



RISC-KIT

Resilience-Increasing Strategies for Coasts – Toolkit

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Coastal FEWS IT infrastructure

Deliverable No: D.3.1 – Coastal FEWS freeware

Ref.: WP3 - Task 3.1

Date: October 2014

Grant Agreement No. 603458
DG Research –FP7-ENV-2013-two-stage



This project has received funding from the European Union's Seventh Programme for Research, Technological Development and Demonstration under Grant Agreement n° [603458]. This publication reflects the views only of the author's, and the European Union cannot be considered liable for any use that may be made of the information contained therein.

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Coastal FEWS IT infrastructure

Deliverable Title	D.3.1 – Coastal FEWS infrastructure
Filename	RISCKIT_D.3.1_Delft-FEWS Coastal_v1
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Date	31/10/2014

Prepared under contract from the European Commission

Grant Agreement No. 603458

Directorate-General for Research & Innovation (DG Research), Collaborative project, FP7-ENV-2013-two-stage

Start of the project: 01/11/2013

Duration: 42 months

Project coordinator: Stichting Deltares, NL

Dissemination level

<input checked="" type="checkbox"/>	PU	Public
<input type="checkbox"/>	PP	Restricted to other programme participants (including the Commission Services)
<input type="checkbox"/>	RE	Restricted to a group specified by the consortium (including the Commission Services)
<input type="checkbox"/>	CO	Confidential, only for members of the consortium (including the Commission Services)

Deliverable status version control

Version	Date	Author	Review
1.0	09/10/2014	Simone, De Kleermaeker (Deltares)	Daniel, Twigt (Deltares)
2.0	28/10/2014	Simone, De Kleermaeker (Deltares)	Daniel, Twigt (Deltares)

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Publishable Summary

This report describes the deliverable related to the first objective of WP3 (and Project Objective 4): the Early Warning System (EWS) framework for hot spot areas consisting of a free-ware system to predict hazard intensities, using coupled hydro-meteo and morphological model.

The EWS framework has been posted on the open Delft-FEWS website, with a link from the RISC-KIT project website, including a description of the system, and supported by a wiki page and internet demo instruction movies on the configuration of the system. This document consists of a description of the developed FEWS system and infrastructure.

The EWS framework is part of the RISC-KIT toolkit, which will be tested through 'Application at case study sites' in WP5.

Executive Summary

This deliverable is the Coastal FEWS (EWS) freeware, including developed model adapters, import modules and master configuration files. The software has been posted on the open Delft-FEWS website (Deltares, Delft-FEWS_download), with a link from the RISC-KIT project website (Deltares, et al., RISC-KIT_web), including a description of the system (i.e. this report), and supported by a wiki page and internet demo instruction movies on the configuration of the system.

1 Introduction

Recent and historic low-frequency, high-impact events such as Xynthia (impacting France in 2010), the 2011 Liguria (Italy) Flash Floods and the 1953 North Sea storm surge which inundated parts of the Netherlands, Belgium and the UK have demonstrated the flood risks faced by exposed coastal areas in Europe. Typhoons in Asia (such as Typhoon Haiyan in the Philippines in November 2013), hurricanes in the Caribbean and Gulf of Mexico, and Superstorm Sandy, impacting the northeastern U.S.A. in October 2012, have demonstrated how even larger flooding events pose a significant risk and can devastate and immobilize large cities and countries.

These coastal zone risks are likely to increase in the future (IPPC, AR5) which requires a re-evaluation of coastal disaster risk reduction (DRR) strategies and a new mix of prevention (e.g. dike protection), mitigation (e.g. limiting construction in flood-prone areas; eco-system based solutions) and preparedness (e.g. Early Warning Systems, EWS) (PMP) measures. Even without a change in risk due to climate or socio-economic changes, a re-evaluation is necessary in the light of a growing appreciation of ecological and natural values which drive ecosystem-based or Nature-based flood defense approaches. In addition, as free space is becoming sparse, coastal DRR plans need to be spatially efficient, allowing for multi-functionality.

1.1 Project objectives

In response to these challenges, the RISC-KIT project aims to deliver a set of open-source and open-access methods, tools and management approaches to reduce risk and increase resilience to low-frequency, high-impact hydro-meteorological events in the coastal zone. These products will enhance forecasting, prediction and early warning capabilities, improve the assessment of long-term coastal risk and optimise the mix of PMP-measures. Specific objectives are:

1. Review and analysis of current-practice coastal risk management plans and lessons-learned of historical large-scale events;
2. Collection of local socio-cultural-economic and physical data at case study sites through end-user and stakeholder consultation to be stored in an impact-oriented coastal risk database;
3. Development of a regional-scale coastal risk assessment framework (CRAF) to assess present and future risk due to multi-hazards (**Figure 1.1**, top panel);
4. Development of an impact-oriented Early Warning and Decision Support System (EWS/DSS) for hot spot areas consisting of: i) a free-ware system to predict hazard intensities using coupled hydro-meteo and morphological models (**this deliverable**) and ii) a Bayesian-based Decision Support System which integrates hazards and socio-economic, cultural and environmental consequences (**Figure 1.1**, centre panel);
5. Development of potential DRR measures and the design of ecosystem-based and cost-effective, (non-)technological DRR plans in close cooperation with end-users for a diverse set of case study sites on all European regional seas and on one tropical coast (**Figure 1.1**; bottom panel);

6. Application of CRAF and EWS/DSS tools at the case study sites to test the DRR plans for a combination of scenarios of climate-related hazard and socio-economic vulnerability change and demonstration of the operational mode;
7. Development of a web-based management guide for developing integrated DRR plans along Europe's coasts and beyond and provide a synthesis of lessons learned in RISC-KIT in the form of policy guidance and recommendations at the national and EU level.

The tools are to be demonstrated on case study sites on a range of EU coasts in the North- and Baltic Sea Region, Atlantic Ocean, Black Sea and Mediterranean Sea, and one site in Bangladesh, see Figure 1.2. These sites constitute diverse geomorphic settings, land use, forcing, hazard types and socio-economic, cultural and environmental characteristics. All selected regions are most frequently affected by storm surges and coastal erosion. A management guide of PMP measures and management approaches will be developed. The toolkit will benefit forecasting and civil protection agencies, coastal managers, local government, community members, NGOs, the general public and scientists.

1.2 Project structure

The project is structured into seven Work Packages (WP) starting with WP1 on 'Data collection, review and historical analysis'; WP2–4 will create the components of the RISC-toolKIT containing an 'Improved method for regional scale vulnerability and risk assessment' (WP2), 'Enhanced early warning and scenario evaluation capabilities for hot spots' (WP3) as well as 'New management and policy approaches to increase coastal resilience' (WP4). The toolkit will be tested through 'Application at case study sites' (WP5). WP6 will be responsible for 'Dissemination, knowledge transfer and exploitation' and 'Coordination and Management' are handled in WP7.

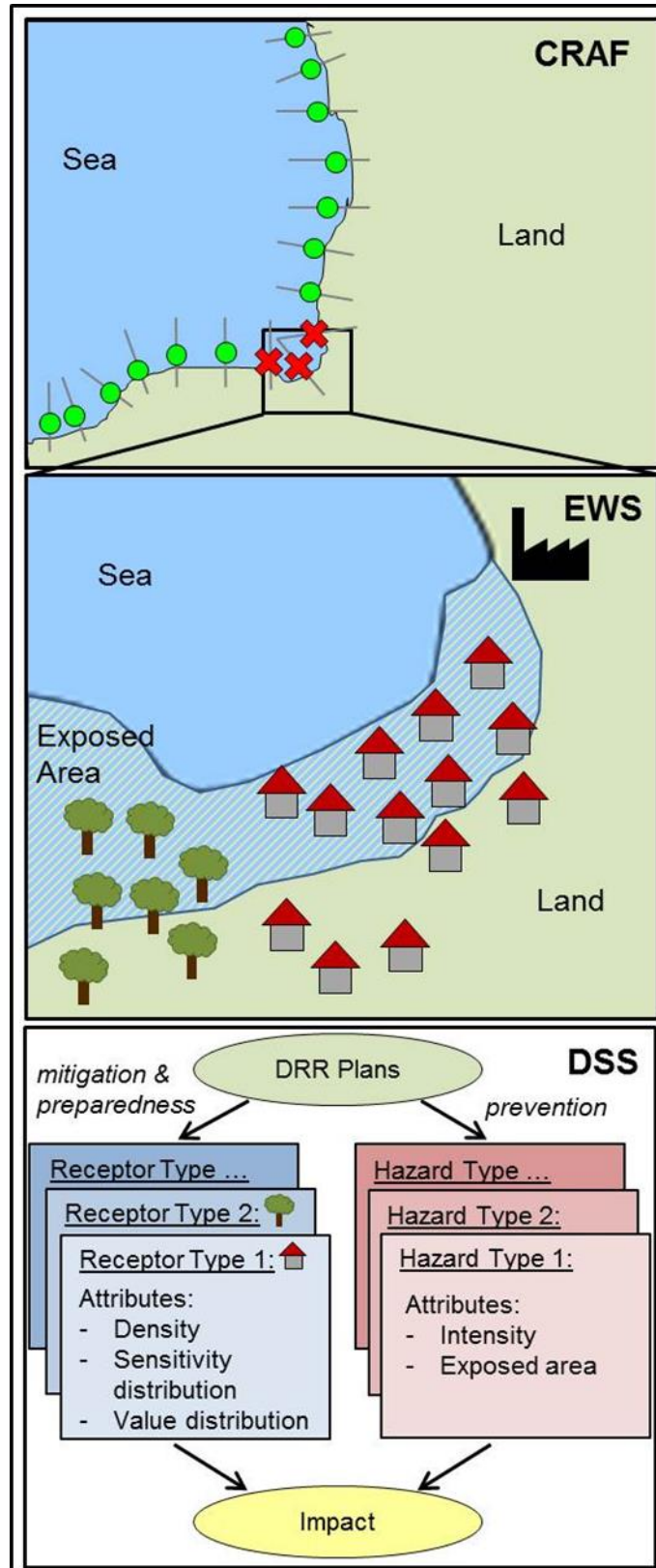


Figure 1.1: Conceptual drawing of the CRAF (top panel), the EWS (middle panel) and the DSS (bottom panel)



Figure 1.2: Case study sites (stars), RISC-KIT case study site partners (blue solid dots) and non-case study site partners (red open circles).

1.3 Deliverable context and objective

The current deliverable 3.1 is part of WP 3. The objectives of WP 3 are to develop:

1. a free-ware Coastal Delft-FEWS system (D3.1) based on Delft-FEWS as a platform to construct a model train to predict detailed spatially-varying hazard intensities, and
2. a Bayesian-based Decision Support System (D3.2) to predict socio-economic, environmental and cultural impacts of the hazard intensities.

The combination of these deliverables is called the Early Warning System/Decision Support System (EWS/DSS) and will be used in WP5 (Application) in two ways: as an operational EWS tool which provides input for emergency decisions, and as an ex-ante scenario evaluation tool to evaluate the optimal mix of prevention, mitigation and preparedness measures. Together, they form Project Objective 4.

This report describes the deliverable related to the first objective of WP3 (and Project Objective 4). This is the EWS framework for hot spot areas consisting of a free-ware system to predict hazard intensities, using coupled hydro-meteo and morphological

model. The EWS framework will be posted on the open Delft-FEWS website, with a link from the RISC-KIT project website, including a description of the system, and supported by a wiki page and internet demo instruction movies on the configuration of the system.

The deliverable for the second objective of WP3, a Bayesian-based Decision Support System, will be added at a later stage (D3.3, Month 17).

1.4 Approach

We start by extending the Delft-FEWS software where necessary. The case study site owners are supported with a training, to be able to make their contribution to the developments.

These software developments go hand in hand with the set-up of the configuration of the Delft-FEWS Coastal application. The case study site owners are supported with another training and online documentation to set-up an application for their case study site. They use the Delft-FEWS Coastal application as a basis.

1.5 Outline of the report

This report is structured as follows.

- In Chapter 1 we place the deliverable within the scope of the RISC-KIT project.
- In Chapter 2 we describe the approach of Task 3.1 in more detail.
- In Chapter 3 gives an overview of the technical developments.
- In Chapter 4 we give an impression of the Delft-FEWS Coastal application.
- In Chapter 5 and 6 we describe the deliverables, respectively the underlying master configuration file and the training and dissemination.
- Chapter 7 holds all references.

We note that the main source of technical and user information regarding the Coastal Delft-FEWS freeware are the RISC-KIT wiki pages. Therefore, we will frequently refer to these wiki pages throughout the next chapters. For ease of use, for the style of References in the text where it concerns the wiki pages we use (Author, Topic), e.g. (Deltares, Import).

Throughout this report, the terms Delft-FEWS Coastal configuration and Master Configuration File refer to the same set of files.

2 Approach

2.1 Delft-FEWS

The development of hydrological and hydrodynamic forecasting and warning systems is an essential element in regional and national strategies. Recent developments in numerical weather prediction, radar data and on-line meteorological and hydrological data collection have resulted in an increasing focus on data import and data processing. The challenges for developing a modern hydrological forecasting and warning system are found in the integration of large data sets, specialised modules to process the data, and open interfaces to allow easy integration of existing modelling capacities.

In response to these challenges, Delft-FEWS provides a state of the art hydrological forecast and warning system. The system is a sophisticated collection of modules designed for building a hydrological forecasting system customised to the specific requirements of an individual organisation.

2.2 Task 3.1: Development of coastal Delft-FEWS IT infrastructure for use in coastal and flash flood applications

The Description of Work is as follows: The basis for the model train (D3.1) is Delft-FEWS (Flood Early Warning System) [as described in Section 2.1, ed.]. In RISC-KIT, Delft-FEWS will be expanded for coastal and flash flood applications. We will first identify data input formats and models that are used in the case studies and which are not yet supported by Delft-FEWS. Subsequently, data processing routines and model adapters are developed for these.

The following expansions of the existing Delft-EWS software infrastructure were created:

1. **Wind and rainfall data formats** used by the case study partners.
2. **Wave and surge model adapters** have been developed for models which partners have already in place.
3. **Coastal morphological model adapters.** As many end-users do not have morphodynamic models, a model adapter has been developed for the open-source XBeach model which has been further developed for this application in task 3.2.
4. **Flash flood model adapters.** This expansion will provide adapters for proven Flash Flood Early Warning Systems (FF-EWS) already developed in the DRIHM and IMPRINTS projects.
5. **Visualisation.** User-friendly visualisation displays have been designed and integrated into the core software of Delft-FEWS to display hazard intensities.
6. Set up of a **master configuration file** as an example and guidance tool for the set up of the Delft-FEWS system at each case study site and a 4 day plenary training course (Milestone 4)
7. Development of a **wiki page**, visual (internet demo movie) and tutorials on the configuration of Delft-FEWS.

Furthermore, Deltares has provided interactive support in the form of **online webinars and training courses** which were held at Delft.

The deliverable of this task is the Coastal Delft-FEWS freeware (D3.1) with developed model adapters, import modules and a master configuration file. The software has been posted on the open Delft-FEWS website (Deltares, [Delft-FEWS_oss_download](#)), with a link from the RISC-KIT project website (Deltares, et al., [RISC-KIT_web](#)), including a description of the system, and supported by a wiki page and internet demo instruction movies on the configuration of the system.

Each of these items is described in the next chapters.

3 Extension of Delft-FEWS for RISC-KIT

3.1 Wind and rainfall data formats

All data that is used as input for the models to be run needs to be imported by Delft-FEWS. Data can be supplied in a variety of formats, not all of which are known to Delft-FEWS. Most data that is used for the RISC-KIT case study sites is supplied in NetCDF or GRIB format, which are already supported by Delft-FEWS. However there was the need to create additional import routines for two data formats not yet supported by Delft-FEWS:

- CS3xTidalSurgeTime
- MetOfficeWW3

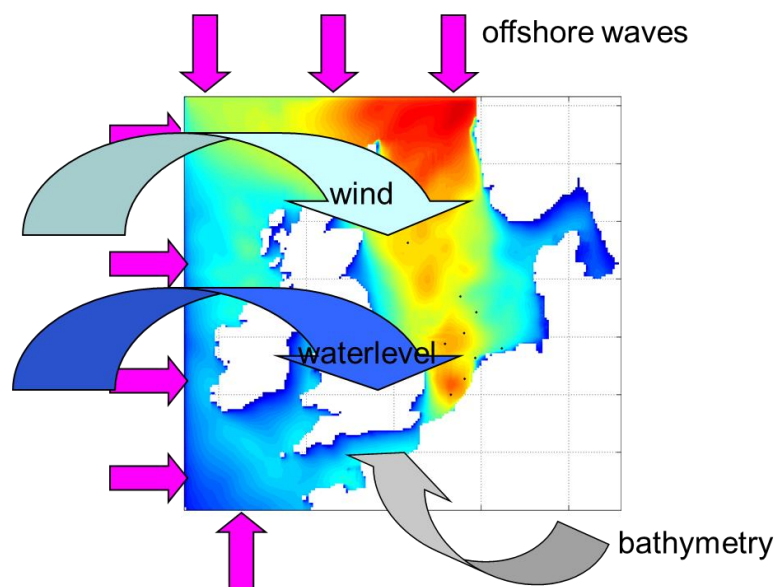


Figure 3.1: Model input, such as wind and water level data

3.2 Model adapters

All models are run from Delft-FEWS, using the general adapter. This general adapter has no knowledge of the specific model, but only prepares the data required to run the model. It organizes the input data and information about the run such as the start and stop time.

Most models will require input data and information about the run in a model specific format. Therefore, the general adapter will make use of a model specific adapter. This model adapter consists of two parts: a pre adapter and a post adapter. The pre adapter converts the data provided by Delft-FEWS into the model specific format. Once the run has been completed, the post adapter converts the model specific output to the NetCDF format. Finally, this output is imported by the general adapter into Delft-FEWS, to be displayed to the user (Deltares, Delft-FEWS).

One could say that the model adapter is a model specific interpreter, translating between the model software and the Delft-FEWS software.

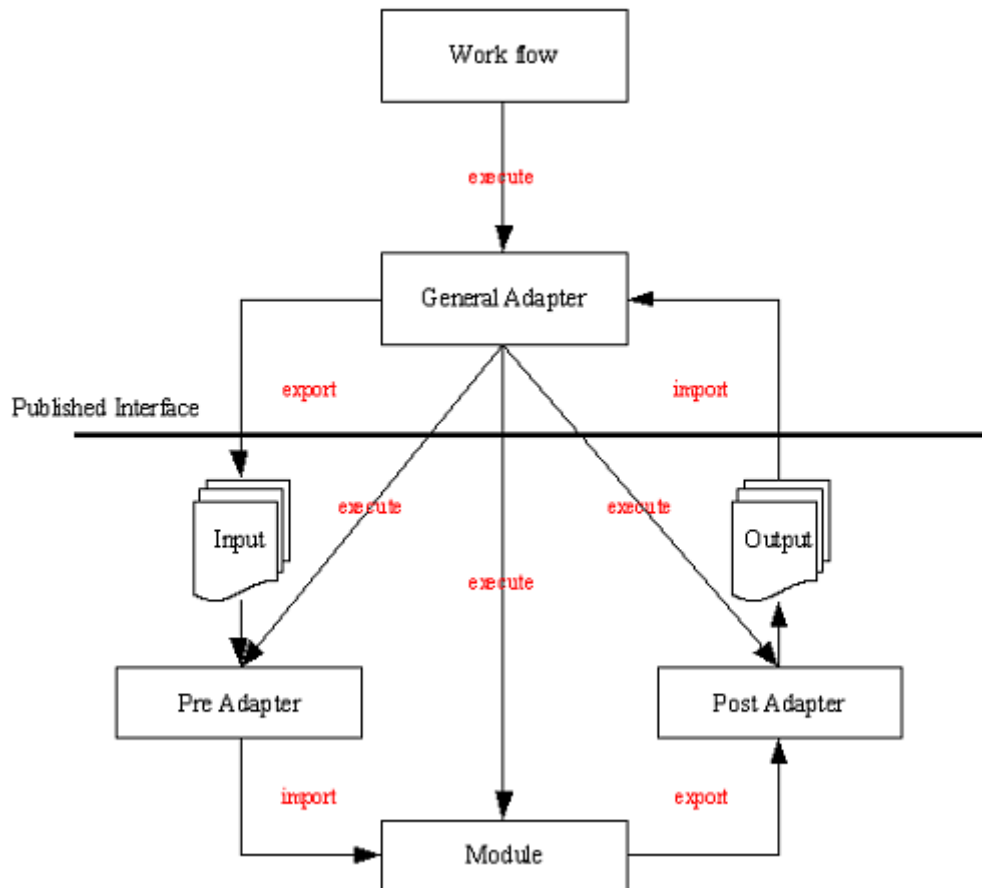


Figure 3.2: The general adapter, model (pre- and post-) adapter and model (module)

3.2.1 Wave and surge model adapters

The following model adapters have been developed or improved for use in Delft-FEWS Coastal:

1. WaveWatch3
2. Delft3D
3. SWAN
4. Selfe
5. Telemac
6. Lisflood

The model adapters that are part of Delft-FEWS software are integrated in Delft-FEWS software version 2014.02. The model adapters that are part of the master configuration file can be found in the folder RISC-KIT/Modules/bin/<model>_adapter/ within the master configuration file (zip file). Some model adapters developed by the partners are not (yet) distributed to Deltares and are therefore not part of the master configuration file.

WaveWatch3 model adapter

The WaveWatch3 model adapter has been developed by Deltares and is part of master configuration file.

The WaveWatch3 pre adapter creates the model specific input by replacing tags in template files:

- ww3_shell.inp.template for run information file ww3_shell.inp
- gx_outf.inp.template for grid output processing file gx_outf.inp
- ww3_out.inp.template for point output processing file ww3_out.inp

Furthermore, it writes log messages to a log file called xbeach.log.

The WaveWatch3 post adapter converts the 2D spectra model output from the model native format to NetCDF (Deltares, Adapter_WW3).

Delft3D model adapter

The Delft3D model adapter has been developed by Deltares and improved by Deltares for use with RISC-KIT and is part of Delft-FEWS software.

The Delft3D model adapter has been improved to use a run info file in NetCDF format as input. This means the delft3dModel adapter xml file is not needed anymore. In this case the information that used to be in the delft3dModel adapter xml file is read from the NetCDF run file, which is generated by Delft-FEWS using the configuration in the Delft-FEWS general adapter configuration file. This makes the configuration easier, since all information to run the Delft3D model adapter is now present in the Delft-FEWS general adapter file that is used to run the Delft3D model (single point of configuration).

The Delft3D pre-adapter converts the NetCDF file specified in the optional property "input_spectra_file_to_convert" to a file in SWAN ascii spectra format. Furthermore, it creates part of the model definition files, by replacing various keywords in any template file. A full list can be found on the wiki page.

The Delft3D post-adapter converts all output from the model output files from the model format to the Delft-FEWS pi format. Scalar time series are written in the XML file timeseries_<runId>.xml. 2D maps are written in ArcInfo ASCII files called <fewParameters>.xml. Currently only output for layer=1 is converted. Furthermore the post-adapter converts all model output .sp2 files in the workDir from the model format to the NetCDF format (Deltares, Adapter_D3D).

SWAN model adapter

The SWAN model adapter has been developed by Deltares and improved by Deltares for the use with SWAN NetCDF version in RISC-KIT and is part of Delft-FEWS software.

The SWAN pre-adapter converts NetCDF file with 2D spectra on point locations exported from Delft-FEWS to SWAN 2D spectra ascii format. It replaces keywords in SWAN model definition file. The option maximumSnapDistance has been added for the import of 2D spectra import.

The SWAN post-adapter converts SWAN .TAB (scalar time series) files to NetCDF format (Deltares, Adapter_SWAN).

Selfe/WWMII model adapter

The Selfe/WWMII model adapter has been developed by LIENSs in Python. The model adapter assumes SELFE and WWMII are run on a cluster, in this case the cluster of the University of La Rochelle. The model adapter will also be executed on this cluster. Therefore, the model adapter is not part of the master configuration file (i.e. the current deliverable).

Selfe is a circulation model, used here in its 2D depth averaged form. It is fully coupled with a spectral wave model: WindWaveModel II (WWMII). The model uses wind sea level pressure and tidal forcing inputs to compute currents, water levels and wave characteristics.

The SELFE/WWMII pre-adapter creates the model specific file needed for the run:

- sflux_air_1.001.nc with the wind and pressure inputs, based on the meteo forcing exported by the GA (NetCDF format).
- sflux_inputs.txt contains the atmospheric metadata needed for the run
- bctides.in with the boundary water level conditions
- param.in with the date (based on the meteo forcing exported by the GA (NetCDF format)) and time step

The SELFE/WWMII post-adapter combines all output files resulting of a parallel run (MPI) into a single output NetCDF file.

Telemac model adapter

The Telemac model adapter has been developed by IMDC. It has been written in Python and is part of the master configuration file (RISC-KIT/Modules/bin/Telemac_adapter/). The adapter has also been made available to the Delft-FEWS community and can be downloaded from the RISC-KIT (IMDC, Adapter_Telemac). It will also be made available from the Delft-FEWS wiki (Deltares, Delft-FEWS).

In general, the TELEMAC 2D Model Adapter will use a steering properties file, in NetCDF format, to run the model and carry out Pre and Post processes.

The Pre Adapter transforms Delft FEWS exported data, in NetCDF format, into the model specific format. This data includes space and time varying wind fields and hydrodynamic boundary conditions. Additionally, it adapts a template configuration file (*.cas file) into a working configuration file.

The Run model executes the Telemac model. The routines in this module are created specifically to run the model remotely in an IMDC cluster, additionally; it is possible to run the model locally in a personal computer.

The Post Adapter main aim is to transform the model results from their native format into NetCDF format which can be read by the Delft FEWS. The map files are transformed into the UGRID-0.9 netcdf convention for unstructured grids (CF-1.6 UGRID-0.9). There are currently 4 output variable configures in the code (VELOCITY U, VELOCITY V, WATER DEPTH, FREE SURFACE) but any Telemac variable can be exported.

Lisflood-FP model adapter

The Lisflood-FP model adapter has been developed by WMO. The pre-adapter and post-adapter are Python modules, so a Python engine should be installed and accessible on the machine. The Python modules rely on the NetCDF4 and the Numpy libraries, which should also be installed. The model adapter assumes a classical folder structure for the Module, containing of a Input folder, an Output folder and a WorkDir folder.

The GeneralAdapter exports two NetCDF-files into the Input folder:

- RiverWaterLevels.nc containing the river water levels for the river points
- StormSurgeLevels.nc containing the storm surge levels

The model adapter starts the model in the WorkDir by starting a file called run_master.bat, which executes three tasks:

- Pre-adapter: extracting Lisflood control files from the NetCDF files in the input folder
- Running the Lisflood model
- Post-adapter: writing the output NetCDF file to the output folder

The GeneralAdapter imports the resulting NetCDF-file InundationDepth.nc.

3.2.2 Coastal morphological model adapters

XBeach model adapter

Deltares has developed a model adapter for the open source XBeach model software. It has been written in Java and is part of the master configuration file (RISC-KIT/Modules/bin/Xbeach_adapter/).

The pre adapter creates the model specific output by replacing tags in template files:

- zs0file.txt for water level input file zs0file.txt
- bcfile.txt and bc.timeXXX.sp2 for SWAN spectrum input files
- params.txt for run information

Furthermore, it writes log messages to a log file called xbeach.log.

There is no post adapter required for Xbeach, since Xbeach supplies the model output in NetCDF format, which can be directly imported by Delft-FEWS (Deltares, Adapter_Xbeach).

3.2.3 Flash flood model adapters

Continuum model adapter

CIMA has developed a model adapter for the flash flood model Continuum. It has been written in Python and is part of the master configuration file (RISC-KIT/Modules/bin/Continuum_adapter/).

The Continuum pre-adapter does the following:

- Converts 2d data fields from the NetCDF file to Continuum input binary files.
- Create the Continuum configuration file by filling the provided template file. The template is filled with the properties specified in the GeneralAdapter

The Continuum post-adapter converts the Continuum ASCII hydrograph output file to NetCDF format.

IMPRINTS model adapter

The model adapters for the flash flood models already developed in the DRIHM and IMPRINTS projects will be developed in Task 3.2 c, which has its deliverable in month M18.

3.3 Running model adapters in Delft-FEWS

3.3.1 Python

Several of the model adapters developed for RISC-KIT have been developed in Python (Continuum, Lisflood-FP, Selfe and Telemac). Since it is required to install Python, we have agreed on a method for this, so that we only need one Python installation for all model adapters to run properly. This is described on the wiki (Deltares, Adapter_in_Python).

3.4 Visualization

3.4.1 User-friendly visualization displays in Delft-FEWS

The extensive capability of Delft-FEWS for visualization of data has been extended with displays for Xbeach to accommodate new parameter data sets as produced by Xbeach. Figure 3.3 shows the wet and dry cells in an XBeach model for Egmond. The hazard intensity can be visualized by means of water levels (see Figure 4.5).

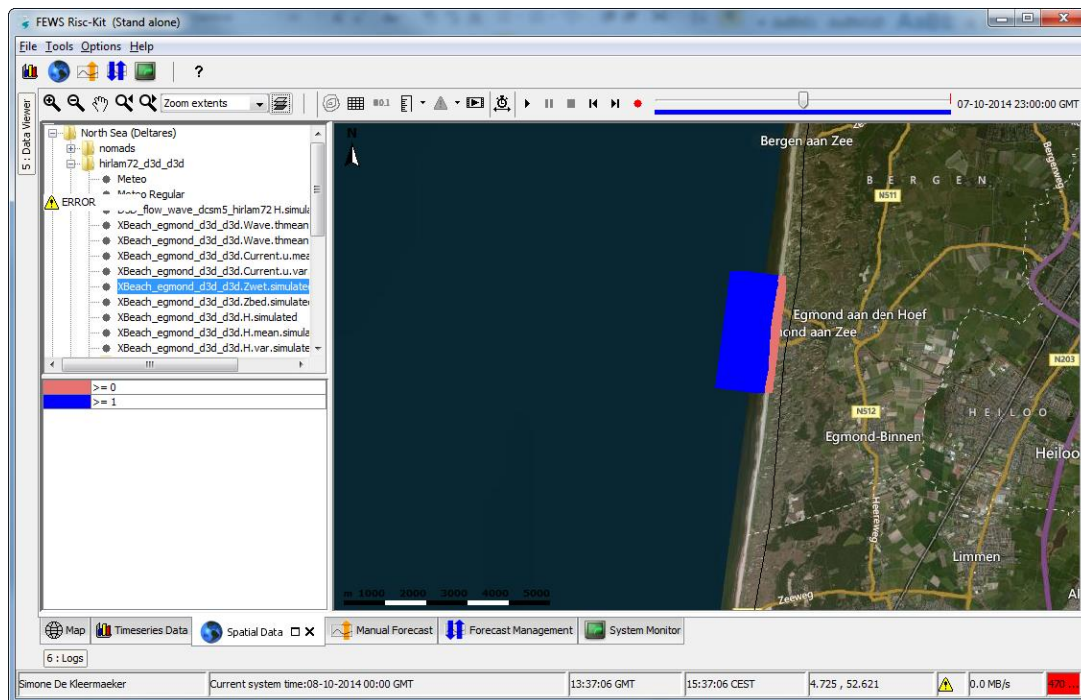


Figure 3.3: Wet (blue) and dry (coral) cells in the Xbeach model for Egmond

In relation of Task 3.2, more work will be done here to also incorporate data from the Bayesian and/or inundation models. This will be done after these models are developed in months M1-M24.

3.4.2 Webviewer

The data collected and processed in Delft-FEWS can be used to provide a webviewer with (real-time) information. The lay-out of a webviewer should be tailored to the needs of the intended users. During the first Plenary Meeting in Cambridge, a workshop was held in which all the case study site owners were asked to design a webviewer for their possible users. To do this effectively, they were asked to answer the following questions:

- What data and information is available or could be made available within the scope of RISC-KIT?
- Which user groups do you foresee for your case study site and what would be their Use Cases?

This resulted in a quite extensive inventory, which is summarised in Table 8.1 and Table 8.2 in Chapter 8 - Appendix: Webviewer inventory.

Webviewer design – mock-up

Based on this inventory, the CSO's designed several webviewers for a selection of user groups / use cases. All these ideas and input was culminated in a mock-up, which will be presented during the second Plenary Meeting in Bologna.

In the execution of WP 5, the CSO's will get more experience with the data and information as available in Delft-FEWS Coastal, but also in other elements of the RISC-KIT project. This will be used to make a Delft-FEWS prototype of the mock-up.

Forecasters

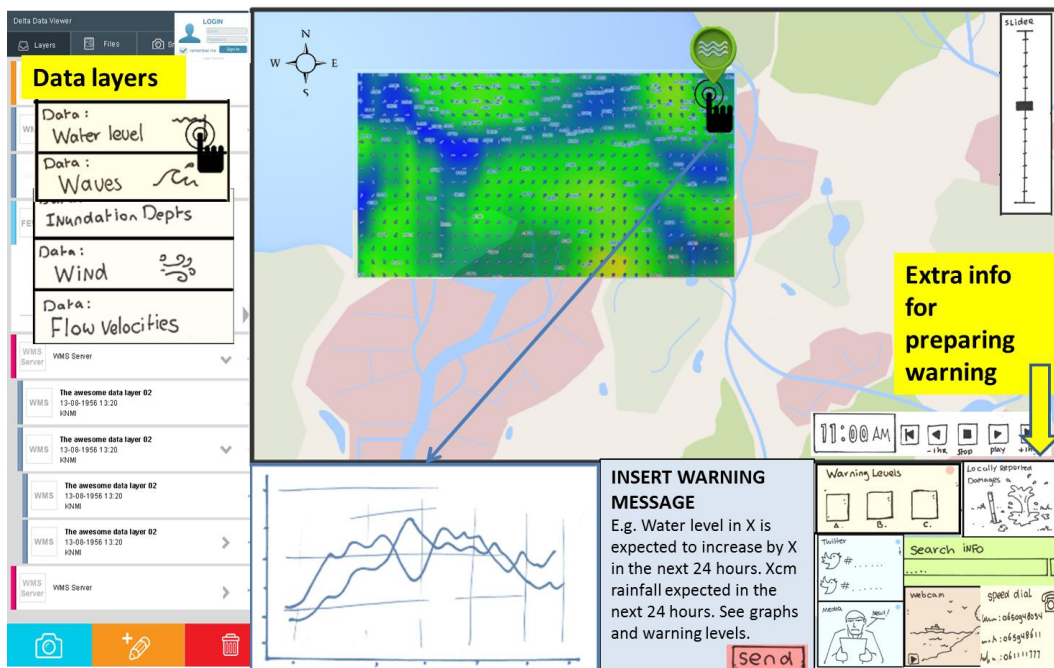


Figure 3.4: Mock-up of webviewer for the User Group of Forecasters (National Government, Flood event phase)

Decision makers

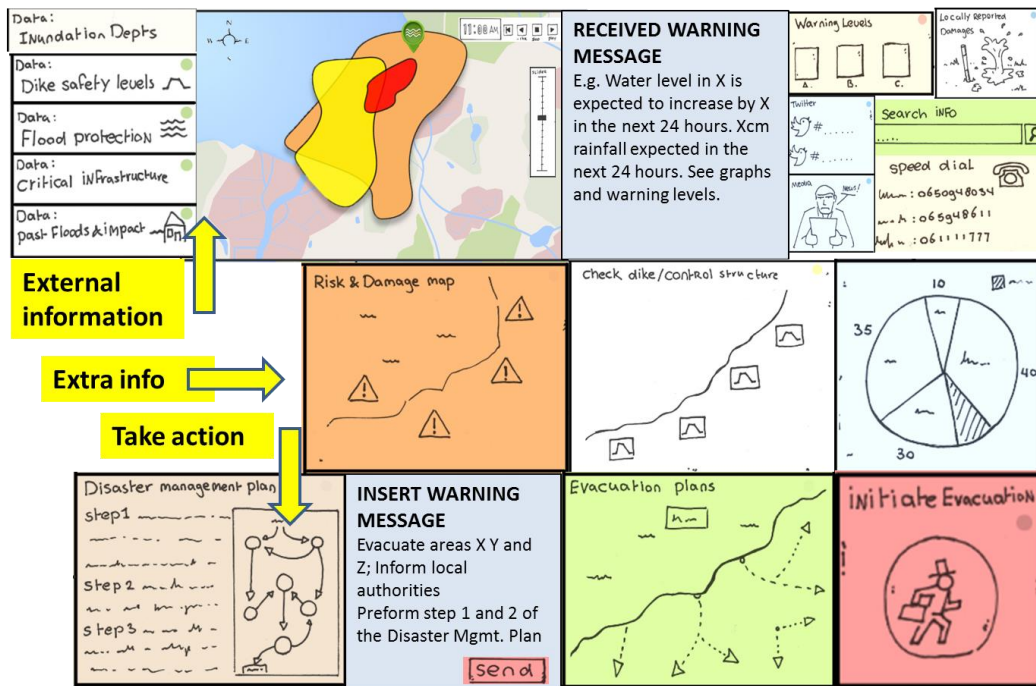


Figure 3.5: Mock-up of webviewer for the User Group of Decision Makers (Local and regional government, Flood event phase)

General public

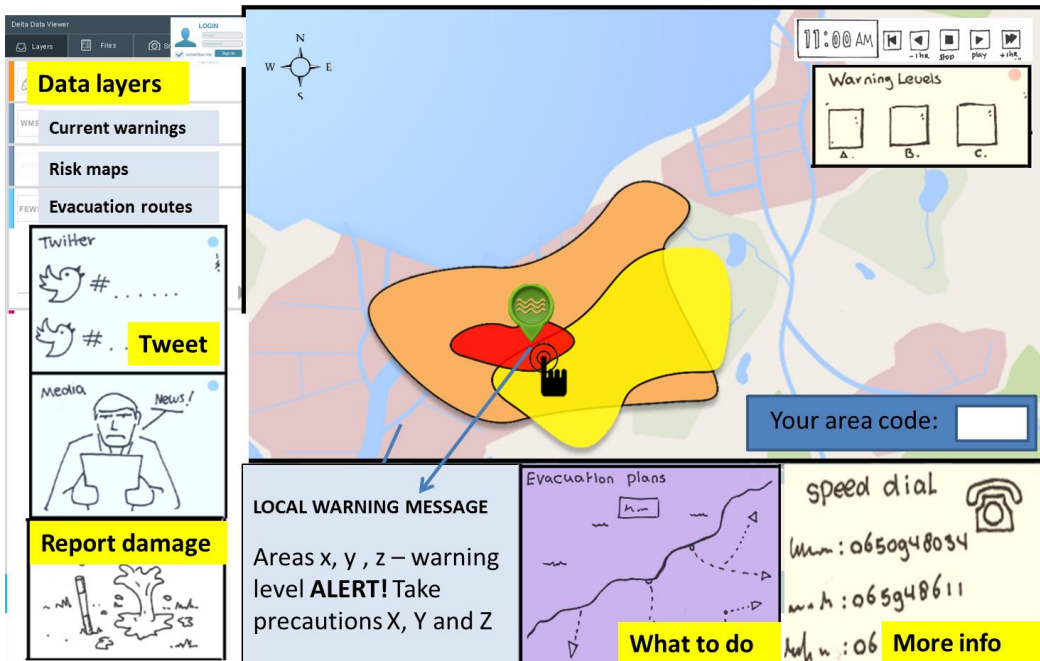


Figure 3.6: Mock-up of webviewer for the User Group of General Public (Flood event phase)

Planners

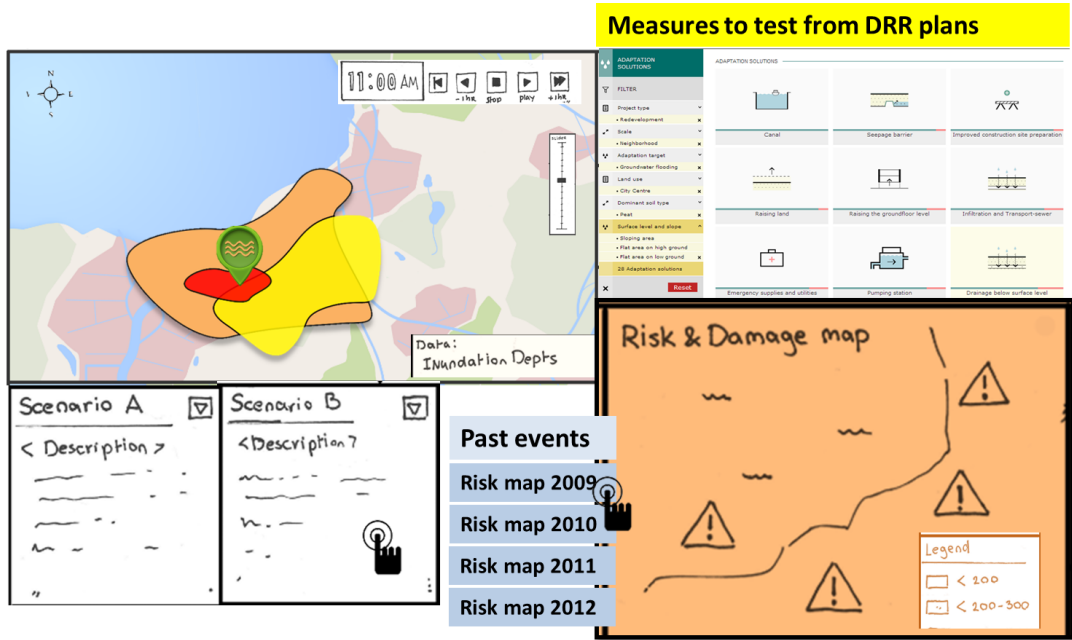


Figure 3.7: Mock-up of webviewer for the User Group of Planners (Prevention phase)

4 Delft-FEWS Coastal

Based on Delft-FEWS, with the expansions as described above, a Delft-FEWS Coastal application has been set up for coastal and flash flood applications. This example configuration consists of the model train for the North Sea, as described in section 5.1. This Delft-FEWS Coastal forms the basis for and holds all necessary examples to set up the configuration for all case study sites by the case study site owners.

All extensions to Delft-FEWS as described are either part of the master configuration file or are part of the online webinars and training courses. All items are described on the wiki, see section 5.5.2 and 6.3.2.

To give an impression of the application, we show some screenshots of the application, showing the extend of example site (Figure 4.1), model results from Xbeach (Figure 3.3)

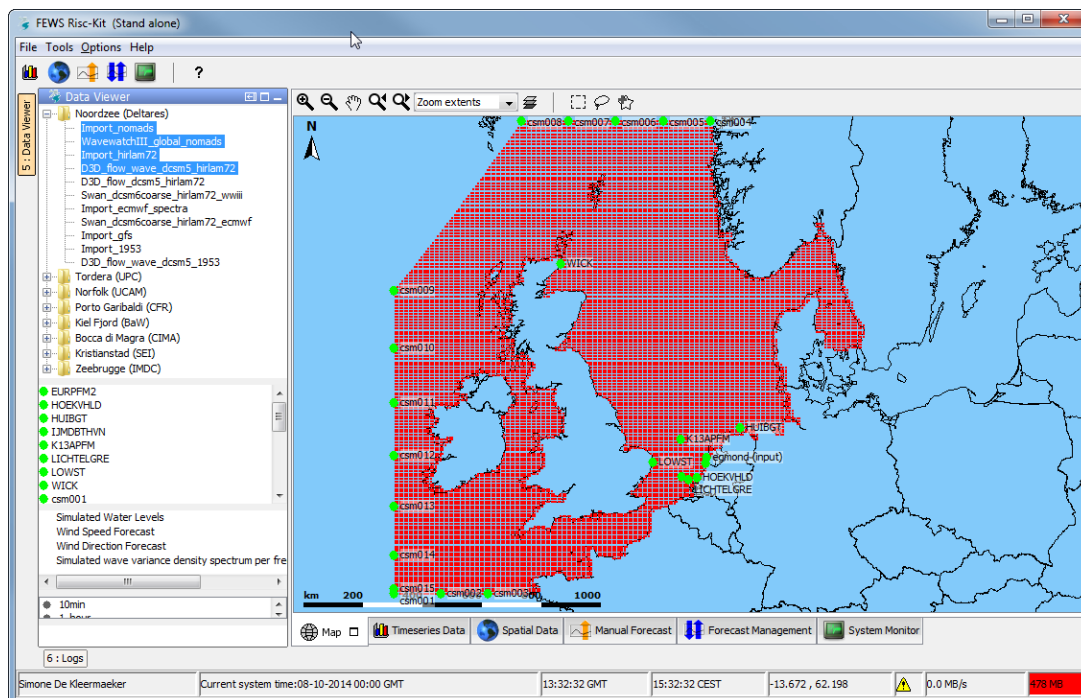


Figure 4.1: Delft-FEWS Coastal – overview of the North Sea grid and locations

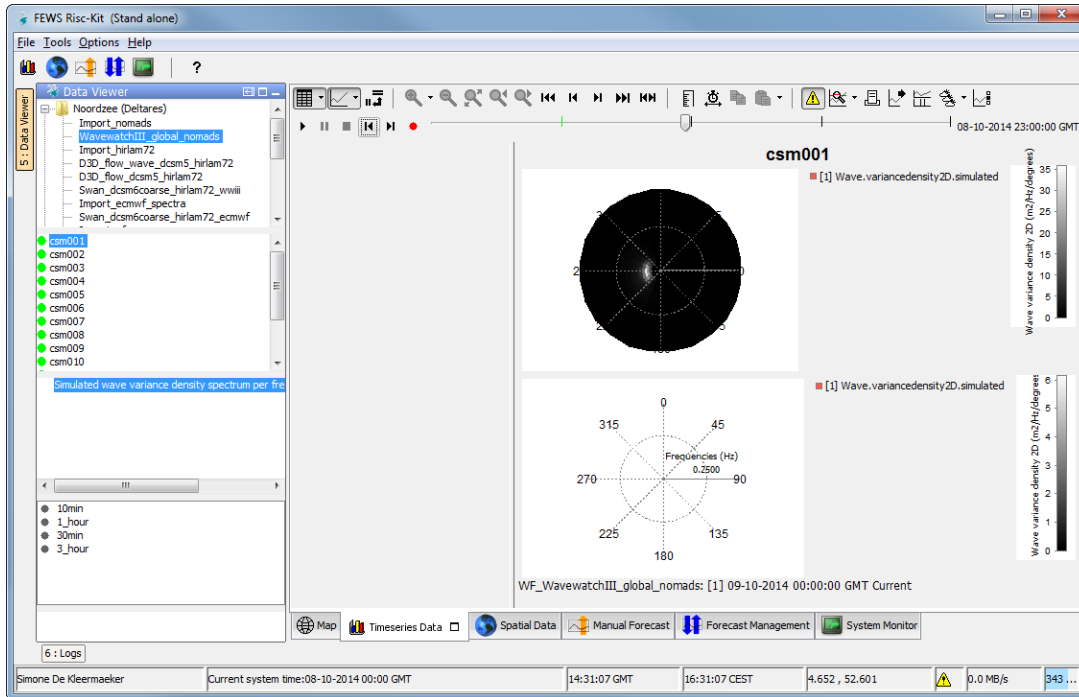


Figure 4.2: 2D spectra from Wavewatch III (Global scale) used as forcing for the Delft3D FLOW/WAVE model

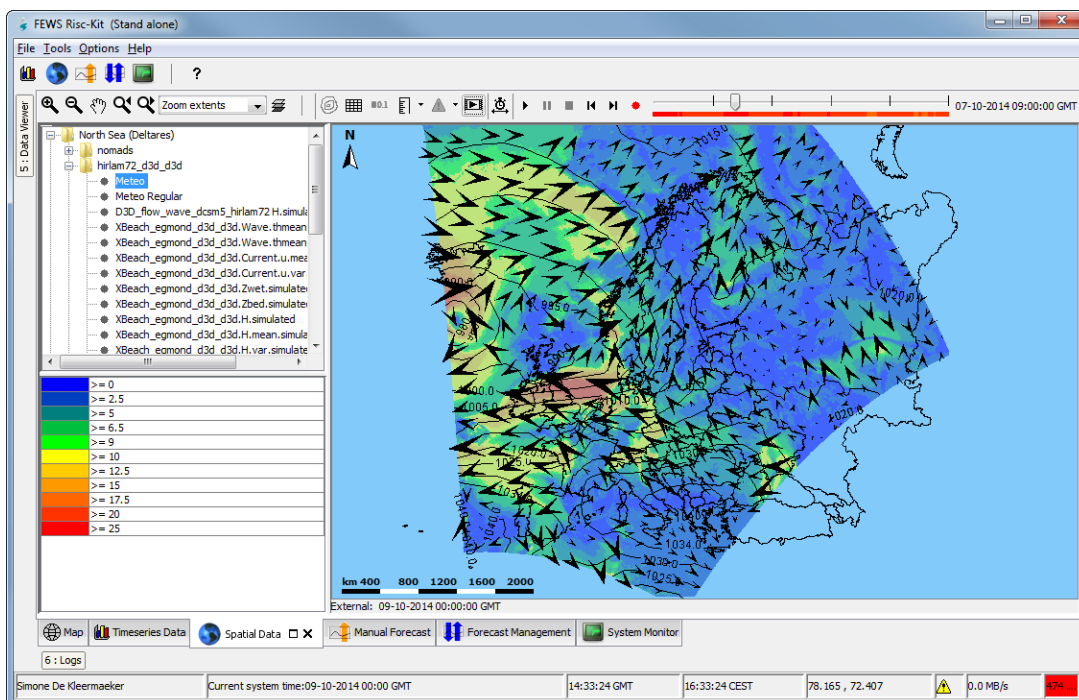


Figure 4.3: Meteo forecast from HIRLAM meteo (KNMI) (European scale)

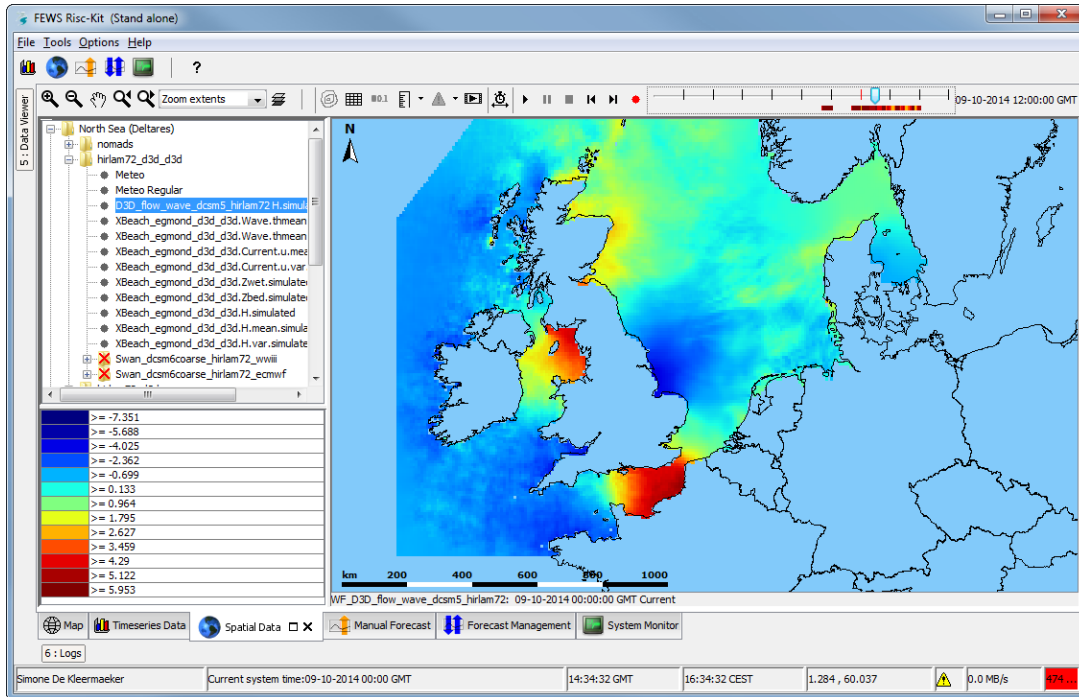


Figure 4.4: Water level forecast from Delft3D FLOW/WAVE model (Regional scale)with HIRLAM meteo used as forcing

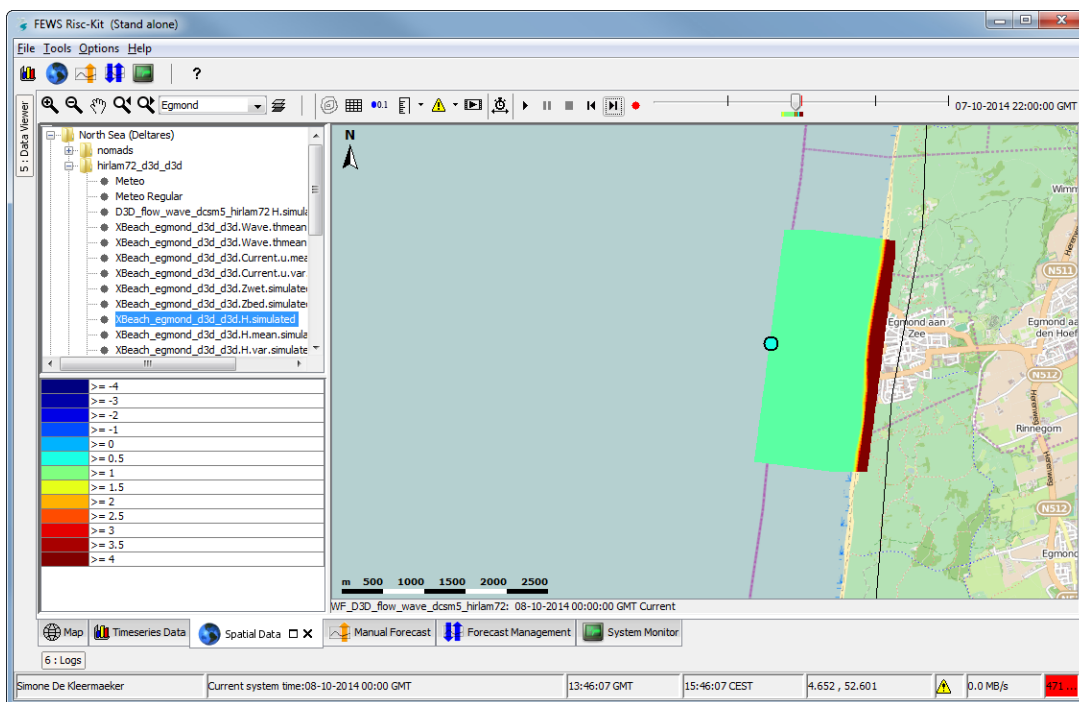


Figure 4.5: Water level (gridded data) from the Xbeach model for Egmond (Local scale), with water level (scalar) forcing from Delft3D FLOW/WAVE model

5 Model configuration file

The master configuration file (a zip file) is the overall result of task 3.1 of WP3. This file contains the configuration of Delft-FEWS Coastal, as applied to the North Sea. It contains an example configuration for the North Sea and the start of the configuration for all the case study sites.

5.1 Model train

The master configuration file consists of the model train (see Figure 5.1) used for this example case study site, including the import of all necessary data, set-up of the different models making use of model adapters and visualization of the results (see chapter 4).

Furthermore, we have added a first version of the configuration of the 11 case study sites. By incorporating this preliminary work, the master configuration gives an overview of all the case study sites, their model grids and their inputs and model outputs. However, these configurations are still very much work in progress, and the final version will be made in Task 5.1 of WP5 (Month 29).

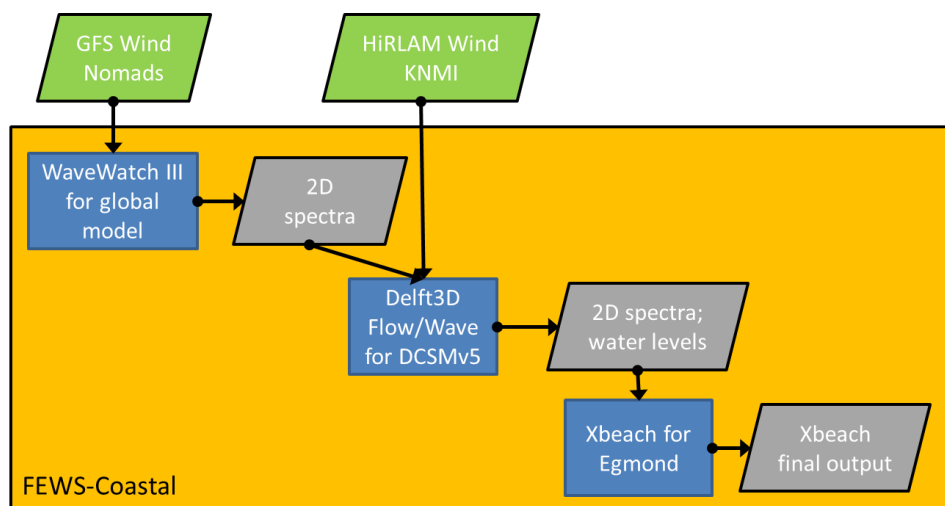


Figure 5.1: Model train for the North Sea

5.2 Use of Delft-FEWS Coastal

5.2.1 Running workflows

The application is ready to be used in an operational environment, which means all tasks (i.e. Workflows) are run automatically, from importing the necessary (meteo) data to running the complete model train every 6 hours. However, within the scope of the RISC-KIT project, the application is used in a so-called stand-alone mode. This means that every task is started manually. The user starts a task via the Manual Forecast Display, by selecting the proper Workflow (see Figure 5.2). The workflow are displayed in the order they need to be executed. In this example we start with the import of the Nomads meteo, which is used as a forcing for the WavewatchIII workflow. This run supplies the 2D spectra boundary conditions that are used in the Delft3D FLOW/WAVE model that is run next, but not before we have also imported

the local Dutch weather forecast HIRLAM v7.2. The model train is completed with an XBeach run, either in hindcast or in forecast mode.

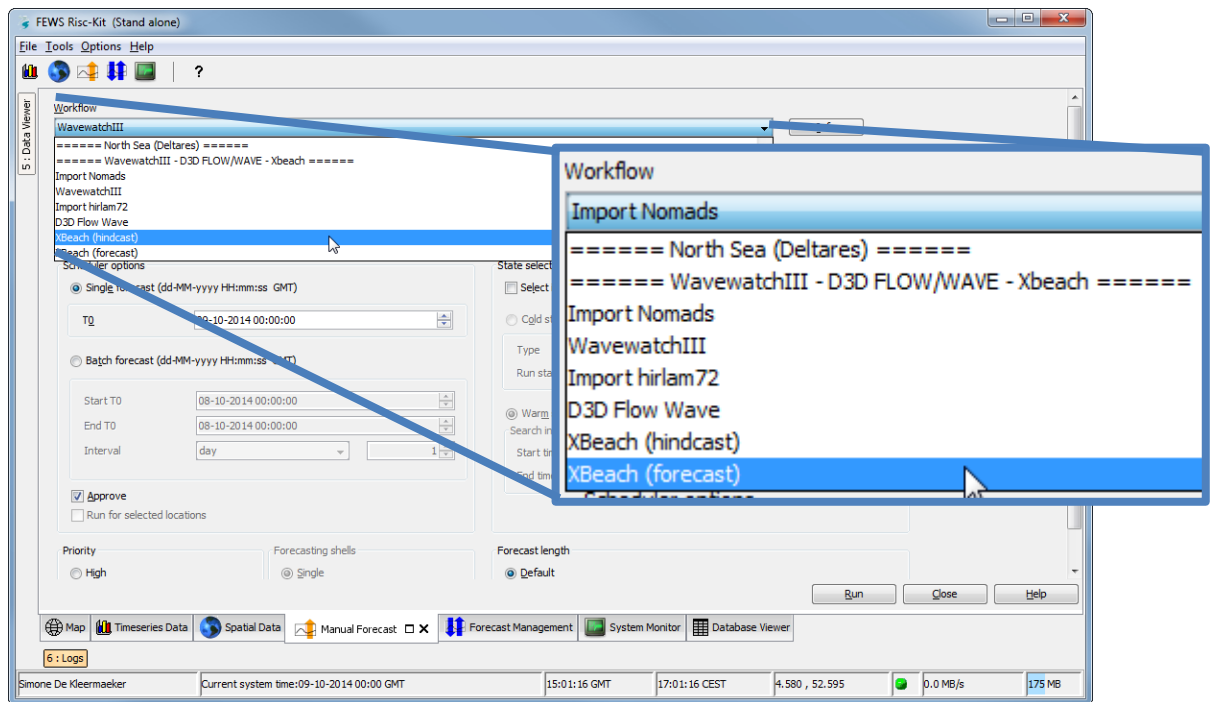


Figure 5.2: Select a Workflow in the Manual Forecast Display to run a model

5.2.2 Displaying results

The data can be displayed as Timeseries Data or Spatial Data, depending on the model output.

To view Timeseries Data, one can open the Data Viewer and select at least one source, location and parameter (see Figure 5.3). This way, both 1D time series as 2D spectra can be displayed (see Figure 4.2).

Gridded data is displayed in the Spatial Data display. In this display, the pre-configured plots are arranged per case study site. Figure 4.3, Figure 4.4 and Figure 4.5 show different spatial displays that have been configured for the North Sea model train.

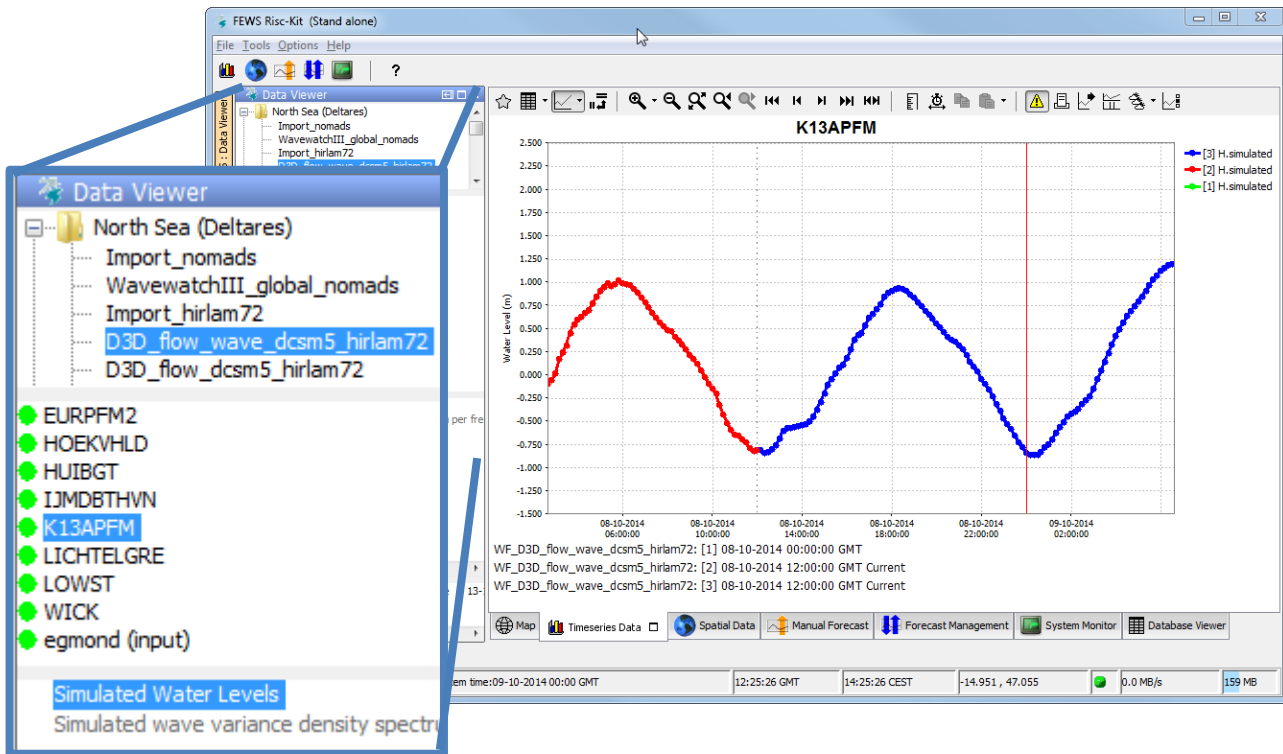


Figure 5.3: Select at least one source, location and parameter in the Data Viewer (enlarged in the figure) to display in the Timeseries Data display (on the right)

5.3 Configuration

In this section we describe those aspects of the Master Configuration File that are specific to the Delft-FEWS Coastal application. More information on this can be found in the presentation used during the Configuration Training (Deltares, Training).

5.3.1 Naming convention

This master configuration file is as generic as possible, with no or little model specific information. This means we use generic names where possible (e.g. moduleConfigFiles, locations and locationSets). Also, the displays (e.g. Filter, DisplayGroups, GridDisplay) are relatively straightforward and not specific. This approach works best if the naming convention throughout the configuration is consistent.

5.3.2 Template ModuleConfigFiles

For the ModuleConfigFiles we have made use of the so called Template files, in order to save you work. The template files make use of keywords or \$PROPERTIES\$. These "variables" are filled in by FEWS on the fly based on the information in the corresponding workflowFile. This means the moduleInstance file is generated automatically each time the workflow is run. This file therefore does not exist as a separate file in the configuration, but still has to be declared in the ModuleInstanceDescriptors.xml. See below for some examples. This approach is only worth your while if the moduleInstance will be multiple times. Therefore, many of the import moduleInstances do not make use of this approach.

5.3.3 Locations and attributes in CSV files

The locations and locationSets are generated as much as possible based on csv files. This method is explained on the Delft-FEWS documentation wiki (Deltares, csv-files)

5.3.4 Model Adapters

The model adapters are part of the configuration (Modules/bin/*_adapter/). The adapters are described on several wiki pages.

- Model adapters (Deltares, Adapter)
 - Delft3D (Deltares, Adapter_D3D)
 - WaveWatch3 (Deltares, Adapter_WW3)
 - SWAN (Deltares, Adapter_SWAN)
 - XBeach (Deltares, Adapter_XBeach)
- Configuration guide on model adapters
 - Quik-start guide for adding an external module in Delft-FEWS (Deltares, Training_quickstart)
 - Guide to add Delft3D models in Delft-FEWS (Deltares, Training_D3D)

5.3.5 ModuleDataSetFiles

In order to allow for file version management a copy of the ModuleDataSetFiles is kept in the folder ModuleDataSetFilesUnzip. In case of changes to the ModuleDataSetFiles, first make a / go to the folder in ModuleDataSetFilesUnzip/ModelX, make the changes and zip this folder to Config/ModuleDataSetFiles, which will be used by FEWS.

5.4 Link to activities of Task 3.1

The master configuration file contains all the results of the tasks performed, as described in section 2.2.

1. Wind and rainfall data formats
2. Model adapters (RISC-KIT/Modules/bin/<model>_adapter/)
 - a. Wave and surge model adapters
 - i. WaveWatch3
 - ii. Delft3D (part of the Delft-FEWS software)
 - iii. Swan (part of the Delft-FEWS software)
 - iv. Selfe
 - v. Telemac
 - vi. LISFLOOD
 - b. Coastal Morphological model adapters
 - i. Xbeach
 - c. Flash flood model adapters
 - i. Continuum

Visualisation (RISC-KIT/Config/DisplayConfigFiles/)

5.5 Deliverables

5.5.1 Master configuration file

The master configuration file can be downloaded from the RISC-KIT website (<http://www.risckit.eu/np4/8/>). Here you will find a link to:

- Master Configuration File (a zip file),
- Delft-FEWS software (version 2014.02) and
- JRE (version 1.7)

5.5.2 Wiki pages for the master configuration file

Everything that is included in the master configuration file is described on the wiki (Deltares, Delft-FEWS Coastal and Deltares, Delft-FEWS).

1. Description of the EWS (Deltares, MasterConfig)
2. Information concerning model adapters for
 - a. Wave and surge models (Deltares, Adapter; Deltares, Adapter_WW3; Deltares, Adapter_D3D; Deltares, Adapter_SWAN; IMDC, Adapter_Telemac; LIENSs, Adapter_Selfe/WWMII; WMO, Adapter_LISFLOOD-FP)
 - b. Coastal morphological and surge model (Deltares, Adapter_Xbeach)
 - c. Flash flood model (CIMA, Adapter_Continuum)
3. Information concerning Wind and rainfall data formats (Deltares, Import; Deltares, Import_CS3x; and Deltares, Import_MOWW3).
4. Information concerning Visualisation (Deltares, Display)

6 Training and dissemination

6.1 Wiki page

There are two wiki's that contain information regarding Delft-FEWS Coastal. The Delft-FEWS configuration documentation wiki (Deltares, Delft-FEWS) contains all documentation regarding the configuration of Delft-FEWS. All developments to Delft-FEWS that have been carried out for RISC-KIT have been documented on this wiki. In section 5.5.2 all relevant wiki's are listed per topic.

The documentation specific to WP3 of RISC-KIT is bundled on a wiki within the RISC-KIT environment (Deltares et al., RISC-KIT_WP3). This wiki holds documentation on the model adapters developed especially for RISC-KIT (see also section 5.5.2), documentation on the training that has been provided and F.A.Q concerning Delft-FEWS configuration (see section 6.3).

6.2 Online webinars and training courses

The knowledge transfer has been concentrated in two training period of two weeks each at Deltares in Delft. The first period focused on developing a model adapter (17-21 March and 14-18 April), the second period focused on making a Delft-FEWS configuration (7-11 July and 29 September-3 October), in fulfilment of Milestone 4

6.2.1 Model adapter training

The first part of the Model Adapter Training was held on 17-21 March in Delft. The training involved a short course on developing a model and adapter and allowed for plenty of hands-on experience. A Delft-FEWS developer was available to answer questions regarding the development of the RISC-KIT specific model adapters.

The participants were given a guide on the development of a Delft-FEWS compliant model adapter (Deltares, Training_Adapter). Furthermore, they received an example model adapter written in Java, as a basis for the RISC-KIT specific model adapters. There are advantages to using Java for a model adapter, however the participants were free to use Fortran or C++ or any other language, as long as there is a NetCDF library available.

The second part of the Model Adapter Training was held on 14-18 April in Delft. The participants were able to review their work in between the training weeks and continue their work to finish the model adapters.

6.2.2 Configuration training

The model adapter training was only relevant for case study site owners who wanted to run model for which there was no model adapter available. The configuration training on the other hand, was relevant for all partners with a case study site.

In the first week we started with the Delft-FEWS configuration course, geared towards the Delft-FEWS Coastal configuration (2 days). The remainder of the week was used to get a hands-on training based on the configuration of the Delft-FEWS Coastal application provided by Deltares.

In the months between both weeks of training, the case study site owners were able to continue their work on the case study site specific applications. Prior to the second week of training, all participants have send their work to Deltares, to be merged in the Delft-FEWS Coastal application.

During the second week there were some lectures, with emphasis on hands-on training. Two Delft-FEWS configurator were available to answer questions concerning the case study site specific configurations. At the end of the second week, all case study site owners had a decent start of their specific configuration. This work has been merged in the final version of the Delft-FEWS Coastal configuration (i.e. the master configuration file).

The participants will finalize their configuration in WP5. To support this, demo instructions movies have been, on the topics of:

- Use of Delft-FEWS Coastal (RISC-KIT application)
- Configuration of an Xbeach model

6.2.3 Webinar

In addition to this, a webinar was held on the 28th of October on the topic of running what if scenario's in Delft-FEWS. This is a methodology to run models which will be used in WP5. The recording of this webinar has been published on the wiki (Deltares, Delft-FEWS; Deltares et al., RISC-KIT_WP3).

6.3 Deliverables

6.3.1 Webinar and training courses

All information and materials from the four training weeks that were held can be found on the RISC-KIT wiki, together with the video's and information on the webinar.

- Training wiki (Deltares, Training)
- Instruction videos (Deltares, Instruction_Videos)
 - Use of Delft-FEWS Coastal (RISC-KIT application)
 - Configuring an Xbeach model
 - What if scenarios (webinar)

6.3.2 Wiki pages on training and dissemination

During the training we have made use of the documentation on the wiki as described in elsewhere in this report. Furthermore, we have made use of additional information on different topic in the form of wiki pages.

- Developing a model adapters (Deltares, Training_adapter)
- Configuring the General adapter (Deltares, Training_quickstart)
- Configuring a Delft3D model (Deltares, Training_D3D)

7 References

For ease of use, for the style of References in the text where it concerns the wiki pages we use (Author, Topic), e.g. (Deltares, Import). Furthermore, the url's in the below references have been abbreviated, using the general Delft-FEWS documentation wiki and the RISC-KIT wiki as starting point. The hyperlinks still contain the complete url.

Delft-FEWS/ = <https://publicwiki.deltares.nl/display/FEWSDOC/>

Delft-FEWS_oss/ = <http://oss.deltares.nl/web/delft-fews/>

RISC-KIT/ = <https://publicwiki.deltares.nl/display/RISCKIT/>

RISC-KIT_PUBLIC/ = <https://publicwiki.deltares.nl/display/RISCKITPUBLIC>

RISC-KIT_website/ = <http://www.risckit.eu/np4/8/>

7.1 References

CIMA, Adapter_Continuum: RISC-KIT_PUBLIC/[Continuum](#)
Deltares, Adapter: Delft-FEWS/[Model+adapters](#)
Deltares, Adapter_D3D: Delft-FEWS/[Delft3D+adapter+with+NetCDF+run+file](#)
Deltares, Adapter_in_Python: Delft-FEWS/[Python+model+adapters+within+FEWS](#)
Deltares, Adapter_SWAN: Delft-FEWS/[SWAN+adapter](#)
Deltares, Adapter_WW3: Delft-FEWS/[WW3+model+adapter](#)
Deltares, Adapter_Xbeach: Delft-FEWS/[XBeach+Adapter](#)
Deltares, csv-files:
Delft-FEWS/[22+Locations+and+attributes+defined+in+CSV+files%2C+Shape-DBF+files+or+external+tables](#)
Deltares, Delft-FEWS: [Delft-FEWS/](#)
Deltares, Delft-FEWS_download: Delft-FEWS_oss/[windows](#)
Deltares, Delft-FEWS Coastal: RISC-KIT_PUBLIC/[RISC-KIT+Coastal+Documentation](#)
Deltares, Display: Delft-FEWS/[07+Display+Configuration](#)
Deltares, Import: Delft-FEWS/[03+Import+Module](#)
Deltares, Import_CS3x: Delft-FEWS/[CS3xTidalSurgeTime](#)
Deltares, Import_MOWW3: Delft-FEWS/[MetOfficeWW3](#)
Deltares, MasterConfig: RISC-KIT_PUBLIC/[Master+Configuration+File](#)
Deltares, et al., RISC-KIT_web: [RISC-KIT_website/](#)
Deltares et al., RISC-KIT_WP3: RISC-KIT/[WP3/](#)
Deltares, Training: RISC-KIT/[Training](#)
Deltares, Training_adapter:
Delft-FEWS/[Developing+a+FEWS+Adapter+\(NetCDF-CF\)](#)
Deltares, Training_D3D:
Delft-FEWS/[Delft3D-FEWS+adapter+configuration+manual](#)
Deltares, Training_quickstart:
Delft-FEWS/[Quick-start+Guide+for+Adding+an+External+Module+in+FEWS](#)
Deltares, Instruction_Videos: RISC-KIT_PUBLIC/[Demo+instruction+movies](#)
IMDC, Adapter_Telemac: RISC-KIT_PUBLIC/[Telemac](#)
LIENSs, Adapter_Selfe/WWMII: RISC-KIT_PUBLIC/[SelfeWWMII](#)
WMO, Adapter_LISFLOOD: RISC-KIT_PUBLIC/[LISFLOOD-FP](#)

8 Appendix: Webviewer inventory

Table 8.1: Data/Information inventory

Local information	
Prevention phase	Flood event phase
Flood protection structure location	Safety status of flood protection structures
Historic flood event info	historic flood event info
Critical infrastructure location	Safety status of local critical infrastructure
Forecast information	
Prevention phase	Flood event phase
Historic water levels; inundation depths; beach erosion; flow velocities; meteo data; water levels at control structures	Real time water levels & meteo data; water levels at control structures
Thresholds	Beach erosion forecast
	Inundation depths
	Flow velocities
Derived information	
Prevention phase	Flood event phase
Risk and damage maps for different hazards	Safety status of critical infrastructure
Direct and indirect effects (building damage, loss in supply over time, tourism)	Safety status of flood protection structures
Info on the impacts of certain risk reduction measures	historic flood event info
Disaster management plans	
Other	
Climate change related scenarios (Prevention phase)	Media (Flood event phase)
Sea level rise	Social media (Twitter & Facebook)
Wave height increase	BBC live feed
	Speed dial to important contacts
	Locally reported damages

Table 8.2: User groups/Use Cases inventory

National government	
Prevention phase	Flood event phase
Forecasting agencies to prepare thresholds	Produce and communicate warnings
Scenario planning tool	Gather real time data
Long term flood risk management strategies	Decide to evacuate
Participatory tool for planning developments	Coordination of civil protection agencies
CZM agency: identify erosion hotspots, summarize potential effects to allocate resources for protection effectively.	
Management plans + training, control of mitigation areas	
Control, evaluation of defense and applying for resources/funding	
Local and regional government	
Prevention phase	Flood event phase
Waterboards can prepare management plans and operation rules	Coordinate civil protection
Response teams can run trainings at basin level	Decide to evacuate
Regional planning WFD, water quality aspects with river basin authorities	Communicate warnings
Erosion mitigation	Check a dike
Long term flood risk management strategies incl. Spatial planning (zoning)	Deployment of temporary measures
Participatory tool for planning developments	
Prioritize needs for investment in beach/coastal areas	
Local Cyclone Preparedness Program Offices - Maintenance of shelters (Bangladesh)	

General public	
Prevention phase	Flood event phase
Understand their risk – decide to get insurance or not	Search for up to date info on the general situation e.g. will my defense hold, how deep will the water be, likelihood of overtopping
Improve risk perception (risk culture/ social memory)	Understand the risk of staying (medical, fire, safety, support)
Development of evacuation and contingency plans as part of DRR plans	When to take protective action e.g. evacuate or move goods/ cattle
Informing micro finance companies of the risk	Evacuation management
Public/Private stakeholder	
Climate change related scenarios (Prevention phase)	Media (Flood event phase)
Understand their risk and take preventive actions	Erect flood barriers
Provide training and educational materials with utilize this info to understand about risk	Construction of temporary flood protection barriers