



Project

VALIDATION REPORT – 2013-Q1

Regional Sea Ice Svalbard

Reference: MYO-WP14-SIW-METNO-ARC-SEAICE_HR-OBS-VALIDATION-2013-Q1

Project N°: FP7-SPACE-2007-1 **Work programme topic:** SPA.2007.1.1.01 - development of upgraded capabilities for existing GMES fast-track services and related (pre)operational services

Start Date of project: 2012/04/01 **Duration:** 36 Months

WP leader: met.no	Issue: 1.0
Contributors: Frode Dinessen	
Date: February 2013	08 February 2013
Dissemination level: CO	



CHANGE RECORD

Issue	Date	§	Description of Change	Author	Checked By
1.0	08.02.2013		New	Frode Dinessen	



TABLE OF CONTENTS

I.1 Overall description of validation task4

I.2 Description of validation system4

I.3 Validation results5

I.4 Further development8

I.5 Conclusion.....9

GLOSSARY AND ABBREVIATIONS

AMSR	Advanced Microwave Scanning Radiometer
NetCDF	Network Common Data Form
SAR	Synthetic Aperture Radar
SIW	Sea Ice and Wind

I.1 Overall description of validation task

AD-1: The objective of the validation is to characterize accuracy and quality of the delivered SIW TAC products. Validation is a continuous on going activity and will mainly be based on operational data, but can be supported by campaign data.

The regional Svalbard sea ice concentration product is an existing product provided by the Sea Ice Service in Tromsø, VNN (met.no). It covers European Arctic with focus on the areas around Svalbard and the Barents sea. The ice charts are primarily used for strategic and tactical planning within the offshore and shipping community. The product are also used for validation of ocean/ice models (Arctic and Global MFC) and the global SIW TAC products. In addition the product are used for initialization of sea ice models. Requirements are strict; demands are for detailed high quality products for several areas. The products are provided every week day (office day). Delta development for MyOcean containg gridding of the product, adding land mask flag and generating a NetCDF file.

The validation will be:

- I A visual validation by using high resolution optical satellite data.
- II Verify that the products are gridded correctly and CF-1.4 compliant NetCDF files are available at the MyOcean ftp server.

I.2 Description of validation system

The regional Svalbard sea ice concentration product is an operational product from the ice service at met.no, which is delivered to MyOcean in order to ease and enhance the use in operational oceanography. The ice charts are primarily based on satellite data from SAR (Radarsat), together with AVHRR and MODIS data. The SAR data are sub-sampled to a spatial resolution of 100x100 m while the optical data from AVHRR and MODIS are sub-sampled to 1000x1000 m resolution. A detailed interpretation of satellite imagery and a subsequent mapping procedure are carried out by skilled (experienced and trained) ice analysts. The ice concentration product is gridded to 1x1 km horizontal resolution.

The product is transmitted from VNN to the SIW-TAC Dissemination Unit at met.no where it is converted from ascii to CF-1.4 compliant NetCDF format. A verification of the data content and quality has been performed. The netCDF file is checked against the CF-Convention compliance checker for NetCDF format developed at the Hadley Centre for Climate Prediction and Research, UK Met Office by Rosalyn Hatcher. The checker can be found at <http://titania.badc.rl.ac.uk/cgi-bin/cf-checker.pl>

Validation of the high resolution regional ice chart of the Arctic Ocean is a challenging task due to lack of ground truth. In the production the satellite data used is expected to have a resolution high enough to represent the ground truth of the mapped area. A main challenge in the Arctic is the cloud cover

large part of the year reduce the ability to use standard meteorological satellite data since these data are weather dependent. The mapping of the ice concentration in this product is therefore heavily depending on satellite data from the active radar sensor SAR (Synthetic Aperture Radar) onboard the Radarsat satellite. This type of data can in some situation be hard to interpret even by a skilled operator. The validation of this product will therefore focus on situations where weather condition allow use optical satellite data.

I.3 Validation results

The product are at irregular intervals manual compared against high resolution optical satellite data with a horizontal resolution down to 250 meter. Data is downloaded from the Modis Rapid Response System (<http://rapidfire.sci.gsfc.nasa.gov/subsets/>) and the Hornsund subset are used. Validation is not carried out in the dark session due to lack of daylight and no visual data available.

The figure below shows an example of a validation scenario. At the upper image is the Ice chart produced by the operator on the 8th of January. The coloured polygons represent area of different ice concentration and follows the standard WMO concentration colour code. Red represent a concentration of 9-10/10, orange 7-8/10, yellow 4-6/10 green 1-3/10 and blue are less than 1/10. Due to the Arctic dark season visual data have not been available for validation. We have therefore used an infra-red channel from the Noaa satellite as showed in the lower left below. Lower right shows the resulting icechart where Radarsat-2 image are used in the analysis.

The infra-red image looks the have a good correlation with the analysed polygons in the icecharts but in some area there looks to be some differences. This is most likely due to time difference between satellite data used in the analyse and satellite data used in the validation.

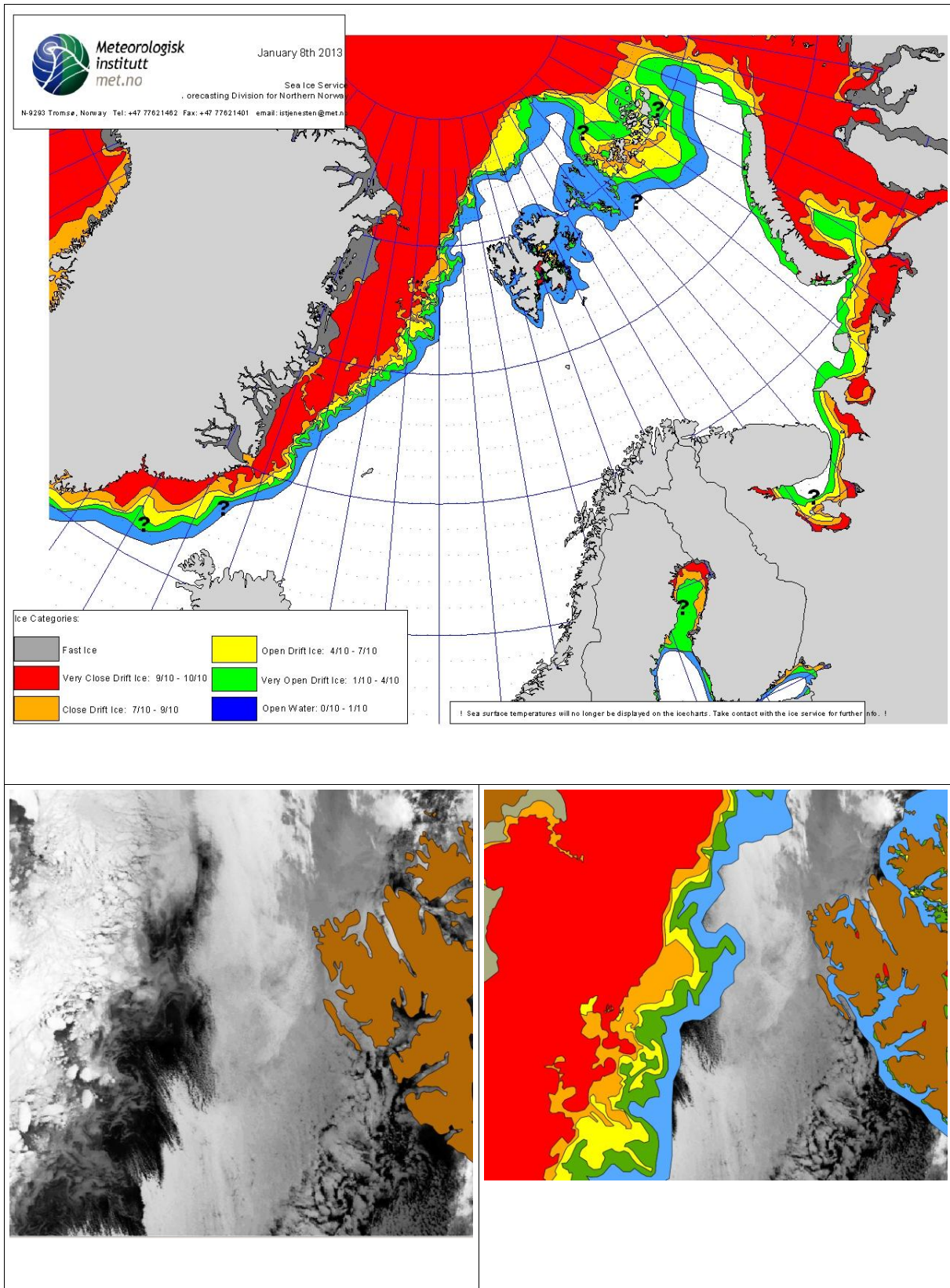


Figure 1: Visual validation of the regional high resolution image of Svalbard 8th of February 2013.

As an alternative to the NOAA data we have also validated the ice charts by using some SAR imaged from the COSMO SkyMed satellite. The data covers a part of south east Greenland from the 10th of

December 2012 as can be seen in the left figure below. The right image shows the associated ice chart from the same area.

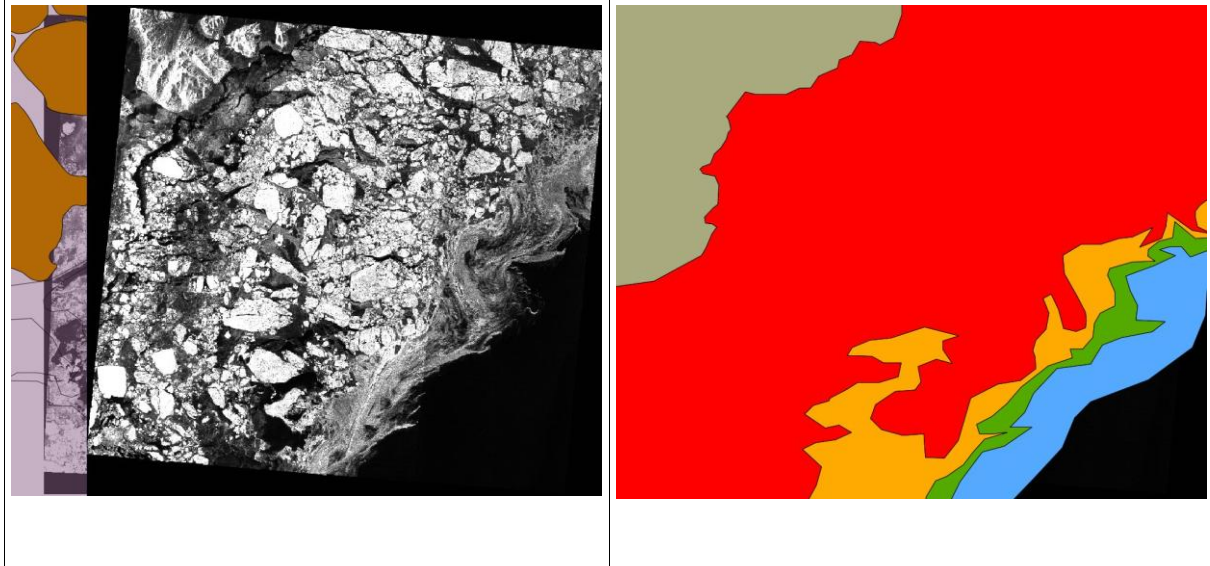


Figure 2: Visual comparison of COSMO-SkyMed data and ice chart from 10th of December 2012.

The product is delivered to the met.no dissemination unit (DU) as an gridded ascii file. At the DU the data is converted to netCDF format following the CF-1.4 version. The data is then made available at the met.no FTP site from where we have downloaded the product. The product is then checked by the CF-checker and the following are the result of this check.

File name: ice_conc_svalbard_201301081500.nc

Output of CF-Checker follows...

```
CHECKING NetCDF FILE: /tmp/17745.nc
```

```
=====
```

```
Using CF Checker Version 2.0.2
```

```
Using Standard Name Table Version 18 (2011-07-22T10:58:54Z)
```

```
Using Area Type Table Version 1 (5 December 2008)
```

```
-----
```

```
Checking variable: crs
```

```
-----
```

```
-----
```

```
Checking variable: xc
```

```
-----
```



Checking variable: yc

Checking variable: lon

Checking variable: ice_concentration

Checking variable: time

Checking variable: lat

Checking variable: concentration_range

ERRORS detected: 0

WARNINGS given: 0

INFORMATION messages: 0

I.4 Further development

The high resolution ice chart is produced by a manual interpretation of satellite data and is a subjective analysis by the operator on duty. A next phase in the validation should therefore be to make an assessment of the ice analyst factor. This can be done by, at regular intervals, have two ice analysts producing independent product based on the same input data. The two products are then compared on a pixel basis and a confusion matrix containing ice concentration classes from the two analysts can be generated. This will give a measure of the uncertainty of the different ice concentration classes and the overall uncertainty of the product.

Another validation attempt is to make an intercalibration between met.no icecharts and DMI ice charts in overlap area (East Greenland). Comparison can be done in the same manner as described above.

Unfortunately there has not been resources available for conduct this kind of validation.

I.5 Conclusion

Validation of the high resolution regional ice chart of the Arctic Ocean is a challenging task due to lack of ground truth. In the production, the satellite data used is expected to have a resolution high enough to represent the ground truth of the mapped area. The product is therefore often used for validation of several automatic generated Arctic sea ice products. In the further is is therefore important to have focus on how the subjective analysis represented by the operator on duty influence on the final product.

The above report is an attempt to validating the operational production of gridded icecharts for MyOcean.