THE ACADEMY by DHI

ECO Lab

Exercise 1: Modelling E.coli bacteria

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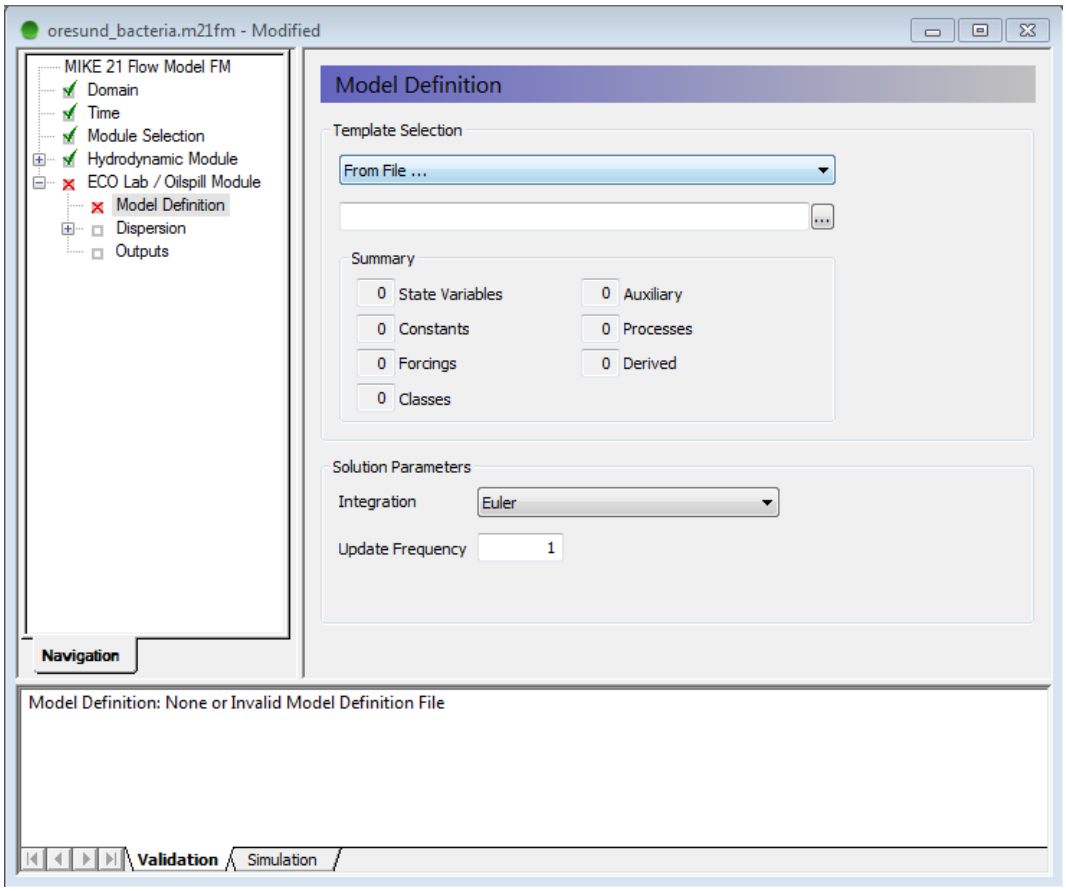
1 Exercise 1: Modelling E.coli bacteria

Getting started

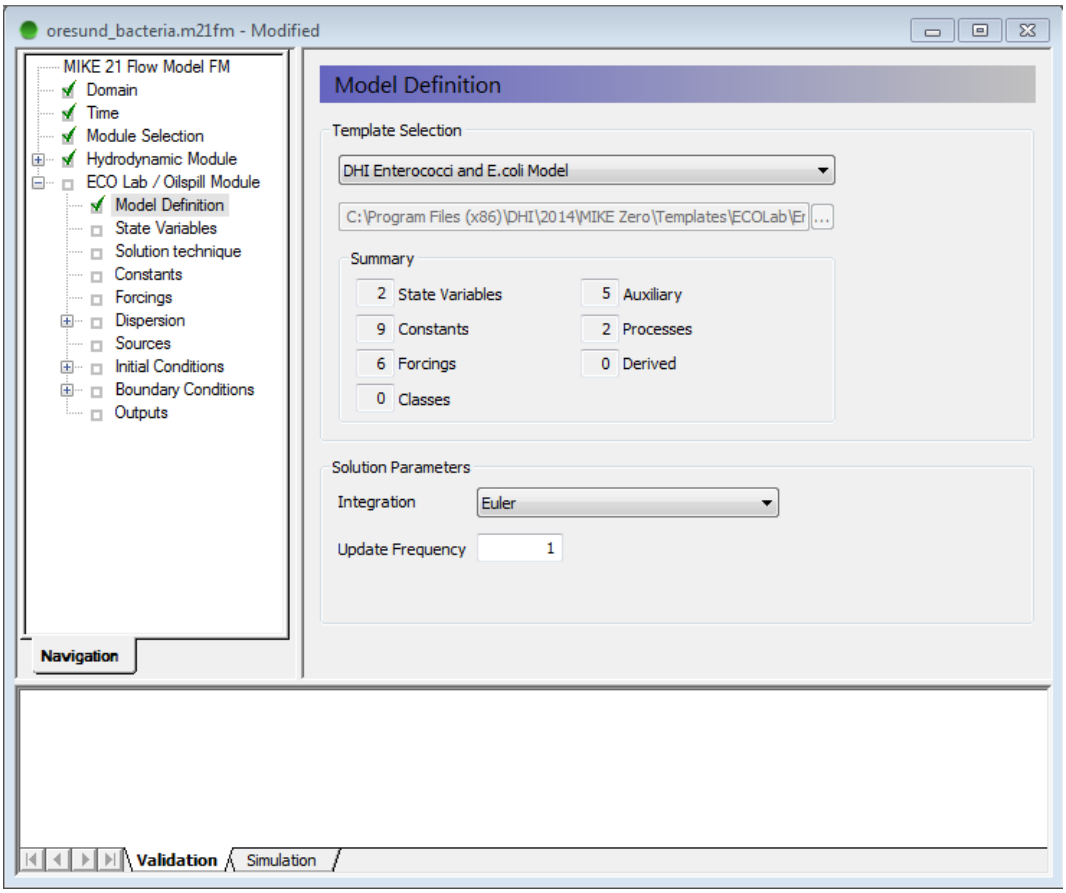
1. Locate the example folder:
   Explore the folder C:\Program Files (x86)\DHI…. and look for …\MIKE Zero\Examples\MIKE_21\FlowModel_FM\HD\Oresund\Calibration_2
2. Open the file: oresund.m21fm
3. Save the file into a working folder and change the name of the setup file.

Template selection

4. In module selection, include ECO Lab.
5. In the model definition you open the 'From file …' menu.



6. Choose the DHI Enterococci and E.coli model.



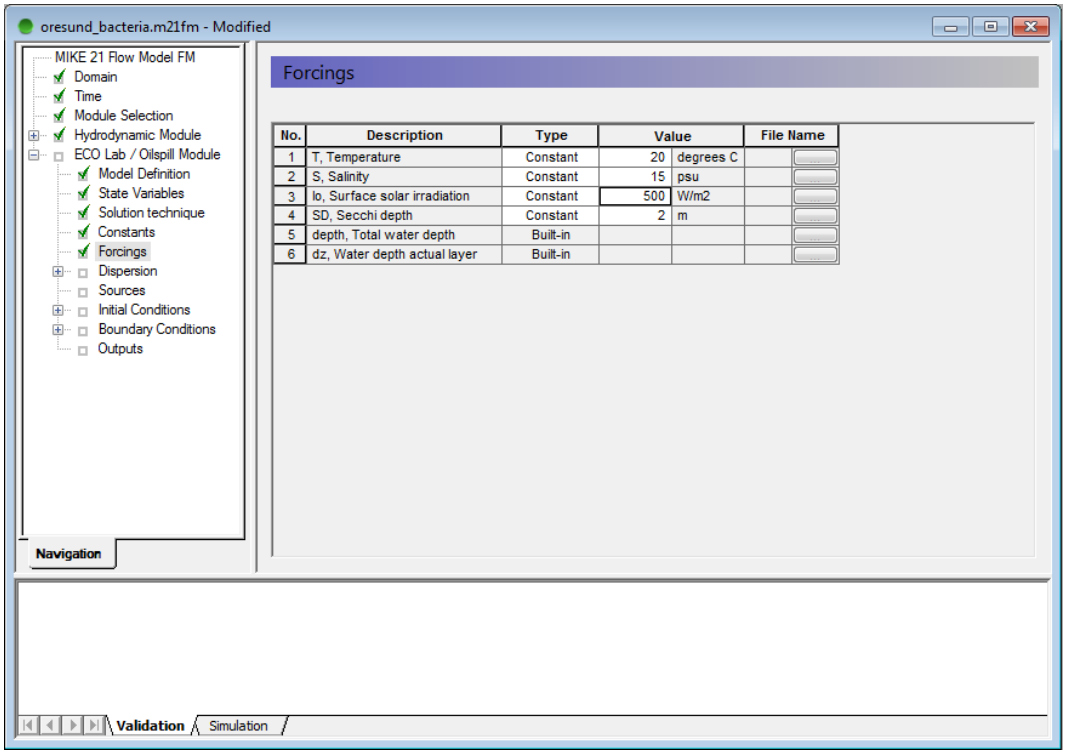
7. Set the update frequency to 5.

State Variables, Solution Technique and Constants

8. For this exercise you do not change anything in the menus: State Variables, Solution Technique and Constants.

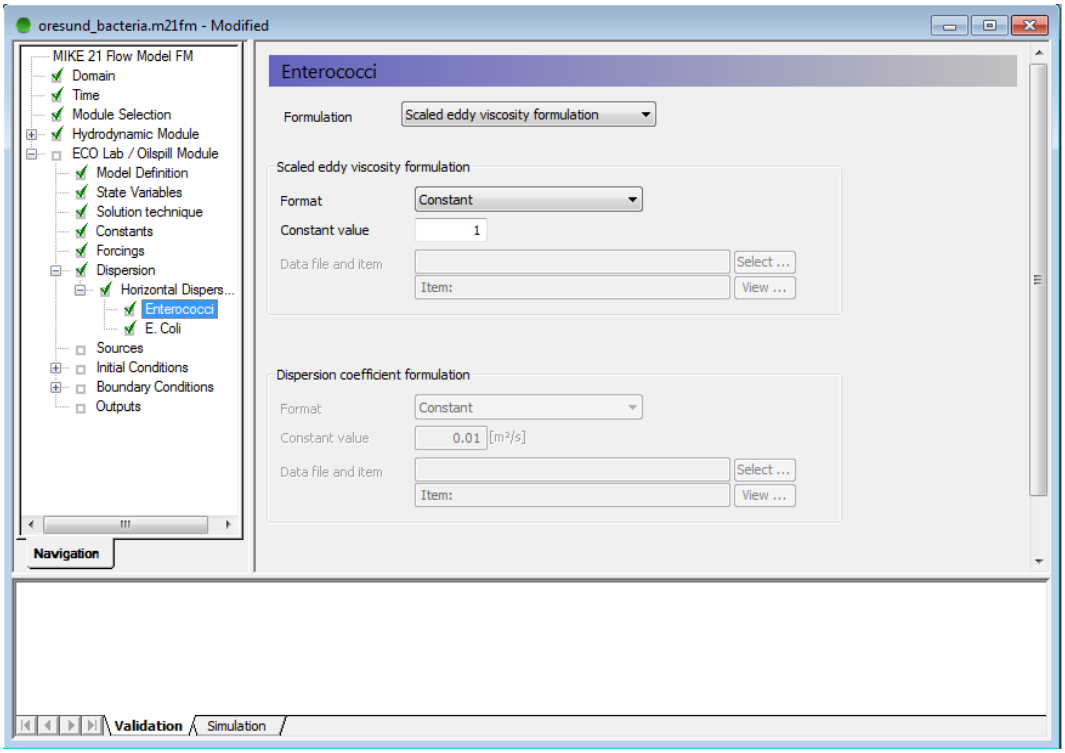
Forcings

9. In the ‘Forcing menu you include the constants as stated in the power point.



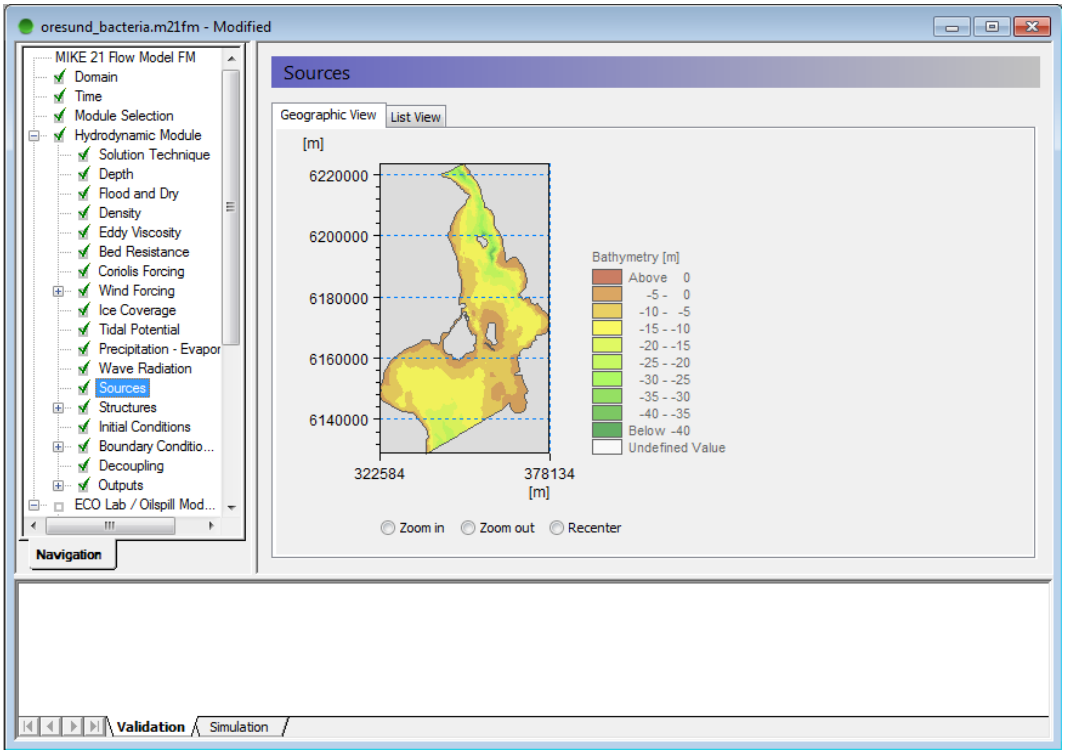
Dispersion

10. For the Dispersion you include ‘Scaled Eddy Viscosity Formulation’ and keep the constant value at 1.

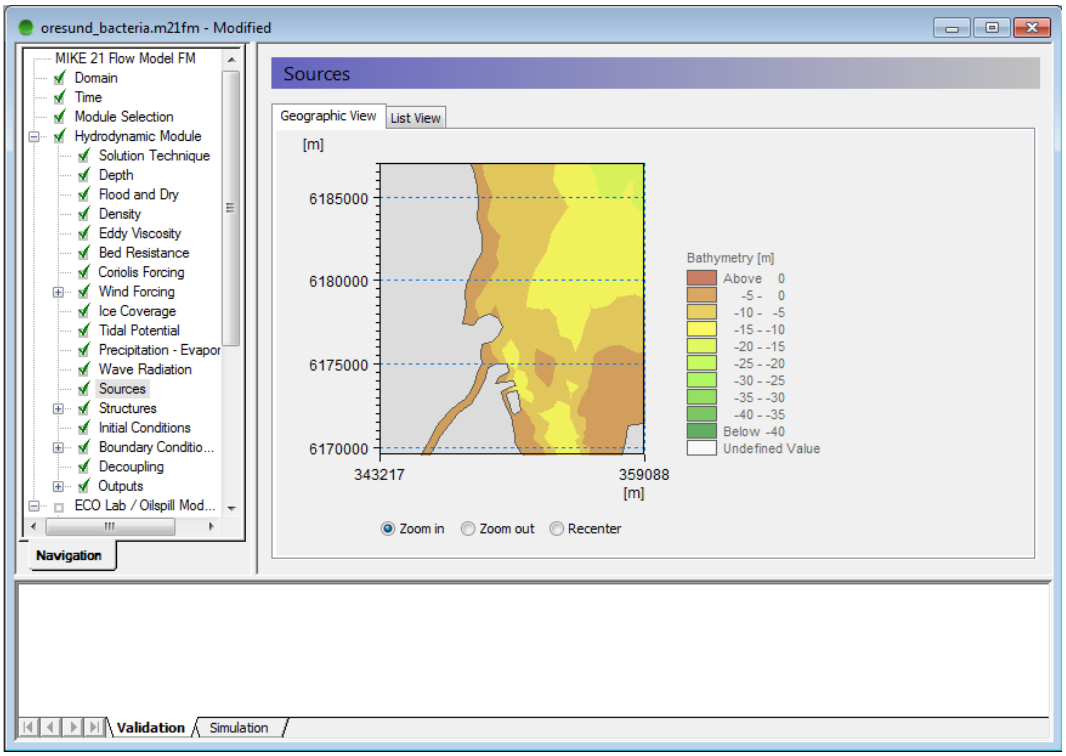


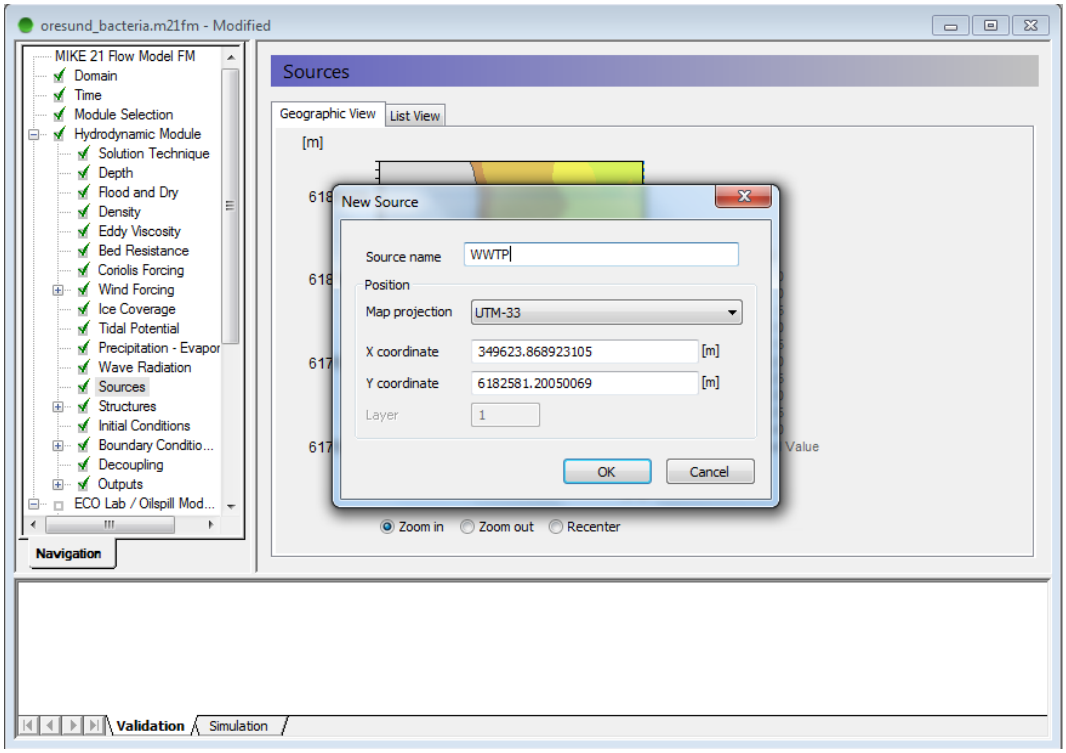
Sources specification

11. For the sources you first need to include one source in the ‘Hydrodynamic section’ – open the hydrodynamic module and enter the ‘Source’ folder.

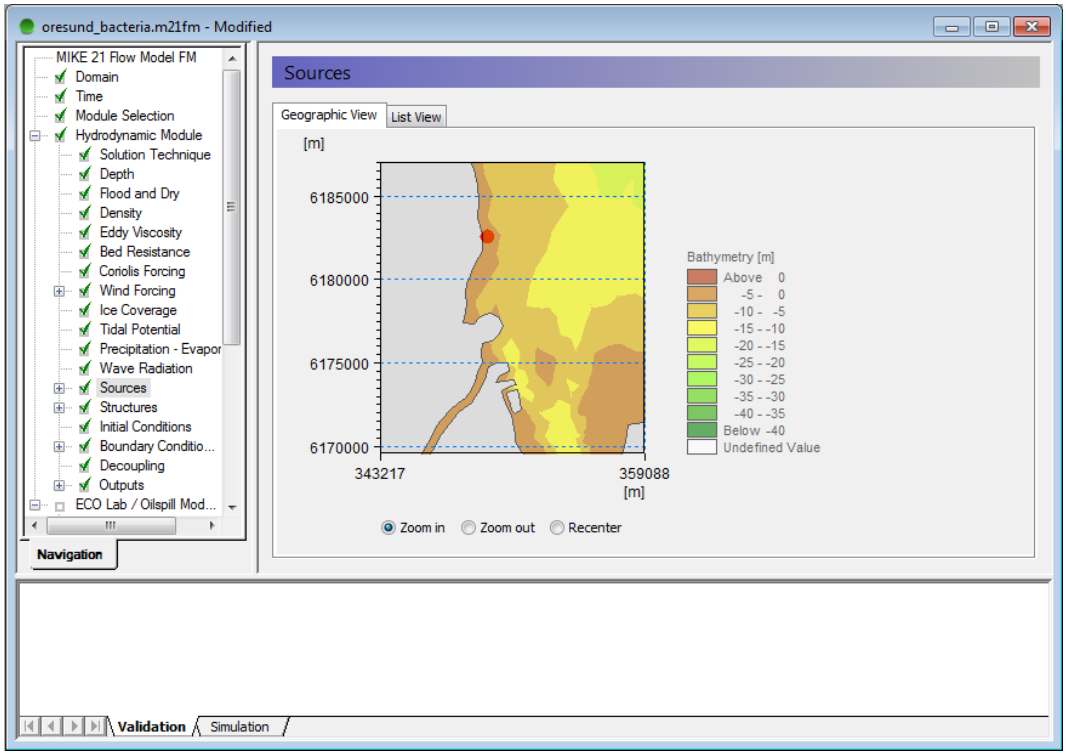


12. Zoom in to a coastal area and double click where you would like to include the source.

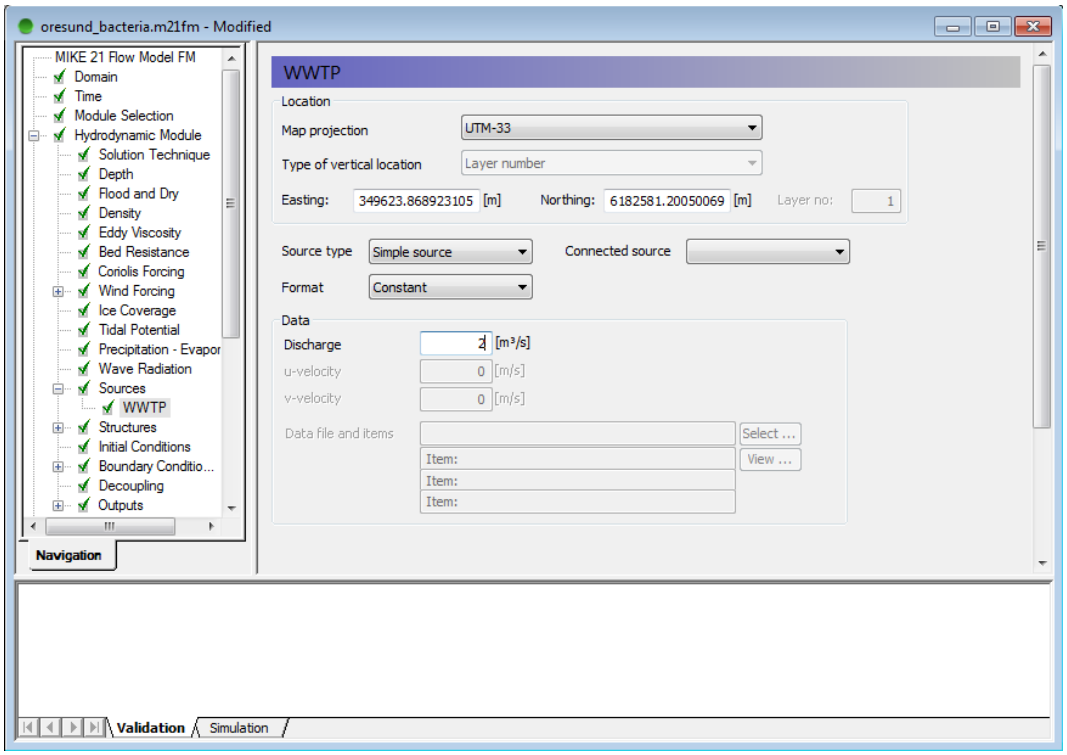




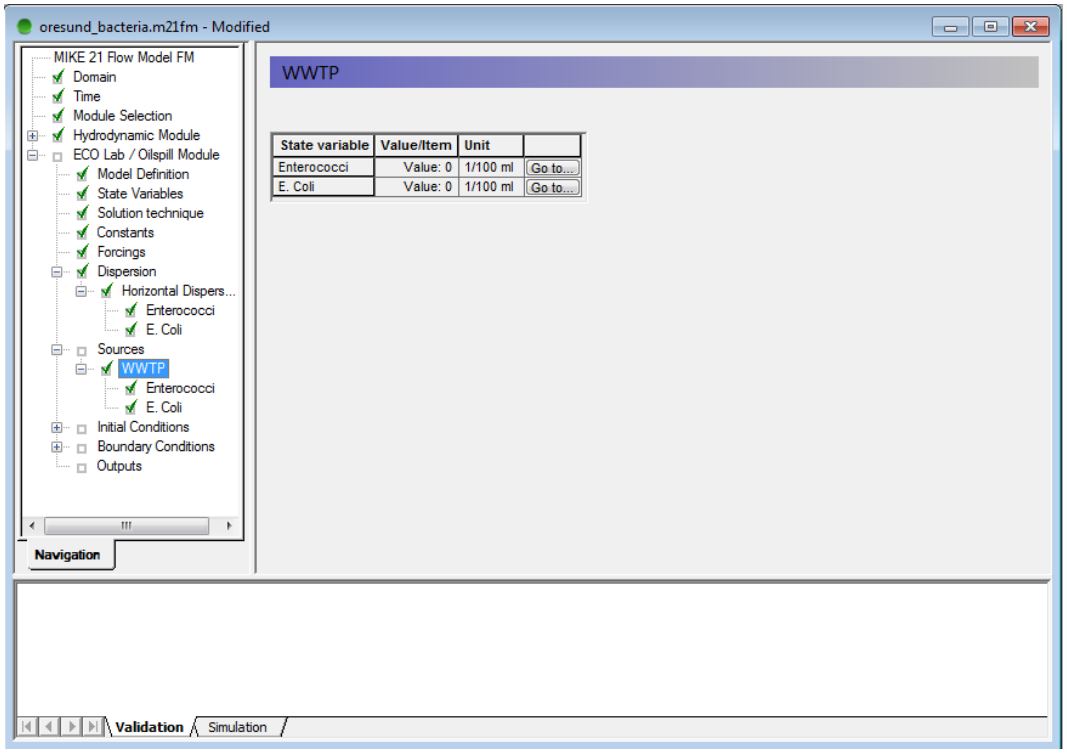
13. You now have a source, and the location is shown on the map.



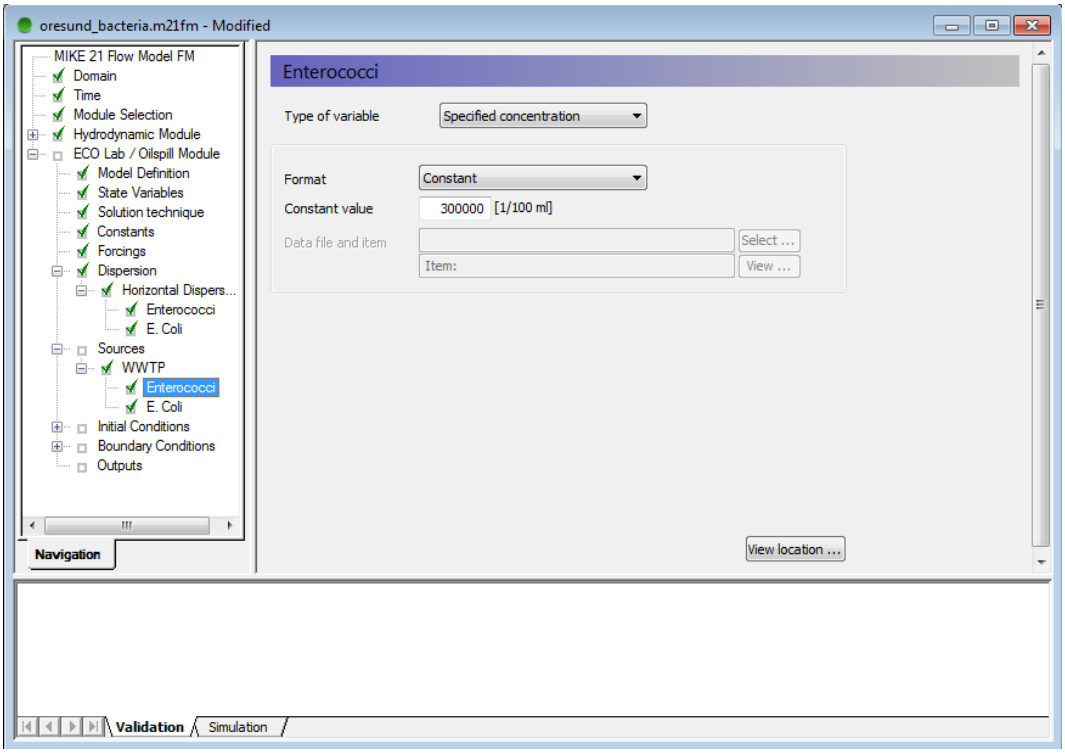
14. Enter the list view, press the ‘go to’ button and include a discharge as listed in the power point.



15. Close the ‘Hydrodynamic section’ and enter the ‘Source’ menu in the ECO Lab section.



16. Press the ‘Go to’ button and enter concentrations as listed in the power point. 300000 enterococci/100 ml and 1000000 E.coli/100 ml.

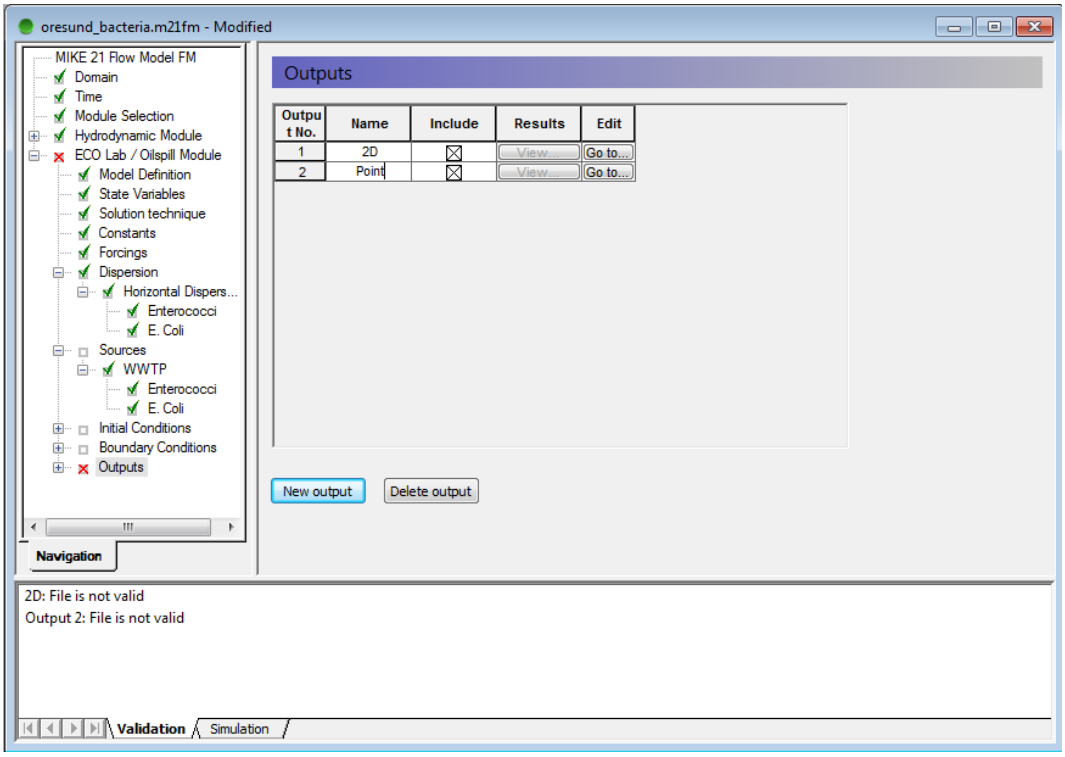


Initial Conditions and Boundary Conditions

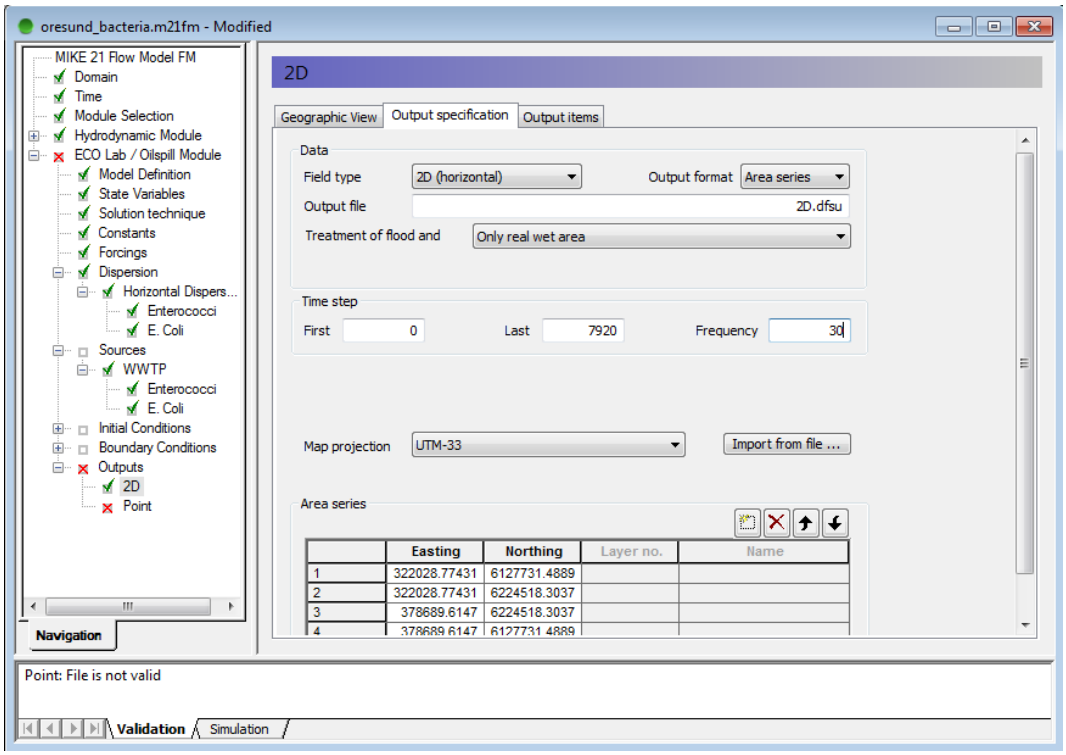
17. Default values for the two bacteria are zero, why we do not need to change anything in the menus for ‘Initial Conditions’ and ‘Boundary Conditions’.

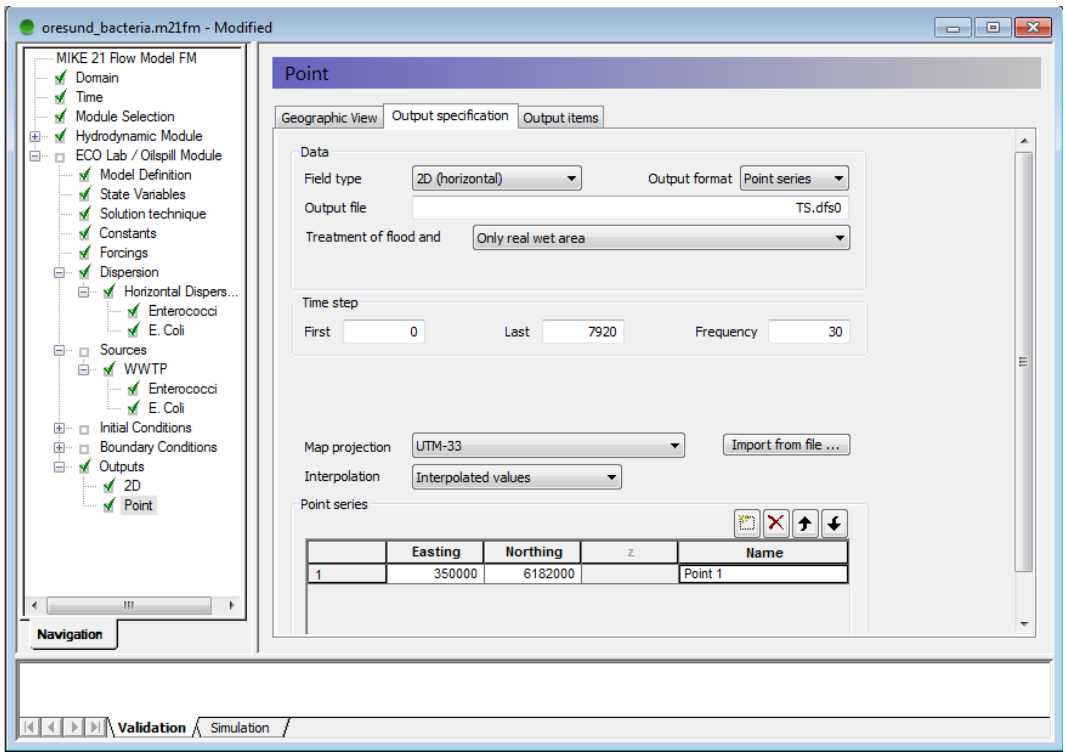
Output specification

18. Enter the output menu and include two new outputs. Name them 2D and Point.



19. Create a 2D output file and a similar time series output as shown in the figures below.



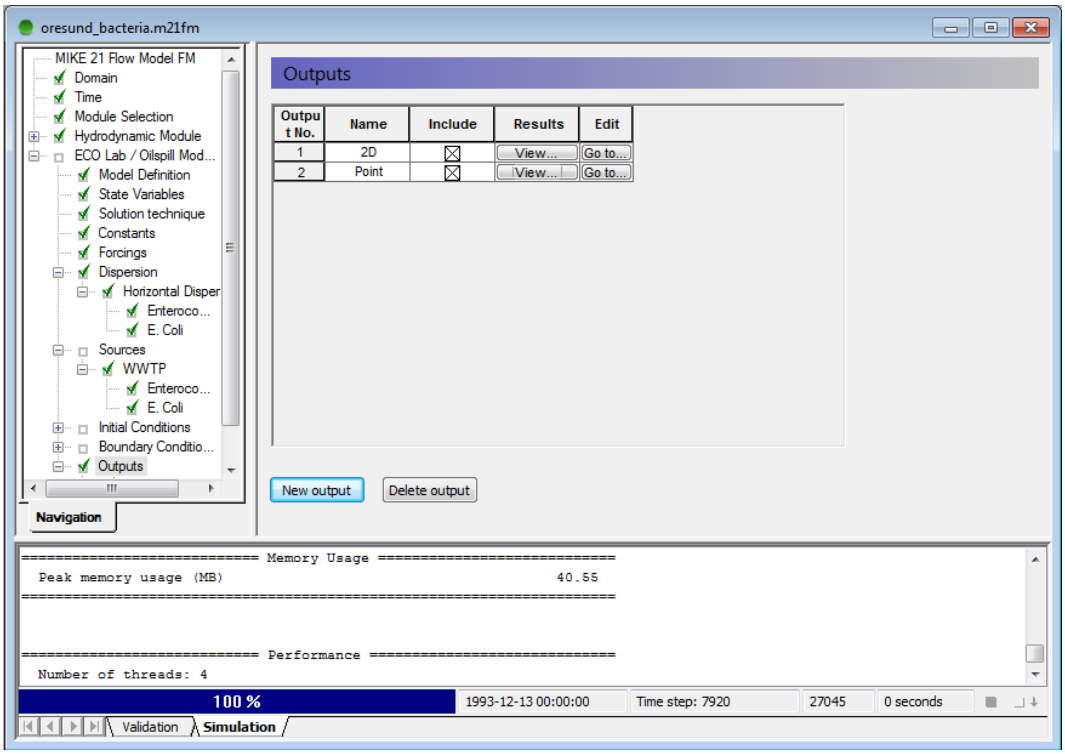


Model execution

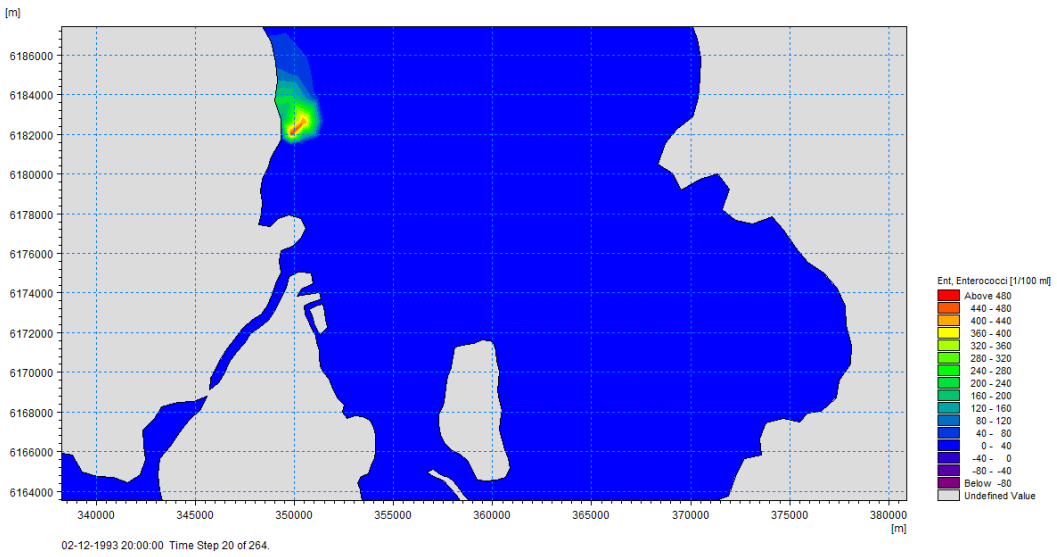
20. Run the model. If the model does not start running, please remove the output from the ‘Hydrodynamic selection’ (the folder for the HD results might be ‘read only’).

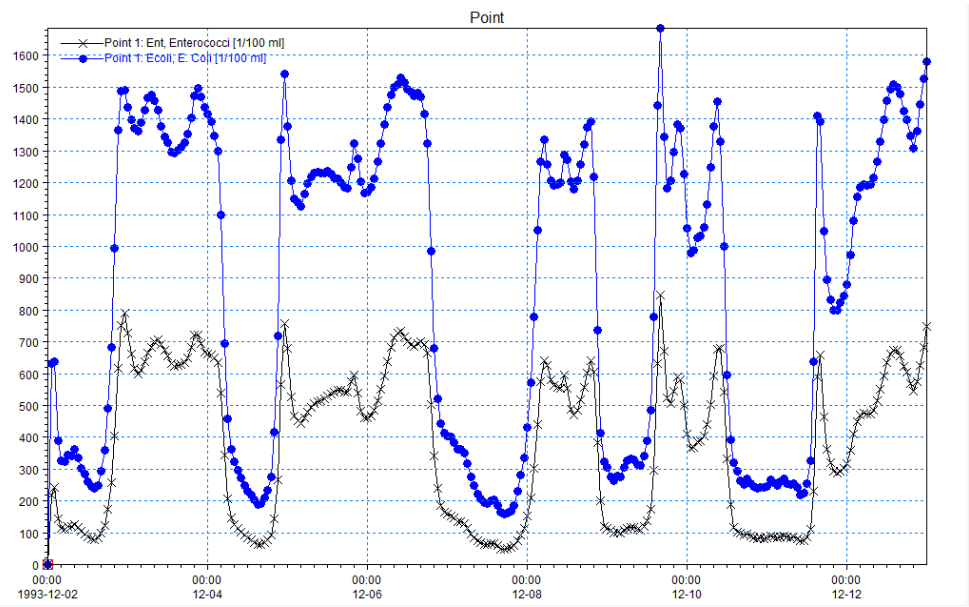
Model results

21. When the model run is completed the model results can be viewed from the output menu, by pressing the ‘view’ button.



22. The 2D results provide an overview of the transport and dilution of the bacteria source, whereas the point series show the results over time. The variance in the concentrations is governed by the current direction.





	Time	1:Point 1: Ent, Enterococci [
0	02-12-1993 00:00:00	0
1	02-12-1993 01:00:00	218.374
2	02-12-1993 02:00:00	243.532
3	02-12-1993 03:00:00	142.997
4	02-12-1993 04:00:00	114.331
5	02-12-1993 05:00:00	111.861
6	02-12-1993 06:00:00	119.668
7	02-12-1993 07:00:00	119.088
8	02-12-1993 08:00:00	126.029
9	02-12-1993 09:00:00	117.33
10	02-12-1993 10:00:00	104.118
11	02-12-1993 11:00:00	97.198
12	02-12-1993 12:00:00	87.468
13	02-12-1993 13:00:00	82.2505
14	02-12-1993 14:00:00	79.2715
15	02-12-1993 15:00:00	83.0601
16	02-12-1993 16:00:00	98.5575
17	02-12-1993 17:00:00	123.231
18	02-12-1993 18:00:00	175.008
19	02-12-1993 19:00:00	256.768
20	02-12-1993 20:00:00	403.299
21	02-12-1993 21:00:00	617.353
22	02-12-1993 22:00:00	752.769
23	02-12-1993 23:00:00	789.978
24	03-12-1993 00:00:00	727.124
25	03-12-1993 01:00:00	662.701
26	03-12-1993 02:00:00	615.383
27	03-12-1993 03:00:00	597.831
28	03-12-1993 04:00:00	609.505
29	03-12-1993 05:00:00	636.789
30	03-12-1993 06:00:00	664.524
31	03-12-1993 07:00:00	683.063
32	03-12-1993 08:00:00	700.34

23. Applying the statistics from the ‘tool’ menu you can calculate the average concentration from the two bacteria: Enterococci and E.coli. For the example provided the average of the two are 379 enterococci/100 ml and 876 E.coli/100 ml.

24. Now try to change the Secchi depth in the ‘Forcing’ menu from 2 m to 5 m. Save the setup in a new name and repeat the model run.

25. The statistics from the model results now show 277 enterococci/100 ml and 575 E.coli/100 ml. Similar tests can be executed by changing temperature, salinity etc.

26. As stated in the power point, you can also try to do the same exercise by applying a 3D model setup. In this case include the source in the surface layer, but keep the remaining constants as in this 2D example.