



# Delft3D 4 Open Source Workshop

**Delft, Nov. 02, 2017**

**Adri Mourits**

**Qinghua Ye**



# Safety in mind

Deltares cares about people. We identify risks, choose to work safely, take our responsibility seriously in looking out for each other and learning from experiences to improve:

[safety@deltares.nl](mailto:safety@deltares.nl)

This way we work safely, without accidents!

**Safety in mind**

## Welcome to Deltares

An emergency, call **+31(0)88 335 7112**

Make sure you know the location of the nearest by emergency exit

Scheduled emergency drills today: **none**

### **In case of an emergency:**

Follow the instructions given by your host or the company emergency services (BHV)

### **When visiting our research facilities:**

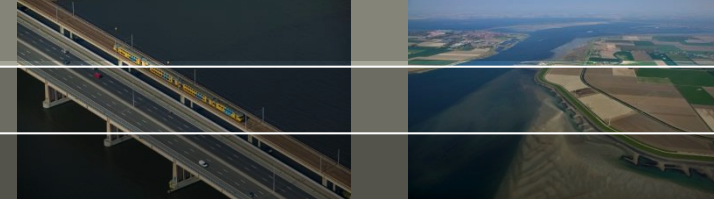
- *Stay with you host*
- *Stay inside the 'blue zone' or marked-off area*
- *Permission is required beforehand if photos or films are to be taken*

WIFI: Deltares / password: pw4GUESTatDeltares

We wish you a pleasant and safe visit and like to thank you for your cooperation.

**Deltares**

# Overview

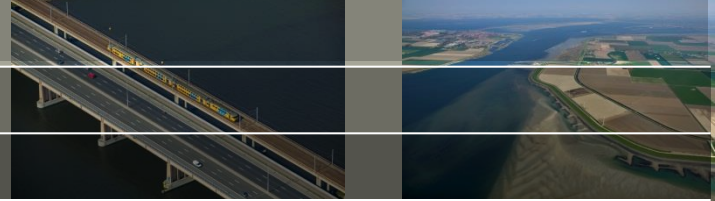


- Introduction Adri
- **Download** You
- Code management Adri
- Development environment Adri
- **Exercises** You
- General code structure Delft3D-FLOW, -MOR, -WAVE Adri
- Ongoing developments Adri
- Short topics Adri

## **Exercises**

Central hall: **You**  
Coffee: 10:30 – 11:00  
Lunch: 12:30 – 14:00  
Coffee: 15:30 – 16:00  
Drinks: 17:30 – 18:30

# Overview



## Organization of this workshop

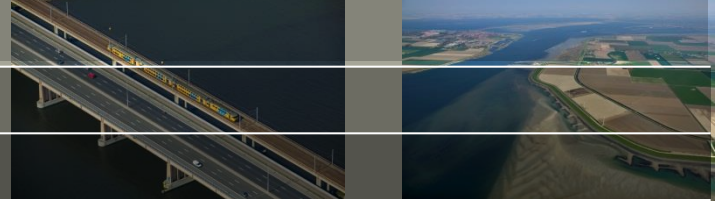
- You will download all information in a minute  
No writing needed
- You do the work
- Adri and Qinghua will coach you
- Work on exercises/your own stuff
- Switch to other workshops
- For the rest:



An aerial photograph showing a large-scale coastal defense system. A prominent dike with a grassy top runs along the edge of a polder, separating it from a large body of water. The polder is divided into various agricultural plots, some of which are brown (plowed) and others green. In the background, a town is visible on a peninsula. The sky is clear and blue.

# Introduction

# Introduction



- Assumed knowledge
  - What is Delft3D?  
<https://www.deltares.nl/en/software/delft3d-4-suite/>
- Delft3D 4 versus Delft3D Flexible Mesh
- NOT in this workshop
  - GUI usage  
<http://oss.deltares.nl/web/delft3d/screen-casts>
  - Creating a model  
<http://oss.deltares.nl/web/delft3d/modelling-guidelines>  
<http://oss.deltares.nl/web/delft3d/training-courses>



Adri Mourits



Qinghua Ye

# Open Source Software site: [www.oss.deltares.nl](http://www.oss.deltares.nl)

## Communities



**Delft3D Flexible Mesh**  
Worldwide open source release is scheduled for 2017. For now, the access is limited to 157 Partners in Development worldwide.



**Delft3D Open Source**  
Integrated suite, simulating 2D/3D flow, sediment transport and morphology, waves and water quality



**OpenEarth Open Source**  
Free and open source initiative to deal with Data, Models and Tools



**XBeach Open Source**



**iMOD Open Source**



**Delta Shell Free Software**

## Communities



**OpenDA Open Source**  
Open interface standard for data-assimilation and calibration of arbitrary numerical models



**OpenMI Open Source**  
Open Modelling Interface standard linking any combination of models, databases and visualisation tools



**RTC-Tools Open Source**  
Modular toolbox dedicated to real-time control (RTC) of hydraulic structures



**Delft-FEWS Free Software**  
Open data and model handling



**DELWAQ Open Source**  
Delft3D engine for water quality and



**Lockfill Free software**  
A quick model determining leveling times and forces on vessels in shipping locks.

## Communities

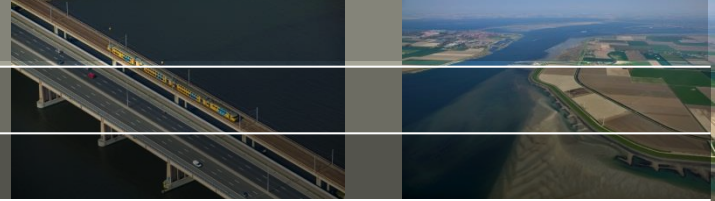


**Serious Gaming Open Source**  
Use serious games for training



**Habitat Free software**  
A spatial analysis tool for ecological assessment of floral or faunal habitat quality and suitability

# Introduction

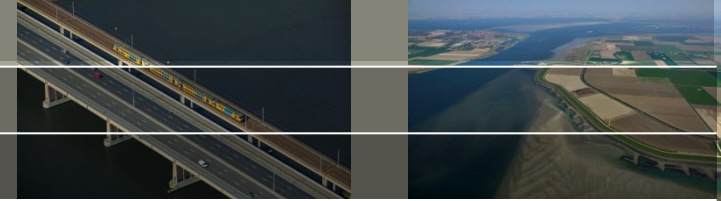


Open Source Software site: [www.oss.deltares.nl](http://www.oss.deltares.nl) -> Delft3D:

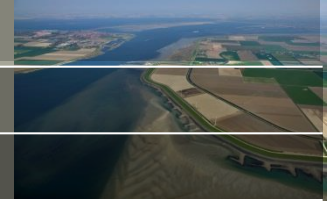
- Getting started, download source code
- Screen casts
- Webinars
- Modelling Guidelines
- FAQ, release notes
- Forum/discussion groups



# Download



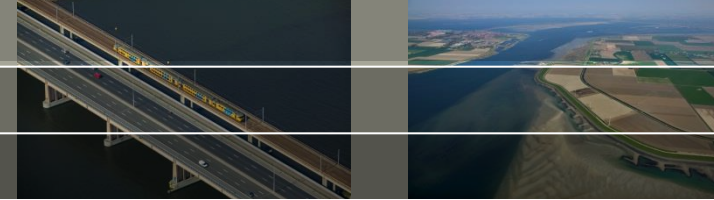
1. Have you installed all [prerequisites software](#)?
2. Are you registered at [oss.deltares.nl](https://oss.deltares.nl)?
3. Use TortoiseSVN to download:  
[https://svn.oss.deltares.nl/repos/delft3d/branches/research/Deltares/20171102\\_workshop](https://svn.oss.deltares.nl/repos/delft3d/branches/research/Deltares/20171102_workshop)  
(~ 5 seconds)
4. Use TortoiseSVN to download:  
<https://svn.oss.deltares.nl/repos/delft3d/tags/7545>  
(~ 5 minutes)



Functionality

APPLICATION

Region



## VisualStudio 2010

check that “Service Pack 1” is installed:

Menu -> Help -> About Microsoft Visual Studio:

Microsoft Visual Studio 2010 Professional - ENU Service Pack 1 (KB983509)  
KB983509

If not: execute “...\\workshop\\sourcecode\\VS10sp1-KB983509.exe”  
(~ 50 minutes)

## VisualStudio 2012

Idem KB2781514,

“...\\workshop\\sourcecode\\VS12patch\_KB2781514.exe”

## VisualStudio 2015 and up

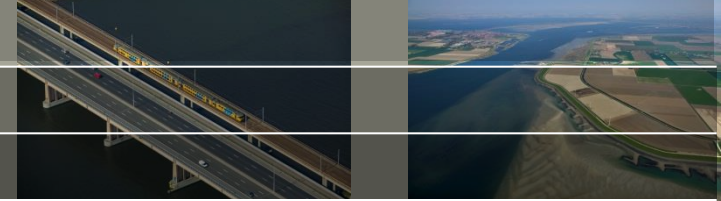
Follow “[this post](#)” link at

<http://oss.deltares.nl/web/delft3d/source-code#prerequisites>

## Linux

You have to take care of all the [prerequisites](#) yourself

# Compilers



## VisualStudio 2010

C/C++ in VisualStudio

Intel Fortran compiler 2011 or higher

## VisualStudio 2012

C/C++ in VisualStudio

Intel Fortran compiler 2013 or higher

## VisualStudio 2015 and up

C/C++ in VisualStudio

Intel Fortran compiler 2016 or higher

## Linux

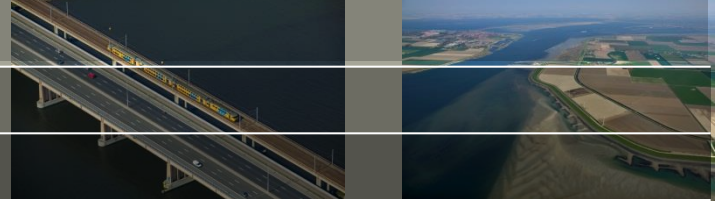
Gnu C/C++/Fortran compilers (free of charge)

or Intel C/C++/Fortran compilers



# Code management

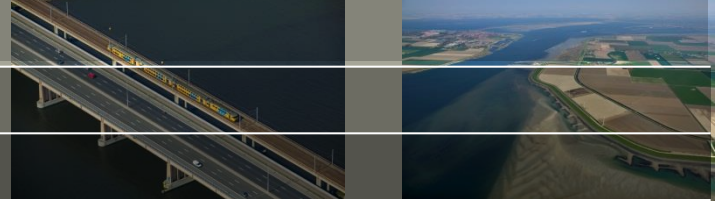
# Code management



## Overview:

- SVN
- Setups
- FLA
- Future Open Source plans

# Code management - SVN



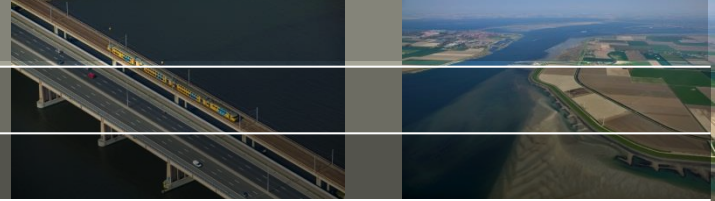
- Trunk, main line:
  - Fixing bugs
  - New developments being merged in
  - Run on testbench

=> Possibly not stable
- Tags:
  - Copies of stable, fully tested Trunk-revisions

=> Use the latest. Currently

<https://svn.oss.deltares.nl/repos/delft3d/tags/7545>
- Branches:
  - Separate develop versions
  - “Your own private version”

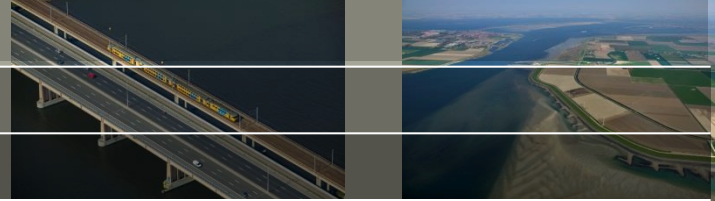
# Code management - SVN



- New branch:
  - For “big” changes
  - When stability is harmed too much
  - Private developments



# Code management



## Overview:

- SVN
- **Setups**
- FLA
- Future Open Source plans

# Code management – Setups

Source code

TEMPORARY EXTRA SERVICE

As long as the source code of the Delft3D graphical user

Receiving from Deltares:

Setups (Windows):

- [Open source installation](#) (“Install-Shield.exe”):  
All User Interfaces but not the FLOW/PART/WAQ/WAVE executables
- Services installation:  
All user interfaces and also FLOW/PART/WAQ/WAVE executables  
(Delft3D service package needed, see <http://oss.deltares.nl/web/delft3d/service-packages>)

Setups (Linux):

- GUIs currently not available
- Services installation: FLOW/PART/WAQ/WAVE executables  
(Delft3D service package needed)
- [hub.docker.com](http://hub.docker.com): create account, request to software@deltares.nl

License File needed when using UserInterfaces / Delft3D-menu.

# Code management – from Deltares



Receiving from Deltares:

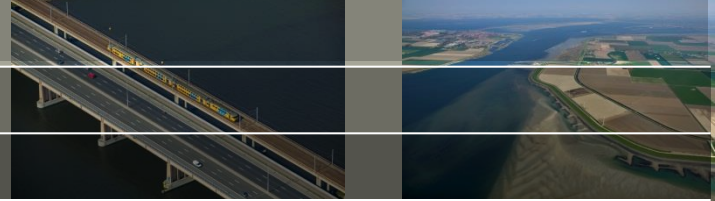
GUI

- QuickPlot source code:

[https://svn.oss.deltares.nl/repos/delft3d/trunk/src/tools\\_lgpl/matlab/quickplot](https://svn.oss.deltares.nl/repos/delft3d/trunk/src/tools_lgpl/matlab/quickplot)

MatLab needed.

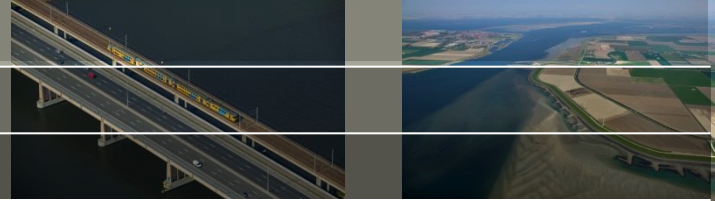
# Code management



## Overview:

- SVN
- Setups
- **FLA**
- Future Open Source plans

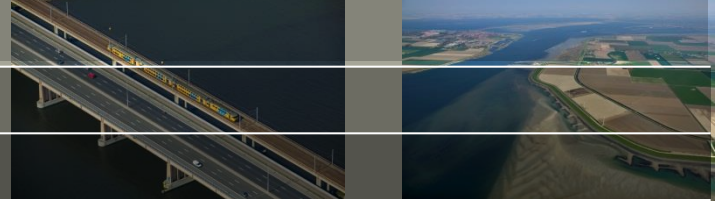
# Code management - FLA



FLA

When delivering source code changes, an [FLA agreement](#) must be signed.

# Code management



## Overview:

- SVN
- Setups
- FLA
- Future Open Source plans

# Code management – future plans



## Future Open Source plans

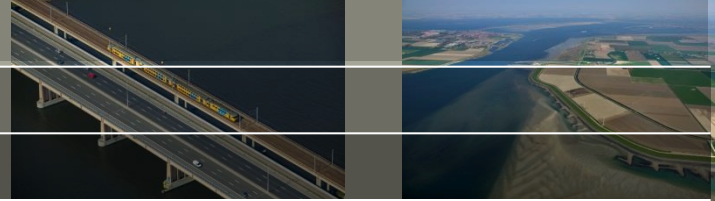
- Flexible Mesh:
  - Currently in a restricted community
  - Source code is available
  - Fully available in 2018
- Delta Shell: request to [software@deltares.nl](mailto:software@deltares.nl)

An aerial photograph showing a coastal development environment. A large body of water is on the left, with a green dike separating it from a large area of agricultural fields. The fields are divided into various colored plots, including green, brown, and tan. A road runs along the dike, and there are some buildings and structures visible. The sky is clear and blue.

# Development environment

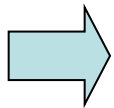


# Development environment



## Overview:

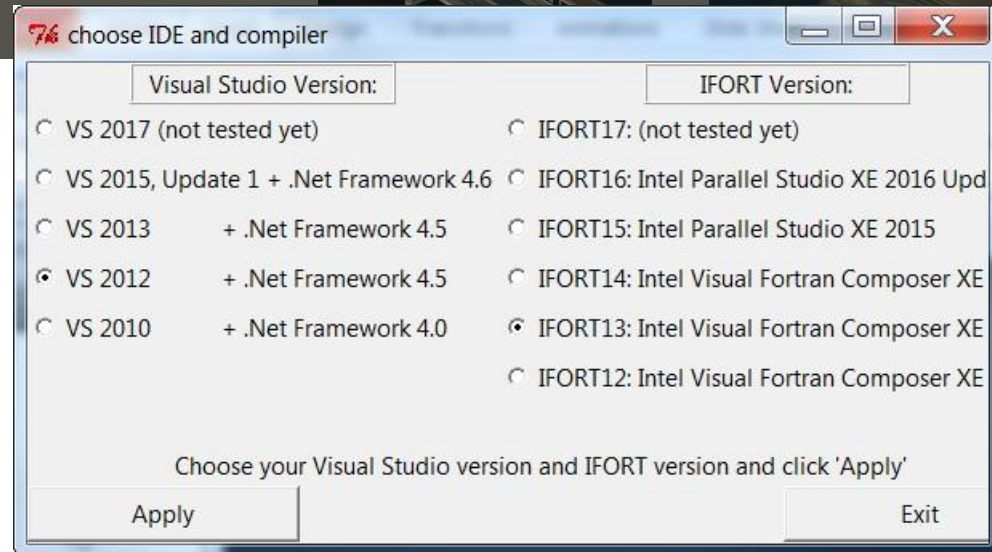
- Windows
  - VisualStudio 2010-2015
- Linux
  - Automake, valgrind
- Resulting files
- Version numbers



See file “....\src\README “

# Development environment Windows

- Execute “prepare\_sln.py”
- Select VS- and Intel-version  
Click "Apply"  
=> delft3d\_open.sln

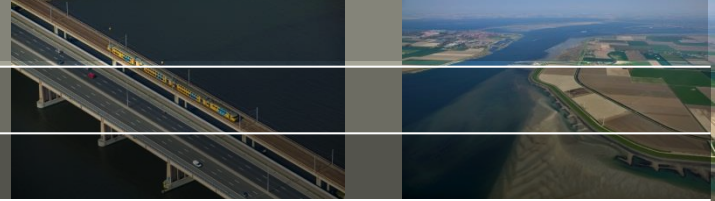


In Visual Studio:

- Build configuration “Release” (default) or “Debug” (only for tracing/solving bugs)
- Platform x64 (default)
- Build

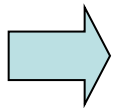


# Development environment



## Overview:

- Windows
  - VisualStudio 2010-2015
- Linux
  - Automake, valgrind
- Resulting files
- Version numbers



See file “....\src\README “

# Development environment Linux

- GNU Autotools/Libtools
- 2 build methods:
  1. If all tools are installed on default location:

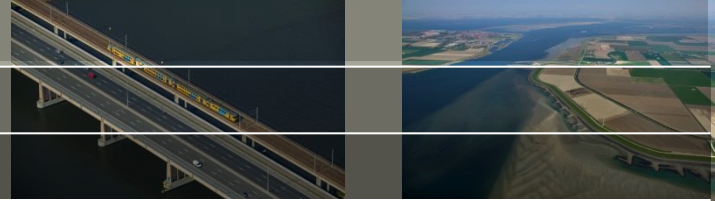
```
./autogen.sh  
./configure --prefix=`pwd`  
make ds-install
```
  2. If some tools are not on default location:  
Check paths/settings in script “build.sh” and execute  

```
build.sh -intel14 -64bit
```
- Debug:  
Add flag `-debug` when executing `build.sh`  

```
valgrind $exedir/d_hydro.exe $argfile
```

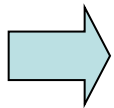
  
TotalView  
Write statements

# Development environment



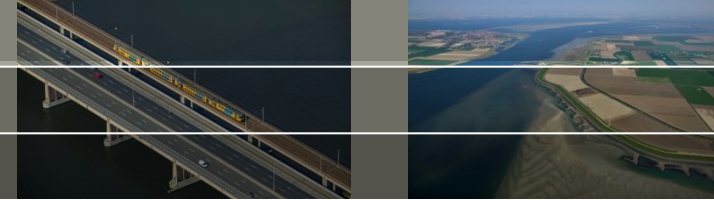
## Overview:

- Windows
  - VisualStudio 2010-2015
- Linux
  - Automake, valgrind
- **Resulting files**
- Version numbers



See file “....\src\README “

# Development environment



## Resulting release files (Windows)

- FLOW:  
src\bin\win64\dflow2d3d\bin:  
d\_hydro.exe  
flow2d3d.dll  
mormerge, plugins, datsel, kubint, lint  
delftonline.dll
- Wave with SWAN:  
src\bin\win64\dwaves\bin:  
wave.exe, wave.dll  
src\bin\win64\swan\bin:  
swan\_4072ABCDE\_del\_w64\_i11\_omp.exe
- src\bin\win64\shared:  
dll's (MPI, compiler, xml etc.)

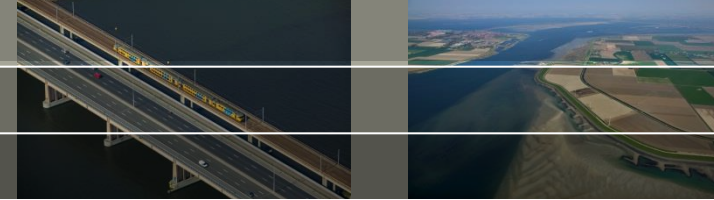
To be started  
Small executable  
XML input file

Big dll containing  
Delft3D-FLOW

Remote Online Visualisation

Install script called via “post build event”

# Development environment



## Resulting release files (**Linux**)

- FLOW:  
src\bin\Inx64\dflow2d3d\bin:  
d\_hydro.exe  
libflow2d3d.so  
mormerge, plugins, datsel, kubint, lint  
libDelftOnline so
- Wave with SWAN:  
src\bin\Inx64\wave\bin:  
wave.exe  
src\bin\Inx64\swan\bin:  
swan\_4072ABCDE\_del\_I64\_i11\_omp.exe
- src\bin\Inx64\shared:  
so's (MPI, compiler, xml etc.)

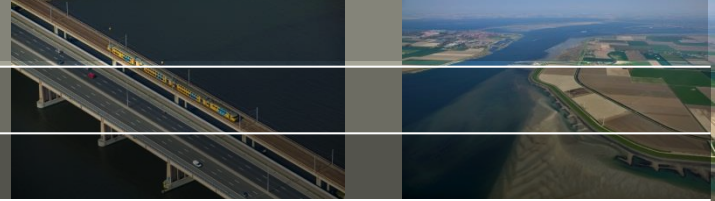
To be started  
Small executable  
XML input file

Big dll containing  
Delft3D-FLOW

Remote Online Visualisation

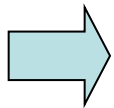
Install script called via “**ds-install rule**”

# Development environment



## Overview:

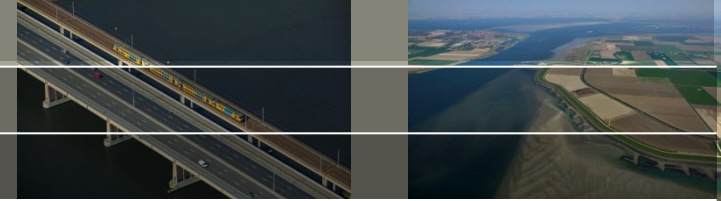
- Windows
  - VisualStudio 2010-2015
- Linux
  - Automake, valgrind
- Resulting files
- **Version numbers**



See file “....\src\README “



# Development environment



Version number

6.02.13.7545

SVN,  
Automatically  
generated  
revision  
number

Minor  
changes,  
used to  
distinct stable  
versions

New major  
functionality

Increased  
when not  
backwards  
compatible

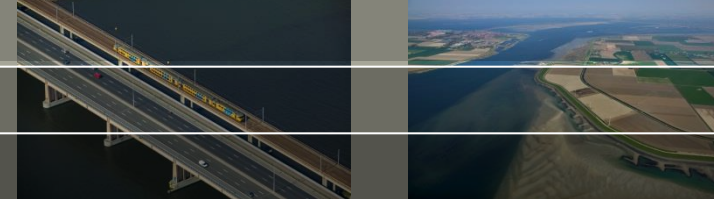
Update\_version\_tools:

- Windows: pre-build commands in projects
- Linux: make rule "BUILT\_SOURCES = ./always"

Every module has it's own version number!

Delft3D WAVE PART  
FLOW DELFTIO DIMR  
WAQ Deltares\_COMMON  
NEFISD\_HYDRO  
ESM  
D-Flow FM

# Development environment



## Update\_version\_tools:

- On every compile action, version number, date and time are generated
- Tri-diag file:

```
*** Deltares, FLOW2D3D Version 6.02.13.7545M, Sep 13 2017, 21:16:30  
***      built from : https://svn.oss.deltares.nl/repos/delft3d/trunk
```

- “c:\Program Files\Deltares\Delft3D 4.03.01\win64\lib\what.exe  
wave.exe”:

```
Deltares, Delft3D-WAVE Version 3.05.04.7545M, Sep 13 2017, 20:57:19  
Deltares, DELFTIO Version 1.09.00.7545, Sep 13 2017, 20:53:11  
Intel Fortran RTL Message Catalog      V16.0-001 Oct 15 2015  
Deltares, DELTARES_COMMON Version 1.00.00.7545, Sep 13 2017, 20:52:16  
Deltares, NEFIS Version 5.09.00.7545M (Win64), Sep 13 2017, 20:52:15
```

Starting executables:

d\_hydro executable starts Delft3D-FLOW dll

Delft3D-WAVE executable

DELWAQ executables

Running dlls via Dimr ([BMI](#)):

- Delft3D-FLOW dll
- D-Waves dll
- D-Waq dll
- D-Flow FM dll
- D-Flow1D
- D-RR
- D-RTC
- Combinations

```
<control>
  <parallel>
    <startGroup>
      <time>0.0 60.0 99999999.0<
      <coupler name="flow2rtc"/>
      <start name="myNameRTC"/>
      <coupler name="rtc2flow"/>
    </startGroup>
    <start name="myNameDFlowFM"/>
  </parallel>
</control>

<component name="myNameDFlowFM">
  <library>dflowfm</library>
  <process>0 1 2</process>
  <mpiCommunicator>DFM_COMM_DFMWORLD
  <workingDir>fm</workingDir>
  <inputFile>weirtimeseries.mdu</inp
</component>
<component name="myNameRTC">
  <library>RTCTools_BMI</library>
  <process>0</process>
  <workingDir>rtc</workingDir>
  <!-- component specific -->
  <inputFile>.</inputFile>
</component>

<coupler name="flow2rtc">
  <sourceComponent>myNameDFlowFM</so
  <targetComponent>myNameRTC</target
  <item>
    <sourceName>observations/Upstr
    <targetName>input_ObservationP
  </item>
</coupler>
<coupler name="rtc2flow">
  <sourceComponent>myNameRTC</source
  <targetComponent>myNameDFlowFM</ta
  <item>
    <sourceName>output_weir_crest_
    <targetName>weirs/weir01/crest
  </item>
</coupler>
```

An aerial photograph showing a coastal area. On the left, a large body of water (likely a bay or estuary) meets a sandy beach. A town with numerous buildings is visible on the left side. To the right, there are extensive agricultural fields in various shades of green and brown, separated by roads and ditches. A prominent feature is a long, narrow strip of land or a dike that runs along the water's edge, with several small structures or markers along its length. The sky is clear and blue.

# Exercises

# Optional exercise 4 (challenge, no guarantees)



Compiling and running D-Flow FM:

1. Checkout the trunk, revision 7758
2. Build solution “delft3d\_open.sln”
3. Build solution “dflowfm\_open.sln”

4. Run testcases in:

[https://svn.oss.deltares.nl/repos/delft3d/branches/research/Deltares/20171102\\_workshop/exercises/exercise4](https://svn.oss.deltares.nl/repos/delft3d/branches/research/Deltares/20171102_workshop/exercises/exercise4)

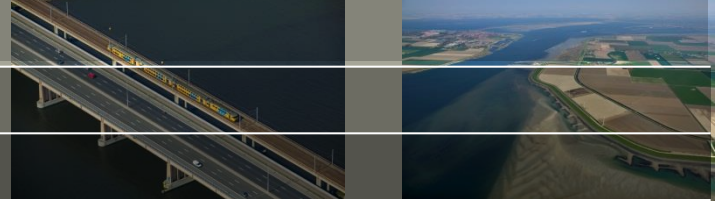
(You will need help!)

5. Compare results with given pictures

An aerial photograph of a coastal region. On the left, a large body of water (likely a bay or estuary) meets a town with numerous buildings. To the right, a large area of agricultural land is visible, divided into various colored plots (green, brown, tan). A prominent feature is a long, narrow strip of land or dike that runs parallel to the water's edge, featuring a series of small, repeating structures that appear to be part of a coastal defense or water management system. The sky is clear and blue.

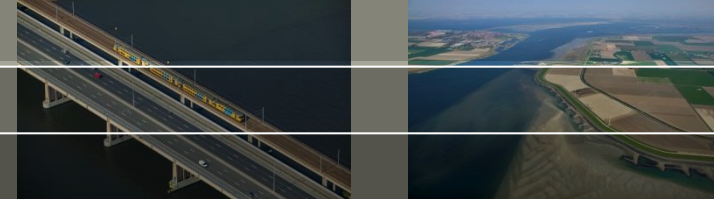
# General code structure

# General code structure



- Directory structure / VS projects
- FLOW
  - Main (DD/OLV)
  - Trisim (gdp)
  - Tricom (time loop)
  - Trisol (ADI)
- MOR
  - Eroded
  - Bott3d
- WAVE
  - SWAN
- Doxygen
- NaN check

# General code structure



FLOW Directory structure

From

top-level

To

`...\src\engines_gp\flow2d3d\packages\kernel\src\compute\adi.f90`





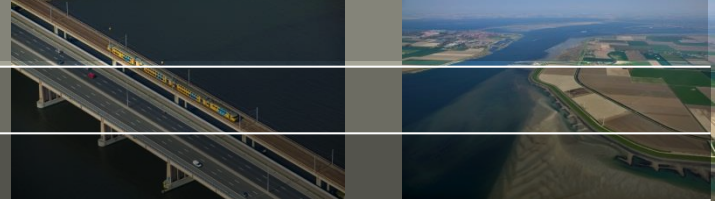
# General code structure

## Directory structure

Name	Ext	Size
[.]	<DIR>	
[.svn]	<DIR>	
[doc]	<DIR>	
[examples]	<DIR>	
[src]	<DIR>	
gpl-3.0	txt	35,824
lgpl-2.1	txt	27,032
tsvn-auto-props		1,173

Name	Ext	Size
[.]	<DIR>	
[bin]	<DIR>	
[engines_gpl]	<DIR>	
[logs]	<DIR>	
[m4]	<DIR>	
[plugins_lgpl]	<DIR>	
[scripts_lgpl]	<DIR>	
[third_party]	<DIR>	
[third_party_open]	<DIR>	
[tools_gpl]	<DIR>	
[tools_lgpl]	<DIR>	
[utils_gpl]	<DIR>	
[utils_lgpl]	<DIR>	
AUTHORS		0
autogen	sh	47,360
build	cmd	1,154
build	sh	10,890
build_gnu	sh	4,982
build_h5	sh	12,355
build_ubuntu.16.0..	readme	5,222
build_ubuntu1604	sh	11,708
build32	cmd	1,101
build32vs15	cmd	1,101
buildvvs15	cmd	1,154
ChangeLog		0
clean	cmd	203
clean	sh	2,812
common	am	4,599
configure	ac	29,624
COPYING		203
delft3d_open	sln	104,196
dflowfm_open	sln	61,828
doxyfile_delft3d		65,708
doxyfile_delwaq		66,583
INSTALL		0
install	cmd	284
install	sh	1,038
io_netcdf	sln	15,267
Makefile	am	232
nefis	sln	23,027
NEWS		0
prepare_sln	cmd	23
prepare_sln	py	27,224
README		6,415
TODD		350

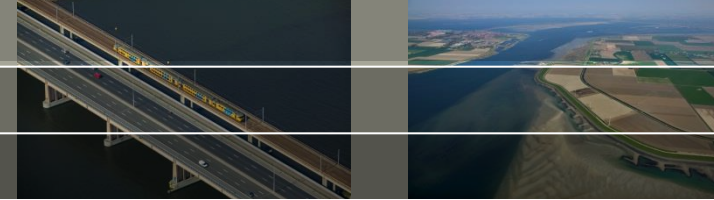
# General code structure



## Directory structure

- **Examples:** Ready-to-run testcases (after compiling release version)
- **Src:** source code
  - **Bin:** resulting executables
  - **Engines\_gpl:** source code per kernel
  - **Third\_party\_open:** source code/binaries from outside this source tree (mainly from outside Deltares)
  - **Tools:** additional programs, Post processing
  - **Utils:** Generic libraries, used by more than one kernel

# General code structure



## Directory structure

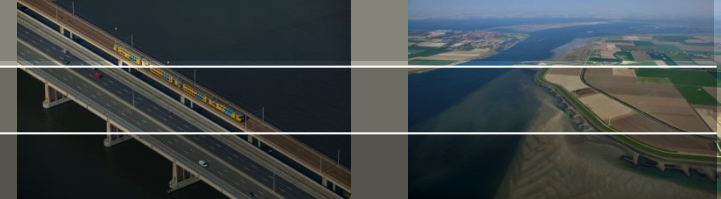
▼ c:\code\oss\src\engines_gp\*.*		
↑ Name	Ext	Size
[-]		<DIR>
[d_hydro]		<DIR>
[dflowfm]		<DIR>
[dimr]		<DIR>
[flow2d3d]		<DIR>
[part]		<DIR>
[waq]		<DIR>
[wave]		<DIR>
Makefile	am	121

▼ c:\code\oss\src\engines_gp\flow2d3d		
↑ Name	Ext	Size
[-]		<DIR>
[bin]		<DIR>
[default]		<DIR>
[doc]		<DIR>
[packages]		<DIR>
[scripts]		<DIR>
Makefile	am	62

## Engines:

- d\_hydro: Executable starting FLOW dynamic lib
- flow2d3d: Delft3D-FLOW kernel
  - Packages: source code, separated from binaries, doc, scripts, etc.
- dimr: Executable starting D-Flow FM and more/combined engines
- dflowfm, part, waq, wave

# General code structure



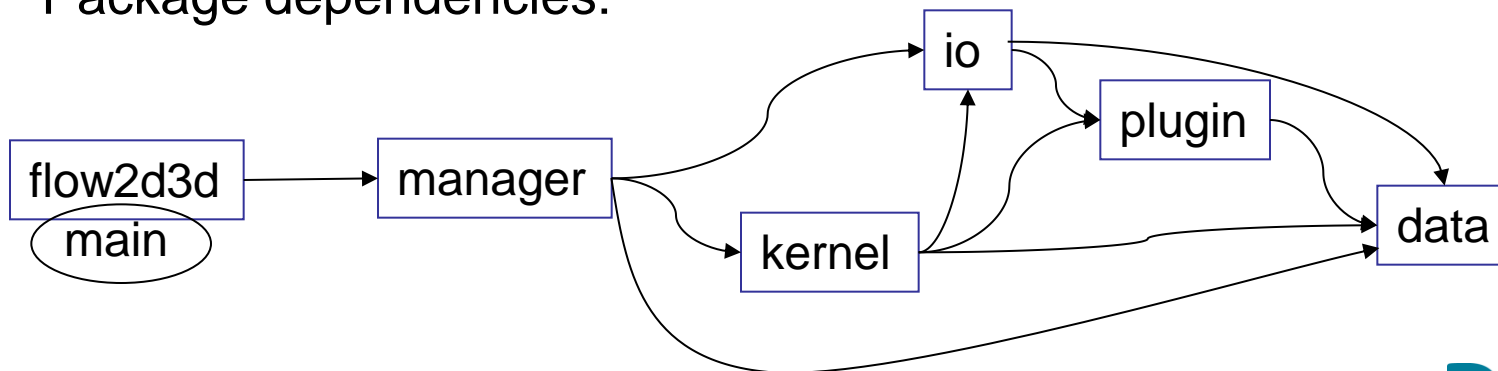
Directory structure

Generic package names

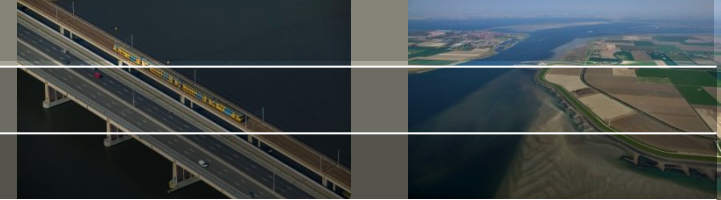
```
▼ c:\code\oss\src\engines_gpl\flow2d3d\packages\*. *
```

Name	Ext	Size
[..]		<DIR>
[data]		<DIR>
[flow2d3d]		<DIR>
[flow2d3d_openda]		<DIR>
[io]		<DIR>
[io_dol_f]		<DIR>
[kernel]		<DIR>
[kernel_dd_f]		<DIR>
[manager]		<DIR>
[plugin_culvert_c]		<DIR>
[plugin_user]		<DIR>
Makefile	am	252

Package dependencies:



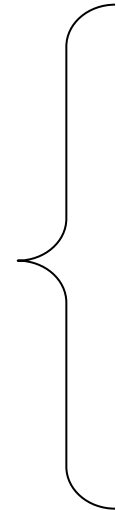
# General code structure



## Directory structure

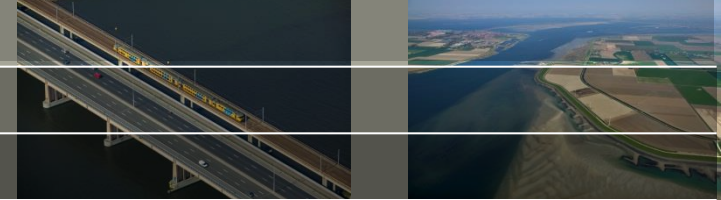
▼ c:\code\oss\src\engines\_gp\flow2d3d\packages\kernel\\*.\*

↑ Name	Ext	Size
↑ [..]		<DIR>
📁 [lib]		<DIR>
📁 [src]		<DIR>
📁 [x64]		<DIR>
📄 kernel	u2d	0
📄 kernel	vfproj	28,222
📄 Makefile	am	57



Each package:  
Separate src  
(,include) and  
binaries

# General code structure



## Directory structure

▼ c:\code\oss\src\engines\_gpl\flow2d3d\packages\kernel\src\\*. \*

↑ Name	Ext	Size
↑ [..]		<DIR>
[compute]		<DIR>
[compute_nearfar]		<DIR>
[compute_roller]		<DIR>
[compute_sediment]		<DIR>
[dd]		<DIR>
[general]		<DIR>
[inichk]		<DIR>
[main]		<DIR>
[non_hydro]		<DIR>
[taylor]		<DIR>
[timedep]		<DIR>
Makefile	am	267

Kernel/src:  
Functional splitting












Traditional  
Trisim structure

# General code structure

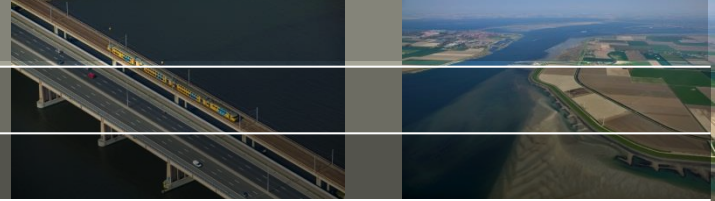
## Directory structure

Files!

▼ c:\code\oss\src\engines\_gp\flow2d3d\packages\kernel\src\compute\\*. \*

↑ Name	Ext	Size
↑ [-]		<DIR>
 adi	f90	42,810
 adv2d	f90	20,520
 bccorr	f90	7,654
 bedform	f90	12,582
 c_vort	f90	7,501
 c_vvv	f90	4,800
 calbf	f90	23,459
 calksc	f90	20,904
 calrou	f90	8,454
 caltmx	f90	7,968
 cdwkad	f90	9,570

# General code structure



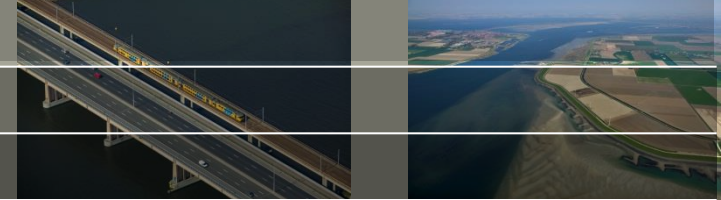
## Directory structure

### Linux:

- Binaries next to source code (\*.o, \*.lo, \*.la) default
- Libraries/executables copied to “src/lib” and “src/bin” default
- ds-install script copies to “src/bin/lnx64” Deltares



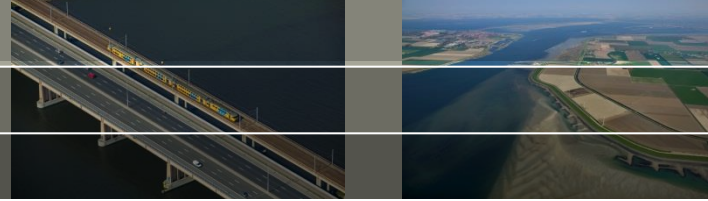
# General code structure



Visual Studio  
2010

- 📁 Solution 'delft3d\_open' (84 projects)
- └─ 📁 engines\_gpl
  - └─ 📁 d\_hydro
    - ▷ 📁 d\_hydro
  - ▷ 📁 dimr
  - └─ 📁 flow2d3d
    - ▷ 📁 data
    - ▷ 📁 flow2d3d
    - ▷ 📁 flow2d3d\_openda
    - ▷ 📁 flow2d3d\_openda\_lib
    - ▷ 📁 io
    - ▷ 📁 io\_dol\_f
    - ▷ 📁 kernel
    - ▷ 📁 kernel\_dd\_f
    - ▷ 📁 manager
    - ▷ 📁 plugin\_culvert\_c
    - ▷ 📁 plugin\_user
  - ▷ 📁 part
  - ▷ 📁 waq
  - ▷ 📁 wave
- ▷ 📁 plugins\_lgpl
- ▷ 📁 tests
- ▷ 📁 third\_party\_open
- ▷ 📁 tools\_gpl
- ▷ 📁 utils\_gpl
- ▷ 📁 utils\_lgpl

# General code structure



exe

FLOW - Main

...\src\engines\_gp\d\_hydro\packages\d\_hydro\src\d\_hydro.cpp

```
main (argc, argv, envp)
```

```
...
```

```
DeltaresHydro * DH = new DeltaresHydro (argc, argv, envp);
```

```
DH->Run ();
```

```
DeltaresHydro::DeltaresHydro (argc, argv, envp)
```

```
...
```

```
dllhandle = LoadLibrary ("flow2d3d");
```

```
entryPoint = GetProcAddress (dllhandle, "DeltaresHydroEntry");
```

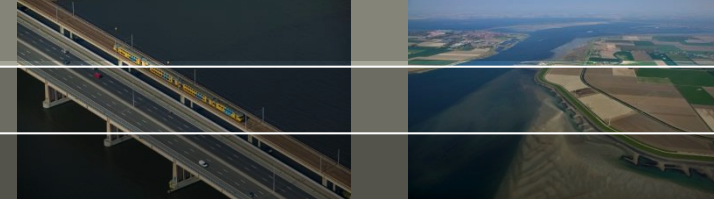
```
DeltaresHydro::~~DeltaresHydro (void)
```

```
DeltaresHydro::Run (void)
```

```
...
```

```
this->startComponent->Run ();
```

# General code structure



dll

FLOW - Main

[...\src\engines\\_gpl\flow2d3d\packages\flow2d3d\src\flow2d3d.cpp](#)

**DeltaresHydroEntry** (DeltaresHydro \* DH)

DH->startComponent = new Flow2D3D (DH);

**Flow2D3D::Flow2D3D** (DeltaresHydro \* DH)

**Flow2D3D::~~Flow2D3D** (void)

**Flow2D3D::Run** (void)

if (this->dd != NULL)

    this->dd->Run ();

else {

    TRISIM (ndom, nmap, id, flags, runid);

}

# General code structure

Fortran

FLOW - Fortran entry for each subdomain:

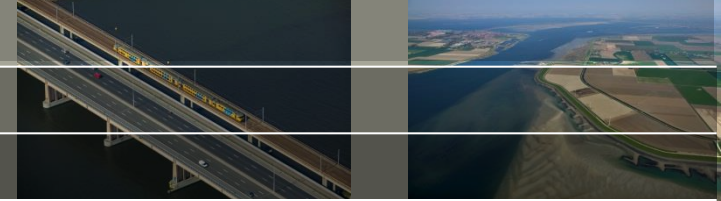
...\src\engines\_gpl\flow2d3d\packages\manager\src\trsim.F90

**subroutine** trsim

```
...  
allocate(gdp)  
...  
retval = trsim_init  
...  
retval = trsim_step  
...  
retval = trsim_finish
```

**gdp**: GlobalDataPointer  
Structure containing  
(pointers to) all  
arrays/parameters being  
global inside one subdomain.  
  
gdp must be passed through  
“everywhere” inside one  
subdomain for thread safety.

# General code structure



FLOW - Subdomain initialization:

...\src\engines\_gp\flow2d3d\packages\manager\src\trsim\_mod.F90

**function** trsim\_init

...

call gdp\_alloc(gdp)

Scan input, write time dependent data to TMP-files

...

call tdatmain

...

call tripoi

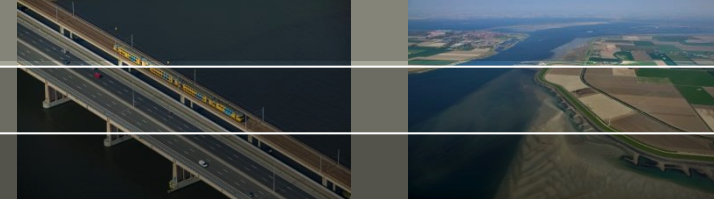
Allocate arrays

...

call tricom\_init

Read complete input  
Check input  
Initialization

# General code structure



FLOW - Subdomain step:

...\src\engines\_gp\flow2d3d\packages\manager\src\trsim\_mod.F90

**function** trsim\_step

    call tricom\_step

...\src\engines\_gp\flow2d3d\packages\manager\src\tricom\_step.F90

**subroutine** tricom\_step

    ...

    do nst = itstrt, itstop - 1, 1

Time loop

        ...

        call postpr

Post processing

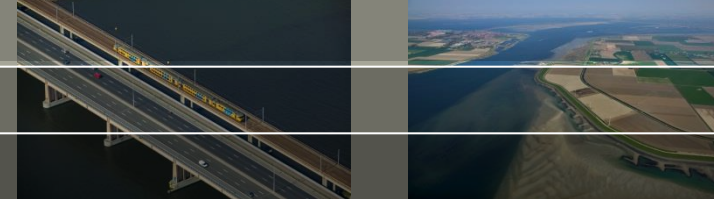
        ... update wave info

        call **trisol** (/z\_trisol/z\_trisol\_nhfull)

Solver

    enddo

# General code structure



FLOW - Subdomain solver:

...\src\engines\_gpl\flow2d3d\packages\kernel\src\main\trisol.f90

**subroutine** trisol

...

**call** f0isf1

timnow = timnow + 0.5\_fp

**call** incbc

**call** adi(...stage1)

... susp. transport solvers

**call** f0isf1

timnow = timnow + 0.5\_fp

**call** incbc

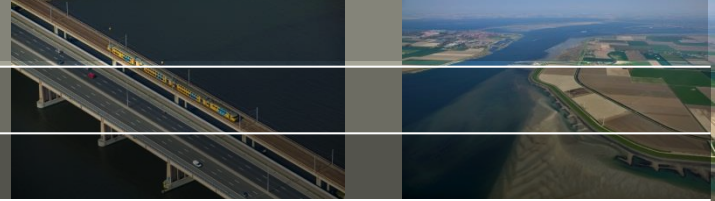
**call** adi(...stage2)

... susp. transport solvers

First half timestep:  
v implicit, u explicit

Second half timestep:  
u implicit, v explicit

# General code structure



## Morphology

...\src\engines\_gp\flow2d3d\packages\kernel\src\main\trisol.f90

**subroutine** trisol

...  
**call** adi(...stage1)  
... susp. transport solvers

**call** eroded

Sediment fluxes at bed

...

**call** bott3d

Bathymetry update

...  
**call** adi(...stage2)  
... susp. transport solvers

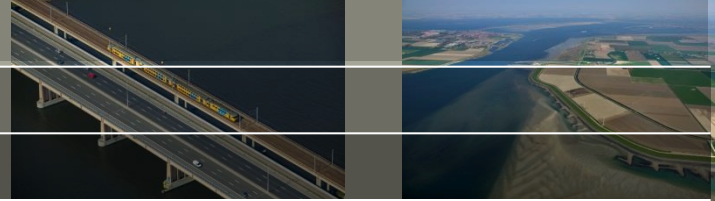
**call** eroded

...

**call** bott3d



# General code structure



WAVE - main

...\src\engines\_gpl\wave\packages\wave\src\wave\_exe.f90

```
program waves_main
```

```
...
```

```
if (not stand_alone)
```

```
    do while perform_step
```

```
        wait for FLOW signal
```

```
        call swan_tot
```

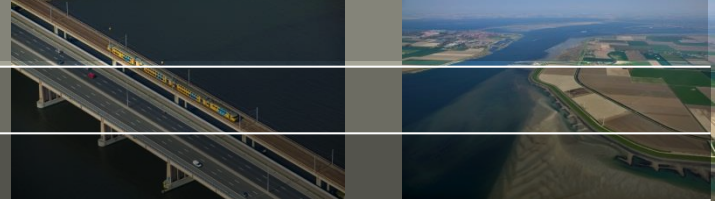
```
    enddo
```

```
else
```

```
    call swan_tot
```

```
endif
```

# General code structure



WAVE – swan\_tot

... \src\engines\_gpl\wave\packages\manager\src\swan\_tot.f90

**subroutine** swan\_tot

...

do itide = 1, swan\_run%nttide

do i\_swan = 1, n\_swan\_grids

... get input (from FLOW)

... write swan input

call run\_swan

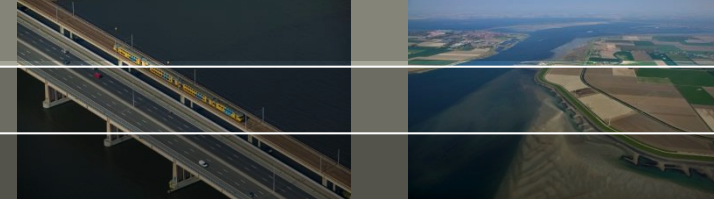
call read\_swan\_output

enddo

... write wave output (to FLOW)

enddo

# General code structure



Code documentation using Doxygen:

[www.oss.deltares.nl](http://www.oss.deltares.nl) -> download -> manuals

Link to preprocessed Doxygen output:

<http://apidocs.oss.deltares.nl/delft3d>

Or generate it yourself:

- Download and install Doxygen from
  - [www.doxygen.org](http://www.doxygen.org)
- Download and install Graphviz from
  - <http://www.graphviz.org/>
- In src directory give command:

```
doxygen doxyfile_delft3d
```
- Open the generated “delft3d-apidoc\html\index.html”
- Search for top level flow routines as a starting point: trisim, tricom, trisol, or specifically for morphology eroded.

# General code structure

## Code documentation using Doxygen

Deltares

Search

> [Main Page](#) > [Modules](#) > [Modules](#) > [Data Types List](#) > [Files](#)

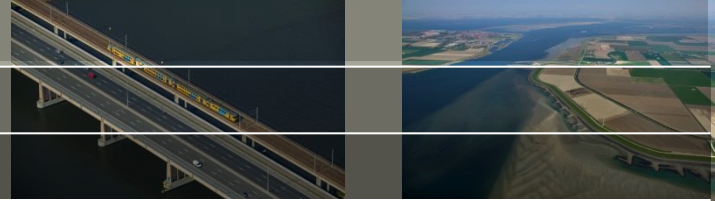
### Delft3D-FLOW API docs

Revision: 3026

- **Main program:** `d_hydro.cpp`
- **Dynamic library entrances:** `flow2d3d_dll.f90`
- **DD and RemoteOLV preparations, start all processes:** `hydra.cpp` (Hydra::Execute)
- **Global data:** `globaldata.f90` (flow, geometry, times, parameters, ...)
- **Subdomain calculation toplevel:** `trisim.f90`
- **Preprocessor: Convert time related data:** `tdatom.f90`
- **Timeloop:** `tricom_step.F90`
- **Main routine within one time step:** `trisol.f90` (sigma layers) `z_trisol.f90` (z layers, hydrostatic) `z_trisol_nhfull.f90` (z layers, non-hydrostatic)

Generated on Sun Oct 13 2013 01:01:51 for Delft3D by [doxygen](#) 1.7.2

# General code structure



Not a Number (NaN) check

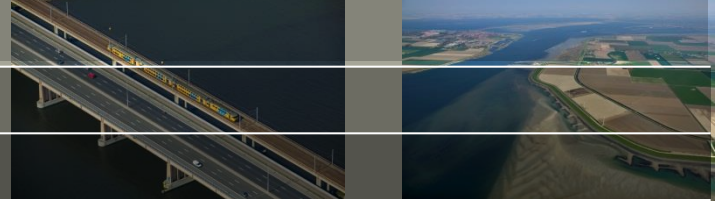
By default, FLOW continues calculation with NaNs:

- Full check is too time consuming
- Input is scanned on NaNs
- Waterlevel is scanned on NaNs every half time step

Debugging with full NaN check (Intel compiler):

- Activate 4 lines of code in trisim.f90 (see next slide)
- Recompile

# General code structure



NaN check

...\src\engines\_gp\flow2d3d\packages\manager\src\trsim.F90

## subroutine trsim

...

use ifcore

...

INTEGER\*4 OLD\_FPE\_FLAGS, NEW\_FPE\_FLAGS

...

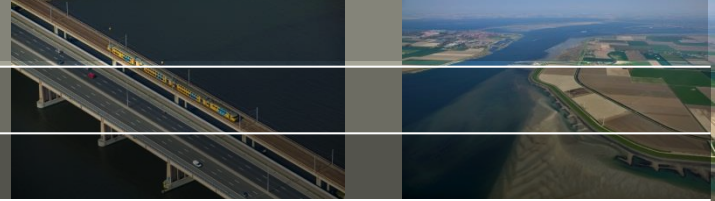
NEW\_FPE\_FLAGS = FPE\_M\_TRAP\_OVF + FPE\_M\_TRAP\_DIV0 +  
FPE\_M\_TRAP\_INV

OLD\_FPE\_FLAGS = FOR\_SET\_FPE (NEW\_FPE\_FLAGS)



# Ongoing developments

# Ongoing developments

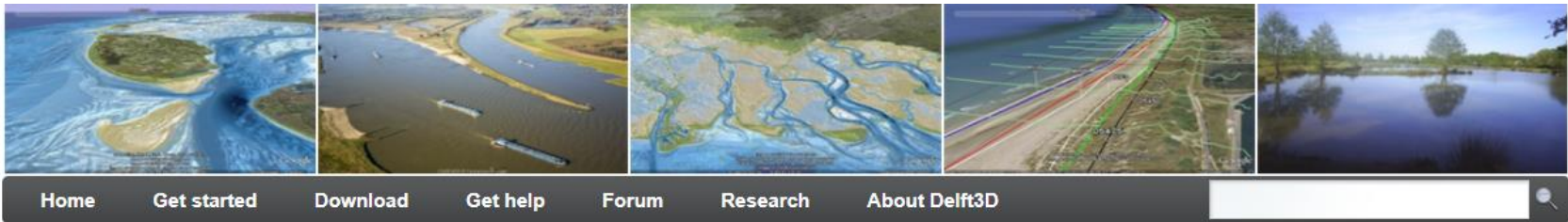


Overview of developments on next 3 slides (for completeness)

- OSS site:  
<http://oss.deltares.nl/web/delft3d/publications>
- Open source branches
- Closed source branches





# Ongoing developments – OSS site



## Publications

The two largest databases which together hold 5.600+ Delft3D articles are ScienceDirect and Google Scholar. Click the logo's below to check live RSS feeds of Delft3D searches on the servers of these databases:

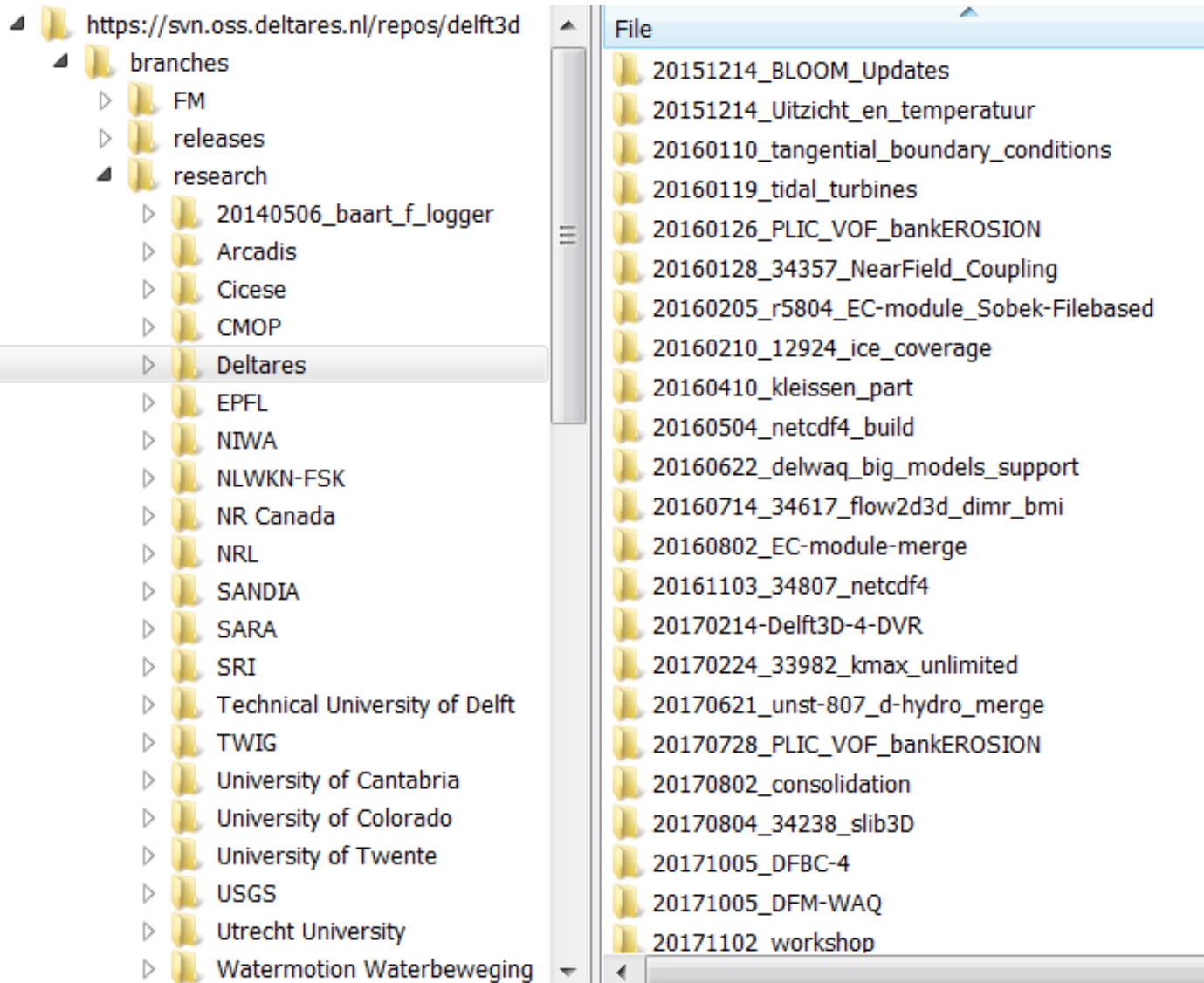
Science Direct	Google Scholar
	

## Alternative databases

Web of knowledge: Very large database as well but sign up required (search for Delft3D)

Publications and research projects of the Royal Netherlands Academy of Arts and Sciences (130+)

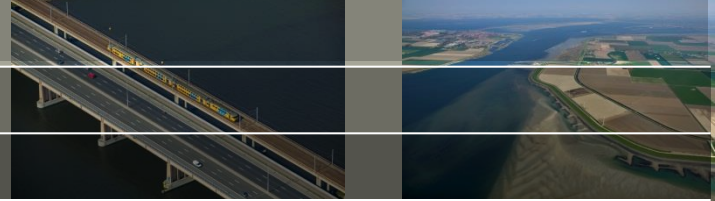
# Ongoing developments – Open source branches



# Ongoing developments – Closed source branches FM

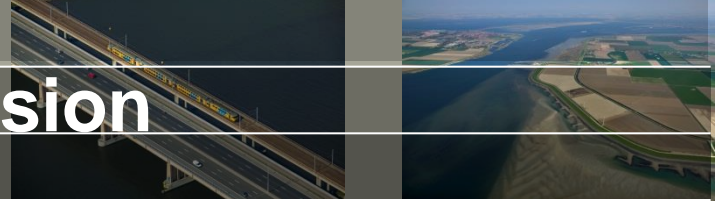
- branches
    - 20130206\_26211-guis-SMHI
    - additional
    - common
    - dflowfm**
    - dist
    - feature
    - guis
    - imod\_manual
    - license\_free
    - release
    - SOBEK 3 (CF\_DLL)
    - sobek-main-apr-2008
    - telemac
    - telemac-dido
    - testbench
    - waq\_bottom\_C
  - dist
  - sandbox
  - tags
  - trunk
- 20131213\_389\_coupling\_with\_delft3d-wave
  - 20131219\_trachytopen\_UNST-376
  - 20140911\_unstruc\_profiling\_vortech
  - 20141017\_unstruc\_sedmor
  - 20141017\_unstruc\_sedmor\_mergefix\_startingat\_42876
  - 20141118\_unstruc\_multibc
  - 20150120\_secondary\_flow\_UNST-485
  - 20150303\_1d2d\_sobek\_dflowfm
  - 20150501\_dflowfm\_integratedmodelling
  - 20150726\_dflowfm-tools\_UNST-167
  - 20151005\_velocity\_reconstruction
  - 20151021\_dflowfm\_tidal\_turbines
  - 20151022\_dflowfm\_xbhyd
  - 20151120\_wave3D
  - 20160809\_dflowfm\_hydrology
  - 20160823\_dflowfm\_43444\_with\_waq\_temp\_output\_patch\_for\_USGS
  - 20161017\_dflowfm\_codecleanup
  - 20170401\_flooding\_pilot\_1
  - 20170627\_sandia\_tidal\_turbines
  - unstruc\_xbeach

# Short topics



- Linux
- Parallel
- Debugging
- Domain Decomposition
- Your suggestions
- ...

# Questions & answers / discussion



Questions or comments?