D-Water Quality modelling with DELWAQ: Open source code compiling and start modelling in Windows

Webinar, March 13, 2013
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Webinar overview

• Introduction
• Quick walkthrough getting and compiling Delft3D and DELWAQ
• Short tour through the source code of DELWAQ
• Common errors when trying to run DELWAQ in debug mode
• Performing a D-Water Quality calculation using the Delft3D GUI
• Questions & answers
Introduction
About this webinar:

Presenter: Michel Jeuken
Organization: Roderik Hoekstra
Cooperators: Jan van Beek
Adri Mourits

Use the webinar chat option for questions
Introduction

Assumed knowledge to follow this webinar

• Just some general knowledge about (what is):
  • Downloading
  • Source code
  • Compiling
  • Binaries (executable, dlls)
  • Run a simulation

• Advised:
  • What is water quality modelling
  • What is Subversion?
Previous webinars on compiling and running Delft3D:

- January 2012 webinar: Compiling on Linux
- February 2012 webinar: Compiling on Windows

This webinar:

- Compiling and running DELWAQ D-Water Quality on Windows
- DELWAQ also compiles and runs on Linux. We tested this using the both the Intel Fortran compiler and GNU Fortran compiler on Red Hat Enterprise.
Introduction

What is DELWAQ D-Water Quality modelling?
- selective modelling of substance and process
- library with substances (>140) and processes (>100)
- several numerical schemes for different requirements
- grid aggregation of the flow grid (2D and 3D)
- output option of derived parameters
- statistical output

What is in open source?
- delwaq1.exe & delwaq1_lib.dll (pre-processing input)
- delwaq2.exe & delwaq2_lib.dll (actual computational kernel)
- This includes the full processes library
Where are delwaq1 delwaq2 used?

- Water quality library
- PLCT GUI
- GUI user input
- other model input
- Delwaq simulation output
- Post Processing
- User

- Hydrodynamic result
- Template file
- Hydr. model
- User input
- Library routines + optional user dll's
- WQ-Model-A
- DELWAQ1 .wrk - files
- DELWAQ2

**Introduction**

Where are delwaq1 delwaq2 used?
Prerequisites
Prerequisites

… for working with the Delft3D-FLOW/-WAVE/-DELWAQ open source code:

www.oss.deltares.nl -> Delft3D -> Download -> Source code ->

1. Prerequisites

- TortoiseSVN (www.tortoisesvn.net) (this webinar: 1.7)
- Intel Fortran compiler 11.0 or higher (this webinar: 12.0)

Also used in this webinar: Total Commander (www.ghisler.com)
(for exploring files/directories)
To run a water quality model you also need output from a hydraulic model like:

- Delft3D
- SOBEK (Not open source)
- Telemac
Downloading the source code
Downloading the source code

First: register on www.oss.deltares.nl -> Delft3D -> Getting started
Then: follow www.oss.deltares.nl -> Delft3D -> Download
   -> Source code -> 3. Download the source code

SVN repository:
• Trunk, main line:
  • Fixing bugs, new developments being merged in, being tested
    => Possibly not stable
• Tags:
  • Copies of stable, fully tested Trunk-revisions
• Branches:
  • Separate develop versions
  • “Your own private version”

We will refer to the folder where you downloaded the code as <myCode>
Switching to hands on of downloading the source code

Using tagged version **research/2360**:  
https://svn.oss.deltares.nl/repos/delft3d/tags/research/2360

**NOTE:** Because of current developments in flow, there is no tagged version of delft3d oss with DELWAQ. We temporarily tagged a version with a stable DELWAQ code that includes a flow that didn’t pass the test bench.
Compiling the source code
Compiling the source code

www.oss.deltares.nl -> Delft3D -> Download -> Source code
-> 4. Compile the source code

1. Open `<myCode>`\`src\d_hydro_open_source.sln` in VS2008 or `<myCode>`\`src\d_hydro_open_source_vs2010.sln` in VS2010
2. Select the "solution configuration" you want: Debug or Release
3. `<Ctrl>><Shift>B`
4. The binaries are installed in directory
   `<myCode>`\`bin\win32` (when building a release)

or in the subdirectory of the executable, e.g.
`<myCode>`\`src\engines_gpl\waq\bin\Debug` (when building a debug)
Switch to hands on of compiling the source code
Short tour through the source-code of DELWAQ
Hands on in Visual Studio

- `delwaq1.exe` which runs `delwaq1_lib.dll`
- `delwaq2.exe` which runs `delwaq2_lib.dll`
- `waq_plugin_wasteload.dll`

- Most of the actual code in:
  - `waq_io`
  - `waq_kernel`
  - `waq_utils_c`
  - `waq_utils_f`
Short tour through the source-code of DELWAQ

Delwaq1

- `dlwq00.f`
- `dlwq01.f`
- `dlwq02.f`
- `dlwq03.f`
- `dlwq04.f`
- `dlwq05.f`
- `dlwq06.f`
- `dlwq07.f`
- `dlwq08.f`
- `dlwq09.f`
- `dlwqS1.f`
- `dlwqP1.f`
- `dlwq5a.f`

Reads all sections of the input file
And prepares the wrk-files for delwaq2

produces runID.lst output file

produces runID.lsp output file
Short tour through the source-code of DELWAQ

Delwaq2

- delwaq2.f
- dlwqi0.f
- dlwqn1.f
- dlwqna.f
- dlwqno.f

initialization

switch to 1 of the 23 integration routines

For historical reasons:
- in 1986 a PC had 640 kB memory
- the (then 7) integration routines were placed in overlays to save memory
Short tour through the source-code of DELWAQ

Delwaq2

Dlwqn#.f

dryfld.f

dlwq_mt3d.f90

proces.f

boundio & openda

dlwq17.f

ndlqo2.f

delpar01.f

ndlq41.f

ndlq15.f

dlqw#........f

dlwert0.f

dlwcqe.f

proint.f

dlwq13.f

drying and flooding
coupling to groundwater
call to the processes library
domaindecomposition / openDA
set boundary conditions
does all output

→ optional end of simulation

sets a particle tracking step
get the new volumes (after $\Delta t$)
add the loads and withdrawals
numerical core of this solver
update other time functions
optional closure error correction
accumulate fluxes for balances
at end write restart file
Compiling the source code (reprise)

Test the resulting binaries:
• Run the script in `<myCode>/examples/06_delwaq`
Debugging in Visual Studio
Give the right arguments to delwaq (1+2):

- Compile the debug version
- Set the right start-up project
- Set the correct working directory (1+2)
- Set the name of the inp-project file (1+2) and
  –p "<myCode>\bin\win32\waq\default\proc_def" as arguments
  (1 only)
- Add a breakpoint
- And start debugging…

- Hands on example data: <myCode>/examples/06_delwaq
Running D-Water Quality using the Delft3D GUI
Obtaining the GUI for the open source engines:

- Visit [http://oss.deltares.nl/web/delft3d/source-code](http://oss.deltares.nl/web/delft3d/source-code)
- Send a mail to receive a download link to:
  
  delft3d_ohmw_4.01.00.rc.01.zip
- Unzip the contents of Delft3D folder in the zip-file to a desired location (e.g. C:\delft3d_ohmw_4.01.00.rc.01\)
  
  - We will refer to the folder where you downloaded the code as <myDelft3D>
- Run <myDelft3D>\substitute_delft3d_env.bat
- Don’t forget to copy the binaries you created from the Delft3D oss source!
  
  - Copy <myCode>\bin\win32 to <myDelft3D>\win32
- To start the GUI run <myDelft3D>\Delft3D\d3d_menu.bat
Switching to hands on running DELWAQ with the GUI

Tutorial data can be found in:
<myDelft3D>/tutorial/waq/friesian_tidal_inlet

Problems running DELWAQ?
First look in lst and lsp file (delwaq1) and the mon file (delwaq2)
Questions & answers
Q: Where do I start from here?
A: Read the general User Manual, and do the tutorial (Chapter 7):

Q: What processes are available in DELWAQ?
A: Read the Processes Technical Reference Manual:

Q: Can I edit the DELWAQ input file without the GUI?
A: Read the Description Input File:
   D-Water_Quality_Description_Input_File.pdf

Q: Can I use my own definition of water quality processes in DELWAQ?
A: Yes, please read the Open Processes Library User Manual:

Find these and all other manuals in <myDelft3D>\manuals
General Delft3D Questions & answers
Q: Can I get pre-built tested executables?
A: Yes, via service packages:
   www.oss.deltares.nl -> Delft3D -> Services

Q: How can I get help on compiling?
A: 1) Info: www.oss.deltares.nl -> Delft3D -> Download
    -> Source code
2) FAQ: www.oss.deltares.nl -> Delft3D -> FAQ
3) Forum: www.oss.deltares.nl -> Delft3D -> Discussion Groups
    -> General

Q: How can I get help on modelling?
A: 1) Training courses: www.oss.deltares.nl -> Delft3D -> Services
   2) Forum: www.oss.deltares.nl -> Delft3D -> Discussion Groups
Q: How can I contribute my own source code?
A: Bugfixes/minor improvements: put on the forum
   (optional: TortoiseSVN -> create patch)
   Get your own branch to work in: mail to oss-webmaster@deltares.nl

Q: Will this webinar be placed on the oss-site?
A: Yes, together with this presentation:
   www.oss.deltares.nl -> Delft3D -> Webinars

Q: What is the next webinar about?
A: “Water Quality modelling with DELWAQ: Principles and notable applications”
   Presenter: Jos van Gils
   Wednesday 10 April 2013, at 17:00 CET
   See www.oss.deltares.nl -> Delft3D -> Webinars