Norwegian Satellite Earth Observation Database for Marine and Polar Research

http://normap.nersc.no

USE CASES

The NORMAP Project team has prepared this document to present functionality of the NORMAP portal. Four use cases describe step-by-step the operations of the system and are accompanied with questionnaires for collecting feedback. As a champion user of NORMAP, you are cordially invited to complete this survey and return it to the project leader Johnny Johannessen (johnny.johannessen@nersc.no)

Your time and effort are most appreciated, and we would like - with your agreement - to keep you involved in the development of NORMAP.

Introduction

NORMAP is a 6 year project funded by the Norwegian Research Council (NRC) under the Infrastructure programme.

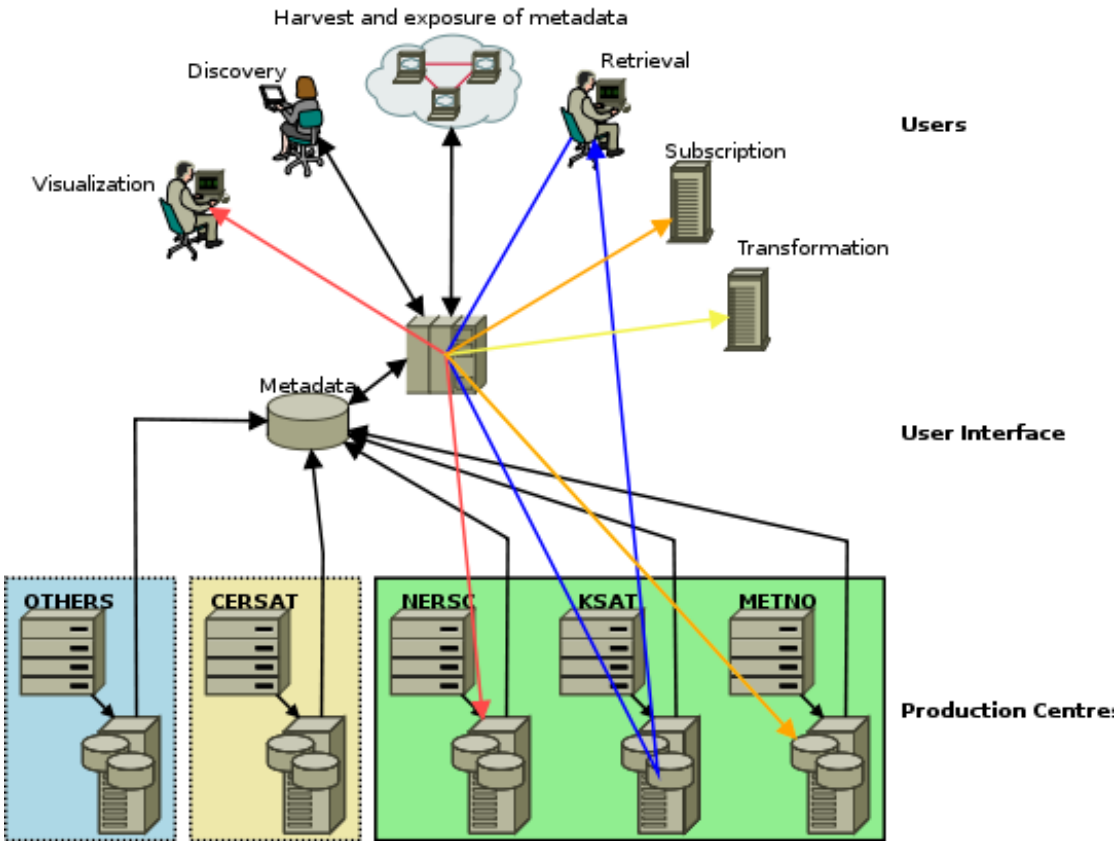
The overall goal of NORMAP is:

- to create and maintain a data repository, including metadata of the high latitude and Arctic regions based on Earth Observation data from polar orbiting satellites to facilitate and stimulate high quality and original multidisciplinary Earth System research, application and education in marine, polar and climate sciences

More specifically, we plan to:

- design and establish the technical framework for the data repository;
- make available a set of selected quality controlled multidisciplinary scientific data products that will support air-sea-ice process studies;
- ensure interoperability with existing national and international data repositories
- advance the effective use of satellite EO data by the scientific community so less time are spent searching and qualifying data giving more time to scientific studies and analyses

The physical outline of NORMAP with intended services is illustrated below:



Temporally and spatially binned satellite data is stored in distributed data repository at the servers of the NORMAP partners institutions together with descriptive metadata. The NORMAP portal collects metadata from the repositories and acts as the main user interface. Users access the NORMAP portal for searching (use case 1), browsing (use case 2), download (use case 3), colocation (use case 4) and analysis (use case 5) of data.

USE CASE 1: Find relevant satellite products

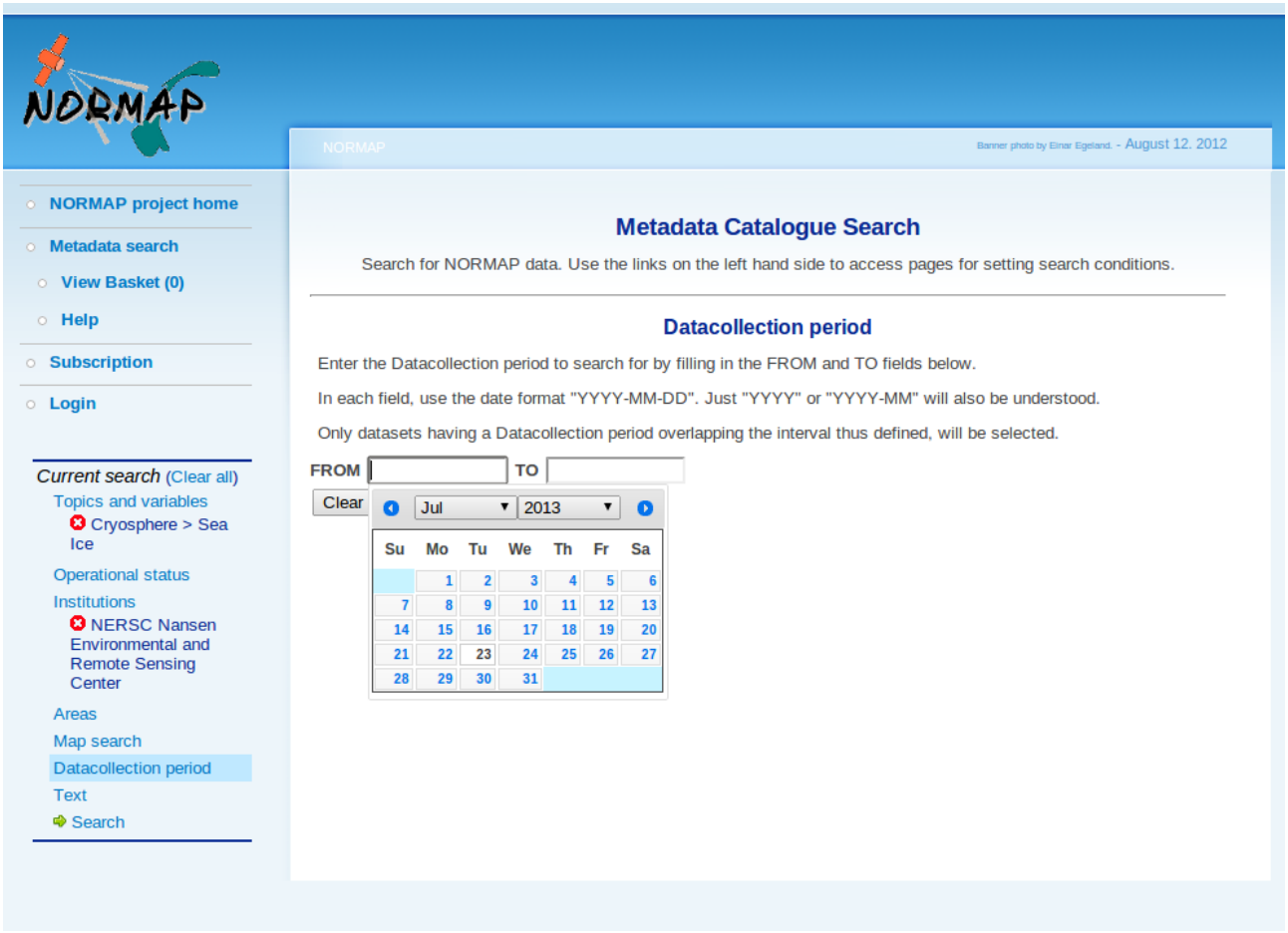
Goal	To enable users to interactively find information about relevant data and products.
Pre-conditions	● An existing online metadata catalogue is accessible for browsing o searching ● Metadata are synchronised between the contributing nodes.
Results	The user receives list of relevant datasets or products satisfying the searching criteria
Normal flow	1. The user compose a search request using concepts like scientific keywords, geographical and temporal constraints etc. (see list of criteria below) 2. The search request is submitted to the online catalogue. 3. The catalogue responds with a ordered list describing the relevant datasets and products including online reference to the datasets.
Notes and Issues	Interfaces and vocabularies should be consistent with SeaDataNet, GCMD. If user specifies time constraints the system should return only few products calculated for this period.

The NORMAP database contains a lot of datasets and products derived from satellite data including:

- Cryosphere products:
- Ocean Products:
- Atmosphere products:

The NORMAP portal allows to find relevant datasets for further online processing or download. In this scenario the user searches for relevant products using the following criteria:

- Predefined list of scientific topics and variables;
- List of data providing institutions;
- List of predefined geographical areas;
- Manual selection of region of interest on interactive map;
- Period of data collection;
- Free text and keywords



Screenshot of the data searching dialog. Sea Ice was already selected among other variables. NERSC was already selected among other institutes. The user is may also specify data collection period.

The system displays a list of products that satisfy the criteria. Each entry in the list is browseable as described in Use Case 2.

Which satellite products you will use in your work?
What temporal and spatial resolution and extent do you need?

Cryosphere products:	**YES**	**NO**
Sea ice concentration, area and extent		
Sea ice drift speed and direction		
Sea ice thickness		
Sea ice type (FYI, MYI)		

Ocean Products:	**YES**	**NO**
Sea surface temperature		
Water quality parameters		
Net primary productivity		
Geostrophic currents speed and direction		
Absolute dynamic topography (Sea surface height)		
Surface currents		
Sea surface salinity		
Wave height and direction		
Surface radiative fluxes		
Sea level anomaly		

Atmosphere products:	**YES**	**NO**
Wind speed and direction		
Polar lows		
Storm tracks		
Water vapor		
Cloud cover		
Cloud top temperature and dynamics		
Latent and sensible heat fluxes		
Rain rate over the ocean		

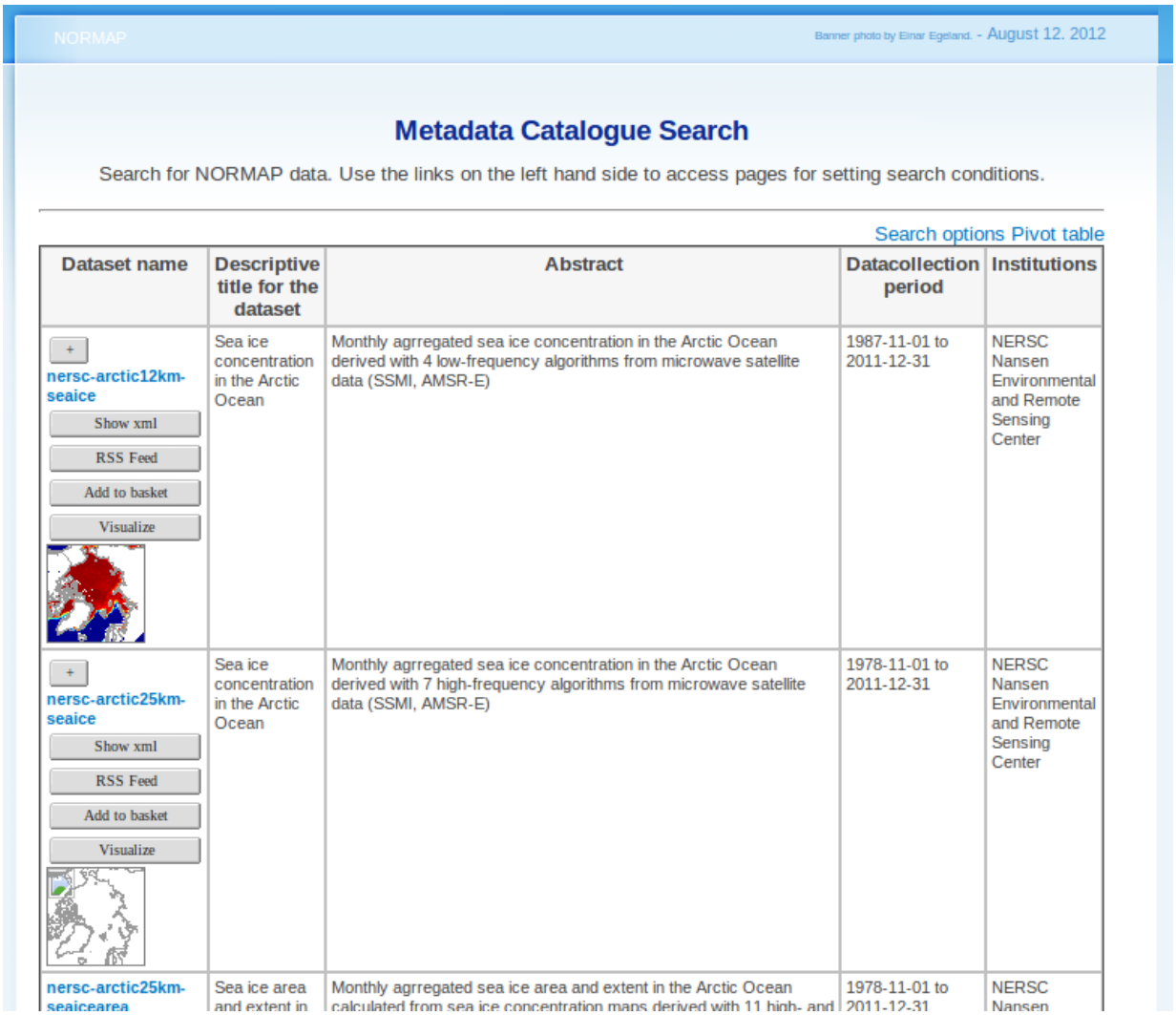
USE CASE 2: Browse the search results

Goal	To provide simple overview and visualization of individual datasets
Pre-conditions	● Data are available in the distributed repositories and documented i the catalogue. ● A visualization service is available. ● The user has found relevant products using the discovery interface
Results	The user receives a description and an image representation of the requested dataset using the integrated viewer
Normal flow	1. Using the result view of the interactive discovery interface the user requests visualisation of a dataset. 2. The user is asked which products from the dataset should be visualised. 3. The product is visualized at the requested time step using the integrated viewer. 4. Detailed description (including the link to the data repository) of the dataset is provided upon request from the user.
Notes and Issues	● Products can have any dimension, e.g. not a map, but a time series. ● OGC WMS is the preferred backend service for maps and images. For time series, profiles, etc., the technical solution is open.

After the search (Use Case 1) the user receives a list of relevant products and is able to browse each product for familiarisation and for further assessment of its relevance.

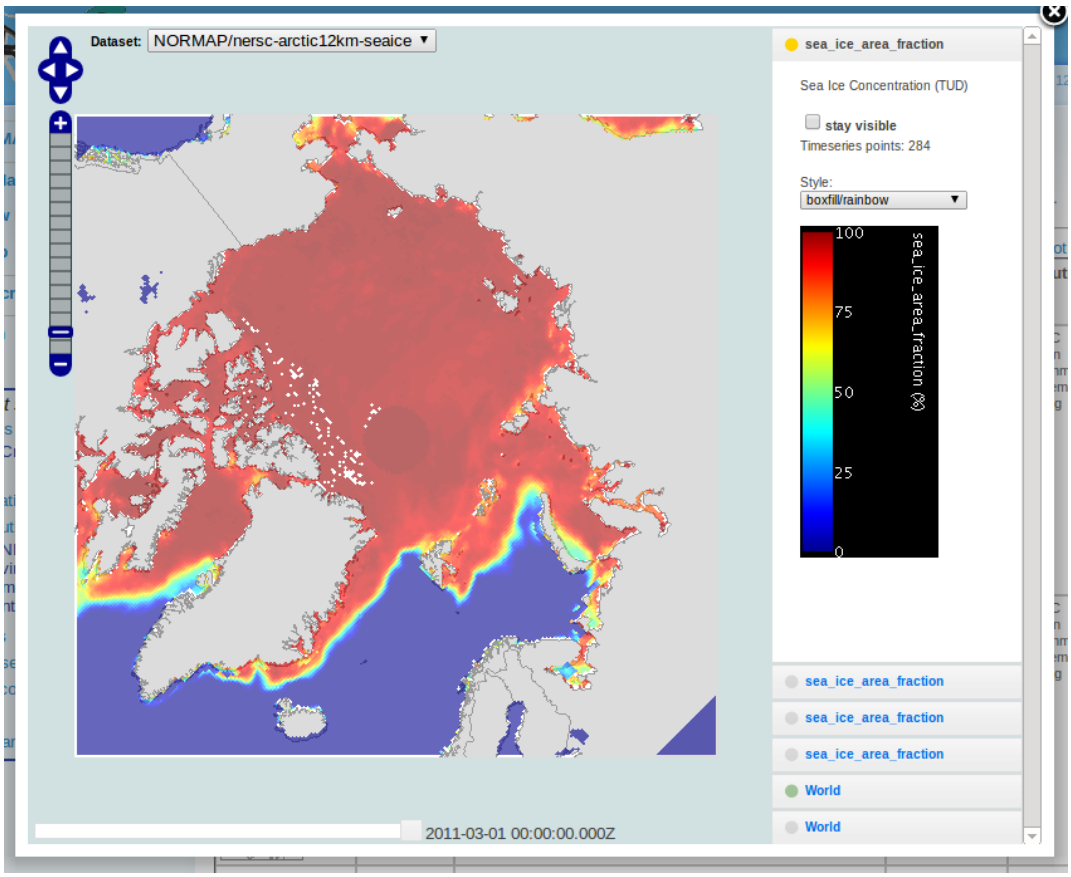
Step 1: The user views metadata for each product including such information:

- Product name
- Abstract
- Institution
- Data collection period
- Spatial resolution
- Contact and References



Screenshot of the list of the found datasets that satisfy searching criteria. The first column contains the link to the data repository (blue) and control buttons: expand the list of products; view detailed metadata, add to basket, visualize, etc. Other columns contain additional information about the dataset (metadata).

Step 2: The user launches the NORMAP interactive viewer of the data. The viewer shows map with continent boundaries and the selected product. The user interactively sets the colorbar, color limits, type of projection, scale (zooming) and spatial extent (panning). The user may choose the date and time of data collection and view the respective frame.



Screenshot of simple visualization of a Sea Ice Concentration product. The interactive viewer allows to select several products from the menu on the right and a colormap. A user can zoom and pan the map or select observation time.

QUESTIONS	YES	NO
Will you inspect the metadata?		
Will you view the simple map?		

What additional information should be included into the metadata?

What additional tools should be added to the NORMAP interactive viewer?

Other comments

USE CASE 3: Download satellite data

Goal	To provide simple download of individual datasets
Pre-conditions	● Data are available in the distributed repositories and documented i the catalogue. ● The user has found relevant products using the discovery interface ● Delivery is achievable through one of the supported data access interfaces.
Results	The user receives a description and an image representation of the requested dataset using the integrated viewer
Normal flow	1. Using the result view of the interactive discovery interface the user requests download of a dataset. 2. Direct access to the product is provided through a standardised interface to the data repository. 3. User downloads the original data from the servers of the data providing institution
Notes and Issues	● At least HTTP and OpenDAP should be implemented as data access interfaces. FTP may also be supported. ● A dataset may be a single file (possible both to download and access online) or an aggregation of several files (possible only to access online)

After the search (Use Case 1) the user receives a list of relevant products and is able to browse each product for familiarisation and for further assessment of its relevance (Use Case 2).

The user is also provided with a link to the repository of the data providing institution where he can download the original files or access the data using WMS, OPeNDAP or other protocols.

Screenshot of the web page of data repository at the data providing institution server. A NetCDF file with the data is accessible for download via HTTP or can be accessed online via OpenDAP.

QUESTIONS	YES	NO
Will you download files with the products to local computer?		
Will you only visualize data online?		
Do you need capability to automatically download multiple files at once?		

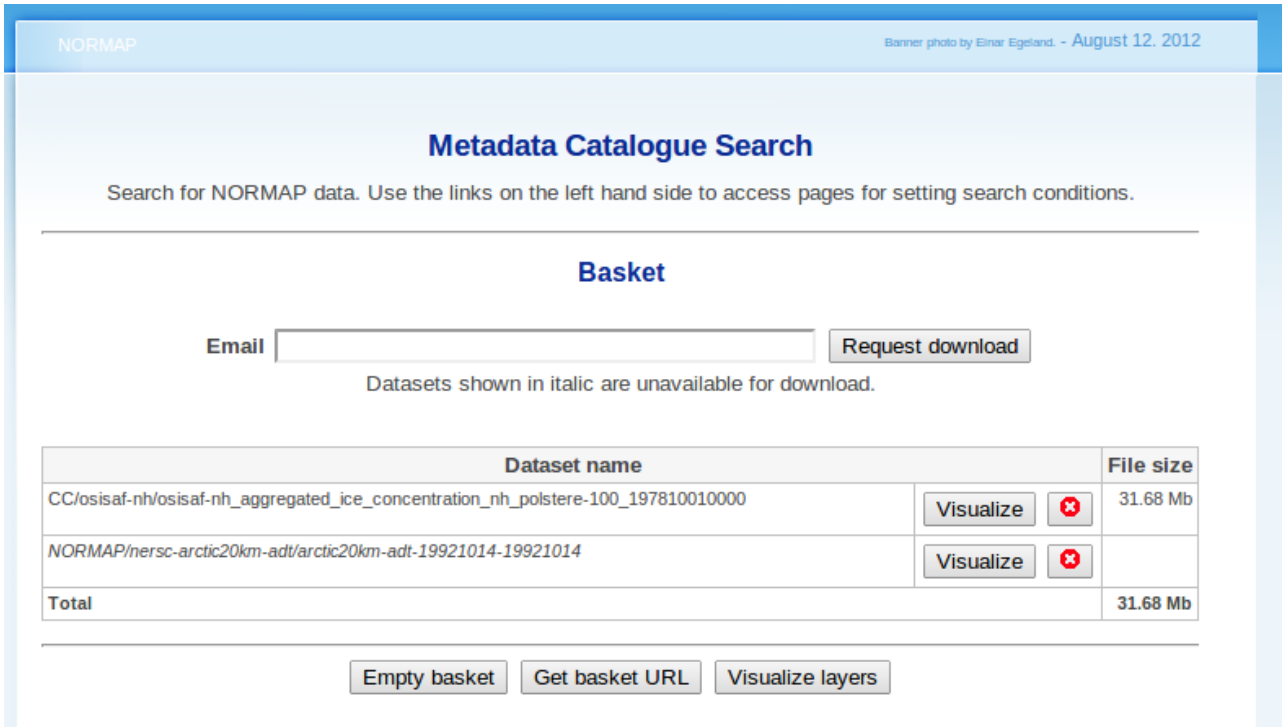
Other comments

USE CASE 4: Collocate several satellite products

Goal	To provide access to several datasets transformed according to the user request of preferred file format, map projection, variables, temporal and spatial resolution and span.
Pre-conditions	● Data are documented in the catalogue. ● Data are available in an online data repository in a format or through an interface supported by the system. ● The user has found one or more relevant products which are listed within the discovery interface ● Delivery is achievable through one of the supported data access interfaces. ● An interface to data transformation capability is integrated in the interactive user interface. ● A number of defined data transformation capabilities are implemented as a web service that can be utilised by the interactive user interface.
Results	The user receives transformed products in accordance with the request.
Normal flow	1. Using the result view of the interactive discovery interface the user tags the product for addition to the basket. 2. The basket contains a list of products that are prepared for further handling using higher order services within the system. 3. The user selects a predefined transformation. 4. The user supplies sufficient information for the transformation to be undertaken. 5. The system responds to user with information on whether this can be done on-the-fly (case A) or has to be a offline service (case B). 6. In case A the system immediately displays list of files ready for on-the-fly transformation. 7. User may continue with on-line analysis of files. 8. In case B the system performs the requested transformation, generates transformed files and notifies the user when the files are ready. 9. User receives notification and downloads the transformed files.
Notes and Issues	1. By transformations are understood e.g. the actions FIMEX can perform on a dataset (reformatting, reprojecting, subsetting etc) 2. The user may receive either an ordinary dataset or a service. 3. Transformation may take a lot of resources; therefore size of the generated dataset should be limited. E.g.: only one time step of several products or several time steps of one product; dimensions of the result should not exceed some limits. 4. If transformation is too heavy then on-the-fly transformation service is not available but only a dataset can be generated.

In this scenario NORMAP allows synergistic use of several satellite data products. Originally satellite data is stored in distributed repositories at servers of the NORMAP institutes in different projections and at different resolution and spatial extent. NORMAP portal allows to collocate selected products in space and time for further joint analysis of multiple satellite derived variables.

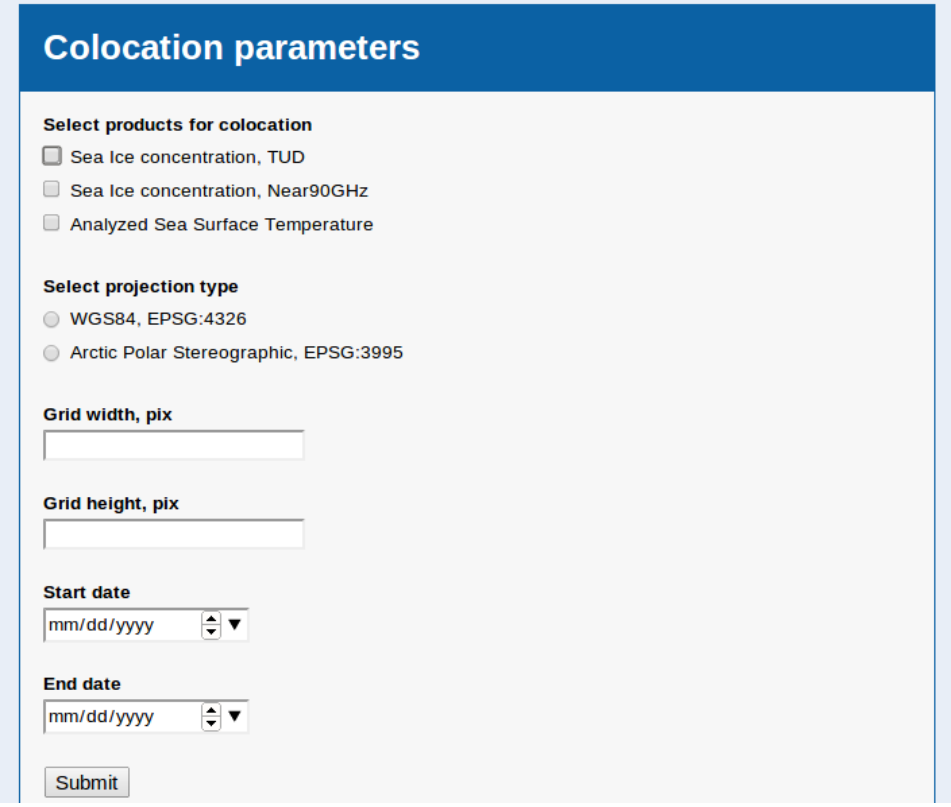
Step 1: The user adds the relevant datasets (found in Use Case 2) to the product basket.
The basket may contain several datasets originating from any institution and in any projection. The maximum number of products in the basket is limited in order to keep the load on the servers reasonably low.



Screenshot of the basket which contains some products for further processing. The user may add or delete products, or request download or visualization of data using control buttons.

Step 2: The user specifies collocation parameters:

- Which products from the selected datasets should be collocated;
- Grid at which colocated products should be available:
    - projection type (e.g. geographic, polar stereographic);
    - resolution or size of the resulting grid;
    - spatial extent of the resulting grid;
- Period of time which contains the selected products;



Prototype of the colocation dialog. The user may select which products to colocate, specify type and parameters of projection and period of colocation.

Step 3: the system provides the following two options to the user:

- Will you only analyze the collocated data online?
- Do you wish to download the collocated dataset to a local computer?

In the first case the system will only prepare a service for transformation of the datasets on-the-fly for further visualization and data extraction (Use Case 5). In the second case the system will generate files with colocated products and notify the user when the files are ready for download.

QUESTIONS	YES	NO
Do you need collocation of several products in your research?		
Will you use time series of satellite observation?		
Will you download collocated data to your local computer?		
Will you visualize collocated data on-line?		

What projection and spatial resolution do you usually need?

Other comments

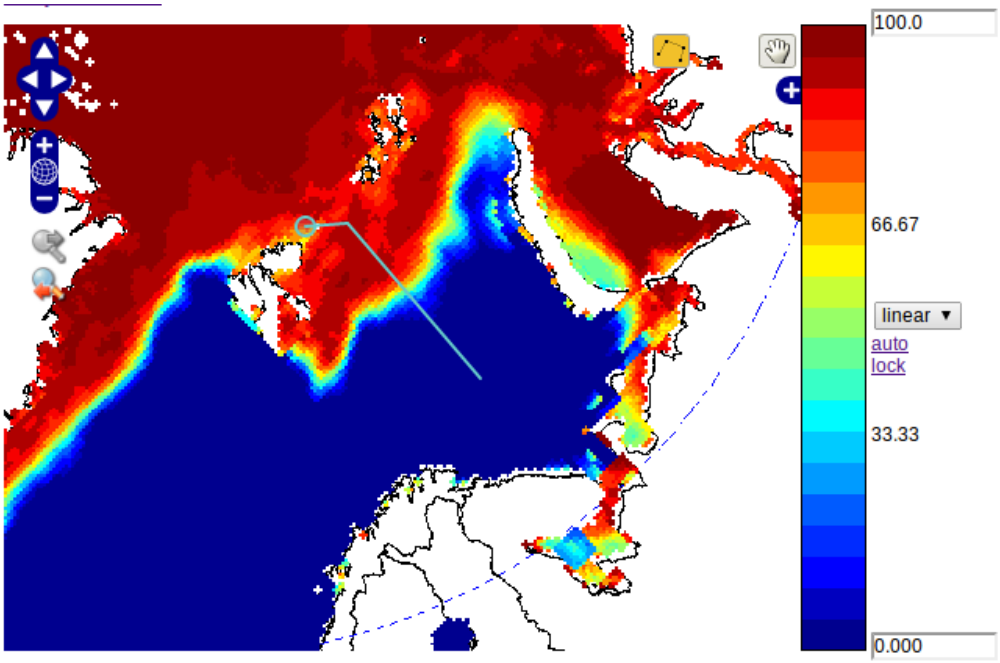
USE CASE 5: Analyze collocated data online

Goal	To provide advanced visual representation of multiple transformed datasets
Pre-conditions	● User has found and collocated relevant datasets as in Use Case 1 and Use Case 4. ● A visualisation service is available.
Results	The user receives advanced visual representation of single or multiple colocated datasets within the integrated viewer
Normal flow	1. Using the selection basket interface the user requests visualisation of elements from multiple datasets. 2. The user is asked which parameters of the datasets that should be visualised and how. 3. The products are visualised in the integrated viewer. 4. The user downloads the extracted data used for generating graphics or the results of visualization: plots and maps
Notes and Issues	Map view, time series view and profile (transect or trajectory) view of a single dataset should be supported.

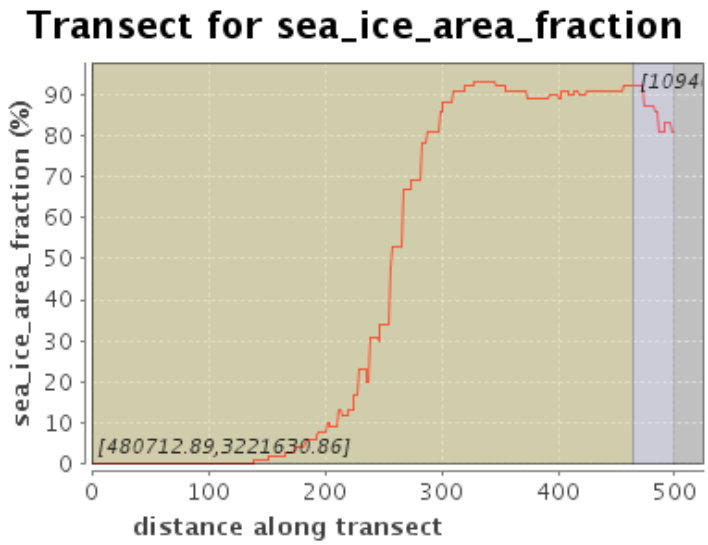
In this scenario NORMAP provides advanced visual representation of multiple colocated datasets with different tools. Prior to analysis the user should collocate the relevant datasets as described in Use Case 4.

1. Extracting point or transect data from collocated datasets

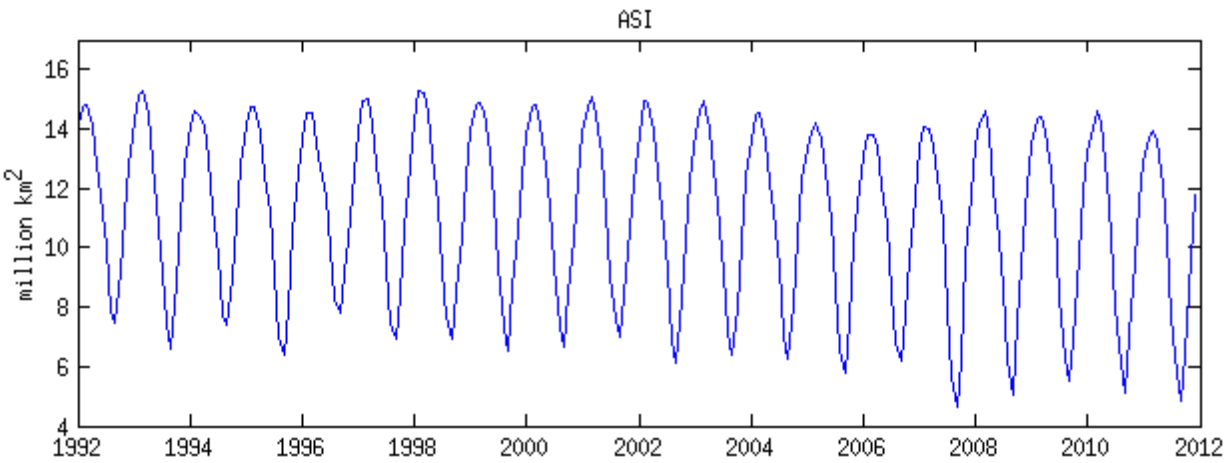
The user visualizes one of the products from the basket and draws a transect polyline (or several points) on the online interactive map. He can select the datasets from which the data should be extracted and specifies if the data should be plotted online. After the request submission the NORMAP system extracts the data from all selected datasets for the given transect and generates a plot online or only dumps the data in text format for further processing in e.g. Excel. If the user has colocated time series of the same product the system may generate hovmoller diagram on request.



Screenshot of the GODIVA2 viewer with a transect line drawn interactively by a user on a map of sea ice concentration across the ice edge.



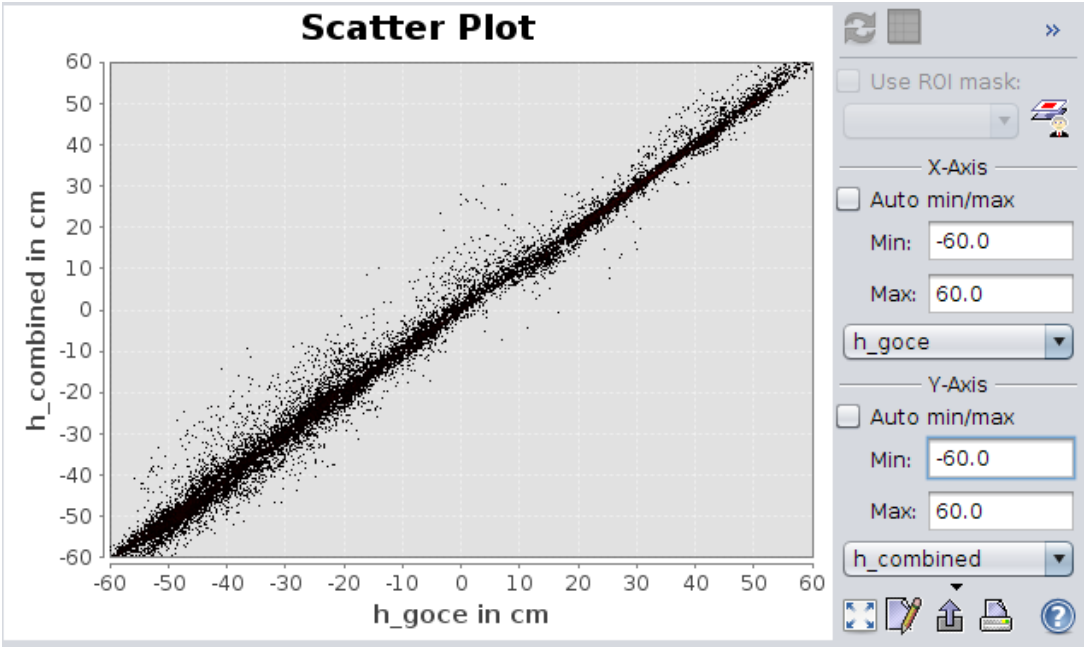
Screenshot from the GODIVA2 viewer with a plot of sea ice concentration values taken along a transect from one frame of monthly averaged product.



Screenshot from Python pyplot window with a plot of sea ice area calculated from time series of monthly averaged product.

2. Comparison of data from collocated datasets using scatter plot

The user selects two or more products from the basket with collocated datasets and optionally draws region of interest (ROI) on the interactive map. The NORMAP system extracts all data (or optionally only random fraction of data) from selected datasets from the given ROI and generates a scatter plot comparing values from different products. Min/max values of the axes are adjustable.



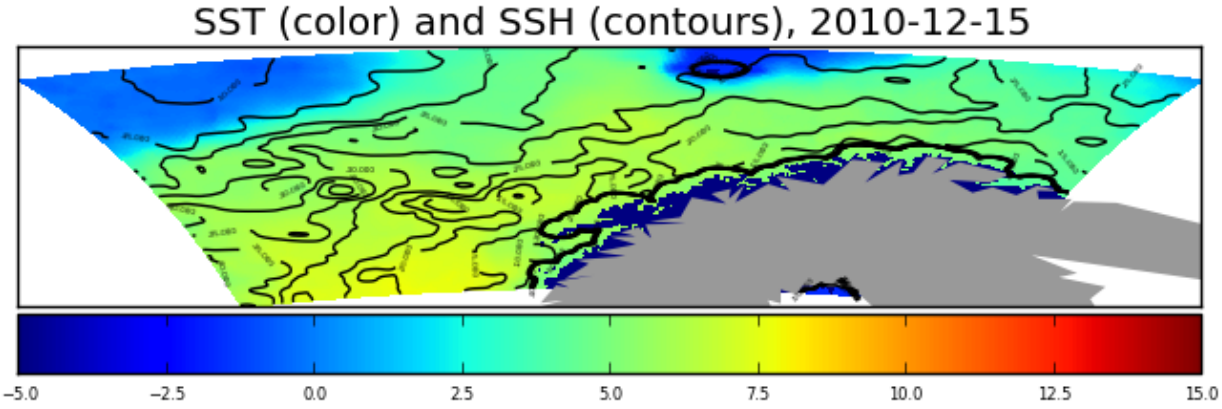
Screenshot from BEAM-Visat window with a scatterplot comparing absolute dynamic sea surface height derived by two algorithms: with use of GOCE or CNES_CLS09 geoid. Min/max values of the axis are adjustable, scatter plot can be based on the entire dataset or only on selected ROI.

3. Histogram

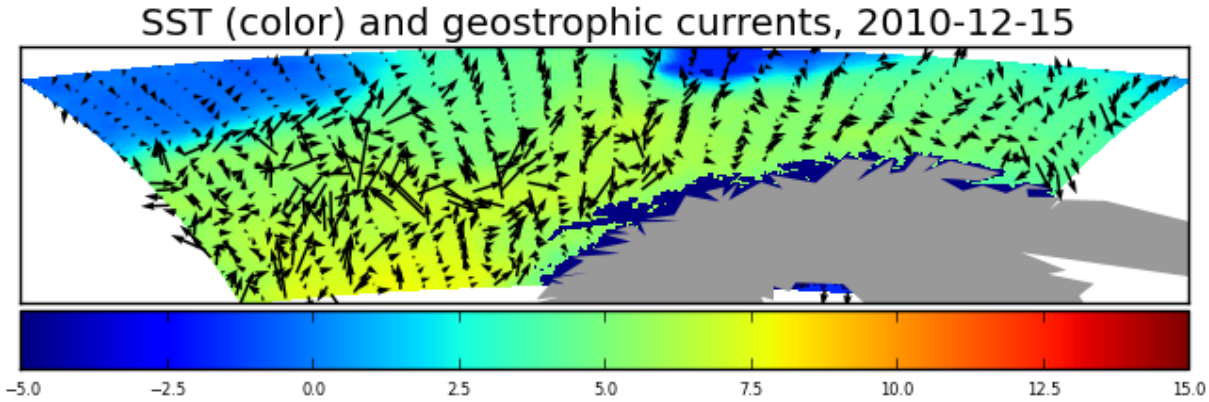
The user selects a product from the basket with collocated datasets and optionally draws ROI on the interactive map. The NORMAP portal extract all data from the selected dataset from the given ROI and generates histogram of value distribution.

5. Visualization of overlaid data

The user adds layers with colocated products from the basket to the interactive map and specifies how the products should be displayed: as a raster, or as a contour plot, or as a directional vector plot. Smoothing of data for contour plots is done on request. The user can specify density of contours on the contour plots and scaling (and type) of arrows on the quiver plot.



Screenshot from Nansat with collocation of two products: absolute sea surface height (shown as contours) and analyzed sea surface temperature (shown in color). A user may adjust min/max values of the plots, colormap, density of contour lines.



Screenshot from Nansat with collocation of two products: total geostrophic currents (shown as arrows) and analyzed sea surface temperature (shown in color). A user may adjust min/max values of the plots, colormap, scale, type and density of arrows.

QUESTIONS	YES	NO
Will you extract data from several colocated datasets online?		
Will you extract data from transect?		
Will you generate transect plots or hovmoller plots online?		
Will you compare several datasets using scatterplot?		
Will you generate maps with overlay of several products (e.g. contour plots) online?		
Do you need other types of plots to visualize your data? (Please indicate which in the comments area below.)		

Other comments