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Description of dispersant application and booms introductions

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This is the addition that has been made to the PART manual describing the way dispersant applications and booms introductions have to be specified in the input file. These features are also not supported by the PART GUI yet.

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1 Hidden features D-WAQ PART

1.1 Initial conditions, oil dispersant and oil booms for the oil module

For the oil module a number of special features is available to give an initial conditions, add oil dispersants and introduce booms to the model. For backwards compatibility the original switch for initial oil has been extended to allow the user define dispersant releases and oil boom introductions as well in a flexible manner. The initial oil setting is already supported by the PART GUI, the dispersant and boom features are not. Currently the GUI produces a section in the inp-file that looks like this:

```
 ;                              Initial condition (oil only)

                0 ; 0 = no initial particles
                  ; 1 = initial oil patches (from *.ini file)
```

When only using inital conditions for oil, this secion can remain the same. To introduce dispersant releases or oil booms, the user can modify the inp-file to an extended switch like this:

```
;                              Special options for oil only
              111;     switches for booms, dispersants and initial conditions
;
;     initial condition for oil (from v3.66)
;     oil_opt  = xx0 : cold start (no particles ar t=0)
;              = xx1 : warm start oil patches to be read from  ini-file
;
;     dispersant events (from v3.76)
;     oil_opt  = x0x : no dispersant events
;              = x1x : dispersant events with with direct chance to disperse per oil type
;
;     boom events (from v3.76)
;     oil_opt  = 0xx : no boom introductions
;              = 1xx : boom introductions with direct chance per day to pass the oilboom
;
```

It is possible to combine all of the features. Setting up each of the features will be explained here.

1.1.1 Initial condition file for the oil module

The initial condition file (ASCII format) specifies one or more polygons that define surface oil patches. Each individual patch can be generated using QUICKIN, by creating a polygon file for each patch, for the file format see section 1.2. If the polygon is not closed, then PART will close it by connecting the first and last co-ordinate of the polygon. More than one patch may be created. A header will then need to be added to each patch to specify the type and amount of oil for this patch and the number of particles associated with this patch. The type of oil will need to be the same as one of the oil types in the input file. An example of a initial conditions file is shown below.

```
*
*  Fraction:   Ekofisk
*  Mass:       1000000 kg
*  Particles:  10000
L00001
          13           2
   1.8809943E+05   6.1560469E+05
```

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```
   1.8784460E+05   6.1639466E+05
   ...
   1.8860074E+05   6.1533856E+05
   1.8809943E+05   6.1560469E+05
*
*  Fraction:   Heavy Fuel Oil
*  Mass:       1000000 kg
*  Particles:  20000
L00002
          22           2
   1.9166405E+05   6.2069936E+05
   1.9486139E+05   6.2244163E+05
   ...
   1.9110883E+05   6.1937831E+05
   1.9166405E+05   6.2069936E+05
```

The keywords `Fraction`, `Mass` and `Particles` are compulsory. The $*$ at the beginning of the line is also required. These three keywords are then followed by a specification of the polygon name. The next line specifies the number of rows and number of columns that define the polygon, followed by the x, y data.

This $<*$.ini$>$ file can be visualised in the visualisation tool of the PART-GUI, by importing the file as a land boundary file.

In the input file the use of initial oil patches looks like:

```
 ;                              Initial condition (oil only)

              1 ; 0 = no initial particles
                ; 1 = initial oil patches (from *.ini file)
 'ekofisk_hfo.ini' ; Initial condition file (including polygones describing the oil patches)
```

- An integer indicating if initial oil patches from a file are used.

Δ If for the oil module initial oil patches are required, then the name of this file is specified.

1.1.2 Oil dispersant application events

As of version 3.76 the computational core of D-WAQ PART supports the definition of dispersant application events. This option is not yet supported trough the GUI, and thus require some editing of the inp-file by the user. What needs to be done is described in this part of the appendix.

```
;                              Special options for oil only
              011;     switches for booms, dispersants and initial conditions
;
;     initial condition for oil (from v3.66)
;     oil_opt = xx0 : cold start (no particles ar t=0)
;             = xx1 : warm start oil patches to be read from  ini-file
;
;     dispersant events (from v3.76)
;     oil_opt = x0x : no dispersant events
;             = x1x : dispersant events with with direct chance to disperse per oil type
;
;     boom events (from v3.76)
;     oil_opt = 0xx : no boom introductions
;             = 1xx : boom introductions with direct chance per day to pass the oilboom
;
 'ekofisk_hfo.ini' ; Initial condition file (including polygones describing the oil patches)

;                              Dispersant releases (oil only)
5    ; number of dispersant events
```

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```
; dd hh mm ss       Ekofisk         HFO       filename polygon
   0 16 45  0       0.950           0.500     'disp-app1.pol'
   0 17 0   0       0.950           0.500     'disp-app2.pol'
   0 17 15  0       0.950           0.500     'disp-app3.pol'
   0 18 30  0       0.950           0.500     'disp-app4.pol'
   0 18 45  0       0.950           0.500     'disp-app5.pol'
```

To accelerate the process dispersion (entrainment) of floating oil from the surface into the water column it is possible to release oil dispersant onto the water surface (see also **??**). These type of events can be added to the model by making extended use of the initial oil switch as described above in section 1.1. For dispersants that switch has to be changed to x1x. Then the user has to specify how many events take place, the time that the events take place (dd hh mm ss), the way the effect is parametrised, the effectiveness parameters itself, and the region where the dispersant is applied. The parameter given is the direct effectiveness of the dispersant, which work as a change that any specific particle within the defined polygon will disperse. This is combine with the already existing oil dispersion process.

The location where the dispersant is applied can be define by a polygon in TEKAL format, and can be generated using QUICKIN. For the file format see section 1.2. If the polygon is not closed, then PART will close it by connecting the first and last co-ordinate of the polygon. Currently the model only uses the first polygon in the file.

1.1.3 Oil boom introductions

As of version 3.76 the computational core of D-WAQ PART supports the introduction of oil booms. This option is not yet supported trough the GUI, and thus require some editing of the inp-file by the user. What needs to be done is described in this part of the appendix.

```
;                          Special options for oil only
              101;     switches for booms, dispersants and initial conditions
;
;     initial condition for oil (from v3.66)
;     oil_opt = xx0 : cold start (no particles ar t=0)
;             = xx1 : warm start oil patches to be read from  ini-file
;
;     dispersant events (from v3.76)
;     oil_opt = x0x : no dispersant events
;             = x1x : dispersant events with with direct chance to disperse per oil type
;
;     boom events (from v3.76)
;     oil_opt = 0xx : no boom introductions
;             = 1xx : boom introductions with direct chance per day to pass the oilboom
;
 'ekofisk.ini' ; Initial condition file (including polygones describing the oil patches)

; dd hh mm ss       type    Ekofisk         filename polygon
;                           Boom introductions (oil only)
3    ; number of oil boom introductions
; dd hh mm ss        Ekofisk         filename polygon
   0  06 00  0        0.900          'booms-initial.pol'
   0  09 00  0        0.900          'booms-extended.pol'
   0  11 00  0        0.850          'booms-full.pol'
```

To stop the spreading of floating oil, it is possible to introduce floating oil booms into the water. These type of events can be added to the model by making extended use of the initial oil switch as described above in section 1.1. For oil booms that switch has to be changed to 1xx. Then the user has to specify the time a certain oil boom layout is introduced, the type of efficiency parametrisation, the efficiency parameter (fraction of oil of each type that stays behind the boom per day), and the polygon file that contains the boom locations. In the current

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implementation there is a chance that the boom will not hold the particle. Then it will cross the boom as if it wasn't there. When it is held by the boom, it will bounce of from it to prevent cluttering of particles at the boom.

The location where the boom is located can be define by a polygon in TEKAL format, and can be generated using QUICKIN. For the file format see section 1.2. Opposed to what is said in the description, for booms the polygon does not have to be closed. PART will not close it by connecting the first and last co-ordinate of the polygon. Currently the model only uses the first polygon in the file. It is possible however to have separate disconnected sections of the boom by using (x=999.999, y=999.999) vertices in the polygon.

1.2 Polygon file

File contents	The co-ordinates of one or more polygons. Each polygon is written in a single block of data
Filetype	ASCII
File format	Free formatted
Filename	<*name*.pol>
Generated	RGFGRID, QUICKIN, D-WAQ DIDO, etc

Record description:

The file may contain one or more polygons. For every polygon the file should contain a line indicating the name of the polygon, followed by a line indicating the number of points making up the polygon and the number of coordinates, i.e. 2, finally followed by the coordinate data.

Record	Record description
	Preceding description records, starting with an asterisk ($*$), and will be ignored.
1	A non blank character string, starting in column one
2	Two integers representing the numbers of rows and number of columns for this block of data
	Two reals representing the x, y or λ, ϕ-coordinate

Restriction:

- ◇ The first record and the last record in the block should be the same

Example:

```
*
* Deltares, Delft3D-DIDO Version 3.39.01.4423:4459, Sep 25 2008, 20:10:54
* 2008-09-25, 22:11:08
*
Observation Area 001
       5   2
   1.8768018E+05   6.1708738E+05
   1.8996981E+05   6.1001035E+05
   1.9746314E+05   6.1266423E+05
   1.9480925E+05   6.1838830E+05
   1.8768018E+05   6.1708738E+05
Observation Area 002
       5   2
```

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```
   2.0011703E+05   6.1818015E+05
   1.9819166E+05   6.1063479E+05
   2.0568498E+05   6.0870942E+05
   2.0797461E+05   6.1599460E+05
   2.0011703E+05   6.1818015E+05
Observation Area 003
       5   2
   1.9340425E+05   6.1396516E+05
   2.0183425E+05   6.1365294E+05
   1.9944054E+05   6.0558720E+05
   1.9522555E+05   6.0595146E+05
   1.9340425E+05   6.1396516E+05
```

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