IWRAP Mk2 v4.7.0

Manual



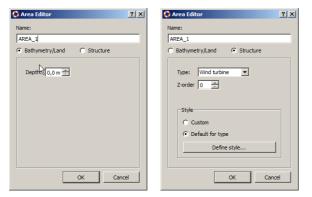
GateHouse A/S Nov 2015 Per Christian Engberg Chief Architect, M.Sc.E.E. Tracking and Monitoring Solutions

List of changes to the application:

• Version 4.7.0

Allisions: In previous versions of WRAP 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...'.

C Import
File: D:/iwrap_data/dnv/test/Batymetry_reduce/Batymetry_reduce.shp
V Depth extraction
Field name
Read all multi polygons
Douglas Peucker
Epsilon (dist): Sm
- Start
Progress Total: 100%
Done!, time used 1 sec Sorting Imported: 2038 Features 2038 Layer count 1 Using projection file 'D://wrap_data/dnv/test/Batymetry_reduce/Batymetry_redu Started
۲
Close

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).

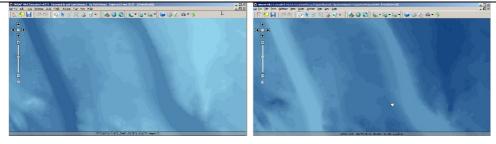
For both Shape and KML files you can choose to simplify the polygons by using the Doglas-Peucker algorithm.

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. WRAP now uses a gradient for Bathymetry coloring, similar as used for e.g. Traffic Density.

🛟 Depth G	radient Editor			<u>? ×</u>
Land color:	Color			
	Depth 50 0	Color		Add
Transparent Reset (atla		hart)	OK	Remove

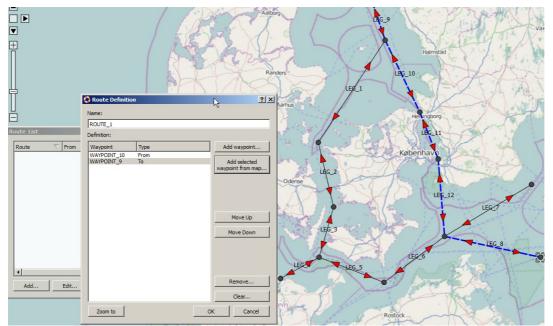
The 'Reset (atlas)' button makes deep area dark and shallow areas lighter, 'Reset (sea chart)' does the inverse. Here you see an example, atlas mode on the left hand side.



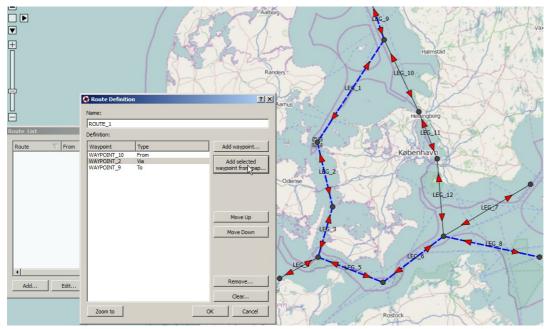
· Bentley-Ottmann algorithm is now used to check if polygons are simple, this gives a huge performance improvement Bentley-Uttmarni algorithm is now used to show a polysor. for large polygons. The Traffic Area Composition dialog has been simplified, the style is now set by pressing the 'Style...' button. 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

- ¢
- 0 0

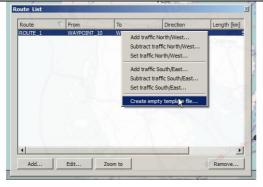
Here is an example of a route between two waypoints. IWRAP automatically chooses the shortest route, indicated with blue dashed lines.



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.

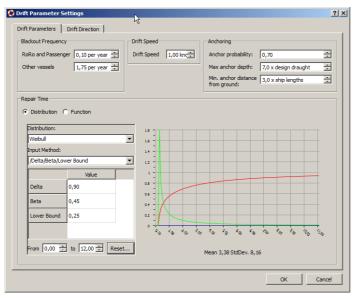


The 'Load...' menu item simply loads and sets the values. You can also e.g use the 'Load and Add...' to add additional traffic. 'Load and Subtract...' removes the traffic and 'Load and multiply...', multiplies the traffic with the factor specified in the file.

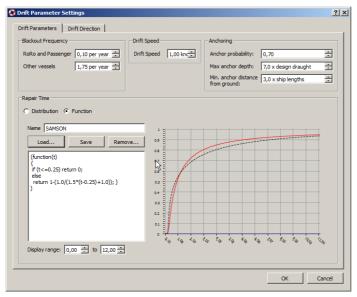
Note, that you should only change the traffic amounts in the files and not modify the layout or other tags in the files.

• 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 WRAP.

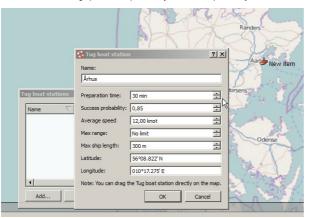


You can either load an existing function, e.g. the SAMSON function or you can write your own. The function must be written in JavaScript.

· 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'.



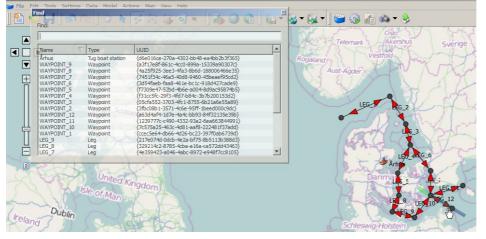
• New map view settings: Show way point label (disabled by default) and possible to change label font and size.

Map View Settings	<u>? ×</u>
Labels	
✓ Legs	Tug boat stations Font
<u> </u>	<u> </u>
Show Legs	Show Waypoints
Show Incidents	Show tug boat stations
Show Areas	Show Traffic Areas
🔽 Show Lateral Distribution	
Show Histograms	
Show Angle Analysis	
Minimum	traffic per angle: 5 % 💼
Draw Arrows on Angle Analysis His	stogram
Show Density	Coloring Show Legend
Density smoothing:	0
Visualise Maximum Leg Width	Show Leg Extension
Indicate Errors on Legs etc	
☑ Show Leg traffic tooltip □ Si	how from which legs ships come from
Show Simulated Tracks	
Reset	OK Cancel

 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.

😫 Project Settings			<u>? ×</u>
Timezone:	(GMT+01:	00) Amster	rdam, Berlin, Bern 💌
Start of Week:	Monday	•	
Default maximum width for new legs:	10000 m	*	Set on all existing legs
Default maximum extension length for new legs :	50000 m		Set on all existing legs
Set work directory			
Dir: d:/no_training/test2			
Use shared data set directory			
Dir:			
Use shared density output directo	ory		
Dir:			
			OK Cancel

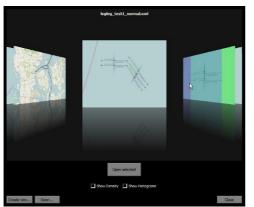
• New find/search function, press CTRL+F, enables you search for all model items.



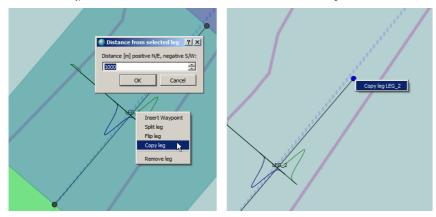
Many minor fixes, e.g. fixed problem with the Google earth integration so if you have had problem with this you may
want to try again.

• Version 4.6.1

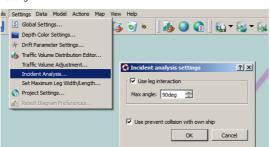
• New startup window. When you open your models, a signature screenshot will be stored for each model. The screenshot along with the name of the model can be used to open an existing model. Note, that before a screenshot is generated the MRAP logo is shown, so if you previously have opened some projects you will see a MRAP 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.

🕻 Extract Model Dat	a				? ×
Parameters					
Angle: 10 deg		<u>*</u>	Min calculated speed:	Disabled	
Bin size: 100 m		<u>*</u>	Max calculated speed:	100,0 kn	*
Max time: 900 s		*	Max distance:	4000 m	*
Use calculated ge	ographical boundary			H	Hide advanced options
Fit distributions					Traffic volumes
Fit: Detailed	-				Extract
Min. width (normal)	2 bins	÷ Smoothing:	2 bins		Convert to year
Min. width (uniform)	2 bins	🛨 Normal dist r	nin: 20 samples	÷	
Debug		Time of Day Fil	ter	Pa:	ssage Line Angle Analysis —
Filter:	🗆 Log	Define filter,	Save filter Load	filter,,,	Configure settings,

- 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.

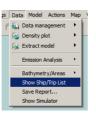


- Save report. You can save a text file containing the traffic distribution of each leg in the mode, access this feature from 'Data/Save Report..'.
- Ship/Trip list. IWRAP can now display tracks/trails/trips of individual ships. In order to use this you have to extract trips first, you can either do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

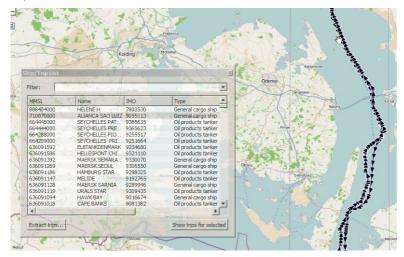
or you can extract it from an existing data set:

Data	a Model	Actions	Мар	View Help
1	Data man	agement	•	🙀 Import Data
8	Density pl	ot	•	Import Additional Data
84	Extract m	odel	•	Export Data
	Emission A		•	Inspect Data Time Distribution
	Emission A	Andrysis		Extract Trips
	Bathymet	ry/Areas	•	Incidents
	Show Ship	/Trip List		
	Save Rep	ort		Import Static Ship Data
	Show Sim	ulator		

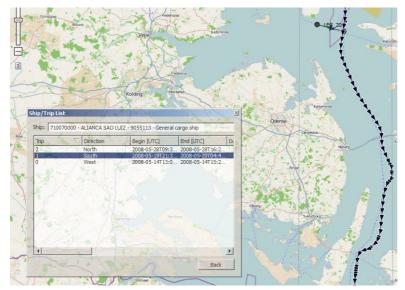
The result can be accessed from:



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.



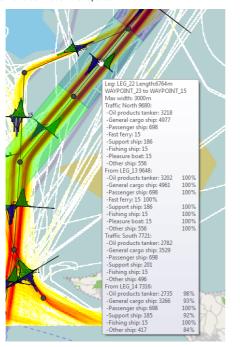
Access this, i.e. the release notes, from the help menu.

• 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 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':

Map View Settings
Labels
✓ Legs
Show Legs
V Show Incidents
Show Areas
Show Lateral Distribution
Show Histograms
V Show Angle Analysis
Minimum traffic per angle: 5 % 🚔
☑ Draw Arrows on Angle Analysis Histogram
Show Density Dynamic Coloring Show Legend Density smoothing:
☐ Visualise Maximum Leg Width ✓ Show Leg Extension ✓ Indicate Errors on Legs etc.
Show Leg traffic tooltip
Show Simulated Tracks
Reset OK Cancel

• Version 4.4.0

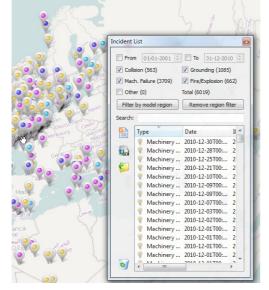
- Simplified dialogs, complex dialogs now have a 'Show advanced options' button.
- · Rearranged data menu.

	Data management	•	Import Data
-	Density plot	•	Import Additional Data
	Extract model	•	Export Data
	Emission Analysis	•	Inspect Data Time Distribution
	Show Simulator		Incidents
ŝ			Import Static Ship Data

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

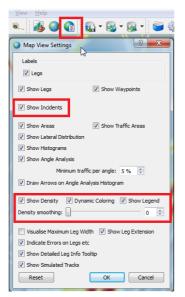


- When importing data, IWRAP now stores the header signature along with the format. This means that IWRAP will
- automatically recognize the format the next time you want to load a file with the same header signature. It is now possible to copy the designed file format to/from clipboard, e.g. when importing 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 <u>'Data/Data management/Incidents...'</u>

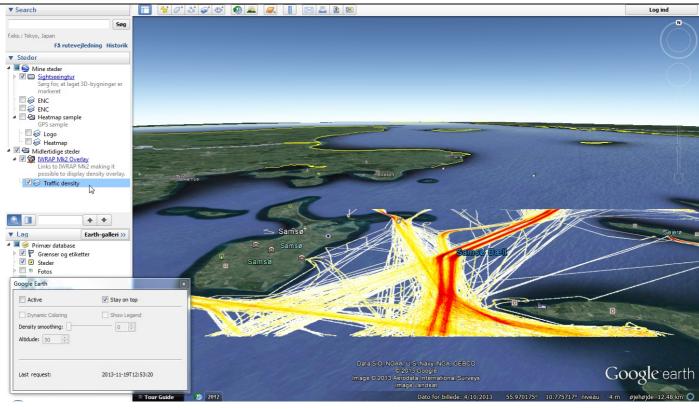


• Traffic Density smoothing (blurring). (Disabled by default see Map view settings)

- 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.
 WRAP now supports a variety of different position formats, see <u>Position Format</u>.
 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 <u>Creating a New Model</u>.

Project		
Name:	test	
Directory/Location:	d:\jwrap_data\temp	
Use name to cre	ate sub directory	

• 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.

Timezone:	(GMT+08:00) Perth	•
Start of Week:	Monday 🔻	
Default maximum width for	new legs: 10000 m 文	
Default maximum extension new legs :	length for 50000 m	
Set data work director	у	
Work dir: d:/iwrap_data	/temp/test	

- \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:

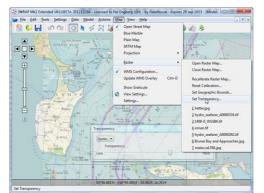
county	4		anument va		IIIOUCIE VI/40	10 24. 11101 11.
cuting	1		Incident v1	1.0	model2 v1.45	lø 24. mar 11:
mpleted			Incident v1	1.0	model2 v1.45	ma 12. mar 10
		n3	n2		Unit	
nding		0,14044000	(16,16%) 0,163	31	Incidents/Year	
nding		0,13709000	(0,00%) 0,1370	19	Incidents/Year	
Indinas		0,27753000	(8,18%) 0,300		Cat and the farment	-
		0,00253743	(0,00%) 0,002		Set result format	
		0,03922570	(0,00%) 0,039		Copy Selection	Ctrl+C
		0,00005580	(0,00%) 0,000		Copy All (incl. head	ers)
					Incidents/Year	
		0,01190010	(0,00%) 0,0119	0	Incidents/Year	
					Incidents/Year	
ollisions		0.05371000	(0.00%) 0.0537	71	Incidents/Year	

• 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
- Additional solution of the sol

7 Time				
) Indude	Exclude			Reset
Begin time	01-07-2012 00:00	▼ I End time	13-07-20	12 11:59
hip filter	Exclude			
MMSI	IMO	Name	w	Add
•			•	Remove.
ihip type filte	r nly () Exclude			
Туре	Length	Speed	Dr	Add
				Edit.
•	***		•	Remove

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.

Notel, 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.

		-		0		. 0
	2 Emission Result		10000	\$	0	٦
	Telef 21 00228 1	02 [6 NDx [6	Fuel [1] Partici	10 M		1
		C02	502	NOx	Fuel A	
	Chemical tanker	0,00	0,00	0,00		1
ř i k i k i k i k	Gastanker	0,00	0,00	0,00		1
and the second second	Container ship	0,00	0,00	0,00		H
Odense	General cargo ship	21.038.87	69.2	666.00		1
and the second s	Bulk cavier	0,00	0,00	0,00		1
P Lad (Star Jak	Ro-Ro cargo ship	0,00	0,00	0,00		
	Passenger ship	5.610,64	3,55	97,50	12	1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Fastferry	211,78	0,14	1,11		U.
	Support ship	2.595,13	51,71	82,15		I
	Fishing ship	63,30	0,63	1,25		
	Pleasure boat	44,32	0,03	0,77		II.
	Othership	1.543,30	15,38	30,76	5	II.
Contraction of the Contraction	Total	50.405.33	875,17	1.490.52	15.9	H
	×					18

• Version 4.0.0

- Web Map Service (WMS) support has been added, see an example in Section Navigating the Map
- New <u>Traffic Area</u> algorithm, it is now possible to define areas/regions with different traffic compositions.
 A <u>Time of day filter</u> 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 <u>Passage Line Angle</u> analysis has been added to the data extraction algorithm.

- Drifting groundings analysis has been improved with anchor handling, see <u>drifting</u>.
 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. WRAP 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

- 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

signed 32 bit

- 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 WRAP. 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?gh20nEWbQ0IB3K87I0000.0*19 1-4-2008 14:06:58 < tab > IAVDM;1;2,A;53;2;??P1joL=<@HP000eDhhDp0000000000000011HA4440HtP00000,0*6A !AIVDM;2;2;2,A;00000000000000,2*26
- 1-4-2008 14:07:01 < tab > !AIVDM,1,1,,B,14QsDc04Qn19nJ`P1?;9F7II0800,0*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 WRAP will try to fix them Added features for adding a Waypoint in the middle of a Leg, splitting and joining a Leg, Modifying Legs ifying Legs and Waypo
- 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 WRAP 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 <u>Defining Bathymetry</u>.
 - 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 functionalityMarble based map engine.

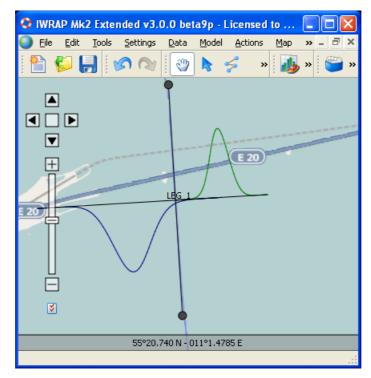
IWRAP Mk2

The objective of the WRAP 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
 - <u>Area Traffic</u>
- <u>Running the algorithm</u>
- <u>Navigating the Map</u>
- 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 Distribution 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 200m and the south going is defined by a normal distribution with mean 1000m and standard deviation of with 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. WRAP 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.

Project		
Name:	test	
Directory/Location:	d:\jwrap_data\temp	
Use name to cre	ate sub directory	

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:

🛟 Project Settings			? ×
Timezone:	(GMT+01:0	0) Amster	dam, Berlin, Bern 🔽
Start of Week:	Monday	•	
Default maximum width for new legs:	10000 m		Set on all existing legs
Default maximum extension length for new legs :	50000 m	÷	Set on all existing legs
Set work directory			
Dir: d:/no_training/test2			
Use shared data set directory —			
Dir:			
Use shared density output directo	pry		
Dir:			
			OK Cancel

The mentioned maximum width and extension length settlings 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:

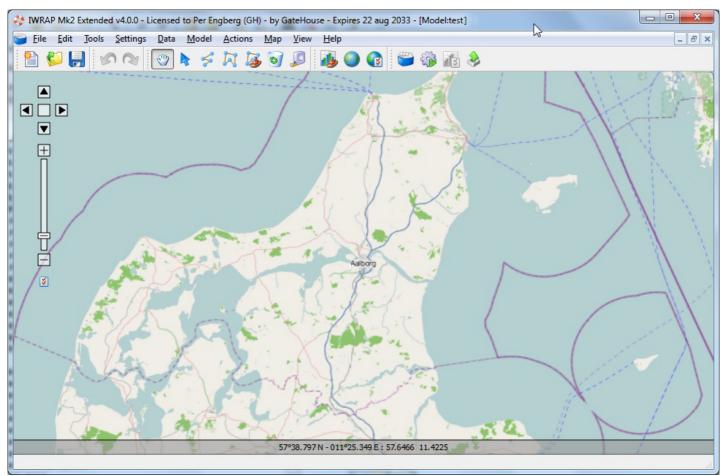
- \imported_ship_data : Used to store the imported IWRAP data from e.g. AIS.
- \model_extraction_temp : Used to store temporary data when generating models from imported data ship data.
- \density : Used to store generated density plot data.
- \emission : Used to store generated emission data.

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

IWRAP Mk2

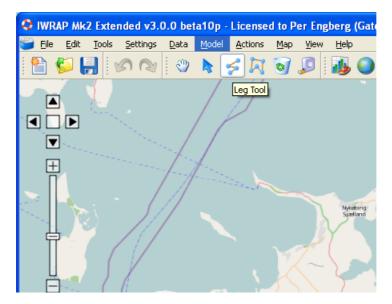
share data with. You can also share the density plot data with another project, see 'Use shared density output directory'.

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. WRAP will try to determine your current geographical location from your current internet connection.



Adding Legs and Waypoints

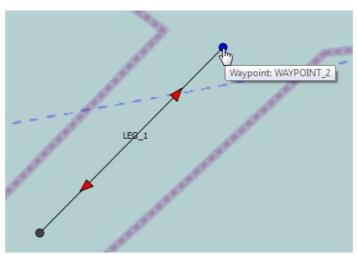
Before adding a Leg, start by zooming in on the area of interest. Then select the Leg Tool from the toolbar:



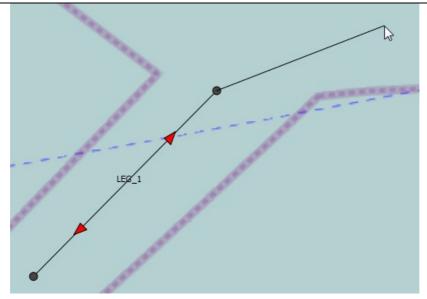
Then click once with the left mouse button at the position where you want to start the leg, this will add the start Waypoint:



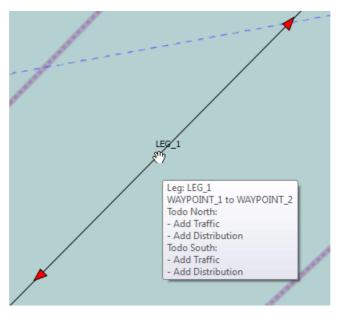
Then click and release once with the left mouse button at the position where you want the leg to end and thereby add the end Waypoint:



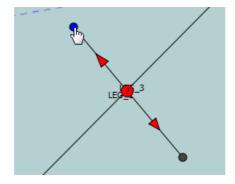
If you want to add a new Leg that is connected to 'LEG_1', then move the cursor over the Waypoint where you want the Leg to start, the cursor will change to a hand symbol. Click once with the left mouse button, the leg is started, and move the cursor to where you want it to stop.



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.

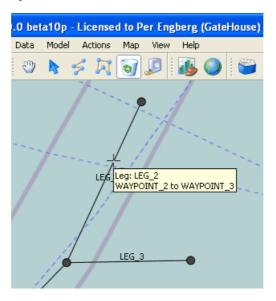
When you have completed adding legs you should end by selecting the Pan tool again:



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

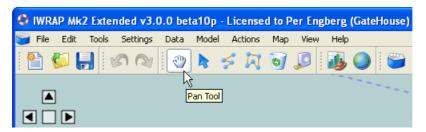
Removing Legs and Waypoints

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:

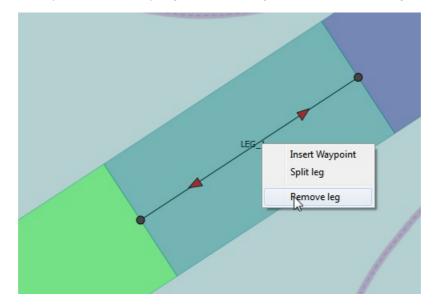


Click the left mouse button and the Leg will be removed, redundant Waypoints are also removed. If you remove a Leg by mistake use the undo function

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

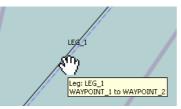


Not matter which tool is selected, you can also always right click on a Leg and select 'Remove Leg...'.

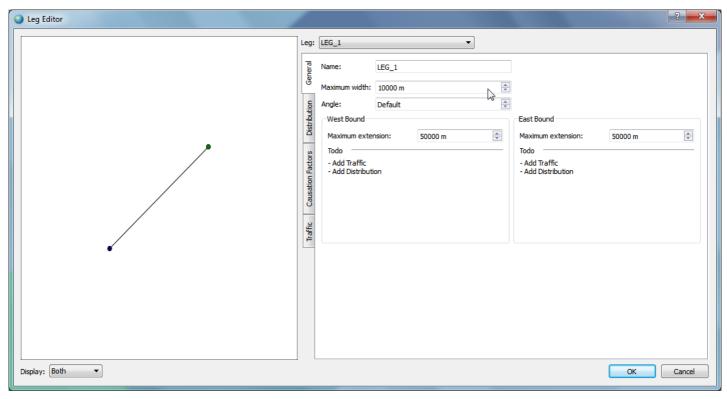


The Leg Editor

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.

.eç	
	Set Max Leg Width/Length: LEG_1
	North/West: 9678 m Vidth: 10000 m South/East: 50000 m V

You can now proceed with specifying:

- <u>Lateral Distribution</u>
 <u>Causation Factors</u>
 <u>Traffic Volumes</u>

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:

Leg:	LEG_1	
General	North Bound	South
U	Distribution Parameters	Dis
Distribution		
actors		
Causation Factors	Add Remove	
Caus	Input Method:	Inpu
	×	
Traffic	Value	
	Weight	We

It is possible to choose from the following distributions;

_	5	
€	Distribution:	? 🗙
	Distribution:	-
	Normal	N 💌
	Normal	
	Gumbel (max)	
	Gumbel (min)	
Т	Lognormal	
4	Uniform	
	Weibull	
	Beta	
	Mean	

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

🥮 Leg Editor	
	Leg: LEG_1 North Bound Distribution Distribution Parameters Normal Weight=1.00,Mean=0,00, Add Remove Input Method: In //Mean/Std. Dev. Value Weight 1,00 Std. Dev. 1 Scale factor: 1,000
Display: Both	

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):

Input Metho	id:	
/Mean/Std.	Dev.	
	¥alue	
Weight	1,00	
Mean	10þ,00 m 💲	
Std. Dev.	1,00 m	

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

Input Method:	
/Mean/Std. Dev.	~
/Mean/Std. Dev.	
/Mean/Cov	

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.

🖇 Leg Editor							
	ΛΛ	Leg:	LEG_1			*	
		General	North	Bound -			Sou
		Ger	Dis	stribution			ſ
		ltion	No No	ormal ormal	Weigh Weigh	t=1.00,Mean=100,0 t=1.00,Mean=50,00	
		Distribution					
		2					
		Causation Factors					
		usation			d	Remove	C
		Ö		ut Metho			Ir
		Traffic	/Me	ean/Std.		*	
		Tra			Value		-
			We	eight	1,00		
			Me	ean	100,00 m		
			St	d. Dev.	10,00 m		
			Scale	factor:	1.000	\$	Sca
	74m	-	Jeale	, ractor,	1,000	V	
Display: North/West 🔽		_					

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:

🔮 Leg Editor				
Leg Editor		Traffic Causation Factors Distribution General 6	LEG_1 North Bound Distribution Parameters Normal Weight=1.00,Mean=100, Normal Weight=1.00,Mean=50,00 Add Remove Input Method: /Mean/Std. Dev. Value Weight 100,00 m Std. Dev. Scale factor: 1,000	-Sou [[]]]]]]]]]]]]]]]]]
Display: North/West 💌	142	m		

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:

Ð	-North Bound	(Causation Reductio	n Factors)	South Bound	Causation Reduc	tion Factors)	
פמומיסו		Causation Reduction Factor	Resulting Causation Factor		Causation Reduction F		
5	Headon:	1,00 🗘	0,5000 E-4	Headon:	1,00	0,5000 E-4	
הוארויו	Overtaking:	1,00 🗘	1,1000 E-4	Overtaking:	1,00	1,1000 E-4	
5	Grounding:	1,00 🗘	1,6000 E-4	Grounding:	1,00	\$ 1,6000 E-4	
n 5	General	1,00 🗘		General:	1,00	•	
	-North Bound			South Bound			
כמתאמנותו ו מכנתו א	Mean time bt	w. checks: Glo	bal Value 🔹	Mean time b	tw. checks:	Global Value	\$
<u>_</u>						Global Set	tinas

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.

Global Settings			? X					
Status: Using IAL	Status: Using IALA definitions							
Default Causation Factors								
Merging:	µ,300 Е	-4						
Crossing:	1,300 E	-4	· · · · · · · · · · · · · · · · · · ·					
Bend:	1,300 E	-4	·					
Headon:	0,500 E	-4	* *					
Overtaking:	1,100 E	-4	<u>.</u>					
Grounding:	1,600 E	-4	<u>.</u>					
Area moving:	0,500 E-4		<u>.</u>					
Area stationary:	0,500 E-4							
Default Causation	Reductio	on Factors						
Passenger Ship:	20,00		*					
Fast Ferry:	20,00		<u>.</u>					
Mean Time Btw. Ch	ecks:	180 s						
Rese	t to IALA	Default						
Use as Default]	Reset to I	Default					
Save to file		Load fro	m file					
			Cancel					

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:

Λ	Leg: LEG_1	South F
		South E Name: Traffi other

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

🔍 Traffic	Traffic Volume Distribution Editor : North Bound									
Data Item: Frequency Viraffic Volume Distribution: TD_5 Viraffic Volume Control Sum Adjusted Frequency:0 Sum Frequency										
	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	~		
<							>			
Show Grap	h 🗌 Hide unuse	ed columns - Traffic Vo	olume Adjustment Fac	tor: 1,00 🗘		0	K Cancel			

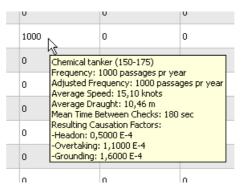
The Traffic Volume Distribution is defined as the annual number of ships operating on the leg in one direction. The annual

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.

€	Traffic Volume Distribution Editor : North Bound								
1	Data Item:	Frequency	🔽 Traffic V	olume Distribution:	D_5				
		Crude oil tanker	Oil products tanker	Chemical tanker	Gas tanker				
	0-25	0	0	0	0				
	25-50	0	0	0	0				
	50-75	0	0	0	0				
	75-100	0	0	0	0				
	100-125	0	0	0	0				
	125-150	0	0	0	0				
	150-175	0	0	1000]	0				
	175-200	0	0	0	0				
	200-225	0	0	0	0				

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:

Traffic Volume Distribution Editor							
Dal	ta Item:	Frequency		~	Traf		
		Frequency Average Speed	N		ts tar		
0-	25	Average Draught Causation Reduction Frequency Adjustme					
25	5-50	0	O	.01			

Selecting the Average Speed changes the appearance of the table:

6	S Traffic Volume Distribution Editor : North Bound										
	Data Item: Average Speed Traffic Volume Distribution: TD_5										
		Crude oil tanker	Oil products tanker	Chemical tanker	Gas tanker	Container ship					
	0-25										
	25-50										
	50-75										
	75-100										
	100-125										
	125-150										
	150-175			(15,10)							
	175-200				inker (150-175) 1000 passages priye						
	200-225			Adjusted F	requency: 1000 passa eed: 15,10 knots						
	225-250			Average Di Mean Time	Average Speed: 13,10 Nots Average Draught: 10,46 m Mean Time Between Checks: 180 sec						
	250-275			-Headon: 0							
	275-300				g: 1,1000 E-4 : 1,6000 E-4						

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.

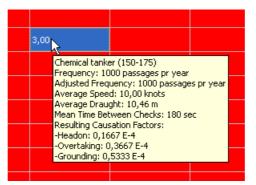
In the Data Item drop-down box you can also select a Causation Reduction Factor:

•	😻 Traffic Volume Distribution Editor : North Bound									
	Data Item: Causation Reduction Factor Traffic Volume Distribution: TD_5									
		Crude oil tanker	Oil products tanker	Chemical tanker	Gas ta					
	Туре	1,00	1,00	1,00	1,00					
	0-25									
	25-50									
	50-75									
	75-100									
	100-125									
	125-150									
	150-175			{1,00}						
	175-200									
	200-225									

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 specific length category of a ship type by selecting Frequency Adjustment Factor in the Data Item drop-down box.

	Data Item: Frequency Adjustment Fact 🗸 Traffic Volume Distribution: TD_5 Sum Adjusted Frequency:1000 Sum Frequency:10									
	Crude oil tanker	Oil products tanker	Chemical tanker	Gas tanker	Container ship	General cargo ship	Bulk carrier	Ro-Ro		
Туре	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00		
)-25										
25-50										
50-75										
75-100										
100-125										
125-150										
150-175			{1,00}							
175-200										
200-225										

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.

c Volume	es						G	GateHouse
🕽 Traffic	Volume Distribu	ition Editor : Nor	th Bound					? 🛛
Data Item:	Frequency Adjustm	ient Facl 🔽 Traffic Vo	olume Distribution:	TD_5	~	Sum Adjusted Freque	ncy:8000 Sum Fred	quency:1000
	Crude oil tanker	Oil products tanker	Chemical tanker	Gas tanker	Container ship	General cargo ship	Bulk carrier	Ro-Rc
Туре	1,00	1,00	2,00	1,00	1,00	1,00	1,00	1,00
0-25								
25-50								
50-75								
75-100								
100-125								
125-150								
150-175			2,00					
175-200			Chemical I	tanker (150-175)				
200-225			Adjusted	y: 1000 passages pr Frequency: 8000 pas	year ssages pr year			
225-250			Average [5peed: 10,00 knots Draught: 10,46 m e Between Checks: 1	80 sec			
250-275			Resulting -Headon:	Causation Factors: 0,1667 E-4				
275-300				ng: 0,3667 E-4 ig: 0,5333 E-4				~
<								>

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.

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:

			? 🛛
Way	point:	W	AYPOINT_2
General		Causation Reduction Factor	Resulting Causation Factor
Ū	Merging:	1,00 🗘	1,3000 E-4
tors	Crossing:	1,00 🗘	1,3000 E-4
n Fac	Bend:	1,00 🗘	1,3000 E-4
Causation Factors			Global Settings
Leg/Leg Traffic			

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.

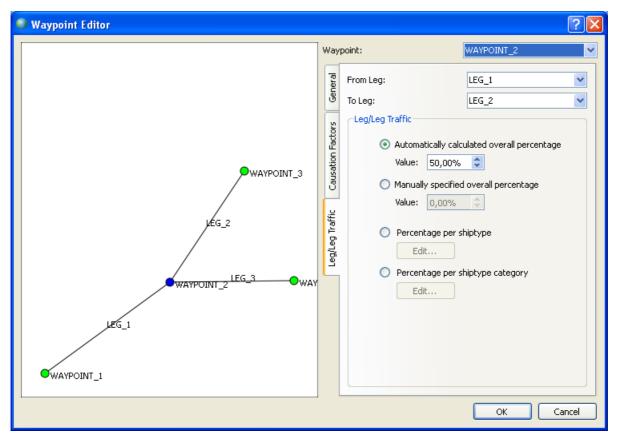
Global Settings			? X					
Status: Using IAL	Status: Using IALA definitions							
Default Causation Factors								
Merging:	µ,300 Е	-4						
Crossing:	1,300 E	-4	· · · · · · · · · · · · · · · · · · ·					
Bend:	1,300 E	-4	·					
Headon:	0,500 E	-4	* *					
Overtaking:	1,100 E	-4	<u>.</u>					
Grounding:	1,600 E	-4	<u>.</u>					
Area moving:	0,500 E-4							
Area stationary:	0,500 E-4							
Default Causation	Reductio	on Factors						
Passenger Ship:	20,00		*					
Fast Ferry:	20,00		<u>.</u>					
Mean Time Btw. Ch	ecks:	180 s						
Rese	t to IALA	Default						
Use as Default]	Reset to I	Default					
Save to file		Load fro	m file					
			Cancel					

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'.

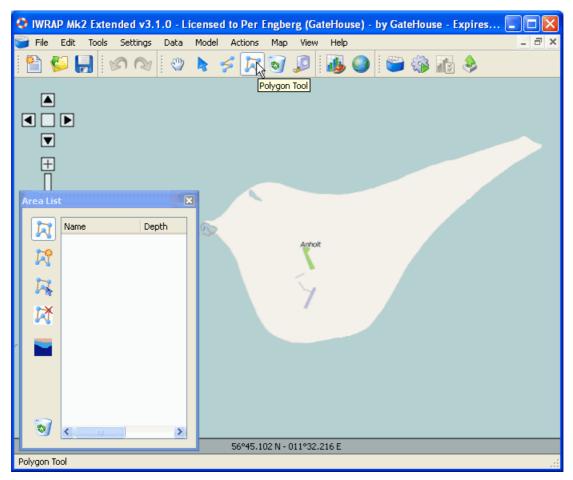


You can also manually choose to set the percentage, select a 'From leg' and a 'To leg' and check the 'Manually specified overall percentage' option and enter a value.

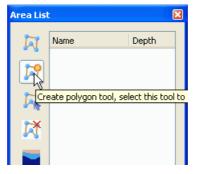
The most complex option is to specify the percentages per ship type or ship category. The last option is if of course the most detailed, and is primarily used when using the import data feature.

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'.



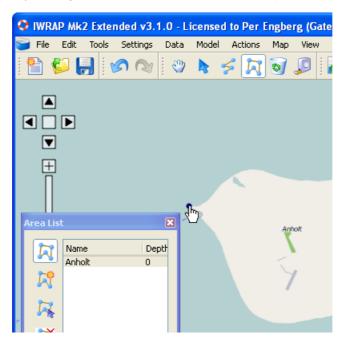
The 'Area Editor' is invoked, enter name and depth of the area:

🗘 Area	Editor 🛛 🛛 🔀
Name:	Anholt
Depth:	0 m 🗘
	OK Cancel

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'.

ALCO LIS		
	Name	Dept
	Anholt	0
1		
X		

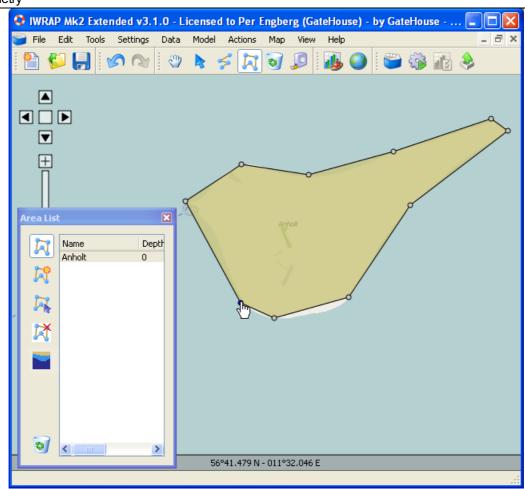
Now you can start drawing the area by clicking with the left mouse button on the map.



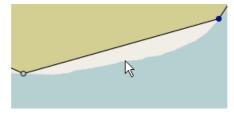
To add more points to the Polygon you just keep on clicking on the map. The polygon may turn red when you add points, this indicates that the polygon is not Simple (e.g. has crossing lines), just keep on adding points until the complete area is specified and then remove line crossings.



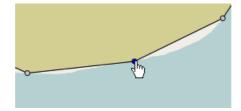
When you are done drawing, the polygon should not be red.



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:



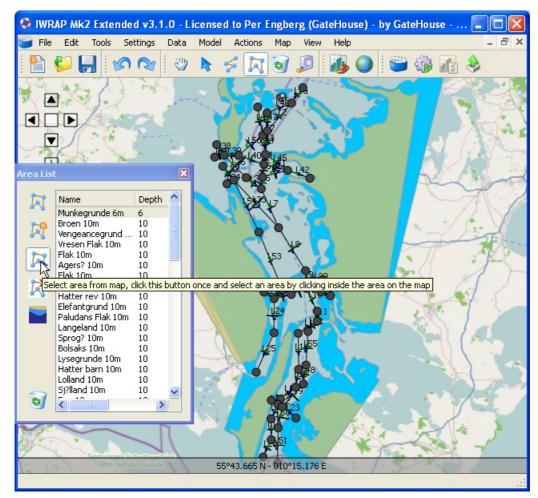
and simply click on the point you want to remove. When you have completed removing points select the edit tool again:



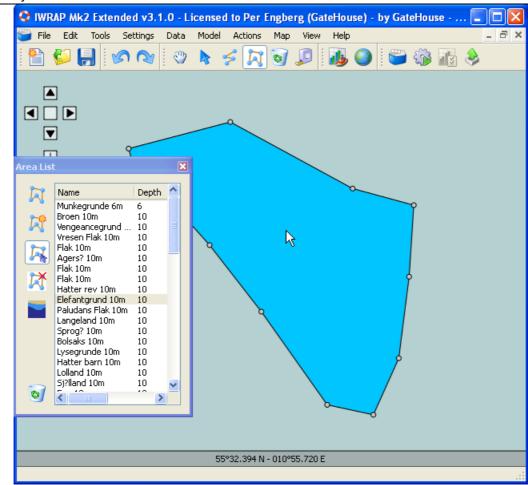
You can remove a complete polygon by selecting it in the list and clicking the 'Remove Complete Polygon' button.



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.

*	-
4	у.
_	$1 \ge 1$

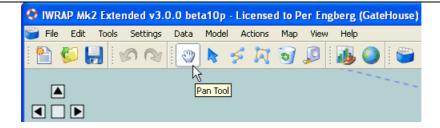
You can make the fill of the polygon transparent and modify the colors by activating the 'Settings/Depth Color Settings...' menu item or clicking the tool button:

🛟 Depth G	radient Editor			<u>? ×</u>
Land color:	Color			
	Depth	Color		Add
	50 0			Edit
				Remove
Transparen	cy:			
Reset (atla	as) Reset (sea o	thart)	ОК	Cancel

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...'.

O Import
File: D:/iwrap_data/dnv/test/Batymetry_reduce/Batymetry_reduce.shp
Depth extraction
Field name
Read all multi polygons
Douglas Peucker
Epsilon (dist): 5 m 🕂
Progress
Total: 100%
Done!, time used 1 sec Sorting Imported: 2038 Features 2038 Layer count 1 Using projection file 'D:/iwrap_data/dnv/test/Batymetry_reduce/Batymetry_redu Started
Close

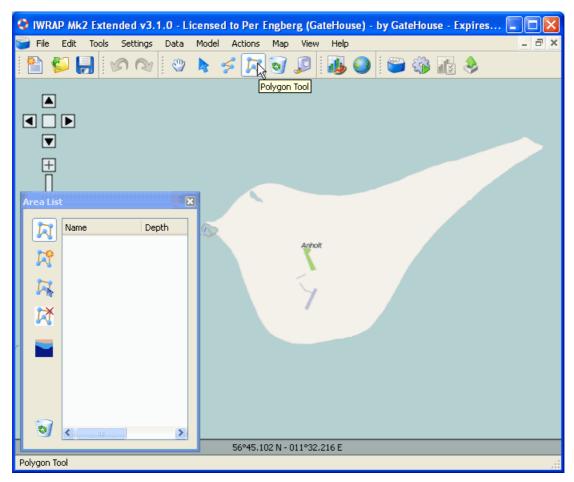
When importing Shape files it is possible to specify a field that contains the depth of the polygon. Furthermore it can be specified how multi polygons are to be handled, sometimes all of them should be included, but the default is to only include the first layer (i.e. they may be interior rings).

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

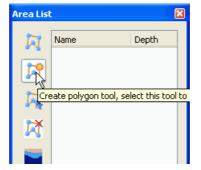
Note that when you import polygons from a file each polygon is tagged with the name of the file. Each time you import the file the polygons from that file will be deleted first.

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:

🕽 Area Editor 🔗 🕺
Name:
AREA_1
C Bathymetry/Land C Structure
Type: Wind turbine
Style
C Custom
O Default for type
Define style
OK Cancel

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...'.

C Import
File: D:/iwrap_data/dnv/test/Batymetry_reduce/Batymetry_reduce.shp
Depth extraction
Field name
🔲 Read all multi polygons
Douglas Peucker
Epsilon (dist): 5 m 📩
Start
Progress Total:
Done!, time used 1 sec Sorting Imported: 2038 Features 2038 Layer count 1 Using projection file 'D:/iwrap_data/dnv/test/Batymetry_reduce/Batymetry_redu Started
۲
Close

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 MRAP. 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.

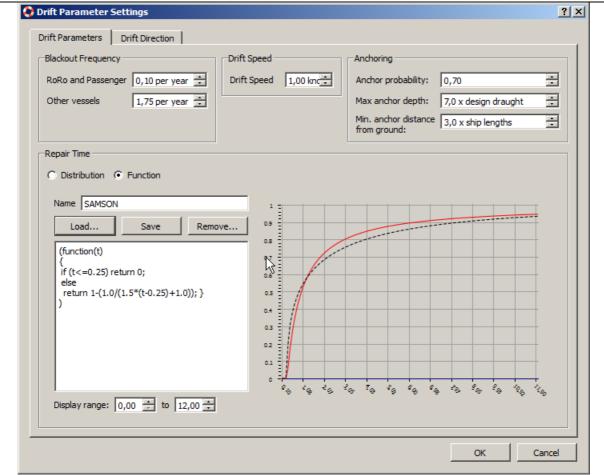
Failure of propulsion machinery may occur at any location along the Leg. A Poisson process is used to model the probability of having a blackout along a leg segment of length.

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.

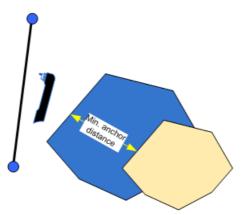
Drift Parameter Settings	\searrow			? ×
Drift Parameters Drift Direction	•			
Blackout Frequency	Drift Speed	Anchoring		
RoRo and Passenger 0,10 per year 💼	Drift Speed 1,00 knc 🗧	Anchor probability:	0,70	÷.
Other vessels 1,75 per year 🗧		Max anchor depth:	7,0 x design draught	3
		Min. anchor distance from ground:		3
Repair Time				
Distribution C Function Distribution: Weibull Input Method: /Delta/Beta/Lower Bound Value Delta 0,90 Beta 0,45 Lower Bound 0,25				- - - - - -
From 0,00 💼 to 12,00 💼 Reset	1	Mean 3,38 StdDev. 8,1	6	
			ОК С	Cancel

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

GateHouse A/S

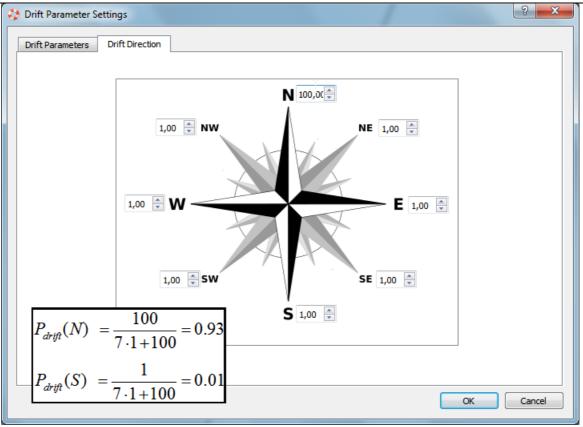


The probability of anchoring when drifting can be specified, note that a certain minimum distance is required for the ship to anchor, i.e. there must be an area that is below the max anchor depth that is longer than the minimum anchor distance in order for the ship to be able to anchor.



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.

GateHouse A/S



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 specified by the 'Succes probability'.

			PH S	Randers
	Tug boat station Name:		? ×	Aar New item
	Århus			\$ Jacol
Tug boat stations	Preparation time:	30 min	Ð,	forsens
Name 🗸	Success probability:	0,85	€k	
	Average speed	12,00 knot	÷	1 A Then
	Max range:	No limit	÷	Odense
	Max ship length:	300 m	÷	at the
	Latitude:	56°08.822' N		A AL
	Longitude:	010°17.275' E		Total 1
•	Note: You can drag t	he Tug boat station directly on the m	ap.	X-1-1-2/1
Add		OK Cancel		A A A A

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:

File Edit Tools Settings Data Model Actions Map View Help File Edit Tools Settings Data Model Actions Map View Help Taffic Area Tool Taffic Area Tool Taffic Area Tool Taffic Area Tool Taffic Area List Taffic Area List Ta	IWRAP Mk2 Extended v4.0.0 - Licensed to Per Engberg (GH) - by GateHouse - Expires 22 aug 2033 - [Model:test1]	
Traffic Area Iol		_ & ×
Traffic Area Iol	🗎 ધ 🔚 🖉 🤍 🔅 ጵ 🗲 🏹 🐼 🥑 🕼 🎱 🚱 🚱 🖓 🖓 😓	
Traffic Area List	Traffic Area Tool	
Traffic Area list		
Traffic Area List		
Traffic Area List		
Name Style Area (kn) Image: Style Image: Style <td></td> <td></td>		
Name Style Area (kn) Image: Style		
	Traffic Area List	
	Name Style Area (kn	
	LEG_1	
56°57,433 N - 010°55,865 E : 56,9572, 10,9311		
56°57/433N - 010°55.865 E : 56.9572 10.9311		
Traffic Area Tool		

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'.

ſ	Traffic Area Lis			
	A	Nam		
	R			

The 'Traffic Area Composition' dialog is displayed:

Traffic /	Area
-----------	------

Disalau atula	_AREA_1		
Display style		1	
Style: Default	•	J	Save as new style Remo
🔽 Fill			V Line
Color: Color	• •••		Color:
Style: Unifo	rm color	•	Style: Dashes separated by a few pixels
Transpa	arency:		Width: 3
Less		More	
T-6	·		
Traffic composit	ion		
Tag	Ship type	Length	Number of ships Visit days Ad
			Edi
			Ren

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.

🛟 Traffic Area Eleme	ent 🤉 🗙
Tag (optional)	<u>k</u>
Ship type:	Fishing ship 🔹
Ship length:	50
Number of ships:	1
Days per year:	Every day 🛓
Visits per day:	1,00 visit(s) per day
Movement time:	1 🔄 (💿 Days / 💿 Hours / 💿 Minutes) per visit
Stationary time:	0 🔄 (💿 Days / 💿 Hours / 💿 Minutes) per visit
Total time per ship per year:	Stationary=0min Movement=21900min
per year.	
Movement Causation Reduction	1,00 🜩 Resulting causation factor: 0,5000 E-4
factor	
Stationary Causation Reduction	1,00 Resulting causation factor: 0,5000 E-4
factor	
	OK Cancel

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:

Days per year:	200 day(s) 🌩
Visits per day:	1,00 visit(s) per day
Movement time:	6 🔦 (🔘 Days / 💿 Hours / 🔘 Minutes) per visit
Stationary time:	3þ 🚔 (◎ Days / ◎ Hours / ◎ Minutes) per visit
Total time per ship per year:	Stationary=6000min Movement=72000min

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:

Days per year:	48 day(s) 崇
Visits per day:	2,00 visit(s) per day
Movement time:	1 🚖 (🔘 Days / 💿 Hours / 🔘 Minutes) per visit
Stationary time:	3 🚖 (🔿 Days / 🔿 Hours / 💿 Minutes) per visit
Total time per ship per year:	Stationary=288min Movement=5760min

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

Tag	Ship type	Length	Number of ships	Visit days	Add
	Other ship	30	1	48	
	Fishing ship	50	1	200	Edit
	Fishing ship	70	1	100	

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 <u>Defining</u> <u>Bathymetry</u> for more detailed description on how to handle area polygons.

Traffic Area	a List		B	
	Name	Style	Area (kn	le la construction de la constru
	RAFFIC_AREA_1		1.787	
2				
1				/
k K				LEG_1
				7
				/
				/
				_
3	<		4	
			P	

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 <u>Defining Bathymetry</u>.

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

🖱 Start J	ob ? 🛛
Algorithm:	Incident
Name:	test
-Debug	
🗌 Gener	rate Debug Log
	OK Cancel

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.

📔 <u>F</u> ile	<u>E</u> dit <u>T</u> ools	<u>S</u> ettings <u>D</u> ata	<u>M</u> odel <u>A</u> ctions <u>M</u> ap	View » – 🗗	
<u>}</u>	🖉 📙 🕅	S (2) (2)	$h \neq \Pi \ \overline{o}$	» ᡀ » 管	
Jobs					
5	State	Name	Algorithm	<u>^</u>	
~	🥝 Completed	test	Incident v1.0		
.	🥝 Completed	test	Incident v1.0		
	🥝 Completed	1	Incident v1.0		
67	🥝 Completed		Incident v1.0		
U	🥝 Completed	1	Incident v1.0		
111111	🥝 Completed	1	Incident v1.0		
	Executing		Incident v1.0		
E	Completed	2	Incident v1.0		
[,,!,,],	Completed	2 2	Incident v1.0 Incident v1.0		
	Completeu	2	Incident v1.0	~	
X 2	<	II		>	
		F	Results		
		test	Unit	<u>^</u>	
Overca	-	U	Incidents/ year		
HeadO	n	0,00418117	Incidents/Year		
Crossin	ng	0,000296573	Incidents/Year		
Mergin	g	0,000531635	Incidents/Year		
Bend		0,000531635	Incidents/Year		
Area		4,02725e-08	Incidents/Year		
	Total Collisions	0.00554105	Incidents/Year	~	

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.

cuting mpleted	1		Incident v1 Incident v1		model2 v1.45 model2 v1.45	lø 24. mar 11:3 ma 12. mar 10
		n3	n2		Unit	
nding		0,14044000	(16,16%) 0,163	1	Incidents/Year	
nding		0,13709000	(0,00%) 0,1370	9	Incidents/Year	
Indinas		0,27753000	(8,18%) 0,300		Cat carult format	
		0,00253743	(0,00%) 0,002	- [Set result format	
		0,03922570	(0,00%) 0,039		Copy Selection	Ctrl+C
		0,00005580	(0,00%) 0,000		Copy All (incl. head	lers)
					Incidents/Year	
		0,01190010	(0,00%) 0,0119	0	Incidents/Year	
					Incidents/Year	
lisions		0,05371900	(0,00%) 0,0537	1	Incidents/Year	

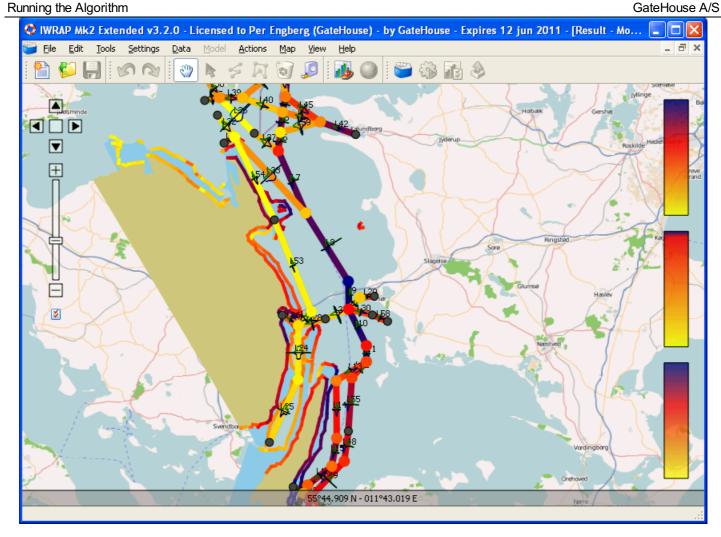
You can change the way the result is displayed by right clicking on the results and selecting "Set result format...". You can select between "Years between incidents" and "Incidents per year", and select the precision of the numbers.

Result Format	ନ ଲାନ୍ତି <mark>କ</mark>
Unit:	Incidents per year 🔹
Precision:	Years between incidents Incidents per year
Display format:	3. Format as [-]9.9 🔹
Percent change precision:	2
Percent change format:	3. Format as [-]9.9 🔹
	OK Cancel

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

🗘 IWR	AP Mk2 Extend				
觉 File	Edit Tools				
1	🖉 🚼 🛛				
<u> </u>	State				
al.	Completed				
	Completed Completed				
Completed					
	Completed				

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.

🧐 Gradient Edi	tor - Legs		? 🔀
Method: Quantile	s 💙		
	Stop Color 100 62 62 0		Add Edit
	toff value, dont color below this	value	Remove
Transparency:		ОК	Cancel

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:

tem HeadOn			Striking 🦺 Struck	Filter: -No filter-		~
	Crude oil tanker	Oil products tanker	Chemical tanker	Gas tanker	Container ship	Ger 🔷
Crude oil tanker	0,000747734	0,000900518	3,91122e-05	3,48108e-05	0,000521201	0,00
Oil products tanker	0,000900518	0,00125679	6,26256e-05	5,45604e-05	0,000744047	0,00
Chemical tanker	3,91122e-05	6,26256e-05	3,93828e-06	2,89511e-06	3,95343e-05	4,98
Gas tanker	3,48108e-05	5,45604e-05	2,89511e-06	2,40668e-06	2,75984e-05	3,5(^E
Container ship	0,000521201	0,000744047	3,95343e-05	2,75984e-05	0,000440653	0,00
General cargo ship	0,000551589	0,000871656	4,98905e-05	3,53061e-05	0,000522551	0,00
Bulk carrier	0,000934915	0,00111281	5,08788e-05	4,06799e-05	0,000649586	0,00
Ro-Ro cargo ship	3,47233e-05	5,19871e-05	2,85762e-06	1,96717e-06	3,10923e-05	3,8(
Passenger ship	0,000187384	0,000315336	1,62689e-05	1,45141e-05	8,5262e-05	0,00
Fast ferry	2,92517e-08	5,0326e-08	2,68593e-09	3,04578e-09	1,80313e-08	3,1:
Support ship	7,42019e-05	0,000169453	8,70342e-06	8,48394e-06	4,72258e-05	0,0(🗸

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:

Running the Algorithm

Name	Description	Show	_
		Add	
			_
		Remove.	
		Edit	

Press Add to define a new template.

-	Diagram	Template Configuration	? 🗙
	Name: Description:	Overtaking	
	Name	Description	Add
			Remove
		ОК	Cancel

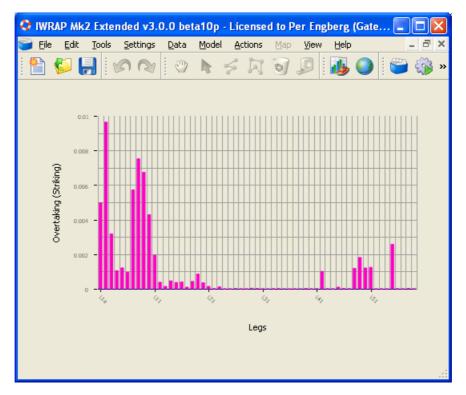
Give the template a name, and press Add to add a diagram:

🗘 Add	Diag	ram	? 🗙
Result			 ·
X-A>	thm: am Sel	Powered Grounding Powered Grounding Drifting Grounding HeadOn (Striking) Area (Striking) HeadOn (Struck) Overtaking (Struck) Area (Struck) Crossing (Striking) Merging (Striking)	
ATH2	~is (a	Bend (Striking)	Cancel

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.

Name	Description	Show
Overtaking		
		Add
		Add Remove

The diagram is shown:



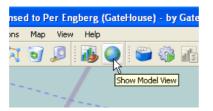
The diagram template is of course stored and can be reused later.

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

ng	ber	g (Gā	ite		. ([X
w	He	elp			_				-	٦	X
			C)	1	e	P	3	3	ŝ	- Ko - To
		-		_		_					
		++	Ħ	Ħ	Ħ	T	H	t	Π		
			Ħ	Π	Π						

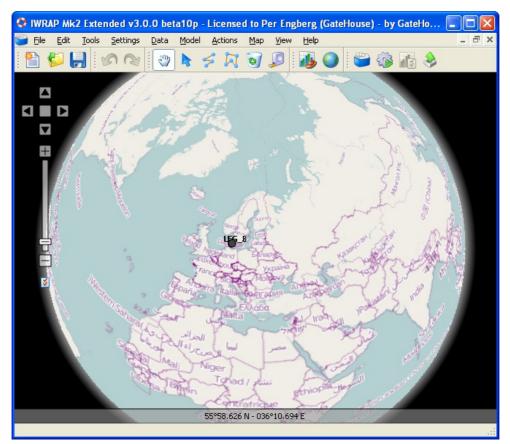
Navigating the MAP

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.

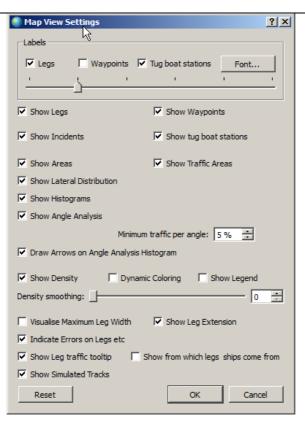


It is possible to adjust the view using the View Setting, click the View Settings button below the Navigator:

Or from the toolbar:



The View Settings dialog is displayed:



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

Selected	Name	Add
	No WMS layer	Edit
V	DK KMS	Edit
	NSIDC	
	WORLDMAP	
	CZ	
	local	
		Remove
Transp	arency:	
ess		Mor

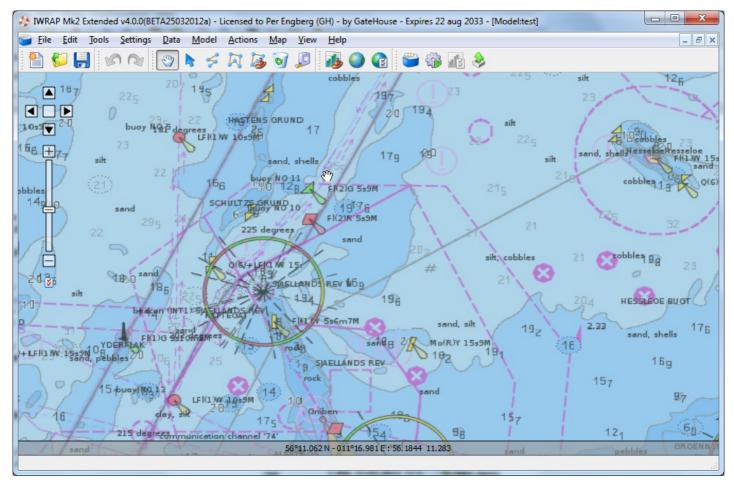
One or more WMS services can be defined, but only one can be active at the time. The WMS layer is drawn on top of the background map e.g. OpenStretMap, the WMS layer can be made transparent so that it is possible to mix and see both maps.

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.

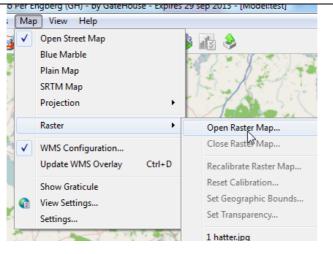
Navigating the MAP

🛟 WMS	Configuration	? ×				
Name:	WORLDMAP	Styles:				
Host:	www2.demis.nl	Username:				
Port:	default 🚔	Password:				
Path:	/worldmap/wms.asp	Filter:				
Version:	1.1.0	Transparent:				
Layers:	Countries,Borders,Coastlines					
Max tile o	diagonal distance: Disabled 🚔					
📃 Geo	graphical boundary					
	✓ North 90°00.	.000 N				
√ We	st 180°00.000 W	✓ East 180°00.000 E				
	✓ South 90°00.	.000 S				
Outside	e label: 🗌 Frame	boundary cells Copy boundary from map				
Base request: =application/vnd.ogc.se_inimage&ignoreillegallayers=TRUE&format=image/IMAGEFORMAT&TRANSPARENT=true Copy to dipboard Paste from dipboard						
		OK Cancel				

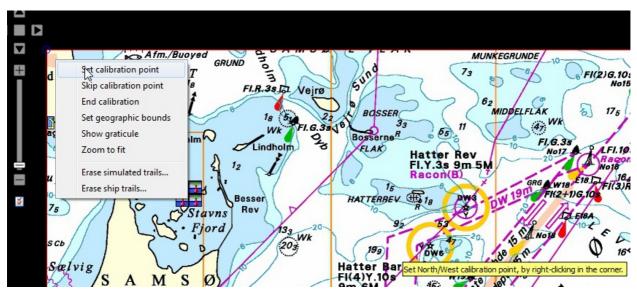
Here is an example of a comercial Danish WMS layer.



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



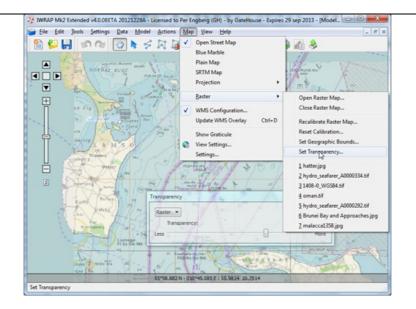
Select the file you want to import. If the file is not a GeoTIFF you will be asked to calibrate the map. Calibration is only necessary if the chart has a boundary, then you have to right click and specify each corner of the map. If the map does not have a boundary you can skip the calibration.



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

Format:	DD®MM.mmm' H 🔫
North Latitude:	55°58. 199' N
South Latitude:	55°42.600' N
West Longitude:	010°33.000' E
East Longitude:	011°15.000' E

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



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:

~~~	A 2110/2010 Election to per (gateriouse) by Gateriouse Expires 15 Jul 21									
Data	Data Model Actions Map View Help									
<b>1</b>	Data management	•		Import Data						
8	Density plot	•		Import Additional Data						
	Extract model	•		Export Data						
	Emission Analysis	•		Inspect Data Time Distribution						
	Show Simulator			Incidents						
_	63.	-		Import Static Ship Data						
	24 7 0			- N						

the 'Static Ship Data Import' dialog is invoked:

🛟 Static Ship Dat	ta Import				? X
Files:					
					Add file
					Remove file
Choose existing fo	ormat:			Load Save	Load last
Field delimiter:	hoose 🔻 Start i	mport at row: 1	▲ ▼		
Fields:					
Header	From file	Туре	Format		Define field
					Clear field
Format to clipboa	rd Format from d	ipboard Data	snippet to clipboard	ОК	Cancel

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.

Static Ship	p Data Import			? 🛛
Files:				
C:/user/gh/iwi	rap/impl/doc/ship_impo	rt/ex1.txt		Add file Remove file
Choose existing Field delimiter: Fields:		mport at row: 2	•	oad) Save)
Header	From file	Туре	Format	Define field
MMSI Ship type Length	356075000 "LNG Tanker" 207	MM5I Length		Clear field
<				>
			ОК	Cancel

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:

\varTheta Field Definit	tion ? 🔀
Header:	Ship type
Field contents:	"LNG Tanker"
Field type:	✓
Field format:	×
Extracted value:	
	OK Cancel

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

🗢 Field Definit	lion 🤶 🔀
Header:	Ship type
Field contents:	"LNG Tanker"
Field type:	✓
Field format:	×
Extracted value:	
	OK Cancel

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

Static Ship Data Import Progress
Progress         Total:         Current step:         Completed in Osecs         -New ships = 2         -Nodified ships = 0         -Rows in files = 2         Processing C:/user/gh/iwrap/impl/doc/ship_import/ex1.txt completed, rows=2         Processing C:/user/gh/iwrap/impl/doc/ship_import/ex1.txt         Importing selected files
Start Close

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:

A 211	vov2013a - Licensed	to pcn	(gate	enouse) - by GateHouse - Expires 19 Ju	4
<u>D</u> ata	<u>M</u> odel <u>A</u> ctions	<u>M</u> ap	Vi	ew <u>H</u> elp	
<b>1</b>	Data management	×		Import Data	ł
8	Density plot	•		Import Additional Data	ł
	Extract model	•		Export Data	I
	Emission Analysis	•		Inspect Data Time Distribution	I
	Show Simulator			Incidents	
200	- 19 ⁻¹⁰			Import Static Ship Data	I

or using the tool buttons:



#### the 'Data Import' dialog is invoked:

🤣 Data Import	? ×
Files:	
	Add files Add directory contents Remove file
Choose existing format:	Clear ad Save Load last
Field delimiter: Choose  Start import at row: 1  Text quote character: None  Fields:	
Header From file Type Format	Define field
Format to clipboard Format from clipboard Data snippet to clipboard	OK Cancel

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,13tsWI?0011:9UHQQj87DHEn00Rj,0*43 1-4-2008 14:06:38 < tab > !AIVDM,1,1,,A,33u=Qm?qh20nEWbQ0IB3K87I0000,0*19 1-4-2008 14:06:58 < tab > !AIVDM,2,1,2,A,53u?j?P1joL=<@HP000eDhhDp00000000000011HA4440HtP00000,0*6A 1-4-2008 14:06:58 < tab > !AIVDM,2,2,2,A,0000000000000,2*26 1-4-2008 14:07:01 < tab > !AIVDM,1,1,,B,14QsDc04Qn19nJ`P1?;9F7I0800,0*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,13tsWI?0011:9UHQQj87DHEn00Rj,0*43 1-4-2008 14:06:38 < tab > !AIVDM,1,1,,A,33u=Qm?qh20nEWbQ0IB3K87I0000,0*19 1-4-2008 14:06:58 < tab > !AIVDM,2,1,2,A,53u?j?P1joL=<@HP000eDhhDp000000000000001HA4440HtP00000,0*6A !AIVDM,2,2,2,A,00000000000000,2*26 1-4-2008 14:07:01 < tab > !AIVDM,1,1,B,14QsDc04Qn19nJ`P1?;9F7Il0800,0*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.:

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

#### \g:1-2-

U:122 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,E4p231]@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,53I;DL01r5P3TP`GP00= \g:2-2-0570*5F\!BSVDM,2,2,0,A,0000000002,0*3D \c:1351245453*5E\!BSVDM,1,1,,B,13I;DL000g0daWNOjJ>s:Hf0HCM,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;136,90000000;5,600000000;146;8812631;"3FRK5";"ID BULKER";70;146;28;16;12;6,20000000 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;6,20000000 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;6,20000000 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;6,20000000

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').

🐉 Data Import					? ×
Files:					
D:\iwrap_data	\training\clean\Hatter_b	arn\aisdata\Hatter Apr	2009.csv	Add dire	Add files
Choose existing	format:		Load	) [Sav	Clear
- Field delimiter:	;	oortatrow: 2 🚔			
Text quote chara		-			
Fields:					
Header	From file	Туре	Format	-	Define field
datetime	01-04-2009 04:35:14				Class Cald
mmsi	244632000	MMSI			Clear field
longitude	10.950000	Longitude	Decimal degrees		
latitude	55.922833	Latitude	Decimal degrees		
navstatus	0		_		
rateofturn	0	ROT			
cog	219	COG			
son	13.7	SOG			
Format to clipbo	Format from clipboa	Data snippet	to clipboard	ОК	Cancel

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.

🗢 Field Definit	tion ? 🔀
Header:	"Time"
Field contents:	1-4-2008 14:06:08
Field type:	✓
Field format:	<b>~</b>
Extracted value:	
	OK Cancel

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

👽 Field Defini	tion [ [ 🔼
Header:	"Time"
Field contents:	1-4-2008 14:06:08
Field type:	Date/Time 🛛 👻
Field format:	d-M-yyyy HH:mm:ss
Extracted value:	ti apr 1 2008 14:06:08
	OK Cancel

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 <u>Time Format</u>

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:

😂 Field Defini	tion 🔹 🛛 🤉 🔀
Header:	"TypeOfShipAndCargo"
Field contents:	70
Field type:	✓
Field format:	<b>~</b>
Extracted value:	
	OK Cancel

Set 'Field type' to 'Ship Type' and set 'Field format' to 'AIS. WRAP indicates how the field will be interpreted i.e. the 'Extracted value' will be 'General cargo ship'. WRAP 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.

🛟 Data Import Progress	?×
	-01-2000 00:00
🛛 🗖 Geographical boundary	
✓ North 55°     ✓ West 010°07.613'E      ✓ South 55°	East 011°40.687 E
Missing Data Duration Threshold Threshold: 10 min * Error Handling Stop if consecutive number of errors >= Disabled **	Image: Constraint of the second se
Stop if total number of errors >= Disabled	Min distance: 250 m
Progress	0%
Current step:	0%
Copy log to clipboard Back	🖓 Start Import 🛛 Ok

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.

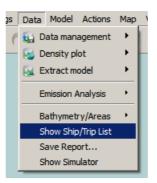
When the dataset has been successfully imported you are ready to try and create a Density Plot

# **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.

/4.	5.2BET	A 085E	PT2014	b - Lie	censed	to pch	(gatehou	se) - by G	iatel
s	Data	Model	Actions	Мар	View	Help			
P	🙀 D	ata mana	agement	•	🙀 Im	port D	ata		
_	S D	ensity plo	ot	•	Imp	oort Add	litional Data	a	ľ
	👰 Б	xtract mo	odel	•	Exp	oort Dat	a		
	E	mission A	nalysis	•		pect Da ract Tric	ta Time Dis	tribution	
		athymetr how Ship		•		idents		_}₹	
	Si	ave Repo	ort		Imp	oort Sta	tic Ship Dat	a	
	S	now Simu	ilator	_					

### The result can be accessed from:

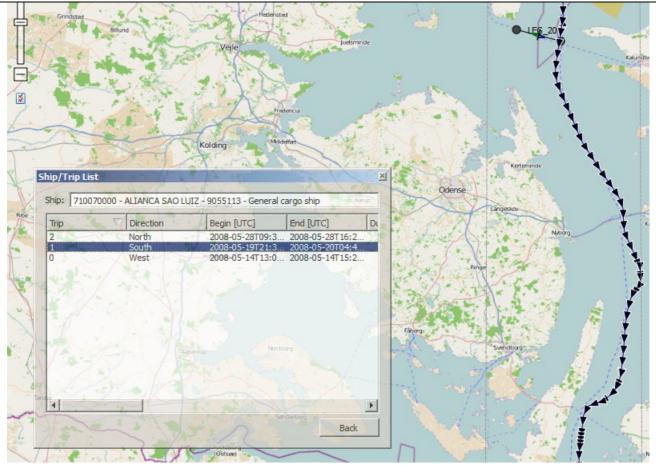


This will display a list with all the ships. Its a good idea to have look at the imported ships and check how many of the have type and length.

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

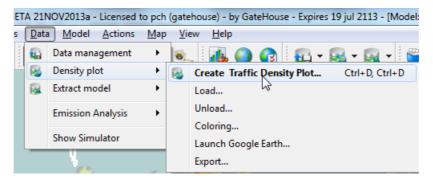
a series of	TALL	in the	Fredericia	Starting .	
	the state	Acres			
1000	El mart	the water	Middelart		N 20 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1.1	Jake	olding	Montan S.		
	1.1.	1 PAL	a second second	a state of the second	Kerteminde
ip/Trip List		Carl Laboration	and a full a set	XI CONTRACTOR	Kerteminde
ip/inplise	i hay the sead	and refe		The state of the s	
ilter:		1.5.5.	Arus	Odense	
incer.		stansfeld	a contraction of the second		jeskov 3
MMSI	V Name	IMO	Туре	AND	STAL /
888404000	HELENE H	7803530	General cargo ship	I LANDAN I	Nyborg
710070000	ALIANCA SAO LUIZ	9055113	General cargo ship	and a far had	- Aria
664445000	SEYCHELLES PAT	9365635	Oil products tanker	St. a Jay Co	
664444000	SEYCHELLES PRE	9365623	Oil products tanker	Ringe	
664288000	SEYCHELLES PIO	9255517	Oil products tanker	as the second	C. C. C.
664209000	SEYCHELLES PRI	9251664	Oil products tanker	1-3-11-X-1-X-	
636091592	ELBTANKDENMARK	9234680	Oil products tanker	in The state of	A CARA A AND
636091586	HELLESPONT CHI	9321110	Oil products tanker		
636091392	MAERSK SEMARA	9330070	General cargo ship		14 State 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
636091269	MAERSK SEOUL	9306550	General cargo ship	Fiborg	603588° (C 🛊 🛛
636091186	HAMBURG STAR	9298325	Oil products tanker		ndborg
636091147	MELIDE	9192765	Oil products tanker		
636091128	MAERSK SARNIA	9289946	General cargo ship		
636091119	URALS STAR	9309435	Oil products tanker		
636091094	HAWK BAY	9016674	General cargo ship	train march 10	
636091018	CAPE BANKS	9081382	Oil products tanker	A The Part	
	12		Satulation	Parts I at	La Ditt 1
Extract trips	1 2 1 1 1		Show trips for selected	and age	
a second second				A A A A A A A A A A A A A A A A A A A	

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.

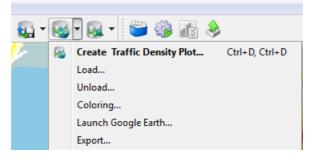


# **Density Plots**

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.

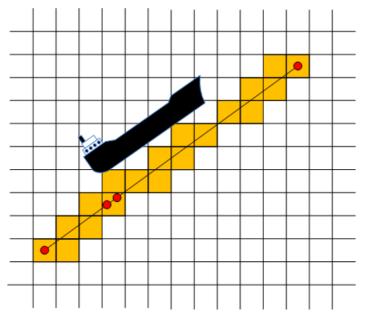
🛟 Create Traffic D	ensity Plot			? X
Parameters				
Density cell size:	50 m	Max time:	900 s	
Min distance:	10 m	Min calculated speed:	1,0 kn	
Max distance:	4000 m	Max calculated speed:	100,0 kn	<b>*</b>
			Show advanced of	options
Progress Total:				0%
Copy log to clipboa	rd Copy list of used ships to clipb	oard Reset settings	🚳 Start	Close 슈

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

**Density Plots** 

Create Traffic Density Plot	<b>NA 1</b>		? ×			
Parameters			13			
Density cell size: 50 m	×	Max time:	900 s			
Min distance: 10 m		Min calculated speed:	1,0 kn 🚖			
Max distance: 4000 m	A. V	Max calculated speed:	100,0 kn			
			Hide advanced options			
Directories	Directories					
Dataset: d:\jwrap_test\kasi_g	Dataset: d:\www.ap_test\kasi_great_belt\imported_ship_data					
Result: d:\jwrap_test\kasi_g	Result: d:\jwrap_test\kasi_great_belt\density					
<ul> <li>✓ North</li> <li>✓ West 011°06.432' E</li> <li>✓ South</li> <li>✓ Filter</li> <li>Define filter</li> <li>Save filter</li> </ul>	East	Copy boundary from	map Load filter			
Progress Total: Copy log to clipboard Copy list	of used ships to clipbo	ard) Reset settings	0%			

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...'.

Data Filter				? ×
√ ▼ Time				
Include O Exc	lude			Reset
👿 Begin time	01-04-2008 00:0	00 🔻 📝 End time	31-05-	2008 23:59 🔻
Ship filter				
Include O Exc	lude			
MMSI	IMO	Name	IWRAP Type	Add
710070000	9055113	ALIANCA SAO	General cargo s	
Ship type filter <ul> <li>Include only</li> </ul>	Exclude			
Туре	Length	Speed	Draught	Add
General cargo s	>=100	>=0	>=0	Edit
•	III		4	Remove
			ОК	Cancel

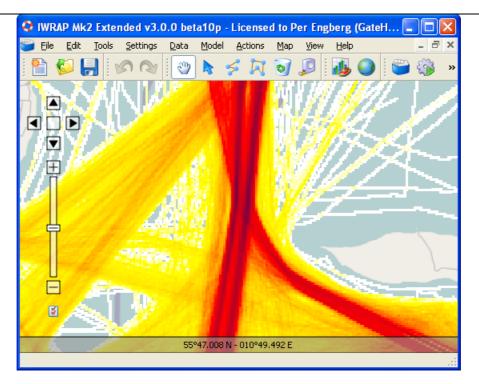
It is possible to include or exclude specific ships, or specify a filter for a ship type. The ship type filter can be specified for 'Any' ship or for one or more of the IWRAP ship types. In the above example it is chosen to exclude a specific ship and include all other ships with a speed >= 10.

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

The <u>Time of day filter</u> can be also be used to filter the dataset.

V Time of Day F	ilter	
Define firter	Save filter	Load filter

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'

🗘 Gradier	nt Editor			? 🗙
Method: 🝳	uantiles 🔽			
	Stop	Color		Add
	100 95 48 0			Edit
Transparence	р :у:		ОК	Remove

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':

	🙀 = 🐼 = 🐼 =
🛟 Ma	ap View Settings
-Lab	els Legs
V S	how Legs 🛛 🐼 Show Waypoints
⊽ s	how Incidents
V S	how Areas 🛛 Show Traffic Areas
V S	how Lateral Distribution
🔽 S	how Histograms
🔽 S	how Angle Analysis
	Minimum traffic per angle: 5 % 荣
<b>V</b> D	raw Arrows on Angle Analysis Histogram
	how Density 📄 Dynamic Coloring 📄 Show Legend ity smoothing: 📄 👘 0 👘
v 🗆	isualise Maximum Leg Width 🛛 🖉 Show Leg Extension
II 🔽	ndicate Errors on Legs etc
▼ S	how Detailed Leg Info Tooltip
▼ S	how Simulated Tracks
	Reset OK Cancel

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.

Time of Day Filter	? ×
Timezone: (GMT+01:00) Brussels, Copenhagen, Madrid, Paris	▼ Start of Week: Monday ▼
24	
18.	
12. 11:08	
6-	
0 to jan 21 2010	
✓ Specify intervals manually Set by day Set by week Invert Exclude/Include	
Use sun postion	Position used for sun calculation preview
Degrees below horizon: Nautical Dawn/Dusk 🔻	Latitude: 00°00.000 N
Invert	Longitude: 000°00.000 W
	Use dataset center Use model center
	OK Cancel

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...':

🎲 Day Time Range Filter
Time range Begin: 16:00 + End: 18:00 +
Indude/Exclude          Include data between begin/end
<ul> <li>✓ Apply to date range</li> <li>From (including): 02-jan-2010 ▼ To (including): 31-mar-2010 ▼</li> </ul>
Apply to week range From (including): Week 53 - lø jan 2 2010 To (including): Week 53 - lø jan 2 2010
From (including):       jan-2010         To (including):       jan-2010
Apply to entire range

or 'Set by Week':

GateHouse	A/S
-----------	-----

💱 Week Time Range F	Filter						? ×
Fetch from week Week: Week 1 - ma	jan 4 2010	•	·				
Week ranges	Monday 1	uesday	Wednesday	Thursday	Friday	Saturday	Sunday
Include/Exclude:	<b>V</b>		<b>V</b>		<b>V</b>		
Begin:	06:00 🌻	06:00 韋	06:00 🌻	06:00 🌻	06:00 🌲	06:00 🚖	06:00 🌻
End:	18:00 🌲	18:00 韋	18:00 🌲	18:00 🌲	18:00 🚖	18:00 🌲	18:00 🌲
Image: Apply to date range         From (including):	-jan-2010 🔻	To (includir	ng): 31-mar	-2010 🔻			
Apply to week ran	ge						
From (including): We	ek 53 - lø jan :	2 2010	To (includi	ng): Week	53 - lø jan 2	2010 🔻	
Apply to month rar	nge						
From (including): jan	-2010 🔻 To	(including):	jan-2010	<b>T</b>			
Save Lo	ad	Ap	ply to entire r	ange		OK (	Cancel

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.

🛟 Time of Day Filter	8
Timezone: (GMT+01:00) Brussels, Copenhagen, Madrid, Paris Entire Period: -	▼ Start of Week: Monday ▼
24 .	
18 .	
12.	
6.	2.5
0	on mar 24 20
Specify intervals manually           Set by day         Set by week         Invert Exclude/Include	
✓ Use sun postion	Position used for sun calculation preview
Degrees below horizon: Nautical Dawn/Dusk 🔻	Latitude: 56°02.349 N
Invert	Longitude: 012°39.636 E
	Use dataset center Use model center
	OK Cancel

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.

Time of Day Filter	? ×
Timezone: (GMT+01:00) Brussels, Copenhagen, Madrid, Paris	▼ Start of Week: Monday ▼
Entire Period: -	
24	
18.	
12	
	7:51
6.	▶
. 0	to mar 4 2010
Specify intervals manually	
Set by day Set by week Invert Exclude/Include	
Vuse sun postion	Position used for sun calculation preview
Degrees below horizon: 28 🗸	Latitude: 56°02.349 N
Invert	Longitude: 012°39.636 E
	Use dataset center Use model center
	OK Cancel

Press Ok to use the filter.

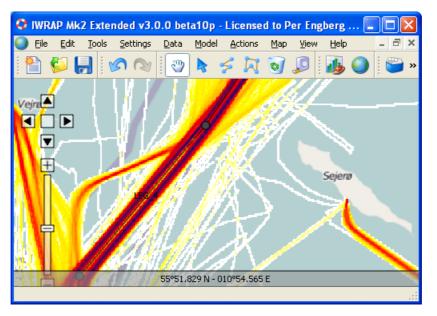
When you are using a Time of Day filter you can see the following table in the log. The table displays the number of samples include/excluded due to the filter for each day/hour of the week.

-Out of order =	= 0 samples					
Time of day fil	ter used!					
Samples pr day	y pr hour ((0	GMT+01:00) Bru	ussels, Copenha	gen, Madrid, Pai	ris) (included/ex	clud
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

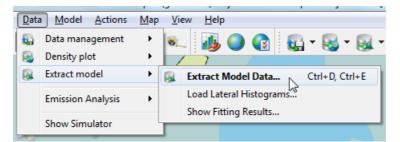
#### **Extract Model Data**

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.

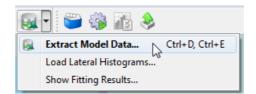
You should already have imported some traffic data into a dataset, created a density plot, and entered the legs, i.e. you should have something like shown below:



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.

🐓 Extract M	odel Data			2	×
Parameters	s				
Angle:	10 deg 🌲	Min calculated	speed:	Disabled	* *
Bin size:	100 m 🌻	Max calculated	d speed:	100,0 kn	* *
Max time:	900 s 🌲	Max distance:		4000 m	* *
🔽 Use ca	lculated geograph	ical boundary	Show ad	dvanced op	tions
-Checkir -Not cor	ed in 60secs ng leg errors, ple nnected = 2265 s ted = 193413 sar	amples			0%
	e above maximu				
-Time ab -Calculat -Outside -Change	bove maximum bove threshold = ted boundary = boundary calcu d decision: = 12	1379 samples (56.0071, 10.63 ilated geograpi	68), (55.7	074, 11.30	
•					•
Copy log to	dipboard		🏐 Start	0	lose

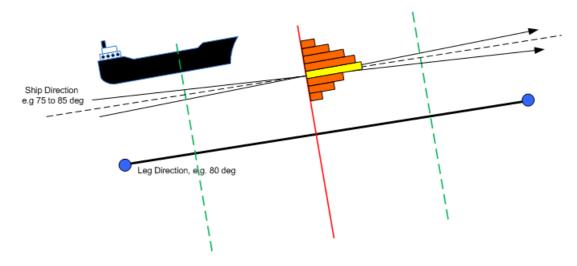
Press 'Show advanced options' to see all possible settings.

🛟 Extract Me	odel Data	1						2	x
Parameters	;								
Angle:	10 deg			▲ ▼	Min calculated speed:	Disabled			*
Bin size:	100 m			▲ ▼	Max calculated speed:	100,0 kn			*
Max time:	900 s			<u>▲</u> ▼	Max distance:	4000 m			
🔽 Use cal	culated ge	ographica	l boundary				Hide	e advanced optio	ns
Fit distribut	ions				6			Traffic volumes	
Fit: Detail	ed		•					Extract	
Min. width	(normal)	2 bins		Smoothing:	2 bins		*	Convert to	year
Min. width	(uniform)	2 bins							
Debug				Time of Da	y Filter		Passa	ge Line Angle Ana	alysis
Filter:			🗖 Log	Define filter	. Save filter Loa	d filter		figure settings	·
Progress									
Total:									0%
Complet -Checkin			wait						Â
-Not con	nected =	2265 sam	nples						Ξ
		413 samp	lles threshold = 183 sam	nlas					
			reshold = 881 sampl						-
			379 samples	-					
-Calculat	ed bound	dary = (56	5.0071, 10.6368), (55.	7074, 11.3049)					
		-	ed geographical= 1	0410 samples					
-Change									
-Samples	s used for	more tha	in one leg: = 0 samp	les					Ŧ
Copy log to	clipboard						- 🚯 S	Start Clo	se

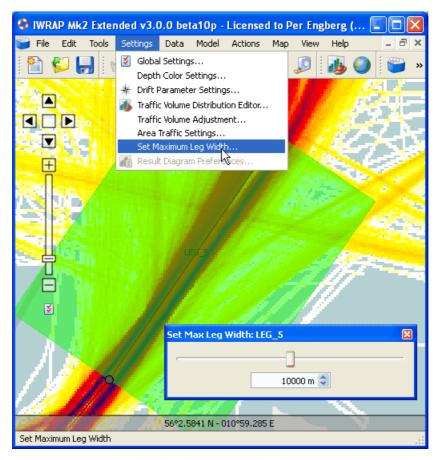
The following parameters can be adjusted:

• 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

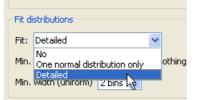
- Bin size. The size of the bins/intervals of the generated histogram.
- Max time. Maximum time between samples, i.e. if samples are separated by more than this factor a new journey is assumed.
- Min calculated speed, samples with speed below this limit is not included.
- Max calculated speed, samples 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 number, this option should only be used for validation/inspection.

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

📝 Time of Day Fi	lter	
Define fitter	Save filter	Load filter

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 WRAP to do a fit, in such situations you should define the distribution manually.

Fitting Error Overview		? 🛛
Fitting Error Overview           Error         Leg         Direc           0.0960479         LEG_5         North           0.0627611         LEG_4         South           0.0578818         LEG_4         North           0.0300393         LEG_5         South           0.0297352         LEG_3         North	Error=0.0960479	
	-4306m	
Edit		Close

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

0	IWR	AP MH	2 Exte	nded v3.	0.0 bet	ta10p -	License	d to P	er Eng	berg			×
0	Eile	<u>E</u> dit	Tools	<u>S</u> ettings	<u>D</u> ata	<u>M</u> odel	<u>A</u> ctions	<u>М</u> ар	⊻iew	<u>H</u> elp		- 8	×
		<b>6</b>	<b>,</b>	<b>S</b> (2)	1		\$ A	0		4	0	6	»
K		) ) <b>&gt;</b>											
	Ē			1	55°58.6	621 N - 0	11°2.0617	E			1	- F.	
													:

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

Passage Line Angle Extracti	on ? X
Bin size:	Same as extract
Max angle from leg:	20 deg 🚖
Number of angle bins:	1
Number of passage lines pr leg:	3
Ok	Cancel

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

3	Passage Line Angle Analysis	
	Configure settings	

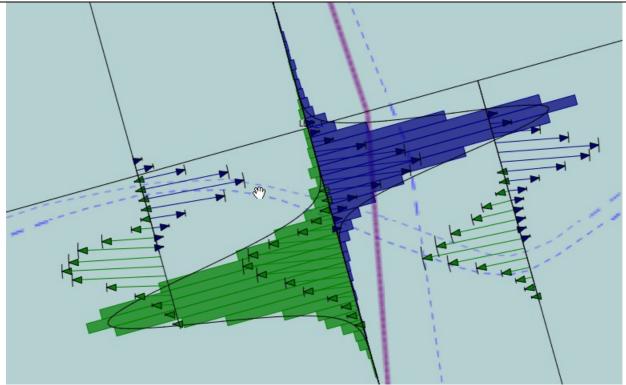
This analysis divides a passage line in to a number of bins and analysis the ships crossing angle. The result is a plot where a line is drawn from the center of the bin, the direction of the line is mean of the angles and the length is relative to the number of ships. The lines of the plot should follow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

The following parameters can be specified:

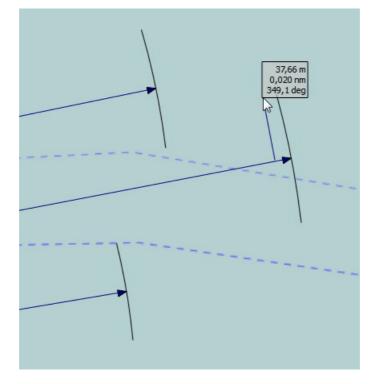
Passage Line Angle Extraction	on ? X
Bin size:	Same as extract
Max angle from leg:	20 deg 🄶
Number of angle bins:	1
Number of passage lines pr leg:	3
	Cancel

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:

Data	<u>M</u> odel <u>A</u> ctions	Map	<u>V</u> i	ew <u>H</u> elp	
	Data management	×		Import Data	IE
8	Density plot	•		Import Additional Data	
8	Extract model	•		Export Data	
	Emission Analysis	•		Inspect Data Time Distribution	
	Show Simulator			Incidents	
	~			Import Static Ship Data	
	200	07	_		

#### the 'Incident List' is displayed:

	21 12 12		
Incident L	ist		8
From	26-01-2012	<b>To</b> 26-0	1-2012 🚊
Collis	ion (0)	🔽 Grounding (	0)
📝 Mach	. Failure (0)	Fire/Explosi	on (0)
📃 Othe	r (0)	Total (0)	
Filter I	by model region	Remove reg	ion filter
Search:			
II 🖭 [	Туре	Date	ID
	d incidents from	<u></u>	
Add	a incidents from	ine j	
0	< <u>III</u>		Þ

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

GateHouse A/S

Importing Incident Data

🧦 Incident Import	? ×
Incident store: C:/Users/pch\jwrap_incidents.inc Files:	
	Add files Add directory contents Remove file
Choose existing format: Field delimiter: Choose  Start import at row: 1  Text quote character: None	Clear Load Save
Fields:	
Header From file Type Format	Define field
Format to dipboard Format from dipboard Data snippet to dipboard	Start Import Ok

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

Files:	/Users/pch\iwrap_inc	idents.inc		
	nland\incidents.csv	,		Add files Add directory contents Remove file
Choose existing for Field delimiter: [; Text quote charact	▼ Start	import at row:	2	Clear Load Save
Fields: Header	From file	Туре	Format	Define field
Casualty Date Location Port Port Country	01-12-2012 North Atlantic	Date	d-M-yyyy	Clear field
Cause 1	Machinery dam.	Incident Typ	e k	

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.

🛟 Field Definitio	n 🤋 🗙
Header:	Cause 1
Field contents:	y damage/failure (e.g. lost rudder, fouled propellor)
Field type:	Incident Type 🔹
Field format:	<b></b>
Extracted value:	Machinery Failure
	OK Cancel

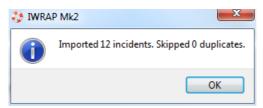
Select the 'Field type', in this case 'Incident type'. Notice that the 'Extracted value' now reflects the value as interpreted by IWRAP. Please check that the interpretation is correct. If the 'Incident type' contains 'colli' as part of the contents it is interpreted as a collision, i.e. is does not 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

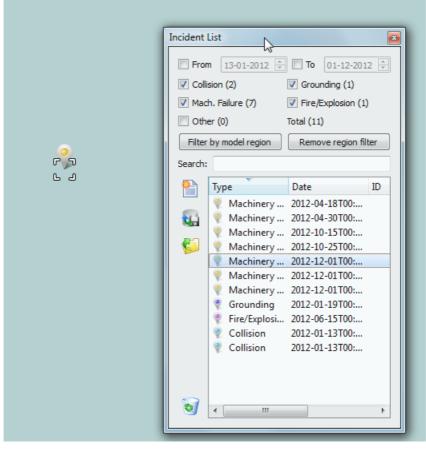
When you specify e.g. the Date and the if the format that is used is not listed in the Field format, you can type it directly, see <u>Time</u> <u>Format</u>.

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

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 edittor is invoked:

1	🛟 Incident	2 ×
	Case ID:	
	Type:	Collision
	Original type:	
	Time:	01-01-2000 00:00
		t: DD⁰MM.mmm'H ▼
	_	
		0°00.000' N
	Longitude: 0	00°00.000' W
	Ships:	
	Link:	
	Description:	
		OK Cancel
		OK Cancel

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

# **Export Data**

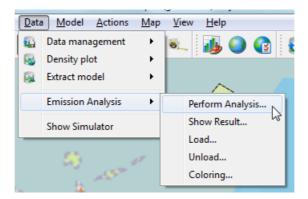
The export data feature enables you to export a dataset to CSV format. This can be used for validation or exchange of data. The Data file will contains the dynamic data and the Ship file will contains static information about the ship. If you specify an empty Data file only the ship information will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

😂 Data Exp	port	?×
-Dataset		
Location:	C:/iwrap_data/great_belt/all_data	
Destination	1	
Data file:	C:/iwrap_data/great_belt/all_data.csv	
Ship file:	C:/iwrap_data/great_belt/all_data_ship.csv	
Options		
Field delimi	ter: ; 💽 🖸 Add header	
Progress -		
	0	%
	Start Close	•

## **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.

Emission Analys	iis			/		? ×
Parameters						
Density cell size:	2500 m 🌲	Max time:	900 s	Max speed:		50,0 kn 🚖
Min distance:	10 m 🌲	Min calculated speed:	1,0 kn	🚔 🔲 Central	latitude:	00°00.000' N
Max distance:	4000 m 🗘	Max calculated speed:	100,0 kn	🗧 🔲 Store C	ell Data	
					Show ad	vanced options
Progress						
Total:						0%
Copy log to clipboa	Copy list of	used ships to dipboard	Reset set	tings	🔉 Start	Close

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

GateHouse A/S

Density o Min distar	ell size: 250		Max time:	900 s	Max speed	d: al latitude:	50,0 kn
Min distar Max dista		m 🖵 )0m 韋	Min calculated speed Max calculated speed			Cell Data	00°00.00
						Hide ad	lvanced op
Directorie	1						
			t_belt\imported_ship_	data			
Result:			t_belt\emission			_	
Geogra	aphical boun	dary √ North	56°06.671' N			D	irection
√ West	010°02.35	51' E		East 011°54	180' E		
		√ Sout	55°32.962' N	Copy b	oundary from map		$\downarrow$
🔲 Filter				Time of	Day Filter		
Define fil	ter Sav	ve filter	Load filter	Define filt	er] Save filte	r Load	filter
Progress							
Total:							

A number of parameters can be used to control the creation of a the analysis, the parameters are mostly identical to the <u>Density</u> <u>Plot</u>. 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.

NRAP Mk2 Extended v4.0.08[TA 20121228A - Licensed to Per	ingberg (GH) - by GateHouse -	Expires 29 sep 2013	- [Model:test]		0 0
File Edit Jools Settings Data Model Actions Mo	p Yiew Help				
S		S 63 10 5		0	
The second se	2 Emission Result			0	0.0
	Tetal [1] CD2 [5] 5	02 (t) NOx (t)	Puel (t) Particle	e (td	
		C02	\$02	NOx	Fuel *
	Chemical tanker	0,00	0,00	0,00	100
	Gas tanker	0,00	0,00	0,00	
and the second second	Container ship	0,00	0,00	0,00	
Odense	General cargo ship	21.038.87	419.25	666.03	66
	Bulk carrier	0,00	0,00	0,00	
	Ro-Ro cargo ship	0,00	0,00	0,00	
a la	Passenger ship	5.610,64	3,55	97,50	1.7
and the second	Fast ferry	211,78	0,14	1,11	1.1
	Support ship	2.595,13	51,71	82,15	
S. A.	Fishing ship	63,30	0,63	1,26	
	Pleasure boat	44,32	0,03	0,77	
C. The State of the second	Other ship	1.543,30	15,38	30,76	5
A CONTRACTOR OF CONTRACTOR	Total	50.405.33	875,17	1.490.52	15.97
	* (				

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').
Μ	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').
уу	the year as two digit number (00-99)
уууу	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)
Н	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)
<b>ZZZ</b>	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	D	efault value
Year	1	900
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.