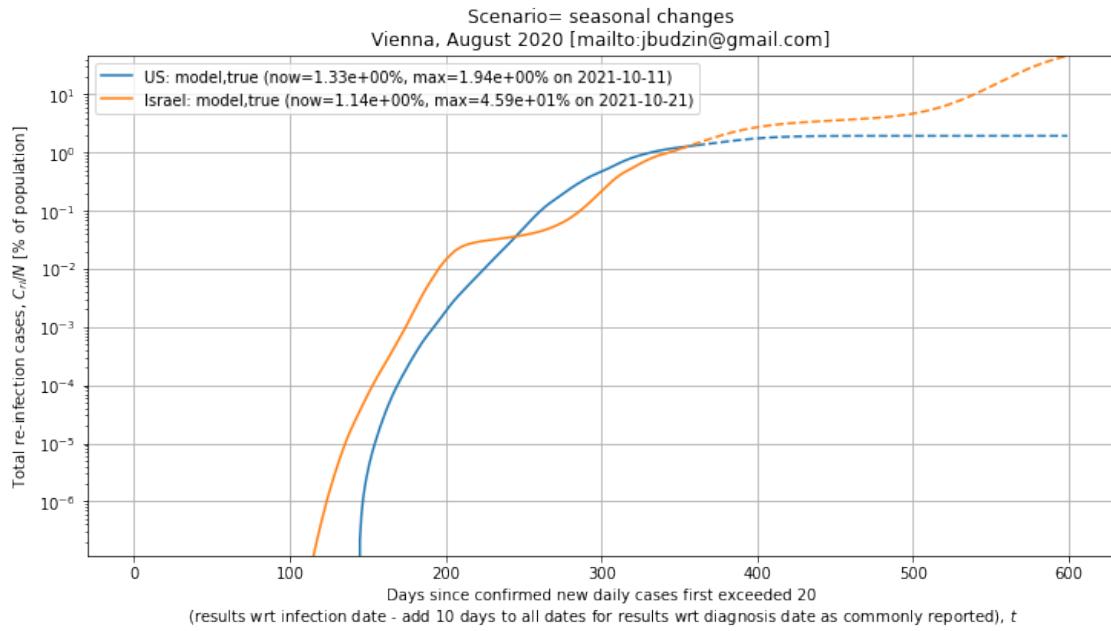
3.2.6 INFECTIOUS



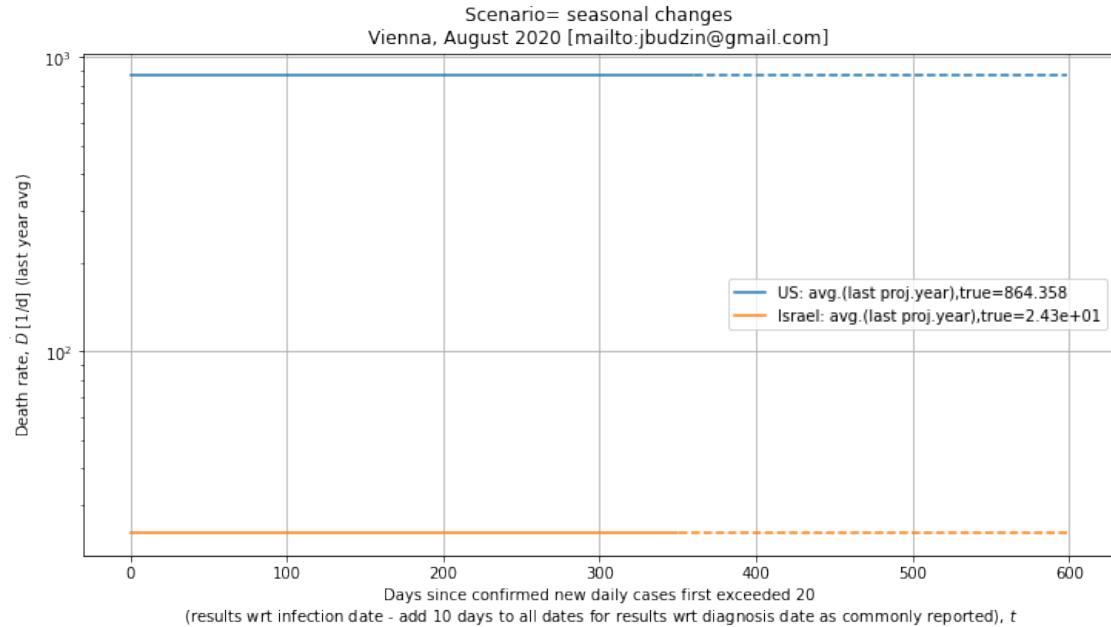
3.2.7 TOTAL CASES

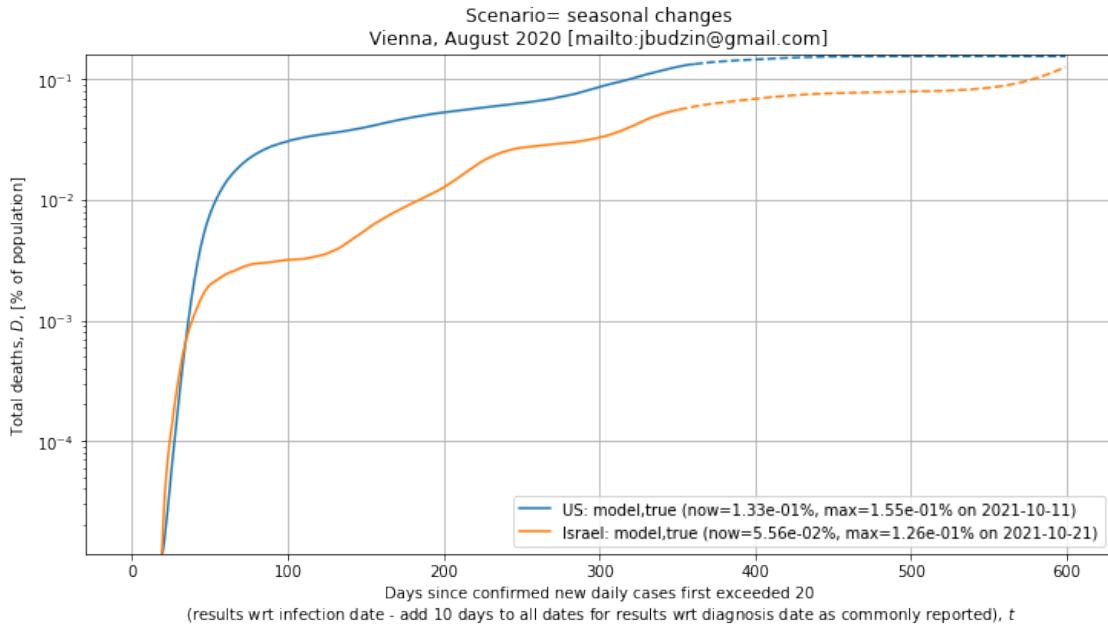


3.2.8 REINFECTIONS



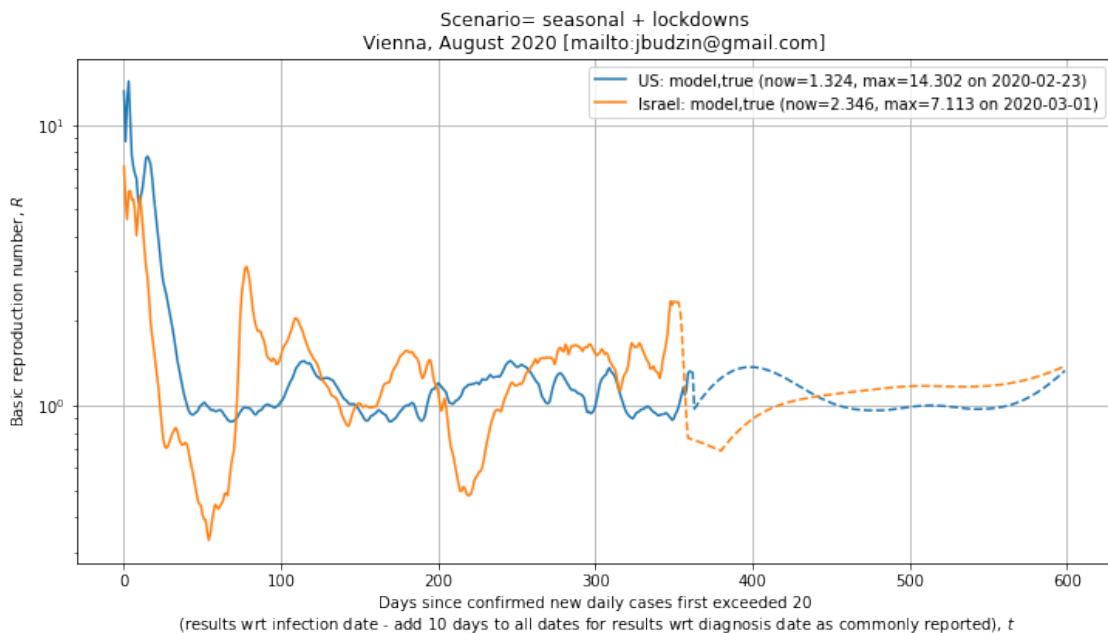
3.2.9 DEATHS



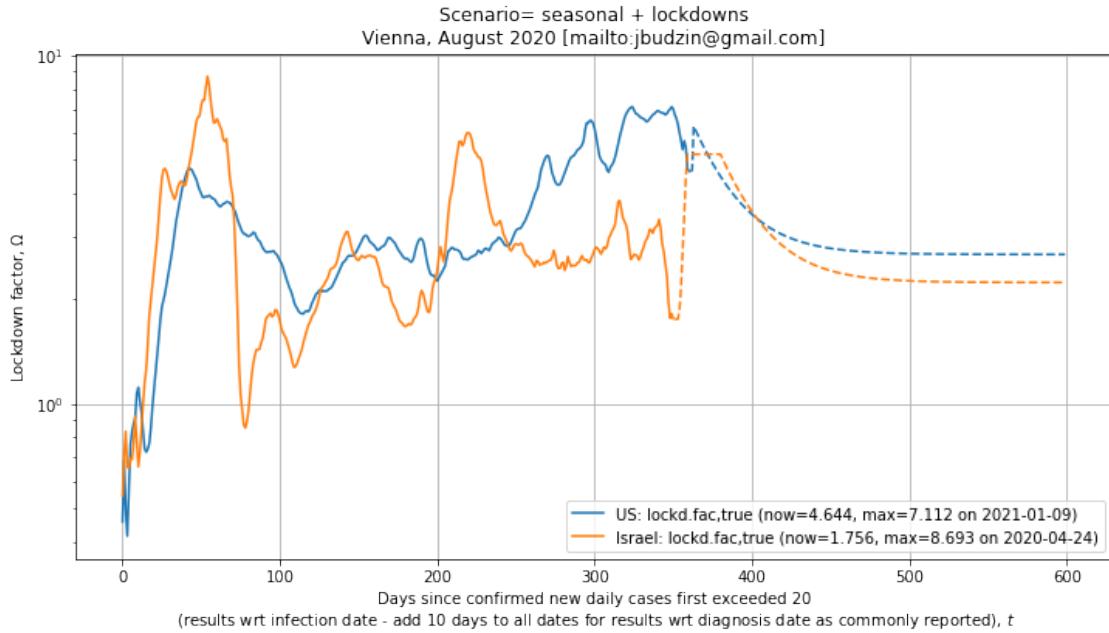


3.3 SCENARIO: seasonal + lockdowns

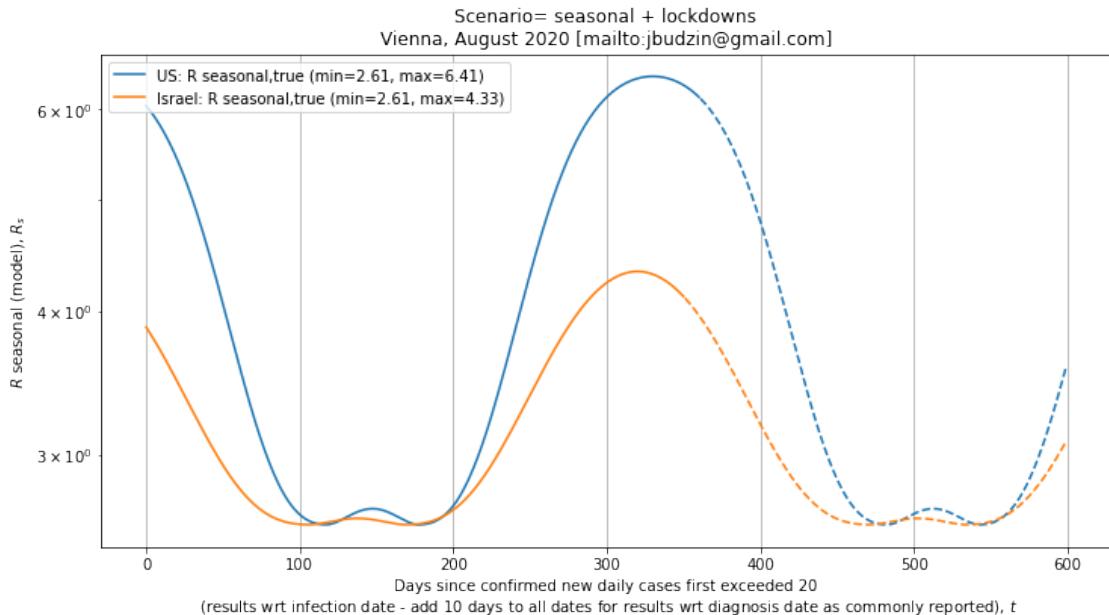
3.3.1 REPRODUCTION NUMBER



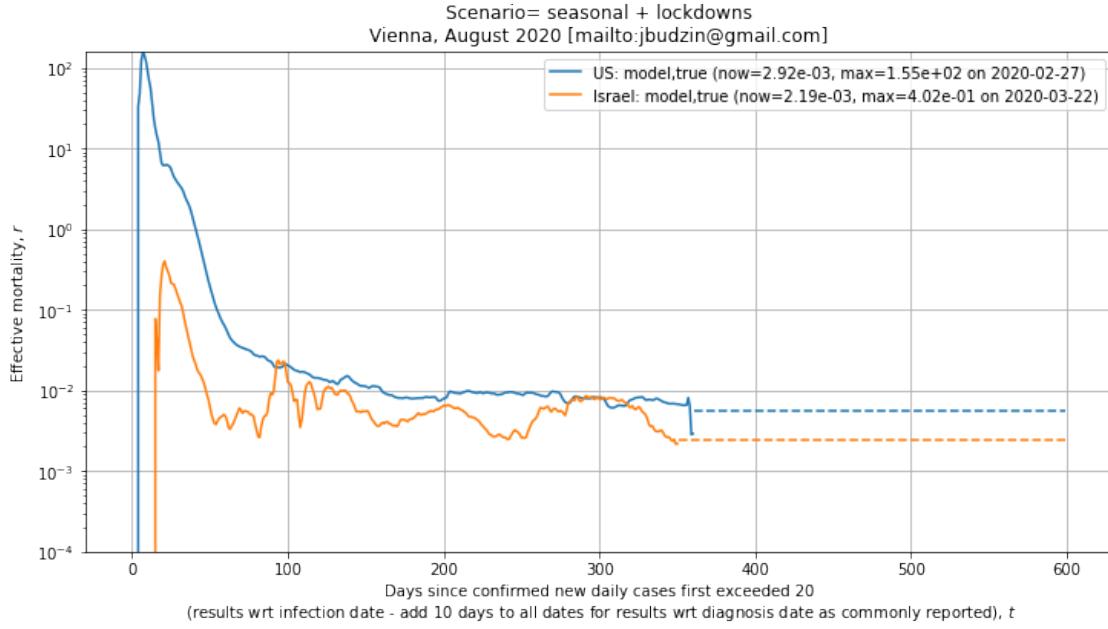
3.3.2 LOCKDOWN FACTOR



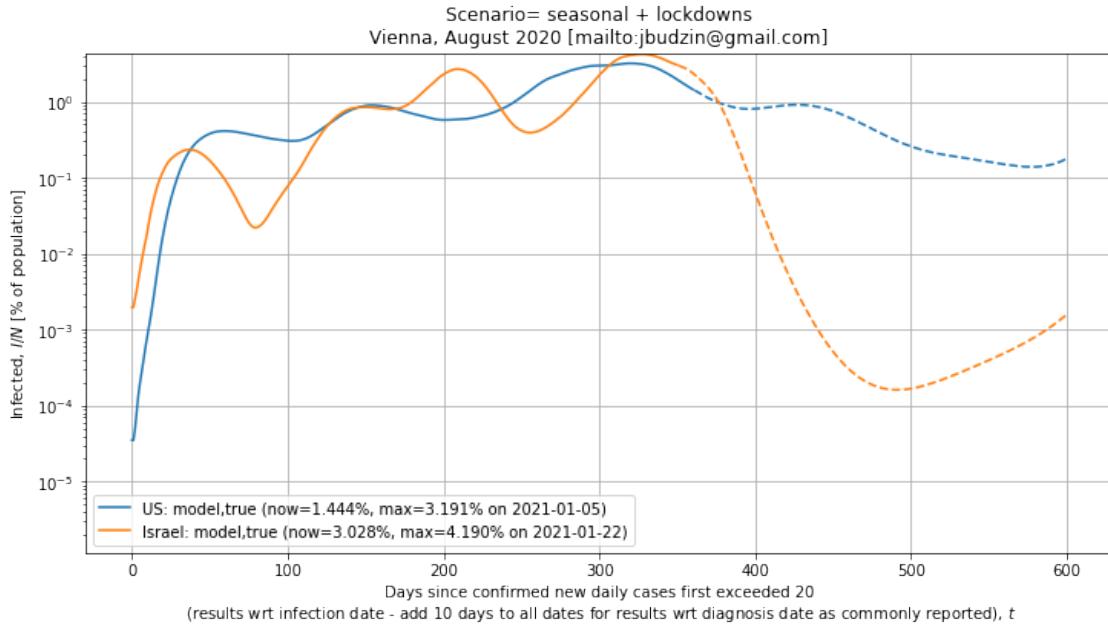
3.3.3 R SEASONAL

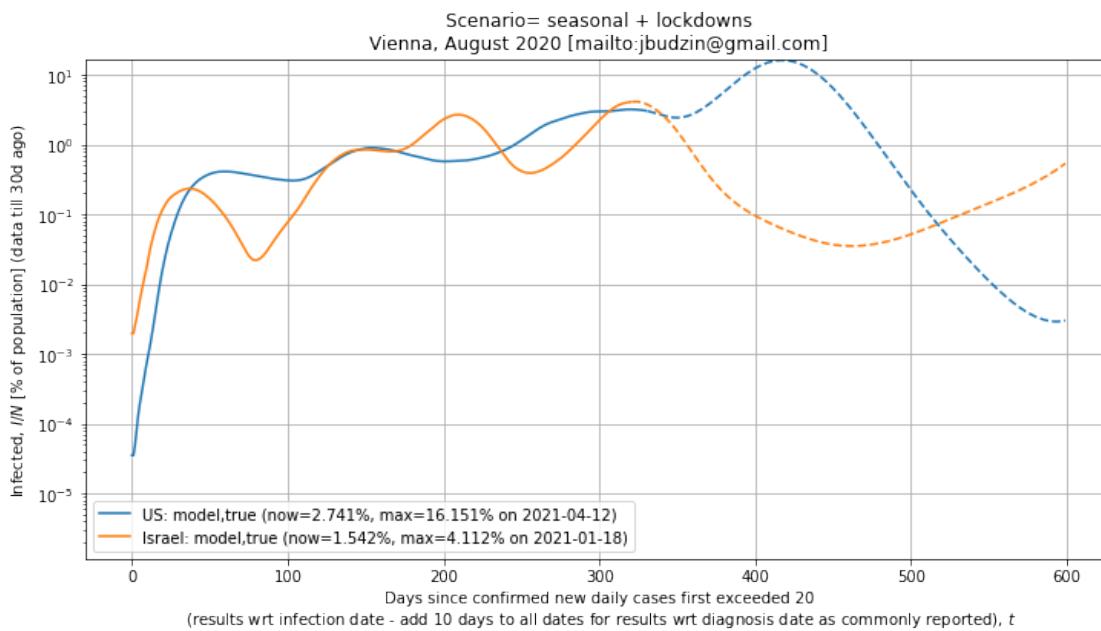
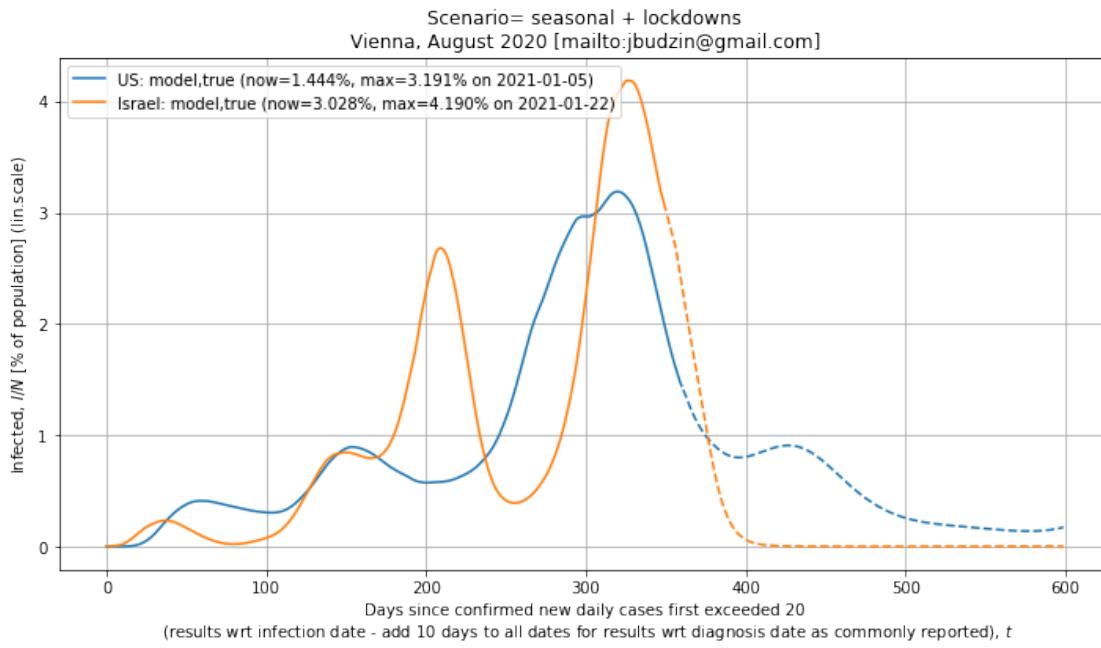


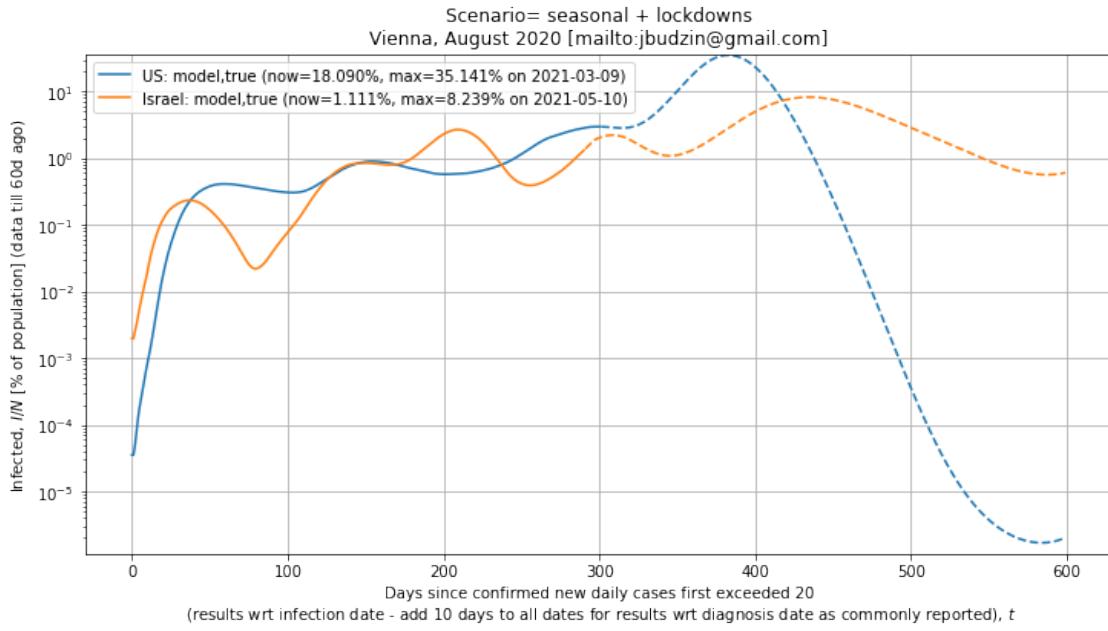
3.3.4 MORTALITY



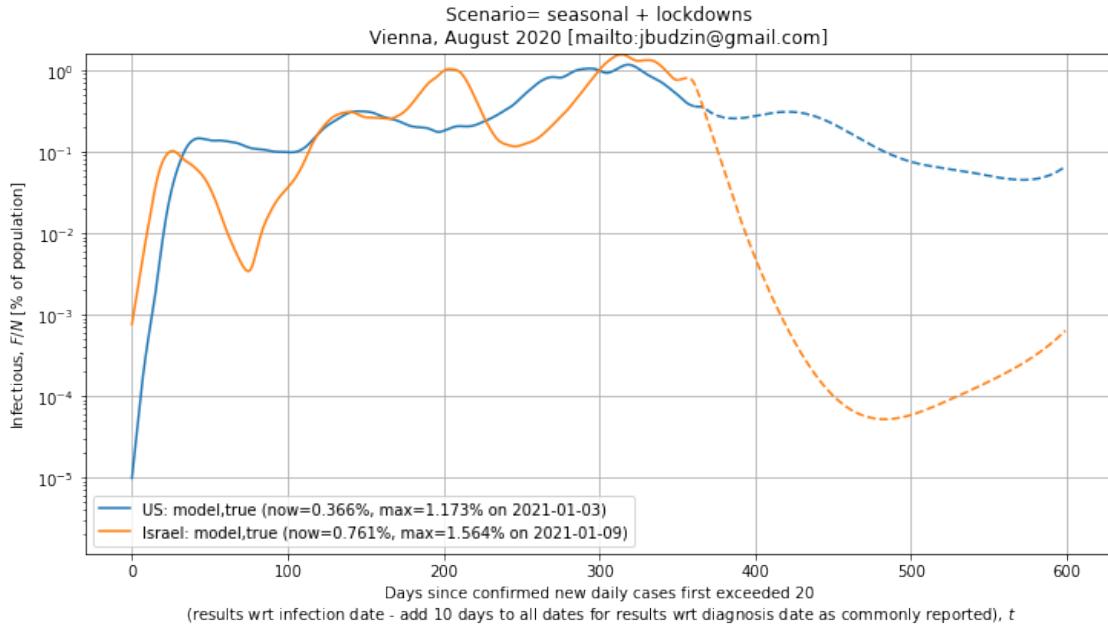
3.3.5 INFECTED



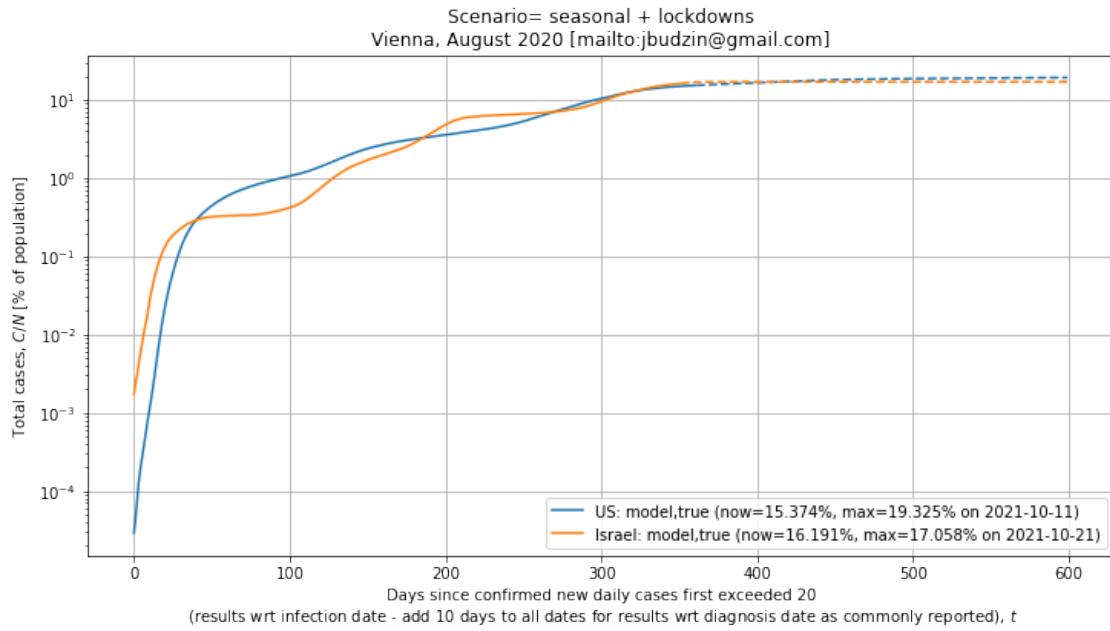




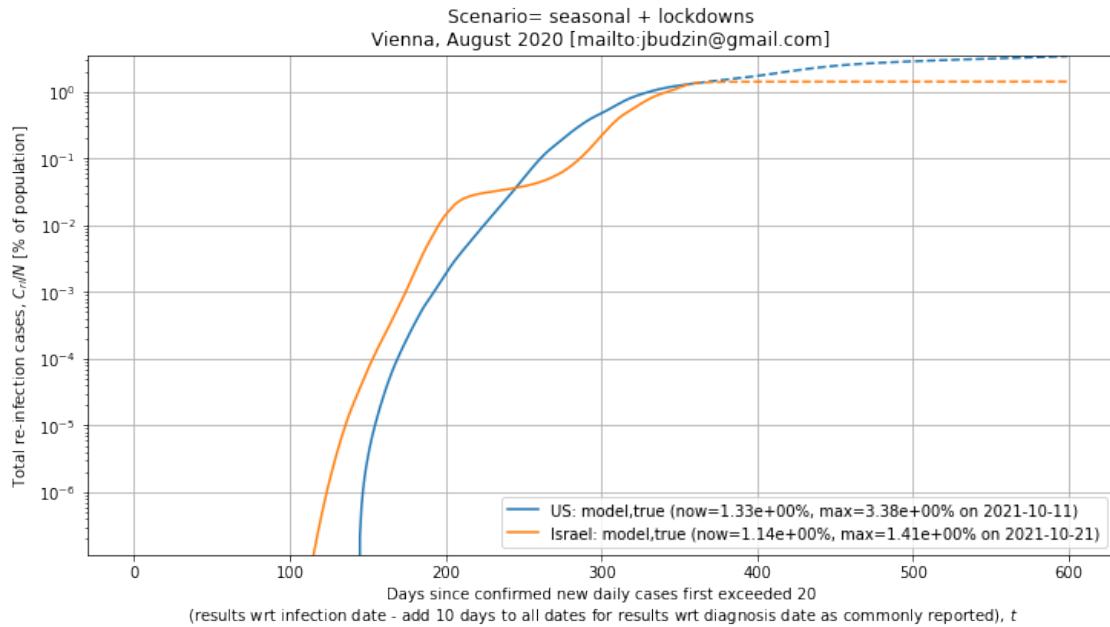
3.3.6 INFECTIOUS



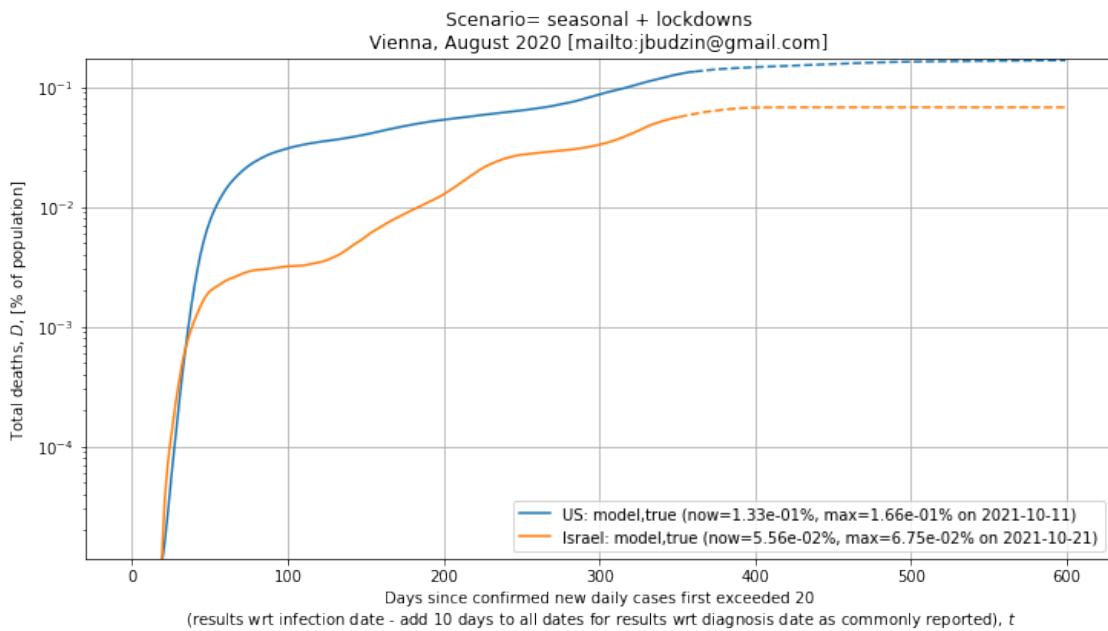
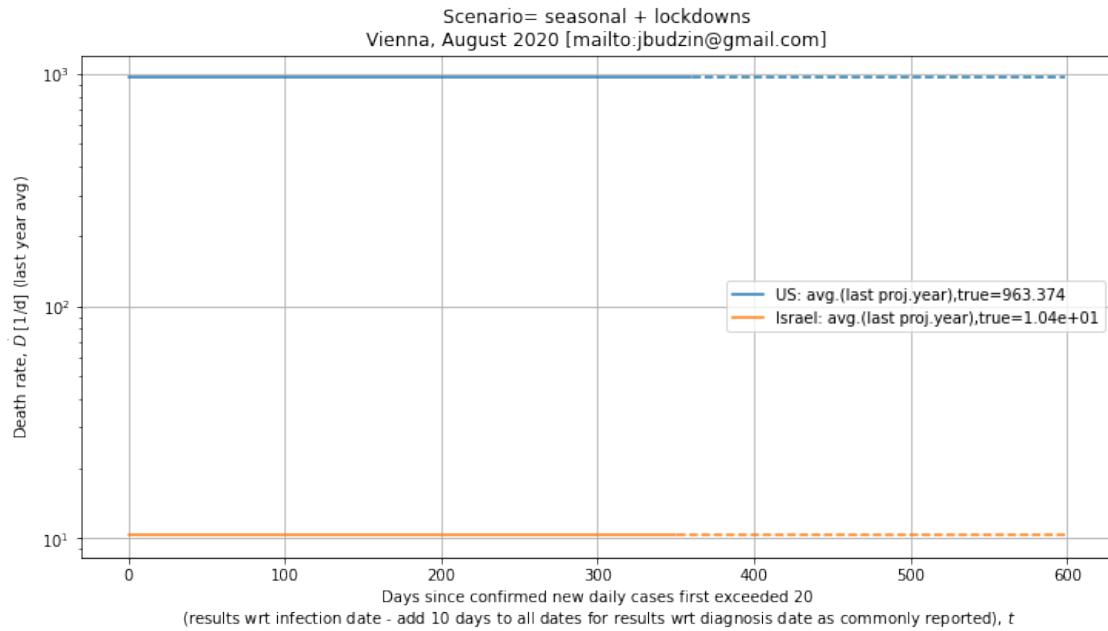
3.3.7 TOTAL CASES



3.3.8 REINFECTIONS

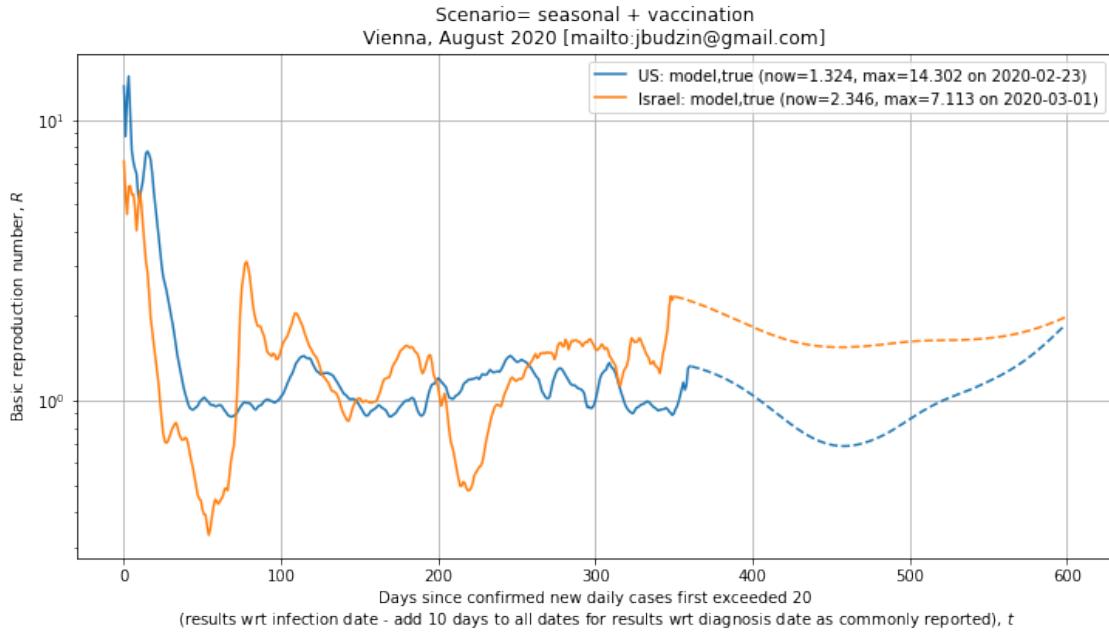


3.3.9 DEATHS

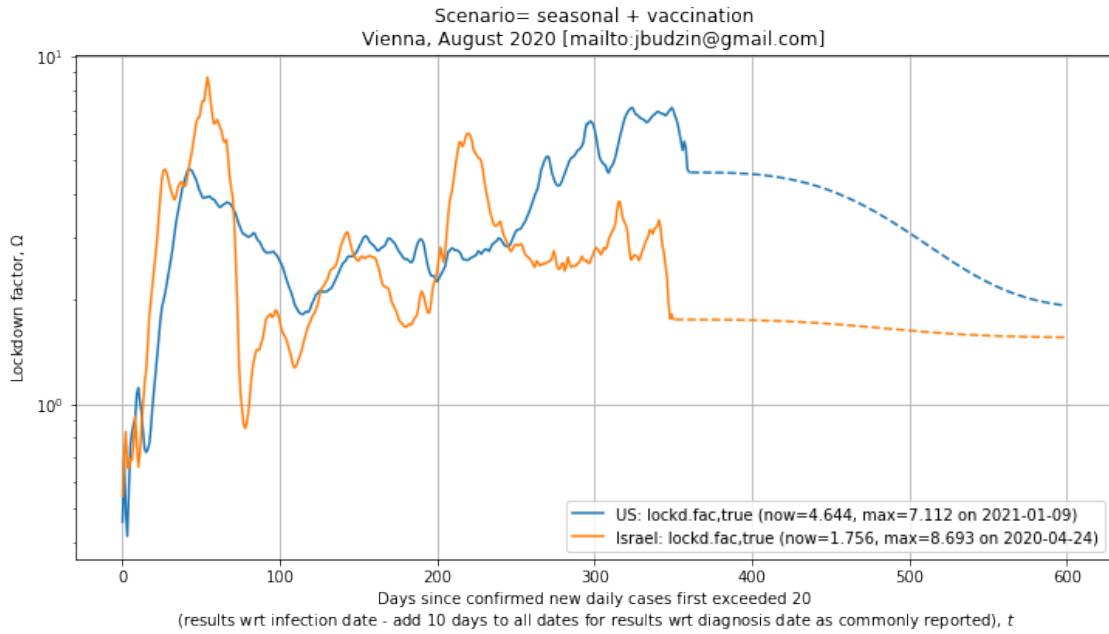


3.4 SCENARIO: seasonal + vaccination

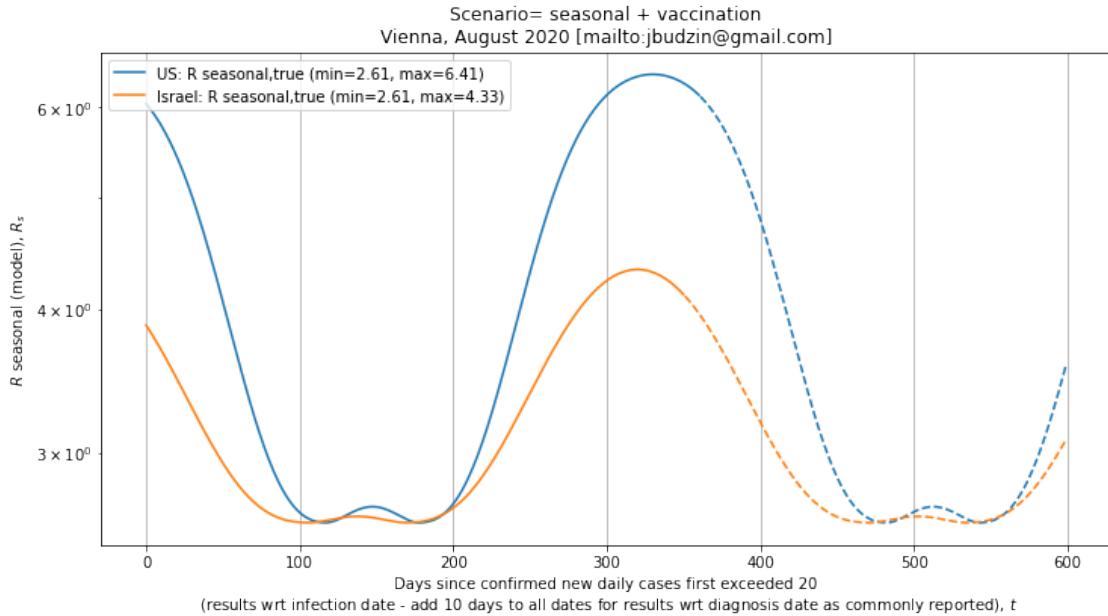
3.4.1 REPRODUCTION NUMBER



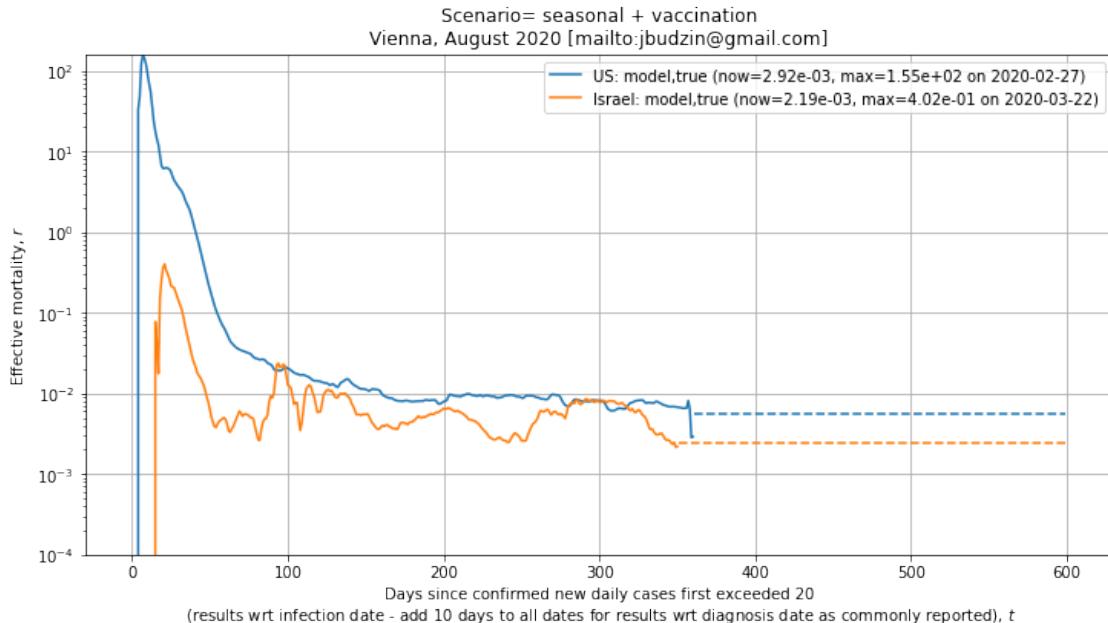
3.4.2 LOCKDOWN FACTOR



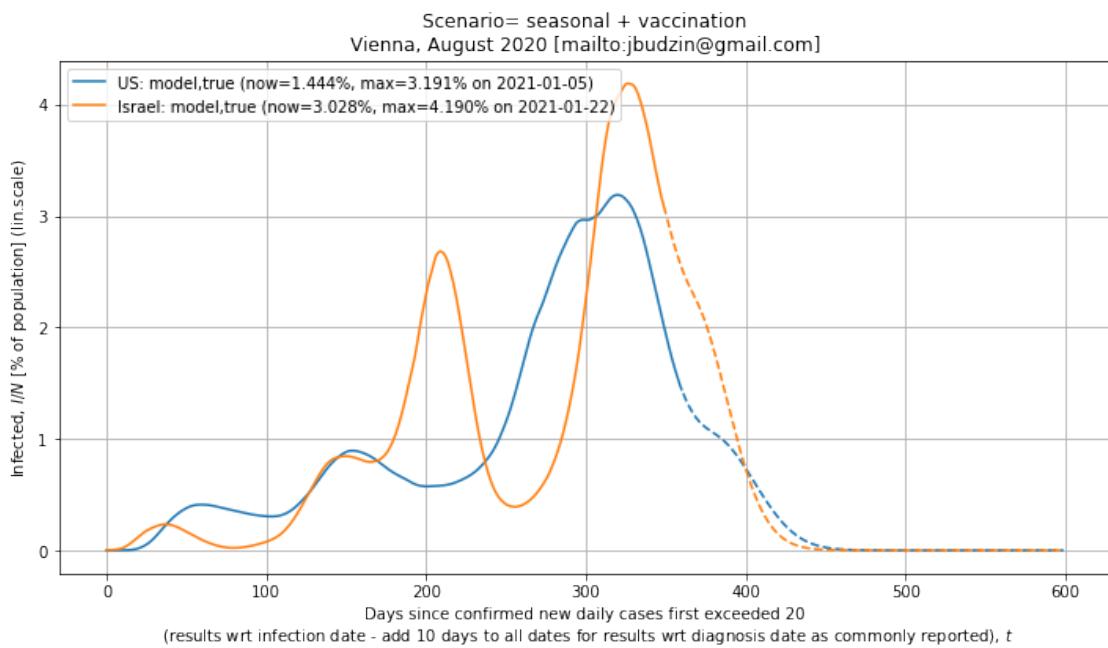
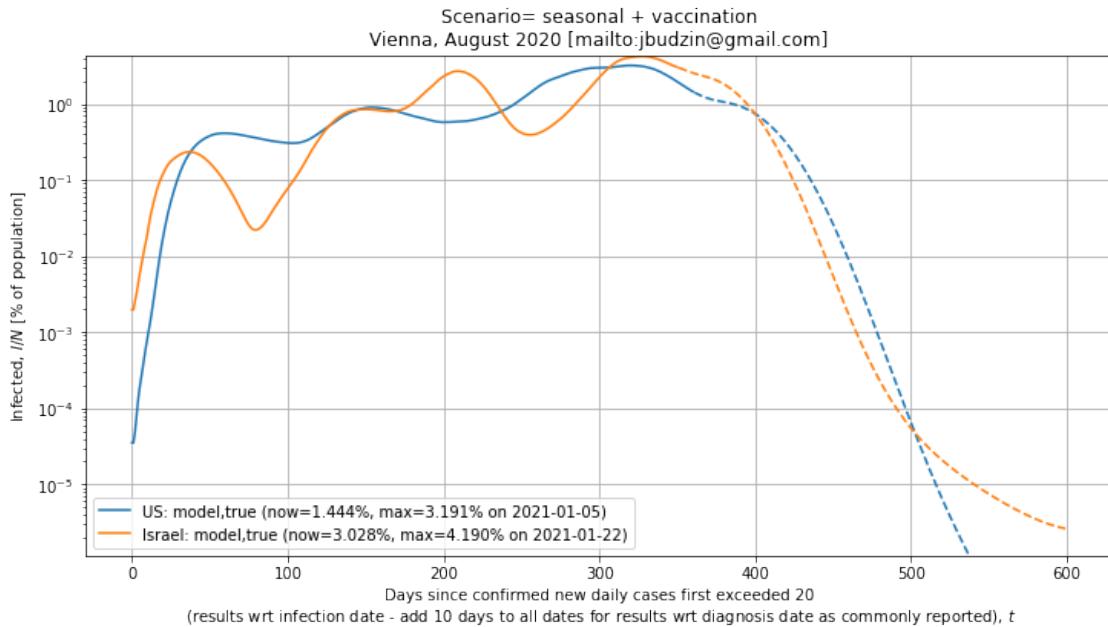
3.4.3 R SEASONAL

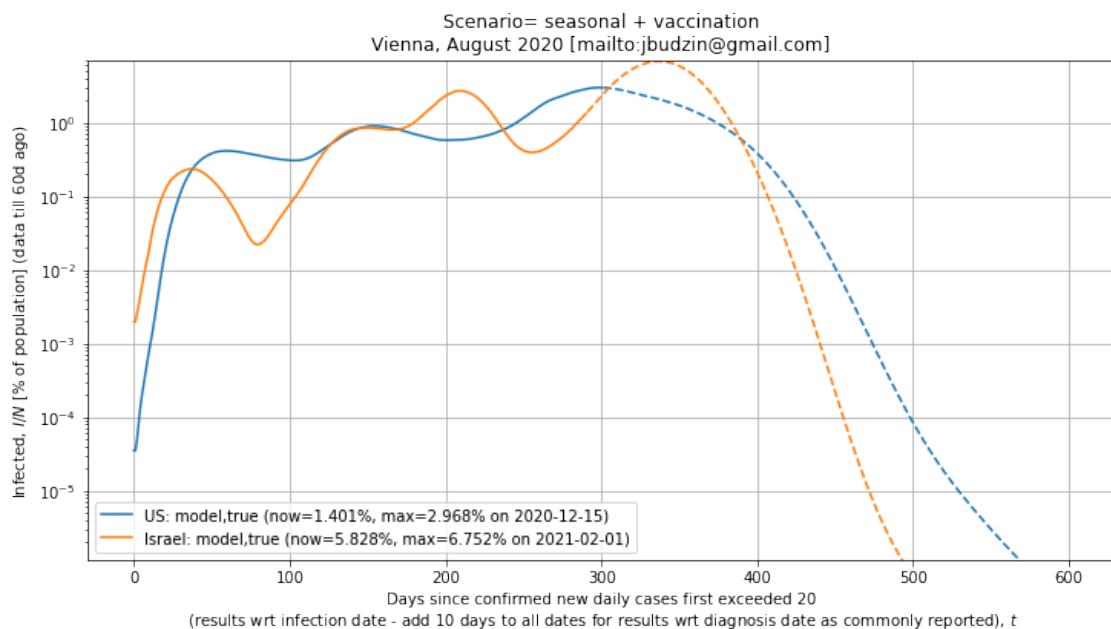
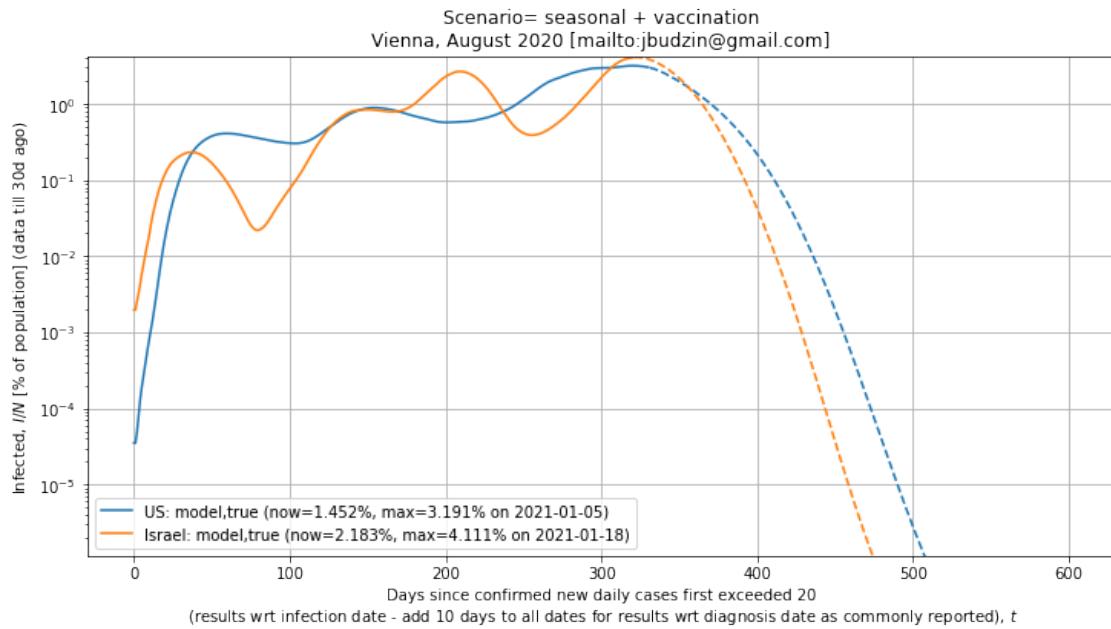


3.4.4 MORTALITY

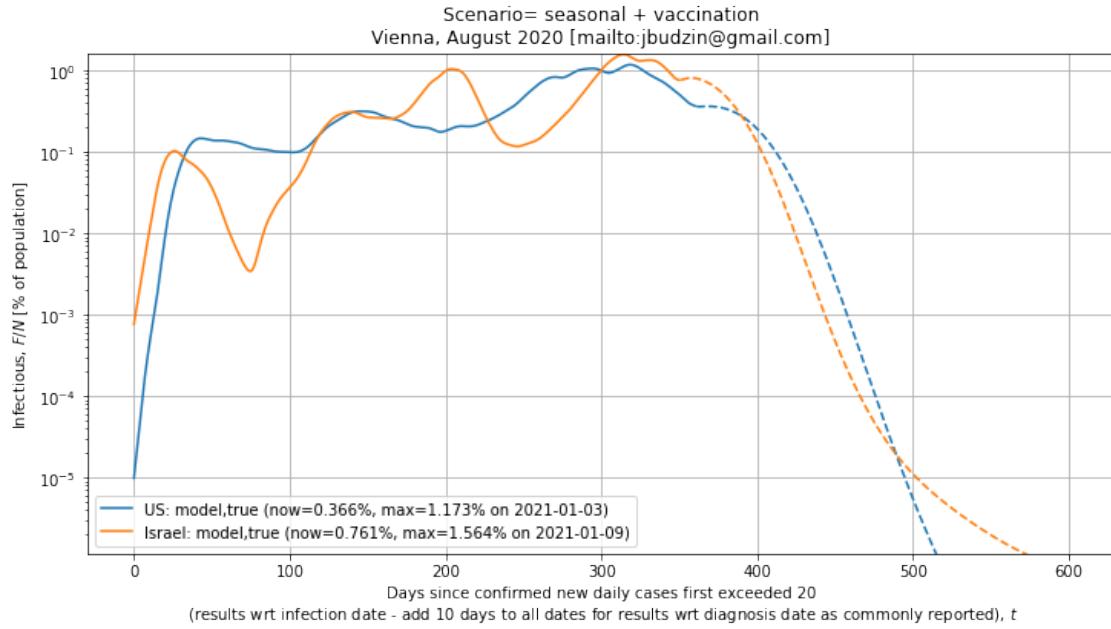


3.4.5 INFECTED

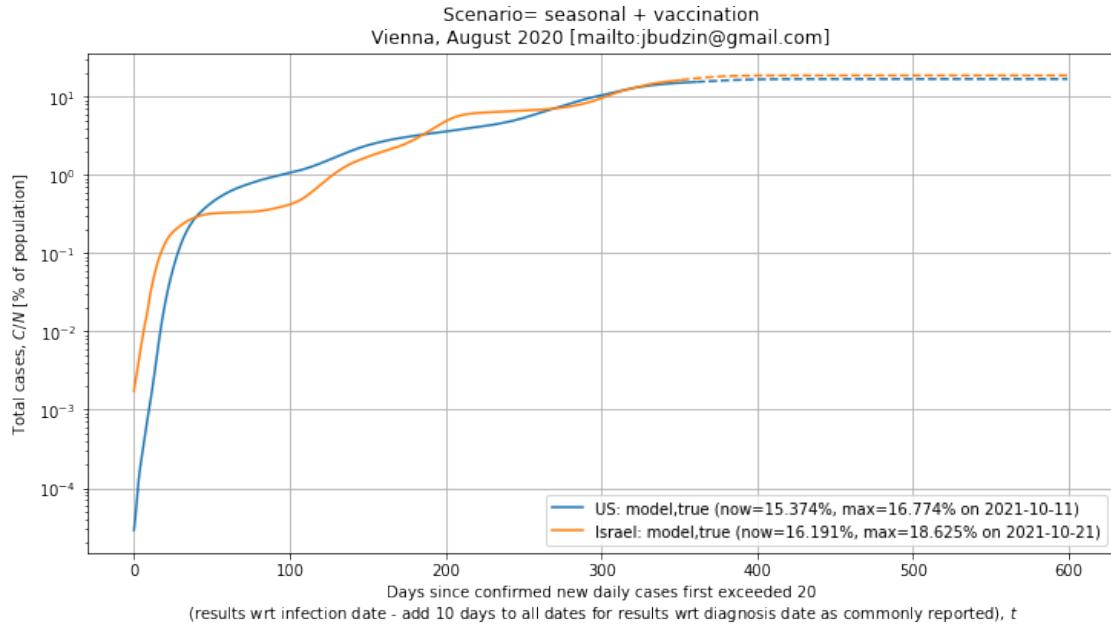




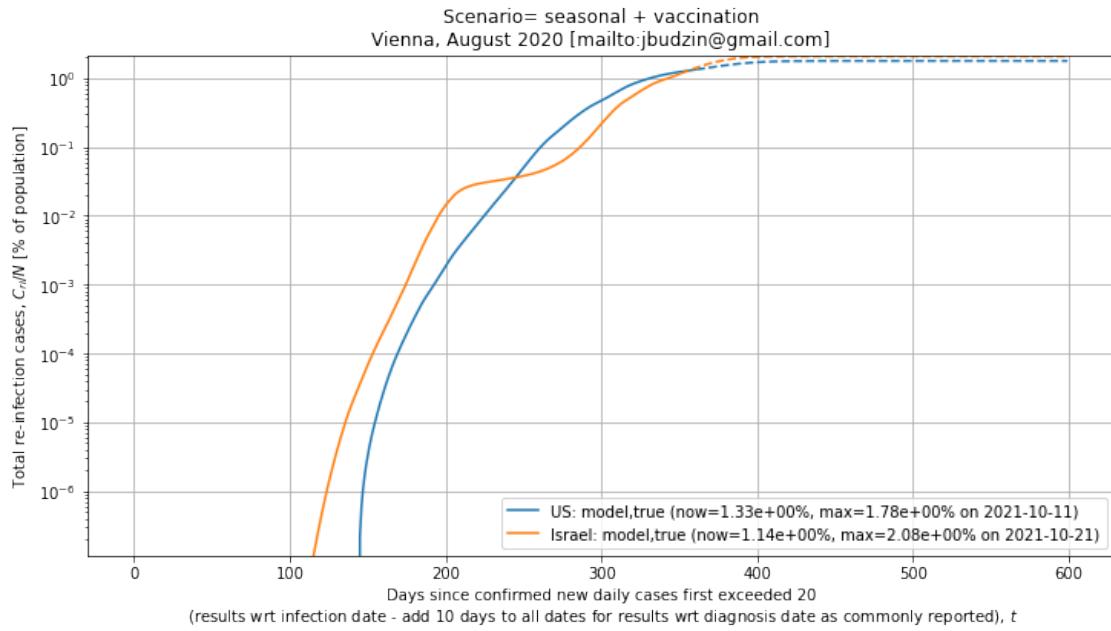
3.4.6 INFECTIOUS



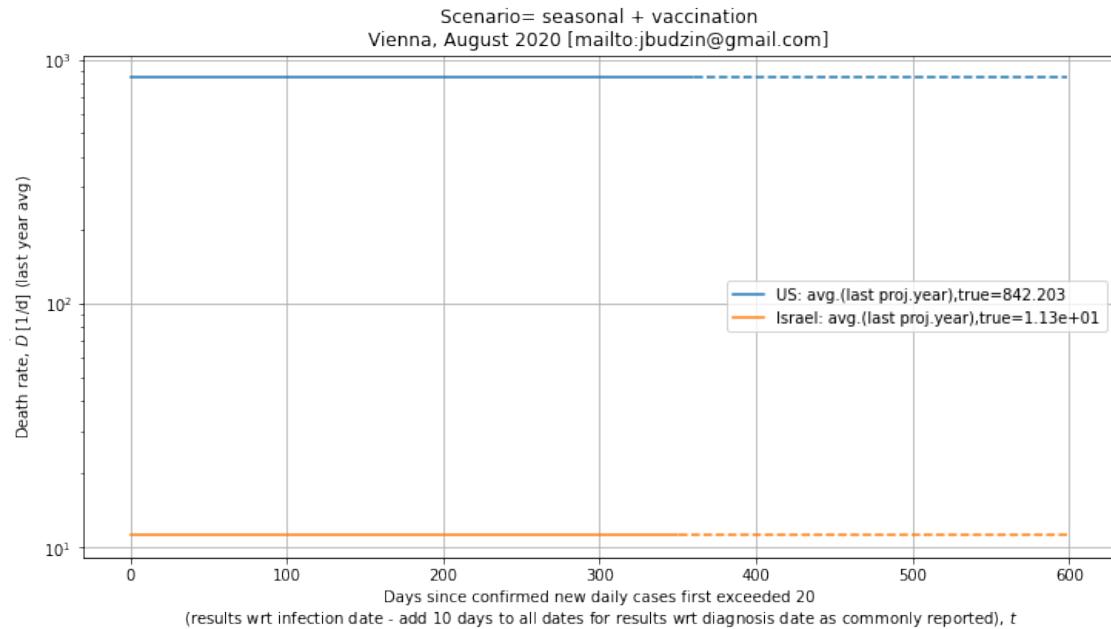
3.4.7 TOTAL CASES

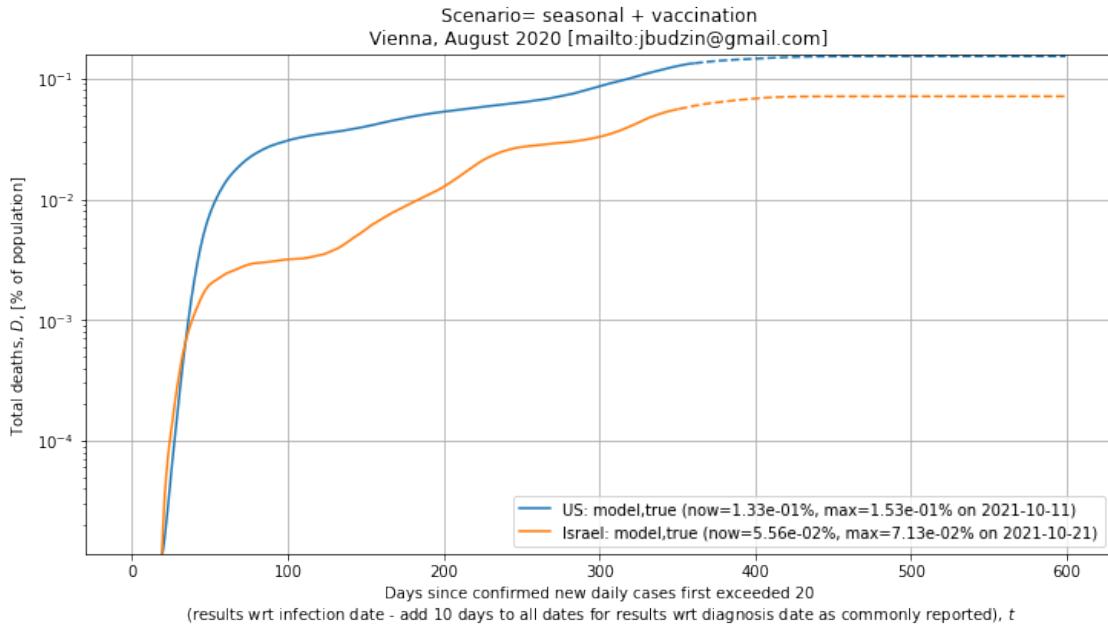


3.4.8 REINFECTIONS



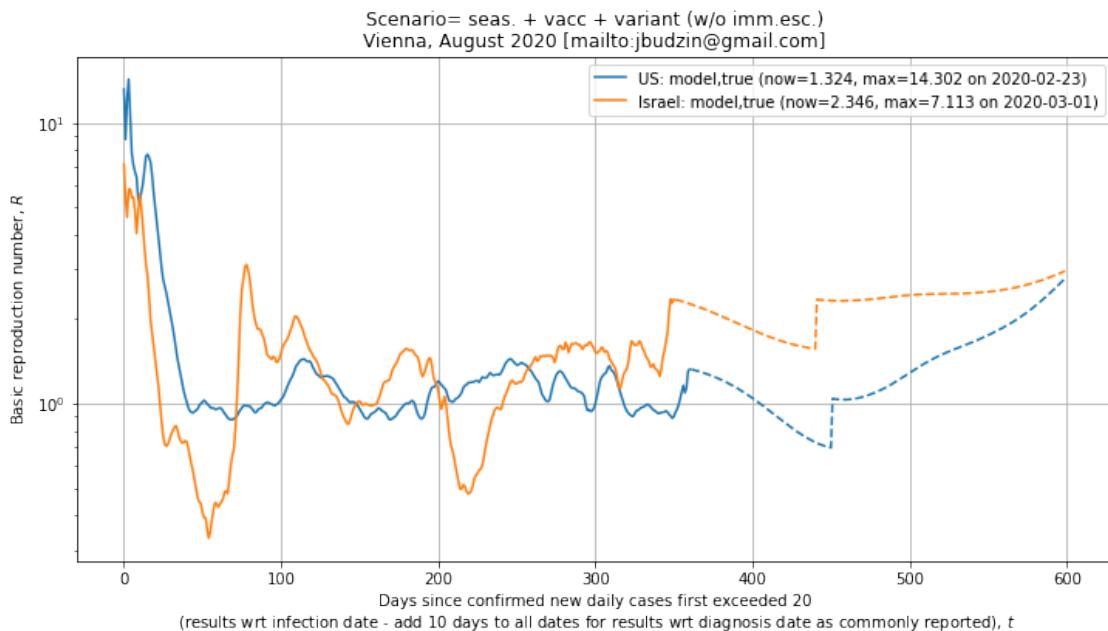
3.4.9 DEATHS



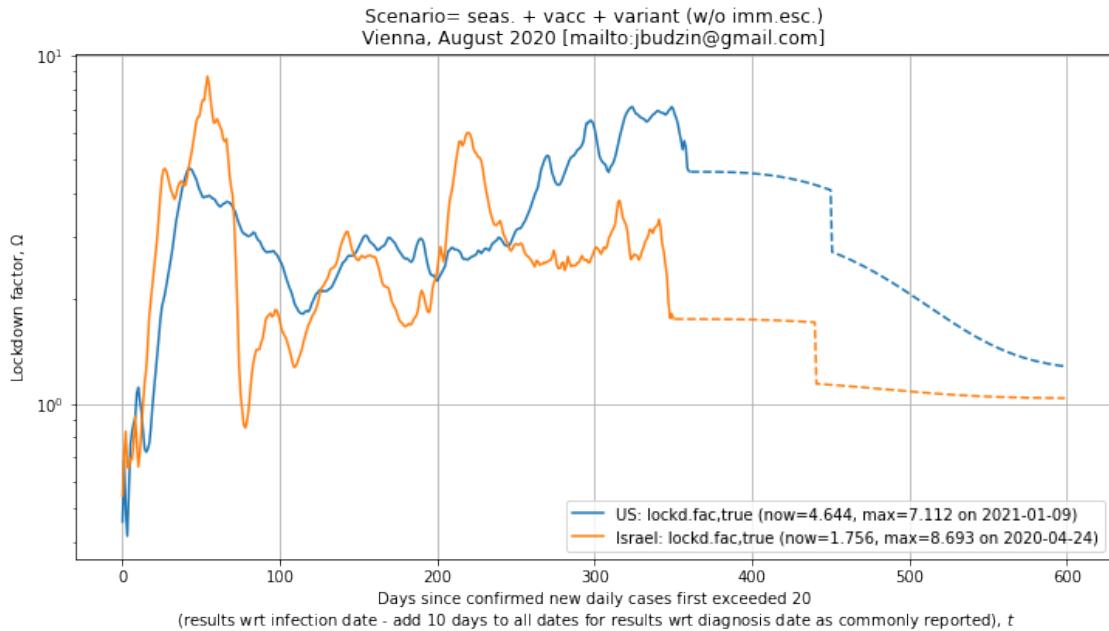


3.5 SCENARIO: seas. + vacc + variant (w/o imm.esc.)

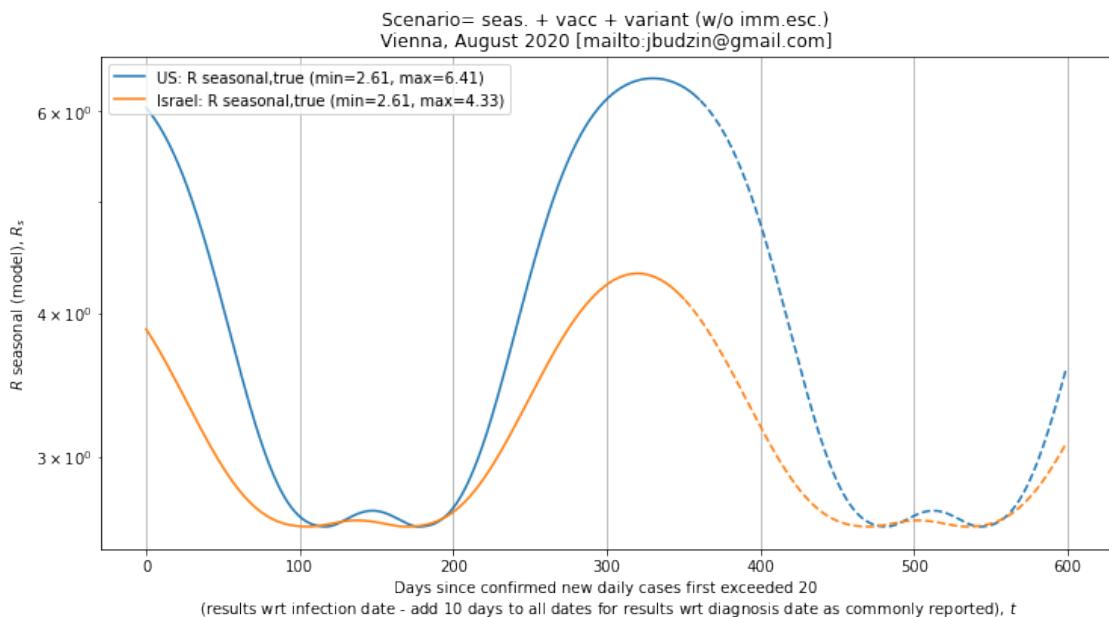
3.5.1 REPRODUCTION NUMBER



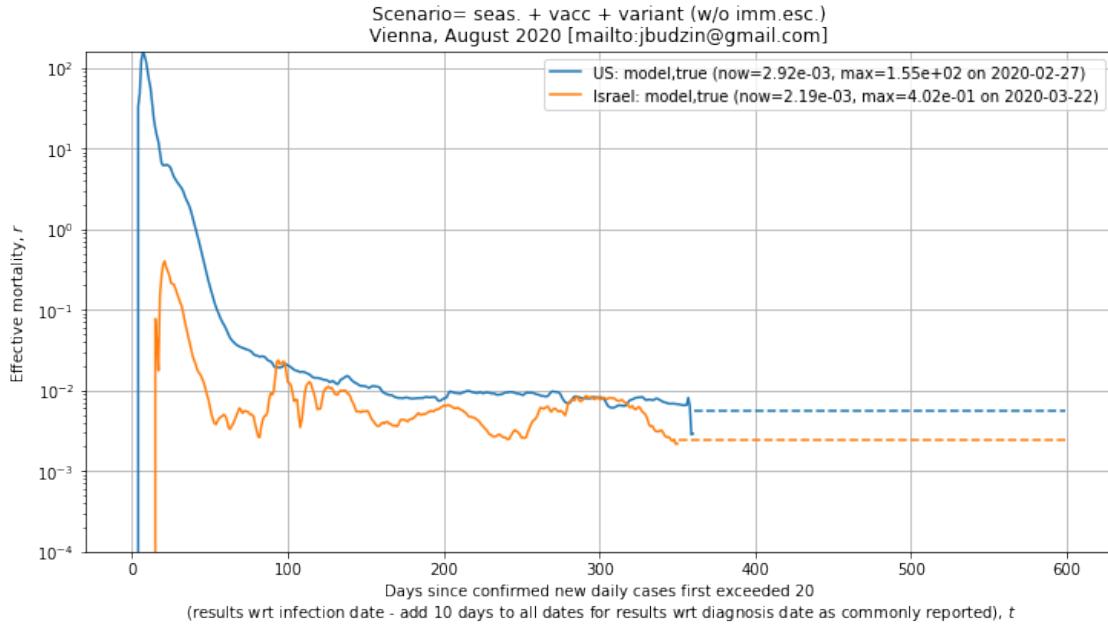
3.5.2 LOCKDOWN FACTOR



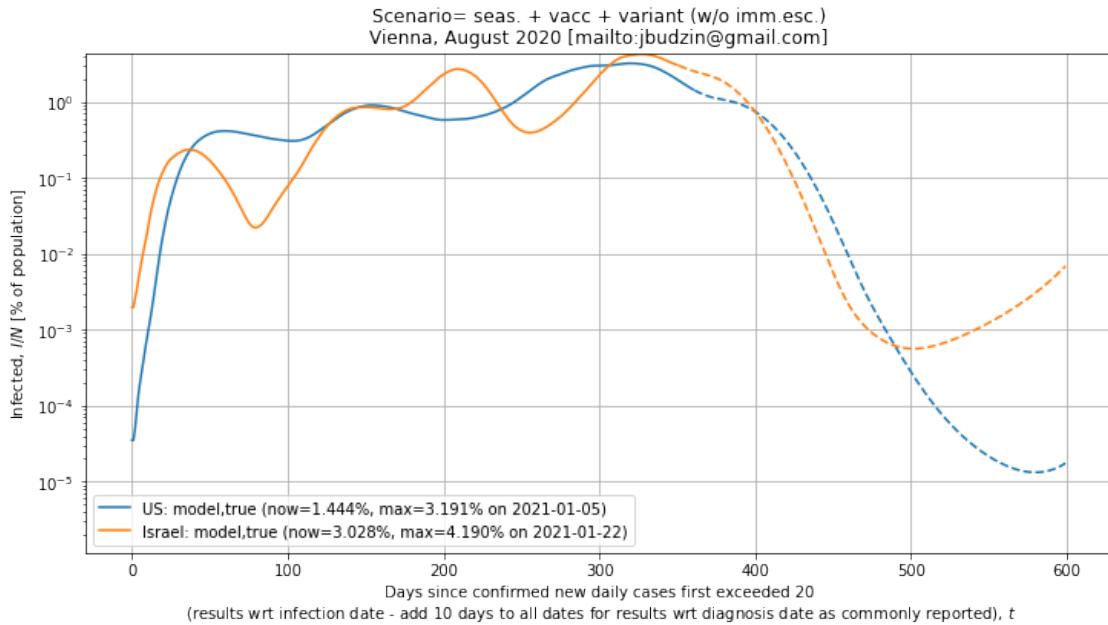
3.5.3 R SEASONAL

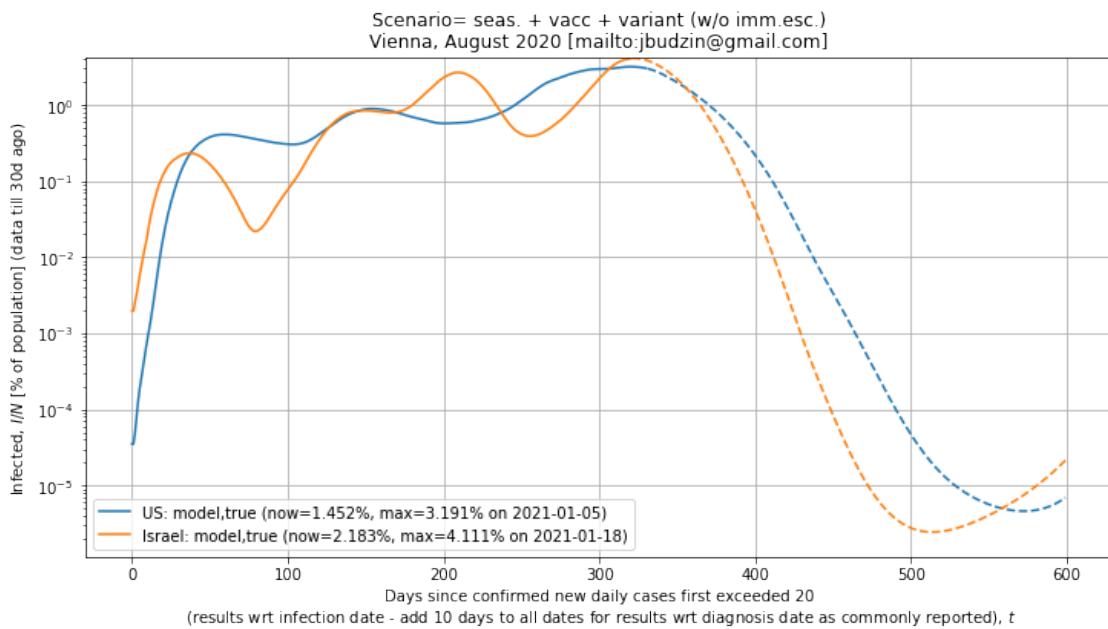
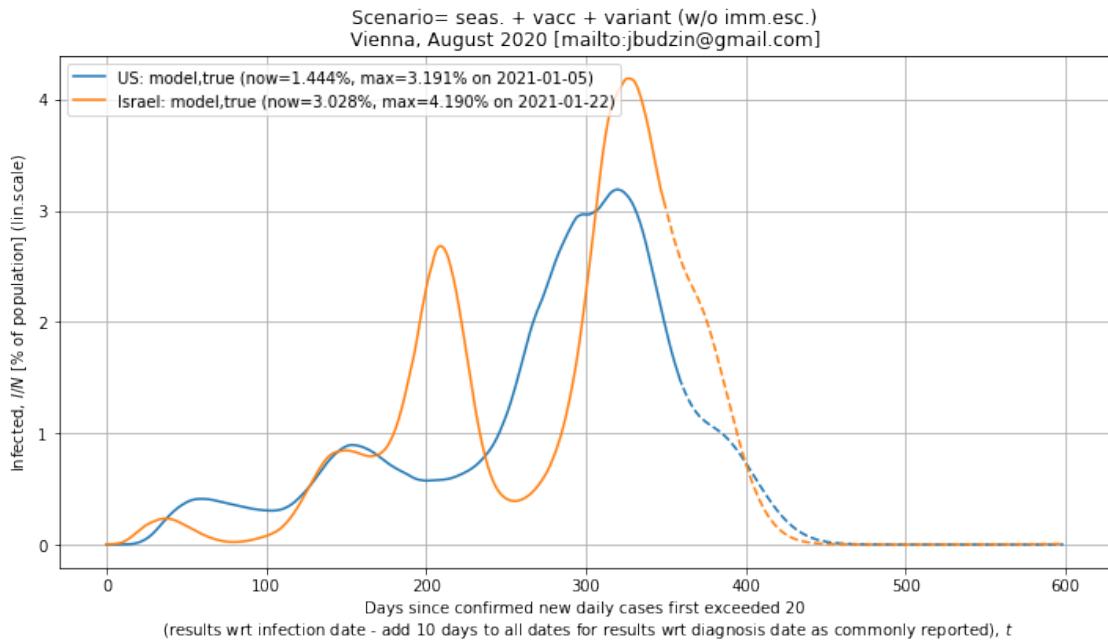


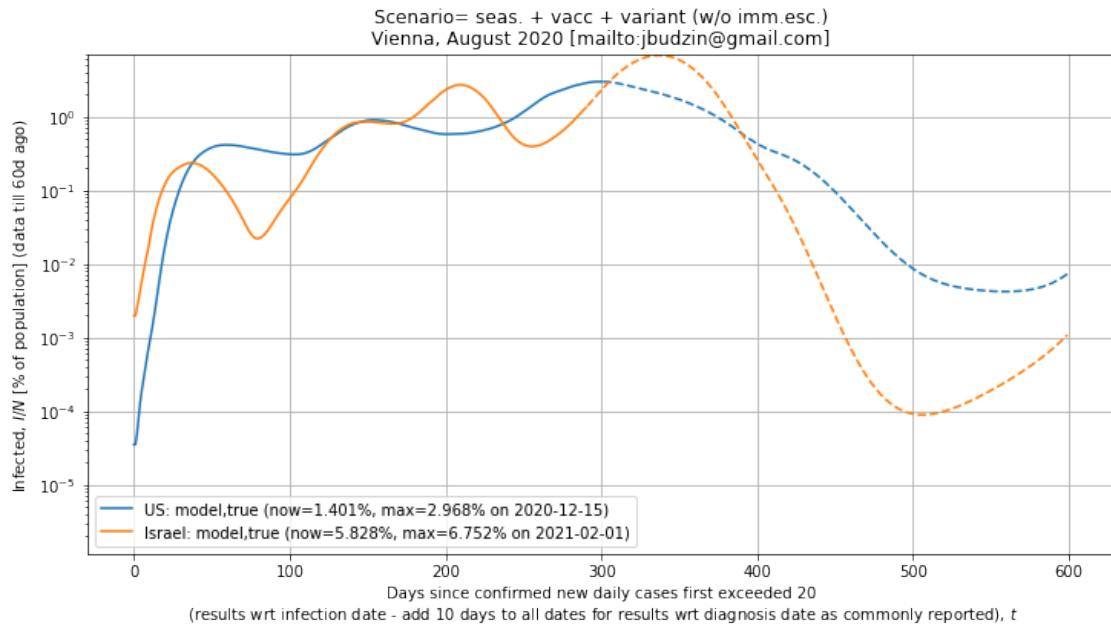
3.5.4 MORTALITY



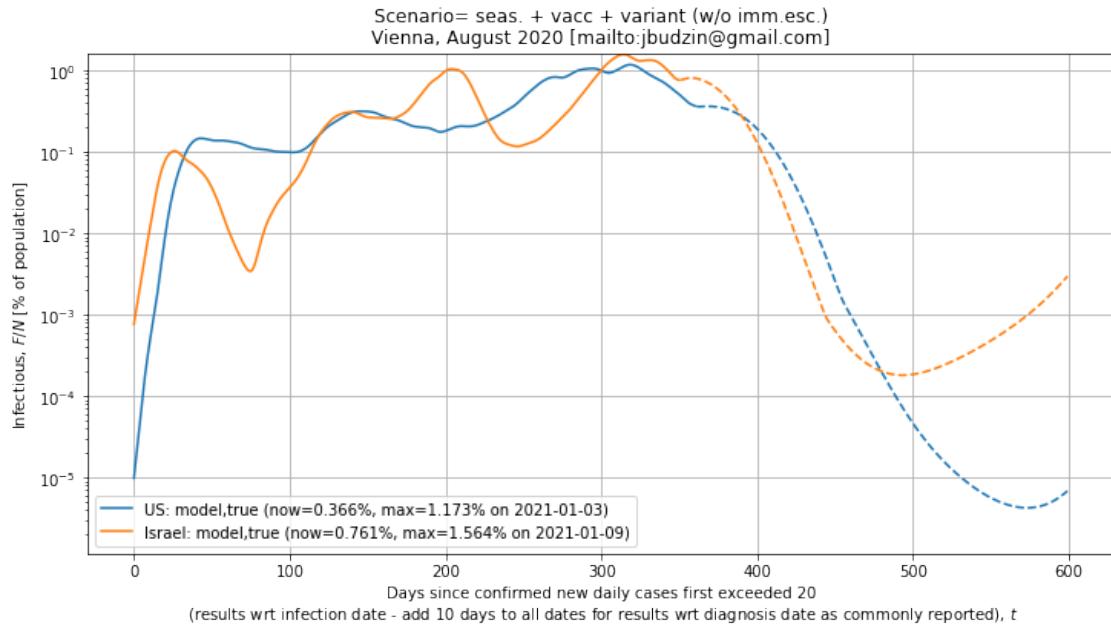
3.5.5 INFECTED



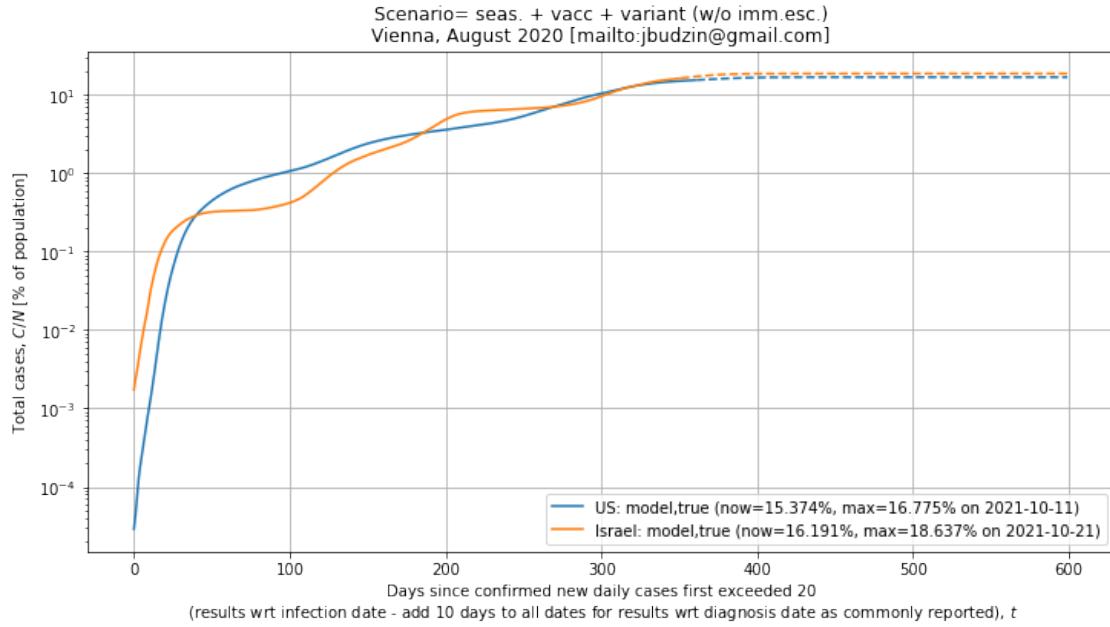




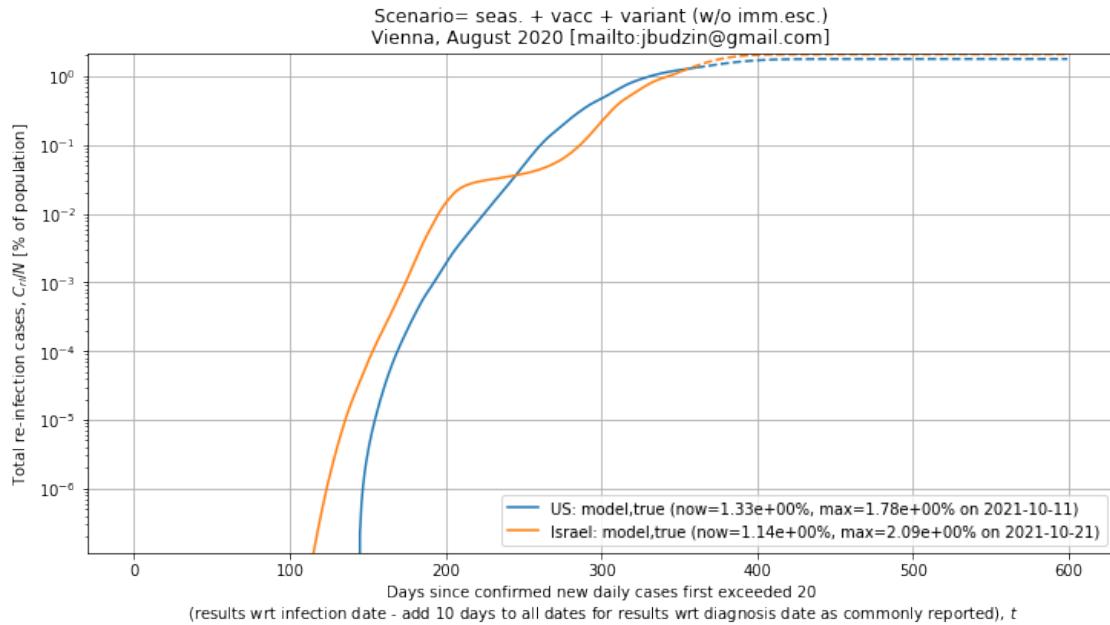
3.5.6 INFECTIOUS



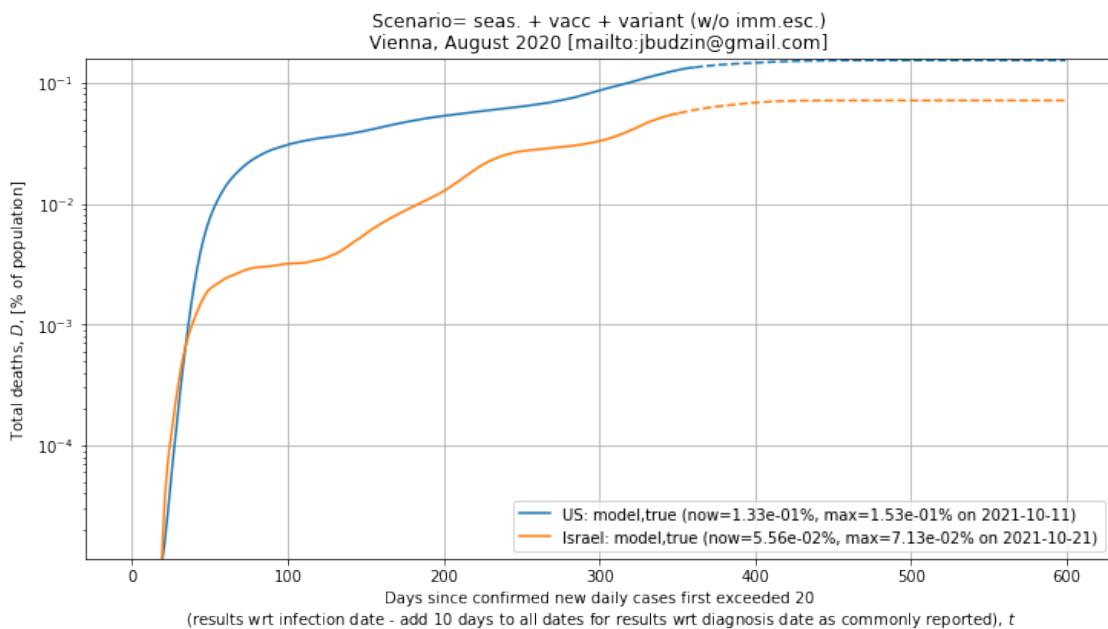
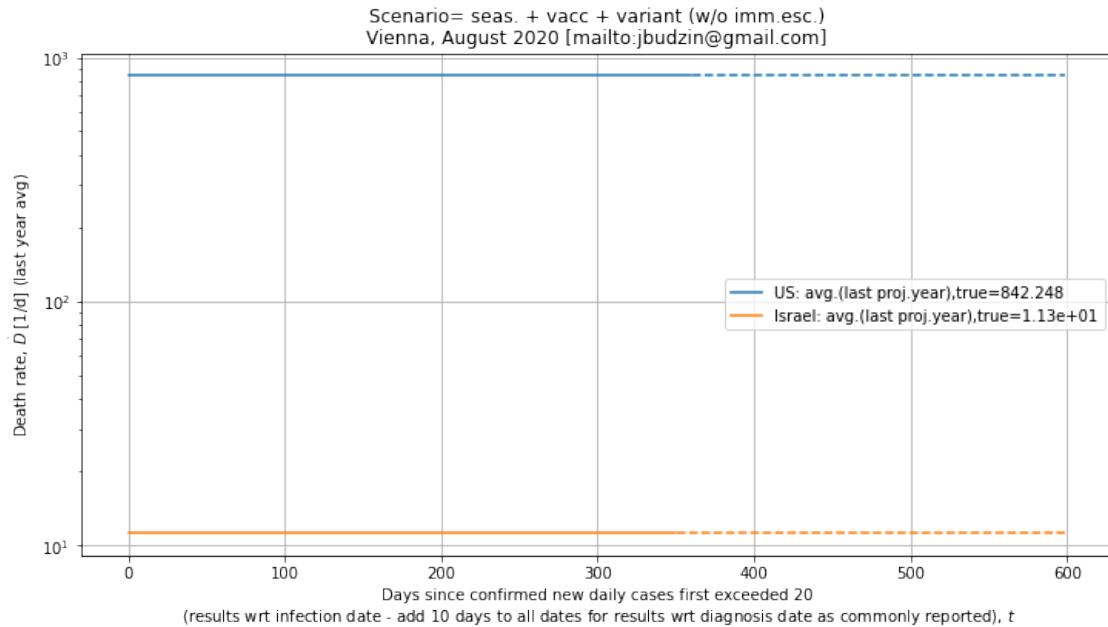
3.5.7 TOTAL CASES



3.5.8 REINFECTIONS

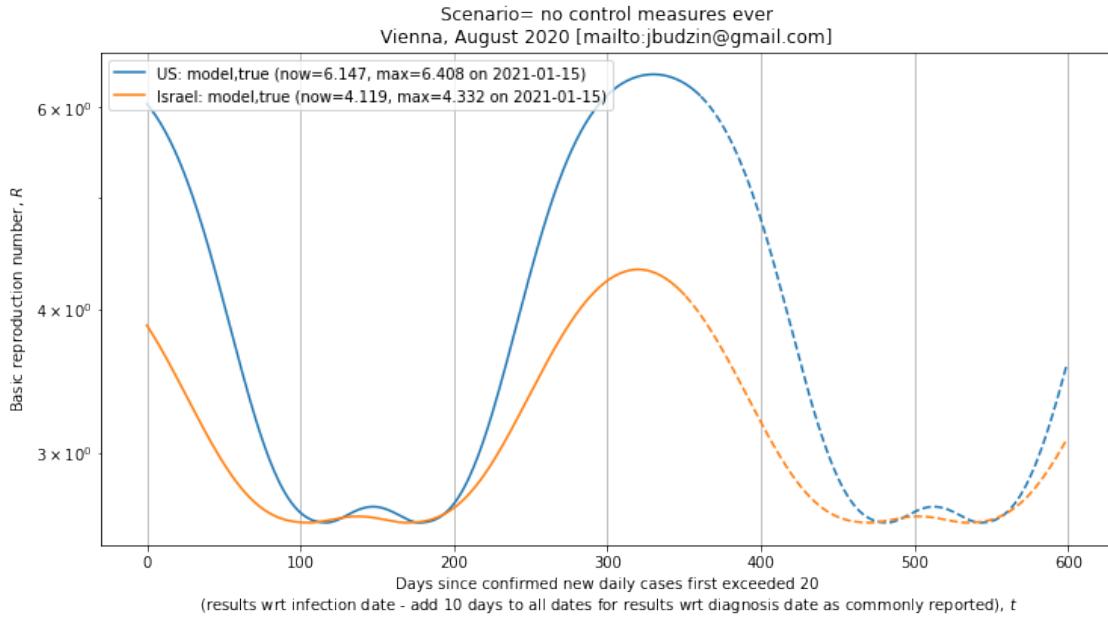


3.5.9 DEATHS

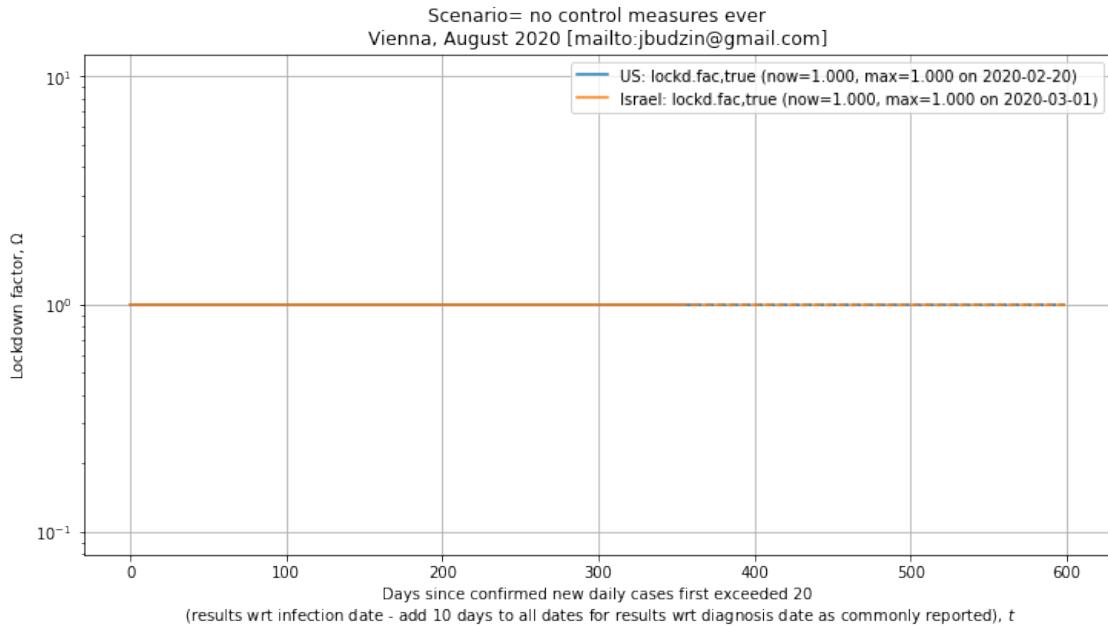


3.6 SCENARIO: no control measures ever

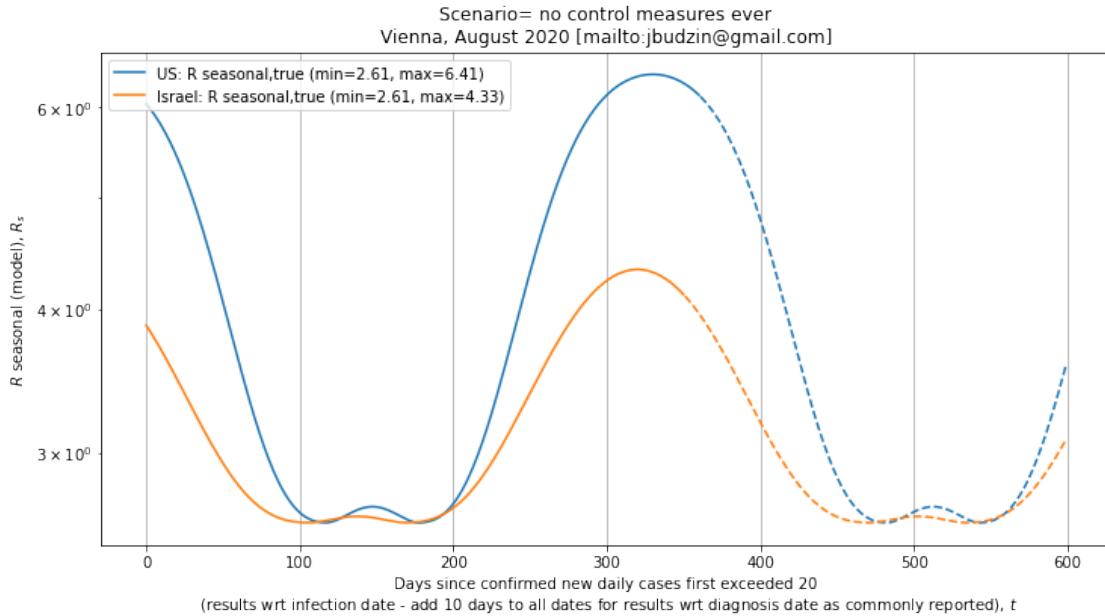
3.6.1 REPRODUCTION NUMBER



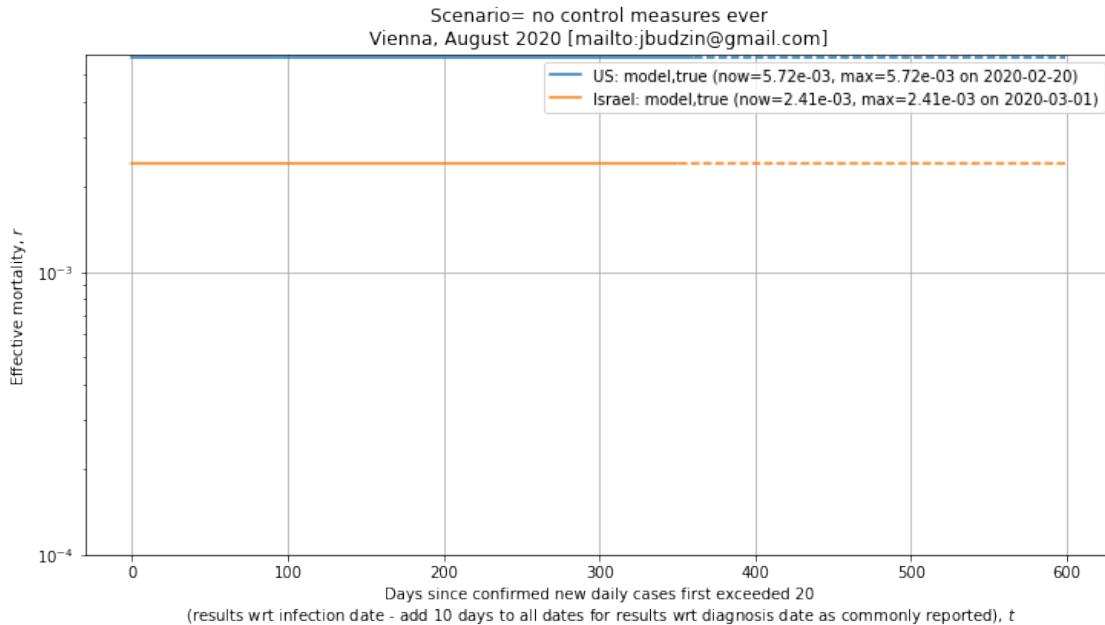
3.6.2 LOCKDOWN FACTOR



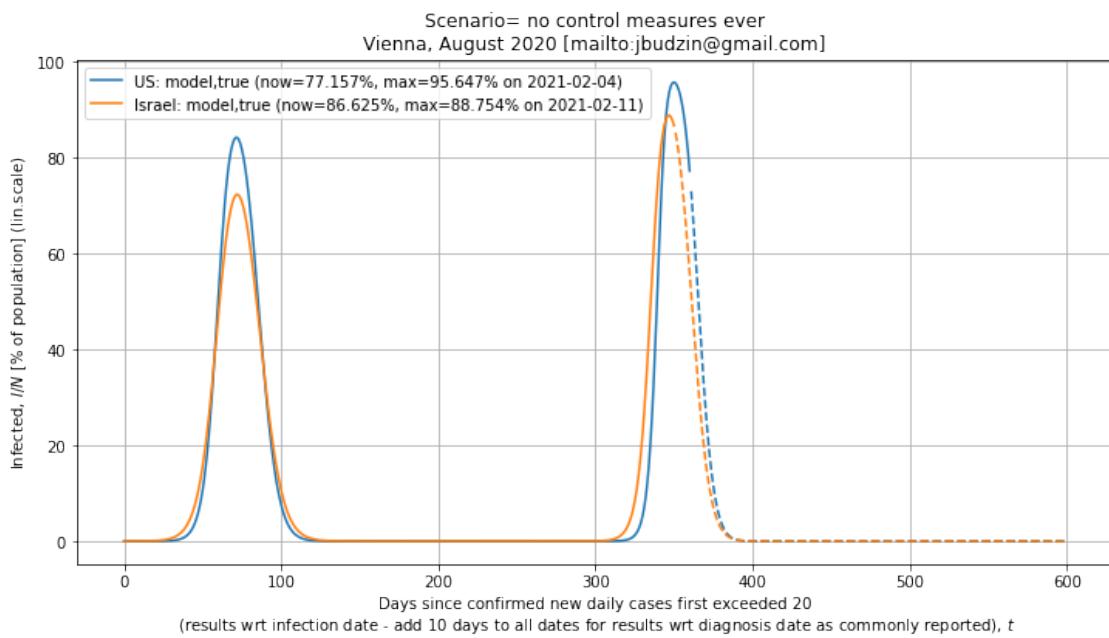
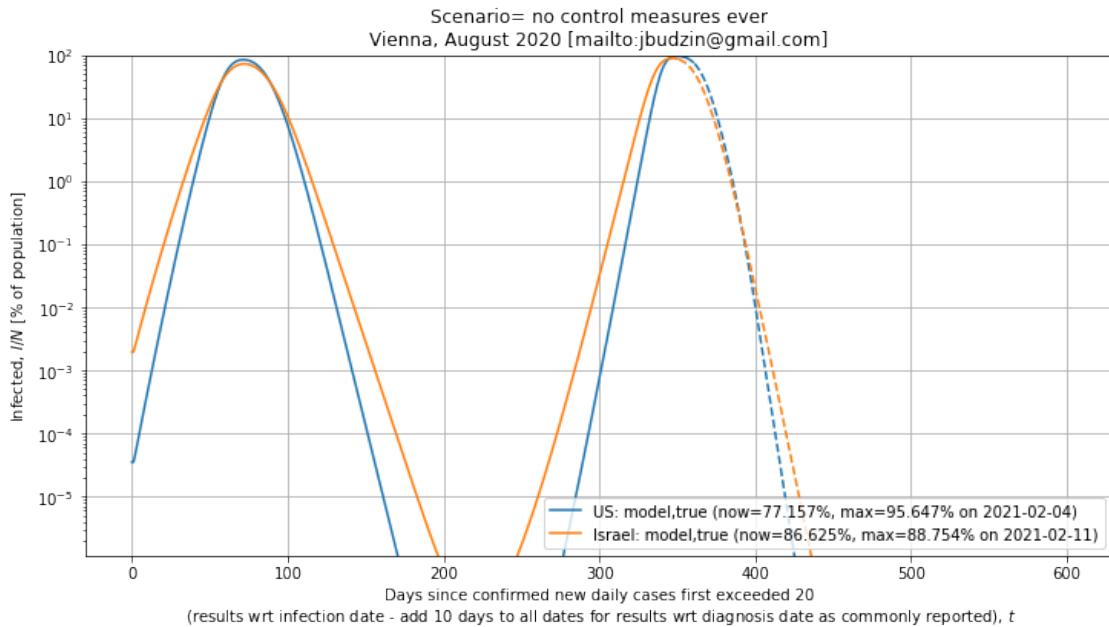
3.6.3 R SEASONAL

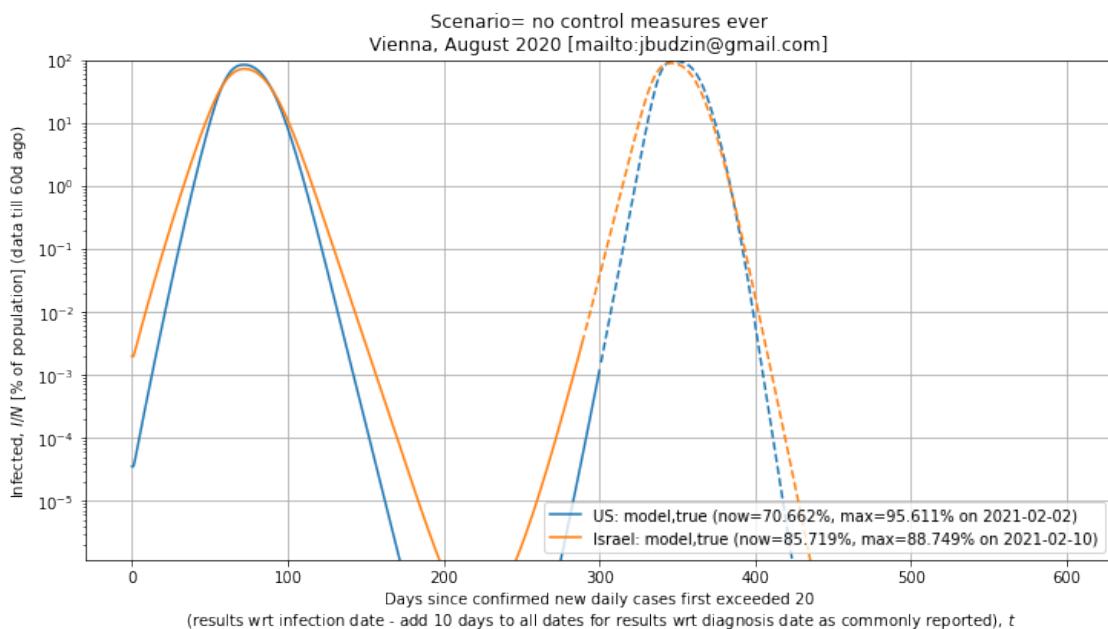
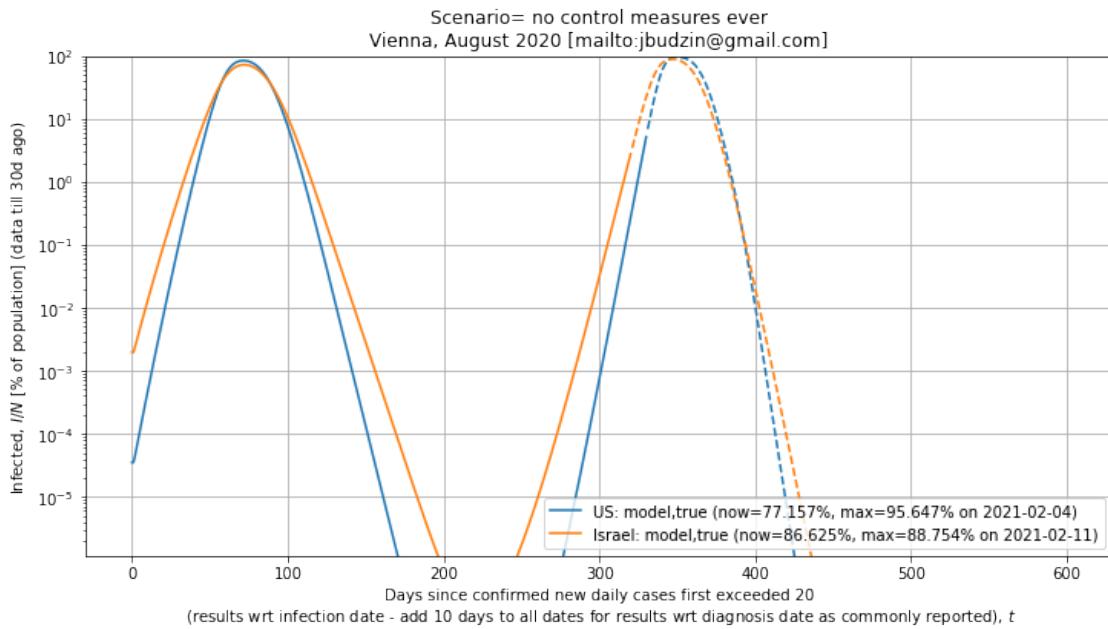


3.6.4 MORTALITY

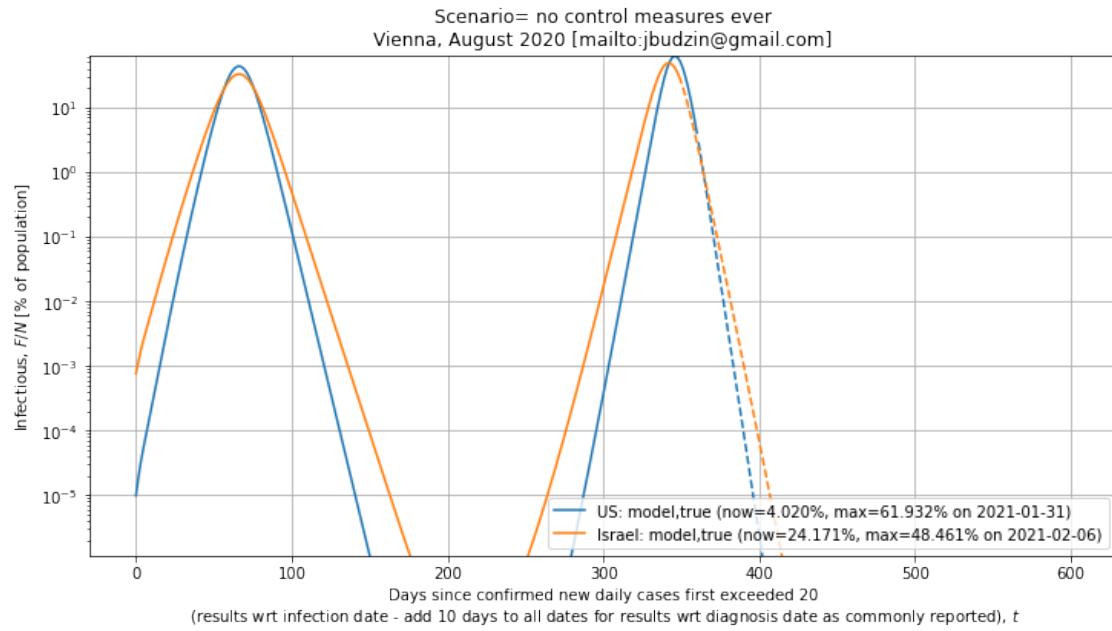


3.6.5 INFECTED

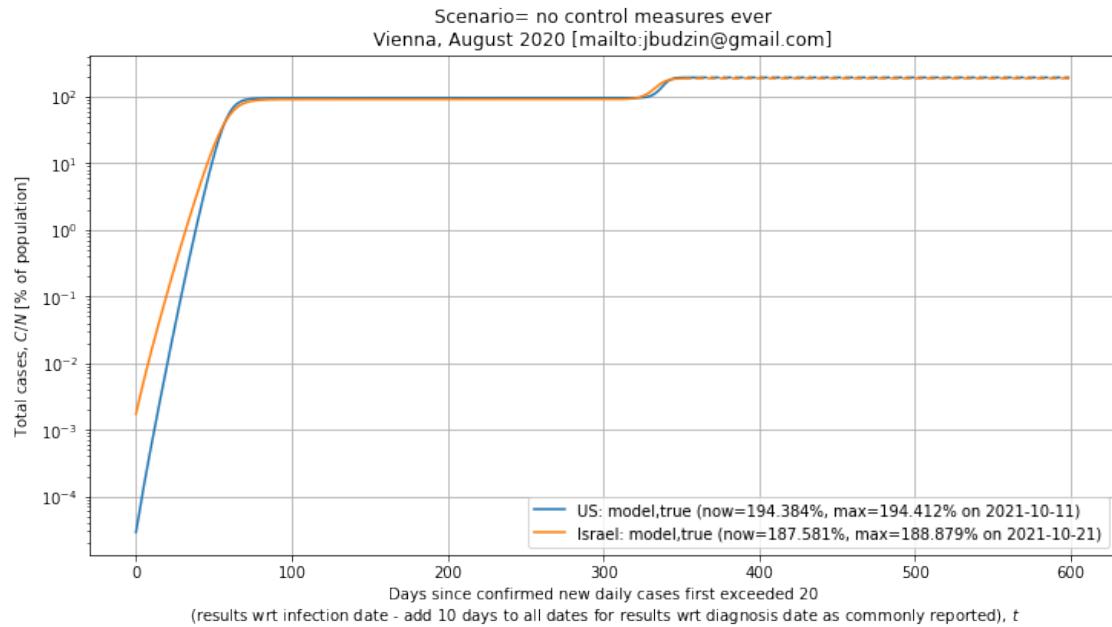




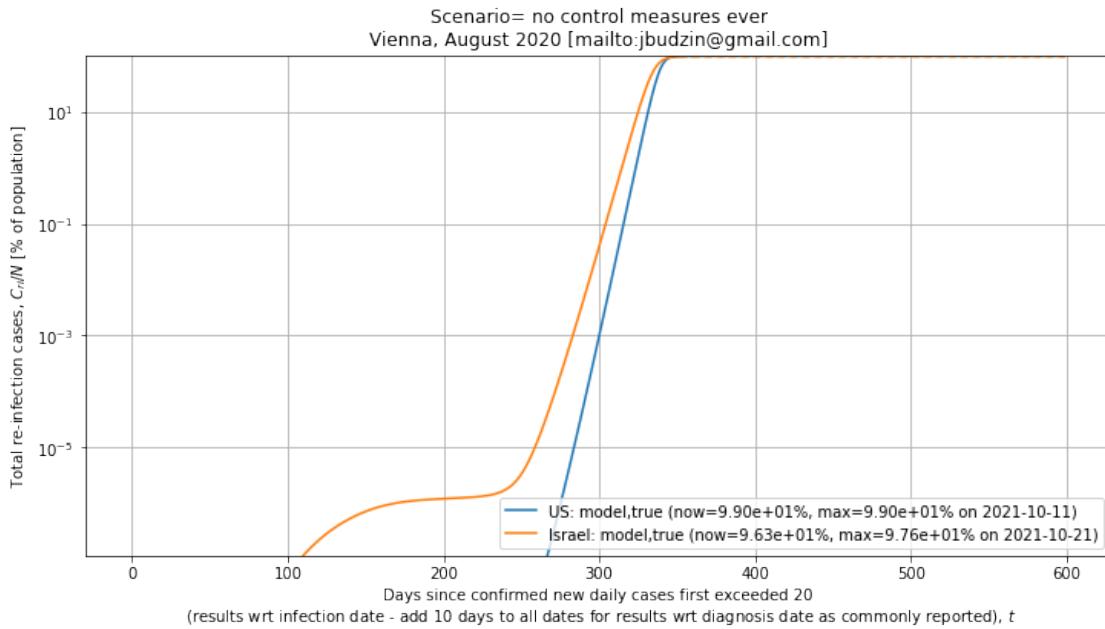
3.6.6 INFECTIOUS



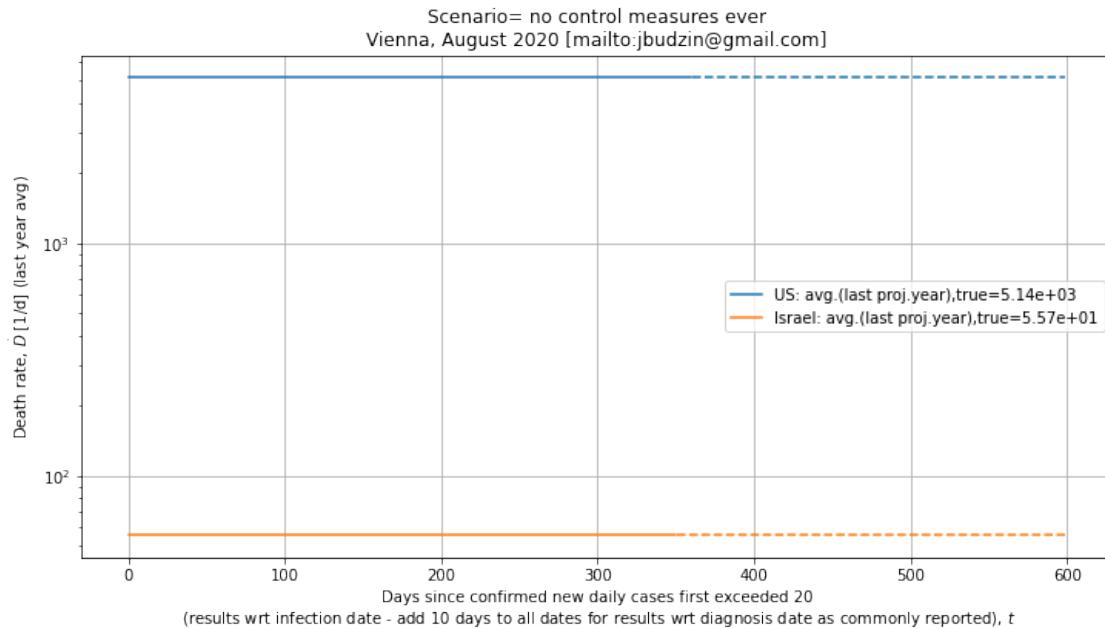
3.6.7 TOTAL CASES

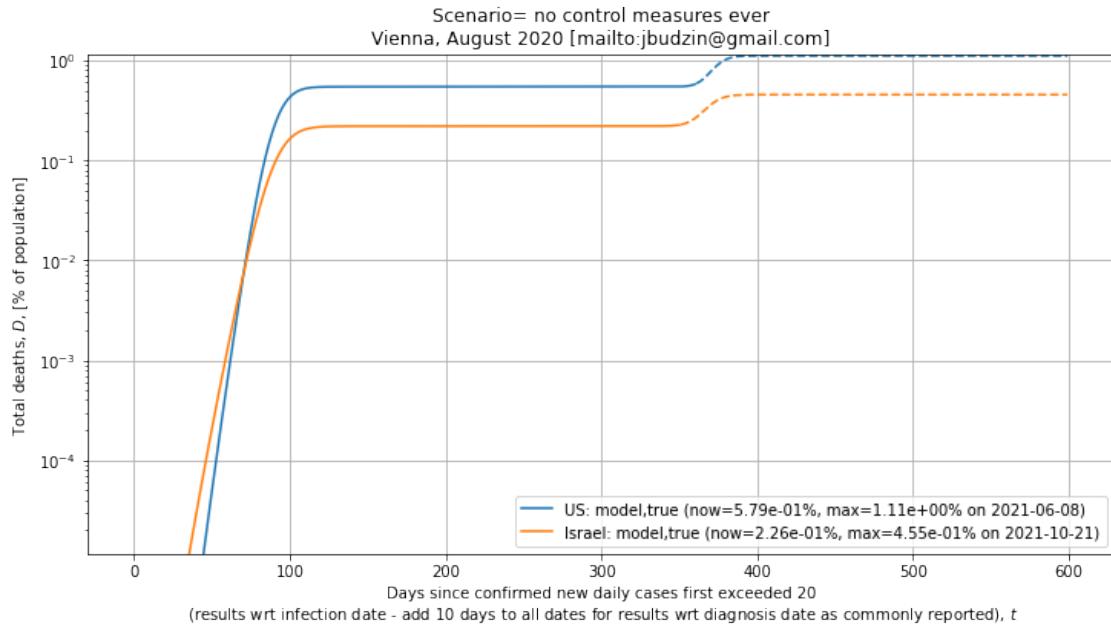


3.6.8 REINFECTIONS



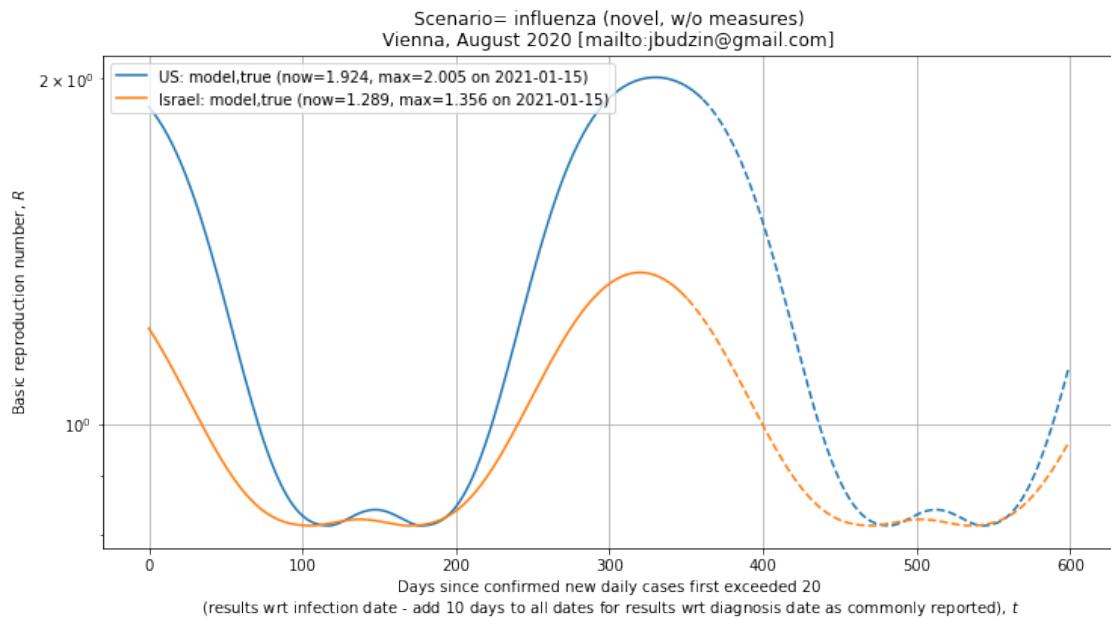
3.6.9 DEATHS



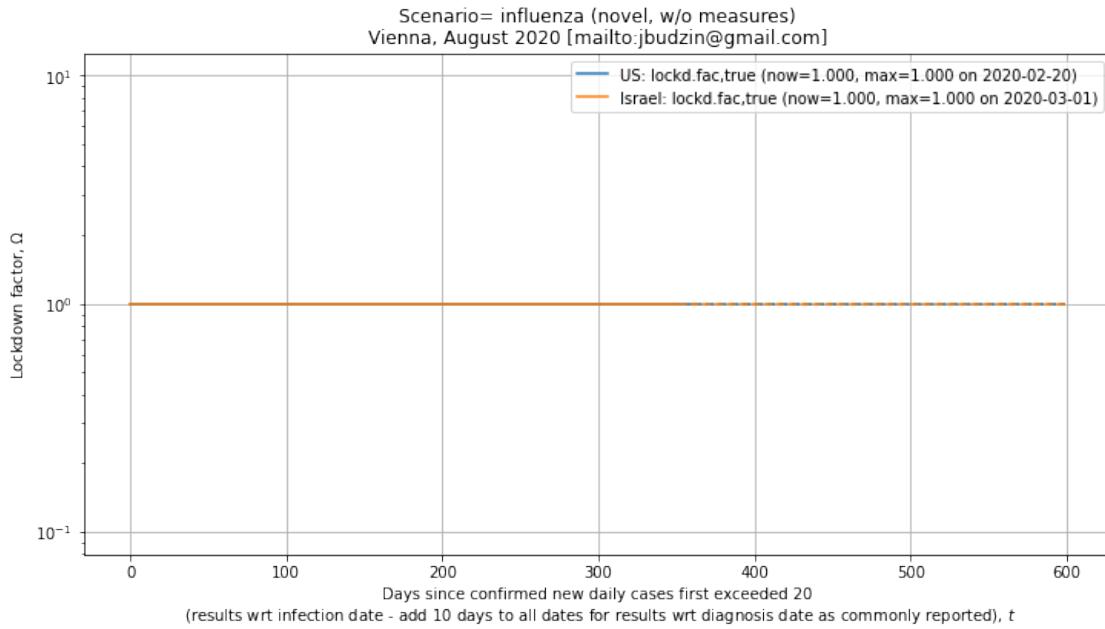


3.7 SCENARIO: influenza (novel, w/o measures)

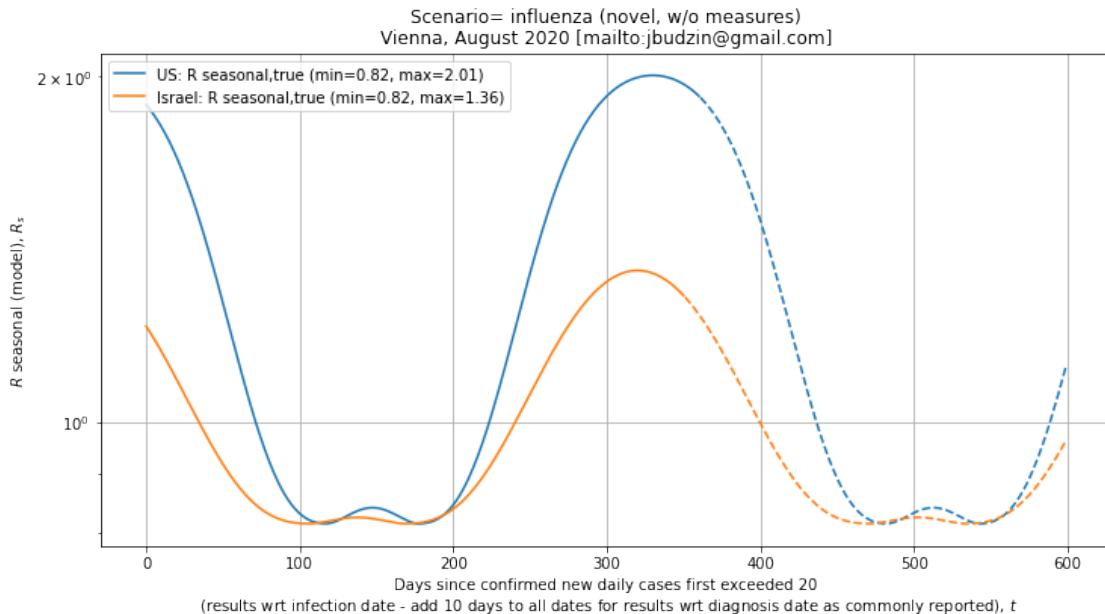
3.7.1 REPRODUCTION NUMBER



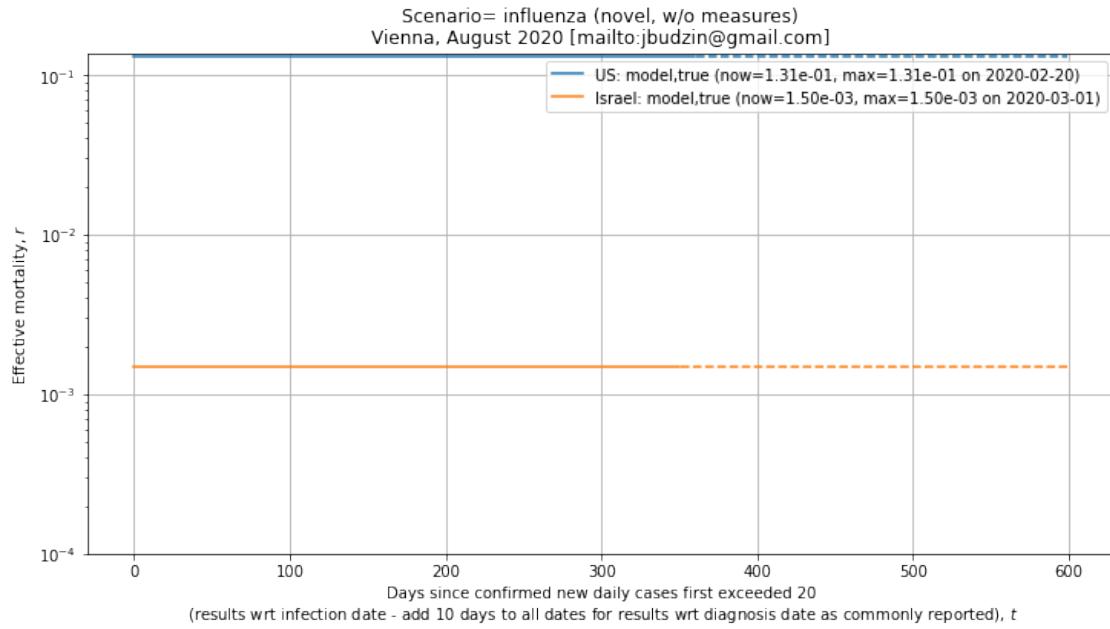
3.7.2 LOCKDOWN FACTOR



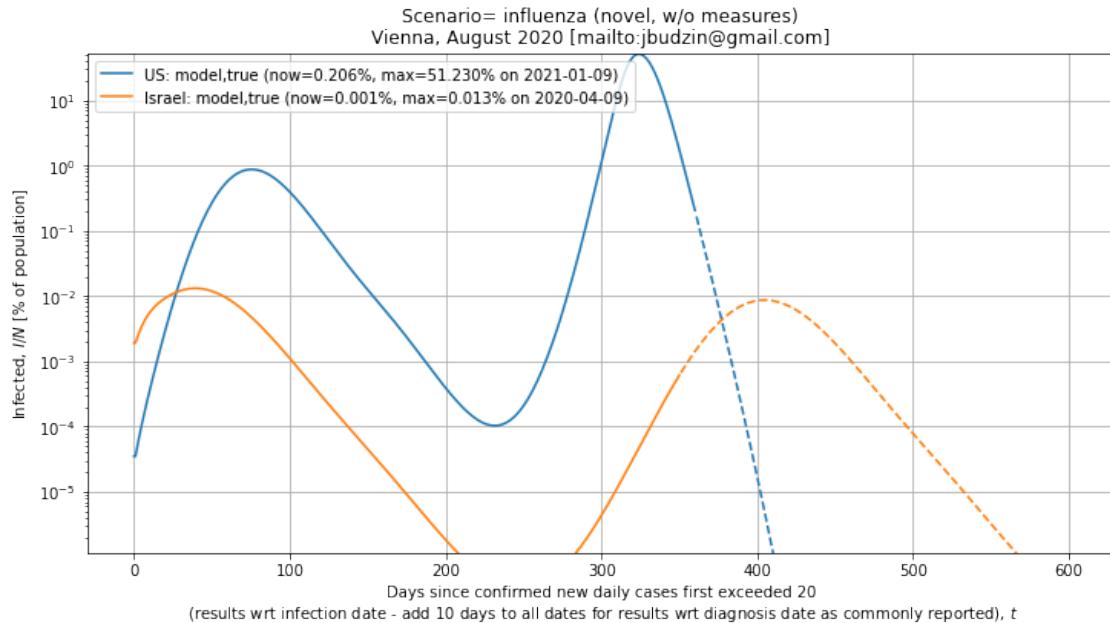
3.7.3 R SEASONAL

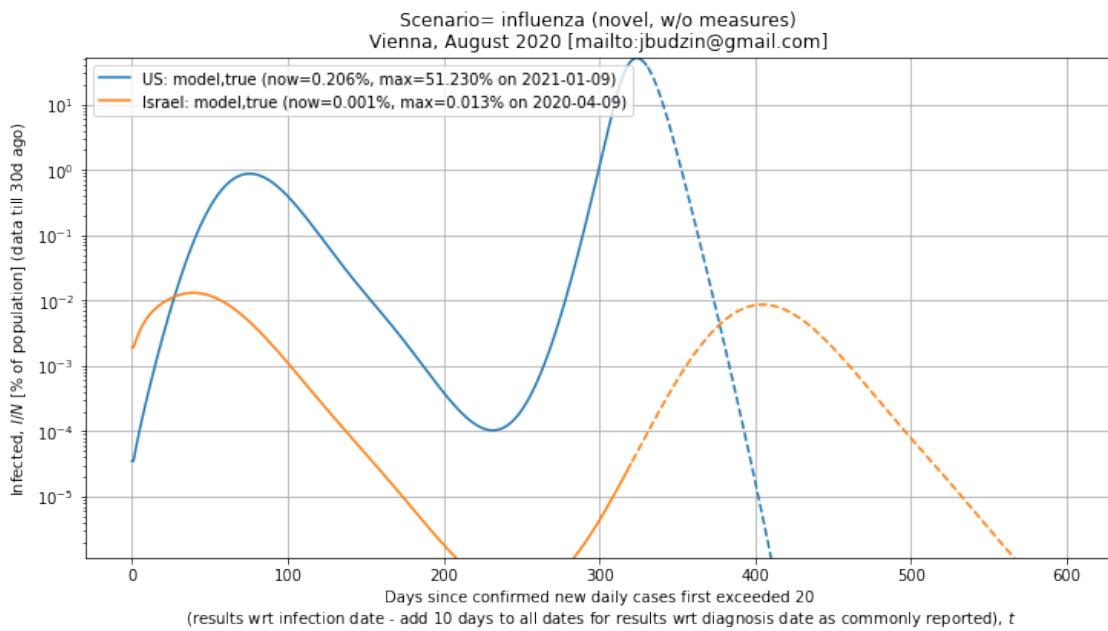
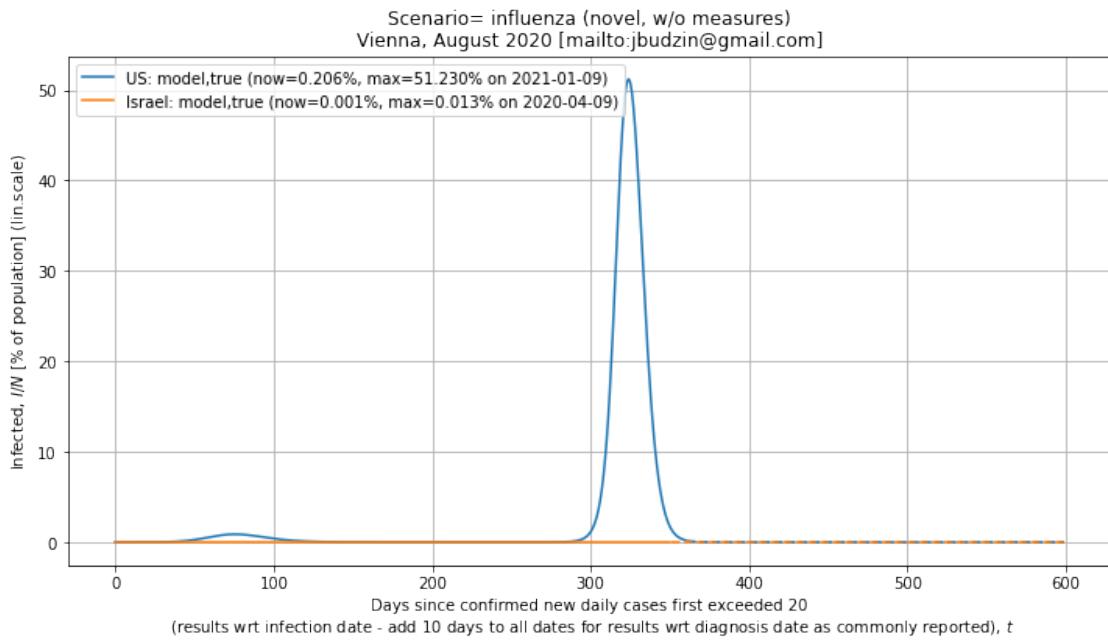


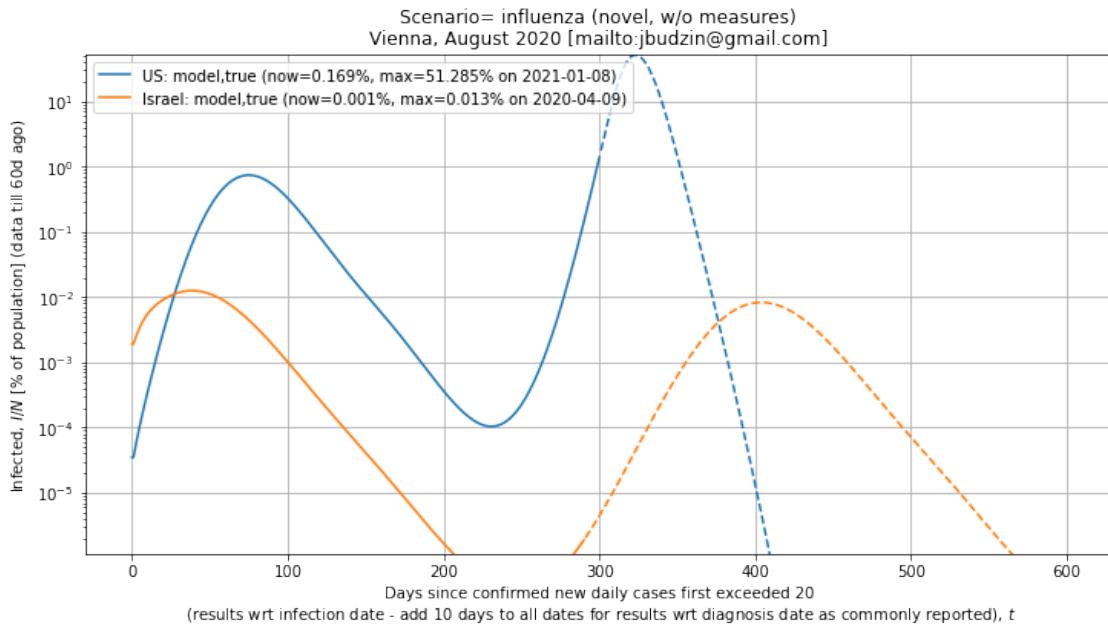
3.7.4 MORTALITY



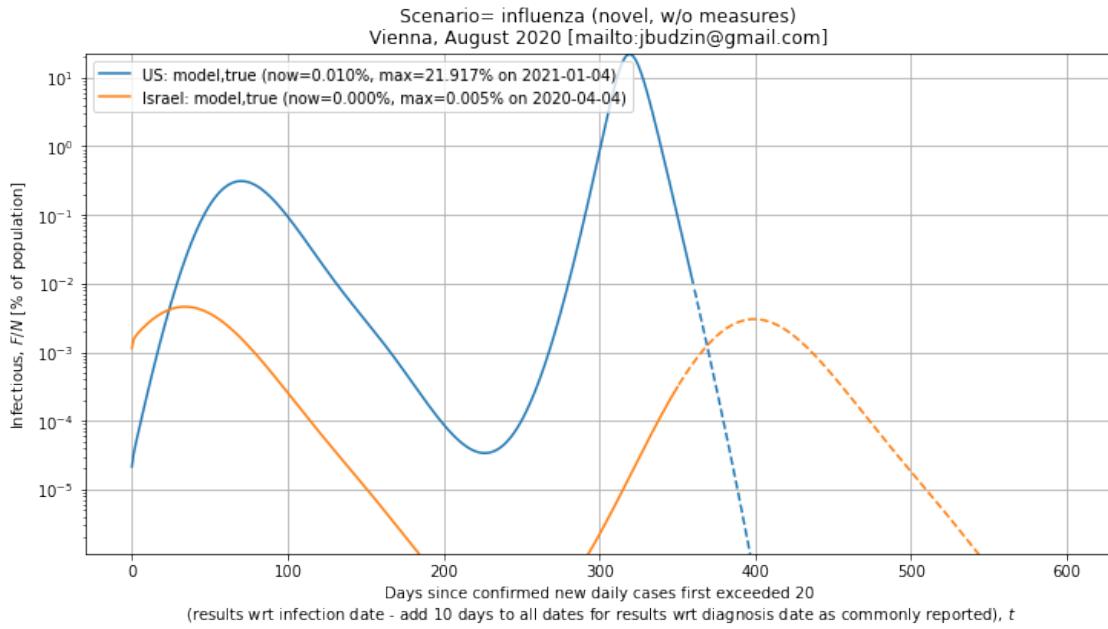
3.7.5 INFECTED



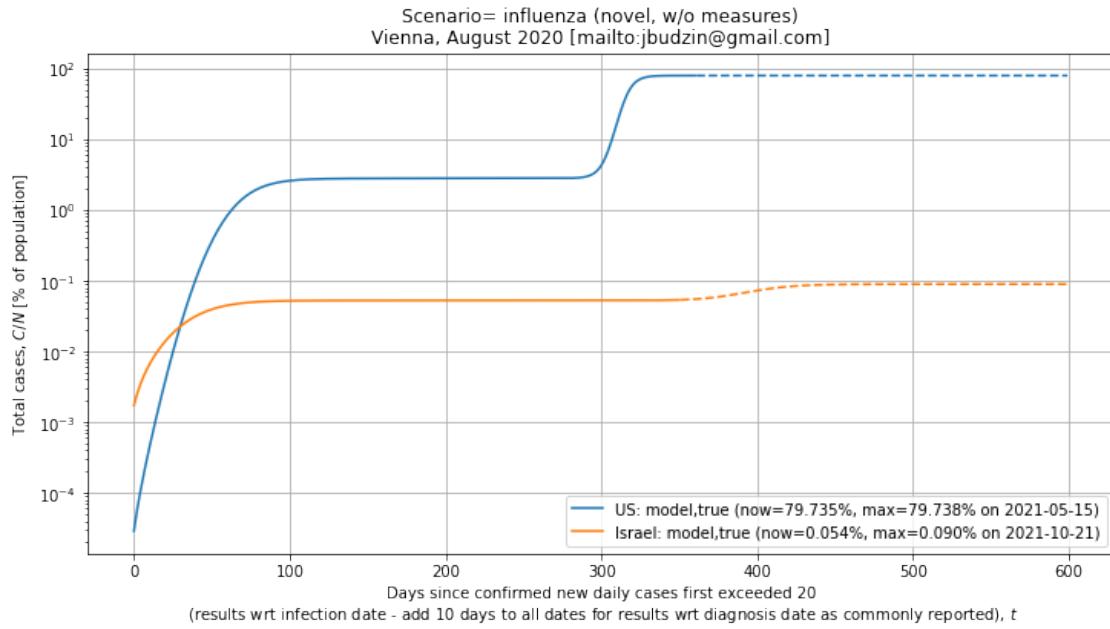




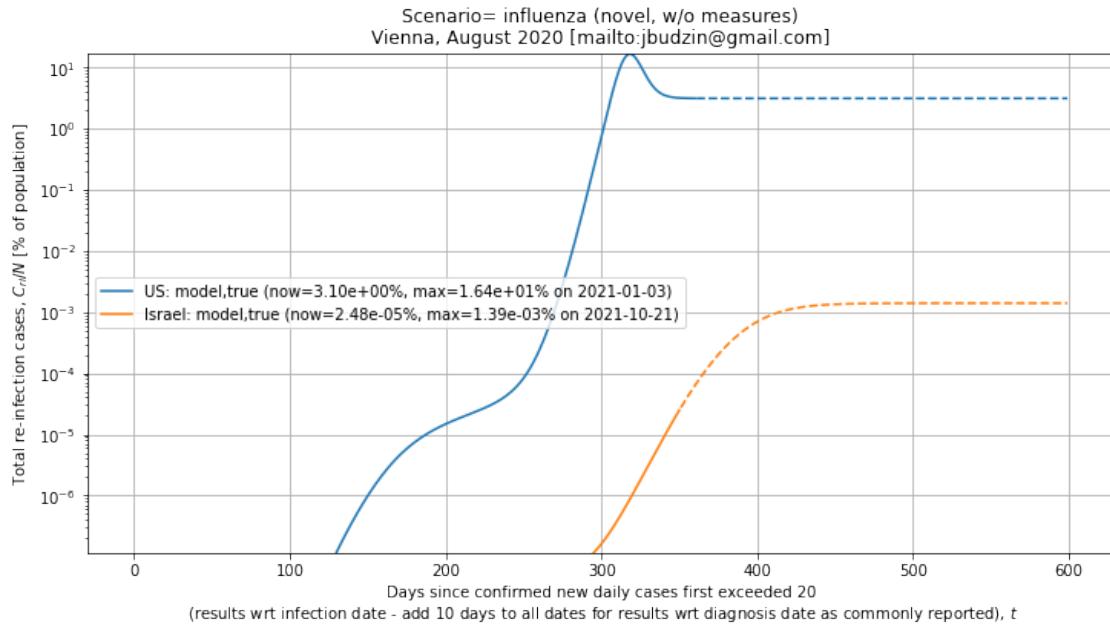
3.7.6 INFECTIOUS



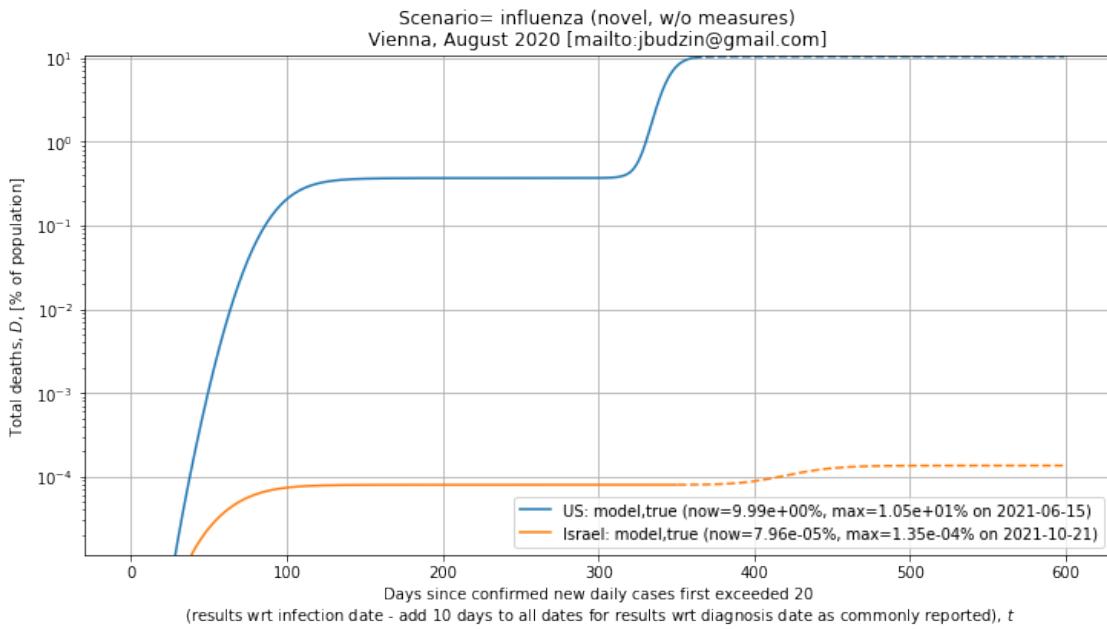
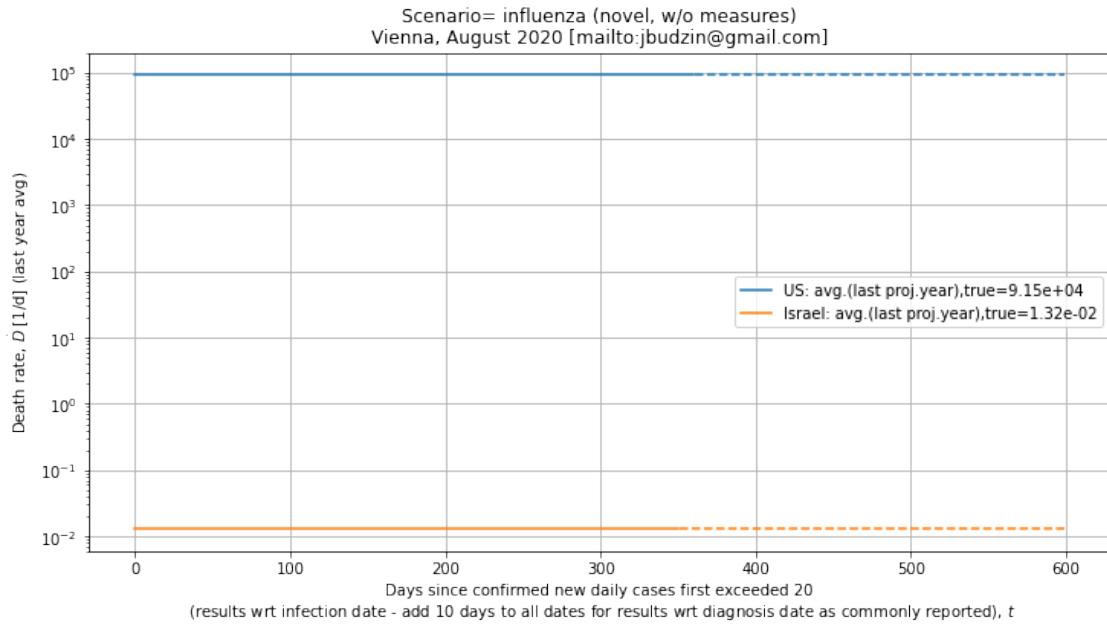
3.7.7 TOTAL CASES



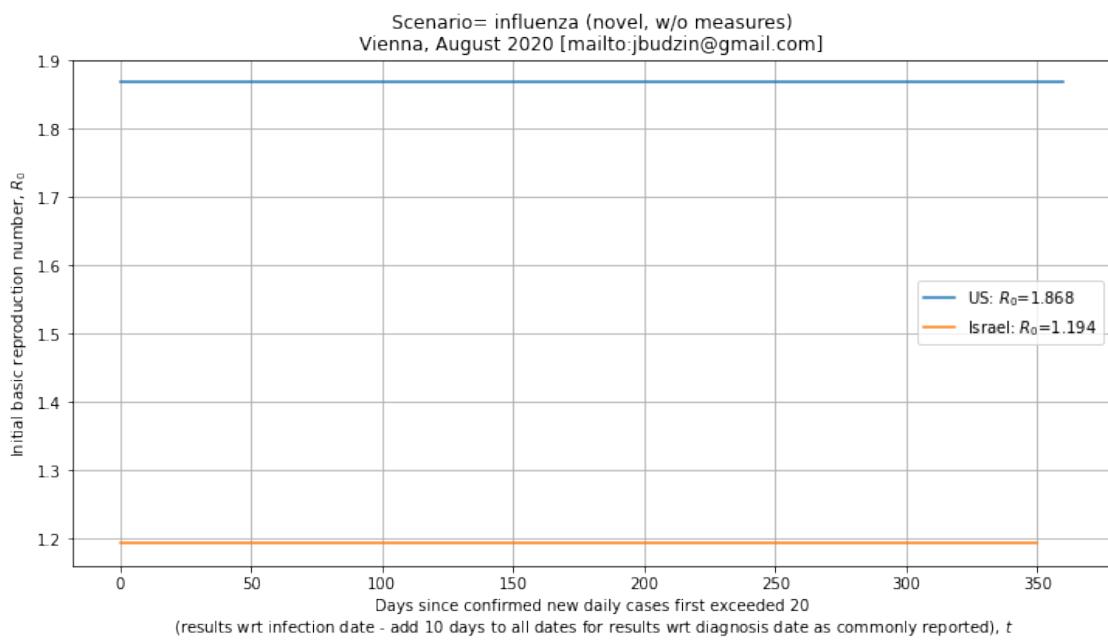
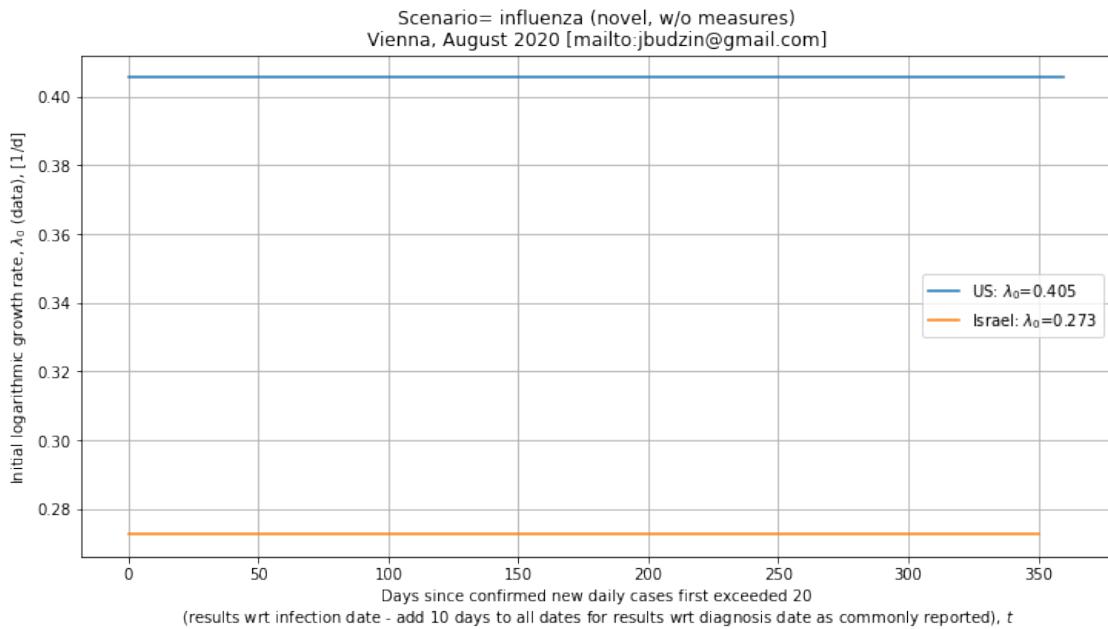
3.7.8 REINFECTIONS



3.7.9 DEATHS



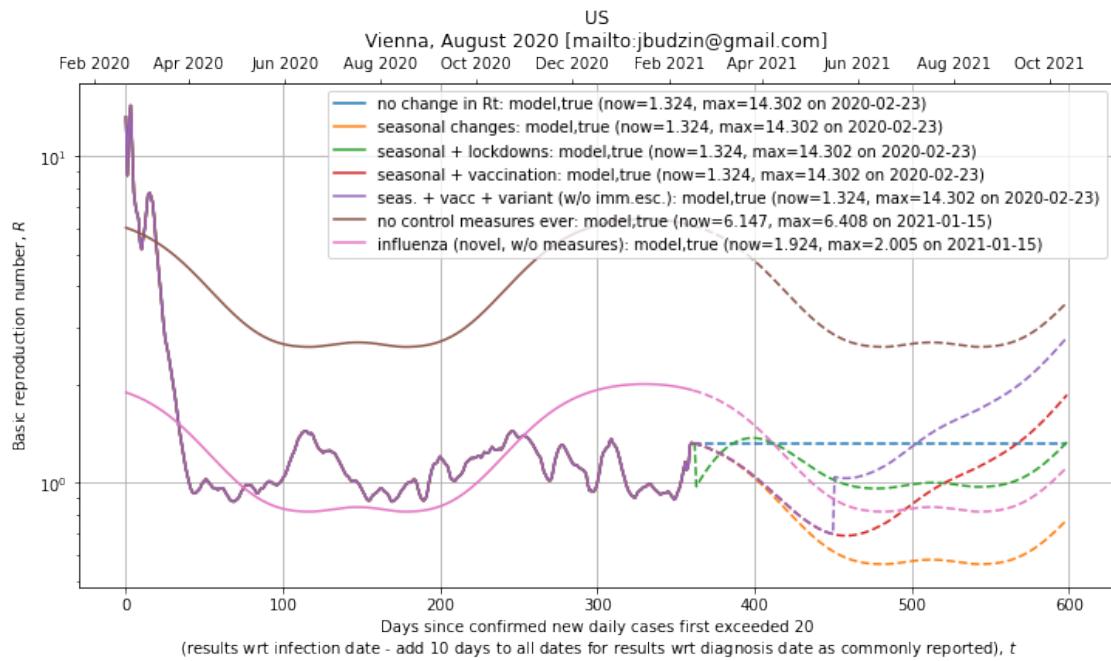
3.8 EARLY STAGES



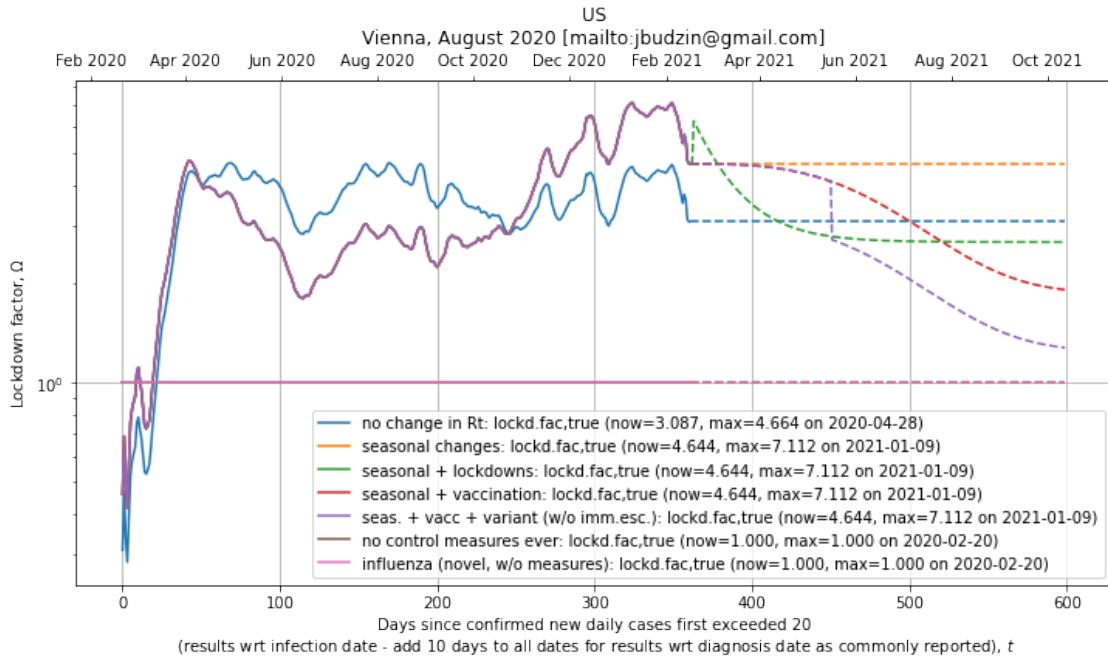
4 SCENARIO COMPARISONS

4.1 COUNTRY: US

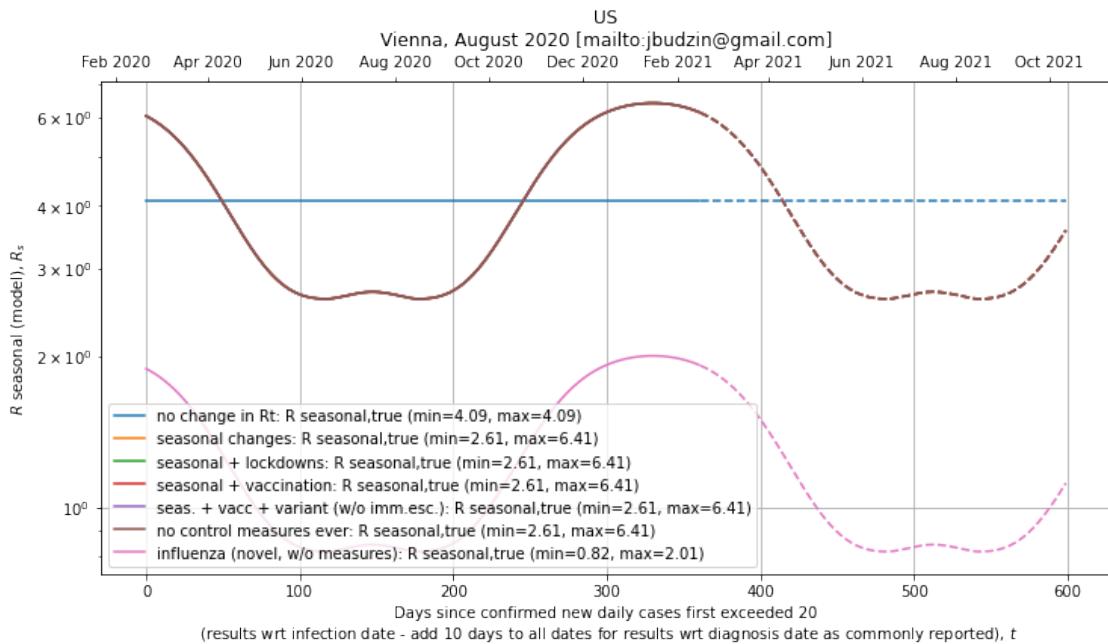
4.1.1 REPRODUCTION NUMBER



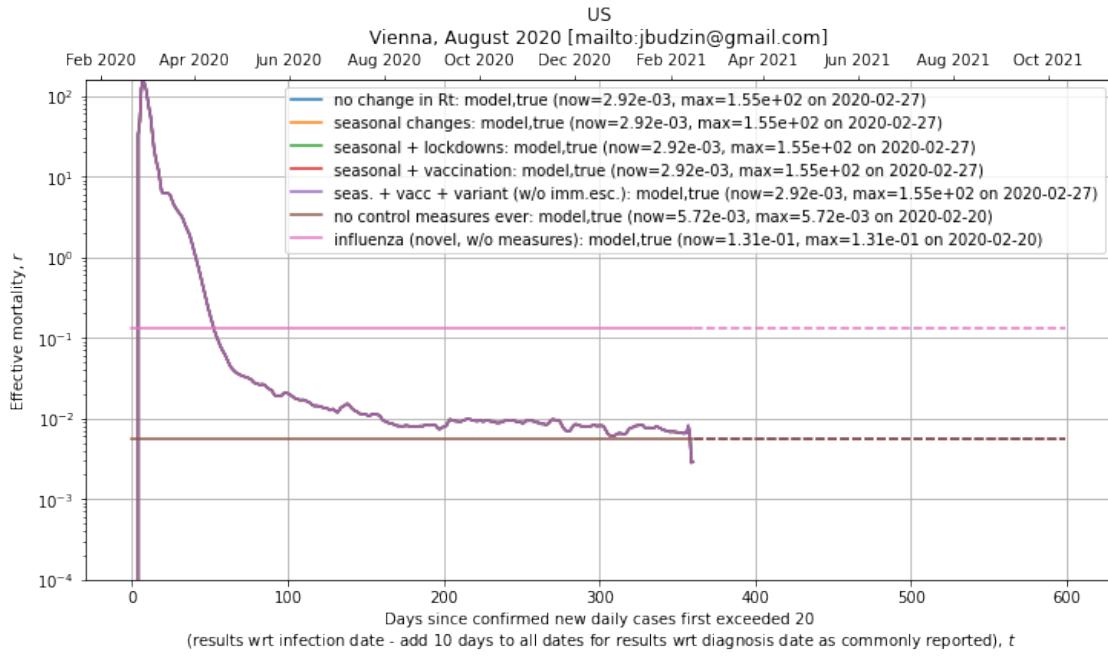
4.1.2 LOCKDOWN FACTOR



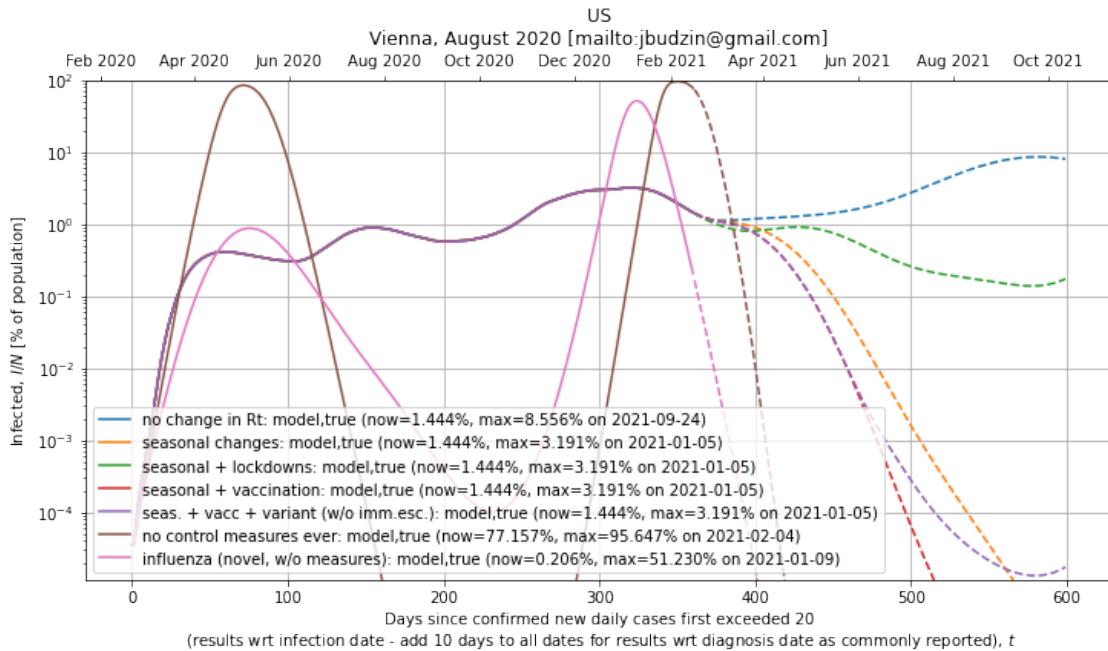
4.1.3 R SEASONAL



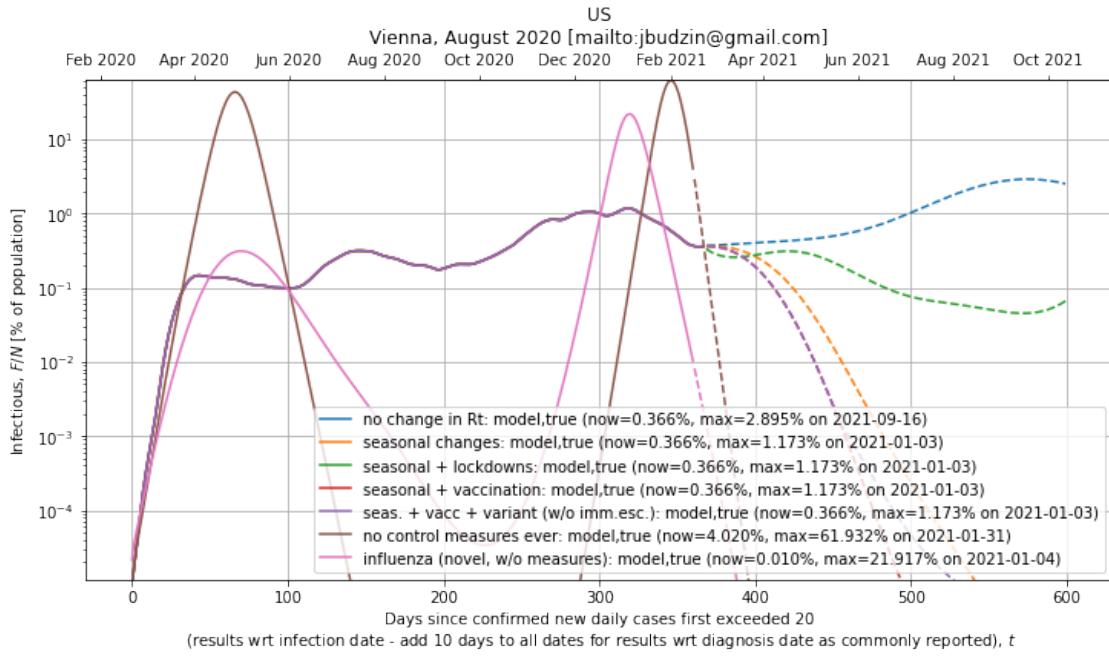
4.1.4 MORTALITY



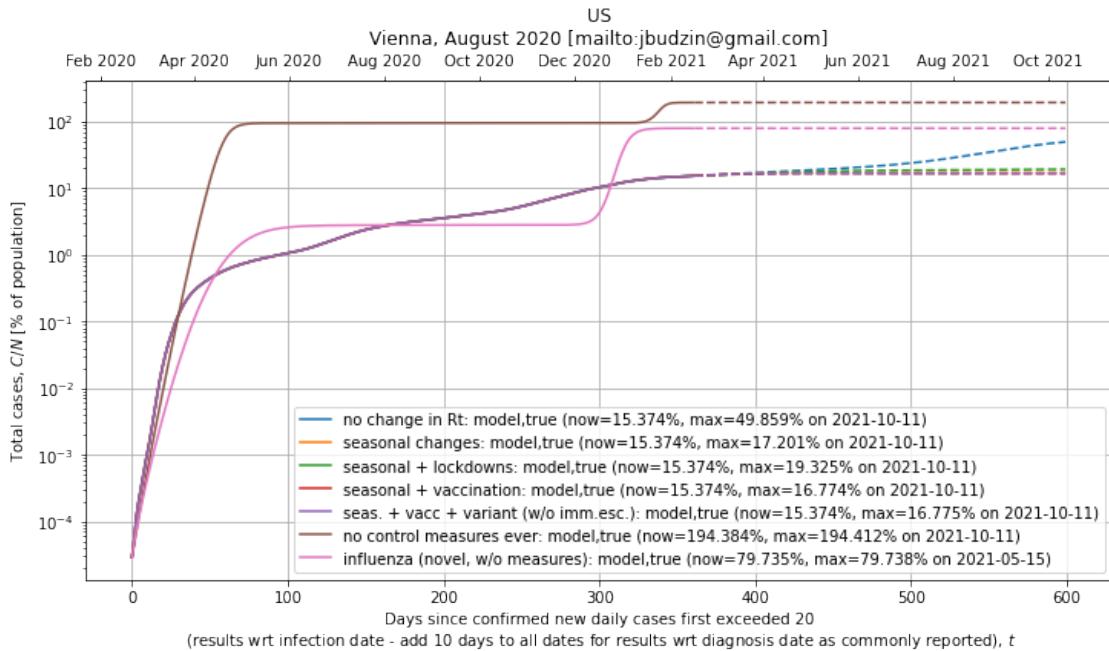
4.1.5 INFECTED



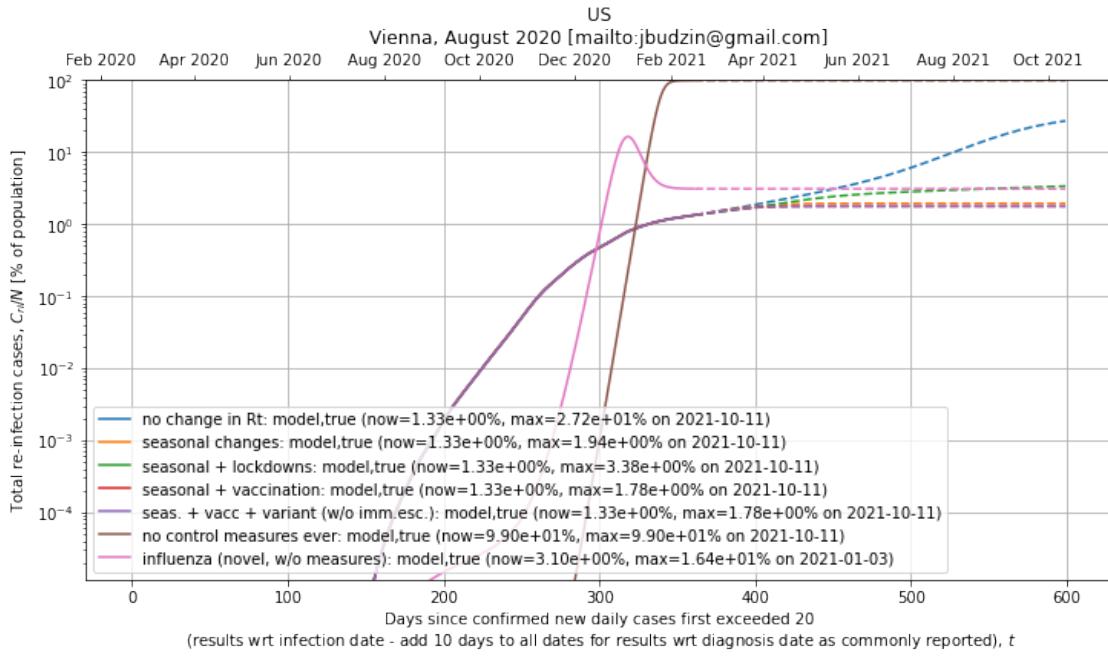
4.1.6 INFECTIOUS



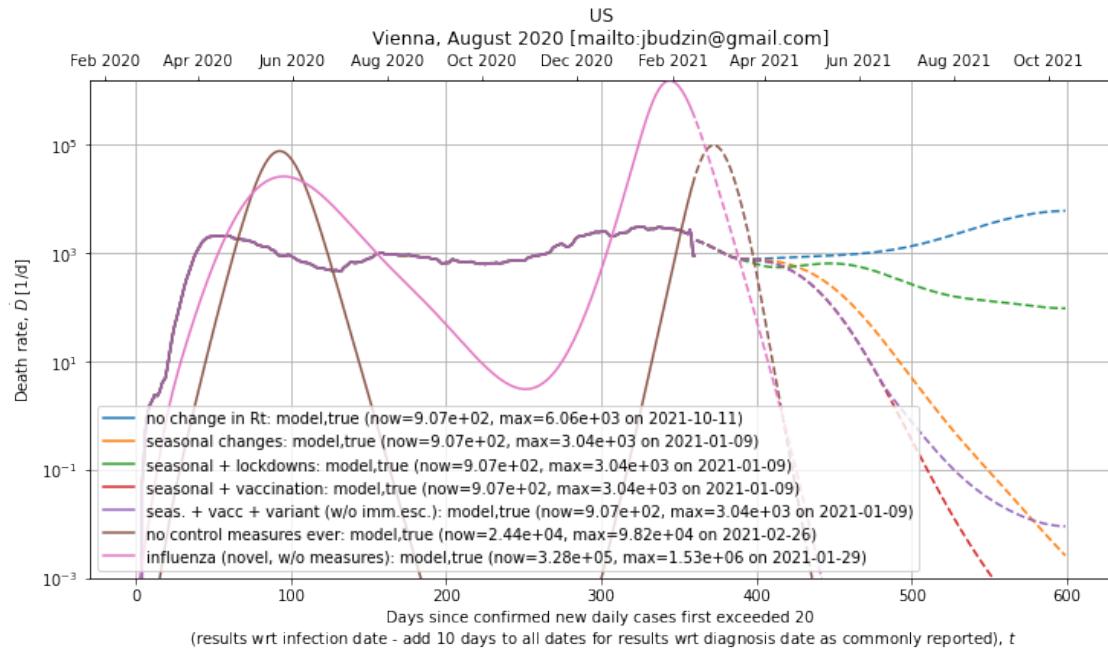
4.1.7 TOTAL CASES

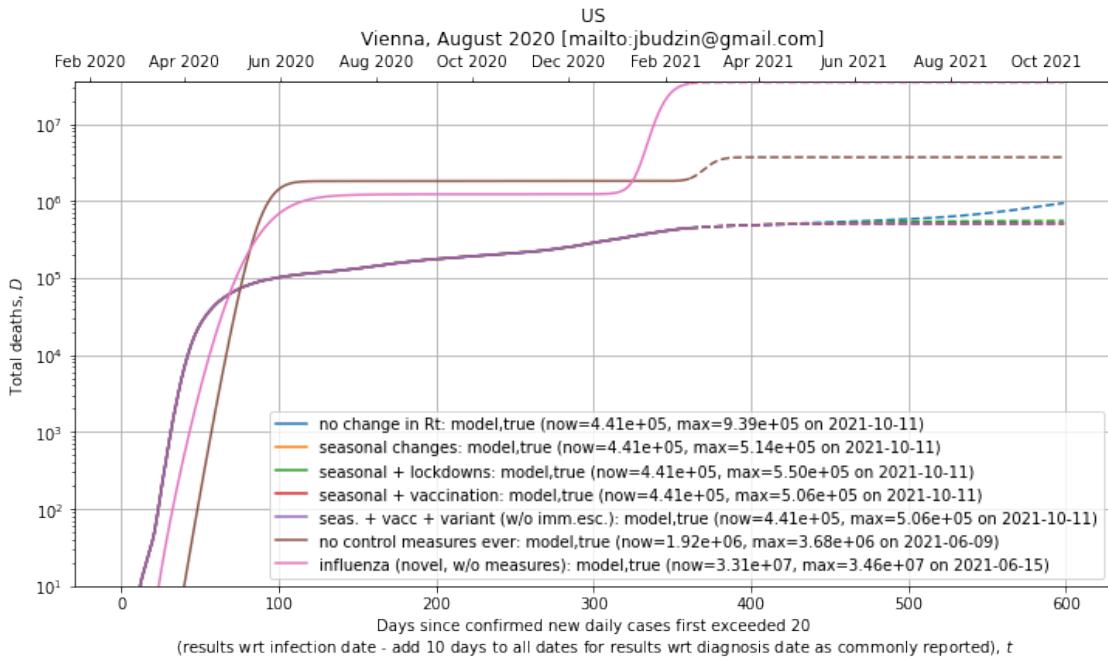
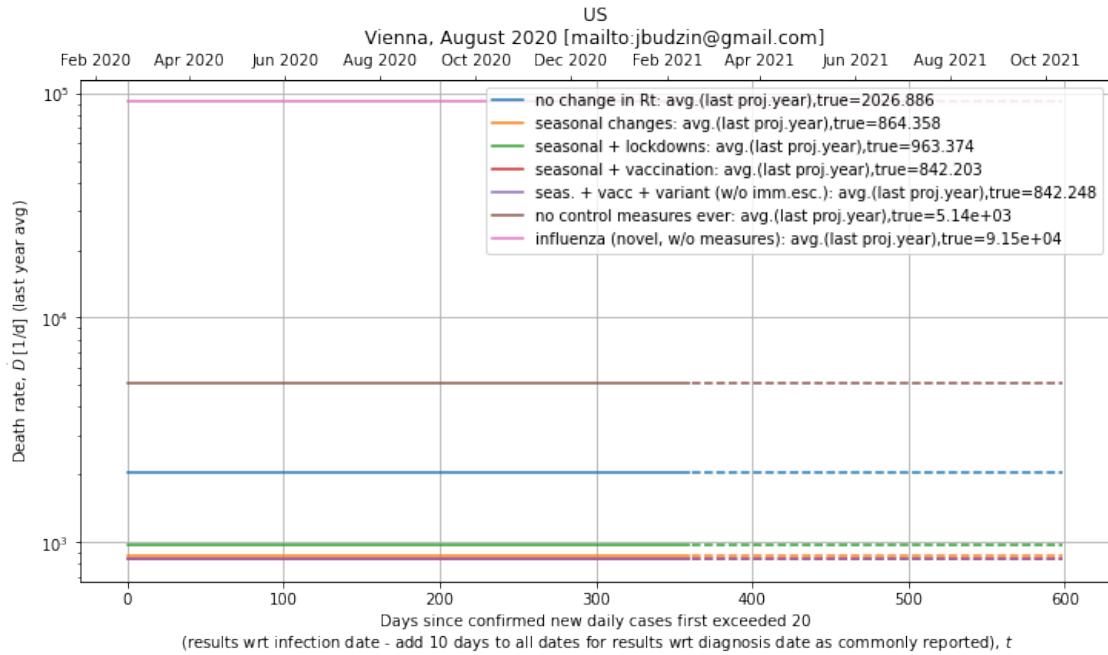


4.1.8 REINFECTIONS



4.1.9 DEATHS





5 MODEL DESCRIPTION

A custom infection-age SIRS model with waning immunity, vaccinations and undetected cases for simulating the COVID-19 pandemics
and control measures and seasonality effects as compared to influenza

Dynamics

$$\dot{C} = \frac{R_e}{\tau_{inf}} F$$

$$\dot{H} = (1 - r) \int_0^\infty p_\gamma \tilde{I} d\tau$$

$$\dot{D} = r \int_0^\infty p_\delta \tilde{I} d\tau$$

$$\dot{D}_\mu = \mu I$$

$$I = \int_0^\infty \tilde{I} d\tau$$

$$F = \tau_{inf} \int_0^\infty p_\beta \tilde{I} d\tau$$

$$(\partial_t + \partial_\tau) \tilde{I} = -p_{\gamma\delta} \tilde{I}$$

$$\dot{L} = \int_0^\infty p_\nu \tilde{J} d\tau'$$

$$J = \int_0^\infty \tilde{J} d\tau'$$

$$(\partial_t + \partial_{\tau'}) \tilde{J} = -p_\nu \tilde{J}$$

$$\dot{U} = \int_0^\infty p_\nu \tilde{K} d\tau'$$

$$K = \int_0^\infty \tilde{K} d\tau'$$

$$(\partial_t + \partial_{\tau'}) \tilde{K} = -p_\nu \tilde{K}$$

$$R_e = \frac{S}{N} R$$

$$S=\Theta(N-I-J-K-D-D_\mu)$$

$$C=I+H+D$$

$$H=J+L$$

$$V=K+U$$

Initial conditions

$$\tilde{I}(0,\tau)=\dot{C}_0\Lambda(\tau)e^{-\lambda_0\tau}$$

$$\tilde{J}(0,\tau')=(1-r_0)\dot{C}_0\Lambda_\nu(\tau')e^{-\lambda_0\tau'}\int_0^\infty p_\gamma(\tau)e^{-\lambda_0\tau}\,d\tau$$

$$\tilde{K}(0,\tau')=0$$

$$\tilde{I}(t,0)=\dot{C}(t)$$

$$\tilde{J}(t,0)=\dot{H}(t)$$

$$\tilde{K}(t,0)=\dot{V}(t)$$

Reported vs true cases

$$\dot{C}=\frac{\dot{C}^*}{\alpha}$$

$$D=D^*$$

Parameter estimation

$$C^*+D_\mu^*\leftrightarrow C_{data}^*$$

$$D^*+D_\mu^*\leftrightarrow D_{data}^*$$

reverse !!!!!!!

$$\dot{C}_{raw}^*(t)=\int_0^\infty p_{diag}(\tau)\dot{C}_{data}^*(t-\tau)\,d\tau$$

$$D_{raw}^*=D_{data}^*$$

Age-specific distributions

$$p_{\gamma\delta} = (1 - r)p_\gamma + rp_\delta$$

%minus loc

$$p_\beta(\tau) \sim U(\tau; \tau_{lat}, \tau_{lat} + \tau_{inf})$$

calc mean and var

$$p_\gamma(\tau) \sim Weibull(\Theta(\tau - \tau_{lat} - \tau_{inf}); \tau_\gamma - \tau_{lat} - \tau_{inf}, s_\gamma)$$

$$p_\delta(\tau) \sim Weibull(\Theta(\tau - \tau_{lat} - \tau_{inf}); \tau_\delta - \tau_{lat} - \tau_{inf}, s_\delta)$$

$$p_\nu(\tau') \sim Weibull(\tau'; \tau_\nu, s_\nu)$$

$$p_{diag}(\tau) = \delta(\tau_{diag})$$

Vaccinations

$$V(t) = \dots$$

Seasonality

$$\Omega(t) = \dots$$

$$R_{seas}(t) = \dots$$

$$M(t) = \dots$$

$$T(t) = \dots$$

where

* - asterisk denotes ... , true otherwise

t - Time since early stages of the epidemic

τ - age of infection (the time elapsed since the last infection)

τ' - Age of immunity (the time elapsed since the last recovery or vaccination)

N - Total population

μ - natural mortality rate (per day per person)

η - vaccine efficacy

.....vaccine coverage

.....vaccine start date , end date

λ_0 - Initial logarithmic growth rate

R_0 - Initial reproduction number

R min, max - seasonal ... and flu

R nor - seas variations

r_0 - Initial disease-related mortality

$\alpha(t)$ - fraction of the reported to true case incidence at time t

\dot{C}_0, \dot{C}_0^* - Initial incidence

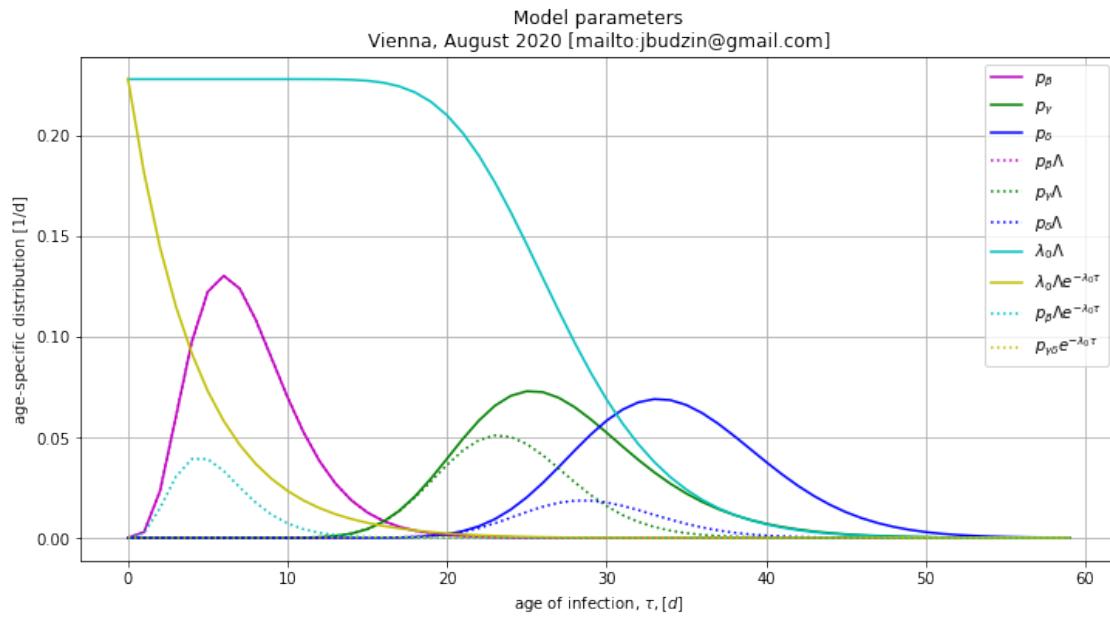
$R(t), R^*(t)$ - Basic reproduction number
 $R_e(t), R_e^*(t)$ - Effective reproduction number
...lockdown factor
.... beta bar , gamma bar, delta bar
lambda (t)
temper (t)
outdoor mobility fac
R normal - pre lockdown
 $r(t), r^*(t)$ - disease-related mortality
 $C(t), C^*(t)$ - Total cases
 $C_{data}^*(t)$ - Total cases data (preprocessed)
 $C_{raw}^*(t)$ - Total cases data (as reported)
 $H(t), H^*(t)$ - total recoveries
 $D(t), D^*(t)$ - deaths attributable to COVID-19 only
 $D_\mu(t), D_\mu^*(t)$ - deaths of the infected population which are attributable to natural mortality
 $D_{tot}(t), D_{tot}^*(t)$ - total deaths
 $D_{data}^*(t)$ - Deaths data (preprocessed)
 $D_{raw}^*(t)$ - Deaths data (as reported)
 $I(t), I^*(t)$ - Infected population at time t
 $F(t), F^*(t)$ - Infectious population at time t
 $S(t), S^*(t)$ - susceptible population at time t
 $\tilde{I}(t, \tau), \tilde{I}^*(t, \tau)$ - Currently infected population at time t with infection age τ
 $L(t), L^*(t)$ - Total lost disease-induced immunities (recovered susceptibles)
 $J(t), J^*(t)$ - currently recovered immune population at time t (Recovered with immunity)
 $\tilde{J}(t, \tau'), \tilde{J}^*(t, \tau')$ - currently recovered immune population at time t with immunity age τ'
 $V(t)$ - Total vaccine-induced immunities
 $V'(t)$ - Total vaccinated
 $V''(t)$ - vacc capacity ???
 $U(t)$ - Total lost vaccine-induced immunities (vaccinated susceptibles)
 $K(t)$ - currently vaccinated immune population at time t
 $\tilde{K}(t, \tau')$ - currently vaccinated immune population at time t with immunity age τ'
 $p_\beta(\tau)$ - age-specific transmission rate
 $p_\gamma(\tau)$ - age-specific recovery rate
 $p_\delta(\tau)$ - age-specific disease-related mortality rate
 $p_v(\tau')$ - age-specific waning immunity rate
 $\Lambda(\tau), \Lambda^*(\tau)$ - probability, for an infected individual, to remain in the infected state until infection age τ (survival function)
 $\Lambda_v(\tau')$ -probability, for an infected individual, to remain in the immune state until immunity age τ'
 τ_{diag} - mean time to diagnosis
 τ_{lat} - mean latent period (the period from the infection to the start of infectiousness)
 τ_{inf} - mean infectious period
 τ_γ - mean time to recovery
 τ_δ - mean time to death
 τ_v - mean time to immunity loss
 s_γ - shape parameter of distribution p_γ
 s_δ - shape parameter of distribution p_δ
 s_v - shape parameter of distribution p_v

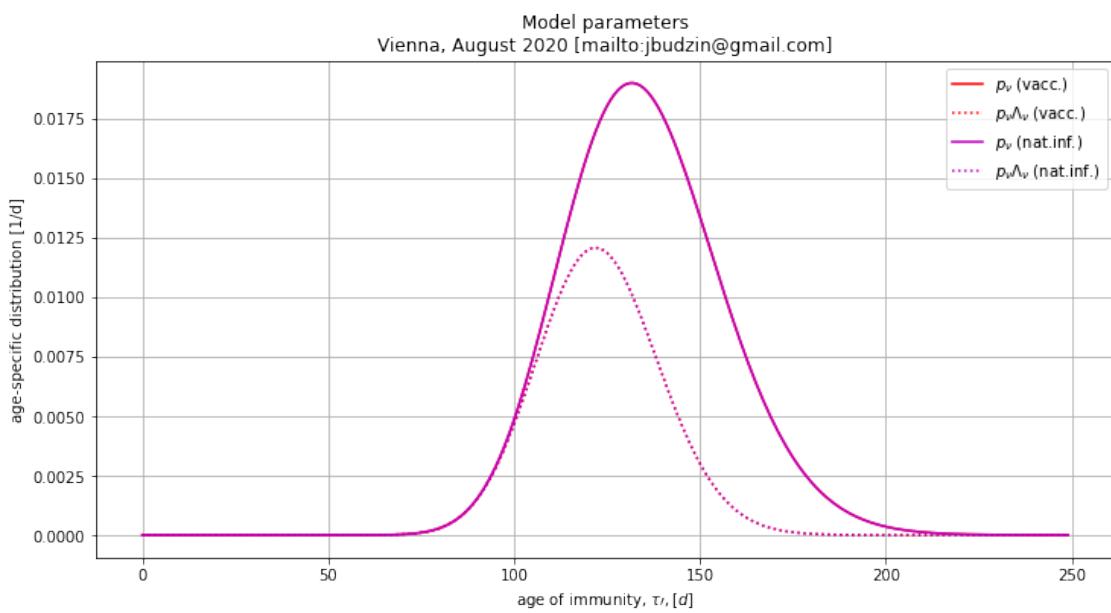
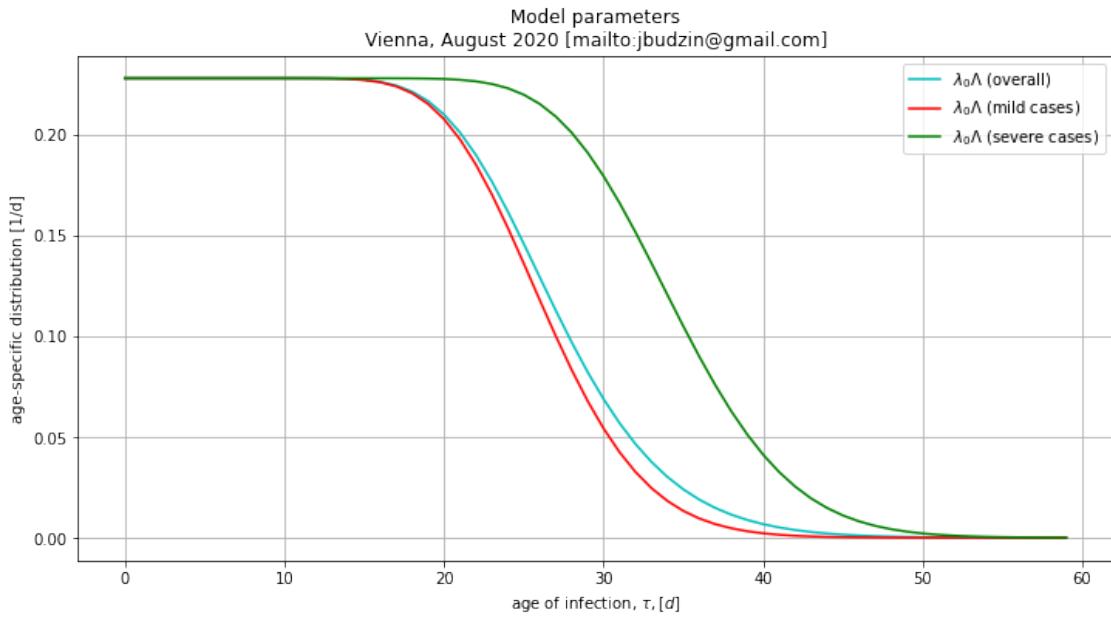
$p_{asym} = 0.40$
 $p_{fev|sym} = 0.91$
 $p_{sev|sym} = 0.138$
 $p_{crit|sym} = 0.047$

$p_{sym} = 1 - p_{asym}$
 $p_{sym,fev} = p_{fev|sym}p_{sym}$
 $p_{hosp} = p_{sev} + p_{crit}$
 $p_{mild} = p_{sym} - p_{hosp}$

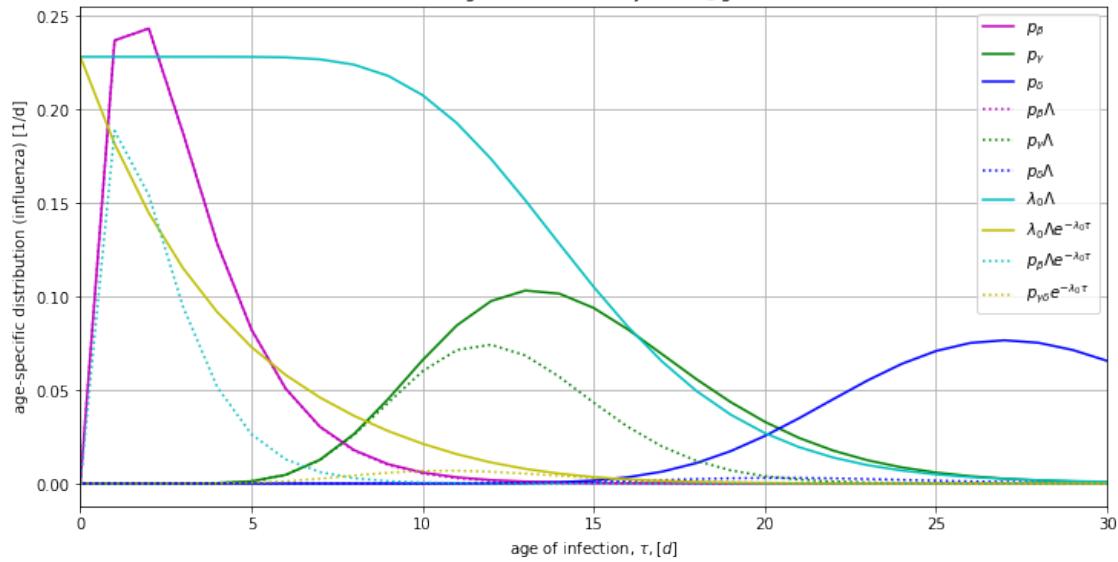
flu params

Theta - ramp fun
 delta - dir delta





Model parameters
Vienna, August 2020 [mailto:jbudzin@gmail.com]



6 KEY FINDINGS

NOT INCLUDED

```
3.7.3 (default, Jul 25 2020, 13:03:44)
[GCC 8.3.0]
/usr/lib/python3/dist-packages/ipykernel_launcher.py
Time elapsed: 1403 (23.38)
Simulation: 188 (221 model calls)
```