IWRAP Mk2 v4.7.0

Manual

GateHouse A/S Nov 2015
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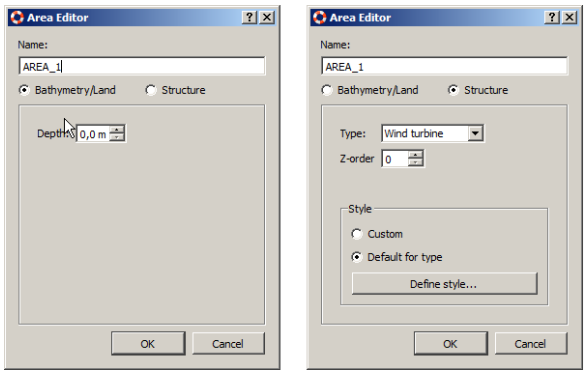
IWRAP Mk2 Release Notes

List of changes to the application:

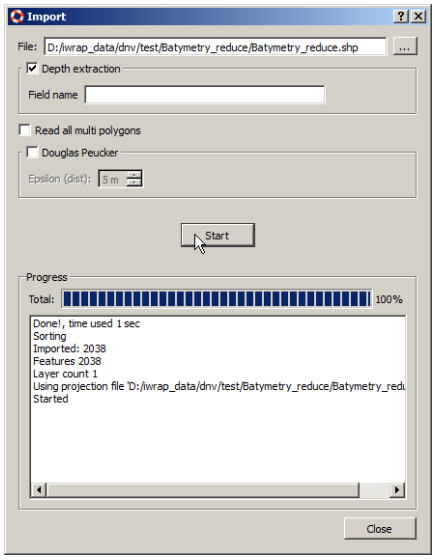
- **Version 4.7.0**
  - Allisions: In previous versions of IWRAP structures e.g. wind turbines have been modelled using grounds. Now it is possible to define structures directly. An allision is a collision between a moving vessel and a stationary object/structure. Allisions now have their own result category i.e. they are no longer mixed with groundings. This means that they are directly visible on the main result view.

    Structures are defined like normal polygon areas, except that you have to tick off the 'Structure' button, see right hand side below.



    Allisions have been assigned their own causation factor.

  - Polygons for Bathymetry, Structures or Traffic Areas can be imported from the Data menu from ESRI shape or KML files. E.g. import Bathymetry shape file from 'Data/Bathymetry/Import ESRI shape file...'.

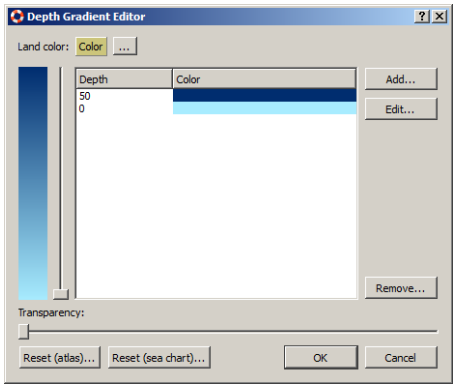


    When importing Shape files it is possible to specify a field that contains the depth of the polygon. Furthermore it can be specified how multi polygons are to be handled, sometimes all of them should be included, but the default is to only include the first layer (i.e. the others may be interior rings).

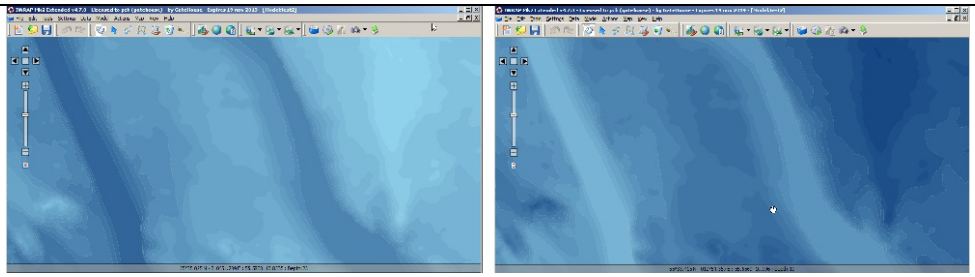
    For both Shape and KML files you can choose to simplify the polygons by using the Doglas-Peucker algorithm.

    Note that when you import polygons from a file each polygon is tagged with the name of the file. Each time you import the file the polygons from that file will be deleted first.

  - New bathymetry coloring. IWRAP now uses a gradient for Bathymetry coloring, similar as used for e.g. Traffic Density.

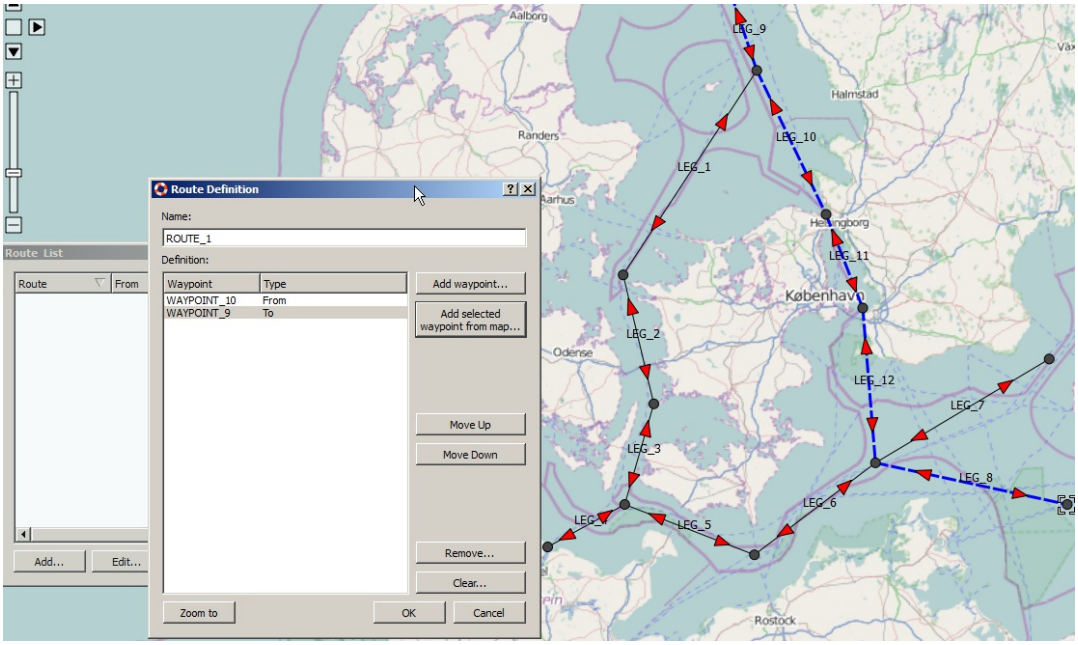


    The 'Reset (atlas)' button makes deep area dark and shallow areas lighter, 'Reset (sea chart)' does the inverse. Here you see an example, atlas mode on the left hand side.

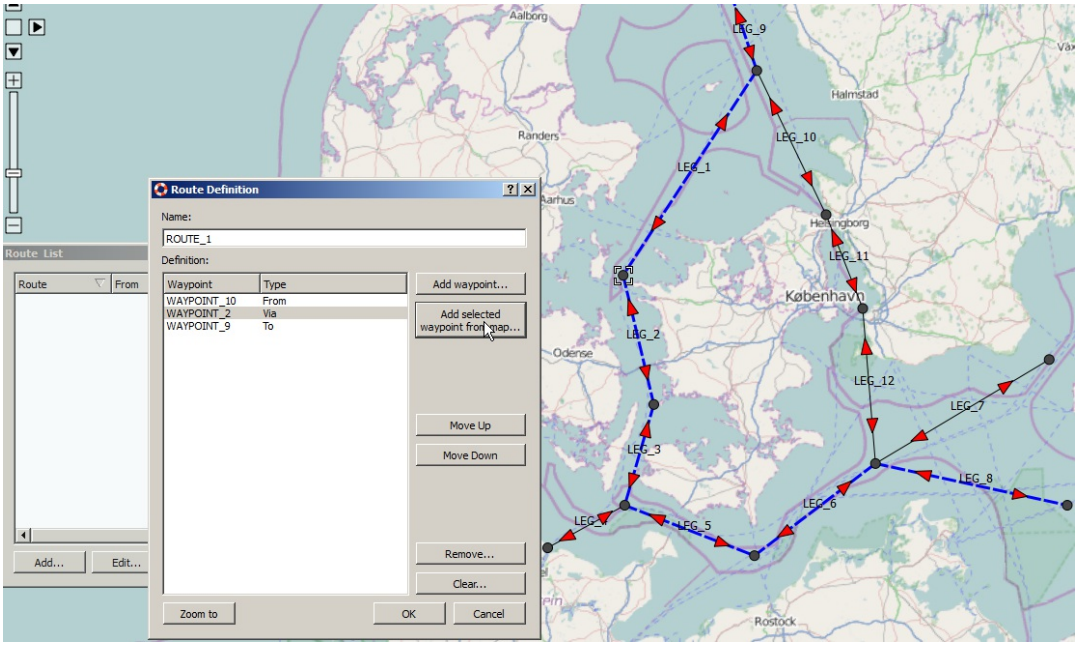


- Bentley-Ottmann algorithm is now used to check if polygons are simple, this gives a huge performance improvement for large polygons.
- The Traffic Area Composition dialog has been simplified, the style is now set by pressing the 'Style...' button.
- Possible to pan when pointer tool is selected i.e. when no selectable object is clicked it is possible to pan the map.
- Routes: This version contains the possibility to define routes. A route consists of a number of waypoints and legs. This can be used to e.g. move traffic from one route to another

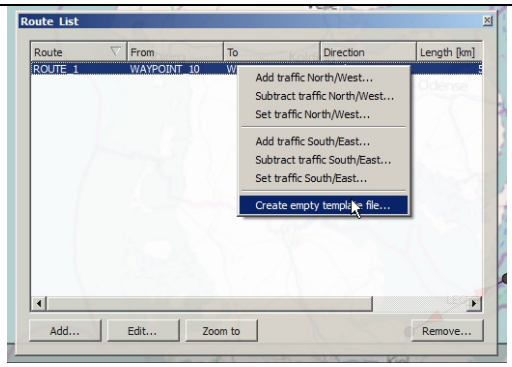
Here is an example of a route between two waypoints. IWRAP automatically chooses the shortest route, indicated with blue dashed lines.



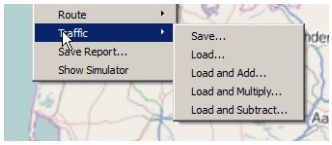
If you don't want the shortest route you can insert one or more via points.



When a route has been defined you can add or subtract traffic from the legs in the waypoint. This is done by e.g. selecting 'Add traffic North/West...' and opening a CSV file with numbers for each ship type and ship length category. You can select the 'Create empty template file...' and save a file that you can e.g. open in Excel and modify and there after use to add or subtract.



- Traffic menu: Using the traffic menu you can save all traffic from all the legs to one CSV file. This file can then be opened in e.g. Excel and modified and there after re-imported into IWRAP.

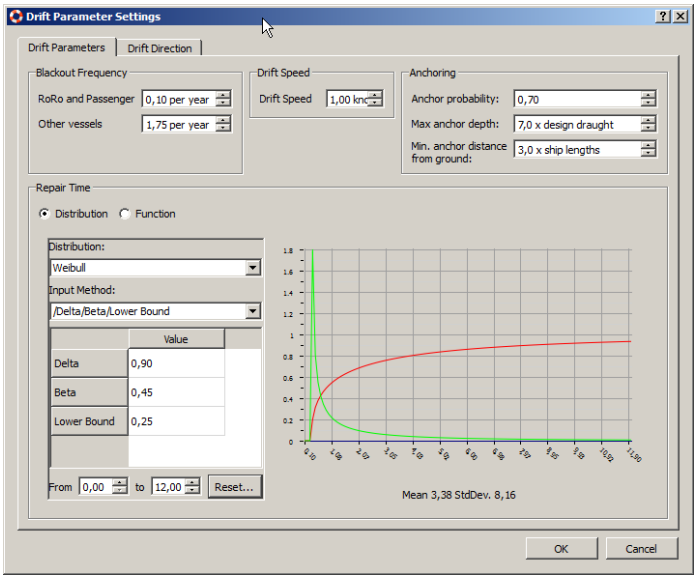


The 'Load...' menu item simply loads and sets the values. You can also e.g use the 'Load and Add...' to add additional traffic. 'Load and Subtract...' removes the traffic and 'Load and multiply...', multiplies the traffic with the factor specified in the file.

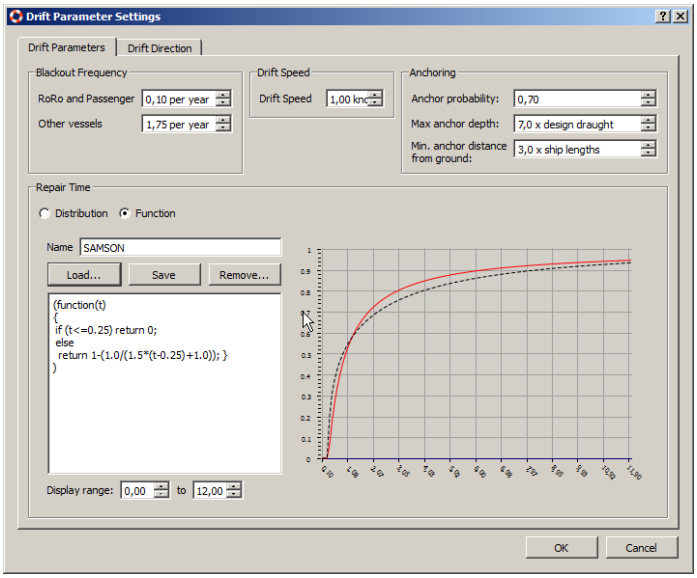
Note, that you should only change the traffic amounts in the files and not modify the layout or other tags in the files.

- Drifting

Drifting parameters and settings have undergone major refactoring for this release. The parameters for the IWRAP standard Repair time Weibull has been adjusted. The previous settings were based on rather old literature studies, the new values have been found by comparison with studies performed in the Netherlands in the SAMSON project.

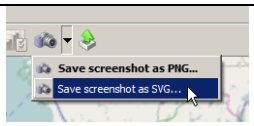


The SAMSON project uses a function, this is now also possible in IWRAP.

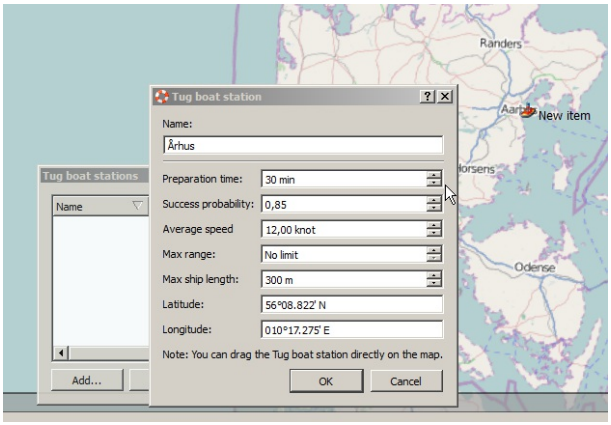


You can either load an existing function, e.g. the SAMSON function or you can write your own. The function must be written in JavaScript.

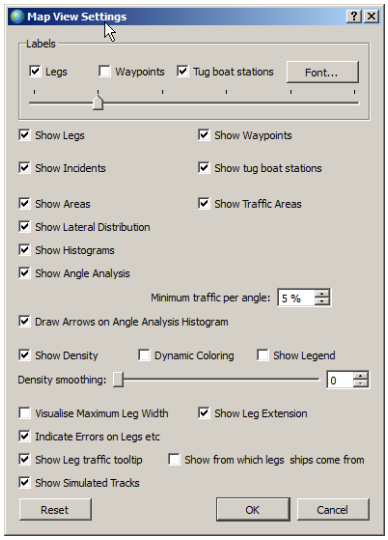
- SVG screenshot: SVG is a vector format, i.e. so it looks much better than the raster screenshot when printed.



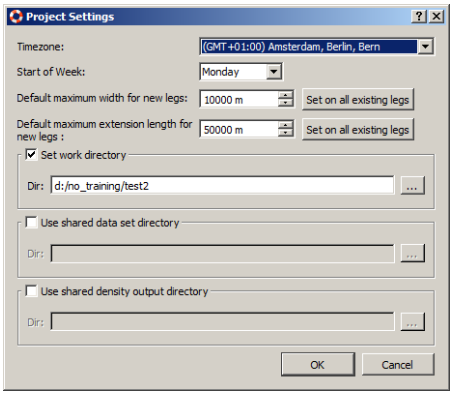
- Tug stations: It is possible to specify the location of tug stations and define their range of operation. This is used for drifting ships, i.e. it is calculated if the Tug Boat can reach the drifting grounding or allision event in time. If this is possible the success of the actual tug operation is specified by the 'Success probability'.



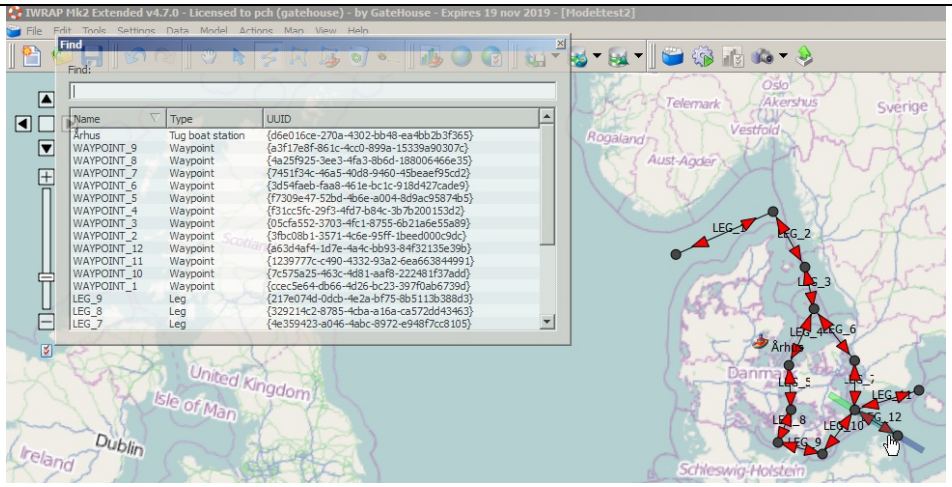
- New map view settings: Show way point label (disabled by default) and possible to change label font and size.



- If you have several models that use the same data set you can now share the data sets between them, see 'Use shared data set directory' below. You will normally find the data set in the 'imported_ship_data' subfolder of the working dir of the project you want to share data with. You can also share the density plot data with another project, see 'Use shared density output directory' below.

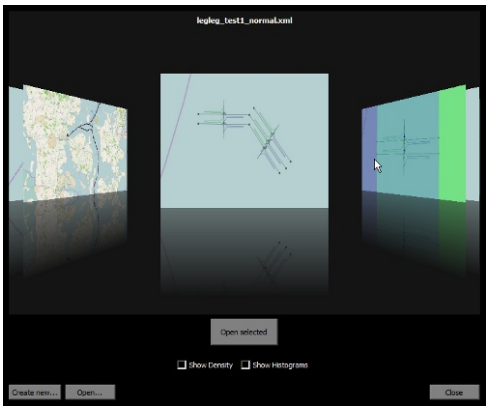


- New find/search function, press CTRL+F, enables you search for all model items.

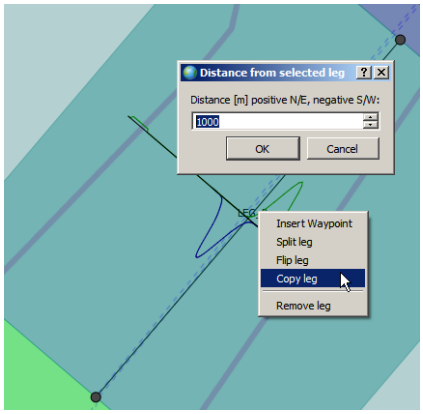


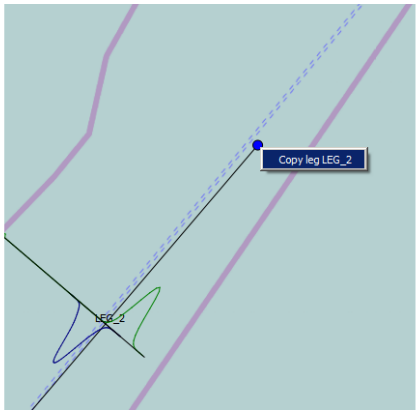
- Many minor fixes, e.g. fixed problem with the Google earth integration so if you have had problem with this you may want to try again.

- **Version 4.6.1**
  - New startup window. When you open your models, a signature screenshot will be stored for each model. The screenshot along with the name of the model can be used to open an existing model. Note, that before a screenshot is generated the IWRAP logo is shown, so if you previously have opened some projects you will see a IWRAP logo, these will automatically be replaced by screenshots as you work with your models. If you have more projects, you can press on the left or right hand side of the screenshot to iterate through the projects or use the left/right/page up/page down keys. Users with extended licenses can tick off the 'Show Density' or 'Show Lateral Histograms', to open these straight away when the project is opened. You can also press the 'Close' button and just open projects as usual from the file menu.

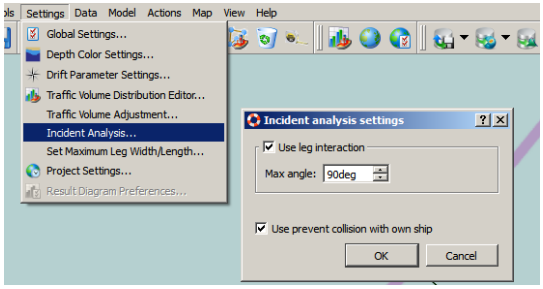


- Own ship handling. If your model is based on data import, IWRAP will now handle cases where the same ship travels both ways on a leg, e.g. ferry traffic.
- Copy leg. It is possible to copy a leg in two ways. You can right-click on the leg itself and specify the distance the copied leg should be displaced from the original. You can also right-click on a waypoint and copy a leg, the copied leg will then be connected to the waypoint and extend onwards in the same direction and same distance as the original.

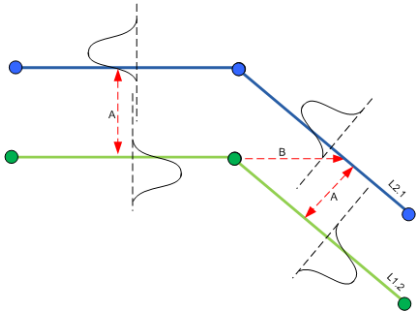




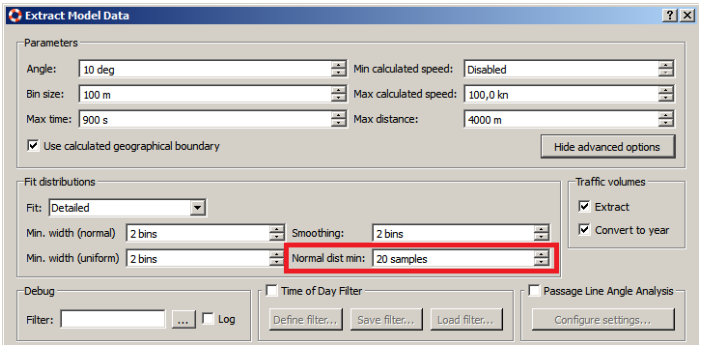
- Flip leg. It is possible to flip a legs waypoints by right clicking on the leg.
- Leg to leg traffic. Parallel legs can now interact in IWRAP. You can specify how parallel the legs should be to allow this, in the 'Incident Analysis 'Settings'.



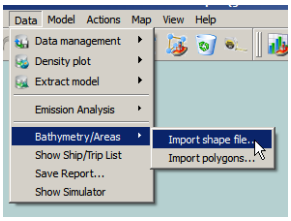
The parallel case is illustrated with an 'A' the following picture. Another scenario that is now handled, is the case where a ship may go on at the end of a leg into the traffic stream of another leg, as illustrated by a 'B' below.



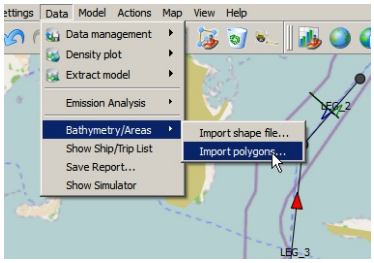
- Normal dist min. When extracting data from AIS, a new parameter has been added 'Normal dist min.' This means that there has to be more this number of samples before Normal distributions are used for the fit, if there are fewer then only a uniform distribution is used.



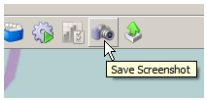
- When comparing results, percentages are now always relative to incidents per year.
- Load shape files. It is now possible to import polygons from shapefiles.



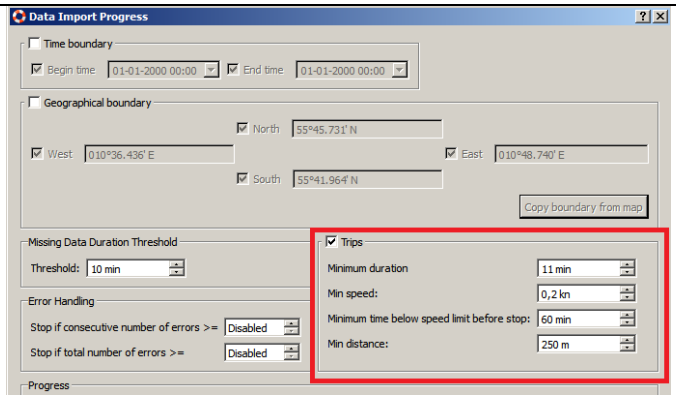
- Built in polygon database. IWRAP now has a built in basic shape database for land and islands. The detail level is very basic, but can be used to get started on a new model.



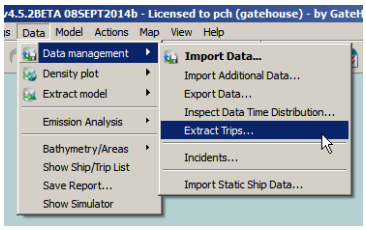
- File name saved as UTF8
- Show help PDF. The PDF help file can now be accessed from the help menu.
- Fixed timezone problem, with e.g. Canada.
- Save screenshot. Its now possible to save the model and result views as PNG files.



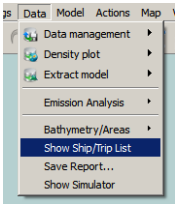
- Save report. You can save a text file containing the traffic distribution of each leg in the mode, access this feature from 'Data/Save Report...' .
- Ship/Trip list. IWRAP can now display tracks/trails/trips of individual ships. In order to use this you have to extract trips first, you can either do this when you do the normal import:



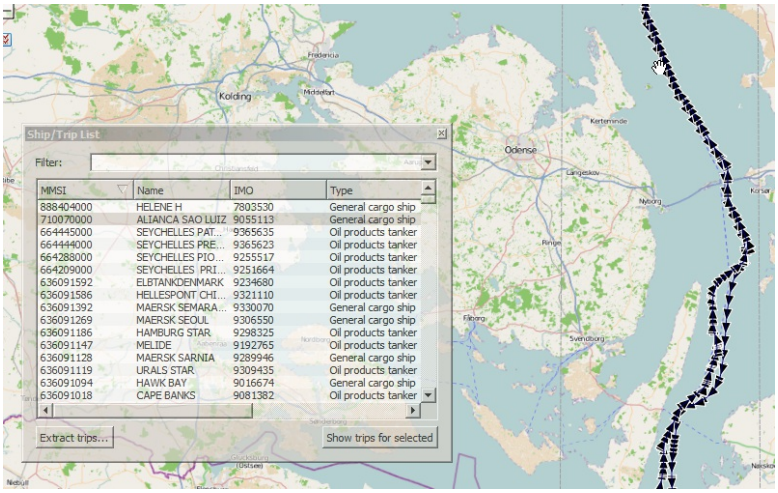
or you can extract it from an existing data set:



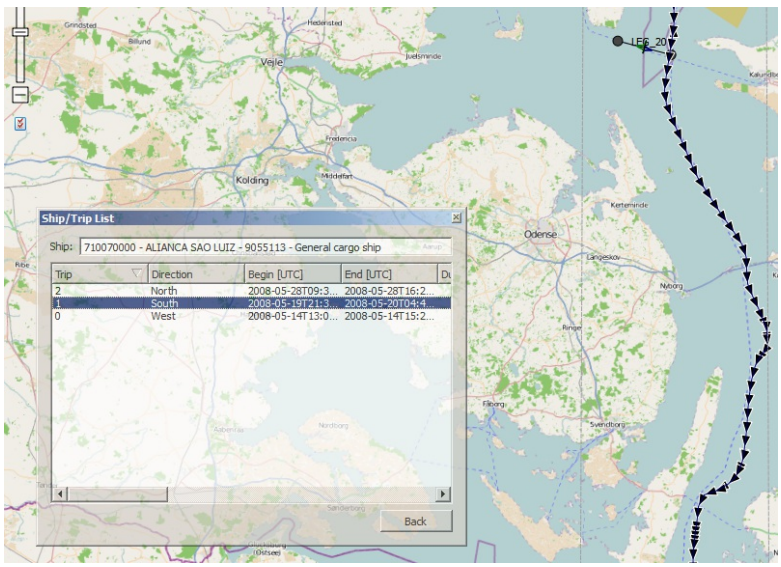
The result can be accessed from:



This will display a list with all the ships. When you double click one of the lines all the trail data for this ship will be shown on the map.



If you press the 'Show trips for selected', a list with the trips for this ship will be shown, you can again double click one of the lines to see the particular trip on the map.



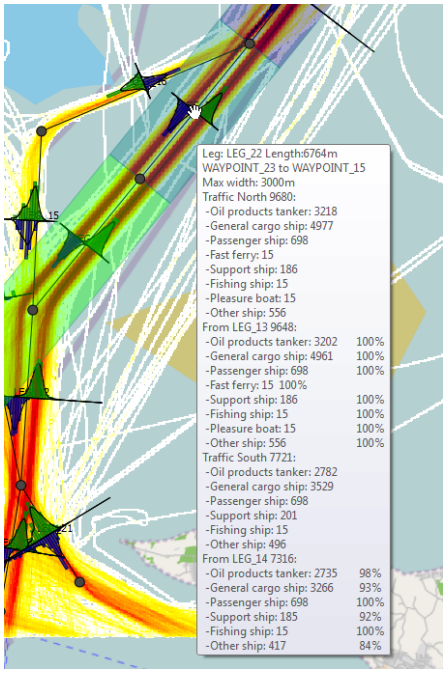
- Access this, i.e. the release notes, from the help menu.

- **Version 4.5.1**

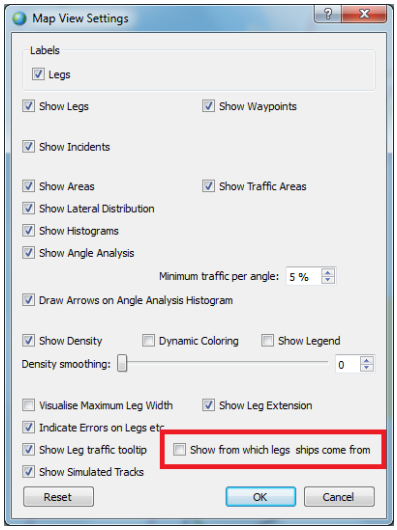
  - Fixed problem when changing to Leg to leg traffic absolute numbers.

- **Version 4.5.0**

  - Fixed problem with OSM maps.
  - Leg to leg traffic is now extracted as absolute numbers when extracting data from AIS. When creating a model manually absolute number can also be used.
  - In the Leg to leg editor, used cells now have a green backgound, to make it easier to distinguish them from not-used cells.
  - In the Leg to leg editor, now has a 'Hide unused columns' button.
  - Added possibility to inspect traffic flow, e.g. at a leg or waypoint you can now inspect where traffic is coming from via the tooltip. This can be useful to insure that the traffic is captured.

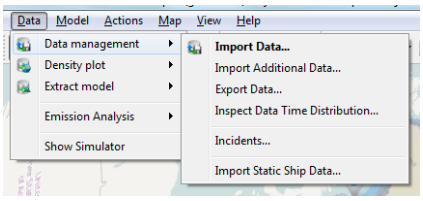


- The traffic flow information on the legs is hidden by default, because the tooltip can get quite large. It can be enabled from the 'Map View Settings dialog':



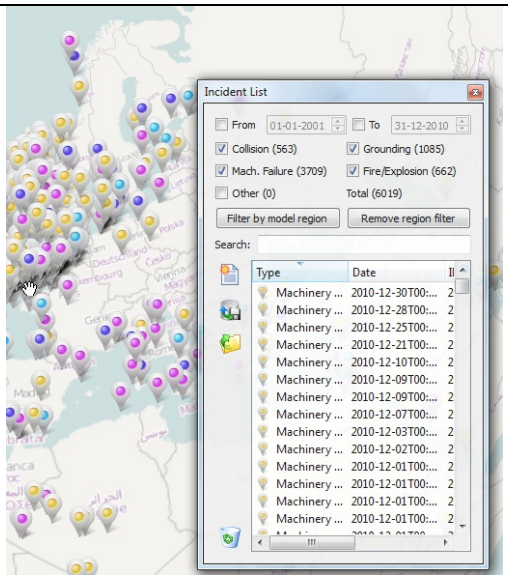
- **Version 4.4.0**

  - Simplified dialogs, complex dialogs now have a 'Show advanced options' button.
  - Rearranged data menu.



  - Added toolbar menu for data management, traffic density and extract model.

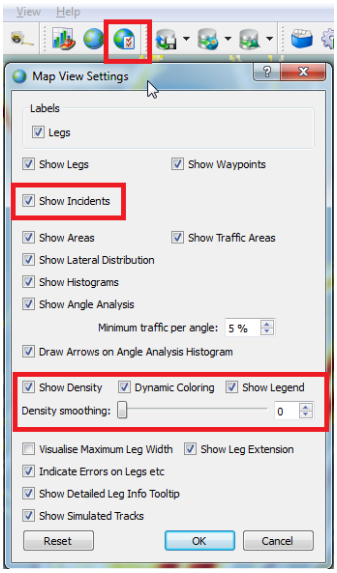
  - When importing data, IWRAP now stores the header signature along with the format. This means that IWRAP will automatically recognize the format the next time you want to load a file with the same header signature.
  - It is now possible to copy the designed file format to/from clipboard, e.g. when importing AIS data.
  - If you need help while importing data, a "Data snippet to clipboard" has been added. This will copy 10 lines from the chosen file, this can then be send to iwrap@gatehouse.dk if you need assistance.
  - Support for importing and displaying incidents, see 'Data/Data management/Incidents...'



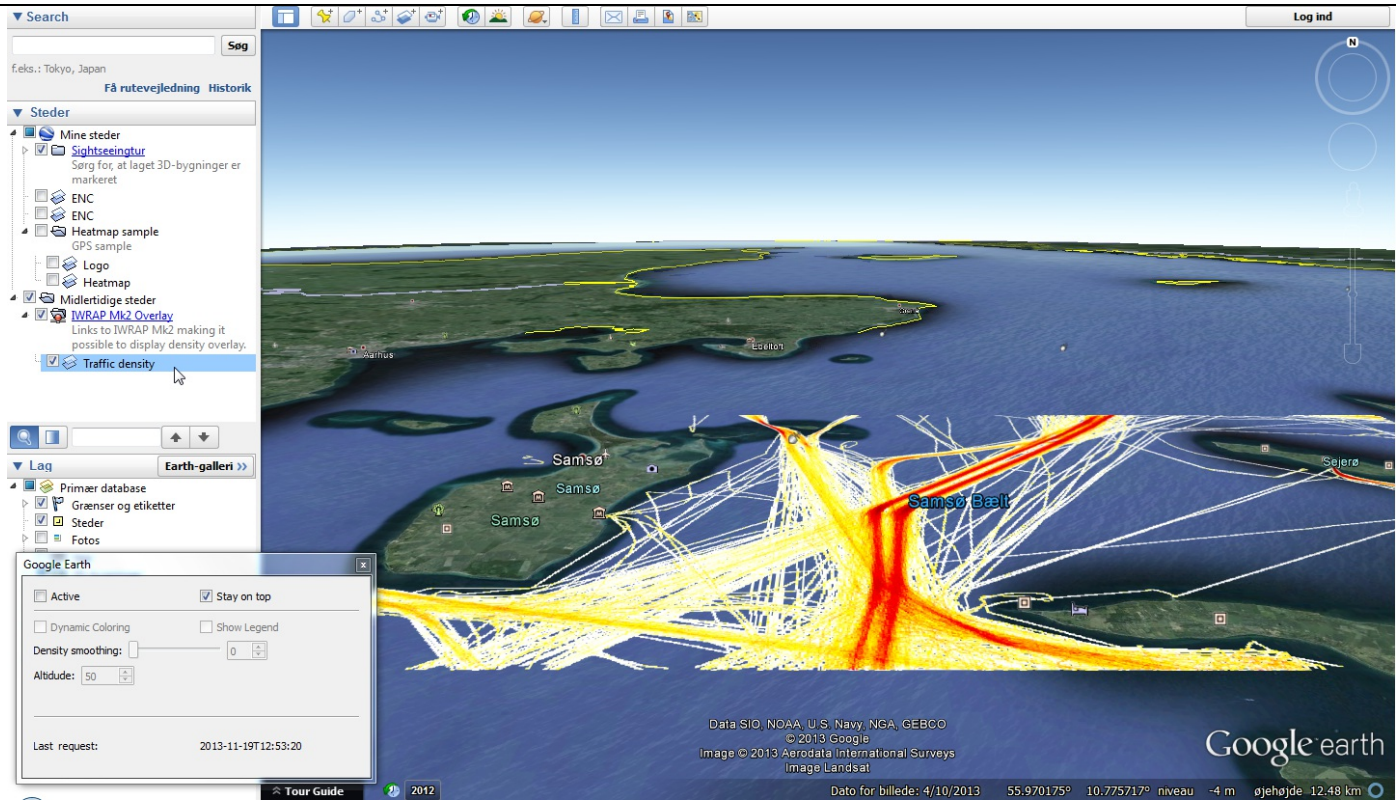
- Traffic Density smoothing (blurring). (Disabled by default see Map view settings)

- Traffic Density legend. (Disabled by default see Map view settings)
- Traffic Density dynamic coloring. (Disabled by default see Map view settings)

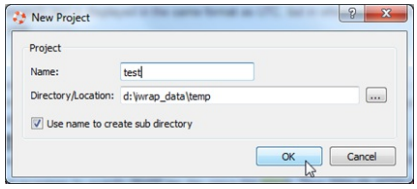
- New Map view settings.



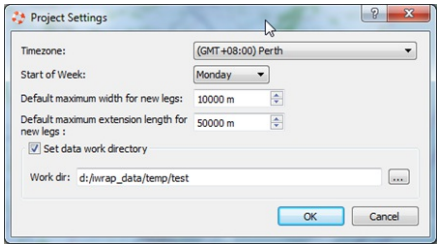
- IWRAP now has a new AIS-TEXT ship type format parser, which tries to guess the ship type from a string, e.g. if the string contains the word 'cargo' it is interpreted as a cargo ship type.
- Fixed bug when using undo while drawing a leg.
- Fixed data import problem for CSV files with quotes.
- IWRAP now supports a variety of different position formats, see Position Format.
- Possibility to show Traffic Density plots on Google Earth.



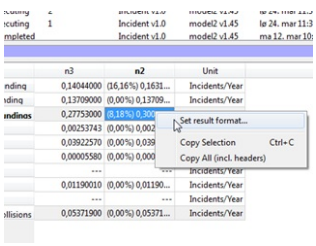
- **Version 4.2.0**
  - Possibility to define driftng parameters per leg.
  - Leg dinstance and angle shown when creating og editing.
  - Detailed leg popup is only shown when hovering above the center og the leg.
- **Version 4.1.0**
  - A new ?Use name to create sub directory? option has been added to the New Project? dialog. If this option is used in the example below the project data will be created and stored under d:\iwrap_data\temp\test?. This option makes it easier to create and manage several projects, see Creating a New Model.



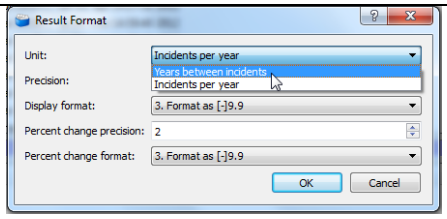
  - The new directory is also used as the default location for working with AIS data, if the "Set data work directory" is used in the project settings, the directory will be stored in the model and used as reference point when working with AIS data. This will create the following structure at the selected work dir.



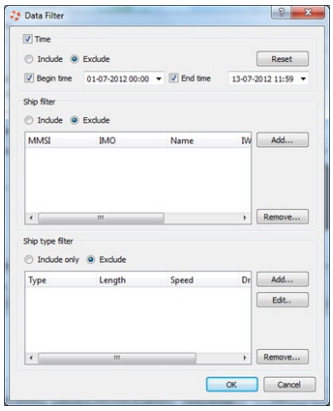
    - \imported_ship_data : Used to store the imported IWRAP data from e.g. AIS.
    - \model_extraction_temp : Used to store temporary data when generating models from imported data ship data.
    - \density : Used to store generated density plot data.
    - \emission : Used to store generated emission data.
  - When comparing results, the change in percent relative to the first selected job is shown:



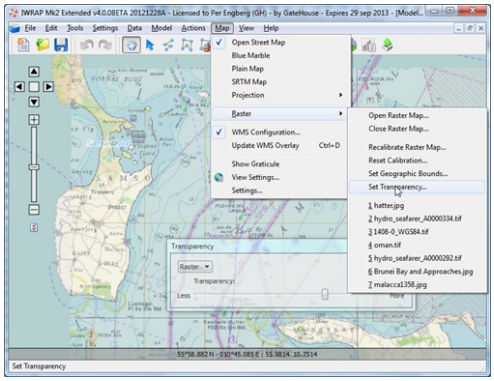
  - When you right-click on the results, it is possible to select between ?Years between incidents? and ?Incidents per year?, and select the precision of the numbers:



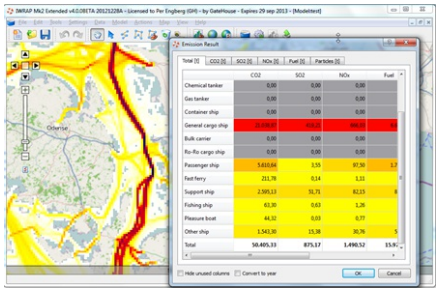
- It is now possible to add additional data to an already existing dataset, i.e. the existing dataset will be merged with the new data.
- You can now use Unix/Posix time stamps when importing data, i.e. seconds since 00:00:00 UTC 1. January 1970. The 64bit version includes milliseconds.
- When creating a Density Plot or using the new Emissions calculation feature it is now possible to a time filter as well as the regular ship and ship type filters. It is possible to exclude or include a certain period.



- When using Raster maps the maps are now projected on top of the background map instead of being shown in a separate window. It is possible to control the transparency of the Raster map.



- It is now possible to use regular WMS services that do not support tiling.
- GeoTIFF raster maps can now be imported without having to specify boundaries.
- A new Emission Analysis has been added to IWRAP. An emission density plot is created to show where the emissions occur. A result view shows how many ton CO2, SO2, NOx are emitted and how many ton fuel is consumed, by ship type and ship length category.
  Note!, this is first version of the algorithm, the results have been checked, and seem to be reasonable. Later a more advanced version of the algorithm will be released.



- **Version 4.0.0**

- Web Map Service (WMS) support has been added, see an example in Section Navigating the Map
- New Traffic Area algorithm, it is now possible to define areas/regions with different traffic compositions.
- A Time of day filter option has been added to the density and data extraction algorithms. It is possible to define the filter manually or to use the sun position.
- A Passage Line Angle analysis has been added to the data extraction algorithm.
- Drifting groundings analysis has been improved with anchor handling, see drifting.
- Set default parameters when creating a new model, can be changed in 'Settings/Project Settings...'.
- It is possible to define the maximum 'Leg extension' length, and thereby limit Drifting groundings at the Leg ends. The maximum extension length is also used for the new area traffic algorithm.
- Possibility to handle a NMEA format where a comma is used separate a timestamp and the NMEA string.
- Milliseconds can now be parsed in timestamps.
- A new join leg possibility has been added.
- When a Leg is split or a waypoint is added in the middle of a leg, the old legs Traffic and Lateral distributions are now copied to the new Leg.
- IWRAP now handles quoted strings correctly in CSV import.
- Fitting error dialog now shows frequency/traffic per leg per shiptype and total.
- A copy to clipboard is added to the Fitting error dialog.
- Indicate Leg traffic frequencies on tooltip/mouseover Legs on the maps.
- Map view settings has been extended with new options and added to the toolbar and menu.
- Control import stop on errors, i.e. it is possible to disregard errors or specify a maximum number of errors.
- Minimum density changed from 25m to 10m.
- Fixed bug in import data progress bar, wouldn't work properly if file(s) had too many lines, now uses 64 bits, instead of

signed 32 bit.
- Problem regarding enabling/disabling density ship filter fixed.
- Extract optimization, check for overlapping legs.
- Copy Leg traffic distribution bug fixed, reduction factor was no correctly copied.
- When creating a new model, IWRAP tries to detect your geographical location from your internet connection and center and zoom to that location.

- **Version 3.4.0**

- A Ship filter is added to the density plot, making it possible to specify which ships should be included or removed.
- A red arrow on a leg is now used to indcate that there is something to be done i.e. adding traffic or adding distributions.
- A red marker with a question mark is used to indicate if two legs cross without having a waypoint.

- **Version 3.3.0**

- A density export feature is added to the Extended/Commercial version, see 'Data/Density/Export...', new density values will be converted to yearly numbers. Old density plots are not converted, you will need to generate the plot again, but this is only necessary if you want to export them.
- Fixed problem when drawing polygons, now it is no longer possible to select leg/waypoint when drawing the polygon.
- If the polygon tool is selected, polygons are always shown transparent.
- The red color used for warning non-simple polygons is set to transparent.
- A new toolbutton has been added to the 'Area List', shotcut for 'Settings/Depth Color Settings...' menu.
- Help file could not always be activated, fixed, tested on Xp and Vista.
- User profile too large problem, limit on map download size has been added, can be adjusted in the new 'Map/Settings...' menu item. The default is 100MB hard disk space and 30MB memory. It is also possible to clear the cache from this menu item.
- Fixed problem when trying to store a model where you dont have write access (the Vista problem), you will now get a warning if you dont have write access.
- 'Current path' was used as default in many places in IWRAP, this has been replaced with the users 'home path'.
- IWRAP will generate a .dmp file in your home path if it crashes, please send them to me, I can use the information to fix the error.
- Fixed issues when closing the project, it was not possible to cancel correctly.
- Added check for model xml file consistency, will e.g. fail if .xml only contains polygons.
- Added help file in pdf format, you can find it in the directory where you installed IWRAP. It is not perfect, but at least it is printable.
- Fixed problem when trying to quit while splash bitmaps where shown at startup.
- It is now possible to import, data where there is no timestamp on the second part of the message 5, e.g..

  1-4-2008 14:06:38 < tab > !AIVDM,1,1,,A,33u=Qm?qh20nEWbQ0lB3K87l0000,0*19
  1-4-2008 14:06:58 < tab > !AIVDM,2,1,2,A,53u?j?P1joL=<@HP000eDhhDp000000000000001HA4440HtP00000,0*6A
  !AIVDM,2,2,2,A,000000000000000,2*26
  1-4-2008 14:07:01 < tab > !AIVDM,1,1,,B,14QsDc04Qn19nJ`P1?;9F7Il0800,0*52

- Density quantile calculation speed optimization
- Marble stars plugin has been added ;-), zoom out on the globe to see it in action

- **Version 3.2.0**

- Improved visualisation of results on map, see Running the Algorithm, results are normalized according to length of Legs and Polygon segments.
- Added check for non-unique guids in polygons in the .xml, if they are not unique IWRAP will try to fix them.
- Added features for adding a Waypoint in the middle of a Leg, splitting and joining a Leg, Modifying Legs and Waypoints
- Changed the default depth color settings, i.e. the deeper the darker. If you are upgrading and earlier version of IWRAP you can go to 'Settings/Depth Color Settings...' menu item and use the Reset button to get the new default colors.
- It is now possible to specify the depth values with one decimal precision.
- The decimal precision has been increased in the storage of floating point numbers.
- Fixed bug in kml import, imported polygons where not simple because start and end points where the same.

- **Version 3.1.0**

- First time you run a new version, the release notes will be shown
- Fixed bug when loading mixed distribution from xml, this error may affect models that use distributions other than normal and uniform
- Proxy settings now handles port number with more than 2 digits
- Added automatic check for and download of IWRAP Mk2 updates. A check is performed automatically when starting the application and can be invoked manually from the file menu.
- Major change to the handling of bathymetry i.e. areas/polygons, see Defining Bathymetry.
  - In order for IWRAP to work correctly it is important that all area polygons are Simple, a check for 'Simple' polygons is added, polygons are colored red if they are not Simple, the points that cause the problem are also indicated with red.
  - A polygon has to be selected from a list (or on the map) before it can be edited.
  - Google Earth like editing of points in the polygon, i.e. no more dragging points to add a new one, just select a point and start clicking to add new points.
  - Possibility to delete complete polygon.
  - Points with identical coordinates are removed.
  - Empty polygons are removed when storing the model.

- **Version 3.0.0**

- First release of extended functionality.
- Marble based map engine.

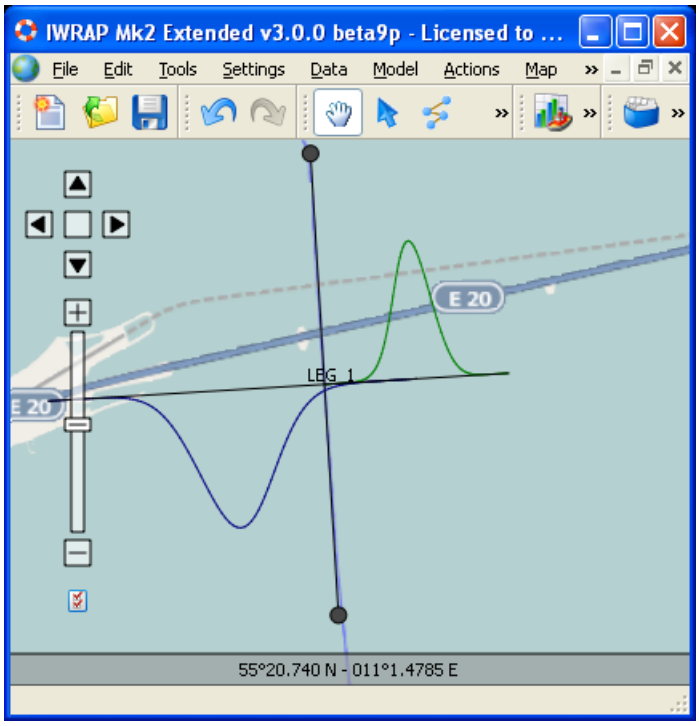
IWRAP Mk2

The objective of the IWRAP Mk2 application is to provide the user with a tool that assist in the quantification of the risks involved with vessel traffic in specified geographical areas. On the basis of a specified traffic intensity and composition the tool allows the user to rationally evaluate and estimate the annual number of collision and grounding in a specified navigational area.

- Basic Concepts
- Working with Models
  - Creating a New Model
  - Adding Legs and Waypoints
  - Modifying Legs and Waypoints
  - Removing Legs and Waypoints
  - Using the Leg Editor
    - Lateral Distributions
    - Causation Factors
    - Traffic Volumes
  - Using the Waypoint Editor
    - Causation Factors
    - Leg to Leg Traffic
  - Defining Bathymetry
  - Defining Structures
  - Drifting
  - Area Traffic
- Running the algorithm
- Navigating the Map
- Generating a Model from Imported Data (Extended version)
  - Importing Ship Type Data
  - Importing Data
  - Extracted ships and trips
  - Density Plots
  - Extract Model Data
  - Exporting Data
  - Importing Incident Data
  - Calculating Emissions

Basic Concepts

In order to perform an analysis you will start by modelling your area of interest. The model primarily consists of waypoints and legs, i.e. traffic lanes. The following picture shows a simple model with one leg, 'LEG_1' and two Waypoints, i.e. a Waypoint is the end of a Leg. A waypoint may be connected to several Legs e.g. in a junction.



Each leg has two directions, in this case North/South. For each direction the traffic composition has to be defined, most importantly the Lateral Distribution and the Traffic Volume. The Lateral Distribtution identifies where the ships travel on the leg, in the example shown below the north going Lateral Disribution is specified by a normal distribution with mean 1000m and standard deviation of 200m and the south going is defined by a normal distribution with mean 1000m and standard deviation of 400 m. This means that the highest peaks on the curves are 1000m away from the center of leg, and the ships going south are wider spread on the leg than ships going north.

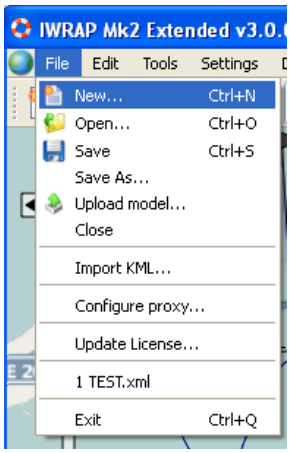
The Traffic Volume distribution is used to define the composition of ship types on the Leg, again this is specified for each direction. IWRAP MK2 distinguishes between the following ship types:

- Crude oil tanker
- Gas tanker
- Container ship
- General cargo ship
- Bulk carrier
- Ro-Ro cargo ship
- Passenger ship
- Fast ferry
- Support ship
- Fishing ship
- Pleasure boat
- Other ship

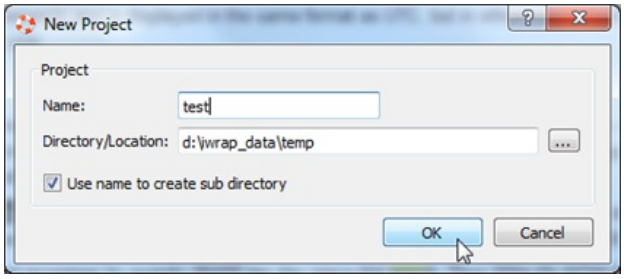
Each ship type is devided into a number of length categories in 25m intervals, 0-25, 25-50 etc., ending withh 400 and above.

IWRAP Mk2

Start IWRAP Mk2 and select File/New (Or press CTRL+N) i.e.:

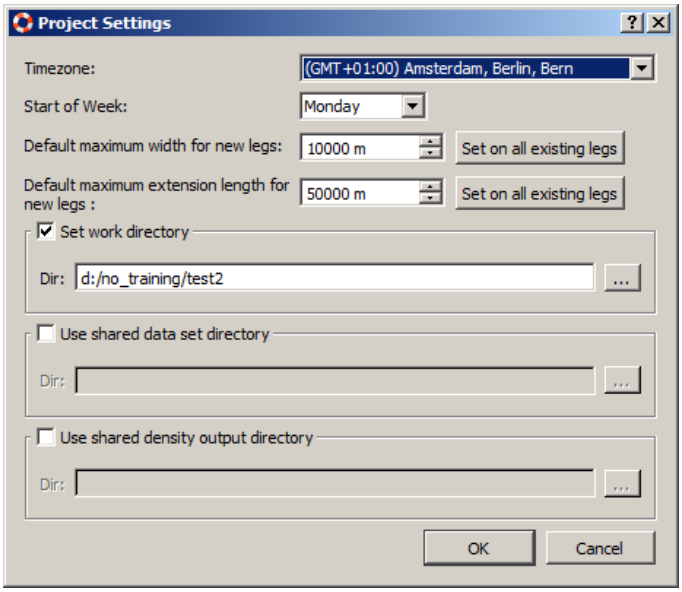


The New Project dialog will appear.



Select the directory/location where you want to place the project/model. If you choose “Use name to create sub directory” option the project name is used to create a subdirectory at the specified location, in this example the project will be created and stored under d:\iwrap_data\temp\test”. This option makes it easier to create and manage several projects. Pressing Ok will create a model xml at the specified location.

You will then be asked to input different initial project settings:



The mentioned maximum width and extension length setttings are described in Leg Editor. You will always be able to modify these project settings later using the 'Settings/Projects settings...' menu item.

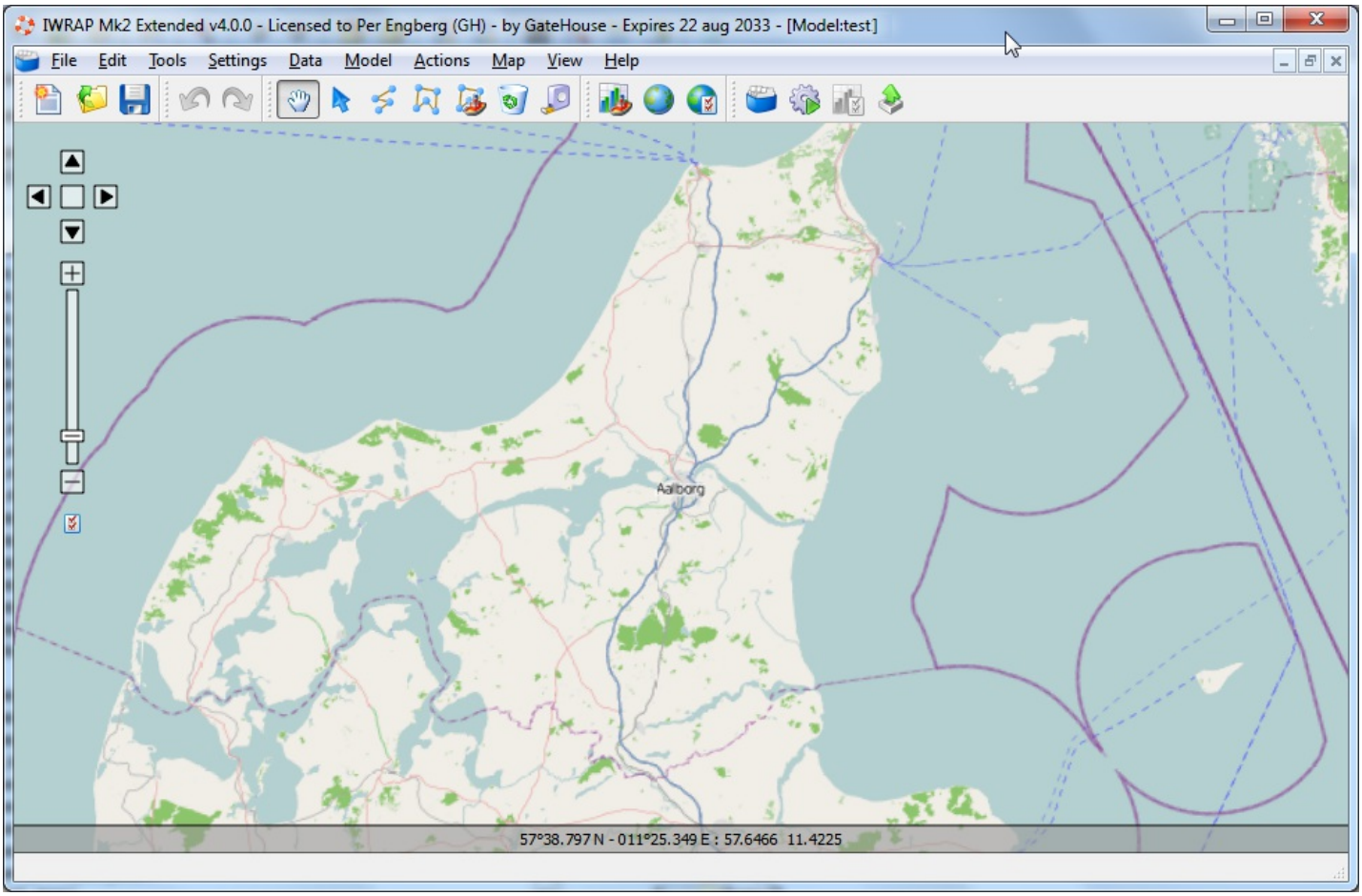
The project directory is used as the default location for working with AIS data. The data work directory will be stored in the model and used as reference point when working with AIS data. This will create the following structure at the selected work dir:

- \imported_ship_data : Used to store the imported IWRAP data from e.g. AIS.
- \model_extraction_temp : Used to store temporary data when generating models from imported data ship data.
- \density : Used to store generated density plot data.
- \emission : Used to store generated emission data.

If you have several models that use the same data set you can now share the data sets between them, see 'Use shared data set directory'. You will normally find the data set in the 'imported_ship_data' subfolder of the working dir of the project you want to

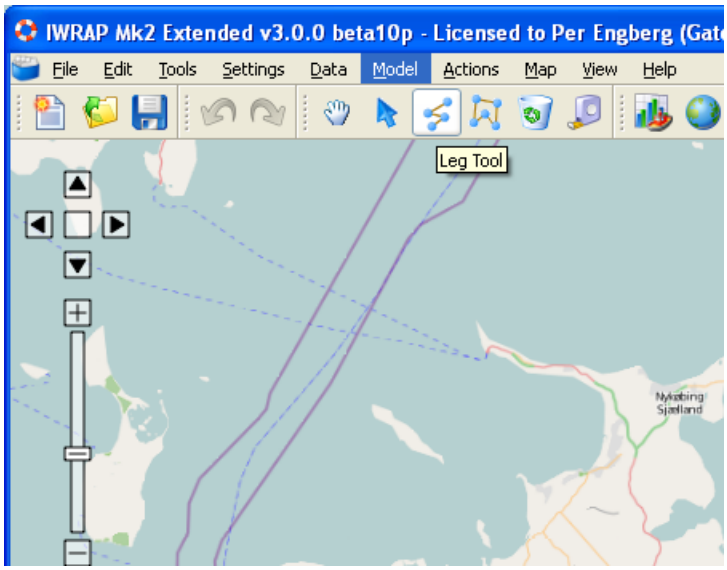
share data with. You can also share the density plot data with another project, see 'Use shared density output directory'.

Press Ok/Cancel to continue, the model map view will be shown. The map data must be downloaded from the internet. Note that the first time it may take some time until the map data is downloaded. IWRAP will try to determine your current geographical location from your current internet connection.

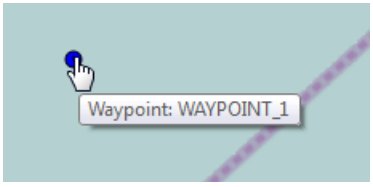


Adding Legs and Waypoints

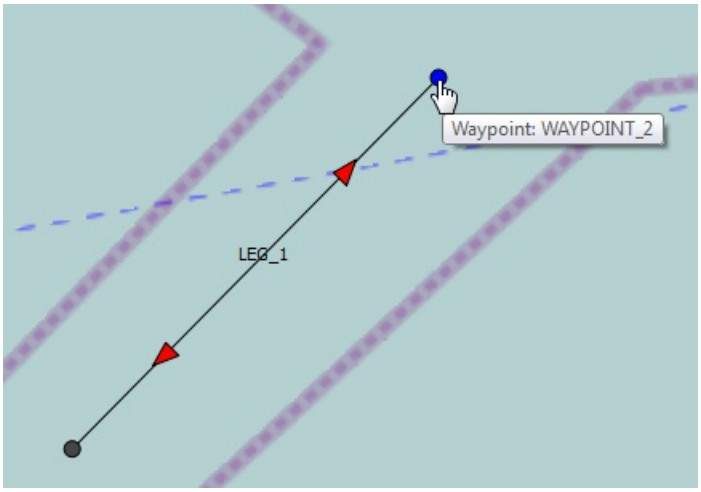
Before adding a Leg, start by zooming in on the area of interest. Then select the Leg Tool from the toolbar:



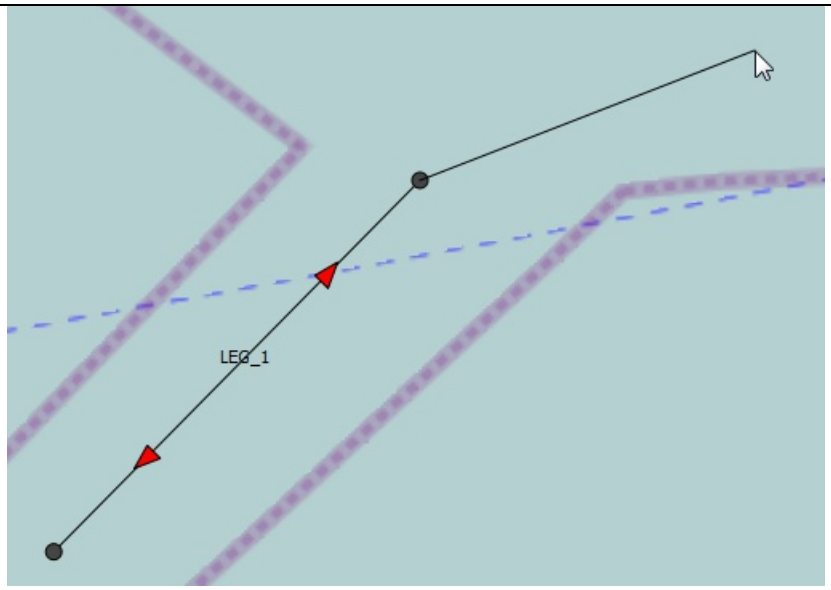
Then click once with the left mouse button at the position where you want to start the leg, this will add the start Waypoint:



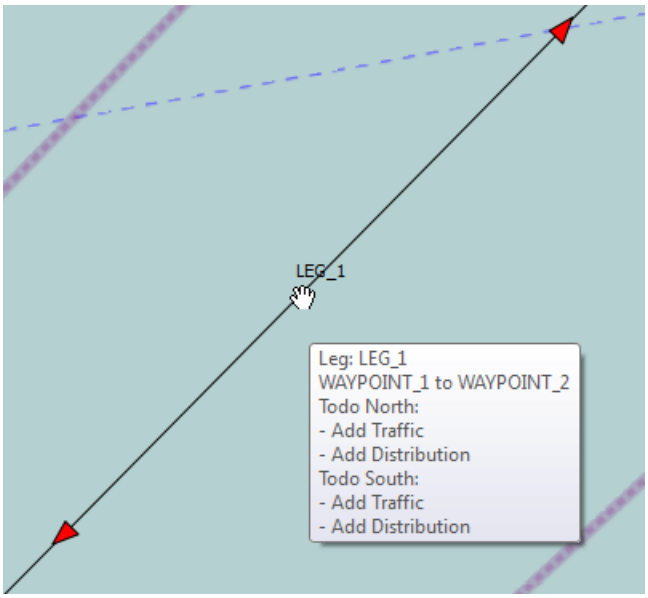
Then click and release once with the left mouse button at the position where you want the leg to end and thereby add the end Waypoint:



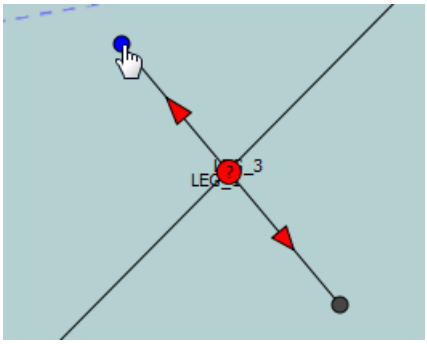
If you want to add a new Leg that is connected to 'LEG_1', then move the cursor over the Waypoint where you want the Leg to start, the cursor will change to a hand symbol. Click once with the left mouse button, the leg is started, and move the cursor to where you want it to stop.



The red arrows that are shown in each direction, indicates that there has to be added some traffic and latterral distribution. When the cursor is above the leg, a tool tip indicates what is to be done.

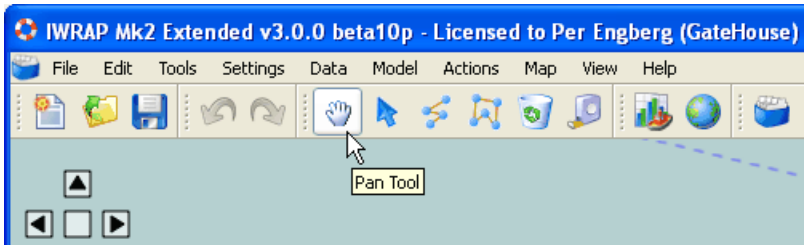


If you add a new leg that crosses another leg you will also get an error indication.



A waypoint should be added at the intersection.

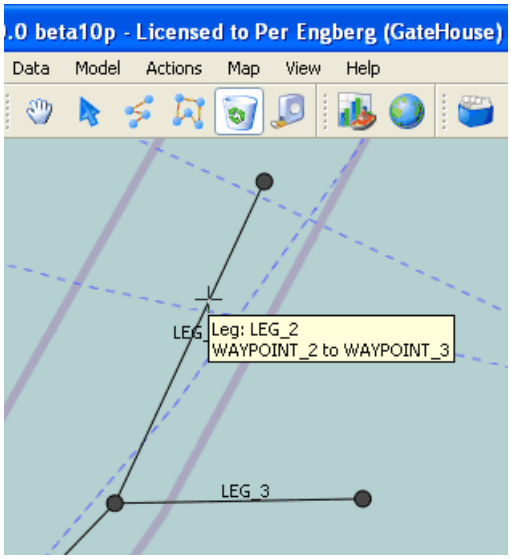
When you have completed adding legs you should end by selecting the Pan tool again:



After you have added the legs you can proceed with specifying Leg characteristics, using the Leg Editor.

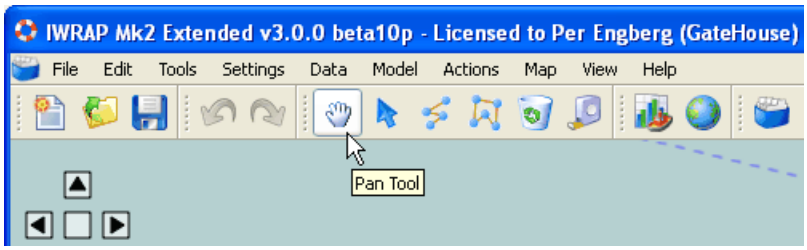
Removing Legs and Waypoints

In order to remove a Leg you should zoom in on the area of interest and select the . Move the cursor above the Leg you want to remove, it will change into a cross-hair symbol:

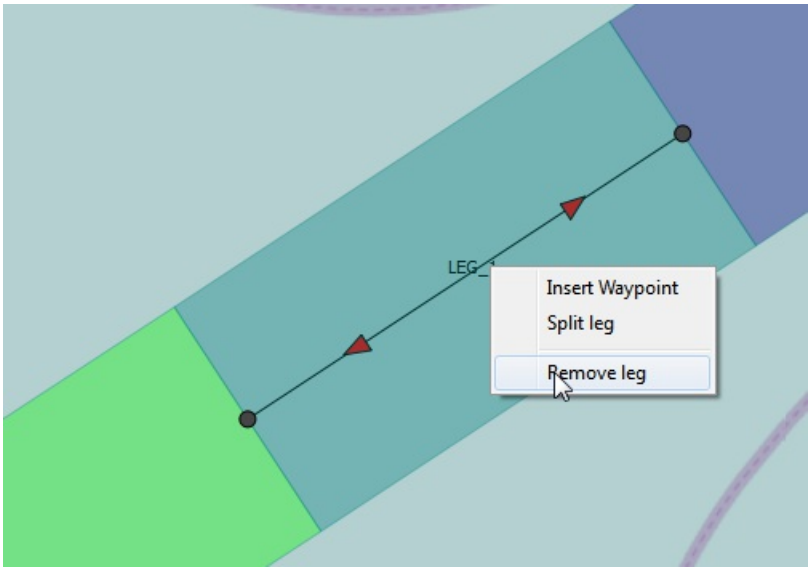


Click the left mouse button and the Leg will be removed, redundant Waypoints are also removed. If you remove a Leg by mistake use the undo function

When you have completed editing the legs you should end by selecting the Pan tool again:

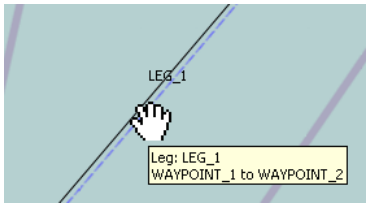


Not matter which tool is selected, you can also always right click on a Leg and select 'Remove Leg...'.

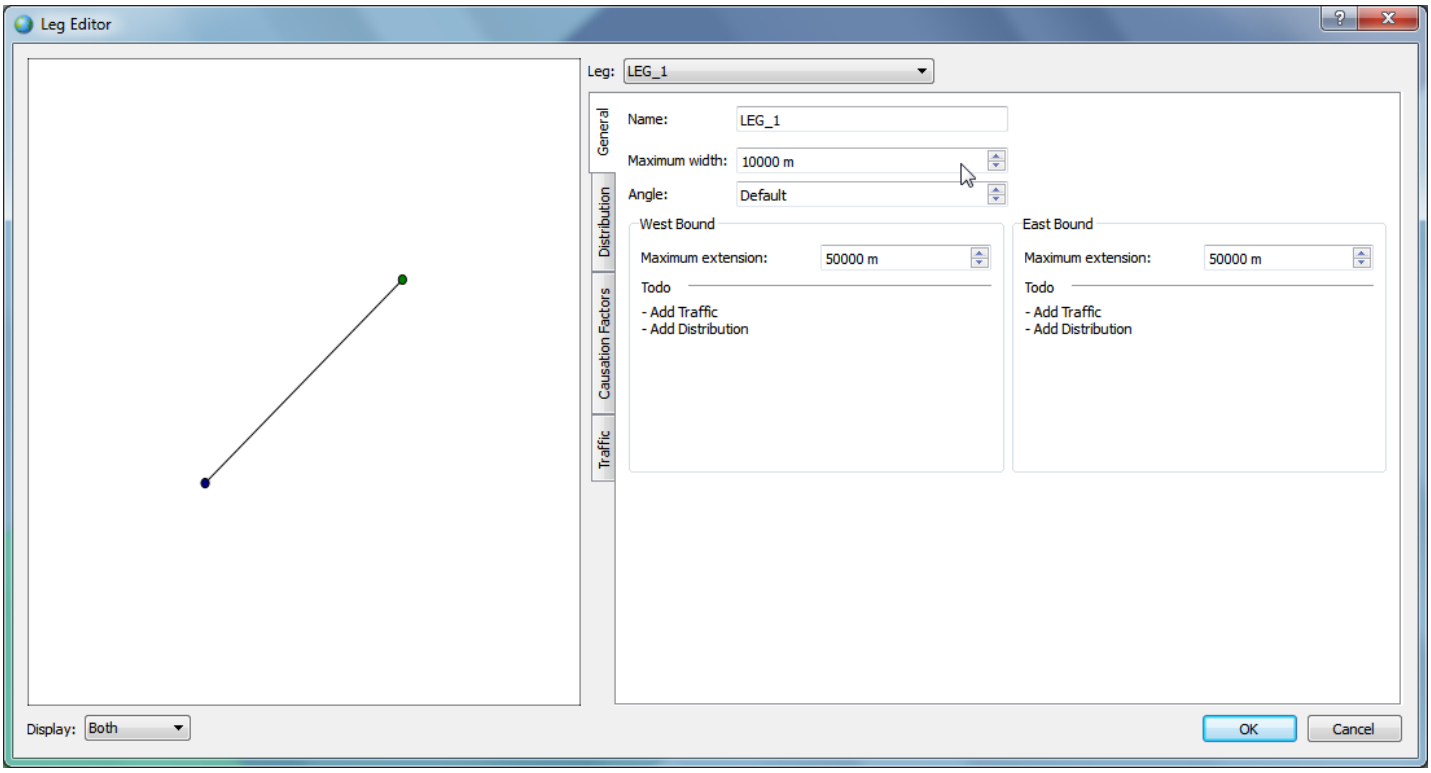


The Leg Editor

The Leg Editor is used to specify Lateral Distribution as well as Traffic Volume compositions in each direction of the Leg. The Leg Editor is shown when you double-click on a Leg. Move the cursor above the Leg until the tooltip is shown and double-click:



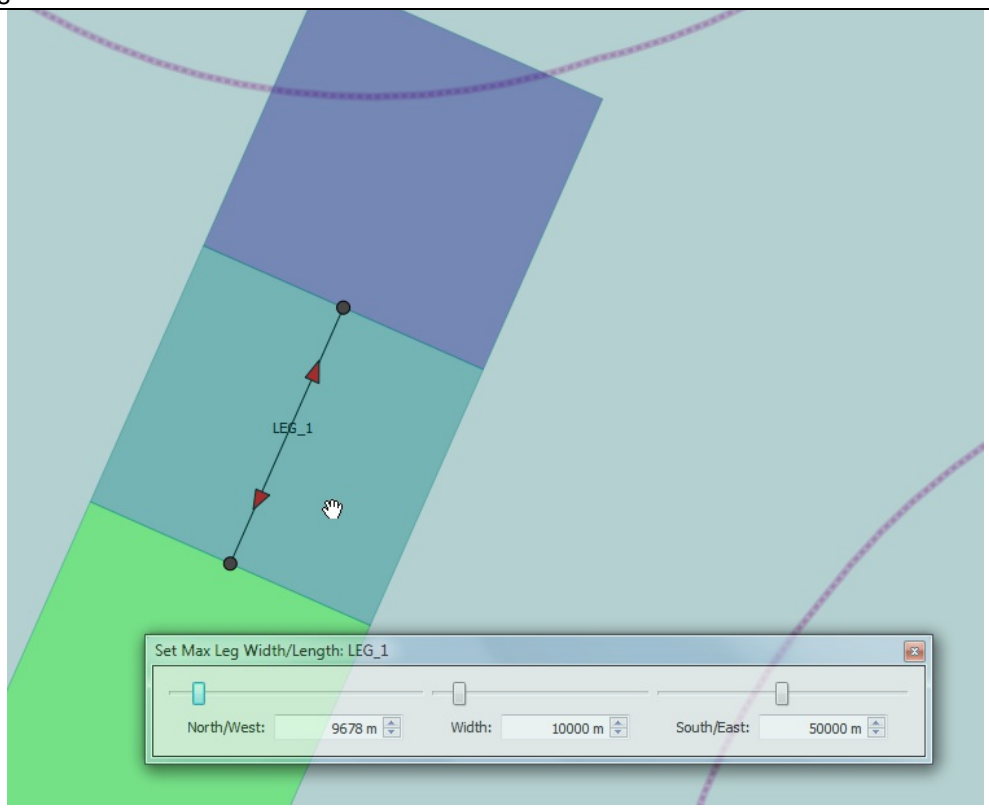
The Leg Editor will appear:



Here you can change the name of the Leg. Maximum width and Angle are used when extracting model data from AIS. The Maximum Width and the Maximum Extension in each direction are illustrated on the following image:

The Maximum Extension is used to control drifting groundings and area collisions, i.e. drifting groundings and area collsions will only occur within the indicated boundaries. You can use 'Settings/Project Settings...' to modify Widths/Extentions for all Legs and/or set the default value for new Legs.

You can also use the 'Settings/Set Maximum Leg Width/Length...' settings. You do this by clicking and selecting the leg you want to modify, and adjusting the width/Length using the sliders or the numerical inputs.

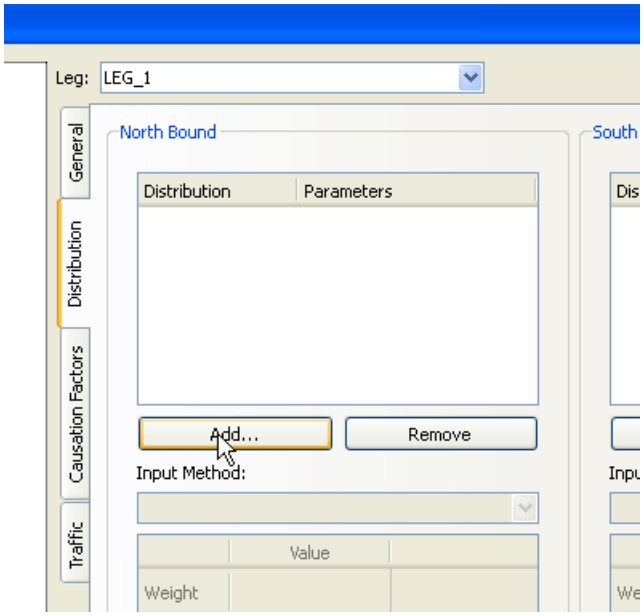


You can now proceed with specifying:

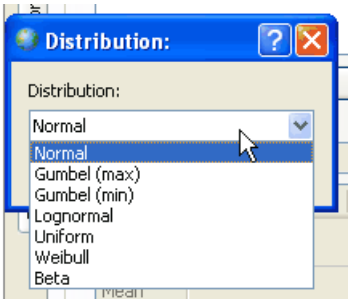
- Lateral Distribution
- Causation Factors
- Traffic Volumes

Lateral Distribution

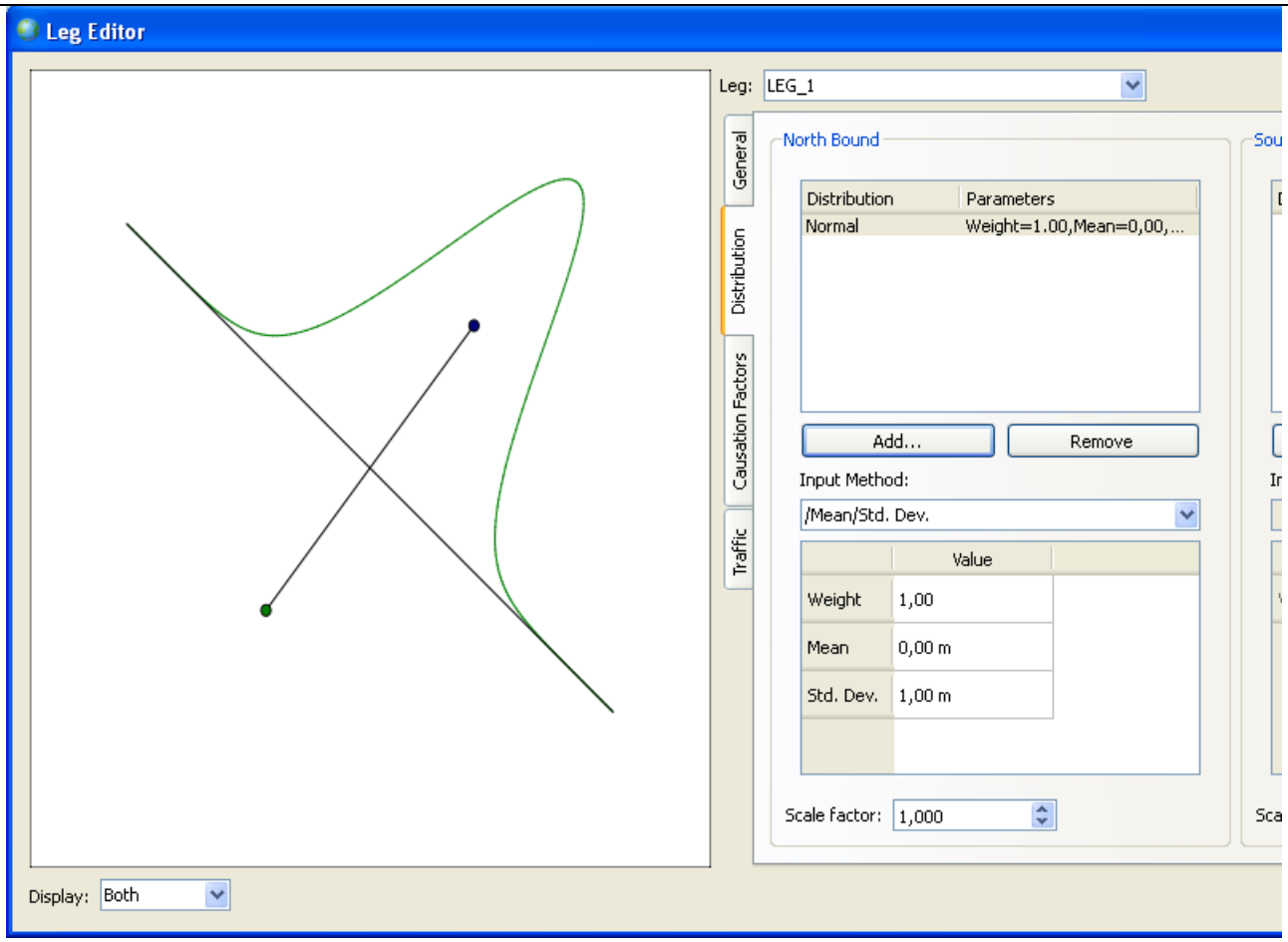
The Lateral Distribution can be added by selecting the 'Distribution' tab. The Distribution tab enables you to specify Lateral Distributions in each direction, just press the Add button:



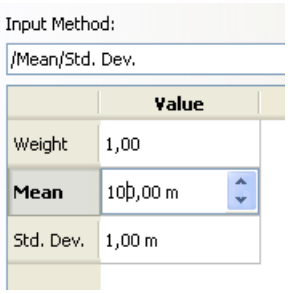
It is possible to choose from the following distributions;



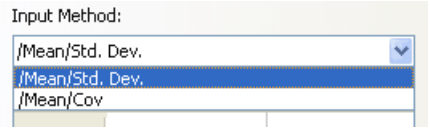
If you e.g. select a Normal distribution, a Normal distribution with mean 0 m and standard deviation 1 is added:



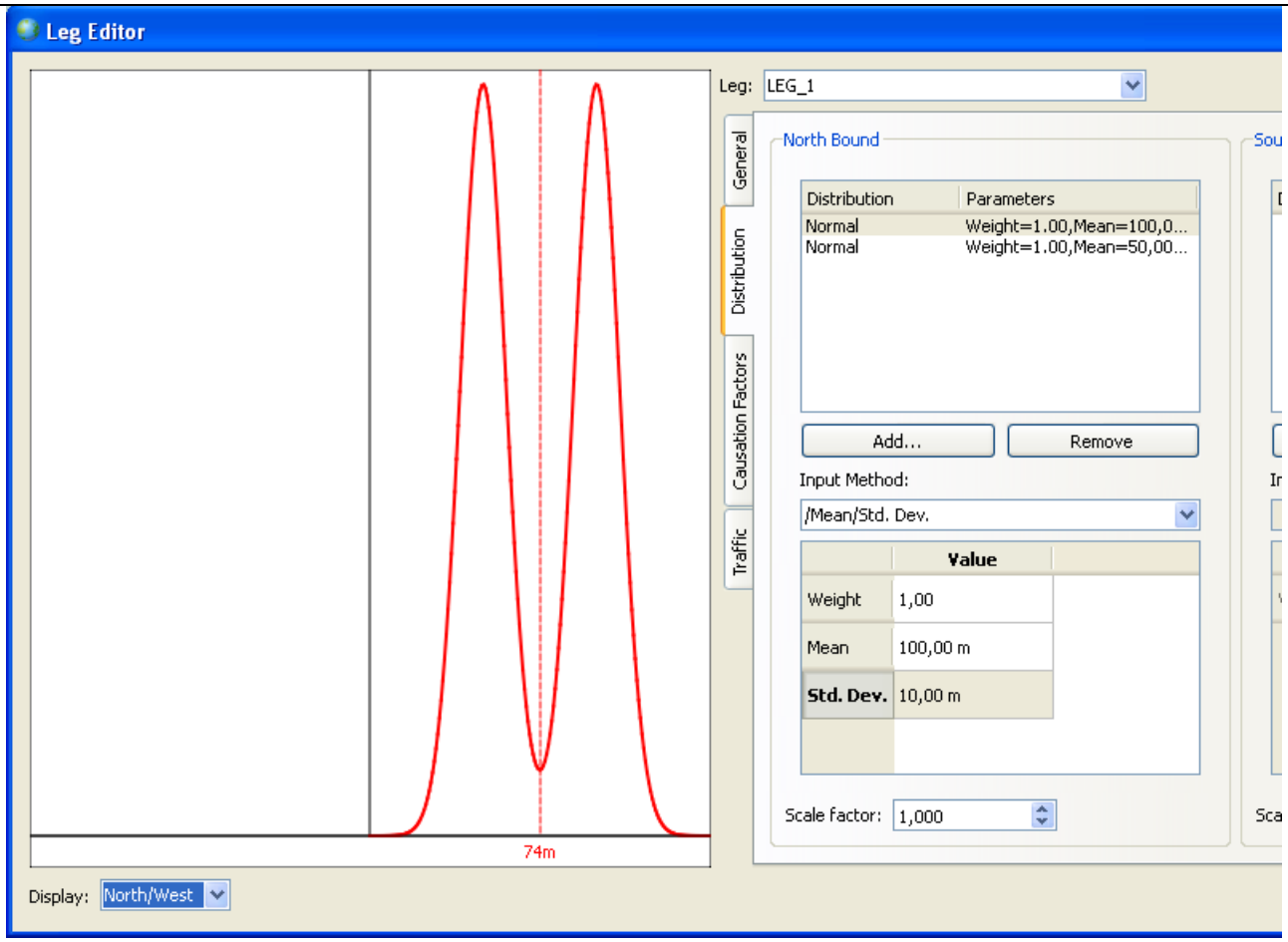
You can of course modify the mean and standard deviations by entering values (press enter or click outside the field for the change to have effect):



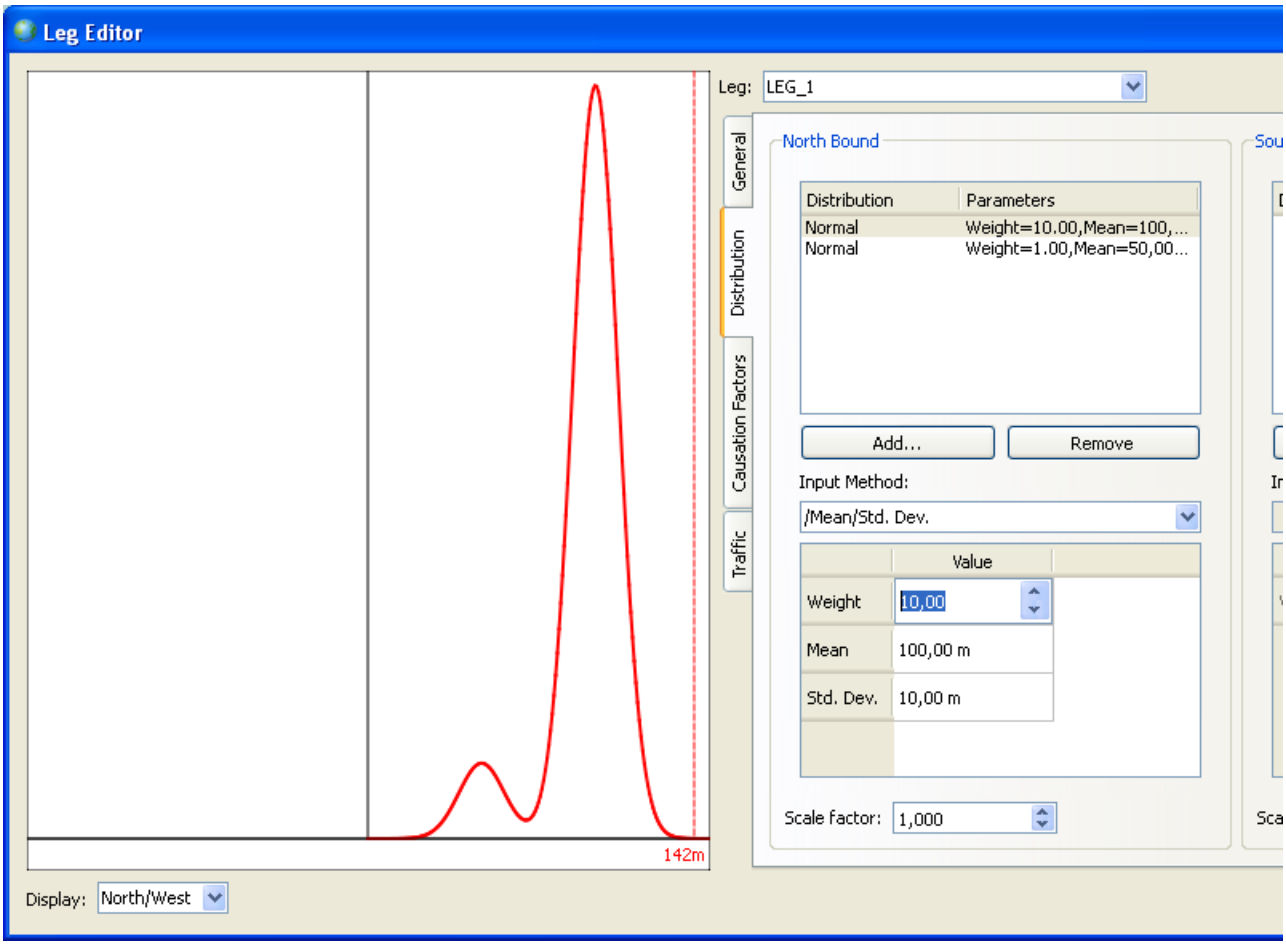
Note that it is also possible to change the Input Method:



You can add and combine any number of distributions, the following example shows 2 Normal distributions combined, note that the Left hand side has changed, you do this by selecting 'Display' in the lower left corner of the dialog.



The Weight parameter can be used to control the relationship between the distributions, if we e.eg set the weight of the first Normal Distribution to 10 instead of 1, we get the following:



The Scale factor is only used when fitting to histograms extracted from, e.g. AIS data.

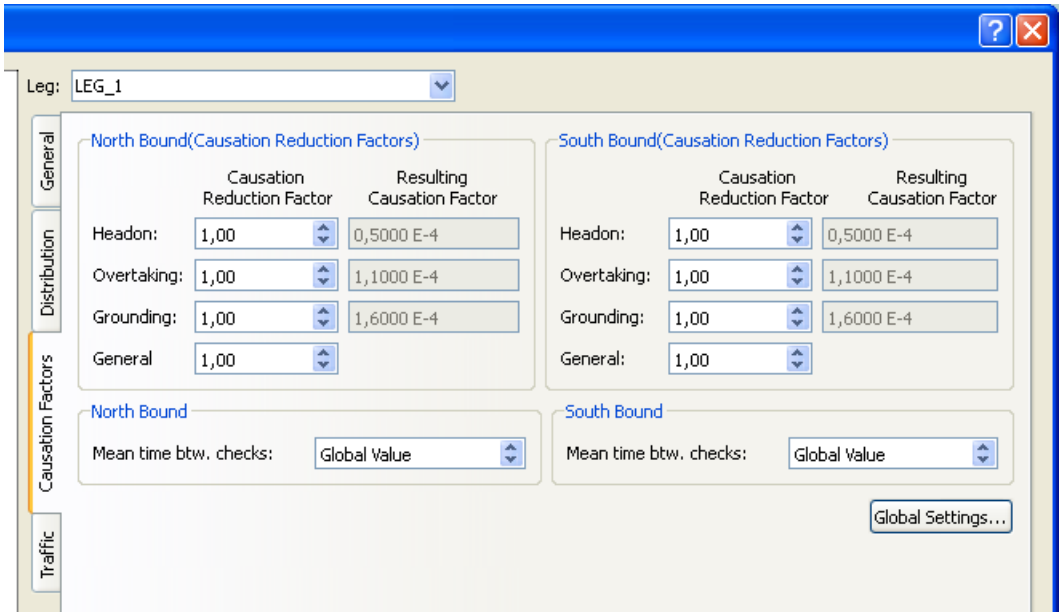
Causation Factors

The causation factor specifies the probability that the officer on the watch will fail to react, e.g. in case the vessel is on collision course with another vessel or the vessel is about to ground.

The causation factors are important for the results since they act as reduction factors on the calculated number of blind navigation collisions. In the specification of the causation factors it should be considered if navigators exhibit extraordinary awareness; possible because of two navigators being present on the bridge. For ferry routes it is typically the case that the causation factor is lower than the average due to the navigators increased situation awareness.

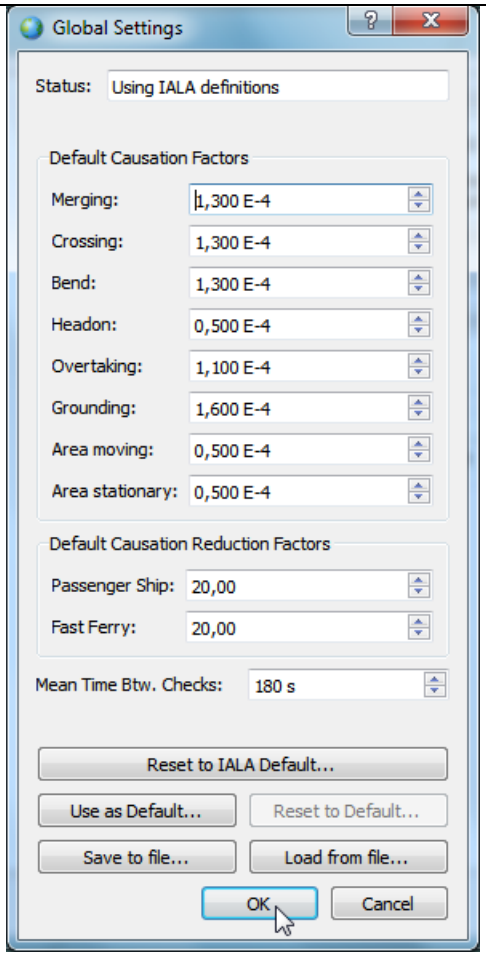
IWRAP Mk2 has a set of causation factors for different events, e.g. head-on collision and grounding. The application uses values that have been selected by IALA experts. The default IALA values can be altered but this is not recommended. Instead the user should apply causation reduction factors, i.e. the causation factor is divided by the reduction factor.

The causation factors reduction can be specified in each direction of the Leg, by selecting the Causation Factor tab:



It is also possible to set the causation reduction on each ship type and size category, see Traffic Volumes.

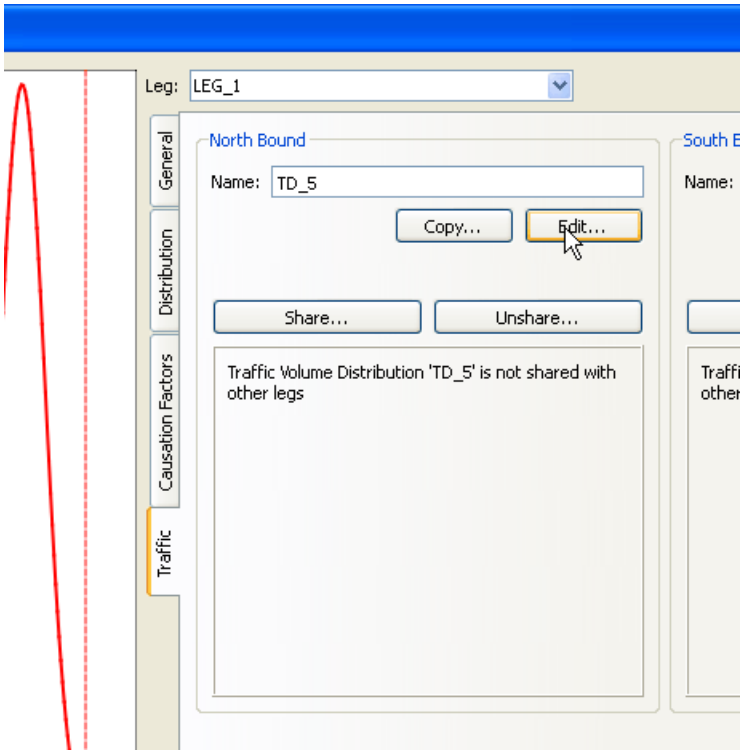
Pressing the 'Global settings...' button, invokes the Global Settings dialog, note that if you change anything here you can always invoke 'reset to IALA default...'. The Status field in the top of the dialog indicates if IALA settings are used.



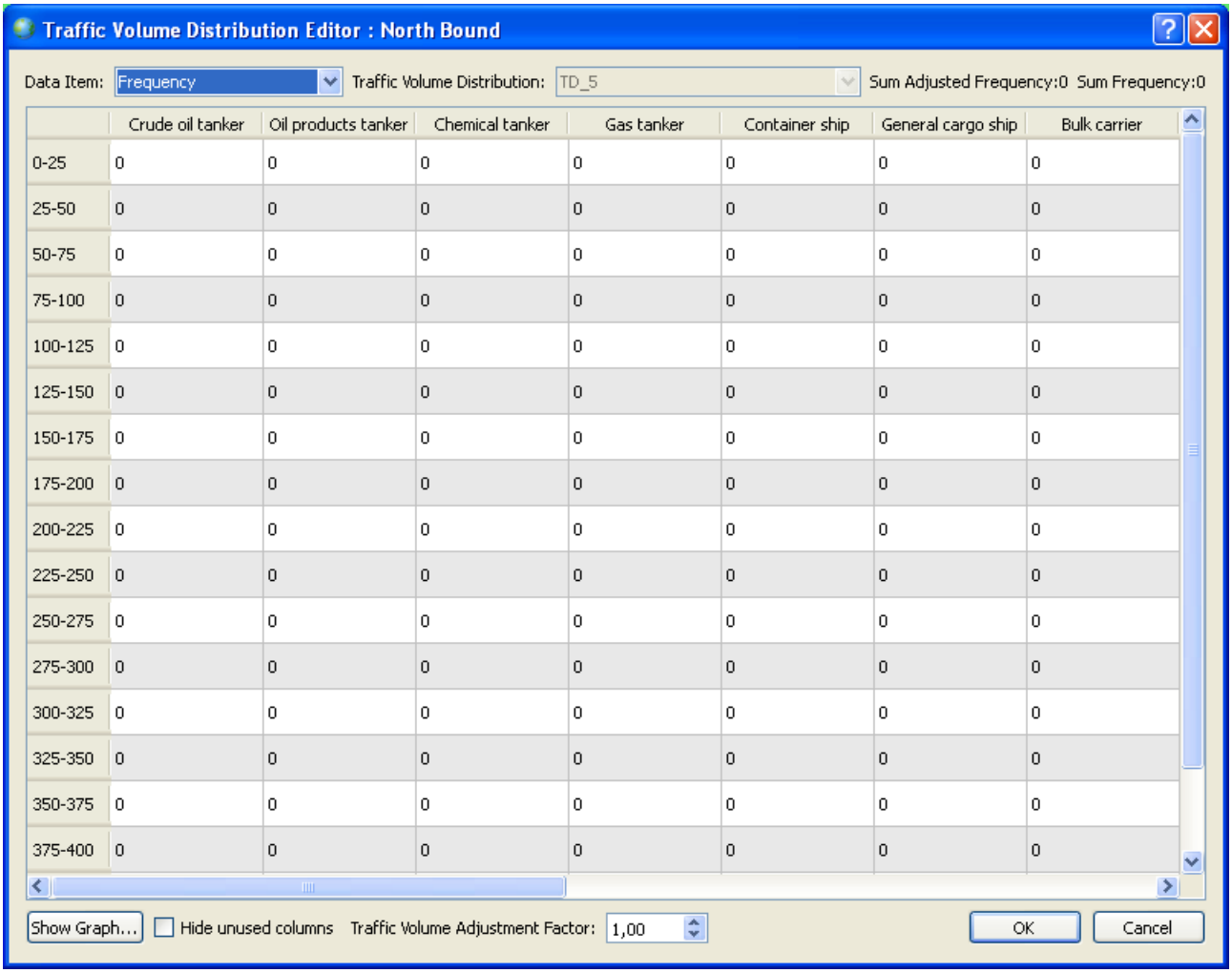
As you can see the ferry types have by default a reduction factor of 20.

Traffic Volumes

The Traffic Volumes specifies the amount of traffic on the Leg. This is specified for each direction the Leg separately. In order to enter the Traffic Volumes you should select the Traffic tab on in the Leg editor:



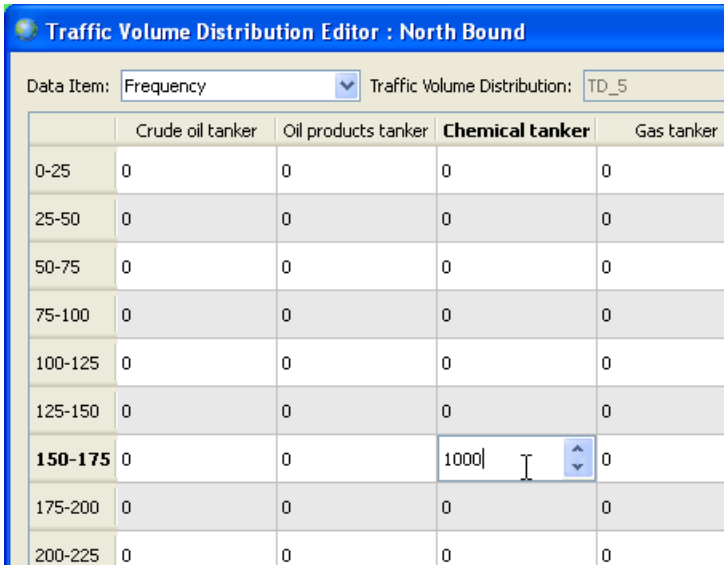
If you press the Edit button in one of the two directions the Traffic Volume Distribution Editor is invoked:



	Crude oil tanker	Oil products tanker	Chemical tanker	Gas tanker	Container ship	General cargo ship	Bulk carrier
0-25	0	0	0	0	0	0	0
25-50	0	0	0	0	0	0	0
50-75	0	0	0	0	0	0	0
75-100	0	0	0	0	0	0	0
100-125	0	0	0	0	0	0	0
125-150	0	0	0	0	0	0	0
150-175	0	0	0	0	0	0	0
175-200	0	0	0	0	0	0	0
200-225	0	0	0	0	0	0	0
225-250	0	0	0	0	0	0	0
250-275	0	0	0	0	0	0	0
275-300	0	0	0	0	0	0	0
300-325	0	0	0	0	0	0	0
325-350	0	0	0	0	0	0	0
350-375	0	0	0	0	0	0	0
375-400	0	0	0	0	0	0	0

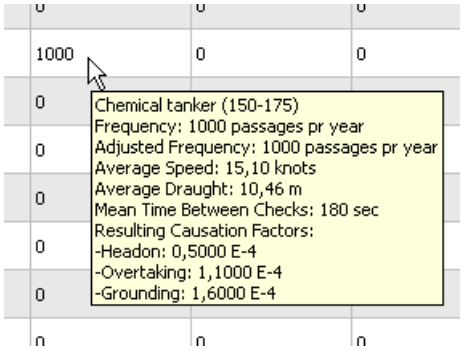
The Traffic Volume Distribution is defined as the annual number of ships operating on the leg in one direction. The annual

number of ships operating on the route is specified as a function of ship type and length. In the example shown here we specify that 1000 Chemical Tankers in the length interval 150-175 are traveling north on the selected Leg per year. Just click on the cell to activate the editor, enter 1000, and press return/enter.

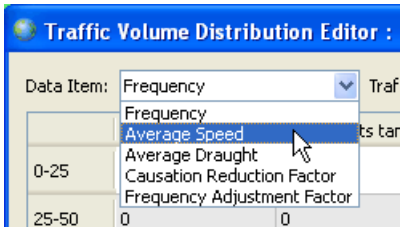


If the upper right corner the total is displayed i.e. 'Sum Frequency'.

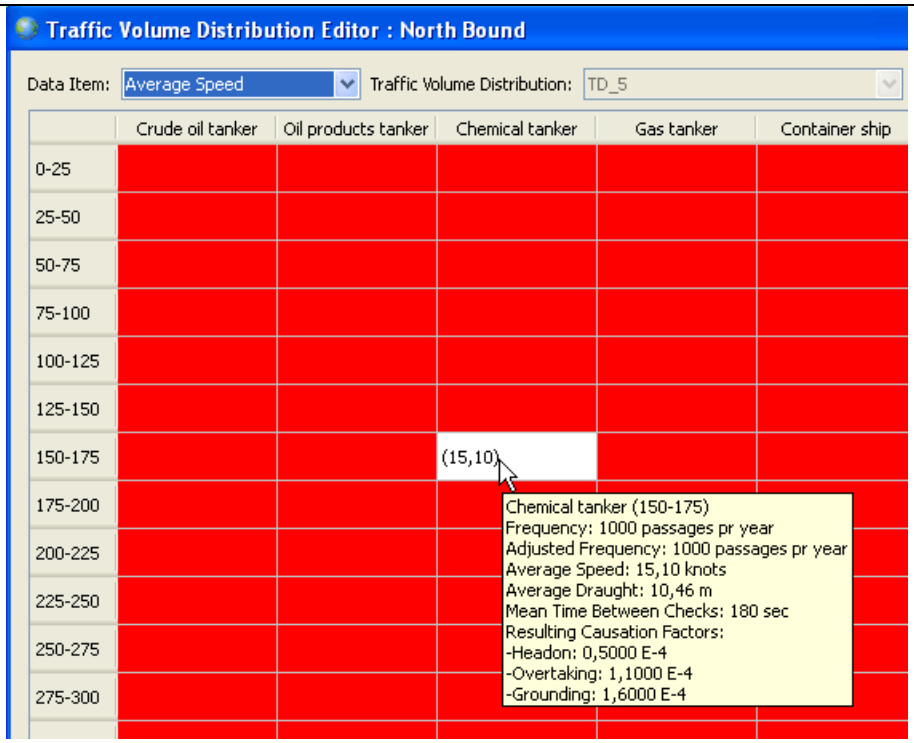
If you move the cursor over the cell, you get a tooltip:



Here you see details for all parameters that affect the calculation for the cell, in this case Chemical Tanker [150-175]. These parameters, e.g. the average speed, can be modified by selecting the Data Item:

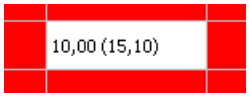


Selecting the Average Speed changes the appearance of the table:



The red cells indicate that the Frequency is zero, so in this case we only have one cell where we can specify Average Speed. You don't have to enter a value, as you can see a number is already indicated i.e. (15,10), this the built-in Average Speed of this class of ship, so if you dont enter any value 15,1 knots is used in the calculations.

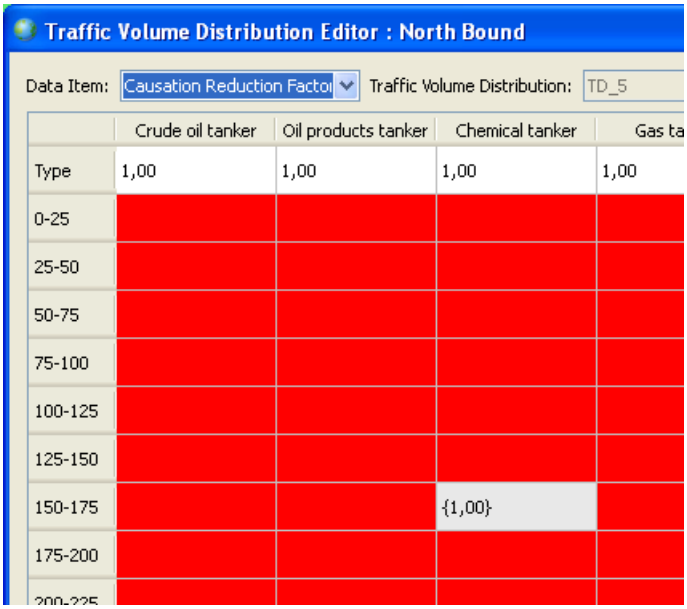
If you enter e.g. 10 knots, you will still be able to see the built-in value in parenthesis for reference.



If you enter e.g. 0 in the field it will go back to use the built-in default value

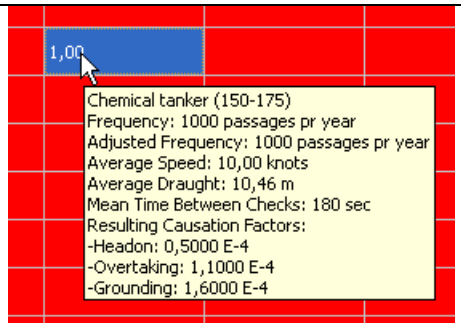
The same principle is used for Average Draught, i.e. you select Average Draught in the Data Item and enter the value in meters, again a built-in value is used by default.

In the Data Item drop-down box you can also select a Causation Reduction Factor:

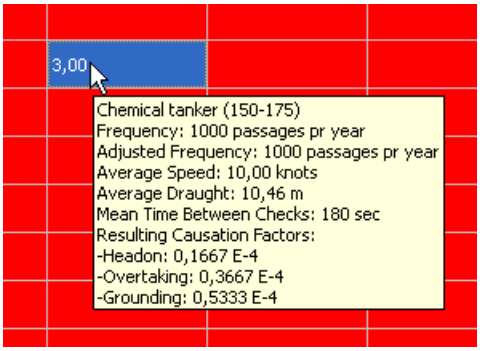


This table can be used to adjust the Causation Factors for a specific type of ship i.e. the top row or a specific length category.

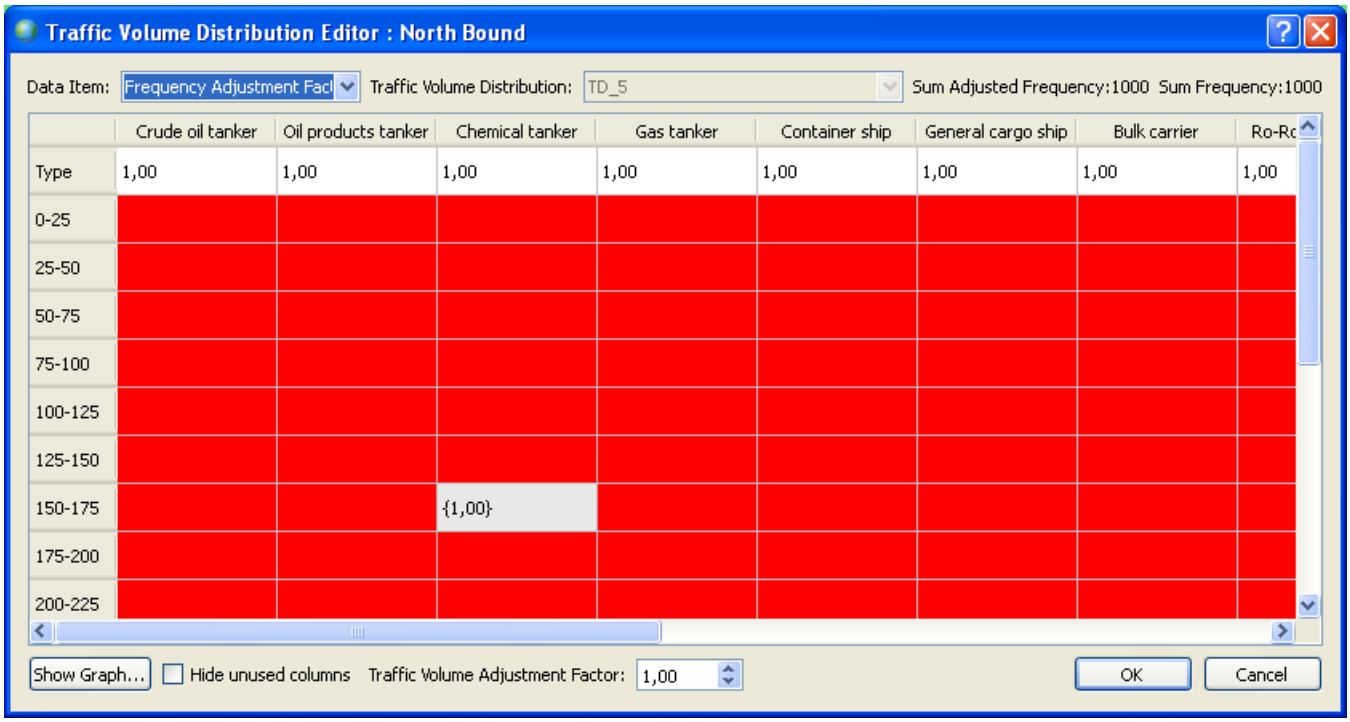
Move the cursor on top of a cell to see the currently used factors:



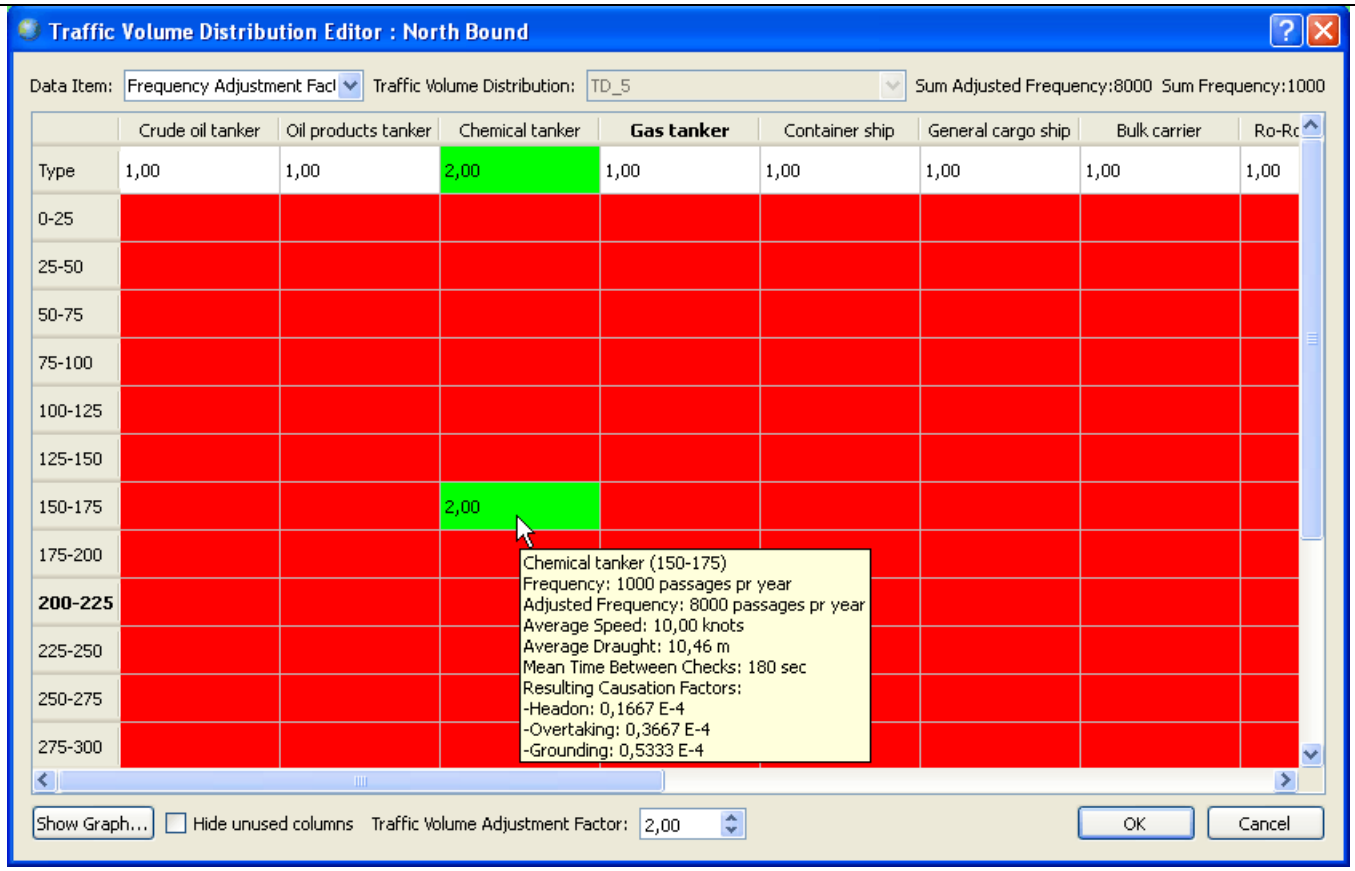
If you e.g. enter 3, you will see the factors drop by this factor.



The Traffic Volume Distribution Editor also allows you to multiply the Frequencies by an adjustment factor. This can be done for the entire table, see the 'Traffic Volume Adjustment Factor' in the bottom of the dialog or for each type of ship or specfic length category of a ship type by selecting Frequency Adjustment Factor in the Data Item drop-down box.



In the example shown below a factor of two has been specified for the entire table, Chemical Taker ship type and the 150-175 meter category, so in total the 150-175 meter category is multiplied by 8 i.e. (2x2x2), i.e. 8000 is used in the calculations.



On any of the tables you can right-click and copy the data to the clipboard.

Causation Factors

The causation factor specifies the probability that the officer on the watch will fail to react, e.g. in case the vessel is on collision course with another vessel or the vessel is about to ground.

The causation factors are important for the results since they act as reduction factors on the calculated number of blind navigation collisions. In the specification of the causation factors it should be considered if navigators exhibit extraordinary awareness; possible because of two navigators being present on the bridge. For ferry routes it is typically the case that the causation factor is lower than the average due to the navigators increased situation awareness.

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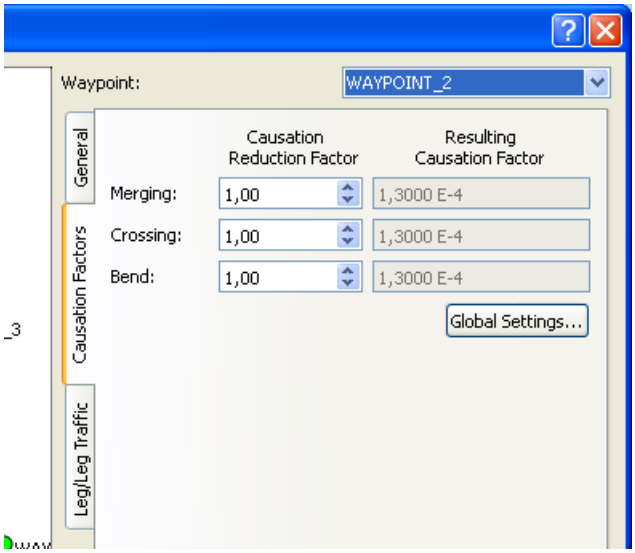
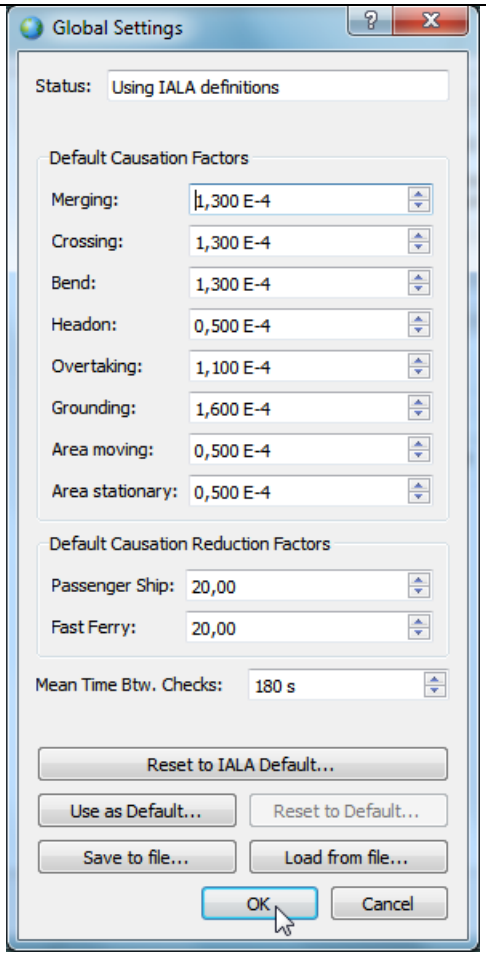
The causation factors reduction can be specified in each direction of the Leg, by selecting the Causation Factor tab:



Pressing the 'Global settings...' button, invokes the Global Settings dialog, note that if you change anything here you can always invoke 'reset to IALA default...'. The Status field in the top of the dialog indicates if IALA settings are used.

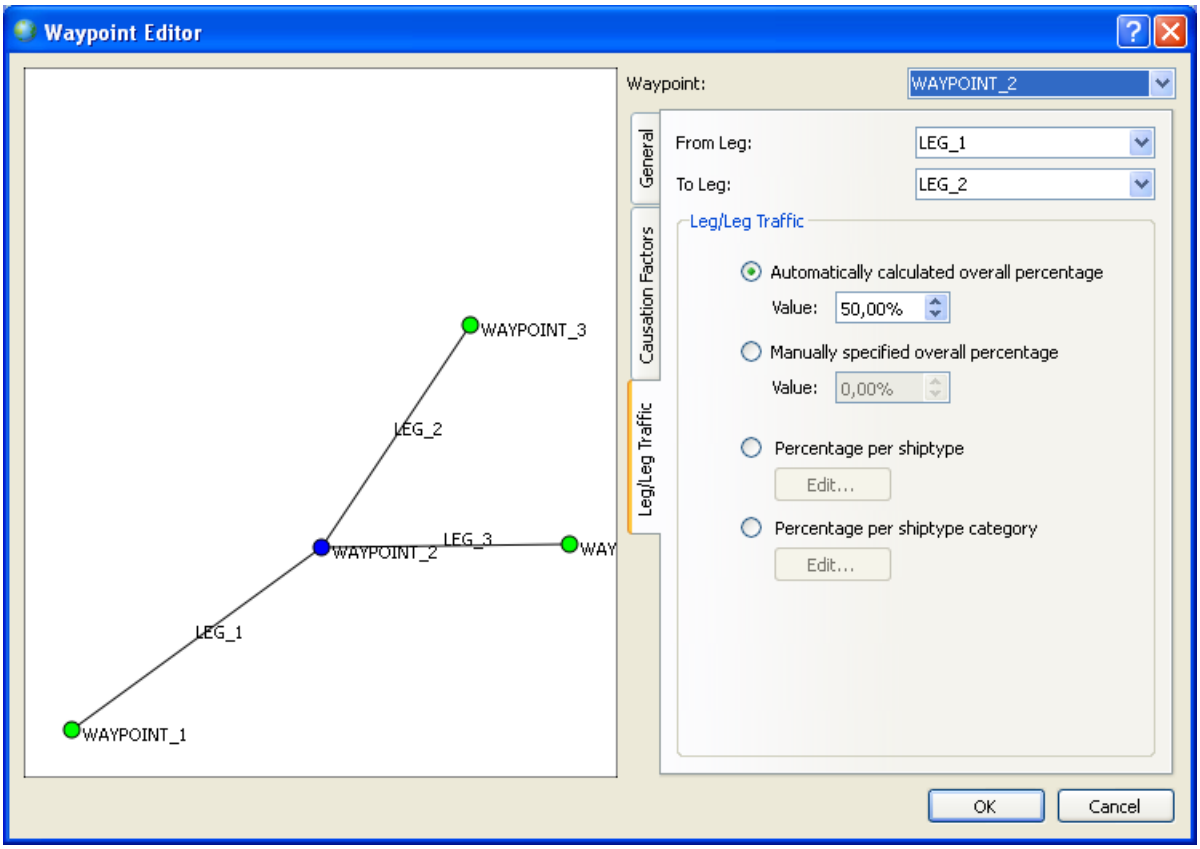


As you can see the ferry types have by default a reduction factor of 20.

Leg to Leg Traffic

The leg/Leg Traffic tab is used to specify how traffic is going through a junction waypoint. A junction is a Waypoint that is connected to more than two other waypoints. For junction waypoints it is possible to specify the amount of traffic going from one Leg to another.

If you do not have any information about the traffic it will be divided equally among the legs, i.e. you check the 'Automatically calculated overall percentage' option which is he default for new Legs. In this case we have 3 legs, so 50% of the traffic coming from 'LEG_1' will go on to 'LEG_2', the rest to 'LEG_3'.

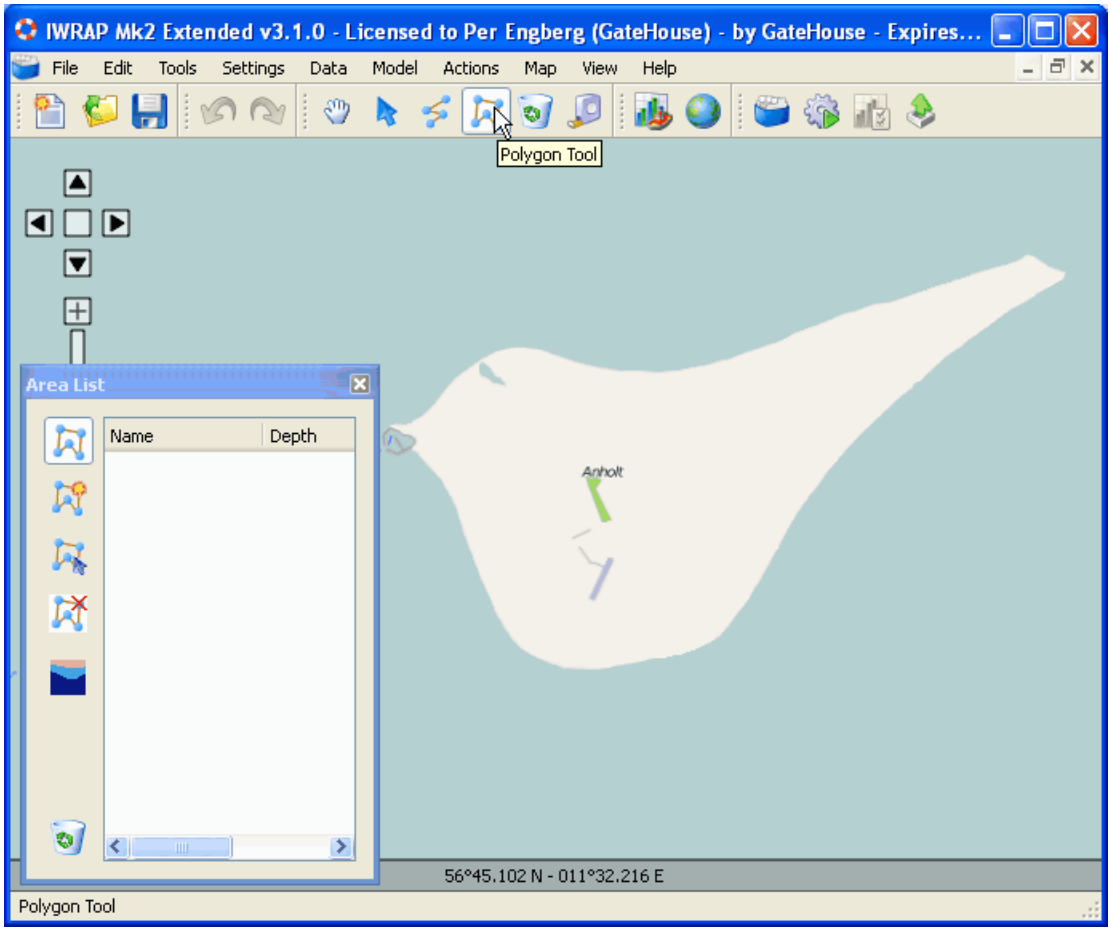


You can also manually choose to set the percentage, select a 'From leg' and a 'To leg' and check the 'Manually specified overall percentage' option and enter a value.

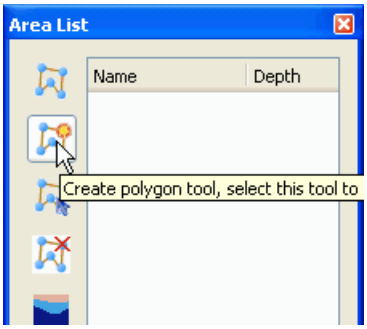
The most complex option is to specify the percentages per ship type or ship category. The last option is if of course the most detailed, and is primarily used when using the import data feature.

Defining Bathymetry

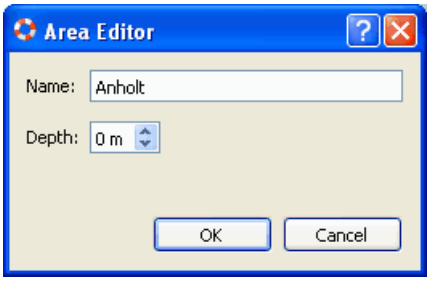
Bathymetry can be defined using one or more polygons with different depth values. Start by zooming in on the region of interest and select the polygon tool from the toolbar:



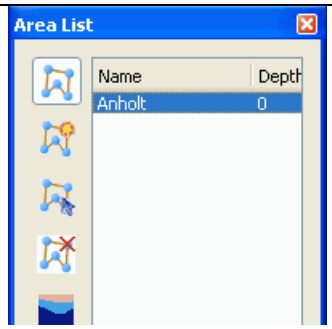
The 'Area List' is shown in the lower left corner of the screen. In order to add a new polygon/area select the 'Create polygon tool'.



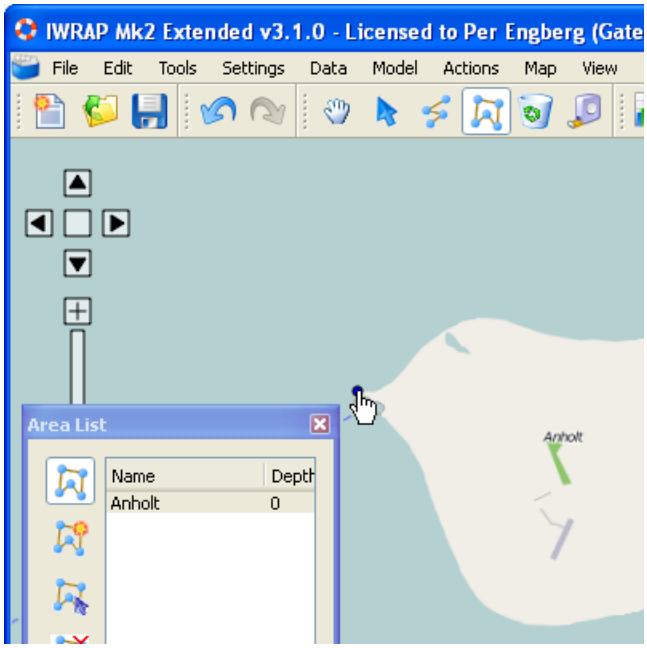
The 'Area Editor' is invoked, enter name and depth of the area:



Press ok and the new area is added to the 'Area List'. You can always double-click on an item in the list to bring up the 'Area Editor'.

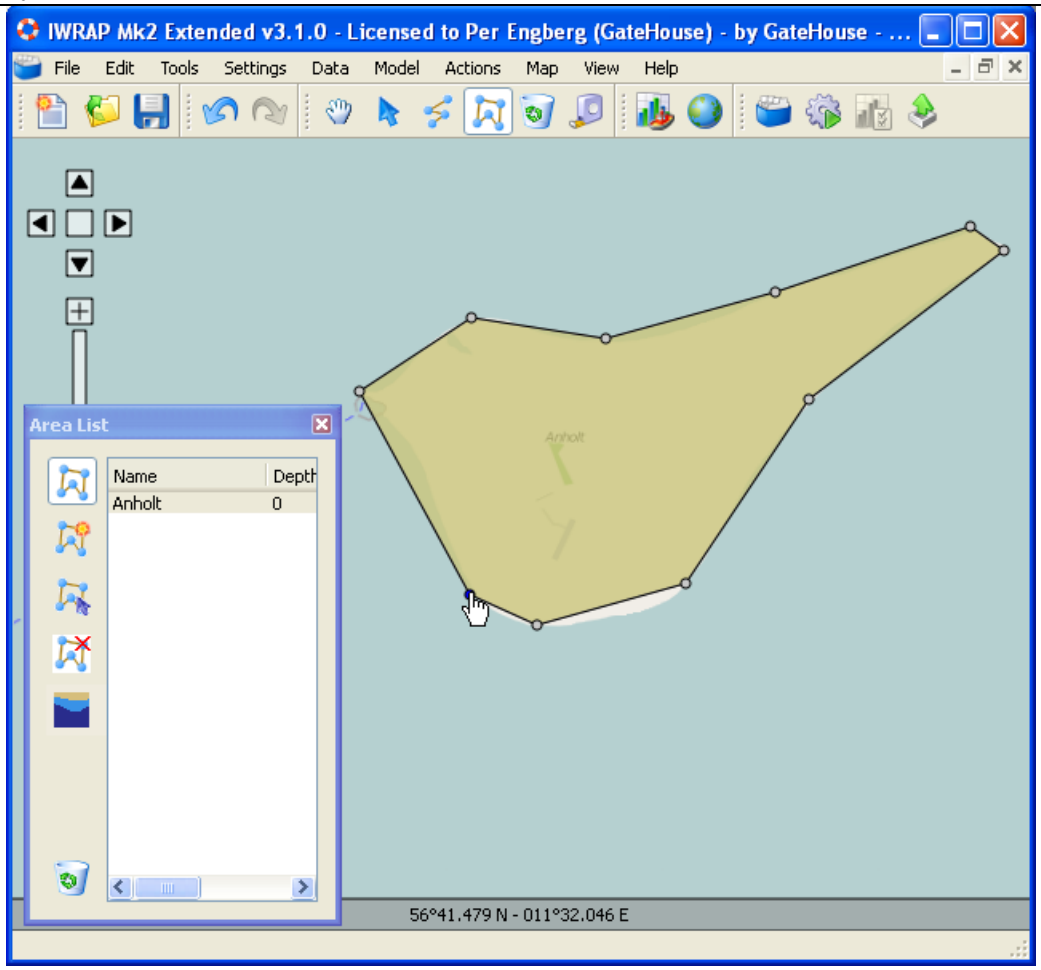


Now you can start drawing the area by clicking with the left mouse button on the map.

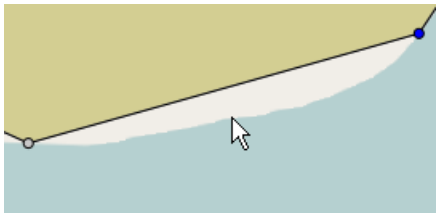


To add more points to the Polygon you just keep on clicking on the map. The polygon may turn red when you add points, this indicates that the polygon is not Simple (e.g. has crossing lines), just keep on adding points until the complete area is specified and then remove line crossings.

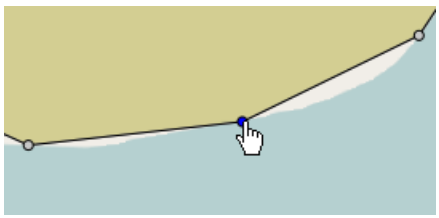
When you are done drawing, the polygon should not be red.



If you need to add a point between 2 existing points, just click the neighboring point:



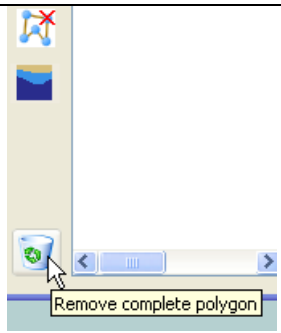
it will turn blue, and add a new by clicking on the new location:



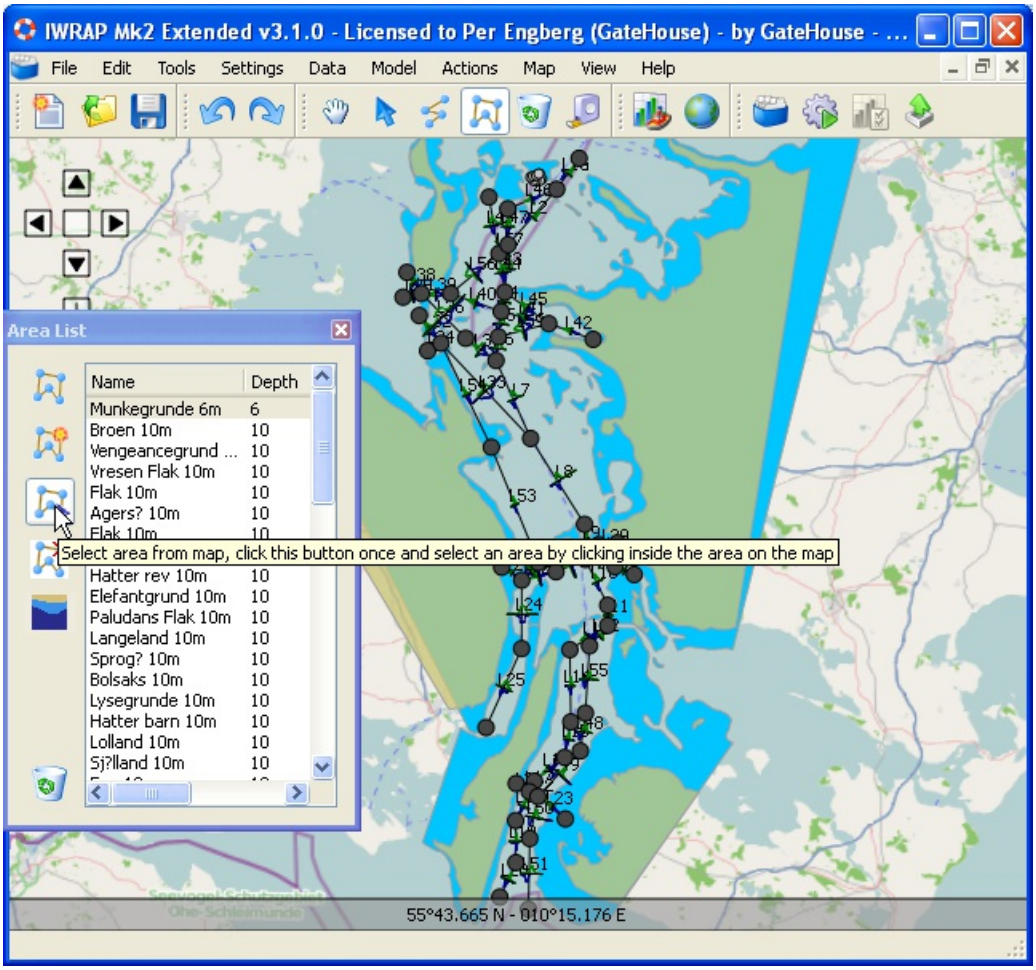
In order to remove a single point in the polygon select:

and simply click on the point you want to remove. When you have completed removing points select the edit tool again:

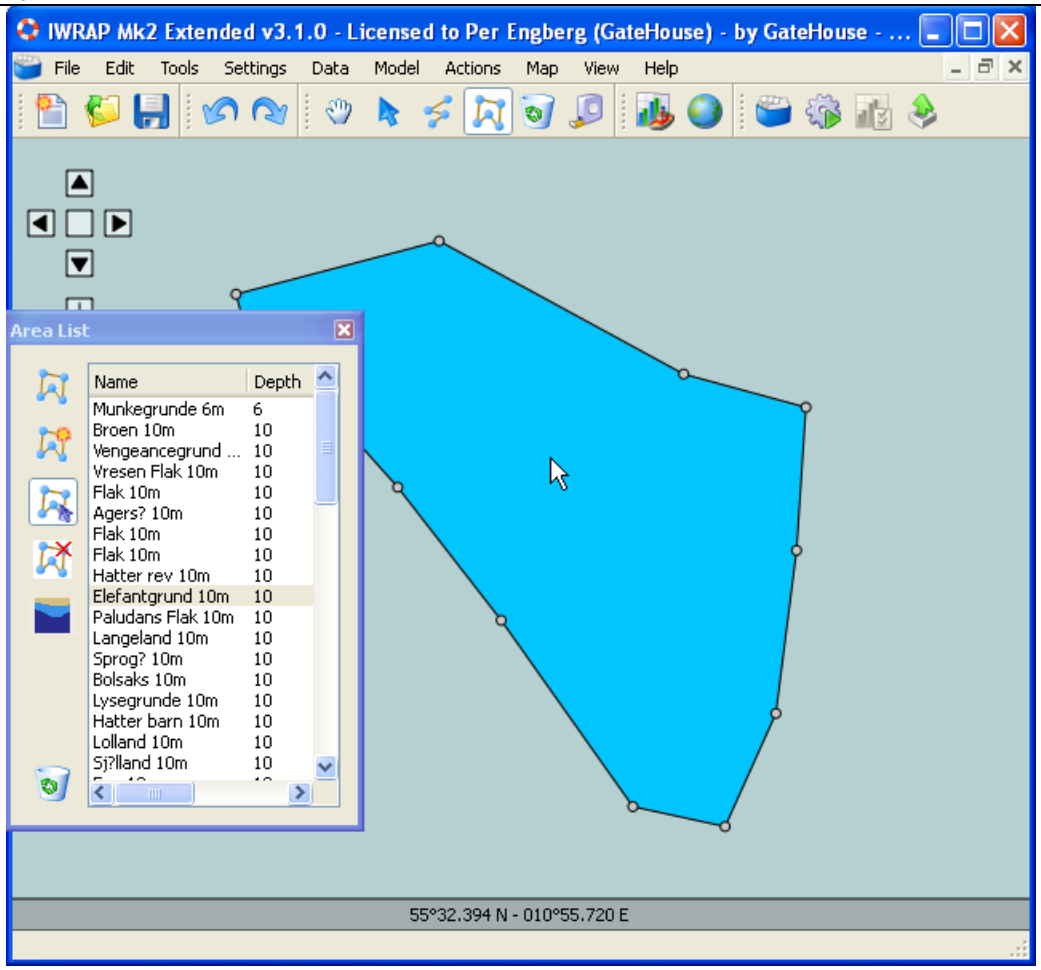
You can remove a complete polygon by selecting it in the list and clicking the 'Remove Complete Polygon' button.



If you have many polygons in your model, you can select them by clicking in the list or you can select them from the map by using the 'Select area from map' tool.

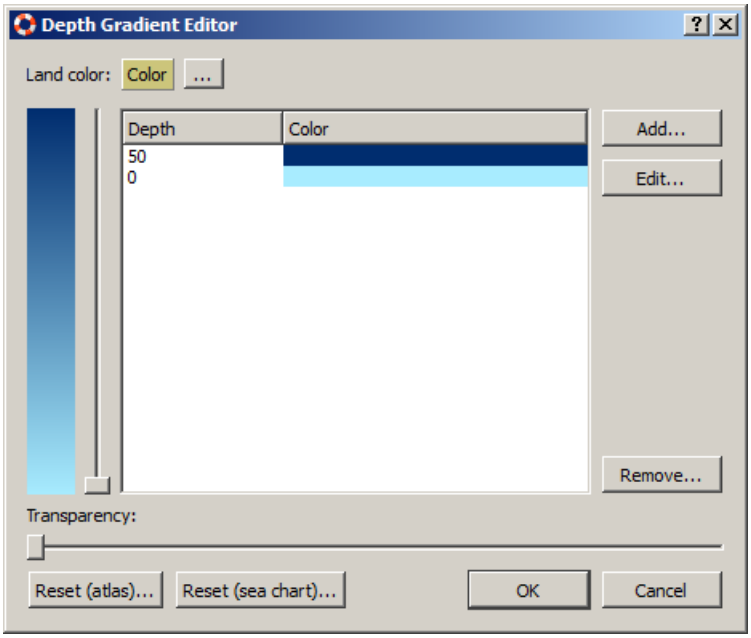


When you click inside the area on the map the area is selected in the list and map is centered on the area



Select the edit tool to start editing the selected polygon.

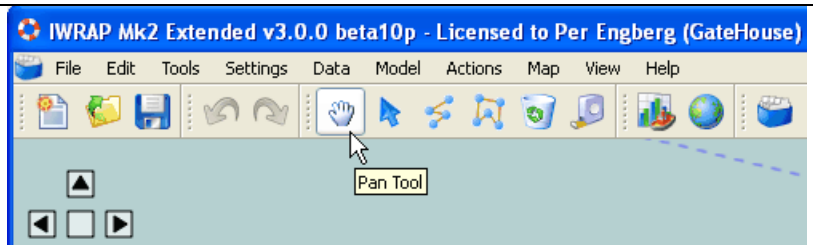
You can make the fill of the polygon transparent and modify the colors by activating the 'Settings/Depth Color Settings...' menu item or clicking the tool button:



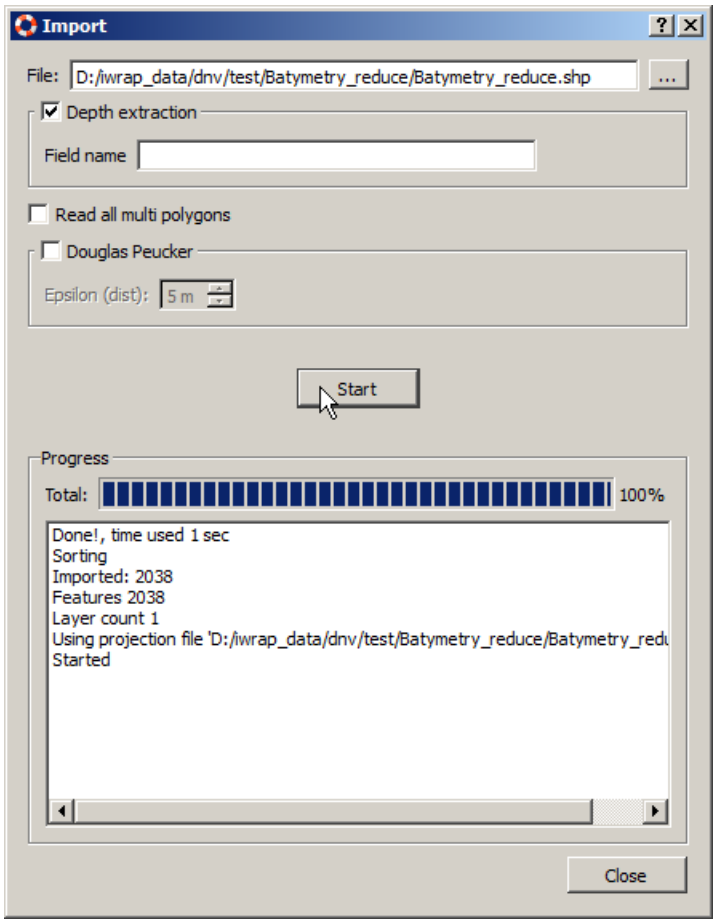
The 'Reset (atlas)' button makes deep area dark and shallow areas ligther, 'Reset (sea chart)' does the inverse.

Use the bottom slider to change transparency for all depth colors.

When you have completed editing polygons you should end by selecting the Pan tool again:



Polygons for Bathymetry can also be imported from the Data menu from ESRI shape or KML files. E.g. import Bathymetry shape file from 'Data/Bathymetry/Import ESRI shape file...'.



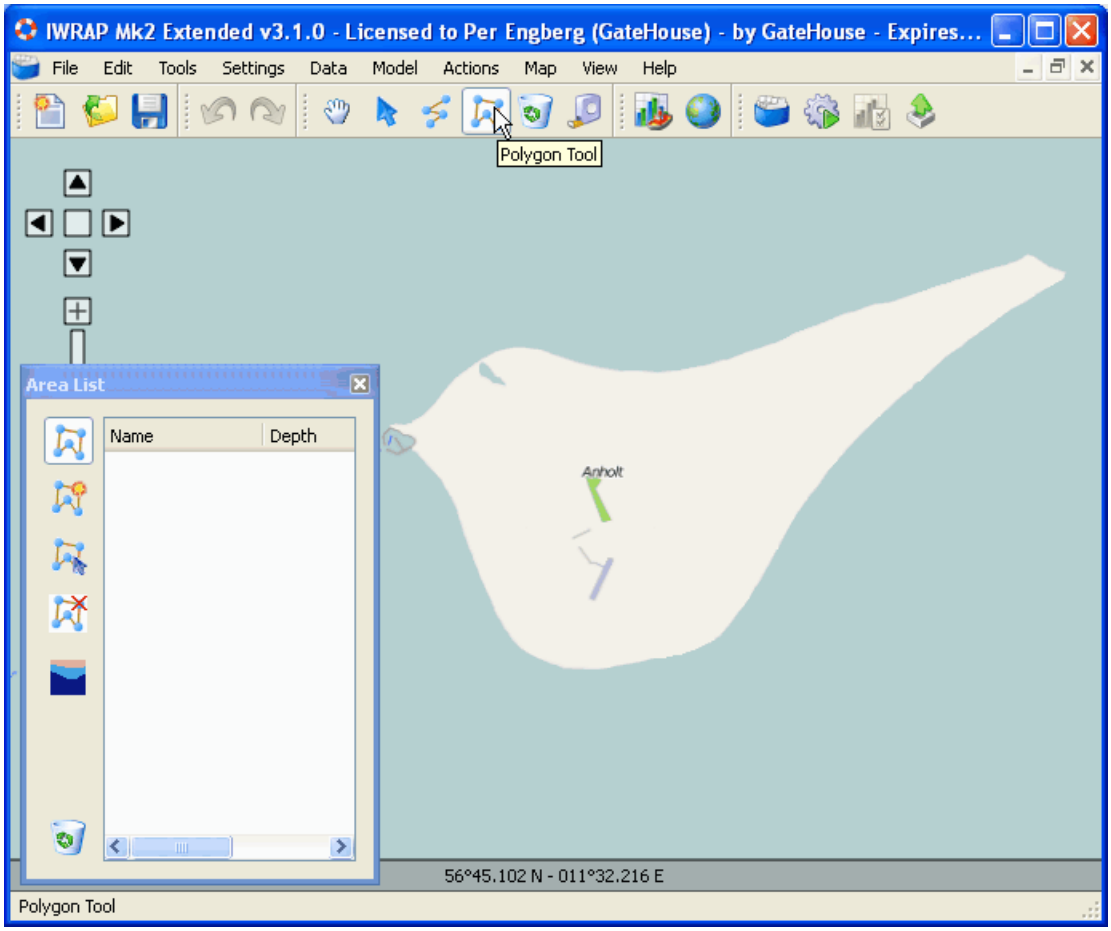
When importing Shape files it is possible to specify a field that contains the depth of the polygon. Furthermore it can be specified how multi polygons are to be handled, sometimes all of them should be included, but the default is to only include the first layer (i.e. they may be interior rings).

For both Shape and KML files you can choose to simplify the polygons by using the Doglas-Peucker algorithm.

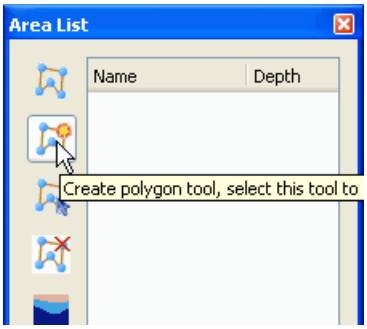
Note that when you import polygons from a file each polygon is tagged with the name of the file. Each time you import the file the polygons from that file will be deleted first.

Defining Structures

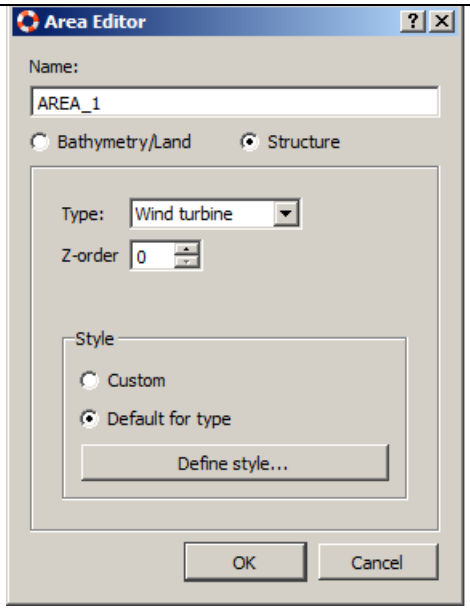
Structures can be defined using one or more polygons. The structure polygons are created the same way as bathymetry polygons. Start by zooming in on the region of interest and select the polygon tool from the toolbar:



The 'Area List' is shown in the lower left corner of the screen. In order to add a new polygon/area select the 'Create polygon tool'.



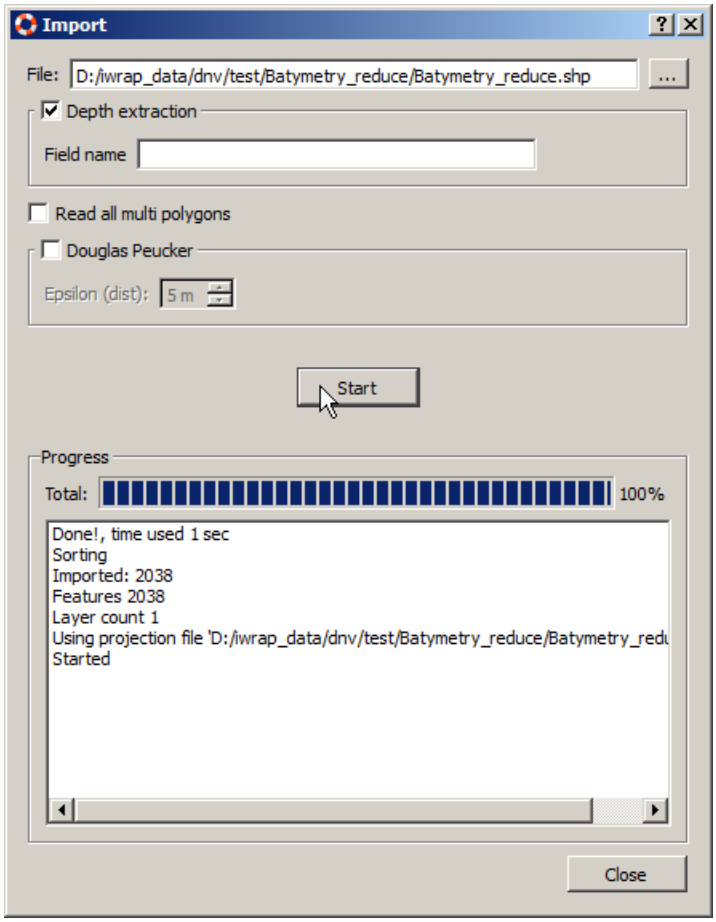
The 'Area Editor' is invoked, enter name and depth of the area:



Select the 'Structure' radio button and select the type of structure you want to model. Press ok and the new area is added to the 'Area List'. You can always double-click on an item in the list to bring up the 'Area Editor'.

Besides this the structure polygon is created the same way as a bathymetry polygon.

Polygons for Structures can also be imported from the Data menu from ESRI shape or KML files. E.g. import a Structure shape file from 'Data/Structure/Import ESRI shape file...'.



When importing Shape files it is possible to specify a field that contains the depth of the polygon. Furthermore it can be specified how multi polygons are to be handled, sometimes all of them should be included, but the default is to only include the first layer (i.e. they may be interior rings).

For both Shape and KML files you can choose to simplify the polygons by using the Doglas-Peucker algorithm.

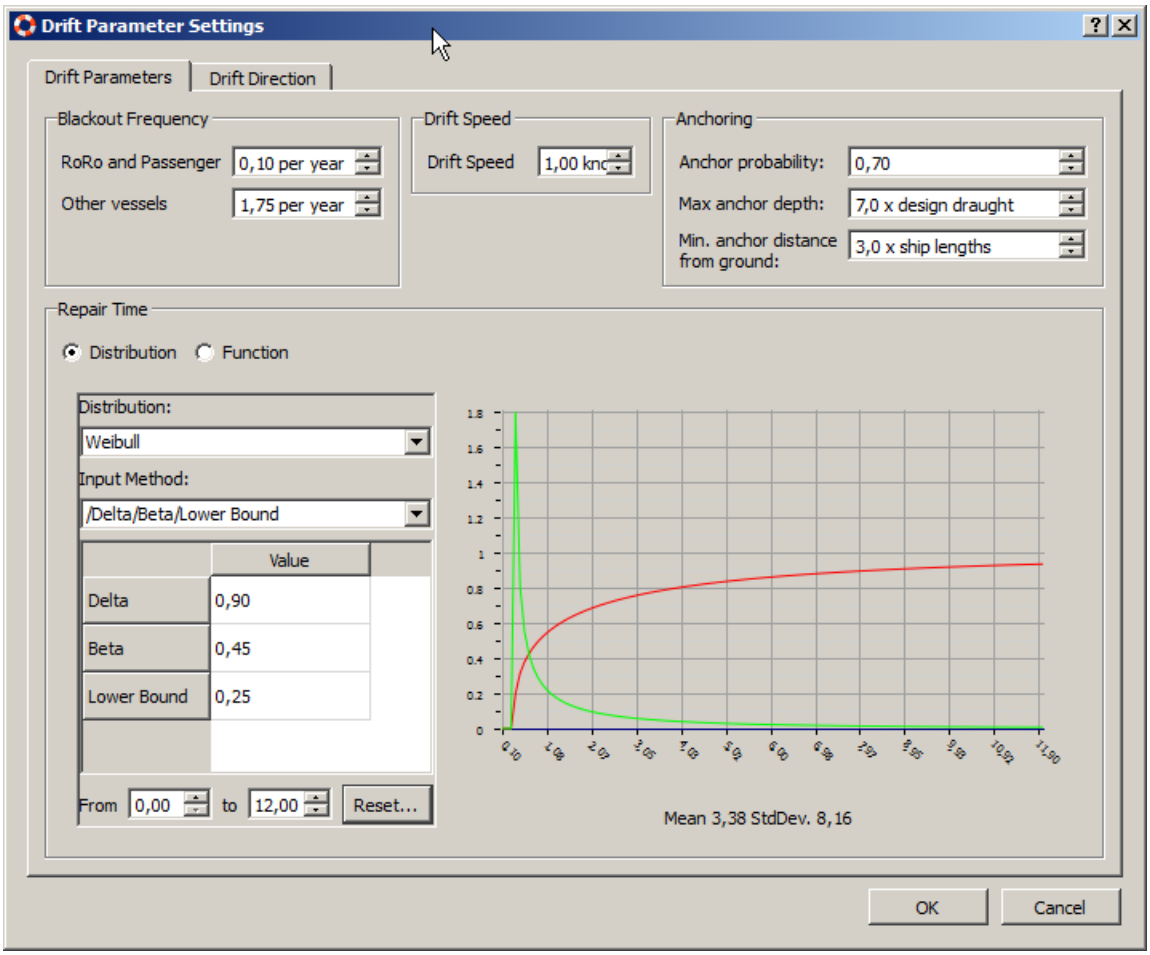
Note that when you import polygons from a file each polygon is tagged with the name of the file. Each time you import the file the polygons from that file will be deleted first.

Drifting

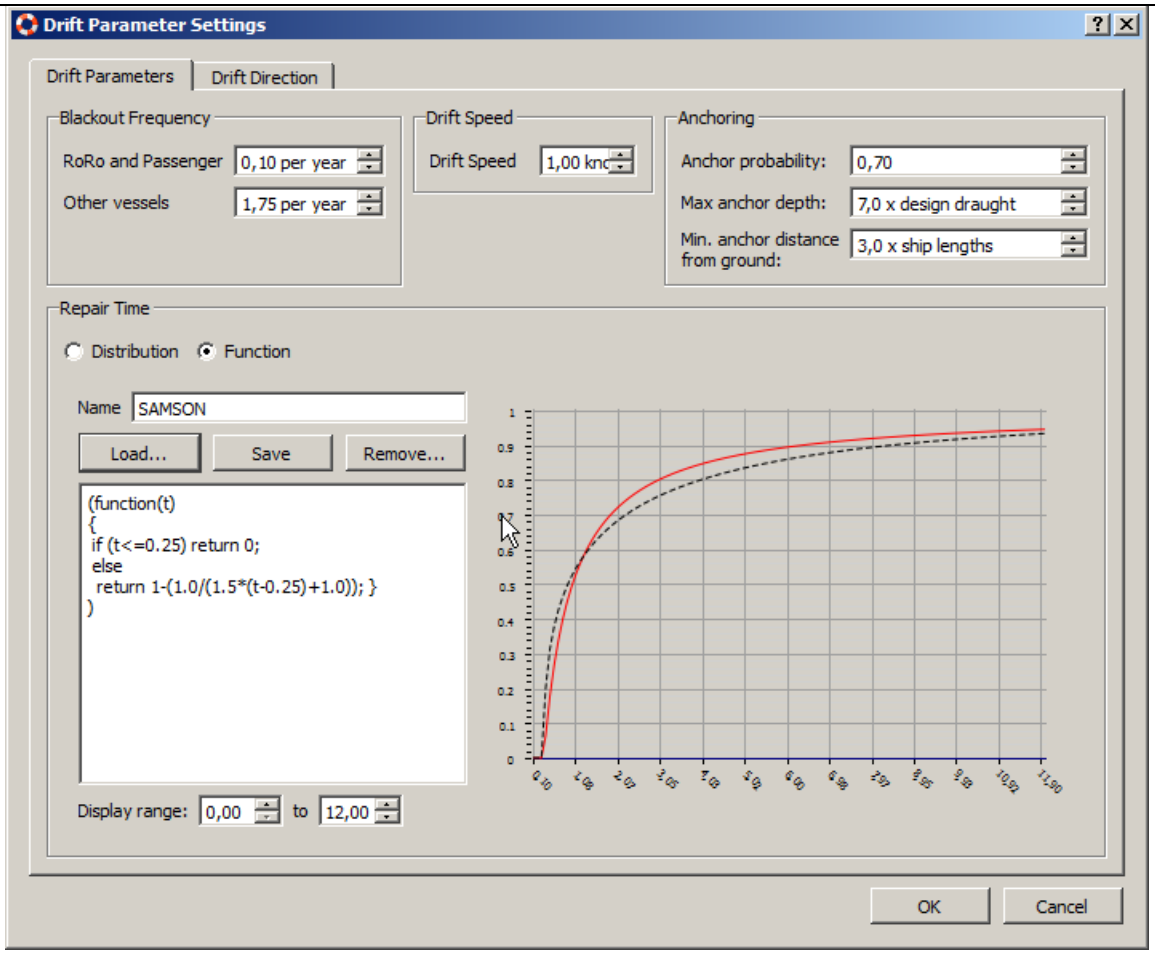
The two main causes for a ship to be drifting are 'rudder stuck' and blackout of the main engine. 'Rudder stuck' is not dealt with in IWRAP. A blackout may be caused by e.g. contaminated fuel, internal fault in the main engine, or failure of the electrical system. The seriousness of the incident depends on the location at which the blackout occurs, the wind/current direction, wind/current speed, and of course the duration of the blackout (that is the drifting time). If a high degree of redundancy has been built into the engine room then the command over vessel may be regained in relative short time. In other situations, the drifting time may be of order of hours. The drifting scenario may be remediated either by repairing the problem, by anchoring the vessel or by calling a tug boat.

Failure of propulsion machinery may occur at any location along the Leg. A Poisson process is used to model the probability of having a blackout along a leg segment of length.

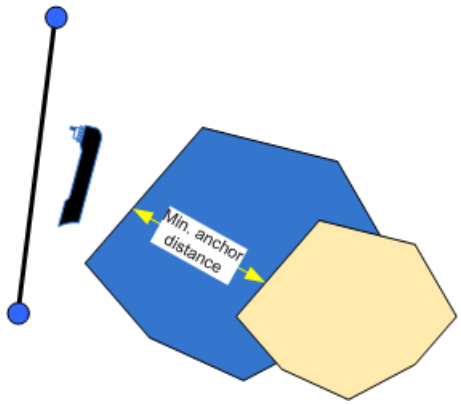
The probability of no repair is defined by the complementary distribution function of the repair time distribution. The default repair time distribution is modeled as a Weibull distribution.



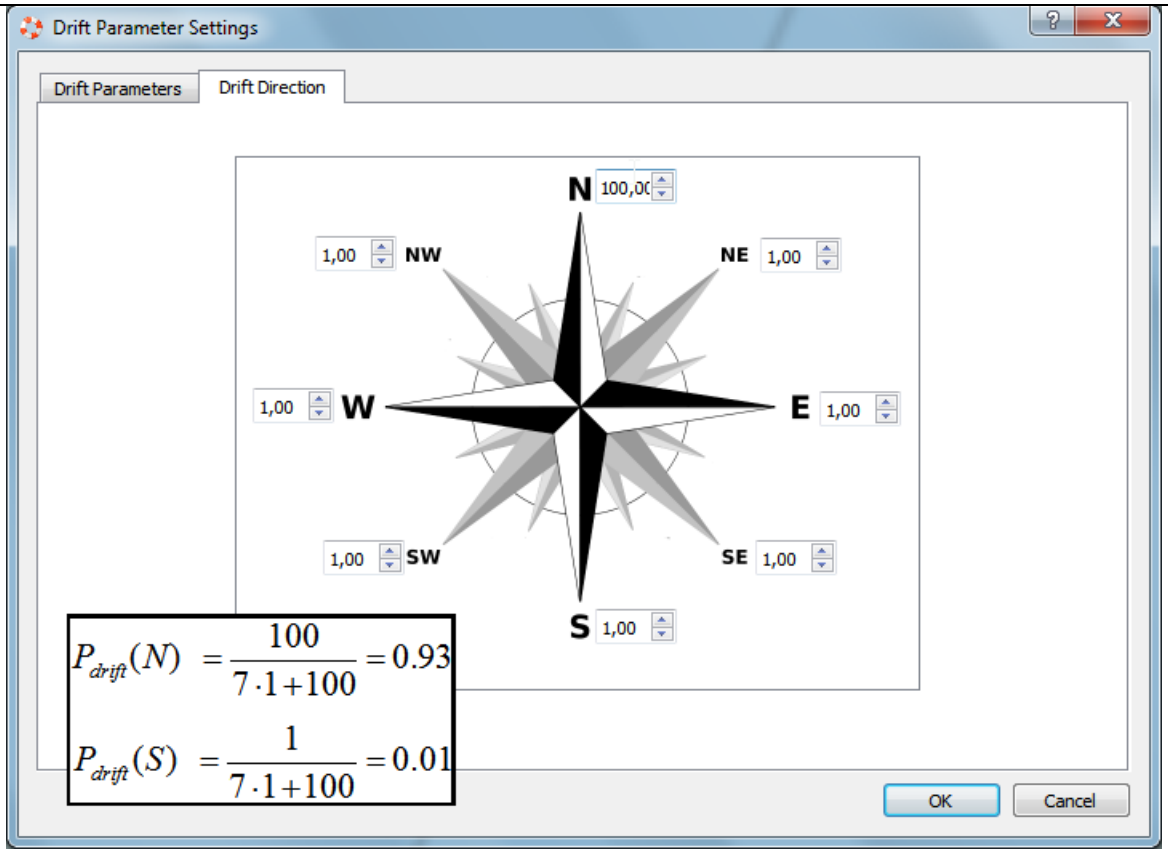
It is also possible to select a function, you can write your own or e.g. load a predefined.



The probability of anchoring when drifting can be specified, note that a certain minimum distance is required for the ship to anchor, i.e. there must be an area that is below the max anchor depth that is longer than the minimum anchor distance in order for the ship to be able to anchor.

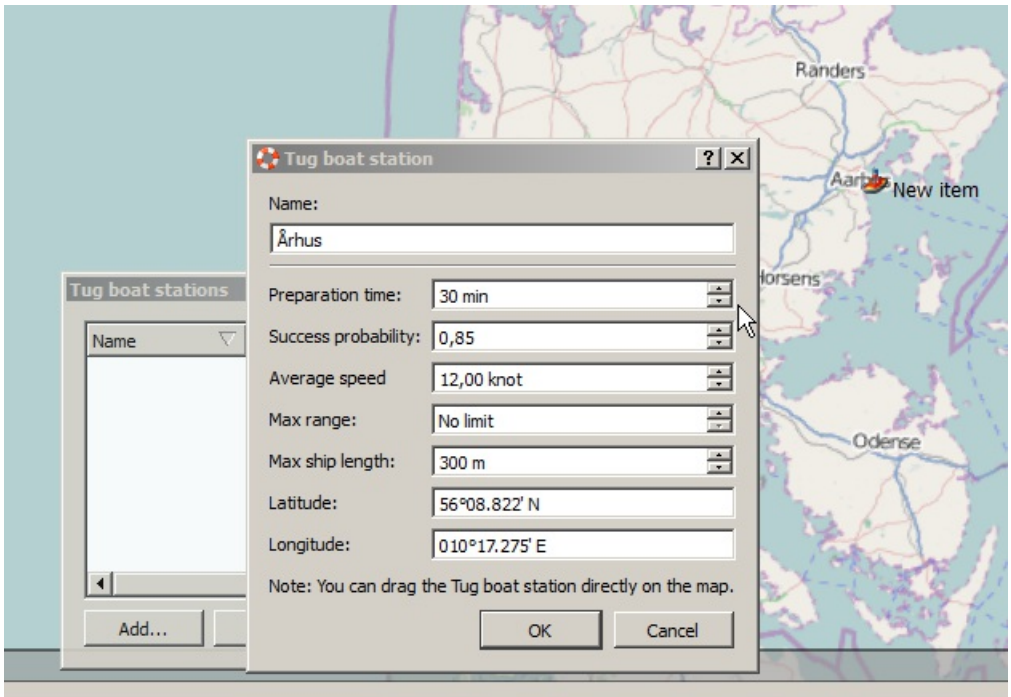


The drift direction can currently only be specified for the entire area. Note that this is not a windrose, the factors in each direction can be used to specify the drifting direction.



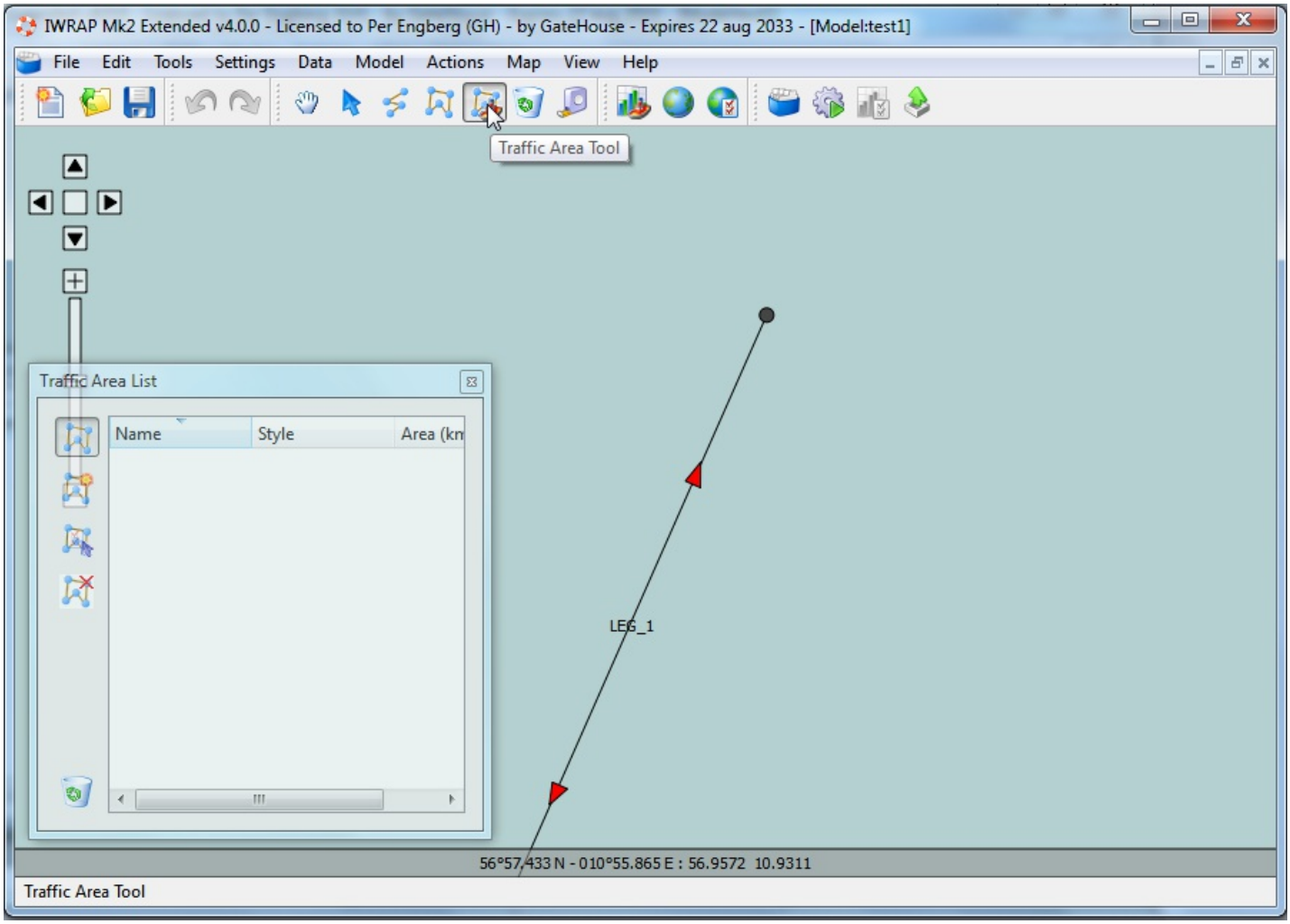
In the shown example the N factor is set to 100 and the rest to 1, this means that the propapility of a north bound drifting direction is 0.92 and the other directions have a probability of 0.01.

It is possible to specify the location og tug stations and define their range of operation. This can be done from the menu 'Data/Tug boats...', this will inkoke the 'Tug boat stations' dialog. Select 'Add..' to add a new tug boat station. Using these definitions it is calculated if the tug boat can reach the drifting grounding or allision event in time. If this is possible the succes of the actual tug operation is specfified by the 'Succes probability'.

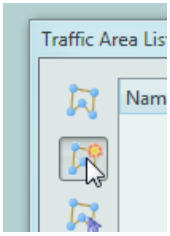


Traffic Area

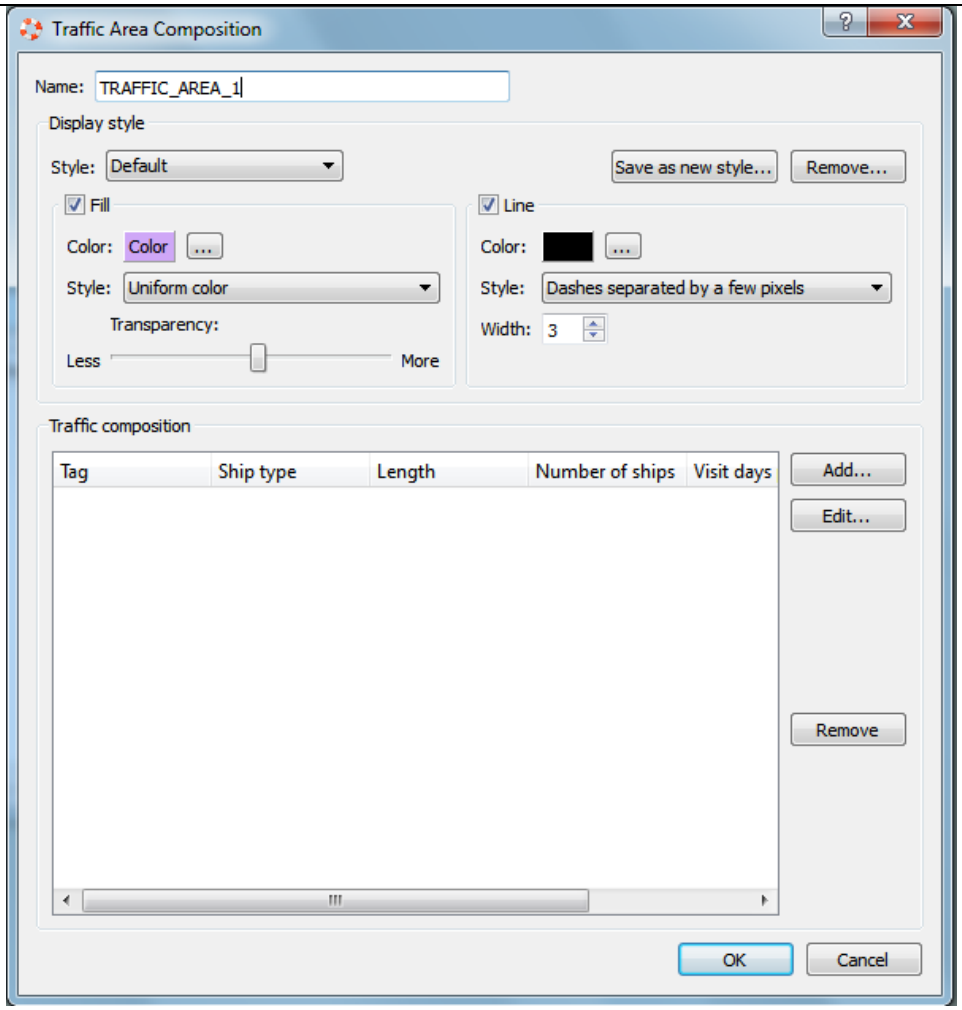
A Traffic Area can be used to model traffic that does not follow traffic lanes e.g. fishing or dredging In order to add a Traffic Area, start by zooming in on the region of interest and select the 'Traffic Area' tool from the toolbar:



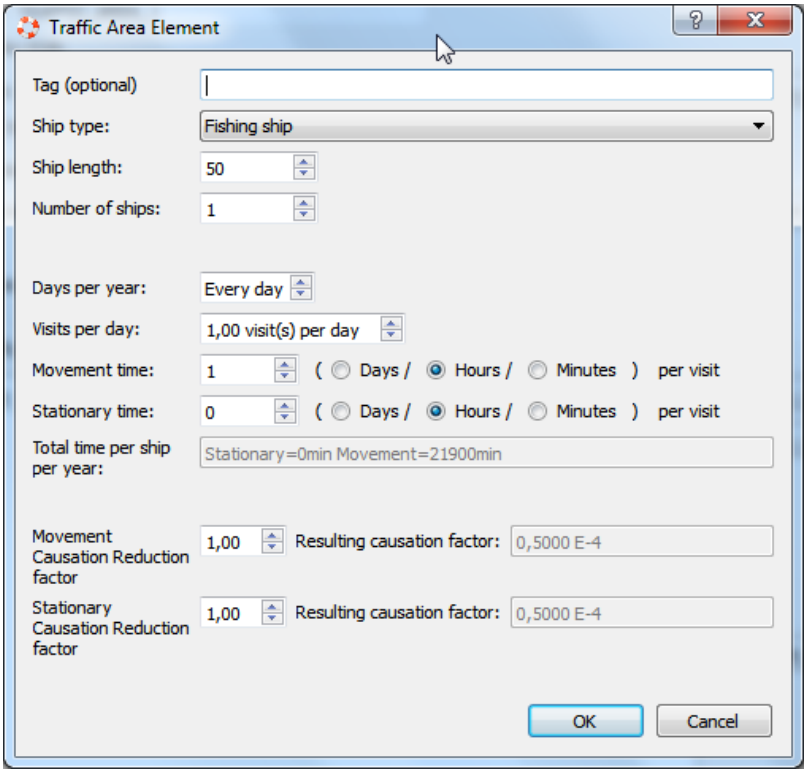
The 'Traffic Area List' is shown in the lower left corner of the screen. In order to add a new traffic area select the 'Create polygon tool'.



The 'Traffic Area Composition' dialog is displayed:



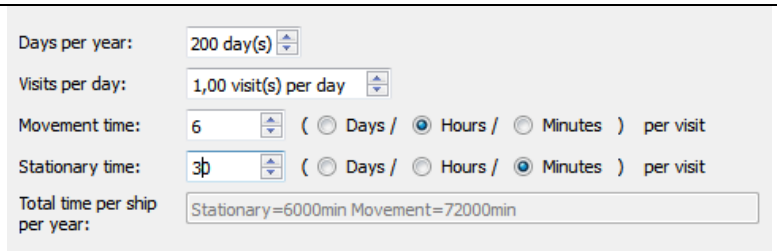
The 'Traffic Area Composition' dialog is used to define the different types of traffic in the area. Press the 'Add...' button in order to add a new Traffic Area Element.



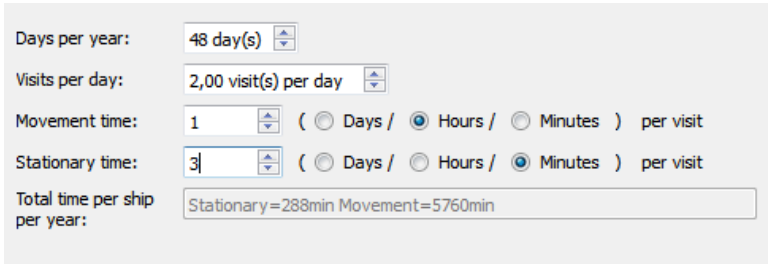
Choose the type of ship you would like to model, the average length and the number of ships.

Next you have to specify how often and how long time the ships are moving and are stationary inside the area.

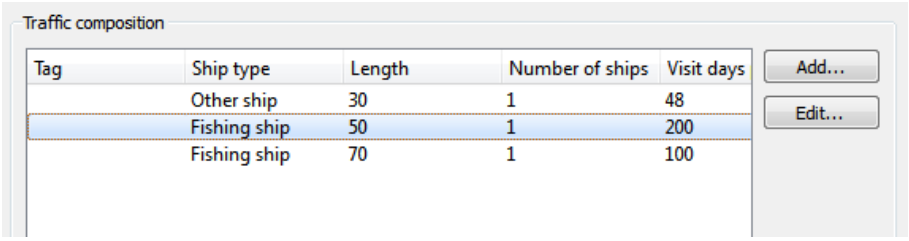
If you e.g. have a number of fishing ships, the configuration could be like this:



If you e.g. have a number of dredging ships, where each ship is active 48 days per year and each of these days the ships make two trips to the area, in each trip it is stationary for 3 hours and moving for 1 hour, the configuration could be like this:



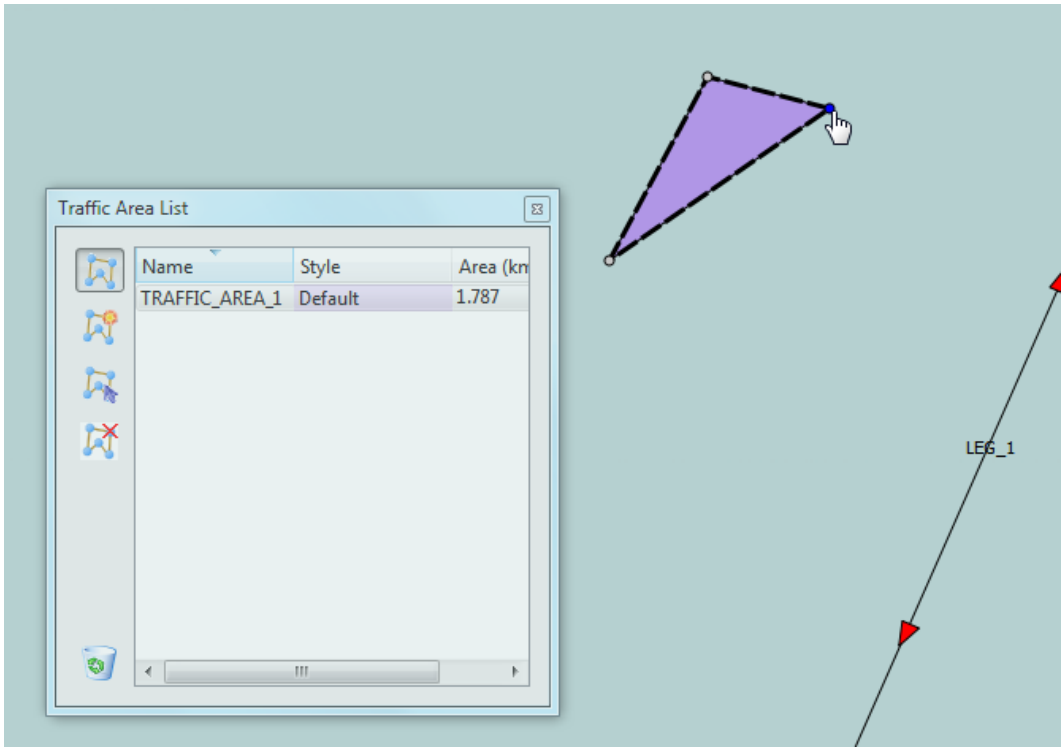
Press Ok when done. You can add as many Traffic Area Elements as you want to the Traffic Composition:



You could e.g. add different fishing or dredging patterns.

When you are satisfied with the Traffic Area Composition, press Ok.

Now you must start drawing the area by clicking on the map and thereby adding vertices to the area polygon. See Defining Bathymetry for more detailed description on how to handle area polygons.

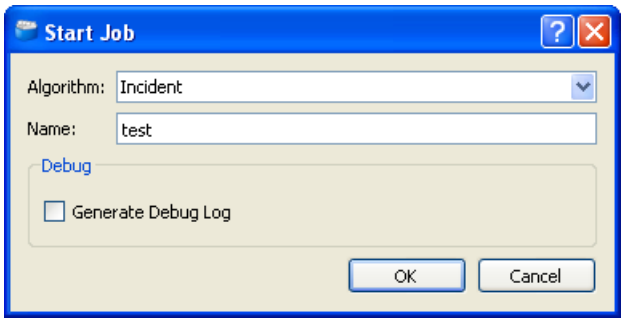


Running the Algorithm

A risk analysis job is run by selecting Start Job from the toolbar:

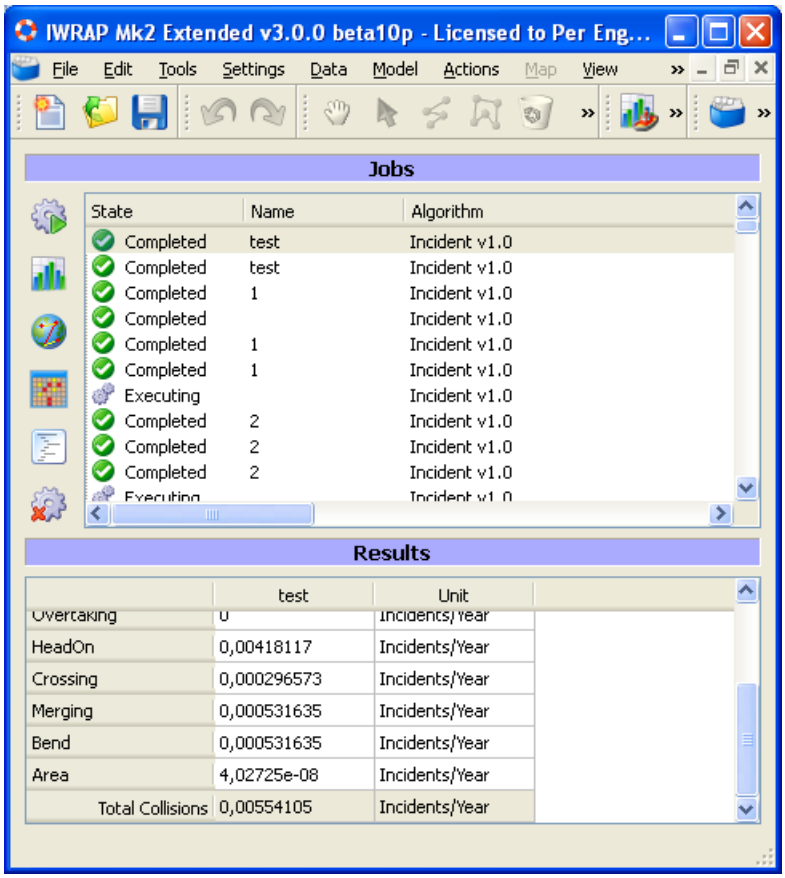
A warning dialog may be displayed indicating that a number of polygons/areas are not Simple, they are drawn with red color on the map, you should correct these polygons before continuing, see Defining Bathymetry.

The Start Job dialog is displayed, give the job a name:

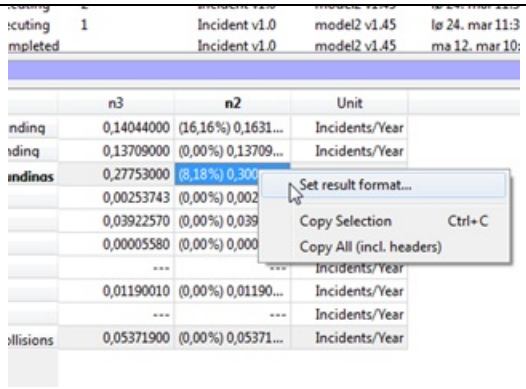


and press Ok. IWRAP Mk2 will take a snapshot of your current model and start processing. The job is added to the top of the Job list.

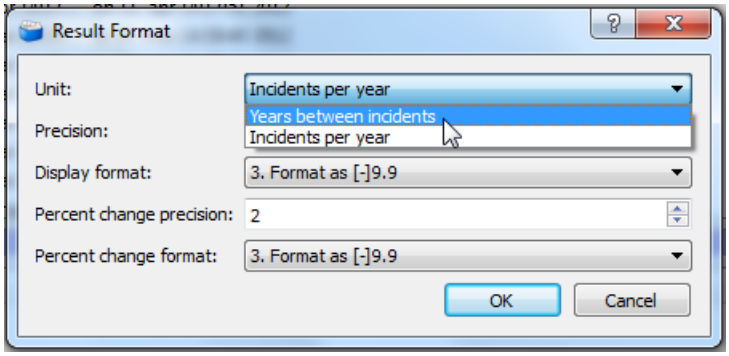
The Job will start in the 'Executing' state. Wait for the job to go to the 'Completed' state. If you select a job (also a job that currently is executing) the result of the analysis will be displayed in the lower Result window. If an executing job is selected the results of the analysis completed so far is displayed.



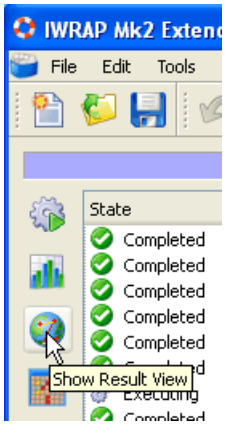
It is possible to select several jobs from the Job list and get the results shown in the Results list, this makes it easy to compare different runs. When comparing results, the change in percent relative to the first selected job is shown.



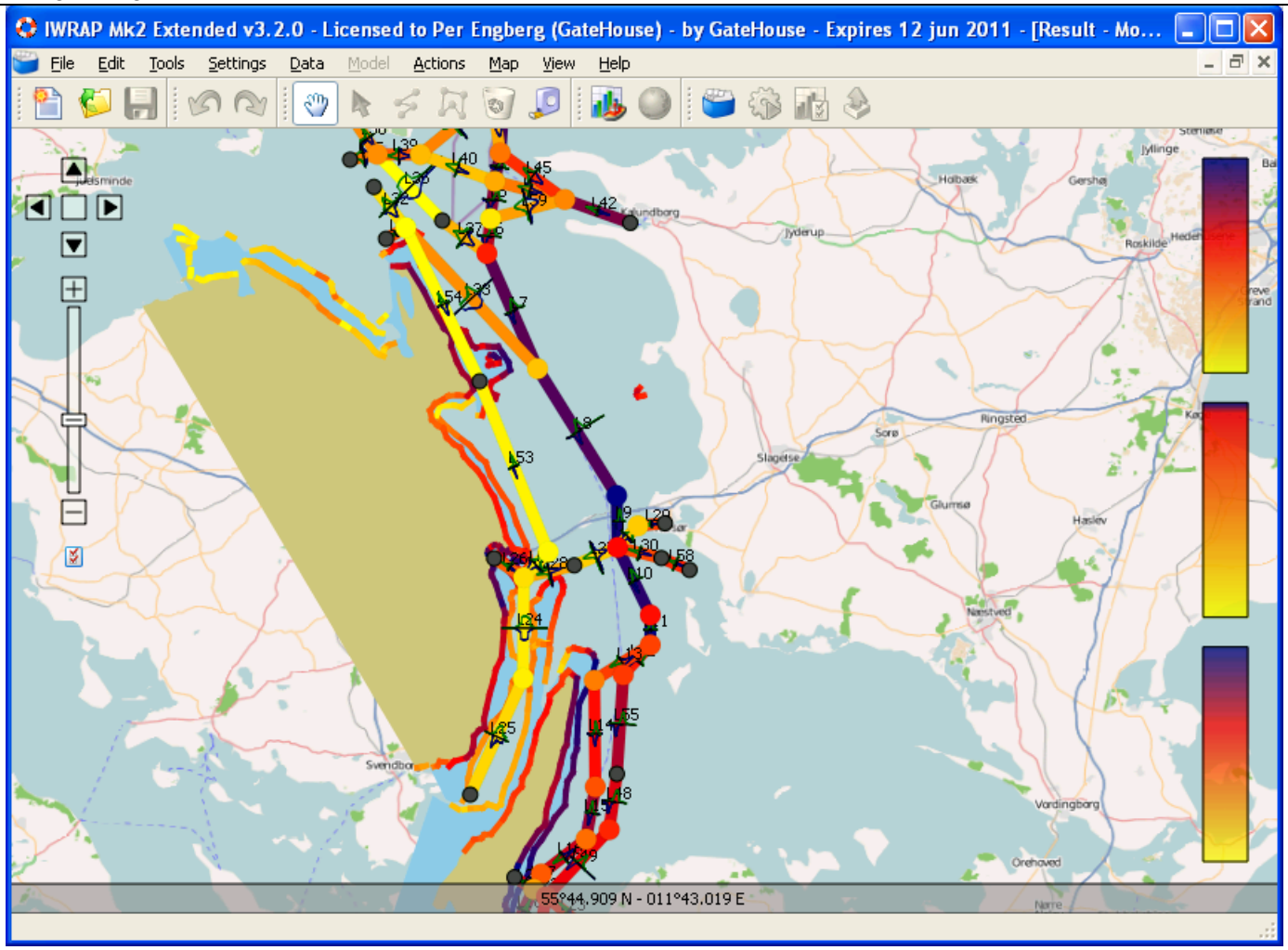
You can change the way the result is displayed by right clicking on the results and selecting “Set result format…”. You can select between “Years between incidents” and “Incidents per year”, and select the precision of the numbers.



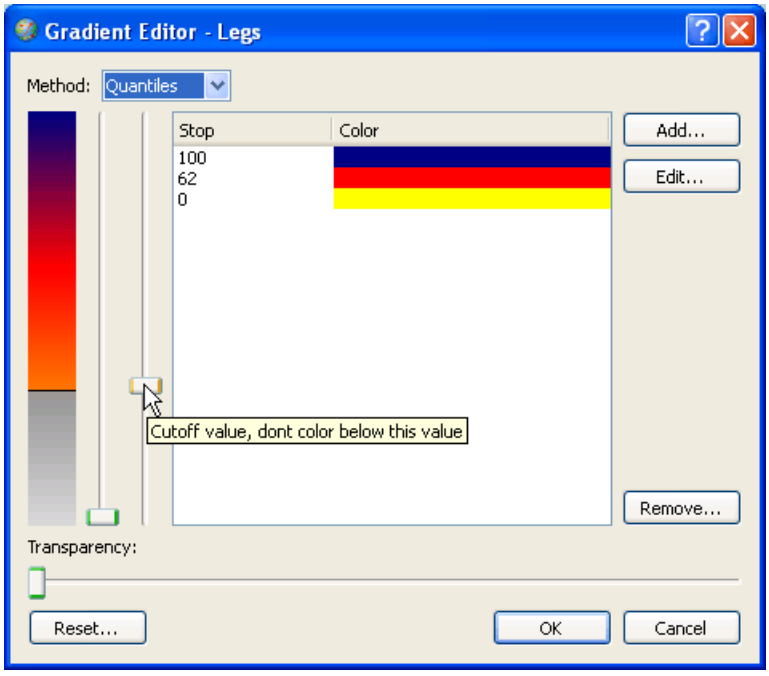
The result can be shown on a map by selecting 'Show Results View'.



The map is colored using three gradients, one for Legs, one for Waypoints and one for Bathymetry/Polygons.



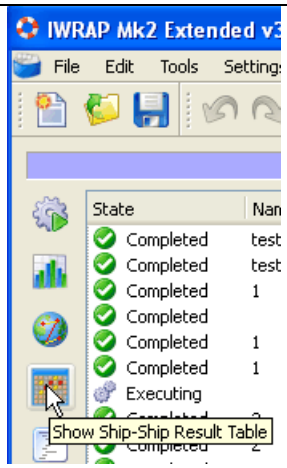
You can click on the gradient to change the color settings etc., the topmost is for the Legs, the middle is for the Waypoints and the last is for the Bathymetry. The default way of coloring is using Quantiles, you can also choose to use Percentage.



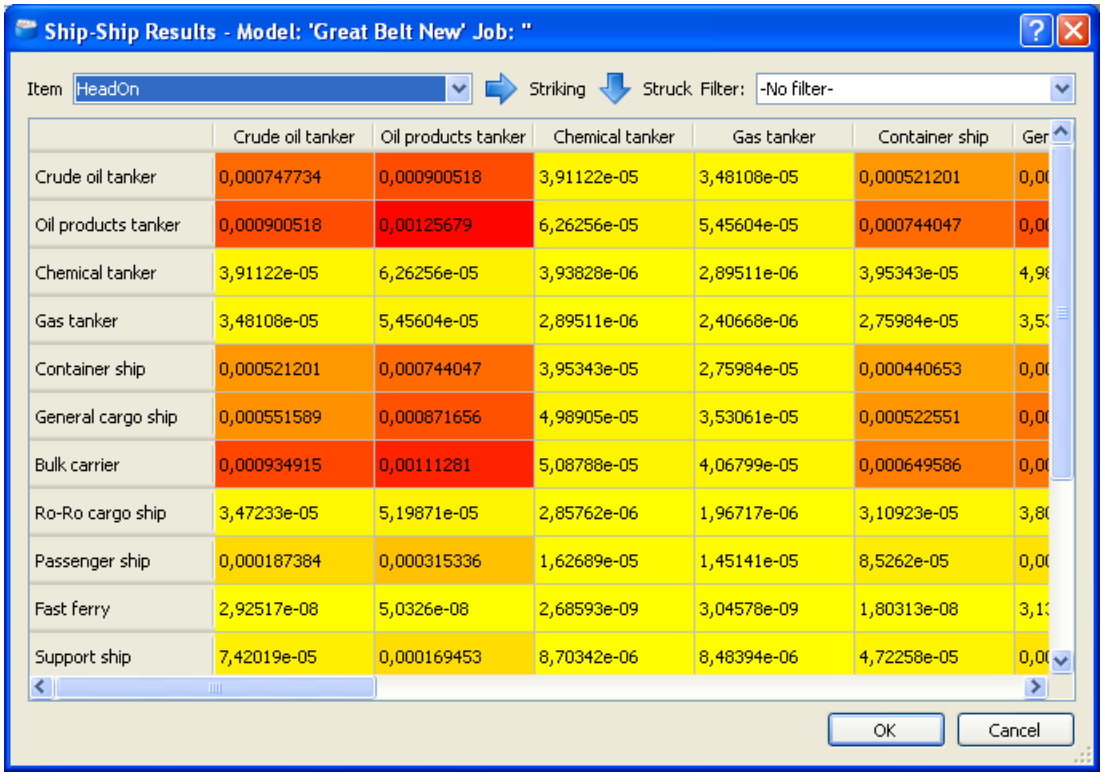
You can add, remove, and edit the colors. Note, the cutoff value slider, this can be used to define a limit on the values of interest, values in the gray area are not shown on the map.

You can always select reset to return to factory default settings.

A second way of analyzing the results is by using the 'Ship-Ship results table', this can be activated from the Job view:

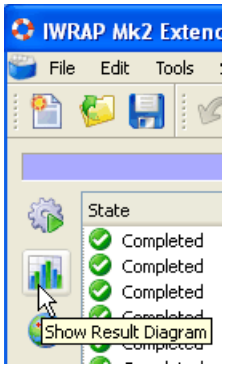


A second way of analyzing the results is by using the 'Ship-Ship results table', this can be activated from the Job view:

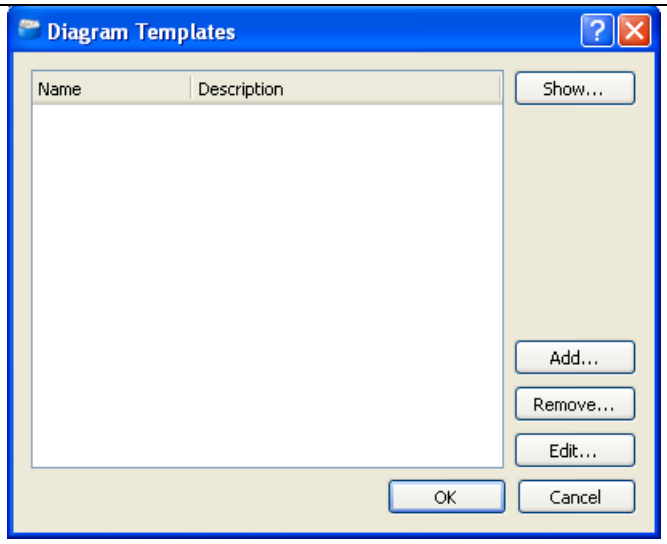


This table indicates the probability of incidents between ship types. The more red the higher the probability. Use Item to select from the different types of incidents; head-on, overtaking, etc. Using the filter you can e.g. filter on a specific Leg. If you right-click on the table you can copy the data to the clipboard.

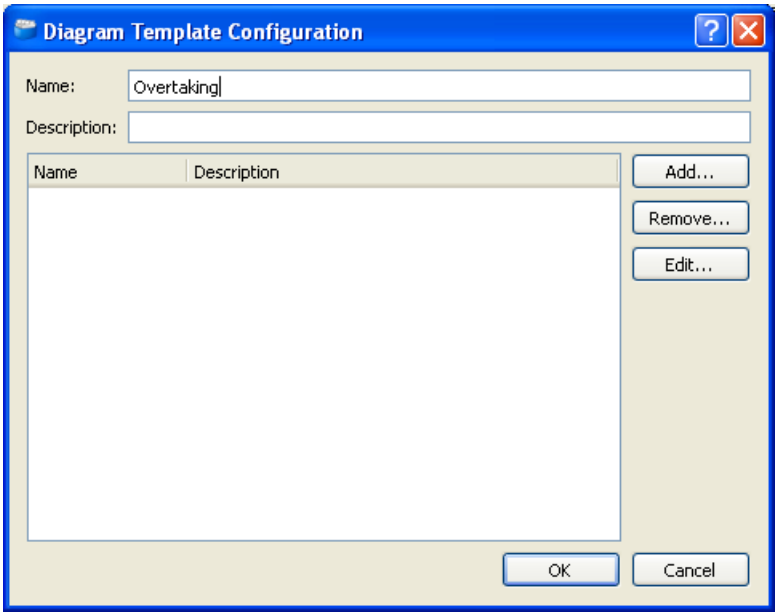
Another option to show results is to use 'Result Diagrams':



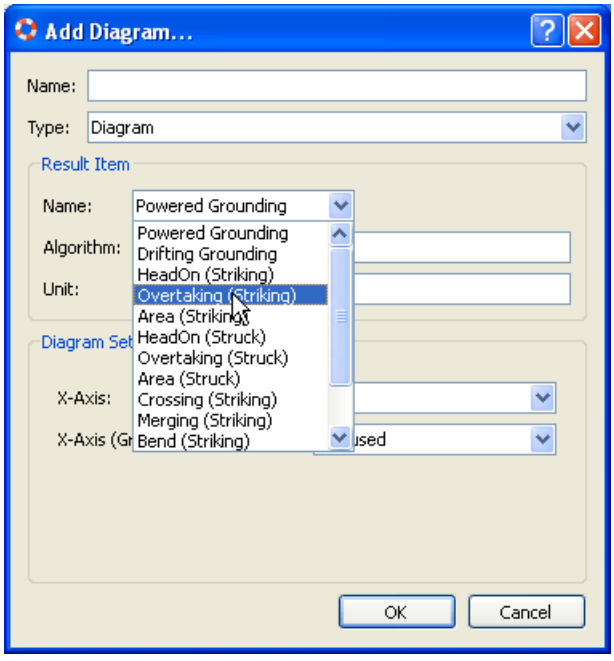
This will show the Diagram Templates dialog:



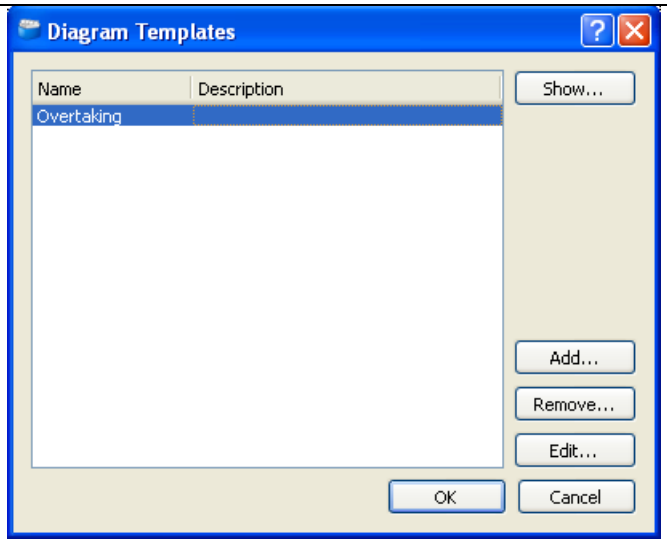
Press Add to define a new template.



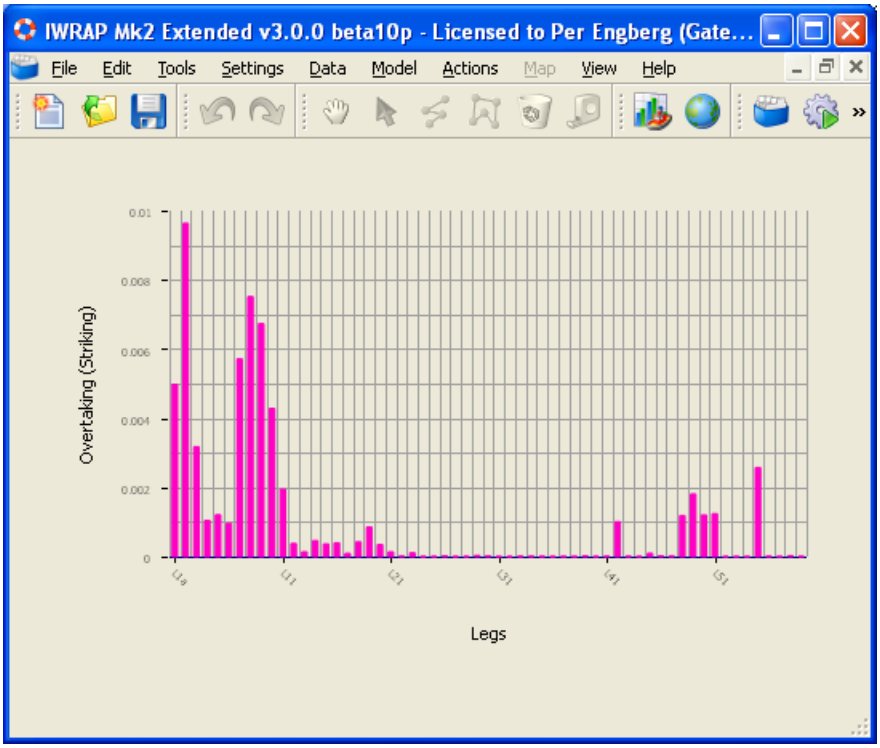
Give the template a name, and press Add to add a diagram:



Press Ok and press Ok again on the 'Diagram Template Configuration' dialog. Now you can double click on the new 'Overtaking' template or select it and press Show.

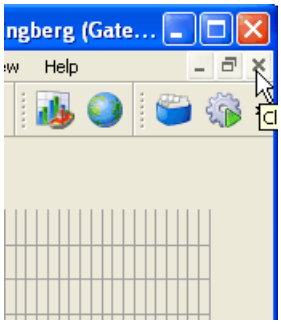


The diagram is shown:



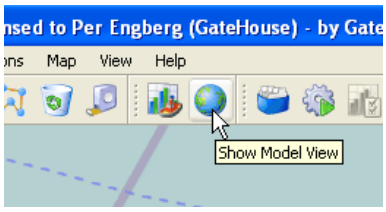
The diagram template is of course stored and can be reused later.

Close the window by using the x in the top right corner or press CTRL+F4.



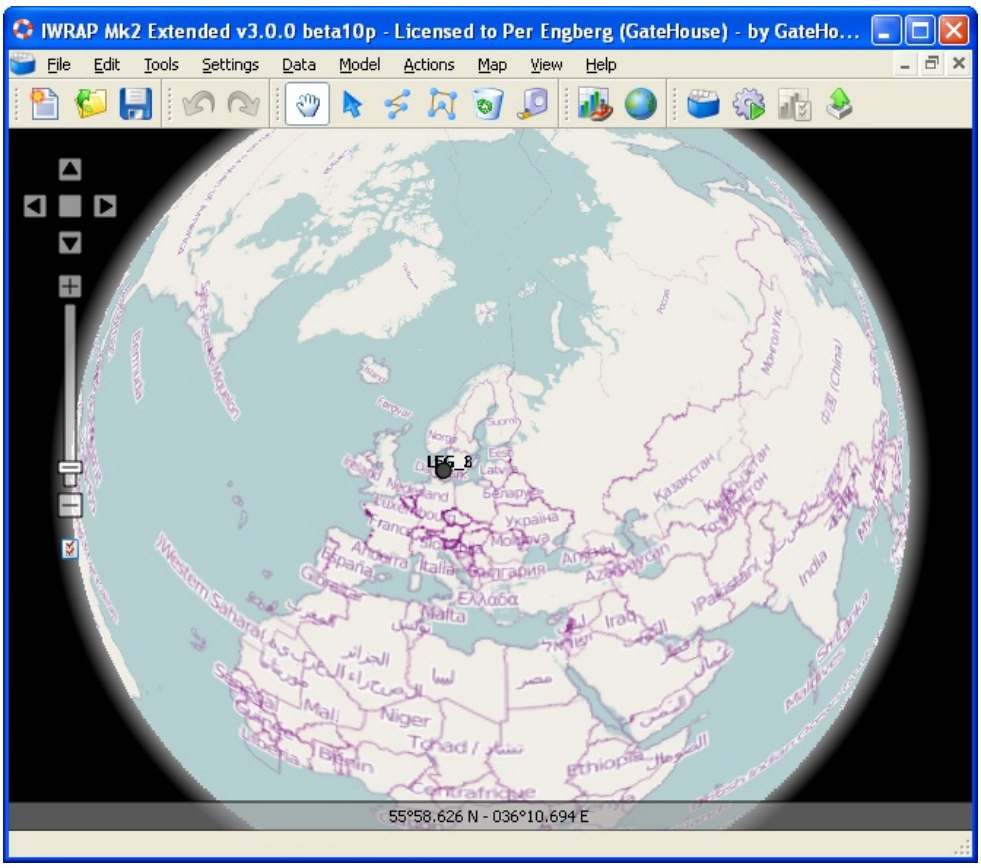
Navigating the MAP

If a model is loaded the Model View can always be displayed using the toolbar icon:

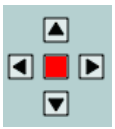


If no map is shown, you may be missing an internet connection or you may have to configure Proxy settings, go to File/Configure Proxy... in the menu.

If the tool is active it is possible to click the left mouse button and pan/drag the map. The maps can also be moved using left/right/up/down keys. Zooming can be done using the mouse wheel or +/- or Page-up/Page-down keys.



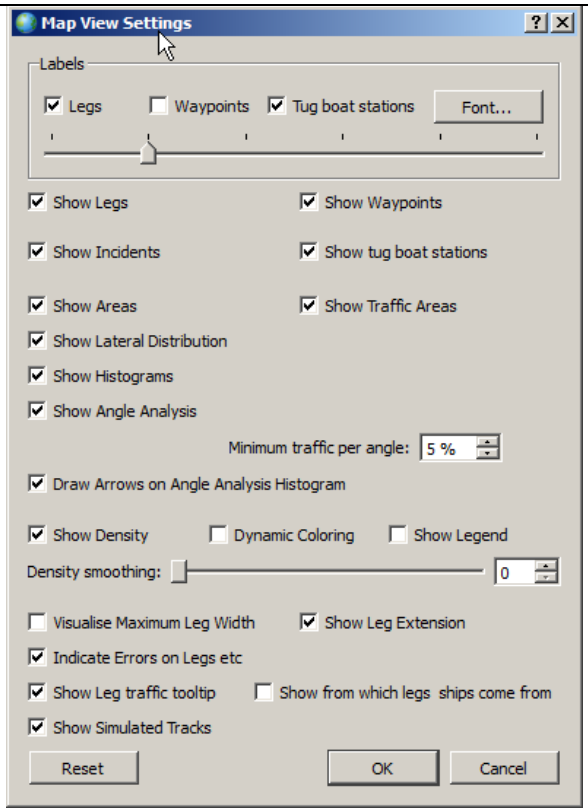
The left hand side of the map contains a Navigator that can also be used to control the map, a useful feature is the 'zoom to fit' button indicated with red below.



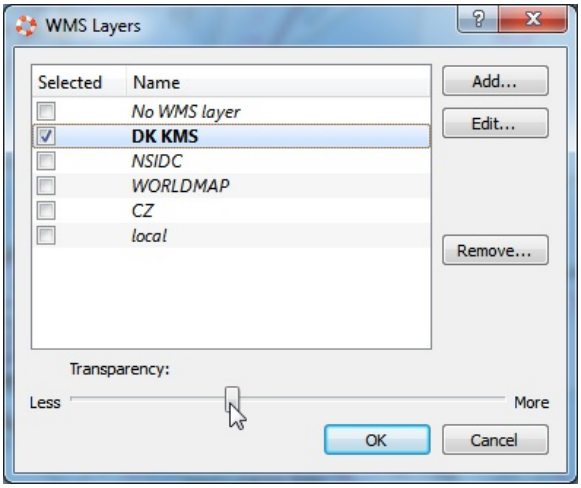
It is possible to adjust the view using the View Setting, click the View Settings button below the Navigator:

Or from the toolbar:

The View Settings dialog is displayed:

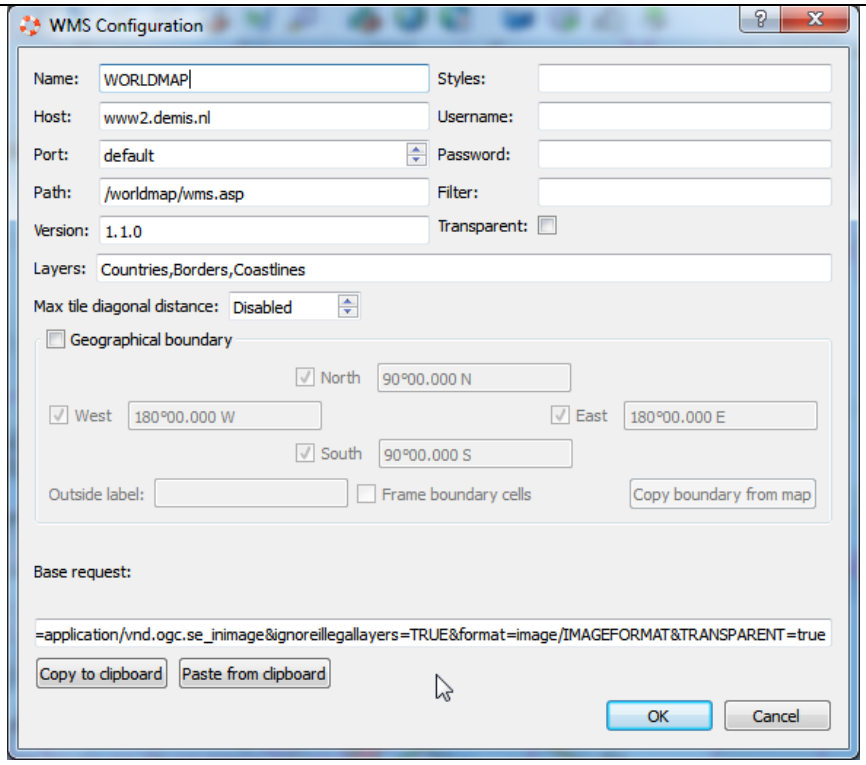


A WMS layer can be added from 'Map/WMS Configuration'.:

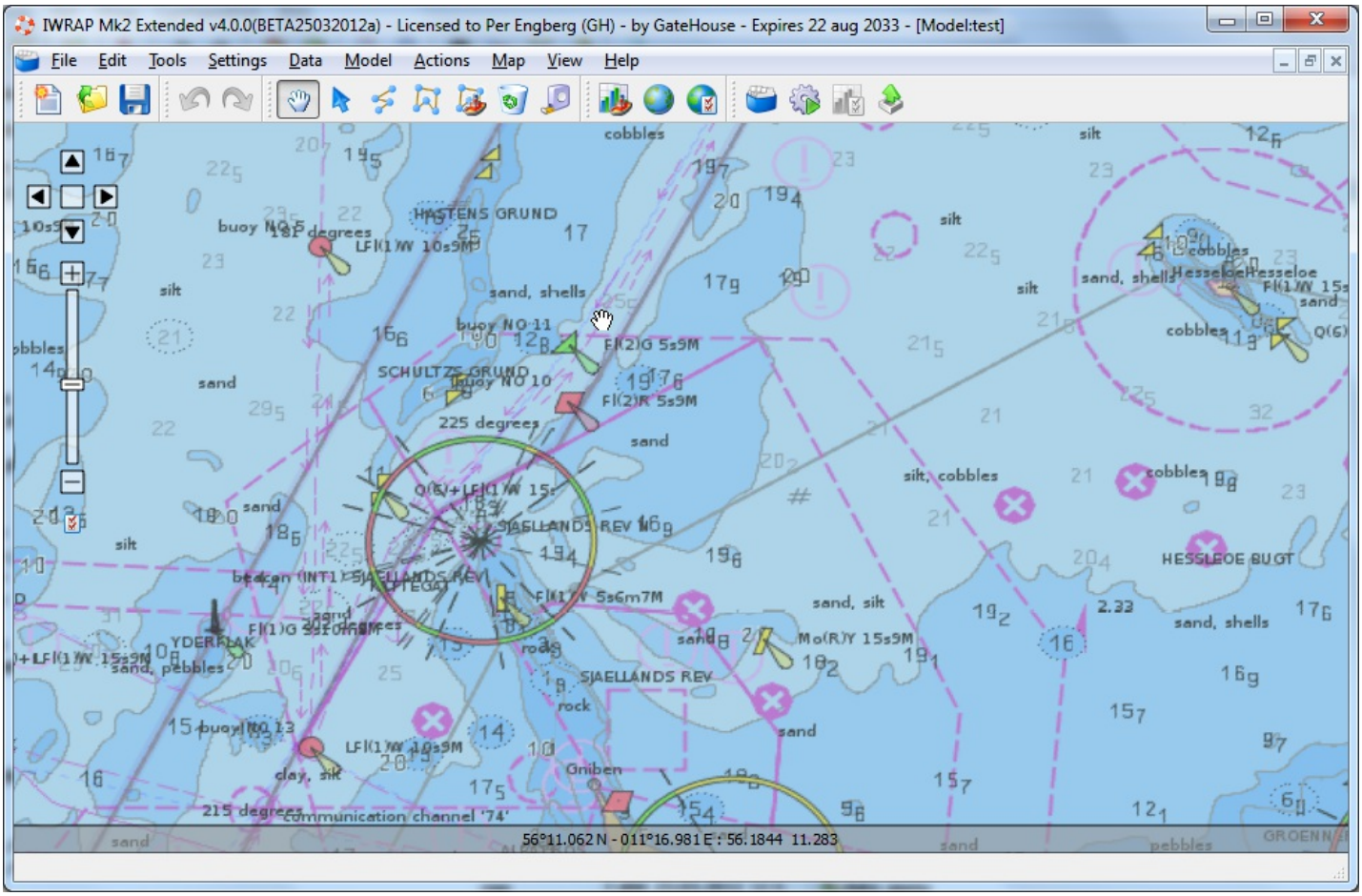


One or more WMS services can be defined, but only one can be active at the time. The WMS layer is drawn on top of the background map e.g. OpenStretMap, the WMS layer can be made transparent so that it is possible to mix and see both maps.

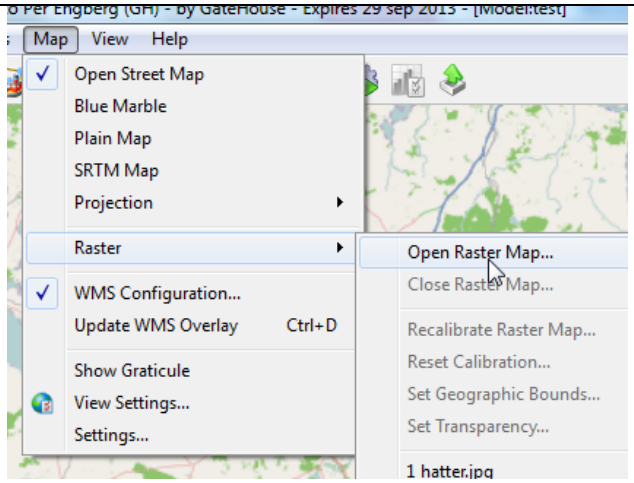
Defining a WMS service is not a simple task. If you have a WMS service you want to use, feel free to contact iwrap@gatehouse.dk for additional support.



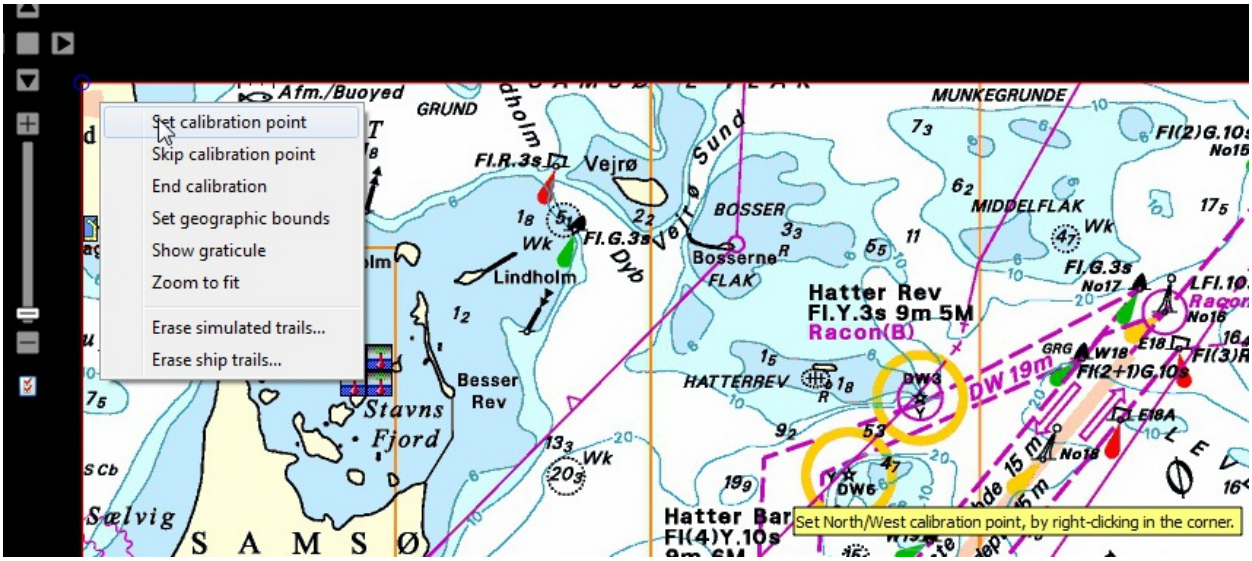
Here is an example of a comercial Danish WMS layer.



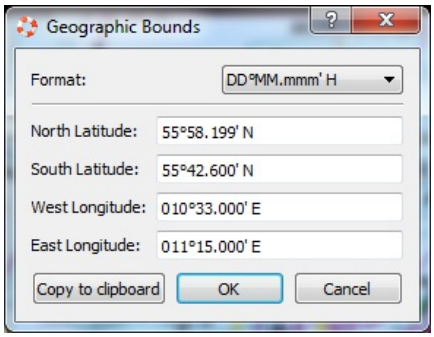
A Raster map can be added from 'Map/Raster/Open Raster Map...'.:



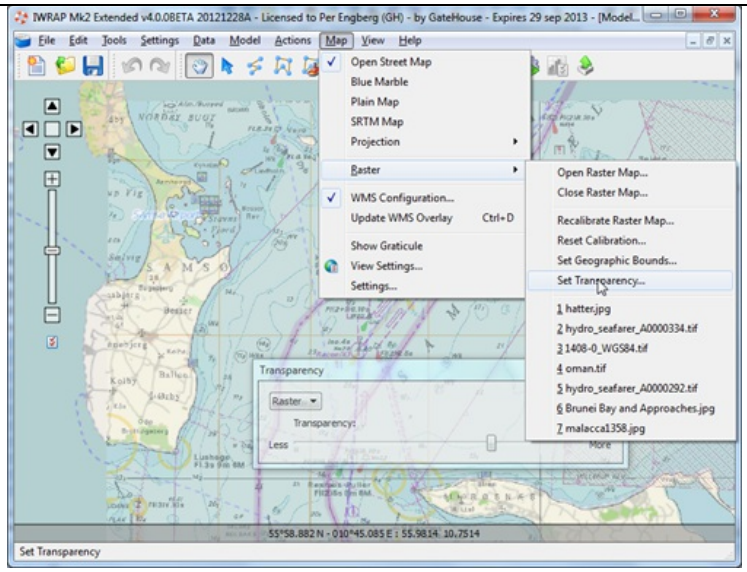
Select the file you want to import. If the file is not a GeoTIFF you will be asked to calibrate the map. Calibration is only necessary if the chart has a boundary, then you have to right click and specify each corner of the map. If the map does not have a boundary you can skip the calibration.



If the file is not a GeoTIFF you can enter the geographic bounds of the chart:



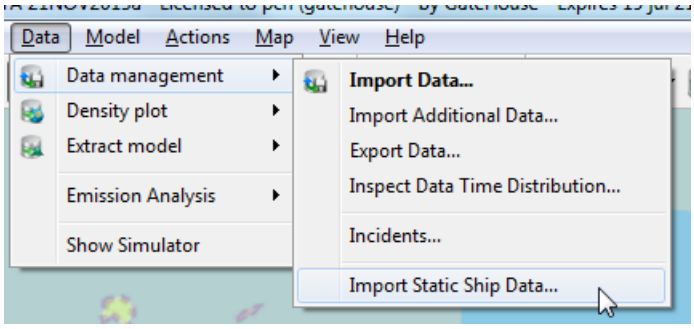
The raster map is now displayed on top of the background map. It is possible to control the transparency of the Raster map.


IWRAP Mk2 Extended v4.0.0BETA 20121228A - Licensed to Per Engberg (GH) - by GateHouse - Expires 29 sep 2013 - [Model...
File Edit Tools Settings Data Model Actions Map View Help
Open Street Map
Blue Marble
Plain Map
SRTM Map
Projection
Raster
WMS Configuration...
Update WMS Overlay Ctrl+D
Show Graticule
View Settings...
Settings...
Open Raster Map...
Close Raster Map...
Recalibrate Raster Map...
Reset Calibration...
Set Geographic Bounds...
Set Transparency...
1 hatter.jpg
2 hydro_seafarer_A0000334.tif
3 1408-0_WGS84.tif
4 oman.tif
5 hydro_seafarer_A0000292.tif
6 Brunei Bay and Approaches.jpg
7 malacca1358.jpg
Transparency
Raster
Transparency:
Less
More
55°58.882 N - 010°45.085 E : 55.9814 10.7514
Set Transparency

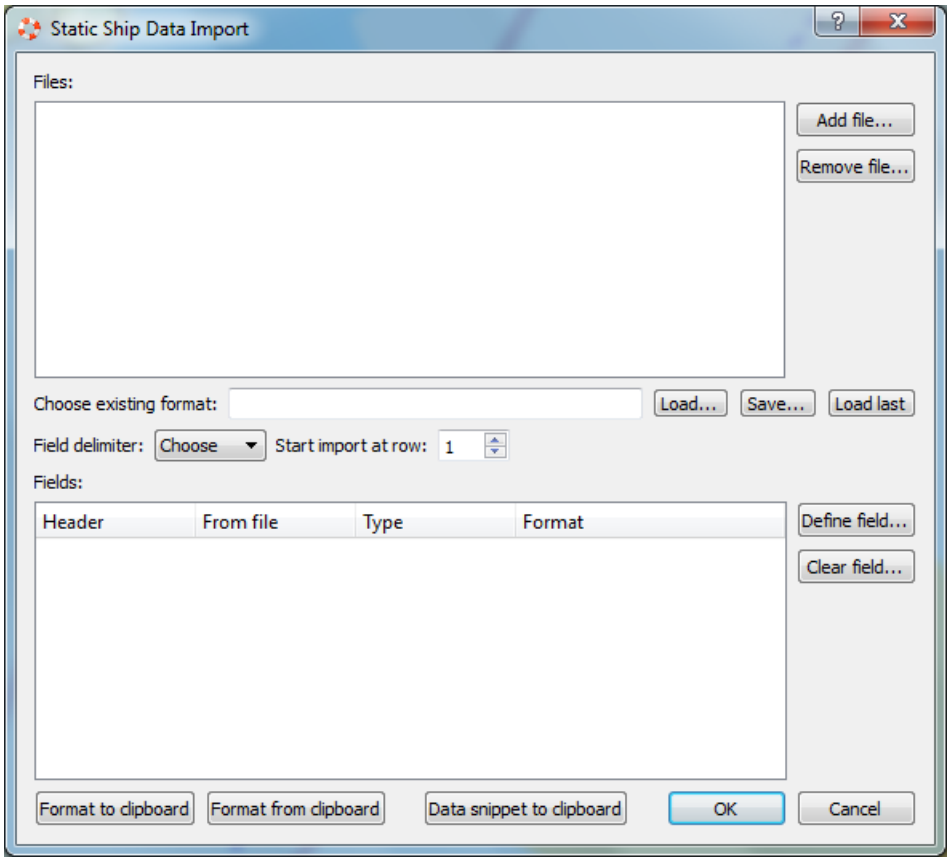
Importing Static Ship Data

This step is used to populate the IWRAP Static Ship Data database. This can be used to identify the correct type and length of specific ship. This step is not mandatory, if it is not used the ship type and length will be extracted from the dynamic data, i.e AIS data (mesg 5).

Select 'Data/Import Static Ship Data' from the menu:



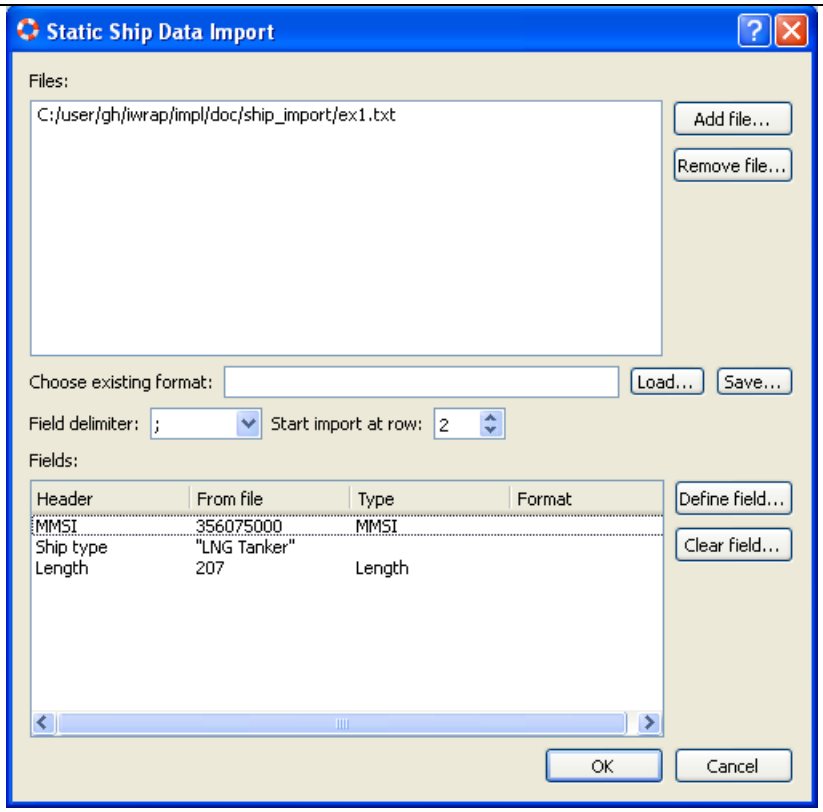
the 'Static Ship Data Import' dialog is invoked:



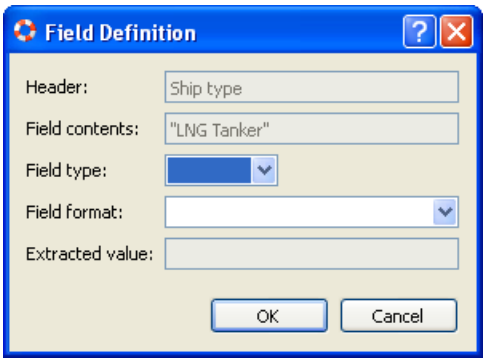
IWRAP supports import of text files with different separators. The text file should contain an MMSI number, a ship type (in Lloyds format) and the length of the ship. A file could e.g. look like this:

MMSI;Ship type;Length
356075000;"LNG Tanker";207
219495000;"General Cargo Ship";69

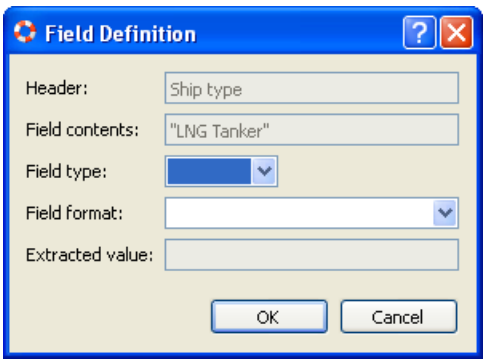
This example file contains a header and 2 ships. Press 'Add File...' to add the file, IWRAP will guess which field separator/delimiter is used in this case semicolon. IWRAP also automatically detects that the first line is a header, and therefore 'Start import at row' is set to 2, and that the first column contains MMSI and the third is the Length.



IWRAP therefore add 3 lines to the Fields list. The second line with Header 'Ship Type' does not have a type, you must specify this yourself, select the line and press 'Define Field...' or simply double click on the line, the 'Field Definition' dialog is shown:



Set 'Field type' to 'Ship Type' and set 'Field format' to 'Lloyds.

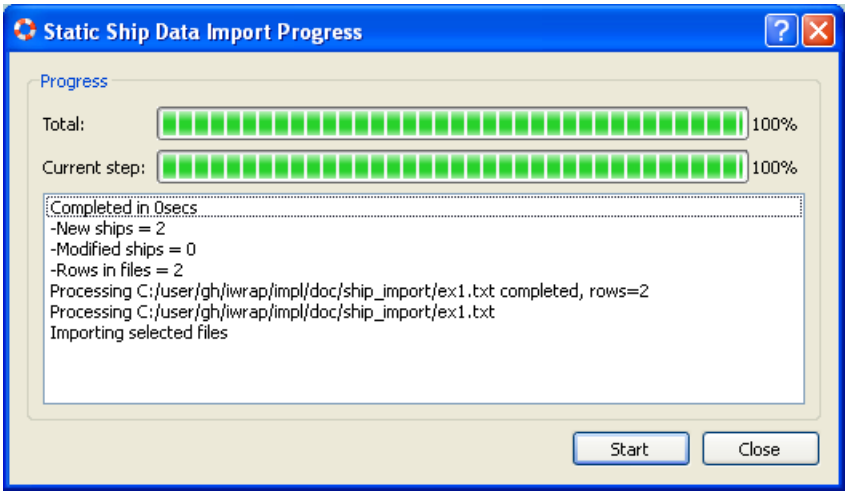


IWRAP indicates how the field will be interpreted i.e. the 'Extracted value' will be 'Gas tanker'. IWRAP supports 3 ways of specifying type:

- 1. Lloyds: Uses Lloyds definition of ship types and maps them to IWRAP types.
- 2. AIS: Uses definition from Message 5: Ship static and voyage related data ITU-1371, see 'Type of ship and cargo type' field, so e.g. 60 is a passenger ship, 80 is a tanker etc.
- 3. IWRAP: it is also possible to specify the IWRAP types directly (case insensitive)
  - Crude oil tanker
  - Gas tanker
  - Container ship
  - General cargo ship
  - Bulk carrier

- Ro-Ro cargo ship
- Passenger ship
- Fast ferry
- Support ship
- Fishing ship
- Pleasure boat
- Other ship

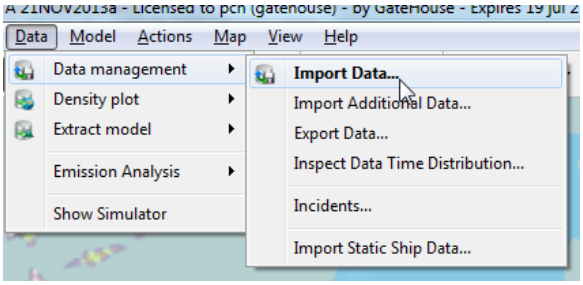
Press ok to close the 'Field Definition' dialog, press ok again to display the 'Static Ship Data Import Progress' dialog. Press 'Start' to import the data



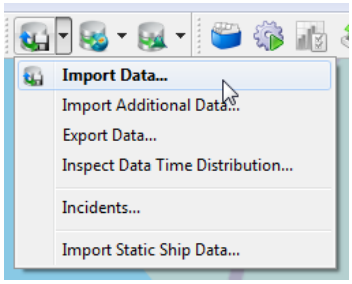
The data has now been imported to the database.

Importing Data

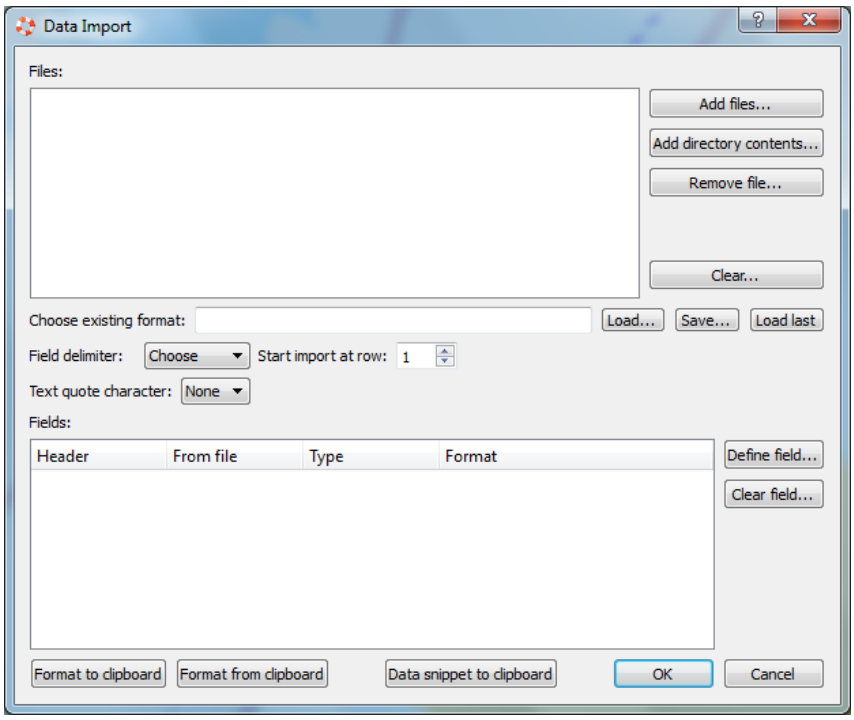
This step is used to import dynamic ship data, i.e. typically AIS data, select 'Data/Data management/Import Data' from the menu:



or using the tool buttons:



the 'Data Import' dialog is invoked:



IWRAP supports import of text files with different separators. The text file can have different contents. The recommended format is to have raw AIS NMEA with timestamps, e.g:

1-4-2008 14:06:08 < tab > !AIVDM,1,1,,A,13tsWl?0011:9UHQQj87DHEn00Rj,0*43
1-4-2008 14:06:38 < tab > !AIVDM,1,1,,A,33u=Qm?qh20nEWbQ0lB3K87l0000,0*19
1-4-2008 14:06:58 < tab > !AIVDM,2,1,2,A,53u?j?P1joL=<@HP000eDhhDp000000000000001l1HA4440HtP00000,0*6A
1-4-2008 14:06:58 < tab > !AIVDM,2,2,2,A,000000000000000,2*26
1-4-2008 14:07:01 < tab > !AIVDM,1,1,,B,14QsDc04Qn19nJ`P1?;9F7ll0800,0*52

< tab > indicates a tab character.

It is also possible to import, this format i.e. no timestamp on the second part of the message 5.

1-4-2008 14:06:08 < tab > !AIVDM,1,1,,A,13tsWl?0011:9UHQQj87DHEn00Rj,0*43
1-4-2008 14:06:38 < tab > !AIVDM,1,1,,A,33u=Qm?qh20nEWbQ0lB3K87l0000,0*19
1-4-2008 14:06:58 < tab > !AIVDM,2,1,2,A,53u?j?P1joL=<@HP000eDhhDp000000000000001l1HA4440HtP00000,0*6A
!AIVDM,2,2,2,A,000000000000000,2*26
1-4-2008 14:07:01 < tab > !AIVDM,1,1,,B,14QsDc04Qn19nJ`P1?;9F7ll0800,0*52

If you only have raw NMEA data but don't have a timestamp for each line you should divide your data into one file per day (UTC), and name each file with year, month and day, xxx_yXXXX_mX_dX.tmp, e.g.:

myfile_y2010_m2_d1.tmp, myfile_y2010_m02_d01.tmp, myfile_d1_m2_y2010.tmp

If you have Comment Block data, select the NMEA format, e.g.

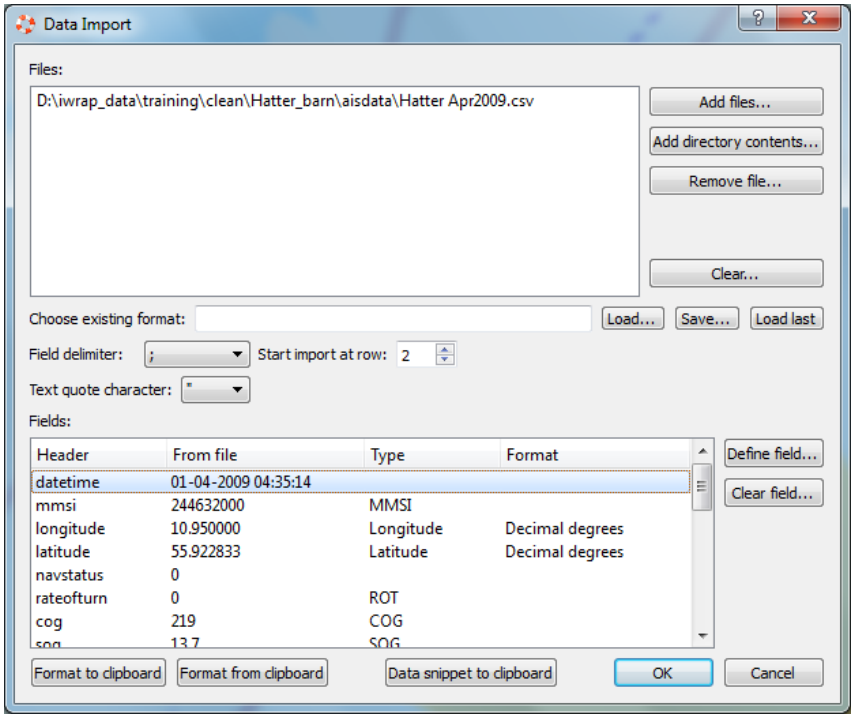
```
\g:1-2-
0569,c:1351245336*22\!BSVDM,2,1,0,A,53P;1j@2@0i784uOH010Dq@4hTp400000000000t1@t::6e;N5Tm83@DQhDQ,0*58
\g:2-2-0569*57\!BSVDM,2,2,0,A,E4p23l1@002,0*20
\c:1351245453*5E\!AIVDM,1,1,,B,13P;1j@01uOjJ2jQbfk3eC140<0L,0*4A
\g:1-2-0570,c:1351245244*2E\!BSVDM,2,1,0,A,53l;DL01r5P3TP`GP00=
\g:2-2-0570*5F\!BSVDM,2,2,0,A,00000000002,0*3D
\c:1351245453*5E\!BSVDM,1,1,,B,13l;DL000g0daWNOjJ>s:l4f0HCM,0*6F
```

You can also import data from a CSV file like:

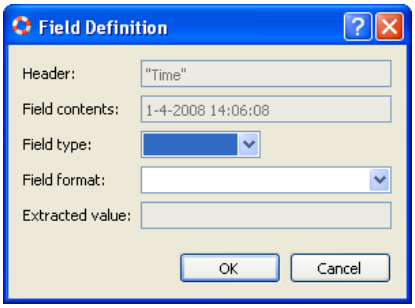
```
"Time";"mmsi";"Lon";"Lat";"COG";"SOG";"Heading";"IMO";"CallSign";"Name";"TypeOfShipAndCargo";"Size_A";"Size_B";"Size_C";"Size_D";"Draught"
1-4-2008 14:06:08;355863000;10,542466670;55,492083330;136,900000000;5,600000000;146;8812631;"3FRK5";"ID
BULKER";70;146;28;16;12;6,200000000
1-4-2008 14:18:26;355863000;10,544116670;55,479200000;239,000000000;3,300000000;241;8812631;"3FRK5";"ID
BULKER";70;146;28;16;12;6,200000000
1-4-2008 14:23:06;355863000;10,537700000;55,476283330;215,900000000;2,400000000;216;8812631;"3FRK5";"ID
BULKER";70;146;28;16;12;6,200000000
1-4-2008 14:32:07;355863000;10,537583330;55,474600000;285,200000000;0,200000000;27;8812631;"3FRK5";"ID
BULKER";70;146;28;16;12;6,200000000
```

If the file contains quoted strings dont forget to select a Text Quote Character i.e. single or doible quote.

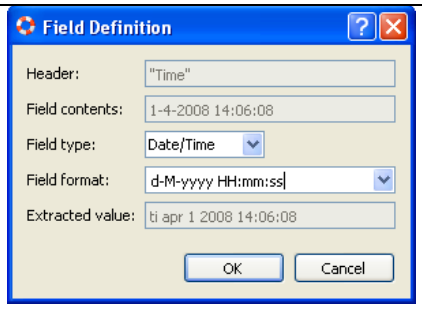
If you have a file like this IWRAP will automatically detect some of the fields/columns using the first line (because it contains 'mmsi').



Notice that IWRAP has inserted a 'type' in some of the fields above e.g. the MMSI number. IWRAP has also automatically determined the field delimiter to be semicolon and the first data row to be the second and thereby skip the header. In this case you have to define the Time field, do this by selecting the line and click 'Define field' or just double-click on the line, the 'Field Definition' dialog will appear.



Select the Date/Time field type and select the Field format:

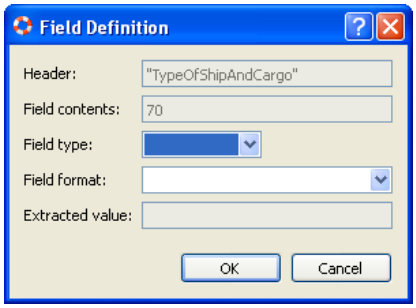


Notice that the 'Extracted value' now reflects the value as interpreted by IWRAP. Please check that the interpretation is correct. If you have another time format that is not listed in the Field format, you can type it directly, see Time Format

The easiest way to input positions is to use decimal degrees, but IWRAP supports a variety of different other formats as well, see Position Format

Press ok to accept the new definition.

Another field that should be handled with care is the 'Ship Type'. In the example handled here a 'TypeOfShipAndCargo' derived from AIS is specified, double-click on this field to display the Field Definition dialog:

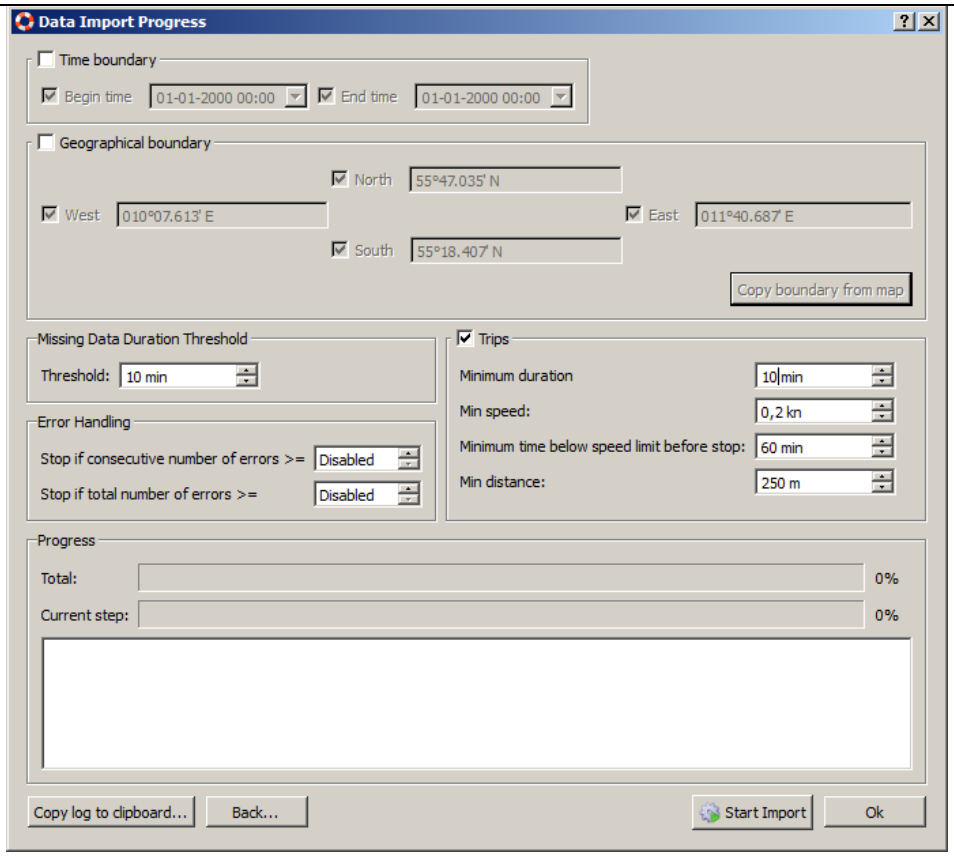


Set 'Field type' to 'Ship Type' and set 'Field format' to 'AIS. IWRAP indicates how the field will be interpreted i.e. the 'Extracted value' will be 'General cargo ship'. IWRAP supports 3 ways of specifying the ship type:

- 1. Lloyds: Uses Lloyds definition of ship types and maps them to IWRAP types.
- 2. AIS: Uses definition from Message 5: Ship static and voyage related data ITU-1371, see 'Type of ship and cargo type' field, so e.g. 60 is a passenger ship, 80 is a tanker etc.
- 3. IWRAP: it is also possible to specify the IWRAP types directly (case insensitive)
  - Crude oil tanker
  - Gas tanker
  - Container ship
  - General cargo ship
  - Bulk carrier
  - Ro-Ro cargo ship
  - Passenger ship
  - Fast ferry
  - Support ship
  - Fishing ship
  - Pleasure boat
  - Other ship

Press ok to accept the new definition.

When all the fields have been defined, press ok again to invoke the 'Data Import Progress' dialog. Here you can limit the dataset in time and geography and you can set the 'Missing Data Duration Threshold'. This threshold is used to determine periods of missing data, the default is 10 minutes. IWRAP keeps track of the data consistency in order to convert the derived figures in to yearly figures.



The 'Trips' section is used to extract trips from the dataset, it is possible to uncheck this and do it later from the 'Data/Data management/Extract trips.." menu.

When you choose 'Start import' you must specify a directory for the new dataset. You can only have one dataset per directory.

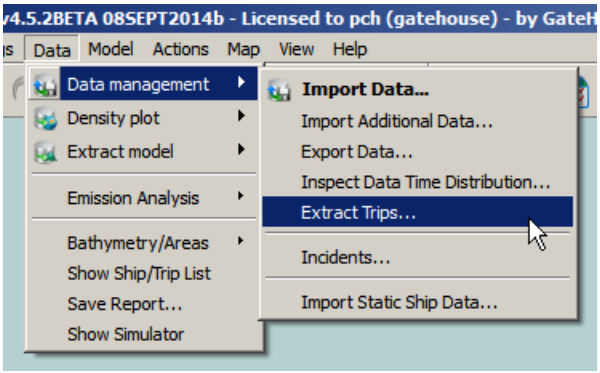
By default, IWRAP does not stop when errors are encountered in the files, instead a log entry is added to the log window with the errorneous data and the line number in the file. You can make IWRAP stop when errors occur by e.g. defining "Stop if total number of errors >=" the maximum errors that you will tolerate.

When the dataset has been successfully imported you are ready to try and create a Density Plot

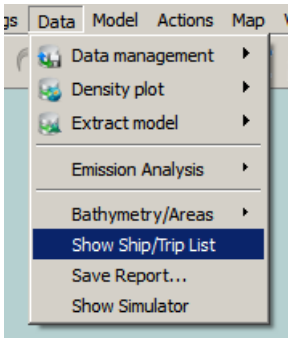
.

Imported Ships and Trips

IWRAP can display extracted ship tracks/trails/trips of individual ships. If you have not extracted the trips when you imported your data you have to extract them first, you can do it now from the 'Data/Data management/Extract trips..' menu.

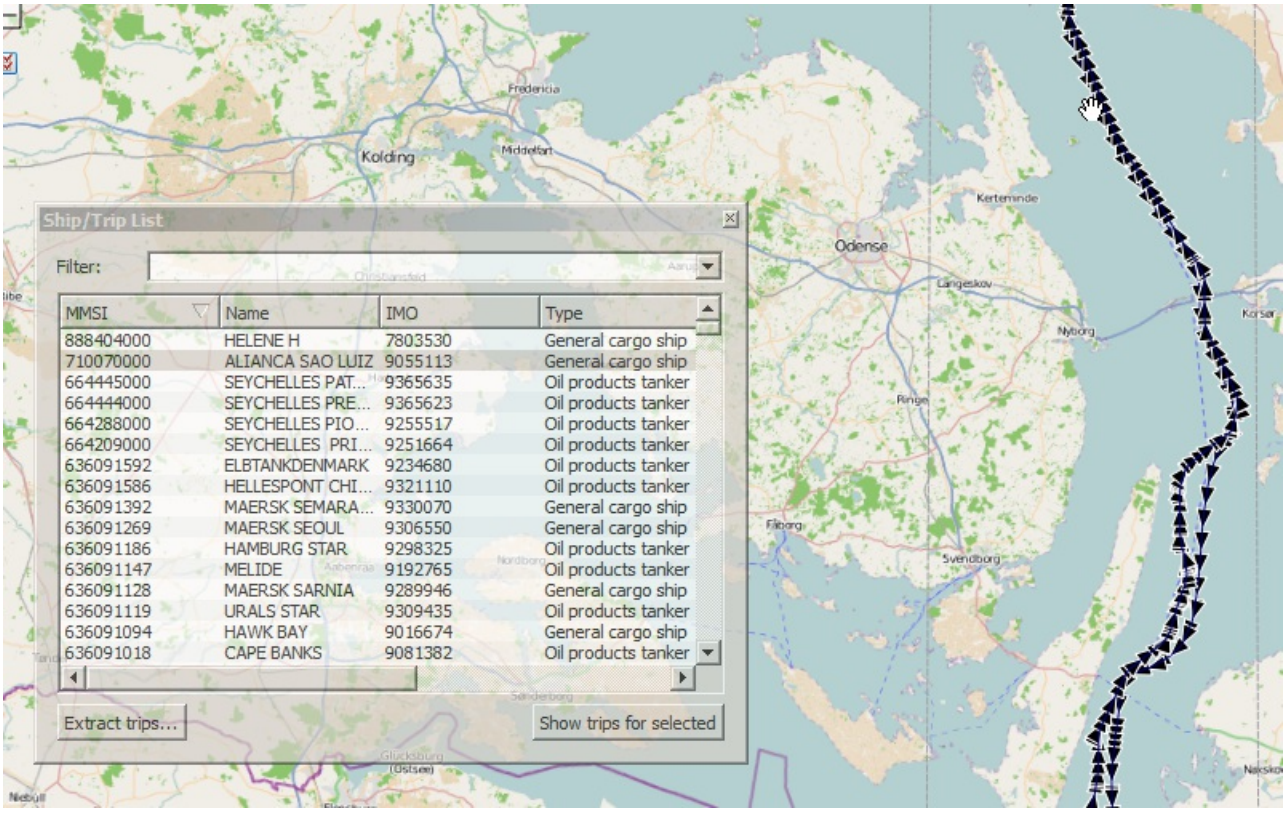


The result can be accessed from:

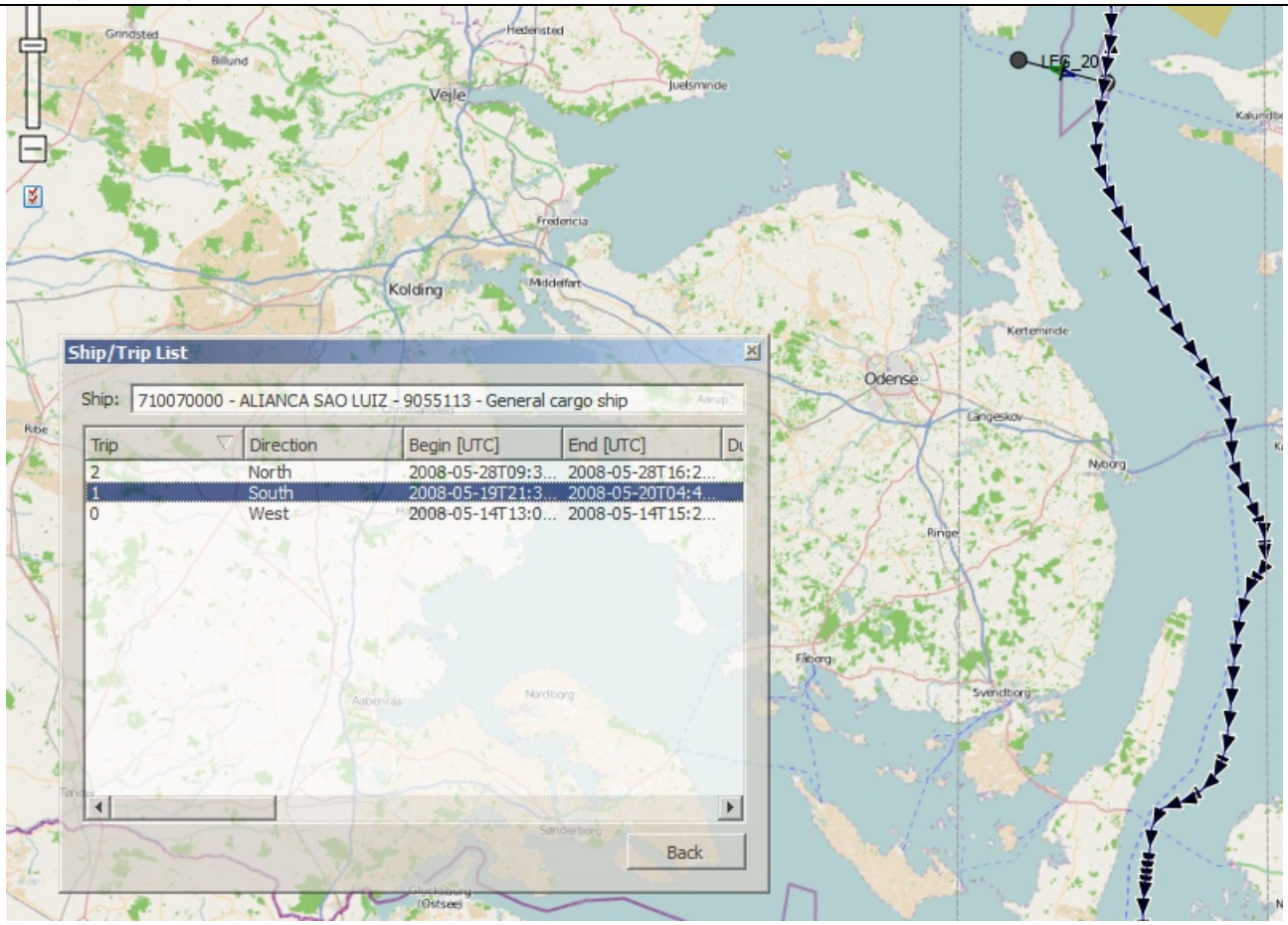


This will display a list with all the ships. Its a good idea to have look at the imported ships and check how many of the have type and length.

When you double click one of the lines all the trail data for this ship will be shown on the map.

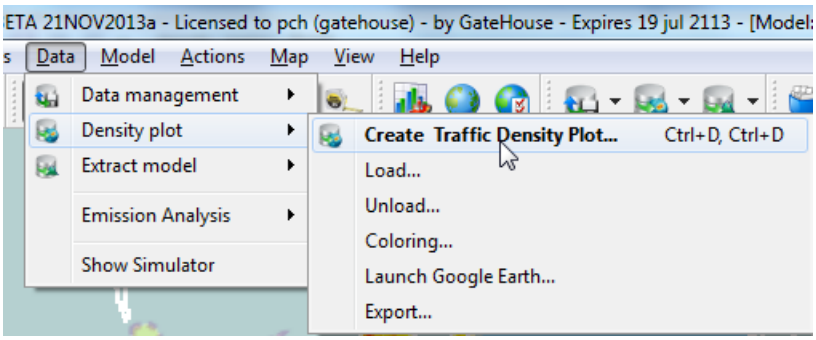


If you press the 'Show trips for selected', a list with the trips for this ship will be shown, you can again double click one of the lines to see the particular trip on the map.

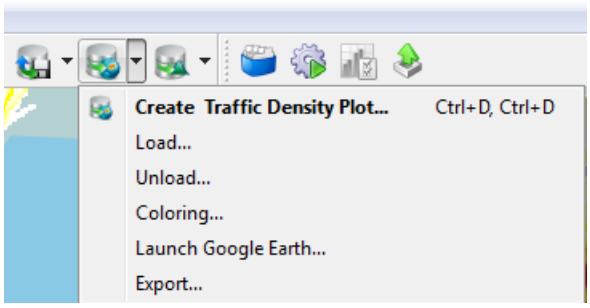

Grindsted
Billund
Hedensted
Vejle
Juelsminde
Fredericia
Kolding
Middelfart
Ribe
Kerteminde
Odense
Langeskov
Nyborg
Ringe
Faaborg
Svendborg
Nordborg
Sønderborg
Ship/Trip List
Ship: 710070000 - ALIANCA SAO LUIZ - 9055113 - General cargo ship
Trip
Direction
Begin [UTC]
End [UTC]
2 North 2008-05-28T09:3... 2008-05-28T16:2...
1 South 2008-05-19T21:3... 2008-05-20T04:4...
0 West 2008-05-14T13:0... 2008-05-14T15:2...
Back

Density Plots

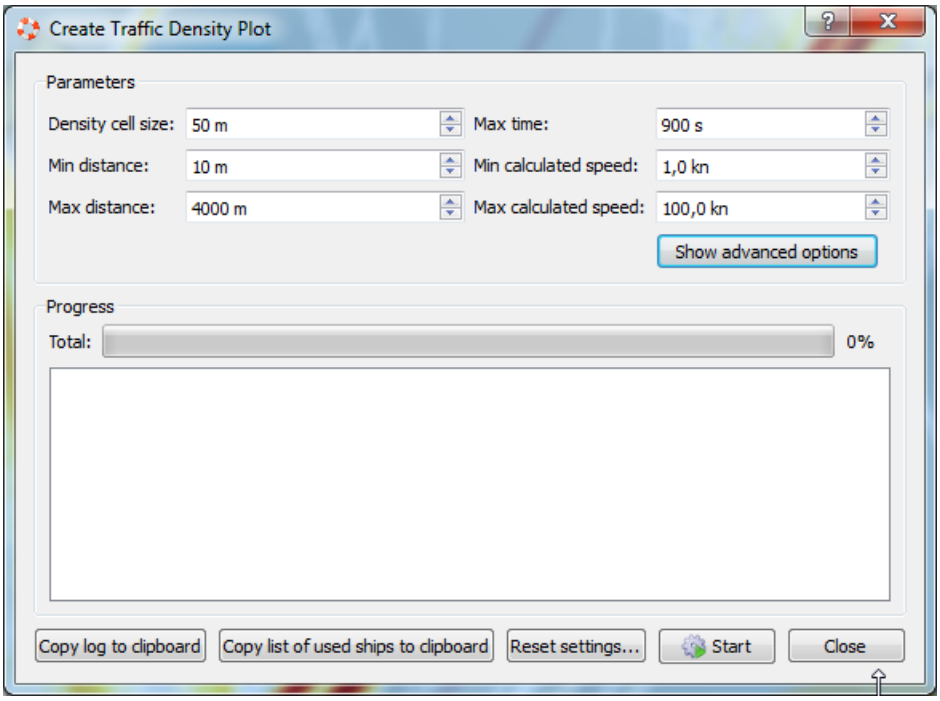
A density plot can be generated based on an imported dataset, select 'Data/Density plot/Create...' from the menu:



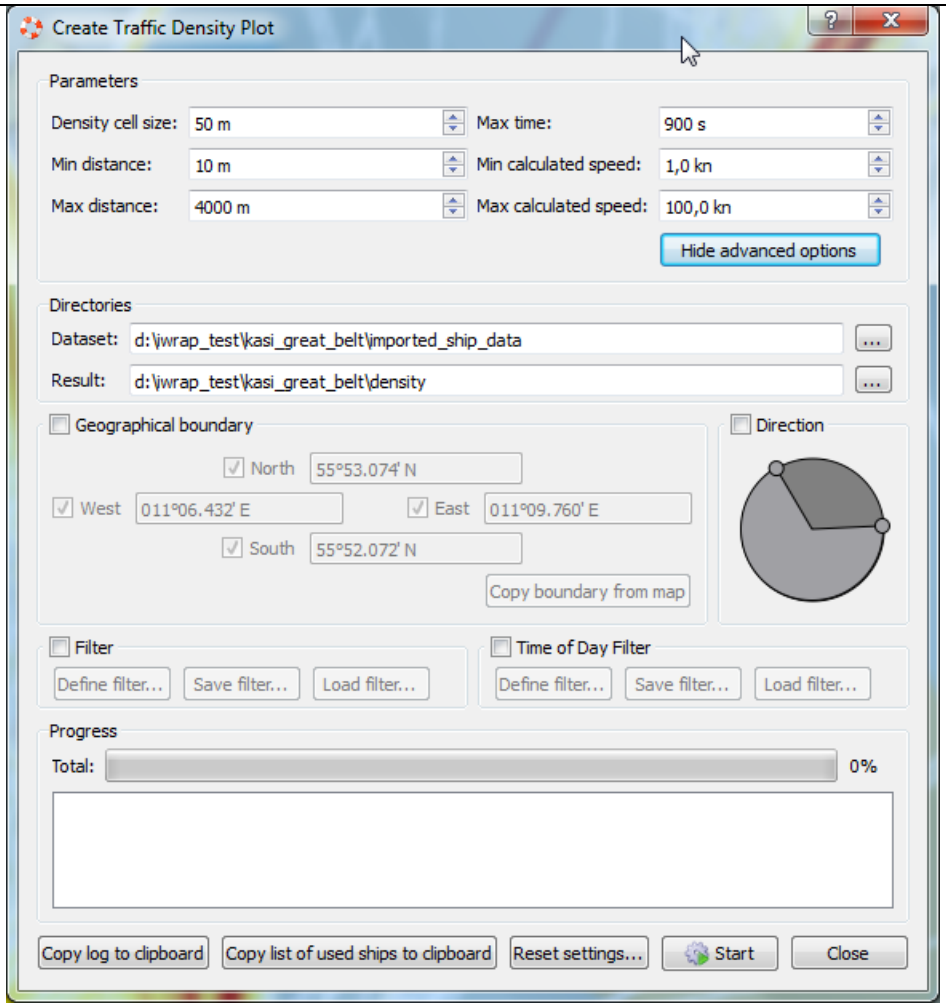
or using the tool buttons:



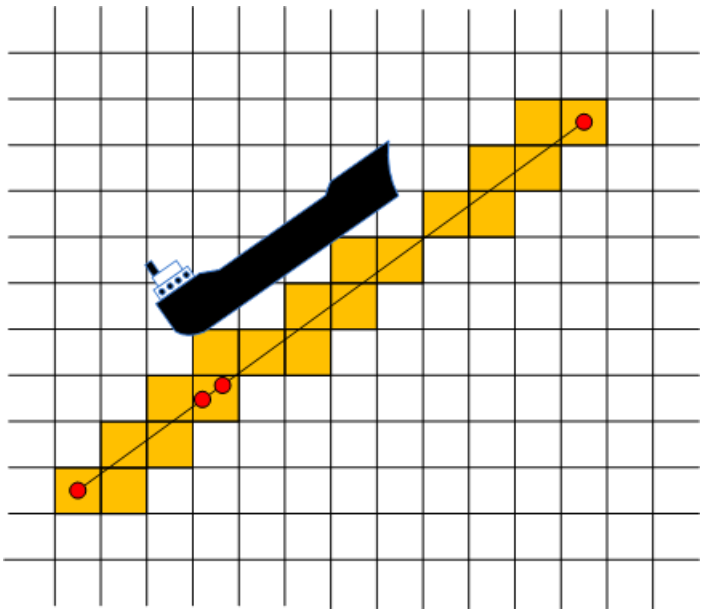
Select the location of the dataset you want to use and specify the location of the result data. You can only have one Density plot in each result directory.



Press 'Show advanced options' to see all possible settings.



The density plot created by IWRAP is a so-called traffic density plot, i.e. it divides the region into a number of cells and counts the number of visits to each cell. A counter is maintained for each cell and increased by one every time a ship visits the cell. If a ship emits more than one position report in the same cell (i.e without leaving the cell in between) the counter will only be increased by one. The algorithm also interpolates between cells if the distance between consecutive reports is below time and distance thresholds. In the figure below the red dots indicate position reports, as shown on this figure the counter in each cell is only increased by one and interpolation is used between reports.

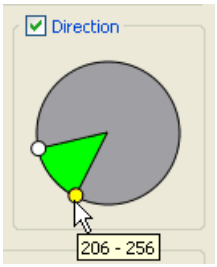


A number of parameters can be used to control the creation of a density plot:

- Density cell size.
- Min distance. Minimum distance between included samples.
- Max distance. Maximum distance between interpolated samples, i.e. samples are included but not interpolated.
- Max time. Maximum time between interpolated samples, i.e. samples are included but not interpolated.
- Min calculated speed, samples with speed below this limit is not included.
- Max calculated speed, samples with speed above this limit is not included.

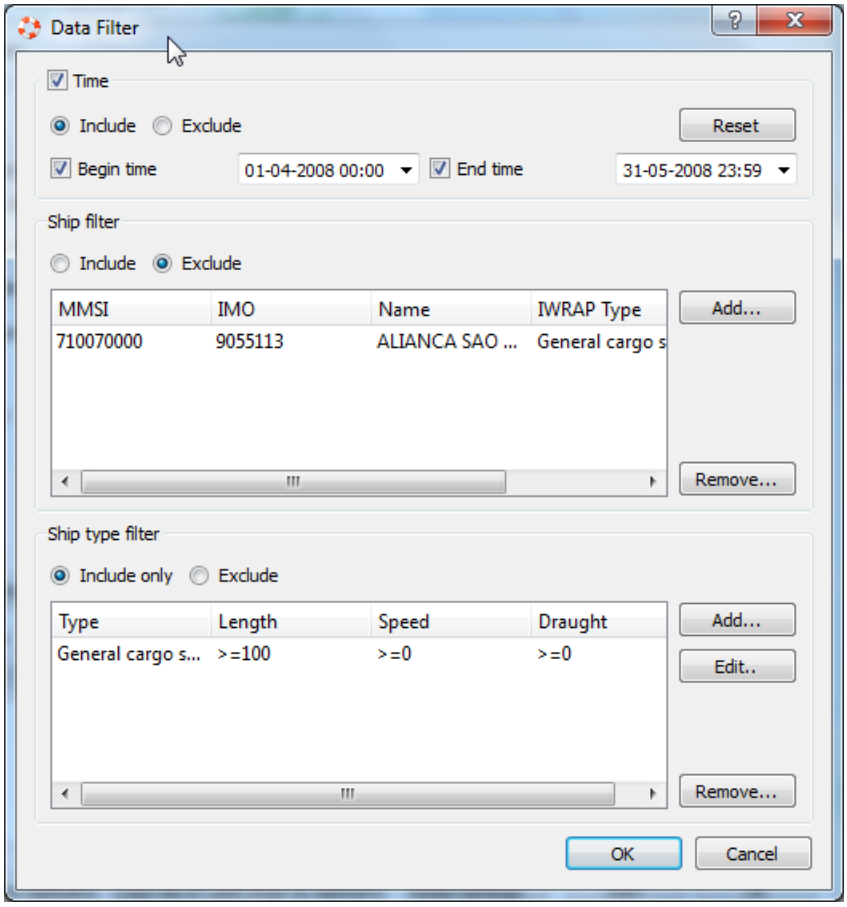
You can use the 'Geographical Boundary' to create several plots that focus on certain areas, this a great help to increase the details.

The Direction filter can be used to only include ships moving in a certain direction. In the example below ships having a heading between 206 and 256 degrees are included. Use the mouse to drag the yellow end-point indicators, right-click on the wheel to set the boundaries or flip the values or use the mouse wheel to rotate the wheel.



The Direction filter can be used to only include ships moving in a certain direction. In the example below ships having a heading between 206 and 256 degrees are included. Use the mouse to drag the yellow end-point indicators, right-click on the wheel to set the boundaries or flip the values or use the mouse wheel to rotate the wheel.

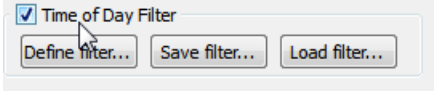
The Data filter can be used to specify constraints on which Ships should be included in the plot, press 'Define filter...'.



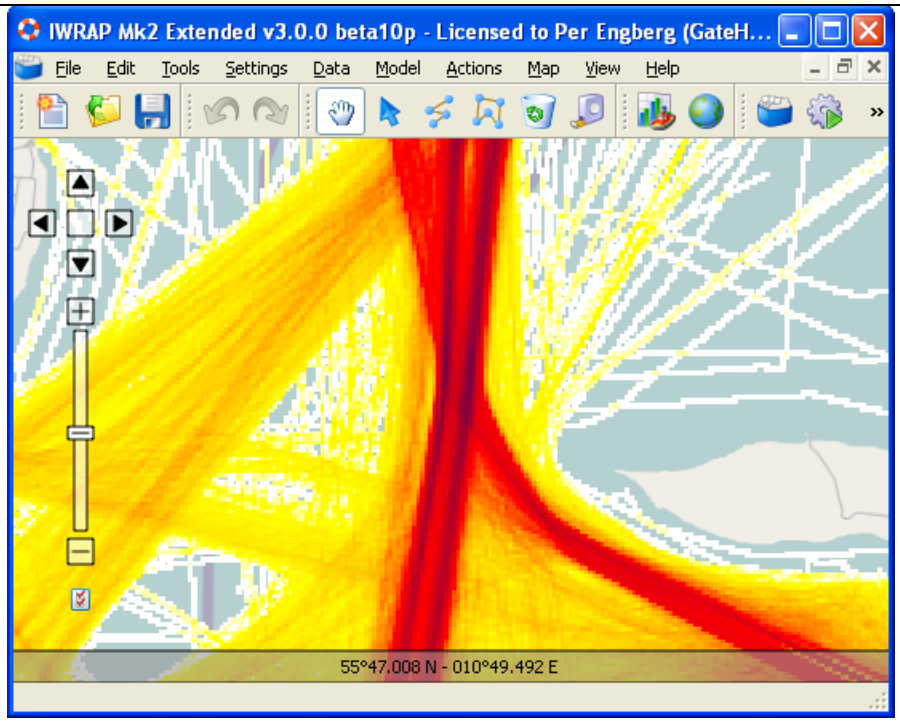
It is possible to include or exclude specific ships, or specify a filter for a ship type. The ship type filter can be specified for 'Any' ship or for one or more of the IWRAP ship types. In the above example it is chosen to exclude a specific ship and include all other ships with a speed >= 10.

It is also possible to exclude a period or only include a certain period of the dataset.

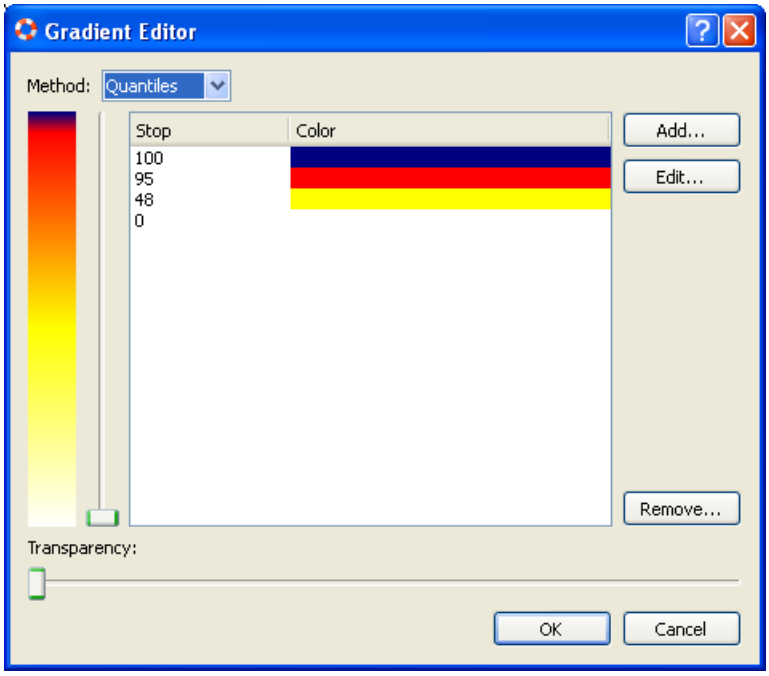
The Time of day filter can be also be used to filter the dataset.



Press Start to create your density plot. When the creation is completed press close. If you have not already opened a model, open or crate a new one and, zoom in on the density plot.

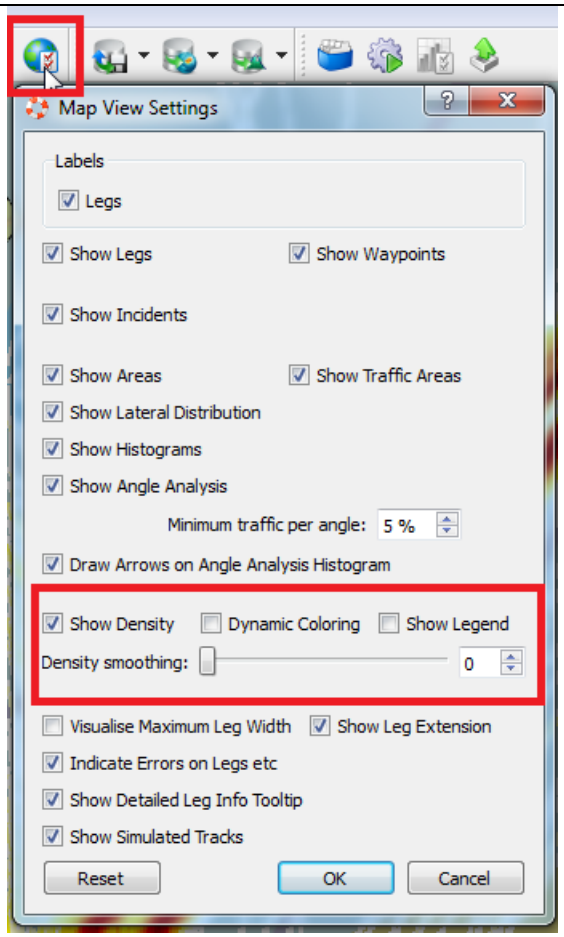


You can Load/Unload density plots from the 'Data/Density plot' menu and you can control the coloring of the plot using 'Data/Density plot/Coloring'



Add/Edit/Remove color stops or use the vertical slider to adjust the position of the stops, by selecting a stop in the list and dragging the slider. Use the horizontal slider to adjust transparency.

There are a number of display settings for the density plot that can be controlled using the 'Map View Settings':



It is possible show/hide the plot, add a legend, and it is possible to smooth the plot:

It is possible to enable dynamic coloring, when this option is enabled the color scale only uses the cells currently in the view:

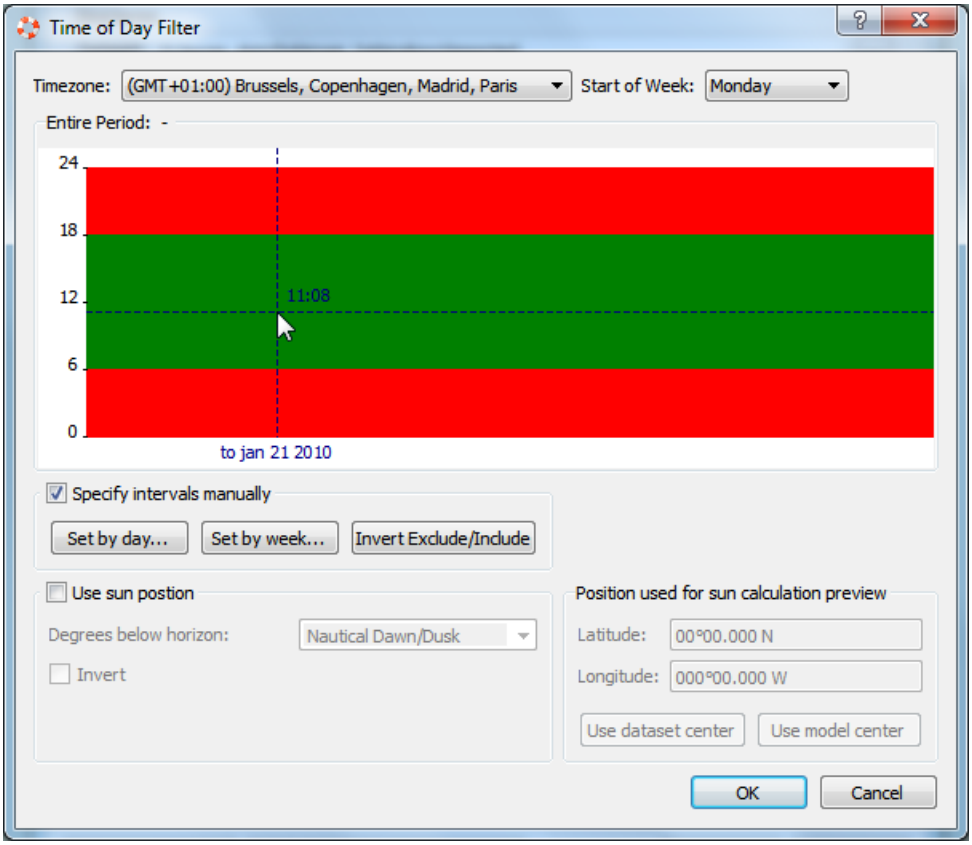
You can export the density data to a text file using the 'Data/Density plot/Export...' menu item.

It is possible to display the Trafic density plot using Google Earth, see Google Earth integration.

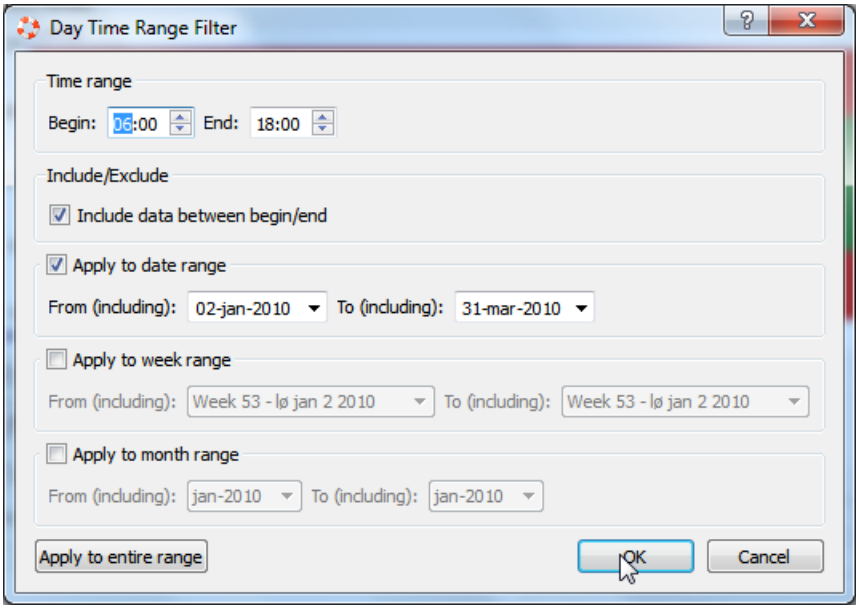
Time of Day Filter

The Time of Day filter can be used to filter the dataset so that only specific hours of the day are included in the analysis.

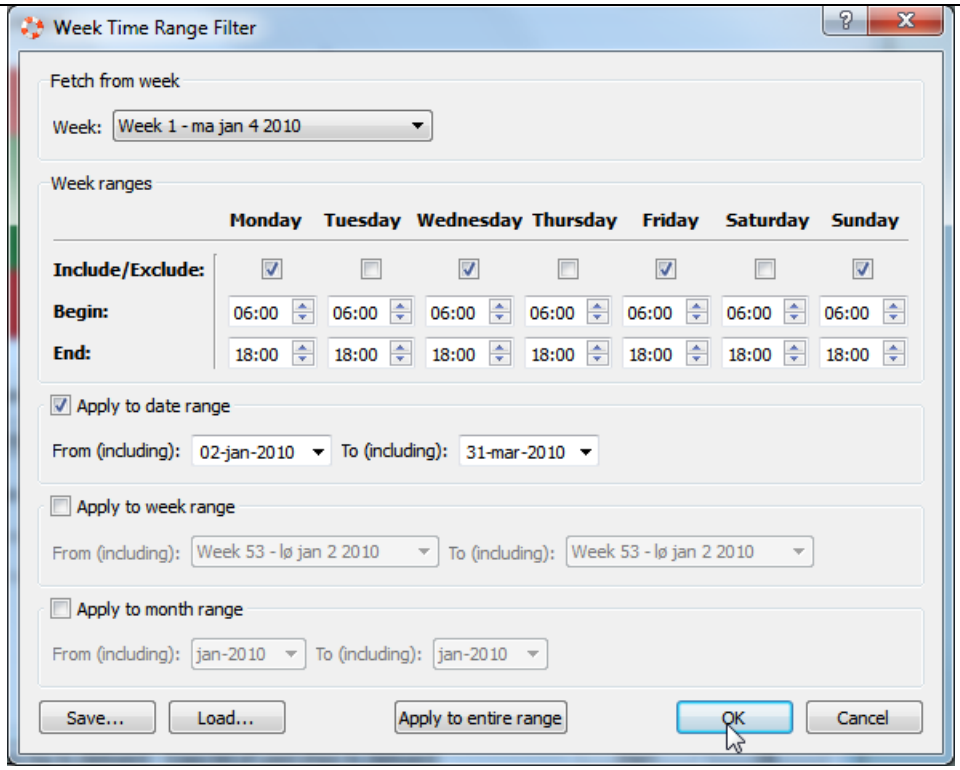
The graph in the top of the dialog visualises the entire dataset, the time periods that will pass the filter are illustrated using green and the rest using red color.



The filter has two different modes: Manual or based on Sun position. In Manual mode you can specify the hours for each day using 'Set by Day...':



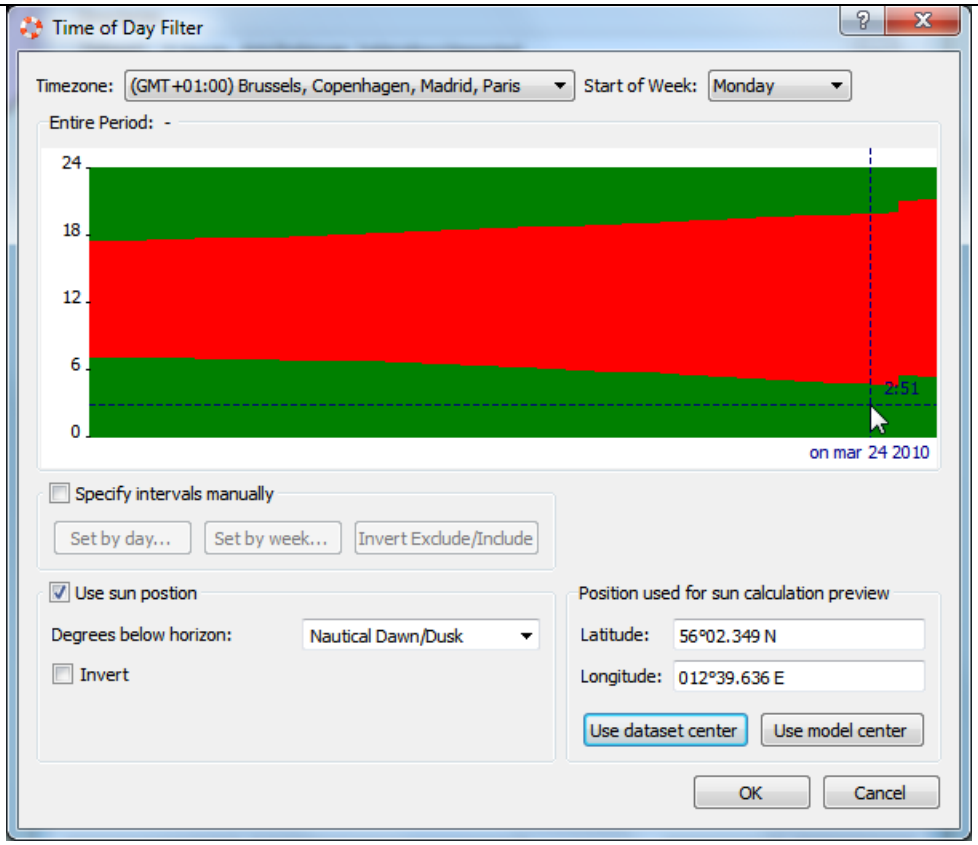
or 'Set by Week':



The above configuration will give the following filter for the dataset used in this example (Note that Tuesday, Thursday and Saturday have excluded the hours from 6 - 18 and the rest have them included:

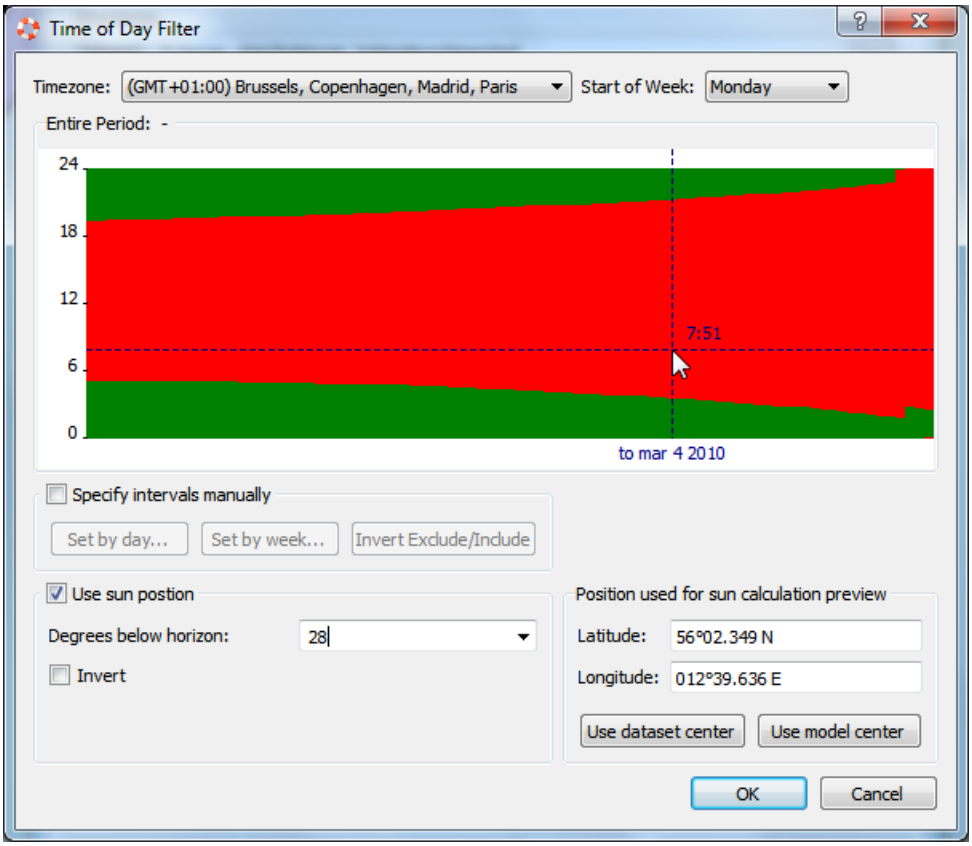
You can use the 'Invert Exclude/Include' to easily invert all of the days in the entire dataset.

In the sun position mode the elevation of the sun is calculated at each position in the dataset. The default is to use Nautical Dawn/Dusk, which means that the sun must be 12 degrees below the horizon.



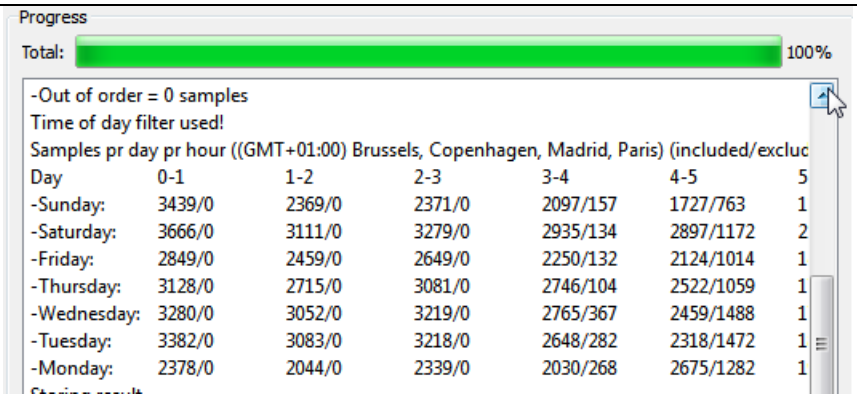
Note that the graph shown here uses the coordinate specified in the dialog, but when the filter is used the position will of course be used instead. Select 'Invert' to switch between including light/dark periods.

Instead of using 'Nautical Dawn/Dusk', you can select 'Apparent Sunrise/Sunset' or you can write a number of degrees, here we have specified 28 degrees below the horizon.



Press Ok to use the filter.

When you are using a Time of Day filter you can see the following table in the log. The table displays the number of samples include/excluded due to the filter for each day/hour of the week.


Progress

Total: 100%

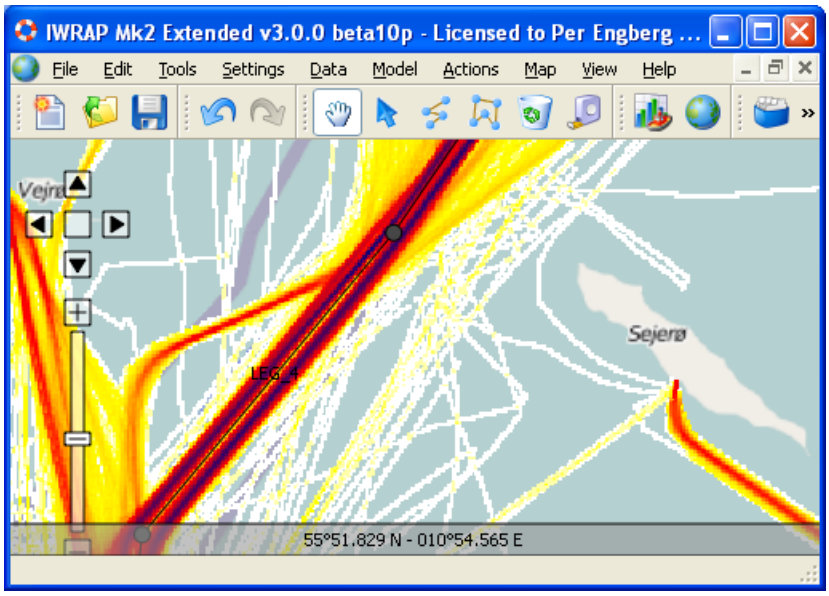
-Out of order = 0 samples
Time of day filter used!
Samples pr day pr hour ((GMT+01:00) Brussels, Copenhagen, Madrid, Paris) (included/excluc

Day	0-1	1-2	2-3	3-4	4-5	5
-Sunday:	3439/0	2369/0	2371/0	2097/157	1727/763	1
-Saturday:	3666/0	3111/0	3279/0	2935/134	2897/1172	2
-Friday:	2849/0	2459/0	2649/0	2250/132	2124/1014	1
-Thursday:	3128/0	2715/0	3081/0	2746/104	2522/1059	1
-Wednesday:	3280/0	3052/0	3219/0	2765/367	2459/1488	1
-Tuesday:	3382/0	3083/0	3218/0	2648/282	2318/1472	1
-Monday:	2378/0	2044/0	2339/0	2030/268	2675/1282	1

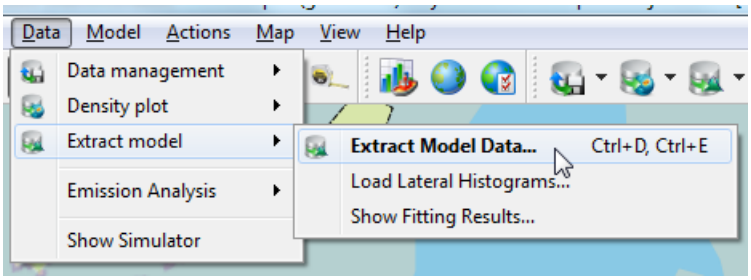
Extract Model Data

The extraction algorithm will extract a lateral histogram for each direction of each leg and use the histograms to determine the lateral distributions. Furthermore the traffic volumes will be determined and the leg to leg traffic will be extracted.

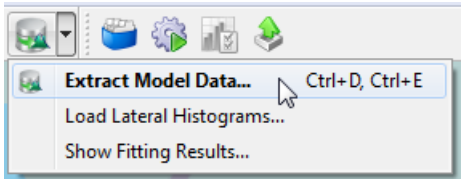
You should already have imported some traffic data into a dataset, created a density plot, and entered the legs, i.e. you should have something like shown below:



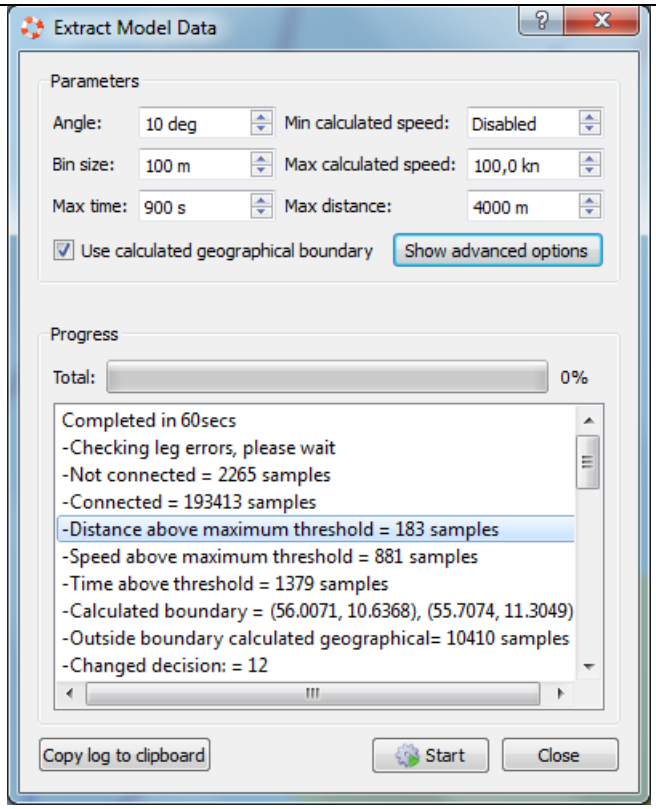
Ensure your model is loaded and select 'Data/Extract Model/Extract Model Data...' from the menu:



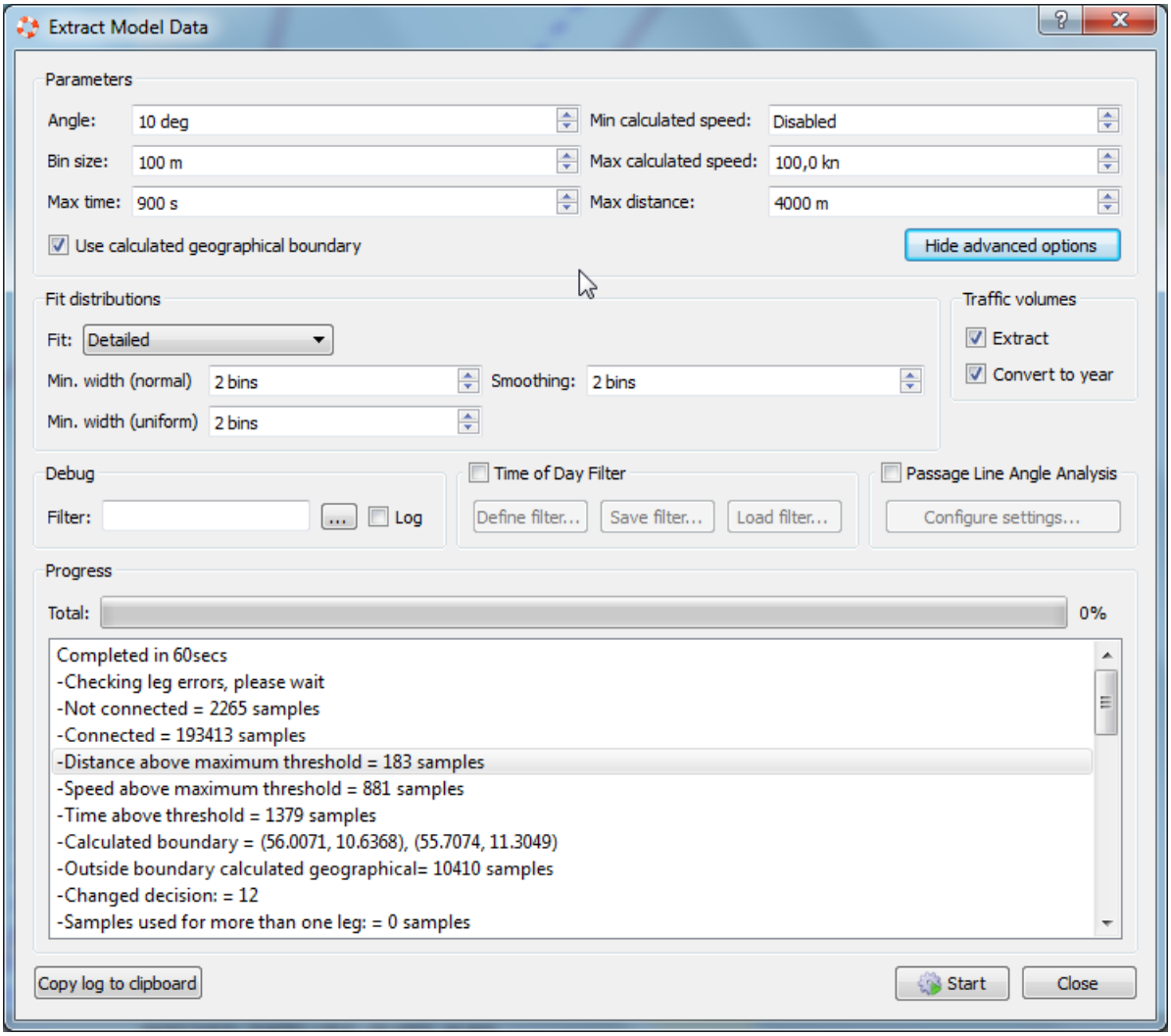
or using the tool buttons:



The extract model data dialog is invoked, from here you can tailor the extraction parameters and run the extraction algorithm. Start by selecting the dataset location you want to use and specify a result directory/location. You should select different result directories for different datasets.



Press 'Show advanced options' to see all possible settings.

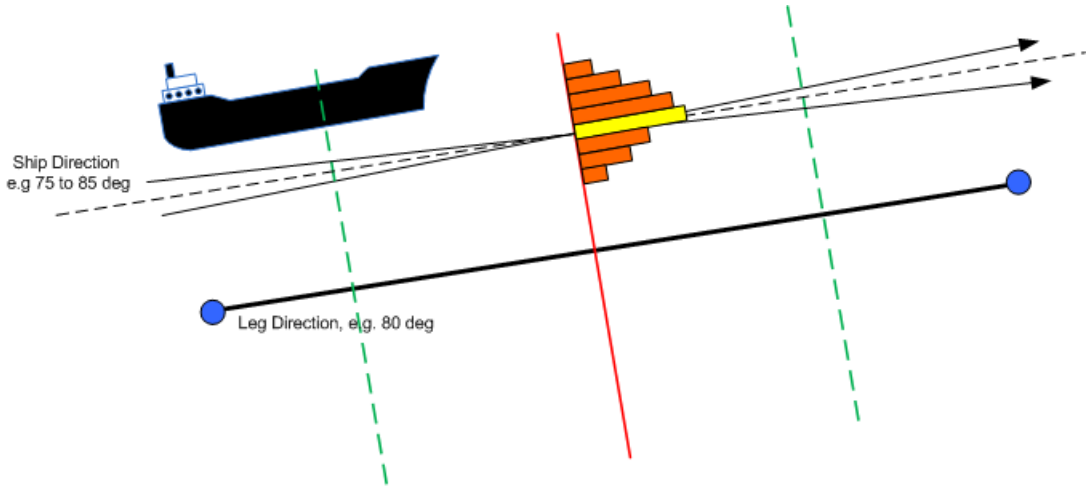


The following parameters can be adjusted:

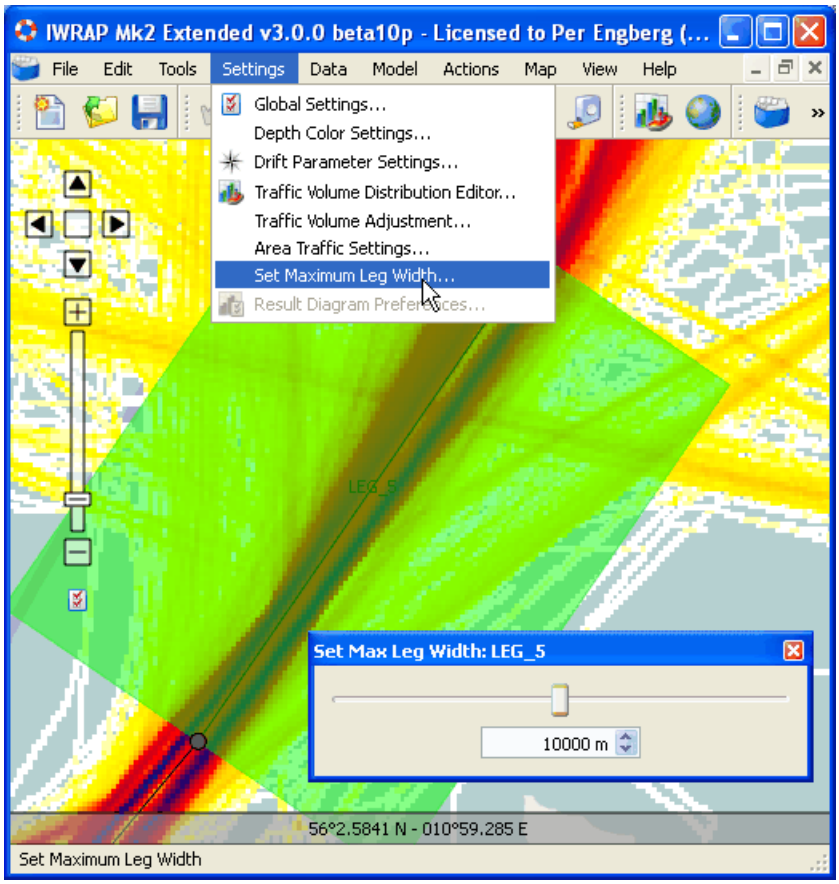
- Angle, the maximum difference in the direction of the ship and the Leg. The picture below shows and example where the Leg has an angle of 80 degrees, in this example the Angle is set to 5 degrees so the ship must have a direction between

75 and 85 degrees. It is also possible to specify this value per Leg, see Leg Editor.

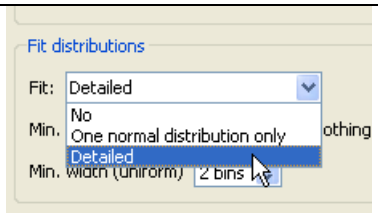
- Bin size. The size of the bins/intervals of the generated histogram.
- Max time. Maximum time between samples, i.e. if samples are separated by more than this factor a new journey is assumed.
- Min calculated speed, samples with speed below this limit is not included.
- Max calculated speed, samples with speed above this limit is not included.
- Max distance, i.e. if samples are separated by more than this factor a new journey is assumed.
- Use calculated geographical boundary, if this option is used IWRAP will calculate a boundary and exclude samples outside the area.



Another parameter that affects the extraction algorithm is the Leg width, the Leg width is by default set to 10km, this means that the algorithm will not use crossings that are further than 5km away from the Leg center. The width can be adjusted using the Leg Editor, or you can use the 'Settings/Set Maximum Leg Width/Length...' settings. Click on the leg you want to modify, and adjust the width/Length using the sliders or the numerical inputs.



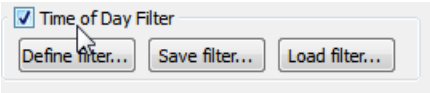
The 'Fit Distributions/Fit' should be set to 'Detailed' in order to do the best possible fit. If 'Detailed' is selected IWRAP will try to use a combination of multiple uniform and normal distributions. The other options can be used in case you need to quickly generate histograms in order to adjust the position of the legs/waypoints. You will typically start by not doing a detailed fit and validate the leg/waypoint locations.



The 'Min width (uniform)' specified that the width of a uniform distribution can not be less than the number of bin width specified. Similarly the 'Min width (normal)' sets a constraint on the standard deviation of normal distributions. The 'Smoothing' option enables you to apply a 'blur' filter, i.e. each frequency in the resulting histogram has a value equal to the average value of its neighboring frequencies. It is a form of low-pass ("blurring") filter..

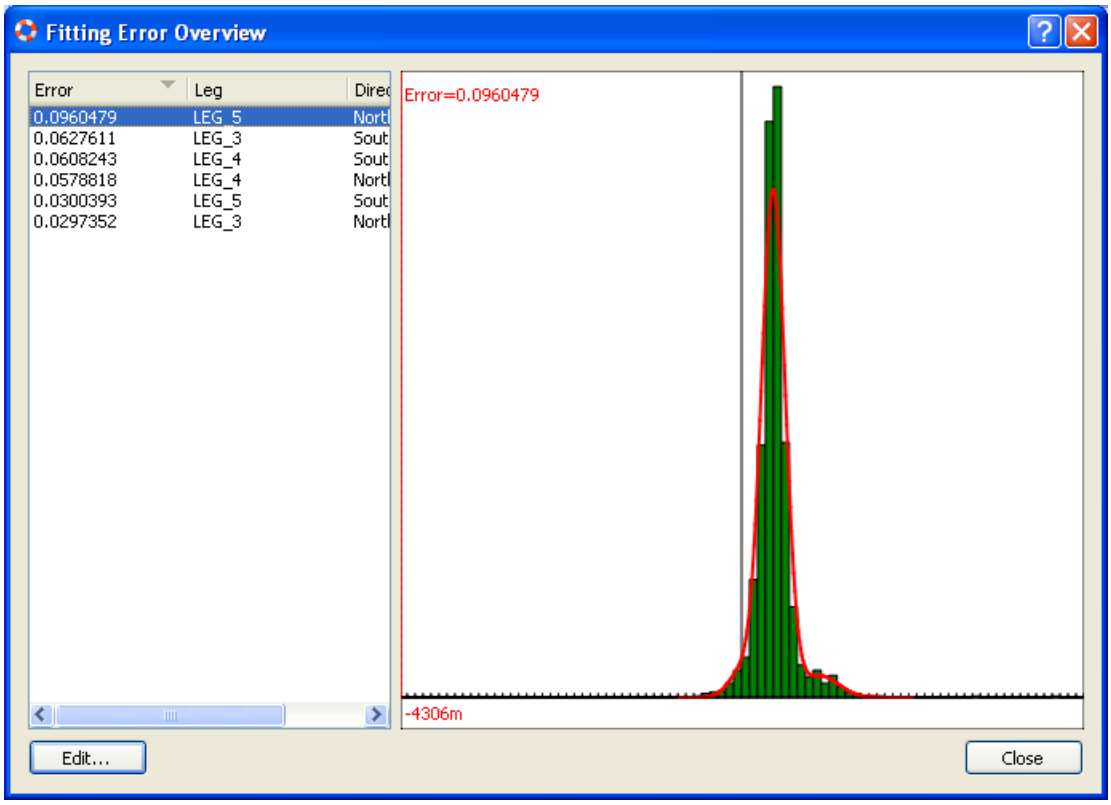
The 'Traffic Volumes' section can be used to control whether traffic volumes should be extracted or not and whether they should be converted to yearly numbers. Normally they should be converted to yearly number, this option should only be used for validation/inspection.

The Time of day filter can be also be used to filter the dataset.

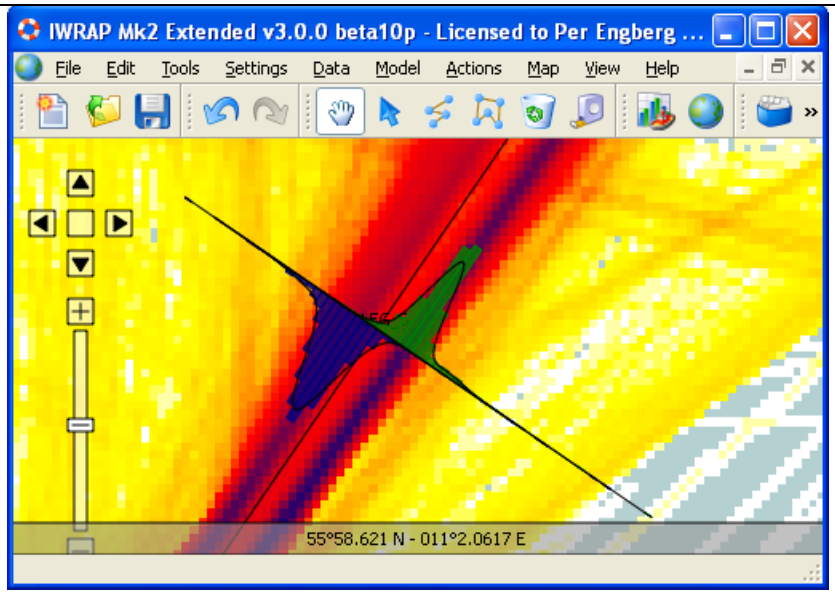


Press Start to perform the extraction, this may take several hours depending on the amount of data and the number of legs.

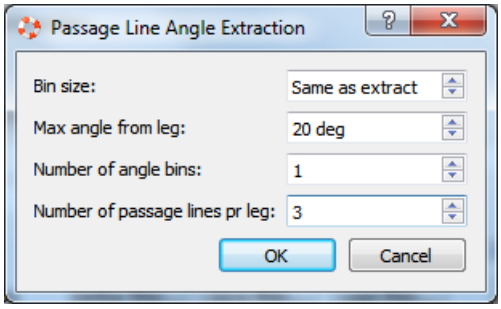
After IWRAP has extracted the data the Fitting Error Overview is displayed, this overview shows the fitting results ordered by the fitting error. In some cases it is impossible for IWRAP to do a fit, in such situations you should define the distribution manually.



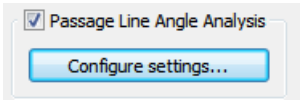
The following shows the result of the extraction on the model view.



It is also possible to use the Passage Line Angle analysis to validate that the Legs are positioned correctly.

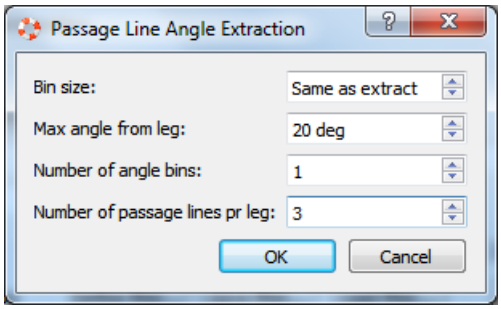


It is also possible to use the 'Passage Line Angle' analysis to validate that the Legs are positioned correctly.



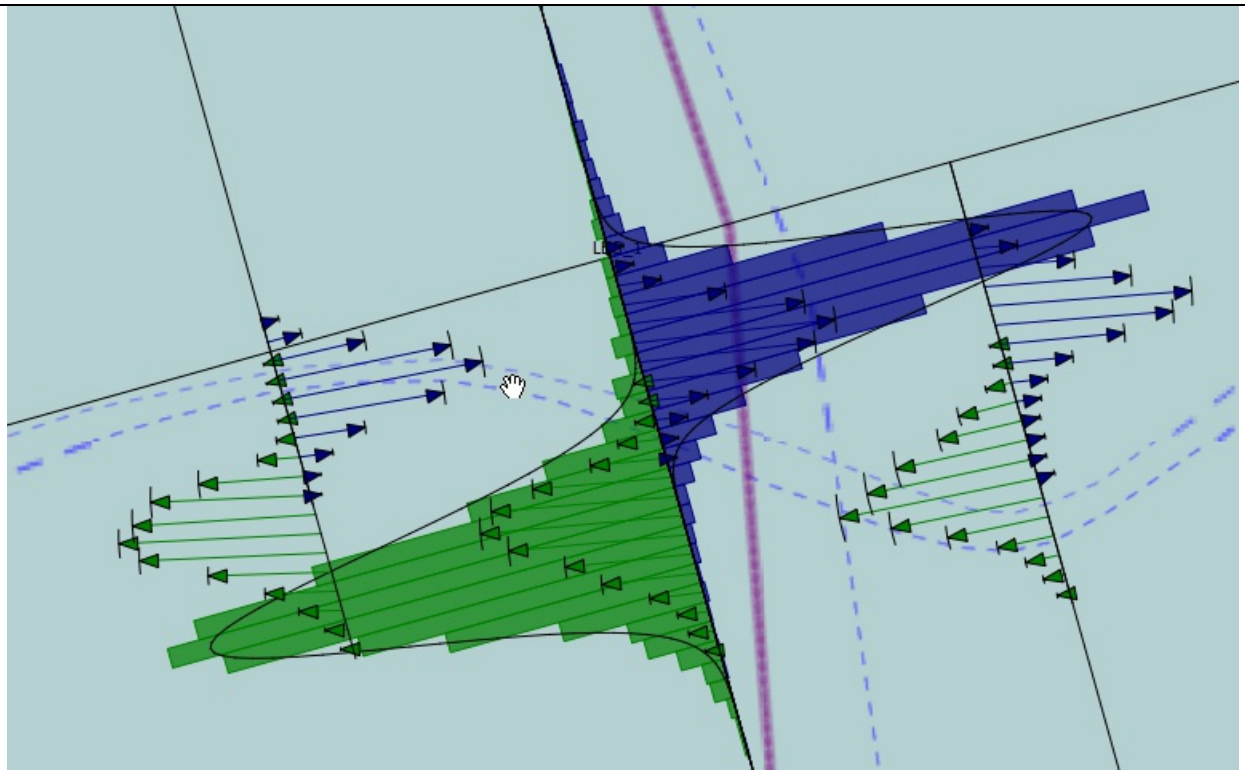
This analysis divides a passage line in to a number of bins and analysis the ships crossing angle. The result is a plot where a line is drawn from the center of the bin, the direction of the line is mean of the angles and the length is relative to the number of ships. The lines of the plot should follow the direction of the Leg.

The following parameters can be specified:

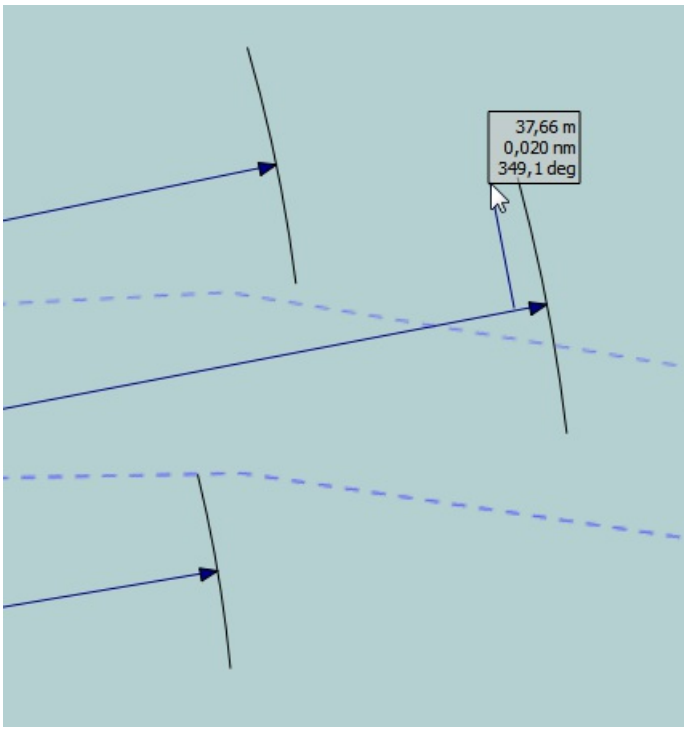


The parameter 'Number of angle bins' is used to divide the 180 degrees that each bin spans (or in this cas 20+20=40), into a number of bins, the result is that more than one line will be drawn from each bin.

Here is an example of a plot generated with the above parameters:

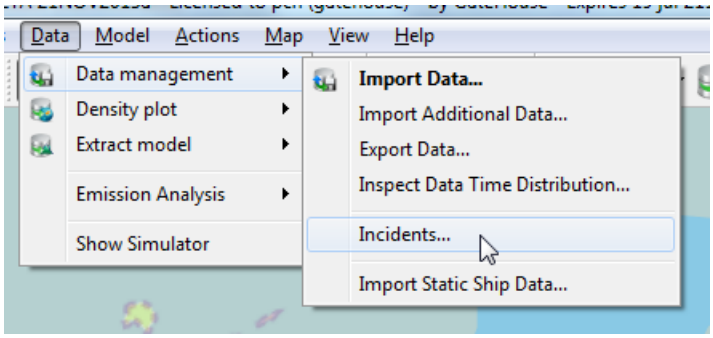


At the tip of each line, an arc is drawn illustrating the standard deviation of the angles of that particular bin.

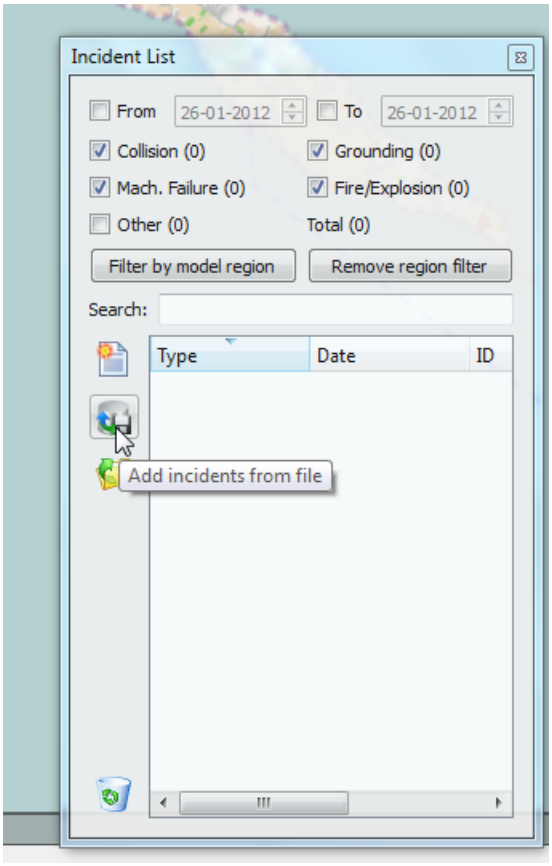


Importing Incident Data

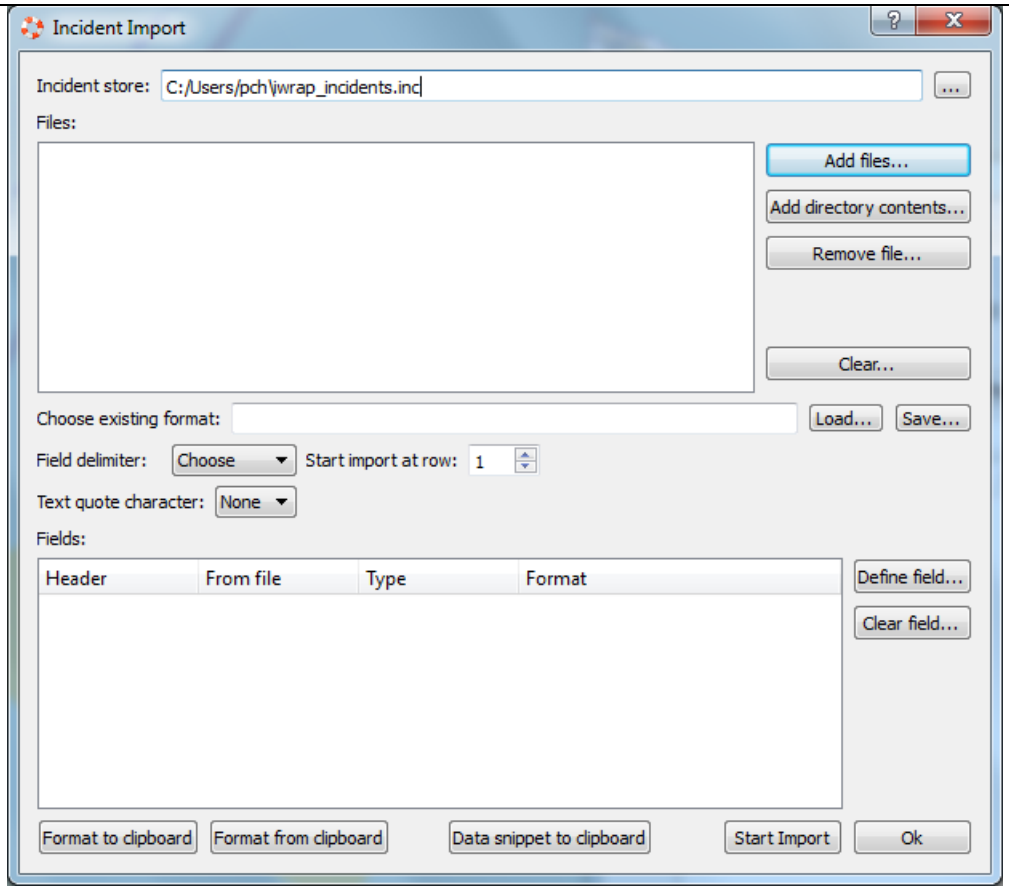
This step is used to import historical incident data, select 'Data/Data management/Incidents...' from the menu:



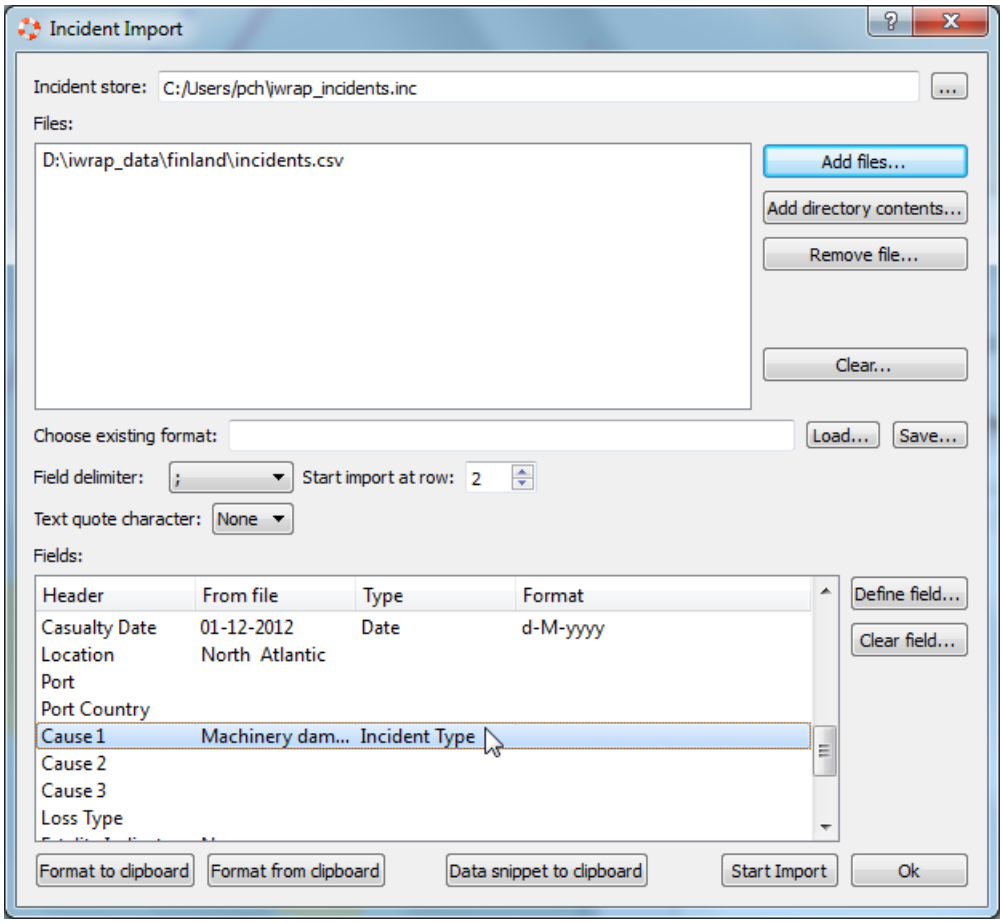
the 'Incident List' is displayed:



press the 'Add incidents from file' tool button in order to import incidents, the 'Incident Import' dialog is shown:



Press 'Add files...' or 'Add directory contents...' to add one or more files to be imported.



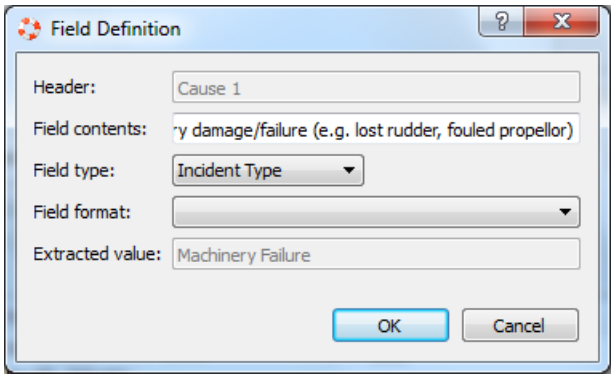
If you have a CSV file with a header IWRAP will automatically try to detect some of the fields/columns.

If the file contains quoted strings dont forget to select a Text Quote Character i.e. single or doible quote.

Notice that IWRAP has inserted a 'type' in some of the fields above e.g. the MMSI number. IWRAP has also automatically determined the field delimiter to be semicolon and the first data row to be the second and thereby skip the header.

It is important to define 'Incident type', 'Date' or 'Date/Time', 'Latitude' and 'Longitude' fields. Furthermore a 'Case ID' field can be imported in order to uniquely pinpoint each incident.

In order to define a field select the line, e.g. the 'Cause 1' column and click 'Define field' or just double-click on the line, the 'Field Definition' dialog will appear.



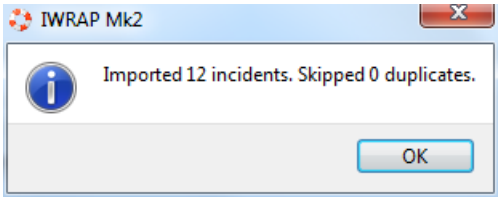
Select the 'Field type', in this case 'Incident type'. Notice that the 'Extracted value' now reflects the value as interpreted by IWRAP. Please check that the interpretation is correct. If the 'Incident type' contains 'colli' as part of the contents it is interpreted as a collision, i.e. is does not matter if the field cotains other characters as well. It is also not case sensitive, so upper and lower case characters can be mixed.

Contains	Result
colli	Collision
fire	Fire/Explosion
explosion	Fire/Explosion
machinery	Machinery Failure
ground	Grounding

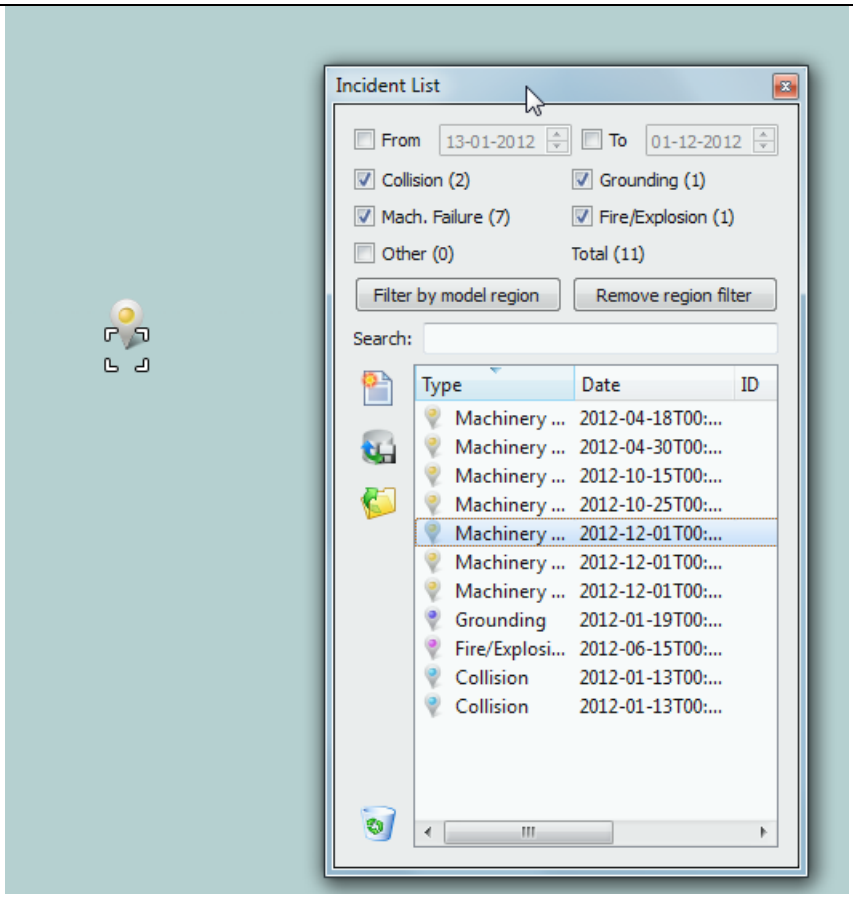
When you specify e.g. the Date and the if the format that is used is not listed in the Field format, you can type it directly, see Time Format.

The easiest way to input positions is to use decimal degrees, but IWRAP supports a variety of different other formats as well, see Position Format.

When all the fields have been defined, press 'Start Import', if the import succeeds the number of imported incidents is show:



The resulting imported incidents are here after show in the 'Incident List'.

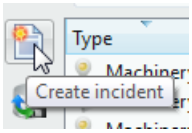


Click on a incident in the list in order to find it on the map or select the icon on the map in order to select in the list (the pointer tool must be selected).

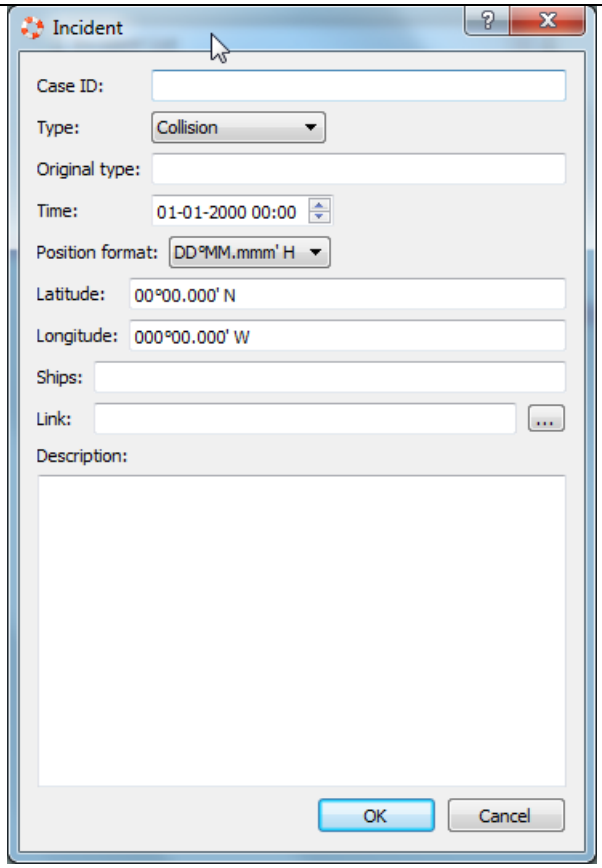
Use the check boxes e.g. 'Collision' in order to specify which incidents should be shown on the map and in the list. The From/To fields can be used to filter the incidents according to time.

If you have defined a model you can use 'Filter by model region' in order to only show the incidents that are 'inside' the model area.

Incidents can be create manually by selecting the 'Create incident' tool button:



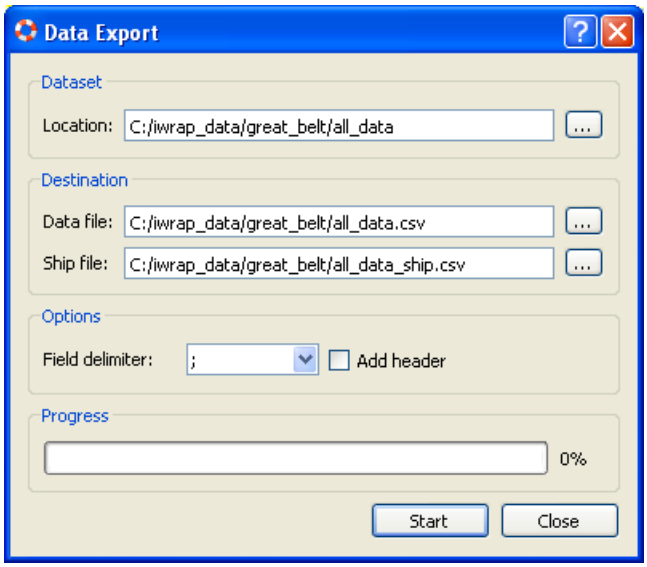
The Incident edtitor is invoked:



The Incident edtitor can of course also be used to edit and/or enrich imported Incidents.

Export Data

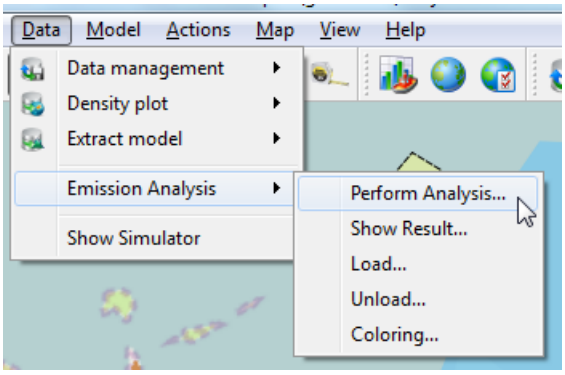
The export data feature enables you to export a dataset to CSV format. This can be used for validation or exchange of data. The Data file will contains the dynamic data and the Ship file will contains static information about the ship. If you specify an empty Data file only the ship information will be exported.



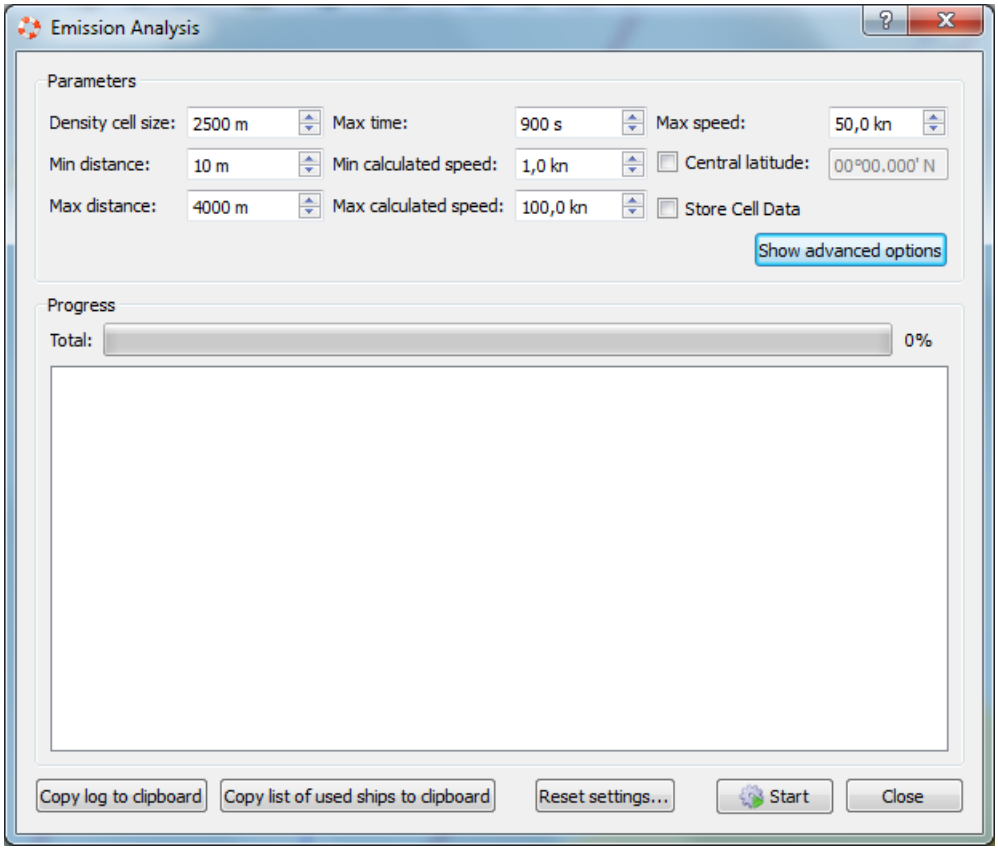
Calculating Emissions

Note: The current implementation, version 1.0, of the emission calculation algorithm is quite basic. The plan is to implement a more advanced version in the next major IWRAP release.

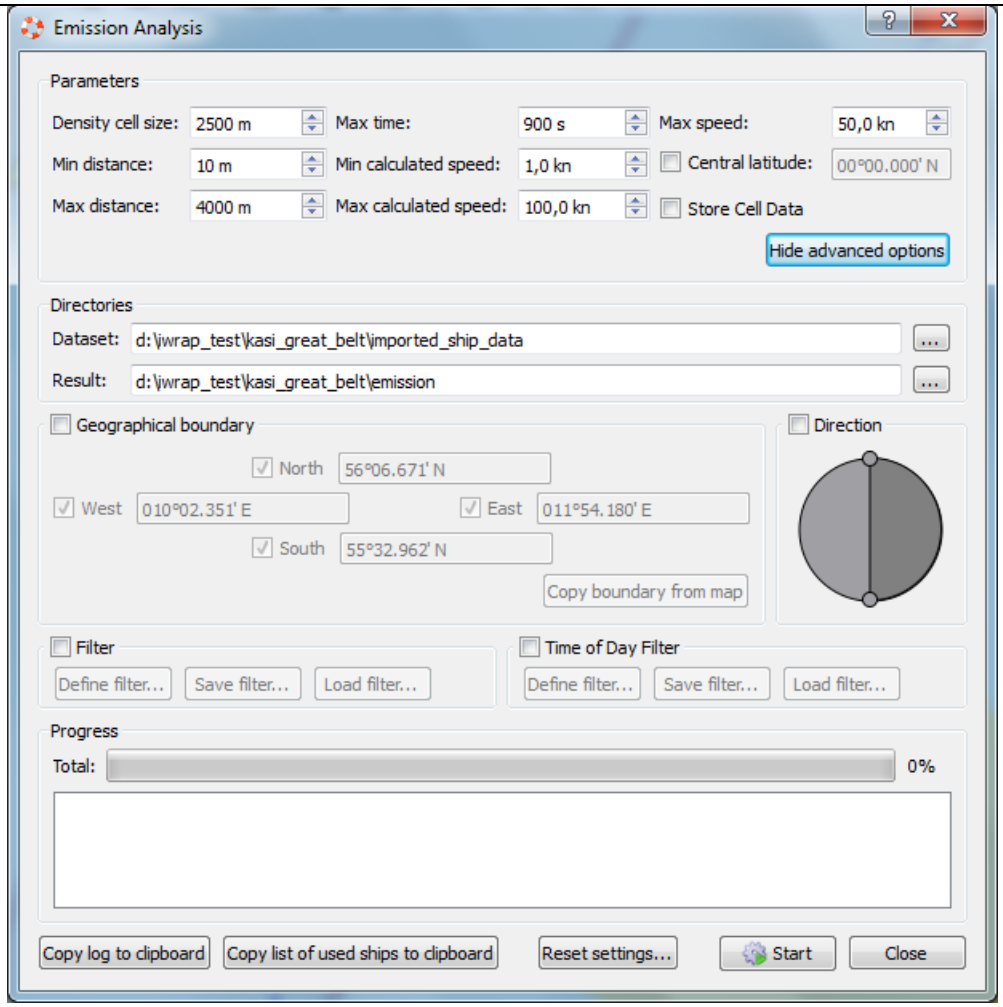
An Emission calculation can be performed based on an imported dataset, select 'Data/Emission Analysis/Create...' from the menu:



Select the location of the dataset you want to use and specify the location of the result data. You can only have one Emission Analysis in each result directory.

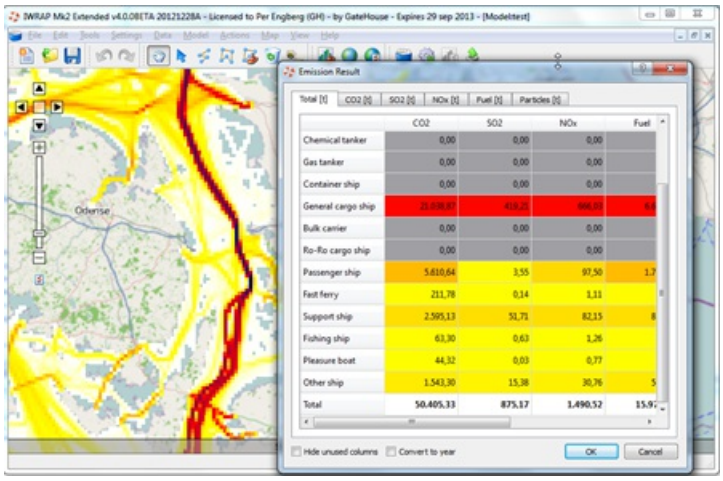


Press 'Show advanced options' to see all possible settings.



A number of parameters can be used to control the creation of a the analysis, the parameters are mostly identical to the Density Plot. A "Max Speed" parameter is used here to filter away reports with too high speed values. The "Store cell data" is used for development of the new more advanced algorithm and should normally not be checked.

Press Start to create your Emission Analysis. When the creation is completed, a dialog with the aggregated results is shown and a density plot is displayed on the map. If you have not already opened a model, open or crate a new one and, zoom in on the density plot.



You can Load/Unload Emission data from the 'Data/Emission Analysis' menu and you can control the coloring of the plot using 'Data/Emission Analysis/Coloring', similar to the Traffic Density Plot.

Time Format

These expressions may be used for the date part of the format string:

Expression	Output
d	the day as number without a leading zero (1 to 31)
dd	the day as number with a leading zero (01 to 31)
ddd	the abbreviated localized day name (e.g. 'Mon' to 'Sun').
dddd	the long localized day name (e.g. 'Monday' to 'Sunday').
M	the month as number without a leading zero (1-12)
MM	the month as number with a leading zero (01-12)
MMM	the abbreviated localized month name (e.g. 'Jan' to 'Dec').
MMMM	the long localized month name (e.g. 'January' to 'December').
yy	the year as two digit number (00-99)
yyyy	the year as four digit number

Note: Day and month names must be given in the user's local language. It is only possible to use the English names if the user's language is English.

These expressions may be used for the time part of the format string:

Expression	Output
h	the hour without a leading zero (0 to 23 or 1 to 12 if AM/PM display)
hh	the hour with a leading zero (00 to 23 or 01 to 12 if AM/PM display)
H	the hour without a leading zero (0 to 23, even with AM/PM display)
HH	the hour with a leading zero (00 to 23, even with AM/PM display)
m	the minute without a leading zero (0 to 59)
mm	the minute with a leading zero (00 to 59)
s	the second without a leading zero (0 to 59)
ss	the second with a leading zero (00 to 59)
z	the milliseconds without leading zeroes (0 to 999)
zzz	the milliseconds with leading zeroes (000 to 999)
AP or A	interpret as an AM/PM time. *AP* must be either "AM" or "PM".
ap or a	Interpret as an AM/PM time. *ap* must be either "am" or "pm".

All other input characters will be treated as text. Any sequence of characters that are enclosed in singlequotes will also be treated as text and not be used as an expression.

For any field that is not represented in the format the following defaults are used:

Field	Default value
Year	1900
Month	1 (January)
Day	1
Hour	0
Minute	0
Second	0

For example:

The 1 January 1998 00:01:02 represented by M1d1y9800:01:02 can be parsed using 'M'M'd'd'y'yyhh:mm:ss

Position Format

The following is a list of examples of different position formats supported by IWRAP. The hemisphere can be given as either N/S/W/E or +/- and can be anywhere in the value string (except for 'Decimal degrees' and 'Dm,H' formats).

IWRAP currently only supports WGS84.

If possible 'Decimal degrees' should be used.

Format	Value	Result
Decimal degrees	58.65375	58.65375
Dm,H	5839.225,N	58.65375
DDMMSSss	W116°14'28.86	-116.24135
DDMMSSss	116°14'28.86"W	-116.24135
DDMMSSss	-116 14 28.86	-116.24135
DDMMSSss	-1161428.86	INVALID
DD.d	-116.24135	-116.24135
DD.d	116.24135° W	-116.24135
DD.d	W116.24135°	-116.24135
Dm,H	00910.660,E	9.17767
DDMM.mmm	00910.660' E	9.17767
DDMMmmm	009° 10.660' E	9.17767

For e.g. DDMMmmm does not care if there is a ° charachter or not as a long as there is a separation, so "009 10 660 E" is the same as "009° 10.660' E" .

If the value has lower or higher precision than e.g. DDMMSSss it is possible to use e.g. DDMMSSs or DDMMSSsss, similar for DDMMmmm and DDMM.mmm.

The format string is the same for latitude and longitude, i.e. you should NOT write e.g. DDDMMSSss for longitude, always use DDMMSSss.