FRONTEX

Frontex/OP/234/2021/RS

Meteorological and Oceanographic Services:

Lot 1 Meteorological Data and Visualisation

Lot 2 Oceanographic Data and Visualisation

Lot 3 Operational Support for Airborne and Sea Operations

Annex II - Terms of Reference

Frontex - European Border and Coast Guard Agency
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Contents

1. Acronyms and Definitions

Acronym, Term	Definition
CM	Contract Manager for all contractual matters
EU	European Union
Frontex	European Border and Cost Guard Agency
FCM	Frontex Contract Manager
MS	A Member State of the European Union
TC	Third country
SAC	Schengen Associated Country
EFS	EUROSUR Fusion Services
Near real time	Delay caused by automated processing and display between the occurrence of an event and reception of the data at some other location
METAR	Meteorological Aerodrome Report
TAF	Terminal Aerodrome Forecast
GAFOR	General Aviation Forecast
JWT	JSON web token

2. Background

2.1. Introduction to the European Border and Coast Guard Agency

Frontex, the European Border and Coast Guard Agency, promotes, coordinates and develops European border management in line with the EU fundamental rights charter and the concept of Integrated Border Management.

To help identify migratory patterns as well as trends in cross-border criminal activities, Frontex analyses data related to the situation at and beyond EU's external borders. It monitors the situation at the borders and helps border authorities to share information with Member States. The agency also carries out vulnerability assessments to evaluate the capacity and readiness of each Member State to face challenges at its external borders, including migratory pressure.

Frontex coordinates and organises joint operations and rapid border interventions to assist Member States at the external borders, including in humanitarian emergencies and rescue at sea. The agency deploys European Border and Coast Guard teams, including a pool of at least 1,500 border guards and other relevant staff to be deployed in rapid interventions. The members of the rapid reaction pool must be provided by Member States upon request by the agency. It also deploys vessels, aircraft, vehicles and other technical equipment provided by Member States in its operations. In addition, Frontex may carry out operations on the territory of non-EU countries neighbouring at least one Member State, in case of migratory pressure at a non-EU country's border.

Frontex, the European Border and Coast Guard, supports Member States with screening, debriefing, identification and fingerprinting of migrants. Officers deployed by the agency refer and provide initial information to people who need, or wish to apply for, international protection, cooperating with the European Asylum Support Office (EASO) and national authorities. It is the national authorities, not Frontex, who decide which person is entitled to international protection.

The agency assists EU Member States in forced returns of people who have exhausted all legal avenues to legitimise their stay within the EU. This help includes obtaining travel documents for the returnees by working closely with consular authorities of the relevant non-EU countries. It can also organise voluntary departures of nationals of non-EU countries who were issued return decisions by Member State authorities. Frontex also organises return operations on its own initiative and "collecting return operations", where returnees are returned with escort officers and transportation provided by their

countries of origin. It has created several pools of return experts to be deployed in Member States when needed.

Frontex supports the cooperation between law enforcement authorities, EU agencies and customs at sea borders. Vessels and aircraft deployed in its operations also collect and share information relevant to fisheries control, detection of pollution and compliance with maritime regulations. The agency works closely with European Fisheries Control Agency (EFCA) and European Maritime Safety Agency (EMSA) to implement multipurpose operations. In these operations, vessels and aircraft deployed for border surveillance can also be used for fishing and environmental monitoring.

Frontex focuses on preventing smuggling, human trafficking and terrorism as well as many other cross-border crimes. It shares any relevant intelligence gathered during its operations with relevant national authorities and Europol.

The agency is the centre of expertise in the area of border control. It develops training curricula and specialised courses in a variety of areas to guarantee the highest levels of professional knowledge among border guards across Europe. It also supports search and rescue operations that arise during border surveillance operations at sea.

2.2. Situational Awareness Division

The Situational Awareness and Monitoring Division (SAM) is a key component of Integrated Border Management, thus enabling its implementation EU-wide by Frontex and by the national authorities of Member States forming the European Border and Coast Guard. SAM is therefore oriented towards operational actors and contributes by fulfilling their information and intelligence needs. The Division drives operational responses to challenges at the EU's external borders and supports decision-making on EU border management and border security, in particular when assessing Member States vulnerabilities. The Division is also increasingly working on its maritime dimension in line with the development of Coast Guard functions entrusted to the Agency. For a successful achievement of thus SAM is in a close cooperation with Frontex Operational Response Division and its Coast Guard and Law Enforcement Unit and Field Deployment Unit. It mobilises and fuses a wide range of sources of information from human intelligence, image & geospatial intelligence, patrolling activities, and aerial surveillance.

2.3. Information Fusion Centre and EUROSUR

The Information Fusion Centre (IFC), an entity within SAM, is a provider of up-to-date, reliable and innovative information services and knowledge and technology driven capabilities in support of the SAM business units and partners. Its information services and capabilities are based on the fusion of a wide range of data amongst which earth observation data, vessel data and data from Frontex operational activities are provided to internal and external stakeholders via the EUROSUR Fusion Services.

EUROSUR is the information-exchange framework designed to improve the management of Europe's external borders. It aims to support Member States by increasing their situational awareness and reaction capability in combating cross-border crime, tackling irregular migration and preventing loss of migrant lives at sea.

The backbone of Eurosur is a network of National Coordination Centres (NCCs). Each member state establishes an NCC, which groups the authorities responsible for border control in a given member state. The main role of the NCC is to coordinate the border surveillance activities on national level and serve as a hub for the exchange of information.

In addition to maintaining and sharing the situational pictures, Frontex also provides information collected from satellites and other surveillance tools at the European level. Member states can use such information to further improve their situational awareness. The collection of these services, called Eurosur Fusion Services, facilitates access to state of the art technologies, help reduce the duplication of efforts by member states and reduces costs.

The Eurosur Fusion Services include automated vessel tracking and detection capabilities, software functionalities allowing complex calculations for detecting anomalies and predicting vessel positions,

as well as precise weather and oceanographic forecasts. Fusion Services use optical and radar satellite technology to locate vessels suspected to be engaged in people smuggling which often puts the lives of migrants in danger.

Besides close-to-real-time services, Frontex also makes available a wide range of analytical products tailored for operational use within Eurosur.

2.4. Current situation

Frontex concluded in July 2017 a similar contract for meteorological and oceanographic services with a service provider for a period of two years with a possibility of extension by another two. At this moment the contract is under execution and shall be finished by the end of July 2021. The agreements and data provision existing under the current contract will not be in place anymore after that date.

It is important to highlight that the new contractor needs to arrange all the necessary agreements and licences directly, as they would be the data and service provider and Frontex will not make any data available for the purpose of this ToR.

Moreover the contractor is strongly encouraged to take advantage of any raw data or service available for the purpose of this contract under European Union's Copernicus Programme. The data and/or service selected to be provided under Copernicus shall be clearly identified in the offer.

3. Subject

3.1. Purpose

The overall purpose of this tender is to establish a long term contractual relationship with the contractor for the purchase of meteorological and oceanographic information services in order to support Frontex operational activities.
These services shall provide precise, robust, detailed, customized and frequently updated information on atmospheric and oceanographic conditions of designated areas, based on the requirements described in this Terms of Reference.
The expected outcomes of using the services is to have better results of patrolling and surveillance activities, efficient resource allocation, reduced stress on the crew members and also to increase safety of missions.

3.2. Scope

The scope of this procurement includes the provision of the following meteorological and oceanographic services divided by lots:

Lot 1: Meteorological data and visualisation

Lot 2: Oceanographic data and visualisation

Lot 3: Operational support for airborne and sea operations

Mentoring to understand the provided data as well as training days at the Frontex premises are part of this contract.

The data shall be provided via the delivery channels specified below and therefore delivery of dedicated hardware and software are not within the scope of this contract.

Finally, the scope does not include providing any personal or classified data.

4. Description of the services

The contractor is requested to provide Frontex with the requested services as specified below.

4.1. Area of interest and coverage

Frontex is operating in a very dynamic operational environment conducting monitoring and surveillance missions in order to detect illegal migration and cross border crime activities as well as carrying out risk analysis. The area of interest stretches from the European sea basins to the Atlantic Ocean and is bounded by the following coordinates:

Longitude: 43°00' W Latitude: 65°00' N	Longitude: 43°00' E Latitude: 73°00' N
Longitude: 43°00' W Latitude: 11°00' N	Longitude: 43°00' E Latitude: 11°00' N

4.2. Deliverables

This procurement foresees deliverables as described below:

4.2.1. Lot 1 Meteorological Data and Visualisation

Under this lot, the contractor is requested to deliver, using the specified communication channels and data formats, the following meteorological information:

- Air Temperature - 2m above ground (°C);
- Dew Point temperature (°C);
- Wind Chill (°C);
- Freezing level altitude (meters, feet);
- Relative Humidity (%);
- Pressure (mBar);
- Wind Direction (degree, radian);
- Wind Gust (km/hr, m/s, knot)
- Wind Speed (km/hr, m/s, knot and Beaufort scale);
- Jet stream (altitude, direction, speed);
- Precipitation occurrence (probability);
- Precipitation amount rate (mm/hr);

- Snow Fall (cm of height);
- Snow Depth (cm);
- Cloud Cover and type of clouds (%);
- Cloud layers and coverage divided in low medium and high clouds (meters above ground);
- Visibility (km, nautical miles);
- Lightings;
- Weather conditions phenomena: smoke, mist, haze, fog, weather front, storm, hail, hailstorm, thunder, dust storm;
- Satellite imagery in visible, infrared and water vapour spectrum;
- Weather radar data;

4.2.2. Lot 2 Oceanographic Data and Visualisation

Under this lot, the contractor is requested to deliver using the specified communication channels and data formats the following oceanographic information:

- Sea surface Temperature (°C);
- Sea wave height (m) / Significant Wave Height (m);
- Sea current speed (m/s);
- Sea current direction (degree, radian);
- Swell height (m);
- Swell direction (degrees);
- Swell period (s);
- Tides (tide state and tide height (m);
- Wind wave height (m);
- Wind wave period (s);
- Wind wave direction (degree);
- Sea state (Douglas scale);

4.2.3. Lot 3 Operational Support for Airborne and Sea Operations

Under this lot the contractor shall provide specific information and also tailored forecast products to support Frontex aerial and sea operations. This shall include:

- Specific aviation weather reports;
- Weather alerts;
- Weather effect charts.

4.2.4. Business Documentation

For each lot the contractor shall deliver the business documents described below, following the set quality standards presented in the ToR and according to the delivery schedule. All delivered business documents shall undergo the formal acceptance procedure. This deliverable shall include:

- Service Delivery Plan including prerequisites to be met on Frontex side in order to receive the service (if any);
- Service Description Document;
- Testing documentation;
- Service management reports;
- Minutes of the meeting;
- Training documentation.

4.2.5. Training

For each lot the contractor shall deliver training services to ensure sufficient guidance to the users in order to gain the optimal competency in usage of the provided services.

4.2.6. Manuals and support

For each lot the contactor shall deliver user manuals on how to read and understand the data provided under the service. In addition to that, the contractor shall support Frontex with subject matter expertise throughout the entire period of the contract. In order to channel the contractual support, the contractor should nominate a Contract Manager, as per point 11.5 of this document.

5. Minimum Quality and Functional Requirements

5.1. Common general requirements

The following general requirements are mandatory for all lots unless otherwise specified.

5.1.1. Development of the services

The development and implementation of the services shall strictly follow Service Delivery Plan and the Service Description Document approved by Frontex.

5.1.2. Service availability

The provided services shall be accessible 24/7 without any transfer limitation. The service has to be available for at least 98% of time.

Availability %	Downtime / year (365 days)	Downtime / month (30 days)	Downtime / week
98%	7.30 days	14.4 hours	3.36 hours

The service is considered available if Frontex is able to access the required data with no delay. In all other cases, the service is considered unavailable (fully or partially).

In case of unlikely events of planned unavailability the Contractor shall inform Frontex at least 72h in advance.

In order to track the service availability the contractor shall set up a dedicated monitoring web service to show the status of each independent endpoints.
The contractor must ensure appropriate support and provide access to 1st line support (Customer Service Desk) to report service interruptions.
In case the interruption periods exceed the above mentioned, Frontex will decide if the Contractor shall either extend the delivery of the service for the period consistent with the non-delivery duration or Frontex will apply the financial penalties as specified below.

5.1.3. Maintainability

The Contractor shall perform proper maintenance activities enabling quality and non-disruptive functioning of the delivered services.

The following tasks and activities shall be performed:

- Monitor and evaluate service performance based on agreed service performance indicators;
- Perform statistical analysis and deliver to Frontex on monthly basis reports on availability of the services as an integral part of the service management report. The format of the report will be mutually agreed between the Contractor and Frontex at the beginning of contract execution.

Maintenance and supporting services shall be provided as described below:

Maintenance and supporting services (24/7)	**Priority 1 issues:** the service is not available at all OR major service components are not available	**Priority 2 issues:** the service is not working partially OR minor service components are not available
Maximum response time	1 hours	4 hours
Maximum expected resolution/workaround time	5 hours	48 hours

In case of service unavailability, Frontex will decide on the Priority of the issue.

PENALTIES Maintenance and supporting services (24/7)	**Priority 1 issues:** the service is not available at all OR major service components are not available	**Priority 2 issues:** the service is not working partially OR minor service components are not available
Exceeding maximum response time	10 EUR/For every exceeded hour	5 EUR/For every exceeded hour
Exceeding maximum resolution /workaround time	20 EUR/For every exceeded hour up to 14.4h/month	10 EUR/For every exceeded hour up to 14.4h/month
	30 EUR/For every exceeded hour above 14.4h/month	15 EUR/For every exceeded hour above 14.4/month

In addition to the above, Frontex reserves the right to request free of charge customized changes to the service, not affecting initial proposal, not exceeding Contractor's workload of 16 working hours per each month. Unused working hours can be cumulated within the existing contract and dedicated to implementation of changes requiring longer implementation effort.

The scope and timeline of changes will be mutually agreed between the Contractor and Frontex each time when a need for change on Frontex side arises.

5.1.4. Testing and implementation of the services

The overall purpose of testing is to ensure that delivered services meet all of the requirements as described in this ToR. The performed tasks and activities shall be conducted according to Test Plan and Test Scenarios documentation approved by Frontex. The services shall be implemented only after all tests are successfully completed and formally accepted by Frontex.

5.2. Data format and delivery channels

The following requirements are mandatory for all lots unless otherwise specified.

a) As a general rule, data format shall be Web Map Service (WMS) and Web Features Service (WFS) in accordance with Open Geospatial Consortium respective standards: *"OpenGIS Web Map Server Implementation Specification Version 1.1.1 to 1.3.0"* and *"OpenGIS Web Feature Service Interface Standard version 1.0.0 to 2.0.0"*.

b) When WMS/WFS is not applicable the required data format is clearly specified.

c) Points, areas and contours shall be delivered using WMS.

d) The contractor is responsible for setting up all the required server software components in order to allow uninterrupted service delivery.

e) Frontex is responsible for setting up the client side.

f) All of the provided WMS must be time-aware in UTC time. All dates should be according with ISO8601 standard, using the following notation: YYYY-MM-DDThh:mm:ssZ or YYYY-MM-DDThh:mm:ss.SSSZ.

g) **GetMap** operation shall be available for all layers.

h) **GetFeatureInfo** operation shall be enabled for each layer and timestamp. XML, JSON and plain text formats must be enabled for **GetFeatureInfo** results.

i) **GetLegendGraphic** operation shall be available for the layers when applicable.

j) Weather alerts shall be delivered also as push notifications via a dedicated REST API. The server endpoint will be set up by Frontex. The message structure shall be the same for all issuing countries and will be defined by the contractor.

k) All web services shall be secured by SSL/TLS encryption in version TLS 1.2 at minimum. Preferable is TLS 1.3. The TLS certificate should be signed by one of the worlds recognized certificate authorities (not self-signed by the internal CA etc).

l) The connections endpoints have to be specified up to IP (internet protocol) address or host and domain name (fully qualified domain name, FQDN). Network edge devices have to enforce traffic based on those definitions (strict allow rule).

m) Additional to the web services, meteograms shall be delivered as HTML5/Javascript report to be easily integrated in the client application as an IFRAME.

n) The meteogram should be exportable and printable as PNG and PDF. The data to create the meteogram should be exportable as CSV or Excel. Excel format shall contain raw data plus graphics. The exportable data shall be accessed by calling a simple URL, without interaction with the meteograms web site.

o) Meteograms application and weather alerts service shall additionally implement JWT or other suggested method for authentication and authorization.

5.3. Map visualization

The following requirements applies to the maps delivered via WMS and are mandatory for all lots unless otherwise specified.

a) The maps shall have the possibility to zoom in and out. Zoom levels shall be according to ArcGIS online/BING maps/Google map standard ranging from 1 (1:591657550.50000) to 20 (1:1128.497220).

b) The zooming should also take into account the relevancy of data where some locations have higher priorities and shall be displayed at all times.

c) The visual outcome of the services presented to an end-user shall allow for extracting various sets of data (combining current conditions + forecast; dynamic ways to switch between time ranges, attributes, etc.)

d) Different flexible configurations of such data extracts should be possible in user-friendly way. The visual output produced shall allow for efficient, reliable and fast data exploring using various available attributes.

e) The required Spatial Reference Systems are WGS 1984 Web Mercator Auxiliary Sphere (102100(3857)) and WGS84 (EPSG: 4326).

f) The spatial resolution should be minimal 0.1 degrees x 0.1 degrees resolution for oceanographic parameters and minimal 0.125 degrees x 0.125 degrees for atmospheric parameters and allow for the highest accuracy possible.

g) Delivered services shall enable for requesting any chosen time (past or future) from the same/individual chosen location or area via WFS.

h) All the services provided shall be implemented in such a way that would allow time to be set to work globally for all the available parameters.

i) All time-aware parameters shall be described by the contractor in the Service Description Document and Service Metadata description (e.g. **GetCapabilities**). All descriptions shall be updated according to data updates.

j) All the attribute types and attribute limited values, like dictionaries returned by service, should be described by the contractor in Service Metadata description (e.g. **GetCapabilities**) and the Service Description Document.

k) In order to keep consistency with the rest of the client application during service design phase Frontex will provide sample styles to be used for the map

5.4. Common requirements for Lot 1 and Lot 2

Under Lot 1 and Lot 2, for all atmospheric and oceanographic information the contractor shall deliver three categories of data:

- Measured;
- Forecast;
- History;

In order to check the functional requirements listed below during offers evaluation process, Frontex may request sample products to be delivered for the period of one week for a limited area.

Measured data

a) Measured detailed atmospheric weather and oceanographic conditions is the service where the source of data would be coming from the meteorological stations, satellites, buoys, ships, other available sources. The outcome should be:

- Detailed atmospheric weather picture of the current situation at the location of interest;
- Detailed oceanographic weather picture of the current situation at sea, at the location of interest.

b) The time range for the measured data service (current atmospheric weather and oceanographic conditions) is considered to be from the latest observations down to 7 days in the past. The full range visualization shall be enabled automatically via the provided delivery channels.

c) Time interval for the measured data shall be hourly, or less.

d) For all the services provided under measured data the service shall be updated hourly.

e) The list of the meteorological stations/buoys being source to all of the provided services shall be provided and kept up to date throughout the entire life time of the contract.

f) For filtering and visualization purposes, the following station parameters shall be indicated:
- Detailed number of stations within the area of interest;
- Station name;
- Station ID;
- Station category (country capital, regional capital, province capital, international airport, national airport, etc.);
- Detailed data report (station approximate frequency e.g. from 0 to 100)
- Time intervals for the station coverage;
- Station elevation (m above sea level);
- Station coordinates (Latitude, Longitude).

g) The coverage of the Area of Interest should be clearly specified, representing the details on: station availability, parameters provided and corresponding frequency of updates of the parameters.

Forecast data

a) Forecast detailed atmospheric weather and oceanographic conditions is the service which shall provide detailed and precise forecast of the state of the atmosphere and sea for all requested parameters and time ranges, based on all possible combinations of available models, measured data and other available sources.

b) The forecast service shall be based on compilation of multiple global numerical forecast models providing the best available solutions taking into account the resolution, accuracy, coverage and all the needs described in these Terms of Reference. The final solution shall provide a fully integrated (also from various model sources, e.g. a combination of regional and global models) and compatible service and it shall present one integrated graphical interface.

c) For the medium range forecast, the European Centre for Medium Range Weather Forecasts (ECMWF) model shall be delivered.

d) The methodology, source of data and forecast model concepts should be clearly explained in the service description document.

e) All forecast services shall allow for data consultation from the nearest data available up to 7 days in the future.

f) The range of time in the forecast shall be:
- Short term forecast: up to +48 hours;
- Medium range forecast: from +48 hours to +7 days.

g) The final solution shall present one single endpoint regardless of the forecast time range used as a source. The ultimate goal is to provide the outcome with the best balance between:
- accuracy;
- confidence;
- detailed information;
- resolution;
- integration between various models;
- usability standards;
- user-friendly presentation;

h) Time interval for the model forecast data shall not exceed 3 hours (for the short term forecast).

i) All forecast services shall be updated with regular intervals at least 4 times per 24 hours.

Historical data

a) The contractor shall be ready to deliver historical measured data for reanalysis purposes older than 7 days and up to 20 years in the past.

b) Climatology layer for Lot 1 should include the following minimum parameters: wind speed, wind direction, precipitation amount, air temperature.
c) Climatology layer for Lot 2 should include the following minimum parameters: significant wave height and wave direction.

Technical proposals containing improvements of minimum number of required parameters for climatology layers in Lots 1 and 2 will be scored higher than proposals limited to minimum requirements.

d) The historical data shall be delivered as raw data or as aggregated data, with monthly averages in formats such as XLSX, CSV or shapefile. Monthly maps when possible should be also delivered.

e) In addition, time series and reports shall be provided if requested. Seasonality plots will be enabled for predefined critical locations and 20 years of hourly time series with monthly average distribution tables will be provided upon Frontex request.

f) The technical conditions of such retrieval shall be specified in the Service description document.

g) Each query and timeframe of the climatology data will be defined by Frontex Service Manager.

h) As a minimum requirement historical data shall be delivered via email to the Frontex Service Manager.

Technical proposals containing improvements in data delivery for climatology with WMS/WFS will receive higher score than proposals limited to minimum requirements.

5.4.1. Data representation

a) Point data

There shall be one WMS endpoint for the point data. A unique layer shall be provided for each parameter of measured (including past data up to 7 days) and forecast data. Measured data could be replaced by immediate forecast to cover gaps in data reported by stations and in stations spatial coverage.

If data is available or comes from various elevations, elevation parameter should be provided when data for a single location is requested.

GetMap request shall return a map image containing icons according with the symbols defined in Service Description.

In order to improve map interpretation each zoom level must contain a subset of stations depending on the scale and/or category. As a result not all the stations will be visible at all scales.

GetMap request shall return a subset of stations depending of the scale / extension, providing min.20 locations per one extension.

GetFeatureInfo shall return:

- stations properties like name, ID, etc;
- measurements or forecast from the stations;
- time of measurement or forecast (in the format specified in this document)

Time-aware **GetFeatureInfo** shall include all scope of the time ranges:

- current and including past data up to 7 days;
- forecast data;

If there is no time provided in the request the service shall return the observations from the latest available time.

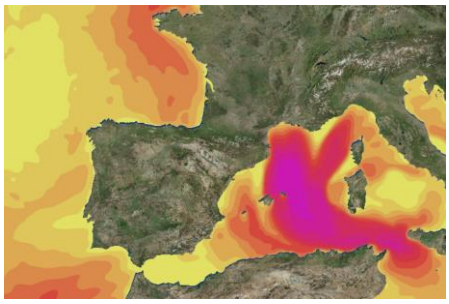
It should be possible to visualize multiple parameters (correlated parameters relevant for a particular location) displayed in a map for the location (e.g. air temperature, weather conditions phenomena) in one aggregated visualization.

b) Area data

There shall be one WMS endpoint for area data. A unique layer shall be provided for each parameter of measured (including past data up to 7 days) and forecast data.

GetMap request shall return a map image presenting the area.

Example of area on a map:



GetFeatureInfo shall return:

- time of measurement;
- the attribute value;
- the attribute unit;
- average measurement error (e.g.: Wind speed measurement average error = 1 m/s);

Time aware **GetFeatureInfo** shall include all scope of the time ranges, available per each attribute:

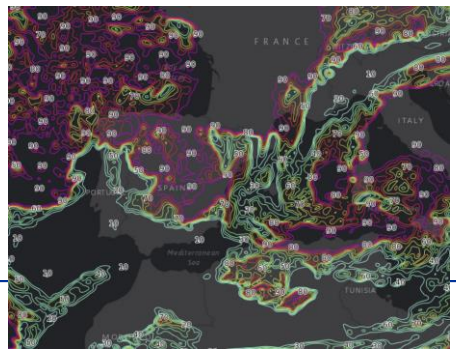
- past analysis data (up to 7 days in the past);
- forecast data;

c) Contour data

There shall be one WMS endpoint for contour data. A unique layer shall be provided for each parameter of measured (including past data up to 7 days) and forecast data.

GetMap request shall return a map image presenting coloured isolines and values associated with the lines.

Example of contour on a map:



GetFeatureInfo shall return:

- time of measurement;
- the attribute value;
- the attribute unit;
- average measurement error (e.g.: Wind speed measurement average error = 1 m/s);

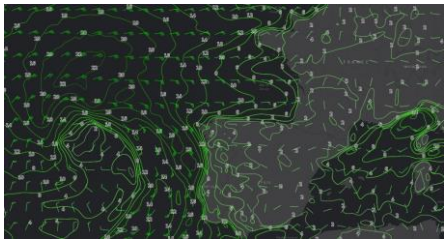
Time aware **GetFeatureInfo** shall include all scope of the time ranges, available per each attribute:

- past analysis data (up to 7 days in the past);
- forecast data;

d) Wind or currents vector

For the attributes related to wind or currents there shall be specific maps created. The attributes shall be presented in a combined point grid including direction and speed. For the direction there should be direction of arrows representing it, and for the speed - colours and thickness of arrows.

The presentation shall comply with the example below:



e) Grid data

There shall be one WMS endpoint for grid data. A unique layer shall be provided for each of the following parameters of measured (including past data up to 7 days) and forecast data:

- wind speed;
- wind direction;
- sea current speed;
- sea current direction;

GetMap request is not needed for this representation. Grid data is necessary only to be consumed by other services and not to be displayed on the map.

The contractor shall propose a proper method for producing grid data taking into consideration the requirements for spatial resolution from map visualisation.
Grid data shall be derived from:

- measured data from observation stations combined with an interpolation method;
- analysis made for forecasting models;

GetFeatureInfo shall return:

- time of measurement/forecast;
- the attribute value;
- the attribute unit;
- average measurement error (e.g.: Wind speed measurement average error = 1 m/s);

Time aware **GetFeatureInfo** shall include all scope of the time ranges, available per each attribute:

- past analysis data (up to 7 days in the past);
- forecast data;

f) *Meteograms*

A dynamically created meteograms should be provided for the forecast data. The meteogram should show the forecast up to 7 days.

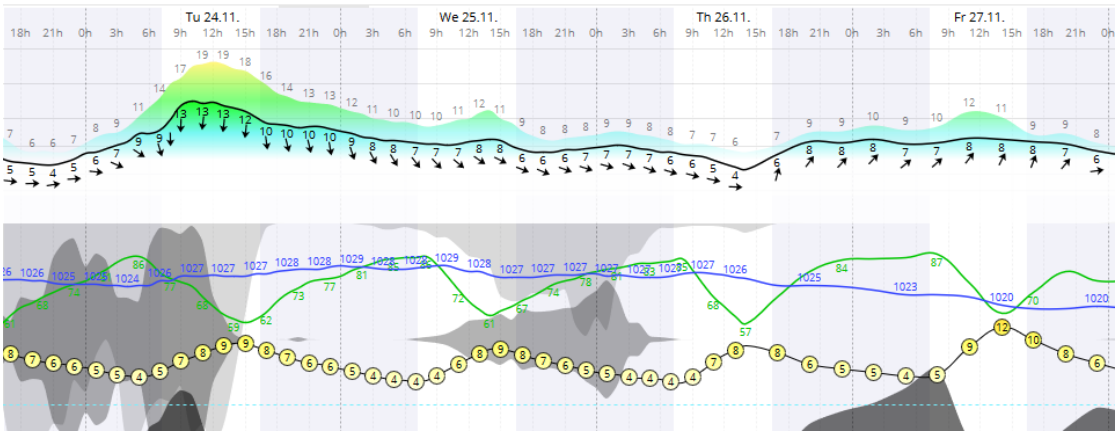
It should be possible to request a meteogram from any point on the map (x and y coordinates in WGS84 Geographic) and the results of such meteograms shall be presented in a new window.

The HTML view shall receive parameters that will be used to build the meteogram. A number of selected parameters should be included (with having a default set parameter). When the meteogram has been loaded, it shall be possible to change the parameter to any other weather parameter (to be allowed to load additional parameters). Several meteograms shall be available in the same view.

The following minimum meteorological parameters shall be available: air temperature, apparent temperature, dew point, precipitations amounts and probability, atmospheric pressure, relative humidity, snowfall amounts, snow depth, total cloud cover, visibility, wind chill, wind direction, speed and gusts.

The following minimum oceanographic parameters shall be available: current direction and speed, sea temperature, total wave height, swell height and period, wind wave height and period.

The presentation should comply with the example below:



g) *Text description*

For each parameter on the map, there shall be a text description (legend with details) made available. It should be possible to request such information to be displayed when needed.

5.5. Specific requirements for Lot 1

a) *Radar derived live animation*

The radar animation shall provide the dynamically updated (animated) live picture of the current precipitation intensity and precipitation type over the area of interest, based on available weather radar data and according to the requirements specified below. The actual development of and movement of precipitation areas shall be presented in an animated visualization of the predictions.
The service shall provide a combination of high resolution model data and precipitation intensity data generated by satellite images.

Live picture from weather radars shall be updated in intervals not exceeding 15 minutes (WSR or/and Doppler weather radar).

The animation shall provide data from the latest known down to 3 days in the past.

The parameters listed below are mandatory:
- Location of precipitation;
- Type of precipitation (rain, snow, hail, sleet, freezing rain);
- Intensity of the precipitation;

The service shall provide the information on the analysis of the precipitation: identification of precipitation intensity, movement and precipitation type.

Water vapour satellite imagery shall be delivered also as a separate layer.

b) Short range radar/precipitation forecasts

The service shall provide the model of development of the precipitation fields across the requested area for the next hours (e.g. based on remote sensing, like radars and using products for building tracks and predictions of the precipitation fields of the localized weather structures, based on data analysis of reflectivity and radial velocity).

Radar reflectivity and minimum 2 hours forecast shall be provided. It should also provide the animated visualization of the predictions. The forecast should allow to identify the areas of precipitation and determine the direction and speed movement of the fields.

c) Cloud animation

The actual development of the weather and clouds moving shall be presented as an image. The cloud animation shall provide the dynamically updated (animated) live picture of the current cloud coverage (live picture for clouds patterns).

Live picture of cloud animation shall be updated in intervals not exceeding 15 minutes.
Animations update shall be not exceeding 30 minute intervals.

Live animation of clouds shall include visible and infrared satellite imagery channels.

The animation shall provide data from the latest known down to 3 days in the past.
The service shall provide the information on the analysis of the clouds: identification of cloud layers with cloud type and coverage, height and temperature.

Where possible, the service shall provide the model of development of the clouds across the requested area, including the visualisation of the predictions.

d) Lightning animation

The lightning animation shall provide the dynamically updated (animated) picture based on lightning data according to the requirements specified below.

Every image shall contain lightning data over the past 60 minutes, with color-coded recentness of the strikes.
The polarity of a strike must be indicated.

GetFeatureInfo request shall return:
- Time of strike;
- Type (cloud to ground or cloud to cloud);
- Amplitude;

The picture with lightning data shall be updated in intervals not exceeding 15 minutes.

The animation shall provide data from the latest known down to 3 days in the past.

5.6. Specific requirements for Lot 2

There is no minimum set of measured oceanographic parameters to be provided. For this kind of data the minimum requirement is to provide forecast data.

However, providing measured oceanographic data from offshore stations is a valuable addition and will be scored higher than proposals providing only the minimum requirement. In this respect the contractor shall provide in the technical offer a clear description including number of stations, locations, measured parameters and frequency of measurements.

5.7. Specific requirements for Lot 3

Under this lot the contractor shall provide specific information and also tailored products to support Frontex aerial and sea operations. The main goal is to optimize patrolling activities and to increase safety of the missions.

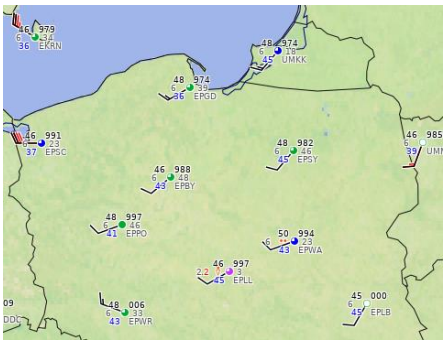
a) Specific aviation weather reports METAR, TAF, SIGMET, AIRMET and GAFOR

There shall be one WMS endpoint for specific aviation weather reports. Unique layers shall be provided for METAR, TAF, SIGMET, AIRMET reports and also for GAFOR charts.

The layers shall be updated in near real time and be available for up to 7 days in the past.

METAR and TAF data shall be available for all airports in Area of Interest. GAFOR charts shall be available for all European issuing countries.

GetMap request shall return a map image presenting specific symbols like in the following example:



GetFeatureInfo shall return:

- raw METAR, TAF, SIGMET, AIRMET
- decoded METAR, TAF, SIGMET, AIRMET;

Time-aware **GetFeatureInfo** shall include all scope of the time ranges, available per each report:

- past analysis data (up to 7 days in the past);

The SIGMET and AIRMET reports shall be delivered in parallel as push notifications via one REST API in near real time. The server end point will be set up by Frontex. The contractor shall propose a JSON message format.

b) Weather alerts

Weather alerts consist of official warnings issued by national weather administrations of the respective country which warn of impacts caused by severe weather.

The service shall include at least weather alerts issued by the European countries forming the southern and eastern EU external border.

Proposals extending the coverage to the neighbouring third countries, especially Western Balkans, will be scored higher than proposals limited to minimum requirement.

There shall be one WMS endpoint for weather alerts. A single layers will include all alerts in the AoI.

GetMap request shall return a map image presenting the area affected, specific symbols or text description.

GetFeatureInfo shall return:

- all fields of the official weather alert;

Time aware **GetFeatureInfo** shall include all scope of the time ranges, available per each report:

- past analysis data since the start of the contract;

The weather alerts shall be delivered in parallel as push notifications via one REST API in near real time. The server end point will be set up by Frontex. The contractor shall propose a JSON message format consistent for all the issuing countries.

c) Weather effect charts

Weather effect charts represents a custom product built for a predetermined area and timeframe showing the influence of weather over different types of land, sea or airborne operations.

The main goal is to have a tailored forecast which will take into consideration all the relevant atmospheric and oceanographic parameters and also the individual characteristics of the assets and communication channels.

The contractor shall define the relevant asset characteristics which need to be considered and Frontex will deliver them for each asset involved.

The weather effect chart will present the combined impact of atmospheric and oceanographic conditions and weather alerts for a specific asset on least three levels:

- No impact (green);
- Moderate impact (yellow);
- Severe impact (red);

Moreover, the chart will show individual impact of the following parameters: clouds, precipitation, wind, visibility, temperature, sea state.

The charts shall be available for the current measured weather conditions and also for short term forecast up to +48 hours.

The charts shall be produced for a limited geographical area where the operation takes place and may include any combination of assets: land, sea or aerial.

The chart shall be available immediately after definition and shall be updated at a maximum interval of 4 hours or in case of any weather alert or significant change in the atmospheric or oceanographic conditions.

However, if the manual intervention is needed for setting up the workflow, the initial delivery time shall not exceed 4 hours.

A sample weather effect chart is presented in *"Appendix 3 - Sample weather effect chart Lot 3"*.

For the purpose of historical analysis all weather effect charts shall be available for the entire period of the contract.

For configuration management of the weather effect charts the contractor shall set up a specific REST API endpoint.

All the necessary data in order to produce weather effect charts lays within the responsibility of the contractor. Frontex will not provide any raw data like the one owned under other lots.

GetMap request shall return a map image presenting the weather effect chart with specific symbols or text description.

GetFeatureInfo shall return:

- all fields in the chart;

Time aware **GetFeatureInfo** shall include all scope of the time ranges, available per each report:

- past charts (up to 7 days in the past);
- forecast charts;

5.8. Web Services Security

REST API services will consume or be provided as REST API calls. Depend on its communication role the service will act as client or server. Frontex expects that the web service regardless of its role will be developed in accordance with the following guidelines:

- Web Applications Secure Development Guidelines by EC DIGIT SECURITY ASSURANCE Version 3.0 Date: 12/05/2017
- Web Application Security Standard C(2018) 7283 final Date: 26/10/2018
- OWASP API Security Top 10 2019
- For topics not covered by above documents the Application Security Verification Standard Version 4.0.1 by OWASP should be used as complementary measure with selection of controls up to the Level 2. Each detailed entry has to be addressed, marked as out scope (if not service relevant) justified and commented (250 requirements in total).

Before service go live Frontex will arrange a penetration test to confirm no serious implementation flaws exists. Please take this into account and plan the system realisation time frame accordingly as such test may reveal something what need to be corrected before the system production start.

5.9. Business documentation

Business documentation shall be delivered for all lots according to the following minimum requirements. All delivered business documents shall undergo the formal acceptance procedure.

a) **Service Delivery Plan** shall include the following chapters:

- Introduction;
- Scope statement;
- Planning assumption and constraints;
- Approach to service design and development;
- Approach to service implementation and operation;
- Prerequisites to be met on Frontex side in order to receive the service (if any);
- Work breakdown structure;
- Detailed master schedule of service design, development & implementation;
- Quality management and service operation performance indicators;
- Risks identified;
- Approach to monitoring, reporting, assessment and supervision procedures;
- Configuration management;
- Change control;
- Annex 1 - Acronyms and definitions

b) **Service Description Document** shall include the following chapters:

- Functional specifications;
- Technical specifications, including minimum software and network requirements;
- Scope and description of each service and its components;
- Visual presentation, including symbology;
- List of the meteorological stations/buoys being source to the provided services;
- Source of data and forecast model concepts;
- All severe weather events/types and sources of data;
- Conditions for retrieval of historical data;
- Data availability and frequency.
- Annex 1 - Acronyms and definitions

c) **Testing documentation** shall include:
- Test Plan;
- Test Scenarios;
- Test Reports.

d) **Service management reports** shall be delivered on monthly basis and shall include the following chapters:
- Summary of the activities for the past month;
- Identified risks and suggestions for their mitigation;
- Statistical analysis reports on service levels;
- Recommendations on improvements;
- List of bugs fixed;
- List of requests for change implemented.

e) **Minutes of the meeting** (MoM) shall be prepared by the contractor within three working days after the meeting. MoM shall be prepared for:
- Meetings;
- Phone conference calls;
- Video conference;

f) **Training documentation** required shall consist of:

1. Training proposal:
- Aims and objectives of the training;
- Training organization, including: agenda, materials, equipment, and location;
- Description of training materials;
- Post-training needs.

2. Training report:
- Summary of the activity;
- Feedback collected by the trainer (including suggestions, requests for improvement);
- Trainer's assessment, including suggestions for improvement.

5.10. Training

For each lot the Contractor shall deliver training services up to 20 man/days per two years of contract. All trainings shall be delivered outside of the contractor premises, as a general rule at the Frontex headquarter. In special situation commonly agreed, the training may be conducted also via videoconference.

Each time a specific training is required, Frontex will send to the contractor all relevant information concerning the training needs, audience, location and dates.

The yearly estimate of amount of trainings as well as indicative dates and locations will be provided to the Contractor by Frontex Service Manager at the beginning of each calendar year. All expenses related to Contractor's staff shall be borne by the Contractor.

Training sessions and all training materials are to be provided exclusively in English language.

At the end of each training activity, the trainer is expected to present the full training report.

6. Frontex data management and dissemination

The data provided under this contract will be incorporated into the Frontex EUROSUR Fusion Services framework. This framework defines the governance, service management and technical structure of information services provision in Frontex for situational picture compilation in order to increase situational awareness.

The data will be fused with other data available to Frontex and shared with selected Frontex stakeholders, such as Member States and partner agencies.

7. Compliancy with EU Data Protection Regulation

The contractor must ensure compliancy with the European Union General Data Protection Regulation (REGULATION (EU) 2018/1725 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL) and must describe in the proposal how the compliancy is achieved.

8. Intellectual property rights

It is under the Contractor's responsibility to obtain the necessary rights and ensure that all sources utilized for producing the deliverables of the present service's contract may be used by Frontex with unlimited access. All potential costs incurred in the licensing of the necessary property rights shall be included in the price of the tender. For Frontex products derived from that data, Frontex retains the IPR.

9. Confidentiality and classification

The data requested to be collected and provided is considered sensitive non-classified. The purpose and the data provided under this contract shall not be shared with 3rd parties. In addition to that, the contract manager of the contractor shall sign a declaration of confidentiality after contract signature.

10. Copernicus programme

The European Union Copernicus programme is the European Union's Earth observation programme. It offers information services that draw from satellite Earth Observation and in-situ (non-space) data.

The European Commission manages the Programme. It is implemented in partnership with the Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Ocean.

Vast amounts of global data from satellites and ground-based, airborne, and seaborne measurement systems provide information to help service providers, public authorities, and other international organisations improve European citizens' quality of life and beyond. The information services provided are **free and openly accessible to users**.

Therefore, the contractor shall ensure that Copernicus data is used primarily when available for the purpose of this tender. For data coming from other sources than Copernicus, the contractor has to confirm that Copernicus does not provide equivalent data/services.

11. Contract implementation

11.1. Contract type and duration

The contract is expected to be concluded for two years with possible extension for another two years (for a maximum total duration of four years). The extension will be automatically applied unless one of the parties receives formal notification to the contrary at least three months before the end of the ongoing duration. Tenderers shall submit tenders which demonstrate that the services could be provided for a period of 4 years in total.

The contract shall be considered terminated by the end of duration. The Contractor remains liable for the quality of the deliverables for the full duration of the contract.

11.2. Delivery schedule

The contract shall enter into force on the next day after is signed by the last contracting party.

The kick-off meeting shall be organized within 5 working days after the contract enters into force. The detailed planning, schedule of deliveries, milestones, structure of deliveries shall be discussed during the meeting.

The closure meeting shall take place within last 14 days of contract performance.

11.2.1. Delivery target for Lot 1 and Lot 2

Under the Lot 1 and Lot 2 the target to start service operation is not more than within **30 working days** after contract's entry into force. In order to achieve this, the following indicative schedule shall be considered:

#	Deliverable	Timeline for Lot 1 and Lot 2
1.	Service Delivery Plan	Within 10 working days after kick-off meeting
2.	Service Description Documents	Within 10 working days after kick-off meeting
3.	Test Plan & Scenarios	Within 5 working days after Frontex approval of the Service Delivery Plan & Service Description Document
4.	Test Reports	Within 5 working days after completion of tests
5.	Service Operation	After completion of the tests, but not later than 15 working days after Frontex approval of the Service Delivery Plan & Service Description Document
6.	Service management reports	On monthly basis after service implementation
7.	Training Proposal	Within 1 week after reception of the training request submitted by Frontex Service Manager

Failing to comply with the schedule shall be considered underperformance.

11.2.2. Delivery target for Lot 3

Under the Lot 3 the target to start service operation is maximum **45 working days** after contract's entry into force. In order to achieve this, the following indicative schedule shall be considered:

#	Deliverable	Timeline for Lot 3
1.	Service Delivery Plan	Within 10 working days after kick-off meeting
2.	Service Description Documents	Within 10 working days after kick-off meeting
3.	Test Plan & Scenarios	Within 10 working days after Frontex approval of the Service Delivery Plan & Service Description Document
4.	Test Reports	Within 5 working days after completion of tests
5.	Service Operation	After completion of the tests, but not later than 30 working days after Frontex approval of the Service Delivery Plan & Service Description Document
6.	Service management reports	On monthly basis after service implementation
7.	Training Proposal	Within 1 week after reception of the training request submitted by Frontex Service Manager

Failing to comply with the schedule shall be considered underperformance.

11.3. Prices and payment

All prices shall be in Euro, excluding VAT. The financial offer shall be submitted for the 2 years duration of the contract and separately for another 2 years of possible extension of the contract.
Payments will be done on a quarterly basis, based on the acceptance signed by Frontex in accordance with the form in Appendix 2. Each quarterly payment shall equal to 1/8 of the contract value for the respective 2-years period. After each quarter of service delivery, the Contractor shall issue an invoice accompanied by signed Appendix 2, which Frontex shall pay within 30 calendar days after its receipt.

11.4. Languages

All the documentation delivered within the contract shall be in English. Moreover all communication, whether written or spoken, shall be in English.

11.5. Contractor's management personnel

The Contractor shall be responsible for providing all necessary personnel to ensure the satisfactory performance of its obligations under this contract and shall supervise and be fully responsible and liable for all the services performed.
The Contractor shall nominate a Contract Manager (CM) for all contractual matters (commercial, technical and operational).
CM will act as a single contact point from the Contractor's side. All the correspondence related to this contract will be addressed to him/her.
In case of absence of the CM the Contractor shall ensure a backup and inform Frontex about the change in writing.

11.6. Frontex personnel

For the proper implementation of this contract Frontex will nominate the Frontex Contract Manager (FCM), who will act as a single contact point for all the matters related to the contract implementation.

The communication between the Contractor and Frontex will be mainly performed via e-mail and phone.

12. Quality and Acceptance criteria

All the services which are part of these Terms of Reference are subject to the Frontex acceptance. Frontex will monitor the quality of the services provided by the Contractor. Elements that will be monitored include:

(i) Full compliance with the Minimum Quality and Functional Requirements stipulated in this ToR;
(ii) Adherence to deadlines;
(iii) Communication skills and ability to cooperate;

Frontex will evaluate the quality and the completeness of the service rendered throughout contract execution and will provide the Contractor with written notice of Acceptance, Partial Acceptance or Non-acceptance.
The Contractor will be immediately informed in case the performance standards are not up to expectations.
In the event Frontex provided the Contractor with a notice of Partial or Non-acceptance, Frontex without affecting the Contractor's actual or potential liability or the Contracting Authority's rights under this contract, shall have the continuing right, at its sole option, to:

(i) refuse to pay any fees or other amounts associated with such services;
(ii) accept such services on the condition that any fees or other amounts payable with respect thereto shall be reduced or discounted to reflect, to Frontex' satisfaction, the deficiencies present therein or the costs likely to be incurred by Frontex to correct such deficiencies; or
(iii) terminate the Contract and/or seek any and all available remedies, including damages;

13. Underperformance and cancellation

Frontex reserves the right to terminate this contract if the Contractor is not respecting its contractual obligations.

14. List of Appendixes

Appendix 1 – Declaration of confidentiality
Appendix 2 – Model Deliverable Acceptance Form
Appendix 3 - Sample weather effect chart Lot 3

Appendix 1 – Declaration of Confidentiality

Tender procedure: Frontex/OP/ /2021/

Provision of Meteorological and Oceanographic Services

Contractor's Declaration of confidentiality

I, _____ (N*ame and Surname*)

in my function of _____ *(full Function name),*

representing _____ *(full Company name),*

hereby declare that I will treat the information and/or documents that are received from Frontex in the context of preparation of the tender and potential execution and/or performance of the above mentioned contract with the strictest secrecy. No information and/or documents will be divulged to third parties.

I am aware that tasks carried out in view of preparation of the tender and potentially execution and/or performance of this contract also are governed by this principle of secrecy.

I am also aware of the fact that the principle of secrecy pointed out in the first paragraph will continue to apply after the completion of the above mentioned contract.

All information and documents received will be used solely for the preparation of the tender and potentially for the execution and/or performance of this contract.

Name of the person: _____

Signature: _____

Place, date: _____

Appendix 2 – Model Deliverable Acceptance Form

Model of Task / Deliverable Acceptance Form

FOR SERVICE CONTRACT No ……

Original document - duly signed - to be attached to the invoice

TASK / DELIVERABLE DESCRIPTION

Please give reference to the Terms of Reference and short description of the task or deliverable.

Please describe observations and reservations if any.

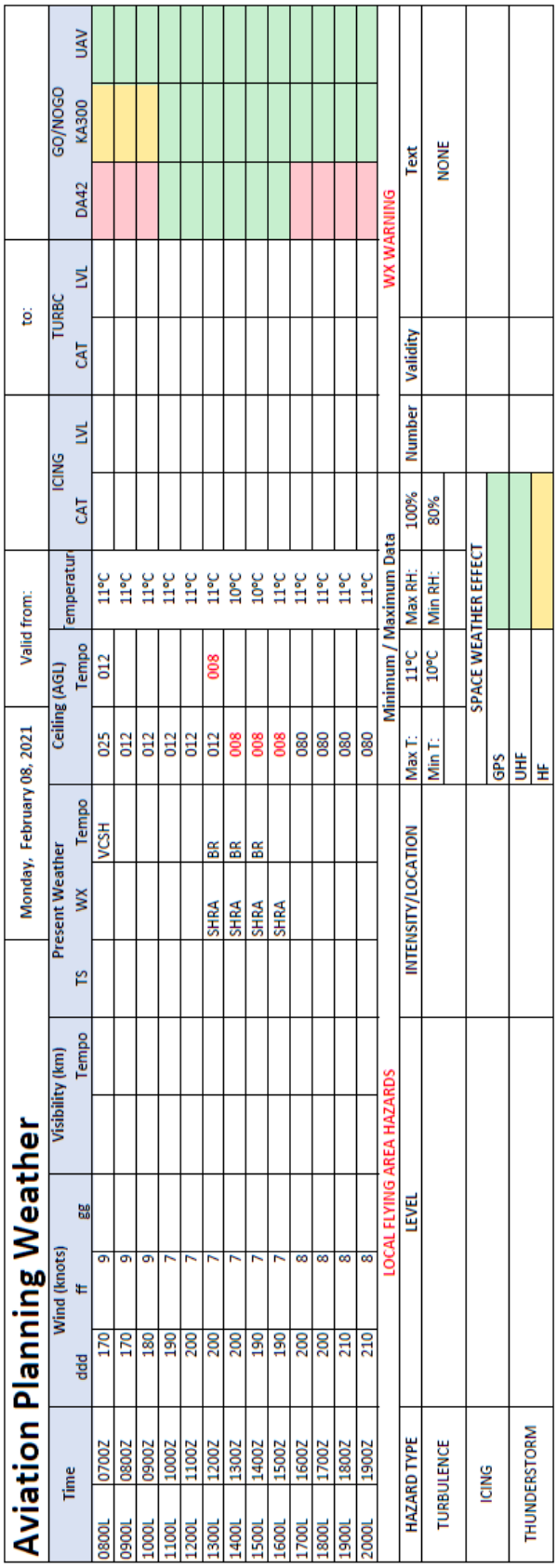
In case of Task/Deliverable rejection please detail reasons.

TASK / DELIVERABLE is ACCEPTED / REJECTED

To be filled in by Frontex:

Official responsible for acceptance (in block capitals):	
Date and signature	
Official responsible for final validation (in block capitals):	
Date and signature	

Appendix 3 - Sample weather effect chart Lot 3



Aviation Planning Weather

Monday, February 08, 2021 | Valid from: | to:

Time		Wind (knots) ddd	ff	gg	Visibility (km)	Tempo	Present Weather TS	WX	Tempo	Ceiling (AGL)	Tempo	Temperatur	ICING CAT	LVL	TURBC CAT	LVL	GO/NOGO DA42	KA300	UAV
0800L	0700Z	170	9						VCSH	025	012	11°C							
0900L	0800Z	170	9							012		11°C							
1000L	0900Z	180	9							012		11°C							
1100L	1000Z	190	7							012		11°C							
1200L	1100Z	200	7							012		11°C							
1300L	1200Z	200	7					SHRA	BR	012	008	11°C							
1400L	1300Z	200	7					SHRA	BR	008		10°C							
1500L	1400Z	190	7					SHRA	BR	008		10°C							
1600L	1500Z	190	7					SHRA		008		11°C							
1700L	1600Z	200	8							080		11°C							
1800L	1700Z	200	8							080		11°C							
1900L	1800Z	210	8							080		11°C							
2000L	1900Z	210	8							080		11°C							

LOCAL FLYING AREA HAZARDS

Minimum / Maximum Data

WX WARNING

HAZARD TYPE	LEVEL	INTENSITY/LOCATION	Max T:	11°C	Max RH:	100%	Number	Validity	Text
TURBULENCE			Min T:	10°C	Min RH:	80%			NONE
ICING			SPACE WEATHER EFFECT						
THUNDERSTORM			GPS						
			UHF						
			HF						