

FUNWAVE modeling of the Canada experiments

March 8, 2025

Important links

- 1) Entire Package
- 2) This documentation
- 3) Data and preparation directory
- 4) References

Purposes

- 1) provide a procedure to conduct numerical simulations of the canada experiments using FUNWAVE-TVD
- 2) preprocessing for model grids
- 3) model setups
- 4) methods of diagnosing numerical results
- 5) matlab scripts for postprocessing results
- 6) preliminary results

modeling procedure

- 1) generate grids. run plot_profile_caseX.m in /data/preprocessing/
- 2) compile the code in /FUNWAVE-TVD/model_work/ using Makefile
- 3) run each case in /FUNWAVE-TVD/model_work

For example,

```
>mpirun -np 8 ./funwave input_01_01.txt
```

The input file is defined as input_CaseNumber_TrialNumber.txt

- 4) postprocessing in /FUNWAVE-TVD/postprocessing/

For example, run Case1_Trial01.m in MATLAB

diagnosing hydrodynamics and sediment transport

See Figure 1.

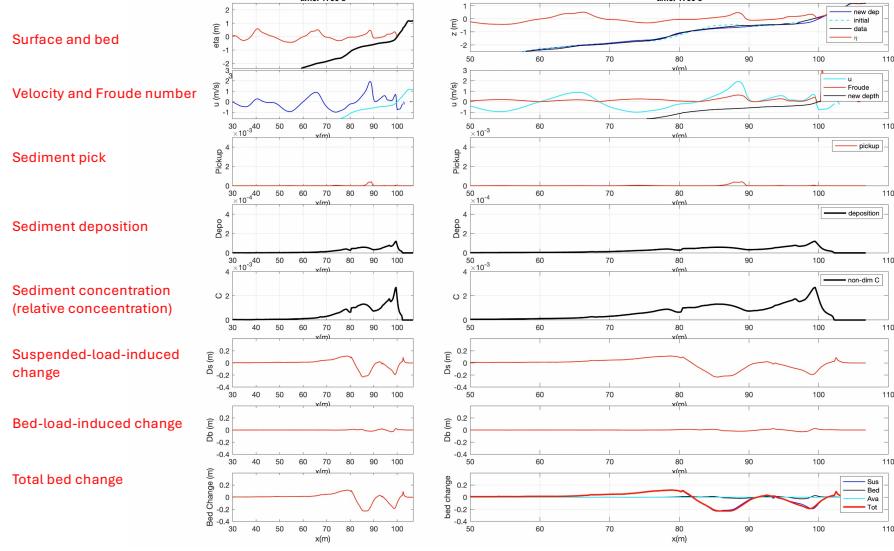


Figure 1: Example of diagnosing program.

Initial assessment

The model/data comparisons of morphological change are generally unsatisfactory. There are several potential causes for poor comparisons

- 1) the model was not tuned
- 2) some profile changes don't look consistent with hydrodynamic conditions. Possibly the model loaded or compared wrong data. In some cases, mass is not conserved in the lab data.
- 3) the model is inappropriate for modeling CASE 6 in which waves are too long ($T=12s$) for wave generation in about 2m depth.
- 4) the model is efficient. Each case costs 30s – 60s on my MAC with 8 cores.

Suggestions

- 1) check the profile data first. I used the smoothed profiles made by Sahar
- 2) the model needs to be tuned in a typical case, and the same parameters can be applied to all other cases. Suggest using an automated program in linux/unix system. I think Windows system can also have this option.
- 3) use the diagnosing script when tuning the model
- 4) model/data comparisons of hydrodynamics inside surfzone are very necessary to find out the problem.

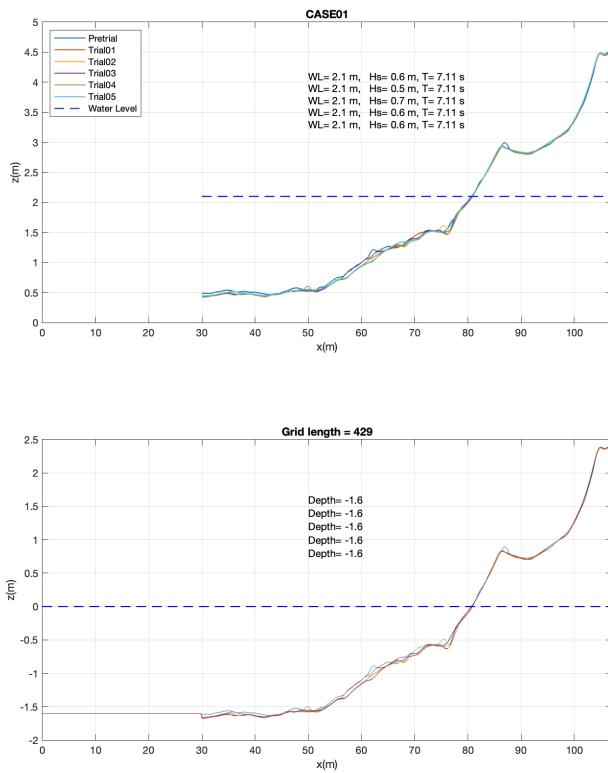


Figure 2: CASE01, data (top panel), model grid (bottom panel).

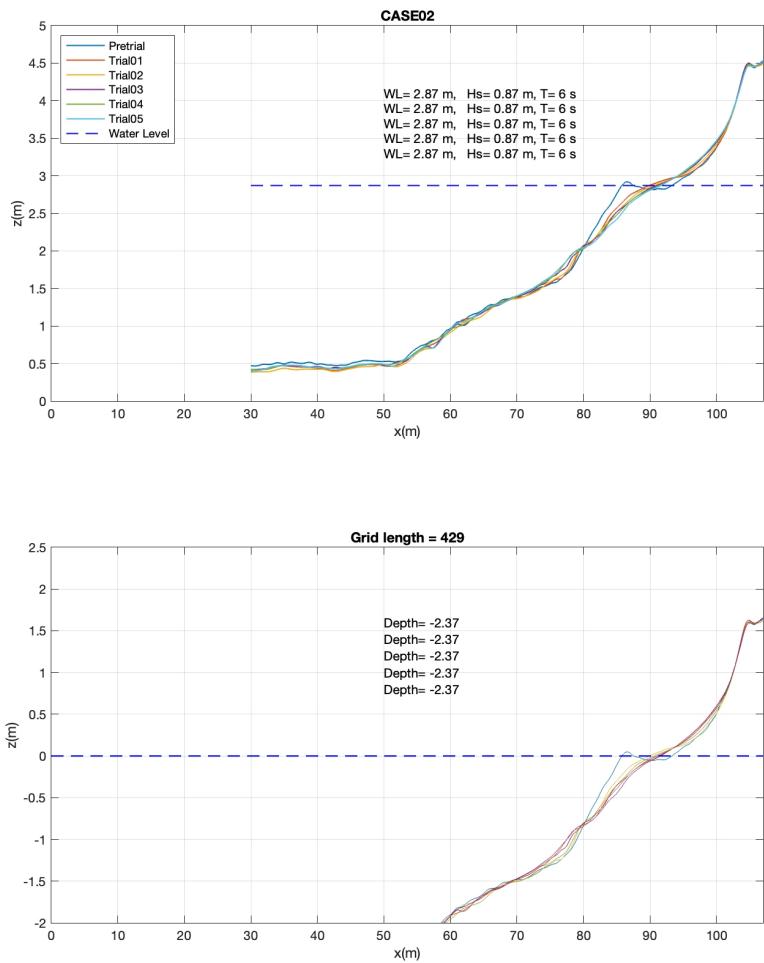


Figure 3: CASE02, data (top panel), model grid (bottom panel).

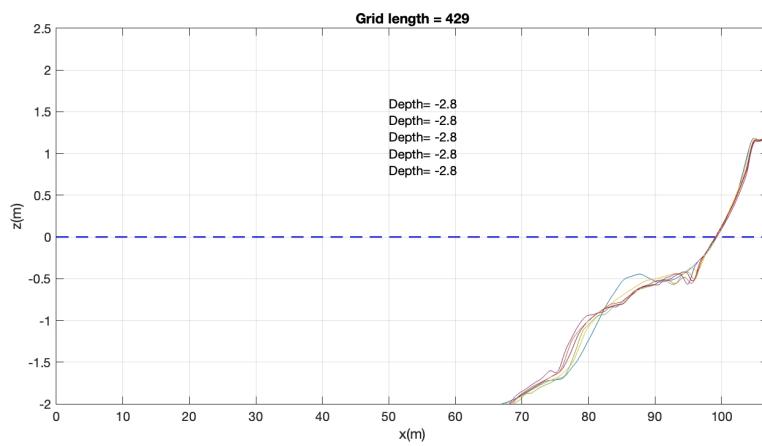
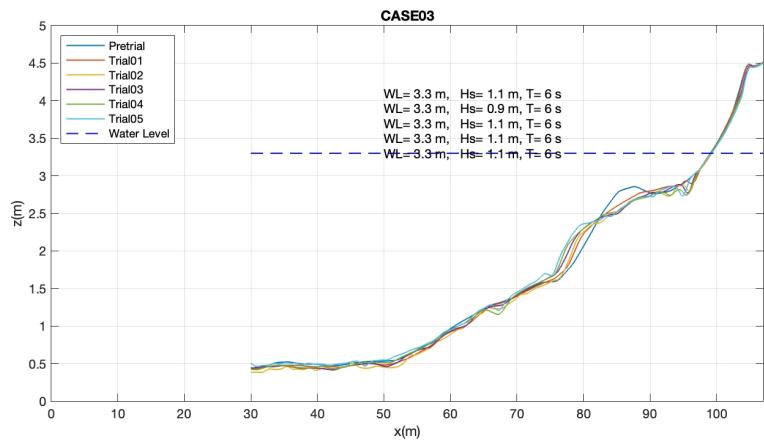


Figure 4: CASE03, data (top panel), model grid (bottom panel).

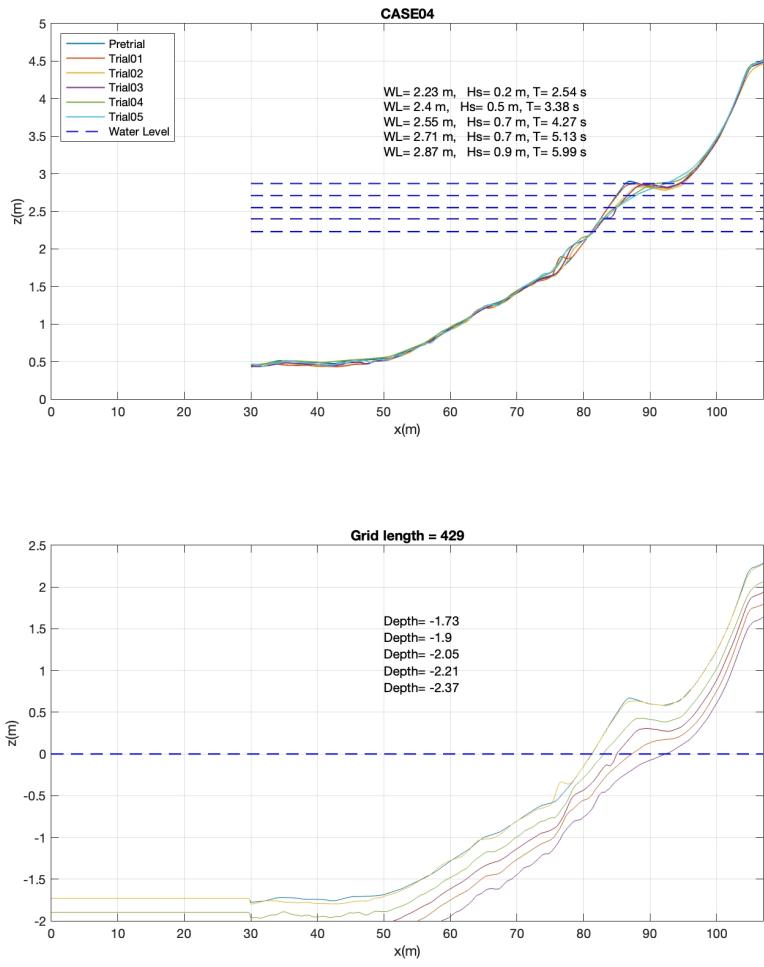


Figure 5: CASE04, data (top panel), model grid (bottom panel).

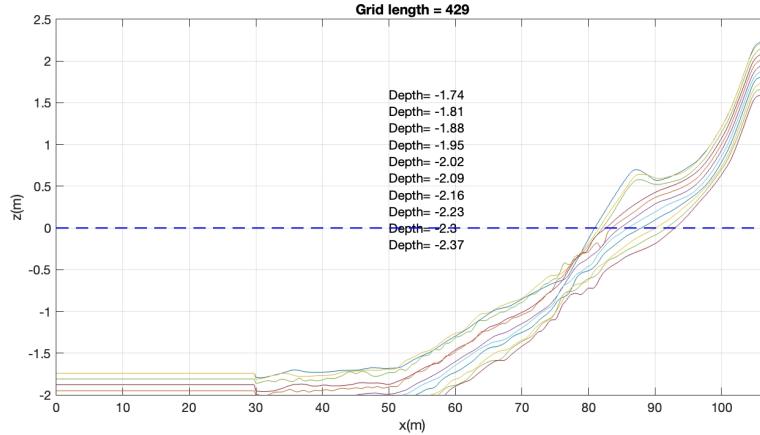
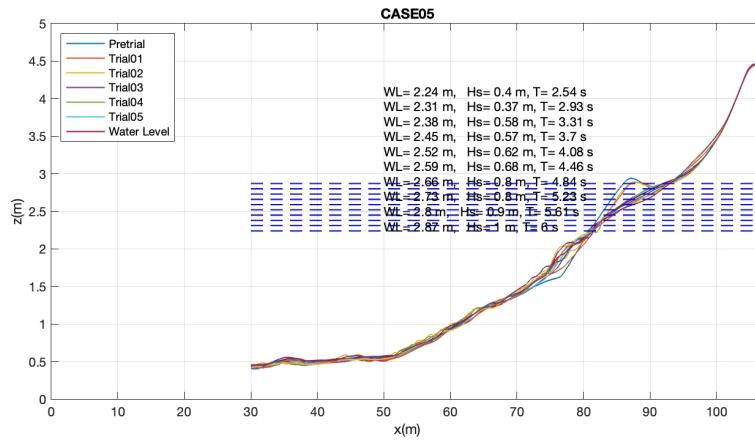


Figure 6: CASE05, data (top panel), model grid (bottom panel).

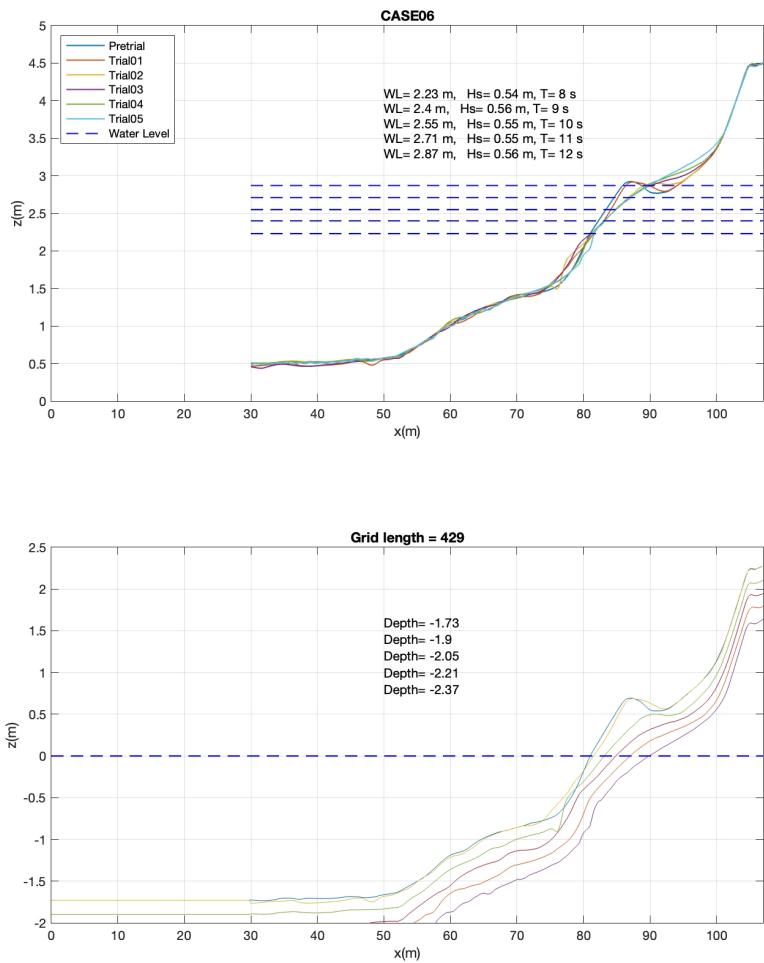


Figure 7: CASE06, data (top panel), model grid (bottom panel).

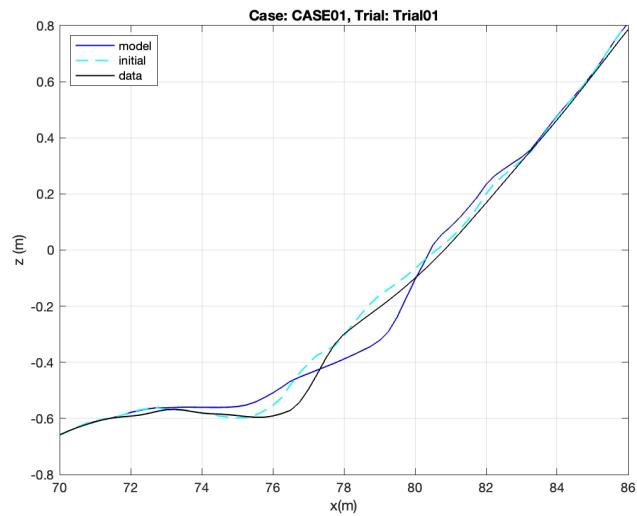


Figure 8: CASE01, Trial01

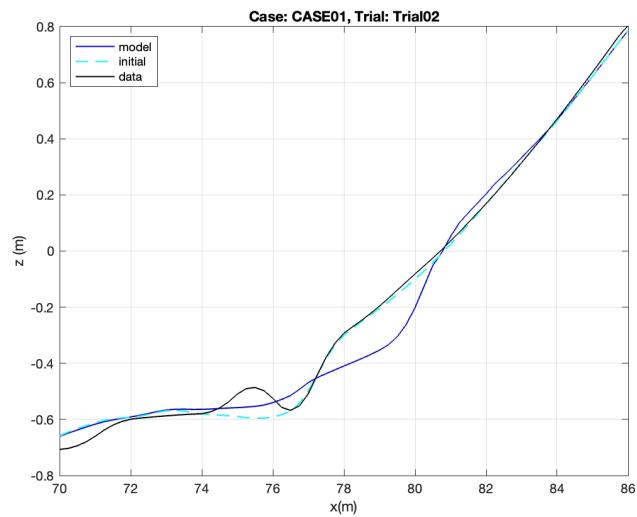


Figure 9: CASE01, Trial02

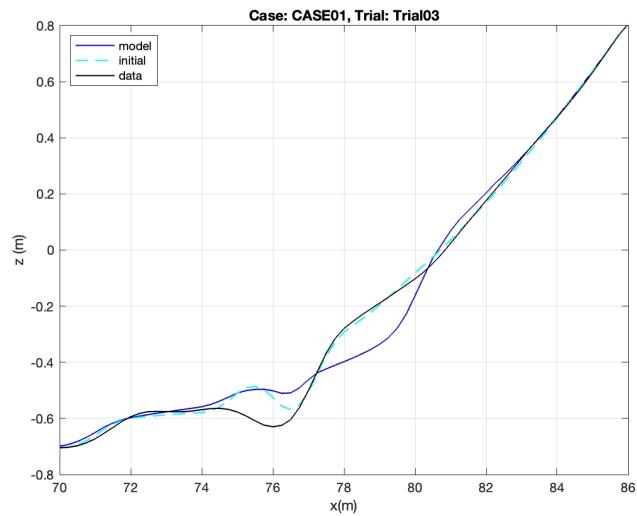


Figure 10: CASE01, Trial03

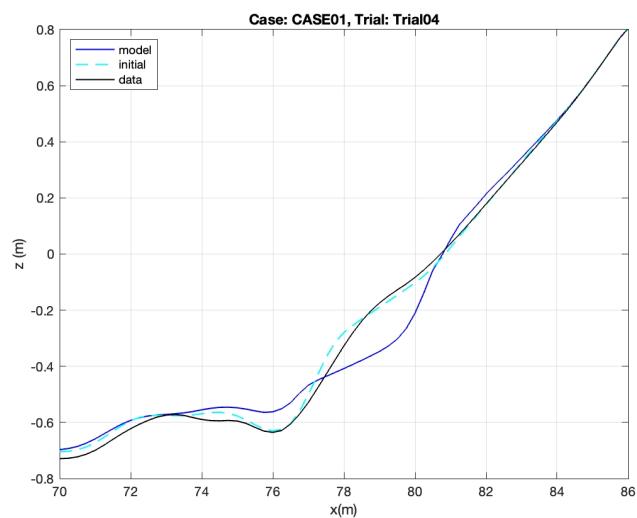


Figure 11: CASE01, Trial04

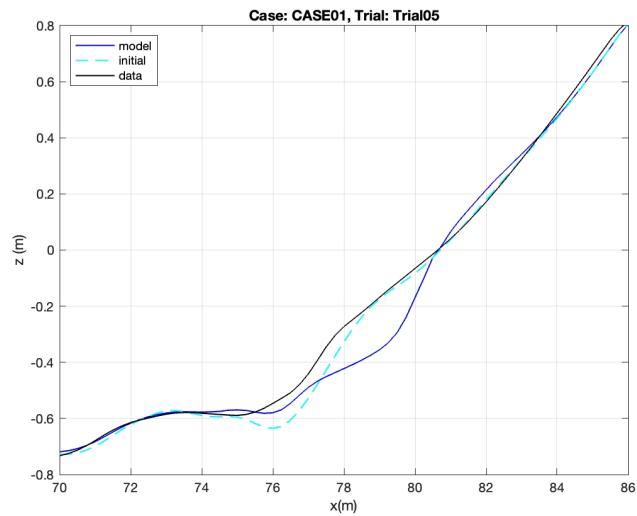


Figure 12: CASE01, Trial05

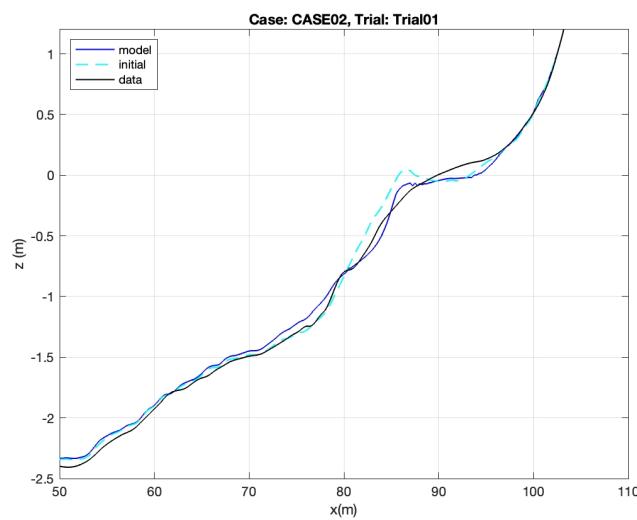


Figure 13: CASE02, Trial01

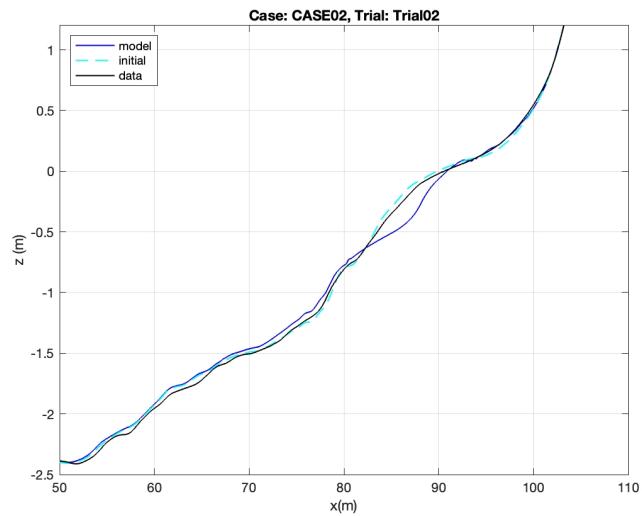


Figure 14: CASE02, Trial02

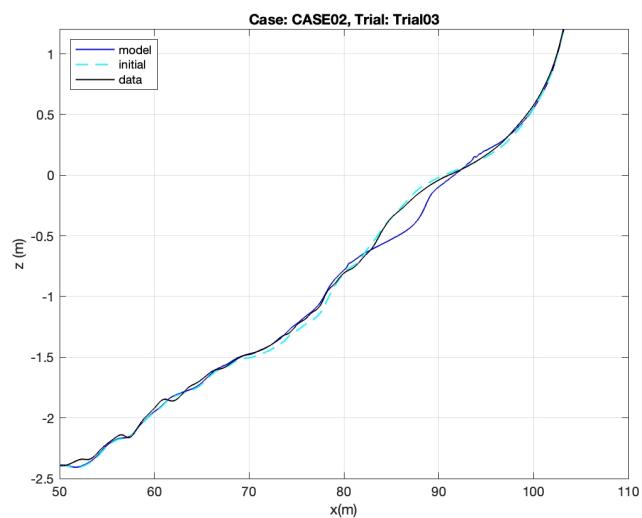


Figure 15: CASE02, Trial03

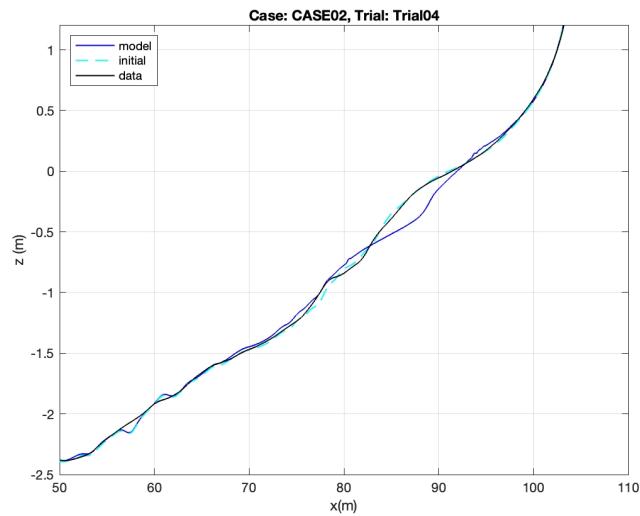


Figure 16: CASE02, Trial04

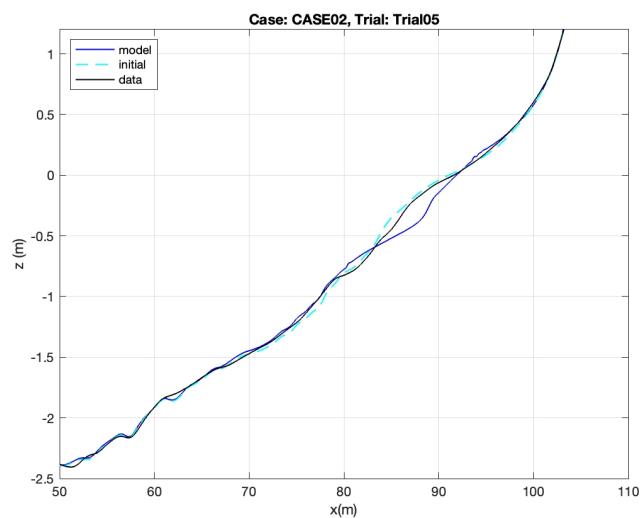


Figure 17: CASE02, Trial05

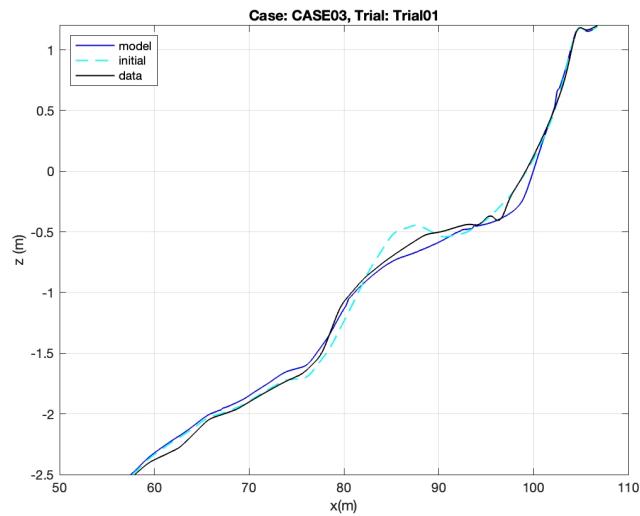


Figure 18: CASE03, Trial01

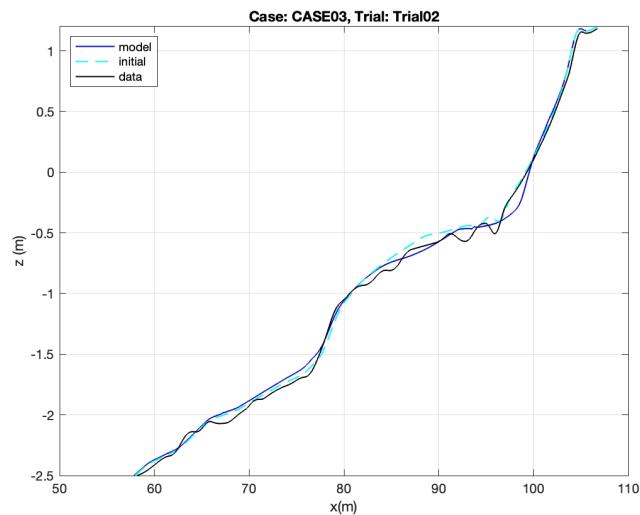


Figure 19: CASE03, Trial02

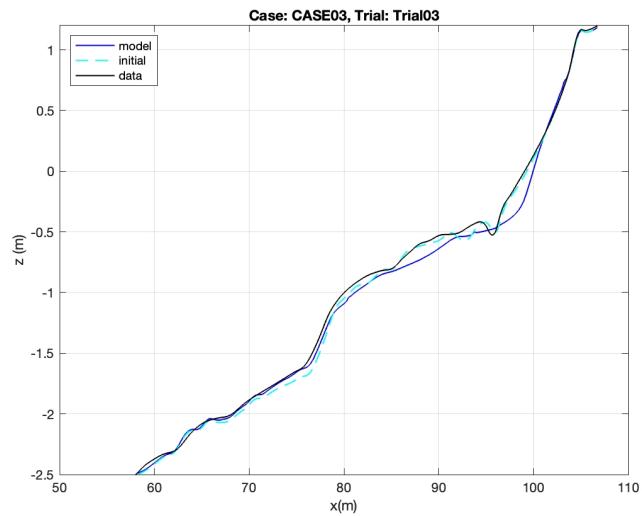


Figure 20: CASE03, Trial03

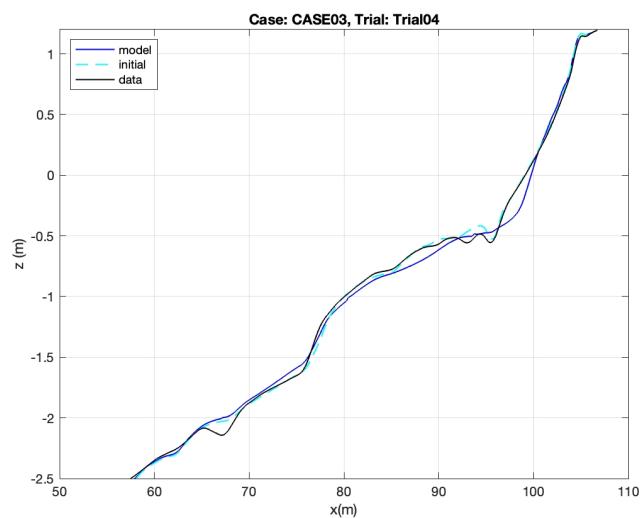


Figure 21: CASE03, Trial04

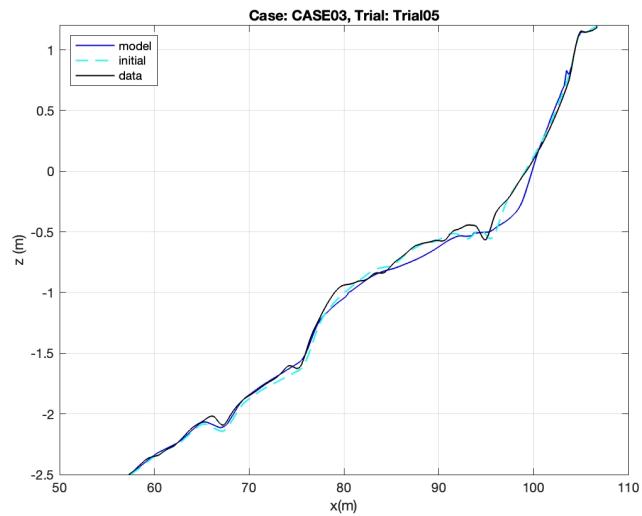


Figure 22: CASE03, Trial05

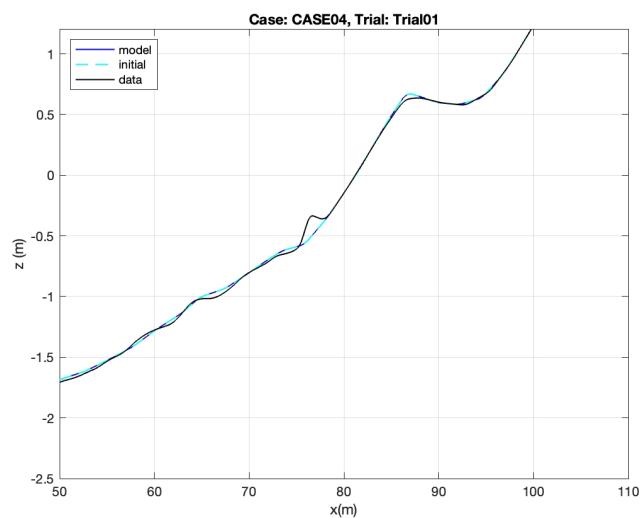


Figure 23: CASE04, Trial01

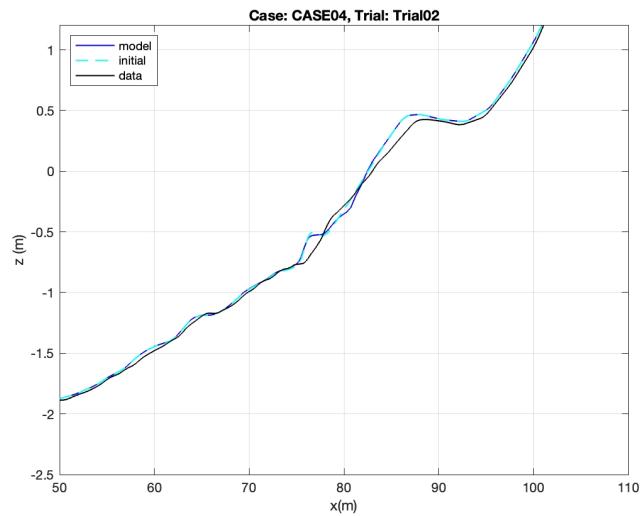


Figure 24: CASE04, Trial02

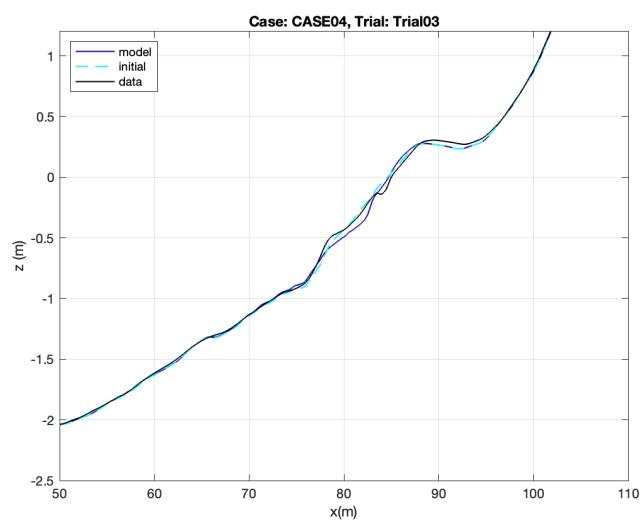


Figure 25: CASE04, Trial03

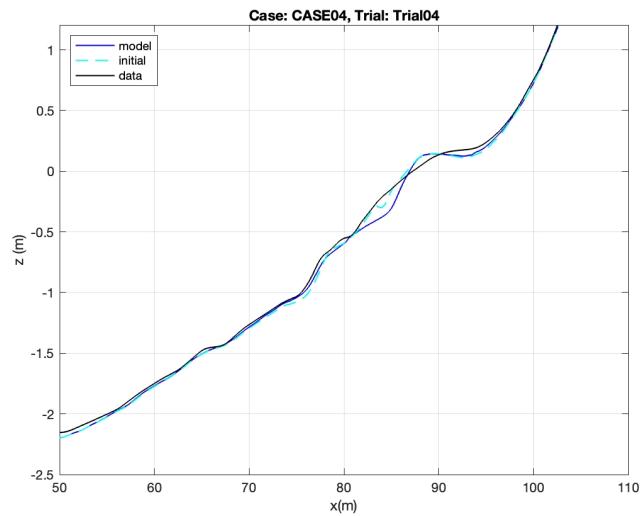


Figure 26: CASE04, Trial04

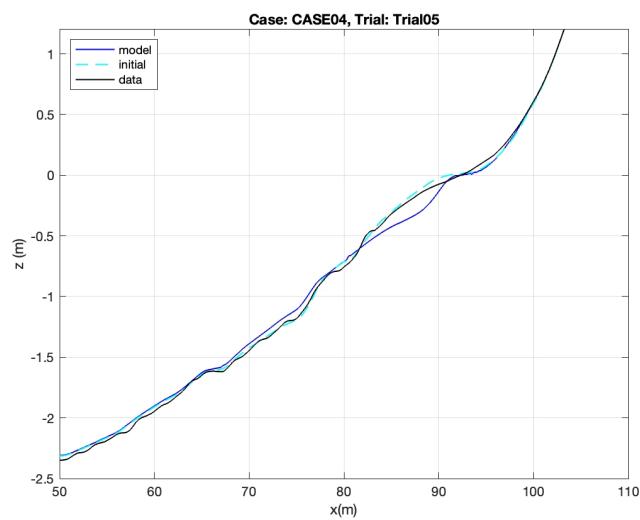


Figure 27: CASE04, Trial05

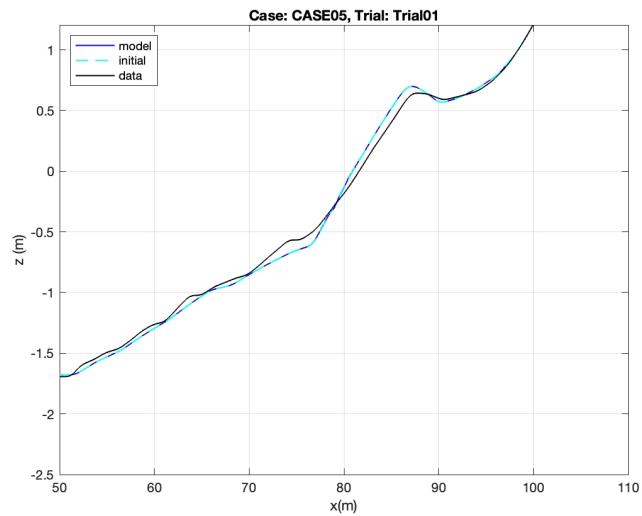


Figure 28: CASE05, Trial01

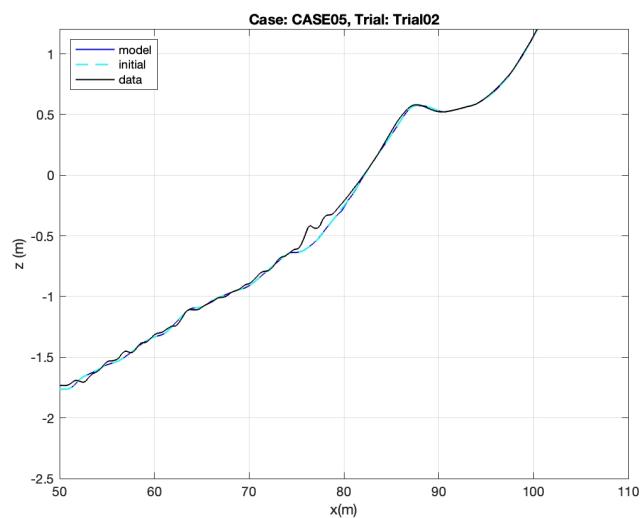


Figure 29: CASE05, Trial02

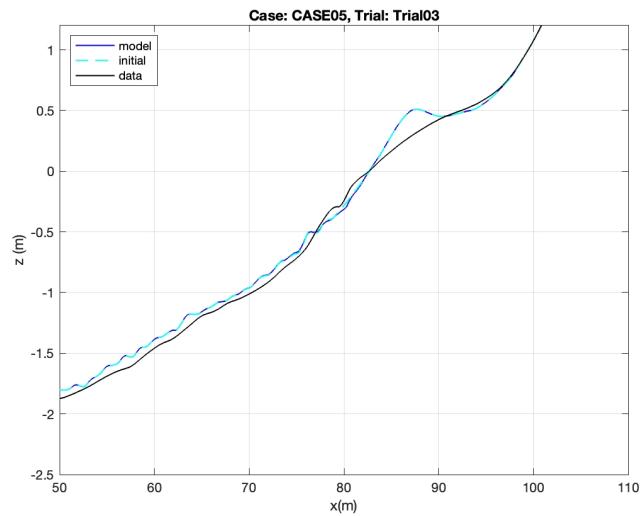


Figure 30: CASE05, Trial03

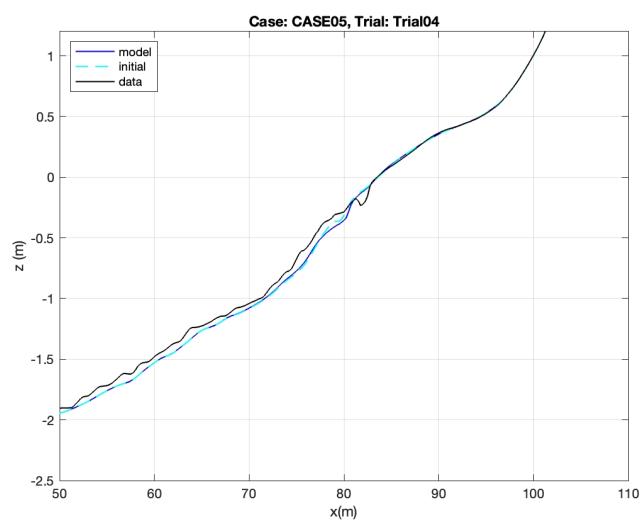


Figure 31: CASE05, Trial04

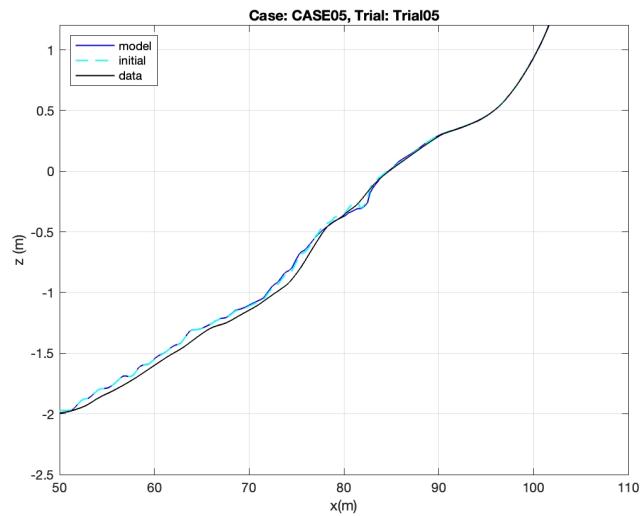


Figure 32: CASE05, Trial05

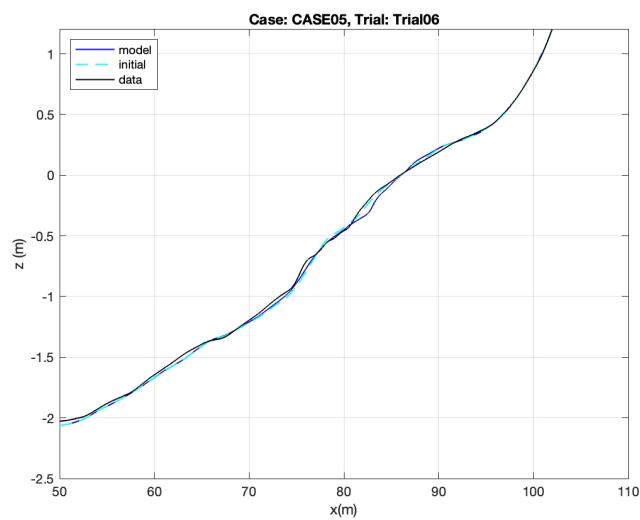


Figure 33: CASE05, Trial06

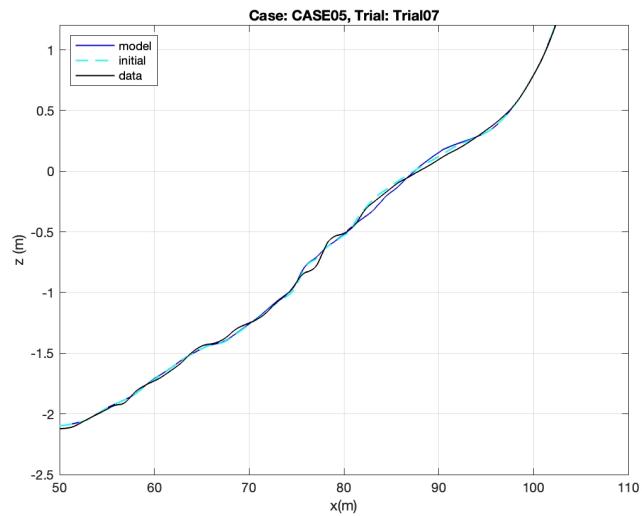


Figure 34: CASE05, Trial07

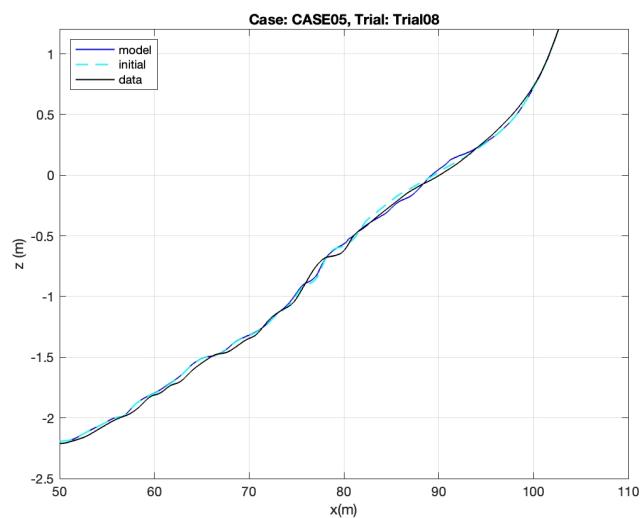


Figure 35: CASE05, Trial08

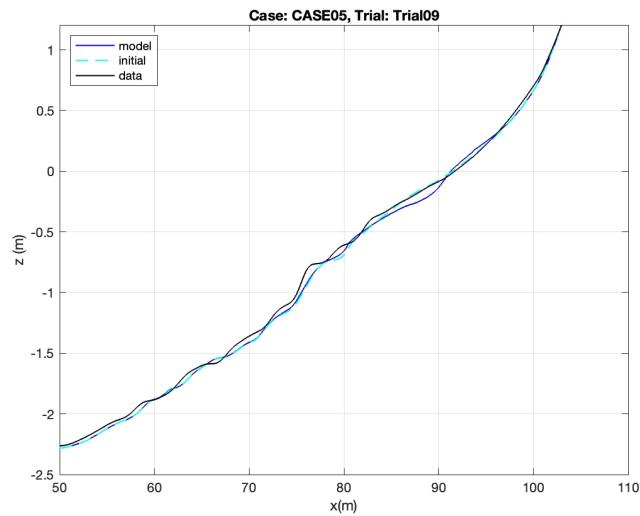


Figure 36: CASE05, Trial09

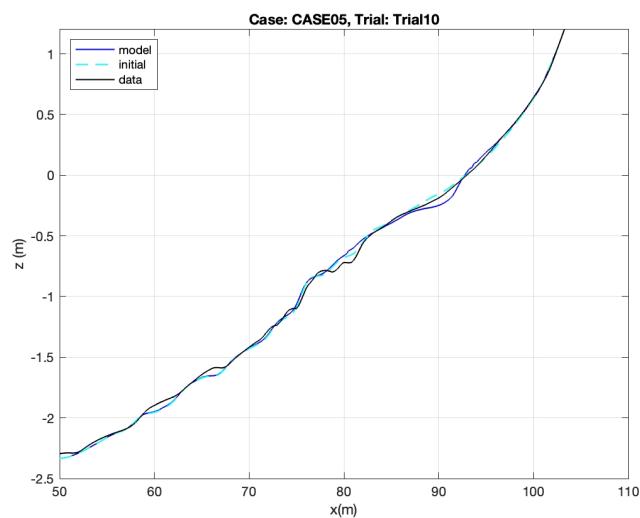


Figure 37: CASE05, Trial10

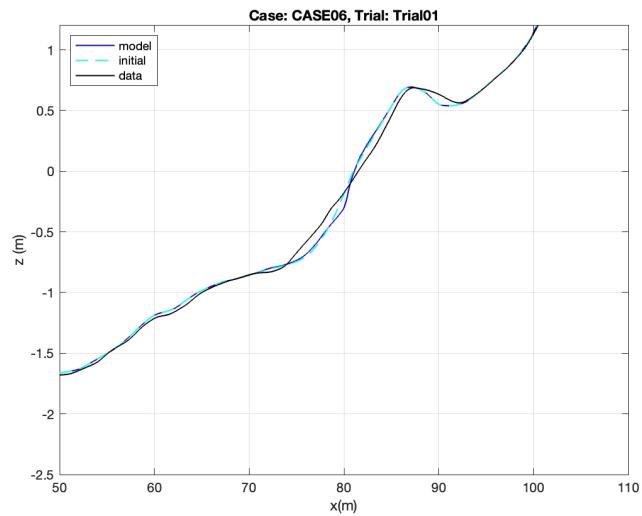


Figure 38: CASE06, Trial01

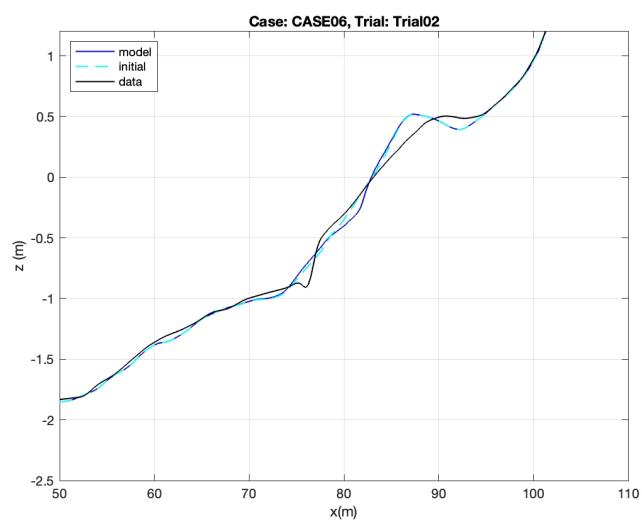


Figure 39: CASE06, Trial02

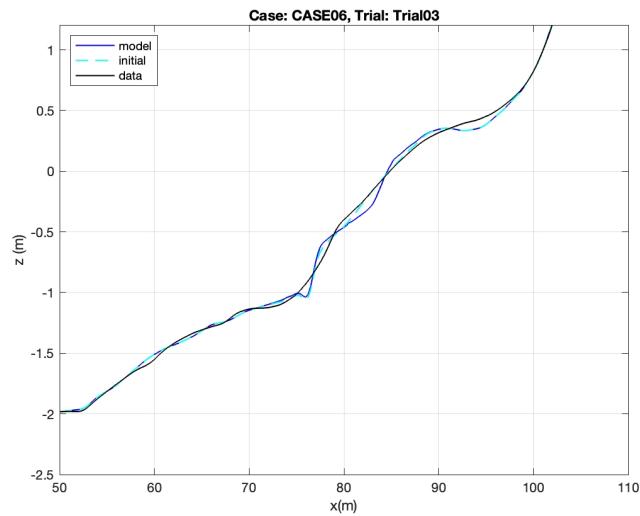


Figure 40: CASE06, Trial03

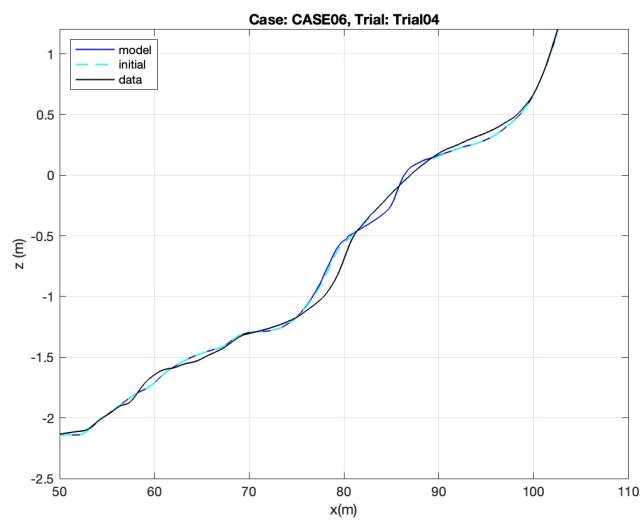


Figure 41: CASE06, Trial04

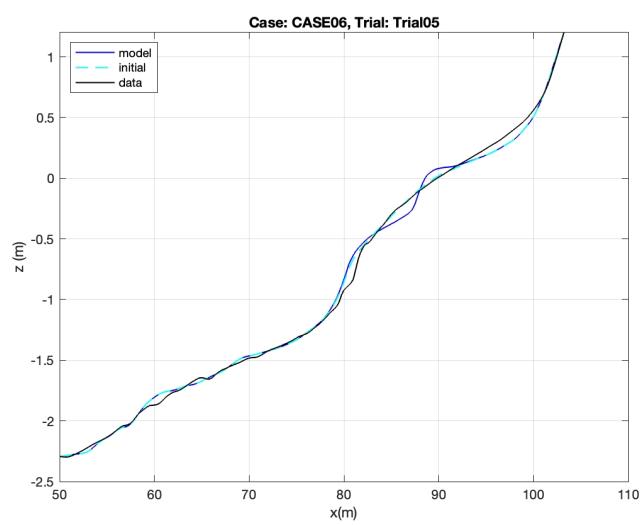


Figure 42: CASE06, Trial05