S5 - Service Portfolio Specifications

C-CORE Report R-12-007-719

Revised February 2012

c-core
Innovative Engineering Solutions

This page is intentionally left blank

S5 - Service Portfolio Specifications

Prepared by:

C-CORE

Prepared for:

ESA - ESRIN
Via Galileo Galilei
CP64
I-00044 Frascati
Italy

C-CORE Report:
R-12-007-719

Revised February 2012

C-CORE
Captain Robert A. Bartlett Building
Morrissey Road
St. John's, NL
Canada A1B 3X5

T: (709) 737-8354
F: (709) 737-4706

Info@ccore.ca
www.c-core.ca

REPORT QA Review

Contract Report No.	R-12-007-719		
Business Area	*Earth Observation*		
Document Title	**S5 – Service Portfolio Specifications**		
Date:	**Feb. 7/2012**	**Report Authored by:**	**Thomas Puestow**
Fiscal Year	**2010-2011**		

Client:	**ESA**				
Client Email:	**ola.grabak@esa.int**				
Project	**Polar View**				
Client's Contract Reference	ESRIN/Contract No. 19276/05/I-EC				
Is this report Confidential to the Client?		**Yes**	☐	**No**	☒

Technical Review *(complete attached checklist)*	Name	**Date**	02/07/2012
Technical Review* Not Applicable ☐ *(complete attached checklist)*	Name	**Date**	
Format & Layout (Rosalie Healey, Diane Seaward, Deirdre Greene, Tina Carrell) *(complete attached checklist)*	Name	**Date**	
Final Approval C-CORE – VP CARD/LOOKNorth – Executive Director	Name President & CEO	**Date**	02/07/2012

*If Required

Please submit a completed copy of this form to Rosalie.

Enclose *Project Performance Evaluation Form* for the client with the final report submission

The correct citation for this report is:

C-CORE (2012) S5 – Service Portfolio Specifications. C-CORE Report R-12-007-719 v3.2, January 2012.

Project Team
Thomas Puestow (Project Manager)
Polar View Team

REVISION HISTORY

VERSION	SVN #	NAME	COMPANY	DATE OF CHANGES	COMMENTS
1.0	n/a	Thomas Puestow	C-CORE	July 2006	Release to ESA
2.0	n/a	Thomas Puestow	C-CORE	July 2007	Release of revised version to ESA
3.0	n/a	Thomas Puestow	C-CORE	October 2008	Release of revised version to ESA
3.1	n/a	Thomas Puestow	C-CORE	February 2011	Release of revised version to ESA
3.2	n/a	Thomas Puestow	C-CORE	February 2012	Release of Revised version to ESA

DISTRIBUTION LIST

COMPANY	NAME	NUMBER OF COPIES
ESA	Ola Grabak	1
Polar View Team		1

TABLE OF CONTENTS

1 INTRODUCTION

The service portfolio specifications document is intended as a technical handbook describing the following technical aspects of each element in the service portfolio:

- Service overview
  - Description of products, algorithms, input data sources and contact details
- Service specifications
  - Available levels of service coverage and customization available
- Standards
  - Applicable user and technical standards, quality control and references
- Service portfolio upgrade
  - Future upgrades and improvements of the existing service lines, including network technology, service delivery and performance enhancement and pricing structures

2 SEA ICE AND ICEBERGS

2.1 Ship and Iceberg Monitoring	
Product Description	• Iceberg and ship detection

All processing algorithms	• **Iceberg and ship detection**
	  • Data download via ftp
	  • CFAR algorithm for iceberg and ship detection
	  • Multi-feature classification algorithm
	  • Generate a target output file
	  • Import image into primary software
	  • Geocode image
	  • Import target output file layer
	  • Perform quality control
	  • Generate final product(s)
	  • Deliver product via email

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (APP); or
	  • RADARSAT-1 (Wide or Fine)
	  • RADARSAT-2 (Wide, ScanSAR, or Fine)
	• **Reference Data**
	  • Previously collected ENVISAT or RADARSAT imagery
	  • CIS and IIP iceberg charts
	• **Local/Regional GIS Data**
	  • Digital Chart of the World
	  • 1:50,000 Topographic Maps

Potential areas of application	• Oil and Gas • Shipping • Tourism • Yacht Races
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Cost less compared to equal geographical coverage with aerial reconnaissance • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification for classification algorithms • Data ordering lead time of 15 days is too long. 3-7 days lead time would be more acceptable.
Location of products	• N/A

(Internet URL)		
Contact Person	• Kelley Dodge, C-CORE Tel: (709) 737-2585 • Polar View Support Line: (709) 737-3735	
Service Specifications		
Specification of the service package	• MANICE file listing iceberg and ship locations, delivered via email	
Specification of the service level available	• Specific area • Period of coverage and frequency	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Pre-season planning • Regular contact and feedback from users • Post-season analysis • Post-season workshop to report on years progress and activities • Constant service support in normal office hours and after hours support in providing near-real time service when image is captured	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Product in MANICE file format specified in Canadian Ice Services, Meteorological Services of Canada, (2005), *Manual of Standard Procedures for Observing and Reporting Ice Conditions (MANICE)*. Revised 9th Ed., June 2005.	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• Validation through visual confirmation through aerial reconnaissance ground truth flights	Yes
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service***	N/A

	provision in close contact with end user	
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Detection and classification of icebergs and ships	Yes
Measurement Units and standards	• Canadian Ice Services, Meteorological Services of Canada, (2005), *Manual of Standard Procedures for Observing and Reporting Ice Conditions (MANICE)*. Revised 9th Ed., June 2005.	Yes
Classification standards, definitions and references	• Power, D., Youden, J., Randell, C., Lane, K. and Flett, D. (2001) Iceberg detection capabilities of RADARSAT synthetic aperture radar. Canadian Journal of Remote Sensing, Vol. 27, No. 5, pp. 476-486 • Canadian Ice Services, Meteorological Services of Canada, (2005), *Manual of Standard Procedures for Observing and Reporting Ice Conditions (MANICE)*. Revised 9th Ed., June 2005.	Yes
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• Data validation standards are being developed through service provision in close contact with the end user • Power, D., Youden, J., Randell, C., Lane, K. and Flett, D. (2001) Iceberg detection capabilities of RADARSAT synthetic aperture radar. Canadian Journal of Remote Sensing, Vol. 27, No. 5, pp. 476-486 • White, F., Spaulding, M. and Gominho, L. (1980) Theoretical Estimates of the Various Mechanisms Involved in Iceberg Deterioration in the Open Ocean Environment. USCG R&D Center Technical Report CG-D-62-80.	Yes
Mapping projections, definitions and format standards	• Default Projection- UTM WGS84	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• Previous collected ENVISAT or RADARSAT-1 imagery • CIS and IIP iceberg charts • Digital Chart of the World • 1:50,000 Topographic Maps	Yes
Certification procedures and	• N/A	N/A

standards		
Standards for handling confidential information	• C-CORE Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Updated classification algorithms • Improved land mask	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• N/A	
Enhanced compliance with user standards and improved validation assurance	• N/A	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• In kind contribution from user in the form of ground truth aerial reconnaissance flights	

2.2 Sea Ice Floe Edge Advisory	
Product Description	• Floe Edge extent • Ice Type Classification (Fast versus Moving) • Ice Stability and possible hazard areas

All processing algorithms	• **Floe Edge Location**
	  • Data download via ftp
	  • Import into primary software (ArcGIS)
	  • Vector Creation (Floe Edge linear features)
	  • Vector integration (30 year average)
	  • Annotation
	  • Product Creation (Photoshop)
	  • Deliver product via website

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (Wide Swath)
	  • RADARSAT (SCANSAR)
	• **Local/Regional GIS Data**
	  • Ice Charts (CIS)

Potential areas of application	• Hazard identification • Emergency Response • Safety
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • RADAR unaffected by cloud • Spatial coverage in a short time • Data acquisition • Frequent Coverage (varies throughout the season) • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas
Location of products (Internet URL)	http://www.noetix.ca/floeedge/
Contact Person	• John Bennett, Noetix Research Tel: (613) 236-1555 • Mark Kapfer, Noetix Research Tel: (613) 236-1555
Service Specifications	
Specification of the service package	• Delivery of floe edge service illustrating extent of fast ice versus moving ice or water
Specification of the service level available	• Specific area • Period of coverage and frequency
Specification of the support services (e.g. identified quality, calibration, and validation	• Pre-season planning • Regular contact and feedback from users • Constant service support in normal office hours in providing near-real time service when image is captured

procedures applicable for each product and subsidiary specs, design and test documents for all production systems)		
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Delineation of fast and moving ice/water	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	• ***N/A***	N/A
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Default Projection- Mercator • Product delivered as geo-tiff or jpeg	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A

Reference data sets	• Ice Charts 30 year average	Yes
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Updated product to resemble PolarView • Different products for each region • Increasing use of RADARSAT, increased frequency of products • Bilingual legend	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• N/A	
Enhanced compliance with user standards and improved validation assurance	• Review of end user post-season reports • Incorporate user suggestions for better, customized products	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Working toward suitable pricing strategy • Seeking alternative funding	

2.3 High-Resolution Ice Charts	
Product Description	• Sea ice concentration chart based satellite radar image with a resolution of 150m covering approximately 400x400km

All processing algorithms	• **Ice concentration chart**
	  • Data download via ftp
	  • Reprojected to met.no ArcView standard projection
	  • Import into ArcView
	  • Manual interpretation based
	  • Deliver product via website, email and ftp

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (Wide Swath)
	  • RADARSAT (Wide)

Potential areas of application	• Maritime operations • Habitat monitoring
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage (at least 3- 4 times per week) • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Noise patterns from wind
Location of products (Internet URL)	• http://polarview.met.no/highresmaps/
Contact Person	• Ice service analyst Norwegian Meteorological Institute Forecasting Division for Northern Norway +47 77 62 13 00 • Head of Ice service: Marcos Porcires +47 77 62 13 00
Service Specifications	
Specification of the service package	• Delivery of sea ice concentration charts in image or shape format
Specification of the service level available	• Specific area: Svalbard • November – April : 1 chart once a week • May – October : 1 chart twice a week • Other areas and times on request depending on data availability and resources.
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Pre-season planning • Statistics • Regular feedback from users • Constant service support in normal office hours

Service Standards		Compliance with user standards
Applicable software and hardware standards (e.g. ECCS)	• No hardware standards • Data format standards are shape format. Other formats are developed in cooperation with end users and distributors electronic sea chart information.	Yes
Configuration control standards for software, data, hardware, documents	• In-house standards developed for operational services are used and continually updated	Yes
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality standards for operational services developed at met.no.	Yes
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed in cooperation with national partners***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Customers feedback database	Yes
Training Standards	• ***Developed in cooperation with other ice services according to "best practice".***	N/A
Promotion Standards	• Standards are as defined by Polar View	Yes
Definition of parameters to be measured	• Classification of sea ice concentration <1/10 – open water 1/10 to 3/10 – Very open drift ice 4/10 to 7/10 – Open drift ice 7/10 to 9/10 – Close drift ice 9/10 to 10/10 – Very close drift ice Fast ice	Yes
Measurement Units and standards	• As per WMO Standard	Yes
Classification standards, definitions and references	• Ice Chart Colour Code Standard. - JCOMM Technical Report Series No. 24, 2004, WMO/TD-No. 1215.	Yes
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are developed in cooperation with other ice services***	N/A
Mapping projections, definitions and format standards	• Default Projection- Polar stereographic	Yes
Calibration and validation	• ***N/A***	N/A

standards, references, procedures and protocols		
Reference data sets	• N/A	N/A
Certification procedures and standards	• Internal training	Yes
Standards for handling confidential information	• N/A	N/A
Reporting standards and requirements	• N/A	N/A
Documentation standards	• Doku Wiki system	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Use of Alt Pol Envisat ASAR data will hopefully improve water/ice classification.	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• The service delivery is continually revised according to requirements from end users. Currently there are no defined updates to be done.	
Enhanced compliance with user standards and improved validation assurance	• A database for exchange of automatic ice observations from ICECAM	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Not applicable since this service is meant to be free of charge in the foreseeable future.	

2.4 Sea Ice Thickness Charts	
Product Description	**High-Resolution Ice Thickness Chart of:** • Ice/open water • Ice-edge • Ice thickness

All processing algorithms	• **For all products**
	  • Data (satellite, buoy, etc.) downloaded
	  • Internally produced ice chart over the Baltic Sea
	  • Import into primary software for data assimilation
	  • Run algorithm
	  • Visualization using GRADS (web service) and IBPlott (icebreakers)
	  • Product check out
	  • Deliver product via website and IBNet

All data inputs required to generate the product	• **Input Data**
	  • Envisat ASAR
	  • RADARSAT SAR
	  • Finnish ice chart over the Baltic Sea (which includes analysis of all available EO and ground truth) with grid information on ice concentration, ice thickness and degree of deformation
	  • Number of SAR data has been increased, in November-May charts produced:
	  ○ 2005/06 245 charts
	  ○ 2006/07 202 charts
	  ○ 2007/08 168 charts
	  ○ 2008/09 240 charts
	  ○ 2009/10 559 charts

Potential areas of application	• Safer shipping • Faster shipping • Emergency Response • Water Quality
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Cloud and daylight independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas • Could be used in applications **Limitations** • Need ground truth verification - thematic and positional
Location of products (Internet URL)	• http://polarview.fimr.fi • http://www.polarview.org • http://legacy.fmi.fi/weather/index_9.html • http://www.baltice.org

Contact Person	• Juha Karvonen, FMI E-mail: juha.karvonen@fmi.fi • Markku Simila, FMI E-mail: markku.simila@fmi.fi • Ari Seina, FMI E-mail: ari.seina@fmi.fi	
Service Specifications		
Specification of the service package	• Delivery of sea ice products as specified in the product description	
Specification of the service level available	• Specific area • Period of coverage and frequency	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Instantaneous user feedback • In situ measurements by icebreakers and coastal stations • Measurements during field campaigns • Pre-season planning • Regular contact and feedback from users • Post-season follow up to report on years progress and activities • Constant service support in normal office hours. Off office hours a call up service.	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• Following the FMI IT-standard	Yes
Configuration control standards for software, data, hardware, documents	• Following the FMI IT-standard	Yes
Quality standards for products	• NRT Delivery Control • Product Validation based on measurements (observations from icebreakers and coastal stations, compared to the computed ice thickness values annually =>annual validation report) • Software/Hardware Development Practices	Yes
Quality standards for services	• NRT Delivery Control • Instantaneous user feedback, user feedback queries=>user feedback reports • Quality Process for Technical Reports	Yes
Calibration Standards	• RADARSAT/Envisat standards: RADARSAT Illuminated & Envisat ASAR Product Handbook	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user.***	N/A
Customer Care Standards	• Instantaneous user feedback • Client Feedback Questionnaire • Workshops	Yes

	• Review of User Reports	
Management and Reporting Standards	• Project Management using PPS (Practical Project Steering method) • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Classification of ice thickness. • Other parameters for which Standards are being developed through service provision in close contact with end user	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	• No international standards. WMO's (World Meteorological Organization) "Sea Ice Nomenclature", where the Expert Team on Sea Ice (ETSI) has prepared some color standard in close cooperation with International Ice Charting Working Group (IICWG). • *Ice thickness vs. EM measurements*: Comparison of SAR Data and Operational Sea Ice Products to EM Ice Thickness Measurements in the Baltic Sea, Proc. IEEE International Geoscience and Remote Sensing Symposium (IGARSS'04), v. V, pp. 3021-3024, 2004. *Water/ice classification vs. ice charts:* Open Water Detection from Baltic Sea Ice Radarsat-1 SAR Imagery, IEEE Geoscience and Remote Sensing Letters, v. 2, n. 3, pp. 275-279, 2005. Dr Thesis work until 2006: Compaction of C-Band Synthetic Aperture Radar Based Sea Ice Information for Navigation in the Baltic Sea, Doctoral Dissertation, 162 p + app. 60, Otamedia, 2006. *In situ measurements VS ice thickness charts:* Polarview@FIMR: WWW-based Delivery of Baltic Sea Ice Products to End-Users, Proc. of the International Geoscience and Remote Sensing Symposium 2007 (IGARSS'07), pp. 1242-1245, 2007. •	Yes
Instrumentation standards	• RADARSAT/Envisat Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Mercator projection • Product delivered as png, tiff, ice	Yes
Calibration and validation	• ***Standards are being developed through service***	N/A

standards, references, procedures and protocols	***provision in close contact with end user***	
Reference data sets	• -	N/A
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process - ISO 9001	Yes
Documentation standards	• ISO 9001	Yes
Communication and data-exchange standards	• FMI IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Development of algorithm for better classification results, including better air temperature response • Expansion of geographical area to cover total Baltic Sea and Danish Straits	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery))	• Implementation of new standards for ice thickness. • Web requests at http://polatview.fimr.fi between January and May has increased radically: o 2006: 73,126 (484/day), annual 130,529 o 2007: 285,345 (1890/day), annual 503,161 o 2008: 307,272 (2022/day), annual 558,845 o 2009: 744,534 (4898/day), annual 1,076,183 o 2010: 1,628,686 (10,786/day), annual 2,242, 049	
Enhanced compliance with user standards and improved validation assurance	• Review of end user post-season field reports • Improve algorithm with cross reference of validation results • Field measurements within field campaigns	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Ice thickness grid is part of My Ocean project delivered via My Ocean Sea Ice and Wind Tactical Assembly Centre to My Ocean Marine Forecasting Centres in use of forcing data in forecasts • Funding model web and icebreaker services after ESA's funding finished in 2012 a combination of in house financing and users paying	

2.5 Met-Ice-Ocean Regional Forecasting	
Product Description	**45h Ice forecasts of:** • Ice drift (speed&direction) • Ice-edge • Total Ice Concentration • Un-Deformed Ice Thickness • Deformed Ice Mean Thickness • Deformed Ice Mean Concentration • Ridged Ice Thickness • Ice Divergence and Convergence

All processing algorithms	• **For all products**
	  • Data (satellite, buoy, etc.) downloaded
	  • Finnish ice chart over the Baltic Sea (which includes analysis of all available EO and ground truth) with grid information on ice concentration, ice thickness and degree of deformation
	  • Import into primary software for data assimilation
	  • Run the HELMI model
	  • Visualization using GRADS (web service) and IBPlott (icebreakers)
	  • Product check out
	  • Deliver product via website and IBNet

All data inputs required to generate the product	• **Input Data**
	  • Envisat ASAR
	  • RADARSAT SAR
	  • NOAA AVHRR
	  • Modis Terra & Aqua
	  • Buoys
	  • Icebreaker reports
	  • Ship measurements
	  • Observation station measurements
	  • HIRLAM forcing data

Potential areas of application	• Safer shipping • Faster shipping • Emergency Response • Water Quality
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • SAR is cloud and daylight independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification - thematic and positional
Location of products	• http://polarview.fimr.fi

(Internet URL)	• http://www.polarview.org • http://legacy.fmi.fi/weather/index_9.html • http://www.baltice.org	
Contact Person	• Jari Haapala, FMI E-mail: jari.haapala@fmi.fi • Jonni Lehtiranta, FMI E-mail: jonni.lehtiranta@fmi.fi • Ari Seina, FMI E-mail: ari.seina@fmi.fi	
Service Specifications		
Specification of the service package	• Delivery of sea ice products as specified in the product description	
Specification of the service level available	• Specific area • Period of coverage and frequency	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Instantaneous user feedback • In situ measurements by icebreakers and coastal stations • Measurements during field campaigns • Pre-season planning • Regular contact and feedback from users • Post-season follow up to report on years progress and activities • Constant service support in normal office hours. Off office hours a call up service.	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• Following the FMI IT-standard	Yes
Configuration control standards for software, data, hardware, documents	• Following the FMI IT-standard	Yes
Quality standards for products	• NRT Delivery Control under FMI's 7/24 desk • Product Validation based on measurements (observations from icebreakers and coastal stations, compared to the computed ice parametres annually =>annual validation report) • Software/Hardware Development Practices	Yes
Quality standards for services	• NRT Delivery Control • Instantaneous user feedback, user feedback queries=>user feedback reports • Quality Process for Technical Reports	Yes
Calibration Standards	• NOAA/Modis/RADARSAT/Envisat standards • HIRLAM Standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Instantaneous user feedback	Yes

	• Client Feedback Questionnaire • Workshops • Review of User Reports	
Management and Reporting Standards	• Project Management using PPS (Practical Project Steering method) • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Classification of ice concentration. • Other parameters for which Standards are being developed through service provision in close contact with end user	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	• WMO's (World Meteorological Organization) "Sea Ice Nomenclature", where the Expert Team on Sea Ice (ETSI) has prepared a color standard in close cooperation with International Ice Charting Working Group (IICWG). • Validation report have been published e.g. *Ice drift calculated from SAR images vs. ice drift buoy:* SAR-Based Estimation of the Baltic Sea Ice Motion, Proc. of the International Geoscience and Remote Sensing Symposium 2007 (IGARSS'07), pp. 2605-2608, 2007. HIGHTSI *model and SAR based ice thickness vs. in situ measurements:* Baltic Sea Ice Thickness Charts Based on Thermodynamic Snow/Ice Model, C-Band SAR Classification and Ice Motion Detection, Proc of the International Geoscience and Remote Sensing Symposium 2008 (IGARSS'08), 2008. Ice Thickness Charts Produced by C-Band SAR Imagery and HIGHTSI Thermodynamic Ice Model, Proc. of the Sixth Workshop on Baltic Sea Ice Climate, Lammi, Finland 2008.	Yes
Instrumentation standards	• NOAA/RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Mercator projection • Product delivered as png, tiff, ice	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A

Reference data sets	• -	N/A
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process - ISO 9001	Yes
Documentation standards	• ISO 9001	Yes
Communication and data-exchange standards	• FMI IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Development of new products, like "uncertainty" products – test ensemble ice forecasts, display of validation data, new geographical areas • Improved product quality (switch to higher-resolution weather forcing data, correction for bias in AMSR-E ice concentration data, improved data assimilation)	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery))	• Implementation of new standards for ice parameters • Web requests at http://polatview.fimr.fi between January and May has increased radically: o 2006: 73,126 (484/day), annual 130,529 o 2007: 285,345 (1890/day), annual 503,161 o 2008: 307,272 (2022/day), annual 558,845 o 2009: 744,534 (4898/day), annual 1,076,183 o 2010: 1,628,686 (10,786/day), annual 2,242, 049	
Enhanced compliance with user standards and improved validation assurance	• Review of end user post-season field reports • Improve algorithm with cross reference of validation results	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Funding model after ESA's funding finished in 2012 a combination of in house financing and users paying	

2.5 Met-Ice-Ocean Regional Forecasting (SMHI)	
Product Description	**10 day Ice forecasts of:** • Ice Concentration • Level Ice Thickness • Ridged Ice Thickness • Ice Ridge Density • Ice Ridge Sail Height • Ice Divergence and Convergence

All processing algorithms	• **For all products**
	  • Data (satellite, buoy etc.) downloaded
	  • Internally produced Ice Map
	  • Import into primary software for data assimilation
	  • Run the HIROMB model (3D-Oceanographic model)
	  • Visualization using Metgraf
	  • Deliver product via website

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT ASAR
	  • AQUA AMSR-E
	  • RADARSAT SAR
	  • NOAA AVHRR
	  • OSI SAF
	  • Buoys
	  • Argos – ship measurements
	  • Ice Breaker report
	  • ECMWF forcing data

Potential areas of application	• Safer shipping • Emergency Response • Water Quality
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification - thematic and positional
Location of products (Internet URL)	• http://www.polarview.org/services/rsif.htm
Contact Person	• Lars Axell, SMHI E-mail: lars.axell@smhi.se • Anette Jönsson, SMHI E-mail: anette.jonsson@smhi.se
Service Specifications	
Specification of the service package	• Delivery of sea ice products as specified in the product description

Specification of the service level available	• Specific area • Period of coverage and frequency	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Pre-season planning • Regular contact and feedback from users • Post-season follow up to report on years progress and activities • Constant service support in normal office hours	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• Following the SMHI IT-standard	Yes
Configuration control standards for software, data, hardware, documents	• Following the SMHI IT-standard	Yes
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• NOAA/RADARSAT/ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management using PPS (Practical Project Steering method) • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Classification of ice concentration. • Other parameters for which standards are being developed through service provision in close contact with end user	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	• WMO's (World Meteorological Organization) "Sea Ice Nomenclature", where the International Ice Charting Working Group (IICWG) has prepared a	Yes

	color standard.	
Instrumentation standards	• NOAA/RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Polar stereographic projection • Product delivered as jpeg	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• N/A	N/A
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process - ISO 9001	Yes
Documentation standards	• ISO 9001	Yes
Communication and data-exchange standards	• SMHI IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Development of new products, like "uncertainty" products – test ensemble ice forecasts, display of validation data, new geographical areas • Improved product quality (switch to higher-resolution weather forcing data, correction for bias in AMSR-E ice concentration data, improved data assimilation)	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• Implementation of new standards for ice parameters	
Enhanced compliance with	• Review of end user post-season field reports	

user standards and improved validation assurance	• Improve algorithm with cross reference of validation results
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• No change.

2.6 Medium-Resolution Ice Charting – Greenland	
Product Description	**Sea ice chart including the following information:** • sea ice total and partial concentration • sea ice stage of development • sea ice floe size • information about primary satellite data source • quality indicator • metadata **Satellite image quick-looks for all Greenland coastal areas** ○ MODIS ○ ENVISAT ASAR ○ NOAA-AVHRR
All processing algorithms	**Ice chart** • Data download via ftp • Data processing including geocoding and geophysical algorithms • Manual data analysis and ice chart production • Approval by Greenland Ice Patrol • Deliver product via e-mail – website **Satellite image quicklooks** • Fully automated data processing and visualisation
All data inputs required to generate the product	• **Input Data** • ENVISAT + RADARSAT SAR • NOAA AVHRR • DMSP SSM/I
Potential areas of application	• Aid planning of operations • provide general information to the public • input to scientific studies • independent validation of automatic products • input to other national ice services
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification
Location of products (Internet URL)	• http://www.polarview.org/services/mric.htm • http://ocean.dmi.dk/arctic/modis.php • http://ocean.dmi.dk/polarview/
Contact Person	Leif Toudal Pedersen, DMI Tel.: +45 39 15 72 48 DMI operational ice service:

	Telf.: +45 39 15 73 15, Fax.: +45 39 15 73 00 E-mail: iskort@dmi.dk • Polar View Support Line: (709) 737-3735	
Service Specifications		
Specification of the service package	• Medium resolution ice chart and near real time satellite image distribution	
Specification of the service level available	• Greenland • Twice per week all year icechart product • Near real time satellite images	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Analysis by certified ice charters • Regular contact and feedback from users • Service support	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• N/A	N/A
Management and Reporting Standards	• N/A	N/A
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Ice concentration, stage of development, floe size.	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	• The information is given according to WMO sea ice normenclature No. 259 and WMO JCOMM Technical documents No. 1214 and 1215.	Yes
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes

Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Default Projection- Lambert	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	N/A	N/A
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• N/A	N/A
Reporting standards and requirements	• N/A	N/A
Documentation standards	• N/A	N/A
Communication and data-exchange standards	• N/A	N/A
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Inclusion of new satellite data for better ice edge detection and ice type discrimination and for more frequent updates.	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery))	• Production of supplementary satellite images have been fully automated, taking advantage of ENVISAT ASAR data acquisition for MyOcean as well as improved availability of MODIS data from Greenland and DMI's own NOAA AVHRR data receiving stations in Greenland and Denmark.	
Enhanced compliance with user standards and improved validation assurance	• N/A	
Financial structure to be	• The service is being integrated into the Greenland Climate	

implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	Research Center.

2.7 Global Sea Ice Monitoring	
Product Description	• Arctic sea ice concentration • Antarctic sea ice concentration • Arctic Mosaics • Antarctic Mosaics • Ice motion vector (additional service) • Lead/New ice (additional service)

All processing algorithms	• **Arctic and Antarctic sea ice concentrations**
	• Level 1 AMSR-E are downloaded twice per day from two servers, one in Boulder, Co., USA (NSIDC), and one in Tokyo, Japan (JAXA) and processed into sea ice concentration data.
	• SAR data are obtained from DTU.
	• Modis data are obtained from a server in the US. Each day, for each region of interest the scene covering best the regions is automatically selected and downloaded. Then, the overlay maps are produced.
	• **Arctic & Antarctic mosaic**
	  • ASAR GM images download via ftp
	  • Import into in house software
	  • Mosaic production using a time range
	  • Range effect correction
	  • Mosaic export (GeoTiff, raw, png)
	  • Deliver product via ftp
	• **Ice motion vector**
	  • Product derived from the mosaic
	  • Import relevant Mosaic into in house software
	  • Production of the ice motion
	  • Export ice motion vector as a text file
	  • Transfer final product to ftp (NIC only)
	  • This product is operationally produce but it is still in the evaluation stage at NIC
	• **Lead / New Ice**
	  • Product derived from the mosaic
	  • Import relevant Mosaic into in house software
	  • Detection algorithm
	  • Change Detection
	  • Export (GeoTiff, raw, png)
	  • Deliver product via ftp (NIC only)
	  • This product is operationally produce but it is still in the evaluation stage at NIC

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT ASAR Global Monitoring mode
	  • AMSR-E passive microwave data
	  • MODIS

Potential areas of application	• Ice mapping and ice chart (Artic and Antarctic) • Climatology

Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Low resolution (1 km)	
Location of products (Internet URL)	• http://www.polarview.org/services/gsim.htm	
Contact Person	• Polar View Support Line: (709) 737-3735	
Service Specifications		
Specification of the service package	• N/A	
Specification of the service level available	• Period of coverage and frequency • Near Real Time	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Regular contact and feedback from users • Constant service support in normal office hours and after hours support in providing near-real time service when image is captured	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting	• Project Management Database	Yes

Standards		
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• N/A	Yes
Measurement Units and standards	• N/A	N/A
Classification standards, definitions and references	• N/A	Yes
Instrumentation standards	• ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Default Projection- UTM WGS84 • User Specified Projection, if needed • Product delivered as geo-tiff , raw and png	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• N/A	Yes
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply	• Technology and performance are been developed in close contact with the users.	

chain through expansion of service network)	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery))	• N/A
Enhanced compliance with user standards and improved validation assurance	• Improve algorithm in close contact with user.
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Working toward suitable pricing strategy

3 RIVER AND LAKE ICE

3.1 River Ice Monitoring	
Product Description	• Ice Front Location • Ice Type Classification • Ice Structure and Stability

All processing algorithms	• **Ice Front Location**
	  • Data download via ftp
	  • Import into primary software
	  • Geocoding using polynomial transform
	  • Change Detection
	  • Annotation
	  • Product delivered via email or ftp site
	• **Ice Type Classification**
	  • Data download via ftp
	  • Import into primary software
	  • Geocoding using polynomial transform
	  • Assignment/selection of class boundaries via visual inspection of ice class interpretation and unsupervised classification
	  • Annotation
	  • Product delivered via email or ftp site
	• **Ice Structure and Stability**
	  • Data download via ftp
	  • Import into primary software
	  • Geocoding using polynomial transform
	  • Change Detection
	  • Annotation
	  • Product delivered via email or ftp site

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (e.g. APP Wide Swath, if APP unavailable)
	  • RADARSAT-1 (e.g. Standard, Wide or Fine depending on river size)
	  • RADARSAT-2 (e.g. Standard, ScanSAR Narrow, Fine Quad)
	• **Reference Data**
	  • Orthorectified Landsat 7, Digital Elevation Models

Potential areas of application	• Flood Hazard Mitigation • Emergency Response • Water Quality • Infrastructure Integrity
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage (at least 3- 4 times per week) • Synoptic view over non-EO sources

	• Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification - thematic and positional
Location of products (Internet URL)	• http://www.polarview.org/services/rim.htm
Contact Person	• Thomas Puestow, C-CORE Tel: (709) 864-2586 • Sherry Warren, C-CORE Tel: (709)864-7696 • Polar View Support Line: (709) 864-3735
Service Specifications	
Specification of the service package	• Delivery of river ice products illustrating ice types
Specification of the service level available	• Specific area • Period of coverage and frequency
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Pre-season planning • Regular contact and feedback from users • Post-season Workshop to report on years progress and activities • Constant service support in normal office hours and after hours support in providing near-real time service when image is captured

Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A

Definition of parameters to be measured	• Classification of ice types- (e.g. water or water on ice; non-consolidated or intact ice; and consolidated ice)	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	Jasek, M. and Weber, F. (2003) *Ice Thickness and Roughness Analysis on the Peace River using RADARSAT-1 SAR Imagery*. CGU HS Committee on River Ice Processes and the Environment. 12th Workshop on the Hydraulics of the Ice Covered Rivers, Edmonton, AB, June 19-20, 2003. Pelletier, K.D., van der Sanden, J. and Hicks, F. (2005) *Synthetic Aperture Radar: Current Capabilities and Limitations for River Ice Monitoring.* 17th Canadian Hydrotechnical Conference, Edmonton , Alberta, August 17-19, 2005. Puestow, T.M., Randell, C.J., Rollings, K.W., Khan, A.A. and Picco, R. (2004) *Near real-time monitoring of river ice in support of flood forecasting in Eastern Canada: Towards the integration of Earth Observation technology in flood hazard mitigation.* IEEE International Geoscience and Remote Sensing Symposium, Anchorage, Alaska, USA, September 20 to 24, 2004. Weber, F., Nixon, D. and Hurley, J. (2003) *Semi-automated classification of river ice types on the Peace River using RADARSAT-1 synthetic aperture radar (SAR) imagery*. Canadian Journal of Civil Engineering Vol. 30, p. 11-27.	Yes
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Default Projection- UTM WGS84 • User Specified Projection, if needed • Product delivered as jpeg, kml, or shapefile	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• Orthorectified Landsat 7 • Digital Elevation Models	Yes
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling	• C-CORE Privacy Policy	Yes

confidential information	• Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database using SVN (Subversion version control system)	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Updated classification scheme on individual user needs by reducing ice classes from 10 to 3 • Different products for each user, supplied different backdrops • Increasing use of ENVISAT, which improved the spatial resolution of products • Ratio or differencing change detection • Adaptive classification taking into account the different beam modes	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• N/A	
Enhanced compliance with user standards and improved validation assurance	• Review of end user post-season field reports • Incorporate into user's database and network • Improve algorithm with cross reference of field measurements	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Most users are currently paying for the service (e.g. NL, Alberta, Yukon and Manitoba provincial governments and Hatch Ltd.) • NB government will make contribution to the service next season • Working toward suitable pricing strategy	

3.2 Lake Ice Monitoring	
Product Description	• Lake ice presence • Lake ice thickness • Days frozen • Integration with traditional ecological knowledge (TEK) • Integration with real-time environmental data

All processing algorithms	• **Process Flow**
	  • Data download via ftp
	  • Import into primary software
	  • Geocoding using polynomial transform
	  • Image interpretation
	  • Overlay of real-time environmental data
	  • Overlay of TEK data
	  • Product delivered via dedicated community portal
	  • Feedback from community users

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (APP, IM)
	  • RADARSAT-1 (Standard/Wide, Fine)
	  • RADARSAT-2 (Standard, Fine Quad)
	• **Reference Data**
	  • Orthorectified Landsat 7, Digital Elevation Models

Potential areas of application	• Fisheries management • Transportation safety
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Data acquisition • Frequent Coverage (at least 3- 4 times per week) • Integrated, synoptic view of EO, environmental data and TEK • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification - thematic and positional • Constant feedback from users facilitates ongoing service refinement
Location of products (Internet URL)	http://nunavik.lakeice.ca/default.aspx?l=en
Contact Person	• Jason Suwala Manager, Environmental Information Systems Hatfield Consultants 200 – 850 Harbourside Drive North Vancouver, BC Canada V7P OA3 Phone: 604-926-3261, Fax: 604-926-5389 jsuwala@hatfieldgroup.com • Polar View Support Line: (709) 864-3735

Service Specifications		
Specification of the service package	• Delivery of lake ice products illustrating ice information via dedicated community web portal	
Specification of the service level available	• Specific area • Period of coverage and frequency	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Pre-season planning • Regular contact and feedback from users • Post-season Workshop to report on years progress and activities • Constant service support in normal office hours and after hours support in providing near-real time service when image is captured	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Classification of ice types- (e.g. water or water on ice; non-consolidated or intact ice; and consolidated ice)	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	Jeffries, M.O., K. Morris, W.F. Weeks and H. Wakabayashi. 1994. Structural-Stratigraphic Features and ERS-1 SAR Backscatter Characteristics of Ice Growing on Shallow Lakes in N.W. Alaska, Winter 1991-92. Journal of Geophysical Research, 99(C11): 22459-22471.	Yes

	Kozlenko, N. and M. O. Jeffries. 2000. Bathymetric mapping of shallow water in thaw lakes on the North Slope of Alaska with spaceborne imaging radar. Arctic, 53(3), 306-316. Duguay, C.R., T.J. Pultz, P.M. Lafleur, and D. Drai. 2002. RADARSAT Backscatter Characteristics of Ice Growing on Shallow Sub-Arctic Lakes, Churchill, Manitoba, Canada. Hydrological Processes 16:1631-1644. Duguay, C.R. and P.M. Lafleur. 2003. Estimating Depth and Ice Thickness of Shallow Subarctic Lakes using Spaceborne Optical and SAR Data. International Journal of Remote Sensing 24: 475-489.	
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Default Projection- UTM WGS84 • User Specified Projection, if needed • Product delivered as jpeg, kml, or shapefile	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• Orthorectified Landsat 7 • Digital Elevation Models	Yes
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• C-CORE Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database using SVN (Subversion version control system)	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance	• Improved interpretation of ice parameters • Improved visual presentation of integrated data streams • Improved spatial coverage and reduced conflicts due to maximized use of RADARSAT and ENVISAT, which • Automated update of ice information on community data portal	

improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• N/A
Enhanced compliance with user standards and improved validation assurance	• Review of end user post-season field reports • Incorporate into user's database and network • Improve algorithm with cross reference of field measurements
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Third-party funding is required to provide long-term financing for community-based user

4 GLACIERS AND SNOW

4.1 Glacier Monitoring	
Product Description	• Glacier facies maps • Historical time series • Melt modeling • Glacier inventories

All processing algorithms	• **Glacier facies maps and historical data processing**
	  • Data download via ftp
	  • Import into primary software
	  • Calibration and Orthorectification
	  • Classification
	  • Annotation
	  • Deliver product
	• **Melt modeling**
	  • Prepare input data: formatting and review
	  • Ingest
	  • Calibrate model
	  • Establish boundary conditions and run model
	  • Review and validate results
	  • Deliver products
	• **Glacier inventory**
	  • Support end user activities through capacity building, training and support

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (e.g. APP Wide Swath, if APP unavailable)
	  • Landsat
	  • ASTER
	  • Climate data
	  • Mass balance data
	• **Reference Data**
	  • In situ observations

Potential areas of application	• Hydropower planning • Climate change monitoring • Water resource management
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Weather independent • Spatial coverage in a short time • Frequent and flexible coverage • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Need ground truth verification - thematic and positional
Location of products (Internet URL)	• http://www.polarview.org/services/gm.htm
Contact Person	• Ian Brown, University of Stockholm: +46 8 16394

	• Polar View Support Line: (709) 737-3735	
Service Specifications		
Specification of the service package	• Delivery of user defined glacier monitoring products	
Specification of the service level available	• Specific area • Period of coverage and frequency	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Pre-season planning • Regular contact and feedback from users • Post-season Workshop to report on years progress and activities • Constant service support in normal office hours and after hours support in providing near-real time service when image is captured	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• Standards are consistent with the literature and are reviewed with the end user	Yes
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• As in the academic literature	Yes
Quality standards for services	• N/A	N/A
Calibration Standards	• RADARSAT/ENVISAT standards	Yes
Validation Standards	• Validation is reviewed with the end user	Yes
Customer Care Standards	• Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• Standards are consistent with academic and professional training	Yes
Promotion Standards	•	N/A
Definition of parameters to be measured	• Glacier surface type/conditions • Melt and mass balance evolution • Glacier area, centre line, ID	Yes
Measurement Units and standards	• SI units	Yes
Classification standards,	Brown, I.A. 2002 Radar facies on the West	Yes

definitions and references	Greenland icesheet:comparison with AVHRR albedo data. Geominformation for European-wide Integration:proc. 22nd Symposium of the European Association of Remote Sensing Laboratories. 367-372. Rau, F., Braun, M., Saurer, H., Gossmann, H., Kothe, G.,Weber, F., Ebel, M. and Beppler, D. 2000 Monitoring multi-year snow cover synamics on the Antarctic Peninsula using SAR imagery. Polarforschung 67 (1/2) 27-40. Hock, R., 2005: Glacier melt: a review of processes and their modeling. Prog. Phys. Geog., 29 (3), 362-391. Braun, M. and Hock, H. 2004: Spatially distributed surface energy balance and ablation modelling on the ice cap of King George Island (Antarctica). Global Planetary Change, 42 (1-4), 45-58.	
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A
Mapping projections, definitions and format standards	• Default Projection- UTM WGS84 • User Specified Projection, if needed • Product delivered as geo-tiff or surfer grids	Yes
Calibration and validation standards, references, procedures and protocols	• ESA calibartaion standards	Yes
Reference data sets	• N/A	N/A
Certification procedures and standards	• Standards are reviewed with the end user	Yes
Standards for handling confidential information	• User defined where sensitivity exists	Yes
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database	Yes
Communication and data-exchange standards	• N/A	N/A
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance	• Faster turn around times of some imagery through semi-automation	

improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• N/A
Enhanced compliance with user standards and improved validation assurance	• Review of end user post-season field reports • Improve algorithm with cross reference of field measurements
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• In sourcing by end users within 3 years

4.1 Glacier Monitoring - Velocity Mapping		
Product Description	• Glacier velocity	

All processing algorithms	• **Glacier Velocity**
	  • SAR data download via ftp
	  • SAR processing (eg. Gamma, Atlantis)
	  • Speckle tracking (customized software, CCRS)
	  • Output products (customized software, CCRS)	

All data inputs required to generate the product	• **Input Data**
	  • RADARSAT Fine (for Canadian Arctic)
	• **Reference Data**
	  • GTOPO30
	  • Landsat
	• **Local/Regional GIS Data**
	  • N/A	

Potential areas of application	• Glacier Mass Balance • Climate Change Monitoring	
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Measurement of remote areas • Weather independent **Limitations** • Temporal coherence limits measuring timeframe to late winter and early spring	
Location of products (Internet URL)	http://www.polarview.org/services/	
Contact Person	• Thomas Puestow, C-CORE Tel: (709) 737-2586 • Polar View Support Line: (709) 737-3735	
Service Specifications		
Specification of the service package	• Glacier velocity maps	
Specification of the service level available	• Canadian High Arctic • Late winter and early spring monitoring	
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• SAR acquisition planning with GSC • Calibration using stable ground • Validation against measured flows (where available)	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards	• ***Standards are being developed through service***	N/A

for software, data, hardware, documents	***provision in close contact with end user***	
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• Ground points	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• ***N/A***	N/A
Promotion Standards	• ***N/A***	N/A
Definition of parameters to be measured	• Glacier velocity	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	Gray, A.L., Mattar, K.E., Vachon, P.W., Bindschadler, R., Jezek, K.C., Forster, R., and Crawford, J.P. (1998). InSAR Results from the RADARSAT Antarctic Mapping Mission Data: Estimation of Glacier Motion using a Simple Registration Procedure, *Proceedings of IGARSS '98*, Vol. 98, pp.1638–1640, Seattle. Gray, A.L., Mattar, K.E., and Sofko, G. (2000). Influence of Ionospheric Electron Density Fluctuations on Satellite Radar Interferometry. *Geophysical Research Letters*, Vol. 27, No. 10, pp. 1451–1454. Gray, A.L., Short, N., Mattar, K.E., and Jezek, K.C. (2001). Velocities and Flux of the Filchner Ice Shelf and Its Tributaries Determined from Speckle Tracking Interferometry. *Canadian Journal of Remote Sensing*, Vol. 27, No. 3, pp. 193–206.	Yes
Instrumentation standards	• RADARSAT/ENVISAT Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user*** *(based on CCRS algorithms and procedures)*	N/A
Mapping projections, definitions and format standards	• User Specified Projection, if needed	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• GTOPO30 • Landsat	Yes

Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• N/A	N/A
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Streamlining processing procedure	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery))	• N/A	
Enhanced compliance with user standards and improved validation assurance	• N/A	
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Working toward suitable pricing strategy	

4.2 Snow Monitoring – Euro – Russian Arctic	
Product Description	• Fraction of Snow covered area (SCA) within 5kmx5km grid cells

All processing algorithms	• **Snow covered area**
	  • Data download via ftp
	  • Import into preprocessing software
	  • Data pre-processing including radiometric calibaration, geo-rectification
	  • Cloud masking
	  • Import to SCA-software
	  • SCA-calculations
	  • On-line validation and quality control
	  • Deliver product via website and also directly to one of the end-users (SYKE hydrological service division)

All data inputs required to generate the product	• **Input Data**
	  • MODIS HKM and 1KM imagery
	• **Reference Data**
	  • Water mask
	• **Local/Regional GIS Data**
	  • Digital Chart of the Baltic Sea on website to show location of the product area

Potential areas of application	• Flood Hazard Mitigation • Hydropower management • Water management in general
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Spatial coverage in a short time • Near-real time data acquisition • Frequent Coverage (at least 3- 4 times per week) • Synoptic view over non-EO sources • Data collection of remote and inaccessible areas • Reliable data collection in inaccessible areas **Limitations** • Weather dependent
Location of products (Internet URL)	• http://www.ymparisto.fi/snowcover
Contact Person	• Sari Metsämäki, Finnish Environment Institute (SYKE) Tel: 358-40-5343856
Service Specifications	
Specification of the service package	• Delivery of snow products illustrating fraction of snow covered area within 5km x 5km grid cells
Specification of the service level available	• Specific area • Period of coverage and frequency
Specification of the support services (e.g. identified quality,	• Pre-season planning • Regular contact and feedback from users • Post-season Workshop to report on years progress and

calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	activities • Constant service support in normal office hours and after hours support in providing near-real time service when image is captured	
Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• ***Standards are being developed through service provision in close contact with end user***	N/A
Configuration control standards for software, data, hardware, documents	• ***Standards are being developed through service provision in close contact with end user***	N/A
Quality standards for products	• Software/Hardware Development Practices	Yes
Quality standards for services	• Quality Process for Technical Reports	Yes
Calibration Standards	• MODIS standards	Yes
Validation Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Customer Care Standards	• Client Feedback Questionnaire • Review of User Reports	Yes
Management and Reporting Standards	• Project Management Database • Document Version Control	Yes
Training Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Promotion Standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Definition of parameters to be measured	• Fraction of snow covered area (percentage of total area of each calculation unit e.g. grid cell or drainage basin)	Yes
Measurement Units and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Classification standards, definitions and references	Metsämäki, S., Anttila, S., Huttunen, M., Vepsäläinen, J. (2005) A feasible method for fractional snow cover mapping in boreal zone based on a reflectance model. *Remote Sensing of Environment, Vol. 95 (1):77-95.*	Yes
Instrumentation standards	• Terra/MODIS Standards	Yes
Standard methods and algorithms for data analysis and modeling	• ***Standards are being developed through service provision in close contact with end user***	N/A

Mapping projections, definitions and format standards	• Default Projection- current: Finnish National Coorinated Grid future: UTM WGS84 • Product delivered as geo-tiff or jpeg and also in numeric form	Yes
Calibration and validation standards, references, procedures and protocols	• ***Standards are being developed through service provision in close contact with end user***	N/A
Reference data sets	• Water mask • Digital Chart of the Baltic Sea area	Yes
Certification procedures and standards	• ***Standards are being developed through service provision in close contact with end user***	N/A
Standards for handling confidential information	• SYKE Privacy Policy	Yes
Reporting standards and requirements	• Quality Assessment Review Process	Yes
Documentation standards	• Project Management Database	Yes
Communication and data-exchange standards	• IT Security Policy	Yes
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• New coloring system for maps • Map interface for easy access (visualization and data download) • Expanded service target area	
Service Delivery Updates (e.g. cost reduction including migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	• N/A	
Enhanced compliance with user standards and improved validation assurance	• standards by current users already followed • adaptation to new users's requirements	
Financial structure to be implemented (e.g. pricing strategy during initial service	• Current status: free products • Future pricing not defined	

uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	

4.3 Snow Monitoring – Central Europe	
Product Description	• Snow Cover Mapping from NOAA AVHRR • Snow Cover Mapping from ENVISAT ASAR

All processing algorithms	• **Snow Cover Mapping from NOAA AVHRR**
	  • Direct reception
	  • Internal data transfer via ftp
	  • Calibration
	  • Geometric processing 1
	  • Snow detection (spectral)
	  • Geometry assessment
	  • Geometric processing 2
	  • Snow detection (spectral + GIS)
	  • Geometry control
	  • Post classification
	  • Products provided via FTP pull
	• **Snow Cover Mapping from ENVISAT ASAR**
	  • Data download via Rolling Archive
	  • Geometric and radiometric processing 1
	  • Geometric fine control
	  • Geometric and radiometric processing 2
	  • Incidence angle correction
	  • Wet + dry snow mapping
	  • Verification of snow mapping
	  • Spatial upscaling
	  • Post classification
	  • Products provided via FTP pull / additional email delivery

All data inputs required to generate the product	• **Input Data**
	  • ENVISAT (ASAR WSM_1P)
	  • NOAA-AVHRR
	• **Reference Data**
	  • For Snow Cover Mapping from NOAA: synthetic optical scene derived from land use information
	  • For Snow Cover Mapping from ENVISAT: synthetic SAR scene derived from several ASAR datasets and land use information
	• **Local/Regional GIS Data**
	  • Land use dataset
	  • Digital elevation model

Potential areas of application	• Flood forecast • Climatological / hydrological studies • Energy production
Advantages and limitations compared to alternate EO and non-EO sources	**Advantages** • Spatial coverage • Frequent coverage • Cross-border datasets • Operational products

	• High reliability • Melting / wet snow identification • Potential to assimilate EO products to spatial modeling **Limitations** • Optical remote sensing limited to daylight and cloud free conditions • Detection of the snow cover from SAR restricted to melting conditions
Location of products (Internet URL)	• N/A – products only accessible for registered users
Contact Person	• Florian Appel, VISTA Tel: +49 89 5238 9803 • Heike Bach, VISTA Tel: +49 89 5238 9802
Service Specifications	
Specification of the service package	• Delivery of spatial snow cover maps, illustrating current snow conditions (snow, snow-free, snow line)
Specification of the service level available	• Specific area • Period of service • Standards of service agreed in close contact with the end users
Specification of the support services (e.g. identified quality, calibration, and validation procedures applicable for each product and subsidiary specs, design and test documents for all production systems)	• Regular contact and feedback from users • Constant service support in normal office hours • Detailed service and product control in warning case / flood events agreed with the end-users (7 day / 24 hour) • Post-season meeting/workshop to report on years progress, activities and future development • Post-season verification of products with in-situ data (provided by the end-users)

Service Standards		**Compliance with user standards**
Applicable software and hardware standards (e.g. ECCS)	• Standards of service had been developed in close contact with end users	Yes
Configuration control standards for software, data, hardware, documents	• Standards of service had been developed in close contact with end users	Yes
Quality standards for products	• Products derived by application of published state-of-the-art methods	Yes
Quality standards for services	• Generation of snow products are conducted using generally accepted methods of science and technology and with highest diligence	Yes
Calibration Standards	• ENVISAT ASAR / NOAA-AVHRR standards	Yes

Validation Standards	• Standards of service validation are developed in close contact with end users	Yes
Customer Care Standards	• Constant service support • Review of user reports	Yes
Management and Reporting Standards	• Project Management Standards	Yes
Training Standards	• N/A	N/A
Promotion Standards	• N/A	N/A
Definition of parameters to be measured	• Snow cover maps comprise information on snow covered and snow free areas, As additional information, the snow line and unclassified areas (e.g. clouds) is displayed.	Yes
Measurement Units and standards	• Standards of service had been developed in close contact with end users	Yes
Classification standards, definitions and references	Appel, F., Bach, H., Löw, A., Ludwig, R., Mauser, W., Schulz, W. (2005): *Operational Monitoring of the Snow Cover Dynamics in Southern Germany - Capabilities of Optical and Microwave Remote Sensing for Improved Flood Forecast*, IGARSS 05 Seoul, IEEE 2005 International Geoscience and Remote Sensing Symposium Proceedings, CD-Publication Appel, F., Bach, H., Demuth, N., Löw, A., Mauser, W., Waske, B. (2004) : *Methodology for the Processing of ASAR Wide Swath Data for the Derivation of Land Surface Properties of the Mosel Catchment.* Proc. ENVISAT Symposium, 6.-10.Sept.2004, Salzburg. Appel, F., Bach, H., Löw, A., Ludwig, R., Mauser, W. (2004): Operational derivation of snow properties from ENVISAT Wide Swath data for assimilation in a hydrological model for improved flood forecast; 4th Symposium on Retrieval of Bio- & Geophysical Paramaters from SAR data, Innsbruck Appel, F., Bach, H., Löw, A., Waske, B., Ludwig, R., Mauser, W., Schulz, W., Merkel, U., Demuth,N. (2004): *InFerno - A project for the integration of remote sensing information in operational water balance modelling and flood forecasting*, Proceedings GGRS 2004 Göttingen/Germany Bach, H., Appel, F., Löw, A., Ludwig, R., Mauser, W., Waske, B., Merkel, U., Schulz, W. (2004):	Yes

	Assimilation of Snow Properties Derived from ASAR Wide Swath Data in a Hydrological Model of the Neckar Catchment for Improved Flood Forecast. Proc. ENVISAT Symposium, 6.-10.Sept.2004, Salzburg.	
Instrumentation standards	• ENVISAT ASAR / NOAA-AVHRR standards	Yes
Standard methods and algorithms for data analysis and modeling	• No specific standard	Yes
Mapping projections, definitions and format standards	• Default Projection- Gauß-Krüger GK3 • Product delivered in user specific format (LM/WHM)	Yes
Calibration and validation standards, references, procedures and protocols	• Calibration and validation of service had been developed in close contact with end users	Yes
Reference data sets	• For Snow Cover Mapping from NOAA: synthetic optical scene derived from land use information • For Snow Cover Mapping from ENVISAT: synthetic SAR scene derived from several ASAR datasets and land use	Yes
Certification procedures and standards	• N/A	N/A
Standards for handling confidential information	• VISTA Privacy Policy • Employee Contracts- Confidentiality Clauses • Non-Disclosure Agreements	Yes
Reporting standards and requirements	• No specific standard	N/A
Documentation standards	• No specific standard	N/A
Communication and data-exchange standards	• No specific standard	N/A
Service Portfolio Upgrades		
Service Network Technology Development and Performance Enhancement (e.g. improved visualization software, more robust classification software, faster assimilation schemes, near-real time processing, performance improvements to be implemented through upgrade of key elements of the supply chain through expansion of service network)	• Additional end product on snow line defined by end-user LUWB • Automatic wet snow / SCA classification for ASAR implemented; this classification considers boundary areas and dry snow zones for detected wet snow areas. Equivalent SCA maps (to NOAA-AVHRR) can be derived for melting conditions from ASAR • Performance improvement for product generation from for ENVISAT ASAR, using ESA's Rolling Archive	
Service Delivery Updates (e.g. cost reduction including	• N/A	

migration to greater use of common infrastructure, (datasets, archives, catalogs, processing chains), implementation of common standards and processes, increased automation in service generation and delivery)	
Enhanced compliance with user standards and improved validation assurance	• Additional end product on snow line defined for enhanced compliance to users demands
Financial structure to be implemented (e.g. pricing strategy during initial service uptake, requirements and constraints due to third party funding sources, cost reduction of service delivery, distribution)	• Users are aware of requested financial contribution after PolarView activities • Service is targeted to be fully implemented as additional data source to station measurements, financed by end-user organistions • Multiple end-users will reduce the cost per product