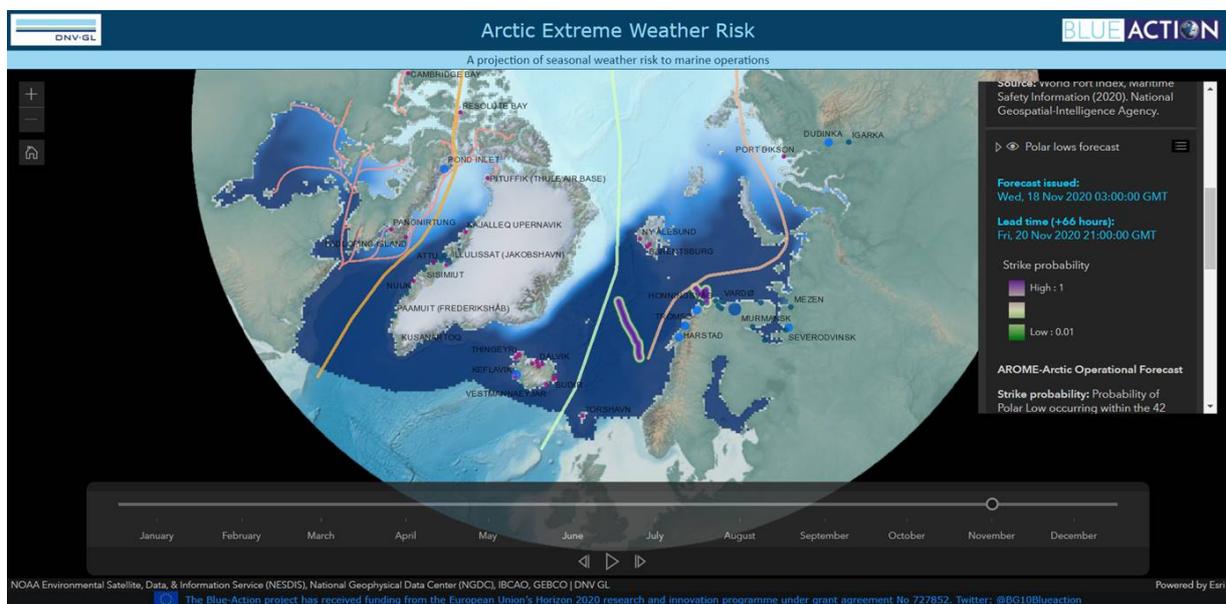# The Arctic Extreme Weather Risk web application

Arctic Risk Map Prototype interface, Picture title. Credits: Øivin Aarnes (DNV GL)

About this document

Deliverable: D5.12 CS3 Product on polar lows
Work package in charge: WP5 Developing and valuing climate and information services
Actual delivery date for this deliverable: November 2020
Dissemination level: The general public (PU)
Dissemination type: OTHER

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Summary for publication

The Arctic Extreme Weather Risk application provides projections of seasonal weather risk to marine operations. The mapping web application contains maps communicating foreseen risks associated with Arctic marine operations and extreme weather events. The mapping application is currently available in the demo version here: https://maps.dnvgl.com/labs/blueaction

- The maps are intended as guidance based on a comprehensive analysis of governing atmospheric conditions, also taking into account the impacts of severe and unpredictable weather situations.
- An online help is also available directly in the application for the users, with definitions and guidance, directly in the application.

This document provided guidelines on how to use the application.

A full factsheet on the application is also available online: https://zenodo.org/record/4073137

Guidelines for using the Arctic Extreme Weather Risk

On entering the application https://maps.dnvgl.com/labs/blueaction, the initial mapping area (spatial extent) is set to the circumpolar Arctic. This is intentional to guide a holistic perspective, and to allow the user to zoom in on a particular region of interest.
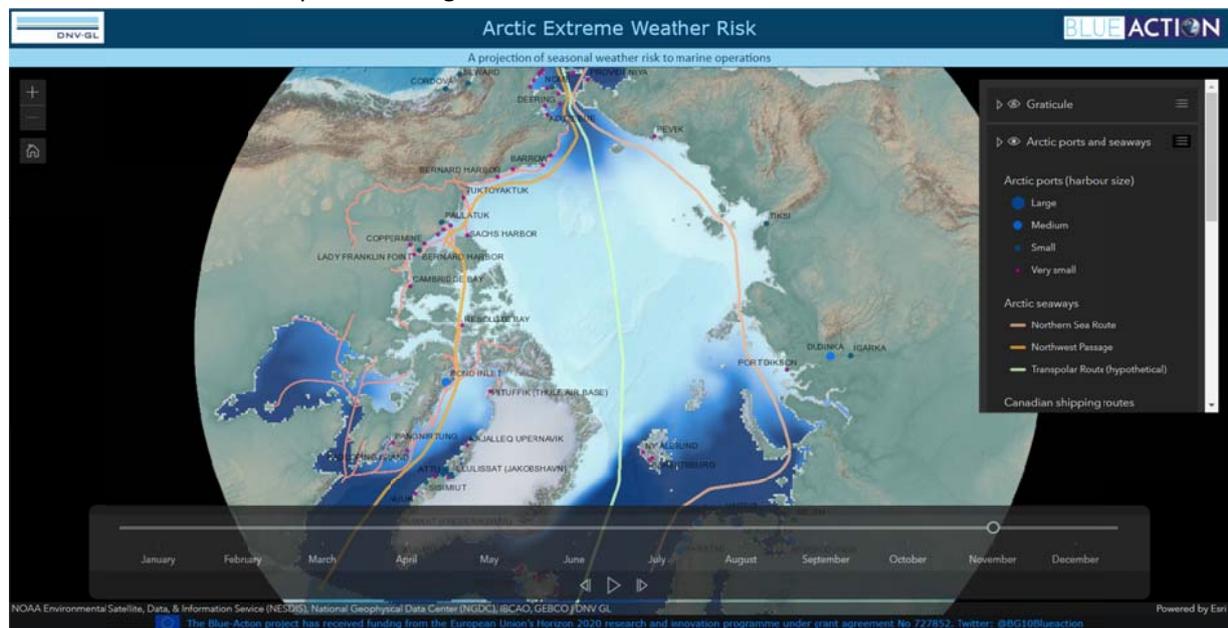

Figure 1: The main view of the application initial state.

User interface components

The application design comprises three main controls.

These are:

1) **Navigational controls** (upper left corner): These allows for interacting with the map, essentially zoom in (+) and out (-) of the map, a home button to return to initial extent (the circumpolar start-up display), and panning in the map (move left, right, up, down) using either mouse click drag-and-release, or the arrow buttons on your keyboard.

2) The **time slider control** (lower part of the display): This control allows for viewing how conditions (and risk) varies throughout the year or season. The map time display changes by dragging the time slider marker manually, or by clicking buttons play/forward/rewind. The time interval used in this assessment is monthly, so the maps indicate risk within this timeframe, i.e. the chance for encountering hazardous conditions in the lapse of each month.

3) The **layer list control**: This control lists available interactive map layers. These are operational layers, such as the layer on Arctic infrastructure - *Arctic ports and seaways*, and image service layers comprising mosaic datasets, i.e. a series of images, each depicting a state of display for a certain variable or composition of variables (Fig.2)
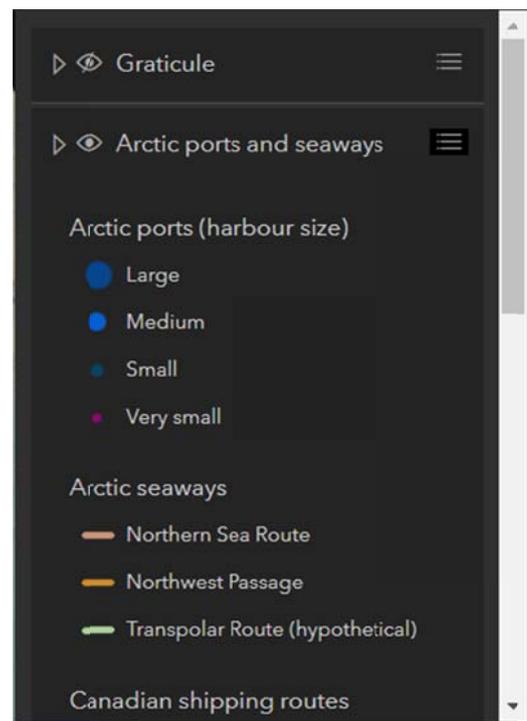

Figure 2: Operational layers control.

The layer list control

Individual layers in the map can be toggled on or off, by ticking the "eye" or layer title in the layer list control:

The control can be scrolled up and down. To view a specific layer alone, such as sea ice concentration, deactivate any active layers (clicking the "eye" again), and scroll down to the end of the list.

The layer list allows for flexible inclusion of additional content in the map in the future, which, depending on the interest, can be seen in relation to other layers.

By activating a specific layer, the legend of this layer expands (becomes visible). Likewise, deactivating a layer will collapse the legend. The legend contains symbols and descriptions used to illustrate features and/or spatial patterns in the map. Seeing different layers in combination (an overlay) may help discover interesting relationships, patterns and features in the underlying data.

Map layers

Each of the layers in the layer list control represent a feature or display relevant to the application or use thereof. In order of appearance, the layers are:

Graticule

The base map graticule is a grid designed to give location reference in terms of Meridians (degrees Latitude) and Parallels (degrees Longitude). The grid also contains reference to the Arctic circle and North pole.

Arctic ports and seaways

This map layer is intended to give notion to existing Arctic infrastructure such as harbours and ports, and to existing and hypothetical Arctic seaways.

Source: World Port Index, Maritime Safety Information (2020). National Geospatial-Intelligence Agency.

Operational forecast

Layer showing probability (strike probability) of polar lows occurring within 42 hours of forecast reference time. This layer updates automatically on a regular basis, currently set to 3:00 AM GMT every night.
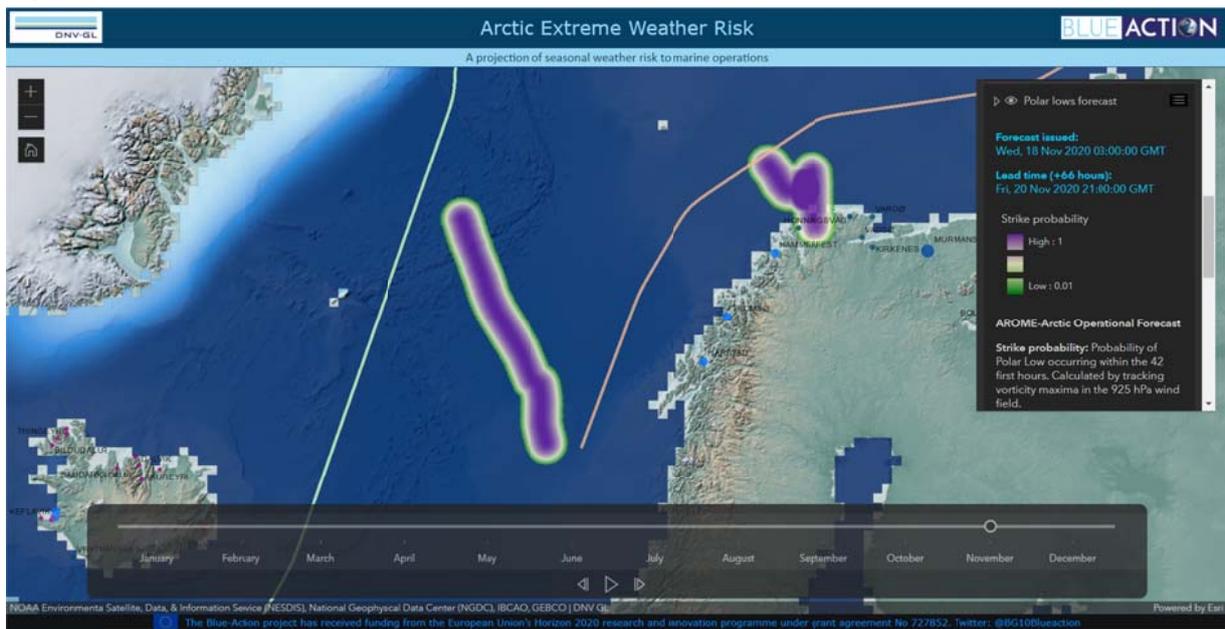

Figure 3: Operational forecast.

Risk of polar lows*

The layer is a projection of risk associated with polar lows. It is built on a model combining likelihood of polar lows occurring in a region, and the impacts such events have on marine operations, i.e. shipping. The result map is generated by a weighted overlay analysis, taking into account degree of influence- and skill in prediction, of factors- winds, sea ice concentration, Marine Cold-Air Outbreaks index (sea-air potential temperature difference), sea temperature, air temperature and sea-air heat fluxes.

Polar low alerts

Any active alerts will show below the ***** layer legend and metadata. These alerts contain messages of warnings to seafarers (e.g. unstable weather conditions ahead, anticipate abrupt changes in weather and sea states) along with instructions on mitigation measures (i.e. Stay in port, return to port, reduce speed, adjust heading, etc.). These alerts are issued by the BarentsWatch/MET Norway Polar Lows Alerts service.

Risk of severe windchill

The layer depicts risk of severe windchill, this is a condition where outdoor work can lead to serious injury.
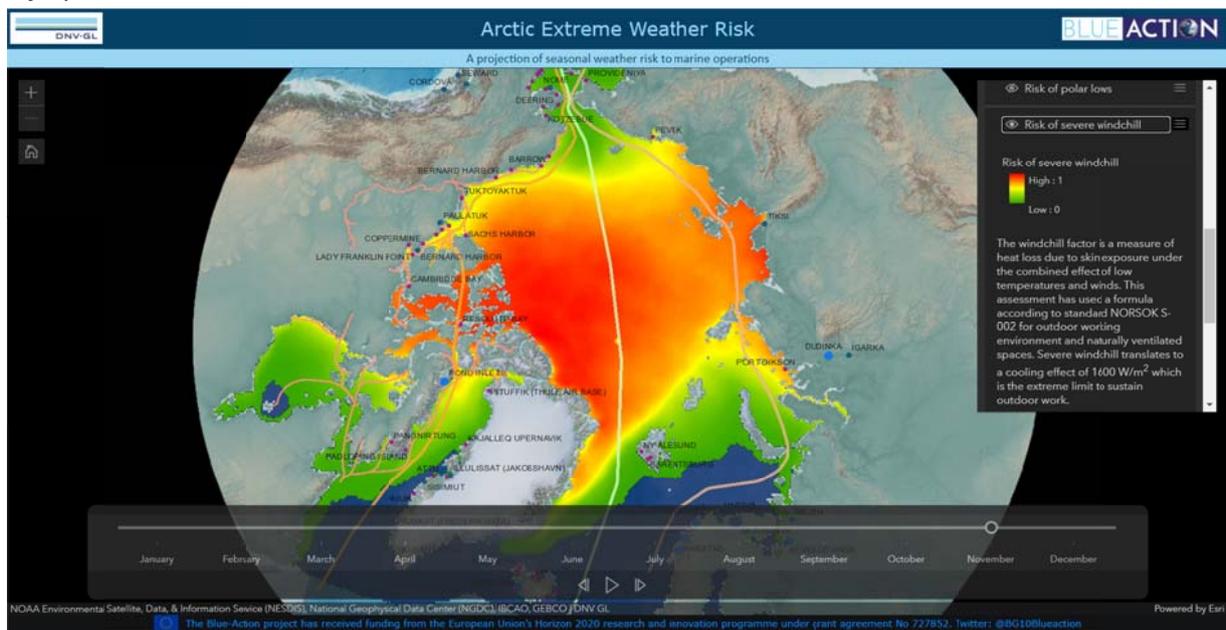

Figure 4: Risk of severe windchill in November.

The windchill factor is a measure of heat loss due to skin exposure under the combined effect of low temperatures and winds. This assessment has used a formula according to standard NORSOK S-002 for outdoor working environments and naturally ventilated spaces. Severe windchill translates to a cooling effect of 1600 W/m2 which is the extreme limit to sustain outdoor work.

Risk of heavy icing

The layer shows risk associated with marine icing. Heavy icing can jeopardize stability and integrity of seagoing vessels. The layer is generated based on a combination of environmental factors in play simultaneously: Winds, low temperatures, and sea water temperatures near freezing point.

Superstructure icing is a serious hazard to ships operating in cold climates. Icing occurs when droplets of sea spray freezes in contact with exterior surfaces. The accumulation of ice, referred to as ice accretion, can severily affect operability and safety of a vessel. This assessment uses the Overland algorithm for predicting icing rates. Heavy icing corresponds to ice accretion of 2 cm/h, which may jeopardize stability and integrity of a medium-sized vessel.

Sea ice concentration

This layer is a dynamic representation of sea ice conditions (i.e. mean fractional area of sea ice coverage) over the last decade.

The sources for these data are the Source: ECMWF/ERA5, Operational Sea Surface Temperature and Sea Ice Analysis (OSTIA) and EUMETSAT Ocean and Sea Ice Satellite Application Facility (OSI-SAF).