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CS3 Extreme weather risks to maritime activities

In this case study, DNV GL, in collaboration with NORCE, looks at understanding extreme weather conditions in the context of maritime operations. The aim is to investigate ways to improve our awareness towards extreme weather formations, and give notion to how the maritime industry can better utilize forecasts on severe weather impacting on safety and navigation in polar waters.

To assess applicability and value of long-term weather predictions, DNV GL has identified the following criteria:

- Critical factors for navigation, sea ice, winds, satellite coverage, visibility, precipitation.
- History of accidents in polar waters
- Patterns in formation and trajectory of polar storms
- Hotspots of polar lows, i.e. Japanese Sea
- Anticipated regions of high commercial interest
- Main fairways in Arctic shipping
- The Northern Sea Route
- Implications of the IMO polar code

In the process, DNV has identified and consulted the following data sources:

Source	Record/Reanalysis/Forecast	Variable/Parameter
WOAD	Historical records of offshore accidents and incidents	Chain of events, causes and consequences
ERA-INTERIM	Reanalysis data	Precipitation, Air Temperature
ECMWF	Operational forecasts, seasonal forecasts https://www.ecmwf.int/en/forecasts/datasets	EFI, Winds, Precipitation
ASR NCAR/UCAR	Reanalysis data	Precipitation, SST, Air Temperature, Surface Pressure, Winds
Copernicus/MEMS	Seasonal forecasts/In-Situ	Winds, Sea ice, SST
MET/BarentsWatch	BarentsWatch portal – polar lows https://www.barentswatch.no/polare-lavtrykk	Polar Lows (Barents Sea)

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Internally, DNV GL colleagues have consulted the WOAD database, world accident database, and are in contact with representatives of the maritime industry in Japan, for feasibility and needs assessment. DNV GL will consider a wider set of scenarios than just polar lows as a phenomenon in itself and they are looking at building a case for Japan shipping, possibly involving the North-East passage, and the Japanese sea, where polar lows tend to be more frequent.

Requirements of DNV GL

DNV GL need access to historical records (of polar lows) and for the case of the study, DNV GL needs a plan for model implementation (WP1) of seasonal forecasts on polar lows. The initial idea (of DNV GL) was to use recorded historical observations of polar lows (and their trajectory), along with their classification scheme (severity), to depict a baseline affinity/frequency of polar lows specific to certain regions. On top of this- and presented in a geographical format (an interactive map), seasonal forecasts of marine cold air outbreaks (MCAOs) could add new knowledge and thus contribute to a richer and more balanced risk picture.

The ideal data [of predictions] would be a probability measure for polar lows (or MCAOs), along with a severity value, for a period 2-3 weeks ahead. Variables should be of reasonable temporal and spatial resolution, as high as possible (e.g. gridded 1 degree zonal, and 1 degree meridional lattice) and packaged in a well-structured form (NetCDF 4) according to the Climate and Forecast Convention 1.5.

Data sources

Provider: Martin King (NORCE)

Which data have been provided:

NORCE had received all the hindcast data needed from UHAM on temperature and pressure in Spring 2017. NORCE and DNV GL met regularly once a month for many months now for discussing issues about MCAOs. NORCE has provided data calculated from ERA-INTERIM related to this in terms of percentiles values of the MCAO index for different months. Next data to be provided by NORCE are the calculation and provision of data related to return values of MCAO: according to NORCE, these fulfill what is written in above in terms of "severity", "frequency", and "geographical" information of MCAOs. There is also a plan by NORCE to start using Copernicus hindcast data (not forecast) in WP1.

Where are these data located:

The data has been sent directly to DNV GL.