WellDataBaseML example: Predicting Well production within Eagle Ford Play

A problem demonstrating how **WellDataBaseML** can be applied to predict oil/gas production.

The machine-lerning problem described here relates to the clasical history matching problems.

If **WellDataBaseML** is not installed, first execute `import Pkg; Pkg.add("WellDataBaseML"); Pkg.add("WellDataBase")` .

In [3]:
```
import WellDataBaseML
```

```
┌ Info: Precompiling WellDataBaseML [b2fc4b94-a46a-4cf9-bc84-39b1d777371f]
└ @ Base loading.jl:1278
```

Unable to load WebIO. Please make sure WebIO works for your Jupyter client. For troubleshooting, please see [the WebIO/IJulia documentation (https://juliagizmos.github.io/WebIO.jl/latest/providers/ijulia/)](https://juliagizmos.github.io/WebIO.jl/latest/providers/ijulia/).

```
┌ Info: Installing pyqt package to avoid buggy tkagg backend.
└ @ PyPlot /Users/vvv/.julia/packages/PyPlot/XHEG0/src/init.jl:118
```

In [6]:
```
import WellDataBase
```

First, the Eagle Ford Play datasets is uploaded:

In [9]:
```
df, df_header, api, recordlength, dates = WellDataBase.read(["csv-201908102
```

...

The loaded data are provided in the follwoing form:

- `df` : data frame containing well production transients
- `df_header` : data frame containing well construction attributes
- `api` : a vector with well API's listed in `df` and df_header`
- `recordlength` : the maximum record lenght (in months) for the processed well dataset
- `dates` : range of dates for which produciton data are availables (in months)

Machine learning (ML) analysis can be performed to predict well production based on this dataset.

Under this example, the goal is to use all the data collected up to 2015 for training.

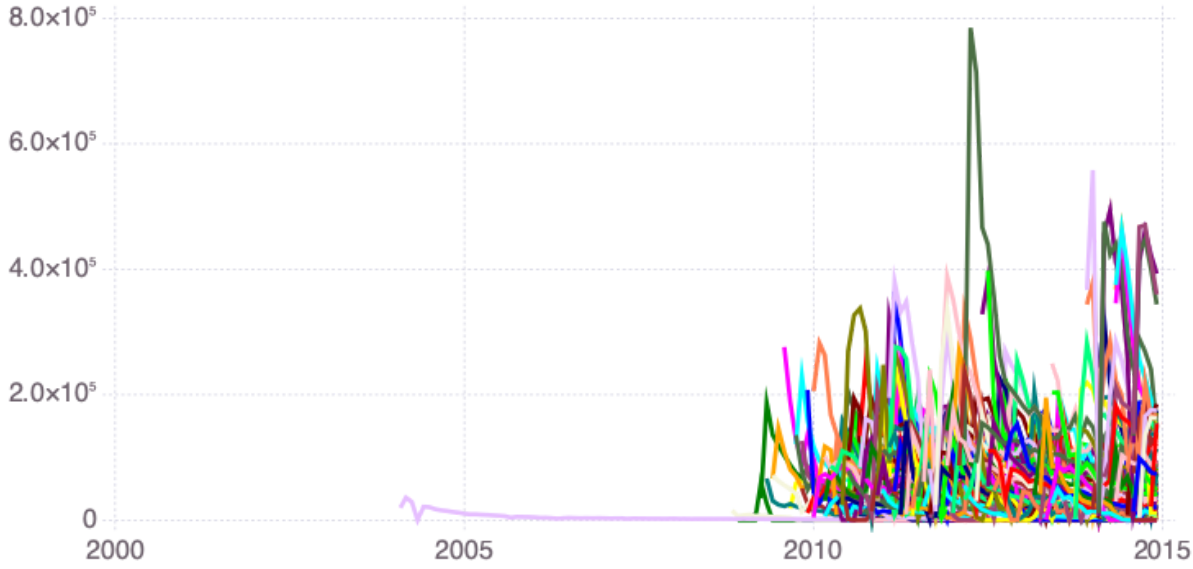
After that, the applied ML methodology performs blind prediction for 1 year ahead (2015-2016).

In [22]:
```
syears = [2015]
eyears = syears .+ 1
```

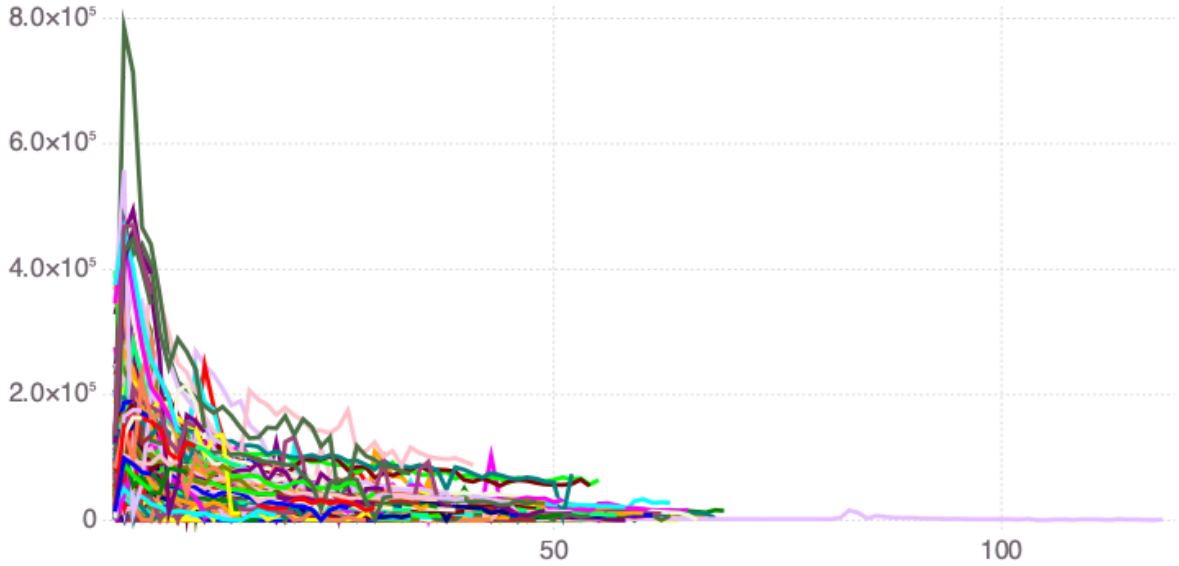
Out[22]:
```
1-element Array{Int64,1}:
 2016
```

ML analyses is excuted as follows:

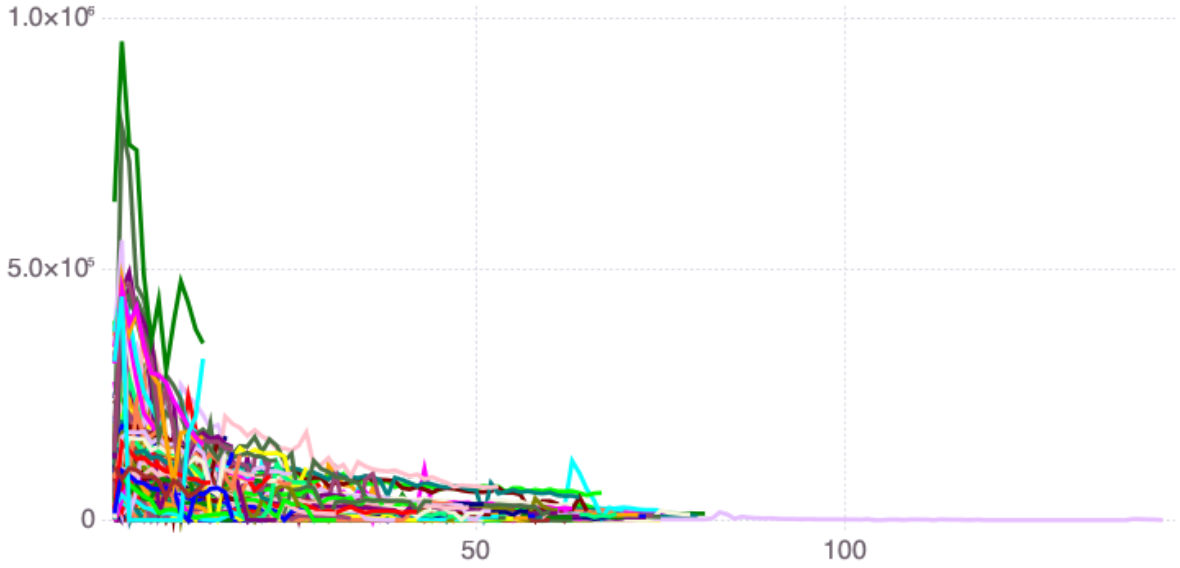
In [23]:
```
WellDataBaseML.execute(syears, eyears, df, df_header, api; workdir="/Users/
```



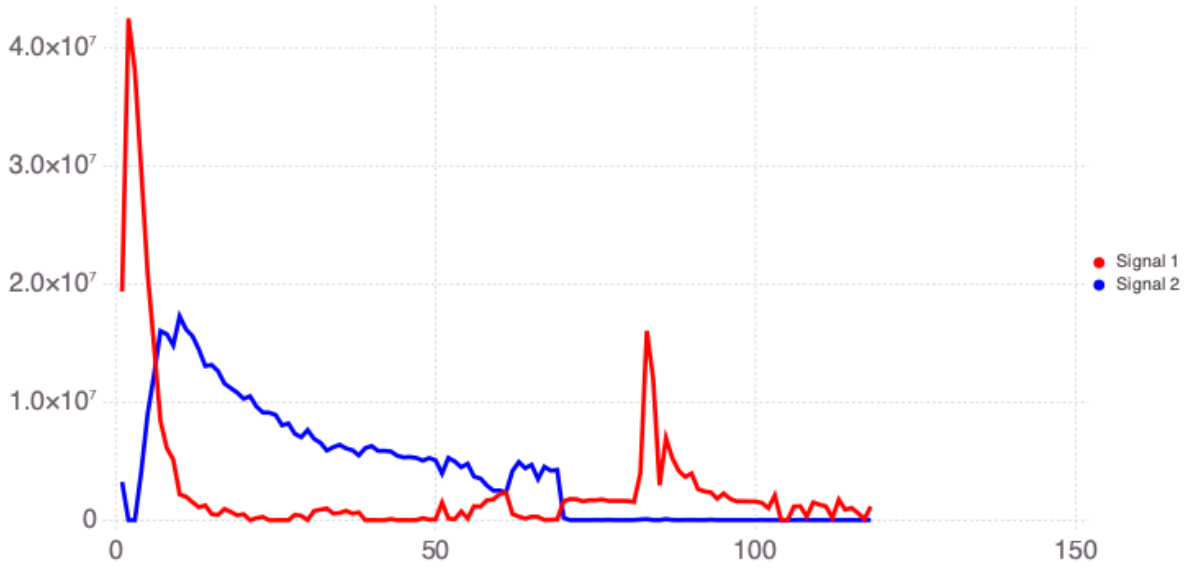

```
[ Info: 2015: Number of wells 322
@ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:122
[ Info: Training matrix size: (118, 322)
@ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:137
```



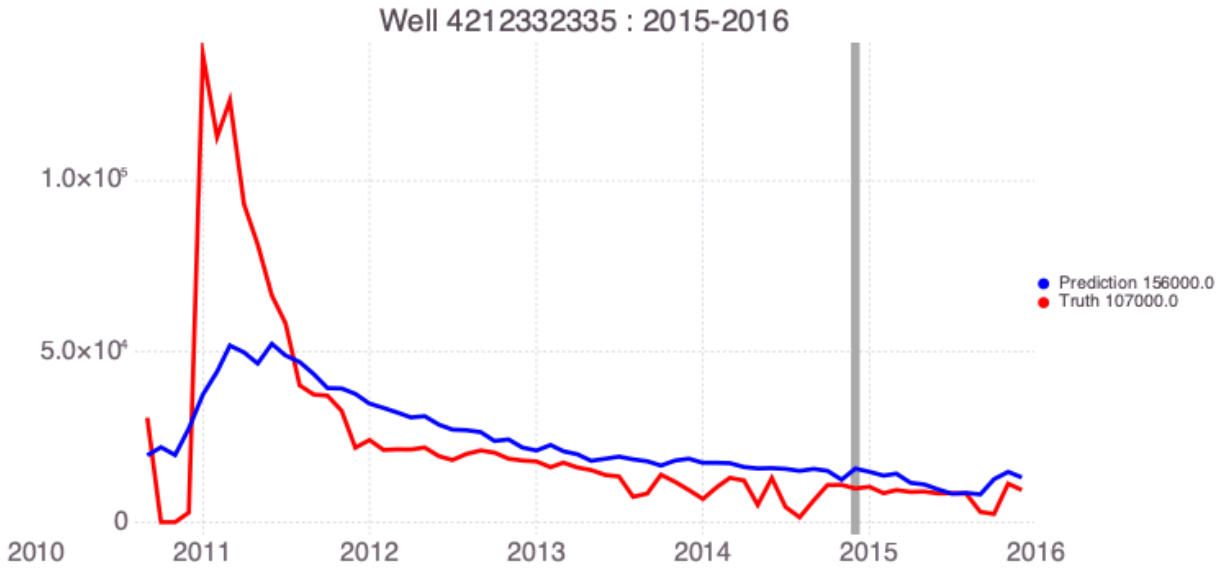

```
[ Info: Training start date: 2004-02-01
@ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:138
[ Info: Training end   date: 2004-02-01
@ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:139
```

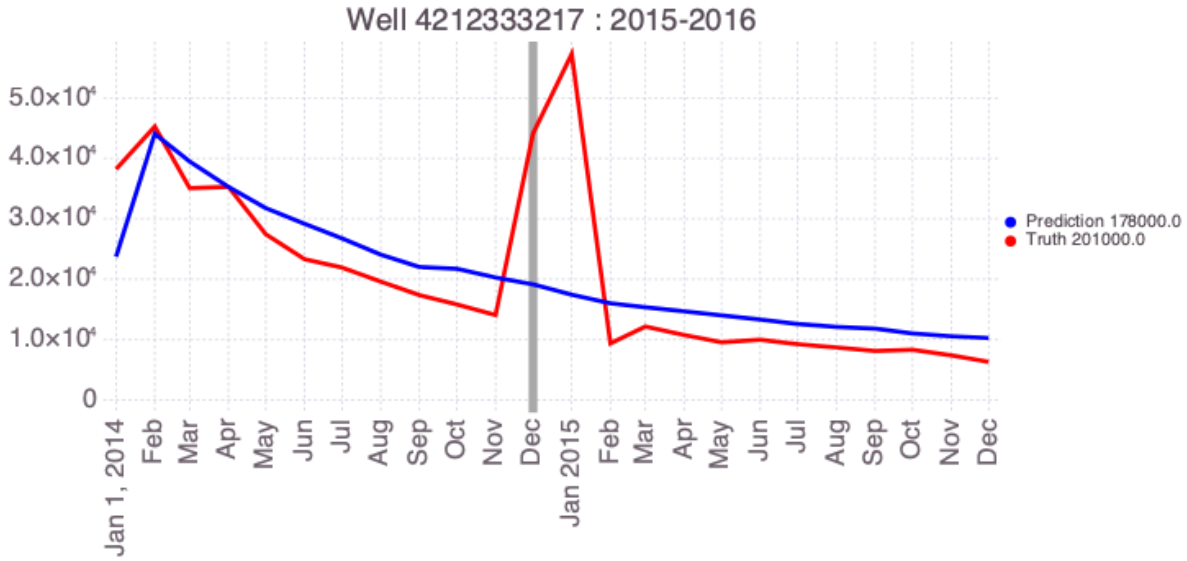


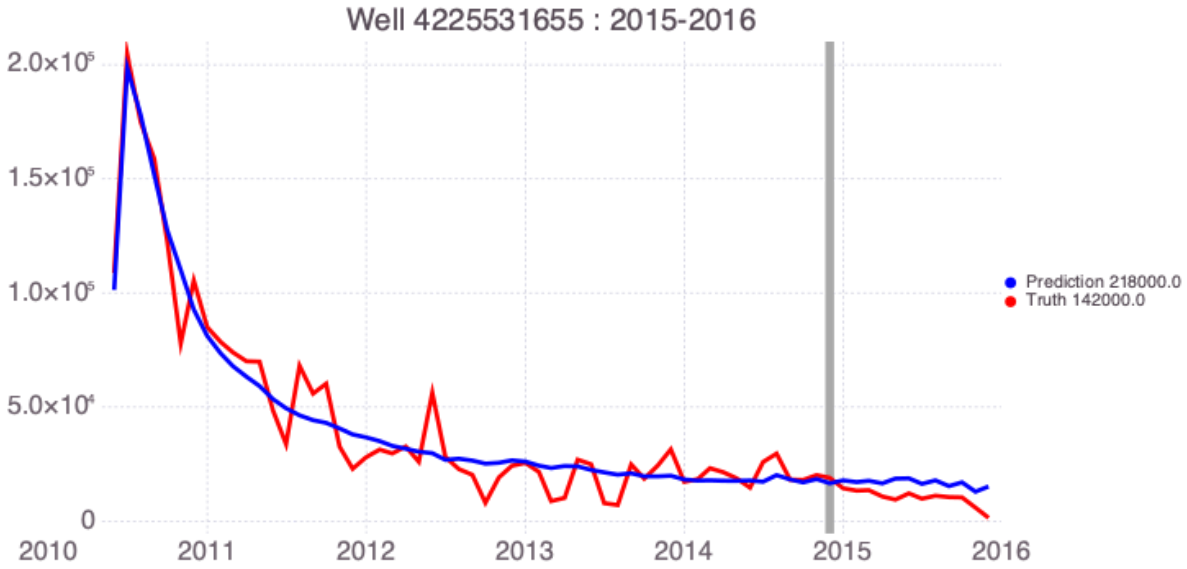

```
┌ Info: Prediction matrix size: (143, 322)
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:144
┌ Info: Prediction start date: 2004-02-01
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:145
┌ Info: Prediction end   date: 2004-02-01
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:146
┌ Info: Training window: 118
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:156
┌ Info: Prediction window: 25
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:157
Dimension 1: No bad indices!
Dimension 2: No bad indices!
┌ Info: Dimension 1 ...
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkChecks.jl:78
┌ Info: Dimension 2 ...
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkChecks.jl:78
┌ Info: NMFk #1: gas_2015 Window 118
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:65
Signals:  2 Fit: 3.739159e+12 Silhouette:    0.1872708 AIC:     214955.6
Signals:  3 Fit: 2.436588e+12 Silhouette:    0.5115209 AIC:     211191.1
Signals:  4 Fit: 1.811994e+12 Silhouette:    0.1589268 AIC:     208859.1
Signals:  5 Fit: 1.341023e+12 Silhouette:   -0.2316457 AIC:     206474.8
Signals:  2 Fit: 3.739159e+12 Silhouette:    0.1872708 AIC:     214955.6
Signals:  3 Fit: 2.436588e+12 Silhouette:    0.5115209 AIC:     211191.1
Signals:  4 Fit: 1.811994e+12 Silhouette:    0.1589268 AIC:     208859.1
Signals:  5 Fit: 1.341023e+12 Silhouette:   -0.2316457 AIC:     206474.8
┌ Info: Results
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkExecute.jl:15
┌ Info: Optimal solution: 3 signals
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkExecute.jl:20
┌ Info: Optimal number of signals: [2, 3] Training window sizes: [118, 11
8]
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:163
```

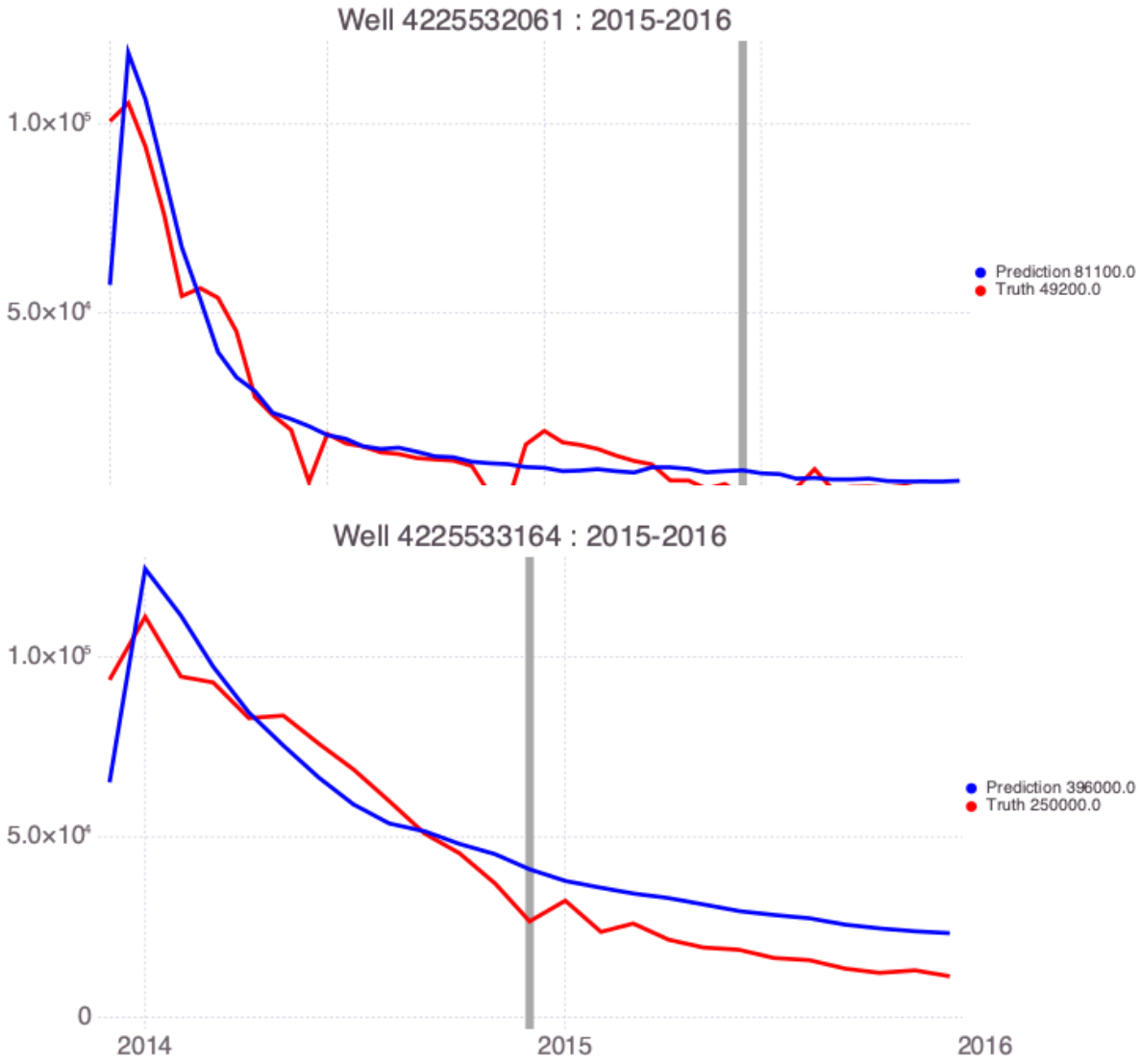


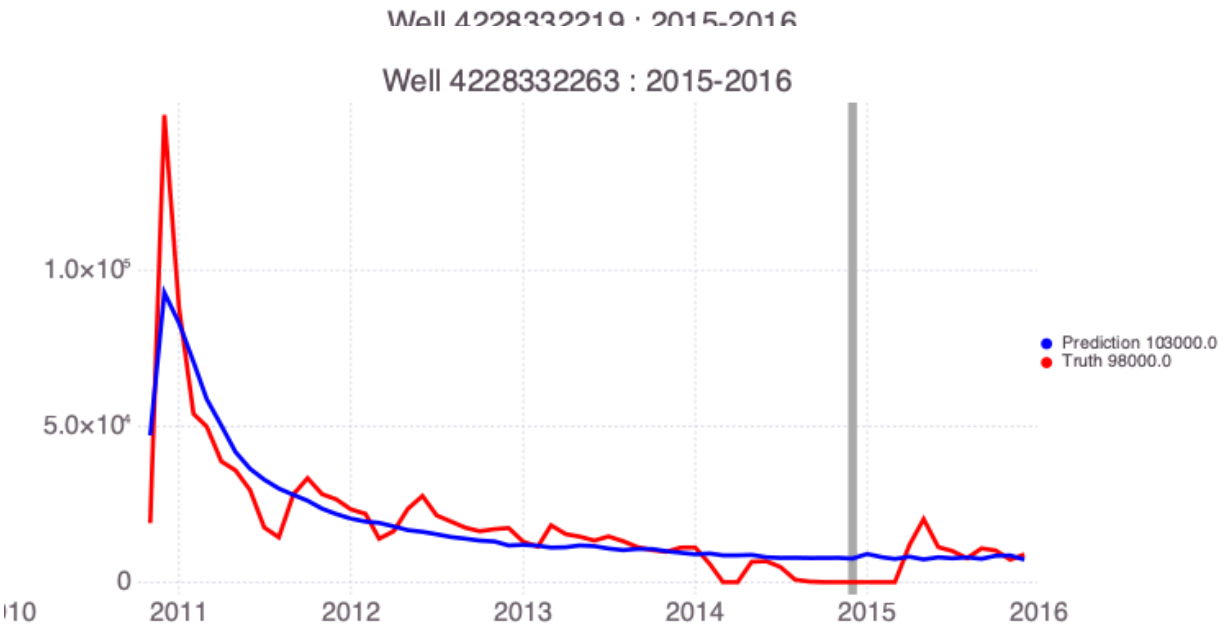

```
Signals:  2 Fit: 3.739159e+12 Silhouette:    0.1872708 AIC:     214955.6
```

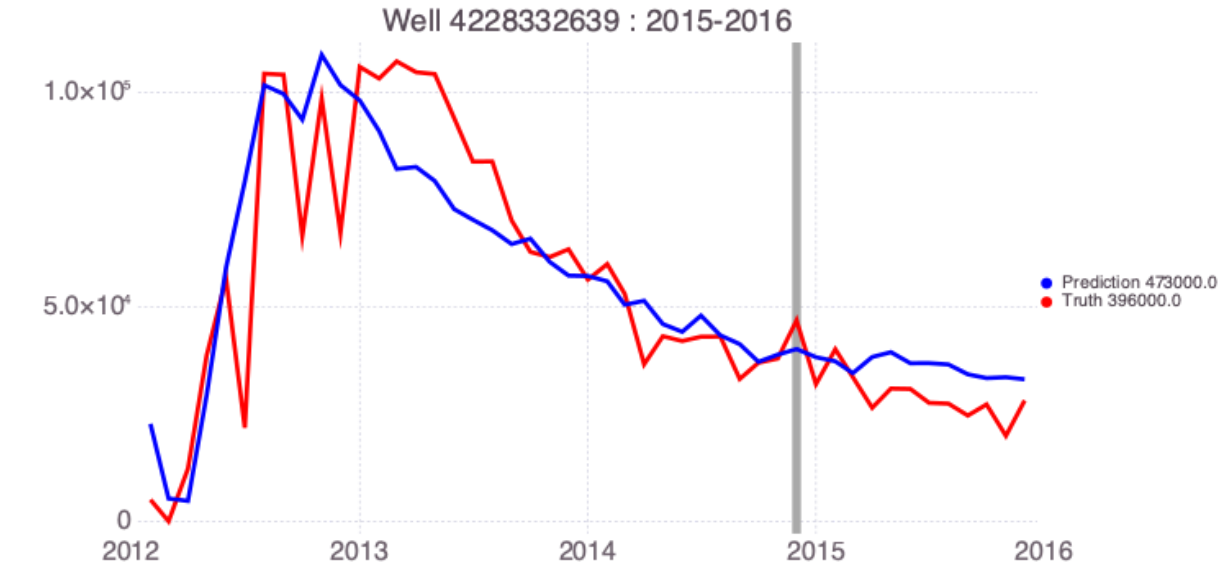


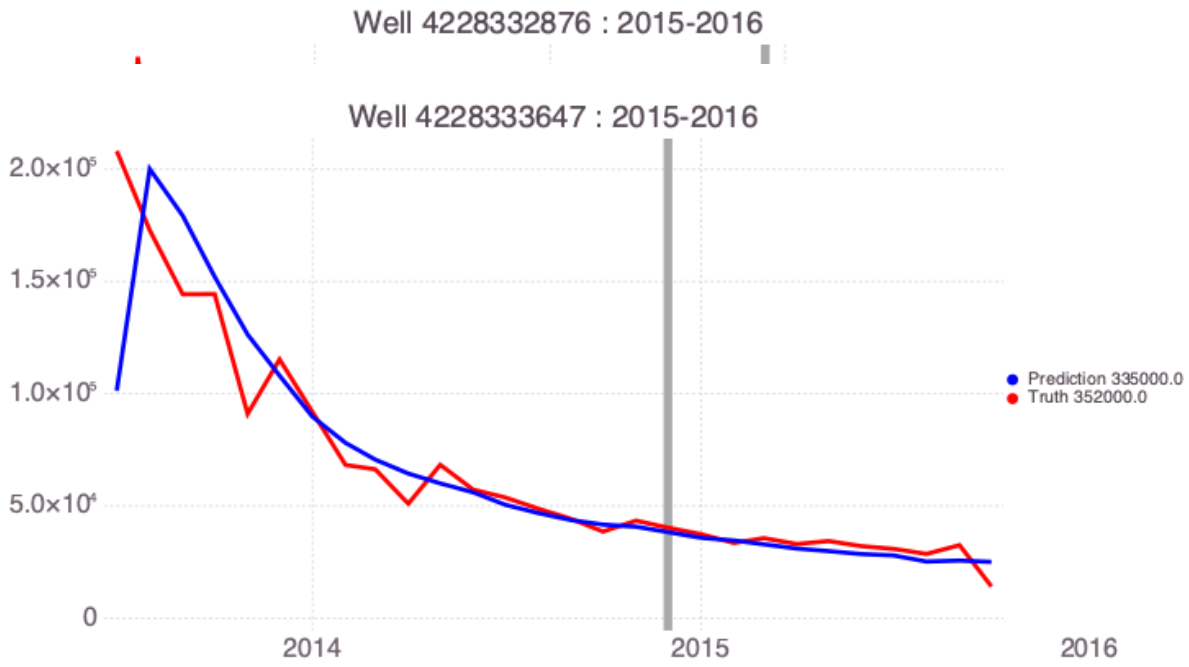

Well 4212333217 : 2015-2016
5.0×10⁴
4.0×10⁴
3.0×10⁴
2.0×10⁴
1.0×10⁴
0
Jan 1, 2014
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Prediction 178000.0
Truth 201000.0

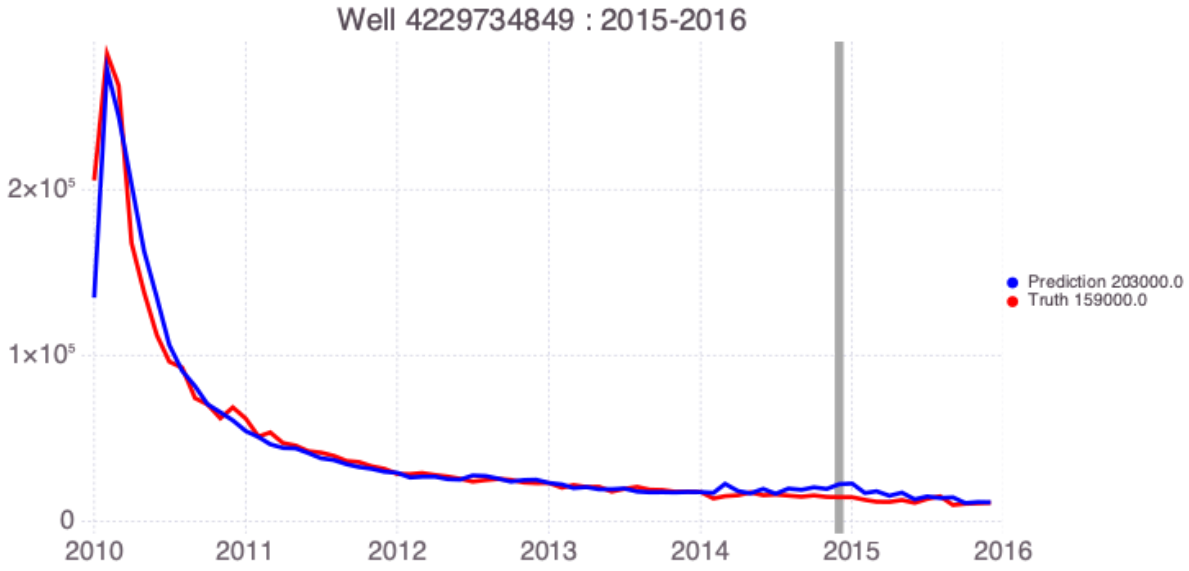

Well 4225531655 : 2015-2016
2.0×10⁵
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
2010
2011
2012
2013
2014
2015
2016
Prediction 218000.0
Truth 142000.0

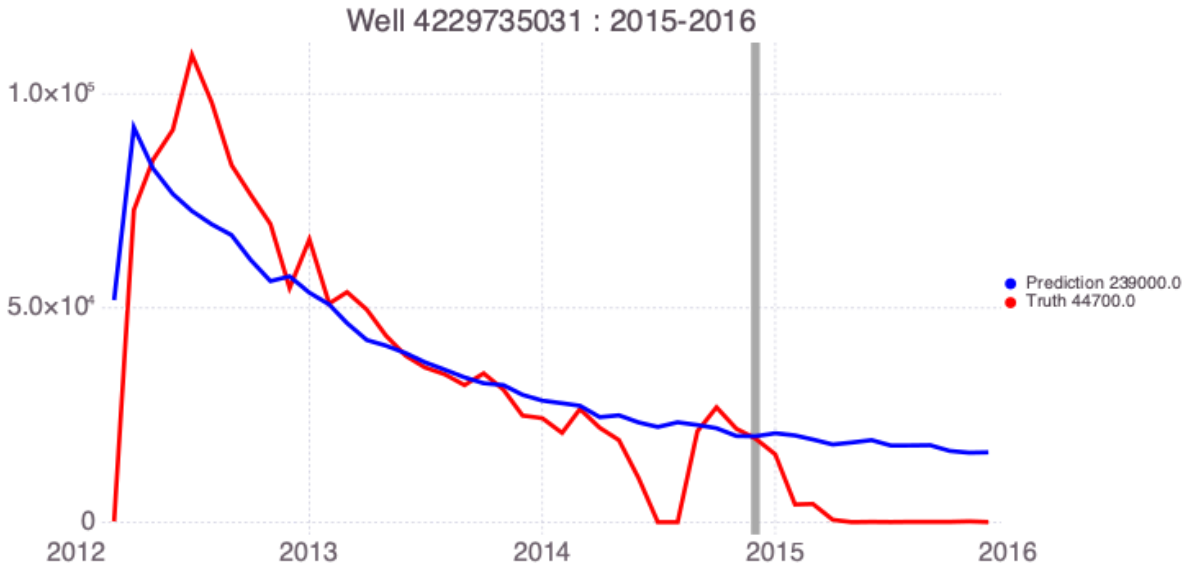

Well 4225532061 : 2015-2016
1.0×10⁵
5.0×10⁴
Prediction 81100.0
Truth 49200.0
Well 4225533164 : 2015-2016
1.0×10⁵
5.0×10⁴
0
2014
2015
2016
Prediction 396000.0
Truth 250000.0

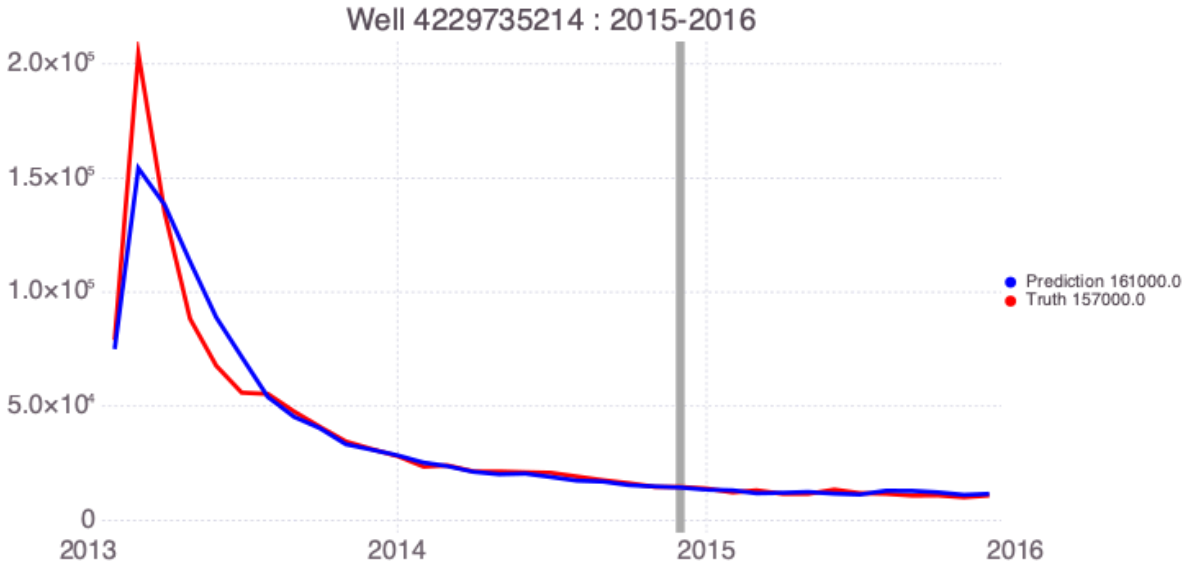

Well 4228332263 : 2015-2016
1.0×10⁵
5.0×10⁴
0
2011
2012
2013
2014
2015
2016
Prediction 103000.0
Truth 98000.0

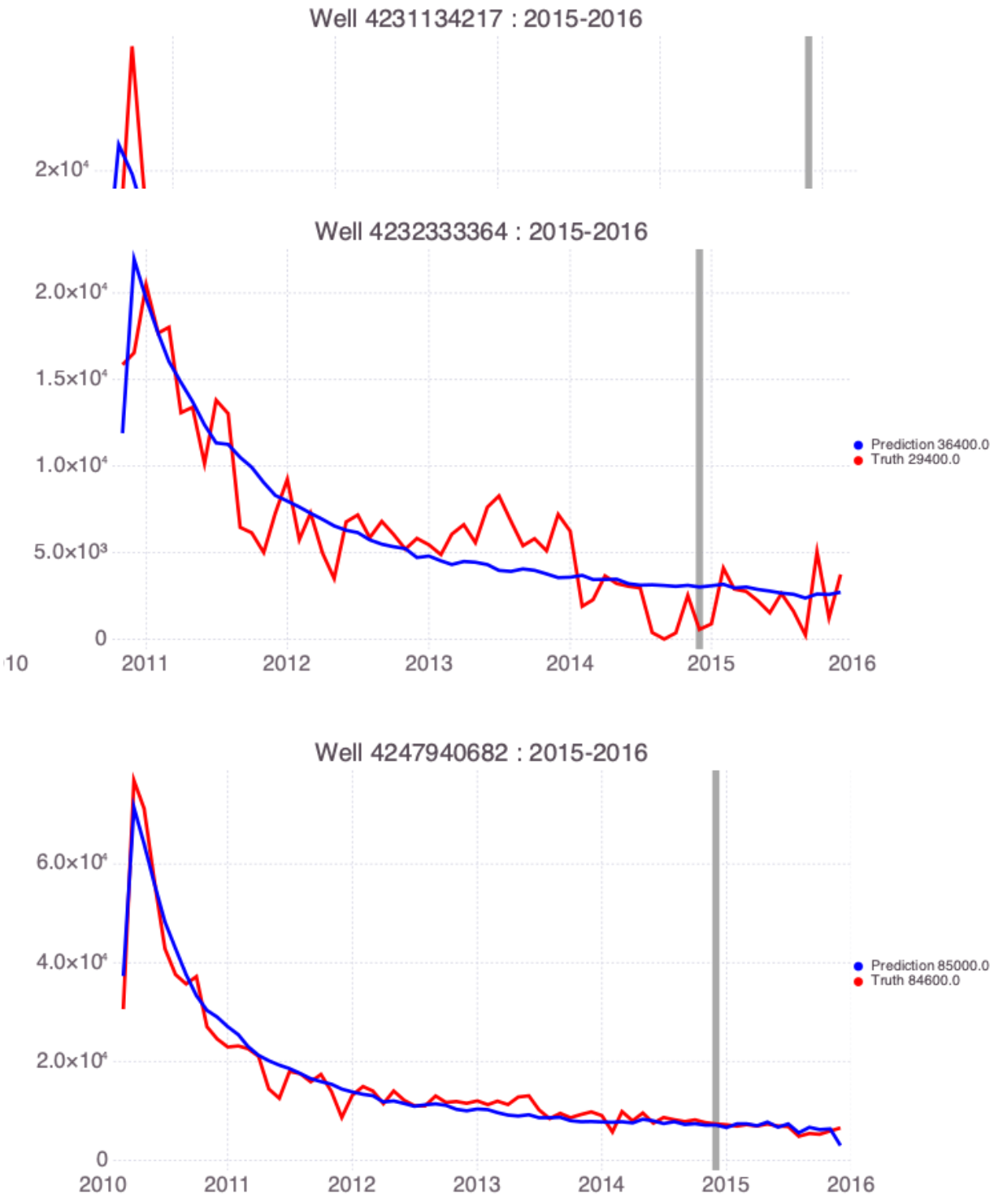

Well 4228332639 : 2015-2016
1.0×10⁵
5.0×10⁴
0
2012
2013
2014
2015
2016
Prediction 473000.0
Truth 396000.0

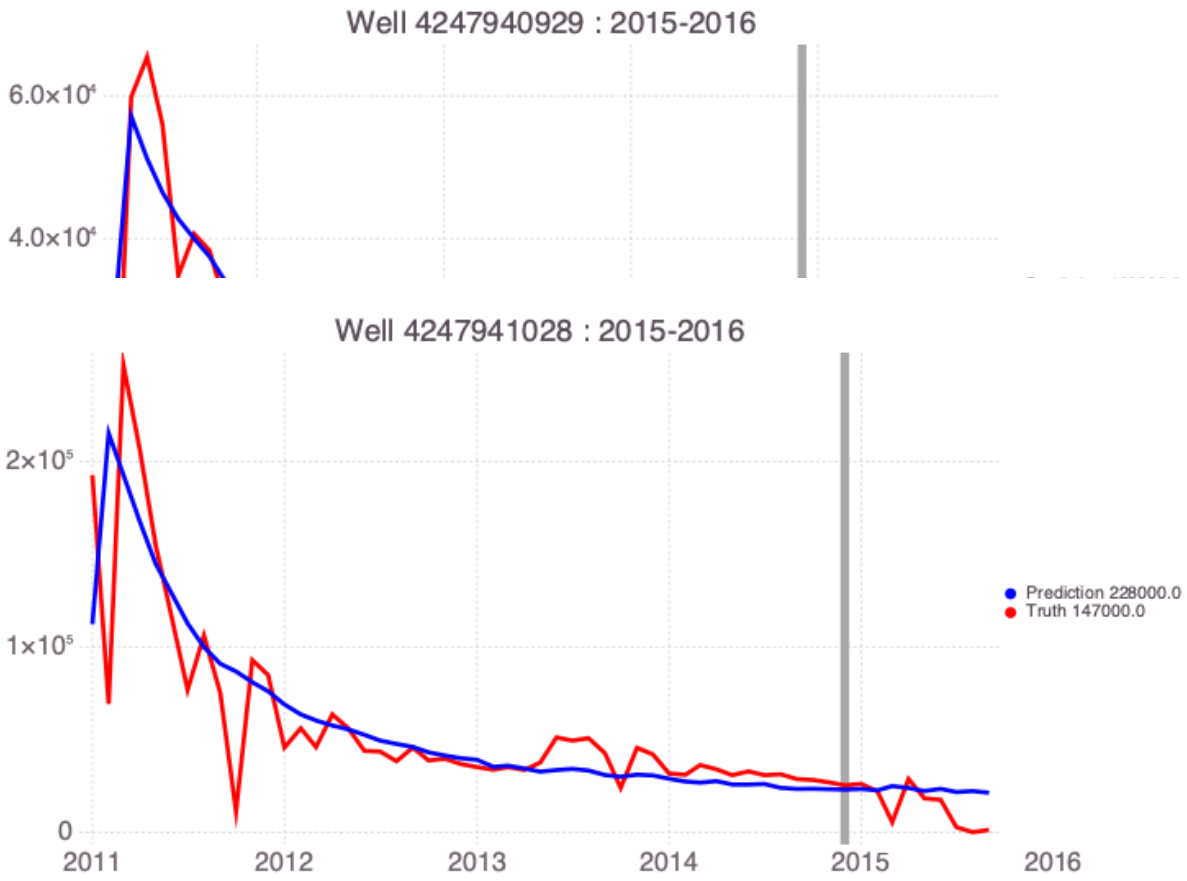

Well 4228332876 : 2015-2016
Well 4228333647 : 2015-2016
2.0×10⁵
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
2014
2015
2016
Prediction 335000.0
Truth 352000.0

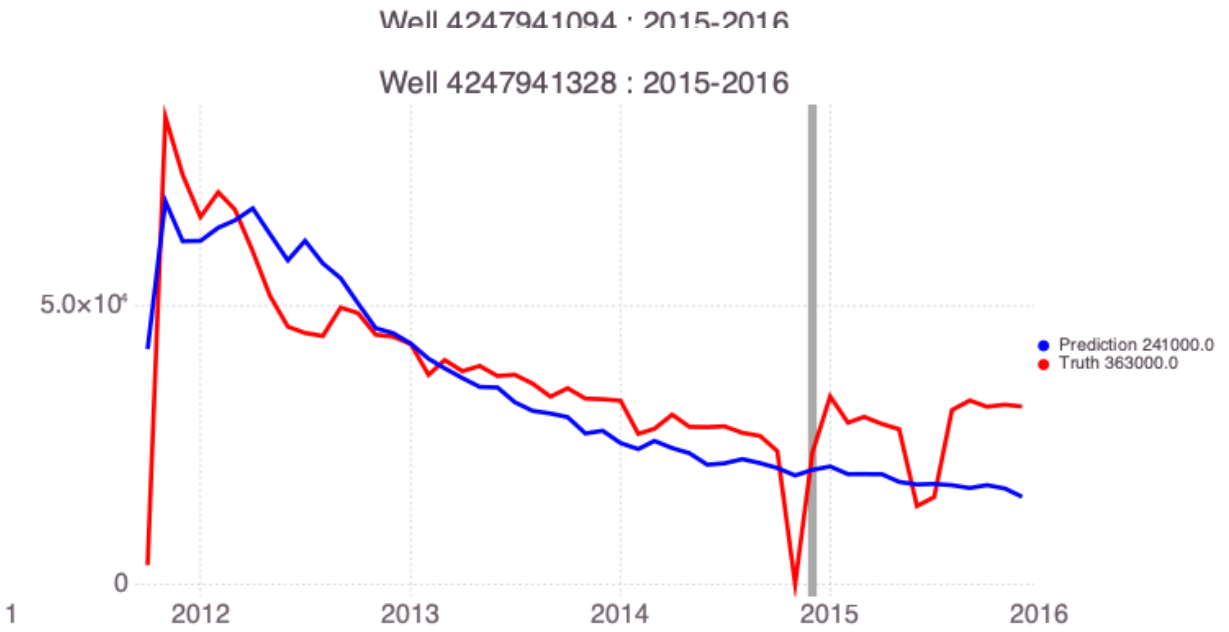

Well 4229734849 : 2015-2016
2×10⁵
1×10⁵
0
2010
2011
2012
2013
2014
2015
2016
Prediction 203000.0
Truth 159000.0

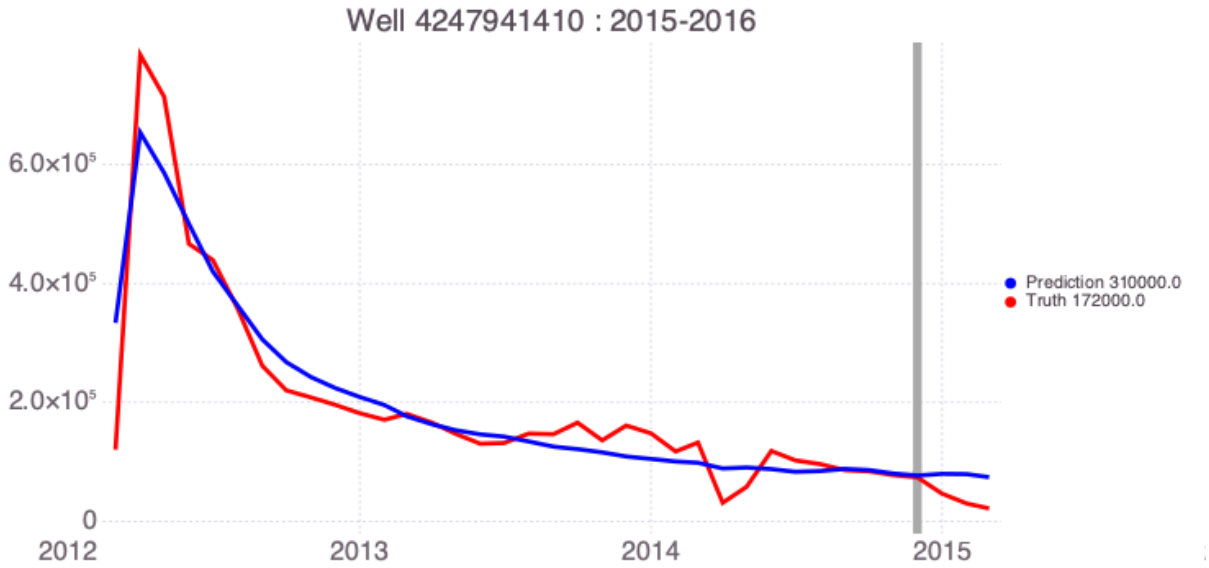

Well 4229735031 : 2015-2016
1.0×10⁵
5.0×10⁴
0
2012
2013
2014
2015
2016
Prediction 239000.0
Truth 44700.0

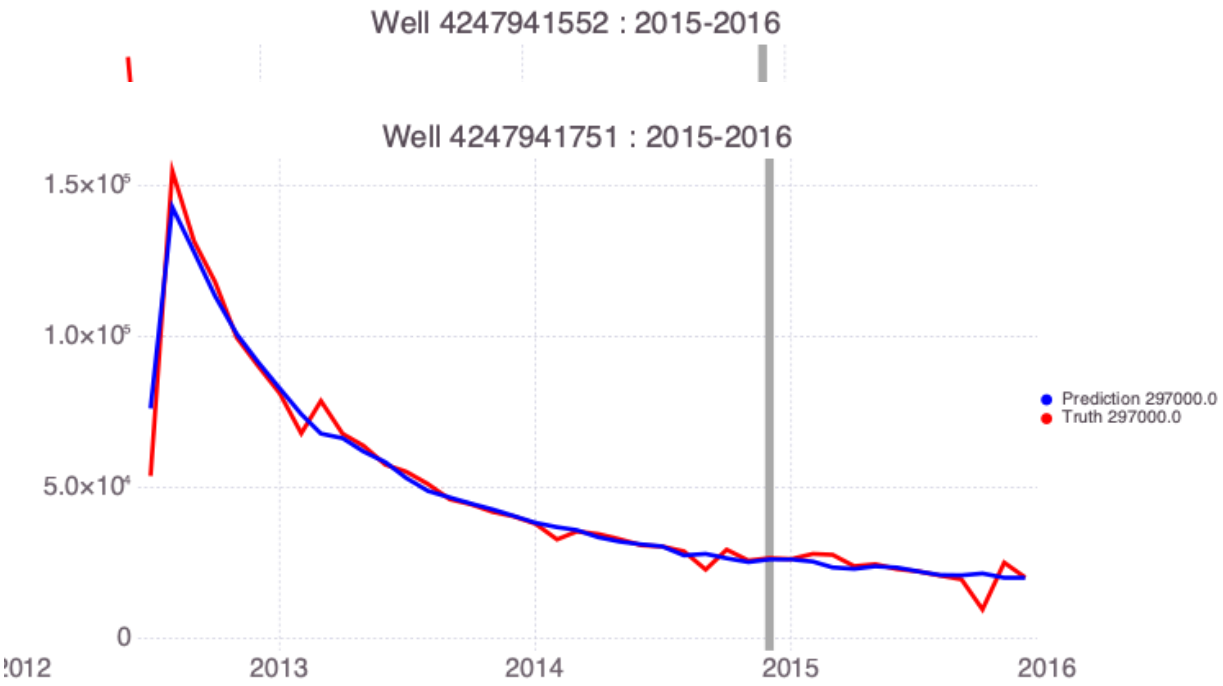

Well 4229735214 : 2015-2016
2.0×10⁵
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
2013
2014
2015
2016
Prediction 161000.0
Truth 157000.0

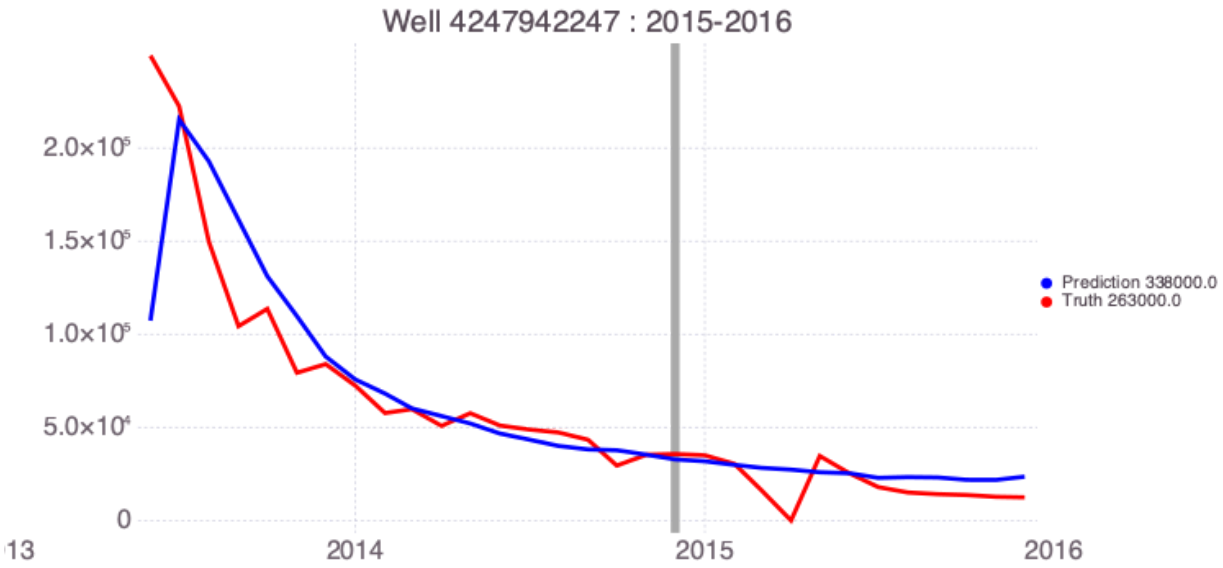

Well 4231134217 : 2015-2016
2×10⁴
Well 4232333364 : 2015-2016
2.0×10⁴
1.5×10⁴
1.0×10⁴
5.0×10³
0
10
2011
2012
2013
2014
2015
2016
Prediction 36400.0
Truth 29400.0
Well 4247940682 : 2015-2016
6.0×10⁴
4.0×10⁴
2.0×10⁴
0
2010
2011
2012
2013
2014
2015
2016
Prediction 85000.0
Truth 84600.0

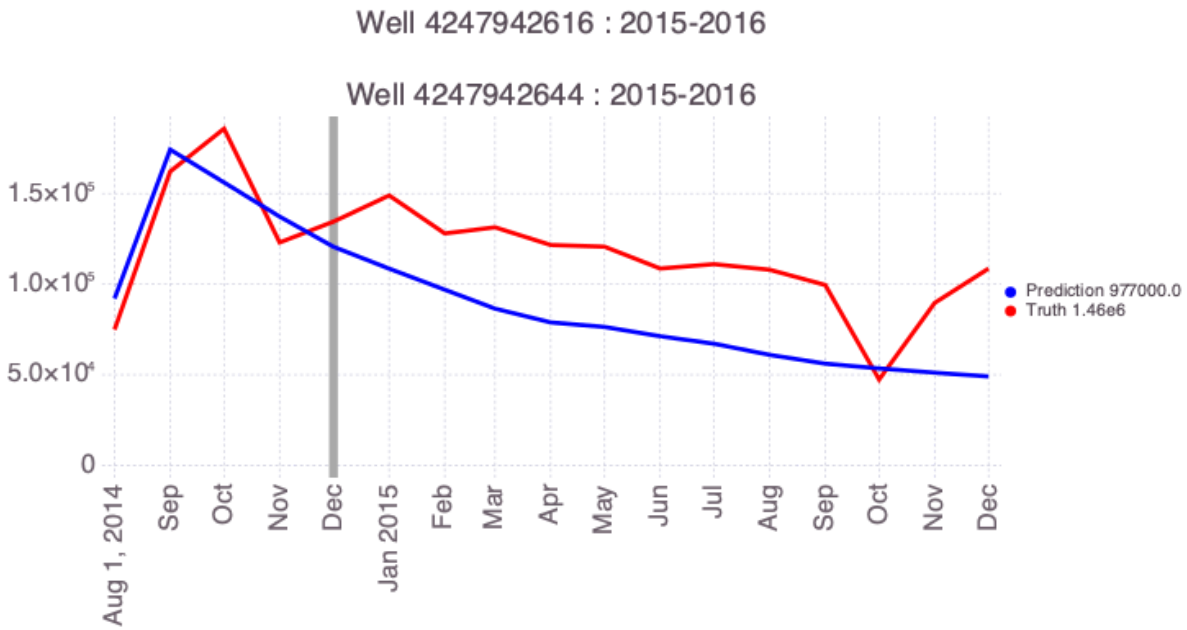

Well 4247940929 : 2015-2016
6.0×10⁴
4.0×10⁴
Well 4247941028 : 2015-2016
2×10⁵
1×10⁵
0
2011
2012
2013
2014
2015
2016
Prediction 228000.0
Truth 147000.0

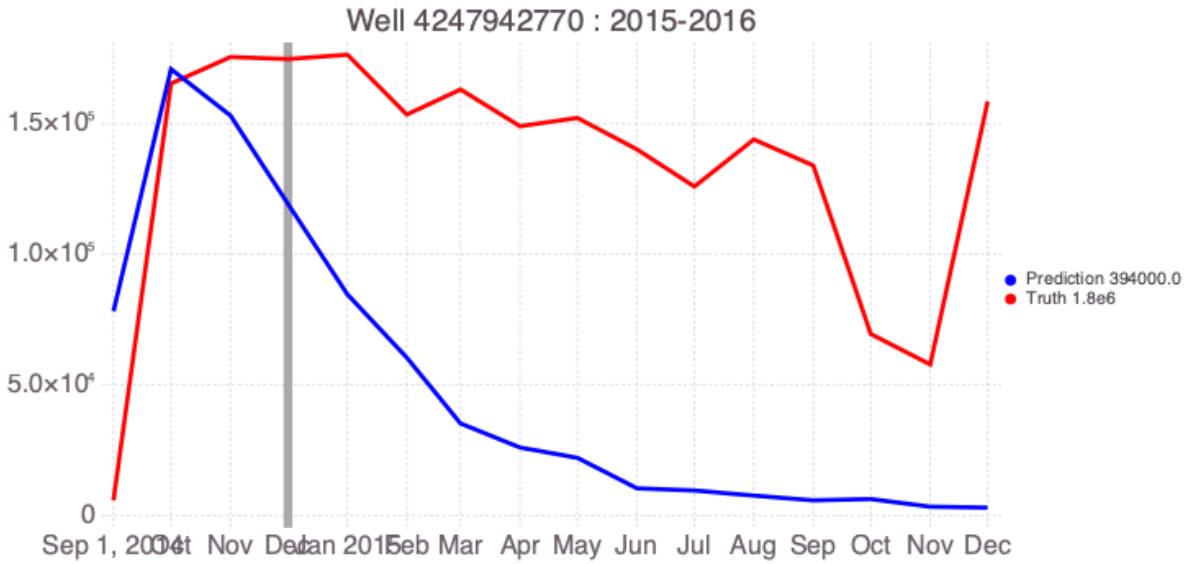

Well 4247941328 : 2015-2016
5.0×10⁴
0
1
2012
2013
2014
2015
2016
Prediction 241000.0
Truth 363000.0

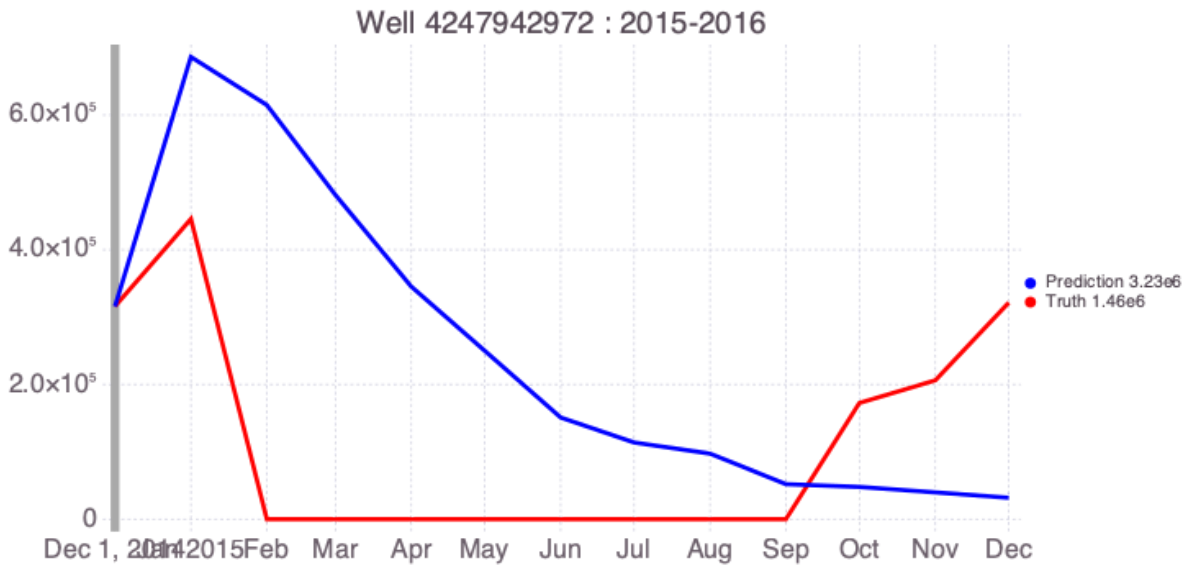

Well 4247941410 : 2015-2016
6.0×10⁵
4.0×10⁵
2.0×10⁵
0
2012
2013
2014
2015
Prediction 310000.0
Truth 172000.0


Well 4247941552 : 2015-2016
Well 4247941751 : 2015-2016
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
2012
2013
2014
2015
2016
Prediction 297000.0
Truth 297000.0

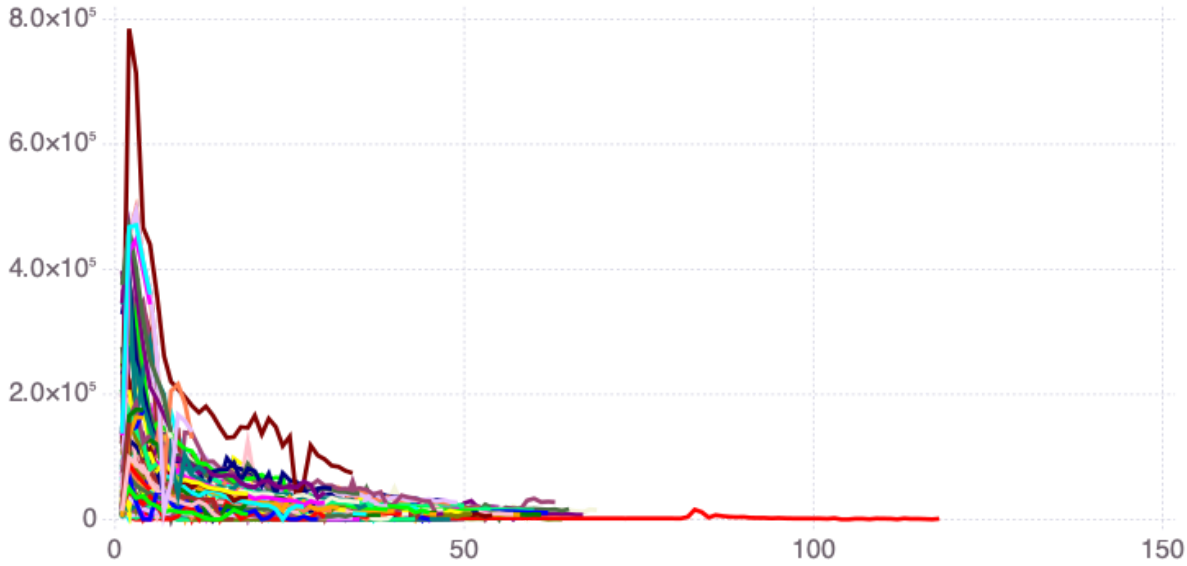

Well 4247942247 : 2015-2016
2.0×10⁵
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
13
2014
2015
2016
Prediction 338000.0
Truth 263000.0

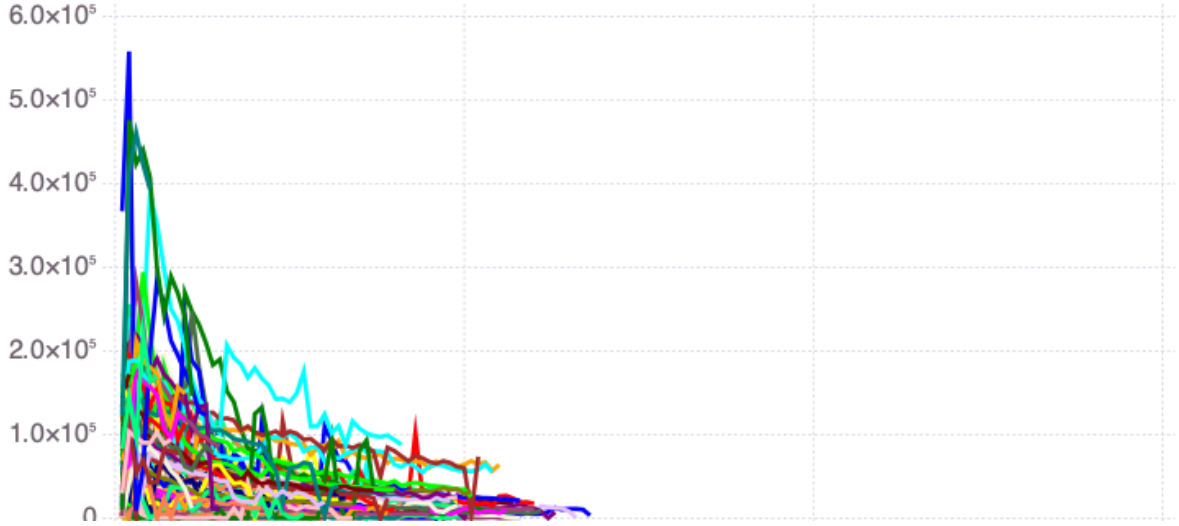

Well 4247942616 : 2015-2016
Well 4247942644 : 2015-2016
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
Aug 1, 2014
Sep
Oct
Nov
Dec
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Prediction 977000.0
Truth 1.46e6


Well 4247942770 : 2015-2016
1.5×10⁵
1.0×10⁵
5.0×10⁴
0
Sep 1, 2014
Oct
Nov
Dec
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Prediction 394000.0
Truth 1.8e6



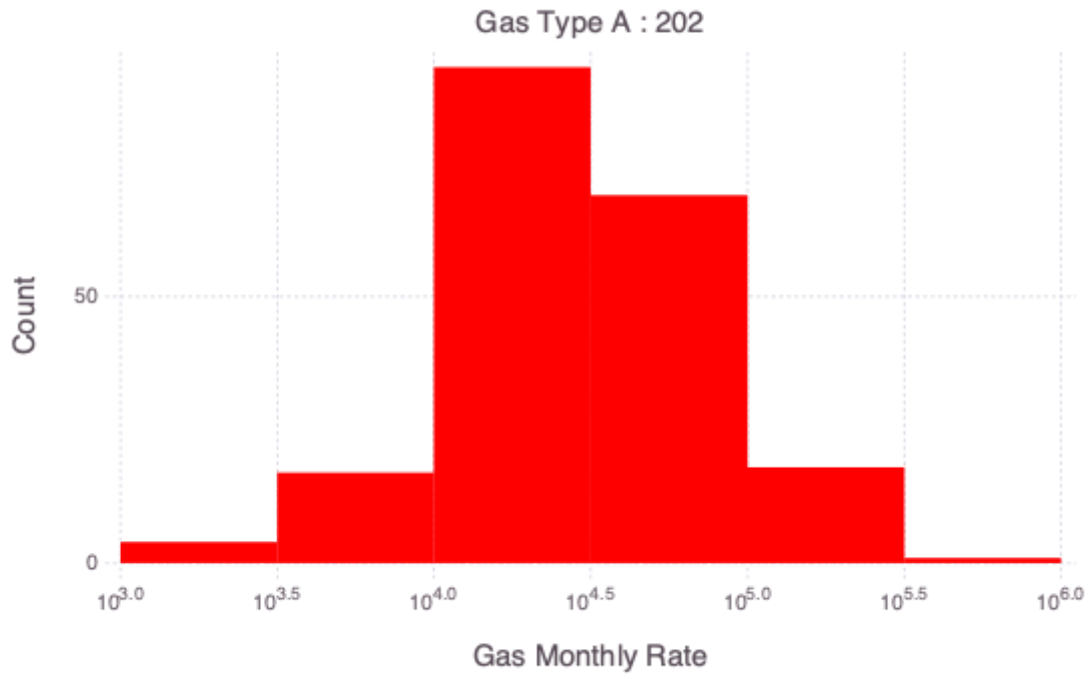

```
┌ Info: Window 2015: Training size 118 Truth size: 299 Prediction size: 2
99 R2 (pred): 0.6957154770204516 R2 (all) 0.8702610728541793
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:221
┌ Info: Type A wells: 202
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:235
```





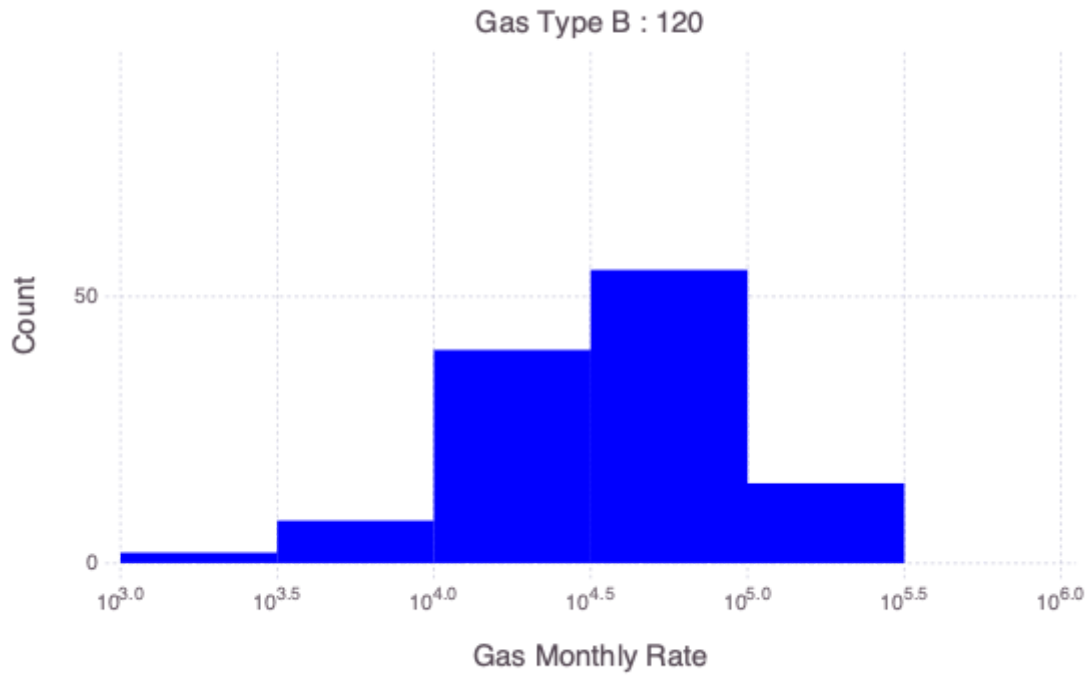

```
[ Info: Type B wells: 120
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:235

1×2 Array{Any,2}:
 "EAGLE FORD"  202


[ Info: Type A wells: 202
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:241
[ Info: Formation
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:242

23×2 Array{Any,2}:
 "SILVERBOW RESOURCES OPER, LLC"     27
 "LAREDO ENERGY OPERATING, LLC"      21
 "PIONEER NATURAL RES. USA, INC."    18
 "SM ENERGY COMPANY"                 15
 "LEWIS PETRO PROPERTIES, INC."      14
 "SN OPERATING, LLC"                 11
 "ROSETTA RESOURCES OPERATING LP"     9
 "BHP BILLITON PET(TXLA OP) CO"       8
 "BHP BILLITON PETROLEUM"             8
 ""                                   6
 "BHP BILLITON PETROLEUM "            6
 "BURLINGTON RESOURCES O & G CO LP"   6
 "DEVON ENERGY PRODUCTION CO, L.P."   6
 "ESCONDIDO RESOURCES OPER CO, LLC"   6
 "MARATHON OIL EF LLC"                6
 "STATOIL TEXAS ONSHORE PROP LLC"     6
 "ENCANA OIL & GAS(USA) INC."         4
 "EQUINOR TEXAS ONSHORE PROP LLC"     4
 "PROLINE ENERGY RESOURCES INC"       3
 "SWIFT ENERGY OPERATING, LLC"        3
 "EOG RESOURCES, INC."                2
 "PERDIDO ENERGY, LLC"                2
 "ZAZA ENERGY, LLC"                   2

1×2 Array{Any,2}:
 "Horizontal"  202

1×2 Array{Any,2}:
 "EAGLE FORD"  120
```

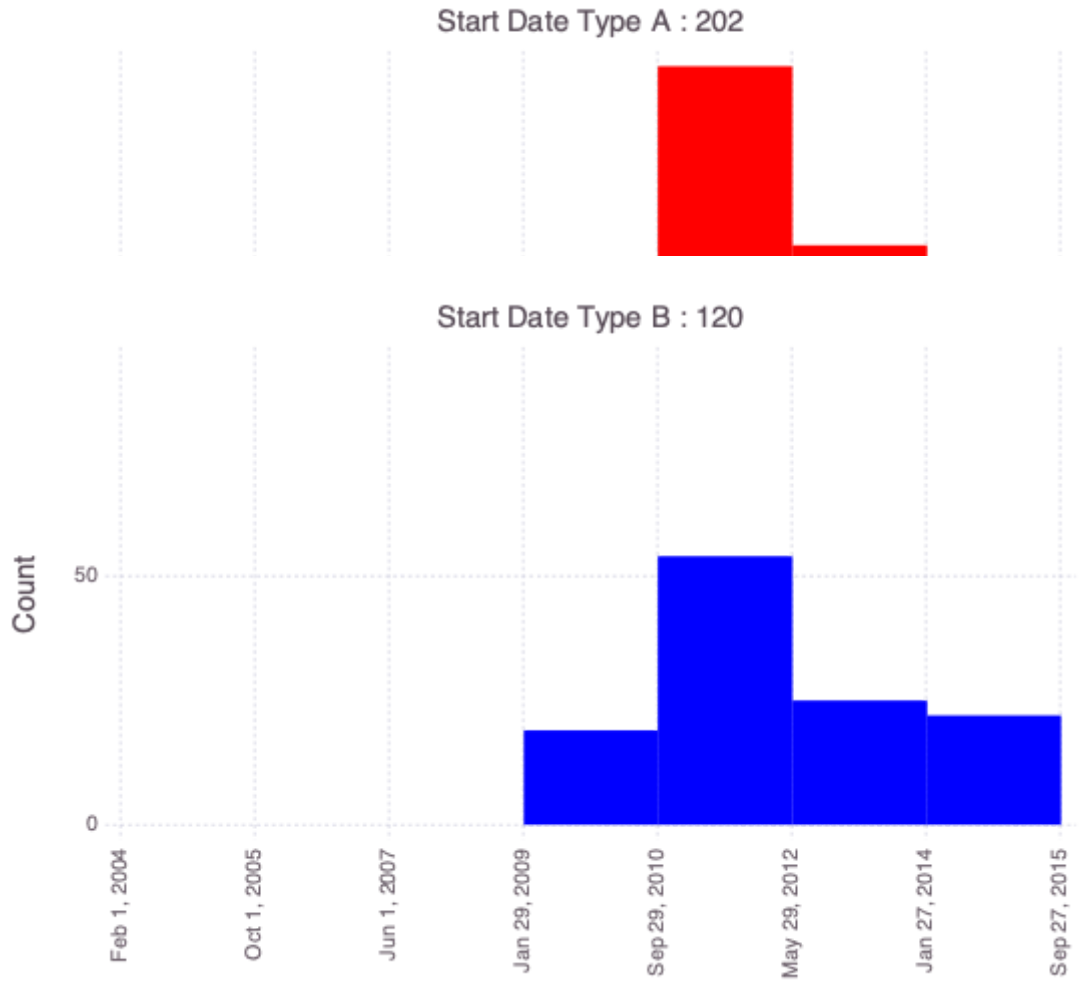
```
19×2 Array{Any,2}:
 "LEWIS PETRO PROPERTIES, INC."      32
 "SM ENERGY COMPANY"                 11
 "PIONEER NATURAL RES. USA, INC."    10
 "BHP BILLITON PET(TXLA OP) CO"       7
 "BURLINGTON RESOURCES O & G CO LP"   7
 "DEVON ENERGY PRODUCTION CO, L.P."   7
 "SILVERBOW RESOURCES OPER, LLC"      7
 "MARATHON OIL EF LLC"                4
 "SN OPERATING, LLC"                  4
 "STATOIL TEXAS ONSHORE PROP LLC"     4
 "ENDEAVOR NATURAL GAS, LP"           3
 "LAREDO ENERGY OPERATING, LLC"       3
 "PERDIDO ENERGY, LLC"                3
 ""                                   2
 "BHP BILLITON PETROLEUM"             2
 "BHP BILLITON PETROLEUM "            2
 "ESCONDIDO RESOURCES OPER CO, LLC"   2
 "FASKEN OIL AND RANCH, LTD."         2
 "ROSETTA RESOURCES OPERATING LP"     2

1×2 Array{Any,2}:
 "Horizontal"  120
```




```
[ Info: Operator
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:244
[ Info: Well type
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:246
[ Info: Type B wells: 120
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:241
[ Info: Formation
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:242
[ Info: Operator
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:244
```

```
┌ Info: Well type
```

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Start Date Type B : 120
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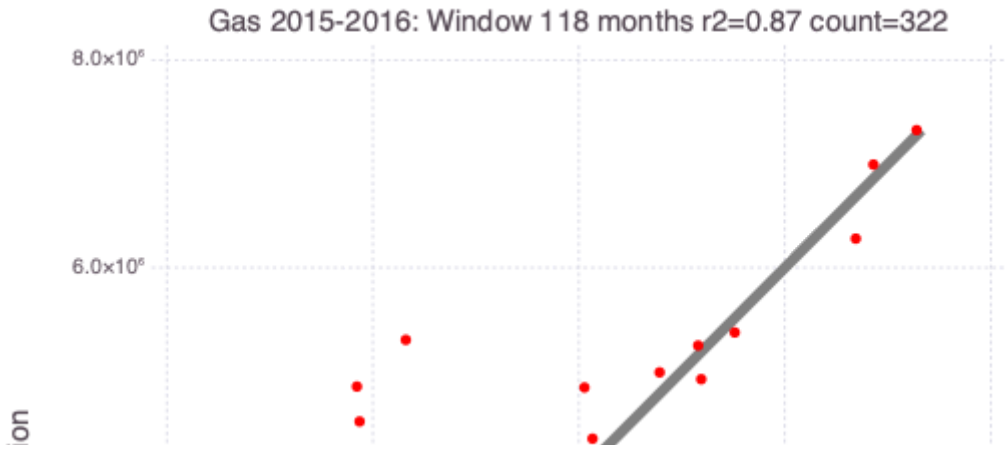
Oct 1, 2005
Jun 1, 2007
Jan 29, 2009
Sep 29, 2010
May 29, 2012
Jan 27, 2014
Sep 27, 2015

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Signals:  3 Fit: 2.436588e+12 Silhouette:    0.5115209 AIC:     211191.1
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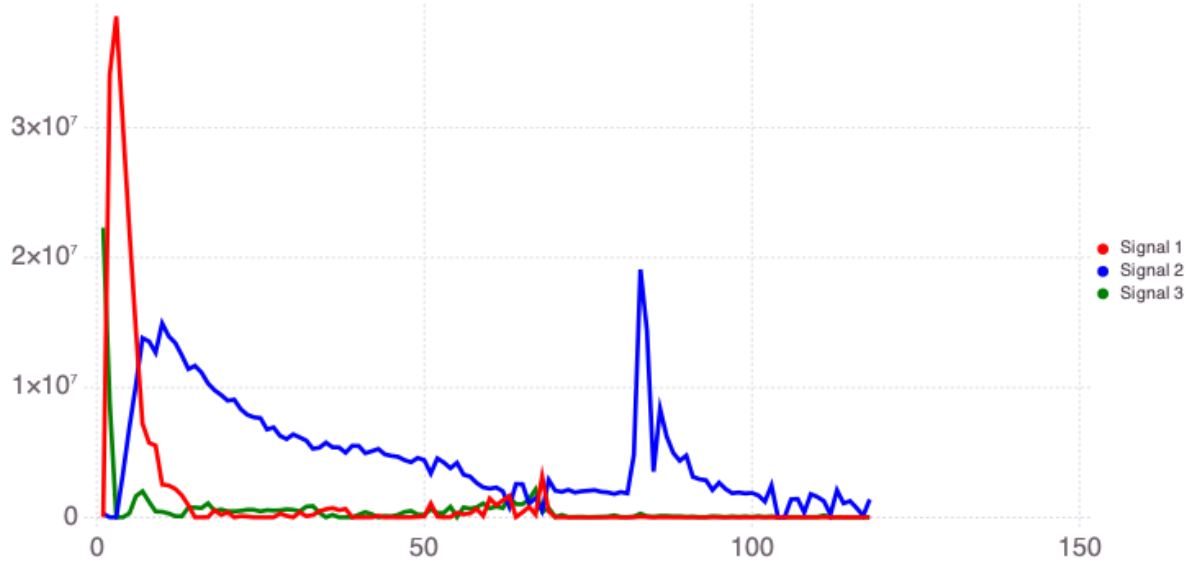

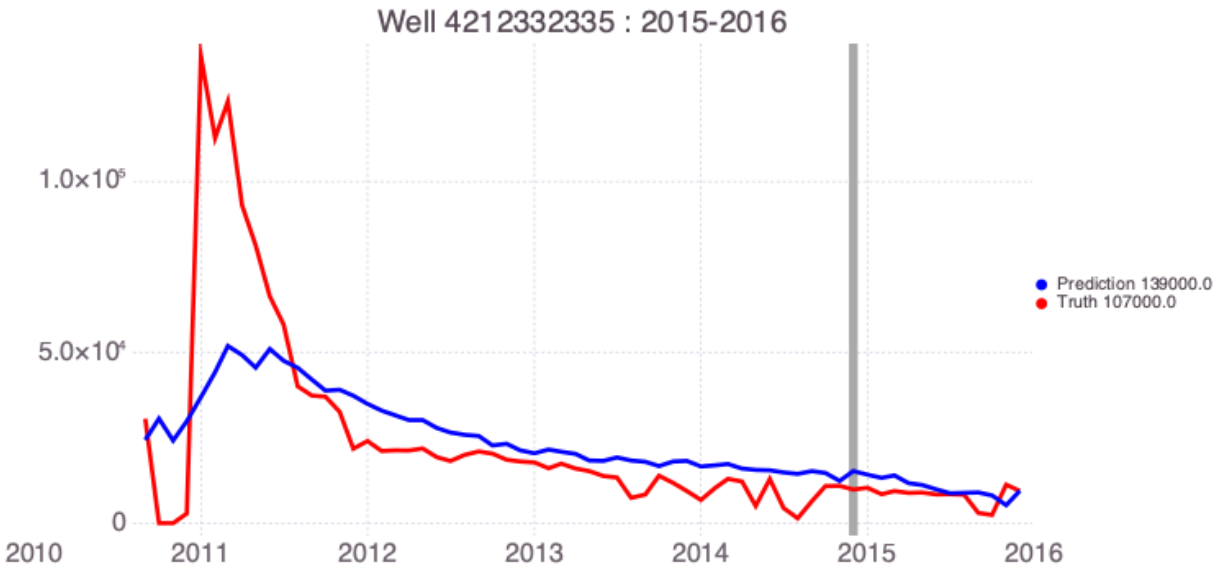

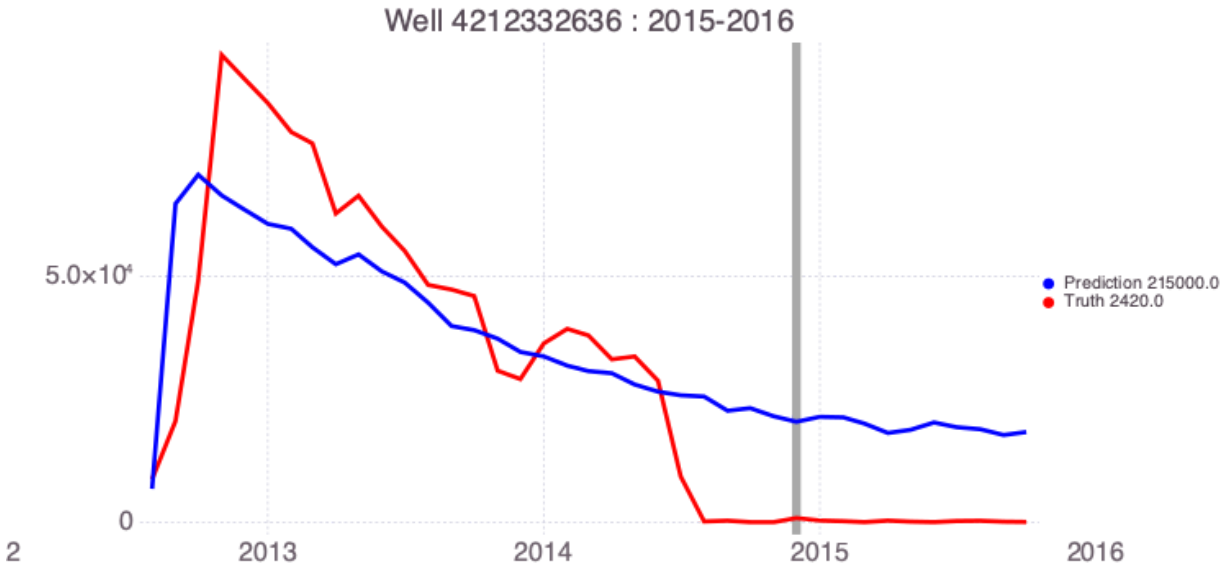
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2
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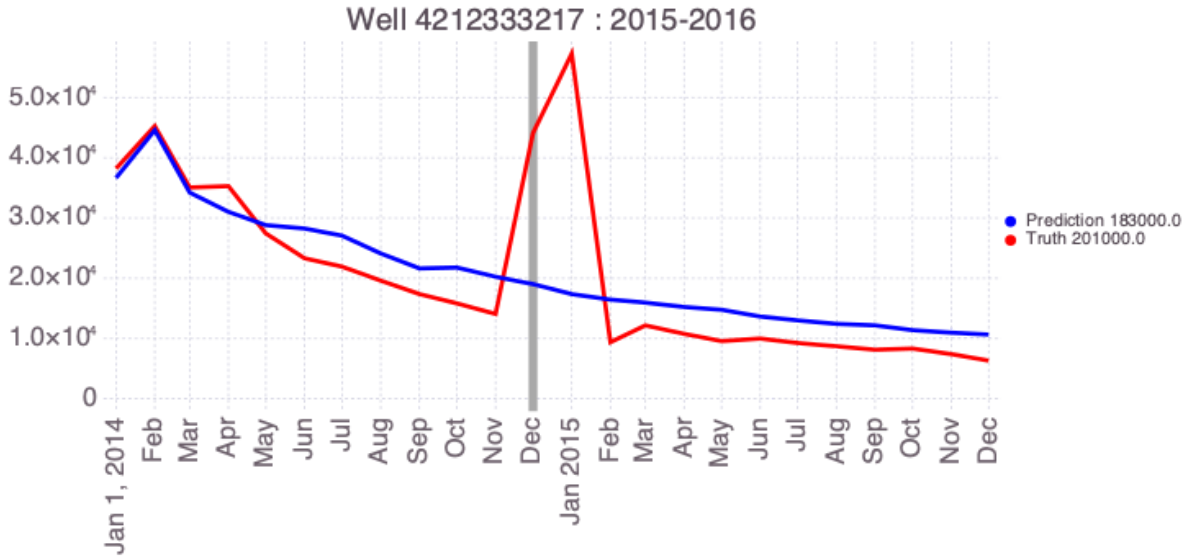
2014
2015
2016
Prediction 215000.0
Truth 2420.0


Well 4212333217 : 2015-2016
5.0×10⁴
4.0×10⁴
3.0×10⁴
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1.0×10⁴
0
Jan 1, 2014
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
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Apr
May
Jun
Jul
Aug
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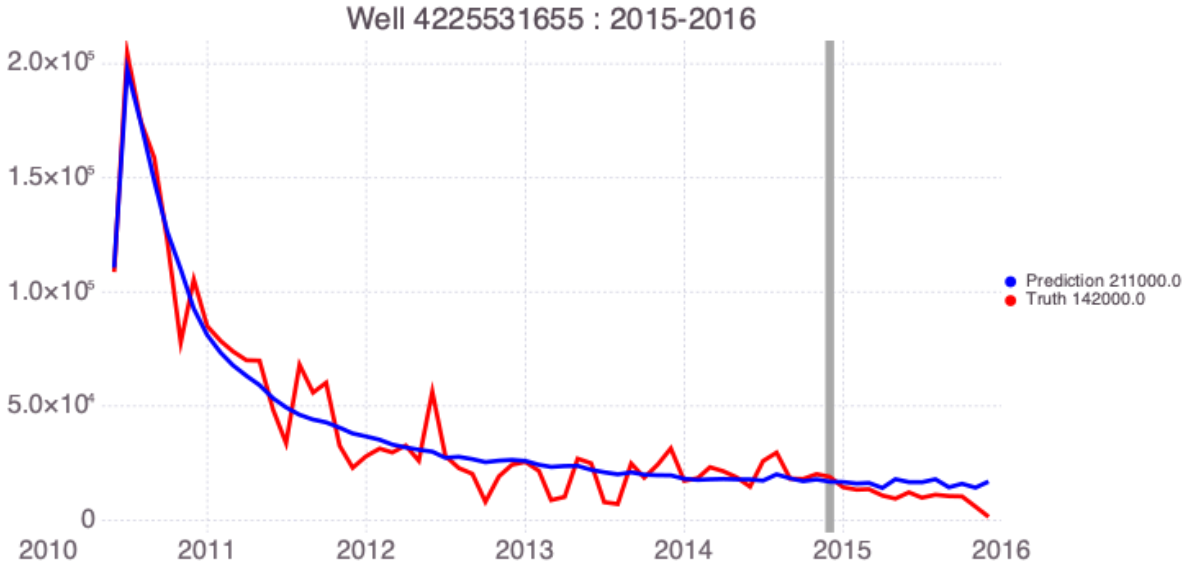
Oct
Nov
Dec
Prediction 183000.0
Truth 201000.0


Well 4225531655 : 2015-2016
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2011
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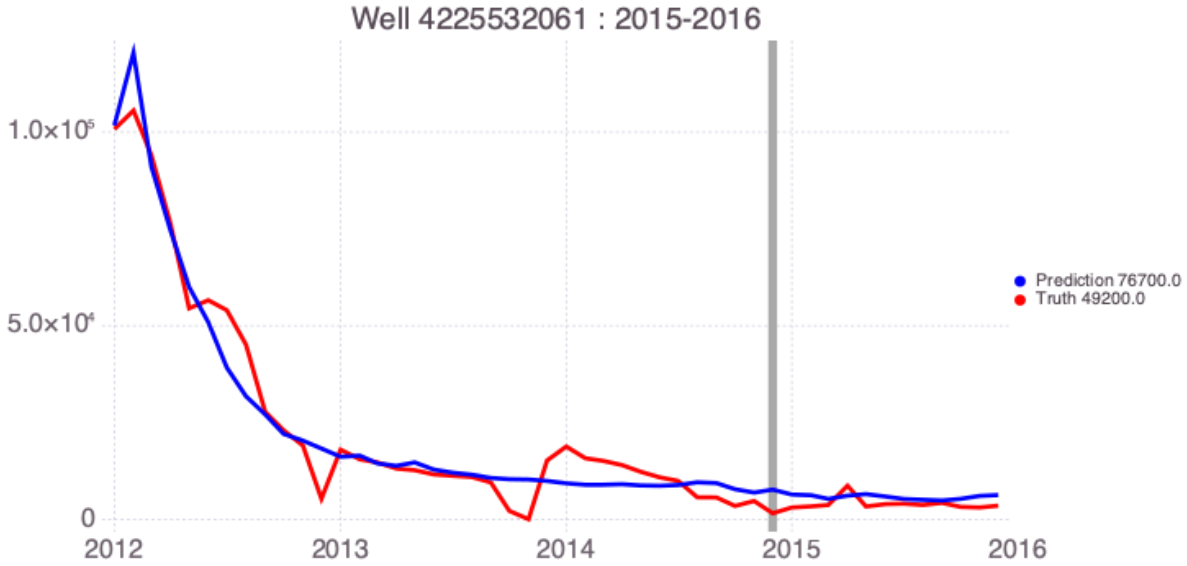
2014
2015
2016
Prediction 211000.0
Truth 142000.0


Well 4225532061 : 2015-2016
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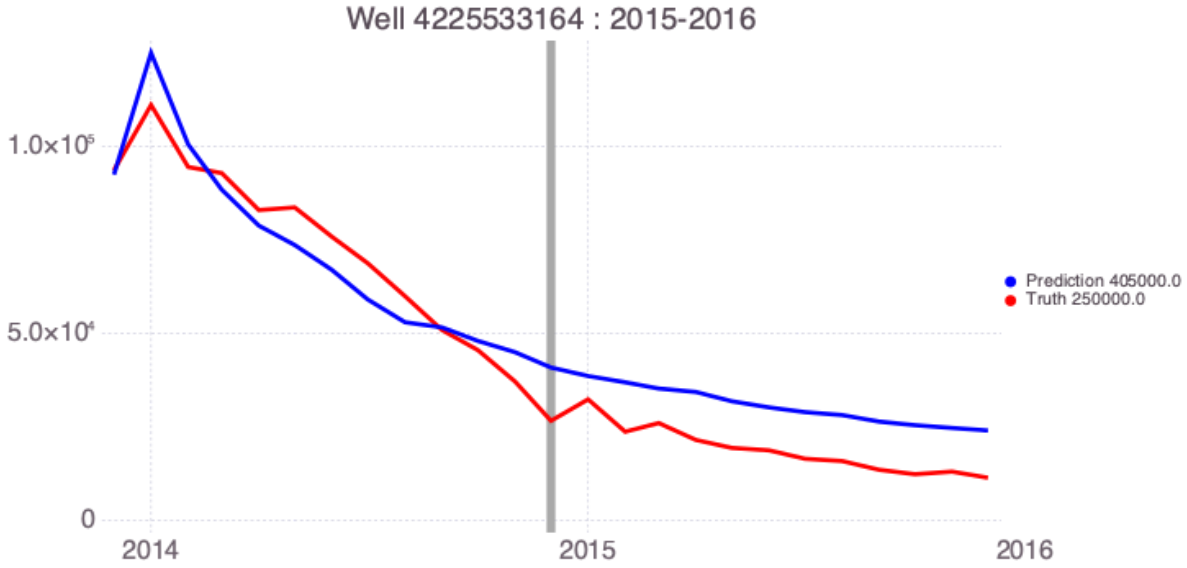
2014
2015
2016
Prediction 76700.0
Truth 49200.0


Well 4225533164 : 2015-2016
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5.0×10⁴
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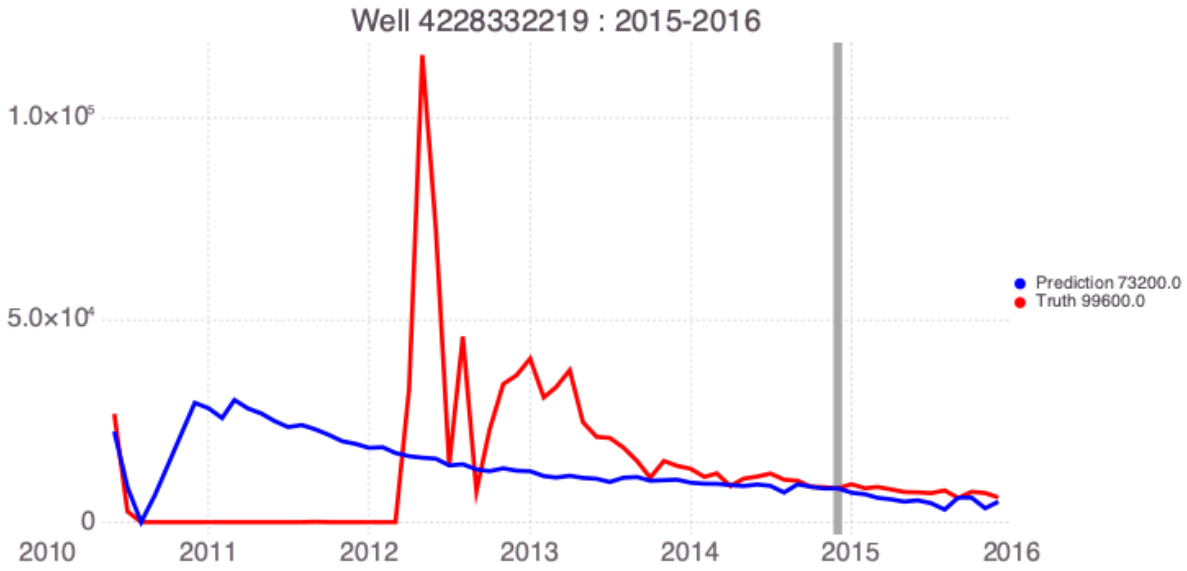
2014
2015
2016
Prediction 405000.0
Truth 250000.0


Well 4228332219 : 2015-2016
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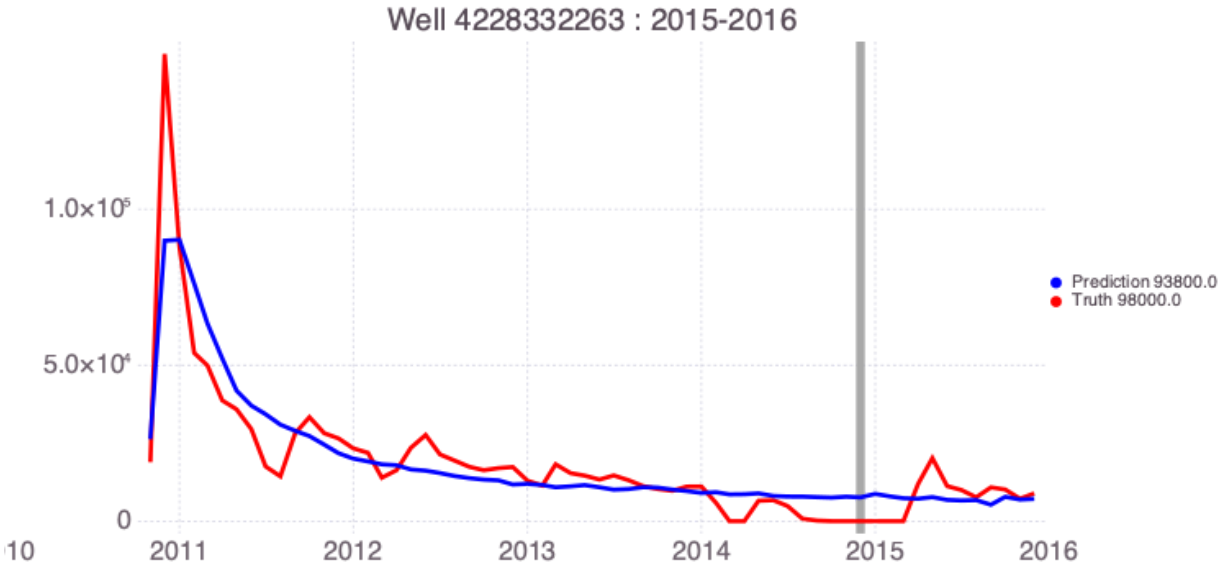
2016
Prediction 73200.0
Truth 99600.0


Well 4228332263 : 2015-2016
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10
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2012
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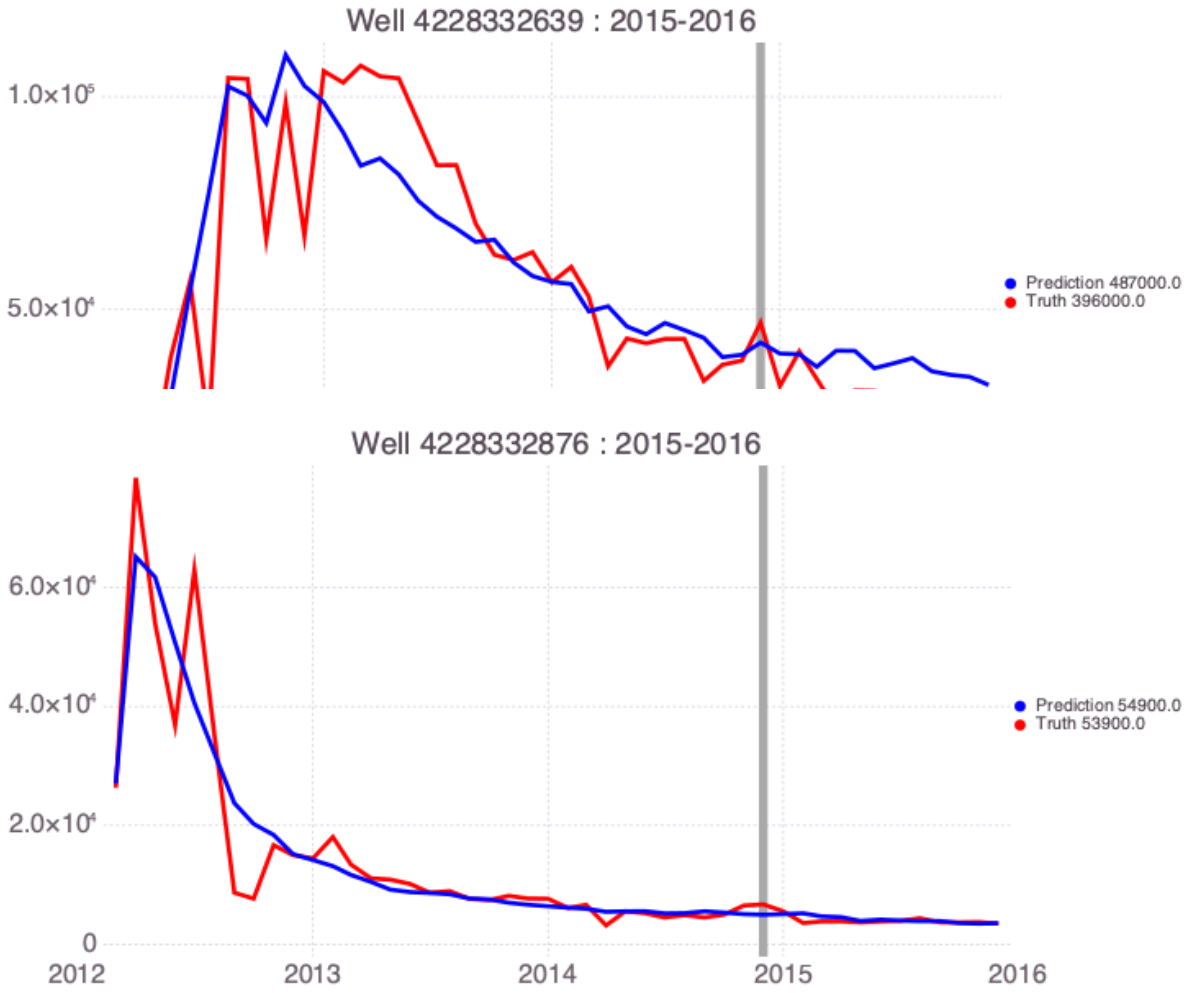
2014
2015
2016
Prediction 93800.0
Truth 98000.0


Well 4228332639 : 2015-2016
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5.0×10⁴
Prediction 487000.0
Truth 396000.0
Well 4228332876 : 2015-2016
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2.0×10⁴
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2014
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2016
Prediction 54900.0
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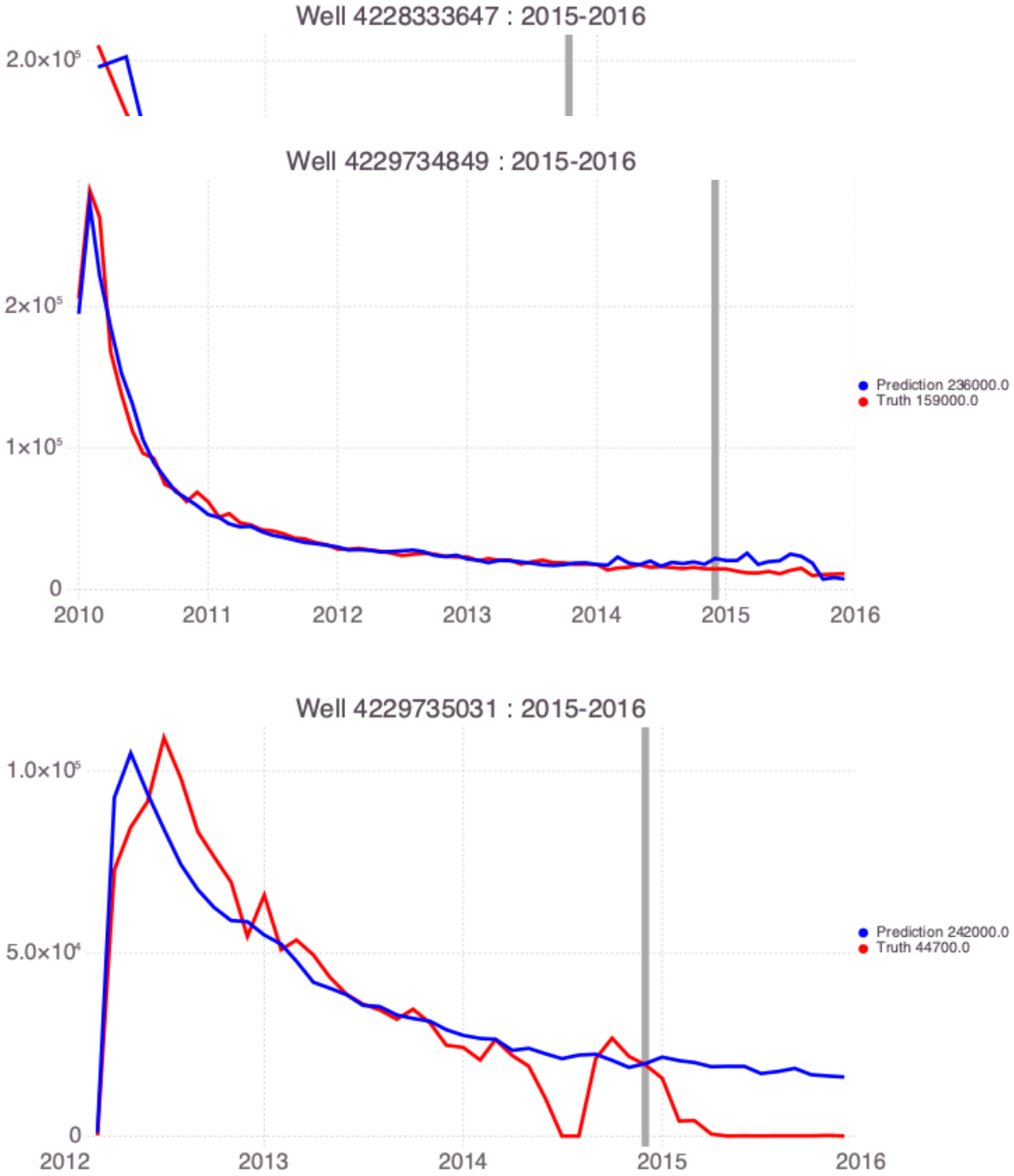
Well 4228333647 : 2015-2016
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Well 4229734849 : 2015-2016
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1×10⁵
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2010
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2012
2013
2014
2015
2016
Prediction 236000.0
Truth 159000.0
Well 4229735031 : 2015-2016
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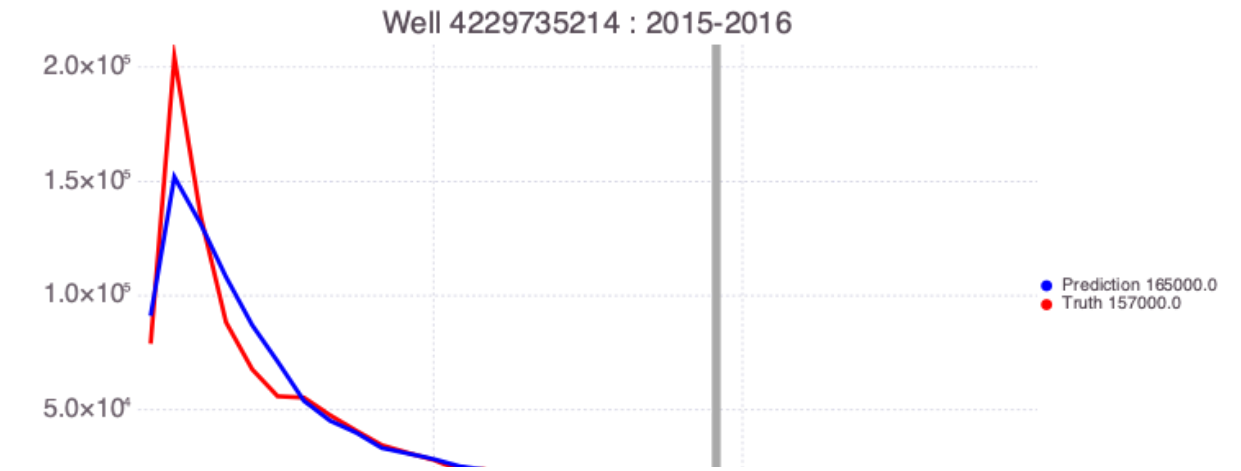
2012
2013
2014
2015
2016
Prediction 242000.0
Truth 44700.0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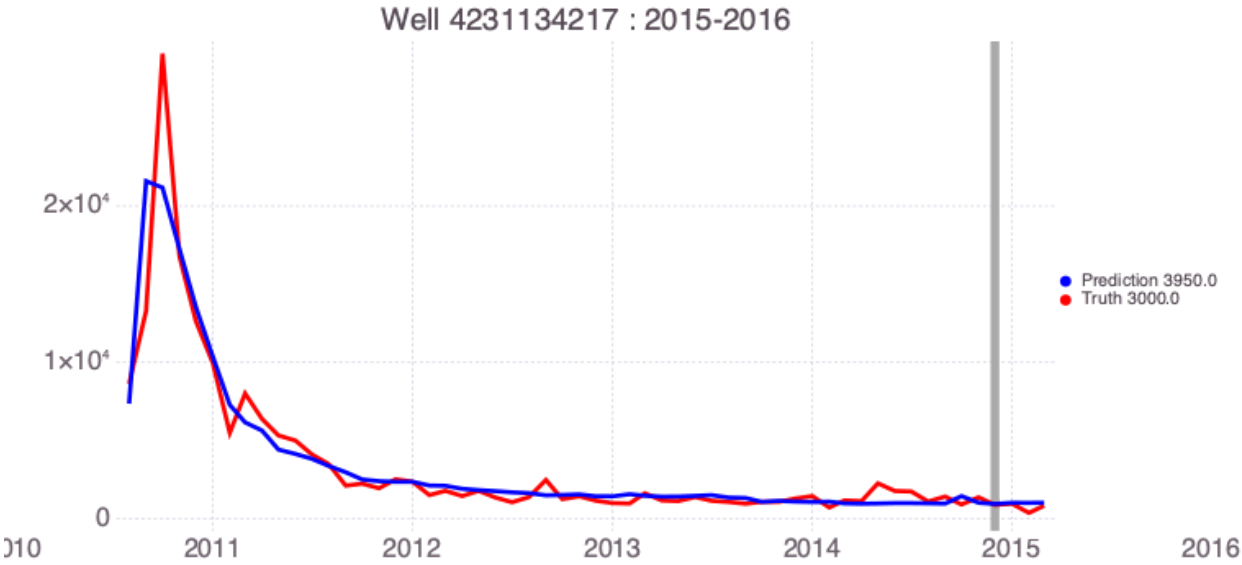
5.0×10⁴
Prediction 165000.0
Truth 157000.0


Well 4231134217 : 2015-2016
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1×10⁴
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2014
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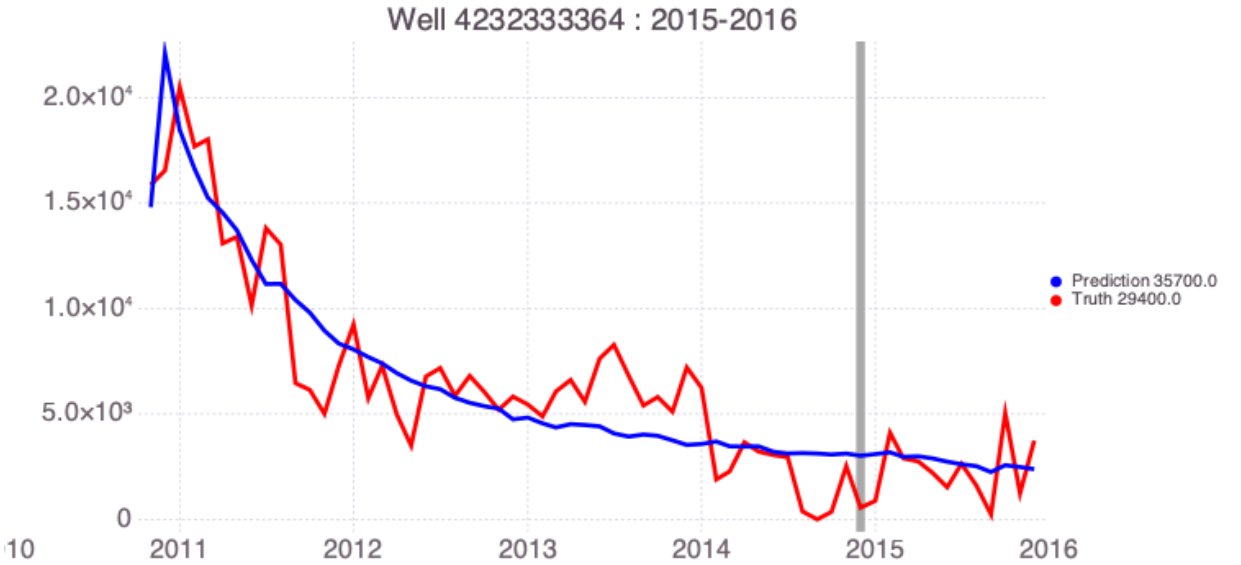
Prediction 3950.0
Truth 3000.0


Well 4232333364 : 2015-2016
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1.5×10⁴
1.0×10⁴
5.0×10³
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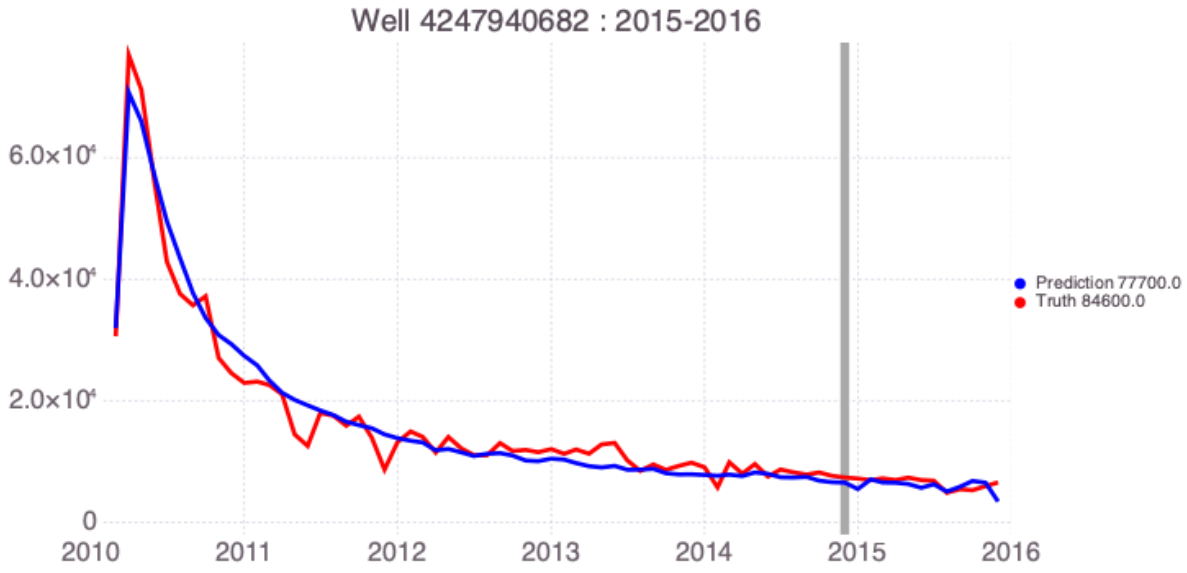
2012
2013
2014
2015
2016
Prediction 35700.0
Truth 29400.0


Well 4247940682 : 2015-2016
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2.0×10⁴
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2011
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2014
2015
2016
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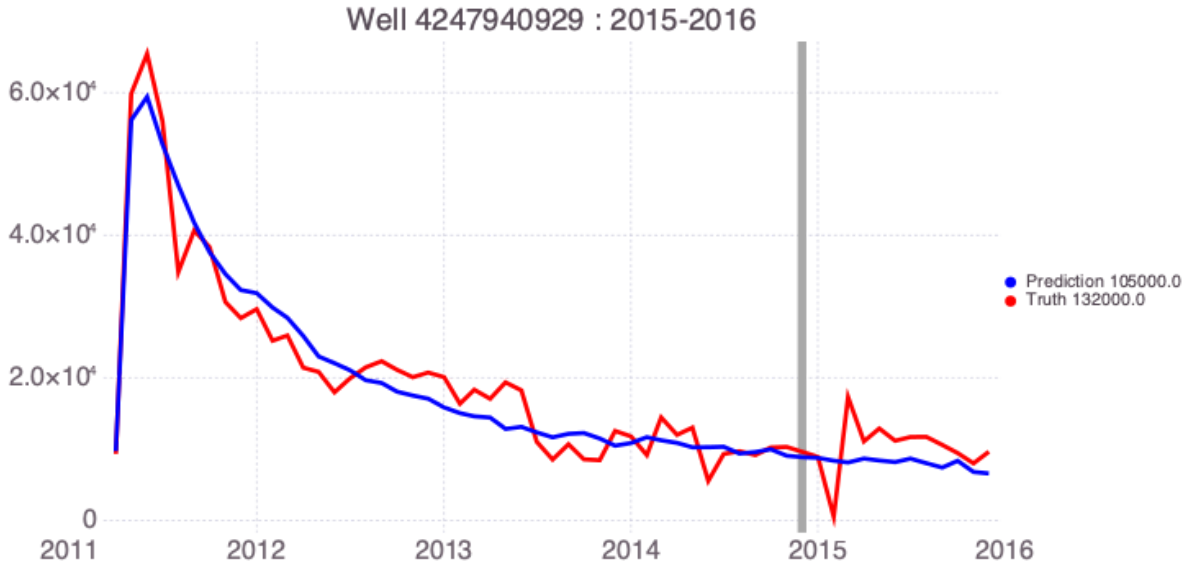
Truth 84600.0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2014
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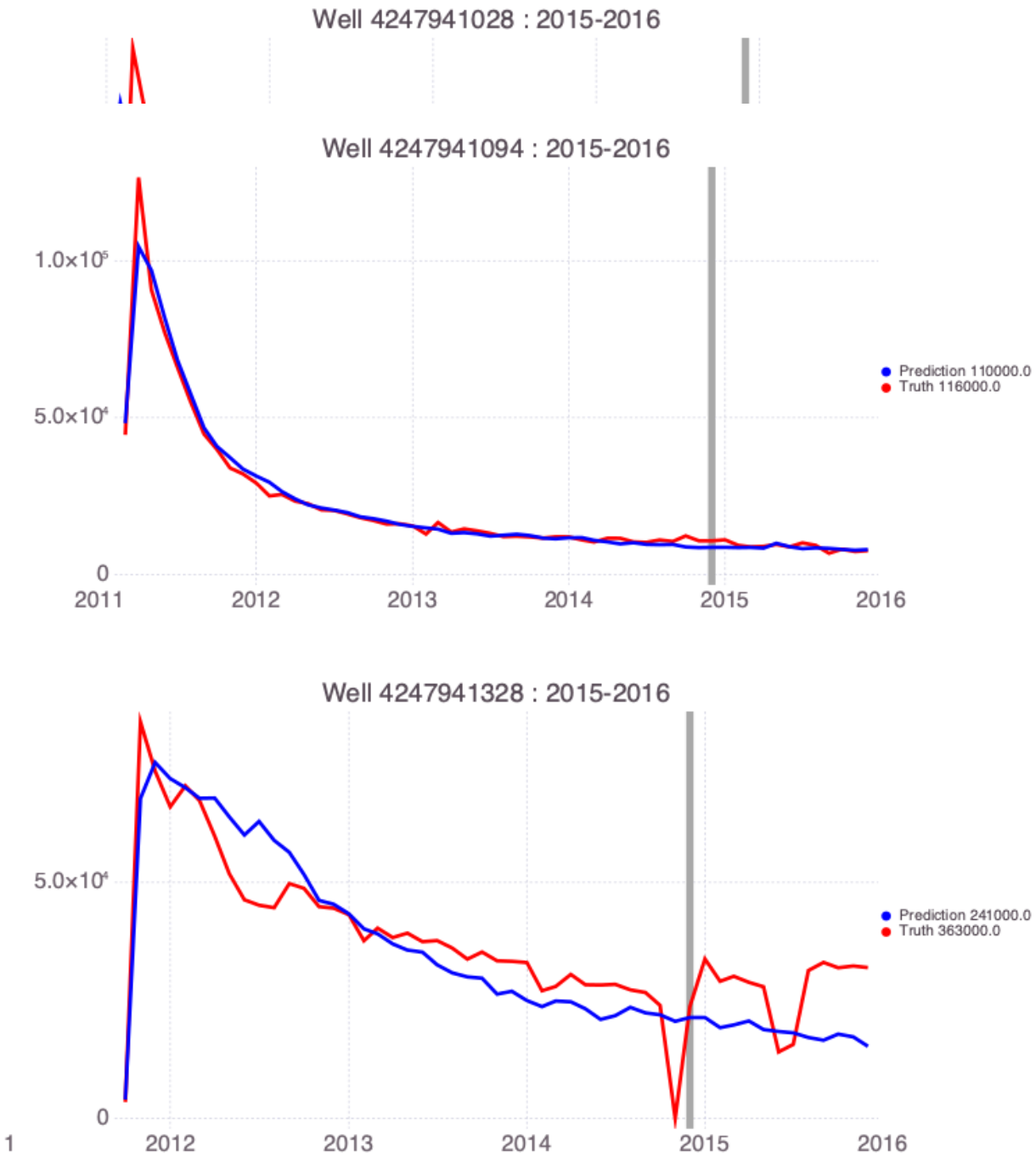
Truth 132000.0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Well 4247941094 : 2015-2016
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2014
2015
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Truth 116000.0
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2015
2016
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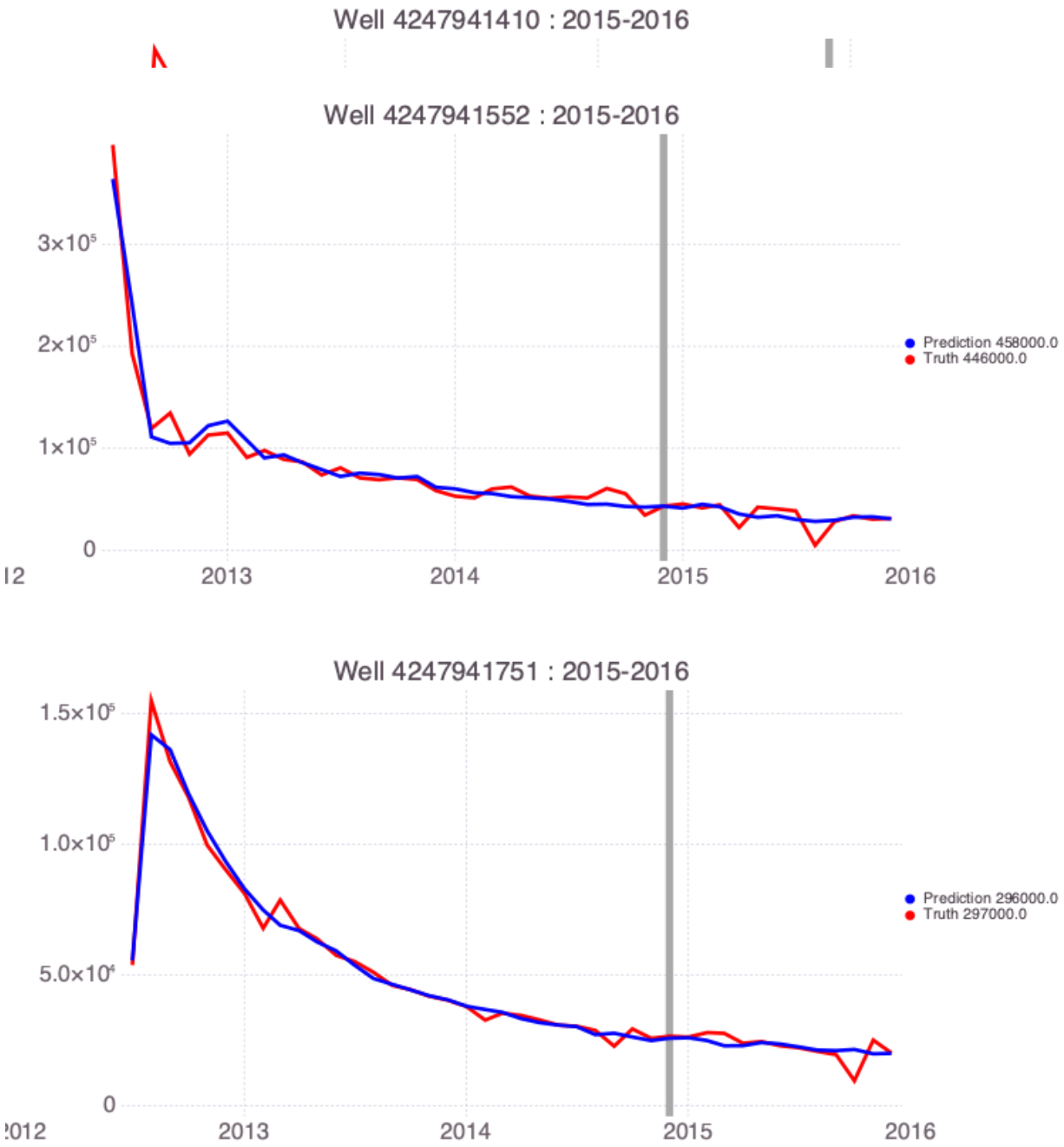
Well 4247941410 : 2015-2016
Well 4247941552 : 2015-2016
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2×10⁵
1×10⁵
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2014
2015
2016
Prediction 458000.0
Truth 446000.0
Well 4247941751 : 2015-2016
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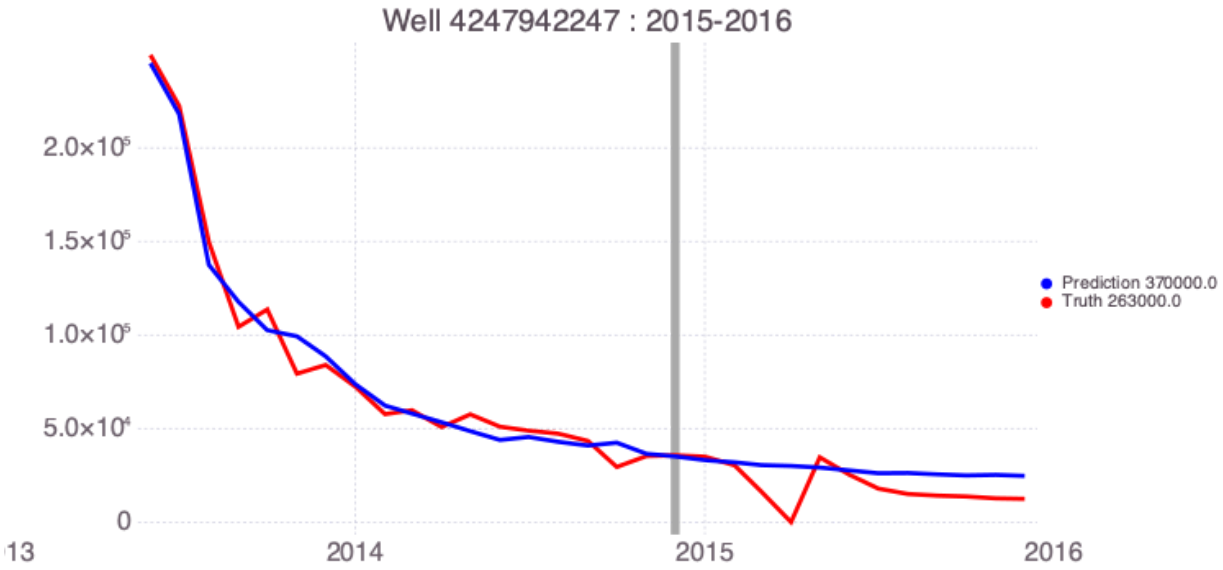
2014
2015
2016
Prediction 296000.0
Truth 297000.0


Well 4247942247 : 2015-2016
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5.0×10⁴
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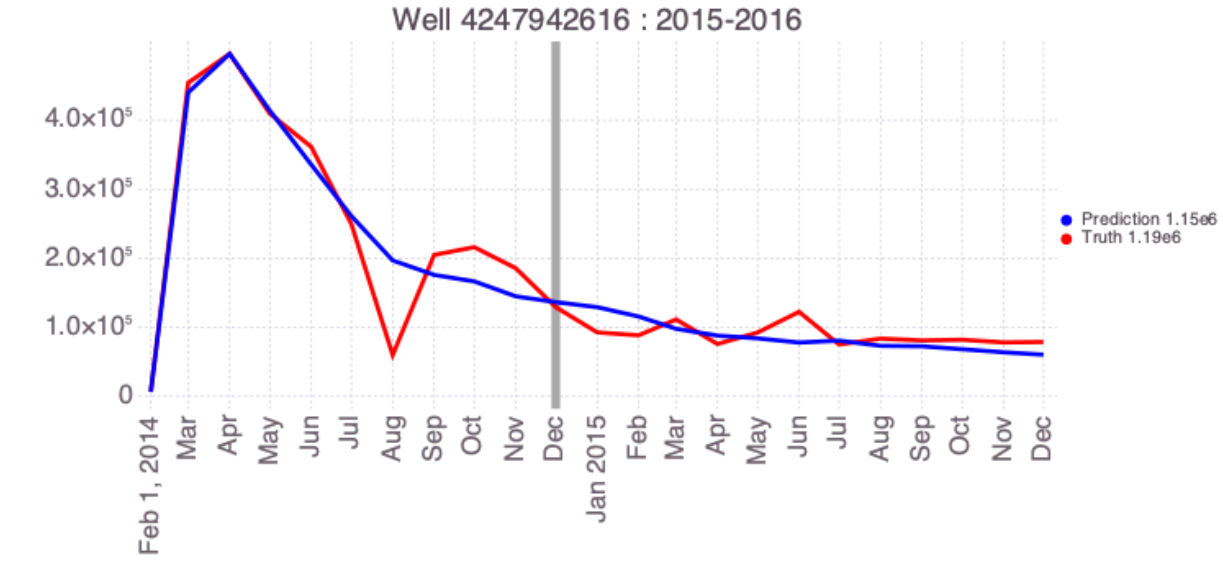
2014
2015
2016
Prediction 370000.0
Truth 263000.0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2.0×10⁵
1.0×10⁵
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Feb 1, 2014
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
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Dec
Jan 2015
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Mar
Apr
May
Jun
Jul
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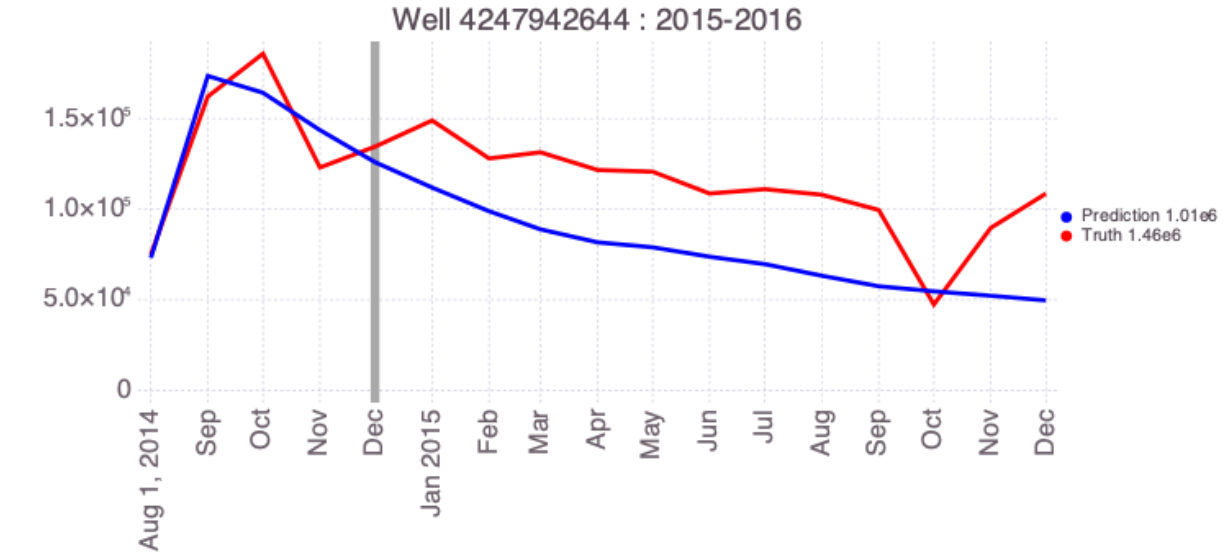
Sep
Oct
Nov
Dec
Prediction 1.15e6
Truth 1.19e6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5.0×10⁴
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Aug 1, 2014
Sep
Oct
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Mar
Apr
May
Jun
Jul
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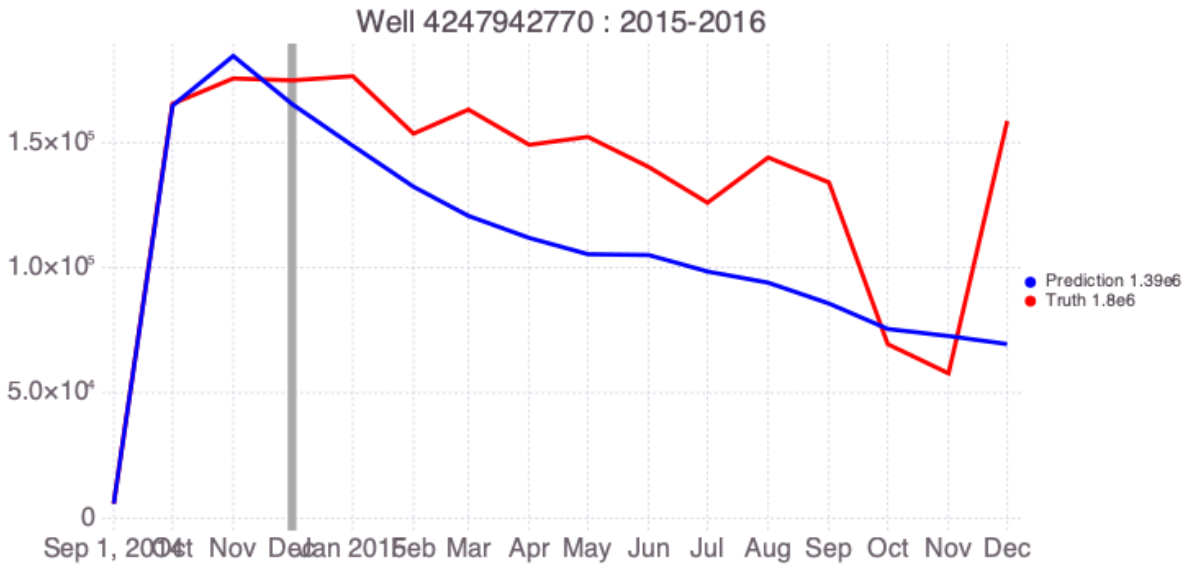
Sep
Oct
Nov
Dec
Prediction 1.01e6
Truth 1.46e6


Well 4247942770 : 2015-2016
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Sep 1, 2014
Oct
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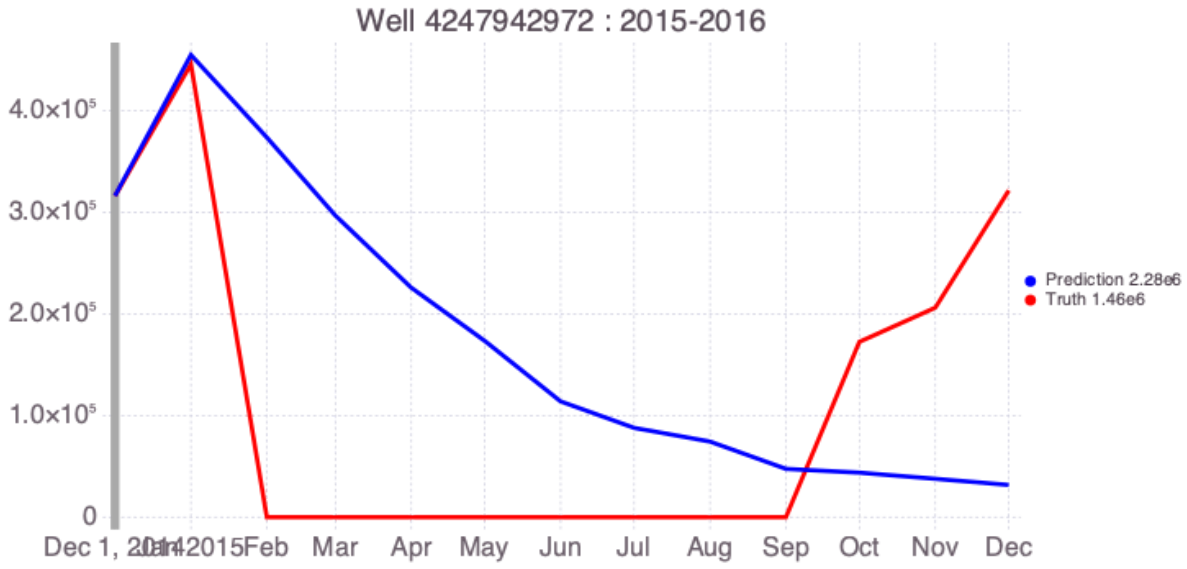
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Prediction 1.39e6
Truth 1.8e6


Well 4247942972 : 2015-2016
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3.0×10⁵
2.0×10⁵
1.0×10⁵
0
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Jan
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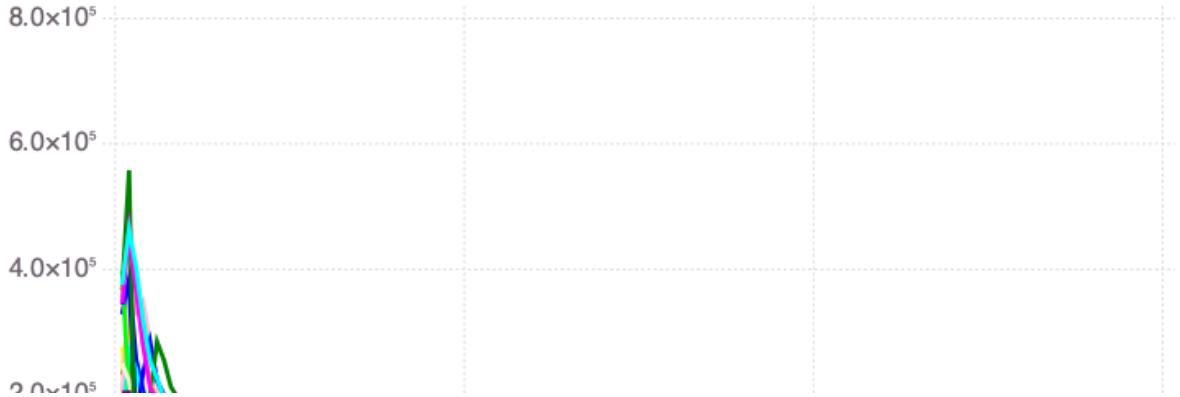
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Prediction 2.28e6
Truth 1.46e6

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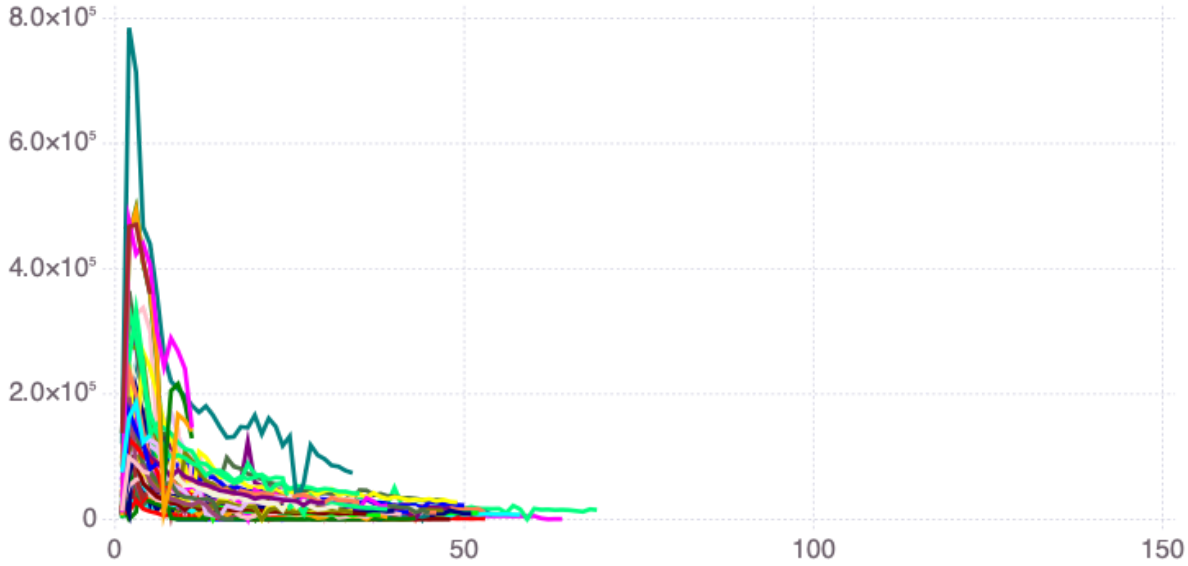
┌ Info: Window 2015: Training size 118 Truth size: 299 Prediction size: 2
99 R2 (pred): 0.8650471996037531 R2 (all) 0.9506983925448549
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:221
┌ Info: Type A wells: 141
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:235
```

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┌ Info: Type B wells: 94
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:235
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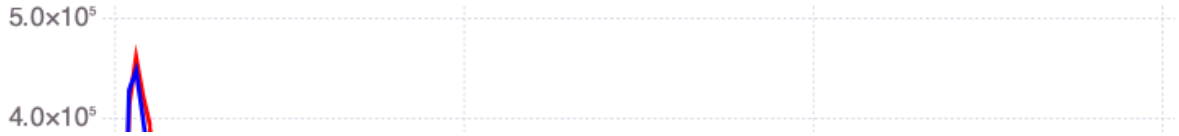


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[ Info: Type C wells: 87
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1×2 Array{Any,2}:
 "EAGLE FORD"  141

21×2 Array{Any,2}:
 "LEWIS PETRO PROPERTIES, INC."      18
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 "SM ENERGY COMPANY"                 12
 "PIONEER NATURAL RES. USA, INC."    11
 "LAREDO ENERGY OPERATING, LLC"       9
 "SN OPERATING, LLC"                  8
 "MARATHON OIL EF LLC"                7
 "BHP BILLITON PET(TXLA OP) CO"       6
 "DEVON ENERGY PRODUCTION CO, L.P."   6
 "STATOIL TEXAS ONSHORE PROP LLC"     5
 ""                                   4
 "BHP BILLITON PETROLEUM"             4
 "BURLINGTON RESOURCES O & G CO LP"   4
 "ENDEAVOR NATURAL GAS, LP"           4
 "ESCONDIDO RESOURCES OPER CO, LLC"   4
 "ROSETTA RESOURCES OPERATING LP"     4
 "BHP BILLITON PETROLEUM "            3
 "ENCANA OIL & GAS(USA) INC."         2
 "EQUINOR TEXAS ONSHORE PROP LLC"     2
 "PERDIDO ENERGY, LLC"                2
 "PROLINE ENERGY RESOURCES INC"       2

1×2 Array{Any,2}:
 "Horizontal"  141

1×2 Array{Any,2}:
 "EAGLE FORD"  94

18×2 Array{Any,2}:
 "LAREDO ENERGY OPERATING, LLC"      12
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 "PIONEER NATURAL RES. USA, INC."     8
 "LEWIS PETRO PROPERTIES, INC."       7
 "SM ENERGY COMPANY"                  7
 "BHP BILLITON PET(TXLA OP) CO"       6
 "BHP BILLITON PETROLEUM"             6
 "ROSETTA RESOURCES OPERATING LP"     5
 "BURLINGTON RESOURCES O & G CO LP"   4
 "SN OPERATING, LLC"                  4
 "BHP BILLITON PETROLEUM "            3
 ""                                   2
 "ENCANA OIL & GAS(USA) INC."         2
 "EQUINOR TEXAS ONSHORE PROP LLC"     2
 "ESCONDIDO RESOURCES OPER CO, LLC"   2
 "MARATHON OIL EF LLC"                2
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 "STATOIL TEXAS ONSHORE PROP LLC"     2
 "SWIFT ENERGY OPERATING, LLC"        2
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```
1×2 Array{Any,2}:
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```
1×2 Array{Any,2}:
 "EAGLE FORD"  87
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 "PIONEER NATURAL RES. USA, INC."     9
 "DEVON ENERGY PRODUCTION CO, L.P."   7
 "SM ENERGY COMPANY"                  7
 "SILVERBOW RESOURCES OPER, LLC"      6
 "BURLINGTON RESOURCES O & G CO LP"   5
 "BHP BILLITON PET(TXLA OP) CO"       3
 "LAREDO ENERGY OPERATING, LLC"       3
 "PERDIDO ENERGY, LLC"                3
 "SN OPERATING, LLC"                  3
 "STATOIL TEXAS ONSHORE PROP LLC"     3
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 "BHP BILLITON PETROLEUM "            2
 "EOG RESOURCES, INC."                2
 "ESCONDIDO RESOURCES OPER CO, LLC"   2
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```
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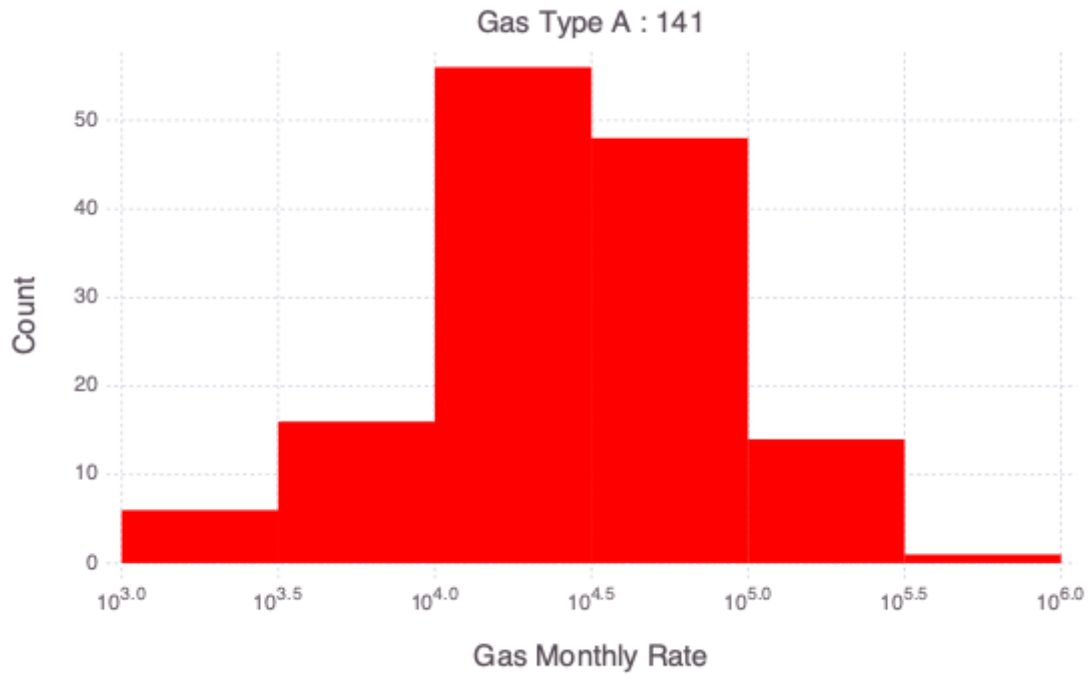

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[ Info: Formation
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:242
[ Info: Operator
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:244
[ Info: Well type
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:246
[ Info: Type B wells: 94
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[ Info: Operator
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[ Info: Well type
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:246
[ Info: Type C wells: 87
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:241
[ Info: Formation
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[ Info: Operator
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:244
[ Info: Well type
└ @ NMFk /Users/vvv/.julia/dev/NMFk/src/NMFkProgressive.jl:246
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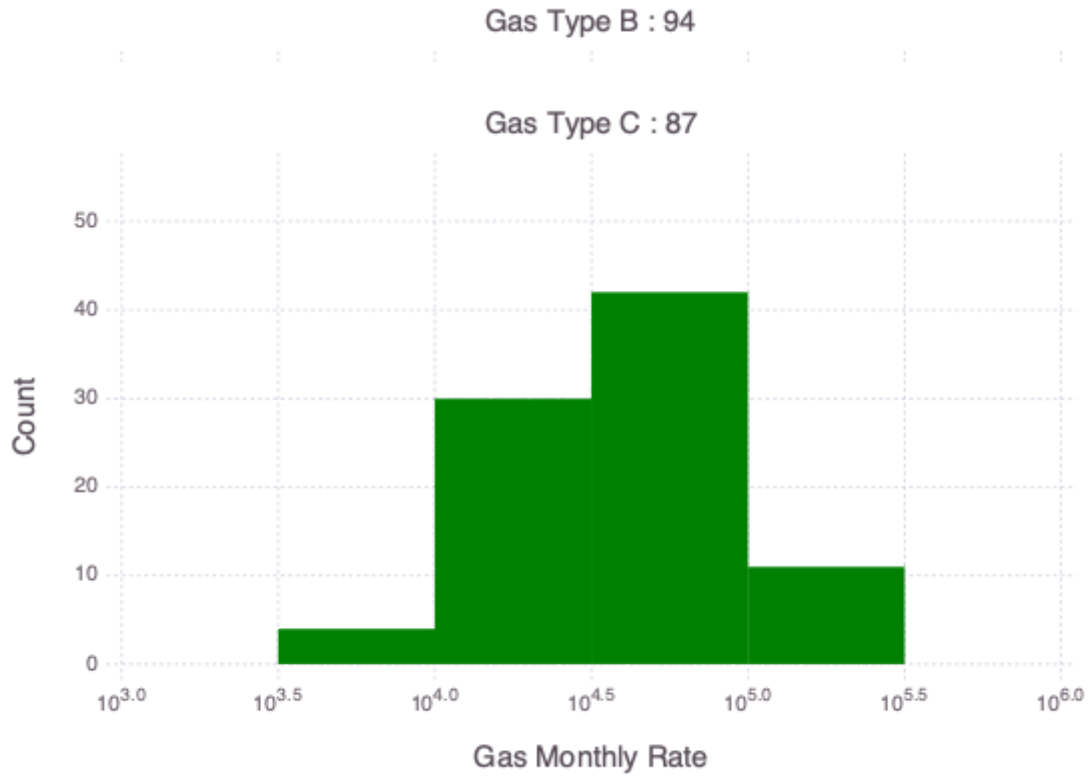
Gas Type B : 94
Gas Type C : 87
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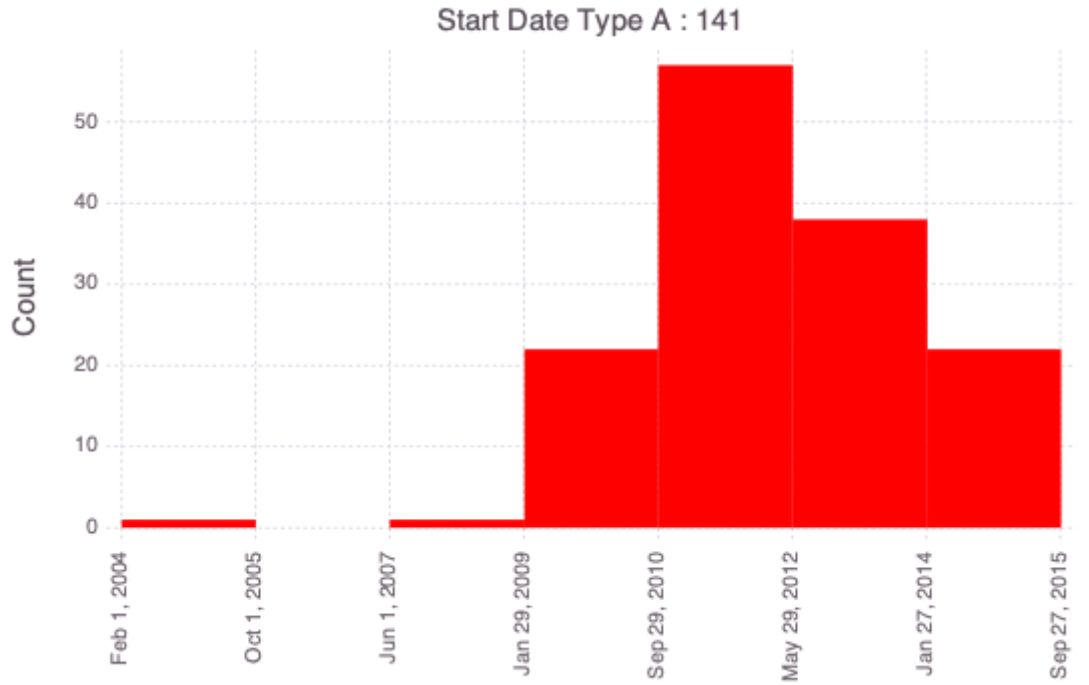
$10^{5.0}$
$10^{5.5}$
$10^{6.0}$
Gas Monthly Rate


Start Date Type A : 141
Count
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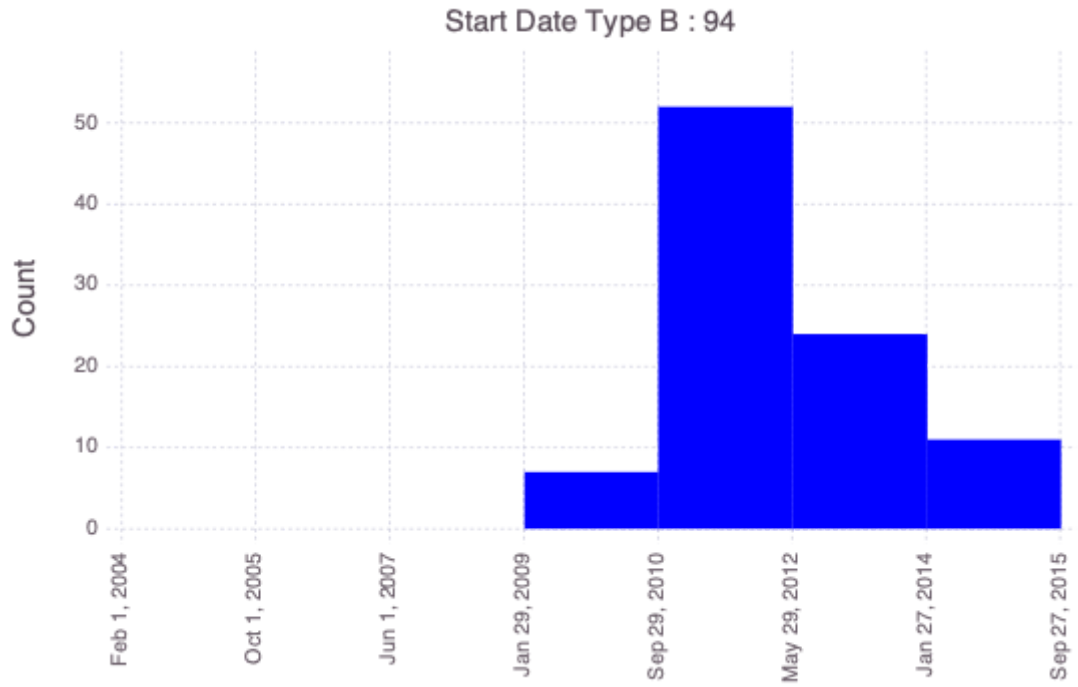
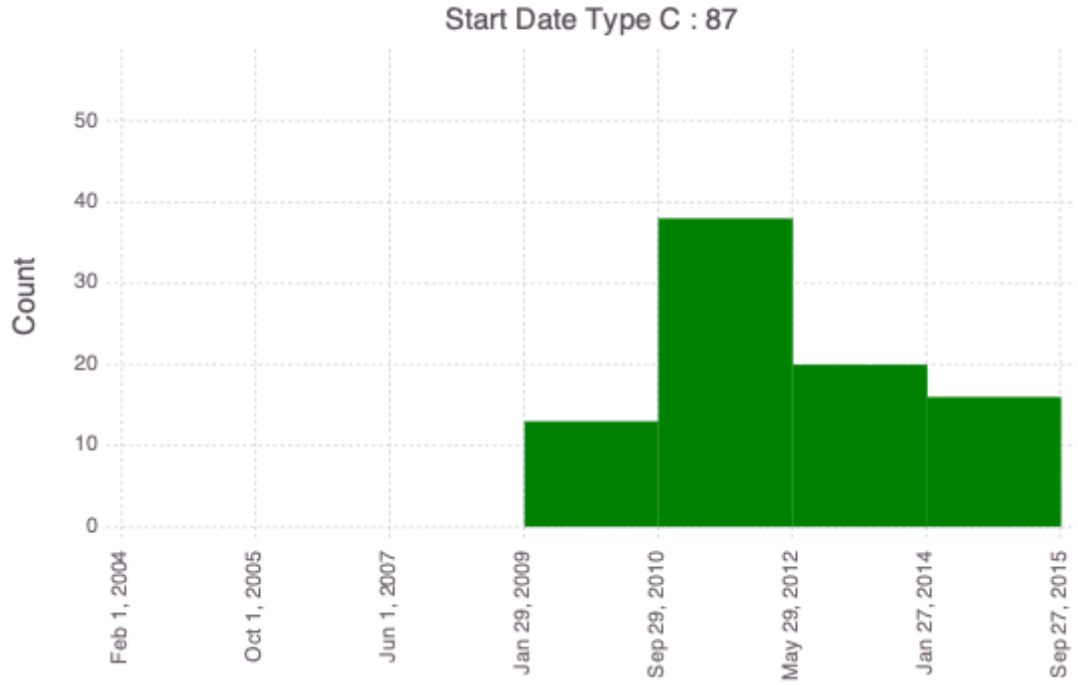
0
Feb 1, 2004
Oct 1, 2005
Jun 1, 2007
Jan 29, 2009
Sep 29, 2010
May 29, 2012
Jan 27, 2014
Sep 27, 2015


Start Date Type B : 94
Count
0
10
20
30
40
50
Feb 1, 2004
Oct 1, 2005
Jun 1, 2007
Jan 29, 2009
Sep 29, 2010
May 29, 2012
Jan 27, 2014
Sep 27, 2015


Start Date Type C : 87
Count
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30
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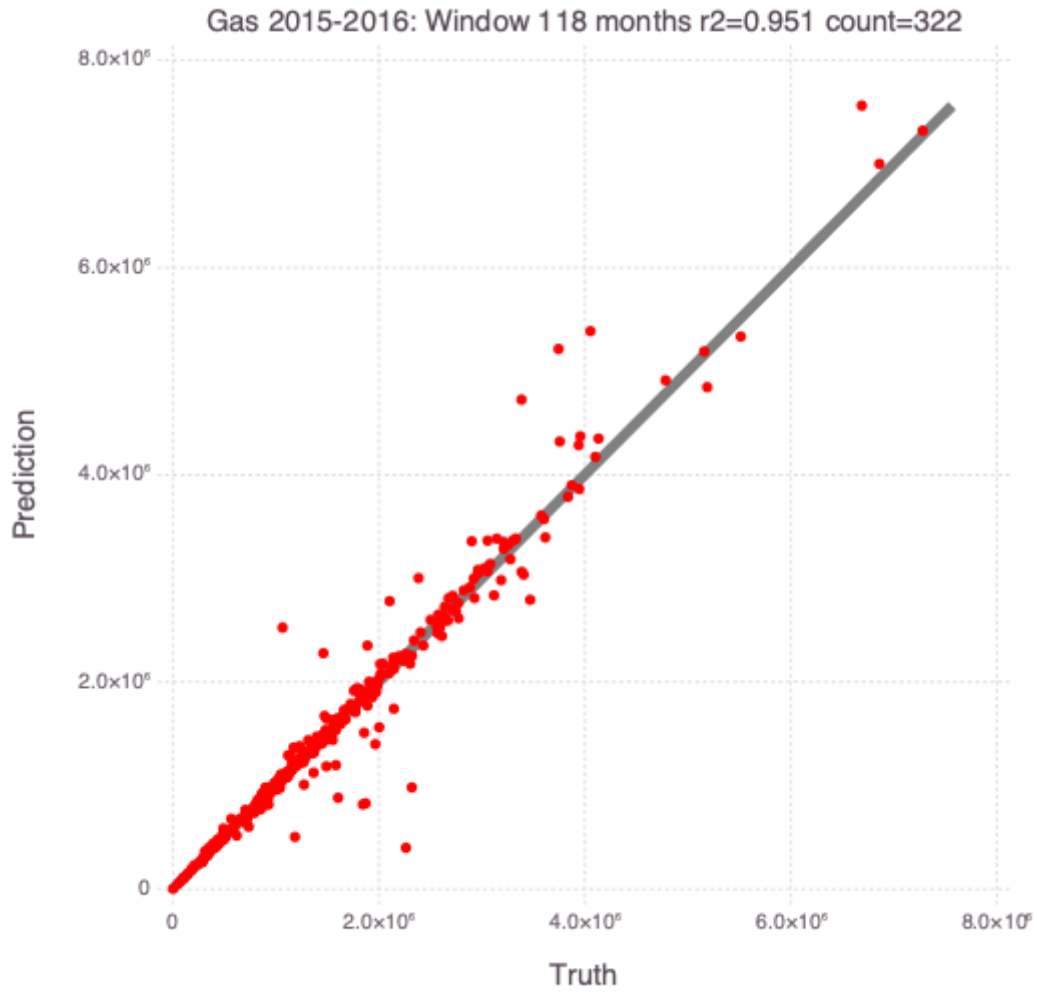
Feb 1, 2004
Oct 1, 2005
Jun 1, 2007
Jan 29, 2009
Sep 29, 2010
May 29, 2012
Jan 27, 2014
Sep 27, 2015


Gas 2015-2016: Window 118 months r2=0.951 count=322
Prediction
Truth
0
2.0×10⁵
4.0×10⁵
6.0×10⁵
8.0×10⁵