Ocean and Sea Ice SAF

Medium Resolution Sea Ice Drift
Product User Manual

GBL MR SID – OSI 407

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Glossary

AAPP - **A**TOVS and **A**VHRR **P**re-processing **P**ackage

AHA - A file format for gridded satellite data, designed at Swedish Met. and Hydro.Inst.

ARGOS - worldwide location and data collection system

ATBD - Algorithm Theoretical Basis Document

AVHRR – Advanced Very High Resolution Radiometer

CDOP – Continuous Development and Operations Phase

DAMAP – A common DMI/Met.no software package for processing satellite data

DLI - Downward Longwave Irradiance

DMI – Danish Meteorological Institute

EPS – EUMETSAT Polar System

EUMETCast - EUMETSAT's Broadcast System for Environmental Data

EUMETSAT - European Organisation for the Exploitation of Meteorological Satellites

FTP – File Transfer Protocal

GTS - Global Telecommunication System

ICEDRIFT-GRID - The fixed 20km grid in which the final ice drift product is delivered.

INPUT-GRID – The fixed 1km grid in polar steroid projection containing the input data, either the *IR*- or the *VIS*, from the AVHRR instrument.

HL – High latitude

IR - Infra Red

KAI – A EUMETSAT tool for processing EPS PFS format products

MCC – Maximum Cross Correlation

MET.NO – Norwegian Meteorological Institute

Metop – EUMETSAT OPerational METeorological polar orbiting satellite

NETCDF – A file format (network Common Data Form)

NH - Northern Hemisphere

NOAA - National Oceanic and Atmospheric Administration

OSISAF – Ocean and Sea Ice Satellite Application Facilities

PROJ4 – A cartographic projection library

SH – Southern Hemishphere

SSI - Surface Solar Irradiance

SST - Sea Surface Temperatures

UMARF - The Unified Meteorological Archive and Retrieval Facility. Receives and archives images and meteorological products from EUMETSAT satellites.

VIS – visible

1. Introduction

1. EUMETSAT Ocean and Sea Ice SAF

For complementing its Central Facility capability in Darmstadt and taking more benefit from specialized expertise in Member States, EUMETSAT created Satellite Application Facilities (SAFs), based on co-operation between several institutes and hosted by a National Meteorological Service. More on SAFs can be read from [www.eumetsat.int].

The Ocean & Sea Ice Satellite Application Facility (OSI SAF) is producing on an operational basis a range of air-sea interface products, namely: wind, sea ice characteristics, Sea Surface Temperatures (SST) and radiative fluxes, Surface Solar Irradiance (SSI) and Downward Long-wave Irradiance (DLI).

For the Continuous Development and Operation Phase (CDOP) 2007 to 2012 - the OSI SAF consortium is hosted by Météo-France. The sea ice processing is performed at the High Latitude processing facility (HL centre), operated jointly by the Norwegian and Danish Meteorological Institutes, met.no and DMI.

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2. Scope of this document

This document is a product manual dedicated to the Medium Range ice drift product (OSI-407), one of 2 OSI SAF ice drift product:

Low resolution ice drift product (OSI-405);

Medium resolution ice drift product (OSI-407).

This Product Manual only describes the medium resolution product.

See [http://osisaf.met.no] for real time examples of the products as well as updated information. The latest version of this document can also be found there, along with up-to-date validation and monitoring information. General information about the OSI SAF is given at [http://www.osi-saf.org].

Chapter 2 of this document presents a brief description of the algorithm and the general methodical features and Chapter 3 gives an overview of the data processing chain. Chapter 4 provides detailed information on the output file content and format, and in chapter 5 an example of the product is shown.

3. Short introduction to the product

This 24h-ice-drift data set is computed twice daily from swath of Infra Red (IR) data from the AVHRR instrument, onboard the Metop satellite. The applied ice drift estimation method is a well acknowledged feature-tracking technique, called the Maximum Cross Correlation technique (MCC) [Maslanik1998][Haarpaintner2006][Ezraty2006], that is described in the product Algorithm Theoretical Basis Document [ATBD]. A prevalent cloud cover over the southern ocean including the ice covered part hereof, cause low data density of the medium resolution ice drift product in the Southern Ocean. A comparison between the OSI-407 data density in the NH and the SH was conducted in the SH_STAT

document (2012). Based on this document, the OSISAF Steering Group has decided that OSI-407 production only will be applied to the NH.

Wide swaths and high repetition rates of the AVHRR data provide full daily coverage of the sea ice covered regions of the NH. However, the IR data are sensitive to clouds and high atmospheric water conditions; hence ice drift data are only produced in areas with clear skies. Particular during the arctic summer the application of IR data for ice drift analysis is limited, as pronounced cloud covers often prevail. Surface melting during summer limits the applicability of IR based ice drift analysis further. This problem is partly solved by applying visible AVHRR data in the period from May to September. VIS data show higher spectral contrast than IR data where surface melt occur, but is equally to the IR data, sensitive to atmospheric water.

This effect is shown in figure 1, where the frequency distribution of produced ice drift vectors from IR and VIS data are plotted. More comprehensive statistic of product coverage and performance is found in the validation report [VAL].
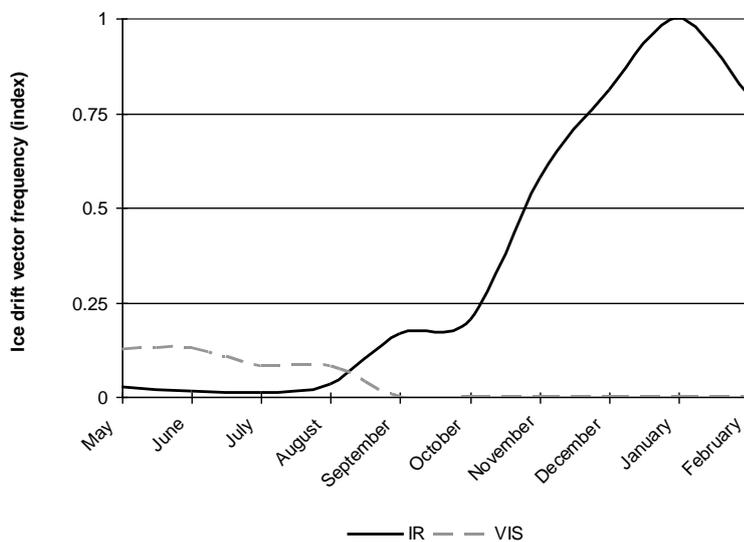
Figure 1 Standardized ice drift vector frequency distribution for IR and VIS data, for an area North of Greenland, during 9 month of 2005/2006. During summer the successfully retrieved ice drift vectors from IR data are practically zero in comparison to the number of produced ice drift vectors during winter. During spring and summer the successfully retrieved ice drift vectors from VIS data are approximately 12 percent of the maximum ice drift vector frequency in January and February. More comprehensive analysis can be found in the validation report [VAL].

The ice drift product is calculated for a 20 km grid for the Northern Hemisphere (NH), only, because persistent cloud cover in the sea ice covered areas of the southern hemisphere prevent this data type from performing with a satisfactory coverage (SH_STATS, 2012).

This product is aimed at sea ice model communities as a means for ice drift validation and/or data assimilation. Obviously the model community prefer consistently large amounts of data for these purposes and this product must therefore be regarded as a complementary product to other high precision and geographically distributed ice drift products, like high resolution SAR ice drift products. From ocean and ice data assimilation communities it is stated that accurate level 2 swath data are preferred over post processed level 4 data. This justifies a continuous production of this product, despite its irregular temporal coverage.

Ice drift detection – technique

In this section, we briefly describe the methodology used to extract ice drift information from two sets of swath data. This is follow by some characteristic values for present setup. The section ends with a description of the filtering procedure applied to remove 'obviously' erroneous ice drift vectors from the data set

2. General method description

The applied Maximum Cross Correlation (MCC) algorithm is a relative simple pattern tracking technique that performs a section-wise matching of geographical distributed data recorded at time T (*reference* data) with data recorded 24h later, at time T + 24h (*compare* data). The best match between *reference* data and a sub-image/section of the *compare* data is thus the match with highest correlation.

First, the raw swath data sets are transformed into a fixed 1 km working grid (see figure 4-left), covering the OSISAF NH-area shown in figure 5. Then for each point in the working grid separated by 20 km (the icedrift-grid), an ice drift vector is attempted retrieved by the iterative best matching routine outlined in figure 2. A matrix around each grid point of icedrift-grid is correlated to any corresponding matrix in the *reference* data that are inside the maximum allowed distance from origin in the *compare* data set, i.e. inside the red circle in figure 2-left. The "maximum allowed distance from a grid point of interest" is determined from a maximum allowed ice drift speed multiplied with the time between the *reference* and the *compare* data sets.
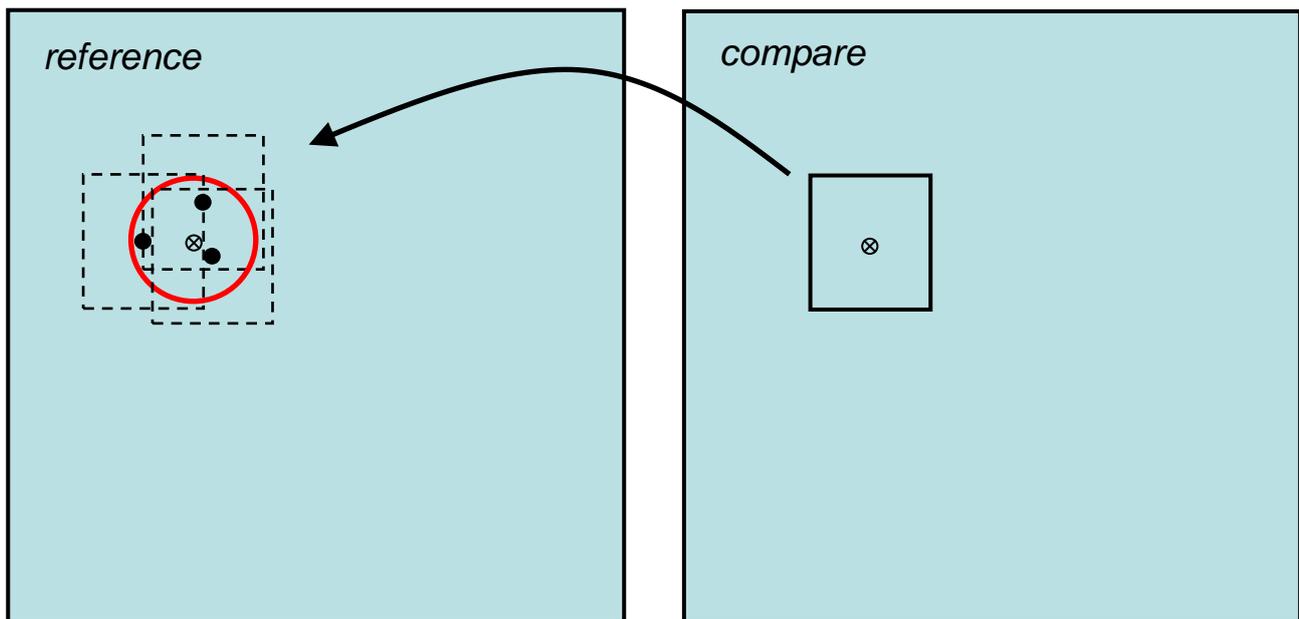
Figure 2 Sketch of the feature tracking procedure. Bold square in *compare* data illustrates the correlation matrix around the ice drift grid point of interest (small circle with cross). Red circle in *reference* data correspond to the maximum allowed drift distance between the *reference* and *compare* data sets. The three punctured squares, with associate centres (black dots), illustrates 3 possible best matches (or maximum correlation matrices) to the compare matrix

The estimated ice drift/displacement at a grid point from time T to T+24h is hence the geographical shift between the grid point in the *compare* data set and the centre of the best matching matrix in the *reference* data set.

1. Production characteristics

The characteristic numbers for this ice drift estimation setup are:

- The correlation matrix is 41*41 pixels, i.e. 41*41km

- The ice drift output grid is 20 by 20 km

- The maximum allowed ice drift speed over 24h is 0.3 m/s, i.e. fixing the maximum allowed daily drift to 25.92 km.

2. Data check

Prior to the ice drift estimation procedure the Cross Correlation window for each grid point is controlled for data validity. This is to minimize processing time and to minimize the number of erroneous ice drift vectors.

First, the OSISAF Ice Edge product (Andersen2007) is applied in order to ensure the presence of sea ice the locations of the icedrift-grid points. Here the classes 'open ice' and 'closed ice' are considered suitable for ice drift estimation, corresponding to all areas with ice concentration higher than 35%. However, this approach excludes coastal regions (the 'unclassified' class) that is masked out in all OSISAF's sea ice products.

Then, each of the icedrift-grid points are checked for the presence of a sufficient number of real data; a consequence of the fact that one AVHRR swath does not cover the full area of interest and to avoid matching dummy-data (see figure 4).

3. Filtering ice-drift vectors

Most ice drift estimation routines are associated with filtering routines to remove erroneous ice drift vectors. In this setup no cloud screening procedure is implemented, despite the fact that the input data are sensitive to atmospheric properties. This consequently produce more erroneous ice drift vectors than routines based on micro wave data, that are much less sensitive to atmospheric opacity than IR and VIS data. The reason for this disposition is that cloud screening in the Arctic is rather difficult, due to comparable properties of cloud and snow/ice surfaces in the VIS and IR spectrum. Therefore, it is decided to ignore the presence of clouds and alternatively to run a comprehensive filter routine for erroneous ice drift vectors after the MCC routine. Whenever an effective cloud screening procedure is available for real time use, it will be implemented in this ice drift procedure.

The effect of the applied filter can be seen in figure 3, showing the un-filtered ice drift estimates and the final product. The filter compares a given ice drift vector to its 5 by 5 gridpoint 'Neighbourhood' to determine whether or not the vector will pass the filter test. See the product ATBD for more detailed description of the filter [ATBD]
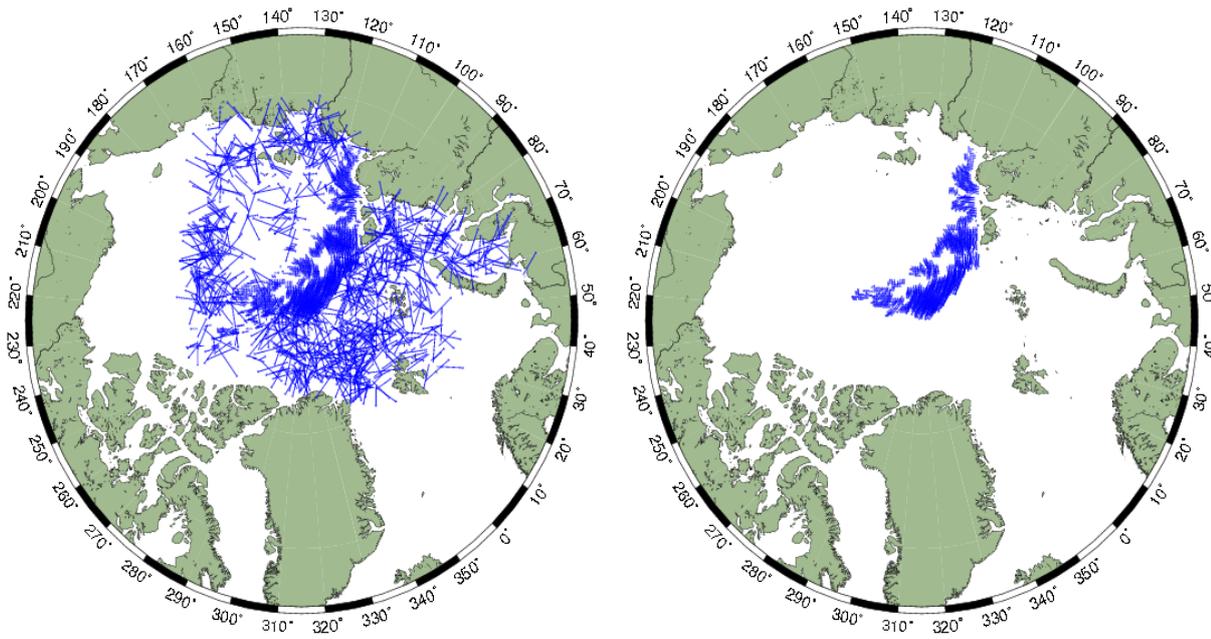
Figure 3 Example of ice drift estimation before applying filter (left) and after filtering of 'obvious' erroneous ice drift vectors (right). The length of the vectors is relatively correct, but scaled for presentation purposes.

3. Processing scheme

The full ice drift production is working in 4 steps. First step is retrieval and concatenation of 3 minute segment data from EUMETCast and to perform geo-location and format conversion. Second step includes running the full ice drift estimation procedure. Third step is the filtering of erroneous ice drift vectors, and the final step is to perform the on-the-fly validation.

1. Pre-processing

The Metop AVHRR Level 1 swath data used here is retrieved as 3 minutes sequences from the EUMETCast data distribution system. All consecutive 3-minute sequences that overlap the area of interest (figure 4) are concatenated into one swath file, using EUMETSAT-programme KAI. The concatenated swath files are via AAPP and DAMAP software transformed into a geographically fixed 1 km grid in the aha file format (see section 4.4), with grid specifications described in table 1.
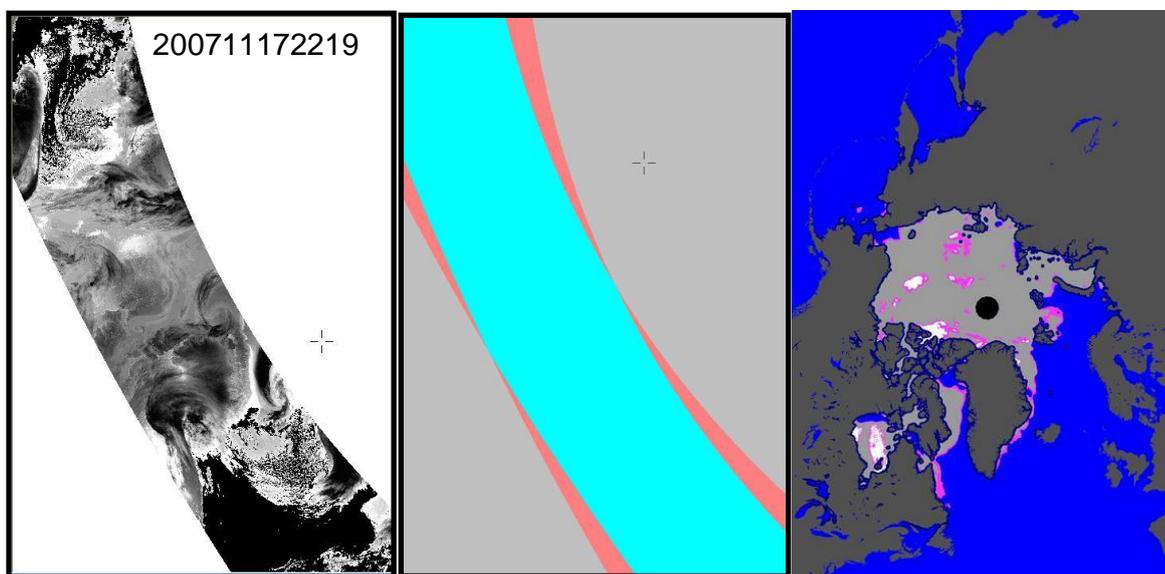
Figure 4 Left is an IR swath transformed into the 1 km grid of OSISAF NH area. In the middle is the overlap between two swath separated by 24h show in blue, and right in an example of the OSISAF ice type product.

Finally, the rectified aha-format is converted into a netCDF format with calibrated albedo and brightness temperature. These data are stored at DMI and used for this ice drift routine, among other applications.

At present the pre-processing is not running optimally, due to various data conversion procedures inherited from old procedures. This will be optimized as soon as resources are available.

2. Running the ice drift estimation procedure

The ice drift production is controlled by a series of scripts that are initiated from by crontab twice daily.

The procedure begins by locating the newest available Metop AVHRR data in netCDF-format (*compare* data). Subsequently the corresponding 24h older *reference* data is found. When a suitable *reference-compare* data pair is found the files are passed to the MCC routine that does the ice drift estimation.

When the ice drift estimation procedure is successful completed the raw (and unfiltered) product is passed to the filtering routine.

3. Validation

After successful filtering, the final ice drift product is passed on to an on-the-fly validation procedure. This procedure generates buoy drift - satellite ice drift data pairs with start and end latitude and longitudes, as well as data pairs of X and Y components of ice drift. Here X and Y are horizontal and vertical drift directions in the NH-subset shown in figures 4 and 5. The matchup data are passed to a data base.

Each quarter the buoy drift - satellite ice drift data pairs are the basis for a quarterly validation report, including RMS-error, bias and mean error statistics. A general validation report is in progress [VAL] and the validation strategy is given in the ATBD document [ATBP].

The applied buoy position data are ARGOS-data provided via the GTS network, collected at DMI.

4. Production timeliness

The timeliness of the full production and archiving routine of the medium resolution ice drift product is less than 6 hours from the instrument time of the last segment of the concatenated EPS files till the product is available from the OSISAF data archive [osisafweb].

The product timeliness and a detailed description of the full production are given in the ATBD [ATBD].

4. Ice Drift product description

The OSI SAF ice drift products are available in NetCDF format [netCDF]. They are all built on the same model to make it easy to merge or mix different ice drift data sets produced by the OSISAF. Results from validation exercises will be available in a separate validation report, at the OSI SAF Sea Ice web portal [osisafweb]. Moreover the ice drift production setup includes an on-the-fly validation to reveal any drift of the quality of the product.

The ice drift product files are designed to follow the CF conventions for gridded products [CF]. Those conventions give rules to present attributes, units and projection as well as dimensions.

Easy-to-use reader and viewer for netCDF are the *'ncdump'* and *'ncview'* programmes and the '**nco**' command line operators are easy-to-use netCDF data and attribute tools [NCDUMP/NCVIEW][NCO]. These programmes can help to get both graphical and text-wise overview of netcdf-files and can also be used to dump selected variable of interest. Output from a ncdump is written in appendix –A, and a brief description is given where the content is not self-explaining. For more demanding and flexible IO handling it is recommended to use the netCDF libraries in scripting or programming applications [netCDF].

1. Parameters and units

A sea ice drift estimate is defined by 6 values: lat0, lon0, t0, lat1, lon1 and t1, where subscript 0 and 1 refer to the reference and compare data, respectively, for positions and times. The ice drift product thus expresses that a parcel of ice which was at position lat 0, lon0 at time t0, is at position lat1, lon1 at time t1. From those 6 quantities, all other ice drift datasets (like drift distance, direction, dX and dY drift components, etc...) can be calculated. Although they can be retrieved from the above mentioned 6 quantities, the drift components along the X and Y axis of the product grid (dX and dY) are included in the product file. This is because:

1. Their later derivation is more complex due to the use of the Earth mapping function;

2. The uncertainty estimates of the ice drift product are given for those two parameters in the validation report.

All geographical coordinate fields are given as decimal degrees (latitude or longitude). The X and Y drift components have unit of km.

In the NetCDF file, the provided datasets are: lat, lon, lat1, lon1, dX and dY, bearing. To produce derived parameters like drift distance and drift bearing, we can refer to great circle algorithms [greatcircle algebra2009].

It is important to note that the product can not be interpreted as a mean sea ice speed estimate for the period between the *reference* and the *compare* positions, as the data contains no information of the path of the sea ice.

2. Times

Though this product is a 24h ice drift product the actual period of ice drift correspond to the time between the two swath data acquisitions. These times are printed both in the filename and in the global attributes of the netCDF file.

Global attributes start_date and end_date in a string format:

:start_date = "YYYY-MM-DD hh:mm:ss UTC"

:stop_date = "YYYY-MM-DD hh:mm:ss UTC"

3. Flag and Quality

This product contains no quality flags. The overall quality can be found in the product validation report [VAL] and in an ice drift inter-comparison report [Hwand and Lavergne, 2010] and on-the-fly validation can be found on the OSI-SAF website (see data distribution). Estimates of the product uncertainties and calculations thereof are given in the validation report [VAL].

A data_status flag explaining whether the drift vector is valid or excluded is included and explained in the product file.

The reason for not providing quality flags with this product and subsequent stratified uncertainty estimates is that the development of such measures is not finalized. The work is ongoing and is based on the assumption that the highest quality ice drift vectors are defined from correlation matrices with well defined maximum correlation peak, and vice versa.

4. Grid and area of interest

The area of interest for this ice drift product is the OSISAF NH area, shown in figure 5. This is the same area for which most other OSISAF sea ice products are produced, namely: ice edge, ice concentration, ice type and the low resolution ice drift product. The area specifications for the two grids applied here, the input and the ice drift grids, are given in tables 1 and 2.
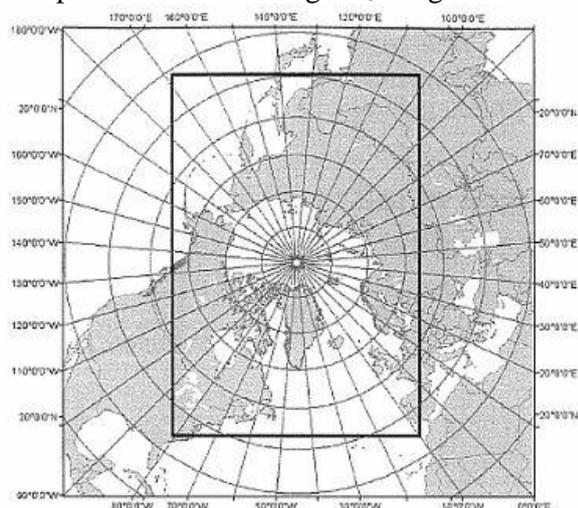
Figure 5 The area of interest outlined with the bold rectangle. See specifications in tables 1 and 2.

Table 1 Geographical definition of the input-grid.

Projection	Polar stereographic projection with true scale at 70°N	
Resolution	1 km	
Size	7600	11200
Central Meridian	45°W	
Corner points UL (dec.degr.)	32.655N	169.160E
Corner points UL (m)	U = -3800000	V = 5600000
Earth axis	a=6378273	b=6356889.44891
PROJ4-string	+proj=stere +a=6378273 +b=6356889.44891 +lat_0=90 +lat_ts=70 +lon_0=-45	

Table 2 Geographical definition of the ice drift-grid.

Projection	Polar stereographic projection with true scale at 70°N	
Resolution	20 km	
Size	379	559
Central Meridian	45°W	
Corner points UL (dec.degr.)	32.854N	169.114E
Corner points UL (m)	U = -3780000	V = 5580000
Earth axis	a=6378273	b=6356889.44891
PROJ4-string	+proj=stere +a=6378273 +b=6356889.44891 +lat_0=90 +lat_ts=70 +lon_0=-45	

5. Data distribution

Sea Ice drift product files can be collected at the OSI SAF Sea Ice FTP server. At the OSI SAF Sea Ice web page [http://osisaf.met.no/p/ice/index.html/]. Here, products from the last 31 days can be collected. The file name convention for the ice drift files at OSI SAF server is:

ice_drift_<area>_<grid>-<resolution>_<platform>-<channel>_<startdate>_<enddate>.nc

<area>: nh for Northern Hemisphere product.

<grid>: projection/grid information, 'polstere' is Polarstereographic in 20 km resolution

<resolution>: Resolution of drift data (200 is 20 km resolution)

<sensor>: Sensor used for the product. i.e. AVHRR.

<channel>: Channel applied from the given platform. Either channel 2 or 4, ch2 or ch4 for VIS or IR, respectively

<date>: Start or End date and time of the product, on format YYYYMMDDhhmn.

Example: **ice_drift_nh_polstere-200_avhrr-ch4_200904092331_200904102310.nc**

Note that the primary separating character is '_' (underscore) and that the secondary one is '-' (dash). For compatibility with the other sea ice products from OSI SAF, a secondary level separator appears between the two dates.

5. Medium resolution ice drift product example

Figure 6 is a plot of the 24h ice drift product. The ice drift is estimated for the overlap between 2 swath data sets from 20090409-2331z and 20090410-2310z, the *reference* and the *compare* data sets. The shown vectors are scaled for plotting purposes and the vector length is not representing the absolute ice drift for the period. Where no vectors are plotted no drift is available, due to either atmospheric disturbance, exclusion in the filtering process, exclusion due bad data or due to no overlap between the two swath data sets – this is explained in the data_status flag in the product file. An output file header dump is shown in Appendix – A, with a brief explanation.
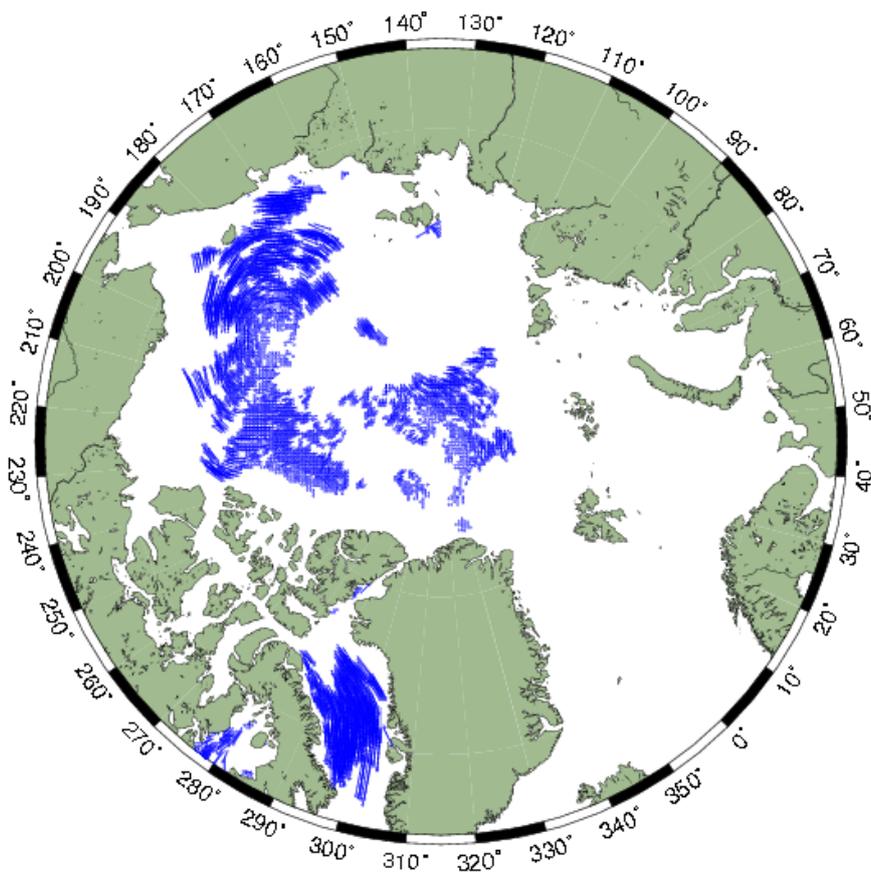
Figure 6 An example of the IR-AVHRR ice drift product from a relative clear 24h period in the Arctic, namely 9th to 10th of April 2009

6. Acknowledgement

Two other projects have financed the research and development efforts necessary to setup this ice drift product. The MERSEA IP ([www.mersea.eu.org]) and the Damocles ([http://www.damocles-eu.org]) projects are acknowledged.

7. Reference

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8. Appendix – NetCDF file

Header information of the mr ice drift product (OSI-407) – from the 'ncdump' program. Bold capital text is added for explanation:

```
netcdf ice_drift_nh_polstere-200_avhrr-ch4_201202140440_201202150419 {
```

OUTPUT GRID:
```
dimensions:
    xc = 379 ;
    yc = 559 ;
variables:
```

PROJECTION SPECIFICATIONS:
```
    int Polar_Stereographic_Grid ;
        Polar_Stereographic_Grid:grid_mapping_name = "polar_stereographic" ;
        Polar_Stereographic_Grid:straight_vertical_longitude_from_pole = -45.f ;
        Polar_Stereographic_Grid:latitude_of_projection_origin = 90.f ;
        Polar_Stereographic_Grid:standard_parallel = 70.f ;
        Polar_Stereographic_Grid:false_easting = 0.f ;
        Polar_Stereographic_Grid:false_northing = 0.f ;
        Polar_Stereographic_Grid:earth_shape = "elliptical" ;
        Polar_Stereographic_Grid:proj4_string = "+proj=stere +a=6378273
            +b=6356889.44891 +lat_0=90 +lat_ts=70 +lon_0=-45" ;
```

X-POSITION IN PROJECTION:
```
    double xc(xc) ;
        xc:axis = "X" ;
        xc:units = "m" ;
        xc:long_name = "xcoordinate in projection (eastings)" ;
        xc:standard_name = "projection_x_coordinate" ;
        xc:grid_spacing = "20 km" ;
```

Y-POSITION IN PROJECTION:
```
    double yc(yc) ;
        yc:axis = "Y" ;
        yc:units = "m" ;
        yc:long_name = "ycoordinate in projection (northings)" ;
        yc:standard_name = "projection_y_coordinate" ;
        yc:grid_spacing = "20 km" ;
```

DRIFT VECTOR STATUS:
```
    int data_status(yc, xc) ;
        data_status:long_name = "grid point status mask" ;
        data_status:value_range = 0s, 5s ;
        data_status:flag_values = 0, 1, 2, 4, 5 ;
        data_status:status_values_meaning = "valid_driftvector
            correlation_less_than_minimum drift_speed_larger_than_maximum \n",
            "data_check_reference_and_compare_data_failed
            drift_vector_removed_by_filter" ;
```

CORRELATION VALUE FROM MCC ROUTINE:
```
    float correlation(yc, xc) ;
```

```
            correlation:correlation_values = "-2, 0-1" ;
            correlation:correlation_values_meaning =
                excluded_due_to_icemask_or_missing_reference_or_comparedata
                correlation_value" ;
            correlation:long_name = "Correlation coefficient" ;

    LATITUDE OF DRIFT START POINT:
    float lat(yc, xc) ;
            lat:units = "degrees_north" ;
            lat:long_name = "latitude coordinate at grid origin
                (at time<start_date>)" ;
            lat:standard_name = "latitude" ;
            lat:grid_mapping = "Polar_Stereographic_Grid" ;

    LONGITUDE OF DRIFT START POINT:
    float lon(yc, xc) ;
            lon:units = "degrees_east" ;
            lon:long_name = "longitude coordinate at grid origin
                (at time <start_date>)" ;
            lon:standard_name = "longitude" ;
            lon:grid_mapping = "Polar_Stereographic_Grid" ;

    LATITUDE OF DRIFT END POINT:
    float lat1(yc, xc) ;
            lat1:units = "degrees_north" ;
            lat1:long_name = "latitude at end of displacement
                (at time <stop_date>)" ;
            lat1:standard_name = "latitude" ;
            lat1:grid_mapping = "Polar_Stereographic_Grid" ;

    LONGITUDE OF DRIFT END POINT:
    float lon1(yc, xc) ;
            lon1:units = "degrees_east" ;
            lon1:long_name = "longitude at end of displacement
                (at time <stop_date>)" ;
            lon1:standard_name = "longitude" ;
            lon1:grid_mapping = "Polar_Stereographic_Grid" ;

    DRIFT IN PROJECTION X DIRECTION:
    float dX(yc, xc) ;
            dX:standard_name = "sea_ice_x_displacement" ;
            dX:units = "km" ;
            dX:long_name = "component of the displacement along the x axis of the
                grid" ;
            dX:grid_mapping = "Polar_Stereographic_Grid" ;

    DRIFT IN PROJECTION Y DIRECTION:
    float dY(yc, xc) ;
            dY:standard_name = "sea_ice_y_displacement" ;
            dY:units = "km" ;
            dY:long_name = "component of the displacement along the y axis of the
                grid" ;
            dY:grid_mapping = "Polar_Stereographic_Grid" ;

// global attributes:
        :title = "OSI SAF - Medium Resolution Sea Ice Displacement" ;
        :abstract = "Gridded ice displacement fields obtained from
            satellite  image\n", "processing. It is a medium resolution
```

```
        product (20 km resolution).\n", "The time span of  the  ice
        displacement  is  approximately  24 hours. \n",
        "This dataset is intended mainly for data validation and
        assimilation, due to large\n",
        "data gaps, caused by opaque atmosphere. \n",
        "Daily products  are  freely  available  from\n",
        "the  OSI SAF distribution chain." ;
:topiccategory = "Oceans Climatology Meteorology Atmosphere" ;
:keywords = "Sea Ice Motion, Sea Ice, Oceanography, Meteorology, Climate,
        Remote Sensing" ;
:gcmd_keywords = "Cryosphere > Sea Ice > Sea Ice Motion\n",
        "Ocean > Sea Ice > Sea Ice Motion\n",
        "Geographic Region > Northern Hemipshere\n",
        "Vertical Location > Sea Surface\n",
        "EUMETSAT/OSISAF > Ocean and Sea Ice Satellite Application Facility,
        \n", "European Organisation for the Exploitation of Meteorological
        Satellites" ;
:activity_type = "Space borne instrument" ;
:Conventions = "CF-1.4" ;
:product_name = "osi_saf_mr_ice_drift" ;
:product_id = "OSI-407" ;
:product_status = "test" ;
:product_version = "1.0" ;
:filter_level = "filtered" ;
:history = "2012-02-15 04:38:00 UTC creation" ;
:area = "Northern Hemisphere" ;
:PI_name = "Gorm Dybkjaer" ;
:contact = "safosi@dmi.dk" ;
:distribution_statement = "Free" ;
:project_name = "EUMETSAT OSI SAF" ;
:institution = "Danish Meteorological Institute" ;
:satelliteID_start = "M02" ;
:satelliteID_end = "M02" ;
:start_date = "2012-02-14 04:40:00 UTC" ;
:stop_date = "2012-02-15 04:19:00 UTC" ;
:platform = "AVHRR" ;
:channel = "ch_4" ;

AREA INSIDE WHICH THIS FILE CONTAINS DATA:
:northernsmost_latitude = 89.33434f ;
:easternmost_longitude = 178.9949f ;
:southernmost_latitude = 69.72678f ;
:westernmost_longitude = -180.f ;

GRIDPOINTS WITH OVERLAPPING INPUT DATA:
:processed_gridpoints = 18248 ;

GRIDPOINTS BEING PROCESSED BUT NOT FILTERED:
:valid_data_prefilter = 4526 ;

GRIDPOINTS - VALID AFTER FILTERING:
:valid_data = 1783 ;

TIME IN DAYS BETWEEN INPUT SWATH DATA:
:leap_days = 0.9854167f ;
:references = "OSI SAF Medium Resolution Sea Ice Drift Product User
        Manual, Dybkjaer, G. v1.0, July 2009\n", "OSI SAF Algorithm
        Theoretical Basis Document for OSI SAF Medium Resolution Sea Ice
        Drift Product, Dybkjaer, G. v1.0, July 2009\n",
```

```
        "Validation and Monitoring of the OSI SAF Medium Resolution Sea Ice
        Drift Product, Dybkjaer, G., v1.0, December 2009 \n",
        "http://saf.met.no\n",
        "http://www.osi-saf.org" ;
    :comment = "This gridded product is based on swath data that are
        sensitive to atmospheric water, \n",
        "thus the data set contains large data gaps and occationally no data.
        \n", "The <valid_data> attribute specifies the number of valid data
        in this specific file." ;
}
```