

CryoLand

User Requirements on Snow Monitoring

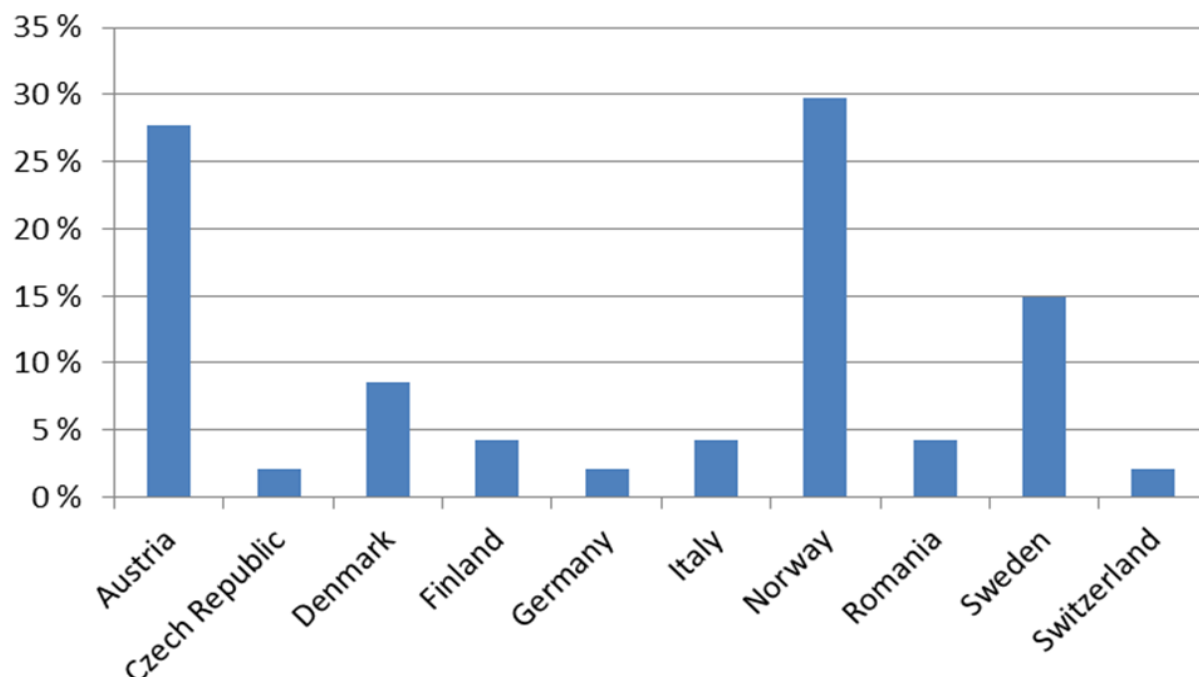


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Contributions from CryoLand Project and User group

- 1) **Review** of previous projects, working groups, etc
 - 2) **User workshops**, with potential users:
Vienna (Austria), Oslo (Norway), Saariselka (Finland), Bucharest (Romania)
 - 3) **Questionnaire**
WS participants, European governmental organisations and companies
 - 4) **Draft User Requirement Document**
 - 5) **User group** (60 organisations, 15 countries + EC organisations)
- 6) **Demo service** Pan-European Snow Extent
 - 7) **User group workshop**: Consolidation of Requirements and priorities
 - 8) **Final User Requirement Document**
- 6) **Continuos User-interaction**
 - **Validation, evaluation** Data provided by the users
 - **Continuous user-project interaction** (individual basis)
 - **Additional workshop**, evaluation, training, etc

Questionair sent to 140 individual Users (June 2011)
46 Users completed the questionnaire (30 March 2012)
60 organisations agreed to be part of User group (to date)



Countries represented in the questionnaire answers

CryoLand User Group, Field of interest

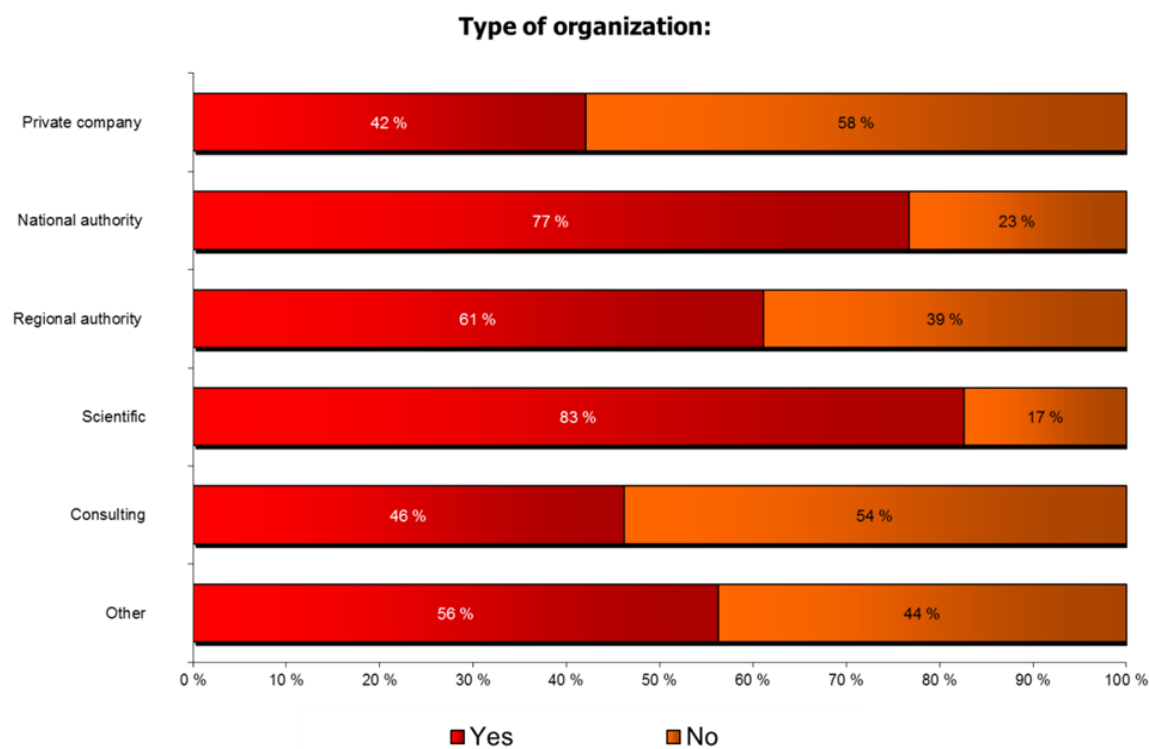


- **Hydrology, water resource management**
 - Hydropower companies
 - Flood warning services
 - Drought, water quality monitoring
- **Numerical weather prediction**
- **Natural hazards, avalanches, glaciers**
- **Climate change**

Different interest in temporal and spatial scales

60 organisations from 15 European countries (to date)

- Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greenland, Italy, Norway, Romania, Slovenia, Sweden, Switzerland + European Commission Organisations
- Avalanche and road mapping, hydrology and flood forecast, glaciology, weather forecast, vegetation research and climate research



77% national authorities

Current User Needs and Use of Snow information

- 80 % already using remote sensing data
- 79% indicate that snow and ice information is important for their services
- **85% states that snow information is of high relevance or essential** (24% w.r.t ice and glaciers)
- 79% use snow and ice data operationally as input to their services
- 80% thinks current data situation is partially satisfactory

What data sources are used?

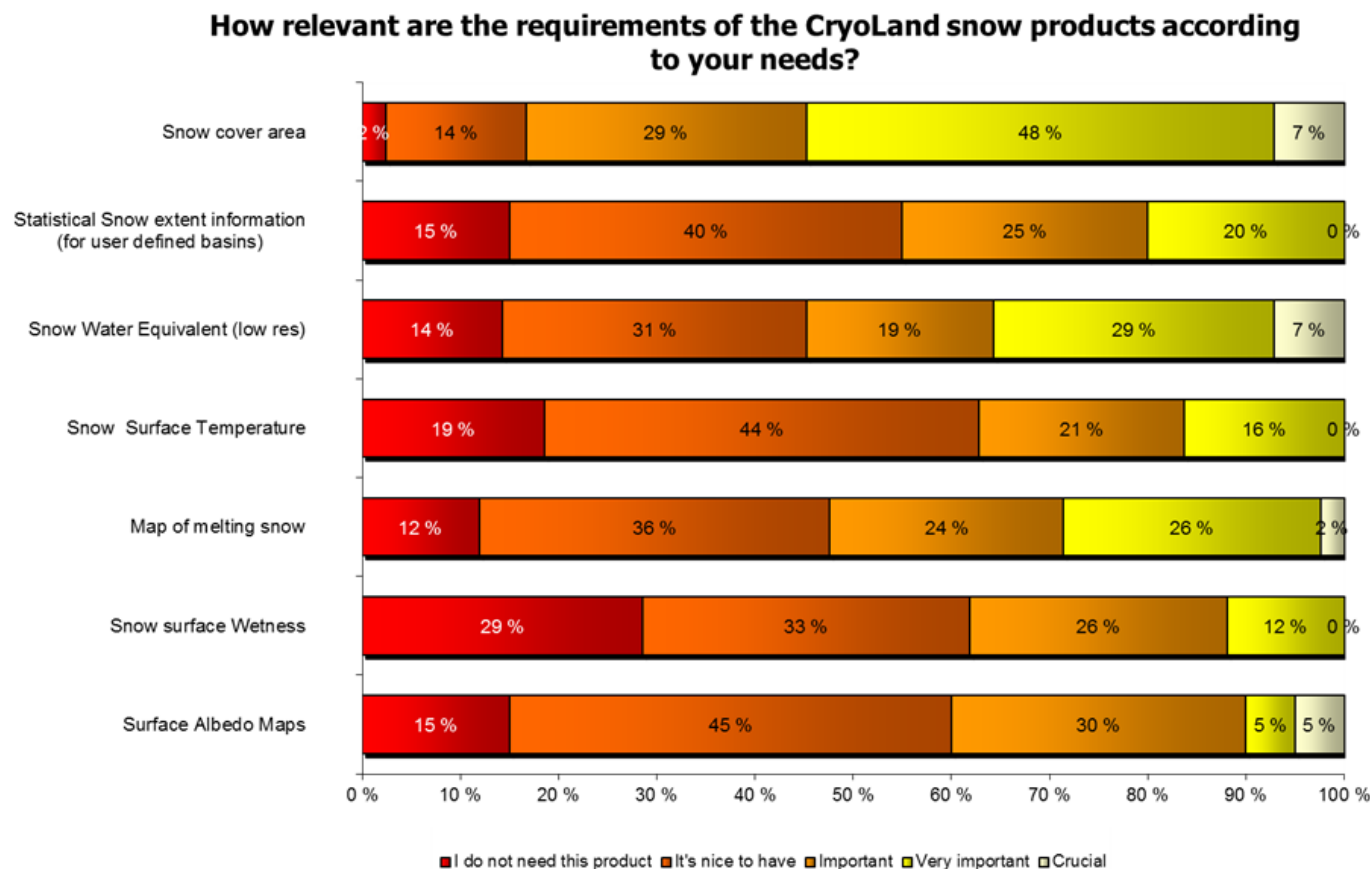


	Total	
Which data sources do you presently use for your snow / land ice products or services?	Percentage	Number
in-situ measurements at stations	83 %	39
spatially interpolated in-situ measurements at stations	47 %	22
modelled data (e.g. climate models),	62 %	29
products from satellite data	62 %	29
if other, specify in text box below:	26 %	12
Total	279 %	131

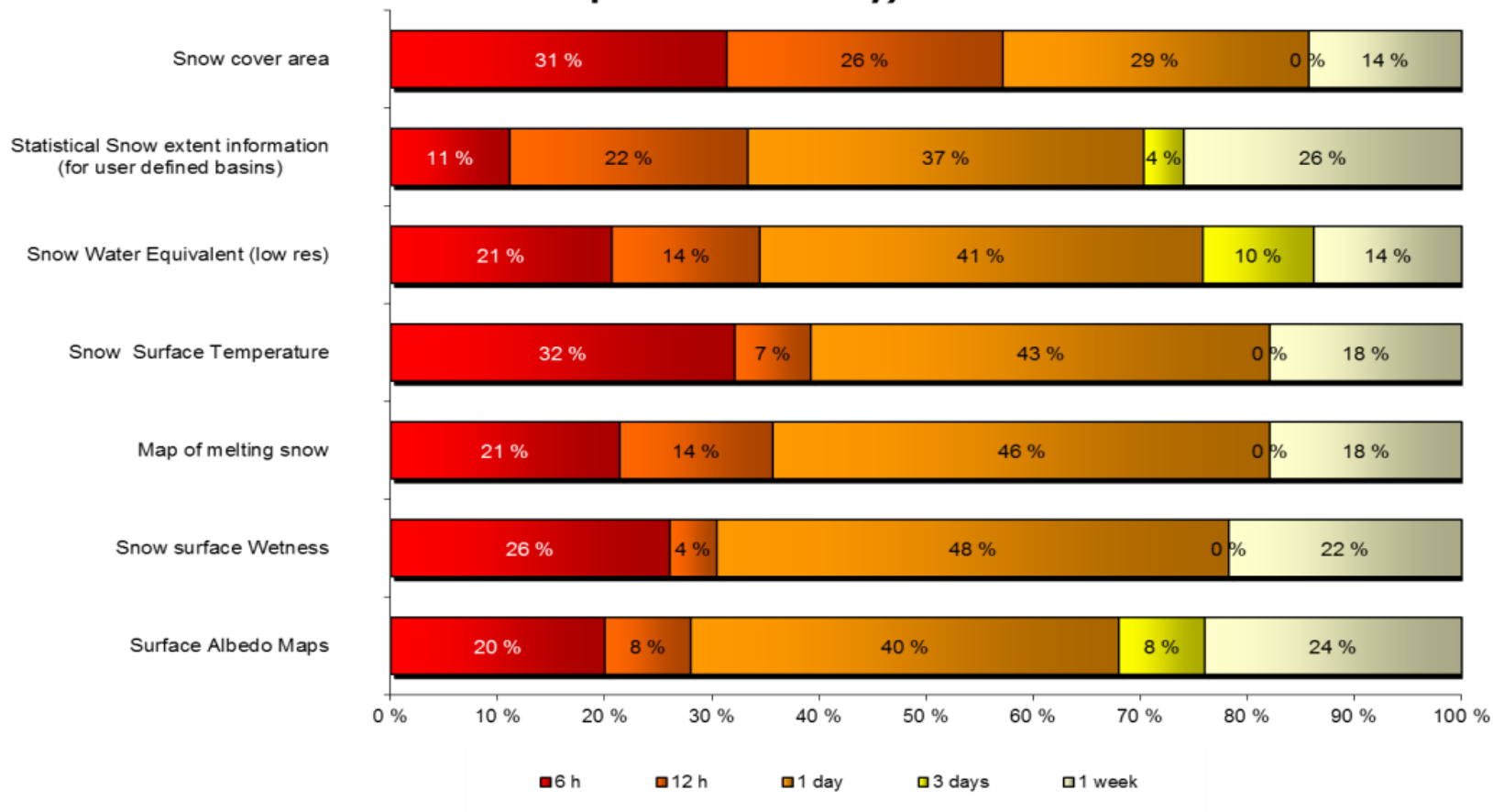
User needs – snow products



- 1st priority: Snow cover area
- 2nd priority: SWE
- 3rd: melting snow, albedo, wetness, temperature
- Full year service (fall/winter/spring)
- Daily basis
- 12 hr latency time (6 hr for some)

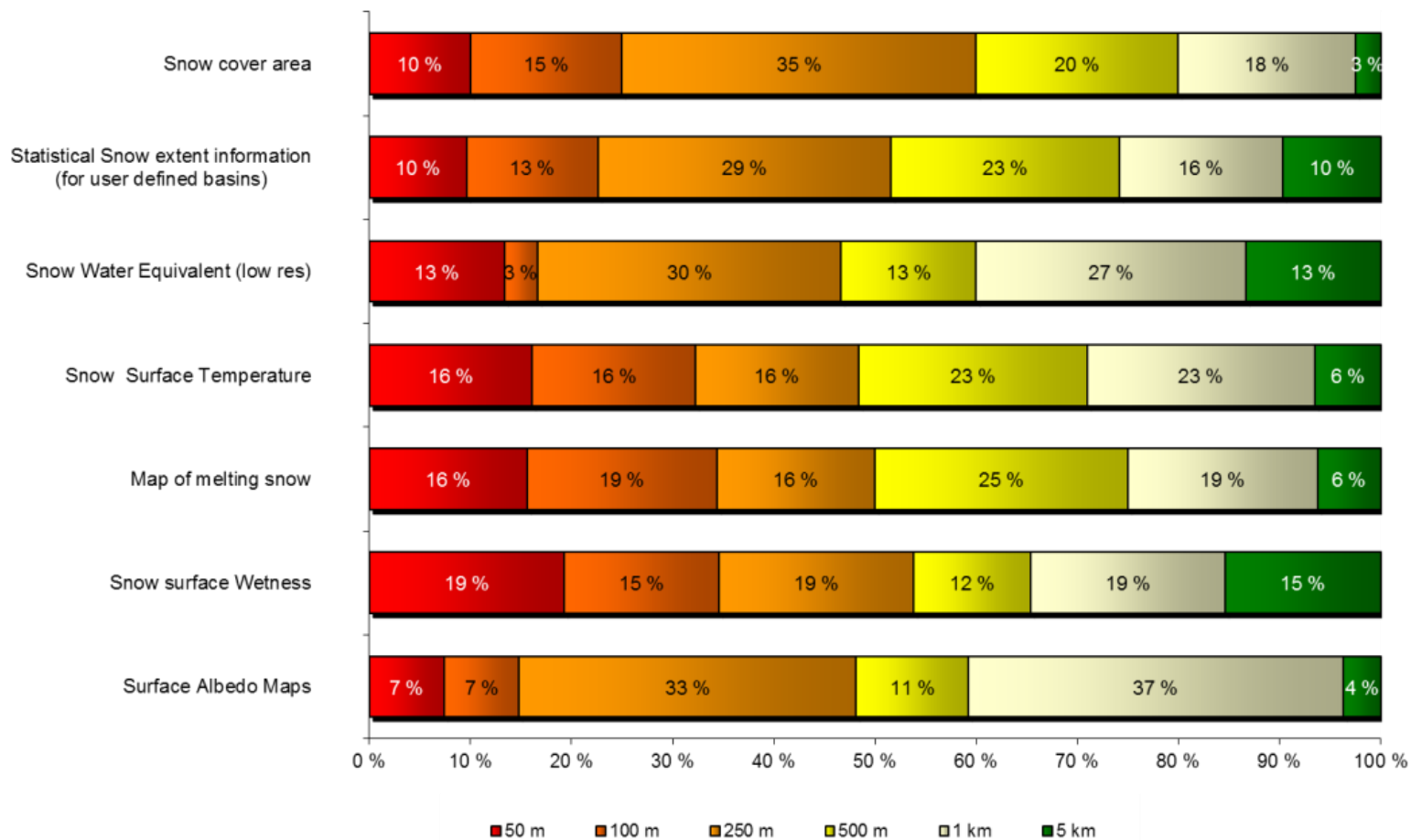


What is the data latency for SNOW COVER products (time from data acquisition to delivery)?



Spatial resolution

What are the spatial resolution requirements for SNOW COVER products?



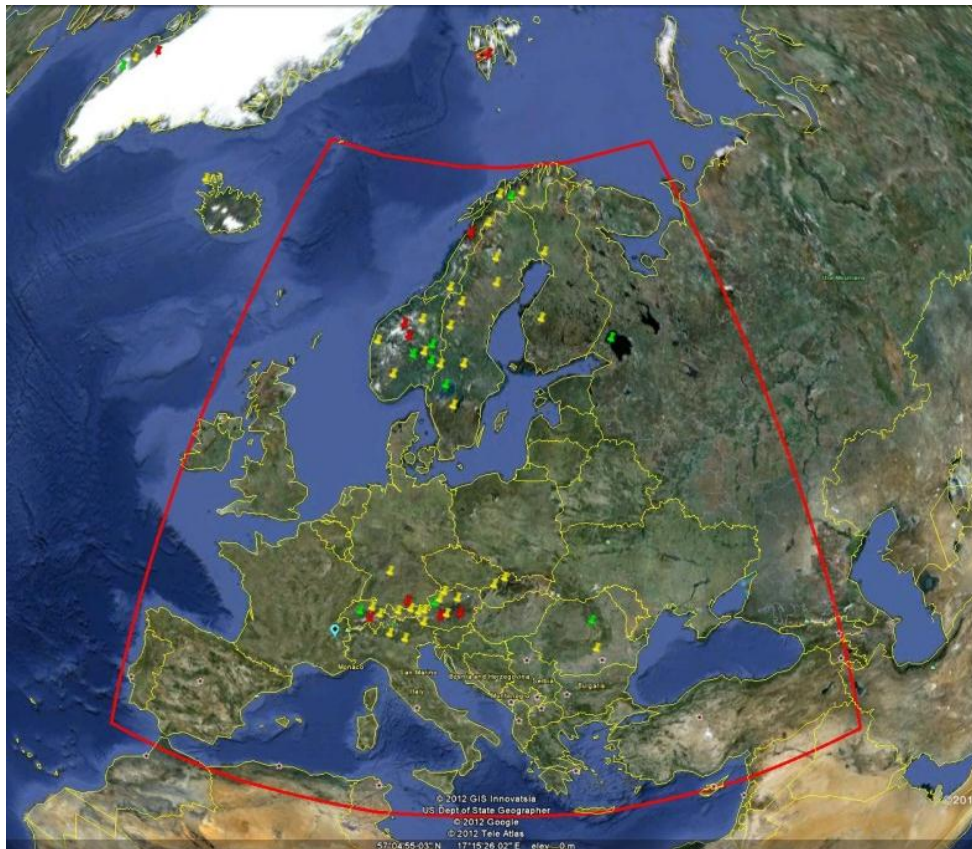
WHAT and WHEN?

User ranking of CryoLand products: high (1), medium (2), low(3)

	Ranking	
Product type	Order	Vote in % of users interested in the product
Snow extent, regional in Nordic and Alps	1	83%
Snow extent, pan-European	1	83%
Snow Water Equivalent (Low res)	1	55%
Melting snow area	2	52%
Statistical snow Information	2	45%
Snow Surface Temperature	3	37%
Snow Surface Wetness	3	38%
Spectral Surface Albedo	3	40%

WHERE?

Nordic Countries, the Alps, Pan-Europeean, and some polar regions



Map of Europe showing marks where users have indicated a need for **snow products (yellow)**, glacier products (red) and lake ice products (green). Additionally, a pan-European product (covering EC countries where snow is **relevant**) is requested by users. The selected coverage area for the **pan-European snow service** is shown with a red polygon

HOW?

Spatial and Temporal resolution with available data, algorithms, processing lines, and CryoLand developments

Product type	Spatial resolution, m	EO sensors	Temporal resolution
Snow extent, regional in Nordic and Alps	250 – 500 m	MODIS, ASAR (archived), Sentinel S1, S3	Daily, full year
Snow extent (local)	25 – 50 m	Landsat, Sentinel S2	Monthly, full year
Snow extent, pan-European	250 – 1000 m	MODIS, Sentinel S1, S3	Daily, full year
Snow Water Equivalent (Low res)	10 – 25 km	SSM/I/S, AMSR2	Daily, dry snow season
Melting snow area	25 – 100 m	ASAR (archived), Sentinel S1, S3	Daily, Spring/Summer/Fall/Winter
Snow Surface Wetness	1000 m	MODIS, Sentinel S3	Daily
Statistical snow Information	HRU/basin	NA	Daily
Spectral Surface Albedo	250 – 500 m	MODIS, Sentinel S3	Daily
Snow Surface Temperature	1000 m	MODIS, Sentinel S3	Daily

User needs – services



- GeoTIFF files (raster data)
- Shape files (vector data)
- Web-GUI preferred for exploring data
- FTP favorite download option
- OpenGIS web feature service (WFS) or Locally installed download clients also interesting
- Other Web Catalogue Services not well known
- Web-GUI invoked processing for tailoring the data to the user need before download of high interest

In WHAT FORMAT?

CryoLand Service Specifications

Req.	Text	Alternative service
1	Web service for search of snow and land ice products	OGC EO-WCS DescribeCoverage/ Set requests
2	Web service for download of snow and land ice products	
3	Reprojection capabilities to other projections within the web service, single data set or data stack	local user tool
4	Data format in GeoTIFF	
5	Data format in shape	
6	Statistical snow Information (statistical parameters TBD)	
7	Flexible storage system with automatically feeding of data from data producers (e.g. KSAT, SYKE) to the system	
8	Distributed nodes that produce snow and land ice products to the CryoLand Service	
9	Tools with simple WEB-GIS functionalities (to be specified)	
10	OpenGIS Web Map Service (WMS)	
11	FTP download	File access via HTTP at Web site
12	Open GIS web feature service	
13	Web GeoPortal to display results of services	
14	Possibility to upload reference data via WFS-T	
15	Possibility to upload file in Web GeoPortal	
16	Possibility to download other data formats (common GIS data formats. e.g. GDAL	

Summary



- User needs for snow, ice and glacier data have been thoroughly investigated by review and user survey
- Most important Snow products (snow cover area and SWE) comply with available Operational or Pilot products
- High interest in flexible and efficient web-based portals for accessing snow remote sensing data