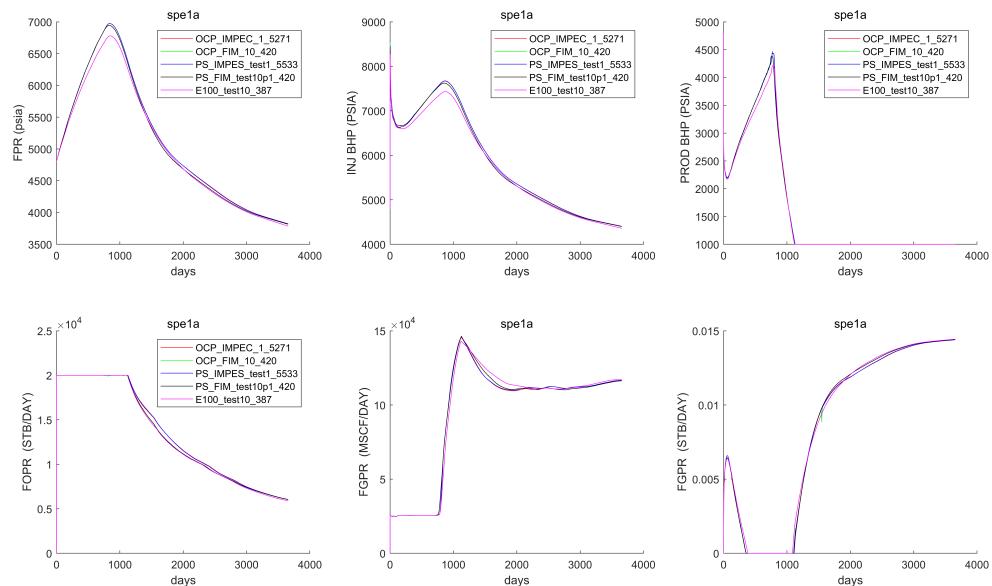


SPE1A



PS_IMPEC_1

0.1 1 0.1

```

Final time:      3655.5 Days
Total time steps: 5533
Total nonlin steps: 5533
Total linear steps: 8828
Linear solver time: 0.932773s
Simulation time:   2.44659s

```

OCP_IMPEC_1

.\OpenCAEporo.exe ..\..\data\spe1a\spe1a.data IMPEC 0.1 1 0.1

```

Final time:      3655.500 Days
Total time steps: 5271
Total Newton steps: 5271 (+39 wasted steps)
Total linear steps: 8327 (+73 wasted steps)
Linear solve time: 0.816s (57.926%)
Simulation time:   1.408s

```

PS_FIM_10

1 10 0.1

```

Final time:      3655.5 Days
Total time steps: 420
Total Newton steps: 434
Wasted Newton steps: 1

```

```
Total linear steps: 1235
Linear solver time: 3.62965s
Simulation time: 4.08421s
```

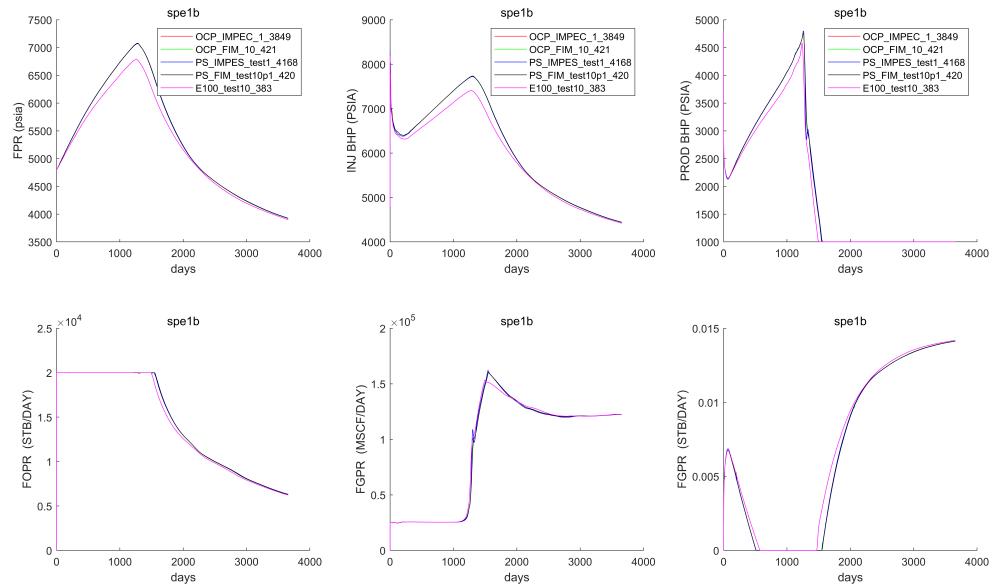
OCP_FIM_10

```
.\OpenCAEPOro.exe ..\..\data\spela\spela.data FIM 1 10 0.1
```

```
precond_type = 69
```

```
Final time: 3655.500 Days
Total time steps: 420
Total Newton steps: 481 (+1 wasted steps)
Total linear steps: 6301 (+18 wasted steps)
Linear solve time: 0.460s (62.080%)
Simulation time: 0.741s
```

SPE1B



PS_IMPES_1

```
0.1 1 0.1
```

```
Final time: 3655.5 Days
Total time steps: 4168
Total nonlin steps: 4168
Total linear steps: 7601
Linear solver time: 0.824397s
Simulation time: 1.99241s
```

OCP_IMPEC_1

```
.\\OpenCAEPoro.exe ..\\..\\data\\spe1b\\spe1b.data IMPEC 0.1 1 0.1
```

Final time: 3655.500 Days
Total time steps: 3849
Total Newton steps: 3849 (+9 wasted steps)
Total linear steps: 7198 (+15 wasted steps)
Linear solve time: 0.654s (60.250%)
Simulation time: 1.086s

PS_FIM_10

```
1 10 0.1
```

Final time: 3655.5 Days
Total time steps: 420
Total Newton steps: 437
Wasted Newton steps: 1
Total linear steps: 1212
Linear solver time: 2.6363s
Simulation time: 3.08908s

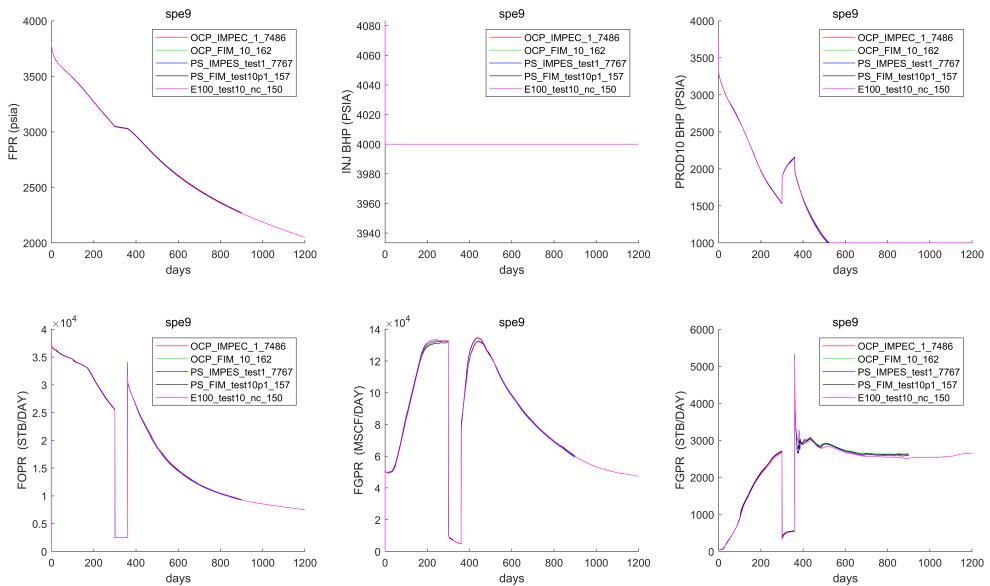
OCP_FIM_10

```
.\\OpenCAEPoro.exe ..\\..\\data\\spe1b\\spe1b.data FIM 1 10 0.1
```

```
precond_type = 69
```

Final time: 3655.500 Days
Total time steps: 421
Total Newton steps: 507 (+1 wasted steps)
Total linear steps: 6361 (+19 wasted steps)
Linear solve time: 0.467s (61.599%)
Simulation time: 0.759s

SPE9



PS_IMPEPS_1

0.1 1 0.1

Final time: 900 Days
 Total time steps: 7767
 Total nonlin steps: 7767
 Total linear steps: 12465
 Linear solver time: 57.9099s
 Simulation time: 276.62s

OCP_IMPEC_1

.\OpenCAEPoro.exe ..\..\data\spe9\spe9_IMPEC.data

Final time: 900.000 Days
 Total time steps: 7486
 Total Newton steps: 7486 (+43 wasted steps)
 Total linear steps: 9897 (+96 wasted steps)
 Linear solve time: 55.544s (61.784%)
 Simulation time: 89.900s

PS_FIM_10

1 10 0.1

Final time: 900 Days
 Total time steps: 157
 Total Newton steps: 216
 Wasted Newton steps: 53
 Total linear steps: 1061
 Linear solver time: 12.3944s
 Simulation time: 27.515s

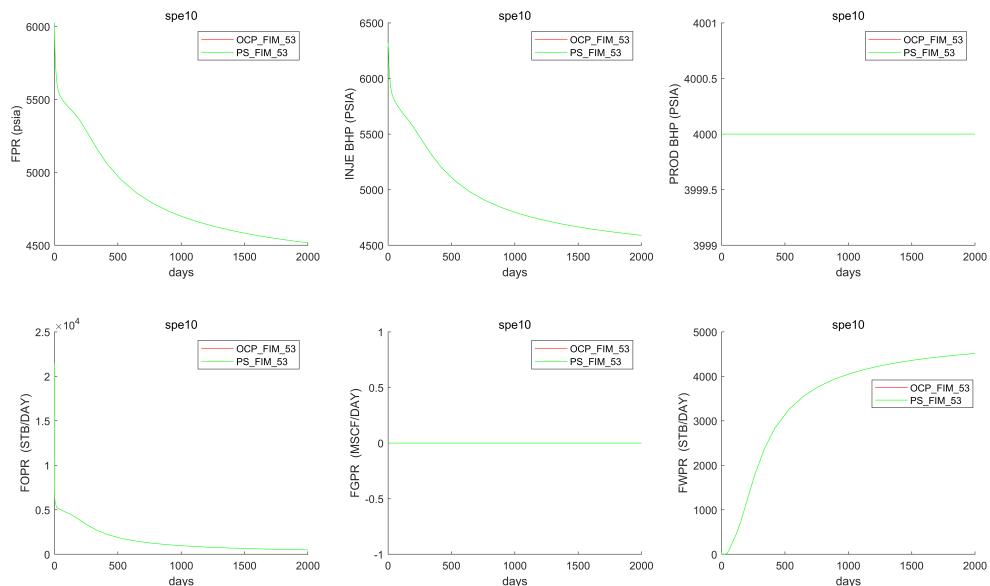
OCP_FIM_10

```
.\OpenCAEPoro.exe ..\..\data\spe9\spe9_FIM.data
```

```
precond_type = 69
```

```
Final time: 900.000 Days
Total time steps: 162
Total Newton steps: 227 (+60 wasted steps)
Total linear steps: 3284 (+824 wasted steps)
Linear solve time: 8.752s (55.793%)
Simulation time: 15.686s
```

SPE10



PS_FIM

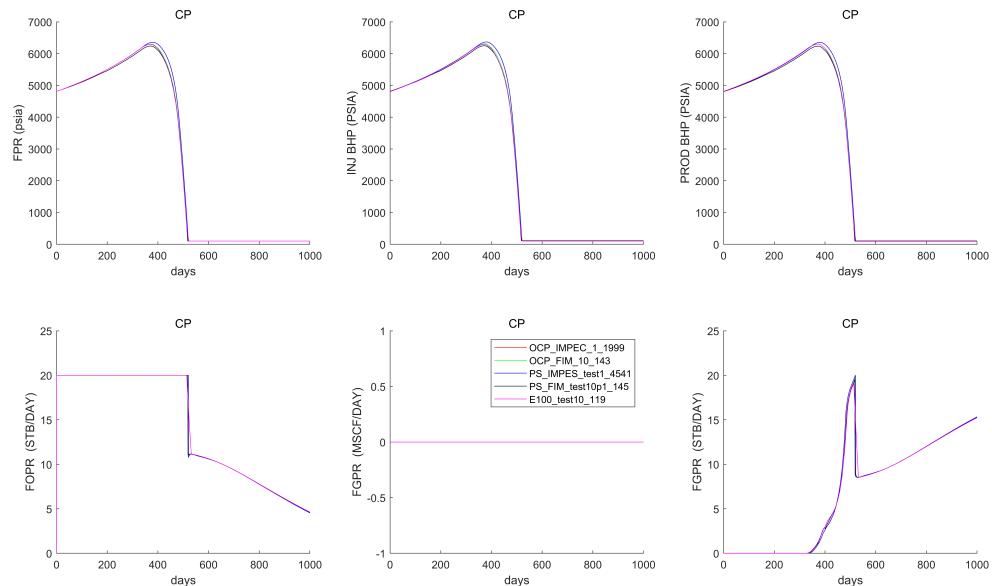
```
Final time: 2000 Days
Total time steps: 53
Total Newton steps: 215
Wasted Newton steps: 5
Total linear steps: 1305
Linear solver time: 1413.86s
Simulation time: 2905.24s
```

OCP_FIM

```
.\OpenCAEPoro.exe ..\..\data\spe10\spe10.data
```

```
Final time: 2000.000 Days
Total time steps: 53
Total Newton steps: 215 (+5 wasted steps)
Total linear steps: 1278 (+40 wasted steps)
Linear solve time: 1403.826s (74.590%)
Simulation time: 1882.050s
```

CP



PS_IMPEC_1

0.1 1 0.1

```
Final time:          1000.000 Days
Total time steps:    4541
Total nonlin steps:  4541
Total linear steps: 4543
Linear solver time: 2.269s
Simulation time:    28.627s
```

OCP_IMPEC_1

```
.\OpenCAEporo.exe ..\..\data\cornerpoint\CP.data  IMPEC 0.1 1 0.1
```

```
Final time:          1000.000 Days
Total time steps:    1999
Total Newton steps:  1999 (+3 wasted steps)
Total linear steps:  13516 (+35 wasted steps)
Linear solve time:   0.045s (38.852%)
Simulation time:     0.115s
```

PS_FIM_10

1 10 0.1

```
Final time:          1000.000 Days
```

```

Total time steps:      145
Total Newton steps:   256
Wasted Newton steps:  4
Total linear steps:   263
Linear solver time:   0.745s
Simulation time:      1.654s

```

OCP_FIM_10

```
. \OpenCAEPoro.exe ...\\data\\cornerpoint\\CP.data  FIM 1  10  0.1
```

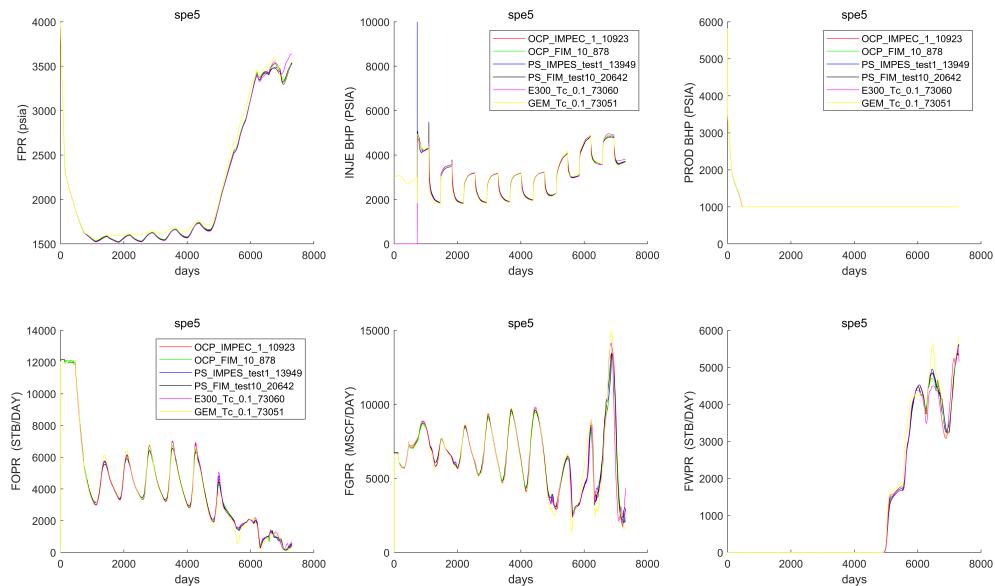
```
precond_type          = 69
```

```

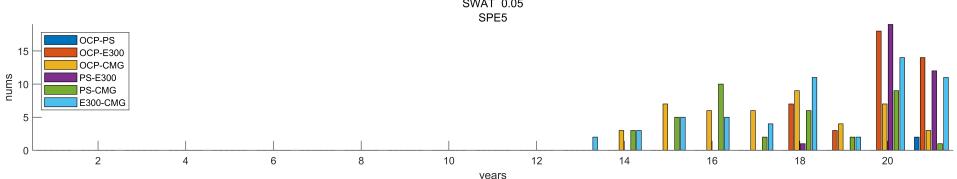
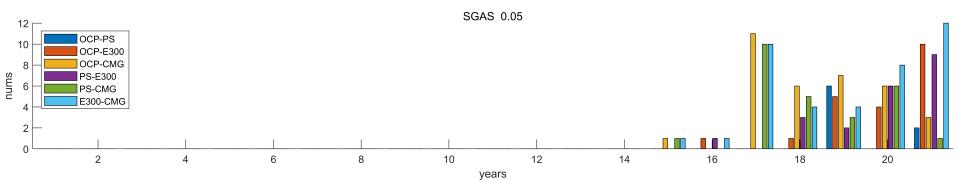
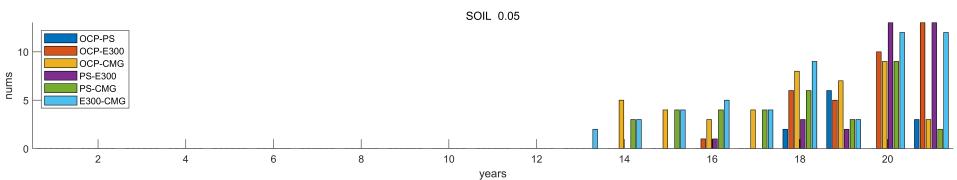
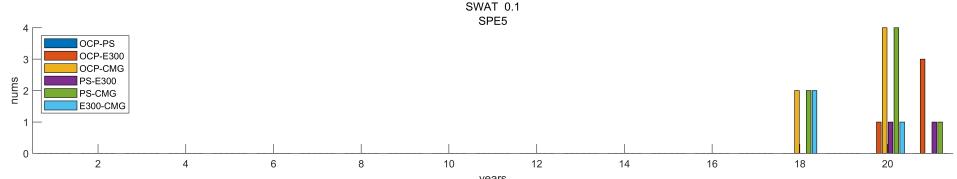
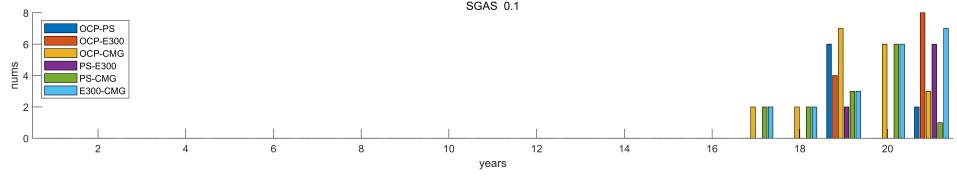
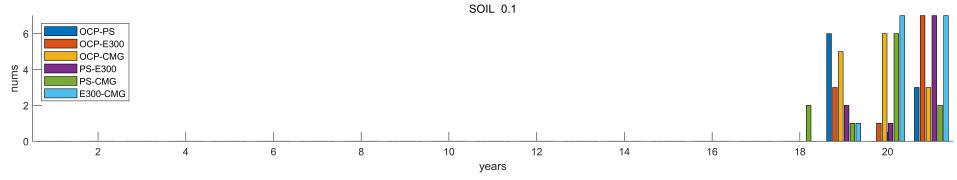
Final time:           1000.000 Days
Total time steps:    143
Total Newton steps:  245 (+7 wasted steps)
Total linear steps:  2293 (+68 wasted steps)
Linear solve time:   0.037s (43.154%)
Simulation time:     0.086s

```

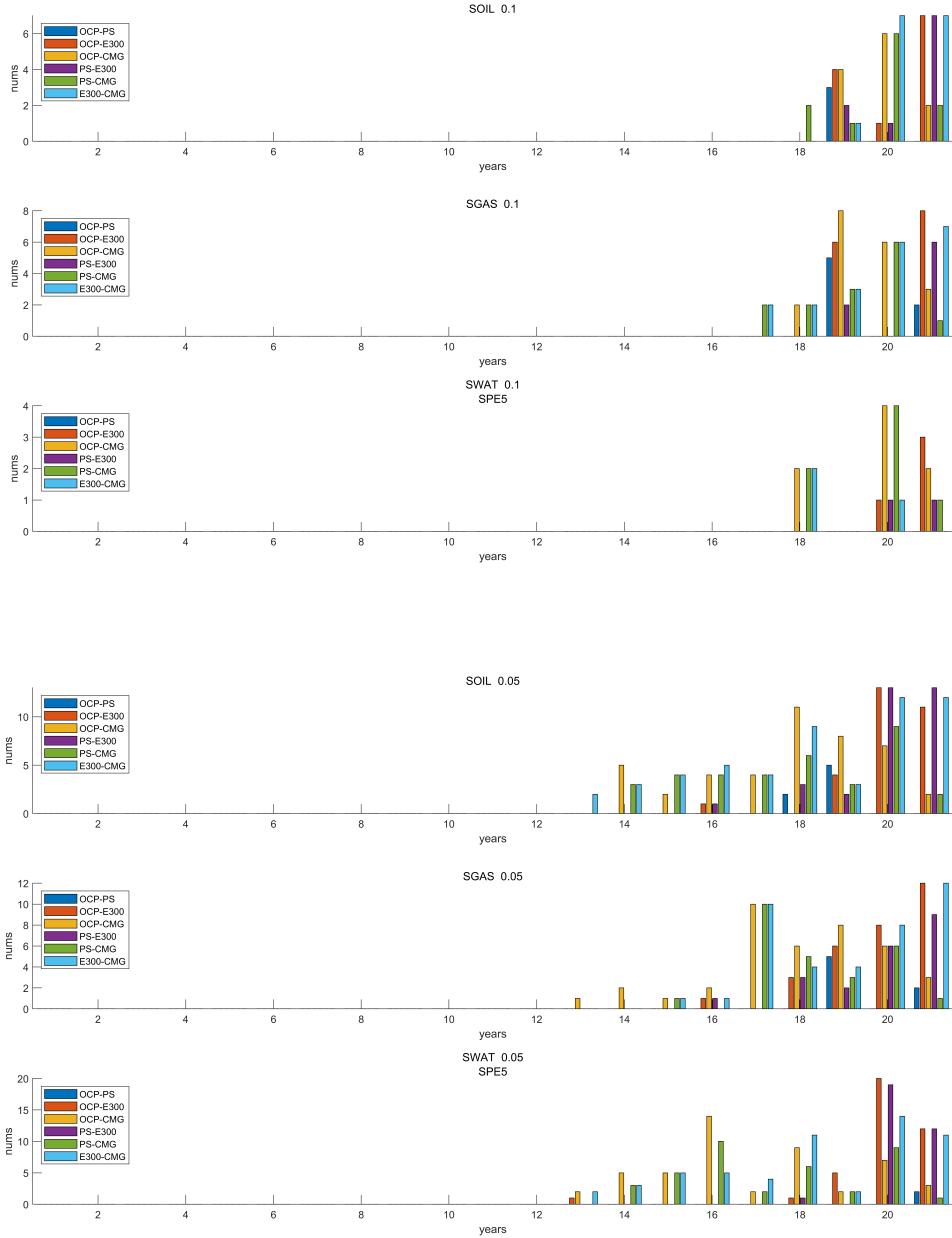
SPE5



饱和度差异对比 (OCP_FIM)



饱和度差异对比 (OCP_IMPEC)



OCP 的 Flash 部分存在效率问题

PS 数据图与下列数据有些差异，但结果几无二致。

PS_IMPES

TMARCH

0.1 1 0.1 5 0.3 0.3 300 0.2 0.3 0.001

```

Final time:          7305 days
Total time steps:    14228
Total nonlin steps:  14228
Total linear steps:  20914
flux time(MassConerve): 0.246282s
flux time(updateproperty): 0.133042s
MassConserve time: 0.596821s
updateProperty time: 47.4394s
Linear solver time: 1.4444s
Simulation time:      51.0602s

```

```

Method      iters      maxIt      tol
SSMSTA     49846316     300      1E-12  1E-2
SSMSP      7802131      100      1E-5
NRSP       3091611      55       1E-6

-----
OCP_IMPEC

.\OpenCAEPoro.exe ..\..\data\spe5\spe5.data  IMPEC  0.1  1  0.1

SSMSTA:    6511743
NRSTA:    20659
SSMSP:    9579276
NRSP:    1741235
=====
Final time:      7305.000 days
Total time steps:   10923
Total Newton steps: 10923 (+80 wasted steps)
Total linear steps: 17386 (+156 wasted steps)
Linear solve time: 1.153s (7.288%)
Simulation time: 15.818s

-----
PS_FIM

1 10 0.01

Final time:      7305 Days
Total time steps: 21060
Total Newton steps: 23072
Wasted Newton steps: 13992
Total linear steps: 55425
Linear solver time: 74.4161s
Simulation time: 288.01s

Method      iters      maxIt      tol
SSMSTA     312298023     100      1E-12
SSMSP      15015547      100      1E-6
NRSP       5624310       55       1E-12

-----
OCP_FIM

.\OpenCAEPoro.exe ..\..\data\spe5\spe5.data  FIM  1  10  0.1

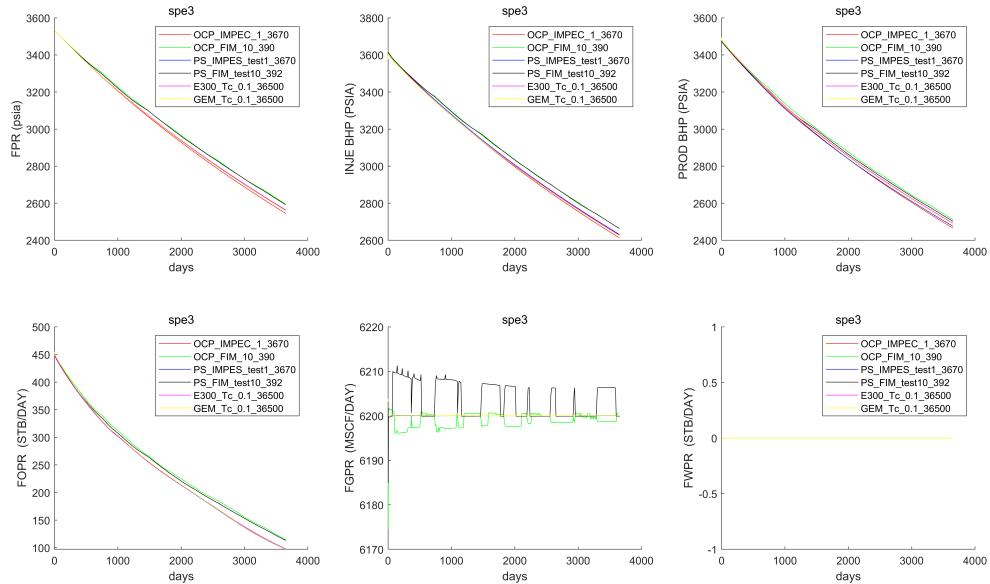
precond_type          = 64

SSMSTA:    1156364
NRSTA:    7900
SSMSP:    1710655
NRSP:    242509
=====
Final time:      7305.000 Days
Total time steps: 878
Total Newton steps: 1633 (+26 wasted steps)
Total linear steps: 4970 (+58 wasted steps)
Linear solve time: 13.091s (74.471%)

```

Simulation time: 17.579s

SPE3



饱和度误差均在 5% 以内

PS_IMPEStest1

0.1 1 0.1

```
Final time: 3650 Days
Total time steps: 3670
Total nonlin steps: 3670
Total linear steps: 7345
flux time(MassConerve): 0.179398s
flux time(updateproperty): 0.175264s
MassConserve time: 0.485313s
updateProperty time: 164.133s
Linear solver time: 1.25312s
Simulation time: 176.526s
```

Method	iters	maxIt	tol
SSMSTA	102544160	300	1E-12 1E-2
SSMSP	22778402	100	1E-5
NRSP	6775525	55	1E-12

OCP_IMPEC

```
.\OpenCAEPoro.exe ..\..\data\spe5\spe5.data IMPEC 0.1 1 0.1
```

SSMSTA: 23835193
NRSTA: 19507

```
SSMSP:      24063413
NRSP:      1468770
=====
Final time:      3650.000 Days
Total time steps: 3670
Total Newton steps: 3670 (+0 wasted steps)
Total linear steps: 7318 (+0 wasted steps)
Linear solve time: 1.037s (2.543%)
Simulation time: 40.777s
```

PS_FIM

```
1 10 0.1
```

```
Final time:      3650 Days
Total time steps: 390
Total Newton steps: 588
Total linear steps: 941
Linear solver time: 5.61642s
Simulation time: 39.5691s
```

Method	iters	maxIt	tol
SSMSTA	17690167	300	1E-12 1E-2
SSMSP	3674930	100	1E-5
NRSP	1222903	55	1E-12

OCP_FIM

```
.\\OpenCAEPoro.exe ..\\..\\data\\spe3\\spe3.data FIM 1 10 0.1
```

```
precond_type = 64
```

```
SSMSTA:      3984873
NRSTA:      10756
SSMSP:      3929150
NRSP:      238198
```

```
Final time:      3650.000 Days
Total time steps: 390
Total Newton steps: 559 (+0 wasted steps)
Total linear steps: 747 (+0 wasted steps)
Linear solve time: 4.464s (30.473%)
Simulation time: 14.649s
```