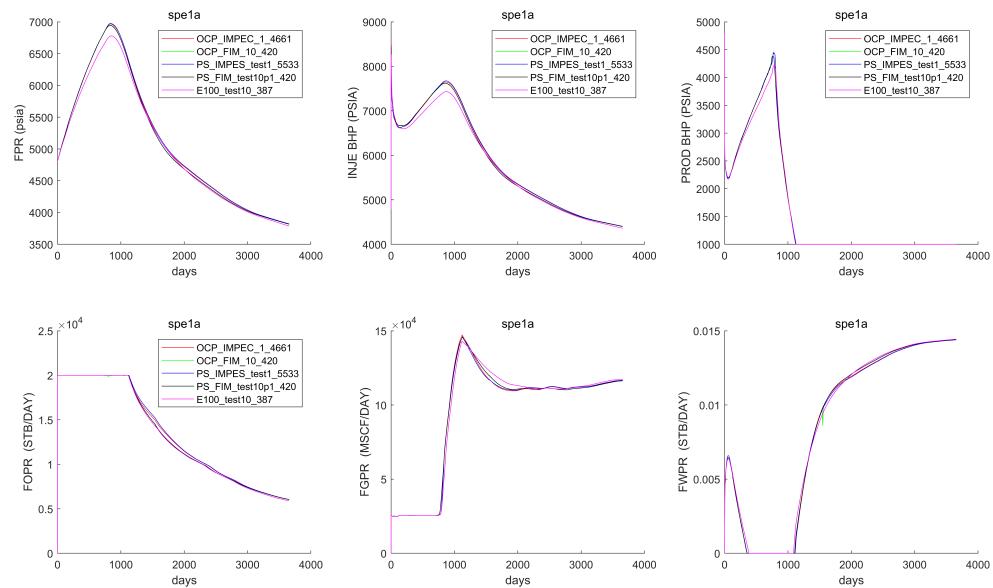


# SPE1A




---

## PS\_IMPES\_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\_IMPES\_1

0.1 1 0.1

```

Final time:      3655.500 Days
Total time steps: 4661
Total Newton steps: 4661 (+51 wasted steps)
Total linear steps: 7785 (+99 wasted steps)
Linear solve time:  0.794s (59.696%)
Simulation time:   1.331s

```

---

## 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

1 10 0.1

precond\_type = 64

Final time: 3655.500 Days  
 Total time steps: 420  
 Total Newton steps: 474 (+1 wasted steps)  
 Total linear steps: 1414 (+4 wasted steps)  
 Linear solve time: 4.950s (94.546%)  
 Simulation time: 5.235s

---

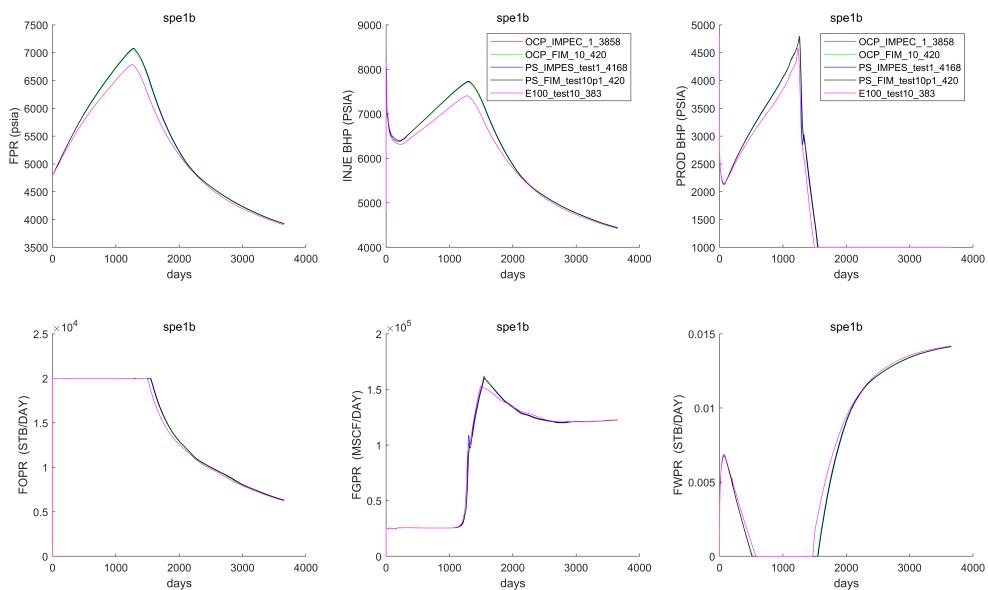
#### OCP\_FIM\_10

1 10 0.1

precond\_type = 69

Final time: 3655.500 Days  
 Total time steps: 420  
 Total Newton steps: 480 (+1 wasted steps)  
 Total linear steps: 6288 (+18 wasted steps)  
 Linear solve time: 0.456s (60.876%)  
 Simulation time: 0.749s

## 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\_IMPES\_1

0.1 1 0.1

Final time: 3655.500 Days  
Total time steps: 3858  
Total Newton steps: 3858 (+19 wasted steps)  
Total linear steps: 7215 (+35 wasted steps)  
Linear solve time: 0.678s (60.894%)  
Simulation time: 1.113s

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

1 10 0.1

precond\_type = 64  
  
Final time: 3655.500 Days  
Total time steps: 420  
Total Newton steps: 502 (+1 wasted steps)  
Total linear steps: 1495 (+4 wasted steps)  
Linear solve time: 3.356s (91.629%)  
Simulation time: 3.663s

OCP\_FIM\_10

1 10 0.1

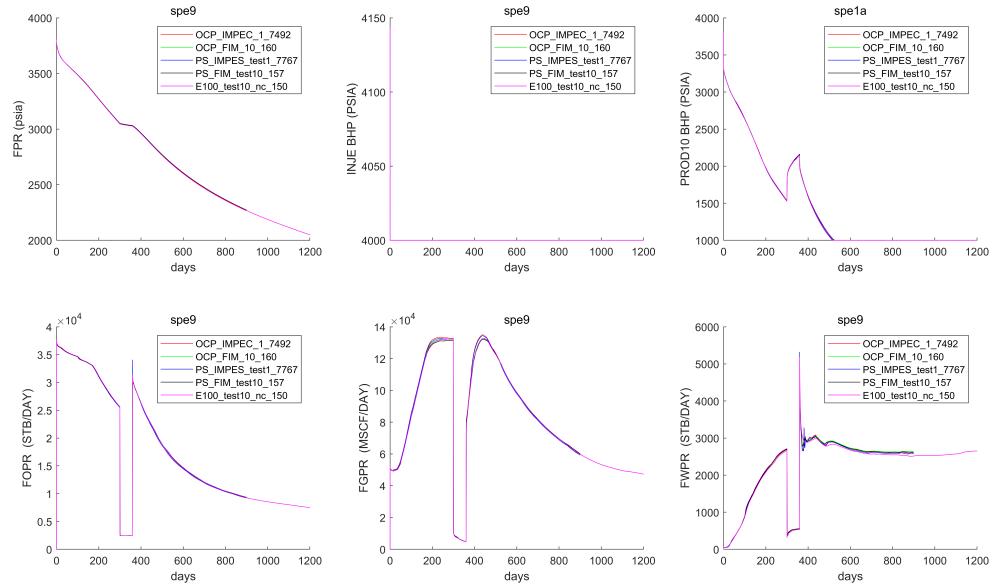
precond\_type = 69

```

Final time:          3655.500 Days
Total time steps:    421
Total Newton steps: 507 (+1 wasted steps)
Total linear steps: 6362 (+19 wasted steps)
Linear solve time:  0.469s (61.180%)
Simulation time:    0.767s

```

## 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\_IMPEPS\_1

0.1 1 0.1  
dplim dslim dnlim dverrlim  
300 0.0005 0.3 0.001

```

Final time:          900.000 Days
Total time steps:    7492
Total Newton steps: 7492 (+42 wasted steps)
Total linear steps: 9903 (+95 wasted steps)
Linear solve time:  54.309s (62.283%)
Simulation time:    87.197s

```

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

1 10 0.1

```
precond_type = 64

Final time:      900.000 Days
Total time steps: 161
Total Newton steps: 225 (+58 wasted steps)
Total linear steps: 854 (+247 wasted steps)
Linear solve time: 12.950s (67.510%)
Simulation time: 19.182s
```

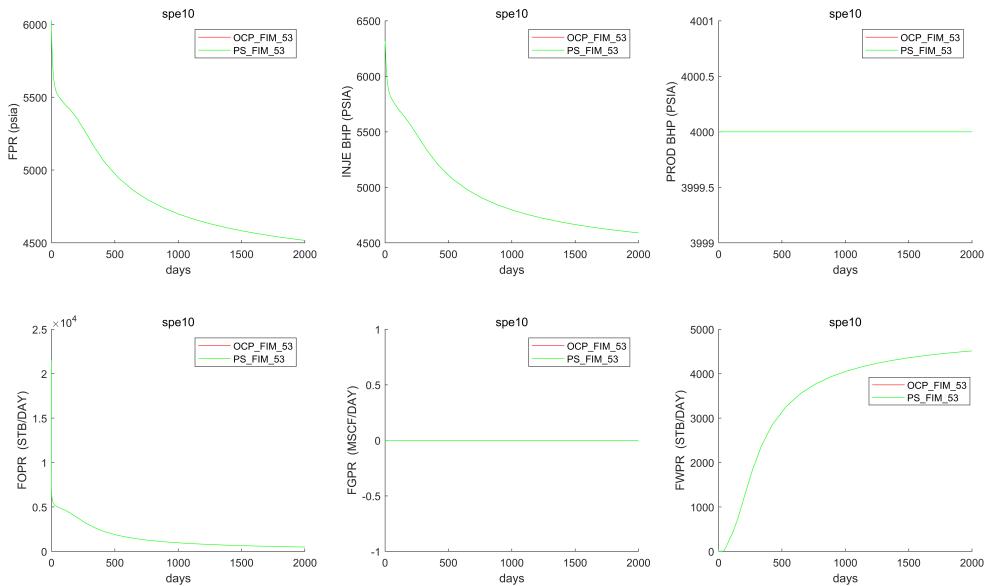
OCP\_FIM\_10

1 10 0.1

```
precond_type = 69

Final time:      900.000 Days
Total time steps: 162
Total Newton steps: 227 (+60 wasted steps)
Total linear steps: 3260 (+808 wasted steps)
Linear solve time: 8.466s (56.374%)
Simulation time: 15.017s
```

## 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

```

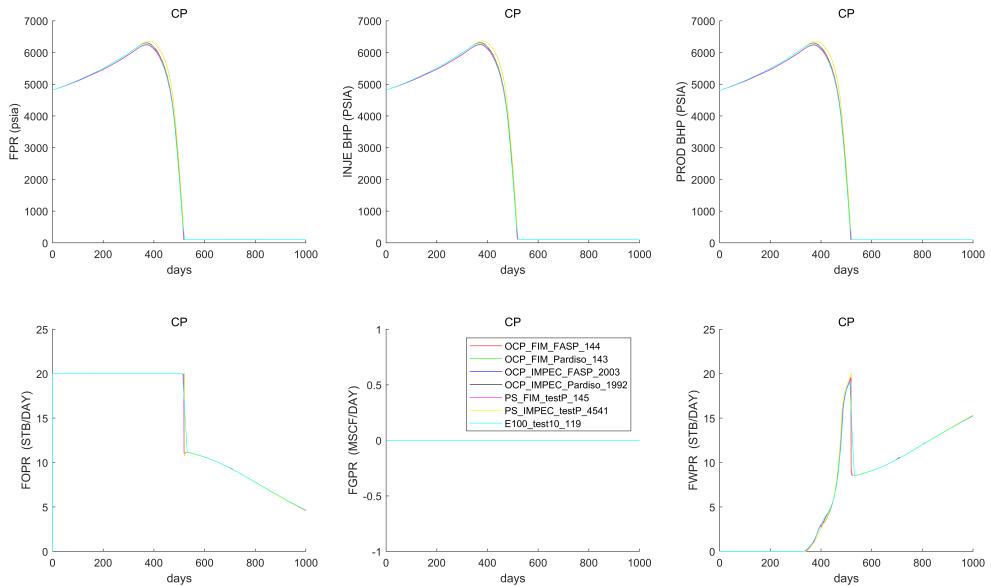
### OCP\_FIM

```

Final time:          2000.000 Days
Total time steps:    53
Total Newton steps: 217 (+5 wasted steps)
Total linear steps: 1294 (+40 wasted steps)
Linear solve time: 1424.577s (75.943%)
Simulation time:    1875.844s

```

**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

0.1 1 0.1

```

Final time:      1000.000 Days
Total time steps: 2003
Total Newton steps: 2003 (+3 wasted steps)
Total linear steps: 13544 (+35 wasted steps)
Linear solve time: 0.043s (41.612%)
Simulation time: 0.103s

```

---

### 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

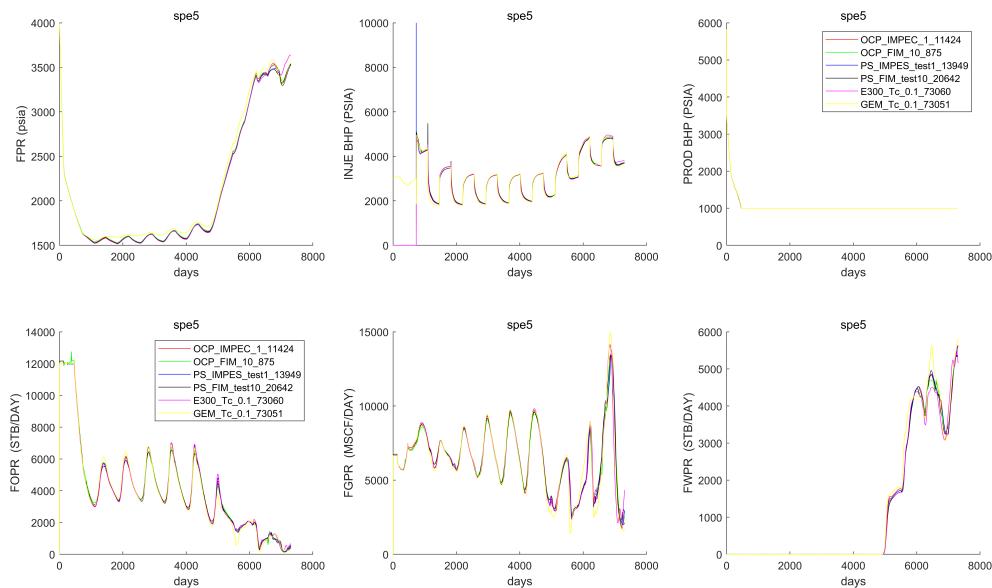
```

## OCP\_FIM\_10

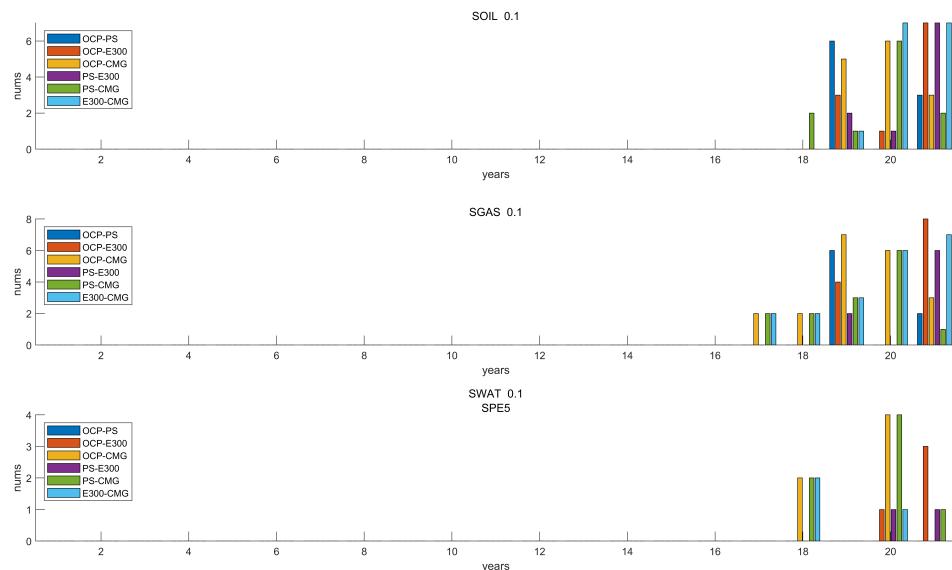
```
1 10 0.1  
precond_type = 69
```

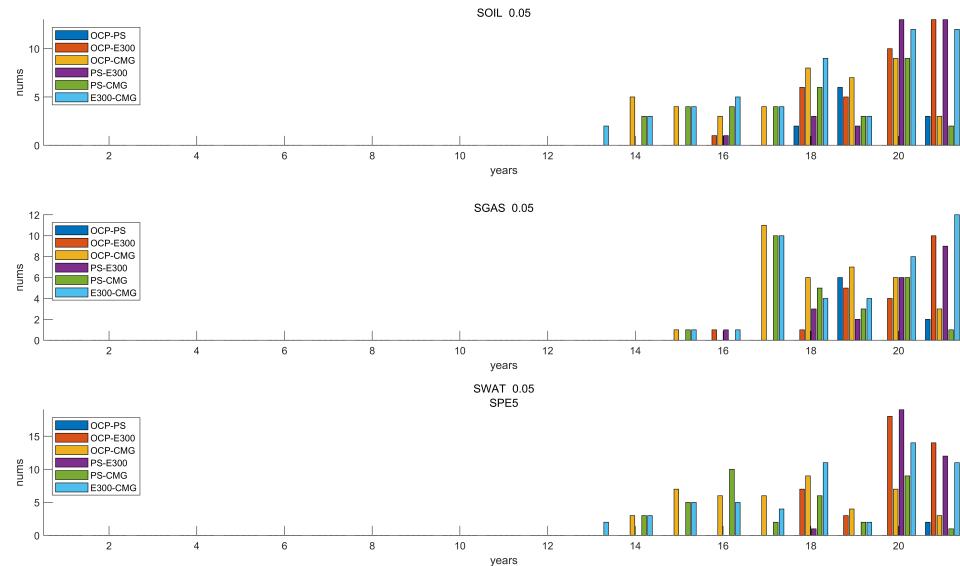
```
Final time: 1000.000 days  
Total time steps: 143  
Total Newton steps: 245 (+6 wasted steps)  
Total linear steps: 2290 (+57 wasted steps)  
Linear solve time: 0.034s (42.420%)  
Simulation time: 0.079s
```

## SPE5

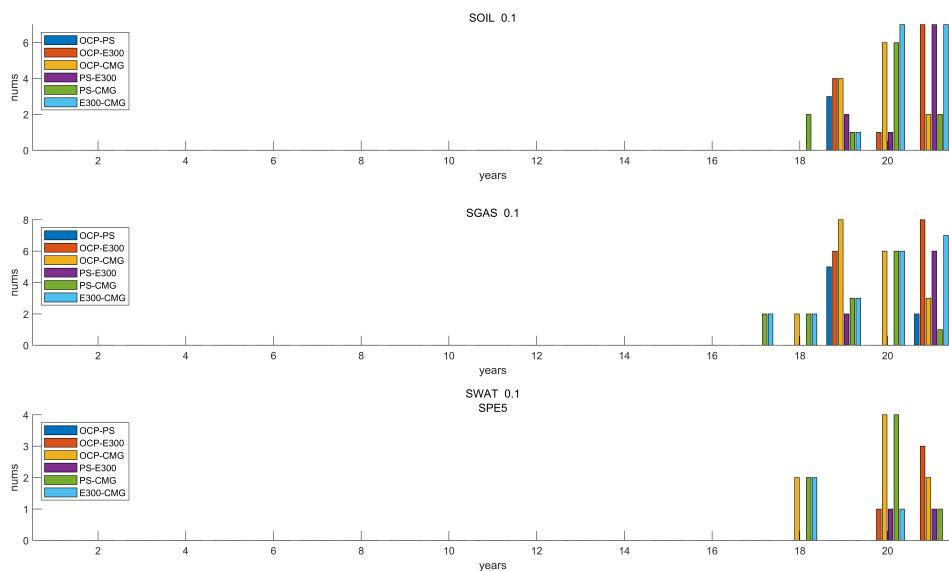


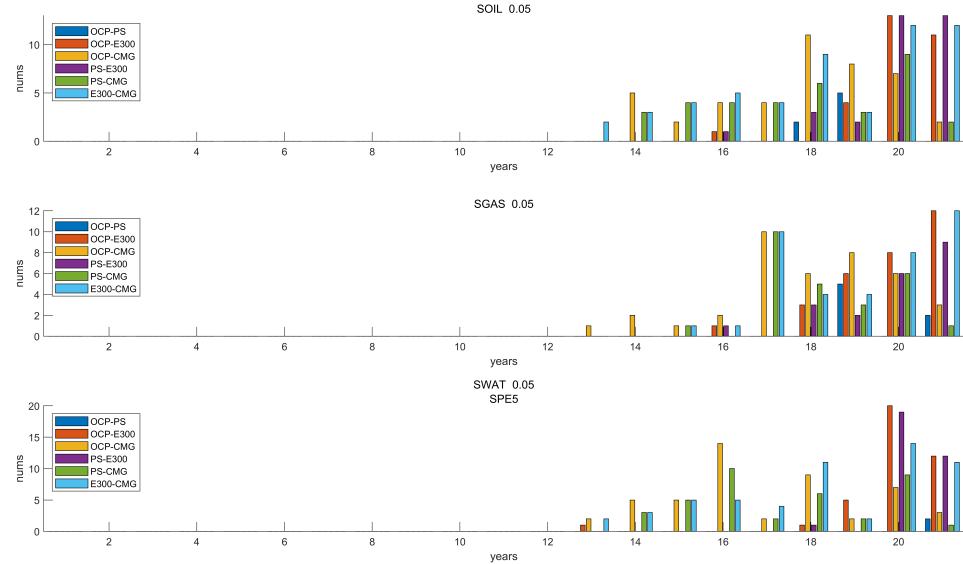
## 饱和度差异对比 (OCP\_FIM)





### 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

```
0.1 1 0.1
```

```

SSMSTA:      6718352
NRSTA:       19695
SSMSP:        19786221
NRSP:         1463313
=====
```

```

Final time:          7305.000 days
Total time steps:   11424
```

```
Total Newton steps: 11424 (+72 wasted steps)
Total linear steps: 17859 (+139 wasted steps)
Linear solve time: 1.234s (5.886%)
Simulation time: 20.969s
```

---

**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**

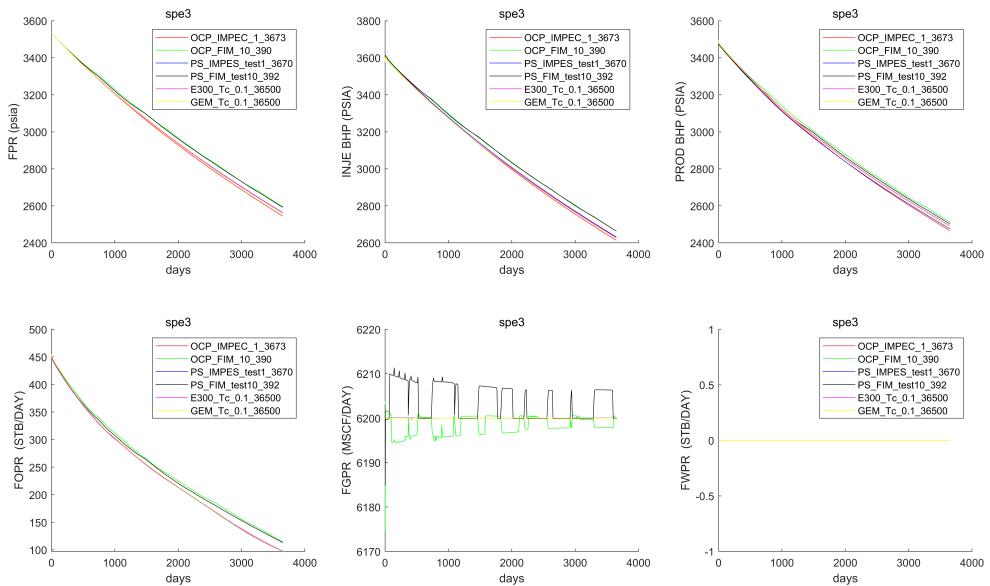
```
1 10 0.1
precond_type = 64
```

```
SSMSTA: 1187658
NRSTA: 8035
SSMSP: 3085834
NRSP: 218804
```

---

```
Final time: 7305.000 Days
Total time steps: 875
Total Newton steps: 1703 (+30 wasted steps)
Total linear steps: 5191 (+70 wasted steps)
Linear solve time: 12.436s (71.856%)
Simulation time: 17.306s
```

## SPE3



饱和度误差均在 5% 以内

#### PS\_IMPEs

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

0.1 1 0.1

```

SSMSTA:      23868228
NRSTA:       19537
SSMSP:        92506242
NRSP:         1829508
=====
Final time:      3650.000 Days
Total time steps: 3673
Total Newton steps: 3673 (+0 wasted steps)
Total linear steps: 7321 (+0 wasted steps)
Linear solve time: 1.104s (1.121%)
Simulation time: 98.496s

```

-----  
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

1 10 0.1

precond\_type = 64

SSMSTA: 3984257  
NRSTA: 10759  
SSMSP: 14585718  
NRSP: 288417

=====

Final time: 3650.000 days  
Total time steps: 390  
Total Newton steps: 558 (+0 wasted steps)  
Total linear steps: 715 (+0 wasted steps)  
Linear solve time: 3.696s (16.837%)  
Simulation time: 21.954s