NOOS-Drift

CMEMS User Uptake tender 67-DEM4-L5

Specification of the simulation request package

Report of task T3.1

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List of the acronyms and abbreviations used

Co-Contractors acronyms:

RBINS	Royal Belgian Institute of Natural Sciences
MET Norway	Norwegian Meteorological Institute
Météo-France	French Meteorological Institute

Bonn Agreement	The Bonn Agreement is the mechanism by which the North Sea States, and the European Union (the Contracting Parties), work together to help each other in combating pollution in the North Sea Area from maritime disasters and chronic pollution from ships and offshore installations. The North Sea States are Belgium, Denmark, France, Germany, Ireland, the Netherlands, Norway, Sweden, and the United Kingdom of Great Britain and Northern Ireland.
CMEMS	Copernicus Marine Environment Monitoring Service
CCS	Central Communication System, the technical core of the NOOS-Drift service.
EuroGOOS	EuroGOOS is an international non-profit association of national governmental agencies, research organisations, and private companies, committed to European-scale operational oceanography within the context of the intergovernmental Global Ocean Observing System (GOOS). Founded in 1994, EuroGOOS has today 41 members from 19 European countries providing operational oceanographic services and carrying out marine research.
KPI	Key Performance Indicator
MSP	Drift Model Service Provider. This acronym represents all the operation drift forecast services connected to the central communication system.
NOOS	North West Shelf Operational Oceanographic System, one of the 5 ROOSes of EuroGOOS.
NWS	the European North West continental Shelf

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1 Introduction

1.1 About NOOS-Drift objectives

Drift models are multi-purpose tools that can forecast the drift trajectory of any objects, substances or resources that are drifting at the sea surface or in the water column. Typically activated several hundred to several thousands of times per year and per country, drift models are among the most valuable tools in the day to day management of the coastal and marine environment, marine resources and maritime safety. However, in order to better assess risk and impacts, the end-users benefiting from these drift services also often request to get accurate and reliable estimation of the uncertainty in the drift forecast.
To answer this difficult question, the members of the NOOS working group on drift have the ambition to develop and operate NOOS-Drift, a transnational multi-models ensemble system to assess and improve drift forecast accuracy in the European North West Continental Shelf Seas. Three members of this working group have taken the leadership to implement the system: **RBINS, MET Norway and Météo-France**.

NOOS-Drift implementation runs from the 15th of May 2018 until the 15th of November 2019.

NOOS-Drift ID Card

Service objectives:

1. To operate a transnational multi-models ensemble system that can produce drift forecast on demand.
2. To develop a set of quantified indicators on drift trajectory accuracy, estimated from the spread of the different drift models forecast connected to NOOS-Drift;
3. To discriminate which differences are due to different trajectory models and which are due to different forcing data;
4. To help identify possible outliers;
5. To improve the end-users trust in the drift model results and help guide them in their decision making process, *a real need expressed by users*

Service domain :
The whole ***European North West Shelf Seas***, with a focus on the territorial waters and exclusive economic zones of Belgium, France and Norway. NOOS members from Denmark, Germany, The Netherlands and Ireland have already expressed interest to join the system once developed and validated.

CMEMS area of benefits:

- Coastal and marine environment
- Marine resources
- Maritime safety

CMEMS products used by all the NOOS-Drift operators:

- northwestshelf-analysis-forecast-phys-004-001-b

NB: According to the NOOS-Drift operator, other CMEMS products are used either upstream to downscale and validate met-ocean forcing in coastal waters or directly as alternative met-ocean forcing in other areas.

NOOS-Drift service operation: from the end of the contract-onwards, if the present offer is awarded.

1.2 About this report

This report presents the **specification of the simulation request package**.

We initially thought this package should be composed of a JSON file providing all the meta-information on the simulation request and a netCDF-CF file[1] containing the initial position and release time of the Lagrangian particles. However, after the meeting in Brussels (Oct 2018), the consortium agreed to use openDrift functionalities to generate the initial particle cloud, meaning that the simulation request package should be reduced to a unique JSON object.

This report presents the specification of this object and is organized as follows:

- Section 2 defines what JSON objects are and how to handle them in python
- Section 3 presents the actual specifications of the simulation request package
- Section 4 presents some examples
- Section 5 presents the tools to generate the initial Lagrangian particles clouds

[1] The report of task 3.2 "Specification of the simulation result package" will details the format of the netcdf file to be used in NOOS-Drift framework.

2 JSON in a nutshell

2.1 JSON objects

JSON is a language-independent data format that uses human-readable text to transmit data objects consisting of attribute–value pairs:

```
"attribute" : value
```

More precisely, A JSON object is a list of attribute–value pairs delimited by curly brackets; each attribute-value pair being separated by a comma:

```
{
  "attribute1" : value1 ,
  "attribute2" : value2 ,
  "attribute3" : value3
}
```

While the attribute is always a string delimited by quotes, the value can be

1. A string delimited by quotes
2. A number
3. Another JSON object
4. An (1D) array of values delimited by squared brackets; each value being separated by a comma

```
{
  "attribute" : [ value1 , value2 ,  value3 ]
}
```

An example of valid JSON files is as follows:

```
{
"linux distro" :
  [
           {
            "Name": "Debian",
            "Version": "9",
            "Install": "apt",
            "Owner": "SPI",
            "Kernel": "4.9"
      },
      {
            "Name": "Ubuntu",
            "Version": "17.10",
```

```
                "Install": "apt",
                "Owner": "Canonical",
                "Kernel": "4.13"
          }
    ]
}
```

2.2 JSON and python

In python, the library “json” allows to readily import (aka load) a json file into a python dictionary or to readily export (aka dump) a python dictionary into a json file.

To import a json file in python:

```
import json
with open('distros.json', 'r') as f:
    distros_dict = json.load(f)

for distro in distros_dict:
    print(distro['Name'])
```

To export a json file in python

```
import json
with open('data.json', 'w') as outfile:
    json.dump(data, outfile)
```

3 NOOS-Drift JSON request file

The JSON request file is subdivided in 4 main blocks, i.e. 4 different JSON objects:

- The first JSON object “**simulation_description**” gives general information on the requested simulation
- The second JSON object “**drifter**” details the oil or the SAR object properties
- The third JSON object “**initial_condition**” presents the release scenario. This block must contain all the pertinent information for generating the initial Lagrangian particle cloud as in openDrift.

- The last JSON object “**model_set_up**” describes the list of processes that are expected to be activated for the simulation.

These 4 JSON objects are further specified in the next subsections.

3.1 JSON object “simulation_description”

The attribute of this objects are:

Attribute name	Mandatory or optional	Description
“request_id”	Mandatory	Integer: unique identifier of the request
“owner_id”	Mandatory	Integer: unique identifier of the user who submitted the simulation request
“title”	Optional	String: short title of the simulation Default: request ID and date of submission
“summary”	Optional	String: description of the simulation; Default: an empty string
“tags”	Optional	List of strings : any relevant information helping to search for the simulation. Default : empty list. Note that the central server can populate it with other default value.
“simulation_type”	Mandatory	String : “forward” or “backward”
“simulation_start_tim e”	Mandatory	String following ISO8601 : “YYYY-MM-DDThh:mm:ssz”
“simulation_end_time ”	Mandatory	String following ISO8601 : “YYYY-MM-DDThh:mm:ssz”

JSON example

```
"simulation_description" : {
   "request_id"      : 1,
    "owner_id"        : 1,
    "title"           : "my_title",
    "summary"         : "my_summary",
    "tags"            :  ["my","list","of","tags"],
    "simulation_type" : "forward",
    "simulation_start_time" : "2018-10-17T13:00:00z",
    "simulation_end_time"  :  "2018-10-17T18:00:00z",
},
```

3.2 JSON object "drifter"

The JSON object “drifter” defines the type of drifter to be considered in the simulation. This object has the following attributes:

Attribute name	Mandatory or optional	Description

“drifter_type”	Mandatory	String : “oil” or “object”
“drifter_name”	Mandatory	String : name of the drifter as in Annex 1 table (in case of object) or in Annex 2 table (in case of oil) An error should be raised if the drifter_name is not found in these 2 tables.
“total_mass”	Optional	Float Total mass (kg) of spilt oil

JSON example

```
"drifter" : {
   "drifter_type" : "oil",
    "drifter_name" : "gasoline",
    "total_mass" : 10000
},
```

In the framework of NOOS-Drift, the consortium has decided to only considered 7 generic oil types (Table 1) and the maximal number of SAR and non SAR objects types (Table 2).

Table 1 List of oil types considered in NOOS-Drift

Drifter_type	Drifter_name	Opendrift	Mothy	OSERIT
“oil”	“gasoline”	*GENERIC GASOLINE density : 750 kg/m³ visco : 2.03 cSt emulsification : no	Gasoline density : 720 kg/m³	'GASOLINE BLENDING STOCK (ALKYLATE)' density 700 kg/m³ visco : 3.6 cSt emulsification : no (1e-4) OSERIT ID : 20
“oil”	“kerosene”	‘FUEL OIL NO.1 (JET FUEL A)’ density : 816 kg/m³ visco : 1.68 cSt emulsification : no	Kerosene density : 780 kg/m³	‘Fuel Oil n° 1’ density : 804 visco : 5.6 emulsification : no (1e-4) OSERIT ID : 19
“oil”	“light crude oil”	‘*GENERIC LIGHT CRUDE’ density : 850 kg/m³ visco : 10.5 cSt emulsification : yes	Light crude oil density : 820 kg/m³	‘Brent blend’ density = 835 kg/m³ visco = 4.5 cSt emulsification : yes (20) OSERIT ID : 1
“oil”	“diesel oil”	*GENERIC DIESEL density : 853 visco : 6.35 emulsification : no	Diesel oil density : 850 kg/m³	‘Marine Diesel’ density = 852 kg/m³ visco = 16.8 cSt emulsification : no (1e-4) OSERIT ID: 22
“oil”	“heavy crude oil”	*GENERIC HEAVY CRUDE density : 936 visco : 1057 cSt emulsification : yes	Heavy crude oil density : 930 kg/m³	‘Alba’ density : 934 kg/m³ visco : 463 cSt emulsification : yes (20) OSERIT ID: 16
“oil”	“fuel oil no. 6”	'*GENERIC FUEL OIL No. 6' density : 969 visco : 50727 cSt emulsification : yes	Fuel oil no. 6 density : 960 kg/m³	‘IFO300’ density : 987 kg/m³ visco : 14676 cSt emulsification : yes (5) OSERIT ID :26

“oil”	“heavy fuel oil”	‘*GENERIC HEAVY FUEL OIL’ density : 969 visco : 50727 emulsification : yes	Heavy fuel oil density : 1020 kg/m³	IFO 300 density : 987 kg/m³ visco : 14676 cSt emulsification : yes (5) OSERIT ID :26

Table 2 List of objects considered in NOOS-Drift - In red objects that is not available in all the models and that should therefore not be used in NOOS-Drift.

drifter_type	drifter_name	Description	openDrift	Mothy	Oserit
object	PIW-1	Person-in-water (PIW), unknown state (mean values)	v	v	v
object	PIW-2	PIW, vertical PFD type III conscious	v	v	v
object	PIW-3	PIW, sitting, PFD type I or II	v	v	v
object	PIW-4	PIW, survival suit (face up)	v	v	v
object	PIW-5	PIW, scuba suit (face up)	v	v	v
object	PIW-6	PIW, deceased (face down)	v	v	v
object	LIFE-RAFT-DB-10	Life raft, deep ballast (DB) system, general, unknown capacity and loading (mean values)	v	v	
object	LIFE-RAFT-DB-11	4-14 person capacity, deep ballast system, canopy (average)	v	v	v
object	LIFE-RAFT-DB-12	4-14 person capacity, deep ballast system, no drogue	v	v	v
object	LIFE-RAFT-DB-13	4-14 person capacity, deep ballast system, canopy, no drogue, light loading	v	v	v
object	LIFE-RAFT-DB-14	4-14 person capacity, deep ballast system, no drogue, heavy loading	v	v	v
object	LIFE-RAFT-DB-15	4-14 person capacity, deep ballast system, canopy, with drogue (average)	v	v	v
object	LIFE-RAFT-DB-16	4-14 person capacity, deep ballast system, canopy, with drogue, light loading	v	v	v
object	LIFE-RAFT-DB-17	4-14 person capacity, deep ballast system, canopy, with drogue, heavy loading	v	v	v
object	LIFE-RAFT-DB-18	15-50 person capacity, deep ballast system, canopy, general (mean values)	v	v	v
object	LIFE-RAFT-DB-19	15-50 person capacity, deep ballast system, canopy, no drogue, light loading	v	v	v
object	LIFE-RAFT-DB-20	15-50 person capacity, deep ballast system, canopy, with drogue, heavy loading	v	v	v
object	LIFE-RAFT-DB-21	Deep ballast system, general (mean values), capsized	v	v	v
object	LIFE-RAFT-DB-22	Deep ballast system, general (mean values), swamped	v	v	v
object	LIFE-RAFT-SB-6	Life-raft, shallow ballast (SB) system AND canopy, general (mean values)	v	v	v
object	LIFE-RAFT-SB-7	Life-raft, shallow ballast system, canopy, no drogue	v	v	v
object	LIFE-RAFT-SB-8	Life-raft, shallow ballast system AND canopy, with drogue	v	v	v
object	LIFE-RAFT-SB-9	Life-raft, shallow ballast system AND canopy, capsized	v	v	v
object	LIFE-RAFT-SB-10	Life Raft - Shallow ballast, canopy, Navy Sub Escape (SEIE) 1-man raft, NO drogue	v		
object	LIFE-RAFT-SB-11	Life Raft - Shallow ballast, canopy, Navy Sub Escape (SEIE) 1-man raft, with drogue	v		
object	LIFE-RAFT-NB-1	Life-raft, no ballast (NB) system, general (mean values)	v	v	v
object	LIFE-RAFT-NB-2	Life-raft, no ballast system, no canopy, no drogue	v	v	v
object	LIFE-RAFT-NB-3	Life-raft, no ballast system, no canopy, with drogue	v	v	v

object	LIFE-RAFT-NB-4	Life-raft, no ballast system, with canopy, no drogue	v	v	v
object	LIFE-RAFT-NB-5	Life-raft, no ballast system, with canopy, with drogue	v	v	v
object	USCG-RESCUE	Survival Craft - USCG Sea Rescue Kit - 3 ballasted life rafts and 300 meter of line	v	v	v
object	AVIATION-1	Life-raft, 4-6 person capacity, no ballast, with canopy, no drogue	v	v	v
object	AVIATION-2	Evacuation slide with life-raft, 46 person capacity	v	v	v
object	LIFE-CAPSULE	Survival Craft - SOLAS Hard Shell Life Capsule, 22 man	v	v	v
object	OVATEK-CRAFT-1	Survival Craft - Ovatek Hard Shell Life Raft, 4 and 7-man, lightly loaded, no drogue (average)	v		
object	OVATEK-CRAFT-2	Survival Craft - Ovatek Hard Shell Life Raft, 4 man, lightly loaded, no drogue	v		
object	OVATEK-CRAFT-3	Survival Craft - Ovatek Hard Shell Life Raft, 7 man, lightly loaded, no drogue	v		
object	OVATEK-CRAFT-4	Survival Craft - Ovatek Hard Shell Life Raft, 4 and 7-man, fully loaded, drogued (average)	v		
object	OVATEK-CRAFT-5	Survival Craft - Ovatek Hard Shell Life Raft, 4 man, fully loaded, drogued	v		
object	OVATEK-CRAFT-6	Survival Craft - Ovatek Hard Shell Life Raft, 7 man, fully loaded, drogued	v		
object	PERSON-POWERED-VESSEL-1	Kayak with person on aft deck	v	v	v
object	PERSON-POWERED-VESSEL-2	Surf board with person	v	v	v
object	PERSON-POWERED-VESSEL-3	Windsurfer with mast and sail in water	v	v	v
object	SKIFF-1	Skiff - modified-v, cathedral-hull, runabout outboard powerboat	v		
object	SKIFF-2	Skiff, V-hull	v	v	v
object	SKIFF-3	Skiffs, swamped and capsized	v	v	v
object	SKIFF-4	Skiff - v-hull bow to stern (aluminum, Norway)	v		
object	SPORT-BOAT	Sport boat, no canvas (*1), modified V-hull	v	v	v
object	SPORT-FISHER	Sport fisher, center console (*2), open cockpit	v	v	v
object	FISHING-VESSEL-1	Fishing vessel, general (mean values)	v	v	v
object	FISHING-VESSEL-2	Fishing vessel, Hawaiian Sampan (*3)	v	v	v
object	FISHING-VESSEL-3	Fishing vessel, Japanese side-stern trawler	v	v	v
object	FISHING-VESSEL-4	Fishing vessel, Japanese Longliner (*3)	v	v	v
object	FISHING-VESSEL-5	Fishing vessel, Korean fishing vessel (*4)	v	v	v
object	FISHING-VESSEL-6	Fishing vessel, Gill-netter with rear reel (*3)	v	v	v
object	COASTAL-FREIGHTER	Coastal freighter. (*5)	v	v	v
object	SAILBOAT-1	Sailboat Mono-hull (Average)	v	v	v
object	SAILBOAT-2	Sailboat Mono-hull (Dismasted, Average)	v		
object	SAILBOAT-3	Sailboat Mono-hull (Dismasted - rudder amidships)	v		
object	SAILBOAT-4	Sailboat Mono-hull (Dismasted - rudder missing)	v		
object	SAILBOAT-5	Sailboat Mono-hull (Bare-masted, Average)	v		
object	SAILBOAT-6	Sailboat Mono-hull (Bare-masted, rudder amidships)	v		
object	SAILBOAT-6b	Sailboat Mono-hull (Bare-masted, rudder hove-to)	v		
object	SAILBOAT-7	Sailboat Mono-hull, fin keel, shallow draft (was SAILBOAT-2)	v	v	v

object	SAILBOAT-8	Sunfish sailing dingy - Bare-masted, rudder missing	v		
object	FV-DEBRIS	Fishing vessel debris	v	v	v
object	SLDMB	Self-locating datum marker buoy - no windage	v		
object	SEPIRB	Navy Submarine EPIRB (SEPIRB)	v		
object	BAIT-BOX-1	Bait/wharf box, holds a cubic metre of ice, mean values (*6)	v	v	v
object	BAIT-BOX-2	Bait/wharf box, holds a cubic metre of ice, lightly loaded	v	v	v
object	BAIT-BOX-3	Bait/wharf box, holds a cubic metre of ice, full loaded	v	v	v
object	OIL-DRUM	55-gallon (220 l) Oil Drum	v	v	
object	CONTAINER-1	Scaled down (1:3) 40-ft Container (70% submerged)	v		
object	CONTAINER-2	20-ft Container (80% submerged)	v		
object	MINE	WWII L-MK2 mine	v	v	
object	REFUGEE-RAFT-1	Immigration vessel, Cuban refugee-raft, no sail (*7)	v	v	v
object	REFUGEE-RAFT-2	Immigration vessel, Cuban refugee-raft, with sail (*7)	v	v	v
object	SEWAGE	Sewage floatables, tampon applicator	v	v	v
object	MED-WASTE-1	Medical waste (mean values)	v	v	v
object	MED-WASTE-2	Medical waste, vials	v		v
object	MED-WASTE-3	Medical waste, vials, large	v		v
object	MED-WASTE-4	Medical waste, vials, small	v		v
object	MED-WASTE-5	Medical waste, syringes	v		v
object	MED-WASTE-6	Medical waste, syringes, large	v		v
object	MED-WASTE-7	Medical waste, syringes, small	v		v
object	CONTAINER-IMMERSED-10pc	Container immersed at 10%			
object	CONTAINER-IMMERSED-20pc	Container immersed at 20%		v	v
object	CONTAINER-IMMERSED-30pc	Container immersed at 30%		v	v
object	CONTAINER-IMMERSED-40pc	Container immersed at 40%		v	v
object	CONTAINER-IMMERSED-50pc	Container immersed at 50%		v	v
object	CONTAINER-IMMERSED-60pc	Container immersed at 60%		v	v
object	CONTAINER-IMMERSED-70pc	Container immersed at 70%		v	v
object	CONTAINER-IMMERSED-80pc	Container immersed at 80%		v	v
object	CONTAINER-IMMERSED-90pc	Container immersed at 90%		v	v
object	CONTAINER-IMMERSED-100pc	Container immersed at 100%		v	v
object	BEACHCRAFT-1	Standup Paddle		v	
object	SAILBOAT-10	Cruising catamaran		v	
object	SAILBOAT-11	10 m sloop		v	
object	FISHING-VESSEL-8	Fishing skiff with sail		v	
object	SKIFF-6	19 foot fibreglass skiff		v	
object	PERSON-POWERED-VESSEL-4	Outrigger canoe		v	
object	BEACHCRAFT-2	Jetski		v	

object	SAILBOAT-9	Sunfish sailboat		v	
object	SKIFF-7	Rigid-hulled inflatable boat		v	
object	LARGE-VESSEL-1	Large vessel (250 m) in loaded condition		v	
object	LARGE-VESSEL-2	Large vessel (250 m) in ballast condition		v	
object	FISHING-VESSEL-7	Poti marara		v	
object	SAILBOAT-12	80 foot trimaran upside down without rigging nor sail in water		v	
object	LARGE-VESSEL-3	50 degree listing ro-ro ship		v	
object	MARINE-MAMMALS-1	Dolphin carcass		v	

3.3 JSON object 'initial_condition'

The initial conditions are provided following the seed_element approach of opendrift.

This object has the following attributes:

Attribute name	Mandatory or optional	Description
"geometry"	Optional	String : "point", "polyline", "polygon" In case of polygon, it is expected that all the Langrangian particle are seeded inside the polygon. The initial and final position must be the same in order to have a closed contour.
"lon"	Mandatory	Scalar or array Longitude in decimal degree
"lat"	Mandatory	Scalar or array Latitude in decimal degree In case of array, the size of the array must be the same for lat.
"radius"	Optional	Scalar or array Radius in meter around each lat-lon pair , within which particles will be randomly seeded. In case of array, the size of the array must be the same for lat.
"number"	Optional	Scalar Total number of particles to be seeded ● Elements are spread equally among the given lon/lat points. ● Default is one particle for each lon-lat pair.
"time"	Mandatory	Scalar or array Time of release
"z"	Optional	Scalar or array Depth of the release
"cone"	Optional	Boolean Default : False If True, lon and lat must be two element arrays, interpreted as the start and end position of a cone within which elements will be seeded. Radius may also be a two element array specifying the radius around the points.

JSON example

```
"initial_condition" : {
   "geometry" : "point",
    "lon" : 2.159,
    "lat" : 52.1,
    "radius" : 1000,
    "number" : 2500,
    "time" : "2018-10-17T13:07:12z"
},
```

3.4 JSON object "model_set_up"

This JSON object is maybe less meaningful in the request file. However, it might be useful in the results package as it provides useful on the simulation executed at each node.

Attribute name	Mandatory or optional	Description
"model"	Mandatory	String Possible values : "undefined", "opendrift", "mothy", "oserit"
"ocean_forcing"	Mandatory	String Possible values : "undefined", "cmems-nws7", "cmems-nws1.5", "cmems-ibi", "cmems-global", "norkyst", "optos", "topaz"
"wind_forcing"	Mandatory	String Possible values : "undefined", "ecmwf", "ukmo", "arpege", "arome", "gfs"
"2D/3D"	Mandatory	String "3D" : drift in 3D "2D" : only drift at the sea surface
"current"	Mandatory	Boolean True : ocean currents have been taken into account in drift computation
"waves"	Mandatory	Boolean True : stokes drift has been taken in account in drift computation
"wind"	Mandatory	Boolean True : wind speed and direction have been taken into account in drift computation
"Beaching"	Mandatory	Boolean True : An particle that has been stranded cannot be resuspended.
"Horizontal spreading"	Optional	Boolean True : in case of oil, spreading at sea surface has been computed

"natural_vertical_dispersion"	Optional	Boolean True : In case of 3D simulation and oil, vertical entrainment in the water column has been activated
"buoyancy"	Optional	Boolean True : In case of oil, oil density has been taken into account to compute resurfacing
"evaporation"	Optional	Boolean True : In case of oil, weathering by evaporation has been taken into account
"dissolution"	Optional	Boolean True : In case of oil, dissolution in the water column has been taken into account
"sedimentation"	Optional	Boolean True : In case of oil, sedimentation at the sea bed is possible

JSON example

```
"model_set_up" : {
    "ocean_forcing" : "nws7",
    "wind_forcing" : "ecmwf",
    "2D/3D drift" : "3D",
    "current" : "True",
    "waves"   : "True",
    "wind"    : "True",
    "beaching" : "True",
    "horizontal_spreading" : "True",
    "natural_vertical_dispersion" : "True",
    "buoyancy" : "True",
    "evaporation" : "True",
    "dissolution" : "False",
    "sedimentation" : "False"
}
```

3.5 The optional JSON object "simulation_result"

This JSON object keeps track of the metadata of a simulation results, including its status code and the results filename.

Attribute name	Mandatory or optional	Description
"status_code"	optional	Integer

<table>
<tr><td></td><td></td><td>
<table>
<tr><th>Code</th><th>Meaning</th></tr>
<tr><td>0</td><td>Model simulation successfully completed (no error)</td></tr>
<tr><td>1</td><td>ERROR: initial position out of model domain</td></tr>
<tr><td>2</td><td>ERROR: initial position on land</td></tr>
<tr><td>3</td><td>ERROR: Simulation start and/or end time are not in the forcing availability period [today – 4 days, today + 4 days]</td></tr>
<tr><td>4</td><td>ERROR : Release time of Lagrangian particle out of the simulation start time and end time windows</td></tr>
<tr><td>5</td><td>ERROR : Drifter type unknown or not available in the model</td></tr>
<tr><td>6</td><td>ERROR: Model cannot handle the requested set-up -> set-up has been adapted</td></tr>
<tr><td>7</td><td>ERROR: any other error in the model pre-processing</td></tr>
<tr><td>8</td><td>ERROR: any error in the model processing</td></tr>
<tr><td>9</td><td>ERROR: any error in the model post-processing : preparation of the model output</td></tr>
</table>
</td></tr>
<tr><td>“result_file_name”</td><td>Optional</td><td>String
Once the netcdf results file exists, the full path to this file.</td></tr>
</table>

JSON example

```
"simulation_result" : {
    "status_code" : 0,
    "result_file_name" :
"/home/oserit/applications/noosdrift/results/noosdrift_012_oserit_optos_ecm
wf.nc",
}
```

3.6 Filename convention

When dispatched by the central communication system, the file containing the json object should be named according this convention:

noosdrift_*requestId*_*modelName*_*oceanForcingName*_*windForcingName****.json***

The advantage of this convention is that a link with the request is always preserved. This will help the development at the central server side.

The non-exhaustive list of possible modelName is 'oserit', 'mothy', 'opendrift', ...

The non-exhaustive list of windForcingName could be 'ecmwf', 'ukmo', ...

The non-exhaustive list of possible oceanForcingName could be 'cmems-nws7', 'cmems-nws1.5', 'cmems-ibi', 'cmems-global', 'norkyst', 'optos', ... The first 4 names are related to CMEMS products. The number refers to the horizontal resolution in km.

4 Examples

4.1 Oil spill – single point instantaneous release


```
{
"simulation_description" : {
   "request_id"      : 1,
    "owner_id"        : 1,
    "title"           : "my_title",
    "summary"         : "my_summary",
    "tags"            :  ["my","list","of","tags"],
    "simulation_type" : "forward",
    "simulation_start_time" : "2018-10-17T13:00:00z",
    "simulation_end_time" :  "2018-10-17T18:00:00z",
},
"drifter" : {
   "drifter_type" : "oil",
    "drifter_name" : "gasoline",
    "total_mass" : 10000
},
"initial_condition" : {
   "geometry" : "point",
    "lon" : 2.159,
    "lat" : 52.1,
    "radius" : 1000,
```

```
        "number" : 2500,
        "time" : "2018-10-17T13:07:12z"
    },
    "model_set_up" : {
        "model" : "opendrift",
        "ocean_forcing" : "cmems_nws7",
        "wind_forcing" : "ecmwf",
        "2D/3D drift" : "3D",
        "current" : "True",
        "waves"   : "True",
        "wind"    : "True",
        "beaching" : "True",
        "horizontal_spreading" : "True",
        "natural_vertical_dispersion" : "True",
        "buoyancy" : "True",
        "evaporation" : "True",
        "dissolution" : "False",
        "sedimentation" : "False"
    }
    }
```

4.2 Oil spill – single point continuous release

```
{
"simulation_description" : {
   "request_id"      : 1,
    "owner_id"        : 1,
    "title"           : "my_title",
    "summary"         : "my_summary",
    "tags"            :  ["my","list","of","tags"],
    "simulation_type" : "forward",
    "simulation_start_time" : "2018-10-17T13:00:00z",
    "simulation_end_time" :  "2018-10-17T18:00:00z",
},
"drifter" : {
   "drifter_type" : "oil",
    "drifter_name" : "gasoline",
    "total_mass" : 10000
},

"initial_condition" : {
   "geometry" : "point",
    "lon" : 2.159,
```

```
        "lat" : 52.1,
        "radius" : 1000,
        "number" : 2500,
        "time" : ["2018-10-17T13:00:00z","2018-10-17T14:00:00z"]
    },

    "model_set_up" : {
        "model" : "opendrift",
        "ocean_forcing" : "cmems_nws7",
        "wind_forcing" : "ecmwf",
        "2D/3D drift" : "3D",
        "current" : "True",
        "waves"   : "True",
        "wind"    : "True",
        "beaching" : "True",
        "horizontal_spreading" : "True",
        "natural_vertical_dispersion" : "True",
        "buoyancy" : "True",
        "evaporation" : "True",
        "dissolution" : "False",
        "sedimentation" : "False"
    }
    }
```

4.3 Oil spill – line instantaneous release

```
    {
    "simulation_description" : {
       "request_id"      : 1,
        "owner_id"        : 1,
        "title"           : "my_title",
        "summary"         : "my_summary",
        "tags"            :  ["my","list","of","tags"],
        "simulation_type" : "forward",
        "simulation_start_time" : "2018-10-17T13:00:00z",
        "simulation_end_time" :  "2018-10-17T18:00:00z",
    },
    "drifter" : {
       "drifter_type" : "oil",
        "drifter_name" : "gasoline",
        "total_mass" : 10000
    },
    "initial_condition" : {
```

```
   "geometry" : "polyline",
    "lon" : [2.159, 2.161,  2.163]
    "lat" : [52.12, 52.10, 52.09 ]
    "radius" : 1000,
    "number" : 2500,
    "time" : "2018-10-17T13:07:12z",
    "cone" = "True"
},
"model_set_up" : {
    "model" : "mothy",
    "ocean_forcing" : "cmems_ibi",
    "wind_forcing" : "ecmwf",
    "2D/3D drift" : "3D",
    "current" : "True",
    "waves"   : "True",
    "wind"    : "True",
    "beaching" : "True",
    "horizontal_spreading" : "True",
    "natural_vertical_dispersion" : "True",
    "buoyancy" : "True",
    "evaporation" : "True",
    "dissolution" : "False",
    "sedimentation" : "False"
}
}
```

4.4 Oil spill – release along a vessel trajectory

```
{
"simulation_description" : {
   "request_id"      : 1,
    "owner_id"        : 1,
    "title"           : "my_title",
    "summary"         : "my_summary",
    "tags"            :  ["my","list","of","tags"],
    "simulation_type" : "forward",
    "simulation_start_time" : "2018-10-17T13:00:00z",
    "simulation_end_time" :  "2018-10-17T18:00:00z",
},
"drifter" : {
   "drifter_type" : "oil",
    "drifter_name" : "gasoline",
    "total_mass" : 10000
},
"initial_condition" : {
```

```
   "geometry" : "polyline",
    "lon" : [2.159, 2.161,  2.163]
    "lat" : [52.12, 52.10, 52.09 ]
    "radius" : 0,
    "number" : 2500,
    "time" : [ "2018-10-17T13:05:00z", "2018-10-17T13:10:00z" ,
"2018-10-17T13:15:00z"  ],
    "cone" = "True"
},
"model_set_up" : {
    "model" : "oserit",
    "ocean_forcing" : "optos",
    "wind_forcing" : "ukmo",
    "2D/3D drift" : "3D",
    "current" : "True",
    "waves"   : "True",
    "wind"    : "True",
    "beaching" : "True",
    "horizontal_spreading" : "True",
    "natural_vertical_dispersion" : "True",
    "buoyancy" : "True",
    "evaporation" : "True",
    "dissolution" : "False",
    "sedimentation" : "False"
}
}
```

4.5 Object – single point release

```
{
"simulation_description" : {
   "request_id"      : 1,
    "owner_id"        : 1,
    "title"           : "my_title",
    "summary"         : "my_summary",
    "tags"            :  ["my","list","of","tags"],
    "simulation_type" : "forward",
    "simulation_start_time" : "2018-10-17T13:00:00z",
    "simulation_end_time" :  "2018-10-17T18:00:00z",
},
"drifter" : {
   "drifter_type" : "object",
    "drifter_name" : "5 PIW-5",
},
"initial_condition" : {
   "geometry" : "point",
```

```
    "lon" : 2.159,
    "lat" : 52.12,
    "radius" : 1000,
    "number" : 2500,
    "time" :  "2018-10-17T13:05:00z",
    "cone" = "False"
},
"model_set_up" : {
    "model" : "oserit",
    "ocean_forcing" : "cmems_nws7",
    "wind_forcing" : "ecmwf",
    "2D/3D drift" : "2D",
    "current" : "True",
    "waves"   : "True",
    "wind"    : "True",
    "beaching" : "False",
    "horizontal_spreading" : "False",
    "natural_vertical_dispersion" : "False",
    "buoyancy" : "False",
    "evaporation" : "False",
    "dissolution" : "False",
    "sedimentation" : "False"
}
}
```

5 Seeding the initial Lagrangian particles cloud

At the physical meeting, Brussels, October 2018, the NOOS-Drift consortium decided to use the seeding functionalities of openDrift in order to generate the initial Lagrangian particles cloud of NOOS-Drift simulations.

To this purpose, MET Norway developed a standalone version of the functionality that can directly read the NOOS-Drift JSON request object and seed the particle clouds. The python script is hosted here : https://github.com/knutfrode/noosdrift and simply returns arrays of lon, lat and time. The example file can be easily tuned in in order to produce the model-specific configuration file. This is the responsibility of each modeller.

6 Conclusion

This report presents the specifications of the NOOS-Drift simulation request file. This file has been designed as a standalone JSON object that contain all the necessary meta-information needed to set-up a drift model simulation.

A piece of code has been produced that is able to read the JSON object and seed the initial particle clouds. This code must be adapted to the model-specific set-up file, but this is the responsibility of each modeller.

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