



# **E040G Deliverable D1 – Offshore Geo-Information Requirements**

**Report  
P-14-043-1133**

**Prepared for:  
European Space Agency**

**Revision 1.0  
August, 2014**

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**Prepared for:**

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**Prepared by:**

C-CORE

**C-CORE Proposal Number:**

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**REVISION HISTORY**

<b>VERSION</b>	<b>SVN</b>	<b>NAME</b>	<b>COMPANY</b>	<b>DATE OF CHANGES</b>	<b>COMMENTS</b>
1.0	n/a	Thomas Puestow	C-CORE	08/11/2014	Submitted to Client

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## 1 INTRODUCTION

This document summarizes the geo-information requirements collected under Task 1 of the European Space Agency (ESA) and International Oil and Gas Producers Association (OGP) Earth Observation for Oil and Gas (EO4OG) initiative. Focusing on met-ocean and environmental information needs in support of offshore oil and gas activities, the following geographic areas of interest were considered:

- Myanmar
- Eastern Mediterranean
- West of Ireland
- Offshore Morocco
- South China Sea
- Falkland Islands

In collecting requirements, special attention was paid to the following life cycle stages of typical oil and gas developments:

- Pre-license acquisition
- Exploration
- Development
- Production
- Decommissioning

### 1.1 APPROACH

In collaboration with the other three EO4OG project consortia (CLS, Hatfield Consultants, and OTM), a template was designed to collect information requirements consisting of the following principal elements:

- Description of data/products currently being used
- Description of limitations and work-around solutions
- Importance of requirement in each life cycle stage
- Geographic context applicable to the requirement
- Principle activities impacted/concerned
- Urgency of technology solution
- Update frequency
- Temporal resolution
- Spatial resolution
- Data quality
- Data coverage and extent
- Data formats

- Timeliness
- Existing standards

The initial data gathering was completed based on existing knowledge and experience within the project team (C-CORE, StormGeo, Stantec, and Hatfield Consultants), together with a review of applicable literature and regulatory information. It is planned to revise the initial requirements based on feedback from the oil and gas industry during August 2014. A revised version of this document will be prepared accordingly.

## 1.2 PRELIMINARY ASSESSMENT OF EO CAPABILITIES

The identified geo-information requirements were subjected to a first analysis with the objective to identify candidate EO-based products and services. To this end, each requirement was assigned to one of the following categories:

- Category 1: mature EO-based services and products exist to address the parameter at least partially in a meaningful way within acceptable bounds of error
- Category 2: extracting the parameter of interest at least partially may be possible
- Category 3: EO is unlikely to contribute in a meaningful way to the parameter

A summary of geo-information requirements, applicable geographic regions and potential for EO-based extraction (Category 1 = green; Category 2 = yellow; Category 3 = red) is presented in Table 1.

Table 1: Offshore Geo-Information Requirements and EO

Challenge ID	Title	Region
OFF1.1	Historic records for winds	All
OFF1.2	Historic records for waves	All
OFF1.3	Historic records for surface currents	All
OFF1.4	Historic records for currents at depth	All
OFF1.5	Wind observations	All
OFF1.6	Wave observations	All
OFF1.7	Surface current observations	All
OFF1.8	Observations of current at depth	All
OFF1.9	Historical Tropical Storm/Tropical Cyclone probability and tracks	South China Sea, West of Ireland, Myanmar
OFF1.10	Tropical Storm/Tropical Cyclone Observations	South China Sea, West of Ireland, Myanmar
OFF1.11	Sea level	All
OFF1.12	Visibility	All
OFF1.13	Squalls	All



Challenge ID	Title	Region
OFF1.14	Ice accretion	Eastern Med, Falklands, West of Ireland
OFF1.15	Sea surface temperatures	All
OFF1.16	Funnel Clouds and Waterspouts	All
OFF1.17	Convective downbursts	All
OFF1.18	Lightning	All
OFF1.19	Hail	All
OFF2.1	Monitoring of landfall site recovery and coastal vegetation	West of Ireland
OFF2.2	Submarine landslides and seabed stability	West of Ireland, Eastern Med, Morocco/Western Sahara
OFF2.3	Shipwrecks and other archaeological value areas	West of Ireland, Eastern Med
OFF2.4	Detection and monitoring of pollutant discharges	All
OFF2.5	Distribution and abundance of marine mammals	West of Ireland, Falklands
OFF2.6	Distribution and abundance of seabirds	West of Ireland, Falklands, Morocco/Western Sahara
OFF2.7	Information on presence and abundance of deep water fauna	Eastern Med
OFF2.8	Scientific independence in environmental monitoring of pollution	Eastern Med
OFF2.9	Security and safety	Eastern Med
OFF2.10	Monitoring of chlorophyll-a	Falklands, South China Sea, Myanmar, Morocco/Western Sahara
OFF2.11	Monitoring of waste management practices	All
OFF2.12	Information on the intertidal and shallow marine environment	Falklands
OFF2.13	Coastal resource mapping of mangroves, coral reefs, wetlands, and sandbanks	South China Sea, Falklands, Myanmar
OFF2.14	Coastal sediment dynamics, estuarine fronts, and land–ocean interactions.	South China Sea
OFF2.15	Coastal upwelling	South China Sea, Morocco/Western Sahara
OFF2.16	Fish and fish habitat	All
OFF2.17	Commercial shipping	All
OFF2.18	Natural and other existing oil seeps	All
OFF2.19	Commercial and recreational fisheries	All

## 2 MET-OCEAN REQUIREMENTS

<b>Challenge ID</b>	OFF1.1
<b>Title</b>	<b>Historic records for winds</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical wind speeds are available in the form of surface-based observations, as reported from ships and buoys, via UCAR (ICOADS), and NOAA (NDBC and NCDC).</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  NCDC: <a href="http://www.ncdc.noaa.gov/oa/rsad/air-sea/seawinds.html">http://www.ncdc.noaa.gov/oa/rsad/air-sea/seawinds.html</a></p> <p>Historical remotely-sensed satellite observations of 10m wind speeds are available via DEOS-RADS, as well as other agencies such as IFREMER (NAIAD).</p> <p>DEOS-RADS: <a href="http://rads.tudelft.nl/rads/rads.shtml">http://rads.tudelft.nl/rads/rads.shtml</a>  IFREMER (NAIAD): <a href="http://naiad.ifremer.fr/">http://naiad.ifremer.fr/</a></p> <p>Historical hindcasts of reanalyzed 10m wind speeds are available via ECMWF (ERA-Interim) and NOAA (WAVEWATCH III).</p> <p>ERA-Interim:  <a href="http://apps.ecmwf.int/datasets/data/interim_full_daily/">http://apps.ecmwf.int/datasets/data/interim_full_daily/</a>  WaveWatch III: <a href="ftp://polar.ncep.noaa.gov/pub/history/waves/">ftp://polar.ncep.noaa.gov/pub/history/waves/</a></p> <p>Historical 0-hour global and/or regional model analyses of 10m wind speeds are available via many global agencies such as NOAA, ECMWF, CMC, JMA, UKMET, and others.</p>
<b>When do you use this kind of dataset?</b>	Historical wind data are used to great extent in all phases of the O&G cycle, except strictly operational tasks.

	<p>The data set is used to assist in qualifying and quantifying the means and extremes of winds in the area of interest, but also to identify frequency of occurrence of wind speeds and weather window (where operational thresholds apply).</p> <p>During the early stages, field assessment/seismics etc. the data are mostly used to assess the operability of the area during different seasons and to assess financial risk and first draft of development costs.</p> <p>During planning of new fields and operations data are used to assess the climatic limitations local/regional weather would have on safety in order to reduce risk for operations, personnel and environment.</p> <p>Finally wind data are important to design of structures that can withstand the local conditions and take into account the risk of the extreme situations of the area.</p>
<p><b>What are your actual limitations and do you have a work around?</b></p>	<p>For more superficial analysis, first looks etc. an estimate is often sufficient and the quality of the data set is not as critical as for design studies. The latter requires long time series (for instance preferably more than 1/4 of the extreme calculated – i.e. 25 yrs for 100 year extreme) and high resolution in time and space in order to catch vigorous short-lived and small scale local phenomena. Data of sufficient quality can be hard to come by in coastal and remote/less developed areas and rougher modeled data/estimates/approximations will be used. Sometimes calibration of modeled data to shorter observed time series has to be made.</p> <p><b>In addition:</b></p> <ul style="list-style-type: none"> <li>*The heights of many historical wind speed observations that are available via ICOADS are unknown, although a portion of the observations include the height of the observation. Similarly, the averaging period of wind observations is a variable that must be reconciled across all record sets prior to effective analyses.</li> <li>*There are also important spatial and temporal limitations of historical surface-based and remotely-sensed 10m wind observations that make the analyses of extreme values very challenging (e.g., most extremes at sea were probably not observed or otherwise sampled).</li> </ul> <p><b>Exemplified by the data sources in this study:</b></p>

	<p><i>Update frequency:</i> Too slow in some cases, some data sources do not extend to real time (1 month or more lag), and "patching" with any available observations is necessary.</p> <p><i>Temporal resolution:</i> 3 and 6 hours is too infrequent and does not catch short-lived extremes, and approximations have to be made.</p> <p><i>Spatial resolution:</i> *Too large outside well known areas (and large even there). Does not catch small scale and local (topography induced) phenomena. Should be 4 km minimum.</p> <p><b>NOTE. High resolution and high update resolution does not equal quality, hence documentation of verification is equally important!!</b></p>
<p><b>Needs and expectations on EO data</b></p>	<p>EO is used for this today, but resolution, update frequency, length of data series and quality is not sufficient for instance design studies. It is used as input in regional reanalysis and hindcast.</p> <p>Need: Long (10 years +) <b>observed</b> time series of high quality (ground-truthed) and with high spatial resolution, especially for coastal areas and emerging O&amp;G areas where demand for such data has been small or non-existent. Or - EO data that can improve modeled reanalyses.</p> <p>Example: Long time series of 10m wind speeds with 1-min, 10-min, 1-hour, and 3-second averaging periods).</p>
<p><b>Challenge classification</b></p>	
<p><b>Pre license</b></p>	<p>3</p>
<p><b>Exp.</b></p>	<p>3</p>
<p><b>Dev.</b></p>	<p>4</p>
<p><b>Prod.</b></p>	<p>4</p>
<p><b>Decom.</b></p>	<p>4</p>
<p><b>Geographic context/ restrictions</b></p>	<p>Applies to all six areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality: Applies to all seasons.</p>

<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	<p>Daily or weekly, since historical data is often used to assess recent events. For some parameters and data sets, monthly is still sufficient.</p> <p>Available today: For the historical re-analyses and archived observations, monthly; however, recent observations are available generally without delay.</p>
<b>Temporal resolution</b>	<p>Data should be at least 1-3 hourly resolution depending on area and phenomena needed to be resolved.</p> <p>Available today: ERA-Interim: 6-hourly WaveWatch III: 3 hourly Surface-bases observation: sub-hourly to less frequently Remotely-sensed satellite observation: sub-daily to less frequently</p>
<b>Spatial resolution</b>	<p>Around 4 km</p> <p>Available: ERA-Interim: 0.75° WaveWatch III: 4 arc-mins, 10 arc-mins, and/or 30 arc-mins, depending on area Surface-bases observation: varies based on the locations of the ship/buoy observations Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters</p>
<b>Data quality</b>	<p>The sources in this document are selected because they are known to have sufficient quality (after some work-arounds and adaptations). In general separate in-depth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not</p>

	<p>another).</p> <p>In general, ground observations and modelled sourced are perceived to be of better quality than EO for historical wind data.</p>
<b>Data Coverage and extent</b>	Regional.
<b>Example format</b>	<p>ERA-Interim: grib and netCDF</p> <p>WaveWatch III: grib and/or grib2</p> <p>Surface-bases observation: text, CSV and/or netCDF</p> <p>Remotely-sensed satellite observation: text</p>
<b>Timeliness</b>	<p>Normally needed urgently, possibly before assessing, planning, or exploring a new field. Hence the data source used for analysis needs to be frequently updated to avoid unnecessary waiting.</p> <p>Daily, weekly or monthly updates of data sets are sufficient, depending on the analysis required.</p>
<b>Existing standards</b>	<p>Multiple paragraphs in DNV-RP-C205, OTO 2001/010, ISO-19001-1, NORSOK-N-003e2, NORSOK-N-006u1, and DNV-OS-J001 contain extensive references to the standard measures of the means and extremes of winds, including the recommended approximations and calculations of return periods and probabilities of exceedance. The DNV series acknowledges that the procedures may not be applicable beyond the area of interest that it was tailored for.</p> <p>In addition, DNV-RP-C205, ISO-19001-1, and DNV-OS-J001 contain cautionary notes regarding the treatment of winds in areas that experience tropical cyclones, such as South China Sea, West of Ireland, and Myanmar.</p>

<b>Challenge ID</b>	OFF1.2
<b>Title</b>	<b>Historic records for waves</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical wind wave heights, swell wave heights, and significant wave heights are available in the form of surface-based observations, as reported from ships and buoys, via ICOADS and NOAA (NDBC).</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a>          NOAA (NDBC): <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a></p> <p>Historical remotely-sensed satellite observations of significant wave heights are available via DEOS-RADS, as well as other agencies such as IFREMER (NAIAD).</p> <p>DEOS-RADS: <a href="http://rads.tudelft.nl/rads/rads.shtml">http://rads.tudelft.nl/rads/rads.shtml</a>          IFREMER (NAIAD): <a href="http://naiad.ifremer.fr/">http://naiad.ifremer.fr/</a></p> <p>Historical hindcasts of reanalyzed significant wave heights are available via ECMWF (ERA-Interim) and NOAA (WAVEWATCH III).</p> <p>ECMWF (ERA-Interim):  <a href="http://apps.ecmwf.int/datasets/data/interim_full_daily/">http://apps.ecmwf.int/datasets/data/interim_full_daily/</a>          NOAA (WaveWatch III):  <a href="ftp://polar.ncep.noaa.gov/pub/history/waves/">ftp://polar.ncep.noaa.gov/pub/history/waves/</a></p> <p>Historical 0-hour global and regional model analyses of significant wave heights are available via many global agencies such as NOAA, ECMWF, CMC, JMA, UKMET, and others.</p>
<b>When do you use this kind of dataset?</b>	<p>Historical wavedata (Hs, Tp, Tz etc.) are used in all phases throughout the O&amp;G cycle, except strictly operational tasks.</p> <p>The data set is used to assist in qualifying and quantifying the qualifying and quantifying the means and extremes of waves in the area of interest, but also to identify frequency of occurrence of wave heights/periods and weather window (where</p>

	<p>operational thresholds apply).</p> <p>During the early stages, field assessment/seismics etc. the data are mostly used to assess the operability of the area during different seasons and to assess financial risk and first draft of development costs.</p> <p>During planning of new fields and operations data are used to assess the climatic limitations local/regional weather would have on safety in order to reduce risk for operations, personnel and environment.</p> <p>Finally wave data are important to design of structures that can withstand the local conditions and take into account the risk of the extreme situations of the area.</p>
<p><b>What are your actual limitations and do you have a work around?</b></p>	<p>For more superficial analysis, first looks etc. an estimate is often sufficient and the quality of the data set is not as critical as for design studies. The latter requires long time series (for instance preferably more than 1/4 of the extreme calculated - i.e. 25 yrs for 100 year extreme) and high resolution in time and space in order to catch vigorous short-lived and small scale local phenomena. Data of sufficient quality can be hard to come by in coastal and remote/less developed areas and rougher modeled data/estimates/approximations will be used. Sometimes calibration of modeled data to shorter observed time series has to be made.</p> <p><b>In addition:</b></p> <p>There are important spatial and temporal limitations of historical surface-based and remotely-sensed wave height observations that make the analyses of extreme values very challenging (e.g., most extremes at sea were probably not observed or otherwise sampled).</p> <p><b>Exemplified by the data sources in this study:</b></p> <p><b>Update frequency:</b></p> <p>To slow in some cases, some data sources do not extend to near real time (1 month or more lag), and "patching" with any available observations is necessary.</p> <p><b>Temporal resolution:</b></p> <p>3 and 6 hours are too infrequent and do not catch short lived extremes, and approximations have to be made.</p> <p><b>Spatial resolution:</b></p> <p>*Too large outside well know areas (and large even there). Does not catch small scale and local (bathymetry induced) phenomena. Should be 4 km minimum.</p>



	<b>NOTE. High resolution and high update resolution does not equal quality, hence documentation of verification is equally important!!</b>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, but resolution, update frequency, length of data series and quality is not sufficient for instance design studies. It is used as input in regional reanalysis and hindcast.</p> <p>Long (10 years +) observed time series of high quality (ground-truthed) and with high spatial resolution, especially for coastal areas and emerging O&amp;G areas where demand for such data has been small or non-existent.</p> <p>EO data that can improve modeled re-analyses.</p> <p>Example: Long time series of significant wave heights and all other wave spectra data.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	4
<b>Dev.</b>	4
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	<p>Applies to all six areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily or weekly, since historical data are often needed to assess recent events. For some parameters and data sets, monthly is

	<p>still sufficient.</p> <p>Available today: For the historical re-analyses and archived observations, monthly; however, recent observations are available generally without delay.</p>
<b>Temporal resolution</b>	<p>Data should be at least 1-3 hourly depending on area and phenomena needed to be resolved.</p> <p>Available today: ERA-Interim: 6-hourly WaveWatch III: 3 hourly Surface-bases observation: sub-hourly to less frequently Remotely-sensed satellite observation: sub-daily to less frequently</p>
<b>Spatial resolution</b>	<p>Around 4 km, maybe less in coastal areas.</p> <p>Available: ERA-Interim: 0.75° WaveWatch III: 4 arc-mins, 10 arc-mins, and/or 30 arc-mins, depending on area Surface-bases observation: varies based on the locations of the ship/buoy observations Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p> <p>In general, ground observations and modelled sourced are perceived to be of better quality than EO for historical wave data.</p>
<b>Data Coverage and extent</b>	<p>Regional.</p>
<b>Example format</b>	<p>ERA-Interim: grib and netCDF WaveWatch III: grib and/or grib2 Surface-bases observation: text, CSV and/or netCDF Remotely-sensed satellite observation: text</p>

<b>Timeliness</b>	Normally needed urgently, possibly before assessing, planning, or exploring a new field. Hence the data source used for analysis needs to be frequently updated to avoid unnecessary waiting. Daily, weekly or monthly updates of data sets are sufficient, depending on the analysis required.
<b>Existing standards</b>	Multiple paragraphs in DNV-RP-C205, OTO 2001/010, ISO-19001-1, NORSOK-N-003e2, NORSOK-N-006u1, and DNV-OS-J001 contain extensive references to the standard measures of the means and extremes of waves, including the recommended approximations and calculations of return periods and probabilities of exceedance. The DNV series acknowledges that the procedures may not be applicable beyond the area of interest that it was tailored for.

<b>Challenge ID</b>	OFF1.3
<b>Title</b>	<b>Historic records for surface currents</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical ocean surface currents data are available via different agencies. They are either based on reanalysis, hindcast model data or derived from satellite observations.</p> <p>Data from Global models: HYCOM+NCODA model system: : <a href="http://hycom.org/dataserver">http://hycom.org/dataserver</a> Three Global reanalysis from MERCATOR, University of Reading and CMCC via MyOcean: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a> Data from regional models: Mediterranean Sea: MEDSEA (MyOcean): <a href="http://www.myocean.eu/">http://www.myocean.eu/</a> Iberian, Biscay and Irish Seas: IBI MFC model: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>, limited in time. European NW Shelf: FOAM: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p> <p>Currents derived from satellite: Global geostrophic currents analysis from MyOcean derived from satellite observations: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a> Global geostrophic currents from NOAA: derived from sea surface height, wind speed and sea surface temperature satellite observations: OSCAR: <a href="http://www.oscar.noaa.gov/">http://www.oscar.noaa.gov/</a>.</p>
<b>When do you use this kind of dataset?</b>	<p>Historical ocean surface current data are used to great extent in all phases throughout the O&amp;G cycle, except strictly operational tasks.</p> <p>The data set is used to assist in qualifying and quantifying the means and extremes of ocean currents in the area of interest. In addition ocean data are important for environmental impact studies, oil spill trajectory modeling, modeling of drilling cuttings etc.</p> <p>During the early stages, field assessment/seismics etc. the data are mostly used to assess the operability of the area during different seasons and to assess financial risk and first draft of</p>

	<p>development costs.</p> <p>During planning of new fields and operations data are used to assess the climatic limitations local/regional weather would have on safety in order to reduce risk for operations, personnel and environment.</p> <p>Finally surface current data are important to design of structures that can withstand the local conditions and take into account the risk of the extreme situations of the area.</p>
<p><b>What are your actual limitations and do you have a work around?</b></p>	<p>Same as for wind and wave, only that data of sufficient quality is rare. Most of this is due to the limited access to observations, and if accessible available update frequency, quality and resolution is normally poor. Little data is available to sufficiently ground truth EO data. In addition data of sufficient quality can be hard to come by in coastal and remote/less developed areas. Modelled data has low quality for on shorter time scales, while climatology is of sufficient quality. These data rarely catch short lived and small scale extremes.</p> <p><b>In addition:</b></p> <p>There are important spatial and temporal limitations of historical surface-based and remotely-sensed ocean current observations that make the analyses of extreme values very challenging (e.g., most extremes at sea were probably not observed or sampled).</p> <p><b>Exemplified by the data sources in this study:</b></p> <p><i>Update frequency:</i> Generally to slow, and not extended to real-time. And observations for "patching" often not available.</p> <p><i>Temporal resolution:</i> Not by far sufficient, often daily snapshots, and averages, does not catch important events.</p> <p><i>Spatial resolution:</i> Not by far sufficient, should have at least 4 km resolution to resolve small scale features and coastal areas.</p> <p><b>NOTE. High resolution and high update resolution does not equal quality, hence documentation of verification is equally important!!</b></p>
<p><b>Needs and expectations on EO data</b></p>	<p>EO is used for this today, but resolution, update frequency, length of data series and quality is not sufficient for instance design studies. It is used as input in regional reanalysis and hindcast.</p>

	<p>Long (10 years +) observed time series of high quality (ground-truthed) and with high spatial resolution, especially for coastal areas and emerging O&amp;G areas where demand for such data has been small or non-existent. Or - EO data that can improve modeled reanalyses.</p> <p>Specific need: Long time series of ocean current data.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	4
<b>Dev.</b>	4
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	<p>Applies to all six areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	<p>Daily or weekly, since historical data is frequently required to assess recent events. For some parameters and data sets, monthly is still sufficient.</p> <p>Available today: For the historical reanalyses and archived observations, monthly; however, recent observations are available generally without delay.</p>
<b>Temporal resolution</b>	<p>Data should be at least 1-3 hourly resolution depending on area and phenomena needed to be resolved.</p> <p>Available today: OSCAR: 5-day moving mean.</p>

	<p>HYCOM+NCODA system: Daily snapshot at 00Z          MyOcean global reanalysis: Monthly (all), weekly (MERCATOR) , daily (CMCC) from 1993          Regional models:          Mediterranean Sea: MEDSEA (MyOcean): Monthly, daily from 1987          Iberian, Biscay and Irish Seas: IBI MFC model: Daily means (and hourly means) from 20110401          European NW Shelf: FOAM: Daily means from 1985</p> <p>Currents, temperature and SST derived from satellite:          Global geostrophic currents and SST analysis based on satellite observations: Weekly and monthly means</p>
<p><b>Spatial resolution</b></p>	<p>Around 4 km, maybe less in coastal areas.</p> <p>Available:          OSCAR: 1/3°</p> <p>HYCOM+NCODA system: 1/12°          MyOcean global reanalysis: 0.25°          Regional models:          Mediterranean Sea: MEDSEA (MyOcean) :6-7 km          Iberian, Biscay and Irish Seas: IBI MFC model: ~2km          European NW Shelf: FOAM: 7 km</p> <p>Currents, temperature and SST derived from satellite:          Global geostrophic currents and SST analysis based on satellite observations: 1/4°</p>
<p><b>Data quality</b></p>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p> <p>In general, ground observations and modelled sourced are perceived to be of better quality than EO for historical current data.</p>
<p><b>Data Coverage and extent</b></p>	<p>Regional</p>

<b>Example format</b>	CSV and/or netCDF
<b>Timeliness</b>	Normally needed urgently, possibly before assessing, planning, or exploring a new field. Hence the data source used for analysis needs to be frequently updated to avoid unnecessary waiting. Daily, weekly or monthly updates of data sets are sufficient, depending on the analysis required.
<b>Existing standards</b>	



<b>Challenge ID</b>	OFF1.4
<b>Title</b>	<b>Historic records for currents at depth</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical ocean currents data for currents at depth are available via different agencies. They are either based on reanalysis, hindcast model data or derived from satellite observations. Quality is lower than for the surface currents due to fewer observations.</p> <p>Data from Global models: HYCOM+NCODA model system: : <a href="http://hycom.org/dataserver">http://hycom.org/dataserver</a> Three Global reanalysis from MERCATOR, University of Reading and CMCC via MyOcean: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a> Data from regional models: Mediterranean Sea: MEDSEA (MyOcean): <a href="http://www.myocean.eu/">http://www.myocean.eu/</a> Iberian, Biscay and Irish Seas: IBI MFC model: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>, limited in time. European NW Shelf: FOAM: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p> <p>Currents derived from satellite: Global geostrophic currents analysis from MyOcean derived from satellite observations: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a> Global geostrophic currents from NOAA: derived from sea surface height, wind speed and sea surface temperature satellite observations: OSCAR: <a href="http://www.oscar.noaa.gov/">http://www.oscar.noaa.gov/</a>.</p>
<b>When do you use this kind of dataset?</b>	<p>Historical ocean current data at depth are used to great extent in all phases of the O&amp;G cycle, except strictly operational tasks.</p> <p>The data set is used to assist in qualifying and quantifying the means and extremes of ocean currents in the area of interest. In addition ocean data are important for environmental impact studies, oil spill trajectory modeling, modeling of drilling cuttings etc.</p> <p>During the early stages, field assessment/seismics etc. the data are mostly used to assess the operability of the area during</p>

	<p>different seasons and to assess financial risk and first draft of development costs.</p> <p>During planning of new fields and operations data are used to assess the climatic limitations local/regional weather would have on safety in order to reduce risk for operations, personnel and environment.</p> <p>Finally surface current data are important to design of structures that can withstand the local conditions and take into account the risk of the extreme situations of the area.</p>
<p><b>What are your actual limitations and do you have a work around?</b></p>	<p>Same as for wind and wave, only that data of sufficient quality is very rare. Most of this is due to the limited access to observations of currents at dept. Most current observations are made at the surface. In addition data of sufficient quality can be even harder to come by in coastal and remote/less developed areas. Modelled data has low quality for on shorter time scales, while climatology is of sufficient quality. These data rarely catch short lived and small scale extremes.</p> <p>There are important spatial and temporal limitations of historical surface-based and remotely-sensed ocean current observations that make the analyses of extreme values very challenging (e.g., most extremes at sea were probably not observed or sampled).</p> <p>Exemplified by the data sources in this study:          Vertical resolution, often to large, does not catch variations in shallow coastal areas. Bottom dynamics not well described.          Update frequency:          Generally to slow, and not extended to real-time. And observations for "patching" often not available.          Temporal resolution:          Not by far sufficient, often daily snapshots, and averages, does not catch important events.          Spatial resolution:          Not by far sufficient, should have at least 4 km resolution to resolve small scale features and coastal areas.          NOTE. High resolution and high update resolution does not equal quality, hence documentation of verification is equally important!!</p> <p>Time consuming to work with these data series, makes accurate</p>

	analyses expensive.
<b>Needs and expectations on EO data</b>	EO cannot be used for this today.  Long (10 years +) observed time series of high quality from gliders, ADCPs etc., in all areas.  Specific need: Long time series of ocean current data.
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	4
<b>Dev.</b>	4
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Applies to all six areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.  Seasonality: Applies to all seasons.
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Available today:
<b>Temporal resolution</b>	Data should be at least 1-3 hourly resolution depending on area and phenomena needed to be resolved.  Available today: OSCAR: 5-day moving mean.  HYCOM+NCODA system: Daily snapshot at 00Z MyOcean global reanalysis: Monthly (all), weekly (MERCATOR) , daily (CMCC) from 1993

	<p>Regional models:          Mediterranean Sea: MEDSEA (MyOcean): Monthly, daily from 1987          Iberian, Biscay and Irish Seas: IBI MFC model: Daily means (and hourly means) from 20110401          European NW Shelf: FOAM: Daily means from 1985</p> <p>Currents, temperature and SST derived from satellite:          Global geostrophic currents and SST analysis based on satellite observations: Weekly and monthly means</p>
<b>Spatial resolution</b>	<p>Around 4 km, maybe less in coastal areas.</p> <p>Available:          OSCAR: 1/3°</p> <p>HYCOM+NCODA system: 1/12°          MyOcean global reanalysis: 0.25°</p> <p>Regional models:          Mediterranean Sea: MEDSEA (MyOcean) :6-7 km          Iberian, Biscay and Irish Seas: IBI MFC model: ~2km          European NW Shelf: FOAM: 7 km</p> <p>Currents, temperature and SST derived from satellite:          Global geostrophic currents and SST analysis based on satellite observations: 1/4°</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p>
<b>Data Coverage and extent</b>	Regional.
<b>Example format</b>	CSV and/or netCDF
<b>Timeliness</b>	<p>Normally needed urgently, possibly before assessing, planning, or exploring a new field. Hence the data source used for analysis needs to be frequently updated to avoid unnecessary waiting. Daily, weekly or monthly updates of data sets are sufficient, depending on the analysis required.</p>
<b>Existing standards</b>	In addition, DNV-RP-C205, ISO-19001-1, and DNV-OS-J001

	contain cautionary notes regarding the treatment of waves in areas that experience tropical cyclones, such as South China Sea, West of Ireland, and Myanmar.
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<b>Challenge ID</b>	OFF1.5
<b>Title</b>	<b>Wind observations</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Real-time and near real-time surface-based observations of 10m wind speeds from ships and buoys are available from many sources including NOAA (NWSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p> <p>Operational 0-hour global and/or regional model analyses of 10m wind speeds are available via many global agencies such as NOAA, ECMWF, CMC, JMA, UKMET, and others.</p>
<b>When do you use this kind of dataset?</b>	<p>These data are used to monitor all day-to-day operations when drilling, surveying etc. To assess current conditions, nowcasting, assess the quality forecast models and plan ahead. Find windows of operability where thresholds apply etc.</p> <p>The aim is to manage risks related to winds, safeguarding lives, protecting assets, and conducting operations. Wind data are particularly important for work at height, during helicopter operations etc.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>There are spatial and temporal limitations of real-time and near real-time surface-based and remotely-sensed 10m wind observations. The observation heights and averaging periods of wind observations are variables that must be reconciled across all record sets prior to analyses. Which means: Data are often not on location. Sensors are too high, shielded, measurements averaged, in wrong formats etc.</p> <p>EO observations are have low resolution in time and space, are difficult to access and read, in difficult formats. Quality is often an issue and data are mostly used to get an overview more than treated as an accurate source of observations. Hence ground</p>

	<p>measurements are used instead.</p> <p>Updates at least hourly, spatial resolution min. 4 km, formats standardised, quality improved and documented.</p>
<p><b>Needs and expectations on EO data</b></p>	<p>EO is used for this today, but resolution, update frequency and quality is not always sufficient. Mostly used as assimilation into models. More severe situations (se hurricanes, squalls etc.) can be detected using these data real time, however the use for point forecasting is limited.</p> <p>Need: Observed time series of high quality (ground-truthed) and with high spatial resolution, especially for coastal areas and emerging O&amp;G areas where demand for such data has been small or non-existent.</p> <p>Specific need: Additional surface-based and remotely sensed observations of 10m wind speeds (with 1-min, 10-min, 1-hour, and 3-second averaging periods).</p>
<p><b>Challenge classification</b></p>	
<p><b>Pre license</b></p>	2
<p><b>Exp.</b></p>	4
<p><b>Dev.</b></p>	3
<p><b>Prod.</b></p>	4
<p><b>Decom.</b></p>	3
<p><b>Geographic context/ restrictions</b></p>	<p>Applies to all six Areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality: Applies to all seasons.</p>
<p><b>Topographic classification / Offshore classification</b></p>	Ocean
<p><b>Activity impacted/concerned</b></p>	
<p><b>Technology Urgency</b></p>	Short term (2-5 years)
<p><b>Information requirements</b></p>	
<p><b>Update frequency</b></p>	Real-time and near real-time. Hourly or 10 min.

	<p>Available today: Depends on source, some sources only 6 or 12 hr, most 3 hourly, few less than 1 hr.</p>
<b>Temporal resolution</b>	<p>Real-time and near real-time. Hourly or 10 min.</p> <p>Available: Surface-based observation: sub-hourly to less frequently Remotely-sensed satellite observation: sub-daily to less frequently</p>
<b>Spatial resolution</b>	<p>Observation on location or around 4 km</p> <p>Available: Surface-based observation: varies based on the locations of the ship/buoy observations Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p> <p>In general, ground observations and modelled sourced are perceived to be of better quality/higher accuracy than EO.</p>
<b>Data Coverage and extent</b>	<p>Regional and as localised as possible.</p>
<b>Example format</b>	<p>Surface-bases observation: text, CSV and/or netCDF Remotely-sensed satellite observation: text</p>
<b>Timeliness</b>	<p>Real-time or near real-time. Forecasts are normally issued 2 to 4 times per day, but continuous monitoring of conditions is required.</p>
<b>Existing standards</b>	<p>Multiple paragraphs in DNV-RP-C205, OTO 2001/010, ISO-19001-1, NORSOK-N-003e2, and NORSOK-N-006u1 contain extensive references to the standard measures of the means of winds.</p>



<b>Challenge ID</b>	OFF1.6
<b>Title</b>	<b>Waves observations</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Real-time and near real-time surface-based observations of wind wave heights, swell wave heights, and significant wave heights from ships and buoys are available from many sources including NOAA (NWSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p> <p>Operational 0-hour global and/or regional model analyses of significant wave heights are available via many global agencies such as NOAA, ECMWF, CMC, JMA, UKMET, and others.</p>
<b>When do you use this kind of dataset?</b>	<p>These data are used to monitor all day-to-day operations when drilling, surveying etc. To assess current conditions, nowcasting, assess the quality forecast models and plan ahead. Find windows of operability where thresholds apply etc.</p> <p>The aim is to manage risks related to waves, safeguarding lives, protecting assets, and conducting operations. Waves and wave periods are particularly important when moving jack-ups, heavy lifts etc. etc.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>There are spatial and temporal limitations of real-time and near real-time surface-based and remotely-sensed wave observations. Which means: Data are often not on location. Sensors of different formats, give different parameters, could be shielded, measurements averaged, in "wrong formats" etc.</p> <p>EO observations are have low resolution in time and space, are difficult to access and read, in difficult formats. Quality is often an issue and data are mostly used to get an overview more than treated as an accurate source of observations. Hence ground measurements are used instead.</p>

	Updates at least hourly, spatial resolution min. 4 km, formats Standardised, quality improved and documented.
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, but resolution, update frequency and quality is not always sufficient. Mostly used as assimilation into models. More severe situations (for instance swells) can be detected using these data real time, however the use for point forecasting is limited.</p> <p>Need: Observed time series of high quality (ground-truthed) and with high spatial resolution, especially for coastal areas and emerging O&amp;G areas where demand for such data has been small or non-existent. Both wind waves and swells are important.</p> <p>Specific need: Additional surface-based and remotely sensed observations of wave spectra data (e.g., heights, directions, and periods of wind waves and swell waves).</p>
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	4
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Real-time and near real-time. Hourly or 10 min.

	<p>Available today: Depends on source, some sources only 6 or 12 hr, most 3 hourly, few less than 1 hr.</p>
<b>Temporal resolution</b>	<p>Real-time and near real-time. Hourly or 10 min.</p> <p>Available: Surface-based observation: sub-hourly to less frequently Remotely-sensed satellite observation: sub-daily to less frequently</p>
<b>Spatial resolution</b>	<p>Observation on location or around 4 km</p> <p>Available: Surface-based observation: varies based on the locations of the ship/buoy observations Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p> <p>In general, ground observations and modelled sourced are perceived to be of better quality/higher accuracy than EO.</p>
<b>Data Coverage and extent</b>	<p>Regional and as localised as possible.</p>
<b>Example format</b>	<p>Surface-bases observation: text, CSV and/or netCDF Remotely-sensed satellite observation: text</p>
<b>Timeliness</b>	<p>Real-time or near real-time. Forecasts are normally issued 2 to 4 times per day, but industry requires continuous monitoring of.</p>
<b>Existing standards</b>	<p>Multiple paragraphs in DNV-RP-C205, OTO 2001/010, ISO-19001-1, NORSOK-N-003e2, and NORSOK-N-006u1 contain extensive references to the standard measures of the means of waves.</p>

<b>Challenge ID</b>	OFF1.7
<b>Title</b>	<b>Surface current observations</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Near real-time ocean surface current data are available via NOAA (NDBC): <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>.  Surface currents derived from satellite:  Global geostrophic currents and SST analysis based on satellite observations: OSCAR: <a href="http://www.oscar.noaa.gov/">http://www.oscar.noaa.gov/</a></p> <p>Global forecast system available on two websites:  RTOFS: <a href="http://polar.ncep.noaa.gov/global/data_access.shtml?">http://polar.ncep.noaa.gov/global/data_access.shtml?</a>  HYCOM+NCODA system: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p> <p>Regional forecast models:  Mediterranean Sea: MEDSEA (MyOcean):  <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>  Iberian, Biscay and Irish Seas: IBI MFC model:  <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>  European NW Shelf: FOAM: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p>
<b>When do you use this kind of dataset?</b>	<p>These data are used to monitor all day-to-day operations when drilling, surveying etc. To assess the current conditions, nowcasting, assess the quality forecast models and plan ahead. Find windows of operability etc.</p> <p>The aim is to manage risks related to surface currents, safeguarding lives, protecting assets, and conducting operations. Knowledge of currents is especially important to access the risks during an oil spill.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>Data availability is the major issue. Few measurements of sufficient quality exist.</p> <p>Data quality is another issue. There are spatial and temporal limitations of real-time and near real-time surface-based and remotely-sensed ocean current observations. Also update frequency, quality and usability of EO data.</p>

	<p>EO observations are have low resolution in time and space, are difficult to access and read, in difficult formats. Quality is often an issue and data are mostly used to get an overview more than treated as an accurate source of observations.</p> <p>Updates at least hourly, spatial resolution min. 4 km, formats Standardised, quality improved and documented.</p> <p>Ground observations are more trusted, but are few, and also have issues with quality.</p>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, but resolution, update frequency and quality is not sufficient. Increasingly used as assimilation into models. More severe situations (for instance eddies/loop current) can be detected using these data real time, however the use for point forecasting is limited.</p> <p>Specific need: Additional surface-based observations of ocean current profiles.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	4
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Real-time and near real-time. Hourly, or 10 minutes averaged over 1 hour (because of noise).

	<p>Available today:          Depends on source, some sources only daily, most 6-3 hrs, few real time</p>
<b>Temporal resolution</b>	<p>Surface-based observation: sub-hourly to less frequently</p> <p>RTOFS (HYCOM+NCODA): 3 hr          HYCOM+NCODA system: Daily snapshot at 00Z</p> <p>Regional models:          Mediterranean Sea: MEDSEA (MyOcean): Daily          Iberian, Biscay and Irish Seas: IBI MFC model: Daily means or hourly means          European NW Shelf: FOAM: Daily means or hourly means</p> <p>Currents, temperature and SST derived from satellite:          Global geostrophic currents and SST analysis based on satellite observations: Weekly and monthly means</p>
<b>Spatial resolution</b>	<p>Observation on location or around 4 km (maybe less in coastal areas).</p> <p>Available:          Surface-based observation: varies based on the locations of the ship/buoy observations          Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters</p> <p>HYCOM+NCODA system: 1/12°</p> <p>Regional models:          Mediterranean Sea: MEDSEA (MyOcean) :6-7 km          Iberian, Biscay and Irish Seas: IBI MFC model: ~2km          European NW Shelf: FOAM: 7 km</p> <p>Currents, temperature and SST derived from satellite:          Global geostrophic currents analysis based on satellite observations: 1/4°</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for</p>

	each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional and as localised as possible.
<b>Example format</b>	netCDF and/or CSV
<b>Timeliness</b>	Real-time or near real-time. Forecasts are normally issued 2 to 4 times per day, but industry requires continuous monitoring of conditions.
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF1.8
<b>Title</b>	<b>Current at depth observations</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Near real-time ocean current data at depth (few) are available via NOAA (NDBC) : <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>, but very little information on currents at depth.</p> <p>Global forecast system available on two websites:  RTOFS: <a href="http://polar.ncep.noaa.gov/global/data_access.shtml?">http://polar.ncep.noaa.gov/global/data_access.shtml?</a>  HYCOM+NCODA system: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p> <p>Regional forecast models:  Mediterranean Sea: MEDSEA (MyOcean):  <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>  Iberian, Biscay and Irish Seas: IBI MFC model:  <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>  European NW Shelf: FOAM: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p>
<b>When do you use this kind of dataset?</b>	<p>These data are used to monitor all day-to-day operations when drilling, surveying etc. To assess current conditions, nowcasting, plan ahead. Find windows of operability etc.</p> <p>To assist in managing risks related to ocean surface currents, safeguarding lives, protecting assets, and conducting operations. Important during subsea oil spills, running risers in deep water and strong currents, using divers and ROVs etc.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>Data availability is the major issue. Few measurements of sufficient quality exist.</p> <p>There are spatial and temporal limitations of real-time and near real-time surface-based and remotely-sensed ocean current observations.</p> <p>EO observations do not exist.</p>
<b>Needs and expectations on EO</b>	EO is not used for this today.



<b>data</b>	Specific need: Additional surface-based observations of ocean current profiles.
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	4
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Applies to all six Areas of interest, except for the cautionary notes about tropical cyclones, which only applies to South China Sea, West of Ireland, and Myanmar.  Seasonality: Applies to all seasons.
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Real-time and near real-time. Hourly, or 10 minutes averaged over 1 hour (because of noise).  Available today: Depends on source, some sources only daily, most 6-3 hrs, few real time
<b>Temporal resolution</b>	Real-time and near real-time. Hourly or 10 min.  Available:  Surface-based observation: observation: sub-hourly to less frequently  RTOFS (HYCOM+NCODA): 3 hr HYCOM+NCODA system: Daily snapshot at 00Z  Regional models: Mediterranean Sea: MEDSEA (MyOcean): Daily

	<p>Iberian, Biscay and Irish Seas: IBI MFC model: Daily means or hourly means European NW Shelf: FOAM: Daily means or hourly means</p> <p>Currents, temperature and SST derived from satellite: Global geostrophic currents and SST analysis based on satellite observations: Weekly and monthly means</p>
<b>Spatial resolution</b>	<p>Observations on location or around 4 km (maybe less in coastal areas).</p> <p>Surface-based observation: varies based on the locations of the ship/buoy observations Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters</p> <p>HYCOM+NCODA system: 1/12°</p> <p>Regional models: Mediterranean Sea: MEDSEA (MyOcean) :6-7 km Iberian, Biscay and Irish Seas: IBI MFC model: ~2km European NW Shelf: FOAM: 7 km</p> <p>Currents, temperature and SST derived from satellite: Global geostrophic currents analysis based on satellite observations: 1/4°</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p>
<b>Data Coverage and extent</b>	<p>Regional and as localised as possible.</p>
<b>Example format</b>	<p>netCDF and/or CSV</p>
<b>Timeliness</b>	<p>Real-time or near real-time. Forecasts are normally issued 2 to 4 times per day, but industry requires continuous monitoring of conditions.</p>
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF1.9
<b>Title</b>	Historical Tropical Storm/Tropical Cyclone probability and tracks
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical observations of tropical cyclone positions, intensities, sizes and other quantitative measures are readily available in six hour intervals (and sometimes more frequently) from multiple global agencies via the best track archives that comprise IBTrACS.</p> <p>IBTrACS: <a href="http://www.ncdc.noaa.gov/ibtracs/">http://www.ncdc.noaa.gov/ibtracs/</a></p>
<b>When do you use this kind of dataset?</b>	<p>Historical observations of tropical cyclones data are used to great extent by the O&amp;G industry in tropical storm prone areas for all phases throughout the O&amp;G cycle, except strictly operational tasks. These data are extremely important to assess risk of operations in these areas, frequency of occurrence, most likely track etc. Also, many other data sources do not catch the extremes in the area without these data added to the time series for the point of interest, since data often are averaged and conditions often are mostly benign.</p> <p>The data set is used to assist in qualifying and quantifying the means and extremes of tropical cyclone in the area of interest. The data set is used to assess operability in the area, to reduce risk when designing structures and operations, to design strategies to avoid severe conditions.</p>
<b>What are your actual limitations and do you have a work around?</b>	The averaging periods of the reported maximum wind speeds in tropical cyclones varies among global agencies and must be reconciled across all record sets prior to analyses.
<b>Needs and expectations on EO data</b>	<p>EO is used for this today in combination with modeled data. Need to know the exact position, strength and accurate extent of the storms and wind speeds is important to assess impact of these storms and assess the future risks.</p> <p>Long time series of 10m wind speeds and directions, wave spectra data (e.g., heights, directions, and periods of wind</p>

	waves and swell waves) and ocean current profiles.
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	4
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	<p>Applies to South China Sea, West of Ireland, and Myanmar.</p> <p>Seasonality:          South China Sea -- Applies to all seasons.          West of Ireland -- Applies primarily to September.          Myanmar. Bimodal. Applies primarily to April/May and October/November.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	annually
<b>Temporal resolution</b>	<p>1-3 hourly</p> <p>Available: Generally 6-hourly, but sometimes more or less frequently</p>
<b>Spatial resolution</b>	<p>10-4 km</p> <p>Available: Generally 0.1° for tropical cyclone center locations</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p>
<b>Data Coverage and extent</b>	Regional or along track.

<b>Example format</b>	netCDF and CSV
<b>Timeliness</b>	Normally needed urgently, possibly before assessing, planning, or exploring a new field. Hence the data source used for analysis needs to be frequently updated to avoid unnecessary waiting. Daily, weekly or monthly updates of data sets are sufficient, depending on the analysis required.
<b>Existing standards</b>	DNV-RP-C205, ISO-19001-1, and DNV-OS-J001 contain cautionary notes regarding the treatment of winds and waves in areas that experience tropical cyclones, such as South China Sea, West of Ireland, and Myanmar.

<b>Challenge ID</b>	OFF1.10
<b>Title</b>	<b>Tropical Storm/Tropical Cyclone Observations</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Near real-time warnings, that include the latest tropical cyclone positions, intensities, sizes and other quantitative measures, are readily available every six hours from multiple global agencies, including RSMC Tokyo (for South China Sea), RSMC Miami (for West of Ireland), and RSMC New Delhi (for Myanmar). Tropical cyclone satellite-derived positions and intensities are available more frequently.</p> <p>RSMC Tokyo: <a href="http://www.jma.go.jp/en/typh/index.html">http://www.jma.go.jp/en/typh/index.html</a>  RSMC Miami: <a href="http://www.nhc.noaa.gov/">http://www.nhc.noaa.gov/</a>  RSMC New Delhi: <a href="http://www.imd.gov.in/section/nhac/dynamic/cyclone.htm">http://www.imd.gov.in/section/nhac/dynamic/cyclone.htm</a></p>
<b>When do you use this kind of dataset?</b>	<p>Real-time observations of tropical cyclones are used to assess the risk of impact of tropical storms in the area of interest. The data are used to assess the position, likely path and impact on the operations. Warnings are issued when thresholds are passed and procedures for safeguarding lives, equipment, assessed area put in place. Equally important is the possibility to conduct operations if the path is likely to stay away from the area of interest.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>The averaging periods of the reported maximum wind speeds in tropical cyclones varies among global agencies and must be reconciled across all record sets prior to analyses.</p>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today in combination with modeled data. Need to know the exact position, strength and accurate extent of the storms and wind speeds is important to assess impact of these storms and assess the near future risks. Ground observations in the hardest hit areas are likely to be destroyed or miss the highest peaks, better knowledge of speeds and extents area important.</p> <p>Long time series of 10m wind speeds and directions, wave spectra data (e.g., heights, directions, and periods of wind waves and swell waves) and ocean current profiles in the</p>

	offshore environment.
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	4
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Applies to South China Sea, West of Ireland, and Myanmar.  Seasonality: South China Sea -- Applies to all seasons. West of Ireland -- Applies primarily to September. Myanmar. Bimodal. Applies primarily to April/May and October/November.
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Generally six times daily, and often more frequently. Position and intensity data may be available hourly in some cases.
<b>Temporal resolution</b>	Hourly.  Available: Advisories/warnings: generally 6-hourly, but sometimes more or less frequently  Center fixes/posits/intensity estimates: sometimes hourly
<b>Spatial resolution</b>	10-4 km Available: generally 0.1° for tropical cyclone center locations
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for

	each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional or along track.
<b>Example format</b>	text
<b>Timeliness</b>	Hourly or more frequent. Forecasts are normally issued 2 to 4 times per day, warnings when thresholds are passed, continuous monitoring of conditions is required.
<b>Existing standards</b>	DNV-RP-C205, ISO-19001-1, and DNV-OS-J001 contain cautionary notes regarding the treatment of winds and waves in areas that experience tropical cyclones, such as South China Sea, West of Ireland, and Myanmar.



<b>Challenge ID</b>	OFF1.11
<b>Title</b>	<b>Sea level</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical sea level heights are available in the form of remotely-sensed satellite observations via DEOS-RADS.</p> <p>DEOS-RADS: <a href="http://rads.tudelft.nl/rads/rads.shtml">http://rads.tudelft.nl/rads/rads.shtml</a></p> <p>Near real-time sea level heights are also available in the form of remotely-sensed satellite observations of sea heights from NOAA (STAR) and DEOS-RADS.</p> <p>DEOS-RADS: <a href="http://rads.tudelft.nl/rads/rads.shtml">http://rads.tudelft.nl/rads/rads.shtml</a>  STAR: <a href="http://www.star.nesdis.noaa.gov/sod/Isa/NearReal-time/">http://www.star.nesdis.noaa.gov/sod/Isa/NearReal-time/</a></p> <p>Global Sea Level mean based on satellite observations:  <a href="http://www.myocean.eu/">http://www.myocean.eu/</a></p>
<b>When do you use this kind of dataset?</b>	<p>Sea levels data sets are used to assess the most likely interval of the sea surface in the area of interest. The data is crucial where there are chances of strong storm surges, large variations of tidal height, but also where wave heights are likely to add to the sea level. The data are used to qualify and quantify the means and extremes of sea heights. Air gap analysis for jack-up rigs and fixed platforms, seismic survey (to calibrate data), mooring analysis are some uses.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>The primary limitation of historical and near real-time sea level heights is that the remotely-sensed satellite observations are not continuous. Modelled data of tidal level and pressure effects are used instead, but wind induced effects are not well represented. Hence these are estimated based on wind data, but are not as accurate as measurements.</p> <p>(Also, improved measurements of sea level heights - high frequency, high resolution - will improve modelling of currents.)</p>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today and probably the best source offshore. However resolution could be better.</p>

	Specific need: Hourly time series of observed sea heights, ideally $\geq 19$ years.
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	4
<b>Prod.</b>	4
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Applies to all six areas of interest. Seasonality: Applies to all seasons.
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Multiple times per day from polar-orbiting satellites. Sufficient.
<b>Temporal resolution</b>	At least daily. Available: Remotely-sensed satellite observation: sub-daily to less frequently
<b>Spatial resolution</b>	50-10 km. Available: Remotely-sensed satellite observation: varies based on platform scanning swath size and other parameters
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	text
<b>Timeliness</b>	Daily, weekly or monthly is sufficient.

<b>Existing standards</b>	<p>Paragraph 11.1 of HSE OTR 2001/010 states: Metocean parameters are required describing wave or sea state heights, wave lengths, periods and direction, current speed and directions, sea level and (if they are likely to cause significant stress ranges) wind speeds.</p> <p>Paragraph 3.15 of ISO 19901-1:2005(E) states: The Mean Sea Level (MSL) is the arithmetic mean of all sea levels measured at hourly intervals over a long period, ideally 19 years.</p> <p>Paragraph 6.7 of NORSOK-N-003e2 states: Characteristic values of individual environmental actions are defined by annual exceedance probabilities. (Note: The sea level thresholds are shown in Table 4 beneath Paragraph 6.7.)</p>
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<b>Challenge ID</b>	OFF1.12
<b>Title</b>	<b>Visibility</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Visibility data are largely limited to surface-based observations from ships and buoys. The historical records of observed visibilities are available via UCAR (ICOADS) and NOAA (NDBC).</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a></p> <p>Real-time and near real-time observations of visibility data are available from many sources including NOAA (NWSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p>
<b>When do you use this kind of dataset?</b>	<p>Visibility data are important in areas prone to frequent reduced visibility. Reduced visibility might slow down operations, tows, stop helicopter operations and other operations that require a certain visibility. Data are used to qualify and quantify the means and extremes of visibilities, and (b) managing risks related to visibility, safeguarding lives, protecting assets, and conducting operations.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>The temporal and spatial resolutions of surface-based observations significantly limits the availability of visibility data. Unless ships or buoys observe and report visibility data, visibilities are not readily available for analysis over vast areas of the ocean.</p> <p>Hard to use for other purposes than real-time observations, historical data are mostly ground observations, often manual and not very accurate. And when automatic, the cause of low visibility is not easily available (precipitation or fog?). Estimates have to be made.</p> <p>Better resolution, more frequent observations (hourly, 15 mins), better algorithms to separate fog from cloud.</p>
<b>Needs and expectations on EO</b>	<p>EO is used for this today and probably the best source to assess the geographical extent of for instance fog. However the</p>

<b>data</b>	<p>resolution and frequency of observations in some regions needs improvement. Also, tools to distinguish for instance fog from other clouds needs to be improved.</p> <p>Specific need: Time-series of surface-based visibility data. Better algorithms to distinguish fog from cloud etc.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	<p>Applies to all six areas of interest.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	<p>Hourly or 15 hourly.</p> <p>Available: Geostationary: Real-time or near real-time observations are available sub-hourly. Polar orbiting rarer. Historical observations are generally updated once per month, for the previous month.</p>
<b>Temporal resolution</b>	Sub-hourly and less frequently.
<b>Spatial resolution</b>	<p>4 km</p> <p>Available: Observations are available based on the location of the ship/buoy observation, therefore the spatial resolution varies greatly.</p>
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for

	each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	Surface-bases observation: text, CSV and/or netCDF
<b>Timeliness</b>	Hourly/15 mins.
<b>Existing standards</b>	Paragraph C.6.11.3 of ISO 19901-1:2005(E) indicates that visibility below 1 km affects flying (e.g., helicopter operations in support of missions).

<b>Challenge ID</b>	OFF1.13
<b>Title</b>	<b>Squalls</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>The identification of squalls, as a characterization of transient 10m wind speeds, is essentially limited to surface-based observations, as reported from ships and buoys. The historical records of observed squalls are available via ICOADS. In addition, historical observed squall data are also available from a small number of proprietary measured data sets as indicated in paragraph C.3.2 of ISO 19901-1:2005(E).</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a></p> <p>Real-time and near real-time observations of squall data, when observed and reported, are available from many sources including NOAA (NWSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p>
<b>When do you use this kind of dataset?</b>	<p>Observations of squalls are used by the O&amp;G industry in squall prone areas for all phases throughout the O&amp;G cycle, except strictly operational tasks. The onset of these events can be sudden and interrupt all kinds of operations on deck, helicopter activity, heavy lifts etc.</p> <p>Historical data are important to assess risk of operations in these areas, frequency of occurrence, strength of gusts etc. Also, many other data sources do not catch the extremes in the area without these data added to the time series for the point of interest, since data often are averaged and conditions often are mostly benign.</p> <p>The data sets are used to assist in (a) qualifying and quantifying the means and extremes of squalls, and (b) managing risks</p>

	related to squalls, safeguarding lives, protecting assets, and conducting operations. The data set is used to assess operability in the area, to reduce risk when designing structures and operations, to design strategies to avoid severe conditions.
<b>What are your actual limitations and do you have a work around?</b>	<p>Squall lines can often be identified from satellite pictures. But the intensity of the convective cell is hard to assess. The temporal and spatial resolutions of surface-based observations significantly limit the identification of squalls, as a characterization of transient 10-meter wind speeds. Unless ships or buoys measure and report squalls, the phenomena are not readily available for analysis over vast areas of the ocean.</p> <p>Hence warnings are based on modelled data and spotting of convective cells instead, not too accurate and might lead to downtime when it is not needed.</p>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, to spot convective cells and try to assess they movement. However, it is hard to assess the wind speed of each individual cell based on satellite data. Also, the direction of movement for each individual cell is often hard to predict. This leads to unnecessary downtime because of warnings.</p> <p>Specific need: Continuous time series of 10m wind speed data in the offshore environment.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)



Information requirements	
<b>Update frequency</b>	<p>Hourly or 15 mins.</p> <p>Available: Real-time or near real-time observations are available sub-hourly and less frequently. Historical observations are generally updated once per month, for the previous month.</p>
<b>Temporal resolution</b>	<p>At least hourly.</p> <p>Available: Sub-hourly and less frequently.</p>
<b>Spatial resolution</b>	<p>4-2 km</p> <p>Available: Observations are available based on the location of the ship observation, therefore the spatial resolution varies greatly.</p>
<b>Data quality</b>	<p>The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p>
<b>Data Coverage and extent</b>	<p>Regional</p>
<b>Example format</b>	<p>Surface-bases observation: text, CSV and/or netCDF</p>
<b>Timeliness</b>	<p>Hourly/15 mins. Hourly or more frequent. Forecasts are normally issued 2 to 4 times per day, warnings when thresholds are passed. But O&amp;G users and forecasters are monitoring conditions continuously.</p>
<b>Existing standards</b>	<p>Paragraph 2.4.3.3 of DNV-RP-C205 discusses a possible modeling solution for squalls, based on vertical wind profiles, but it is not necessarily applicable beyond the Norwegian Sea.</p> <p>Paragraph 7.4 of ISO 19901-1:2005(E) states: The concept of a wind spectrum is only applicable to steady wind conditions. As squalls are not steady, the time and spatial variation of the wind speed in a squall cannot be described by a wind spectrum. Analysis of actions and action effects caused by squalls requires the specification of a time series of wind velocity.</p>

<b>Challenge ID</b>	1.14
<b>Title</b>	<b>Ice Accretion</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>The identification of historical ice accretion events is essentially limited to reports from surface based observations, as reported from ships and buoys. The historical records of events involving weather conditions that potentially resulted in ice accretion are available via ICOADS.</p> <p>Real-time and near real-time observations of weather conditions that could potentially result in ice accretion are available from many sources including NOAA (NWSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a></p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p>
<b>When do you use this kind of dataset?</b>	<p>Ice accretion might affect and slow down operations on deck, as well as alter the load of structures (if heavy icing occurs). Data are used to (a) qualify and quantify the means and extremes of weather conditions that potentially resulted in ice accretion, and (b) manage risks related to weather conditions that could potentially result in ice accretion, safeguarding lives, protecting assets, and conducting operations.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>Although surface-based observations report weather events that could result in ice accretion, the observations do not always quantify ice accretion events.</p> <p>The temporal and spatial resolutions of surface-based observations significantly limit the identification of ice accretion events. Unless ships or buoys measure and report ice accretion, the parameter is not readily available for analysis over vast areas of the ocean.</p>

<b>Needs and expectations on EO data</b>	Specific need: More surface-based observations that quantify and verify ice accretion.
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	4
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	Eastern Mediterranean, Falklands, and West of Ireland. Seasonality: Eastern Mediterranean, West of Ireland - applies to Northern Hemisphere's winter Falklands - applies to Southern Hemisphere's winter
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Real-time or near real-time observations are available sub-hourly and less frequently. Historical observations are generally updated once per month, for the previous month.
<b>Temporal resolution</b>	Sufficient. Sub-hourly and less frequently.
<b>Spatial resolution</b>	Observations are available based on the location of the ship observation, therefore the spatial resolution varies greatly.
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Local
<b>Example format</b>	Surface-bases observation: text, CSV and/or netCDF

<b>Timeliness</b>	Daily or twice daily.
<b>Existing standards</b>	NA

<b>Challenge ID</b>	1.15
<b>Title</b>	<b>Sea Surface Temperatures</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>The sea surface temperatures in the offshore environment are identified through a variety of surface-based observations and modeled reanalyses.</p> <p>Historical sea surface temperatures, observed from ships and buoys, are available via ICOADS, whereas modeled historical sea surface temperatures are available from NOAA (ESRL).</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a>  ESRL:  <a href="http://www.esrl.noaa.gov/psd/data/gridded/data.cobe2.html">http://www.esrl.noaa.gov/psd/data/gridded/data.cobe2.html</a></p> <p>Near real-time sea surface temperatures are available from many sources including NOAA (NWSSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p> <p>NWSSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p> <p>Global Sea Surface temperature analysis based on observations from NCOF (via MyOcean): OSTIA: <a href="http://www.myocean.eu/">http://www.myocean.eu/</a>  Global Sea Surface Temperature analysis based on satellite observations from NOAA: OISST:  <a href="ftp://eclipse.ncdc.noaa.gov/pub/OI-daily-v2/NetCDF/">ftp://eclipse.ncdc.noaa.gov/pub/OI-daily-v2/NetCDF/</a></p>
<b>When do you use this kind of dataset?</b>	<p>Sea surface temperatures are important to assess corrosion on steel structures, to assess potential ice accretion from sea spray icing etc. It also has an impact on the behaviour of an oil spill. The data assist in (a) qualifying and quantifying the means and extremes of sea surface temperatures, and (b) managing risks related to sea surface temperatures, safeguarding lives, protecting assets, and conducting operations.</p>

<b>What are your actual limitations and do you have a work around?</b>	Remotely-sensed sea-surface temperatures from geostationary and polar-orbiting satellites provide a healthy record set of historical and current sea surface temperatures. There are no significant limitations.
<b>Needs and expectations on EO data</b>	The needs related to sea-surface temperatures are generally met. Deep-water temperatures, however, require more observations for better analysis results.
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	1
<b>Dev.</b>	2
<b>Prod.</b>	2
<b>Decom.</b>	1
<b>Geographic context/ restrictions</b>	Applies to all six Areas of interest. Seasonality: Applies to all seasons.
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily
<b>Temporal resolution</b>	At least daily. Available: Daily and less frequently.
<b>Spatial resolution</b>	Surface-based: Observations are available based on the location of the ship/buoy observation, therefore the spatial resolution varies greatly. Remotely-sensed: Dependant on the IR resolution of the scanning platform, which varies. NOAA OI SST product has 0.25 grid cell resolution. OSTIA product has about 6 km grid cell resolution but is effective accuracy is coarser especially close the coast line.
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work

	<p>around and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).</p>
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	Surface-bases observation: text, CSV and/or netCDF Remotely-sensed satellite observation: CSV and/or netCDF
<b>Timeliness</b>	Daily
<b>Existing standards</b>	NA

<b>Challenge ID</b>	1.16
<b>Title</b>	<b>Funnel Clouds and Waterspouts</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Funnel clouds and waterspouts in the offshore environment are identified through a variety of surface-based observations.</p> <p>Historical funnel clouds and waterspouts, observed from ships, are available via ICOADS.</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a></p> <p>Near real-time observations of funnel clouds and waterspouts are available from many sources including NOAA (NWSTG), NOAA (MADIS), NOAA (NDBC), UCAR, and numerous other data distribution centers.</p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  NDBC: <a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p>
<b>When do you use this kind of dataset?</b>	<p>Observations of funnels/sprouts are mostly used by the O&amp;G industry in funnel/spout prone areas for all phases during operations. The onset of these events can be sudden and interrupt all kinds of operations on deck, helicopter activity etc as they pose a large threat to personnel onboard rigs and vessels. Historical data are important to assess risk of operations in these areas, frequency of occurrence, strength of gusts etc., but are mostly used as input to improve operational forecasting. Also, many other data sources do not catch the extremes in the area without these data added to the time series for the point of interest, since data often are averaged and conditions often are mostly benign.</p> <p>The data set is used to assist in (a) qualifying and quantifying the means and extremes of funnel clouds and waterspouts and (b) managing risks related to funnel clouds and waterspouts, safeguarding lives, protecting assets, and conducting</p>



	operations. The data set is used to assess operability in the area, to reduce risk when designing structures and operations, to design strategies to avoid severe conditions.
<b>What are your actual limitations and do you have a work around?</b>	<p>Convective cells can often be identified from satellite pictures. But it is difficult (impossible) to assess the likelihood of funnels/sprouts based on satellite alone. The temporal and spatial resolution of surface-based observations significantly limits the identification of funnel clouds and waterspouts in the offshore environment. Unless ships report funnel clouds and waterspouts, the events are not readily available for analysis over vast areas of the ocean.</p> <p>Hence warnings are based on modelled data, and spotting of convective cells in satellite pictures. Not too accurate and might lead to downtime when it is not needed.</p>
<b>Needs and expectations on EO data</b>	Specific need: More surface-based observations that verify the existence of funnel clouds and waterspouts in the offshore environment.
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	1
<b>Prod.</b>	3
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Real-time or near real-time observations are available sub-hourly and less frequently. Historical observations are generally updated once per month, for the previous month.
<b>Temporal resolution</b>	At least hourly.

	Available: Sub-hourly and less frequently.
<b>Spatial resolution</b>	4-2 km Available: Observations are available based on the location of the ship observation, therefore the spatial resolution varies greatly.
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional.
<b>Example format</b>	Surface-bases observation: text, CSV and/or netCDF
<b>Timeliness</b>	Real- time or near-real time
<b>Existing standards</b>	NA

<b>Challenge ID</b>	1.17
<b>Title</b>	<b>Convective Downbursts</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	Offshore convective downbursts that are beyond the footprints of land-based radar systems are currently not directly identified via products; however, the existence of convective downbursts may be indirectly inferred by using geostationary and polar-orbiting satellite observations, as well as surface-based observations. Most convective downbursts offshore are not qualified and quantified properly, because, typically, the events are not directly observed.
<b>When do you use this kind of dataset?</b>	<p>Observations of convective downbursts are mostly used by the O&amp;G industry in affected areas during operations. The onset of the events can be sudden and interrupt all kinds of operations on deck, helicopter activity etc as they pose a large threat to personnel onboard rigs and vessels. Historical data are important to assess risk of operations in these areas, frequency of occurrence, strength of gusts etc, but are mostly used as input to improve operational forecasting. Also, many other data sources do not catch the extremes in the area without these data added to the time series for the point of interest, since data often are averaged and conditions often are mostly benign.</p> <p>The data set is used to assist in (a) qualifying and quantifying the means and convective downbursts and (b) managing risks related to these events, safeguarding lives, protecting assets, and conducting operations. The data set is used to assess operability in the area, to reduce risk when designing structures and operations, to design strategies to avoid severe conditions.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>In the absence of surface-based radar data, in order to qualify and quantify convective downbursts at sea requires (a) vertical wind profile data, (b) satellite imagery and (c) surface wind data, which must be analyzed together. Typically, the spatial and temporal resolution of a and c are inadequate for the identification of historical convective downbursts.</p> <p>Hence warnings are based on modelled data and spotting of</p>

	convective cells in satellite pictures, not too accurate and might lead to downtime when it is not needed.
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, to spot convective cells and try to assess they movement. However, it is hard to assess the wind speed of each individual cell based on satellite data. Also, the direction of movement for each individual cell is often hard to predict. This leads to unnecessary downtime because of warnings.</p> <p>Specific need: Continuous time series of 10m wind speed data in the offshore environment. Specific need: Higher temporal and spatial resolution of vertical wind profiles, and surface wind data are needed to verify the occurrences of convective downbursts in the offshore environment.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	1
<b>Prod.</b>	3
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	The parameter is not directly available in observations.
<b>Temporal resolution</b>	The parameter is not directly available in observations.
<b>Spatial resolution</b>	The parameter is not directly available in observations.
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth

	verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	The parameter is not directly available in observations.
<b>Timeliness</b>	Real- time or near-real time
<b>Existing standards</b>	NA

<b>Challenge ID</b>	1.18
<b>Title</b>	<b>Lightning</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical surface-based lightning observations are available via ICOADS. Historical remotely-sensed lightning data are available via NASA, as well as proprietary commercial sources WSI (GLN), and Vaisala (GLD360).</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a>  NASA: <a href="ftp://ghrc.nsstc.nasa.gov/pub/data/otd/">ftp://ghrc.nsstc.nasa.gov/pub/data/otd/</a>  NASA: <a href="ftp://ghrc.nsstc.nasa.gov/pub/data/lis/science/">ftp://ghrc.nsstc.nasa.gov/pub/data/lis/science/</a>  WSI: <a href="http://www.wsi.com/products-lightning-global-lightning-network.htm">http://www.wsi.com/products-lightning-global-lightning-network.htm</a>  Vaisala: <a href="http://www.vaisala.com/">http://www.vaisala.com/</a></p> <p>Near real-time observations of lightning are available from many sources including NOAA (NWSTG), NOAA (MADIS), UCAR, and numerous other data distribution centers, as well as proprietary commercial sources WSI (GLN), and Vaisala (GLD360).</p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a>  WSI: <a href="http://www.wsi.com/products-lightning-global-lightning-network.htm">http://www.wsi.com/products-lightning-global-lightning-network.htm</a>  Vaisala: <a href="http://www.vaisala.com/">http://www.vaisala.com/</a></p>
<b>When do you use this kind of dataset?</b>	<p>Observations of lightning are mostly used by the O&amp;G industry during operational tasks. The onset of these events can be sudden and interrupt all kinds of operations on deck, helicopter activity etc as they pose a large threat to personnel onboard rigs and vessels. Historical data are important to assess risk of operations in these areas, frequency of occurrence etc., but are mostly used as input to improve operational forecasting.</p> <p>The data set is used to assist in (a) qualifying and quantifying the means and extremes of lightning and (b) managing risks related to lightning, safeguarding lives, protecting assets, and</p>

	conducting operations. The data set is used to assess operability in the area, to reduce risk when designing structures and operations, to design strategies to avoid severe conditions.
<b>What are your actual limitations and do you have a work around?</b>	<p>Surface-based observations, surface-based remote network sensors, and remote sensors in orbit collectively provide a healthy coverage pattern for global lightning, although the lightning strike data based on surface-based network sensors is proprietary and very expensive for commercial interests to obtain.</p> <p>Hence warnings are based on modelled data, and spotting of convective cells in satellite pictures, and where available lightning sensors. Not too accurate and might lead to downtime when it is not needed.</p>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, to spot convective cells and try to assess they movement. However, it is hard to assess the wind speed of each individual cell based on satellite data. Also, the direction of movement for each individual cell is often hard to predict. This leads to unnecessary downtime because of warnings.</p> <p>Specific need: Continuous time series of 10m wind speed data in the offshore environment. Specific need: Less expensive (or free) access to detailed lightning strike data, which is currently proprietary and quite expensive for commercial interests to acquire for commercial research.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	1
<b>Prod.</b>	3
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean

<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Historical: Daily and less frequently. Near real-time: Sub-minutely and less frequently.
<b>Temporal resolution</b>	Real time or near real-time, 10 mins.  Available: Surface-based observations: Sub-hourly and less frequently. Remotely-sensed surface network observations: Sub-minutely and less frequently. Remotely-sensed satellite observations: Sub-daily and less frequently.
<b>Spatial resolution</b>	Surface-based observations are available based on the location of the ship observation, therefore the spatial resolution varies greatly. Remotely-sensed surface network observations: <1 km and coarser. Remotely-sensed satellite observations: 3 km and coarser.
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	netCDF and CSV
<b>Timeliness</b>	Real- time or near-real time
<b>Existing standards</b>	NA



<b>Challenge ID</b>	1.19
<b>Title</b>	<b>Hail</b>
<b>Challenge originator: interviewed company</b>	
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Historical surface-based hail observations are available via ICOADS.</p> <p>ICOADS: <a href="http://rda.ucar.edu/datasets/ds540.0/">http://rda.ucar.edu/datasets/ds540.0/</a></p> <p>Near real-time observations of hail are available from many sources including NOAA (NWSTG), NOAA (MADIS), UCAR, and numerous other data distribution centers.</p> <p>NWSTG: <a href="ftp://tgftp.nws.noaa.gov/data/observations/">ftp://tgftp.nws.noaa.gov/data/observations/</a>  MADIS: <a href="ftp://pftp.madis-data.noaa.gov/">ftp://pftp.madis-data.noaa.gov/</a>  UCAR: <a href="http://thredds.ucar.edu/thredds/idd/newPointObs.html">http://thredds.ucar.edu/thredds/idd/newPointObs.html</a></p>
<b>When do you use this kind of dataset?</b>	<p>Observations of large hail events can be used by the O&amp;G industry to assess the risk of these events happening. Large hail can be disruptive to all operations on deck, damage equipment etc. Historical data are important to assess risk of operations in these areas, frequency of occurrence etc., but are mostly used as input to improve operational forecasting.</p> <p>The data set is used to assist in (a) qualifying and quantifying the means and extremes of hail and (b) managing risks related to hail, safeguarding lives, protecting assets, and conducting operations. The data set is used to assess operability in the area, to reduce risk when designing structures and operations, to design strategies to avoid severe conditions.</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>The temporal and spatial resolutions of surface-based observations significantly limit the identification of hail events in the offshore environment. Unless ships measure and report hail, the parameter is not readily available for analysis over vast areas of the ocean.</p>
<b>Needs and expectations on EO data</b>	<p>EO is used for this today, to spot convective cells and try to assess they movement. However, it is hard to assess the wind speed of each individual cell based on satellite data. Also, the direction of movement for each individual cell is often hard to</p>

	<p>predict. This leads to unnecessary downtime because of warnings.</p> <p>Specific need: Continuous time series of 10m wind speed data in the offshore environment. Specific need: More surface-based observations that verify the existence of hail in the offshore environment.</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	2
<b>Dev.</b>	1
<b>Prod.</b>	2
<b>Decom.</b>	1
<b>Geographic context/ restrictions</b>	<p>Applies to all six Areas of interest.</p> <p>Seasonality: Applies to all seasons.</p>
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Real-time or near real-time observations are available sub-hourly and less frequently. Historical observations are generally updated once per month, for the previous month.
<b>Temporal resolution</b>	<p>At least hourly.</p> <p>Available: Sub-hourly and less frequently. .</p>
<b>Spatial resolution</b>	<p>4-2 km</p> <p>Available: Surface-based observations are available based on the location of the ship observation, therefore the spatial resolution varies greatly.</p>
<b>Data quality</b>	The selected sources in this document are selected because they are known to have sufficient quality (after some work arounds and adaptations). In general separate indepth verification studies has to be made for each source planned to be used for analysis, and the analysis has to be repeated for

	each geographical area (since sources might be of sufficient quality in one area but not another).
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	Surface-bases observation: text, CSV and/or netCDF
<b>Timeliness</b>	Real- time or near-real time
<b>Existing standards</b>	NA

### 3 ENVIRONMENTAL REQUIREMENTS

<b>Challenge ID</b>	OFF2.1
<b>Title</b>	<b>Monitoring of landfall site recovery and coastal vegetation</b> Includes initial characterization and vulnerability of coastline and nearshore environment
<b>Challenge originator: interviewed company</b>	Enterprise Energy Ireland Ltd
<b>General Description</b>	
<b>What data/products do you use?</b>	Vegetation data currently collected through shoreline surveys, but satellite imagery has been used to help with broad vegetation classification
<b>When do you use this kind of dataset?</b>	When offshore production transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
<b>What are your actual limitations and do you have a work around?</b>	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily be repeated on a seasonal basis.
<b>Needs and expectations on EO data</b>	High resolution maps that will allow characterization/classification of coastal vegetation and coastal substrate
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	1
<b>Dev.</b>	1
<b>Prod.</b>	1
<b>Decom.</b>	1
<b>Geographic context/restrictions</b>	- Ireland
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Mid-Term (5-10 years)

<b>Information requirements</b>	
<b>Update frequency</b>	One-off, perhaps every few years might be helpful
<b>Temporal resolution</b>	Seasonal
<b>Spatial resolution</b>	1m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.2
<b>Title</b>	<b>Submarine landslides and seabed stability</b> Detection, aging of submarine slides Site Surveys for Geohazards
<b>Challenge originator: interviewed company</b>	<p>ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources</p> <p>Galil B. and Herut B. 2011. <i>Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel</i>. IOLR Report H15/2016</p> <p>Georgiopoulou, A., S. Krastel, D. G. Masson and R. B. Wynn. 2007. <i>Repeated Instability Of The New African Margin Related To Buried Landslide Scarps</i>. Pp. 29-36 in <i>Submarine Mass Movements and Their Consequences, Advances in Natural and Technological Hazards Research Vol. 27</i>.</p> <p>General requirement</p>
<b>General Description</b>	
<b>What data/products do you use?</b>	Sidescan, multibeam sonar bathymetry maps, sub-surface data if available
<b>When do you use this kind of dataset?</b>	<p>During seismic surveys to determine susceptibility of substrate to seismic activities and gain information on substrate stability</p> <p>During exploration and development to help determine of anchor placement or location of production platform</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>This data is currently not available unless the area has seen recent multibeam mapping.</p> <p>Current data acquisition is vessel based and thus expensive and time consuming</p>
<b>Needs and expectations on EO data</b>	<p>Not sure, EO capabilities can address this as it requires penetration to ocean floor</p> <p>Unclear - require sub-sediment penetration into ocean floor</p>
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	3, 4(2.37)

<b>Dev.</b>	4(2.37)
<b>Prod.</b>	
<b>Decom.</b>	
<b>Geographic context/ restrictions</b>	Western Ireland, Eastern Mediterranean, Morocco / Western Sahara  Everywhere(2.37)
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Strategic decision enabler  Cost reduction, reduction of HSE risk associated with vessel based surveys (2.37)
<b>Technology Urgency</b>	Mid-Term (5-10 years)
<b>Information requirements</b>	
<b>Update frequency</b>	One-off
<b>Temporal resolution</b>	None
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.3
<b>Title</b>	<b>Shipwrecks and other archaeological value areas</b> Geophysical mapping of the upper sub-surface and detection of man-made features on the seafloor
<b>Challenge originator: interviewed company</b>	Enterprise Energy Ireland Ltd and ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland's offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources  Galil B. and Herut B. 2011. <i>Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel</i> . IOLR Report H15/2013
<b>General Description</b>	
<b>What data/products do you use?</b>	Historic database showing location of shipwrecks and map of documented archeological sites where available, ROV survey data, multibeam data, sediment grabs
<b>When do you use this kind of dataset?</b>	Impact assessments, seismic surveys
<b>What are your actual limitations and do you have a work around?</b>	Use the aforementioned databases but they are limited to knowledge from areas that have previously been surveyed for other purposes
<b>Needs and expectations on EO data</b>	Not sure, EO capabilities can address this as it requires penetration to ocean floor
<b>Challenge classification</b>	
<b>Pre license</b>	4
<b>Exp.</b>	4
<b>Dev.</b>	
<b>Prod.</b>	
<b>Decom.</b>	
<b>Geographic context/restrictions</b>	Western Ireland, Eastern Mediterranean
<b>Topographic classification / Offshore classification</b>	Ocean



<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Mid-Term (5-10 years) Long Term (10+ years)( Eastern Mediterranean)
<b>Information requirements</b>	
<b>Update frequency</b>	One-off
<b>Temporal resolution</b>	None
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.4
<b>Title</b>	<p><b>Detection and monitoring of pollutant discharges</b>          Cement, cuttings, mud, oil discharges</p> <p>Monitor coastal and offshore oil pollution to assess the impact of pollution on the marine environment</p> <p>Monitoring of pollution arising from oil spillage and gas flaring</p>
<b>Challenge originator: interviewed company</b>	<p>ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland’s offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources</p> <p>Galil B. and Herut B. 2011. <i>Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel</i>. IOLR Report H15/2012.</p> <p>RPS Energy. 2009. <i>Environmental Impact Assessment for Offshore Drilling The Falkland Islands</i>. Report prepared for Rockhopper Exploration PLC.</p> <p>Huang, Weigen, Fu, Bin. 2002. <i>Remote Sensing for Coastal Area Management</i>. Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People’s Republic of China in China. <i>Coastal Management</i>, 30:271–276, 2002.; UNEP, 2005. Wilkinson, C., DeVantier, L., Talaue-McManus, L., Lawrence, D. and D. Souter. South China Sea, GIWA Regional assessment 54. University of Kalmar, Kalmar, Sweden.</p> <p>BOBLME (2011) Country report on pollution – Myanmar. BOBLME-2011-Ecology-13; Ramamurthy, V.D. and J. Sreenivasan. 1983. Sources of Oil Pollution along the Indian Coasts of Arabian Sea, Bay of Bengal Indian Ocean, and its Impact on Commercial Fisheries. <i>Anales Del Instituto de Ciencias del Mar Y Limnología</i>.</p> <p>Akpomuvie, Orhioghene, Benedict. 2011. Tragedy of Commons: Analysis of Oil Spillage, Gas Flaring and Sustainable Development of the Niger Delta of Nigeria. <i>Journal of Sustainable Development</i>. Vol. 4, No. 2.</p>

	<p>IPIECA publications on oil spill avoidance, preparedness response and best practices (<a href="http://www.ipieca.org/topic/oil-spill-preparedness/oil-spill-report-series">http://www.ipieca.org/topic/oil-spill-preparedness/oil-spill-report-series</a>)</p>
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Models, aerial surveillance, satellite imagery, drifter buoys, in situ monitoring at platforms</p>
<b>When do you use this kind of dataset?</b>	<p>To aid in trajectory modeling, spill response and protection of important ecological and archeological areas</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>Validations of trajectory models is difficult and in case of a spill in situ monitoring is limited to aerial surveillance, weather limitations of current technology</p>
<b>Needs and expectations on EO data</b>	<p>High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/restrictions</b>	All Regions
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Operational, response capability enhancement
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	1-6 h during time of discharge
<b>Temporal resolution</b>	1-6 h during time of discharge
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High

<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	High resolution image
<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.5
<b>Title</b>	<b>Distribution and abundance of marine mammals</b>
<b>Challenge originator: interviewed company</b>	OSPAR Commission. 2009 document. Assessment. ERT Scotland. 2008. Third strategic environmental assessment for oil and gas activity in Ireland’s offshore Atlantic waters: IOSEA3 Rockall Basin. Prepared for Department of Communications, Energy and Natural Resources.  RPS Energy. 2009. <i>Environmental Impact Assessment for Offshore Drilling The Falkland Islands</i> . Report prepared for Rockhopper Exploration PLC.
<b>General Description</b>	
<b>What data/products do you use?</b>	Abundance and distribution data from ship-based or aerial surveys
<b>When do you use this kind of dataset?</b>	During seismic and drilling activities to determine impacts of noise on marine mammals and during discharges to determine vulnerability and impact
<b>What are your actual limitations and do you have a work around?</b>	Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability, seasonal data and weather dependant
<b>Needs and expectations on EO data</b>	High resolution imagery that would allow counting and possibly identifying marine mammals when at the surface. Could be visual or IR
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Western Ireland, Falklands

<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Cost reduction, reduction of HSE risk associated with vessel based and aerial surveys, improved project planning
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Weekly-monthly
<b>Temporal resolution</b>	Weekly-monthly
<b>Spatial resolution</b>	1-10m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important except for spill
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.6
<b>Title</b>	<b>Distribution and abundance of seabirds</b> Includes interaction of bird populations with light
<b>Challenge originator: interviewed company</b>	<p>OSPAR Commission. 2009 document. Assessment of impacts of offshore oil and gas activities in the North-East Atlantic.</p> <p>Woods, R., R. Ingham, &amp; A. Brown. 2009. Falkland Islands (Malvinas). Pp 205 – 212 in C. Devenish, D. F. Díaz Fernández, R. P. Clay, I. Davidson &amp; I. Yépez Zabala Eds. <i>Important Bird Areas Americas - Priority sites for biodiversity conservation</i>. Quito, Ecuador: BirdLife International (BirdLife Conservation Series No. 16).</p> <p>Camphuysen CJ. &amp; J. van der Meer. 2010. <i>Wintering seabirds in West Africa: foraging hotspots off Western Sahara and Mauritania driven by upwelling and fisheries</i>. African Journal of Marine Science, Vol. 27(2), pp. 427-437</p>
<b>General Description</b>	
<b>What data/products do you use?</b>	<p>Direct observations of bird-light/flare interactions</p> <p>Direct observations of birds using ship-based and/or aerial surveys</p>
<b>When do you use this kind of dataset?</b>	<p>During exploratory drilling and production when lighted platforms are out there and/or there is flaring</p> <p>During seismic and drilling activities to determine impacts of light on seabirds and during discharges to determine vulnerability and impact</p>
<b>What are your actual limitations and do you have a work around?</b>	<p>Bird mortality due to light and flares is sporadic and dependent on time of year (migration periods) and weather. Assessment is difficult for those reasons, requires constant monitoring, but can affect large numbers of birds (up to 10% of migrating birds in North Sea)</p> <p>Vessel and aerial surveys are time consuming and expensive. Current data products are adequate but need to be updated and repeated on a regular basis due to high natural variability</p>
<b>Needs and expectations on EO data</b>	<p>Unclear - requires high temporal spatial resolution and cloud penetration</p> <p>High resolution imagery that would allow counting and possibly identifying seabirds. Could be visual or IR</p>

<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	1(Ireland), 3
<b>Dev.</b>	1(Ireland), 3
<b>Prod.</b>	1(Ireland), 3
<b>Decom.</b>	1(Ireland)
<b>Geographic context/ restrictions</b>	Western Ireland, Falklands, Morocco / Western Sahara
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Cost reduction, reduction of HSE risk associated with vessel based surveys
<b>Technology Urgency</b>	Mid to Long Term (5-10, 10+ years(Ireland))
<b>Information requirements</b>	
<b>Update frequency</b>	Weekly-monthly
<b>Temporal resolution</b>	Weekly-monthly
<b>Spatial resolution</b>	<1m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	In vicinity of drill site
<b>Example format</b>	High resolution image
<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.7
<b>Title</b>	<b>Information on presence and abundance of deep water fauna</b> Includes deep-water coral and other vulnerable seabed habitat
<b>Challenge originator: interviewed company</b>	Galil B. and Herut B. 2011. <i>Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel</i> . IOLR Report H15/2011
<b>General Description</b>	
<b>What data/products do you use?</b>	ROV surveys and multibeam
<b>When do you use this kind of dataset?</b>	During environmental impact assessments (EIAs), oil spill response, environmental damage assessment
<b>What are your actual limitations and do you have a work around?</b>	ROV and multibeam surveys are expensive and time consuming
<b>Needs and expectations on EO data</b>	Not sure, EO capabilities can address this as it requires penetration to ocean floor and species and/or habitat identification
<b>Challenge classification</b>	
<b>Pre license</b>	4
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	- Eastern Mediterranean
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Mid-Term (5-10 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Yearly, for monitoring of change, but hourly during oil spills
<b>Temporal resolution</b>	Seasonal or yearly
<b>Spatial resolution</b>	1-10m
<b>Data quality</b>	High



<b>Data Coverage and extent</b>	In vicinity of drill site and along possible submarine pipelines for monitoring, but regional for spills
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important, near real time for spill
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.8
<b>Title</b>	<b>Scientific independence in environmental monitoring of pollution</b> Accidental spills, drill cuttings, atmospheric emissions, light and noise
<b>Challenge originator: interviewed company</b>	Galil B. and Herut B. 2011. <i>Marine environmental issues of deep-sea exploration and exploitation activities (oil and gas) off the coast of Israel</i> . IOLR Report H15/2014
<b>General Description</b>	
<b>What data/products do you use?</b>	Aerial surveillance, self-reporting
<b>When do you use this kind of dataset?</b>	Any time once exploratory drilling commences
<b>What are your actual limitations and do you have a work around?</b>	Public confidence in self-reporting is low, aerial surveillance or other types of independent monitoring are few, expensive or non-existent
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting and tracking slicks and plumes of discharged materials
<b>Challenge classification</b>	
<b>Pre license</b>	
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/restrictions</b>	- Eastern Mediterranean
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Due diligence tool
<b>Technology Urgency</b>	Immediately (0-2 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily
<b>Temporal resolution</b>	Daily

<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area
<b>Example format</b>	High resolution image
<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.9
<b>Title</b>	<b>Security and safety</b>
<b>Challenge originator: interviewed company</b>	U.S. Energy Information Administration. Eastern Mediterranean Region. Overview of oil and natural gas in the Eastern Mediterranean region. Last updated August 12, 2013.
<b>General Description</b>	
<b>What data/products do you use?</b>	Aerial surveillance, coast guard, satellite imagery
<b>When do you use this kind of dataset?</b>	Any time once exploratory drilling commences
<b>What are your actual limitations and do you have a work around?</b>	Physical security of offshore operations due to political instability is a concern and could cause environmental damage in the area
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting unauthorized shipping and other activity in the vicinity of offshore operations
<b>Challenge classification</b>	
<b>Pre license</b>	
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	- Eastern Mediterranean
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Immediately (0-2 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily
<b>Temporal resolution</b>	Daily
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area

<b>Example format</b>	High resolution image
<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.10
<b>Title</b>	<b>Monitoring of chlorophyll-a</b> Productivity and harmful algal blooms (HAB)
<b>Challenge originator: interviewed company</b>	<p>RPS Energy. 2009. <i>Environmental Impact Assessment for Offshore Drilling The Falkland Islands</i>. Report prepared for Rockhopper Exploration PLC.</p> <p>DanLing Tang, Hiroshi Kawamura, Tran Van Dien, MingAn Lee. 2004. <i>Offshore phytoplankton biomass increase and its oceanographic causes in the South China Sea</i>. Marine Ecology Progress Series. Vol. 268: 31-41.</p> <p>Jing Yu, Dan-Ling Tang, Im-Sang Oh, and Li-Jun Yao. 2007. <i>Response of Harmful Algal Blooms to Environmental Changes in Daya Bay, China</i>. Terr. Atmos. Ocean. Sci., Vol. 18, No. 5, 1011-1027.</p> <p>Patidar, B. 2006. <i>Application of remote sensing and GIS in the analysis of environment of Bay of Bengal</i>. MSc., Dissertation, Barkatullah University, Bhopal(MP)- National Institute of Oceanography, Goa, India</p> <p>Pelegrí, J.L. et al. 2005. <i>Coupling between the open ocean and the coastal upwelling region off northwest Africa: water recirculation and offshore pumping of organic matter</i>. Journal of Marine Systems, Volume 54, Issues 1–4, February 2005, Pp. 3-37 Available online at: <a href="http://www.sciencedirect.com/science/article/pii/S0924796304002027">http://www.sciencedirect.com/science/article/pii/S0924796304002027</a></p>
<b>General Description</b>	
<b>What data/products do you use?</b>	Ship-based sampling (plankton tows), MODIS and SeaWifs ocean colour  Ship-based measurements; satellite images
<b>When do you use this kind of dataset?</b>	To determine timing and magnitude of productivity and HABs in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
<b>What are your actual limitations and do you have a work around?</b>	<p>EEM data is generally collected around production platforms without a broader spatial or temporal environmental context. If changes in productivity or biota are detected around the site, it may not be clear whether it is a human induced effect or if it reflects an independent regional shift in ocean conditions. Data is sparse and SeaWifs is offline.</p> <p>To collect all these environmental data would require extensive ship surveys which are time consuming and expensive</p>

<b>Needs and expectations on EO data</b>	Ocean colour imagery  Satellite imagery to detect features such a productivity (colour), SSH, temperature, winds, waves, fronts, etc.
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	– Falklands, South China Sea, Myanmar, Morocco / Western Sahara
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Possible reduction of environmental liability
<b>Technology Urgency</b>	Immediately (0-2 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily-weekly Daily-seasonal (Morocco / Western Sahara)
<b>Temporal resolution</b>	Daily-weekly Daily-seasonal (Morocco / Western Sahara)
<b>Spatial resolution</b>	100m 1-100m (Morocco / Western Sahara)
<b>Data quality</b>	Medium to high
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	Ocean colour imagery
<b>Timeliness</b>	Within a month  As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.11
<b>Title</b>	<b>Monitoring of waste management practices</b>
<b>Challenge originator: interviewed company</b>	RPS Energy. 2009. <i>Environmental Impact Assessment for Offshore Drilling The Falkland Islands</i> . Report prepared for Rockhopper Exploration PLC.  General requirement
<b>General Description</b>	
<b>What data/products do you use?</b>	Self-reporting, ship-based water sampling, aerial surveys, ship to shore waste transfer
<b>When do you use this kind of dataset?</b>	Environmental and compliance monitoring
<b>What are your actual limitations and do you have a work around?</b>	Self-reporting is not trusted, other sampling is infrequent and expensive
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting and tracking plumes of discharged materials
<b>Challenge classification</b>	
<b>Pre license</b>	
<b>Exp.</b>	1
<b>Dev.</b>	1
<b>Prod.</b>	1
<b>Decom.</b>	1
<b>Geographic context/ restrictions</b>	All regions
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Public trust, compliance, environmental liability
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily-weekly
<b>Temporal resolution</b>	Daily-weekly
<b>Spatial resolution</b>	100m
<b>Data quality</b>	Medium to high



<b>Data Coverage and extent</b>	District area, vessel route and onshore site
<b>Example format</b>	Mid-high resolution image
<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.12
<b>Title</b>	<b>Information on the intertidal and shallow marine environment</b>
<b>Challenge originator: interviewed company</b>	Falkland islands Biodiversity Strategy: 2008 – 2018. 2008. Falkland Islands Government: Environmental Planning Department. Available at: <a href="http://www.epd.gov.fk/wp-content/uploads/BiodiversityStrategy09.pdf">http://www.epd.gov.fk/wp-content/uploads/BiodiversityStrategy09.pdf</a>
<b>General Description</b>	
<b>What data/products do you use?</b>	Data currently collected through shoreline and small boat surveys, but satellite imagery has been used to help with broad classification
<b>When do you use this kind of dataset?</b>	When offshore produced in transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
<b>What are your actual limitations and do you have a work around?</b>	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily repeated on a seasonal basis
<b>Needs and expectations on EO data</b>	High resolution maps that will allow characterization/classification of inter and sub-tidal environment
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	1
<b>Dev.</b>	1
<b>Prod.</b>	1
<b>Decom.</b>	1
<b>Geographic context/restrictions</b>	- Falklands
<b>Topographic classification / Offshore classification</b>	Shallow Water
<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Mid-Term (5-10 years)
<b>Information requirements</b>	
<b>Update frequency</b>	One-off, perhaps every few years might be helpful
<b>Temporal resolution</b>	Seasonal
<b>Spatial resolution</b>	1m

<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.13
<b>Title</b>	<b>Coastal resource mapping of mangroves, coral reefs, wetlands, and sandbanks</b>
<b>Challenge originator: interviewed company</b>	<p>Huang, Weigen, Fu, Bin. 2002. <i>Remote Sensing for Coastal Area Management</i>. Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People’s Republic of China in China. <i>Coastal Management</i>, 30:271–276, 2002.</p> <p>UNEP, 2005. Wilkinson, C., DeVantier, L., Talaue-McManus, L., Lawrence, D. and D. Souter. South China Sea, GIWA Regional assessment 54. University of Kalmar, Kalmar, Sweden.</p> <p>BOBLME (2011) Country report on pollution – Myanmar. BOBLME-2011-Ecology-14</p>
<b>General Description</b>	
<b>What data/products do you use?</b>	Data currently collected through shoreline, small boat, and dive surveys but satellite imagery has been used to help with broad classification
<b>When do you use this kind of dataset?</b>	When offshore production transported to shore via pipeline, or operation requires construction of a terminal and has associated shipping with potential of oil spills in nearshore environment
<b>What are your actual limitations and do you have a work around?</b>	EO products have been used in some cases but are expensive. Using EO products for this would still require on-the-ground validation, but if area is extensive, assessment in this way would save time and could easily be repeated on a seasonal basis.
<b>Needs and expectations on EO data</b>	<p>High resolution maps that will allow characterization/classification of inter and sub-tidal and nearshore environment</p> <p>High resolution maps that will allow characterization/classification of coral reefs</p>
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	1
<b>Dev.</b>	1
<b>Prod.</b>	1
<b>Decom.</b>	1
<b>Geographic context/restrictions</b>	- South China Sea, Falklands, Myanmar

<b>Topographic classification / Offshore classification</b>	Shallow Water
<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Mid-Term (5-10 years)
<b>Information requirements</b>	
<b>Update frequency</b>	One-off, perhaps every few years might be helpful  One-off for initial assessment and monthly for monitoring purposes
<b>Temporal resolution</b>	Seasonal
<b>Spatial resolution</b>	1m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	District area, vessel route and onshore site
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.14
<b>Title</b>	<b>Coastal sediment dynamics, estuarine fronts, and land–ocean interactions.</b>
<b>Challenge originator: interviewed company</b>	Huang, Weigen, Fu, Bin. 2002. <i>Remote Sensing for Coastal Area Management</i> . Laboratory of Ocean Dynamic Processes and Satellite Oceanography Second Institute of Oceanography State Oceanic Administration Hangzhou, People’s Republic of China in China. <i>Coastal Management</i> , 30:271–276, 2002.
<b>General Description</b>	
<b>What data/products do you use?</b>	Models, aerial surveillance, satellite imagery
<b>When do you use this kind of dataset?</b>	To monitor coastal erosion, freshwater run-off and other dynamics that can influence currents and sedimentation in the nearshore environment
<b>What are your actual limitations and do you have a work around?</b>	Acquiring data of this type is difficult and expensive, requires modeling and in-situ data validation
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting and tracking plumes and oceanic fronts
<b>Challenge classification</b>	
<b>Pre license</b>	
<b>Exp.</b>	1
<b>Dev.</b>	1
<b>Prod.</b>	1
<b>Decom.</b>	
<b>Geographic context/ restrictions</b>	- South China Sea
<b>Topographic classification / Offshore classification</b>	Shallow Water
<b>Activity impacted/concerned</b>	Operational, response capability enhancement
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	1-6 h during time of discharge
<b>Temporal resolution</b>	1-6 h during time of discharge

<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	High resolution image
<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.15
<b>Title</b>	<b>Coastal upwelling</b> Includes index of seasonal and inter-annual variations of summer upwelling
<b>Challenge originator: interviewed company</b>	Xie, S.-P., Q. Xie, D. Wang, and W. T. Liu. 2003. <i>Summer upwelling in the South China Sea and its role in regional climate variations</i> . J. Geophys. Res., Vol. 108(3261), doi:10.1029/2003JC001867, C8.  Pelegrí, J.L. et al. 2005. <i>Coupling between the open ocean and the coastal upwelling region off northwest Africa: water recirculation and offshore pumping of organic matter</i> . Journal of Marine Systems, Volume 54, Issues 1–4, February 2005, Pp. 3-37 Available online at: <a href="http://www.sciencedirect.com/science/article/pii/S0924796304002027">http://www.sciencedirect.com/science/article/pii/S0924796304002027</a>
<b>General Description</b>	
<b>What data/products do you use?</b>	Ship-based measurements; satellite images
<b>When do you use this kind of dataset?</b>	To determine timing and magnitude of productivity in the area - would help with assessing change in ocean climate on a regional basis that would be reflected in environmental effects monitoring (EEM) data around the operation without causal linkage
<b>What are your actual limitations and do you have a work around?</b>	To detect timing and extent of upwelling would require extensive ship surveys which are time consuming and expensive
<b>Needs and expectations on EO data</b>	Satellite imagery to detect upwelling features such a productivity, SSH, temperature
<b>Challenge classification</b>	
<b>Pre license</b>	1
<b>Exp.</b>	1
<b>Dev.</b>	1
<b>Prod.</b>	1
<b>Decom.</b>	1
<b>Geographic context/restrictions</b>	- South China Sea, Morocco / Western Sahara
<b>Topographic classification / Offshore</b>	Ocean



<b>classification</b>	
<b>Activity impacted/concerned</b>	Possible reduction of environmental liability
<b>Technology Urgency</b>	Immediately (0-2 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Weekly-seasonal South China Sea Daily-seasonal (Morocco / Western Sahara)
<b>Temporal resolution</b>	Weekly-seasonal South China Sea Daily-seasonal (Morocco / Western Sahara)
<b>Spatial resolution</b>	100m
<b>Data quality</b>	Medium to high
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	Ocean colour imagery
<b>Timeliness</b>	Within a month South China Sea As close to real-time as possible (Morocco / Western Sahara)
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.16
<b>Title</b>	<b>Fish and fish habitat</b>
<b>Challenge originator: interviewed company</b>	General requirement
<b>General Description</b>	
<b>What data/products do you use?</b>	Sidescan and multibeam survey data for habitat, stock-assessment and fishing effort data for fish distribution and abundance
<b>When do you use this kind of dataset?</b>	During impact assessment, environmental monitoring, spill response and damage assessment
<b>What are your actual limitations and do you have a work around?</b>	Data is highly seasonal and expensive to collect through dedicated surveys
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting fish habitat features
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Everywhere
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Strategic decision enabler
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	One-off for initial assessment, seasonal for monitoring, but near real time in case of a spill
<b>Temporal resolution</b>	One-off for initial assessment, seasonal for monitoring, but near real time in case of a spill
<b>Spatial resolution</b>	1-10m
<b>Data quality</b>	high

<b>Data Coverage and extent</b>	District area, vessel route and onshore site
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.17
<b>Title</b>	<b>Commercial shipping</b> (not including shipping activity related to offshore oil operations)
<b>Challenge originator: interviewed company</b>	General requirement
<b>General Description</b>	
<b>What data/products do you use?</b>	Aerial surveillance, satellite imagery, AIS, logbook port-inspections
<b>When do you use this kind of dataset?</b>	During initial assessment to determine placement of offshore installation in context of commercial shipping lanes
<b>What are your actual limitations and do you have a work around?</b>	AIS is not available everywhere, other shipping data is hard to get or confidential
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting and tracking ship traffic
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	
<b>Dev.</b>	
<b>Prod.</b>	
<b>Decom.</b>	
<b>Geographic context/ restrictions</b>	Everywhere
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Data accessibility and logistic feasibility
<b>Technology Urgency</b>	Mid-Term (5-10 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily-weekly
<b>Temporal resolution</b>	Daily-weekly
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High

<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.18
<b>Title</b>	<b>Natural and other existing oil seeps</b>
<b>Challenge originator: interviewed company</b>	General requirement
<b>General Description</b>	
<b>What data/products do you use?</b>	Any visual detection of oil seeps from unknown sources (through aerial surveillance, sat imagery, oiled wildlife, ship based reports)
<b>When do you use this kind of dataset?</b>	During initial environmental assessment and during environmental monitoring
<b>What are your actual limitations and do you have a work around?</b>	Observations are by chance, not due to dedicated surveys. Operators may be charged for pollution in cases where they are not the cause
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting slicks
<b>Challenge classification</b>	
<b>Pre license</b>	3
<b>Exp.</b>	3
<b>Dev.</b>	3
<b>Prod.</b>	3
<b>Decom.</b>	3
<b>Geographic context/ restrictions</b>	Everywhere
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Operational, environmental monitoring, spill response
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Daily-weekly
<b>Temporal resolution</b>	Daily-weekly
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	Regional

<b>Example format</b>	High resolution image
<b>Timeliness</b>	Reference data - timeliness not important
<b>Existing standards</b>	

<b>Challenge ID</b>	OFF2.19
<b>Title</b>	<b>Commercial and recreational fisheries</b>
<b>Challenge originator: interviewed company</b>	General requirement
<b>General Description</b>	
<b>What data/products do you use?</b>	Data from resource management agency responsible for fisheries
<b>When do you use this kind of dataset?</b>	During initial environmental assessment and during oil spills
<b>What are your actual limitations and do you have a work around?</b>	Exact location of fisheries effort and not always easy to come by and in case of a spill real-time information is needed to determine economic impact
<b>Needs and expectations on EO data</b>	High resolution imagery capable of detecting and tracking fishing activity
<b>Challenge classification</b>	
<b>Pre license</b>	2
<b>Exp.</b>	2
<b>Dev.</b>	2
<b>Prod.</b>	2
<b>Decom.</b>	2
<b>Geographic context/ restrictions</b>	Everywhere
<b>Topographic classification / Offshore classification</b>	Ocean
<b>Activity impacted/concerned</b>	Strategic decision enabler and spill response
<b>Technology Urgency</b>	Short term (2-5 years)
<b>Information requirements</b>	
<b>Update frequency</b>	Weekly
<b>Temporal resolution</b>	Weekly
<b>Spatial resolution</b>	10-100m
<b>Data quality</b>	High
<b>Data Coverage and extent</b>	Regional
<b>Example format</b>	High resolution image



<b>Timeliness</b>	As close to real-time as possible
<b>Existing standards</b>	

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