Use Case Descripton

D5.2

Polar View Team

Version 1.1, 19/09/2024

DESIDE - Use Case Descripton

Destination Earth DESP Use Cases: DestinE Sea Ice Decision Enhancement (DESIDE) *Use Case Descripton* D5.2

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AMENDMENT HISTORY

This document shall be amended by releasing a new edition of the document in its entirety. The Amendment Record Sheet below records the history and issue status of this document.

Table 1. Amendment Record Sheet

ISSUE	DATE	REASON
0.1	11/12/2023	Initial in-progress draft
1.0	12/12/2023	First released version
1.1	19/09/2024	Second released version

Chapter 1. Introduction

1.1. Purpose and Scope

This document represents the Use Case Descriptor (UCD) for the Destination Earth DESP Use Cases: DestinE Sea Ice Decision Enhancement (DESIDE) project 8482 with ESA contract 4000140320/23/I-NS.

1.2. Structure of the Document

Chapter 2, *Overview*

This section provides an overview of the Destination Earth DESP Use Cases: DestinE Sea Ice Decision Enhancement (DESIDE).

1.3. Reference Documents

The following is a list of Applicable and Reference Documents with a direct bearing on the content of this document.

Reference	Document Details	Version
[SOW]	Statement of Work Destination Earth DESP Use Cases selection - Round 1 Reference: CS301353.Docref.0002	1.0
[Proposal]	Proposal No. 8482: DestinE Sea Ice Decision Enhancement (DESIDE)	1.1 06/06/2023

1.4. Terminology

The following terms have been used in this document.

Term	Meaning
Admin	User with administrative capabilities on a platform.
Code	The codification of an algorithm performed with a given programming language - compiled to Software or directly executed (interpreted) within the platform.
Discovery	User finds products/services of interest to them based upon search criteria.
Interactive Web Application	An Interactive Application for analysis provided as a rich user interface through the user's web browser.
Key-Value Pair	A key-value pair (KVP) is an abstract data type that includes a group of key identifiers and a set of associated values. Key-value pairs are frequently used in lookup tables, hash tables and configuration files.

Term	Meaning
Object Store	A computer data storage architecture that manages data as objects. Each object typically includes the data itself, a variable amount of metadata, and a globally unique identifier.
Products	EO data (commercial and non-commercial) and Value-added products.
Software	The compilation of code into a binary program to be executed within the platform on-line computing environment.
User	An individual using the services.
Visualization	To obtain a visual representation of any data/products held within the platform - presented to the user within their web browser session.
Web Coverage Service (WCS)	OGC standard that provides an open specification for sharing raster datasets on the web.
Web Feature Service (WFS)	OGC standard that makes geographic feature data (vector geospatial datasets) available on the web.
Web Map Service (WMS)	OGC standard that provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases.
Web Map Tile Service (WMTS)	OGC standard that provides a simple HTTP interface for requesting map tiles of spatially referenced data using the images with predefined content, extent, and resolution.
Web Processing Services (WPS)	OGC standard that defines how a client can request the execution of a process, and how the output from the process is handled.

1.5. Glossary

The following acronyms and abbreviations have been used in this document.

Term	Definition
ADD	Architecture Design Document
AOI	Area of Interest
API	Application Programming Interface
COG	Cloud optimized GeoTiff
EO	Earth Observation
EOX	EOX IT Services GmbH
ESA	European Space Agency
FUSE	Filesystem in Userspace
ICD	Interface Control Document
JSON	JavaScript Object Notation
KVP	Key-value Pair

Term	Definition
M2M	Machine-to-machine
OGC	Open Geospatial Consortium
PMP	Project Management Plan
REST	Representational State Transfer
SDD	Software Design Document
SFTP	Secure File Transfer Protocol
SRF	Software Reuse File
SRN	Software Release Note
SRP	Software Release Plan
SRS	Software Requirements Specification
SSH	Secure Shell
STAC	Spatio-Temporal Asset Catalog
SUM	Software User Manual
SVVP	Software Verification and Validation Plan
SVVR	Software Verification and Validation Report
TOI	Time of Interest
UMA	User-Managed Access
US	User Story
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Map Tile Service
WPS	Web Processing Service
WPS-T	Transactional Web Processing Service

Chapter 2. Overview

Polar View Earth Observation Limited is working in collaboration with EOX IT Services, Drift+Noise Polar Services, the Danish Meteorological Institute, the Norwegian Meteorological Institute, and the Finnish Meteorological Institute to develop a fully functional Use Case that utilizes the DESP/DestinE system capabilities and data and adds value to meet the needs of policy and decision makers who require information on the past, current, and forecasted sea ice and other relevant conditions for operational purposes in the Baltic Sea, European Arctic Ocean, and the rest of the polar regions.

The Use Case will build on and complement existing operational and climate sea ice products and services including those provided by the Copernicus Marine Service, the national Ice Services, the ESA Polar Thematic Exploitation Platform (Polar TEP), and the commercial Drift+Noise IcySea app. The Use Case will augment and improve on the current offerings by:

- Aggregating information of different types and from different sources to provide common products that span jurisdictional boundaries.
- Producing new products that will improve the ability of users to make good decisions.
- Making the products available in ways and means that are appropriate for the skills and requirements of different user communities.

One driver for the project is the regulation of the International Maritime Organization (IMO) of the United Nations mandating that ships operating in the polar regions meet certain requirements (the Polar Code). Among other things, the Polar Code specifies a range of information that ships traveling in polar waters are required to access for planning and operations. The Use Case will demonstrate the value of short and medium-term forecasts of sea ice, meteorological, and ocean conditions suitable for strategic and tactical decision making by ships and their owners.

A second driver for the project is the effect of climate change on polar conditions that will impact long-term planning and policy development for polar operations such as fishing, tourism, scientific research campaigns, oil and gas development, and supplying northern communities. The Use Case will deliver long-term forecasts of how changing sea ice and other conditions will affect where different types of ships will be able to travel in the polar regions compared to historical averages.

Benefits to polar operations and the rest of society will include increased safety of life and property, decreased pollution, and protection of sensitive environmental areas.

Chapter 3. Use cases

3.1. Introduction

Use cases are focused on input and output with the process in between described. The main focus is on stakeholder use and requirements.

3.2. Climate perspective

Table 2. Use Case description for AMAP.

Name	Pan-Arctic and regional sea ice climate indicators
Last updated	2024-02-14
Last updated by	Øystein Godøy
Goal	To provide an integrated dataset combining sea ice climate indicators based on observations (e.g. EUMETSAT Ocean and Sea Ice SAF) and climate model projections. These indicators should be available Pan Arctic as well as regional indicators for specific areas. Accompanying this will be a web service allowing users to interactively play with various regions and projections. The combination of observed and projected indicators will help establish trust in projections. This web service can be integrated in AMAP defined dashboards which they are developing.
Actors	• AMAP secretariat (Pan-Arctic and regional levels) • Norwegian Directorate for Environment (is interested in the regions in the European part of the Arctic) • DESIDE sea ice climate experts • DESIDE service development expert
Pre-conditions	1. EUMETSAT Sea Ice SAF Sea Ice Climate Products (https://osi-saf.eumetsat.int/products/sea-ice-products OSI-430-a, OSI-450-a, OSI-455, OSI-458) available in DEDL/DESP. 2. EUMETSAT Ocean and Sea Ice SAF Sea Ice Index (https://osi-saf.eumetsat.int/products/sea-ice-products OSI-420) available in DEDL/DESP. 3. Selected IPCC CMIP model sea ice output is available in DEDL/DESP for processing into indicators. 4. MET sea ice indicator visualisation tool is available (e.g. https://cryo.met.no/en/sea-ice-index-monthly, daily and monthly setup exist today) for integration in dashboard of choice of the stakeholder.
Post-conditions	1. An integrated/combined dataset of sea ice climate indicators based on observations and model simulations. 2. The above mentioned dataset available in the sea ice indicator tool mentioned above, available for integration in user defined dashboards.

Normal flow	1. The stakeholder community through AMAP identifies an area of interest. 2. The visualisation tool integrated in the AMAP defined dashboard is launched. 3. Within the visualisation tool the user can compare historical (based on observations) sea ice indicators with future projections (based on carefully selected climate model scenarios) in order to establish a trust in future projections based on historical performance.
Notes and issues	1. Need to define whether sea ice drift should be part of the use case. 2. This use case is based on previous elaborations through the SUDARCO project focusing on trustworthy climate projections for 2050 in the Gakkel ridge area in the Arctic Ocean. 3. The sea ice climate experts has to define which climate models that are trustworthy concerning sea ice projections in the areas of interest. 4. Ask AMAP whether they want to use dashboards developed by DESIDE. 5. Ask AMAP which regional indicators they want.

3.3. Baltic Sea

Table 3. Use Case description for the Baltic Sea.

Name	Baltic Sea icebreaker management.
Last updated	2024-03-08
Last updated by	Marko Mäkynen
Goal	Provide sea ice information for the Baltic Sea icebreaker management by Finnish Transport Infrastructure Agency (FTIA). The needed sea ice information includes ice movement observations using both buoys and radars as well as forecasts of sea-ice movement and compression, and volume and deformation characteristics of sea ice.
Actors	• Finnish Meteorological Institute • Finnish Transport Infrastructure Agency • DESIDE software development experts • DESIDE service development expert
Pre-conditions	The following data sets need to be available via the DESP platform: SAR based ice drift and forecasted ice drift from Copernicus Marine Service (CMEMS). Sea ice thickness, SAR and icechart based and forecasted, from CMEMS
Post-conditions	Combined dataset of sea ice information based on satellite observations and model simulations available. Validate sea ice data based on ship data/feedback. Include datasets into the various DESIDE platforms e.g. Polar Dashboard.

Normal flow	1. Provide FTIA with access to a selected DESIDE platform. 2. Collect and analyze feedback on the data usability, accuracy, etc.
Notes and issues	

The Finnish Transport Infrastructure Agency (FTIA) has the responsibility of arranging icebreaking services to Finnish winter ports. The agency procures icebreaking services from service providers. Furthermore, FTIA sets assistance restrictions to Finnish ports and coordinates the use of icebreaking resources. FTIA acts in close coordination with the Swedish Maritime Administration (SMA) regarding icebreaking in the Gulf of Bothnia.

Currently FTIA uses FMI's ice charts and forecasts as well as the HELMI SEA-ice model and the satellite and ice radar images. From their viewpoint the most interesting developments to products would be a better coverage for ice movement observations using both buoys and radars as well as forecasts of sea-ice movement and compression. In addition, information concerning the volume and deformation characteristics of sea ice, if possible divided by the sea area, are important.

The FTIA and SMA have jointly developed an icebreaker management and information sharing system where ice and weather data it utilized by winter navigation authorities, icebreakers, and other winter navigation operators. Any services that can be used via the IBNet-system, would provide the most added value to FTIA. Ilmanet is also a valuable resource.

3.4. Ships in ice

Table 4. Use Case description for AWI, Ponant and others.

Name	Use case: Ships in ice
Last updated	2024-09-25
Last updated by	Jakob Buenger

Goal	Provide navigation-relevant, high temporal and spatial resolution sea ice information products to ice going ships. The data needs to be delivered in an easy-to-use user-friendly way which provides interpretation help and allows for easy decision-making even without expert sea ice knowledge. Due to the dynamic nature of moving sea ice, forecasts of the variable conditions are oftentimes mission-critical as well. Account for user-specific ice information needs: • Research ship data support: ◦ for long transits (strategic planning) ◦ very short term tactical navigation to fulfill research goals ◦ high update frequency • Expedition Cruise ship data support: ◦ for long transits ◦ tactical planning ◦ data handling as easy as possible (crews with limited scientific background)
Actors	• Alfred Wegener Institute Helmholtz Center for Polar and Marine Research (Research Institute operating the Icebreaker Polarstern) • Ponant (Expedition Cruise Operator) • Various other partners of Drift+Noise that haven't been mentioned in the proposal specifically • DESIDE software development experts • DESIDE ice consultant (Drift+Noise)

Pre-conditions	The following data sets need to be available via the DESP platform: • RADARSAT Constellation Mission (RCM) SAR imagery (https://www.eodms-sgdot.nrcan-rncan.gc.ca/) • Sentinel-1 (ESA) SAR imagery (https://browser.dataspace.copernicus.eu/) • Sea ice drift forecast data (TOPAZ5, neXtSIM)(https://data.marine.copernicus.eu/product/ARCTIC_ANALYSISFORECAST_PHY_002_001/description and https://data.marine.copernicus.eu/product/ARCTIC_ANALYSISFORECAST_PHY_ICE_002_011/description) • ICON wind forecast data (https://opendata.dwd.de/weather/nwp/icon/grib/) • Sea ice charts from all the national ice services: 1. DMI: https://download.dmi.dk/public/ICESERVICE/ 2. US NIC, weekly charts: https://usicecenter.gov/Products 3. US NWS, daily charts Alaska: https://portal.aoos.org/?ls=CGOnN2L_#map 4. Canadian Ice Service, daily charts 5. Canadian Ice Service, weekly charts 6. AARI (not sure about this one): http://ice.aari.aq 7. Norway (we only have access to the newest zip file): https://cryo.met.no/sites/cryo/files/latest/NIS_arctic_latest_pl_a.zip 8. Argentinian Hydrographic Institute, weekly charts (twice a week): https://www.hidro.gob.ar/Smara/glacio/sglaciologica_ing.asp?op=2
Post-conditions	1. Added value data sets (morphed images) 2. Create intermediate data sets (drift forecast trajectories) 3. Validate morphed images based on ship data/feedback 4. Include above-mentioned data set into the various DESIDE platforms e.g. PolarTEP 5. Include RCM and ice charts in IcySea
Normal flow	1. Provide users with preliminary access to the various DESIDE platforms 2. Collect their feedback 3. Implement feedback
Notes and issues	• Implementation into IcySea (contract issue), IcySea code won't be shared • Define areas of interest: ◦ AWI: Arctic-wide ◦ Ponant: special interest in data for the journey to the North Pole • Connect local ship data with image processor

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