Seventh Framework Program FP7-SPACE-2010-1
Stimulating the development of downstream GMES services

Grant agreement for: Collaborative Project. Small- or medium scale focused research project
Project acronym: **SIDARUS**
Project title: Sea Ice Downstream services for Arctic and Antarctic Users and Stakeholders

Grant agreement no. 262922
Start date of project: 01.01.11
Duration: 36 months
Project coordinator: Nansen Environmental and Remote Sensing Center, Bergen, Norway

D9.2: Report on demonstration no.2 and services utility

Due date of deliverable: 31.12.2013

Actual submission date: 07.02.2014

Organization name of lead contractor for this deliverable: NERSC

Project co-funded by the European Commission within the Seventh Framework Programme, Theme 6 SPACE		
Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission)	
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ISSUE	DATE	CHANGE RECORDS	AUTHOR
1.0	07/02/2014	complied	Mohamed Babiker N. Longépé, Jon Bergh

SIDARUS CONSORTIUM

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5	The Chancellor, Masters and Scholars of the University of Cambridge	UCAM	UK
6	Norwegian Meteorological Institute, Norwegian Ice Service	Met.no	NO
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8	B.I. Stepanov Institute of Physics of the National Academy of Sciences of Belarus	IPNASB	BR

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SUMMARY
The main objective for WP9 is to plan and impalement two demonstration periods where products are disseminated to selected users and feedback is collected. This report covering the second demonstration period. The report presents 8 different demonstrations and products each targeting special users. AWI and met.no produced ice drift products for Fram strait, the product was presented to Statoil and has been used during a research cruise in the Farm strait. After the Statoil cruise a following up meeting was held between met.no and Statoil showed great interest in the SIDARUS products and expressed that in future oil exploration phase products like this would be of great interest for their operations. University of Bremen presented Sea ice albedo and melt pond fraction products to university louvain la neuve and NERSC, both answered very positively. University of Bremen also presented thin ice thickness products to the ice service of DMI and the product used operationally each day. NERSC has been updated the users at TOTAL E&P as well as other main actors of the oil and gas exploration and production in the European Arctic of the progress of the Barents and Kara Sea forecasting model and the products. CLS have developed several products; Iceberg monitoring service for offshore oil rig safety, Iceberg monitoring for the Vendée Globe challenge and iceberg detection in Kara Seas.

1 Sea Ice drift and deformation for Statoil in Fram strait (by met.no and AWI)

The oil company Statoil conducted a research cruises in the Fram strait/ north east-Greenland. One of the main goals of these cruises was to investigate the ice conditions in these areas for possible oil exploration. During the cruise upward looking sonars was put on the sea bed for monitoring sea ice drift. Data from these sonars will be collected later.

Statoil is one of the core users for the SIDARUS project. During the cruise the Norwegian ice service provided ice drift products from AWI together with regular products from the ice service at met.no. The Ice drift production from AWI was generated form Radarsat-2 images ordered as part of the MyOcean project and delivered in png format. At the same time the ice service did a manual detection of ice floes in the same images and from this manually derived the ice drift. The drift vectors from these products was compared to the automatic derived SIDARUS product and showed a good agreement.

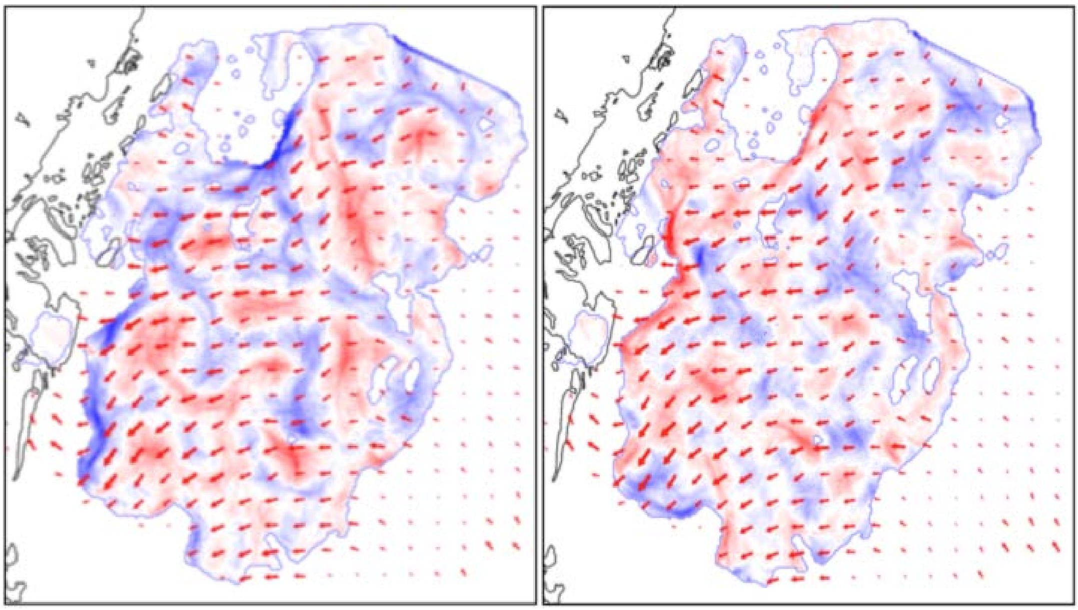


Figure 1-1 Examples of ice drift products from SAR: (a) Divergence map derived from Radarsat-2 image pair recorded on 16.09.2012. The red arrows are the calculated velocity field. Red are zones of divergence, blue zones are convergent regions. (b) Vorticity map from the same data set. Red areas rotate in anticlockwise direction, while blue areas rotate clockwise.

Another SIDARUS product that was demonstrated for Statoil is the ice-thickness product produced by University of Bremen. This product shows ice-thickness up to 0.5 meter. A link to regular updated products was provided giving them the possibility to regularly download products. The products are available as png and netCDF formats (see section 3).

Providing data to users operating in the Arctic, above approximately 76 degree north, may be a challenging task due to coverage of data communication. During this demonstration we did experience some problem distributing data. This was especially noticeable for large graphical data files

After the Statoil cruise a following up meeting was held between met.no and Dr. Kenneth Eik Johannessen from Statoil. He showed great interest in the SIDARUS products and expressed that in a future oil exploration phase products like this would be of great interest for their operations.

2 Sea ice albedo and melt pond fraction (by UB)

Thierry Fichefet, Uni Louvain la Neuve, and Laurent Bertion of NERSC have been contacted and answered very positively.

The algorithm for retrieval ice albedo and melt pond fraction, using this theory, was developed, and realised as a software MPD (Melt Pond Detection). The software package involves processing of MERIS data from the initial data (level 1b, full orbits) till the resulting maps which contain melt pond fraction and spectral albedo for each grid point of the scene.

This software package generates these operational products in the period from May to September; additionally it provides estimation of the pixel albedo retrieval error and standard deviation. The resulting format of the output is NetCDF with the NSIDC 12.5 km grid. Daily averages are now produced instead of swath data.

Figure 2-1 shows the weekly average of the melt pond fraction for second week of June 2009 (left) and a spatial trend of albedo for the second week of June derived from the data for all available years 2002-2011 (right)

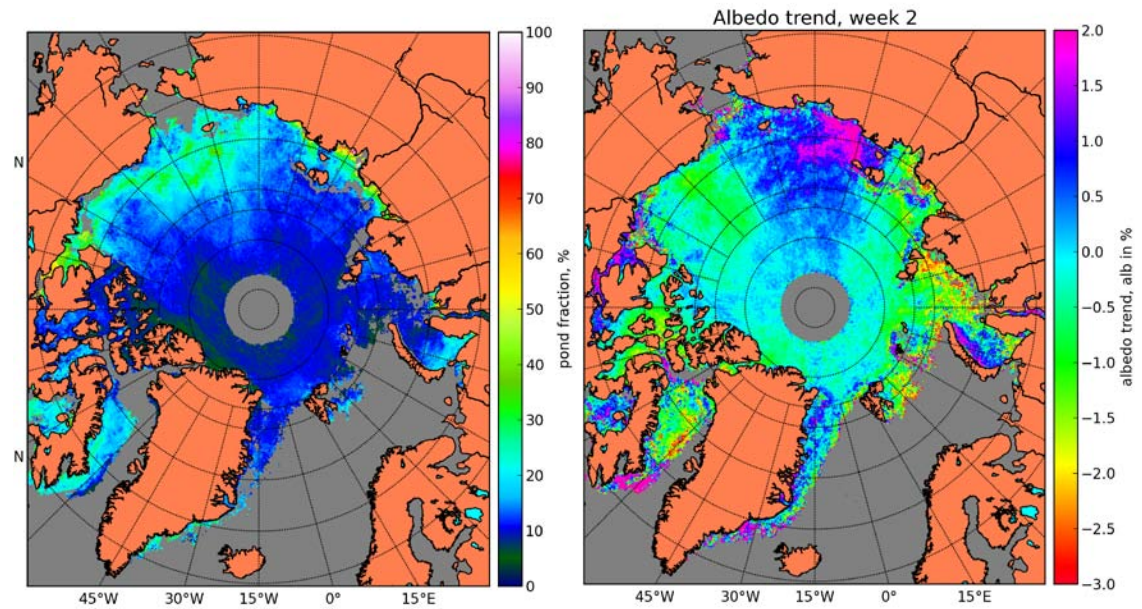


Figure 2-1: Example of MERIS products: (a) weekly average of *melt pond fraction for the second week of June 2009. Notice the melt onset in Beaufort sea and melt free MYI areas;* (b) *sea ice albedo trend for the second week of June for years 2002-2011. Notice the positive albedo trend in the East-Siberian Sea.*

3 Thin ice Thickness

Users are the ice service DMI and UCL (Seymour Laxon). The ice service of DMI receives our thin ice data operationally each day. Cooperation with UCL is about climatological analysis of thickness thin ice from SMOS and thick ice from Cryosat.

The SMOS derived ice-thickness product from University of Bremen has been demonstrated to the sea ice modelers at met.no for use in the data assimilation process. Here, The SMOS sea ice thickness data have been used for FRAMPS as initial sea ice thickness, together with OSISAF sea ice type data. Except during the summertime, SMOS generally provides good estimate of thin sea ice thickness up to 50 cm. For sea ice thickness over 50 cm, a thickness ice is denoted. This is useful when combined with the OSISAF multiyear sea ice type data to form an overall picture of the sea ice thickness.

Figure 3-1 shows the 1-day sea ice forecast of the European Arctic for January 17, 2014 (obtained from polarview.met.no). As can be seen, the ice north of Svalbard shows a clear increase towards the north. The sea ice drift pattern is generally consistent with the OSISAF satellite observed coarse resolution results.

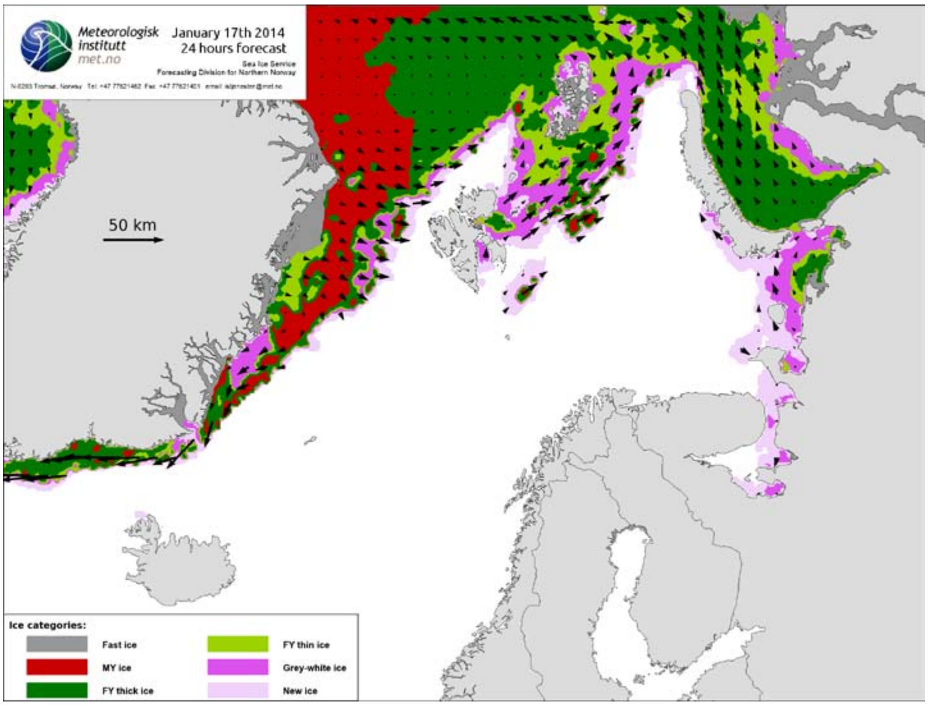


Figure 3-1-1: Sea ice forecast of the European Arctic for January 17, 2014

The ice –thickness products from SMOS has also been included into the operational ice service at met.no. The products are compared against Radarsat-2 images used in the operational ice chart production. From this comparison it is difficult to get a quantitative value quality but the product looked to be in good agreement with detection of thin and new frozen ice in the Radarsat-2 images.

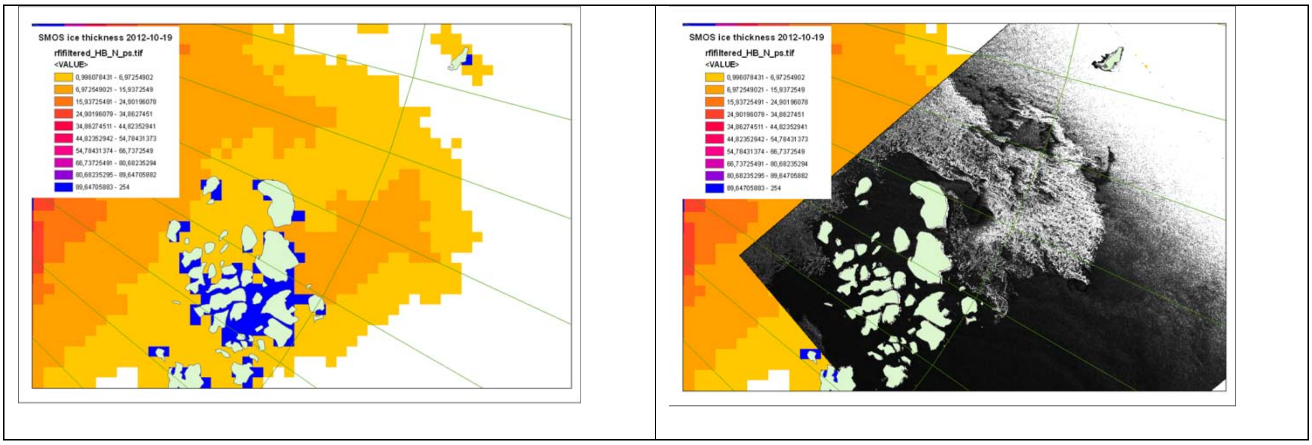


Figure 3-2-2: To the left is the smos ice-thickness product from 19. October 2012. The right image shows a Radarsat-2 dataset from the same day containing new frozen sea ice.

4 Sea ice forecast model of the Barents & Kara Seas (NERSC)

The users at TOTAL E&P as well as other main actors of the oil and gas exploration and production in the European Arctic have been regularly updated of the progress of the Barents and Kara Sea forecasting model and the products (Fig. 4-1). Several presentation of the sea ice forecast system have been given to users during the third period:

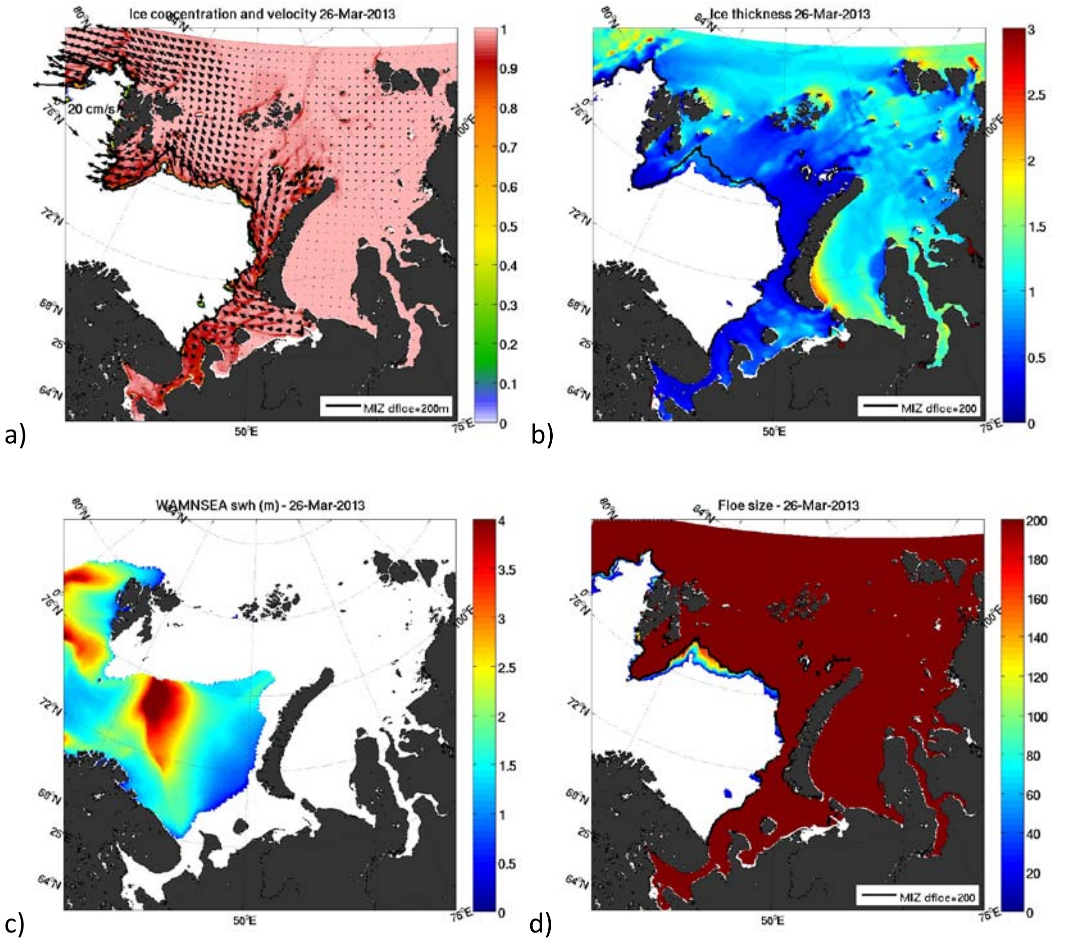


Figure 4-1 Forecast with the WIM forecast model for the 26th of Mars 2013, a) sea ice concentration and velocity, b) sea ice thickness (m), c) significant wave height (m) from met.no (WAMNSEA10km), and d) maximum floe size (m) produced by the WIM module. The impac

Continuous work has been done to keep the automatic Barents and Kara Seas forecast system operational and running. Manual recover and modifications of the system has been conducted when the automatic system has failed due to server shut downs or updates, or when data sources are missing or modified. On average keeping the system updated has taken one working day per week. The new wave-in-ice code has been implemented in the sea ice model as an option, and the input/output system in the model has been adjusted to handle relevant data. A parallel forecast system, and webpage, has been set up to run with the new wave-in-ice module active. The wave-in-ice forecast also includes maps of ice floe size (dfloe) as well as the transition line between the marginal ice zone and the pack ice (dfloe=200m). Validation to OSI-SAF 15% sea ice concentration has been performed within the automatic system and presented on the web pages. Further validation has been done offline, for instance model results have been compared to MODIS thin ice charts and OSI-SAF sea ice concentration.

5 The Vagabond monitoring (by CLS)

CLS provided sea ice monitoring service by SAR images for Eric Brossier on his sailing vessel Vagabond, during his expedition in Baffin Bay. Vagabond is an expedition yacht built in 2000, designed for sailing in ice, and is equipped to work as a moving base camp for scientists in Polar Regions. Vagabond left Brest, France, in May 2011 for a scientific expedition in Baffin Bay.

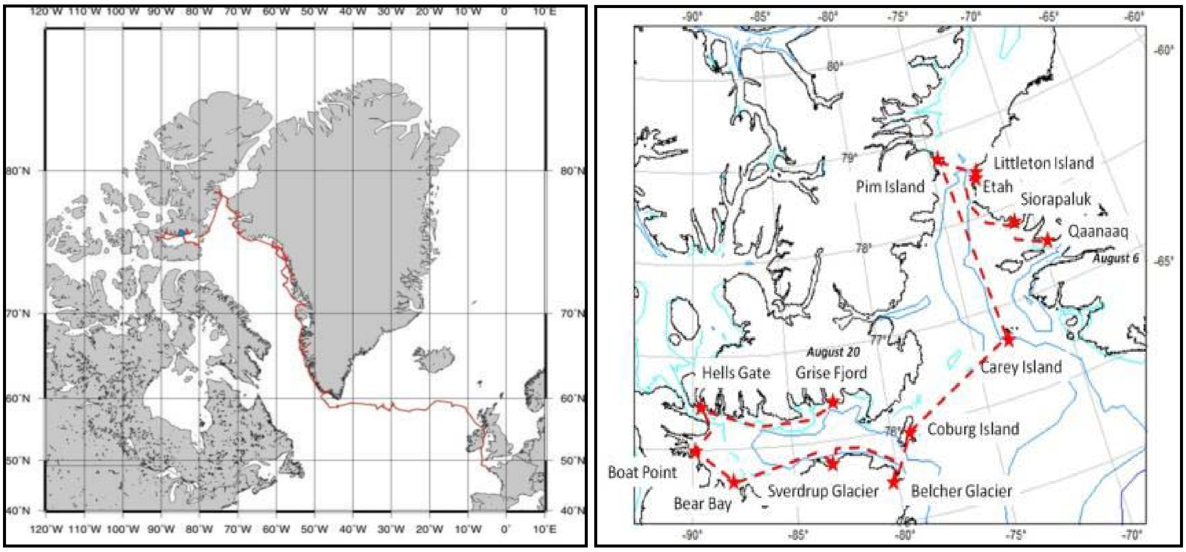


Figure 5-1 Route of Vagabond on October 31, 201: from Brest to Grise Fiord, Nunavut, Canada

From October 2011 to July 2012, Vagabond overwintered near the village of Grise Fiord, Ellesmere Island, Nunavut, Canada, and provided scientific measures in glaciology and oceanography for universities in Canada.

On a regular basis, CLS analyzed medium resolution SAR images centered on the Argos position of Vagabond. CLS radar analysts sent the results to Eric Brossier by email, each time providing both large view and zoomed images, along with wind maps when available. Data had to be compressed (less than 50 kB) due to his limited internet access. From June 2011 to November 2011, CLS analyzed 28 images, following the route of Vagabond. Some images had a real impact on Eric’s decisions.

On July 5th, Vagabond is stuck in Melville Bay. SAR image confirmed that ice is too thick for Vagabond to head towards North West, so Eric and his team decided to go back to allow the scientists to join an airport before the end of their mission.

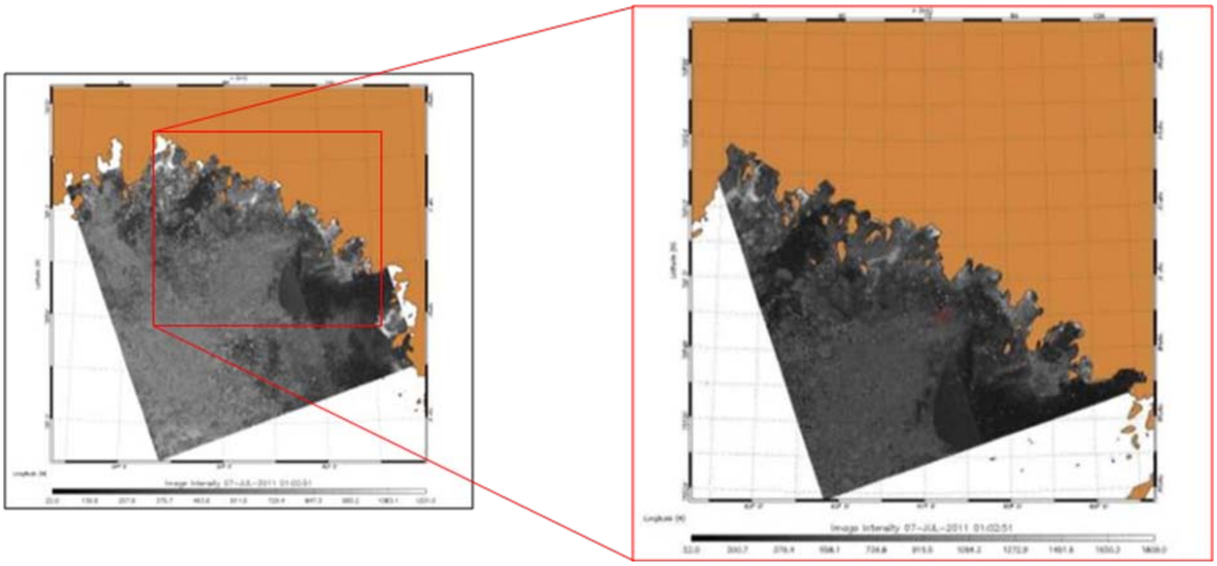


Figure 5-2 Vagabond stuck in Melville Ba, as imaged by ENVISAT on July 5th, 2011

Situation was better on July 12th, so Vagabond could continue its route to Qaanaaq, where another scientific team joined Eric and his family. On July 26th, Vagabond reached Qaanaaq, and waited for the beginning of "Ice and Ocean" mission, from August 6th to August 20th. On August 4th, Vagabond received in situ meteorological data from a Danish scientific team. These data reported high winds at Hans Island: 12.6 m/s, heading 215 degrees, south along the Kennedy Channel, and at a temperature of 4.8 degrees. By analyzing a SAR image acquired on the same day, we were able to compare these in situ information with SAR information, and we obtained pretty similar result: winds around 6 and 8 m/s, and a direction of 220°.

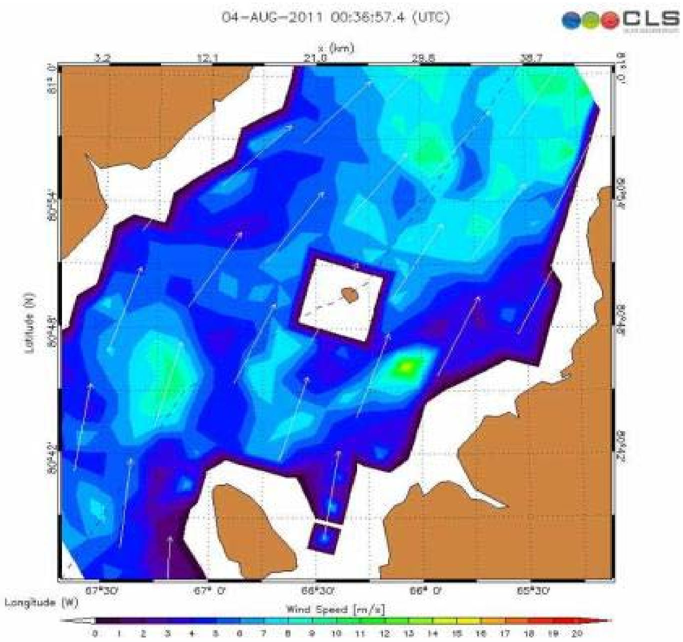


Figure 5-3 SAR-based retrieved winds measured by ASAR/ENVISAT on Aug. 4, 2011

On August 24th, Vagabond was protected from strong winds in a fjord near Grise Fiord. Wind map sent by CLS showed that the wind was blowing at approximately 20 m/s.

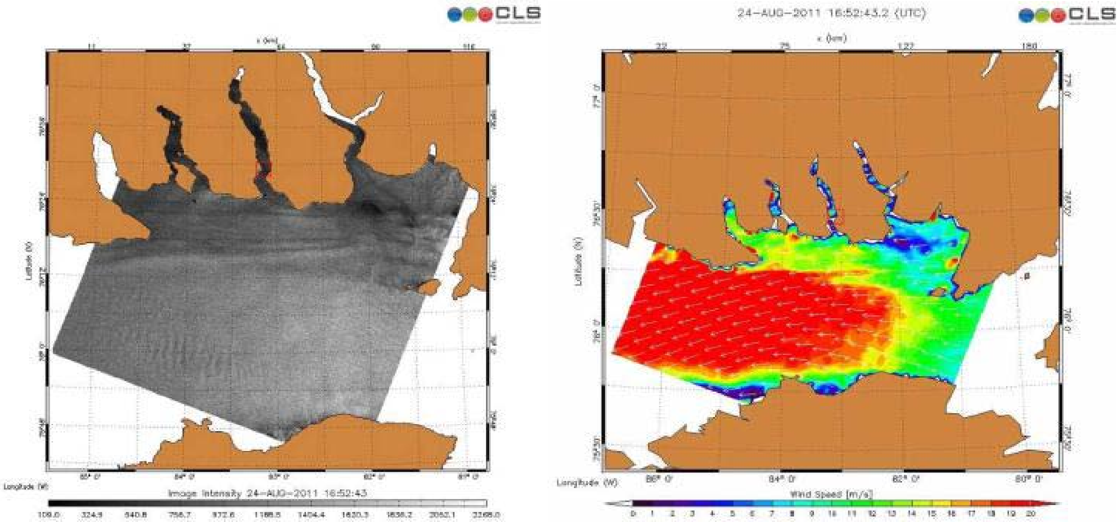


Figure 5-4 SAR-based retrieved winds measured by ASAR/ENVISAT on Aug. 24, 2011

On September 6th, Eric decided to use SAR images to slightly modify his plans. SAR images showed very strong winds at the potential overwinter site. Wind is stronger at the planned site (76°26.9'N, 84°41.1'W) than at the current location of Vagabond (76°40.0'N, 83°22.1'W) or at the previous overwinter site (76°30.0'N, 83°56.0'W). Choosing this location was crucial, as the sailing vessel were stuck in this ice for 10 months. On October 3rd, the sea started to freeze. We noticed on the SAR images that the ice was covering a huge area. October 11th marked the day when Vagabond was stuck for 10 months. Eric could start his scientific activities, and waited for the ice to be solid enough to allow visitors to come from the nearby village.

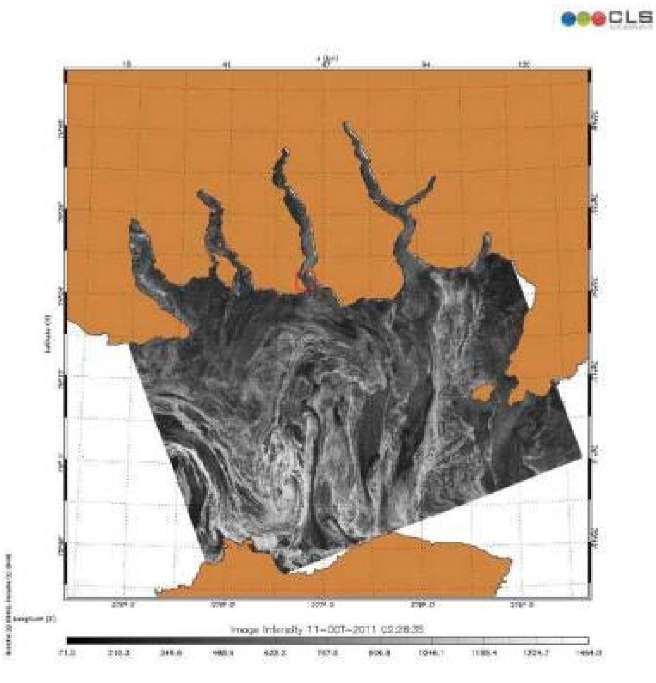


Figure 5-5 Sea ice imaged by ENVISAT on October 11, 2011

6 Iceberg monitoring service for offshore oil rig safety (and maritime security) (by CLS)

The aim of the Icebergs Monitoring Service is to allow a surveillance of the ice conditions in the vicinity of the site of interest (Oil & Gas platforms, seismic survey areas,).

The Icebergs Monitoring Service is based on satellite technologies for iceberg detection, on numerical modelling for icebergs drifting, and GIS/web map server for the visualisation of the ice reports. The idea is to provide on a regular basis an Icebergs Situation Map giving the icebergs conditions in real time and in a few days forecast.

The service is adaptable according to the level of surveillance required. Frequency of bulletins (Icebergs Situation Maps) can be decreased or increased, and specific SAR scenes acquisition can be programmed to complete the routine altimetry and SAR detections.

6.1 Proposed methodology

Three levels of surveillance are defined around the location of interest, according to the level of alert to rise. These levels of alert and the corresponding areas are defined arbitrary and can be adjusted to comply with the user's requirements for ice management:

- Surveillance mode: monitor the whole area and provide a seasonal surveillance of the ice and icebergs conditions by using altimetry and medium-resolution SAR imagery every 2-3 days: production of weekly bulletin
- Second level if icebergs are entering a Warning area closed to the area of interest by using daily medium-resolution SAR imagery: production of daily report
- Icebergs are entering the Critical area (e.g. 7-day interval between the icebergs and the platform): late SAR images programming enabled.

In order to provide an operational service and offer the necessary ability to react to sudden alerts, the icebergs monitoring service has to rely on an operational chain. This operational chain is the main structure of this service and has been especially developed for this purpose (see Figure 6).

6.2 BANQUIS operational chain

To answer the client requirement for operationality and reactivity, all the systems detailed in the first paragraphs have to be integrated into a unique operational chain. The integration of all the systems (altimetry, radar, model, SIG) is a complicated task. All the inter-connections have to be well identified to guarantee that the end product will deliver the expected service. Several levels of connections have to be established between the different components:

1. Collect of Icebergs detections from three different systems:
    - Positions of Icebergs observed with satellite altimetry
    - Positions of Icebergs observed with SAR imagery
    - Positions of Icebergs observed “in situ” (from helicopter, vessel watch, Argos beacons)
2. Acquisition of the necessary oceanographic data (wind, current, temperature, tides, bathymetry)

3. Integration of the position of observed icebergs and necessary oceanographic forecast data into the Drift Model
4. Integration of icebergs monitoring results in a GIS for the end-user:
    - Results of altimetry detection
    - Results of SAR detection
    - Results of drift modelling

The processing chain collects the information on icebergs observations (altimetry, radar, in situ), acquire the necessary metocean data in due time, and run the drift model in order to forecast the icebergs positions. All the results (from altimetry analyses, radar analyses, model prediction) are then exported to a GIS to allow further analyses from an expert or visualisation for the end-user.

The operational chain, named BANQUIS (Bulletin for the Analyse and Quantification of Icebergs by Satellite), has been developed in the frame of the project to orchestrate these different tasks.

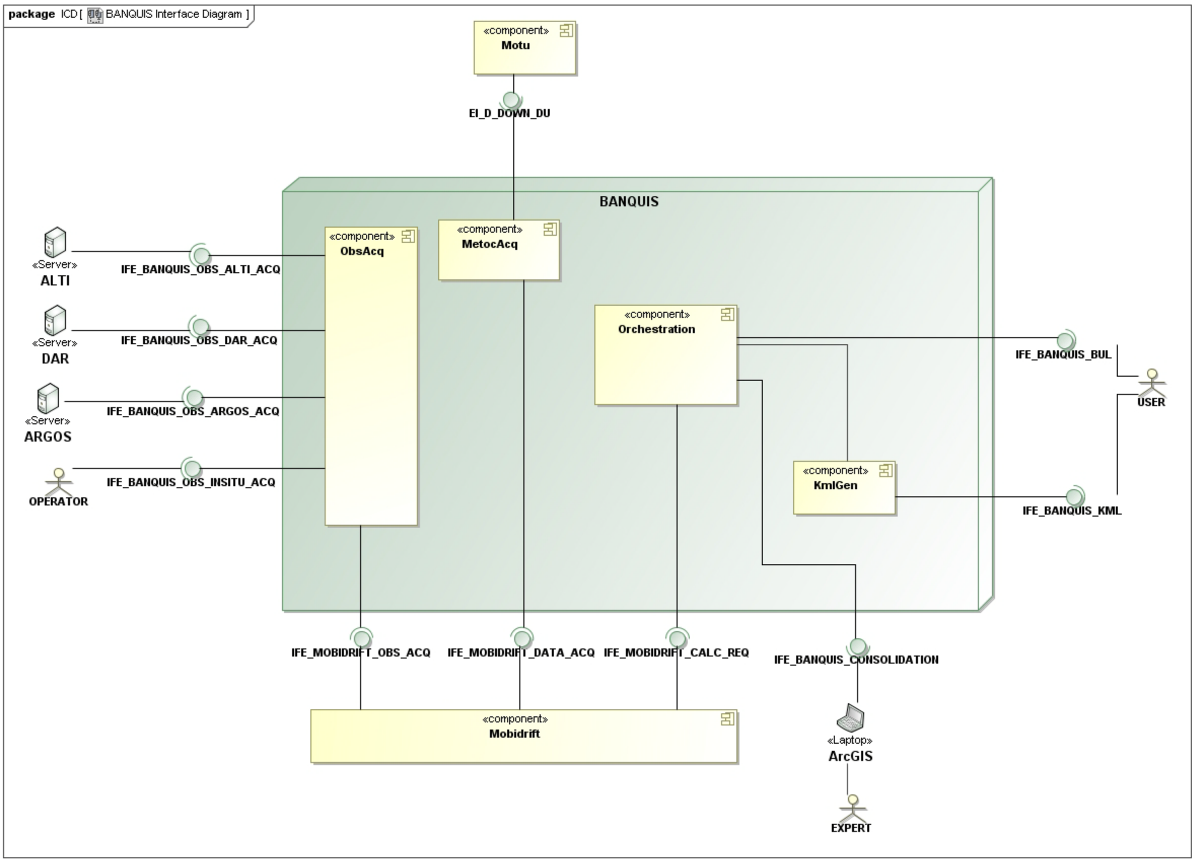


Figure 6-1 : Processing chain for the Iceberg Monitoring Service

6.3 Real-case demonstration

The real-case demonstration is based on July 2012 data. For this purpose, altimetry Cryosat data from July 2012 was analysed using the 3-peaks algorithm (see Deliverable D8.1 for additional information regarding altimeter-based iceberg detection).

4 radar images were made available for the demonstration period thanks to the Datawarehouse mechanism (DWH_CORE11 dataset) and have been analysed by the CLS VIGISAT operators:

- 10/07/2012 05:45 : RADARSAT-2 image, ScanSAR Wide, HH, HV polarization
- 12/07/2012 04:46 : RADARSAT-2 image, ScanSAR Wide, HH, HV polarization
- 31/07/2012 05:32 : RADARSAT-2 image, ScanSAR Wide, HH, HV polarization
- 02/08/2012 04:33 : RADARSAT-2 image, ScanSAR Wide, HH, HV polarization

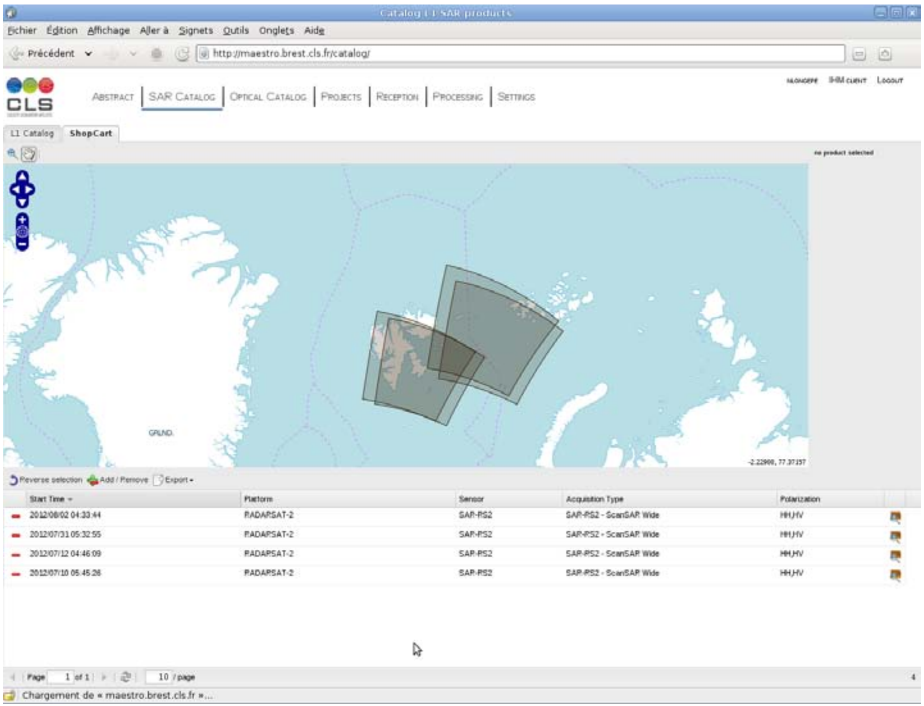


Figure 6-2 : Snapshot of CLS SAR Catalog with the 4 radar images analysed

BANQUIS operational chain is activated in order to recreate the real conditions for this demonstration. Altimetry and SAR detection results for the demonstration period are ingested in the BANQUIS Observation Module. Oceanographic data are acquired for the period from 1st July to 5th August 2012 and the Mobidrift Module is run in simulating the real-time conditions. The following section describes the Ice report generated with the Ice report Module.

6.4 Ice report

Every day, the ice reports are generated for n pre-defined areas. For the purpose of the demonstration, ice reports are generated for the 3 areas described in Section 2.1: the seasonal, warning and critical areas. In this case study, there were no icebergs detected in the Warning and the Critical areas as defined in Section 2.1. The report presented below is for the seasonal area.

Figure 8 presents an example of ice report generated for visualization in Google Earth.

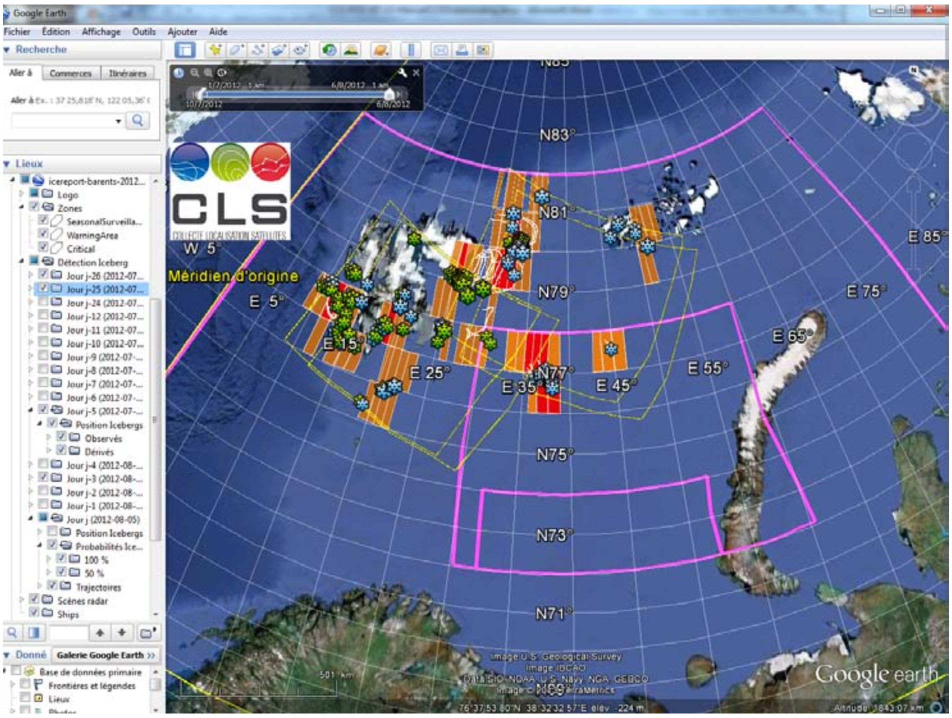


Figure 6-3 : Snapshot of an Ice report for visualization in Google Earth: Green flocks for model drifted icebergs from SAR observations, blue flocks for SAR observations (if any on the D-day), and purple for altimetry detections or model drifted from altimetry detection.

The report is presented by default for the D-day of report generation. Iceberg reports are provided for 12 days in the past and 3 days in forecast. Furthermore, probability of presence of icebergs is also presented in the ice report. The probability of presence of icebergs is the result of the Monte Carlo algorithm activated in the Mobidrift simulation (see Deliverable D7.3 "Forecasting in Antarctica" due at T0+34). Red squares show the area of 50% probability of occurrence of icebergs. Orange plus red squares show the area of 100% probability of occurrence of icebergs. Trajectories and probability grids are only given for the D-day and 3 days forecast of report.

7 Iceberg monitoring for the Vendée Globe challenge (by CLS)

The Vendée Globe is a round-the-world single-handed yacht race, sailed non-stop and without assistance. The race was founded by Philippe Jeantot in 1989, and since 1992 has taken place every four years. The 2012-2013 edition started on November 10, 2012 with 20 participants. The race is open to monohull yachts conforming to the Open 60 class criteria (overall length, draught, appendages and stability, as well as numerous other safety features).

The last participants crossed the Cape Horn some days ago (as of Jan. 22, 2013) and as a consequence, the iceberg monitoring services ended. Nonetheless, the race have not finished yet, and this service will be fully described in the final deliverable D9.2 due at T0+36.

The role of CLS during the Vendee Globe challenge was notably to ensure that all the skipers naviguate in safe waters:

- by setting with the organisers some ice gates, obligatory waypoints which are segment on a given latitude that the sailors must cross by putting either of the coordinates to starboard.
- by providing daily iceberg report including detected icebergs with forecast locations

To perform such an integrated service, CLS have used not only SAR and altimeter iceberg detections (see deliverables D5, D8.1) but also its drift model, the so-called MOBIDRIFT described in D7.3 (due at T0+34).

7.1 Phase 1

During the first phase of the service (from July to November 2012), CLS used altimeter-based detections and acquired 30 radar scenes around the Antarctica as seen by Figure 9. The aim of this phase was threefold:

- To evaluate the general situation in the South
- To verify and adjust the detection and drift process
- To define the route and pre-define the location of the ice gates.

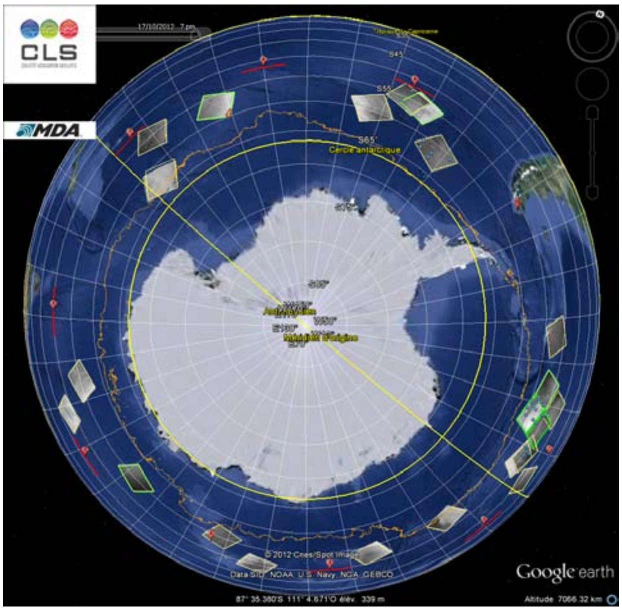


Figure 7-1 SAR acquisitions during phase #1 from July to November 2012

The ice situation nearby South Georgia was quite critical mid-August since the large C19c iceberg was in the area (a remnant of the larger Iceberg C-19, which calved off Antarctica's Ross Ice Shelf in May 2002), and many ice fragments could be detected nearby. These small icebergs drifted eastward as confirmed by the two consecutive acquisitions on Aug. 17 and Sept 3, 2012. A set of other SAR acquisitions enabled us to adjust the drift process. This will be documented in the deliverables of WP7.

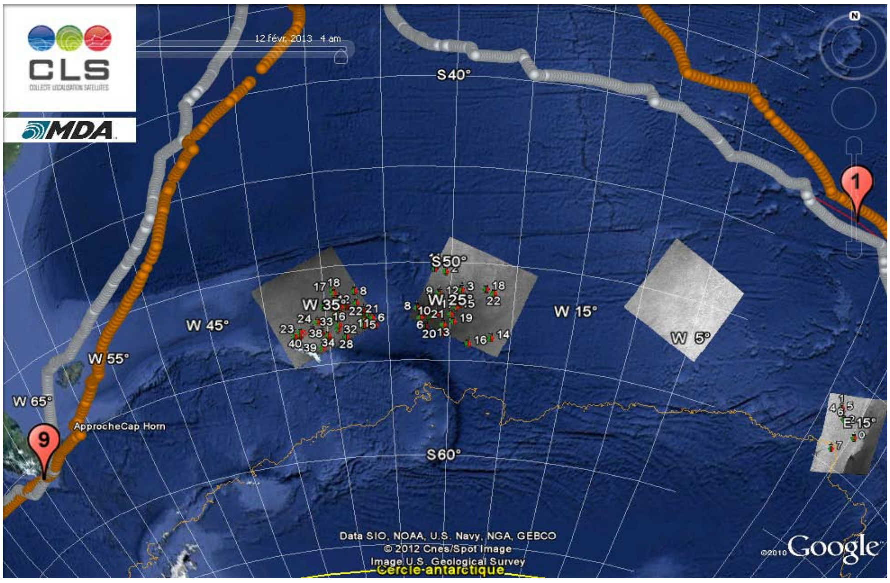


Figure 7-2 Acquisitions with detected icebergs on Aug 17, 2012 (left frame) and on Sept. 3, 2012 (central frame)

7.2 Phase 2/3

During the 2nd phase of the service (from the start of the race on Nov. 10, 2012 to the crossing of Cape Horn for the 1st participant), a set of SAR images was acquired taking into account the progress of the sailboats. One of the main constraints for data acquisitions was the fact that the race director could only change the position of a gate N if no entry had already crossed the previous gate N-2. This implied to plan far ahead the SAR acquisitions while keeping a day-to-day awareness of the race. For this second phase, the BANQUIS chain were used to produce the daily ice reports which were sent to the race organizer every morning.

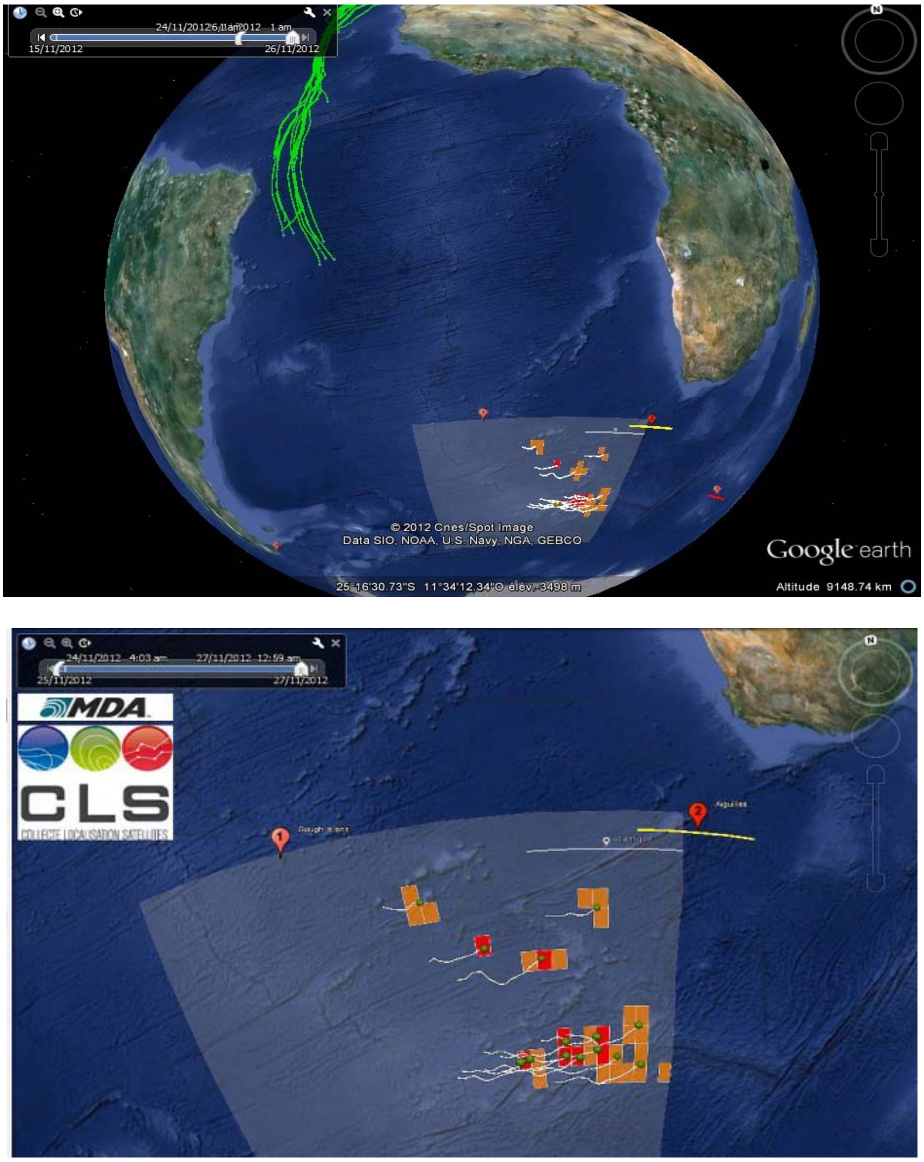


Figure 7-3 Repositioning the "Aiguilles ice gate" thanks to SAR-based detected icebergs and drift modelling: Overview of the sailboats' location on Nov. 27, 2012 (Top) and change of the location of the ice gate (Bottom)

During phase #3 (starting from about January 1st, 2013), a continuous monitoring of the ice situation have been carried out for all the participants. Daily ice reports were generated as well. This phase ended on January 17, 2013.

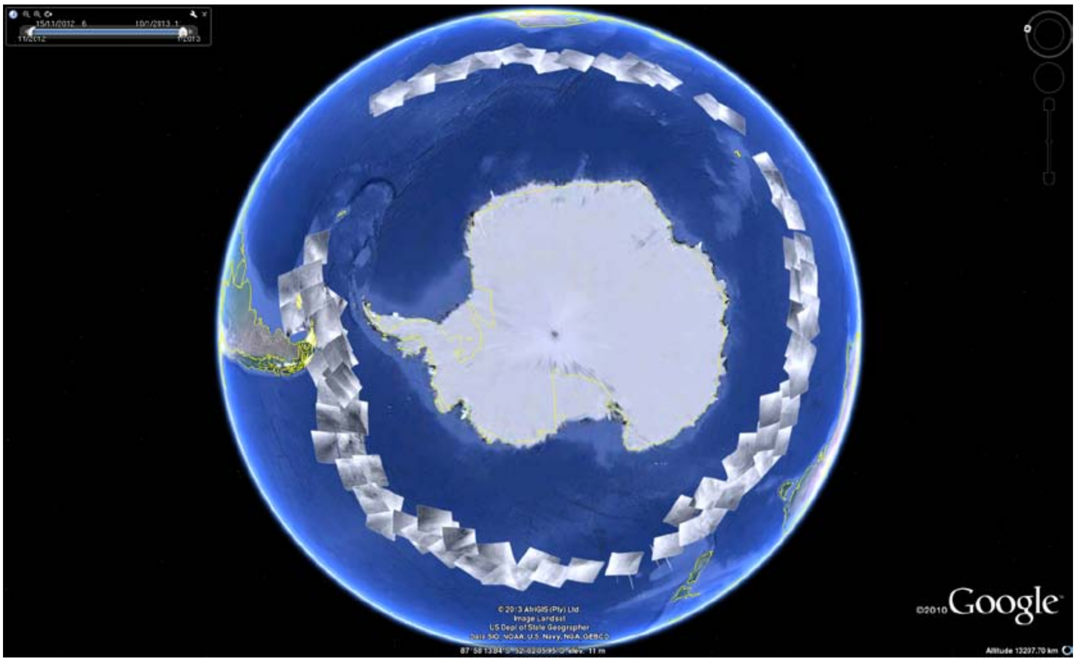


Figure 7-4 Radar scenes acquired in the frame of VG2012 during phase 1 and phase 2

CLS service enabled a safe navigation in Antarctica waters during the 2012-2013 Vendee-Globe Challenge since no collision with icebergs has been reported.

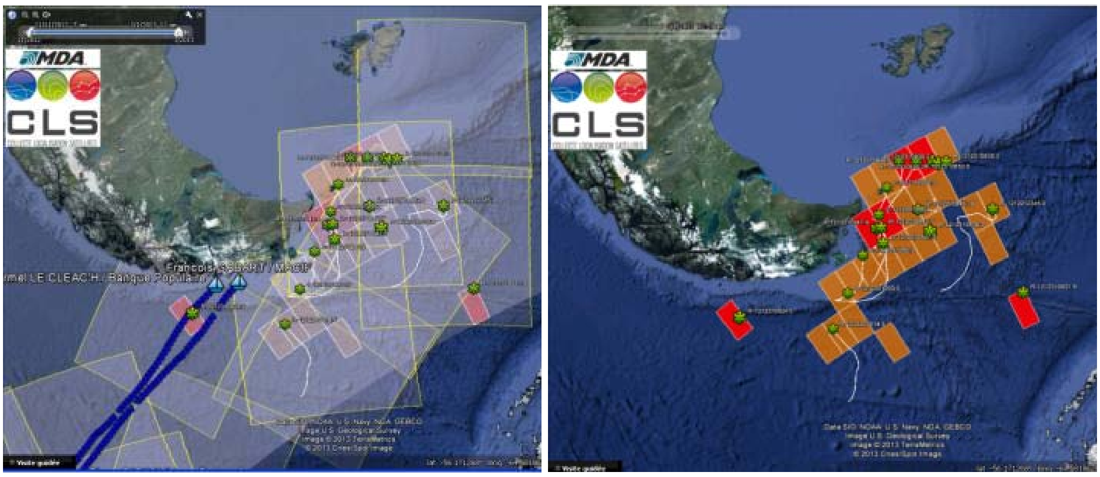


Figure 7-5 Ice bulletin with all data displayed (Left) and icebergsituation (Right) for Cape Horn

During the following months after the end of the race, several meetings with race organizer took place and back-and-forth discussions took place regarding:

- The ice bulletins: Especially, we collected detailed feedbacks which will be used to further adjusted the ice bulletins to ease the communications towards skippers but also general public.
- Data format exchange to remain compliant with navigation software
- MOBIDRIFT output and visualization: issue when re-run daily ice bulletins with different metoc data (case when re-analyse metoc data are available a posteriori), high resolution ice bulletin for risky area (e.g. Cape Horn).

8 Demonstration of iceberg detection in Kara Seas (by CLS)

Starting from approximately July 20, 2012, the Russian Arctic and Antarctic Research Institute (AARI) carried out an expedition in the area east of Novaya Zemlya. They were interested in obtaining data on iceberg distribution near the northern coast of Novaya Zemlya. At the same time, the scientific research ship/icebreaker Mikhail Somov was on site.

To perform the iceberg demonstration service, we tried to acquire two images via the datawarehouse mechanism in the ”fast24” mode. Unfortunately, the image acquired on Aug 6., 2012 was received 3 days after acquisition which was too long for this NRT demonstration. The other one acquired on Aug. 9 was received "just 24 hours" after the acquisition.

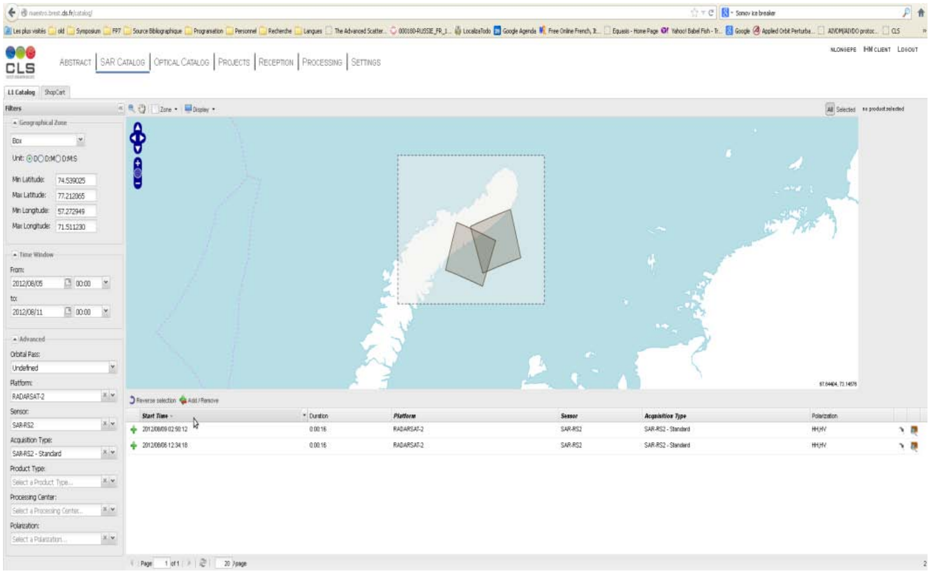


Figure 8-1 Coverage of the two RS2 scenes acquired via the DWH mechanism for the AARI iceberg demonstration.

The most attractive regions were areas close to glaciers like Vershinskogo, Roze, etc... As requested by AARI, the following iceberg reports were produced (see Figure 13 and Figure 14).

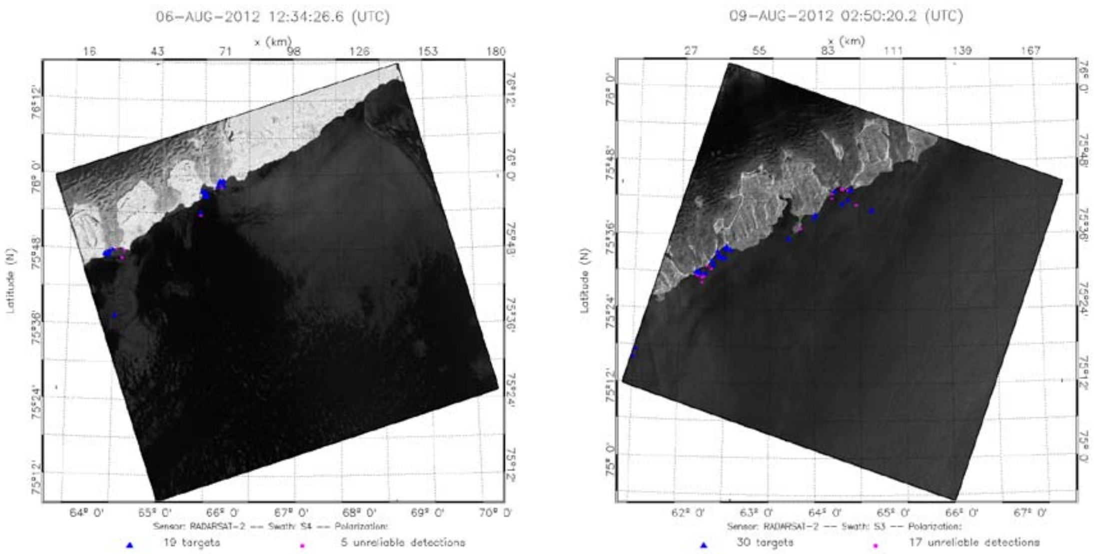
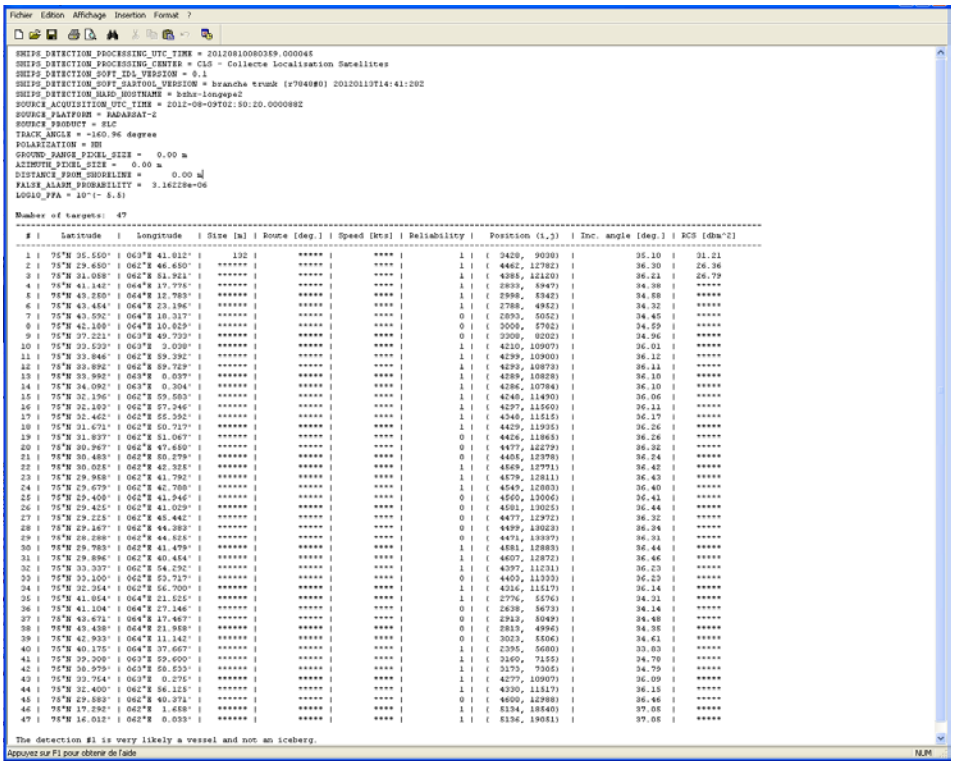


Figure 8-2 Iceberg reports generated from the two RS2 images acquired on Aug. 6-9, 2012



```
SHIPS_DETECTION_PROCESSING_UTC_TIME = 20120810080359.000045
SHIPS_DETECTION_PROCESSING_CENTER = CLS - Collecte Localisation Satellites
SHIPS_DETECTION_SOFT_IDL_VERSION = 0.1
SHIPS_DETECTION_SOFT_SARTOOL_VERSION = branche trunk [r7040#0] 20120113T14:41:20Z
SHIPS_DETECTION_HARD_HOSTNAME = bzhx-longepe2
SOURCE_ACQUISITION_UTC_TIME = 2012-08-09T02:50:20.000088Z
SOURCE_PLATFORM = RADARSAT-2
SOURCE_PRODUCT = SLC
TRACK_ANGLE = -160.96 degree
POLARIZATION = HH
GROUND_RANGE_PIXEL_SIZE =   0.00 m
AZIMUTH_PIXEL_SIZE =   0.00 m
DISTANCE_FROM_SHORELINE =      0.00 m
FALSE_ALARM_PROBABILITY =  3.16228e-06
LOG10_PFA = 10^(- 5.5)

Number of targets:  47
--------------------------------------------------------------------------------------------------------------------------------------
 # |   Latitude    |  Longitude    | Size [m] | Route [deg.] | Speed [kts] | Reliability |  Position (i,j)  | Inc. angle [deg.] | RCS [dbm^2]
--------------------------------------------------------------------------------------------------------------------------------------
 1 | 75°N 35.550' | 063°E 41.012' |    132 |      ***** |      **** |    1 | ( 3420,  9030) |    35.10 |  31.21
 2 | 75°N 29.650' | 062°E 46.650' | ****** |      ***** |      **** |    1 | ( 4462, 12782) |    36.30 |  26.36
 3 | 75°N 31.058' | 062°E 51.921' | ****** |      ***** |      **** |    1 | ( 4385, 12120) |    36.21 |  26.79
 4 | 75°N 41.142' | 064°E 17.775' | ****** |      ***** |      **** |    1 | ( 2833,  5947) |    34.38 |  *****
 5 | 75°N 43.250' | 064°E 12.783' | ****** |      ***** |      **** |    1 | ( 2998,  5342) |    34.58 |  *****
 6 | 75°N 43.454' | 064°E 23.196' | ****** |      ***** |      **** |    1 | ( 2788,  4952) |    34.32 |  *****
 7 | 75°N 43.592' | 064°E 10.317' | ****** |      ***** |      **** |    0 | ( 2893,  5052) |    34.45 |  *****
 8 | 75°N 42.100' | 064°E 10.029' | ****** |      ***** |      **** |    0 | ( 3000,  5702) |    34.59 |  *****
 9 | 75°N 37.221' | 063°E 49.733' | ****** |      ***** |      **** |    0 | ( 3308,  8202) |    34.96 |  *****
10 | 75°N 33.533' | 063°E  3.038' | ****** |      ***** |      **** |    1 | ( 4210, 10907) |    36.01 |  *****
11 | 75°N 33.846' | 062°E 59.392' | ****** |      ***** |      **** |    1 | ( 4299, 10900) |    36.12 |  *****
12 | 75°N 33.892' | 062°E 59.729' | ****** |      ***** |      **** |    1 | ( 4293, 10873) |    36.11 |  *****
13 | 75°N 33.992' | 063°E  0.037' | ****** |      ***** |      **** |    1 | ( 4289, 10828) |    36.10 |  *****
14 | 75°N 34.092' | 063°E  0.304' | ****** |      ***** |      **** |    1 | ( 4286, 10784) |    36.10 |  *****
15 | 75°N 32.196' | 062°E 59.583' | ****** |      ***** |      **** |    1 | ( 4248, 11490) |    36.06 |  *****
16 | 75°N 32.103' | 062°E 57.346' | ****** |      ***** |      **** |    1 | ( 4297, 11560) |    36.11 |  *****
17 | 75°N 32.462' | 062°E 55.392' | ****** |      ***** |      **** |    1 | ( 4348, 11515) |    36.17 |  *****
18 | 75°N 31.671' | 062°E 50.717' | ****** |      ***** |      **** |    1 | ( 4429, 11935) |    36.26 |  *****
19 | 75°N 31.837' | 062°E 51.067' | ****** |      ***** |      **** |    0 | ( 4426, 11865) |    36.26 |  *****
20 | 75°N 30.967' | 062°E 47.650' | ****** |      ***** |      **** |    0 | ( 4477, 12279) |    36.32 |  *****
21 | 75°N 30.483' | 062°E 50.279' | ****** |      ***** |      **** |    0 | ( 4405, 12378) |    36.24 |  *****
22 | 75°N 30.025' | 062°E 42.325' | ****** |      ***** |      **** |    1 | ( 4569, 12771) |    36.42 |  *****
23 | 75°N 29.958' | 062°E 41.792' | ****** |      ***** |      **** |    1 | ( 4579, 12811) |    36.43 |  *****
24 | 75°N 29.679' | 062°E 42.708' | ****** |      ***** |      **** |    1 | ( 4549, 12883) |    36.40 |  *****
25 | 75°N 29.400' | 062°E 41.946' | ****** |      ***** |      **** |    0 | ( 4560, 13006) |    36.41 |  *****
26 | 75°N 29.425' | 062°E 41.029' | ****** |      ***** |      **** |    0 | ( 4581, 13025) |    36.44 |  *****
27 | 75°N 29.225' | 062°E 45.442' | ****** |      ***** |      **** |    0 | ( 4477, 12972) |    36.32 |  *****
28 | 75°N 29.167' | 062°E 44.383' | ****** |      ***** |      **** |    0 | ( 4499, 13023) |    36.34 |  *****
29 | 75°N 28.288' | 062°E 44.625' | ****** |      ***** |      **** |    0 | ( 4471, 13337) |    36.31 |  *****
30 | 75°N 29.783' | 062°E 41.479' | ****** |      ***** |      **** |    1 | ( 4581, 12883) |    36.44 |  *****
31 | 75°N 29.896' | 062°E 40.454' | ****** |      ***** |      **** |    1 | ( 4607, 12872) |    36.46 |  *****
32 | 75°N 33.337' | 062°E 54.292' | ****** |      ***** |      **** |    1 | ( 4397, 11231) |    36.23 |  *****
33 | 75°N 33.100' | 062°E 53.717' | ****** |      ***** |      **** |    0 | ( 4403, 11333) |    36.23 |  *****
34 | 75°N 32.354' | 062°E 56.700' | ****** |      ***** |      **** |    1 | ( 4316, 11517) |    36.14 |  *****
35 | 75°N 41.054' | 064°E 21.525' | ****** |      ***** |      **** |    1 | ( 2776,  5576) |    34.31 |  *****
36 | 75°N 41.104' | 064°E 27.146' | ****** |      ***** |      **** |    0 | ( 2638,  5673) |    34.14 |  *****
37 | 75°N 43.671' | 064°E 17.467' | ****** |      ***** |      **** |    0 | ( 2913,  5049) |    34.48 |  *****
38 | 75°N 43.438' | 064°E 21.958' | ****** |      ***** |      **** |    0 | ( 2813,  4996) |    34.35 |  *****
39 | 75°N 42.933' | 064°E 11.142' | ****** |      ***** |      **** |    0 | ( 3023,  5506) |    34.61 |  *****
40 | 75°N 40.175' | 064°E 37.667' | ****** |      ***** |      **** |    1 | ( 2395,  5680) |    33.83 |  *****
41 | 75°N 39.300' | 063°E 59.600' | ****** |      ***** |      **** |    1 | ( 3160,  7155) |    34.70 |  *****
42 | 75°N 38.979' | 063°E 58.533' | ****** |      ***** |      **** |    1 | ( 3173,  7305) |    34.79 |  *****
43 | 75°N 33.754' | 063°E  0.275' | ****** |      ***** |      **** |    1 | ( 4277, 10907) |    36.09 |  *****
44 | 75°N 32.400' | 062°E 56.125' | ****** |      ***** |      **** |    1 | ( 4330, 11517) |    36.15 |  *****
45 | 75°N 29.583' | 062°E 40.371' | ****** |      ***** |      **** |    0 | ( 4600, 12988) |    36.46 |  *****
46 | 75°N 17.292' | 062°E  1.658' | ****** |      ***** |      **** |    1 | ( 5134, 18540) |    37.05 |  *****
47 | 75°N 16.012' | 062°E  0.033' | ****** |      ***** |      **** |    1 | ( 5136, 19051) |    37.05 |  *****

The detection #1 is very likely a vessel and not an iceberg.
```

Figure 8-3 Iceberg detection report in .txt format generated from the RS2 image acquired on Aug. 9, 2012.

The feedback from AARI is quite good. Among the different detected targets, CLS reported a potential vessel, which was confirmed by AARI as the “Mikhail Somov” vessel.

9 Automatic SAR ice classification provided as an Online service

The procedure of RADARSAR-2 SAR image sea ice classification is described in D5.4 and provides the base of the on-line service available at http://web.nersc.no/project/maires/catalog.php.

Below is a screenshot of the service page with some classification results for the February 6 2013.

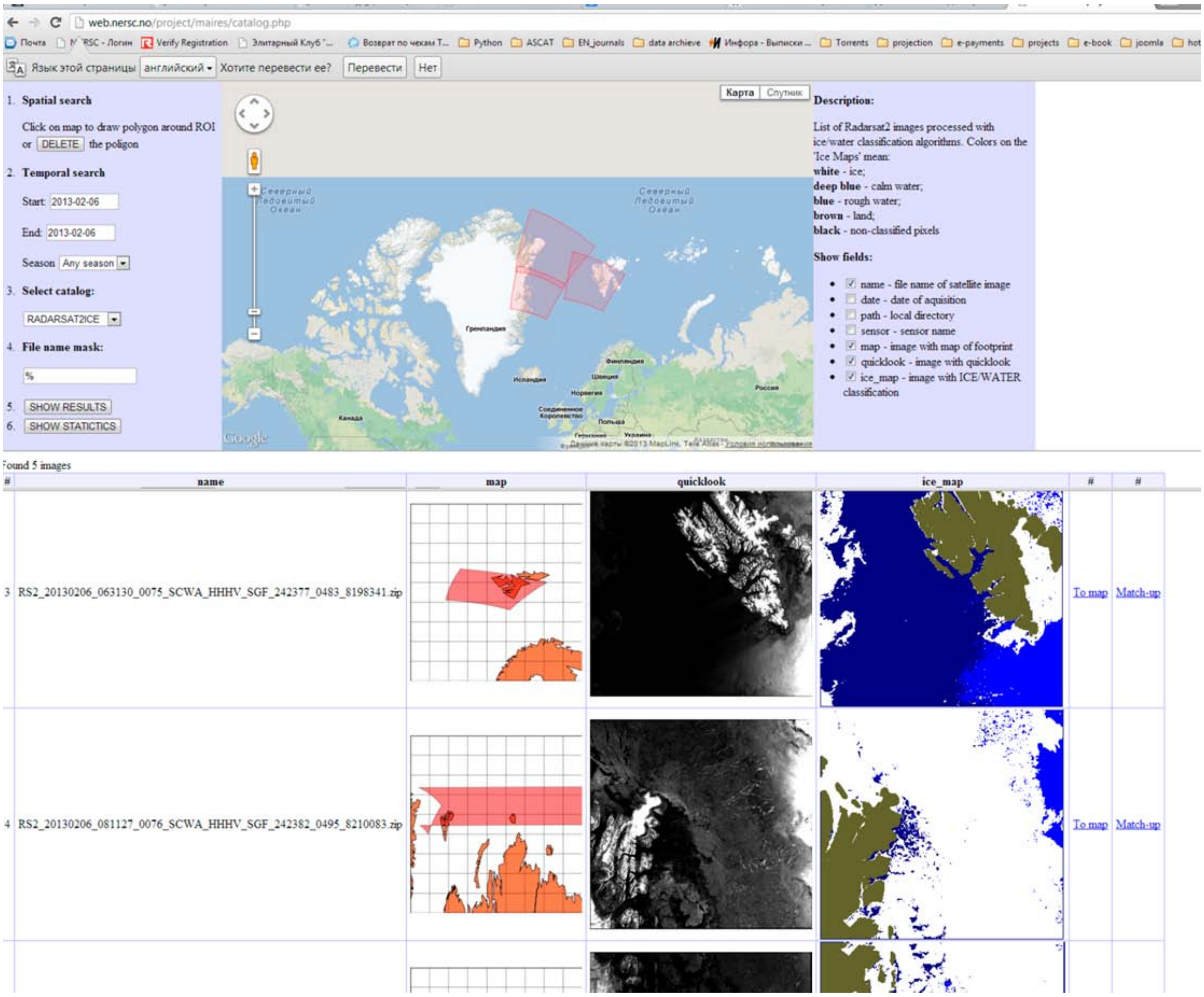


Fig. 9-1. Screenshot of sea ice classification service page.

In the menu on the left one should select RADARSAT2ICE catalogue in order to use the described service. The dates (Temporal search: Start / End) should be selected. How much information for selected dates will be displayed depends on the choice of the fields on the right. The information will be presented in a table and in the right part of the user menu the names of the possible fields of that table are listed. The possibilities are the following:

- name – file name of satellite image

- date – acquisition date
- path – the name of the local directory
- sensor – sensor name
- map – a part of global map with the margins of the image overlaid
- quick-look – a small low resolution picture of the image
- ice map – a map with the results of classification based on SVMs.

At last the SHOW RESULTS button should be clicked. The list of images (quick-looks) and classification results for selected dates will appear in the table below the interface of the service. The provided classes are:

- ice white
- calm water dark blue
- rough water blue
- land green
- unclassified pixels black.

Activation of the button SHOW STATISTICS will display statistics for selected dates – how many images are there in the dataset for the selected period. The position of the images will be shown on the global map. This statistic function can be very useful in the beginning of image analysis since it shows data availability for the period of interest.

END OF DOCUMENT