ESA GlobSnow – User Workshop 1, Innsbruck, Austria
12-13 January 2010

Location: Institut für Naturgefahren und Waldgrenzregionen (Department of Natural Hazards and Alpine Timberline), BFW – Bundesamt für Wald, Seminarroom, 1st Floor, Hofburg Rennweg 1, 6020 Innsbruck, Austria

Present: Florian Appel (Vista)

Annett Bartsch (University of Vienna)

Gabrielle Bippus (ENVEO)

Peter Bissolli (DWD)

Bojan Bojkov (ESA - ESRIN)

Yves Buehler (SLF)

Chris Derksen (EC)

Florian Figwer (University of Innsbruck)

Nando Foppa (MeteoSwiss)

Reinhard Fromm (BFW)

Thomas Geist - Austrian Space Agency (FFG)

Markus Heidinger (ENVEO)

Michael Kern (ESA - ESTEC)

Amir Ali Khan (Newfoundland and Labrador)

Jarkko Koskinen (FMI)

William Lahoz (NILU)

Kari Luojus (FMI)

Petra Malcher (ENVEO)

Sari Metsämäki (SYKE)

Florian Muller (ENVEO)

Nico Mölg (EURAC)

Thomas Nagler (ENVEO)

Jouni Pulliainen (FMI)

Philipp Rastner (EURAC)

Helmut Rott (ENVEO)

Vladimir Ryabinin (WCRP / WMO)

Lothar Schuller (EUMETSAT)

Rune Solberg (NR)

Karl Voglmeier (University of Innsbruck)

Thomas Voigt (ETC/ACC)

Andreas Wiesmann (GAMMA)

Marc Zebisch (EURAC)

<u>**Executive Summary:**</u>

The User WorkShop 1 of the ESA DUE GlobSnow project was held at Hofburg, Innsbruck, Austria, during 12-13 January 2010. The purpose of the meeting was to present the work carried out during the first phase of the project, including: the algorithm evaluation results for Snow Extent (SE) and Snow Water Equivalent (SWE) products, the selected GlobSnow algorithms and the prototype datasets. A key objective was to openly discuss the results obtained and determine the direction of the project in the future with the user community. In addition to the presentations given by the GlobSnow consortium, the User community gave presentations on several different topics concerning the GlobSnow and satellite-based snow and cryosphere monitoring efforts in general.

The detailed minutes of the WS1 meeting, 12 January 2010 (day 1):

Jouni Pulliainen (FMI): An overview of the GlobSnow project
Jouni Pulliainen gave an overview presentation on the project, describing the organization and the schedule, the planned end-products and the purpose of the User Workshop 1 in question. The presentation is available for download through the GlobSnow-web pages, along with all the other presentations of the workshop.

After the presentation several questions were presented:
William Lahoz: Question regarding the ESA Climate Change Initiative (CCI), whether snow will be among the ECVs of CCI in the future? The decision on the possible inclusion of snow for the future phases of CCI has not been made yet, so it is a possibility.

Ali Khan: Is a one year period enough to demonstrate the near-real time snow service? Answer: The time preiod is determined by the project boundaries, but FMI will try to continue with the service if everything goes as planned. Additionally, FMI has been involved in the EUMETSAT HydroSAF project that has demonstrated operational SWE service for Eurasia already for a few years now, so the consortium has previous experience in running operational services.

Lothar Schuller: Is the creation of homogenous data sets (an ECV) a goal of the GlobSnow project? Answer: The Satellite data will not be modified concerning the FCDR. However the homogenization of products is taken into account for example in the SWE algorithm by accounting for the sensor characteristics (using the emission model within the SWE algorithm).

Vladimir Ryabinin (WMO/WCRP): WCRP and snow: yes and no(w)
Vladimir Ryabinin gave an overview on the developments and work done at WMO and WCRP in the area of climate and cryosphere research and observations, including WCRP's role in gathering field data, connecting people and organizations, proposing actions and directing climate research and observation taking into account the importance of snow within the climate system.

The discussion and questions after the presentation (presentation is also available through the GlobSnow web pages):
Ali Khan: There are a lot of issues with standards in snow monitoring as different organizations have different methods and differences in measurement techniques for the various parameters. Additionally there are serious problems with climate modeling as the model predictions for Newfoundland are very different in different model. Besides Newfoundland is sometimes simply missed in the coarse resolution model output. Is there something WMO could do to amend this?
Answer: Reliability and quality of the information are needed for both the models and measurements (including also the products produced in GlobSnow). This is something advocated by WMO/WCRP and as well the Global Cryosphere Watch but is not an easy task to accomplish. I agree that there is a problem at high resolution scale and in

the next WCRP model runs for IPCC there will be a focused effort on downscaling the projections.

Bojan Bojkov: Is there a concern for decrease in (snow monitoring) weather stations. Answer: Yes, it is definitely a problem as the data from weather stations is needed for the validation and calibration of remote sensing retrievals. WMO conducts monitoring of reporting from meteorological stations, including data received in the SYNOP code but the quality of reporting on snow is not reviewed. Besides, standards of reporting snow observations are set at the level of WMO Regional Associations and in principle may be different while we need to assemble global datasets from them.

Lothar Schüller: Satellite observations will not make ground measurements obsolete, as they are in many cases needed to support and validate them, even as some of the decision makers seem to believe otherwise.

Rune Solberg (NR): Overview on the SE product
Rune Solberg gave an overview on the GlobSnow SE product. He presented the path taken in the development, the current state of the development work, the algorithms, examples of the already released prototype products and the work still ahead to create the long term datasets on a global scale.

The questions after the presentation:
William Lahoz: How was the SE algorithm validation carried out, what was the comparison/reference data? Answer: The evaluation/validation was carried out using high resolution optical data as ground truth; high resolution optical data is extremely accurate and has been shown to agree with ground based measurements extremely well on the spatial resolutions in question. Actual ground truth measurements (snow path measurements) were in addition available for the Finnish test region.

Ryabinin: Aggregation is moving towards high temporal (and spatial) resolution and high resolution products will definitely be interesting for the user community also. This means that the daily product should definitely be included in the product portfolio, even if it has limitations on spatial coverage. Answer: The current plans for the GlobSnow project will guarantee the distribution of daily SE products.

Thomas Nagler (ENVEO): GlobSnow SAR Study
Thomas gave an overview presentation on the SAR work carried out within the GlobSnow. The key message was that SAR can improve the spatial and temporal coverage in SE estimation due being able to measure independent of illumination and cloud conditions; however the currently available data would not significantly improve the long term (15 years) dataset and SAR will not be utilized for the second or third phases of GlobSnow. However in the future with the launch of Sentinel-1 satellites the impact of SAR will be significantly greater and needs to be considered in the future.

Bojan Bojkov: What is causing the issue with patchiness (lower SAR SE values than optical in common). The methodology is different for SAR and optical and causes

differences in the estimates. The SAR response is heavily affected by surface roughness and when the snow is melting and ground is revealed from beneath the SAR method typically interprets the rough surface as snow free.

Additional question from audience: Do the agricultural areas show erroneous SE estimates due to the growing season showing up in change detection algorithms. Answer: The change detection certainly sees the growing season in the satellite images, this however is not a problem since it can be easily compensated for (corrected) in the post-processing steps (the methodology has been demonstrated in past projects).

Kari Luojus (FMI): Overview of the GlobSnow SWE product
Kari Luojus gave an overview presentation of the SWE product. He presented the algorithm evaluation efforts, described the selected GlobSnow SWE algorithm, showed examples of the released prototype products and described the known issues and the needed work to create the long term dataset for SWE.

The questions after the presentation:
Lothar Schüller: what is the difference between the ESA GlobSnow SWE product and the EUMETSAT H-SAF SWE product? Answer: there are two different teams (from two different departments) working at FMI with the two projects. The teams are working in co-operation and the SWE algorithm is the same but the focus is different in the projects. The H-SAF-project that started several years earlier to GlobSnow has focused on the European domain for hydrological end-use applications (development and implementation of an operational near real time product for a restricted area), whereas the goal of the GlobSnow is to produce a long term climate dataset and a product covering the whole Northern Hemisphere (demonstrating the SWE estimation on a global scale) in addition to the near real time product. Additionally, the SWE products are produced in different grids and the end-products of the two projects are different even though the algorithm is mathematically the same; in HSAF the end-product is a combination of different SAF products and the SWE assimilation product is an intermediate product in the overall production chain. The development work carried out within the GlobSnow project can be utilized in the H-SAF project and vice versa.

Andreas Wiesmann (GAMMA): Overview of the GlobSnow Near Real Time Processing System
Andreas Wiesmann presented the development plans for the GlobSnow near-real time processing system. The target date to get a test version of the processing system running is 1 October 2010. For the near-real time processing system the only bottle neck seems to be the access to the WMO synoptic weather station data used within the SWE processing.

The discussion after the presentation:
Vladimir Ryabinin: Data access to the WMO synop data can and should be arranged through WMO information system, granting a delay of around one hour to the data

after the measurements. This would (will) remove the remaining issue with achieving processing time of less than 24 hours from the satellite data acquisition.

Bojan Bojkov: The GlobSnow near-real time operations are planned to start during the fall 2010, thus providing snow information for the snow season of 2010-2011.

Michael Kern (ESA): Future Missions for the Cryosphere (ESA perspective)
Michael Kern presented the current and upcoming cryosphere related missions of ESA. There is a lot of data already available from ERS-1/2, Envisat and other satellites and in addition to these there are new upcoming mission to be launched in the near future and the current round for the next Earth Explorer mission includes a satellite directly designed for cryosphere monitoring (CoReH2O). The key message was that there is a huge amount of existing data from ESA sensors directly feasible for monitoring of cryosphere and a great potential for improved monitoring capabilities within the near future missions.

The question from audience: What is the potential of SMOS for terrestrial cryosphere applications? Answer: The issue is being investigated and there is certainly potential for cryosphere applications using SMOS data.

The detailed minutes of the WS1 meeting, 13 January 2010 (day 2):

Sari Metsämäki (SYKE): SCAmod method for fractional snow cover mapping
Sari Metsämäki gave a presentation on the SCAmod method that is used for the non-mountainous parts of the globe on SE mapping. SCAmod covers all the non-mountainous areas, working both on forested and non-forested areas. The validation results acquired from the different test sites show that it is more accurate than the NASA fractional MODIS product for forested regions. Further, the extension of the transmissivity map utilized by the SCAmod method was shown to be feasible for global scale using the GlobCover data as proxy. Evaluation showed that the SCAmod algorithm employed using GlobCover derived transmissivity was working relatively well for the evaluated regions.

The questions after the presentation:
Question: Does the snow on forest canopy affect the SE retrievals? Answer: The algorithm evaluates the snow on ground. Typically the snow on canopy lasts only for a short period of time and is usually not an issue during the melting season, but it can affect the estimation accuracy in some cases.

Question: Does SCAmod work better on plains than the NLR method? Answer: SCAmod did perform better based on the evaluation carried within GlobSnow. The evaluations have been reported on the Design Justification File v2 (DJF-v2).

Question: Has there been an evaluation of cloud coverage? Answer: There has been an investigation for the cloud masking algorithms but no could coverage statistics have

not been evaluated. Investigation of cloud cover statistics should be investigated during Phase 2 if possible.

Rune Solberg (NR): Evaluation and validation of the GlobSnow SE product
Rune Solberg gave an overview on the validation activities that were carried out during the first phase of GlobSnow project.

The questions after the presentation:
Question: Was there an investigation on the effect of vegetation state for SE estimation accuracy? Answer: No, such tests have not been part of the evaluations this far.

Nando Foppa: Has the SCAmod been evaluated for mountains? Answer: SCAmod is working fairly well on mountainous forests according to the evaluations carried out for the Norwegian the test site.

Thomas Nagler (ENVEO): Investigating the Cloud masking approaches for GlobSnow
Thomas Nagler presented the cloud masking approaches that have been investigated for GlobSnow purposes. Basically, there has not been an operational cloud masking approach that could discriminate between clouds and snow. The consortium had to implement and evaluate a new cloud masking approach that could be utilized with AATSR data. Investigations showed that a rather simple approach using channel thresholds for cloud discrimination worked rather well for the evaluated areas. The cloud detection issue needs to be still investigated during the future phases of the project. The main conclusion at this stage is that the AATSR operational cloud mask can not be used for cloud snow discrimination, and is not usable for GlobSnow purposes.

Nando Foppa: What is the sensitivity of the SCDA algorithm to the calibration of the AATSR sensor? Answer: The sensor is well calibrated and stable, thus it does not have an effect the cloud detection algorithm.

Question: How difficult was the adjusting of thresholds for the difference areas? Answer: Adjusting the thresholds for the Alps was relatively easy, and needed only a slight modification to one of the thresholds.

Question: Has the algorithm performance been tested for different cloud types? Answer: Investigation of the algorithm performance with different cloud types were not carried out yet. The masking approach is basically classifying the clouds into thick clouds and semi-transparent clouds which are combined to a binary cloud mask.

Question: Is there a possibility to provide a confidence map for the cloud masks? Answer: This is something that could be investigated and added to the product if found to be feasible.

Question: Has the consortium investigated the work carried out with the AVHRR as it has similar channels to the AATSR? Answer: There has not been a thorough investigation regarding the AVHRR cloud masking efforts. The consortium needs to investigate the issue.

An additional remark: ESA SnowRadiance project is investigating cloud masking approaches as well. This work should be looked at by the GlobSnow team.

Rune Solberg (NR): Potential GlobSnow SE aggregation products
Rune Solberg presented some potential aggregated products for GlobSnow SE and certain aggregated products that have been used in the currently available snow products. There are a lot of possible ways to make the aggregated products and the final selection should be based on the User feedback. One of the key questions in addition to the aggregation period was whether to show the latest or average snow information for the aggregated products (or a minimum). Additionally, supplemental data fields can be used to provide more detailed information, e.g. by stating the number of observations with snow cover out of the total observations of aggregation period. The initial proposition from the GlobSnow consortium was providing a 10 days and a monthly product, showing the average snow extent, with supplemental data showing the number of snow days (per pixel) and the first and last days of snow observations in the period (per pixel).

Discussion on the aggregated products:
Ali Khan: Prefers 7, 10 or 14 days, not a longer aggregated product. Most recent observation are also needed (the daily products).
Peter Bissolli: Suggests average aggregated product, and the maximum SE (minimum not as important as maximum). Monthly product is essential. If minimum and maximum are both available, then one can see the variance of snow cover for the said aggregated product. Number of observations would definitely be useful information also.

Nando Foppa: The aggregation period between 7 to 10 days would be of interest.

Reporting the SE estimates acquired with low solar illumination conditions would be very important. The samples that may have issues with solar illumination should not be masked out left to the product and identified with a proper flag.

Vladimir Ryabinin: Providing aggregated products is not necessarily the best approach and it is difficult to derive a product that will suit all the needs. A proposed solution is to provide software that can be utilized by the users to carry out the aggregation according to the users particular needs.

William Lahoz: In addition to the aggregated data, it would help to provide the amount of variation within the data used for aggregation.

Thomas Voigt: Long term trends are of great interest for EEA. They would mainly be interested to be able to determine and show trends for different years on a longer time scale.

Annett Bartsch: For the ESA DUE Permafrost there is a clear need for the weekly aggregated product. For the high latitudes used in the Permafrost project the spatial coverage would not be an issue.

The conclusion of the discussion was that there are different needs for the different users. It was clear that by providing supplementary data fields the aggregated products would be applicable for the largest part of the user community. If there would be a way to provide software that could be used to derive the aggregated products, it would be possible to serve the needs for all the users. The main candidates for the aggregation period (in addition to the monthly product which was decided to be provided) were the 7-days, 10-days and 14-days products and the main interest lay on the average and the maximum products; however by providing suitable supplementary data fields the product can be made applicable to all user needs leaving the aggregation period as the key question to be solved. The ultimate solution would be to produce all the main products (7, 10 and 14-days), but this will probably not be feasible during the second phase of the GlobSnow project.

Chris Derksen (EC): Additional details on the SWE validation work
Chris Derksen gave an overview of the SWE validation work carried out within the GlobSnow project. The evaluation consisted of comparing the currently available products and algorithms over three main test regions with an extensive ground truth dataset. The validation clearly showed that the FMI algorithm is the strongest candidate for GlobSnow. In addition the consortium is significantly pushing the envelope by creating a daily SWE dataset going back to 1978. The open issues for the evaluation for the Phase 2 were: evaluation of the parameters for wet snow masking; determining error bars for the long term dataset and validation of snow-on/snow-off dates using ground truth data. An additional assessment should be made to compare the internal error estimates versus actual retrieval uncertainty.

Questions after the presentation:
Michael Kern: What efforts would be conducted to assess the accuracy of the SWE product since the uncertainty field produced from the assimilation scheme is more of an internal error. Were there plans to compare the SWE variance fields with actual retrieval accuracy relative to reference datasets? Answer: Yes, this is a necessary step and will be investigated in phase 2 of the project. The internal error is mainly comprised of the uncertainties assigned to the weather station data (has been investigated for Finland) and the error estimate produced by the snow emission model. It was also noted that the error of the weather station observations could be determine for Canadian data as well. An additional question was raised concerning the possible additional product, the effective snow grain size, and it could be assessed using the observational datasets from Canada and Finland

Jouni Pulliainen (FMI): Features of the final SWE product and possibilities for additional products

Jouni Pulliainen gave a presentation on the finalization efforts planned for the SWE product and the additional products that can be generated along the SWE information. The potential additional products include the effective snow grain size and a coarse resolution background snow extent derived using the radiometer data. For the finalization efforts, the consortium will investigate the filtering of suspicious weather station observations in order to improve the SWE maps. Investigation of the assigned accuracy for the weather station observations needs also further investigations with data from Canada and Russia. Additionally wet snow masking will still be investigated for the SWE product and a mountain mask will be added (including glaciers and ice sheets). Detection of snow line -> can be used to create the coarse background SE products.

Questions after the presentation:
Peter Bissolli: How is the missing weather station data treated? This is a problematic issue for the SWE estimation, but it is mitigated by using the satellite microwave observations. The snow line can be detected from the satellite data. It would still be of great benefit if all the station would report the snow status even when there is zero snow on the ground.

Kari Luojus (FMI): Aggregation of the SWE product

Kari Luojus presented examples of aggregated SWE products. The main difference for the SE product is the fact that the daily SWE data do not have any significant data gaps, and thus the need for aggregated products is lesser, the daily products can be used as such. The proposition from the consortium is in addition to the dialy data to provide a monthly average and a monthly maximum and an aggregated product that matches the SE product.

The discussion after the presentation:
Vladimir Ryabinin proposed to contact the WCRP hosted "Cryolist"-email list to ask for feedback on the aggregation issue both for the SE and SWE products.

Annett Bartsch reminded that they would need a weekly product for the ESA DUE Permafrost project.

Bojan Bojkov mentioned that the SE and SWE monthly aggregated products should be delivered in the same spatial grid to make for easy comparison and evaluation for the end users.

USER PRESENTATIONS

The GlobSnow user community was invited to give presentations on their on-going snow monitoring activities and potential uses for the GlobSnow end-products. The User presentations ranged from very specific presentations on snow monitoring in regional level to snow monitoring activities carried out by institutions for climate research and long term monitoring activities. The presentation included several users who are going to utilize the GlobSnow products in their monitoring efforts or as a

input data for new products such as the permafrost products envisioned for Northern latitudes. Lothar Schüller gave an overall presentation on the activities by EUMETSAT for snow, climate and cryosphere monitoring. All the user presentations can also be downloaded from the GlobSnow workshop web pages, among all the other presentations given during the two days of the User workshop.

The User presentation were:

Snow Monitoring in Newfoundland and Labrador, Canada
Presented by Ali Khan, Government of Newfoundland and Labrador, Canada

Dr. Ali Khan described the snow monitoring efforts of the Government of NewFoundland and Labrador. They are using remote sensing data along with more traditional methods to monitor the river discharge and flooding events on an area where there can be several meters of snow during the winter season. Dr. Khan indicated that they are going to evaluate the utilization of GlobSnow products as an input data for their monitoring system.

Toward assimilation of snow data
Presented by William Lahoz, Norwegian Institute for Air research (NILU), Norway

Dr. William Lahoz described the importance of snow in hydrological processes especially in the northern latitudes and described the efforts of NILU in assimilating different data sources to better understand the hydrological cycle, he also pointed out the positive impact of assimilation of snow information for land hydrology purposes. Dr. Lahoz indicated interest in utilizing the GlobSnow snow products for the on-going assimilation work.

Polar View Snow Services and Application in Hydrology
Presented by Florian Appel, Vista Remote Sensing in Geosciences GmbH, Germany

Mr. Florian Appel described the work conducted by Vista within the Polar View consortium concerning snow monitoring. Polar View is a multinational consortium developing products for the polar regions of Earth. Mr. Appel promised to look at the possibility of utilizing the GlobSnow products within the Polar View services.

SnowClim - the European snow climate monitoring programme of Deutscher Wetterdienst (DWD)
Presented by Peter Bissolli – Deutscher Wetterdienst (DWD), Germany

Dr. Peter Bissolli described the work carried out by the Deutcher Wetterdienst (DWD) for long term climate monitoring in Europe. Dr. Bissolli described one of the functions of DWD, which is working as an expert advisor for WMO on climate issues on regional level. DWD has collected long term datasets describing cryospheric parameters over Europe which are available for interested parties through the DWD on request. Dr. Bissolli indicated their interest on looking at the GlobSnow products

as an additional data source or as a comparable dataset for their climate monitoring activities.

GlobSnow product use within the ESA DUE Permafrost project
Presented by Annette Bartsch – Vienna University of Technology, Austria

Dr. Annette Bartsch described the activities of the on-going ESA DUE Permafrost project for which she is acting as the project coordinator. The objective of the project is to establish a monitoring system based on mostly existing satellite data products for permafrost on northern regions. The GlobSnow products will be utilized within the permafrost as input and supplementary data for certain products. The Permafrost project will organize their first User workshop during 2 May 2010 in Vienna.

Snow products and activities in the EUMETSAT Network of Satellite Application Facilities
Presented by Lothar Schüller – EUMETSAT, Germany

Dr. Lothar Schüller described the activities of the EUMETSAT on cryosphere monitoring field and in particular the Satellite Application Facilities network (SAF) of the EUMETSAT. The SAFs are formed by different organizations that are producing additional operational products using EUMETSAT satellite data for various end-users under EUMETSAT guidance. Dr. Schüller gave a slightly more detailed view of the land surface analysis SAF and the hydrology SAF which are producing operational snow products within the EUMETSAT SAF framework. Dr. Schüller indicated that the EUMETSAT SAF approach might be a possible way to bring the research and development projects initiated by ESA, such as the GlobSnow, into operational domain.

PANEL DISCUSSION - chaired by Bojan Bojkov ESA
The panel discussion summed up the discussions from the two days of Workshop and gave an overall view for the road ahead for the GlobSnow project. Bojan Bojkov briefly summed the key decisions that have been made for the products during the user workshop and the previous user meetings and internal meetings of the project. The key decisions discussed were related to aggregation, coverage, format, projection and the estimation accuracy.

Aggregation
The aggregation issue was one of the key questions of the workshop. However, as the discussion showed, there are very different needs for the different users. It was agreed that the consortium will propose a set of products in the minutes and the users can comment them. The consortiums proposition as the aggregated products is:

The final decision whether to go with the 7-days or the 10-days product depends on further User feedback…

(FSC stands for fractional snow cover, 4CL stands for 4 class snow cover product.)

FINNISH METEOROLOGICAL INSTITUTE

	Snow Extent	Snow Water Equivalent
Daily product	Daily FSC & Daily 4CL snow	Daily SWE
7-days *or* *10-days*	FSC & 4 CL snow - Average snow conditions - First day of snow - Last day of snow - Number of snow observations	Average SWE Maximum SWE
Monthly	FSC & 4CL snow - Average snow conditions - First day of snow - Last day of snow - Number of snow observations	Average SWE Maximum SWE

Coverage

The spatial coverage of the snow extent product is slightly limited for a daily product. However, the ATSR family of sensors has very stable on-orbit calibration features and is extremely well usable for snow monitoring. Additionally using the ATSR family it is possible to extend the temporal coverage to fifteen years (starting from 1995) and it was clear after the workshop that the plan to concentrate on the ATSR-2 and AATSR data for the current GlobSnow project is the best option.

It was added that the methodologies developed within the project are robust and can be easily modified to different sensor, thus if a suitable dataset would be produced by a different institution, it could be utilized for the long term dataset also by the GlobSnow consortium,

Format

The final GlobSnow products will be provided in NetCDF format using CF metadata convention.

Projection

The projection for the SWE data will be in EASE-Grid in 25x25km nominal resolution. The projection for the SE data will be in latitude-longitude grid in WGS84. The aggregated products shall be provided also in the same projection with the 25km x 25km spatial resolution.

Accuracy

The estimation accuracy will be reported for each pixel for both the SE and SWE products.

Concerning the cloud masking the confidence value for clouds should be included for the Simple SCDA algorithm, if a feasible way to provide it is found

The SE product needs to include quality flags for
- Clouds
- Solar zenith angle (estimated data needs to be provided also for the flagged pixels)
- Masking confidence (if found feasible)