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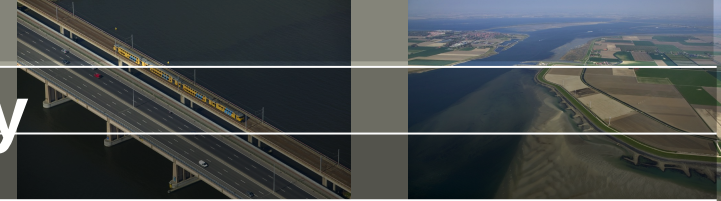
Calibration of an estuary with Delft-3D flow

Martin Verlaan, Firmijn Zijl

**Stef Hummel, Julius Sumihar, Nils van Velzen,
Albrecht Weerts, Ghada El Serafy, Herman
Gerritsen, ...**

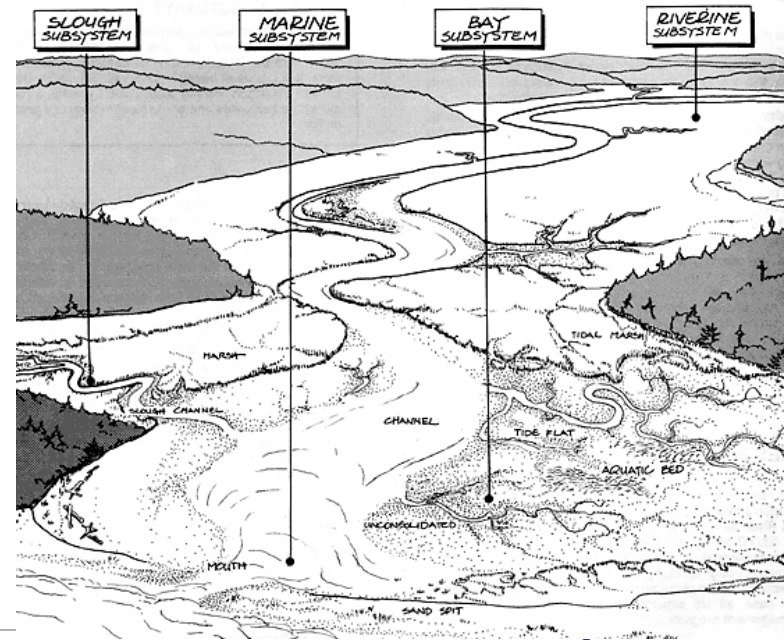
Deltares, TU Delft, VORtech

Simplified model of an estuary

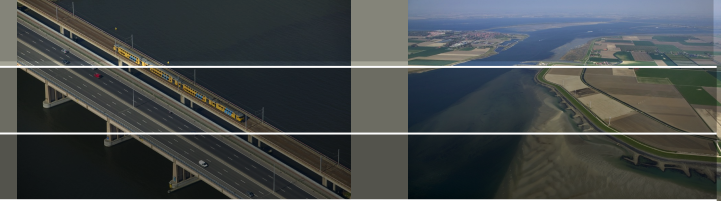


River discharge boundary

- One dimensional model
- Tidal boundary M2 (12h25min) and S2 (12h)
- Constant slope depth
- Constant river inflow
- 3 Observation locations
- Observations are not real but generated with 'truth' model.

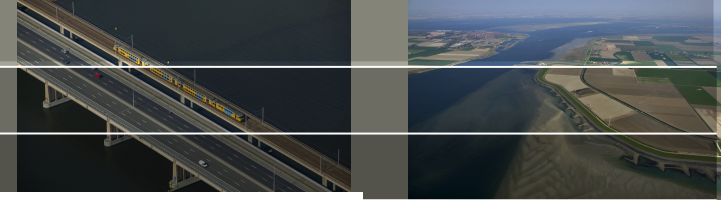


Questions

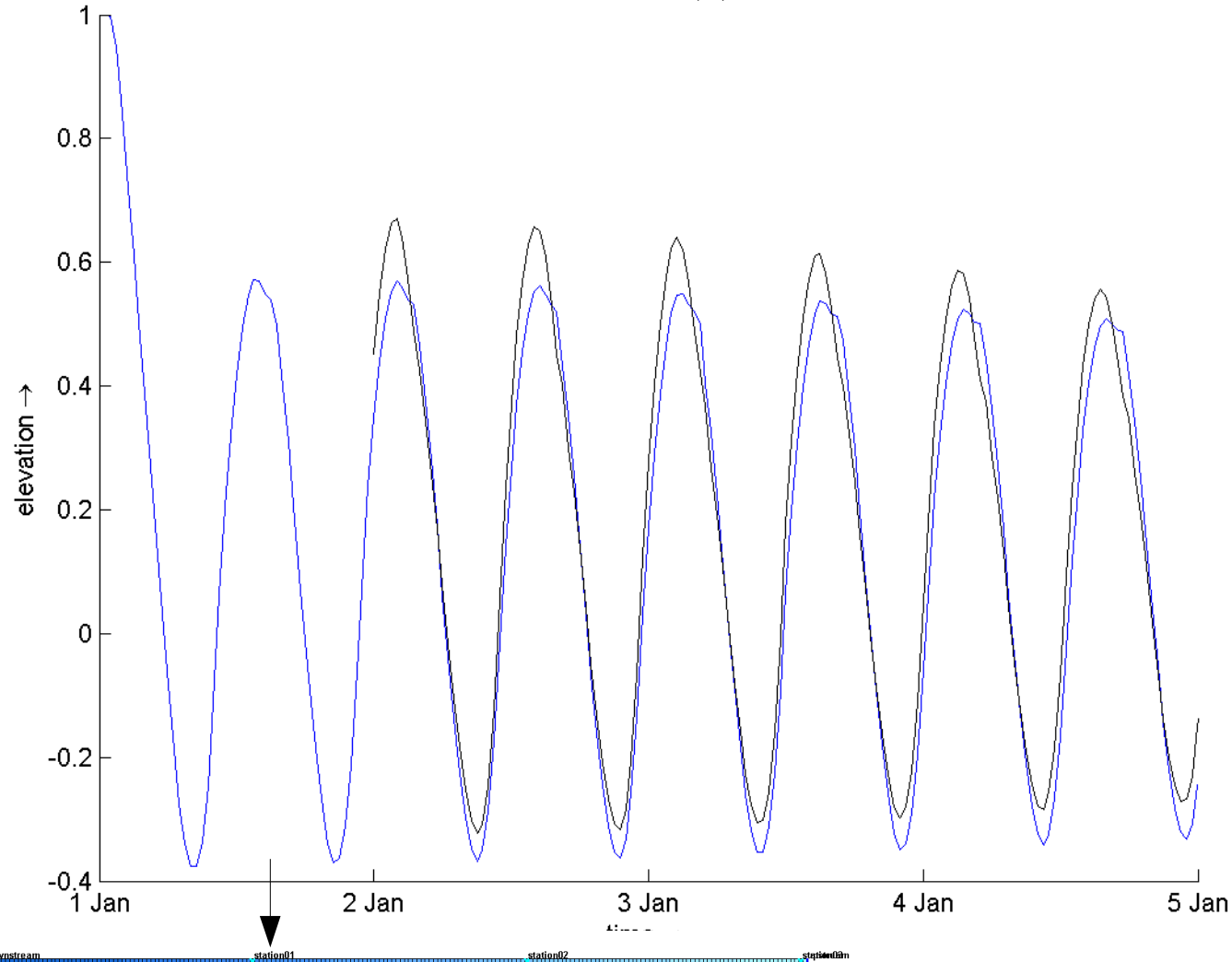


- Download estuary.zip from <http://www.openda.org/course> and unpack
- Install openda_d3d_plugin.zip in the OpenDA bin-directory
- Run the simulation with OpenDA, using the main OpenDA file simulate.oda
- Prepare some time-series plots with quickplot
 - Start matlab in direcory src/tools_lgpl/matlab/quickplot/progrsrc and run d3d_qp
 - the observations are available as tekal file, for including them in the plots (use add to plot and change the color)
 - Output can be found in estuary/work/work0
- What are the most likely causes of differences between observations and model?

Initial performance

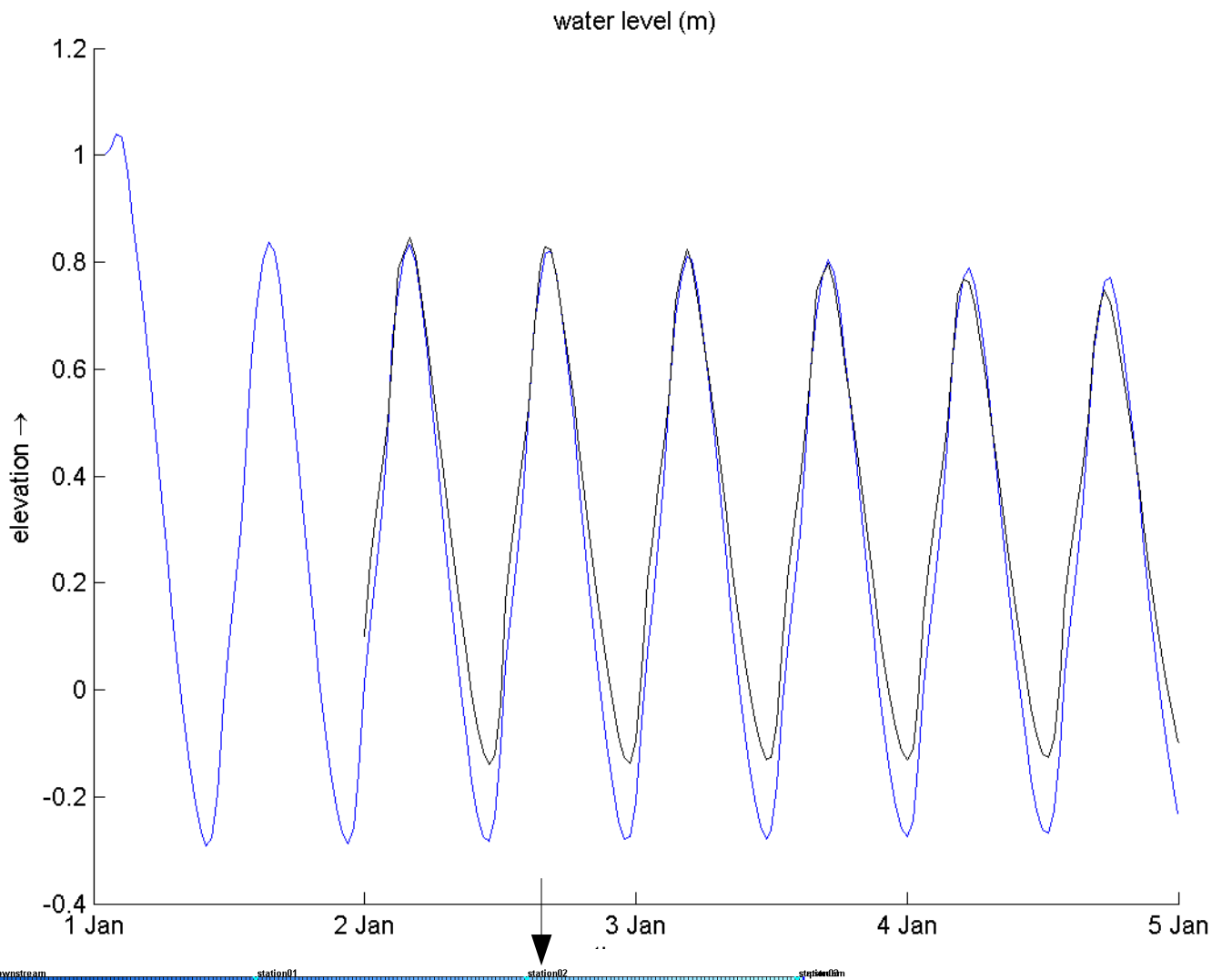
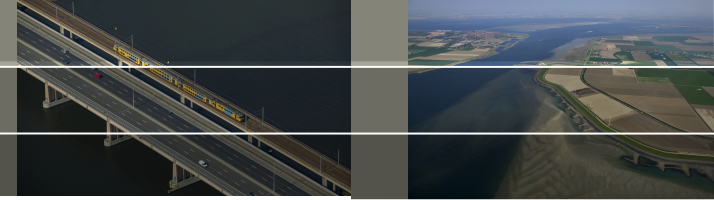


water level (m)



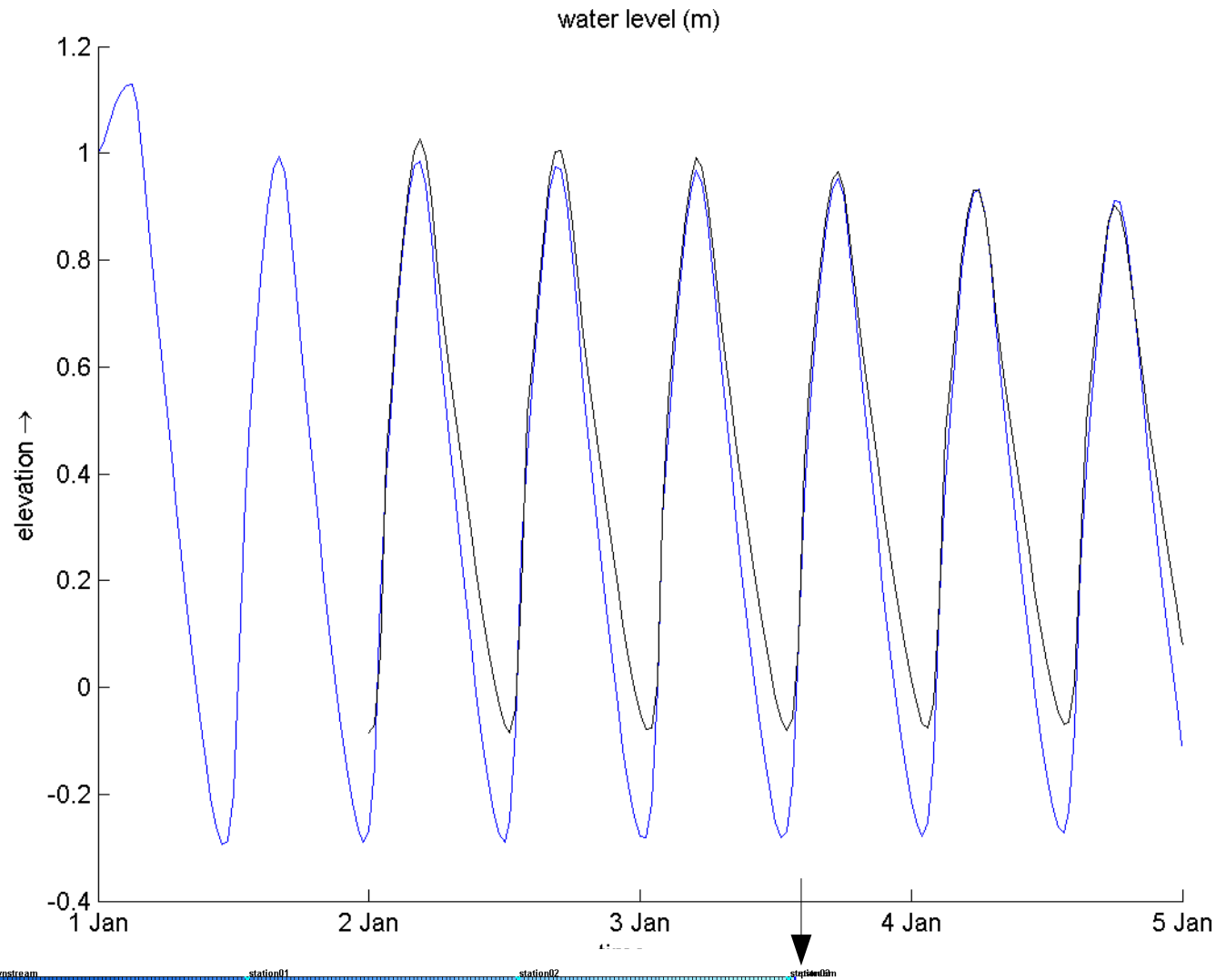
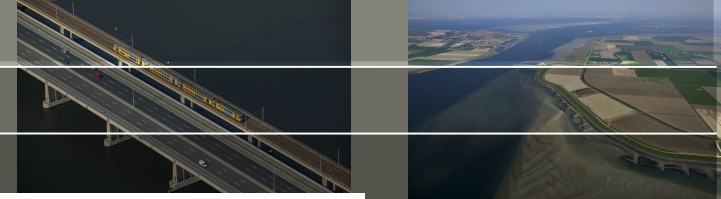
RMSE=9cm

Initial performance



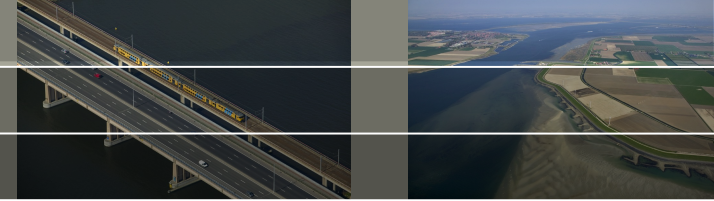
RMSE=12cm

Initial performance



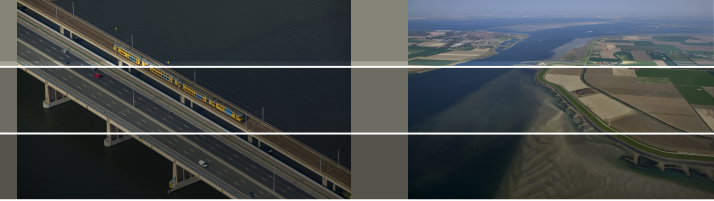
RMSE=7cm

Questions

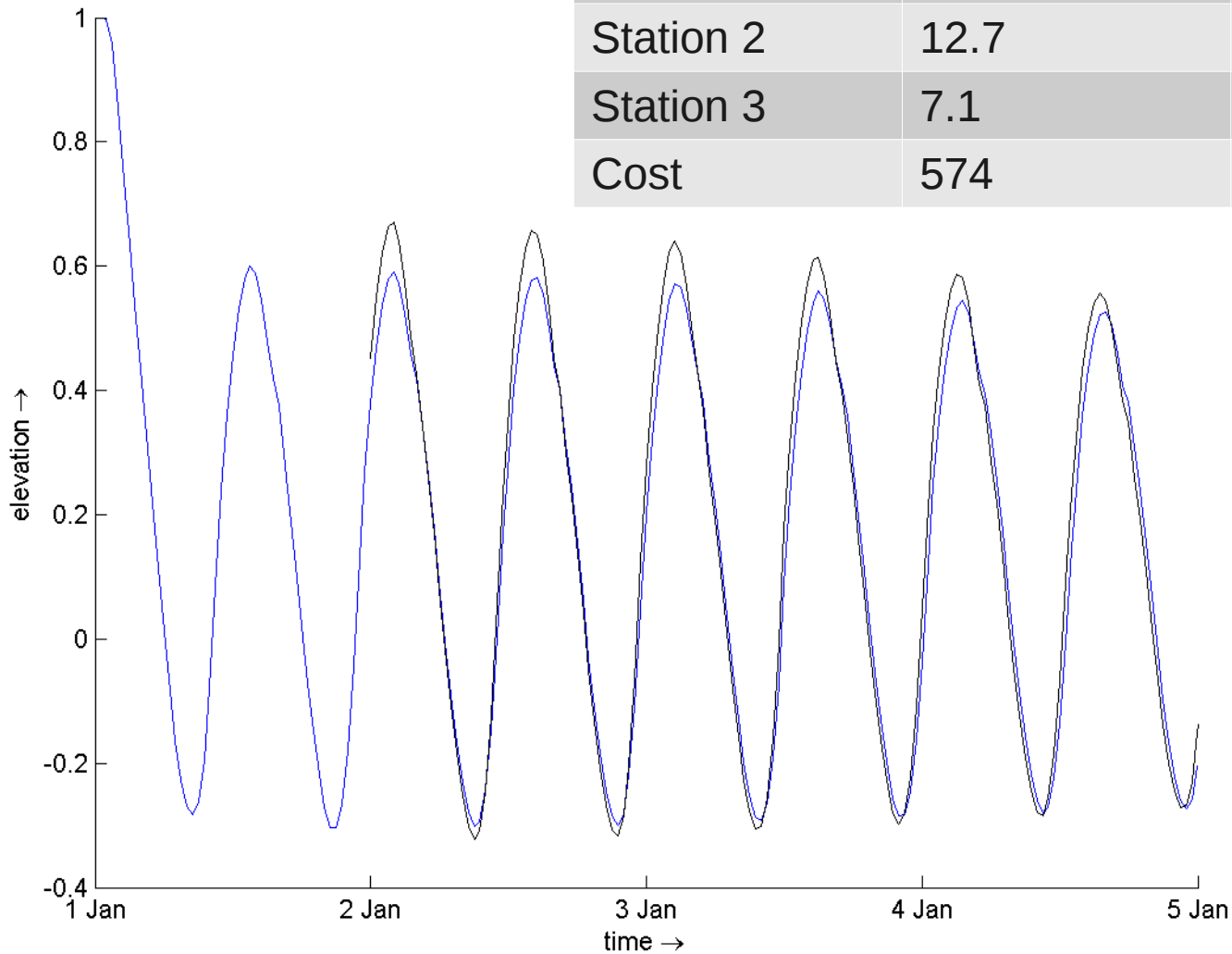


- Run the calibration for a globally constant change to the bathymetry (experiment DEP)
 - Start OpenDA with estuary/calibration.oda
 - Look at the output in the control tab and output tab
 - The output of each of the runs can be found in work/work<number>
 - Plot the time-series with quickplot.
- Is this what you expected?

Calibration Depth

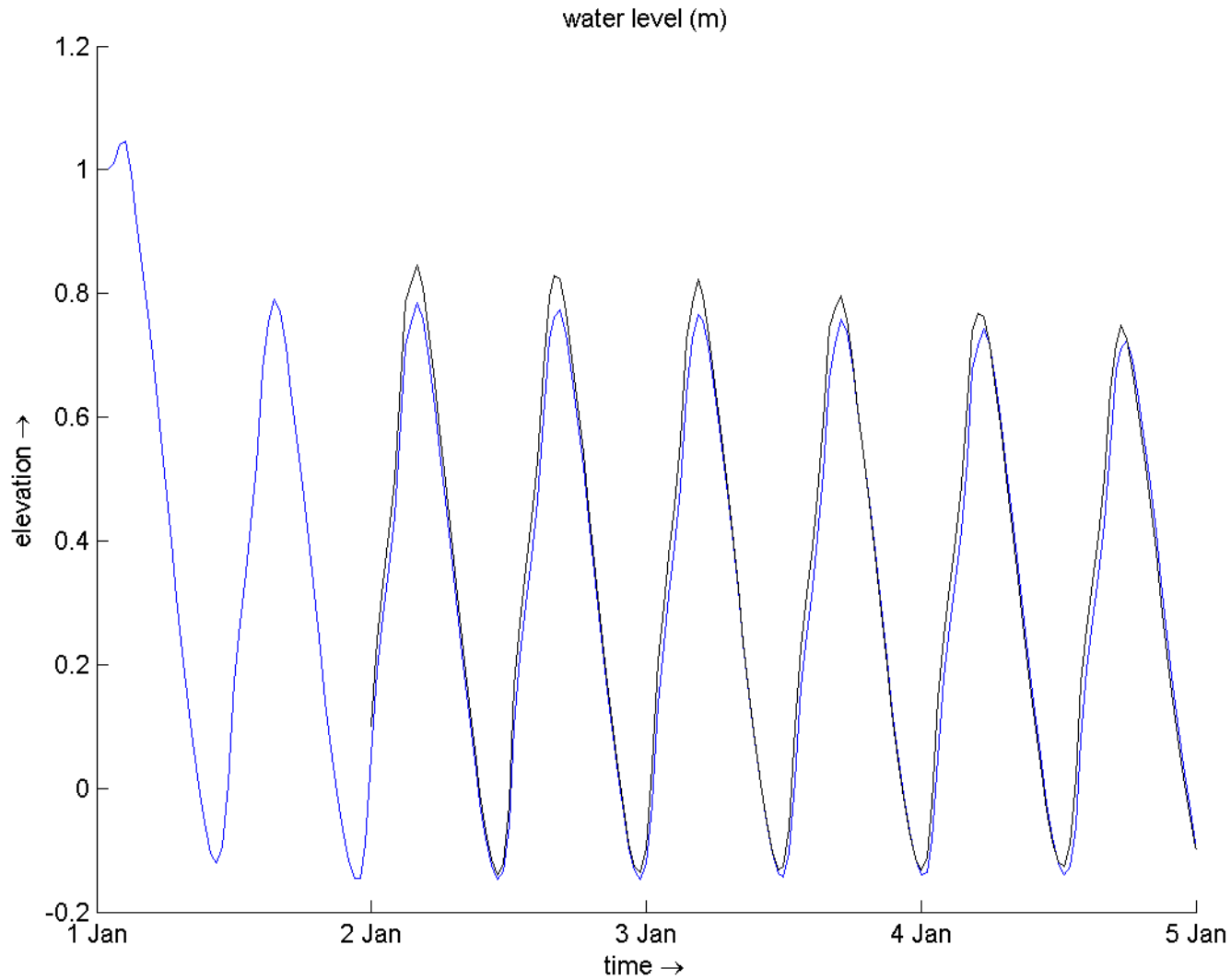
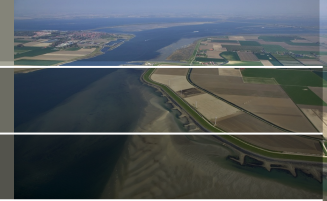


Station 1

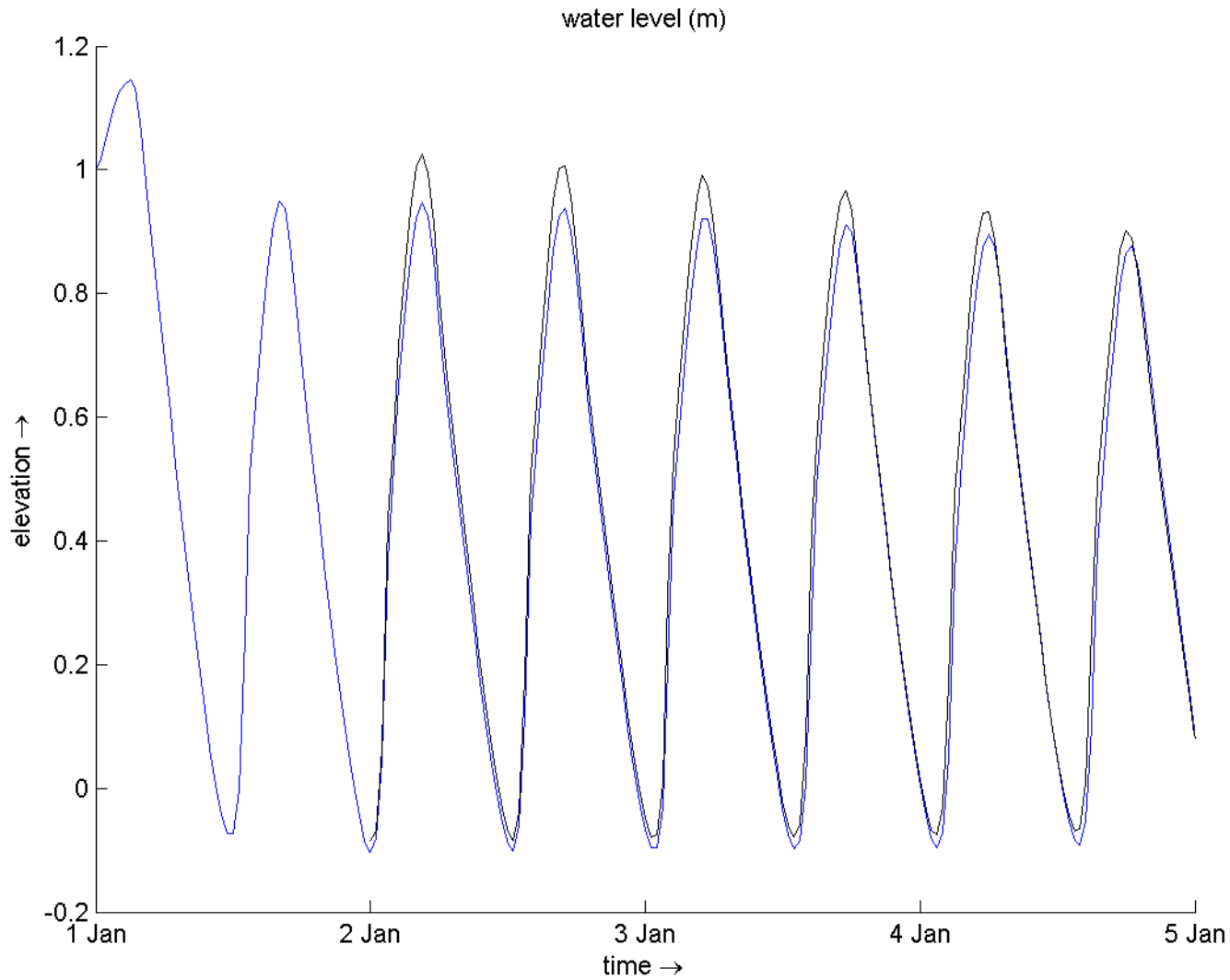
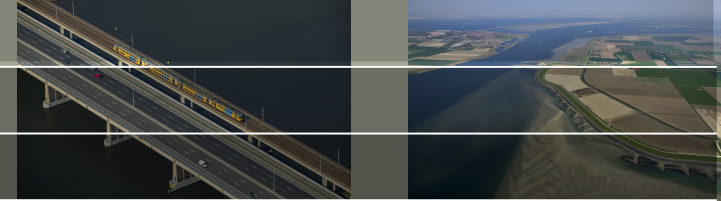


Name	First guess	DEP calib.
Station 1	9.2 cm	4.5
Station 2	12.7	5.0
Station 3	7.1	4.9
Cost	574	134

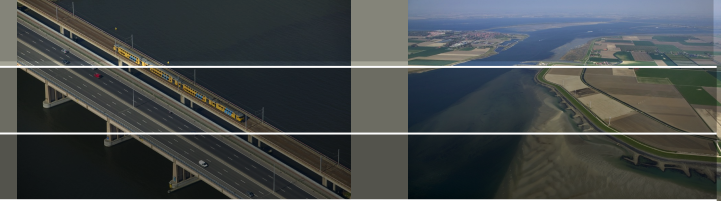
DEP output Station 2



DEP output Station 3



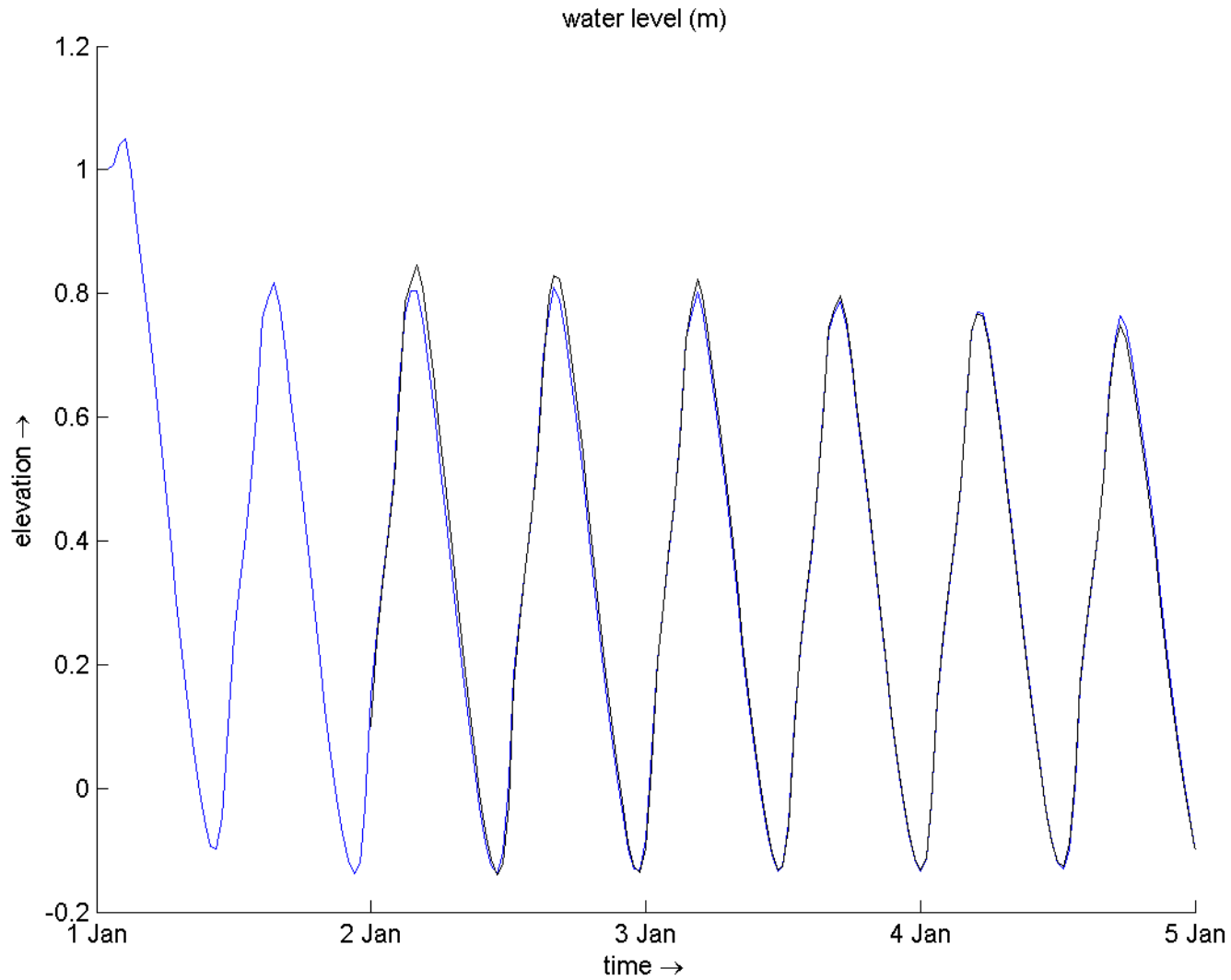
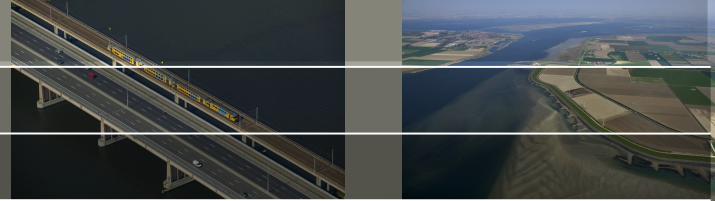
Questions



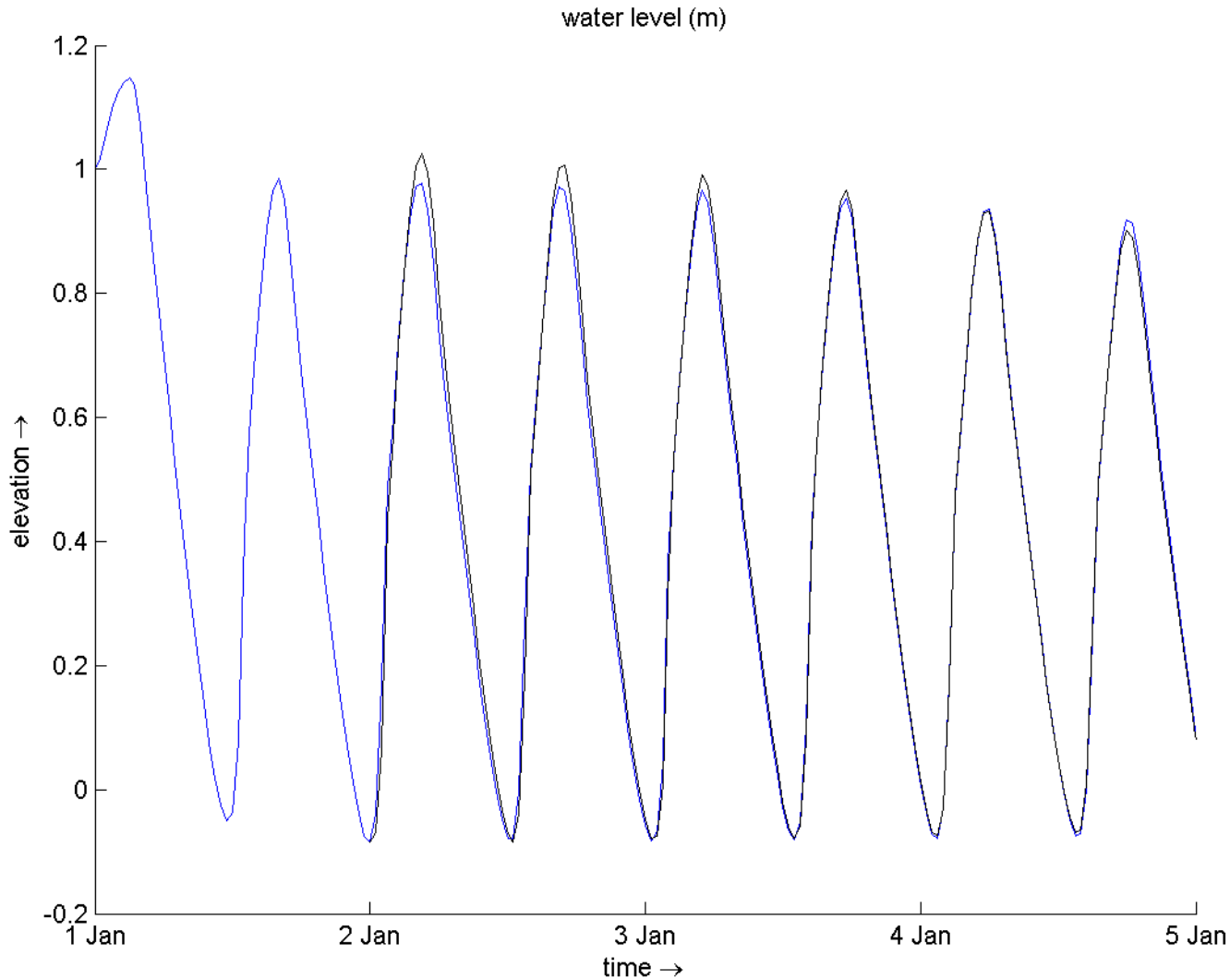
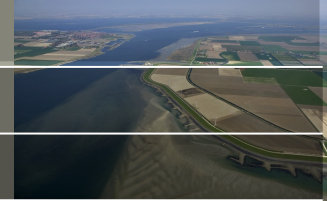
Since the amplitude shows a similar deviation from observations in the whole domain we add calibration of M2 tides at boundary.

- Add the calibration (experiment DEP+M2)
 - Uncomment M2 section in stochModel/D3DStochModel.xml
 - Run calibration
 - Look at the output and plot the time-series.
 - Is this what you expected?

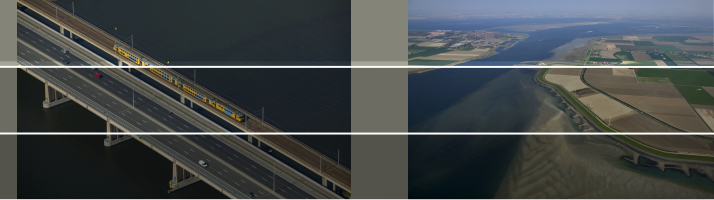
DEP+M2 output Station 2



DEP+M2 output Station 3



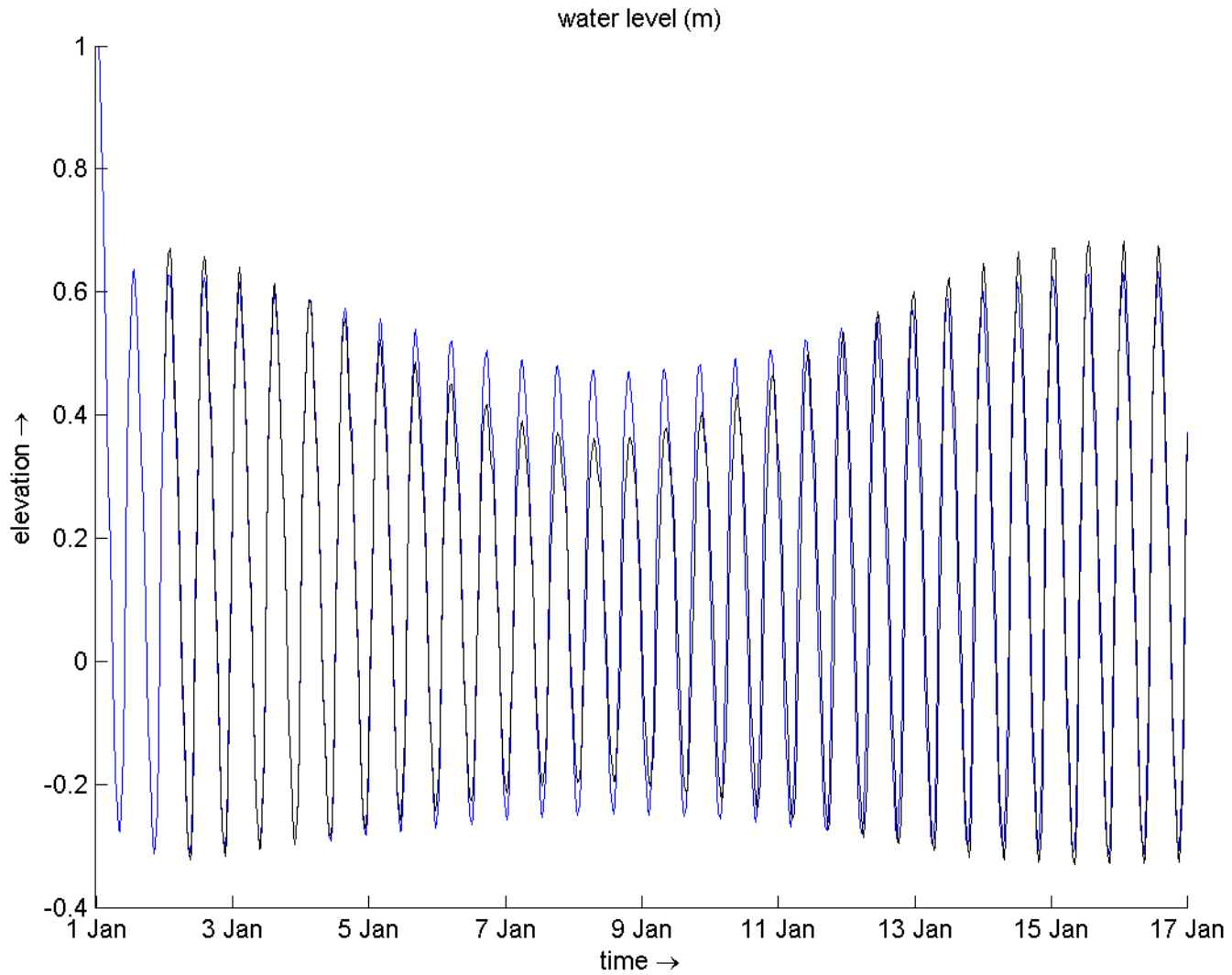
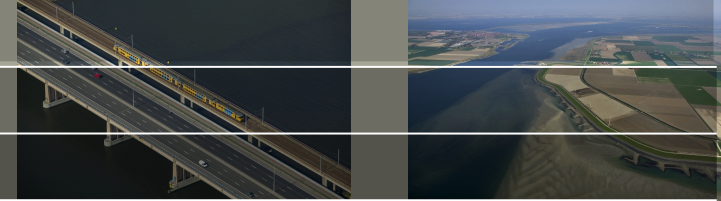
Questions



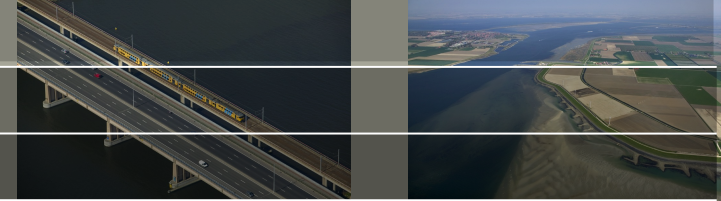
The output looks nice. The cost-function is much lower, but there is still a problem...

- Make a longer run with the final run of experiment DEP+M2
 - Modify `work/work<last_number>/estuary.mdf` and change the `Tstop = 2.3040000e+004` which is 17-1-1991 0:00h; alternatively use the `delft3d-gui`.
 - Run `deltares_hydro.exe` for this case
 - Make time-series plots
 - What is wrong?

Long run for DEP+M2 result

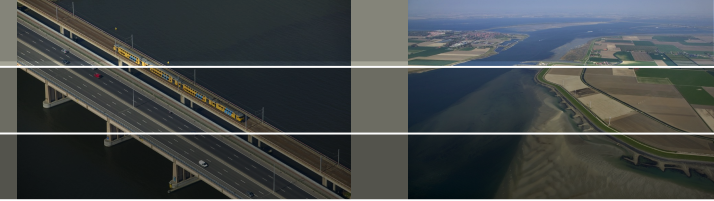


Questions



- The error in S2 was attributed to M2. Let's make fix this with a longer simulation and adding S2 to the calibration**
- Add S2 to calibration and lengthen simulation experiment DEP+M2
 - Modify input_d3d/estuary.mdf and change the Tstop = 2.3040000e+004 which is 17-1-1991 0:00h; see also estuary_long.mdf
 - Lengthen the observations in stochobserver/noosObservations.xml to 17-1-1009 0:00h; see noosObservations_long.xml
 - Uncomment S2 section in stochModel/D3DStochModel.xml
 - Run calibration with OpenDA
 - What would go wrong if we would use only 3 days of observations for calibration of S2 and M2?

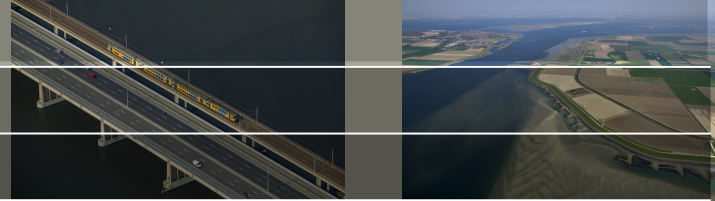
Calibration DEP+M2+S2



Name	First guess	DEP+M2+S2
Station 1		0.9cm
Station 2		0.7
Station 3		0.2
Cost	5281	1.5

Parameter	Final value (change)	True values
M2.Amplitude	0.1 cm	0.0 cm
M2.Phase	0.4 degr	0.0 degr
S2.Amplitude	10.1 cm	10.0 cm
S2.Phase	0.3 degr	0.0 degr
Depth	-92cm	-100cm

And much more



- Calibration of roughness
- Calibrate blocks of the grid for depth or roughness
- Proportional instead of additive modification of parameters
- Make subselections of observations
- Restarts
- Parallel computing
- Output formats and selection
- Try other algorithms
- Calibration of other models, such as sobek, swan or waqua
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