

dflowFM exercise

OpenDA course

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Running your first simulation



1. Where the configuration of the algorithm can be found?
3. To which file the results will be written?

SequentialSimulation.oda

```
SequentialSimulation.oda
1  <?xml version="1.0" encoding="UTF-8"?>
2  <openDaApplication xmlns="http://www.openda.org" xmlns:xsi="
   "http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
   "http://www.openda.org http://schemas.openda.org/opendaApplication.xsd">
3    <stochObserver className=
   "org.openda.observers.NoosTimeSeriesStochObserver">
4      <workingDirectory>./stochObserver</workingDirectory>
5      <configFile>noosObservations.xml</configFile>
6    </stochObserver>
7    <stochModelFactory className=
   "org.openda.blackbox.wrapper.BBStochModelFactory">
8      <workingDirectory>./stochModel</workingDirectory>
9      <configFile>dflowfmStochModel.xml</configFile>
10   </stochModelFactory>
11   <algorithm className=
   "org.openda.algorithms.kalmanFilter.SequentialSimulation">
12     <workingDirectory>./algorithm</workingDirectory>
13     <configString>SequentialSimulation.xml</configString>
14   </algorithm>
15     <timingSettings doTiming="true"></timingSettings>
16   <resultWriter className="org.openda.resultwriters.MatlabResultWriter">
17     <workingDirectory>./</workingDirectory>
18     <configFile>SequentialSimulation_results.m</configFile>
19   </resultWriter>
20 </openDaApplication>
21
```



Running your first simulation



2. Where the observations are stored?

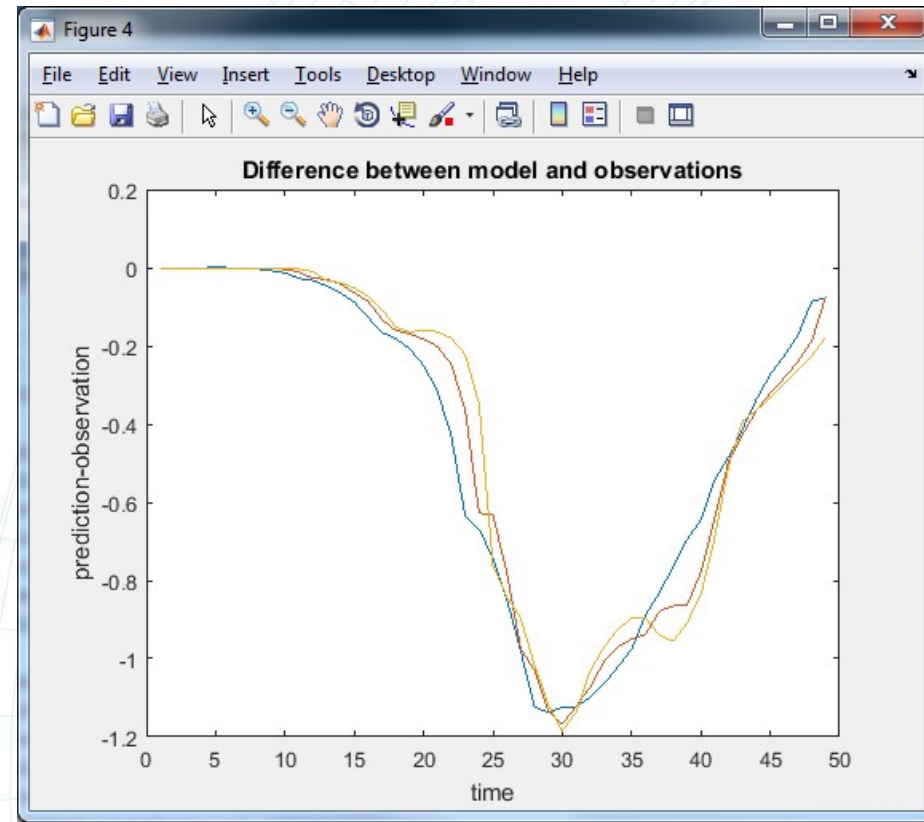
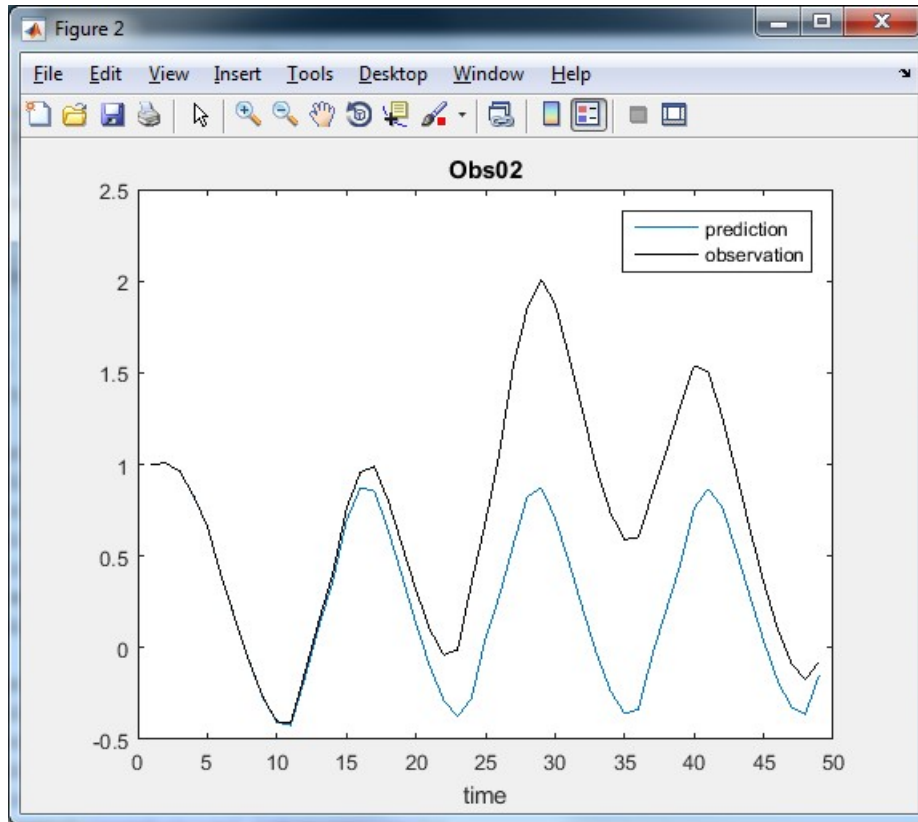
```
SequentialSimulation.oda x
1 <?xml version="1.0" encoding="UTF-8"?>
2 <openDaApplication xmlns="http://www.opendata.org" xmlns:xsi="
  http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.opendata
  http://schemas.opendata.org/openDaApplication.xsd">
3   <stochObserver className="org.opendata.observers.NoosTimeSeriesStochObserver">
4     <workingDirectory>./stochObserver</workingDirectory>
5     <configFile>noosObservations.xml</configFile>
6   </stochObserver>
7
8   noosObservations.xml x
9     <timeSeries status="use" standardDeviation="0.05"
10      minDateTime="199101010000" maxDateTime="199101030000">
11       waterlevel_station01.noos
12     </timeSeries>
13     <timeSeries status="use" standardDeviation="0.05"
14      minDateTime="199101010000" maxDateTime="199101030000">
15       waterlevel_station02.noos
16     </timeSeries>
17     <timeSeries status="use" standardDeviation="0.05"
18      minDateTime="199101010000" maxDateTime="199101030000">
19       waterlevel_station03.noos
20     </timeSeries>
21   </noosObserver>
```

SequentialSimulation.oda

noosObservations.xml



Plot the results



Understanding the configuration



1. Can you find which variables form the model state vector?

dflowfmStochModel.xml

```
dflowfmStochModel.xml x
1  <?xml version="1.0" encoding="UTF-8"?>
2  <blackBoxStochModel xmlns="http://www.openda.org" xmlns:xsi="
   http://www.w3.org/2001/XMLSchema-instance"
3  xsi:schemaLocation="http://www.openda.org
   http://schemas.openda.org/blackBoxStochModelConfig.xsd">
4
5    <modelConfig>
6      <file>./dflowfmModel.xml</file>
7    </modelConfig>
8
9    <vectorSpecification>
10     <state>
11       <noiseModel id="boundaryNoiseModelSurge" className=
12         "org.openda.noiseModels.TimeSeriesNoiseModelFactory"
13         workingDirectory="." >
14         <configFile>BoundaryNoiseSurge.xml</configFile>
15         <exchangeItems>
16           <exchangeItem id="waterlevelnoise" operation="add"
17             modelExchangeItemId="westboundary_noise.1:waterlevelbnd"/>
18         </exchangeItems>
19       </noiseModel>
20       <vector id="s1"/>
21       <vector id="unorm"/>
22     </state>
23     <predictor>
24       <vector id="station01.waterlevel"/>
25       <vector id="station02.waterlevel"/>
26       <vector id="station03.waterlevel"/>
27     </predictor>
28   </vectorSpecification>
29 </blackBoxStochModel>
```



Understanding the configuration



2. How is the uncertainty specified, what should be changed to add more uncertainty to the boundary values of the model?

dflowfmStochModel.xml

```
dflowfmStochModel.xml
1 <?xml version="1.0" encoding="UTF-8"?>
2 <blackBoxStochModel xmlns="http://www.opendata.org" xmlns:xsi="
3   xsi:schemaLocation="http://www.opendata.org
4   http://schemas.opendata.org/blackBoxStochModelConfig.xsd">
5   <modelConfig>
6     <file>./dflowfmModel.xml</file>
7   </modelConfig>
8
9   <vectorSpecification>
10    <state>
11      <noiseModel id="boundaryNoiseModelSurge" className="
12        org.opendata.noiseModels.TimeSeriesNoiseModelFactory"
13        workingDirectory=".">
14        <configFile>BoundaryNoiseSurge.xml</configFile>
15        <exchangeItems>
16          <exchangeItem id="waterlevelnoise" operation="add"
17            modelExchangeItemId="westboundary_noise.1:waterlevelbnd"/>
18        </exchangeItems>
19      </noiseModel>
20    </state>
21  </vectorSpecification>
22 </blackBoxStochModel>
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```

```
BoundaryNoiseSurge.xml
1 <?xml version="1.0" encoding="UTF-8"?>
2 <mapsNoiseModelConfig>
3   <simulationTimespan timeFormat="dateTimeString">
4     199101010000,199101010100,...,199101050000</simulationTimespan>
5   <timeSeries id="waterlevelnoise" location="westboundary"
6     "waterlevel" standardDeviation="0.2" timeCorrelationScale="hours"
7     timeCorrelationScaleUnit="hours" initialValue="0.0"/>
8 </mapsNoiseModelConfig>
```

BoundaryNoiseSurge.xml



Understanding the configuration



3. Can you find to which input file noise (uncertainty) will be added?

dflowfmStochModel.xml

```
<noiseModel id="boundaryNoiseModelSurge" className="
"org.openda.noiseModels.TimeSeriesNoiseModelFactory"
workingDirectory=".">
  <configFile>BoundaryNoiseSurge.xml</configFile>
  <exchangeItems>
    <exchangeItem id="waterlevelnoise" operation="add"
      modelExchangeItemId="westboundary_noise.1:waterlevelbnd"/>
  </exchangeItems>
</noiseModel>
```

dflowfmModel.xml

```
<vector id="westboundary_noise.1:waterlevelbnd" ioObjectId=
"boundaries" elementId="westboundary_noise.1:waterlevelbnd"/>
```

dflowfmWrapper.xml

```
<ioObject className=
"org.openda.model_dflowfm.DFlowFMTimeSeriesDataObject">
  <file>%mdufile%</file>
  <id>boundaries</id>
</ioObject>
```

dflowfmModel.xml

```
<alias key="mdufile" value="estuary.mdu"/>
```

Understanding the configuration



4. What do you have to change when you put the model input in a different folder?

dflowfmWrapper.xml

```
<!-- for each model instance, the template directory will be  
cloned to create the instance directory -->  
<initializeActionsUsingDirClone instanceDir=  
"%instanceDir%%instanceNumber%" templateDir="%templateDir%"/>
```

dflowfmModel.xml

```
<alias key="templateDir" value="./input_dflowfm"/>
```


Understanding the configuration



5. Assume (not the case here) there is a 4-th time series as well written to the estuary_his.nc file where do you need to make changes in order to be

dflowfmModel.xml

```
<alias key="hisfile" value="estuary_his.nc"/>
<alias key="mapfile" value="estuary_map.nc"/>
</aliasValues>

<timeInfoExchangeItems start="start_time" end="end_time"/>
<exchangeItems>
  <vector id="start_time" ioObjectId="mdufile" elementId="start_time" />
  <vector id="end_time" ioObjectId="mdufile" elementId="end_time" />
  <vector id="s1" ioObjectId="mapfile" elementId="s1"/>
  <vector id="s0" ioObjectId="mapfile" elementId="s0"/>
  <vector id="unorm" ioObjectId="mapfile" elementId="unorm"/>
  <vector id="u0" ioObjectId="mapfile" elementId="u0"/>
  <vector id="station01.waterlevel" ioObjectId="hisfile" elementId="station01.waterlevel"/>
  <vector id="station02.waterlevel" ioObjectId="hisfile" elementId="station02.waterlevel"/>
  <vector id="station03.waterlevel" ioObjectId="hisfile" elementId="station03.waterlevel"/>
  <vector id="westboundary_noise.1:waterlevelbnd" ioObjectId="boundaries" elementId="westboundary_noise.1:waterlevelbnd"/>
  <vector id="westboundary_surge.1:waterlevelbnd" ioObjectId="boundaries" elementId="westboundary_surge.1:waterlevelbnd"/>
</exchangeItems>
```

dflowfmStochModel.xml

```
<predictor>
  <vector id="station01.waterlevel"/>
  <vector id="station02.waterlevel"/>
  <vector id="station03.waterlevel"/>
</predictor>
```

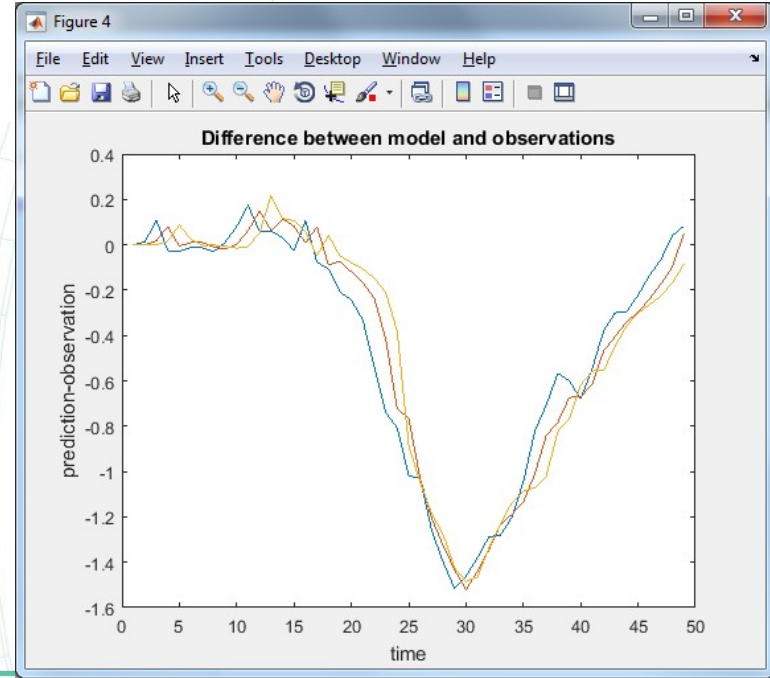


Algorithm configuration



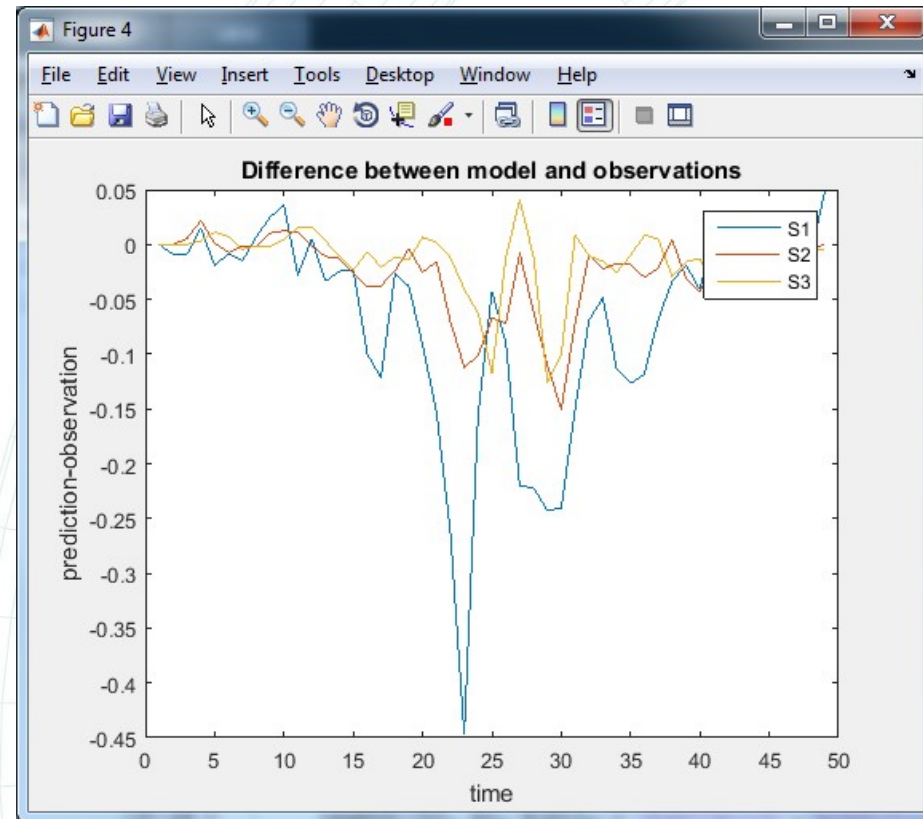
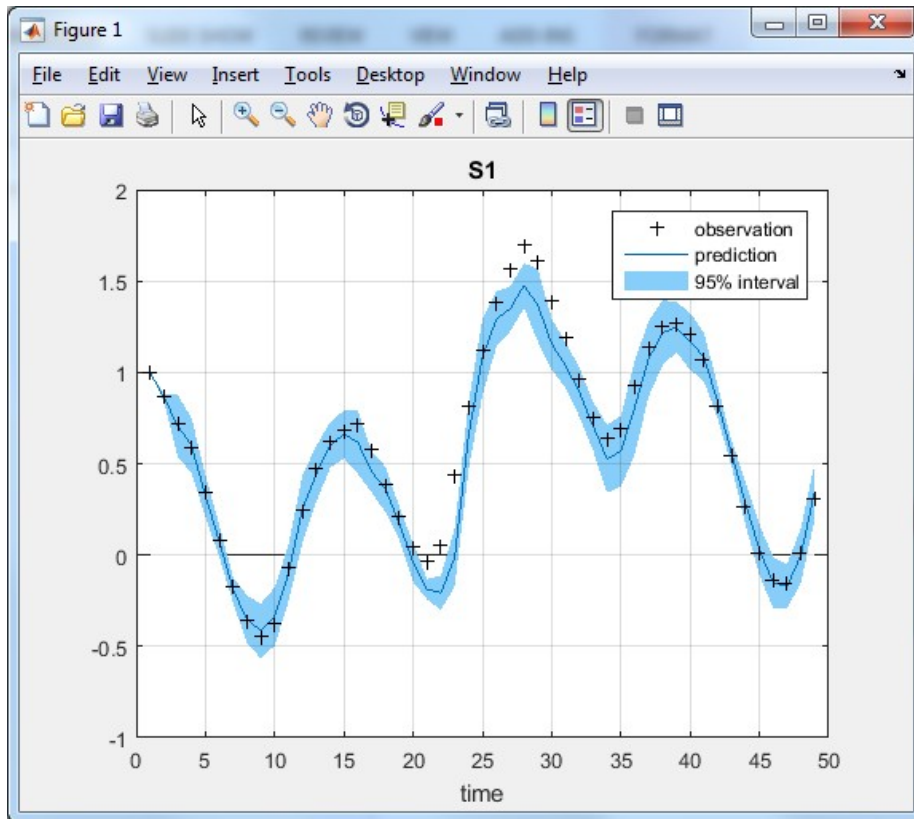
```
SequentialSimulation.xml x
```

```
1 <SequentialSimulationConfig xmlns="http://www.opendata.org" xmlns:xsi="
2 http://www.w3.org/2001/XMLSchema-instance"
3 xsi:schemaLocation="http://www.opendata.org
4 http://schemas.opendata.org/algorithm/sequentialSimulation.xsd">
5
6 <analysisTimes type="fromObservationTimes" ></analysisTimes>
7 <!-- selection to add noise to a model. This should probably be false
8 unless you are generating data for a twin-experiment -->
9 <mainModel stochParameter="false" stochForcing="false" stochInit="false"/>
10 </SequentialSimulationConfig>
```

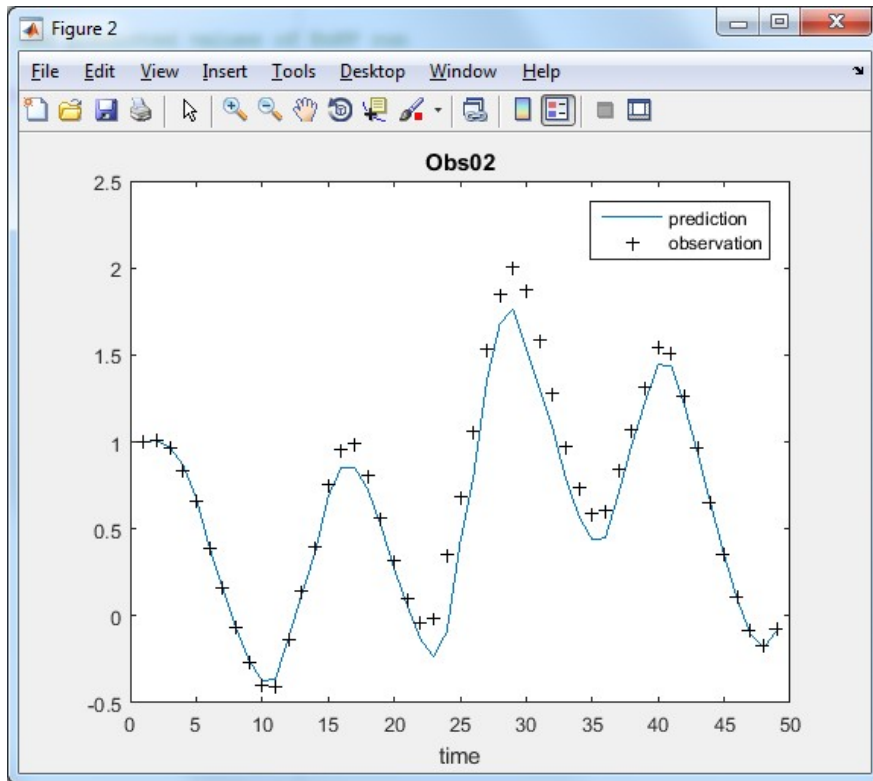


Ensemble Kalman Filter

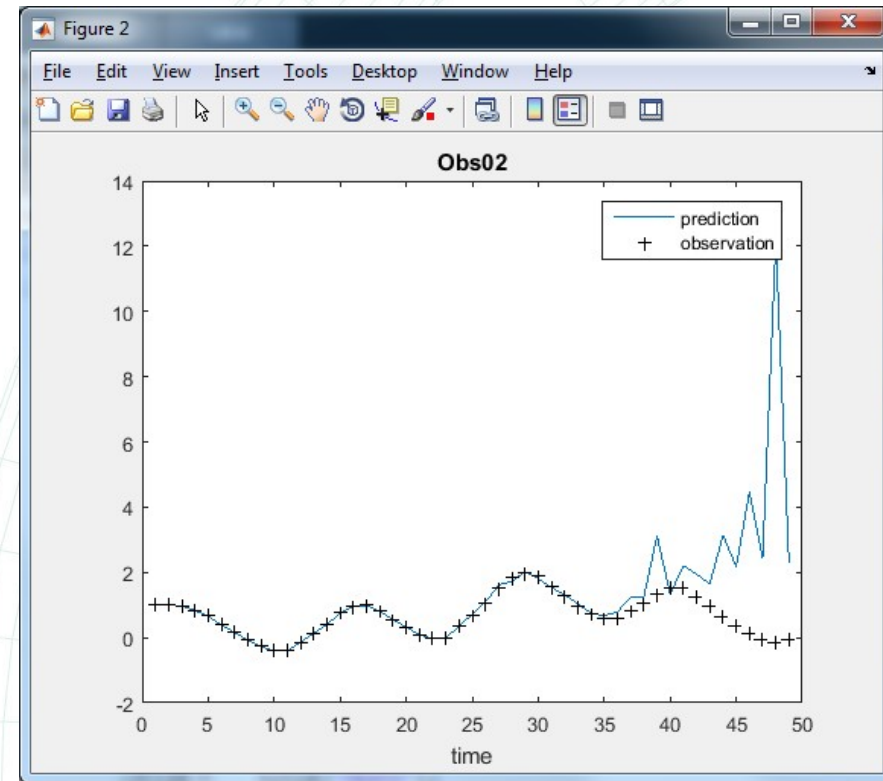
Reference Run



Ensemble Kalman Filter



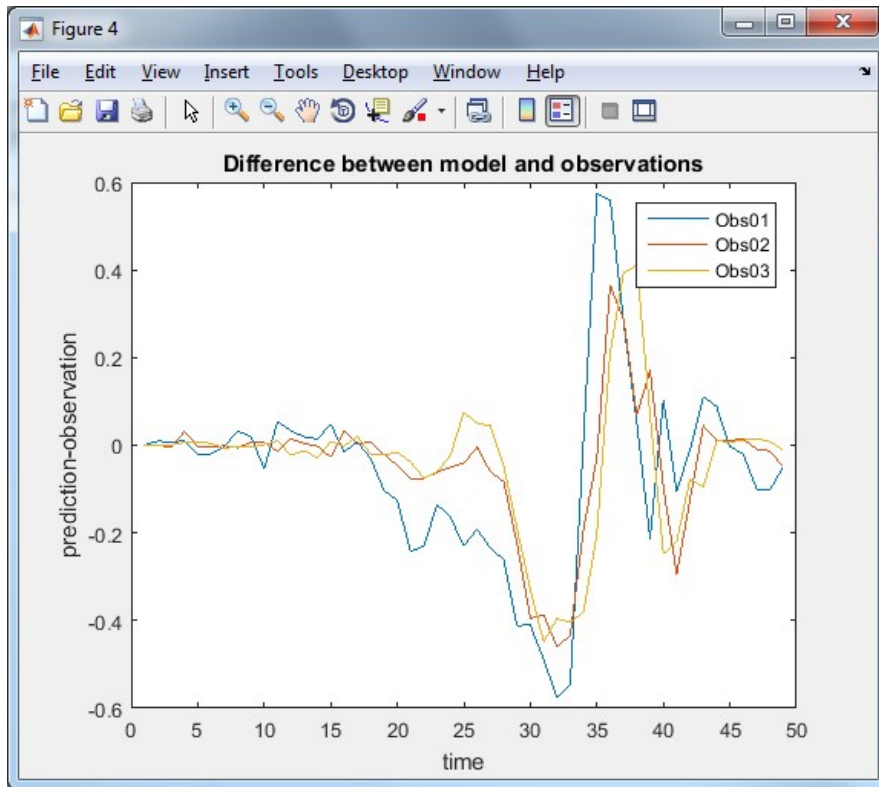
Standard deviation 0,20



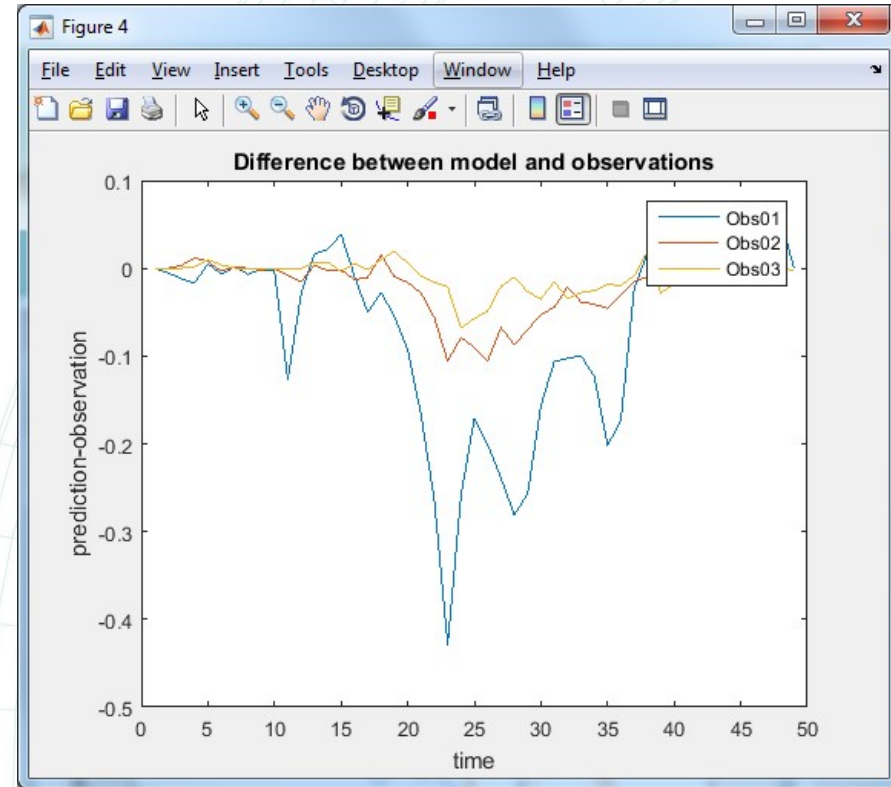
Standard deviation 0,001



Ensemble Kalman Filter



Ensemble size 3



Ensemble size 25